United States Department of Agriculture Agricultural Marketing Service | National Organic Program Document Cover Sheet https://www.ams.usda.gov/rules-regulations/organic/national-list/petitioned

Document Type:

⊠ National List Petition or Petition Update

A petition is a request to amend the USDA National Organic Program's National List of Allowed and Prohibited Substances (National List).

Any person may submit a petition to have a substance evaluated by the National Organic Standards Board (7 CFR 205.607(a)).

Guidelines for submitting a petition are available in the NOP Handbook as NOP 3011, National List Petition Guidelines.

Petitions are posted for the public on the NOP website for Petitioned Substances.

□ Technical Report

A technical report is developed in response to a petition to amend the National List. Reports are also developed to assist in the review of substances that are already on the National List.

Technical reports are completed by third-party contractors and are available to the public on the NOP website for Petitioned Substances.

Contractor names and dates completed are available in the report.

Petition to Amend 7 CFR §205.601 to Add Polyoxin D Zinc Salt as a Synthetic Substance Allowed for Use In Organic Crop Production (May 31, 2016): February 2, 2018 Addendum

NON-CONFIDENTIAL

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> > February 2, 2018

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EXECUTIVE SUMMARY

Proposed Amendment

Kaken Pharmaceutical Co., Ltd. (Kaken) proposes to <u>amend 7 CFR §205.601(i) to add polyoxin D zinc</u> <u>salt</u> as a synthetic substance allowed for use in organic crop production as plant disease control.

Petitioned Substance

The petitioned substance is <u>limited</u> to polyoxin D zinc salt which is a 1:1 complex of polyoxin D and zinc. The CAS number for polyoxin D zinc salt is 146659-78-1. The U.S. Environmental Protection Agency registration number of Polyoxin D Zinc Salt Technical is EPA Reg. No. 68173-1. The associated formulation proposed for use in organic agriculture is limited to the polyoxin D zinc salt 5SC formulation [Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 67173-4) and Oso 5%SC Fungicide (EPA Reg. No. 67173-4-70051)].

Polyoxin D is <u>naturally occurring</u>. It is a fermentation product of a naturally occurring microorganism that is <u>not</u> genetically modified.

Polyoxin D is highly water soluble. To reduce its water solubility and thereby increase resident time on plant surfaces, polyoxin D is converted to polyoxin D zinc salt via a simple chemical reaction. This simple chemical reaction is the rationale for the National Organic Standards Board's April 2013 recommended classification of polyoxin D zinc salt as a synthetic substance. Kaken purchases the starting material containing zinc and does <u>not</u> control the origin of the zinc (mined vs recycled).

Based upon detailed chemical analyses submitted to and reviewed and accepted by the US EPA, Polyoxin D Zinc Salt Technical (EPA Reg. No. 68173-1) does <u>not</u> contain any toxicologically significant heavy metal impurities at or above the level of detection.

Petition Scope

Fourteen polyoxins have been identified and have been designated polyoxin A through polyoxin N. Polyoxin A through polyoxin N each have a *different* chemical structure. The properties of polyoxins vary with the chemical structures.

The petitioned substance does <u>not</u> include all polyoxins. Specifically, the petitioned substance does <u>not</u> include:

- Polyoxin A through C;
- Polyoxin E though N;
- Polyoxin A through C in combination with zinc; and/or
- Polyoxin E though N in combination with zinc.

Polyoxin Complex is <u>outside</u> the scope of this petition. Polyoxin Complex is a produced by Kaken and is marketed in Asia. Polyoxin Complex contains multiple polyoxins and has significantly different efficacy compared to polyoxin D zinc salt.

Not an Antibiotic

Worldwide, Polyoxin D Zinc Salt Technical is produced and registered <u>exclusively</u> by Kaken Pharmaceutical Co., Ltd. (Kaken). This does <u>not</u> make Polyoxin D zinc salt an antibiotic. Polyoxin D and polyoxin D zinc salt are <u>not</u> antibiotics. Worldwide, polyoxin D and polyoxin D zinc salt have <u>never</u> been marketed for use as pharmaceuticals for use in human medicine or in veterinary medicine. Based upon screening data, polyoxin D has <u>no commercially viable efficacy</u> against tested common human or veterinary pathogens (bacteria, fungi, and yeast).

Reduced Risk Pesticide

Polyoxin D zinc salt is a <u>reduced risk biopesticide</u> for the control of listed fungal pathogens on crops.

- Polyoxin D is <u>naturally occurring</u>. It is a fermentation product of a naturally occurring microorganism (non-GMO).
- Polyoxin D zinc salt has a <u>non-toxic mode of action</u>. It is a competitive enzyme inhibitor and stops the growth and pathogenicity of sensitive crop pathogenic fungi. Polyoxin D zinc salt <u>does not kill the target fungi</u>.

Polyoxin D zinc salt is regulated by the US Environmental Protection Agency's Biopesticide and Pollution Prevention Division, *i.e.*, the <u>same</u> US EPA Division that regulates the NOP <u>non-synthetic</u> active ingredients. The currently permitted NOP synthetic active ingredients:

- Are <u>not</u> considered by the US EPA to be reduced risk pesticides; and
- Are regulated as conventional pesticides by the US EPA Registration Division.

Polyoxin D zinc salt has been classified by NOP as a synthetic substance due to the chemical reaction used to convert polyoxin D to polyoxin D zinc salt. Nonetheless, as a reduced risk biopesticide, polyoxin D zinc salt <u>is in many ways like an NOP non-synthetic pesticide product</u>. During the spring 2013 public hearing, Dr. Davis, a former chair of the NOSB Crops Subcommittee, described polyoxin D zinc salt as a "naturally derived fermentation product with a twist."

Especially Low Risk to Humans from Short-Term and Long-Term Exposure

The US Environmental Protection Agency has determined that the polyoxin D zinc salt 5% suspension concentrate formulation (a.k.a. Veggieturbo and Oso) is practically non-toxic via oral, dermal, and inhalation exposure. Also, it is not irritating. The polyoxin D zinc salt 5% SC formulation does not cause eye irritation or skin irritation. The risk from short term exposure is so low that <u>EPA does not require a</u> <u>first aid statement</u> for the polyoxin D zinc salt 5% SC formulation.

The US Environmental Protection Agency has determined that the polyoxin D zinc salt has no toxicological end-point to use in a human risk assessment. Polyoxin D zinc salt:

- Does <u>not</u> cause genetic damage (is <u>not</u> mutagenic);
- Does <u>not</u> cause birth defects (is <u>not</u> teratogenic);
- Does <u>not</u> cause infertility (is <u>not</u> a reproductive toxin);
- Does <u>not</u> cause cancer (is <u>not</u> carcinogenic);
- Does <u>not</u> cause adverse effects on the nervous system (is <u>not</u> neurotoxic);
- Does <u>not</u> cause adverse effects on the immune system (is <u>not</u> immunotoxic); and
- Does <u>not</u> cause adverse effects in any organ system (is <u>not</u> chronically toxic).

Low Environmental Exposure

The polyoxin D zinc salt 5SC formulation is effective at low application rates. The maximum application rate is 13 fl oz formulation/acre (equivalent to <u>0.045 Ib Al/acre</u>). By comparison:

- Nu Cop 50 WP (EPA Reg. No. 45002-7) containing 77% (w/w) copper hydroxide is applied to grapes at a maximum of 2 lb/acre (equivalent to <u>1.54 Ib Al/acre</u>; and
- Micro Sulf (EPA Reg. No. 55146-7) containing 80% sulfur is applied to grapes at a maximum rate of 10 lb formulation/acre (equivalent to <u>8.0 Ib Al/acre</u>).

Therefore, the polyoxin D zinc salt application rate is <u>significantly lower</u> (34 times lower and 178 times lower in these examples) than some example OMRI-listed alternative products on an active ingredient basis.

Rapid Environmental Degradation

The US Environmental Protection Agency has determined that the polyoxin D zinc salt degrades rapidly in water and soil under normal environmental conditions. Therefore, polyoxin D zinc salt will not accumulate in the environment. Polyoxin D degrades to a small organic molecule first identified in dog urine. This degradate is absorbed by roots and serves as a crop nutrient. The zinc in polyoxin D zinc salt is applied at a micronutrient level that is beneficial to plants.

The US Environmental Protection Agency has determined that polyoxin D zinc salt:

- Is practically non-toxic to birds, algae, honey bees;
- Is moderately toxic to fish and aquatic invertebrates; and
- Does <u>not</u> pose a risk to surface water or groundwater when used as directed.

Risk is the product of Hazard and Exposure.

Risk = Hazard x Exposure.

Given the low application rate and rapid degradation rate of polyoxin D zinc salt, *i.e.*, <u>low</u> <u>environmental exposure</u>, the US EPA has determined that the polyoxin D zinc salt has <u>low</u> <u>environmental risk</u>, <u>including for fish and aquatic invertebrates</u>.

Separately, Kaken has conducted additional studies summarized in the May 31, 2016 petition that have determined that polyoxin D zinc salt, when used as directed, <u>does not adversely effect</u>:

- Earthworms;
- Growth or development of ladybird beetles; and
- Beneficial soil fungi.

Its low environmental risk enables polyoxin D zinc salt to play an important role in *integrated pest* <u>management (IPM)</u> programs.

Unique, Non-Toxic Mode of Action and Resistance Management

Polyoxin D zinc salt has a unique, non-toxic mode of action. No other active ingredient registered for use in North America has the same mode of action (FRAC Code 19). This unique, non-toxic mode of action enables polyoxin D zinc salt to play an important role in <u>resistance management</u> programs. In 45 years of commercial use, there have been <u>no reports of pest resistance to polyoxin D zinc salt</u>.

Grower Need

Based upon <u>disease economic significance and efficacy data alone</u>, there is organic grower need for the polyoxin D zinc salt 5SC formulation for treatment of:

- Blueberries for control of:
 - Alternaria blight (Alternaria spp.); and
 - Botrytis blight (*Botrytis cinerea*);
- <u>Caneberries</u> for control of:
 - Botrytis fruit rot (*Botrytis cinerea*); and
 - Powdery mildew (Podosphaera aphanais);
- <u>Cranberries</u> for control of:
 - Cottonball (Monilinia oxycocci); and
 - Fruit rot complex (*Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, and *Physalospora vaccinii*, etc.);
- Grapes for control of:
 - Phomopsis fruit rot (*Phomopsis viticola*);
- <u>Strawberries</u> for control of:
 - Anthracnose fruit rot (*Colletotrichum acutatum*);
 - Gray mold (*Botrytis cinerea*);
 - Leather rot (*Phytophthora cactorum*); and
 - Phomopsis fruit rot (soft rot) (Phomopsis obscurans); and
- <u>Basil</u> for control of:
 - Downy mildew (*Peronospora belbahrii*).

OMRI-listed alternatives initially identified as having comparable or superior efficacy and therefore identified for more detailed comparisons were:

- <u>Blueberries/mummyberry (*Monilinia vaccinii-corymbosi*): Optiva;</u>
- <u>Grapes black rot (*Guignardia bodwellii*)</u>: Badge X2 and Nu-Cop 50 WP;
- <u>Grapes/bunch rot (*Botrytis cinerea*)</u>: Double Nickel 55 and Double Nickel LC;
- <u>Grapes/downy mildew (*Plasmopara viticola*)</u>: Badge X2, Cueva, and Oxidate;
- <u>Grapes/powdery mildew (Erysiphe necator)</u>: Micro Sulf, Lifegard WG and Stargus; and
- <u>Strawberries/Phomopsis leaf spot (Phomopsis obscurans)</u>: Cueva.

Based upon more detailed analysis for other crop/disease combinations for berries and small fruits, there is organic grower need for:

- <u>Blueberry/mummyberry control</u>. Compared to Optiva, the polyoxin D zinc salt 5SC formulation offers organic blueberry growers:
 - Competitive efficacy for control of mummyberry;
 - A treatment option *after* mummyberry is first observed;
 - Competitive worker and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grape/black rot control</u>. Compared to Badge X2 and Nu-Cop 50 WP, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive efficacy for control of black rot;
 - Greater crop, worker, and environmental safety;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop (0-day PHI instead of 1-day; 4-hour worker re-entry interval instead of 48-hours or 24-hours);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grape/bunch rot control</u>. Compared to Double Nickel 55 and Double Nickel LC, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of bunch rot;
 - A treatment option <u>after</u> bunch rot is first observed;
 - Competitive worker and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

- <u>Grape/downy mildew control</u>. Compared to Badge X2, Cueva, and Oxidate, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of downy mildew;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Greater to significantly greater crop, worker, and environmental safety;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grape/powdery mildew control</u>. Compared to Micro Sulf, Lifegard WG and Stargus, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of powdery mildew;
 - A treatment option *after* powdery mildew is first observed;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Competitive or superior crop, worker, and environmental safety;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
 - Increased applicator comfort (no respirator is required as is required for Lifegard WG and Stargus);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Strawberry/Phomopsis leaf spot (blight)</u>. Compared to Cueva, the polyoxin D zinc salt 5SC formulation offers organic strawberry growers:
 - Competitive efficacy for control of Phomopsis leaf spot;
 - A treatment option <u>after</u> Phomopsis leaf spot is first observed;
 - Competitive or superior crop, worker, and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM);
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

Please note:

- For scheduling reasons, the grower needs analysis is limited to berries and small fruits and basil. Similar results are anticipated if other crop/disease combinations were analyzed.
- There is no EPA registered, OMRI-listed alternative for treatment of cranberries for control of cottonball (*Monilinia oxycocci*).

Compatibility with OMRI-Listed Alternative Products

The polyoxin D zinc salt 5SC formulation, when added to a treatment program, provides <u>superior</u> <u>control</u> of blueberry mummyberry fruit infections (fruit strikes) than when the following products are used alone:

- Actinovate (containing *Streptomyces lydicus* WYEC 108; no FRAC Code; biological);
- Double Nickle LC (containing *Bacillus amyloliquefaciens* strain 747; FRAC Code 44);
- Regalia (containing *Reynoutria sachalinensis* extract; FRAC Code P5), and
- NovaSource's Lime-Sulfur (containing calcium polysulfide; FRAC Code M2).

Kaken does <u>not</u> recommend the use of polyoxin D zinc salt as a tank-mix partner or as part of a treatment program with products containing *Trichoderma* fungi (Bio-Tam and RootShield).

No Non-Synthetic Alternative

For a pesticide product to be used in the United States, it must be registered by the U.S. Environmental Protection Agency (US EPA). The registration includes detailed descriptions of the starting materials, production process, and final product specifications plus a large volume of human and environmental safety data. These details are fixed for polyoxin D zinc salt.

Polyoxin D (without the zinc) is <u>not</u> a non-synthetic alternative to polyoxin D zinc salt. Polyoxin D (without the zinc) is <u>not</u> a US EPA registered pesticide. The time and expense of pursuing such a registration would be prohibitive. Even if this were not the case, commercially significant efficacy would first need to be demonstrated.

Crop Residue and Export Considerations

The US EPA has established a tolerance exemption for residues of polyoxin D zinc salt for all crops (preharvest and post-harvest) treated according to good agricultural practice (40 CFR §180.1285).

Crops grown in the United States using the polyoxin D zinc salt 5SC formulation according to the US EPA registered label may be exported to:

- Canada;
- Mexico;
- New Zealand;
- South Korea; and
- Taiwan.

These countries have made similar low risk determinations for polyoxin D zinc salt and have enacted regulations that are similar to EPA's tolerance exemption. Numerical maximum residue limits (MRLs) have not been established.

Kaken is pursuing additional imported crop authorizations for polyoxin D zinc salt that are similar to the US EPA's tolerance exemption. Applications to permit importation of crop commodities treated with polyoxin D zinc salt are pending or in preparation. The list of pending applications include the European Union.

Cultural Practices

Kaken proposes that the inclusion of the allowed synthetic active ingredients listed in 7 CFR \$205.601(i), by itself, is evidence that cultural practices alone are <u>not</u> sufficient to address organic grower needs.

<u>Use of Polyoxin D Zinc Salt as Part of Resistance Management Programs and Integrated Pest</u> <u>Management (IPM) Programs</u>

In the efficacy trials, the polyoxin D zinc salt 5SC formulation was applied application after application. This is an *artificial* design to demonstrate efficacy for each crop/disease combination. Kaken intends that the polyoxin D zinc salt 5SC formulation, when used commercially, will be:

- Rotated and/or tank-mixed with other products with different modes of action; and
- Part of thoughtfully designed resistance management programs and integrated pest management (IPM) programs.

Level Playing Field

Kaken proposes that the National Organic Standards Board and the National Organic Program should have a level playing field when considering proposed additions to the list of synthetic substances allowed for use in organic crop production. The criteria used in the evaluation of polyoxin D zinc salt should be no more restrictive than those applied to the synthetic substances currently listed in 7 CFR \$205.601(i) as permitted in organic agriculture for use on crops as plant disease control.

INTRODUCTION

On May 31, 2016, Kaken Pharmaceutical Co., Ltd. to the National Organic Program (NOP) a Petition to Amend 7 CFR §205.601 to Add Polyoxin D Zinc Salt as a Synthetic Substance Allowed for Use In Organic Crop Production (May 31, 2016).

The purpose of this addendum is to update the May 31, 2016 petition to:

- Propose new uses for organic growers consistent with the January 3, 2018 EPA stamped accepted label; and
- Provide:
 - The most recent stamped accepted label for VEGGIETURBO 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4; January 3, 2018);
 - Summaries of new efficacy data for the polyoxin D zinc salt 5SC formulation;
 - Summaries of published efficacy data for US EPA registered OMRI-listed alternative products;
 - An update regarding international regulatory approvals for imported crop commodities; and
 - An updated rationale for approval of the petition.

US EPA STAMPED ACCEPTED LABEL

The current label for Veggieturbo 5SC Suspension Concentrate Fungicide was stamped Accepted by the US EPA on January 3, 2018 and includes many new uses. Please see Appendix 1 for a copy of the EPA stamped accepted label.

NEWLY PETITIONED USES

The proposed new uses of the polyoxin D zinc salt 5SC formulation for use in organic production are use on:

- <u>Grapes</u> for treatment of:
 - Black rot (*Guignardia bodwellii*);
 - Downy mildew (Plasmopara viticola); and
 - Phomopsis fruit rot (*Phomopsis viticola*);
- <u>Strawberries</u> for treatment of:
 - Anthracnose fruit rot (*Colletotrichum acutatum*);
 - Leather rot (*Phytophthora cactorum*);
 - Phomopsis leaf spot (blight) (*Phomopsis obscurans*); and
 - Phomopsis fruit rot (*Phomopsis obscurans*); and
- Basil for treatment of:
 - Downy mildew (*Peronospora belbahrii*).

CROP GROUP 13: BERRIES AND SMALL FRUITS: GRAPES: Black rot (Guignardia bidwellii)

Economic Importance

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Black rot is one of the most serious diseases of grapes in the eastern United States and has the potential to be the "Achilles heel" for organic producers. Fruit rot is the most damaging phase of the disease, but all green tissues of the vine are susceptible to infection. This disease can be especially damaging in organic production because organic-approved fungicides are largely ineffective. Therefore, strict implementation of sanitation practices and other available horticultural techniques is essential, especially on moderately to highly susceptible varieties. Black rot can cause complete crop loss in warm, wet years if it is not properly managed.

<u>Biology</u>

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Infected leaves develop relatively small, brown circular lesions surrounded by distinct dark margins; black, pimplelike fruiting bodies ("pycnidia") are scattered within these spot-like lesions. Black, elongated lesions on petioles (leaf stems) may cause affected leaves to wilt and drop. Large, black, elliptical lesions on infected shoots may contribute to breakage by wind. The disease is most common and damaging on berries which appear chocolate brown when first infected, but soon become dark brown with numerous black, pimple-like pycnidia on the surface. Berries eventually shrivel into hard, black raisin-like mummies, most of which remain firmly attached to the berry stem. The black rot fungus overwinters primarily in these mummified fruit, either on the vineyard floor or in clusters retained within the vine. It can also overwinter within cane lesions when these develop.

Rain triggers the release of infective spores from all sources, and infection occurs if susceptible tissues remain wet for a sufficient length of time, which depends on temperature.

Hours of Leaf Wetness Required for a Black Rot Infection Period At Various Temperatures Following a Rain	
(Source: R. A. Spotts. 1977.	The Ohio State University.)
Temperature (°F)	Hours of Continual Wetness from Rain
50	24
55	12
60	9
65	8
70	7
75	7
80	6
85	9
90	12

Spores within cane lesions are available for infection starting at bud break. However, the majority of overwintering spores in most vineyards (those within mummified fruit on the ground) first become available about 2-3 weeks after bud break, reach peak levels about 1-2 weeks before bloom, and are usually depleted within one to several weeks after the start of bloom, depending on the season. However, in years with dry spring weather when only a few rains occur, the fungus does not discharge all of its spores as early as usual, and significant spore discharge may extend several weeks beyond bloom if this is when rains finally develop.

Pycnidia develop within lesions caused by current season infections and release a new crop of spores during the late spring and summer, beginning about 2-3 weeks after infection first occurs. These secondary rounds of spore release and infection are responsible for disease spread and are the cause of most economic loss when it occurs. Fruit are highly susceptible to infection for the first 2-3 weeks after bloom. They become progressively less susceptible as they continue to develop, finally becoming highly resistant about 5-8 weeks after bloom, depending on the variety and year. In general, "Concord" fruit appear to become resistant about 1-2 weeks earlier than those of Vinifera varieties. Thus, the most critical time to control berry infections is during the first few weeks after the start of bloom.

Cultural Control

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Removal of mummified clusters from the canopy during pruning significantly reduces disease pressure for the coming season; burying mummies on the ground before or soon after budbreak, by cultivation or covering them with mulch, also can contribute to a reduction of inoculum if disease was severe the previous season. CAUTION: When mummified fruit are not dropped to the ground during dormant pruning operations, large numbers of spores will be produced within the canopy throughout the period of berry development. Research has shown that this prolonged period of high spore production, combined with the closeness of the spores to newly-developing berries, significantly increases the pressure for berry rot. <u>Therefore, complete removal of mummies from the canopy is an absolutely critical component of a black rot management program for organic growers.</u> (Emphasis added.)

All fungicides currently approved for organic production are weak against black rot, although copper has moderate efficacy if applied very regularly. Therefore, growers of organic grapes should pay strict attention to the above sanitation procedures, because they are the most important defenses against this disease, which can be the "Achilles heel" of organic grape production in eastern viticulture. Cultural practices that open the canopy also are beneficial because they promote drying and improve spray coverage.

	Management Options (Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)
Scouting/thresholds	Severe loss is usually the result of disease spread within and among clusters after it first gets established on a few berries in the early stages of fruit development. Scout for symptoms of black rot regularly beginning 10 days to 2 weeks after cap fall. Remove diseased clusters and/or consider regular copper applications during wet weather periods on varieties where this material can be used, especially if more than a trace level of disease is found.
Slightly susceptible varieties	Cascade, Cayuga White, Chancellor, Chelois, Corot noir, DeChaunac, Elvira, GR7, Ives, Marquette, Noiret, Traminette, Vidal blanc, and Vignoles.
Cultural management	<u>Sanitation</u> . Remove all mummies from the canopy and drop to the ground during dormant pruning operations. Around bud break, cultivate beneath the vines to bury mummies or cover them with mulch.
	<u>Canopy management</u> . Prune and train the vines to promote air circulation and speed drying of the leaves and fruit. Establish new plantings away from wooded areas, where wild grapes can serve as a source of black rot spores.
Chemical treatment	Copper products on varieties not sensitive to this material.

Management Options

2016 IR-4 Grower Priority

The most recent IR-4 Workshop for prioritization of research to address grower needs for disease control was held September 21, 2016 in Orlando, FL. Black rot control on grapes was identified as a grower need for prioritization (organic category <u>and</u> fruit category).

CROP GROUP 13: GRAPES: Downy mildew (Plasmopara viticola)

Economic Importance

(Source: Ash, G. Downy Mildew of Grape. 2000. *The Plant Health Instructor*. DOI: 10.1094/PHI-I-2000-1112-01. Updated 2005.)

Downy mildew is a highly destructive disease of grapevines in all grape-growing areas of the world where there is spring and summer rainfall at temperatures above 10° C (50° F). Crop losses in individual years can be 100% if the disease is not controlled during favorable weather. Early infection of young bunches can lead to significant crop loss, whereas, severe leaf infection affects the source-sink relationship in the vine and may lead to defoliation and possible sunburn or lack of fruit ripening. This destruction of leaf tissue may affect sugar accumulation and growth in the subsequent season. Currently, there are no suitable sources of resistance in commercially acceptable varieties, so fungicides are the primary means of disease control.

Biology

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Downy mildew is caused by a fungus-like organism that can infect berries, leaves, and young shoots. Leaf lesions appear as yellow or reddish-brown areas on the upper surface, with corresponding white, downy, or cottony fungal growth directly opposite on the lower surface. (Note that downy mildew growth appears only on the lower surface of a leaf lesion and looks cottony, whereas powdery mildew can occur on both sides of the lesion and looks more like baby powder). Leaf lesions become brown and dead with age, and severely infected leaves fall prematurely. Young, infected shoots and cluster stems may curl and are characteristically covered with the white, "downy" growth of the fungus on mornings following rain or dew the night before. Berries on infected cluster stems may fail to set or can turn brown and eventually shrivel, depending on the time of infection. Berries that are directly infected while very young may become entirely covered with a fuzzy white fungal growth when wet from evening rain or early morning dew. Cluster infections that occur later in the season cause berries to remain hard, with a mottled light green to brown or red appearance.

Frequent rainfall and high humidity are the most important environmental factors promoting downy mildew epidemics. The downy mildew organism overwinters as dormant spores within infected leaves on the vineyard floor or (more commonly) within the upper soil layer, and first becomes active in the spring about 2-3 weeks before bloom. Infective spores are then produced during rainy periods if temperatures are above 52°F, and are splashed from the soil onto susceptible tissues to cause the season's first (primary) infections. (Note that inoculum for such early-season infections come strictly from within the vineyard.) Epidemic disease development can then result from repeated cycles of new infections, which are caused by new spores produced within the white fungal growth on diseased tissues. These spores are produced only at night when the relative humidity is extremely high (>95%). They can be blown relatively long distances and cause infection when they land on susceptible tissues that remain wet for just a few hours. (Note that such disease spread can also originate from nearby vines outside the vineyard.)

The generation period for the fungus (time from spore germination and infection to the production of a new "crop" of secondary spores) is only 4 to 5 days at optimum temperatures in the mid- to upper-70s, allowing explosive disease development during extended periods of warm, humid weather with periodic rain showers. On some varieties, including all Vinifera varieties, this can be particularly destructive during the several week period before and after bloom, when fruit clusters are highly susceptible to infection. Young leaves remain highly susceptible to infection so long as they continue to be produced, although even older leaves can become diseased under high-pressure conditions. Uncontrolled infections can cause extensive defoliation in wet years, limiting both fruit ripening and

vine winter hardiness. Winter kill of buds or even entire vines is not uncommon when spraying stops too early on susceptible varieties in a bad downy mildew season. Disease can develop at a wide range of temperatures, from the low 50s to the mid-80s, although the rate of spread is slower while at the edges of the range.

<u>Management</u>

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Downy mildew management programs should focus on:

- Preventing early disease establishment and destructive cluster infections during the pre-bloom and early post-bloom periods; and
- Limiting secondary spread on the foliage during the summer and early fall.

Any practice that improves air circulation and speeds drying within vine canopies will help to control downy mildew.

Because primary infections can first occur 2-3 weeks before bloom, protection may need to start at this time on Vinifera varieties and on highly susceptible hybrid and Labrusca varieties (e.g., Chancellor, Catawba, Niagara) if the weather is wet. This is particularly true if significant disease occurred the previous year which would contribute to high levels of overwintering inoculum within the vineyard. Clusters should be protected on all but the most highly resistant varieties from the immediate prebloom period through the first or second post-bloom spray, depending on the weather.

Continued protection against disease spread during the summer should be based on variety susceptibility, the extent of favorable weather conditions, and the amount of disease already in the vineyard (secondary inoculum). Downy mildew has the potential for "explosive" spread if the disease is active and weather conditions favor its development. However, in many years, hot, drier weather causes the downy mildew fungus to become inactive during mid-summer. Thus, it is worthwhile to scout vineyards during this time for the presence of active disease and to determine the need for protective sprays based on such findings. Also, recognize that fruit lose their susceptibility to infection by midsummer, although protection against leaf infections and consequent defoliation may need to continue throughout the summer, depending on weather conditions.

Downy Mildew Management Options (Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)		
Scouting/thresholds	Scout vineyards in mid-summer for the presence of sporulating lesions that may spread infections to leaves during warm, wet weather.	
Slightly susceptible varieties	Baco noir, Cascade, Chelois, Concord, Foch, Frontenac, Frontenac gris, Himrod, Marquette, Moore's Diamond, Steuben, and Valvin Muscat.	
Cultural management	<u><i>Canopy management</i></u> . Prune and train the vines to promote air circulation, reduce humidity, and speed drying of the leaves and fruit.	
	<u>Vineyard management</u> . Orient rows to improve air movement within the vineyard. Avoid sites prone to fog or heavily wooded areas.	
Chemical treatment	Copper products are very effective, although they must be reapplied frequently (7-day to 10-day intervals) during periods of wet weather to provide continued protection.	

2016 IR-4 Grower Priority

The most recent IR-4 Workshop for prioritization of research to address grower needs for disease control was held September 21, 2016 in Orlando, FL. Downy mildew control on grapes was identified as a grower need for prioritization (fruit category).

CROP GROUP 13: GRAPES: Phomopsis Fruit Rot (Phomopsis viticola)

Economic Importance

(Source: Wayne F. Wilcox, Grape Disease Control, 2015. Cornell University.)

Wayne F. Wilcox of Cornell University reported that over the years, he believes he has seen Phomopsis cause more pronounced economic loss on Concord and (especially) Niagara grapes than any other disease. Most hybrid and *V. vinifera* cultivars are susceptible as well, and whereas they tend to be less problematic in the vast majority of these commercial blocks for several reasons, that does not have to be true.

Biology

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Phomopsis cane and leaf spot and fruit rot are most likely to become problems when the Phomopsis fungus is allowed to build up on dead canes or pruning stubs in the vines and effective early-season sprays for this disease are omitted. In conventionally managed vineyards, economic losses have been especially severe on Niagara, and to a lesser extent, Concord, although many other Labrusca, hybrid, and Vinifera varieties are susceptible as well.

Infected rachises and shoots develop black lesions that may split the green tissue (shoots) or appear sunken (rachises). Numerous lesions give the shoot surface a blackened, scabby appearance, and may coalesce to girdle the rachises. Severe infection weakens the tissues at these spots and can cause infected shoots to break off during high winds, or infected clusters to break before and during harvest. Small, pinprick-sized lesions, with brown or black centers surrounded by a small and often yellow margin, can be numerous on the leaves early in the season. These infections cause little harm themselves, but provide a good indication that the fungus is present in the vine and capable of causing more serious losses on other organs if not effectively managed.

Infected berries remain symptomless until late summer or pre-harvest, when they turn brown, often beginning at the point of attachment to the pedicel (berry stem) and become covered with black, pimple-like fruiting bodies. Such berries eventually shrivel up into raisin-like "mummies", at which time they look very similar to berries infected with black rot. On fruit, the two diseases are best distinguished by the initial location, timing, and development of symptoms. Phomopsis lesions typically (but not always) start where the berry is attached to its stem, whereas black rot lesions start at random locations on the fruit. Also, Phomopsis lesions do not appear until late summer or early fall on the fruit, often just before harvest. In contrast, most black rot symptoms appear by late July or early August, and all diseased berries should be evident by veraison. Finally, berries infected with Phomopsis are usually quite easy to detach from their stem by lightly touching them or giving a gentle pull, whereas those with black rot typically remain attached firmly to the berry stem.

Black fruiting bodies of the Phomopsis fungus overwinter in infected wood (diseased canes or pruning stubs) and rachises. During wet periods, spores ooze from the fruiting bodies and are distributed by raindrops onto nearby susceptible tissues. For this reason, young shoots and clusters directly beneath old canes and pruning stubs are at greater risk than those that are trained to grow above these sources.

Extended periods of wet weather are particularly favorable for disease development. Shoot and leaf infections can occur anytime between bud break and early summer, although they are most common during the first few weeks of growth. Shoot and leaf lesions appear within 3 to 4 weeks after infection, but they do not serve as a source of disease spread during the current season. Rachises can be infected anytime after the young clusters first emerge until fungal spores are depleted in early

summer, although infections that occur soon after cluster emergence in the early growing season are the most damaging. Infections that occur on the pedicels (berry stems) during this period can also move into the fruit, causing them to rot before harvest.

Fruit appear to be most susceptible to direct infection from bloom through pea-sized berries, after which few spores are available for new infections. Fruit infection occurs sporadically, since it requires extended periods of rain and wetness. However, serious losses can result if the growing season is excessively wet and protection is not maintained with an effective Phomopsis fungicide from the early shoot growth period through fruit set.

Disease Management

(Source: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)

Diseased canes should be removed during pruning to reduce inoculum. Research has shown that dead canes and pruning stubs can produce extremely high levels of Phomopsis spores, and these sources should be specifically targeted for removal as part of a Phomopsis management program. Recent research from Ohio suggests that when inoculum is present, moderately-severe infection can develop after about 26 hours of wetness at an average temperature of 48°F, 16 hours at 54°F, and 12 hours at 60-68°F (shorter and longer periods of wetness should reduce and increase disease severity, respectively).

Copper and sulfur are only weakly effective; thus, organic growers should pay strict attention to the removal of infected wood from within the canopy.

(Sourc	Phomopsis Management Options e: 2015 Organic Production and IPM Guide for Grapes. Cornell University Cooperative Extension.)
Scouting/thresholds	Note "hot spots" of disease activity within individual vines; try to identify the likely source of the fungus causing these infections (pruning stubs, dead canes) and target for removal.
Slightly susceptible varieties	Baco Noir, Cayuga White, Elvira, GR7, Marquette, Marquis, Vanessa, Ventura, and Vidal blanc.
Cultural management	 <u>Sanitation</u>. Remove all dead wood, infected wood and pruning stubs from the canopy during dormant pruning operations. <u>Canopy management</u>. Prune and train the vines to promote air circulation and speed drying of the shoots and clusters. In some instances performing "cane pruning" rather than "spur or cordon pruning" in vinifera and hybrids will result in ensuring new wood is laid down on the fruiting wire every year. <u>Vineyard management</u>. Orient rows to improve air movement within the vineyard.
Chemical treatment	<u>Copper and sulfur are weakly effective and may cause injury on sensitive</u> <u>varieties.</u> Early-season copper use may also injure more tolerant varieties if applied under cool and/or humid, slow-drying conditions. (Emphasis added.)

2016 IR-4 Grower Priority

The most recent IR-4 Workshop for prioritization of research to address grower needs for disease control was held September 21, 2016 in Orlando, FL. Phomopsis control on grapes was identified as a grower need for prioritization (fruit category).

CROP GROUP 13: STRAWBERRIES: Anthracnose Fruit Rot (Colletotrichum acutatum)

<u>Economic Importance</u> (Source: Averre, C.W., Jones, R.K., and Miholland, R.S., Strawberry Diseases and Their Control, North Carolina State Extension)

Anthracnose fruit rot (*Colletotrichum acutatum*) can be a very destructive disease on California cultivars grown on black plastic. It has been reported to cause 60-75% fruit loss. The disease is most destructive during warm, wet weather. During warm wet periods, on a highly susceptible cultivar such as Pajaro or Chandler, anthracnose can be extremely difficult to control.

Pathogens

(Source: Strawberry Anthracnose. U Massachusetts Extension. A. Madeiras, 2016)

Anthracnose is a general term for diseases caused by species of the fungus *Colletotrichum*. In the Northeast, anthracnose of strawberries is caused by *Colletotrichum acutatum*, which can infect all parts of the plant. *Colletotrichum acutatum* has become increasingly troublesome since it was first identified in the US in 1986. Fruit rot is of particular concern as the fruit is rendered unmarketable. *Colletotrichum fragariae* and *Colletotrichum. gloeosporioides* are more commonly associated with a lethal crown rot, but these species are more common in warmer climates. *Colletotrichum acutatum* is endemic in the Northeast, but may also be brought in on infected transplants.

Signs and Symptoms

(Source: Strawberry Anthracnose. U Massachusetts Extension. A. Madeiras, 2016)

All three *Colletotrichum* species associated with strawberry anthracnose can cause leaf spots and/or dark lesions on petioles and stolons, crown infections, flower blight, and fruit rot. Leaf spots caused by *Colletotrichum acutatum* are brown to black and often more numerous along leaf tips and margins. The spots differ somewhat from the randomly distributed gray to black spots caused by *Colletotrichum fragariae* or *Colletotrichum gloeosporioides*. Petioles and stolons may become girdled, causing death of leaves and daughter plants. Open flowers are more susceptible to blight than closed buds.

Anthracnose can also affect fruit at any stage of development from flowering to harvest. On fruit, symptoms may begin as small light colored or water-soaked lesions a few millimeters in diameter. These lesions grow progressively larger and darker as they mature and end as sunken black spots. After a few days, salmon-colored masses of conidia appear in the lesions. Fruit may eventually become shrunken and mummified. Crowns infected by *Colletotrichum* species will be firm and reddish-brown inside. The discoloration may be uniform or show light and dark brown streaks. *Colletotrichum acutatum* is capable of causing crown infections, but plants usually survive, remain stunted, and produce few berries. Crown infections may occur in the nursery, but can remain latent until well after planting. *Colletotrichum acutatum* can also cause root lesions.

Life Cycle

(Source: Strawberry Anthracnose. U Massachusetts Extension. A. Madeiras, 2016)

Colletotrichum acutatum survives winter in plant debris, particularly mummified fruit. Primary inoculum is produced in spring. The optimum temperature for disease development is about 27°C ($80^{\circ}F$). However, the fungus can infect fruit at lower temperatures, and spring infections may remain latent until warm, wet conditions induce disease development. Lesions produce conidia that may continue the infection process throughout the growing season. The time from infection to first sporulation is 7-11 days at 5°C and 2-3 days at 25°C. The fungus can produce conidia at temperatures from 5-35°C, though production is most abundant at 22-26°C. An adequate period of surface

wetness is also required for infection. At 25-30°C, infection occurs in less than 24 hours, but at lower temperatures, a longer wetness period is required. Spores are most often spread by splashing rain, but they may also be transported by insects, animals, and farm workers. Although *Colletotrichum acutatum* has a wide host range that includes many fruit, vegetable, and weed species, research suggests that strains of *Colletotrichum acutatum* that are pathogenic on strawberries are relatively host specific.

<u>Management</u>

Strawberry/Anthracnose Management Options (Source: 2016 Organic production and IPM Guide for Strawberries, Cornell Cooperative Extension)		
Scouting/Thresholds	None established.	
Variety susceptibility	No known resistance varieties. 'Jewel' shows little infection in field conditions.	
Cultural management	 Provide good air circulation by controlling weeds and reducing planting density. Use of protected production structures, such as low tunnels, reduces anthracnose occurrence by limiting fruit wetness. The anthracnose fungus is spread throughout a planting by splashing raindrops or sprinkler irrigation. Straw mulch may reduce the rate of disease spread relative to bare ground (less rain splash). 	
Chemical treatment	See table below.	

(Source: Strawberry Anthracnose. U Massachusetts Extension. A. Madeiras, 2016)

Both organic and conventional fungicides are more effective when applied preventatively. OMRI approved products include Cease (*Bacillus subtilis* QST 713), which has been shown to provide some protection from fruit rot. Copper and sulfur based compounds are also available. However, neither is very effective for anthracnose control and both can be phytotoxic under certain conditions.

CROP GROUP 13: STRAWBERRIES: Leather Rot (Phytophthora cactorum)

Economic Importance

(Source: Leather Rot of Strawberry, Michael A. Ellis, Department of Plant Pathology, Ohio State University Extension)

Leather rot of strawberry has been reported in many regions of the United States. In many areas, it is considered a minor disease of little economic importance. However, excessive rainfall during May, June and July can lead to severe losses in fruit yield and quality resulting from leather rot. Commercial growers in Ohio have lost up to 50 percent of their crop to leather rot. The leather rot fungus primarily attacks the fruit, but many also infect blossoms.

(Source: Leather Rot of Strawberry, NC State Extension, https://content.ces.ncsu.edu/leather-rot-of-strawberry)

Leather rot, caused by *Phytophthora cactorum*, may cause substantial losses of fruit yield in wet years, and is particularly troublesome for pick-your-own operations, where undetected diseased fruit mixed in with healthy fruit may result in bitter tasting jams and jellies. Leather rot has been recorded only once since 1997 in plasticulture systems but may be a problem in matted row systems. *Phytophthora* spp. may also cause crown rot of strawberry, although these two diseases do not necessarily occur together.

Description

(Source: 2016 Organic Production and IPM Guide for Strawberries, Cornell Cooperative Extension)

Leather rot is caused by *Phytophthora cactorum*. Infected areas on immature fruit are brown, whereas those on maturing fruit appear bleached out. On all fruit, the infected areas are tough, leathery, and discolored on the inside as well as the outside of the fruit. Diseased fruits have a pungent smell and bitter taste. Leather rot is most severe during periods of abundant warm rains during the fruiting period and in flooded soils. The cultural practices listed in the table below are the most effective control procedures.

Management Options

(Source: 2016 Organic Production and IPM Guide for Strawberries, Cornell Cooperative Extension)

Leather Rot Management Options	
Scouting/thresholds	None established.
Variety susceptibility	No known resistant varieties.
Cultural management	 Plant only on a well-drained site or provide supplemental drainage. Growing strawberries on raised beds will also reduce disease severity. Minimize soil flooding through site selection; by avoiding planting in ruts; and by preventing or reducing soil compaction. Provide an extra layer of straw mulch between rows throughout the fruiting season. The mulch provides a physical barrier between the soilborne pathogen and the susceptible fruit.

Listing a pest on a pesticide label does not assure the pesticide's effectiveness.

CROP GROUP 13: STRAWBERRIES: Phomopsis Leaf Spot/Blight and Fruit Rot (Soft Rot) (*Phomopsis obscurans*)

Economic Importance

(Source: N. A. Peres, 2015 Florida Plant Disease Management Guide: Strawberry, Univ. of Florida IFAS Extension)

Phomopsis leaf blight and Phomopsis soft rot, caused by *Phomopsis obscurans*, can occasionally cause serious problems on strawberry, especially on plants propagated in nurseries from the southeastern United States.

<u>Biology</u>

(Source: 2016 Organic Production and IPM Guide for Strawberries, Cornell University Cooperative Extension)

Leaf lesions begin as small, circular to irregular, reddish, or purplish spots. As they expand, lesion centers become necrotic and turn light brown with a dark purple halo. Older lesions along major leaf veins develop into large V-shaped lesions that eventually kill the leaf. Heavy leaf infections can inhibit the production of flower buds for the following year, predispose a plant to winter injury, and provide inoculum for infection of the fruit caps. Fruit may also be infected in some instances.

Management Options

Phomopsis Leaf Blight (<i>Phomopsis obscurans</i>) Management Options (Source: 2016 Organic Production and IPM Guide for Strawberries, Cornell University Cooperative Extension)		
Scouting/thresholds	None established	
Variety susceptibility	There are no reports of cultivar resistance to leaf blight but Jewel shows low infection rates.	
Cultural management	Destroying infected leaves at renovation (e.g., mowing and burying) will reduce the amount of carry-over inoculum. Promoting air circulation (plant spacing and weed control) will reduce foliage drying time and limit infection periods.	
Chemical treatment	An early season fungicide application is recommended when carry-over inoculum from the previous year is high or conditions are favorable for disease development.	

Listing a pest on a pesticide label does not assure the pesticide's effectiveness.

CROP GROUP 19: HERBS AND SPICES

CROP GROUP 19: BASIL: Downy Mildew (Peronospora belbahrii)

Economic Importance

[Source: Michelle Grabowski, Basil Downy Mildew, University of Minnesota Extension. (Not dated.)]

Basil downy mildew was first officially identified in Minnesota in 2012. Under the right weather conditions, basil downy mildew can spread rapidly and result in complete yield loss. Although *Peronospora belbahrii*, the pathogen that causes basil downy mildew, cannot survive MN's winters, it can be reintroduced on infected seed or transplants or by windblown spores.

Identification

[Source: Michelle Grabowski, Basil Downy Mildew, University of Minnesota Extension. (Not dated.)]

- Infected leaves first turn yellow in areas restricted by major veins. With time, the entire leaf turns yellow.
- Irregular black spots appear on infected leaves as they age.
- Fluffy gray spores grow on the underside of infected leaves.
- Infection starts on lower leaves and moves up the plant.

Biology

[Source: Michelle Grabowski, Basil Downy Mildew, University of Minnesota Extension. (Not dated.)]

Peronospora belbahrii, the pathogen that causes basil downy mildew, can be carried on seed, transplants, or fresh leaves. Infected transplants and leaves may not show symptoms if maintained in cool dry conditions. Spores of *Peronospora belbahrii* can also travel long distances on moist air currents. *Peronospora belbahrii* tolerates cool weather and can infect and produce spores in temperatures as low as 59°F. The pathogen, however, thrives in warm, humid conditions. As a result, the most devastating damage is often seen in late summer.

Peronospora belbahrii needs two different mating types to produce tough resting spores known as oospores. Currently, only one mating type has been found in the USA. As a result, no oospores are formed, and the pathogen will not be able to survive Minnesota's harsh winters. This may change if the second mating type is introduced.

Management

[Source: Michelle Grabowski, Basil Downy Mildew, University of Minnesota Extension. (Not dated.)]

Resistant Varieties

There are no resistant varieties of sweet basil (*Ocimum basilicum*) available. Commercially popular varieties are highly susceptible. Lower disease levels have been observed in red leaf basil varieties (*Ocimum basilicum purpurescens*) and in lemon flavored varieties (*Ocimum citridorum*). Only varieties of *Ocimum americanum* have shown no symptoms or sporulation when inoculated with downy mildew.

Varieties with no to low disease are not necessarily good substitutes for susceptible sweet basil varieties. They often have different leaf color and flavor, dramatically affecting the final product. Growers should choose the most resistant variety that is acceptable to their market. Breeders are working to combine the flavor and other characteristics of sweet basil with the resistance found in other species of *Ocimum*.

Cultural Control

Peronospora belbahrii is carried on seed. All seedlings and transplants should be monitored closely for yellowing leaves and gray downy growth on the lower surface of the leaf. If basil downy mildew is identified on any plant, it should be removed and destroyed immediately.

Increase row width and distance between plants to provide good air movement between plants to allow leaves to dry quickly after rain, dew or irrigation. Use drip irrigation if possible. If sprinkler irrigation is the only option, water deeply and infrequently early on a sunny day so leaves dry quickly in the sun. In greenhouse production, adjust ventilation to reduce humidity.

Diseased plants that are past harvest should be promptly tilled under to reduce the spread of the pathogen from one plant to another through spores produced on infected leaves.

Fungicides

Certain fungicides can protect plants from basil downy mildew but sprays must begin before infection occurs to be effective. *Peronospora belbahrii* is not a true fungus but rather a member of the Oomycota. As a result, many common fungicides provide no control against downy mildew. In one study, extreme periods or rainy wet weather resulted in no control by any fungicide combination.

2016 IR-4 Grower Priority

The most recent IR-4 Workshop for prioritization of research to address grower needs for disease control was held September 21, 2016 in Orlando, FL. Downy mildew control on basil was identified as a grower need for prioritization (vegetable category) and was selected as an "A priority" (highest priority category) for funding.

EFFICACY DATA FOR THE POLYOXIN D ZINC SALT 5SC FORMULATION

During the April 2013 public heading before the NOSB regarding polyoxin D zinc salt, a member of the NOSB commented that the NOSB needed to receive and review efficacy data for polyoxin D zinc salt to confirm that it works. Also, California registrations was <u>not</u> considered by the NOSB to be sufficient documentation of efficacy.

A "map" for the location of trial-by-trial efficacy summaries included in the May 31, 2017 petition and this addendum is provided below. Uses are organized by crop group number and then alphabetically by the disease common name. New efficacy trials have focused on berries and small fruits (Crop Group 13).

"Ma	ap" of Summarized Efficacy Trial	s that Included the	e Polyoxin D Zinc Sa	lt 5SC F	ormulation	
Disease	Pathogen	Crop Tested and Trial Sequence	May 31, 201 Petition	6	February 2, 201 Addendum	8
		No. for Crop/Disease	Trial No.	Page No.	Trial No.	Page No.
Crop Group 1: Root ar	nd Tuber Vegetables					
Botrytis Vine Rot, Gray Mold, Tan Spot	Botrytis cinerea	Potatoes #1	CER-2011-029	148		
Early Blight	Alternaria solani	Potatoes #1	CER-2011-029	90		
		Potatoes #2	CER-2011-030	92		
		Potatoes #3	CER-2012-028	94		
Late Blight	Phytophthora infestans	Potatoes #1	CER-2012-027	321		
Crop Group 4: Leafy V	egetables (except Brassica Vege	tables)				
Downy Mildew	Bremia lactucae	Lettuce #1	CER-2011-046	177		
		Lettuce #2	CER-2013-014	179		
		Lettuce #3	CER-2013-032	181		
Gray Mold	Botrytis cinerea	Lettuce #1	CER-2011-014	141		
Powdery Mildew	Golovinomyces cichoracearum	Lettuce #1	CER-2012-074	267		
White Rust	Albugo occidentalis	Spinach #1	CER-2014-063	81		
		Spinach #2			CER-2015-152	64
Crop Group 8: Fruiting	g Vegetables	•	•		•	
Early Blight	Alternaria solani and A. tomatophila	Tomatoes #1	CER-2014-095	102		
Late Blight	Phytophthora infestans	Tomatoes #1	CER-2011-027	326		
Powdery Mildew	Leviellula taurica	Tomatoes #1	CER-2012-016	270		
	Odium neolycopersici	Tomatoes (GH) #1	BCGGA-2015-03	310		
Target Spot	Corynespora cassiicola	Tomatoes #1	CER-2014-095	213		
Crop Group 9: Cucurb	it Vegetables	•				•
Anthracnose	Colletotrichum orbiculare	Cucurbits #1	CER-2014-057	209		
Downy Mildew	Pseudoperonospora cubensis	Cucumber #1	CER-2012-067	394		
		Pumpkin #1	CER-2015-145	396		
Gummy Stem Blight	Didymella bryoniae	Cantaloupe #1	IND-2012-125	219		
		Cucumber #1	BCGGA-2015-02	221		
		Watermelon #1	CER-2011-028	224		
		Watermelon #2	CER-2012-051	226		
Powdery Mildew	Podosphaera xanthii	Cucumber #1	R-14-10-0	381		
		Pumpkin #1	CER-2015-145	383	1	
		Pumpkin #2	CER-2015-149	385	1	
Southern Blight	Sclerotinium rolfsii	Squash #1	CER-2012-050	400		1

"Maj	p" of Summarized Efficacy Tria	ls that Included the	Polyoxin D Zinc Sa	lt 5SC F	ormulation	
Disease	Pathogen	Crop Tested and Trial Sequence	May 31, 201 Petition	6	February 2, 2018 Addendum	3
		No. for Crop/Disease	Trial No.	Page No.	Trial No.	Page No.
Crop Group 11: Pome F	ruits					
Fly Speck	Zygophiala jamaicensis	Apples #1	CER-2012-025	415		
Powdery Mildew	Podosphaera leucotricha	Apples #1	CER-2012-020	362		
		Apples #2	CER-2015-012	364		
		Apples #3	CER-2015-034	366		
		Apples #4			CER-2015-033	66
Sooty Blotch Complex	Geastrumia polystigmatus, Leptodontium elatus, and Peltaster fructicola	Apples #1	CER-2012-025	258		
Scab	Venturia inaequalis	Apples #1	CER-2012-025	409		
Crop Group 12: Stone F	ruits					1
Brown Rot Blossom	Monilinia fructicola and	Cherries #1	CER-2015-035	283		
Blight	Monilinia laxa	French Prune #1	CER-2013-121	285		
Fruit Brown Rot	<i>Monilinia fructicola</i> and <i>Monilinia Iaxa</i>	Nectarine #1 and Peach #1	CER-2013-119	287		
Powdery Mildew	Podosphaera clandestina	Cherries #1	CER-2015-032	352		
		Cherries #2			CER-2015-035	68
Crop Group 13: Berries	and Small Fruits: Blueberries					1
Alternaria Fruit Rot	Alternaria spp.	Blueberries #1	CER-2012-049	107		
Botrytis Blight	Botrytis cinerea	Blueberries #1	CER-2015-009	116		
Mummyberry	Monilinia vaccinii-corymbosi	Blueberries #1	CER-2015-008	299		
		Blueberries #2	CER-2015-143	301		
		Blueberries #3			KAK-2016-Blueberry- MI	70
		Blueberries #4			KAK-2016-Blueberry- WA-Conv	74
		Blueberries #5			KAK-2016-Blueberry- WA-Org	76
		Blueberries #6			KAK-2017-Blueberry- WA-Org	79
Crop Group 13: Berries	and Small Fruits: Caneberries	•	•	•	•	•
Botrytis Fruit Rot &	Botrytis cinerea	Raspberries #1	IND-2015-RASP	155		
Cane Botrytis		Raspberries #2			IND-2016-Rasp-WA	82
		Raspberries #3			KAK-2017-Rasp-MI	84
Powdery Mildew	Podosphaera aphanis	Blackberries #1	CER-2012-060	331		
		Raspberries #1			KAK-2017-Rasp-MI	86
Crop Group 13: Berries	and Small Fruits: Cranberries					
Cottonball	Monilinia oxycocci	Cranberries #1	IND-2014-165	292		
		Cranberries #2	IND-2015-208	294		
		Cranberries #3			11:SMF011 (2016; WI)	88
Fruit Rot Complex	Coleophoma empetri, Colletotrichum acutatum,	Cranberries #1	IND-2014-166	191		
	Colletotrichum gloeosporioides,	Cranberries #2	CER-2015-104	193		
	Phyllosticta vaccinii, and Physalospora vaccinii, etc.	Cranberries #3			11:SMF011 (2016; WI)	90

"Ma	p" of Summarized Efficacy Tri	als that Included the	Polyoxin D Zinc Sal	t 5SC F	ormulation	
Disease	Pathogen	Crop Tested and Trial Sequence	May 31, 2016 Petition		February 2, 2018 Addendum	
		No. for Crop/Disease	Trial No.	Page No.	Trial No.	Page No.
Crop Group 13: Berries	and Small Fruits: Grapes	-	•	-	•	-
Black Rot	Guignardia bidwellii	Grapes #1			KAK-2016-Grape-MI	31
		Grapes #2			KAK-2017-Grape-MI	33
		Grapes #3			KAK-2016-Grape-PA	35
		Grapes #4			KAK-2017-Grape-PA	37
Bunch Rot	Botrytis cinerea	Grapes #1	CER-2013-002	124		
		Grapes #2	CER-2013-021	126		
		Grapes #3	CER-2014-045	128		
		Grapes #4	CER-2015-115	131		
		Grapes #5	CER-2015-140	134		
		Grapes #6			9:SMF011	94
Downy Mildew	Plasmopara viticola	Grapes #1			KAK-2016-Grape-MI	39
		Grapes #2			KAK-2017-Grape-MI	41
Phomopsis Fruit Rot	Phomopsis viticola	Grapes #1			KAK-2016-Grape-MI	43
		Grapes #2			KAK-2017-Grape-MI	46
Powdery Mildew	Erisyphe necator	Grapes #1	CER-2011-013	241		
		Grapes #2	CER-2012-069	244		
		Grapes #3	CER-2013-021	247		
		Grapes #4	CER-2015-019	249		
		Grapes #5	CER-2015-140	252		
		Grapes #6			KAK-2016-Grape-MI	96
		Grapes #7			KAK-2017-Grape-MI	99
		Grapes #8			KAK-2017-Grape-PA	101
Crop Group 13: Berries	and Small Fruits: Strawberrie	s				
Anthracnose Fruit Rot	Colletotrichum acutatum	Strawberries #1			KAK-2016-SBerry-MI	48
		Strawberries #2			KAK-2017-SBerry-MI	50
Gray Mold	Botrytis cinerea	Strawberries #1	CER-2012-070	166		
		Strawberries #2	CER-2014-038	168		
		Strawberries #3	Review Article, Adaskaveg <i>et al.</i> , 2013	170		
		Strawberries #4			KAK-2016-SBerry-MD	104
		Strawberries #5			KAK-2016-SBerry-MI	106
		Strawberries #6			KAK-2017-SBerry-MI	108
Leather Rot	Phytophthora cactorum	Strawberries #1			KAK-2016-SBerry-MI	52
		Strawberries #2			KAK-2017-SBerry-MI	54
Phomopsis Leaf Spot	Phomopsis obscurans	Strawberries #1			KAK-2016-SBerry-MI	56
		Strawberries #2			KAK-2017-SBerry-MI	59
Powdery Mildew	Podosphaera aphanis,	Strawberries #1	CER-2012-070	342		
	Sphacelotheca sp.	Strawberries #2	CER-2013-008	344		
Crop Group 19: Herbs a	and Spices	-	-			-
Downy Mildew	Peronospora belbahrii	Basil #1			IND-2015-218	62

NEW EFFICACY DATA FOR NEWLY PETITIONED USES

CROP GROUP 13: BERRIES AND SMALL FRUITS: GRAPES / Black Rot (Guignardia bidwellii)

#1: Trial No. KAK-2016-Grape-MI

a. <u>Design</u>

	Grape T	es / Black Rot (rial No. KAK-2((<i>Guignardi</i> 016-Grape [,]	<i>ia bidwellii</i>) #1: -MI: Design					
Title:	Eval grap	Evaluation of fungicides for control of foliar and fruit diseases of juice grapes, 2016							
Author and affiliation:	A. M Mich	. Schilder, J. N 11gan State Uni ^r	۸. Gillett, a versity	and R. W. Sysak					
Publication:	PDM	PDMR (planned for fall 2018 publication)							
Location:	Fenr	Fennville, MI							
Crop:	Grap	be (Vitis labrus	ca "Niagar	a')					
Disease name:	Blac	k rot							
Pathogen:	Guig	gnardia bidweli	lii						
Test plot design:	Ranc	Jomized compl	ete block						
Number of replicates:	4								
Application equipment:	Rese	earch sprayer w	vith 5-foot	spray boom					
Spray volume:	50 ga 75 g	50 gal/acre (May 8, 2016 to July 1, 2016) 75 gal/acre (remainder of the season)							
Application type(s):	Prev	rentative							
Number of applications:	7 (0	so at 10-day to	16-day in	tervals)					
Chronology:		Application		Growth Stage	Disease Assessment				
	No.	Date	Interval	1	Date				
	1	05/23/2016		3-5 inch shoot	09/09/2016				
	2	06/08/2016	16 days	10-16 inch shoot					
	3	06/21/2016	13 days	Bloom					
	4	07/01/2016	10 days	Pea-size fruit					
	5	07/12/2016	11 days	2 nd post-bloom					
	6	07/27/2016	15 days	3 rd post bloom					
	7	08/03/2016 ^A	7 days						
	8	08/10/2016	7 days	4 th post-bloom					
Disease assessment methodology:	• 2 • 1 • <u>5</u> • (25 randomly selected leaves and clusters from the center vine in each plot were visually rated. Incidence = Percent leaves or clusters with disease. Severity = Percent area symptomatic on diseased plants only. Overall Severity = (Incidence x Severity) / 100. 							
A. 08/03/2016 application to control downy milde	i was lin w.	nited to selecte	ed treatme	ent programs that inclu	uded Ridomil Gold SL				

Grapes / Black Rot (<i>Guignardia bidwellii</i>) #1: Trial No. KAK-2016-Grape-MI: Results (9/10/2016)									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incidence (%)	Severity (%)	Overall Severity (%)	Percent Control
Untreated control			Not Applicable			82.0 a	45.4 a	37.44 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	46.0 b	10.3 b	4.66 b	87
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	17.0 def	3.4 cd	0.64 c	98
Ranman	2.75 fl oz		Cyazofamid	21	1,2,3,4, 5,6,8	24.0 cd	2.2 de	0.63 c	98
Silwet L-77	2 fl oz		Nonionic surfactant	NA					
Manzate Pro-Stick	3 lb		Cymoxanil	27	1, 2	0.0 g	0.0 g	0.0 c	100
Pristine 38WG	12.5 oz		Boscalid	7	3,4,6,8				
			Pyraclostrobin	11					
Super Spread 90	0.125%		Non-ionic surfactant	NA					
Ziram 76DF	3 lb		Ziram	M3	5				
Ridomil Gold			Mefenoxam	4	7				
Treatment means followed by the same letter are not statistically different according to the Fischer's Protected SD test at P \leq 0.05.									

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported the black rot disease pressure to be light on leaves and moderate on fruit.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 87% and 98% control, respectively, of black rot on grape clusters.

No OMRI-listed products were evaluated in this trial.

#2: Trial No. KAK-2017-Grape-MI

a. <u>Design</u>

Grapes / Black Rot (<i>Guignardia bidwellii</i>) #2: Trial No. KAK-2017-Grape-MI: Design										
Title:	Evalua	valuation of fungicides for control of foliar diseases of juice grapes, 2017								
Author and affiliation:	A. M.C	A. M.C. Schilder, J. M. Gillett, and R. W. Sysak								
	Michig	Nichigan State University								
Publication:	PDMR	PDMR (planned for fall 2018 publication)								
Location:	Fennvi	lle, MI								
Crop:	Grape	('Niagara')								
Disease name:	Black r	rot								
Pathogen:	Guidna	ardia bidwell	ii							
Test plot design:	Rando	Randomized complete block								
Number of replicates:	4	4								
Application equipment:	Resear	Research sprayer with 5-foot boom								
Spray volume:	40 gallons/acre (first 3 applications) 50 gallons/acre (later season applications)									
Application type(s):	Preventative									
Number of applications:	7									
Chronology:	App. Code	Application Dates	App. Interval (Days)	Growth Stage	Disease Assessment Dates					
	Α	05/16/2017		3-5 inch shoots	08/23/2017					
	В	05/30/2017	14	7-17 inch shoots						
	С	06/10/2017	11	Pre-bloom/bloom						
	D	06/21/2017	11	1 st post-bloom; bb-size fruit						
	Е	07/11/2017	19	2 nd post-bloom; pea-size fruit						
	F	07/25/2017	14	3 rd post-bloom; pre-bunch closure						
	G	08/14/2017	20	4 th post-bloom; bunch closure						
Disease assessment methodology:	Incider Severit Overal	nce: % of lea ty: % area syn l severity: (In	ves or clu mptomat icidence :	isters with disease. ic on diseased plant parts only. x Severity) / 100.						

Grapes / Black Rot (<i>Guignardia bidwellii</i>) #2: Trial No. KAK-2017-Grape-MI: Results: Leaves										
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)	
Untreated control			Not Applicable			62.0 a	13.2 a	8.2 a		
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	26.0 c	3.9 c	1.1 c	87	
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J		ABCDEFG	40.0 b	6.5 b	2.6 b	68	
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727		ABCDEFG	35.0 b	6.5 b	2.3 b	72	
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	40.0 b	5.6 b	2.3 b	72	
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG					
Treatment means followed by the same letter are not statistically different according to the Fischer's Protected LSD test at P \leq 0.05.										

Grapes / Black Rot (<i>Guignardia bidwellii</i>) #2: Trial No. KAK-2017-Grape-MI: Results: Clusters									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)
Untreated control			Not Applicable			66.0 a	36.9 a	36.9 a	
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	29.0 ef	5.2 bc	5.2 bcd	86
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J	44	ABCDEFG	43.0 b	7.9 b	7.9 b	79
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727	44	ABCDEFG	42.0 bc	6.0 bc	6.0 bc	84
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	41.0 bcd	7.4 b	7.4 b	80
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG				
Treatment means followed by the same letter are not statistically different according to the Fischer's Protected LSD test at P \leq 0.05.									

The researchers described the black rot disease pressure:

- On grape leaves as light; and
- On grape clusters as moderate.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided 87% and 86% control of black rot on grape leaves and clusters, respectively.

OMRI-listed products evaluated in this trial included Lifegard WG and Stargus. Oso applied at 13 fl oz/acre provided control of black rot on grapes that is numerically <u>superior</u> to that of Lifegard WG and Stargus.

#3: Trial No. KAK-2016-Grape-PA

a. <u>Design</u>

Grapes / Black Rot (<i>Guidnardia bidwellii</i>) #3: Trial No. KAK-2016-Grape-PA: Design											
Title:	Evalua 'Conco	Evaluation of OSO 5% and other alternative fungicides on <i>Vitis labrusca</i> Concord' grapes, 2016.									
Author and affiliation:	Bryan Lake E Penn S	aryan Hed ake Erie Regional Grape Research and Extension Center Penn State University									
Publication:	PDMR	2DMR 11:SMF009									
Location:	North	North East, PA									
Crop:	Grapes	Grapes (Concord)									
Disease name:	Black ı	Black rot									
Pathogen:	Guidna	ardia bidwell	<i>'</i> //								
Test plot design:	Rando	mized comple	ete block								
Number of replicates:	4	4									
Application equipment:	Friend	Friend covered-boom plot sprayer									
Spray volume:	50 gall	50 gallons/acre (100 psi)									
Application type(s):	Prever Mumm	Preventative assumed. Mummies were placed in the trellis as a source of inoculum.									
Number of applications:	6 (Oso	; no applicati	ion C2 at	21 days after	the first application.)						
Chronology:	Application			Days After	Growth Stage	Disease					
	Code	Dates	Interval (Days)	First Application		Assessment Dates					
	Α	05/23/2016		0	3-6 inch shoots	08/08/2016					
	В	06/02/2016	9	9	10-12 inch shoots	08/30/2016					
	С ₁	06/11/2016	9	18	Immediate pre- bloom						
	C ₂ *	06/14/2016	12*	21	Bloom (not used for Oso)						
	D	06/21/2016	10**	28	1 st post-bloom						
	E	06/30/2016	9	37	2 nd post-bloom						
	F	07/12/2016	12	49	Pea-size berries						
	 * Included exclusively in the treatment program that began with Manzate. Not used for Oso and the other treatments. ** Application interval for Oso and other treatments excluding the Manzate treatment program. 										
Disease assessment methodology:	Severit area ir Incidei Severit	Severity was rated using the Barratt-Horsfall scale and was converted to % area infected (0-100%) using Elanco conversion tables. ncidence = Percent clusters diseased. Severity = Percent area of clusters diseased.									
b. Results

This trial was conducted during a local drought. Total rainfall for May, June, July, and September was 2.1, 1.9, 2.7, 4.5 and 5.2 inches, respectively. Dry weather during May, June, and July made for very unfavorable conditions for fungal infections and resulted in low levels of disease.

For clusters with no mummies in the trellis to serves as inoculum, the disease pressure was too low (2.0% incidence and 0.05% severity) for meaningful data. Statistical differences in incidence and severity were observed for clusters for which black rot mummies were included in the trellis.

		Grap Trial I	es / Black Rot (<i>Guid</i> No. KAK-2016-Grape	nardia k PA: Res	<i>idwellii</i>) #3: sults: Cluster	s			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Witl	n Mummie to Serve a	s in the Tre s Inoculum	llis
						Incide	ence	Seve	rity
						Measured (%)	% Control	Measured (%)	% Control
Untreated control			Not Applicable			55.0 ab		7.02 b	
OSO 5%	13.0 fl oz	50	Polyoxin D zinc salt	19	ABC ₁ DEFG	53.6 ab	2.5	7.26 b	-3.4
Fracture	36.6 fl oz		Banda de Lupinus albus doce (BLAD)	BM1	ABC ₁ DEFG	51.3 b	6.7	9.02 ab	-28.5
Double Nickel	3 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	ABC₁DEFG	76.7 a	-39.5	12.98 a	-84.9
Badge X2	1.75 lb		Copper hydroxide, Copper oxychloride	M1	ABC₁DEFG	15.0 c	72.7	1.29 c	81.6
Lime	1.75 lb		Calcium hydroxide	NA	ABC ₁ DEFG				
Conventional standard:									
Manzate Prostik	3 lb		Cymoxanil	27	AB	0.8 c	98.5	0.02 c	99.7
• Ziram	4 lb		Zinc dimethyldithio- carbamate	M3	C ₂ DEF				
Quintec	4 fl oz		Quinoxyfen	13	C ₂ E				
Vivando	10.3 fl oz		Metrafenone	U8	D				
Toledo	4 oz		Tebuconazole	3	G				
Treatment means follo	wed by the sam	e letter a	are not statistically	differen	t according	to Fisher's I	DS test at	$t P \leq 0.05.$	

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided very modest control of black rot incidence (2.5%) in grape clusters when cages with black rot mummies were attached to the trellis to serve as inoculum. In the absence of the mummies, no significant black rot was observed.

OMRI-listed products evaluated in this trial included Double Nickel and a tank-mixture of Badge X2 and lime. Based upon this trial, Oso provided:

- <u>Superior</u> performance compared to Double Nickel; and
- <u>Inferior</u> performance compared to Badge X2 tank-mixed with lime.

Fracture is a biopesticide. However, based upon the label posted to the Internet, Fracture is <u>not</u> OMRIlisted.

#4: Trial No. KAK-2017-Grape-PA

a. <u>Design</u>

	Gra	apes / Black Trial No. KA	Rot (<i>Guia</i> K-2017-G	<i>Inardia bidwei</i> rape-PA: Desi	// <i>ii</i>) #4: gn							
Title:	Evalua 'Conco	tion of OSO 5 ord' grapes, 2	5% and otl 2017.	ner alternativ	e fungicides on Vitis I	labrusca						
Author and affiliation:	Bryan Lake E Penn S	yan Hed ke Erie Regional Grape Research and Extension Center ann State University										
Publication:	PDMR	MR (submitted)										
Location:	North	orth East, PA										
Crop:	Grape	apes (Concord)										
Disease name:	Black	ack rot										
Pathogen:	Guidn	idnardia bidwellii										
Test plot design:	Rando	mized comple	ete block									
Number of replicates:	4	· · ·										
Application equipment:	Friend	iend covered-boom plot sprayer										
Spray volume:	50 gal	50 gallons/acre (100 psi)										
Application type(s):	Prever Mumm	ntative assum ies were plac	ied. ced in the	trellis as a sc	ource of inoculum.							
Number of applications:	7											
Chronology:		Application	1	Days After	Growth Stage	Disease						
	Code	Dates	Interval (Days)	Application		Assessment Dates						
	Α	05/10/2017		0	3-6 inch shoots	08/04/2017						
	В	05/19/2017	9	9	10-12 inch shoots	08/30/2017						
	C	05/28/2017	9	18	12-16 inch shoots							
	D	D 06/08/2017 11 29 Immediate pre- bloom										
	Е	06/18/2017	10	39	1 st post-bloom							
	F	06/28/2017	10	49	2 nd post-bloom							
	G	07/09/2017	11	60	3 rd post-bloom							
Disease assessment methodology:	Severi percer	ty was rated nt area infect	using the ed (0-100	Barratt-Horsf %) using Eland	all scale and was conv to conversion tables.	verted to						

For both the 2016 and 2017 trials conducted in North East, PA first applications were made when the grapes were at 3-6 inch shoot stage. The 2017 trial included one more application than the 2016 trial at the same location. The 2017 trial included an application at 12-16 inch shoot length that was not included in the 2016 trial. The 2017 trial included an application at 60 days after the last treatment, whereas the last application in the 2016 trial was made 49 days after the first application.

b. Results

This trial was conducted during the second year of a local drought. Total rainfall for May, June, July, August, and September was 5.70, 3.62, 0.84, 2.35, and 2.7 inches, respectively. Dry weather conditions greatly limited black rot development, particularly during July.

For clusters with no mummies in the trellis to serves as inoculum, the disease pressure was too low for meaningful data. Statistical differences in incidence and severity were observed for clusters for which black rot mummies were included in the trellis.

		Grape Trial N	es / Black Rot (<i>Guidna</i> No. KAK-2017-Grape-PA	<i>rdia bid</i> A: Resul	<i>lwellii</i>) #4: ts: Clusters				
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	With t	Mummie o Serve a	es in the Trel Is Inoculum	lis
						Incident	ce (%)	Severity	/ (%)
						Measured	% Control	Measured	% Control
Untreated control			Not Applicable			85.8 a		20.66 a	
OSO 5%	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	59.2 ab	31.0	12.16 ab	41.1
Fracture	36.6 fl oz		Banda de Lupinus albus doce (BLAD)	BM1	ABCDEFG	85.0 ab	1.2	20.13 a	2.6
Double Nickel	3 qt		Bacillus amyloliquefaciens str. D747	44	ABCDEFG	85.0 ab	1.2	22.44 a	-8.6
Badge X2	1.75 lb		Copper hydroxide, Copper oxychloride	M1	ABCDEFG	44.2 b	48.5	5.47 b	73.5
Lime	1.75 lb		Calcium hydroxide	NA	ABCDEFG				
Conventional standard:									
Manzate Prostik	3 lb		Cymoxanil	27	ABCD	0.8 c	99.1	0.02 b	99.9
• Ziram	4 lb		Zinc dimethyldithio- carbamate	M3	EFG				
Quintec	4 fl oz		Quinoxyfen	13	DG				
Vivando	10.3 fl oz		Metrafenone	U8	E				
Toledo	4 oz		Tebuconazole	3	F				
Treatment means follo	wed by the same	e letter a	are not statistically dif	ferent	according to	Fisher's Ll	DS test at	$P \le 0.05.$	

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided 41.1% control of black rot on grape clusters when cages with black rot mummies were attached to the trellis to serve as inoculum. In the absence of the mummies, no significant black rot was observed.

OMRI-listed products evaluated in this trial included Double Nickel and a tank-mixture of Badge X2 and lime.

Fracture is a biopesticide. However, based upon the label posted to the Internet, Fracture is <u>not</u> OMRIlisted.

Based upon this trial, Oso applied at 13 fl oz/acre provided control of black rot on grapes that was:

- <u>Superior</u> to that of Double Nickel; and
- <u>Statistically equivalent</u> to that of Badge X2 tank-mixed with lime.

CROP GROUP 13: GRAPES / Downy mildew (Plasmopara viticola)

#1: Trial No. KAK-2016-Grape-MI

Gr	apes T	/ Downy Mildev rial No. KAK-20	w (<i>Plasmo</i> 16-Grape-	<i>para viticola</i>) #1: MI: Design							
Title:	Evalı grap	uation of fungio es, 2016	ides for c	ontrol of foliar and fru	it diseases of juice						
Author and affiliation:	A. M Mich	. Schilder, J. M igan State Univ	. Gillett, a rersity	and R. W. Sysak							
Publication:	PDMR (planned for fall 2018 publication)										
Location:	Fennville, MI										
Crop:	Grap	Grape (Vitis labrusca "Niagara')									
Disease name:	Downy mildew										
Pathogen:	Plas	mopara viticola	7								
Test plot design:	Ranc	omized comple	ete block								
Number of replicates:	4										
Application equipment:	Rese	arch sprayer w	ith 5-foot	spray boom							
Spray volume:	50 ga 75 ga	al/acre (May 8, al/acre (remair	2016 to J nder of the	uly 1, 2016) e season)							
Application type(s):	Preventative										
Number of applications:	7 (0	so at 10-day to	16-day int	tervals)							
Chronology:		Applicatio	n	Growth Stage	Disease Assessment						
	No.	Date	Interval		Date						
	1	05/23/2016		3-5 inch shoot	09/12/2016						
	2	06/08/2016	16 days	10-16 inch shoot							
	3	06/21/2016	13 days	Bloom							
	4	07/01/2016	10 days	Pea-size fruit							
	5	07/12/2016	11 days	2 nd post-bloom							
	6	07/27/2016	15 days	3 rd post bloom							
	7	08/03/2016 ^A	7 days								
	8	08/10/2016	7 days	4 th post-bloom							
Disease assessment methodology:	 25 randomly selected leaves and clusters from the center vine in each plot were visually rated. Incidence = Percent leaves or clusters with disease. Severity = Percent area symptomatic on diseased plants only. Overall Severity = (Incidence x Severity) / 100. 										
to control downy mildew.	as (11										

			Grapes / Downy Mildew Trial No. KAK-2016-Grap	(<i>Plasmop</i> pe-MI: Res	<i>para vitico</i> sults (9/12	o <i>la</i>) #1: 2/2016)			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incidence on Leaves (%)	Severity on Leaves (%)	Overall Severity on Leaves (%)	Percent Control on Leaves
Untreated control			Not Applicable			83.0 a	44.3 a	36.68 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	39.0 bc	7.6 b	2.89 b	92
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	6.0 e	1.3 d	0.10 d	99
Ranman	2.75 fl oz		Cyazofamid	21	1,2,3,4, 5,6,8	3.0 ef	1.0 de	0.06 d	99
Silwet L-77	2 fl oz		Nonionic surfactant	NA					
Manzate Pro-Stick	3 lb		Cymoxanil	27	1, 2	0.0 f	0.0 f	0.0 d	100
Pristine 38WG	12.5 oz		Boscalid	7	3,4,6,8				
			Pyraclostrobin	11	1				
Super Spread 90	0.125%		Non-ionic surfactant	NA	1				
Ziram 76DF	3 lb		Ziram	M3	5				
Ridomil Gold	1		Mefenoxam	4	7,8				
Treatment means for 0.05.	ollowed by	the sam	ne letter are not statistica	lly differ	ent accord	ding to the F	ischer's Prot	ected SD te	st at P ≤

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported the downy mildew disease pressure to be moderately high.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 92% and 99% control, respectively, of downy mildew on grape leaves.

a. <u>Design</u>												
	Grape	es / Downy Mi	ldew (<i>Pla</i>	asmopara viticola) #2:								
T :41	F 1	valuation of fungicides for control of foliar diseases of juice grapes, 2017										
	Evalua		ides for o	control of foliar diseases of juice gr	apes, 2017							
Author and affiliation:	A. M.C. Michig	. Schilder, J. an State Univ	M. Gillet ersity	t, and R. W. Sysak								
Publication:	PDMR	DMR (planned for fall 2018 publication)										
Location:	Fennvi	ennville, MI										
Crop:	Grape	rape ('Niagara')										
Disease name:	Downy	owny mildew										
Pathogen:	Plasmo	opara vitacola	а									
Test plot design:	Rando	mized comple	ete block									
Number of replicates:	4	· ·										
Application equipment:	Resear	esearch sprayer with 5-foot boom										
Spray volume:	40 gall 50 gall	40 gallons/acre (first 3 applications) 50 gallons/acre (later season applications)										
Application type(s):	Prever	ntative										
Number of applications:	7											
Chronology:	App. Code	Application Dates	App. Interval (Days)	Growth Stage	Disease Assessment Dates							
	А	05/16/2017		3-5 inch shoots	09/21/2017							
	В	05/30/2017	14	7-17 inch shoots								
	C	06/10/2017	11	Pre-bloom/bloom								
	D	06/21/2017	11	1 st post-bloom; bb-size fruit								
	Е	07/11/2017	19	2 nd post-bloom; pea-size fruit								
	F	07/25/2017	14	3 rd post-bloom; pre-bunch closure								
	G	08/14/2017	20	4 th post-bloom; bunch closure								
Disease assessment methodology:	Incider Severit Overal	nce: % of lea ty: % area sy l severity: (Ir	ves or clu mptomat icidence :	isters with disease. ic on diseased plant parts only. x Severity) / 100.								

			Grapes / Downy Mildew Trial No. KAK-2017-Gra	(<i>Plasmo</i> ape-MI:	<i>para viticoi</i> Results: Clu	<i>la</i>) #2: Isters			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)
Untreated control			Not Applicable			78.0 a	55.5 a	43.1 a	
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	36.0 c	5.7 bc	2.1 cd	95
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J	44	ABCDEFG	42.0 b	6.9 b	2.9 b	93
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727	44	ABCDEFG	38.0 bc	6.4 b	2.5 bc	94
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	38.0 bc	6.0 b	2.3 bc	94
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG				
Treatment means 0.05.	followed by th	ne same	e letter are not statistica	lly diffe	rent accord	ing to the F	ischer's Pro	otected LSD t	est at P \leq

The researchers described the downy mildew disease pressure as moderately high.

No phytotoxicity was observed.

Discussion c.

In this trial, Oso applied at 13 fl oz/acre provided 95% control of downy mildew on grape clusters.

OMRI-listed products evaluated in this trial included Lifegard and Stargus. Oso applied at 13.0 fl oz/acre provided control of downy mildew on grape clusters that was numerically superior to that provided by Lifegard WG and Stargus.

CROP GROUP 13: GRAPES / Phomopsis Fruit Rot (Phomopsis viticola)

#1: Trial No. KAK-2016-Grape-MI

Grap	es / I T	Phomopsis Frui rial No. KAK-20	t Rot (<i>Pho</i>)16-Grape-	<i>mopsis viticola</i>) #1: MI: Design								
Title:	Evalı grap	uation of fungio es, 2016	cides for c	ontrol of foliar and fru	it diseases of juice							
Author and affiliation:	A. M Mich	A. M. Schilder, J. M. Gillett, and R. W. Sysak Michigan State University										
Publication:	PDM	PDMR (planned for fall 2018 publication)										
Location:	Fenr	Fennville, MI										
Crop:	Grap	Grape (Vitis labrusca "Niagara')										
Disease name:	Phor	Phomopsis fruit rot										
Pathogen:	Phor	nopsis viticola										
Test plot design:	Ranc	Jomized comple	ete block									
Number of replicates:	4											
Application equipment:	Rese	arch sprayer w	ith 5-foot	spray boom								
Spray volume:	50 ga 75 ga	al/acre (May 8, al/acre (remair	2016 to J nder of the	uly 1, 2016) e season)								
Application type(s):	Preventative											
Number of applications:	7 (0:	so at 10-day to	16-day int	tervals)								
Chronology:		Applicatio	n	Growth Stage	Disease Assessment							
	No.	Date	Interval		Date							
	1	05/23/2016		3-5 inch shoot	09/15/2016							
	2	06/08/2016	16 days	10-16 inch shoot								
	3	06/21/2016	13 days	Bloom								
	4	07/01/2016	10 days	Pea-size fruit								
	5	07/12/2016	11 days	2 nd post-bloom								
	6	07/27/2016	15 days	3 rd post bloom								
	7	08/03/2016 ^A	7 days									
	8	08/10/2016	7 days	4 th post-bloom								
Disease assessment methodology:	• • •	25 randoml each plot w Incidence = Severity = F Overall Sev	y selected vere visual Percent l Percent ar erity = (In	leaves and clusters fr ly rated. eaves or clusters with ea symptomatic on dis cidence x Severity) / 1	om the center vine in disease. eased plants only. 00.							
to control downy mildew.	us un											

		Gra Trial	apes / Phomopsis Fruit F No. KAK-2016-Grape-MI	Rot (<i>Phoi</i> : Results	mopsis viti s: Rachis (9	<i>icola</i>) #1: 9/15/2016)			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incidence (%)	Severity (%)	Overall Severity (%)	Percent Control
Untreated control			Not Applicable			57.0 a	22.4 a	12.64 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	39.0 b	10.4 b	3.98 b	68
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	14.0 fg	3.6 d	0.55 de	96
Ranman	2.75 fl oz		Cyazofamid	21	1,2,3,4,	20.0 ef	3.5 d	0.71 d	94
Silwet L-77	2 fl oz		Nonionic surfactant	NA	5,6,8				
Manzate Pro-Stick	3 lb		Cymoxanil	27	1, 2	2.01	1.0 ef	0.04 g	99
Pristine 38WG	12.5 oz		Boscalid	7	3,4,6,8				
			Pyraclostrobin	11	1				
Super Spread 90	0.125%		Non-ionic surfactant	NA	1				
Ziram 76DF	3 lb		Ziram	M3	5				
Ridomil Gold			Mefenoxam	4	7				
Treatment means fo	ollowed by t	he same	letter are not statistical	ly differ	ent accorc	ling to the F	ischer's Pro	otected SD te	est at P ≤

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported the Phomopsis disease pressure to be low to moderate.

No phytotoxicity was observed.

c. <u>Comparison to OMRI-Listed Products</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 68% and 96% control, respectively, of Phomopsis fruit rot on grape rachis (main axis of the cluster).

		Gra Tria	apes / Phomopsis Fruit F Il No. KAK-2016-Grape- <i>N</i>	Rot (<i>Pho</i> . II: Result	<i>mopsis viti</i> ts: Fruit (9	<i>icola</i>) #1: /15/2016)			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incidence (%)	Severity (%)	Overall Severity (%)	Percent Control
Untreated control			Not Applicable			57.0 a	41.7 a	23.62 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	39.0 b	20.3 b	7.68 b	67
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	14.0 fg	7.0 d	1.06 de	96
Ranman	2.75 fl oz		Cyazofamid	21	1,2,3,4, 5,6,8	20.0 ef	7.1 d	1.42 d	94
Silwet L-77	2 fl oz		Nonionic surfactant	NA					
Manzate Pro-Stick	3 lb		Cymoxanil	27	1, 2	2.01	1.3 ef	0.05 e	99
Pristine 38WG	12.5 oz		Boscalid	7	3,4,6,8	1			
			Pyraclostrobin	11					
Super Spread 90	0.125%		Non-ionic surfactant	NA					
Ziram 76DF	3 lb		Ziram	M3	5	1			
Ridomil Gold			Mefenoxam	4	7				
Treatment means f 0.05.	ollowed by t	he same	letter are not statistica	ly differ	ent accord	ling to the F	ischer's Pro	otected SD te	est at P ≤

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 67% and 96% control, respectively, of Phomopsis fruit rot on grapes.

#2: Trial No. KAK-2017-Grape-MI

	Grapes	/ Phomopsis Trial No. KAI	Fruit Rot	(<i>Phomopsis viticola</i>) #2:								
Title:	Evalua	aluation of fungicides for control of foliar diseases of juice grapes, 2017										
Author and affiliation:	A. M.C	. Schilder, J.	M. Gillet	t, and R. W. Sysak	~p~~, _~							
	Michig	higan State University										
Publication:	PDMR	MR (planned for fall 2018 publication)										
Location:	Fennvi	ennville, MI										
Crop:	Grape	rape ('Niagara')										
Disease name:	Phomo	omopsis fruit rot										
Pathogen:	Phomo	omopsis vitaola										
Test plot design:	Rando	mized comple	ete block									
Number of replicates:	4											
Application equipment:	Resear	earch sprayer with 5-foot boom										
Spray volume:	40 gall 50 gall	0 gallons/acre (first 3 applications) 0 gallons/acre (later season applications)										
Application type(s):	Prever	itative										
Number of applications:	7											
Chronology:	App. Code	Application Dates	App. Interval (Days)	Growth Stage	Disease Assessment Dates							
	Α	05/16/2017		3-5 inch shoots	09/25/2017							
	В	05/30/2017	14	7-17 inch shoots								
	С	06/10/2017	11	Pre-bloom/bloom								
	D	06/21/2017	11	1 st post-bloom; bb-size fruit								
	Е	07/11/2017	19	2 nd post-bloom; pea-size fruit								
	F	07/25/2017	14	3 rd post-bloom; pre-bunch closure								
	G	08/14/2017	20	4 th post-bloom; bunch closure								
Disease assessment methodology:	Incider Severit Overal	nce: % of lea ty: % area sy l severity: (Ir	ves or clu mptomat icidence :	usters with disease. ic on diseased plant parts only. x Severity) / 100.								

		G	rapes / Phomopsis Fruit Trial No. KAK-2017-Gra	Rot (<i>Pho</i> ape-MI: I	mopsis vitie Results: Clu	<i>cola</i>) #2: sters			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)
Untreated control			Not Applicable			88.0 a	51.8 a	45.5 a	
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	28.0 cd	4.8 d	1.4 c	97
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J	44	ABCDEFG	44.0 b	12.7 b	5.6 b	88
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727	44	ABCDEFG	34.0 c	11.5 b	3.8 b	92
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	8.0 e	1.8 de	0.3 d	99
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG				
reatment means followed by the same letter are not statistically different according to the Fischer's Protected LSD test at P \leq 0.05.									

The researchers described the Phomopsis fruit rot disease pressure as moderate.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided 97% control of Phomopsis fruit rot on grape clusters.

OMRI-listed products evaluated in this trial included Lifegard and Stargus. Oso applied at 13.0 fl oz/acre provided control of Phomopsis fruit rot on grapes that was statistically <u>superior</u> to that provided by Lifegard WG and Stargus.

CROP GROUP 13: STRAWBERRIES / Anthracnose Fruit Rot (Colletotrichum acutatum)

#1: Trial No. KAK-2016-SBerry-MI

Strawber	Strawberries /Anthracnose Fruit Rot (<i>Colletotrichum acutatum</i>) #1: Trial No. KAK-2016-Sberry-MI: Design								
Title:	Eval matt	uations of fur ted-row straw	ngicides f /berry, 20	or control of leaf and fr)16	uit rot diseas	ses in			
Author and affiliation:	A. M Mich	. C. Schilder, igan State Ur	N. M. Gi niversity	llett, and R. W. Sysak					
Publication:	PDM	PDMR (planned for fall 2018 publication)							
Location:	Cam	den, MI							
Crop:	Strav	wberry (<i>Fraga</i>	arias x an	anassa 'Wendy')					
Disease name:	Anth	racnose fruit	rot						
Pathogen:	Colle	etotrichum a	cutatum						
Test plot design:	Ranc	domized comp	olete bloo	:k					
Number of replicates:	4								
Application equipment:	Hand	dheld Smith C	ontracto	r Sprayer (29 psi)					
Spray volume:	75 gal/acre								
Application type(s):	Preventative								
Number of applications:	7								
Chronology:			Applicat	tion	Disease	Harvest			
	No.	Date	Interval	Growth Stage	Assessment Dates	Dates			
	1	05/09/2016		Green up	06/23/2016	06/16/2016			
	2	05/18/2016	9 days	Bloom		06/24/2016			
	3	05/24/2016	6 days	2 nd bloom after frost					
	4	06/01/2016	7 days	Bloom and green fruit					
	5	06/07/2016	6 days	Green fruit					
	6	06/15/2016	7 days	Green and red fruit					
	7	06/23/2016	8 days	Red fruit					
Disease assessment	• \	/isual field ra	tings: 50	berries were selected r	andomly.				
methodology:	• [)isposable glo	ves were	used to pick berries an	d changed be	etween plots			
	to reduce cross-contamination.								
	Harvest was from the center of plots. Dest harvest: 25 marketable barries from each plot were placed								
		ouidistant or	n metal so	reens in aluminum trav	s and incuba	ted at 72°F			
	a	and 100% relation	tive humi	dity. After 4 days, the	berries were	inspected			
	f	or fungal spo	rulation.	,,.,.,.					

	Strawberries /Anthracnose Fruit Rot (<i>Colletotrichum acutatum</i>) #1: Trial No. KAK-2016-Sberry-MI: Results									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	tive Ingredient FRAC Field Incidence (%) 4-Day Post-Har Code Marketable Fr (1 st Harves 6/16/2016		-Harvest e Fruit ^A vest; 2016)				
					Measured	Percent Control	Incidence (%)	Percent Increase		
Untreated control			Not Applicable		27.0 a		7.5 a			
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	5.5 b	80	28.0 bc	273		
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	4.0 bc	85	25.0 b	233		
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	5.0 b	80	27.0 bc	260		
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	5.0 b	81	38.0 c	407		
Pristine	11.5 oz		Boscalid	7	1					
			Pyraclostrobin	11						
Treatment m Protected LS A. Harveste appeared	Treatment means followed by the same letter are not statistically different according to Fisher's Protected LSD test at $P \le 0.05$. A. Harvested 1 day after last application. All berries used in the post-harvest incubation test									

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported that the Anthracnose incidence observed in the field on fruit was moderate.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided:

- 80% and 85% control, respectively, of field incidence of anthracnose fruit rot on strawberries; and
- 273% and 233% increases, respectively, of 4-day post-harvest marketable fruit.

One OMRI-listed product was evaluated in this trial. Oso applied at 13 fl oz/acre provided <u>superior</u> field control of anthracnose on strawberries compared to Serifel.

#2: Trial No. KAK-2017-SBerry-MI

Strawbe	rries /Anthracno Trial No.	ose Fruit Rot KAK-2017-Sb	(<i>Colletotrichum acutatu</i> perry-MI: Design	ım) #2:						
Title:	Evaluation of matted-row s	Evaluation of fungicides for control of leaf and fruit rot diseases in matted-row strawberry, 2017								
Author and affiliation:	A. M. C. Schil Michigan Stat	A. M. C. Schilder, J. M. Gillett, and R. W. Sysak Michigan State University								
Publication:	PDMR (planne	d for fall 201	8 publication)							
Location:	Camden, MI									
Crop:	Strawberry (F	ragaria x ana	anassa 'Wendy')							
Disease name:	Anthracnose f	ruit rot								
Pathogen:	Colletotrichu	m acutatum a	and <i>Colletotrichum dem</i>	atium						
Test plot design:	Randomized c	complete bloc	ck							
Number of replicates:	4									
Application equipment:	Smith Contrac	Smith Contractor Sprayer (29 psi)								
Spray volume:	75 gallons/ac	75 gallons/acre								
Application type(s):	Preventative									
Number of applications:	5									
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates						
	05/01/2017		Green up	06/22/2017 (field ratings)						
	05/07/ 2017	7	50% bloom	06/26/2017 (post-harvest ratings)						
	05/24/2017	17	Bloom							
	05/31/2017	7	Bloom and green fruit							
	06/14/2017 14 Red fruit									
Disease assessment methodology (post- harvest):	25 marketable screens in alu relative humi sporulation.	25 marketable berries from each plot were placed equidistantly on metal screens in aluminum trays and incubated at room temperature and 100% relative humidity. After 4 days, berries were visually assessed for final								

Strawberries /Anthracnose Fruit Rot (<i>Colletotrichum acutatum</i>) #2: Trial No. KAK-2017-Sberry-MI: Results										
Treatment	Rate/	g	Active Ingredient	FRAC	Арр	4-Day Post-Harvest				
	Acre a.i./ Code C		Code Code Colleto		richum tum	Colletotrichum dematium				
						Incidence (%)	Control (%)	Incidence (%)	Control (%)	
Untreated control			Not Applicable			10.0 a		43.0 a		
Oso 5%	13 fl oz	50	Polyoxin D zinc salt	19	ABCDE	1.0 b	90	5.0 b	88	
Conventional standard:										
Topsin	4.5 fl oz		Thiophanate-methyl	1	A	2.0 b	80	9.0 b	79	
Captan 4L	3 qt		Captan	M4	A					
Fontelis	24 fl oz		Penthiopyrad	7	BCE					
Switch 62.5	12 oz		Cyprodinil	9	D					
			Fludioxonil	12	1					
Treatment mear 0.05.	ns followed b	y the sam	ne letter are not statistica	lly differe	nt accordir	ng to the Fish	ier's Prote	cted LSD te	st at P ≤	

Overall Severity = [(Incidence) x (Severity)] / 100.

The researchers described the Botrytis disease pressure as moderately high.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided 90% and 88% control, of anthracnose on 4-day postharvested strawberries caused by *Colletotrichum acutatum* and *Colletotrichum dematium*, respectively.

CROP GROUP 13: STRAWBERRIES / Leather Rot (Phytophthora cactorum)

#1: Trial No. KAK-2016-SBerry-MI

Str	Strawberries / Leather Rot (<i>Phytophthora cactorum</i>) #1: Trial No. KAK-2016-Sberry-MI: Design								
Title:	Eval matt	Evaluations of fungicides for control of leaf and fruit rot diseases in matted-row strawberry, 2016							
Author and affiliation:	A. M Mich	.C. Schilder, igan State Ur	N. M. Gil niversity	lett, and R. W. Sysak					
Publication:	PDM	R (planned fo	r fall 201	8 publication)					
Location:	Cam	den, MI							
Crop:	Strav	wberry (<i>Fraga</i>	arias x an	anassa 'Wendy')					
Disease name:	Leat	her rot							
Pathogen:	Phyt	ophthora cac	torum						
Test plot design:	Ranc	lomized comp	olete bloo	:k					
Number of replicates:	4								
Application equipment:	Hand	Handheld Smith Contractor Sprayer (29 psi)							
Spray volume:	75 g	75 gal/acre							
Application type(s):	Prev	Preventative							
Number of applications:	7	7							
Chronology:			Applicat	tion	Disease	Harvest			
	No.	Date	Interval	Growth Stage	Assessment Dates	Dates			
	1	05/09/2016		Green up	06/23/2016	06/16/2016			
	2	05/18/2016	9 days	Bloom		06/24/2016			
	3	05/24/2016	6 days	2 nd bloom after frost					
	4	06/01/2016	7 days	Bloom and green fruit					
	5	06/07/2016	6 days	Green fruit					
	6	06/15/2016	7 days	Green and red fruit					
	7	06/23/2016	8 days	Red fruit					
Disease assessment methodology:	• V • D • H • H • F • a	 7 [06/23/2016 8 days Red fruit Visual field ratings: 50 berries were selected randomly. Disposable gloves were used to pick berries and changed between plots to reduce cross-contamination. Harvest was from the center of plots. Post-harvest: 25 marketable berries from each plot were placed equidistant on metal screens in aluminum trays and incubated at 72°F and 100% relative humidity. After 4 days, the berries were inspected 							

Strawberries / Leather Rot (<i>Phytophthora cactorum</i>) #1: Trial No. KAK-2016-Sberry-MI: Results										
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Field Incidence on Fruit (%)		4-Day Post-Harvest Marketable Fruit ^A (1 st Harvest; 6/1462016)		
						Measured	Percent Control	Incidence (%)	Percent Increase	
Untreated control			Not Applicable			31.0 a		7.5 a		
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1-7	5.0 b	84	28.0 bc	273	
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1-7	0.5 cd	98	25.0 b	233	
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	1-7	3.0 bc	90	27.0 bc	260	
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	1-7	2.5 bc	92	38.0 c	407	
Pristine	11.5 oz		Boscalid	7						
			Pyraclostrobin	11						
Treatment m A. Ha vis	rvested 1 of the second	wed by the day after l se or soft a	e same letter are not statistica ast application. All berries us areas) before incubation starte	ally diffe ed in the ed.	erent acc e post-ha	ording to Fish arvest incubat	er's Protec ion test app	ted LSD test a beared market	t P ≤ 0.05. able (no	

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported that the leather rot incidence observed on fruit in the field was moderate.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this study, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided:

- 84% and 98% control, respectively, of in-field incidence of leather rot on strawberries; and
- 273% and 233% increases, respectively, of 4-day post-harvest marketable fruit.

One OMRI listed product was evaluated in this trial. Oso applied at 13 fl oz/ acre provided <u>superior</u> control of field incidence of leather rot on strawberries compared to Serifel.

#2: Trial No. KAK-2017-SBerry-MI

Str	awberries / Lea Trial No.	ther Rot (<i>Phy</i> KAK-2017-St	y <i>tophthora cactorum</i>) #2 perry-MI: Design	2:					
Title:	Evaluation of matted-row s	fungicides fo trawberry, 2(r control of leaf and frui)17	it rot diseases in					
Author and affiliation:	A. M. C. Schild Michigan Stat	der, J. M. Gil e University	lett, and R. W. Sysak						
Publication:	PDMR (planne	d for fall 201	8 publication)						
Location:	Camden, MI								
Crop:	Strawberry (F	ragaria x ana	anassa 'Wendy')						
Disease name:	Leather rot								
Pathogen:	Phytophthora	cactorum							
Test plot design:	Randomized c	omplete bloc	:k						
Number of replicates:	4								
Application equipment:	Smith Contrac	Smith Contractor Sprayer (29 psi)							
Spray volume:	75 gallons/ac	75 gallons/acre							
Application type(s):	Preventative								
Number of applications:	5								
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates					
	05/01/2017		Green up	06/22/2017 (field ratings)					
	05/07/ 2017	7	50% bloom	06/26/2017 (post-harvest ratings)					
	05/24/2017	17	Bloom						
	05/31/2017	7	Bloom and green fruit						
	06/14/2017	14	Red fruit						
Disease assessment methodology (post- harvest):	25 marketable screens in alu relative humi	e berries fron minum trays dity. After 4	n each plot were placed and incubated at room t days, berries were visua	equidistantly on metal cemperature and 100% ally assessed for final					
	sporulation.								

	Strawberries / Leather Rot (<i>Phytophthora cactorum</i>) #2: Trial No. KAK-2017-Sberry-MI: Results									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Field Ra Leather Ro	Field Rating of Leather Rot on Fruit		4-Day Post-Harvest Marketable Fruit	
						Incidence (%)	Control (%)	Incidence (%)	Increase (%)	
Untreated control			Not Applicable			56.8 a		2.0 a		
Oso 5%	13 fl oz	50	Polyoxin D zinc salt	19	ABCDE	10.8 b	81	49.0 b	2350	
Conventional standard:										
Topsin	4.5 fl oz		Thiophanate-methyl	1	А	7.5 b	87	40.0 b	1900	
Captan 4L	3 qt		Captan	M4	А					
Fontelis	24 fl oz		Penthiopyrad	7	BC E					
Switch 62.5	12 oz		Cyprodinil	9	D					
			Fludioxonil	12						
Treatment means 0.05.	followed by th	he same I	letter are not statistica	ally differe	ent accord	ing to the Fis	her's Prote	cted LSD te	st at P ≤	

The researchers described the leather rot disease pressure as moderately high.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided:

- 81% control of leather rot; and
- a 2350% increase in 4-day post-harvest marketable strawberries.

#1 Trial No. KAK-2016-SBerry-MI

Straw	berries	s / Phomopsis Trial No. KAł	s Leaf Spo (-2016-Sb	ot <i>(Phomopsis obscuran</i> berry-MI: Design	s) #1:				
Title:	Evalı matt	uations of fur ed-row straw	ngicides f /berry, 20	or control of leaf and fr)16	uit rot diseas	ses in			
Author and affiliation:	A. M Mich	.C. Schilder, igan State Ur	N. M. Gil niversity	lett, and R. W. Sysak					
Publication:	PDM	R (planned fo	r fall 201	8 publication)					
Location:	Cam	Camden, MI							
Crop:	Strav	wberry (<i>Fraga</i>	arias x an	<i>anassa</i> 'Wendy')					
Disease name:	Phor	nopsis leaf sp	ot						
Pathogen:	Phor	nopsis obscur	rans						
Test plot design:	Ranc	lomized comp	olete bloo	:k					
Number of replicates:	4	4							
Application equipment:	Hand	Handheld Smith Contractor Sprayer (29 psi)							
Spray volume:	75 ga	75 gal/acre							
Application type(s):	Prev	Preventative							
Number of applications:	7								
Chronology:			Applicat	tion	Disease	Harvest			
	No.	Date	Interval	Growth Stage	Assessment Dates	Dates			
	1	05/09/2016		Green up	06/23/2016	06/16/2016			
	2	05/18/2016	9 days	Bloom		06/24/2016			
	3	05/24/2016	6 days	2 nd bloom after frost					
	4	06/01/2016	7 days	Bloom and green fruit					
	5	06/07/2016	6 days	Green fruit					
	6	06/15/2016	7 days	Green and red fruit					
	7	06/23/2016	8 days	Red fruit					
Disease assessment methodology:	Visua Post equi and for f	<u>al field rating</u> -harvest ratin distantly on r 100% relative ungal sporula	<u>s</u> : 25 lea ligs: 25 ma netal scre humidity tion and	ves were randomly sele arketable berries form eens on aluminum trays /. After 4 days, berries disease incidence for ir	ected. each plot wer and incubate were assesse ndividual path	re placed ed at 72°F ed visually nogens.			

	Strawberries / Phomopsis Leaf Spot <i>(Phomopsis obscurans)</i> #1: Trial No. KAK-2016-Sberry-MI: Field Results								
Treatment	Rate/	g a.i./	Active Ingredient	FRAC		Leaves			
	Acre	ha		Code	Incidence (%)	Severity (%)	Overall (%)	Control (%)	
Untreated control			Not Applicable		10.3 a	39.5 a	4.1 a		
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	2.0 b	2.9 b	0.06 b	98	
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	0.0 c	0.0 c	0.0 b	100	
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	1.0 bc	1.8 bc	0.03 b	99	
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	0.5 c	0.8 bc	0.02 b	99	
Pristine	11.5 oz		Boscalid	7					
			Pyraclostrobin	11					
Treatment me Protected LSI	Treatment means followed by the same letter are not statistically different according to Fisher's Protected LSD test at $P_{c} = 0.05$								

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers described the Phomopsis leaf spot incidence and severity on leaves as low.

No phytotoxicity was observed.

	Strawberries / Phomopsis Fruit Rot <i>(Phomopsis obscurans)</i> #1: Trial No. KAK-2016-Sberry-MI: 4-Day Post-Harvest Results										
Treatment	Rate/	g a.i./	Active Ingredient	FRAC		Marketab	le Fruit				
	Acre	ha		Code Harvest		est 1	Harve	est 2			
					Incidence (%)	Increase (%)	Incidence (%)	Increase (%)			
Untreated control			Not Applicable		7.5 a		15.0 a				
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	28.0 bc	273	46.0 bc	207			
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	25.0 b	233	62.0 bc	313			
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	27.0 bc	260	47.0 bc	213			
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	38.0 c	407	68.0 bc	353			
Pristine	11.5 oz		Boscalid	7							
	Pyraclostrobin 11										
Treatment me Protected LSI	eans follov) test at P	wed by t ≤ 0.05.	he same letter are not	t statist	ically differ	ent accord	ing to Fishe	er's			

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided:

- 98% and 100% control, respectively, of Phomopsis leaf spot on strawberry leaves; and
- Up to 273% and 313% increase, respectively, in marketable strawberries.

One OMRI-listed products was evaluated in this trial. Oso applied at 13 fl oz/acre provided:

- <u>Superior</u> control of Phomopsis leaf spot compared to Serifel; and
- <u>Superior</u> control of Phomopsis fruit rot compared to Serifel.

#2 Trial No. KAK-2017-SBerry-MI

Strawberries	/ Phomopsis Le Trial No.	af Spot and F KAK-2017-Sb	ruit Rot (<i>Phomopsis obs</i> erry-MI: Design	curans) #2:						
Title:	Evaluation of matted-row s	Evaluation of fungicides for control of leaf and fruit rot diseases in matted-row strawberry, 2017								
Author and affiliation:	A. M. C. Schil Michigan Stat	der, J. M. Gil e University	lett, and R. W. Sysak							
Publication:	PDMR (planne	d for fall 201	8 publication)							
Location:	Camden, MI									
Crop:	Strawberry (F	ragaria x ana	anassa 'Wendy')							
Disease name:	Phomopsis lea	af spot and fr	uit rot							
Pathogen:	Phomopsis ob	scurans								
Test plot design:	Randomized o	complete bloc	ck							
Number of replicates:	4									
Application equipment:	Smith Contrac	Smith Contractor Sprayer (29 psi)								
Spray volume:	75 gallons/ac	75 gallons/acre								
Application type(s):	Preventative									
Number of applications:	5									
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates						
	05/01/2017		Green up	06/22/2017 (field ratings)						
	05/07/ 2017	7	50% bloom	06/26/2017 (post-harvest ratings)						
	05/24/2017	17	Bloom							
	05/31/2017	7	Bloom and green fruit							
	06/14/2017 14 Red fruit									
Disease assessment methodology (post- harvest):	25 marketable screens in alu relative humi- sporulation.	U6/14/201/14Red fruit25 marketable berries from each plot were placed equidistantly on metal screens in aluminum trays and incubated at room temperature and 100% relative humidity. After 4 days, berries were visually assessed for final ensurementation								

	Strawberries / Phomopsis Leaf Spot <i>(Phomopsis obscurans</i>) #2: Trial No. KAK-2017-Sberry-MI: Results: Field Ratings									
Treatment	Rate/ Acre	g a.i./	Active Ingredient	FRAC Code	App Code	Fiel P	Field Rating of Leaves for Phomopsis Leaf Spot			
		ha				Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)	
Untreated control			Not Applicable			35.1 a	15.5 a	5.4 a		
Oso 5%	13 fl oz	50	Polyoxin D zinc salt	19	ABCDE	17.4 b	4.6 b	0.8 b	83	
Topsin	4.5 fl oz		Thiophanate- methyl	1	A	15.9 b	5.3 b	0.9 b	87	
Captan 4L	3 qt		Captan	M4	A					
Fontelis	24 fl oz		Penthiopyrad	7	BC E		ĺ			
Switch 62.5	12 oz		Cyprodinil	9	D					
			Fludioxonil	12						
Treatment m Protected LS	Teans foll D test at	owed $P \le 0$.	by the same letter ar .05.	e not s	tatistica	lly differen	t accordin	g to the Fi	isher's	

	Stra	wberri Tria	ies / Phomopsis l No. KAK-2017-S	Fruit Ro Sberry- <i>I</i>	ot <i>(Phon</i> MI: Post-	nopsis obscu Harvest Res	<i>urans</i>) #2: sults		
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	4-Day Post Phomopsis	t-Harvest Fruit Rot	4-Day Post Marketat	t-Harvest de Fruit
						Incidence (%)	Control (%)	Incidence (%)	Increase (%)
Untreated control			Not Applicable			20.0 a		2.0 a	
Oso 5%	13 fl oz	50	Polyoxin D zinc salt	19	ABCDE	4.0 b	80	49.0 b	2350
Conventional standard:									
Topsin	4.5 fl oz		Thiophanate- methyl	1	A	3.0 b	85	40.0 b	1900
Captan 4L	3 qt		Captan	M4	А				
Fontelis	24 fl oz		Penthiopyrad	7	BC E				
Switch 62.5	12 oz		Cyprodinil	9	D				
			Fludioxonil	12					
Treatment me Protected LSD	ans follow test at P	ed by ≤ 0.05	the same letter	are not	statisti	cally differe	ent accord	ing to the F	Fisher's

The researchers described the Phomopsis <u>*leaf spot*</u> field incidence as moderate and the overall Phomopsis leaf spot severity as low.

The researchers described the post-harvest Phomopsis *fruit rot* incidence as moderately low.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided:

- 83% control of Phomopsis leaf spot on strawberry leaves;
- 80% control of 4-day post-harvest Phomopsis fruit rot; and
- a 2350% post-harvest increase in marketable fruit.

#1: Trial No. IND-2015-218

	Basil / Downy Mildew (Trial No. IND-	<i>Peronospora belbahrii</i>) ‡ 2015-218: Design	<i>‡</i> 1:				
Title:	Evaluation of biopesti	cides for downy mildew	in basil with a potted plant				
	assay						
Author and affiliation:	Margaret Tuttle McGra Cornell University	ath					
Publication:	PDMR 10:V034	PDMR 10:V034					
Location:	Greenhouse, then fiel	Greenhouse, then field (Riverhead, New York)					
Crop:	Basil (variety not spec	Basil (variety not specified)					
Disease name:	Downy mildew	Downy mildew					
Pathogen:	Peronospora belbahri	Peronospora belbahrii					
Test plot design:	Not applicable						
Number of replicates:	1 replicate; 10 seedlin	1 replicate; 10 seedlings/treatment					
Application equipment:	Not applicable						
Spray volume:	Seedling dipped into f	ungicide solutions					
Application type(s):	Preventative						
Number of applications:	1						
Chronology:	Application Dates	Application Interval	Disease Assessment Dates				
	09/22/2015	NA	09/30/2015				
Methodology:	Potted seedlings were with treatment solution both sides of the basil to dry in the greenhou hours, the seedlings w in garbage bags during production.	e dipped into treatment a on to ensure contact of a l leaves. The dipped pot use overnight. During th vere outdoors during day g nighttimes for high hur	solutions instead of sprayed the treatment solution with tted seedlings were allowed e next approximately 72 rtimes and in the greenhouse nidity to promote spore				

			Basil / Downy Mildew (<i>Peror</i> Trial No. IND-2015-	<i>iospora</i> 218: Re	<i>belbahrii</i>) # sults	1:			
Treatment	Rate/ Acre	g a.i./	Active Ingredient	FRAC Code	Severi 10/13	ty (%) /2015	Inciden 10/09	Mean Percent	
		ha			Measured	Percent Control	Measured	Percent Control	Control
Untreated control			Not Applicable		45.3		100		
Oso	13 fl oz	50	Polyoxin D zinc salt	19	16.7	63.1	60	40	52
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	40.0	1.15	80	20	11
Double Nickel	1.5 lb		<i>Bacillus amyloliquefaciens</i> str. D747	44	35.7	21.2	80	20	21
MilStop	3 lb		Potassium bicarbonate	NC	38.3	15.5	30	70	43
Trilogy	1%		Neem oil	NC	18.3	59.6	50	50	55
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	28.8	36.4	20	80	58
Sil-Matrix	3 qt		Potassium silicate	NC	18.0	60.3	20	80	70
Cueva	4 qt		Copper octanoate	M1	NA	NA	0	100	100
Revus	8 fl oz		Mandipropamid	40	40.0	11.7	10	90	51
NC = Not classifi	ed.			-	-		-		

The researcher did not comment of the relative downy mildew disease incidence or severity.

No phytotoxicity was reported.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided 52% control of downy mildew on basil.

With the exception of Revus, all of the alternative treatments are OMRI-listed. Based upon this trial, Oso applied at 13 fl oz/acre provided control of downy mildew on basil that was:

- <u>Superior</u> to that provided by Actinovate AG, Double Nickel, and MilStop;
- <u>Similar</u> to that provided by Trilogy; and
- <u>Inferior</u> to that provided by Regalia, Sil-Matrix, and Cueva.

NEW EFFICACY DATA FOR USES INCLUDED IN THE MAY 31, 2016 PETITION

CROP GROUP 4: LEAFY VEGETABLES: SPINACH / White Rust (Albugo occidentalis)

#2: Trial No. CER-2015-152

a. <u>Design</u>									
	Spinach / White Rust Trial No. CER [.]	(<i>Albugo occidentalis</i>) #2 2015-152: Design	2:						
Title:	2015-2016 Fungicide T	2015-2016 Fungicide Trial for Control of Spinach White Rust							
Author and affiliation:	Larry Stein and Marcel Devin Kerstetter and T	Larry Stein and Marcel Valdez, Texas A&M AgriLife Extension Service; and Devin Kerstetter and Tyler Knight, Del Monte Corporation							
Publication:	Not published								
Location:	Del Monte Research Fa	rm near Crystal City, TX							
Crop:	Spinach (variety Virofl	ay)							
Disease name:	White rust								
Pathogen:	Albugo occidentalis								
Test plot design:	Not reported								
Number of replicates:	Not reported								
Application equipment:	Foliar spray	Foliar spray							
Spray volume:	15 gallon/acre								
Application type(s):	Preventative								
Number of applications:	4								
Chronology:	Application Dates	Application Interval	Disease Assessment Dates						
	2015/12/11		2016/01/19						
	2015/12/23	14 days	2016/01/29						
	2016/01/08	15 days							
	2016/01/19	11 days							
Disease assessment rating:	1 = No white rust. 10 = Blown out.								

		Spina	ch / White Rust (<i>Albugo occidental</i> Trial No. CER-2015-152: Results	'is) #2:					
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Disease R 01/29/2	Disease Rating ^A 01/29/2016		
						Measured	Percent Control		
Untreated control			Not Applicable			4.5 c			
Oso	6.5 fl oz	25	Polyoxin D zinc salt	19	ABCD	2.3 a	49		
Induce	4 oz		Non-ionic wetter/spreader	NA					
Orondis	4.8 oz		Mandipropamid	40	ABCD	2.0 a	55		
Induce	4 oz		Non-ionic wetter/spreader	NA					
Actinovate	6 oz		Streptomyces lydicus WYEC 108	NC	ABCD	2.0 a	55		
Induce	4 oz		Non-ionic wetter/spreader	NA					
Zampro	14 oz		Ametoctradin	45	ABCD	2.0 a	55		
			Dimethomorph	40					
Induce	4 oz		Non-ionic wetter/spreader	NA					
Double Nickel LC	1 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	AC	3.5 b	22		
Cueva	20 oz		Copper octanoate	M1	BD				
Induce	4 oz		Non-ionic wetter/spreader	NA	ABCD				
Treatment mea significance crit A. Disease	ns followe teria were rating: 1	d by the was not = No wh	same letter are not statistically di reported. ite rust. 10 = Blown out.	fferent	. She s	tatistical te	st and		

On January 19, 2015, the last application was made and disease was first observed. Therefore, the first three applications were preventative and the last application was curative.

The researchers indicated that the disease pressure was low.

Upon returning to the trial site on February 12, 2016 to make the final rating and to determine the main cause of the problems, the trial had been destroyed by feral hogs. Nonetheless, the data provide for comparison of disease control through January 29, 2016, *i.e.*, 10 days after the last treatment.

Please note that the no white rust rating is 1 in this trial and was 0 in the 2014 trial.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre tank-mixed with Induce (a non-ionic wetter/spreader) provided 49% control of white rust on spinach.

OMRI-listed products evaluated in this trial included Actinovate, Double Nickel LC, and Cueva. Based upon this trial, Oso applied at 6.5 fl oz/acre provided control of white rust on spinach that was:

- Statistically *equivalent* to that provided by Actinovate; and
- Statistically <u>superior</u> to that provided by alternate applications of Double Nickel and Cueva.

CROP GROUP 11: POME FRUITS

APPLE / Powdery Mildew Storage Rot (Podosphaera leuotricha)

#4: Trial No. CER-2015-033

a. <u>Design</u>								
Apple /	Powdery Mildew Sto Trial No. C	rage Rot (<i>Podo</i> : ER-2015-033: D	<i>sphaera leuotricha</i> esign	ə) #4:				
Title:	Evaluation of the E LC Against Commo	fficacy of Oso 5 n Storage Rot P	5%SC Fungicide, Cu athogens on Apple	ueva and Double Nickel es				
Author and affiliation:	Ron Britt Ron Britt & Associa	ites						
Publication:	Not published							
Location:	Wapato, Washingto	on						
Crop:	Apples (Granny Sm	ith)						
Disease name:	Powdery mildew st	orage rot						
Pathogen:	Podosphaera leuco	tricha						
Test plot design:	Randomized compe	ete block						
Number of replicates:	4							
Application equipment:	Rears airblast spray	yer (110 psi)						
Spray volume:	100 gallons/acre							
Application type(s):	Preventative (not e	evaluated for p	owdery mildew be	fore application)				
Number of applications:	1	1						
Chronology:	Application Dates	Application Interval	Harvest Date	Disease Assessment Dates				
	09/29/2015	NA	Not reported	12/14/2015 12/15/2015 02/03/2016 02/05/2016				
Disease assessment methodology:	For each treatmen were punctured wi punctured. Apples <u>Evaluation of punc</u> 0 = No infection. 1 = Infection at the 2 = Infection sprea <u>Evaluation of apple</u> 0 = No infection. 1 = Less than 2% ap 2 = More than 2% a	t, 200 apples w th a wire to fac were placed in <u>tured apples</u> : e site of the punc d past the punc <u>es not puncture</u> pple surface wa pple surface wa	ere harvested. The cilitate infection. Into cold storage. Incture. Incture site. Ind: s infected.	ne skin of 100 apples 100 apples were not				

b.	<u>Results</u>								
		Apple /	Powdery	y Mildew Storage Rot (Podosp	haera leuo	tricha) #4	:	
				Trial No. CER-2015-0	33: Res	ults			
Tr	eatment	Rate/	g a.i./	Active Ingredient	FRAC	Inciden	ce (%)	Inciden	ce (%)
		Acre	ha		Code	Not Punctured		Punctured	
						2/5/2016		2/3/2016	
						Measured	Percent	Measured	Percent
							Control		Control
Unti	reated			Not Applicable		55.5 a		96.0 a	
cont	trol								
Oso		6.5	25	Polyoxin D zinc salt	19	49.2 a	11.4	87.0 a	9.4

NA

M1

44

44

-0.9

-3.6

5.4

56.0 a

57.5 a

52.5 a

92.2 a

95.5 a

96.5 a

4.0

0.5

0.5

Treatment means followed by the same letter are not statistically different according to the LSD test at P = 0.05.

The researcher did not describe the relative powdery mildew storage rot disease pressure.

Sticker/spreader

Copper octanoate

amyloliquefaciens

amyloliquefaciens

Bacillus

str. D747 *Bacillus*

str. D747

c. <u>Discussion</u>

Double Nickel 1 gt

Double Nickel 2 qt

R-56

Cueva

0.25%

<mark>(v/v)</mark> 2 qt

Based upon this trial, Oso field applied at 6.5 fl oz/acre tank-mixed with R-56 (a sticker-spreader) provided 11.4% and 9.4% decreased incidence of powdery mildew storage rot of apples that were not punctured and punctured, respectively, before storage.

The OMNI-listed products evaluated in this trial included Cueva and Double Nickel. Based upon this trial:

- Oso provided <u>superior</u> control of powdery mildew storage rot of apples compared to both Cueva and Double Nickel.
- Cueva at 2 qt/acre and Double Nickel at 1 qt/acre were <u>ineffective</u> against powdery mildew storage rot of apples for apples not punctured prior to storage, *i.e.*, disease incidence for these treatments exceeded the disease incidence in the untreated control.

CROP GROUP 12: STONE FRUITS: CHERRIES / Powdery Mildew (Podosphaera clandestina)

Cherries #2: Trial No. CER-2015-035

Cher	ries / Powdery / Trial No	Aildew (<i>Podospl</i>). CER-2015-035	<i>haera clandesi</i> : Design	tina) #2:						
Title:	Comparison of 1	ungicides for m	anagement of	cherry diseases	, 2015					
Authors and affiliation:	J. W. Pscheidt, John P. Bassinette, and L. A. Jones Oregon State University									
Publication:	PDMR 10:STF009									
Location:	Corvallis, OR									
Crop:	Sweet cherry ('Bing')									
Disease name:	Powdery mildew									
Pathogen:	Podosphaera cl	Podosphaera clandestina								
Test plot design:	Randomized co	mplete block								
Number of replicates:	Not reported									
Application equipment:	Hydraulic handgun sprayer (100 psi)									
Spray volume:	164 gal/acre									
Application type:	Preventative and curative									
Number of applications:	7 (all pre-harve	st)								
Chronology:	Application Dates	Growth Stage	Application Intervals	Brown Rot Blossom Blight Assessment Dates	Harvest Date					
	03/26/2015	Popcorn		04/14/2015	06/10/2015					
	04/02/2015	Full bloom	7 days							
	04/15/2015	Petal fall	13 days							
	04/29/2015	Fruit set	14 days							
	05/12/2015		13 days							
	05/26/2015		14 days							
	06/09/2015	Pre-harvest	14 days							

	Cherries	/ Powde / Tria	ery Mildew (<i>Podosphaera clande</i> Il No. CER-2015-035: Results	estina) #1	2:	
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Powdery (Leav (%)	Mildew es)
					Measured	Percent Control
Untreated control			Not Applicable		53.5 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	43.0 ab	19.6
Induce	32 fl oz/100 gal		Non-ionic wetter/spreader	NA		
Merivon	6 fl oz		Fluxapyroxad	7	17.5 cde	67.3
			Pyraclostrobin	11		
Induce	32 fl oz/100 gal		Non-ionic wetter/spreader	NA		

Symptoms of powdery mildew were first observed and confirmed on May 18, 2015, *i.e.*, after applications 1-5 and before applications 6-7. Therefore, the applications were preventative <u>and curative</u>.

The researchers described the disease pressure as low.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre tank-mixed with Induce (a non-ionic wetter/spreader) provided 19.6% control of powdery mildew on cherries.

CROP GROUP 13: BERRIES AND SMALL FRUITS: BLUEBERRIES / Mummyberry (*Monilinia vaccinii-corymbosi*)

#3: Trial No. KAK-2016-Blueberry-MI

		Blueberries / N Trial	lummyberi No. KAK-2	y (<i>Monilinia vaccinii-corymbosi</i>) #3: 016-Blueberry-MI: Design						
Title:	Evalua	ting fungicides	for contro	l of mummy berry and post-harvest fruit	rot in blueber	ries, 2016.				
Author and affiliation:	A. M. C Michiga	C. Schilder, J. <i>I</i> an State Univer	M. Gillett, rsity	and R. W. Sysak						
Publication:	PDMR (planned for fa	ll 2018 put	olication)						
Location:	Bangor	, MI								
Crop:	Bluebe	rry (<i>Vaccinium</i>	corymbos	um 'Berkeley')						
Disease name:	Mumm	Aummy berry								
Pathogen:	Monilii	Ionilinia vaccinii-corymbosi								
Test plot design:	Randor	andomized complete block								
Number of replicates:	4									
Application equipment:	Hand-h	and-held Smith Contractor Sprayer (29 psi)								
Spray volume:	40 gall 50 gall	O gallons/acre through May 19, 2016. O gallons/acre thereafter.								
Application type(s):	Preven	reventative								
Number of applications:	4 (Shoo 8 (Mum	4 (Shoot strike evaluations) 8 (Mummies per bush evaluations)								
Chronology:	Application			Growth Stage	Disease	Harvest Date				
	No.	Dates	Interval		Assessment Dates					
	1	04/18/2016		Early green tip; apothecia cup ave. diameter 1/8 inch	05/16/2016	07/14/2016				
	2	04/26/2016	8 days	Late green tip with some early pink bud; apothecia cup ave. diameter 1/4 inch	05/25/2016					
	3	05/06/2016	13 days	Pink bud with some early bloom	07/08/2016					
	4	05/19/2016	13 days	Bloom, some apothecia sill present						
	6	05/31/2016	12 days	Petal fall						
	7	06/14/2016	15 days	Green fruit						
	8	07/07/2016	23 days	10% blue fruit						
Disease assessment methodology:	 Mur bus Fift tray wer 	07/07/2016 23 days 10% blue fruit Mummified berries on the ground were counted in a 6.5 x 6.5 foot section under the two center bush for each plot. Fifty ripe berries per subplot were harvested, placed equidistantly on metal screens in aluminum trays and incubated at room temperature and 100% relative humidity. Ten days later, the berries were rated for post-harvest health by observing sporulation on the berries.								

Treatment	Rate/ g a. Acre ha	./ Active Ingredient	FRAC Code	App.	No. Shou	ot Strikes			
Untropted		a.i./ Active Ingredient ha		Code	per (05/16	Bush 5/2016)			
Untroptod					Measured	Percent Control			
control		Not Applicable			57.8 a				
Oso 5%SC 6.5	ifloz 25	Polyoxin D zinc salt	19	1,2,3,4	5.3 cde	90.8			
Oso 5%SC 6.5	i fl oz 25	Polyoxin D zinc salt	19	1,2,3,4	7.0 bcde	87.9			
LI 700 0.12	25% (v/v)	Penetrant, acidifier	NA						
Oso 5%SC 13 f	fl oz 50	Polyoxin D zinc salt	Polyoxin D zinc salt 19 1,2		0.0 f	100			
Double Nickel 1.06)6 qt	Bacillus amyloliquefaciens str. D747	44	1,2,3,4	12.0 b	79.2			
Double Nickel 2.1	l qt	Bacillus amyloliquefaciens str. D747	44	1,2,3,4	3.5 cdef	93.9			
Kenja 400SC 13.5	.5 fl oz	Isofetamid	7	1,2,3,4	7.0 bcde	87.9			
Indar 2F 6 fl	l oz	Fenbuconazole	3	1,2,3,4	0.0 f	100			
Oso 5%SC 6.5	i fl oz 25	Polyoxin D zinc salt	19	1,3	0.0 f	100			
LI 700 0.12	25% (v/v)	Non-ionic surfactant	NA	1		l			
Indar 2F 6 fl	l oz	Fenbuconazole	3	2,4	<u> </u> !				
		Blu Trial	eberries / Mummyberry (No. KAK-2016-Blueberry-	<i>Monilini</i> MI: Resu	<i>ia vaccinii-coryi</i> Ilts: Field and P	<i>mbosi</i>) #3 Post-Harvest			
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Treatment	Treatment Rate/ Acre a		Active Ingredient	FRAC Code	App. Code	No. Mui per E	nmies Sush	Percent 10 I Post-H	Healthy Days Iarvest
						Measured	Percent Control	Measured	Percent Increase
Untreated control			Not Applicable			32.3 a		70.0 ns	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4,6,7,8	3.0 def	90.7	50.5	-27.9
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4,6,7,8	3.8 de	88.2	73.5	5.0
LI 700	0.125% (v/v)		Non-ionic surfactant	NA					
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4,6,7,8	0.0 f	100	73.5	5.0
Double Nickel	1.06 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	1,2,3,4,6,7,8	8.0 bc	75.2	73.5	5.0
Double Nickel	2.1 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	1,2,3,4,6,7,8	4.0 de	87.6	78.0	11.4
Kenja 400SC	13.5 fl oz		lsofetamid	7	1,2,3,4,6,7,8	6.0 cd	81.4	71.5	2.1
Indar 2F	6 fl oz		Fenbuconazole	3	1,2,3,4,6,7,8	0.0 f	100	71.5	2.1
Bravo Weather Stik	4 qt		Chlorothalonil	M5	1,3	0.0 f	100	75.0	7.1
Indar 2F	6 fl oz		Fenbuconazole	3	2,4,6	1			
Pristine	23 oz		Boscalid	7	7,8				
			Pyraclostrobin	11					
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,3,6,8	0.0 f	100	75.0	7.1
LI 700	0.125% (v/v)		Non-ionic surfactant	NA					
Indar 2F	6 fl oz		Fenbuconazole	3	2,4				
Pristine	23 oz		Boscalid	7	7				
			Pyraclostrobin	11					

ns. No significant differences were found according to the Fisher's Protected LSD test at P \leq 0.05.

The first assessments were performed May 16, 2016, *i.e.*, after applications 1-3 and before applications 4-8. Disease was observed. Therefore:

- Applications 1 to 3 are assumed to be preventative, and
- Applications 4 to 8 were *curative*.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial:

- Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 90.7% and 100% control, respectively, of Mummyberry on blueberry fruit.
- Oso was applied at 6.5 fl oz/acre with and without LI 700 (a non-ionic surfactant) as a tank-mix partner. Oso <u>without</u> LI 700 provided numerically <u>superior</u> control of the number of mummies per bush (90.7% control without LI 700 vs 88.2% control with LI 700).
- No statistical differences were observed in the 10-day post-harvest number of healthy blueberries.

The only OMRI-listed product evaluated in this trial was Double Nickel. Oso provided <u>superior</u> control the number of mummies per blueberry bush (90.7% and 100% control) compared to Double Nickel (75.2% and 87.6% control).

#4: Trial No. KAK-2016-Blueberry-WA-Conv

Bluet	Derries / Mummyberry Trial No. KAK-2016-F	(<i>Monilinia vaccin</i> Slueberry-WA-Con	<i>ii-corymbosi</i>) #4: v: Design					
Title:	Conventional Mumm	v Berry & Botrytis	Control in Blueb	erries #2				
Author and affiliation:	Alan Schreiber Agricultural Develop	Alan Schreiber Agricultural Development Group, Inc.						
Publication:	Not published; permission received.							
Location:	Mt. Vernon, Washing	Mt. Vernon, Washington						
Crop:	Highbush Blueberry (variety: Reka)							
Disease name:	Mummy berry							
Pathogen:	Monilinia vaccinii-corymbosi							
Test plot design:	Randomized complete block							
Number of replicates:	4							
Application equipment:	Rears OverRo							
Spray volume:	100 gallons/acre							
Application type(s):	Preventative							
Number of applications:	6							
Chronology:	Application Dates	Application Intervals	Growth Stage	Disease Assessment Dates				
	03/05/2016			05/03/2016				
	03/16/2016	11 days		06/25/2016				
	03/31/2016	15 days						
	04/15/2016	16 days	50% bloom					
	04/25/2016	10 days	80% bloom					
	05/06/2016	11 days						

	Blueberries / Mummyberry (<i>Monilinia vaccinii-corymbosi</i>) #4: Trial No. KAK-2016-Blueberry-WA-Conv: Results								
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incider Flower/ Strikes pe (05/03/2	nce: 'Leaf er Plot 2016)	Incidence: Mummified Berries (06/25/2016)	
						Measured	Percent Control	Measured	Percent Control
Untreated control			Not Applicable			13.5 a		17.8 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	ABCDEF	2.3 b	83.0	2.8 b	84.3
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	ABCDEF	2.3 b	83.0	2.3 b	87.1
Chlorothalonil	32 fl oz		Chlorothalonil	M5	А	0.8 b	94.1	0.3 b	98.3
Indar 2F	6 fl oz		Fenbuconazole	3	В				
Proline	5.7 fl oz		Prothioconazole	3	C				
Switch 62 WG	11 oz		Cyprodinil	9	D				
			Fludioxonil	12					
Pristine	18 oz		Boscalid	7	E				
			Pyraclostrobin	11					
Abound	10 fl oz		Azoxystrobin	11	F				
Elevate	1.5 lb		Fenhexamid	17	F				
Chlorothalonil	32 fl oz		Chlorothalonil	M5	А	0.8 b	94.1	2.8 b	84.3
Indar 2F	6 fl oz		Fenbuconazole	3	BC				
Switch	14 oz wt		Cyprodinil	9	D				
			Fludioxonil	12					
Indar 2F	6 fl oz		Fenbuconazole	3	AB	3.3 b	75.6	1.5 b	66.7
Pristine	20 oz		Boscalid	7	C				
			Pyraclostrobin	11					
Switch	14 oz wt		Cyprodinil	9	D				
			Fludioxonil	12					

The first treatment was applied March 5, 3016. Based upon feedback from Washington State University plant pathologists, this was prior to ascospore release (*i.e.*, prior to crop infection). Therefore, the treatments were applied preventatively.

The researcher described the mummyberry pressure as moderate.

No phytotoxicity was reported.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided:

- 83.0% control of flower/leaf strikes at both application rates; and
- 84.3% and 87.1% control, respectively, of the number of mummified berries.

No OMRI-listed products were evaluated in this trial.

#5: Trial No. KAK-2016-Blueberry-WA-Org

Blueb	erries / Mummybe Trial No. KAK-20	rry (<i>Monilinia vaco</i> 16-Blueberry-WA-(<i>cinii-corymbosi</i>) #5: Drg: Design					
Title:	Organic Mummy I Washington 2016	Organic Mummy Berry & Botrytis Control in Blueberries of Western Washington 2016						
Author and affiliation:	Alan Schreiber Agricultural Deve	Alan Schreiber Agricultural Development Group, Inc.						
Publication:	Not published; permission received.							
Location:	Mt. Vernon, Washington							
Crop:	Highbush Blueber	Highbush Blueberry (variety: Reka)						
Disease name:	Mummy berry							
Pathogen:	Monilinia vaccinii-corymbosi							
Test plot design:	Randomized complete block							
Number of replicates:	4							
Application equipment:	Rears OverRo							
Spray volume:	100 gallons/acre							
Application type(s):	Preventative							
Number of applications:	7							
Chronology:	Application Dates	Application Interval	Growth Stage	Evaluation Dates				
	02/27/2016		Veg Bud	05/03/2016				
	03/07/2016	9 days	Veg Tip	06/23/2016				
	03/16/2016	9 days	Pre Bud					
	03/25/2016	9 days	Pink Bud					
	03/31/2016	6 days	10% Bloom					
	04/08/2016	9 days	30% Bloom					
	04/15/2016	7 days	50% Bloom					

Blueberries / Mummyberry (<i>Monilinia vaccinii-corymbosi</i>) #5: Trial No. KAK-2016-Blueberry-WA-Org: Results												
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRA C Code	Appl Code	Incide Leaf Strik (05/03/	ence es/Plot) (2016)	Incide (Infected (06/23/	nce I Fruit) 2016)			
						Measured	Percent Control	Measured	Percent Control			
Untreated control			Not Applicable			16.0 abc		45.0 a				
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	ABCDEF	26.3 a	-64.4	37.0 a	17.8			
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	ABCDEF	10.8 c	32.5	31.5 a	30.0			
Fracture	20 fl oz		Banda de Lupinus albus doce (BLAD)	M12	ABCDEFG	21.0 abc	-31.3	39.8 a	11.6			
Zen-O-Spore	4 lb		<i>Ulocladium oudemansii</i> (U3 Strain)	NC	ABCDEFG	18.0 abc	-12.5	32.5 a	27.8			
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108		ABCDEFG	16.8 abc	-5.0	39.0 a	13.3			
Double Nickel LC	1 qt	Bacillus amyloliquefacien str. D747		44	ABCDEFG	12.8 bc	20.0	33.5 a	25.6			
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ABCDEFG	12.0 c	25.0	39.0 a	13.3			
NovaSource's Lime-Sulfur	2% v/v		Calcium polysulfide		ABCD	9.8 c	38.8	36.0 a	20.0			
Oso 5%SC	13 fl oz		Polyoxin D zinc salt		BDF	25.3 ab	-58.1	24.3 a	46.0			
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ACEG							
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	BDF	20.8 abc	-30.0	32.8 a	27.1			
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ACEG							
Actinovate AG	12 oz		<i>Streptomyces lydicus</i> WYEC 108	NC	ACEG							
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	EFG	15.8 abc	1.3	29.3 a	34.9			
NovaSource's Lime-Sulfur	2% v/v		Calcium polysulfide	M2	ABCD							
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	ACEG	21.5 abc	-34.4	25.8 a	42.7			
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	BDF							
Actinovate AG	12 oz		<i>Streptomyces lydicus</i> WYEC 108	NC	ACEG	22.0 abc	-37.5	39.0 a	13.3			
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ACEG							
Double Nickel LC	1 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	BDF							
Zen-O-Spore	4 lb		<i>Ulocladium oudemansii</i> (U3 Strain)	NC	BDF							
Treatment means f	ollowed by	/ the sa	Treatment means followed by the same letter are not statistically different according to Bartlett's X2 test at P = 0.05.									

The first application was made on February 27, 2016. Based upon feedback from Washington State University plant pathologists, this was prior to ascospore release (i.e., prior to crop infection). Therefore, the treatments were applied preventatively.

The researcher described the mummyberry pressure as moderate.

No phytotoxicity was reported.

c. <u>Discussion</u>

In this trial:

- Oso applied at 6.5 fl oz/acre provided no control of mummyberry leaf strike incidence and 17.8% control of fruit mummies; and
- Oso applied at 13 fl oz/acre provided 32.5% control of leaf strike incidence and 30.0% control of fruit mummies.

The reduction in efficacy observed on this trial compared to the nearby trial using conventional pesticides (Trial No. KAK-2016-Blueberry-WA-Conv) is postulated to be due to the "re-inoculation" of the Oso subplots by the surrounding subplots for the organic treatments with no or lesser mummyberry control.

OMRI-listed products evaluated in this trial as single product treatments included Actinovate AG, Double Nickel LC, Regalia, NovaSource's Lime-Sulfur, and Zen-O-Spore. (Based upon information on the Internet, Zen-O-Spore is not EPA registered for use on blueberries.) In these single product evaluations, Oso applied at 13 fl oz/acre provided:

- <u>Superior</u> control of fruit mummies for all evaluated OMRI-listed products;
- <u>Superior</u> control of leaf strike incidence compared to Zen-O-Spore, Actinovate AG, Double Nickel LC, and Regalia; and
- <u>Slightly less</u> control of leaf strike incidence than provided by Nova-Sources Lime-Sulfur (32.5% vs 38.8% control).

Actinovate AG, Double Nickel LC, Regalia, NovaSource's Lime-Sulfur were also evaluated as rotation partners with Oso at 13 fl oz/acre. For all of the evaluated rotations with Oso, the control of fruit mummies by Oso rotated with the OMRI-listed rotation partner was <u>superior</u> to the control provided by the OMRI-listed product used alone. Oso used in rotation with:

- <u>Actinovate</u> provided <u>superior</u> control of fruit mummies compared to Oso used alone and compared to Actinovate used alone.
- <u>Regalia and Actinovate</u> provided <u>superior</u> control of fruit mummies compared to Regalia used alone and compared to Actinovate used alone.
- <u>NovaSource's Lime-Sulfur</u> provided <u>superior</u> control of fruit mummies compared to Oso used alone and compared to NovaSource's Lime-Sulfur used alone.
- <u>Regalia</u> provided <u>superior</u> control of fruit mummies compared to Oso used alone and compared to Regalia used alone.

Fracture was also evaluated in this trial. Fracture is a biopesticide. Based upon the label posted to the Internet, Fracture is not an OMRI-listed product.

#6: Trial No. KAK-2017-Blueberry-WA-Org

Blueberries / Mummyber	ry (<i>Monilinia vacci</i>	<i>inii-corymbosi</i>) #6: Tr	ial No. KA	K-2017-Bl	lueberry-WA-Org:				
		Design							
Title:	Effect of Organic	: Fungicides on Blueb	erry Mum	my Berry					
Author and affiliation:	T. Walters and A	. Schreiber							
	Agricultural Deve	elopment Group, Inc.							
Publication:	Not published; p	ermission.							
Location:	Near Mt. Vernon, Washington								
Crop:	Blueberries (highbush)								
Disease name:	Mummy berry								
Pathogen:	Monilinia vaccinii-corymbosi								
Test plot design:	Randomized complete block								
Number of replicates:	4								
Application equipment:	Over the row spray mount								
Spray volume:	64 gallons/acre								
Application type(s):	Preventative								
Number of applications:	8 (trial); 7 (Oso)								
Chronology:	Application	Application Dates	Application		Disease				
	Code		Interva	l (Days)	Assessment				
			Trial	Oso	Dates				
	А	03/19/2017			07/07/2017				
	В	03/30/2017	11	11					
	С	04/04/2017	5	5					
	D	04/11/2017	7	7					
	E	04/18/2017	7	7					
	F	04/25/2017	7	7					
	G	05/02/2017	7	18					
	Н	05/13/2017	11						
Disease assessment methodology:	Number of infect	tions per 100 random	ly picked	berries.					

Blueberries / Mummyberry (<i>Monilinia vaccinii-corymbosi</i>) #6: Trial No. KAK-2017-Blueberry-WA-Org: Results								
Treatment	Rate/	g a.i./	Active Ingredient	FRAC	App. Code	Incider	nce (%)	
	Acre	ha		Code		Measured	Percent Control	
Untreated control			Not Applicable			6.3 a		
Oso	6.5 fl oz	25	Polyoxin D zinc salt	19	ABCDEFH	2.3 de	63	
Oso	13 fl oz	50	Polyoxin D zinc salt	19	ABCDEFH	2.0 de	68	
Regalia	2 qt		Reynoutria sachalinensis extract	P5	ABCDEFGH	3.3 cde	48	
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ABCDEFGH	3.8 bcde	40	
Double Nickel LC	1 qt		Bacillus amyloliquefaciens str. D747	44	ABCDEFGH	5.5 ab	13	
Oso	13 fl oz		Polyoxin D zinc salt	19	ABCDEFGH	2.0 de	68	
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ABCDEFGH			
Stimplex	4.8 oz/10 gal		Cytokinin	NC	ABCDEFGH			
Oso	13 fl oz		Polyoxin D zinc salt	19	ABCDEFGH	1.8 e	71	
Regalia	2 qt		Reynoutria sachalinensis extract	P5	ABCDEFGH			
Oso	13 fl oz		Polyoxin D zinc salt	19	BDF	3.3 cde	48	
Regalia	2 qt		Reynoutria sachalinensis extract	P5	BDR			
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ACEGH			
Stimplex	4.8 oz/10 gal		Cytokinin	NC	ACEGH			
Oso	13 fl oz		Polyoxin D zinc salt	19	BDF	3.0 cde	52	
Double Nickel LC	1 qt		Bacillus amyloliquefaciens str. D747	44	BDF			
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ACEGH			
Stimplex	4.8 oz/10 gal		Cytokinin	NC	ACEGH			
Oso	13 fl oz		Polyoxin D zinc salt	19	EFG	2.3 de	63	
Lime-Sulfur Solution	2% v/v		Calcium polysulfide	M2	ABCDH			
Lime-Sulfur Solution	2 gal		Calcium polysulfide	M2	ABCD	4.0 bcd	37	
Lime-Sulfur Solution	3.5 gal		Calcium polysulfide	M2	ABCD	4.0 bcd	37	
Lime-Sulfur Solution	7.5 gal		Calcium polysulfide	M2	ABCD	2.5 de	60	
Lime-Sulfur Solution	8 gal		Calcium polysulfide	M2	ABCD	1.8 e	71	
Lime-Sulfur Solution 8 gal Calcium polysulfide M2 ACE 3.3 cde 48								
Treatment means follow	wed by the sam	e letter	are not statistically different (P = 0.0	5, LSD).				

Treatments were applied preventatively.

The researchers reported that the mummyberry disease pressure was low. Based upon communications with the lead researcher, the 2017 growing season was unusually dry.

No phytotoxicity was reported.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 63% control and 68% control of blueberry mummies.

The following OMRI-listed products were also evaluated in this trial: Actinovate AG, Double Nickel LC, Regalia, and Lime-Sulfur Solution. Stimplex is an OMRI-listed biostimulant and was included in tankmixes that were evaluated. In this trial, Oso applied at 13 fl oz/acre provided:

- <u>Superior</u> control of mummyberry incidence compared to Actinovate AG, Double Nickel
 LC, Regalia, and Lime-Sulfur Solution (2 to 7.5 gal/acre) used alone; and
- Statistically <u>equivalent</u> control of mummyberry incidence compared to high dose Lime-Sulfur Solution (8 gal/acre).

In this trial, Oso applied at 13 fl oz/acre was used in rotation with Actinovate AG, Double Nickel LC, Regalia, and/or Lime-Sulfur Solution and sometimes Simplex. In these rotations, the efficacy of Oso in rotation with Actinovate AG, Double Nickel LC, Regalia, and/or Lime-Sulfur Solution was superior to the OMRI-listed products used alone.

CROP GROUP 13: BERRIES AND SMALL FRUITS: CANEBERRIES / Gray Mold (Botrytis sp.)

Raspberries #2: Trial No. IND-2016-Rasp-WA

Raspberries /Botrytis Fruit Rot <i>(Botrytis</i> sp.) #2: Trial No. IND-2016-Rasp-WA: Design									
Title:	Raspberry Botry	Raspberry Botrytis Field Efficacy Program - 2016							
Author and affiliation:	Tom Walters Agricultural Dev	Tom Walters Agricultural Development Group, Inc.							
Publication:	Not published (permission)								
Location:	Everson, Washin	Everson, Washington							
Crop:	Raspberry (varie	Raspberry (variety Meeker)							
Disease name:	Botrytis fruit rot	Botrytis fruit rot							
Pathogen:	Botrytis sp.	Botrytis sp.							
Test plot design:	Randomized complete block								
Number of replicates:	4								
Application equipment:	Rears OveRo (130 psi)								
Spray volume:	100 gal/acre								
Application type(s):	Preventative								
Number of applications:	6								
Chronology:	Application Date	Application Interval	Growth Stage	Disease Assessment Dates					
	05/05/2016		10% bloom	07/09/2016					
	05/16/2016	11 days	30% bloom	07/12/2016					
	05/25/2016	9 days	50% bloom						
	06/07/2016	12 days	1 st harvest						
	06/17/2016	10 days							
	06/29/2016	12 days	Mid-harvest						
Disease assessment methodology:	For each plot, a counted. A tota each evaluation	For each plot, all berries were inspected, and all infected berries were counted. A total of 5520 row feet (more than a mile) were examined at each evaluation.							

	Raspberries / Botrytis Fruit Rot <i>(Botrytis</i> sp.) #2: Trial No. IND-2016-Rasp-WA: Results								
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Incide (No. Infected E (07/12/	nce 3erries/Plot) 2016)			
					Measured	Percent Control			
Untreated control			Not Applicable		21.0 abc				
Oso 5SC	12 fl oz	46	Polyoxin D zinc salt	19	10.0 c	52.4			
Oxidate	32 fl oz/ 100 gal		Hydrogen dioxide	NC	27.8 a	-32.4			
PH~D 11.3WDG	6.2 oz		Polyoxin D zinc salt	19	19.8 abc	5.7			
Elevate 50	1.5 lb		Fenhexamid	17	17.0 abc	19.0			
Switch 62.5	14 oz		Cyprodinil	9	16.8 abc	20.0			
			Fludioxonil	12					
Iprodione 4	1 pt		Iprodione	2	14.0 abc	33.3			
Pristine 38	23 oz		Boscalid	7	13.0 bc	38.1			
			Pyraclostrobin	11					
Luna Tranquility 45	18 fl oz		Fluopyram	7	9.8 c	53.3			
			Pyrimethalin	9					
Captan 80	2.5 lb		Captan	M4	7.8 c	62.9			
Treatment means followed by the same letter are not statistically different according to the Bartlett's X2 test at P = 0.03									

The researchers described the Botrytis disease pressure as low. There was virtually no disease pressure until the end of the trial. Disease was first observed on July 9, 2016 (10 days after the last application). The treatments were therefore assumed to have been applied preventatively.

No phytotoxicity was reported.

c. <u>Discussion</u>

In this study, Oso applied at 12 fl oz/acre provided 52.4% control of Botrytis fruit rot on raspberries.

Oxidate was the only OMRI-listed product evaluated in this trial. Oso provided statistically <u>superior</u> control of Botrytis fruit rot on raspberries compared to Oxidate.

Oxidate was *ineffective* in this trial. More Botrytis fruit rot was observed in the Oxidate treatment than in the untreated control.

Two formulations of polyoxin D zinc salt were evaluated in this trial. Oso is the 5% suspension concentrate formulation. PH-D is the 11.3% water dispersible granular formulation. <u>Oso provided</u> <u>noticeably superior Botrytis fruit rot control compared to PH-D (52.4% compared to 5.7%).</u>

Raspberries #3: Trial No. KAK-2017-Rasp-MI

Raspberries / Botrytis Fruit Rot (<i>Botrytis cinerea</i>) #3: Trial No. KAK-2017-Rasp-MI: Design									
Title:	Evaluation of f tunnel-grown r	Evaluation of fungicides for control of powdery mildew and Botrytis in tunnel-grown raspberries, 2017							
Author and affiliation:	A, M. C. Schild Michigan State	A, M. C. Schilder, J. M. Gillett, and R. W. Sysak Michigan State University							
Publication:	PDMR (planned for fall 2018 publication)								
Location:	Haygrove tunnel in Lawton, MI								
Crop:	Raspberry (<i>Rubus idaeus</i>)								
Disease name:	Botrytis fruit rot								
Pathogen:	Botrytis cinerea								
Test plot design:	Randomized complete block								
Number of replicates:	4								
Application equipment:	Hand-held Smith Contractor Sprayer (29 psi)								
Spray volume:	50 gallons/acre on 05/16/2017 75 gallons/acre for the remainder of the season								
Application type(s):	Preventative								
Number of applications:	5								
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates					
	05/16/2017		Green up	07/15/2017					
	05/30/2017	14	40% bloom						
	06/13/2017	14	Bloom and green fruit						
	06/20/2017	7	Green fruit						
	06/29/2017	9	Red fruit						
Disease assessment methodology:	Incidence: % of leaves or fruit with disease. Severity: % area symptomatic on diseased plant parts only. Overall severity: (Incidence x Severity) / 100.								

Raspberries / Botrytis Fruit Rot (<i>Botrytis cinerea</i>) #3: Trial No. KAK-2017-Rasp-MI: Results							
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Field Incidence on Fruit (%)		
					Measured	Percent Control	
Untreated control			Not Applicable		53.3 a		
Oso	6.5 fl oz	25	Polyoxin D zinc salt	19	10.0 de	81	
Oso	13 fl oz	50	Polyoxin D zinc salt	19	0.0 f	100	
Botector	10 oz		<i>Aureobasidium pullulans</i> strains DSM 14940 and DSM 14941	NC	21.1 b	60	
Double Nickel LC	3 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	16.7 bc	69	
Cueva	2 gal		Copper octanoate	M1	14.5 cd	73	
Fracture	35 fl oz		Banda de Lupinus albus doce (BLAD)	M12	14.5 cd	73	
Kenja 400SC	13.5 fl oz		Isofetamid	7	8.9 e	83	
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA			
Kenja 400SC	15.5 fl oz		lsofetamid	7	0.0 f	100	
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA			
Prolivo	4 fl oz		Pyriofenone	U8	8.9 e	83	
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA			
Prolivo	5 fl oz		Pyriofenone	U8	0.0 f	100	
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA			
Switch 62.5WG	14 oz		Cyprodinil	9	0.0 f	100	
			Fludioxonil	12			
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA			
Treatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at $P < 0.05$.							

The researcher described the Botrytis disease pressure as high, especially for a field rating of Botrytis fruit rot.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 81% and 100% control of Botrytis fruit rot, respectively.

OMRI-listed products evaluated in this trial were Botector, Double Nickel LC and Cueva.

Based upon this trial, Oso applied at both 6.5 fl oz/acre and at 13 fl oz/acre provided <u>superior</u> control of Botrytis fruit rot on raspberries compared to Botector, Double Nickel and Cueva.

Fracture is a biopesticide, but based upon information on the Internet, is not OMRI-listed.

CROP GROUP 13: BERRIES AND SMALL FRUITS: CANEBERRIES / Powdery Mildew (*Podosphaera aphanis*)

Raspberries #1: Trial No. KAK-2017-Rasp-MI

a. <u>Design</u>								
Raspberr	ies / Powdery Mil	Idew (Podosphaei	ra aphanis var. aphanis) #	1:				
	I rial No.	KAK-2017-Rasp-/	AI: Design					
Title:	Evaluation of f tunnel-grown r	Evaluation of fungicides for control of powdery mildew and Botrytis in tunnel-grown raspberries, 2017						
Author and affiliation:	A. M. C. Schild Michigan State	ler, J. M. Gillett, University	and R. W. Sysak					
Publication:	PDMR (planned for fall 2018 publication)							
Location:	Haygrove tunnel in Lawton, MI							
Crop:	Raspberry (Rubus idaeus)							
Disease name:	Powdery mildew							
Pathogen:	Podosphaera aphanis var. aphanis							
Test plot design:	Randomized complete block							
Number of replicates:	4							
Application equipment:	Hand-held Smith Contractor Sprayer (29 psi)							
Spray volume:	50 gallons/acre on 05/16/2017 75 gallons/acre for the remainder of the season							
Application type(s):	Preventative							
Number of applications:	5							
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates				
	05/16/2017		Green up	07/15/2017				
	05/30/2017	14	40% bloom					
	06/13/2017	14	Bloom and green fruit					
	06/20/2017	7	Green fruit					
	06/29/2017	9	Red fruit					
Disease assessment methodology:	Incidence: % of leaves or clusters with disease. Severity: % area symptomatic on diseased plant parts only. Overall severity: (Incidence x Severity) / 100.							

	Raspb	erries / P	owdery Mildew (<i>Podosphaera apha</i> Trial No. KAK-2017-Rasp-MI: Resu	<i>inis</i> var. ults	<i>aphanis</i>) #1	:		
Treatment	Rate/	g a.i./	Active Ingredient	FRAC	Γ	Leaves (7)	/15/2017)	
	Acre	ha		Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)
Untreated control			Not Applicable		57.3 a	12.2 a	7.0 a	
Oso	6.5 fl oz	25	Polyoxin D zinc salt	19	13.3 ef	1.5 e	0.2 e	97
Oso	13 fl oz	50	Polyoxin D zinc salt	19	0.0 g	0.0 f	0.0 e	100
Cueva	2 gal		Copper octanoate	M1	41.3 b	7.3 b	3.0 b	57
Double Nickel LC	3 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	38.7 bc	7.8 b	3.0 b	57
Botector	10 oz		<i>Aureobasidium pullulans</i> strains DSM 14940 and DSM 14941	NC	33.3 cd	5.5 c	1.8 c	74
Fracture	35 fl oz		Banda de Lupinus albus doce (BLAD)	M12	28.0 d	3.4 d	1.0 d	86
Kenja 400SC	13.5 fl oz		Isofetamid	7	18.7 e	2.0 e	0.4 e	94
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA				
Prolivo	4 fl oz		Pyriofenone	U8	8.0 f	0.7 ef	0.1 e	99
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA				
Kenja 400SC	15.5 fl oz		Isofetamid	7	0.0 g	0.0 f	0.0 e	100
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA				
Prolivo	5 fl oz		Pyriofenone	U8	0.0 g	0.0 f	0.0 e	100
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA				
Switch 62.5WG	14 oz		Cyprodinil	9	0.0 g	0.0 f	0.0 e	100
			Fludioxonil	12	1			
Kinetic	3 fl oz/100 gal		Non-ionic surfactant	NA				
Treatment means f	ollowed by the s	ame lette	er are not statistically different acc	cording	to the Fishe	r's Protec	ted LSD tes	tatP ≤

The researchers reported that the powdery mildew disease pressure was moderate on leaves and not evident on fruit.

No phytotoxicity was observed.

c. <u>Discussion</u>

Based upon this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided 97% and 100% control, respectively, of powdery mildew on raspberry leaves.

OMRI-listed products evaluated in this trial included Cueva, Double Nickel LC, and Botector. Oso provided statistically <u>superior</u> control of powdery mildew on raspberry leaves compared to that provided by Cueva (57% control), Double Nickel LC (also 57% control), and Botector (74% control).

Fracture is a biopesticide, but based upon information on the Internet, is not OMRI-listed.

CROP GROUP 13: CRANBERRIES / Cottonball (Monilinia oxycocci)

#3: Trial No. 11:SMF011(2016; WI)

a. Design

	Cranberries / Cottonball (<i>Monilini</i> Trial No. 11:SMF011(2016; W	<i>a oxycocci</i>) #3: I): Design				
Title:	Evaluation of fungicides for contr 2016	ol of cranberry cottonball in Wisconsin,				
Authors and affiliation:	P. McManus and R.S. Perry University of Wisconsin					
Publication:	PDMR 11:SMF011					
Location:	Near City Point, WI	Near Warrens, WI				
Crop:	Cranberry (cultivar Ben Lear)	Cranberry (cultivar Ben Lear)				
Disease name:	Cottonball					
Pathogen:	Monilinia oxycocci					
Test plot design:	Randomized compete block					
Number of replicates:	5					
Application equipment:	CO ₂ backpack sprayer (31 psi)					
Spray volume:	28.4 gal/acre					
Number of applications:	2					
Application interval:	8 days	12 days				
Application dates:	07/07/2016 (10% bloom) 07/15/2016 (50% bloom)	07/06/2016 (10% bloom) 07/18/2016 (50% bloom)				
Disease assessment date(s):	09/22/2016	09/13/2016				
Yield calculation:	One barrel = 100 pounds (industry	/ standard)				

b. <u>Results</u>

Cranberries / Cottonball (<i>Monilinia oxycocci</i>) #3: Trial No. 11:SMF011(2016; WI): Incidence on Fruit									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	% Cotto Incide City Poi	ttonball % Coti idence Incic Point, WI Warre		onball ence is, WI	
					Measured	Percent Control	Measured	Percent Control	
Untreated control			Not Applicable		11.9 a		10.7 a		
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	4.0 cde	66	5.8 bcd	46	
X77	0.25% (v/v)	NA	Non-ionic spreader	NA					
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	4.0 cde	66	5.2 cd	51	
Kenja 400SC	15.5 fl oz		Isofetamid	7	6.1 bc	49	7.1 abc	34	
Freatment means followed by the same letter are not statistically different according to Fisher's Protected LSD test at P = 0.05.									

Cranberries / Cottonball (<i>Monilinia oxycocci)</i> #3: Trial No. 11:SMF011(2016; WI): Yield										
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Yie (Barrels City Poi	ld /Acre) int, WI	Yield (Barrels/Acre Warrens, Wi			
					Measured	Percent Increase	Measured	Percent Increase		
Untreated control			Not Applicable		265.3 b		318.3 b			
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	310.4 a	17.0	339.1 ab	6.53		
Х77	0.25% (v/v)	NA	Non-ionic spreader	NA						
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	313.6 a	18.2	353.8 ab	11.2		
Kenja 400SC	15.5 fl oz		Isofetamid	7	300.9 ab	13.4	335.6 ab	5.4		
Treatment me Protected LSE	Freatment means followed by the same letter are not statistically different according to Fisher's Protected LSD test at P = 0.05.									

The date of first observation of cottonball symptoms was not reported. Therefore, the treatments are assumed to have been preventative.

The researchers described the cottonball disease pressure as low at both sites.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial report, Oso applied at 6.5 fl oz/acre tank-mixed with X77 (a non-ionic spreader) applied at 0.25% (v/v) at <u>two different trial sites</u> provided:

- 66% and 46% control, respectively, of cottonball on cranberries; and
- 17.0% and 6.53% increased cranberry yield, respectively.

Regalia was the only OMRI-listed product evaluated in this trial. In this trial, Oso and Regalia provided statistically *equivalent*:

- Control of cottonball on cranberries; and
- Increased yields.

CROP GROUP 13: CRANBERRIES / Cranberry Fruit Rot Complex (*Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, and *Physalospora vaccinii*, etc.)

#3: Trial No. 11:SMF012 (2016; WI)

Cranbo	Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3: Trial No. 11:SMF012 (2016; WI): Design										
Title:	Evaluation	n of fungicides	for control of cranberry fruit	rot in Wisc	onsin, 2016						
Authors and affiliation:	P. McMan University	us and R.S. Per of Wisconsin	ry								
Publication:	PDMR 11:	SMF012									
Location; Crop; Crop age	Oakdale;	akdale; cranberry 'Stevens'; 30 years old									
	Valley Jur	nction; cranber	ry 'Stevens'; 3 years old								
	Warrens;	cranberry 'Mul	lica Queen'; 3 year old 3								
	Mather; c	ranberry 'GHI'	; 3 years old								
	Tomah; cı	ranberry 'Scarl	et Knight'; 2 years old								
Disease name:	Cranberry	fruit rot comp	olex								
Pathogen:	Ripe rot: Bitter rot: Viscid rot Early rot: Blotch rot	ipe rot:Coleophoma empetriitter rot:Colletotrichum spp."iscid rot:Phomopsis vacciniiarly rot:Phyllosticta vacciniilotch rot:Physalospora vaccinii									
Test plot design:	Randomiz	ed complete b	lock								
Number of replicates:	5										
Application equipment:	CO ₂ backp	oack sprayer (3	1 psi)								
Spray volume:	28.4 gal/a	acre									
Number of applications:	2										
Chronology:	Site	App. Date	Growth Stage	App. Interval	Disease Assessment						
	Oakdale	06/30/2016	Full bloom	11 days	09/29/2016						
		07/11/2016	Late bloom/early fruit set								
	Valley	06/30/2016	Full bloom	11 days	09/27/2016						
	Junction	07/11/2016	Late bloom/early fruit set								
	Warrens	06/24/2016	Full bloom	14 days	09/08/2016						
		07/08/2016	Late bloom/early fruit set								
	Mather	06/30/2016	Full bloom	11 days	09/27/2016						
		07/11/2016 Late bloom/early fruit set									
	Tomah	06/24/2016	Full bloom	14 days	09/06/2016						
		07/08/2016	Late bloom/early fruit set								
Disease assessment methodology:	Soft, disco	olored fruit									

Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3a: Trial No. 11:SMF012 (2016; WI): Results: Oakdale									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Fruit Rot I (%	uit Rot Incidence Yi (%) (Barre		ld /Acre)	
					Measured	Percent Control	Measured	Percent Increase	
Untreated control			Not Applicable		31.3 a		322 ab		
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	6.9 c	78.0	295 ab	-8.4	
Х77	0.25% (v/v)	NA	Non-ionic spreader	NA					
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	7.2 c	77.0	294 ab	-8.7	
Kenja 400SC	15.5 fl oz		Isofetamid	7	24.6 b	21.4	343 a	6.5	
Freatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at P = 0.05.									

Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3b: Trial No. 11:SMF012 (2016; WI): Results: Valley Junction										
Treatment	Rate/	ga.i./	Active Ingredient	FRAC	Fruit Rot I	ncidence	Yie	ld		
	Acre	ha		Code	(%)	(Barrels	(Barrels/Acre)		
					Measured	Percent	Measured	Percent		
						Control		Increase		
Untreated control			Not Applicable		35.2 a		141 d			
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	4.5 b	87.2	238 a-d	68.8		
X77	0.25% (v/v)	NA	Non-ionic spreader	NA						
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	22.8 a	35.2	198 a-d	40.4		
Kenja 400SC	Kenja 400SC 15.5 fl Isofetamid 7 35.9 a -2.0 156 cd 10.6									
Treatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at P = 0.05.										

Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3c: Trial No. 11:SMF012 (2016; WI): Results: Warrens										
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Fruit Rot In (%	ruit Rot Incidence Yield (%) (Barrels/Acı				
					Measured	Percent Control	Measured	Percent Increase		
Untreated control			Not Applicable		40.5 a		443 a			
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	17.8 c	56.0	359 ab	-19.0		
Х77	0.25% (v/v)	NA	Non-ionic spreader	NA						
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	20.8 c	48.6	348 ab	-21.4		
Kenja 400SC	Kenja 400SC 15.5 fl Isofetamid 7 31.3 b 22.7 394 ab -11.1									
Treatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at P = 0.05.										

Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3d: Trial No. 11:SMF012 (2016; WI): Results: Mather									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Fruit Rot II (%)	t Rot Incidence Yield (%) (Barrels/Acr			
					Measured	Percent Control	Measured	Percent Increase	
Untreated control			Not Applicable		61.6 a		91 d		
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	44.3 ab	28.1	130 a-d	42.9	
X77	0.25% (v/v)	NA	Non-ionic spreader	NA					
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	44.5 ab	27.8	138 a-d	51.6	
Kenja 400SC	15.5 fl oz		Isofetamid	7	63.8 a	-3.6	91 d	0.0	
Treatment mean Protected LSD te	Treatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at P = 0.05.								

Cranberries / Fruit Rot Complex (<i>Coleophoma empetri</i> , etc.) #3e: Trial No. 11:SMF012 (2016: WI): Results: Tomah									
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Fruit Rot Incidence (%)		Yield (Barrels/Acre)		
					Measured	Percent Control	Measured	Percent Increase	
Untreated control			Not Applicable		33.3 a		374 bc		
Oso 5SC	6.5 fl oz	25	Polyoxin D zinc salt	19	19.1 c	42.6	317 b-e	-15.2	
X77	0.25% (v/v)	NA	Non-ionic spreader	NA					
Regalia 5EC	2 pt		<i>Reynoutria sachalinensis</i> extract	P5	23.4 bc	29.7	305 b-e	-18.4	
Kenja 400SC	15.5 fl oz		Isofetamid	7	33.8 a	-1.5	276 de	-26.2	
Treatment means followed by the same letter are not statistically different according to the Fisher's Protected LSD test at P = 0.05.									

The diseases assessment date was after the last application treatment. Therefore, the treatments were assumed to be preventative.

The researchers described the cranberry fruit rot disease pressure at all sites to be high.

No phytotoxicity was observed on fruit or foliage.

c. <u>Discussion</u>

In this trial report which included 5 different trial sites, Oso applied at 6.5 fl oz acre tank-mixed with X77 (a non-ionic spreader) applied at 0.25% (v/v) provided:

- 78.0%, 87.2%, 56.0%, 28.1%, and 42.6% (mean 58.4%) control of cranberry fruit complex; and
- -8.4%, 68.8%, -19.0%, 42.9%, and -15.2% (mean 13.8%) increased cranberry yield.

Regalia 5EC was the only OMRI-listed product that was also evaluated in this trial.

- For 4 of the 5 trials sites, Oso provided statistically <u>equivalent</u> control of cranberry fruit rot complex compared to Regalia;
- For the Valley Junction site, Oso provided statistically <u>superior</u> control of cranberry fruit rot complex compared to Regalia; and
- For all 5 trial sites, Oso provided statistically <u>equivalent</u> increased yield of cranberries.

CROP GROUP 13: BERRIES AND SMALL FRUITS: GRAPES / Bunch Rot (Botrytis cinerea)

#6: Trial No. 9:SMF001

	Grapes / Bunch Rot (<i>Botrytis cinerea</i>) #6: Trial No. 9:SMF001: Design									
Title:	Management of grape Botrytis bunch rot with experimental, organic and conventional fungicides, 2014									
Author and affiliation:	T. T. Nguyen, N. S. University of Califo	Morris, and W. D. ornia, Davis, CA	Gubler							
Publication:	PDMR 9:SMF001									
Location:	Napa County, CA									
Crop:	Grape (Vitis 'Charc	Grape (<i>Vitis</i> 'Chardonnay')								
Disease name:	Bunch rot									
Pathogen:	Botrytis cinerea									
Test plot design:	Randomized complete block									
Number of replicates:	4									
Application equipment:	Nifty-Fifty pump ta	nk/engine spray sy	/stem							
Spray volume:	200 gal/acre									
Application type(s):	Preventative									
Number of applications:	3									
Chronology:	Application Dates	Application Interval (Days)	Growth Stage	Disease Assessment Dates						
	05/08/2014		Bloom	10/06/2014						
	06/12/2014 35 Pre-close									
	07/17/2014	35	Veraison							

	Grapes / Bunch Rot (<i>Botrytis cinerea</i>) #6: Trial No. 9:SMF001: Results									
Treatment	Rate/	g a.i./	Active Ingredient	FRAC	Inciden	ce (%)	Severit	.y (%)		
	Acre	ha		Code	Measured	Percent Control	Measured	Percent Control		
Untreated control			Not Applicable		22.8 a		4.4 a			
Tavano 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	4.0 cd	82.5	1.5 bc	59.1		
Isofetamid	20 fl oz		Isofetamid	7	2.0 cd	91.2	0.0 c	100		
Elevate	16 fl oz		Fenhexamid	17	4.0 cd	82.5	0.2 c	95.5		
Double Nickel LC	2 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	1.0 d	95.6	0.3 bc	93.2		
Double Nickel 55WDG	20 oz		<i>Bacillus amyloliquefaciens</i> str. D747	44	5.0 cd	78.1	1.3 bc	70.5		
Treatment means t test at $\alpha = 0$.	ans followed	l by the	same letter are not st	atistica	lly differen	t accordi	ng to the Si	tudent's		

No phytotoxicity was reported.

c. <u>Discussion</u>

In this trial, Tavano (containing 5% polyoxin D zinc salt) applied at 6.5 fl oz/acre provided:

- 82.5% control of grape bunch rot incidence; and
- 59.1% control of grape bunch rot severity.

Double Nickel LC and Double Nickel 55WDG are OMRI-listed products evaluated in this trial. Tavano provided relative to these products:

- Statistically *equivalent* control of bunch rot incidence; and
- Statistically <u>equivalent</u> control of bunch rot severity.

CROP GROUP 13: BERRIES AND SMALL FRUITS: GRAPES / Powdery Mildew (Erysiphe necator)

#6: Trial No. KAK-2016-Grape-MI

	Grapes T	/ Powdery Milo rial No. KAK-20	dew (<i>Erysiph</i> 16-Grape-MI	<i>ne necator</i>) #6: : Design						
Title:	Eval grap	uation of fungic es, 2016	ides for con	trol of foliar and fruit	diseases of juice					
Author and affiliation:	A. M Mich	. Schilder, J. M Nigan State Univ	. Gillett, and ersity	d R. W. Sysak						
Publication:	PDM	R (planned for 1	fall 2018 pub	olication)						
Location:	Fenr	nville, MI								
Crop:	Grap	be (Vitis labrusc	a "Niagara')							
Disease name:	Pow	dery mildew								
Pathogen:	Erys	iphe necator								
Test plot design:	Rand	domized comple	ete block							
Number of replicates:	4									
Application equipment:	Rese	earch sprayer w	ith 5-foot sp	ray boom						
Spray volume:	50 g 75 g	50 gal/acre (May 8, 2016 to July 1, 2016) 75 gal/acre (remainder of the season)								
Application type(s):	Prev	Preventative								
Number of applications:	7 (Oso at 10-day to 16-day intervals)									
Chronology:		Applicati	on	Growth Stage	Disease					
	No.	Date	Interval		Assessment Date					
	1	05/23/2016		3-5 inch shoot	09/10/2016					
	2	06/08/2016	16 days	10-16 inch shoot						
	3	06/21/2016	13 days	Bloom						
	4	07/01/2016	10 days	Pea-size fruit						
	5	07/12/2016	11 days	2 nd post-bloom						
	6	07/27/2016	15 days	3 rd post bloom						
	7	08/03/2016 ^A	7 days							
	8	08/10/2016	7 days	4 th post-bloom						
Disease assessment methodology:	 25 randomly selected leaves and clusters from the center vine in each plot were visually rated. Incidence = Percent leaves or clusters with disease. Severity = Percent area symptomatic on diseased plants only. Overall Severity = (Incidence x Severity) / 100. 									
to control downy milder	w.									

FRAC Code 19 19 21	App. Code 1,2,3,4, 5,6,8 1,2,3,4, 5,6,8 1,2,3,4,	Incidence on Leaves (%) 63.0 a 30.0 b 5.0 de 1.0 e	Severity on Leaves (%) 38.4 a 8.2 b 1.5 de	Overall Severity on Leaves (%) 24.23 a 2.45 bc 0.10 d	Percent Control on Leaves 90 99
19 19 19 21	1,2,3,4, 5,6,8 1,2,3,4, 5,6,8 1,2,3,4,	63.0 a 30.0 b 5.0 de 1.0 e	38.4 a 8.2 b 1.5 de	24.23 a 2.45 bc 0.10 d	90 99
19 19 21	1,2,3,4, 5,6,8 1,2,3,4, 5,6,8 1,2,3,4,	30.0 b 5.0 de 1.0 e	8.2 b 1.5 de	2.45 bc 0.10 d	90 99
19 21	1,2,3,4, 5,6,8 1,2,3,4,	5.0 de	1.5 de	0.10 d	99
21	1,2,3,4,	1.0 e	0.5.of	0.02.4	
	5,6,8		0.5 81	0.02 d	99
NA	•				
27	1, 2	0.0 e	0.0 f	0.0 d	100
7	3,4,6,8	1			
11					
NA					
M3	5	1			
4	7,8				
	27 7 11 NA M3 4	27 1, 2 7 3,4,6,8 11 NA M3 5 4 7,8	27 1, 2 0.0 e 7 3,4,6,8 0.0 e 11 0.0 e 0.0 e NA 0.0 e 0.0 e 4 7,8 0.0 e	27 1, 2 0.0 e 0.0 f 7 3,4,6,8 0.0 f 0.0 f 11 NA 0.0 f 0.0 f M3 5 0.0 f 0.0 f 4 7,8 0.0 f 0.0 f	27 1, 2 0.0 e 0.0 f 0.0 d 7 3,4,6,8 0.0 f 0.0 f 0.0 d 11 NA 0.0 f 0.0 f 0.0 d M3 5 0.0 f 0.0 f 0.0 f 0.0 d 4 7,8 0.0 f 0.0 f 0.0 f 0.0 f

			Grapes / Powdery Milde	w (Erysi	phe necati	or) #6:			
		Tri	al No. KAK-2016-Grape-MI	: Results	: Cluster (9/10/2016)			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App. Code	Incidence on Cluster (%)	Severity on Cluster (%)	Overall Severity on Cluster (%)	Percent Control on Cluster
Untreated control			Not Applicable			58.0 a	15.8 a	9.20 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	25.0 b	4.3 b	1.11 b	88
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1,2,3,4, 5,6,8	5.0 ef	1.8 cde	0.13 c-f	99
Ranman	2.75 fl oz		Cyazofamid	21	1,2,3,4, 5,6,8	1.0 f	0.5 de	0.02 ef	99
Silwet L-77	2 fl oz		Nonionic surfactant	NA					
Manzate Pro-Stick	3 lb		Cymoxanil	27	1, 2	0.0 f	0.0 e	0.0 f	100
Pristine 38WG	12.5 oz		Boscalid	7	3,4,6,8				
			Pyraclostrobin	11					
Super Spread 90	0.125%		Non-ionic surfactant	NA					
Ziram 76DF	3 lb		Ziram	M3	5				
Ridomil Gold			Mefenoxam	4	7,8				
Treatment means fo 0.05.	ollowed by	the sam	ne letter are not statistical	ly differ.	ent accord	ling to the F	Fischer's Prote	ected SD te	st at P ≤

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

The researchers reported the powdery mildew disease pressure to be moderate on leaves and low on clusters.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre provided:

- 90% and 99% control, respectively, of powdery mildew on grape leaves; and
- 88% and 99% control, respectively, of powdery mildew on grape clusters.

No OMRI-listed products were evaluated in this trial.

#7: Trial No. KAK-2017-Grape-MI

	Grap	es / Powdery Trial No. KAI	Mildew (<-2017-Gr	<i>Erysiphe necator</i>) #7: rape-MI: Design							
Title:	Evalua	tion of fungio	ides for a	control of foliar diseases of juice gra	apes, 2017						
Author and affiliation:	A. M.C	. Schilder, J.	M. Gillet	t, and R. W. Sysak							
	Michig	an State Univ	ersity								
Publication:	PDMR	(planned for t	fall 2018	publication)							
Location:	Fennvi	lle, MI									
Crop:	Grape	('Niagara')									
Disease name:	Powde	wdery mildew									
Pathogen:	Erysipi	ysiphe necator									
Test plot design:	Rando	mized comple	ete block								
Number of replicates:	4										
Application equipment:	Resear	esearch sprayer with 5-foot boom									
Spray volume:	40 gall 50 gall	40 gallons/acre (first 3 applications) 50 gallons/acre (later season applications)									
Application type(s):	Preven	Preventative									
Number of applications:	7										
Chronology:	App. Code	Application Dates	App. Interval (Days)	Growth Stage	Disease Assessment Dates						
	Α	05/16/2017		3-5 inch shoots	09/18/2017						
	В	05/30/2017	14	7-17 inch shoots							
	C	06/10/2017	11	Pre-bloom/bloom							
	D	06/21/2017	11	1 st post-bloom; bb-size fruit							
	Е	07/11/2017	19	2 nd post-bloom; pea-size fruit							
	F	07/25/2017	14	3 rd post-bloom; pre-bunch closure							
	G	08/14/2017	20	4 th post-bloom; bunch closure							
Disease assessment methodology:	Incider Severit Overal	nce: % of lea ty: % area sy l severity: (Ir	ves or clu mptomation	usters with disease. ic on diseased plant parts only. x Severity) / 100.							

Grapes / Powdery Mildew (<i>Erysiphe necator</i>) #7: Trial No. KAK-2017-Grape-MI: Besults: Leaves											
Treatment	ment Rate/ g Active Ingredient FRAC App Code Incidence Severity Overall Cont Acre a.i./ ha Code (%) (%) (%) (%)										
Untreated control			Not Applicable			79.0 a	44.0 a	34.9 a			
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	28.0 d	4.4 c	1.2 b	97		
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J		ABCDEFG	36.0 b	5.5 c	2.0 b	94		
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727		ABCDEFG	42.0 b	6.9 b	2.9 b	96		
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	39.0 b	4.9 c	1.9 b	95		
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG						
Freatment means followed by the same letter are not statistically different according to the Fischer's Protected LSD test at P \leq 0.05.											

			Grapes / Powdery Mild Trial No. KAK-2017-Gr	ew (<i>Erys</i> ape-MI:	<i>iphe necato</i> Results: Clu	r) #7: sters			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Severity (%)	Overall Severity (%)	Control (%)
Untreated control			Not Applicable			85.0 a	43.0 a	36.6 a	
Oso	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	8.0 e	2.5 cd	0.3 d	99
Lifegard WG	4.5 oz/ 100 gal		<i>Bacillus mycoides</i> isolate J	44	ABCDEFG	25.0 bc	4.2 b	1.1 b	97
Stargus	64 fl oz		<i>Bacillus amyloliquefaciencs</i> strain F727	44	ABCDEFG	29.0 b	3.8 bc	1.1 b	97
Intuity 4SC	6 fl oz		Mandestrobin	11	ABCDEFG	27.0 bc	3.9 bc	1.1 b	97
Super Spread 90	0.125% (v/v)		Non-ionic surfactant	NA	ABCDEFG				
Treatment means 0.05.	followed by th	ne same	e letter are not statistica	lly diffe	rent accord	ing to the F	ischer's Pro	etected LSD t	test at $P \leq$

The researchers described the powdery mildew disease pressure as moderate.

No phytotoxicity was observed.

c. Discussion

In this trial, Oso applied at 13 fl oz/acre provided 97% and 99% control of powdery mildew on grape leaves and clusters, respectively.

Lifegard WG and Stargus are OMRI-listed products evaluated in this trial. Oso provided:

- Numerically <u>superior</u> control of powdery mildew on grape leaves compared to Lifegard WG and compared to Stargus.
- Statistically <u>superior</u> control of powdery mildew on grape clusters compared to Lifegard WG and compared to Stargus.

#8: Trial No. KAK-2017-Grape-PA

	Grap	bes / Powdery Trial No. KA	y Mildew (K-2017-G	(<i>Erysiphe neca</i> rape-PA: Desi	<i>ator</i>) #8: gn							
Title:	Evalua 'Conco	tion of OSO 5 ord'grapes, 2	5% and oth 2017.	ner alternative	e fungicides on Vitis Ia	abrusca						
Author and affiliation:	Bryan Lake E Penn S	Hed rie Regional itate Universi	Grape Res	search and Ex	tension Center							
Publication:	PDMR	(submitted)										
Location:	North	East, PA										
Crop:	Grapes	s (Concord)										
Disease name:	Powde	ry mildew										
Pathogen:	Podosp	losphaera xanthii										
Test plot design:	Rando	ndomized complete block										
Number of replicates:	4											
Application equipment:	Friend	covered-boo	m plot sp	rayer								
Spray volume:	50 gall	0 gallons/acre (100 psi)										
Application type(s):	Prever	reventative										
Number of applications:	7	7										
Chronology:		Application		Days After First	Growth Stage	Disease Assessment						
	Code	Dates	Interval (Days)	Application		Dates						
	А	05/10/2017		0	3-6 inch shoots							
	В	05/19/2017	9	9	10-12 inch shoots							
	С	05/28/2017	9	18	12-16 inch shoots							
	D	06/08/2017	11	29	Immediate pre- bloom							
	Е	06/18/2017	10	39	1 st post-bloom							
	F	06/28/2017	10	49	2 nd post-bloom							
	G	07/09/2017	11	60	3 rd post-bloom							
						08/03/2017 (clusters)						
						08/15/2017 (leaves)						
Disease assessment methodology:	Severit area ir	ty was rated nfected (0-10	using the 0%) using	Barratt-Horsf Elanco conve	all scale and was conv rsion tables.	verted to %						

			range / Dowdorn Mildow / Frag	inha na	actor #9.			
		T	rial No. KAK-2017-Grape-PA: F	lesults:	Clusters			
Treatment	Rate/	g a.i./	Active Ingredient	FRAC	App Code	Incidence	Severi	ty (%)
	Acre	ha		Code		(%)	Measured	% Control
Untreated control			Not Applicable			90.0 ab	6.29 a	
OSO 5%	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	42.0 d	1.03 e	84
Fracture	24.4 fl oz		Banda de Lupinus albus doce (BLAD)	BM1	ABCDEFG	90.0 a	3.91 bcd	38
Fracture 36.6 fl oz Banda de Lupinus albus doce (BLAD)					ABCDEFG	92.0 a	3.42 bcd	46
Double Nickel	1.5 qtBacillus amyloliquefaciens str. D747			44	ABCDEFG	89.0 ab	4.78 bc	24
Double Nickel	3 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	ABCDEFG	91.0 a	5.20 ab	17
Badge X2	1.75 lb		Copper hydroxide, Copper oxychloride	M1	ABCDEFG	69.0 bc	2.57 cde	59
Lime	1.75 lb		Calcium hydroxide	NA	ABCDEFG			
Conventional standard:								
Manzate Prostik	3 lb		Cymoxanil	27	ABCD	61.0 cd	1.64 de	74
• Ziram	4 lb		Zinc dimethyldithiocarbamate	M3	EFG			
Quintec	intec 4 fl oz Quinoxyfen		Quinoxyfen	13	DG			
Vivando	Vivando 10.3 fl oz Metrafenone		Metrafenone	U8	E			
Toledo	4 oz		Tebuconazole	3	F			
Treatment means fo	llowed by th	e same le	etter are not statistically differ	ent acc	cording to F	isher's LDS te	est at $P \leq 0.05$	j.

		G	rapes / Powdery Mildew (<i>Erysi</i> Trial No. KAK-2017-Grape-PA:	iphe ne	cator) #8:			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Incidence (%)	Sever (%)	ity
						Measured	Measured	Percent Control
Untreated control			Not Applicable			98.0 a	16.32 a	
OSO 5%	13.0 fl oz	50	Polyoxin D zinc salt	19	ABCDEFG	75.0 bc	3.09 bc	81
Fracture	ture 24.4 fl oz Banda de Lupinus albus doce (BLAD)				ABCDEFG	85.0 bc	5.74 bc	65
Fracture 36.6 fl oz Banda de Lupinus albus doce (BLAD)					ABCDEFG	86.0 abc	8.66 abc	47
Double Nickel	1.5 qt	Bacillus amyloliquefaciens str. D747		44	ABCDEFG	89.0 ab	7.18 bc	56
Double Nickel	3 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	ABCDEFG	91.0 ab	9.98 ab	39
Badge X2	1.75 lb		Copper hydroxide, Copper oxychloride	M1	ABCDEFG	19.0 e	0.54 c	97
Lime	1.75 lb		Calcium hydroxide	NA	ABCDEFG			
Conventional standard:								
Manzate Prostik	3 lb		Cymoxanil	27	ABCD	42.0 d	1.27 e	92
• Ziram	4 lb		Zinc dimethyldithiocarbamate	M3	EFG			
Quintec	4 fl oz Quinoxyfen		Quinoxyfen	13	DG			
Vivando	/ivando 10.3 fl oz Metrafenone			U8	E			
Toledo	4 oz		Tebuconazole	3	F			
Treatment means fo	llowed by th	e same le	etter are not statistically differ	rent acc	cording to Fi	sher's LDS te	st at $P \leq 0.05$.	

The researcher described the powdery mildew development on grape clusters and grape leaves as moderately high.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided:

- 84% control of powdery mildew severity on grape clusters; and
- 81% control of powdery mildew severity on grapes leaves.

OMRI-listed products evaluated in this trial included Double Nickel and Badge X2 tank-mixed with Lime. Oso provided:

- Numerically *superior* control of powdery mildew severity on grape clusters and leaves compared to Double Nickel; and
- Statistically <u>equivalent</u> control of powdery mildew severity on grape clusters and leaves compared to Badge X2 tank-mixed with lime.

CROP GROUP 13: BERRIES AND SMALL FRUITS: STRAWBERRIES / Botrytis Fruit Rot (Botrytis cinerea)

#4: Trial No. KAK-2016-Sberry-MD

St	rawberries / Boti Trial No. K	rytis Fruit Rot AK-2016-Sberr	(<i>Botrytis cinei</i> y-MD: Design	rea) #4:								
Title:	Evaluation of o Botrytis fruit ro	rganic and con ot in strawberr	ventional fung ies, 2016	icides for the co	ontrol of							
Author and affiliation:	E. E. Koivunen Univ. of Maryla	E. E. Koivunen and C. L. Swett Univ. of Maryland										
Publication:	Submitted to P	lant Disease M	anagement Re	ports								
Location:	Queenstown, M	D										
Crop:	Strawberry (Fra	agaria x anana	ssa 'Chandler')								
Disease name:	Botrytis Fruit R	Botrytis Fruit Rot										
Pathogen:	Botrytis cinerea	Botrytis cinerea										
Test plot design:	Randomized co	Randomized complete block										
Number of replicates:	4											
Application equipment:	Twin TeeJet nozzles (60 psi)											
Spray volume:	93 gal/acre											
Application type(s):	Preventative											
Number of applications:	9											
Chronology:	Application	Application		Assessment Dat	es							
	Dates	Interval	AUDPC	Incidence	Marketable Fruit							
	03/30/2016		05/06/2016	05/06/2016	05/18/2016							
	04/06/2016	7 days	05/18/2016	05/18/2016	05/25/2016							
	04/13/2016	7 days	05/25/2016	05/25/2016	06/01/2016							
	04/20/2016	7 days	06/01/2016	06/01/2016								
	05/25/2016	5 days										
	05/30/2016	5 days										
	05/04/2016	5 days										
	05/10/2016	6 days										
	05/18/2016	8 days										
Soil:	Not fumigated.											

Strawberries / Botrytis Fruit Rot (<i>Botrytis cinerea</i>) #4:												
Treatment	Rate/	a	Active Ingredient	FRAC	AK-2016 App.	-Sberry-MD: Incide	Results	I	Marketa	ble Fruit		
	Acre	a.i./		Code	No.	(%)	Perc	ent	Grams	Grams/Plant	
		ha				Measured	Percent Control	Measured	Percent Increase	Measured	Percent Increase	
Untreated control (Water)			Not Applicable			14.4 b		67.5 a		114.3 a		
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	1-9	5.6 ab	61.1	66.3 a	-1.88	114.1 a	-0.17	
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	1-9	4.4 a	69.4	80.0 a	18.5	143.1 a	25.2	
Organic Std: • Regalia	4 qt		<i>Reynoutria sachalinensis</i> extract	P5	1-9	9.4 ab	34.7	67.5 a	0.00	115.9 a	1.34	
Actinovate	12 oz		Streptomyces Iydicus	NC	2,4,6,8							
• Silwet	0.8 qt		Non-ionic surfactant	NA	2-9							
Serenade ASO	4 qt		<i>Bacillus subtilis</i> str. QST 713	44	3,5,7,9							
Treatment me comparison te	ans foll st at P =	owed I = 0.05.	by the same letter a	re not s	tatistical	ly different	according	to ANOVA	and Tukey	's multiple	means	

Treatments were applied preventatively. Foliage remained healthy.

The researchers described the Botrytis fruit rot disease pressure as relatively low due to the cool spring.

No phytotoxicity was observed.

c. <u>Discussion</u>

This trial was conducted on the eastern shore of Maryland where humidity is high, pick-your-own strawberry farms are common, and soil fumigation is not used due to the close proximity of the Chesapeake Bay.

In this trial, Oso applied at 6.5 fl oz/acre and 13 fl oz/acre, in the absence of soil fumigation for pest control, provided:

- 61.1% and 69.4% control, respectively, of Botrytis fruit rot incidence; and
- -1.88% and 18.5% increased strawberry marketable fruit, respectively.

The local standard treatment program of organic strawberries includes Regalia, Actinovate, Silwet, and Serenade ASO and was evaluated in this trial. Treatment with Oso provided:

- <u>Superior</u> control of Botrytis fruit rot incidence compared to the organic standard treatment program; and
- <u>Superior</u> marketable strawberry yield compared to the organic standard treatment program.

#5: Trial No. KAK-2016-Sberry-MI

St	rawbe	rries / Botryt Trial No. KAł	is Gray M (-2016-Sb	old (<i>Botrytis cinerea</i>) # perry-MI: Design	5:						
Title:	Eval mati	uations of fur ted-row straw	ngicides f /berry, 20	or control of leaf and fr)16	uit rot diseas	ses in					
Author and affiliation:	A. M Mich	A. M.C. Schilder, N. M. Gillett, and R. W. Sysak Michigan State University									
Publication:	PDM	R (planned fo	r fall 201	8 publication)							
Location:	Cam	den, MI									
Crop:	Strav	wberry (<i>Fraga</i>	arias x an	anassa 'Wendy')							
Disease name:	Botr	Botrytis gray mold									
Pathogen:	Botr	Botrytis cinerea									
Test plot design:	Rand	andomized complete block									
Number of replicates:	4										
Application equipment:	Hand	Handheld Smith Contractor Sprayer (29 psi)									
Spray volume:	75 g	75 gal/acre									
Application type(s):	Prev	Preventative									
Number of applications:	7										
Chronology:		Application Disease Harve Assessment Date									
	No.	Date	Interval	Growth Stage	Dates (Berries)						
	1	05/09/2016		Green up	06/23/2016	06/16/2016					
	2	05/18/2016	9 days	Bloom		06/24/2016					
	3	05/24/2016	6 days	2 nd bloom after frost							
	4	06/01/2016	7 days	Bloom and green fruit							
	5	06/07/2016	6 days	Green fruit							
	6	06/15/2016	7 days	Green and red fruit							
	7	06/23/2016	8 days	Red fruit							
Disease assessment methodology:	 Visual field ratings: 50 berries were selected randomly. Disposable gloves were used to pick berries and changed between plot to reduce cross-contamination. Harvest was from the center of plots. Post-harvest: 25 marketable berries from each plot were placed equidistant on metal screens in aluminum trays and incubated at 72°F and 100% relative humidity. After 4 days, the berries were inspected for fungal sporulation. 										

Strawberries / Botrytis Gray Mold (<i>Botrytis cinerea</i>) #5: Trial No. KAK-2016-Sberry-MI: Results										
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	Field Incidence (%)		4-Day Post-Harvest ^A Incidence (%) (1 st Harvest; 6/16/2016)		4-Day Post-Harvest ^A Marketable Fruit(%) (1 st Harvest; 6/16/2016)	
					Measured	Percent Control	Measured	Percent Control	Measured	Percent Increase
Untreated control			Not Applicable		39.0 a		39.0 a		7.5 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	6.0 b	85	27.0 cd	31	28.0 bc	273
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	5.5 bc	86	25.0 cd	36	25.0 b	233
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	3.5 bc	91	35.0 bc	10	27.0 bc	260
Serifel	4 oz		<i>Bacillus amyloliquefanciens</i> strain MBI 600	44	6.5 b	83	21.0 d	46	38.0 c	407
Pristine	11.5 oz	1	Boscalid	7	1					
			Pyraclostrobin	11						
Treatment means followed by the same letter are not statistically different according to Fisher's Protected LSD test at P ≤ 0.05. A. Harvested 1 day after last application. All berries used in the post-harvest incubation test appeared marketable (no visible disease or soft areas) before incubation started.										

The first assessments were performed after the last treatment. Therefore, all treatments are assumed to be preventative.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided:

- 86% control of field incidence of Botrytis fruit rot on strawberries; and
- 233% increased 4-day post-harvest marketable strawberries.

OMRI-listed products evaluated in this trial included Serifel. Oso applied at both 6.5 fl oz/acre and at 13 fl oz/acre provided control of Botrytis on strawberries that was statistically <u>equivalent</u> to the field and post-harvest control of Botrytis provided by Serifel.
#6: Trial No. KAK-2017-Sberry-MI

a. <u>Design</u>

Str	awberries / Bo Trial No.	trytis Gray M KAK-2017-Sb	old (<i>Botrytis cinerea</i>) #6 berry-MI: Design	:
Title:	Evaluation of matted-row s	fungicides fo trawberry, 20	r control of leaf and fru)17	it rot diseases in
Author and affiliation:	A. M. C. Schil Michigan Stat	der, J. M. Gil e University	lett, and R. W. Sysak	
Publication:	PDMR (planne	d for fall 201	8 publication)	
Location:	Camden, MI			
Crop:	Strawberry (F	Tragaria x ana	anassa 'Wendy')	
Disease name:	Botrytis gray	mold		
Pathogen:	Botrytis ciner	rea		
Test plot design:	Randomized o	complete bloo	ck	
Number of replicates:	4			
Application equipment:	Smith Contrac	ctor Sprayer ((29 psi)	
Spray volume:	75 gallons/ac	re		
Application type(s):	Preventative			
Number of applications:	5			
Chronology:	Application Dates	Application Interval (days)	Growth Stage	Disease Assessment Dates
	05/01/2017		Green up	06/22/2017 (field ratings)
	05/07/ 2017	7	50% bloom	06/26/2017 (post-harvest ratings)
	05/24/2017	17	Bloom	
	05/31/2017	7	Bloom and green fruit	
	06/14/2017	14	Red fruit	
Disease assessment methodology (post- harvest):	25 marketable screens in alu relative humi sporulation.	e berries fror minum trays dity. After 4	n each plot were placed and incubated at room 1 days, berries were visua	equidistantly on metal emperature and 100% ally assessed for final

b. <u>Results</u>

			Strawberries / Botrytis G Trial No. KAK-20	ray Mold)17-Sberi	(<i>Botrytis</i> y-MI: Res	s <i>cinerea</i>) #6: sults			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRAC Code	App Code	Field Rating Gray / on Fi	of Botrytis Nold ruit	4-Day Post Marketab	-Harvest le Fruit
						Incidence (%)	Control (%)	Incidence (%)	Increase (%)
Untreated control			Not Applicable			53.5 a		2.0 a	
Oso 5%	13 fl oz	50	Polyoxin D zinc salt	19	ABCDE	3.3 b	94	49.0 b	2350
Standard program:									
Topsin	4.5 fl oz		Thiophanate-methyl	1	A	3.3 b	94	40.0 b	1900
Captan 4L	3 qt		Captan	M4	А				
Fontelis	24 fl oz		Penthiopyrad	7	BCE				
Switch 62.5	12 oz		Cyprodinil	9	D				
			Fludioxonil	12					
Treatment mean 0.05.	s followed	by the sa	me letter are not statisti	cally diff	erent acc	cording to the	Fisher's Prot	ected LSD te	st at P ≤

The researchers described the Botrytis disease pressure in the field as moderately high.

No phytotoxicity was observed.

c. <u>Discussion</u>

In this trial, Oso applied at 13 fl oz/acre provided:

- 94% control of Botrytis fruit rot on strawberries; and
- 2350% increased 4-day post-harvest marketable strawberries.

No OMRI-listed products were evaluated in this trial.

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EVALUATION OF ORGANIC GROWER NEED

STEP 1: Cumulative Efficacy Data Summary for Polyoxin D Zinc Salt Petitioned Uses

Efficacy data for the polyoxin D zinc salt 5SC formulation summarized in the May 31, 2016 petition and this addendum for which polyoxin D zinc salt was used in the absence of other fungicide products is further summarized below. The table below includes mean percent control data based upon the application rate. Curative treatments are highlighted. Non-ionic surfactants and other adjuvants are noted when used.

Cum	ulative Summary	/ of the Effic	cacy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	e (EPA R	eg. No.	68173-4)	and Oso 5%S	C Fungi	cide (EPA F	Reg. No.	68173-4-70	J51)
Disease	Pathogen	Crop	Trial No.	State	Formulation ¹	No.	Application	Applica	tion Rate	Ground M	ean	Mean	Application	Inocu-	Max. Pest	Phyto-	Publication	Notes
		Tested & Sequence No.				App.	Interval (Days)	fl oz/ acre	g a.i./ ha	Cont Leaves	rol (%) Fruit	Yield Increase (%)	Type(s)	lated?	Pressure in UTC (%)	tox ?	Status	
CROP GROUP	1: ROOT AND TU	JBER VEGET	ABLES		•						•		•		•		•	
Early Blight	Alternaria solani	Potatoes #1	CER-2011-029	MI	CX-10440	8	7	3.8 7.5	15 29	19.3 22.2	NA NA	26.4	Preventative and curative	No	45.0	No	PDMR 6:V107	
		Potatoes #2	CER-2011-030	PA	CX-10440	4	14 - 18	3.75	14 29	18.1 39.7	NA NA	NA NA	Preventative and curative	Yes	AUDPC = 922.6	No	PDMR 6:V113	
		Potatoes #3	CER-2012-028	PA	CX-10440	7	7 - 8	6.5	25	41.9	NA	13.5	Preventative and curative	Yes	AUDPC = 340	No	PDMR 7:V105	
							Mean	3.75 -	14 - 15	18.7	NA	26.4						
								6.5 - 7.5	25 - 29	34.6	NA	10.2	1					
								13	50	41.9	NA	6.5						
Late Blight	Phytophthora infestans	Potatoes #1	CER-2012-027	PA	CX-10440	5	7	13	50	10.1	NA	13.9	Preventative and curative	Yes	AUDPC = 1612	No	PDMR 7:V094	
		-					_						_					
Tan Spot	Botrytis cinerea	Potatoes #1	CER-2011-029	MI	CX-10440	8	7	3.8 7.5	15 29	74.9 71.4	NA NA	26.4 6.9	Preventative	No	35.0	No	PDMR 6:V107	
CROP GROUP	4: LEAFY VEGET	ABLES (EXC	EPT BRASSICA	VEGETA	BLES)						•		•					
Downy Mildew	Bremia lactucae	Lettuce #1	CER-2011-046	CA	CX-10440	4	14 - 15	3.75	14	47.5	NA	NA	Preventative	No	100	No	Certis data;	
								7.5	29	33.7	NA	NA	and curative				not published.	
		Lettuce #2	CER-2013-014	CA	Oso	8	7	6.5	25	50	NA	NA	Preventative	No	12.58	No	Certis data;	
								13	50	62	NA	NA	and curative		lesions/		not	
		Lettuce #3	CER-2013-032	CA	Oso + Syl-Tak (surfactant; 4 fl oz/A)	4	6 - 10	13	50	46.2	NA	NA	Preventative	No	4.26 lesions/ head	No	Not published. Permission	
							Mean	3.75	14	47.5	NA	NA					receiveu.	
							cu.i	6.5 -7.5	25 - 29	42	NA	NA						
								13	50	54	NA	NA						
Gray Mold	Botrytis cinerea	Lettuce #1	CER-2011-014	CA	CX-10440	4	10 - 11	3.75	14	30.0	NA	6.1	Preventative	No	52.62	No	Certis data;	
								7.5	29	41.7	NA	6.5					published.	
																		1

Cumu	Ilative Summary	of the Effic	acy of the Po	lyoxin D Applie	Zinc Salt 5SC d as a Foliar S	Suspe Spray	ension Conce to Growing	entrate l Food Cre	Fungicide	(EPA R Ground	eg. No. (Applica	68173-4) ation Equ	and Oso 5%S0 ipment	C Fungio	cide (EPA R	eg. No.	68173-4-70	051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applicat	tion Rate	Me Cont	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
Powdery Mildew	Golovinomyces	Lettuce #1	CER-2012-074	AZ	CX-10440	4	8 - 11	3.75	14	69	NA	NA	Preventative	No	3.9	No		
	ciciidi aceai uni							6.5	25	69	NA	NA	and curative		(0-5 scale)		0. 1 1 7 7	
White Rust	Albugo occidentalis	Spinach #1	CER-2014-063	тх	Oso	4	5 - 9	6.5	25	53	NA	NA	Curative	No	100	No	Not published. Permission received.	Disease present before first application.
		Spinach #2	CER-2015-152	ТХ	Oso + Induce (non-ionic surfactant; 4 oz/A)	4	11 - 15	6.5	25	49	NA	NA	Preventative	No	4.5 on 1 to 10 scale	No	Not published. Permission received.	New data.
							Mean	6.5	25	51	NA	NA						
CROP GROUP	8: FRUITING VEC	GETABLES	•		T	1							1	1				•
Early Blight	Alternaria solani	Tomatoes #1	CER-2014-095	FL	Oso	8	6 - 9	6.5	50	38.4	NA	NA	Preventative and curative	Yes	55.0	No	PDMR 9:V072	
		T : "4	CED 2011 027	-	CV 10110	4	()	7.5	20	(1)			D		546.0	N		
Late Blight	infestans	Tomatoes #1	CER-2011-027	FL	CX-10440	4	0-8	7.5	29	64.3	NA	NA	Preventative	NO	546.0 lesions/ plot	NO	published. Permission received.	
Powdery Mildew	Leviellula taurica	Tomatoes #1	CER-2012-016	CA	CX-10440	3	9 - 14	13	50	47.3	NA	14.5	Curative	No	93.5	No	Not published. Permission received.	See also Odium neolycopersici.
Powdery Mildew	Odium	Tomatoes #1	BCGGA-2015-	Green-	Oso	4	7	4.1	15	84.8	NA	3.5	Preventative	Yes	62.5	No	Canadian	See also
	пеортусорегыст		05	nouse				6.8 12.7	26.2	86.9	NA	11.4			-		Plant	taurica.
		l				2	14	13.7	52.7	90.Z	NA NA	14.0	1				Pathology	
	-					-	17	20.5	75	82.9	NA	19.3	1					
							Mean	4.1	15	84.8	NA	3.5						
								6.8	26.2	86.9	NA	11.4						
								13.7	52.7	86.4	NA	4.3						
								20.5	75	82.9	NA	19.3						
Target Spot	Corynespora cossiicola	Tomatoes #1	CER-2014-095	FL	Oso	8	6 - 9	6.5	25	38.4	NA	NA	Preventative and curative	Yes	55.0	No	PDMR 9:V072	

Cum	ulative Summary	y of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	e (EPA R	eg. No.	68173-4)	and Oso 5%S	C Fungi	cide (EPA R	Reg. No	. 68173-4-70	051)
Disease	Pathogen	Crop	Trial No	Applie State	E as a Foliar	Spray	Application	Applica	ops Using	Ground	a Applica	Mean	Application	Inocu-	Max Pest	Phyto-	Publication	Notes
Discuse	rutiogen	Tested &	macho.	State	ronnatation	App.	Interval	Аррпса	cion nate	Cont	rol (%)	Yield	Type(s)	lated?	Pressure in	tox ?	Status	notes
		Sequence					(Days)	fl oz/	g a.i./	Leaves	Fruit	Increase			UTC (%)			
			1		1			acre	na	<u> </u>		(/0)	1					1
	Colletotrichum	Watermelon	CEP-2014-057	тү	Oso + Capsil	7	6 - 11	6.5	25	87	NA	33	Proventative	No	1 38	No	Not	Phytotoxicity
Antinachose	orbiculare	#1	CER 2014-037		(surfactant; 12 fl oz/100 gal)	,	0 - 11	0.5	23	02		5.5	and curative		(Scale of 0 to 5)		published. Permission received.	observed in alternative treatment program: chlorothalonil + mancozeb + zoxamide.
Gummy Stem Blight	Didymella bryoniae	Cantaloupe #1	IND-2012-125	Green- house	CX-10440	1	Not Applicable	14	54	54 86.7 NA NA Preventative Yes 100 Permission received. obse submitted alter to Plant Armin Progress. 52.7 61.0 NA 20.3 Preventative and curative and curat	Phytotoxicity observed for alternatives: Armicarb and Organocide.							
		Cucumber #1	BCGGA-2015-	Green-	Oso	4	7	13.7	52.7	61.0	NA	20.3	Preventative	Yes	90.8	No	Canadian	20.5 fl oz/acre
			02	nouse		2	14	13.7	52.7	60.7	NA	15.8	and curative				Plant	labeled rate.
						2	14	20.5	75	58.9	NA	21.9					Pathology	
		Watermelon	CER-2011-028	SC	CX-10440	7	7 - 12	27	27	33.6	NA	NA	Preventative	Yes	99.9	No	PDMR	Exceeds
		#1 Watermelen	CED 2012 051	64	CX 10110	7	F O	54	51	62.5	NA	NA	and curative	Vaa	95.0	Na	6:VUZ3	labeled rate.
		#2	CER-2012-031	GA	CX-10440		J - 7	0.5	25	25.7	NA	NA	Culative	ies	05.0	NO	to Plant Health	days before first fungicide
								13.0	50	30.6	NA	NA					Congress. Permission received.	treatment.
							Mean	6.5	25	25.7	NA	NA	_					
								13.0 - 14	50 - 54	57	NA	18.1	-					
Powdery Mildew	Podosphaera	Cucumbers	R-14-10-0	Green-	Veggieturbo	2	7	6.5	25	80	NA NA	21.9 NA	Curative	Yes	80.0	No	Kaken data:	Disease
i owaci y mikaci	xanthii	#1		house	5SC	-	,	13	50	81	NA	NA		105	00.0	110	not published.	confirmed before first
xan		Pumpkins #1	CER-2015-145	IL	Oso + Activator (non-ionic surfactant; 0.125%)	7	6 - 8	6.5	25	67	NA	NA	Preventative and curative	No	30	No	Not published. Permission received.	treatment.
		Pumpkin #2	CER-2015-149	GA	Oso	5	7	6.5	25	51.7	NA	NA	Preventative	No	72.5 (0 to 100 scale; 100 = Plant mortality.	No	Not published. Permission received.	
							Mean	6.5	25	66	NA	NA	_					
								13	50	81	NA	NA						

Cum	ulative Summar	y of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	e (EPA R	eg. No.	68173-4)	and Oso 5%S	C Fungi	cide (EPA R	leg. No	. 68173-4-70	0051)
Discost	Dathanan	Carr	Trial Ma	Applie	ed as a Foliar	Spray	to Growing	Food Cr	ops Using	Ground	d Applica	ation Equ	ipment	1	Have Darah	Dhute	Dublication	Netes
Disease	Patnogen	Tested & Sequence	That No.	State	Formulation	App.	Interval (Davs)	Applica		Cont	ean rol (%) Fruit	Yield	Type(s)	lated?	Pressure in	tox ?	Status	Notes
		No.					(20)	acre	ha	Leaves	TTUIL	(%)			0.0(///			
Downy Mildew	Pseudo- peronospora cubensis	Cucumber #1	CER-2012-067	DE	CX 10440	5	5 - 7	6.5	25	57.1	NA	37.1	Preventative	No	17.5	No	Not published. Permission	
	cubensis							15	50	57.1	INA	10.0					received.	
		Pumpkin #1	CER-2015-145	IL	Oso + Activator (non-ionic surfactant; 0.125%)	7	6 - 8	6.5	25	78	NA	NA	Preventative and curative	No	20.75	No	Not published. Permission received.	
							Mean	6.5	25	68	NA	37.1	1	ļ		ļ		
		6 1 1/1	CED 2012 050	61	CV 10110	0		13	50	37.1	NA	18.0			2		C 11 1 1	F 1:
Southern Blight	rolfsii	Squash #1	CER-2012-050	GA	CX-10440	9	/	6.5 13	25 50	NA NA	59 82	48Z 552	Preventative	NO	2 on a 1 to 10	NO	not	treatment.
								-			-				scale		published.	
	11. POWE ERUIT	TS																
Fly Speck	Zvgophiala	Apples #1	CER-2012-025	VA	CX-10440	9	12 - 20	6.5	25	NA	93	NA	Preventative	No	87	No	PDMR	Ι
<i>,</i>	jamaicensis							13	50	NA	70	NA	and curative				7:PF034	
Powdery Mildew	Podosphaera Ieucotricha	Apples #1	CER-2012-020	WA	CX-10440	5	6 - 14	6.5	25	56	NA	NA	Preventative and curative	No	35.5	No	Certis data; not	
								13.0	50	54	NA	NA					published.	
		Apples #2	CER-2015-012	WA	Oso	5	8 - 27	6.5	25	14.4	78.2	NA	Preventative and curative	No	61.3	No	Certis data; not published	
		Apples #3	CER-2015-034	WA	Oso + sticker/ spreader (R-56 or SB56; not specified; rate not reported)	6	13 - 19	6.5	25	40.5	NA	NA	Preventative and curative	No	30.8	No	Certis data; not published.	
		Apples #4	CER-2015-033	WA	Oso + R-56 (sticker/ spreader; 0.25%; v/v)	1	NA	6.5	25	NA	10.4	NA	Preventative	No	96.0	No	Certis data; not published.	New data. Storage rot; fruit punctured and not punctured.
							Mean	6.5	25	37	44.3	NA						
-						_		13.0	50	54	NA	NA						
Scab	Venturia inaequalis	Apples #1	CER-2012-025	VA	CX-10440	9	12 - 28	6.5	25	53	62 46	NA NA	Curative	No	87	No	PDMR 7:PF034	Scab was present before the first
																		fungicide application.
		4 1 1/4	CED 2012 025		CV 10110	-	42		25		70				0.1		00000	
Sooty Blotch Complex	Geastrumia	Apples #1	CER-2012-025	VA	CX-10440	9	12 - 28	6.5	25	NA	/9	NA	Preventative and curative	No	94	No	PDMR 7:PF034	
	etc.							13	50	NA	56	NA						

Cum	ulative Summar	y of the Effic	cacy of the Po	lyoxin D Applie	Zinc Salt 5SC	Suspe Sprav	ension Conc	entrate l Food Cr	Fungicide	e (EPA R Ground	eg. No. 1 Applic	68173-4) ation Equ	and Oso 5%S	C Fungi	cide (EPA F	Reg. No.	68173-4-70	051)
Disease	Pathogen	Crop Tested & Sequence	Trial No.	State	Formulation ¹	No. App.	Application Interval (Days)	Applicat	tion Rate	M Cont Leaves	ean rol (%) Fruit	Mean Yield Increase	Application Type(s)	Inocu- lated?	Max. Pest Pressure in UTC (%)	Phyto- tox ?	Publication Status	Notes
		No.						acre	ha	Louros		(%)						
CROP GROUP	12: STONE FRU	ITS				-		T					_				•	•
Brown Rot Blossom Blight	<i>Monilinia fructicola</i> and <i>Monilinia Iaxa</i>	Cherries #1	CER-2015-035	OR	Oso + Induce (wetter/ sticker; 32 fl oz/100 gal)	7	7 - 14	6.5	25	96.5	NA	NA	Preventative and curative	No	14.3	No	PDMR 10:STF009	Applications initiated before bloom.
		French prunes #1	CER-2013-121	CA	CX-10440	1	NA	6	23	85.9	NA	NA	Curative	Yes	65.1	No	UC Repository 07 CPB 6	Inoculated 24 hr before first treatment.
										97.3	NA	NA	Preventative	Yes	63.8			Inoculated 4 hr after first treatment.
							Mean	6 - 6.5	23 - 25	93.2	NA	NA						
Brown Rot Fruit	. Monilinia	Nectarines	CER-2013-119	CA	CX-10440	1	NA	3.5	13	NA	18	NA	Preventative	Yes	85.3	No	Internet	Pre-harvest
Rot	fructicola	#1						13	50	NA	20	NA]	(post-			(Adaskaveg,	treatment.
		Peaches #1						3.5	13	NA	13	NA		nar- vest)	67.9		2013)	post-narvest inoculation and
								13	50	NA	19	NA		,				evaluation.
		Cherries #1	CER-2015-035	OR	Oso + Induce (wetter/ sticker; 32 fl oz/100 gal)	7	7 - 14	6.5	25	NA	78	NA	Preventative and curative	No	6.0	No	PDMR 10:STF009	Pre-harvest treatment. Post-harvest evaluation.
							Mean	3.5	13	NA	16	NA						
								6.5	25	NA	19	NA						
					-			13	50	NA	20	NA	-					
Powdery Mildew	Podosphaera clandestina	Cherries #1	CER-2015-032	WA	Oso + R-56 (spreader/ sticker; 32 fl oz/100 gal)	4	14 - 15	6.5	25	60.0	NA	NA	Preventative and curative	No	89.0	No	Certis data; not published.	
		Cherries #2	CER-2015-035	OR	Oso + Induce (wetter/ sticker; 32 fl oz/100 gal)	7	7 - 14	6.5	25	19.6	NA	NA	Preventative	No	53.3	No	PDMR 10:STF009	New data. Applications initiated before bloom.
							Mean	6.5	25	39.8	NA	NA						

Cum	ulative Summary	y of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate l	Fungicide	e (EPA R	eg. No.	68173-4	and Oso 5%S	C Fungi	cide (EPA R	Reg. No.	68173-4-70	051)
Disease	Dethermon	Court	Trial Ma	Applie	d as a Foliar	Spray	to Growing	Food Cr	ops Using	Ground	d Applica	ation Equ	uipment	La a a c	Mary Dart	Dhute	Dublication	Mataa
Disease	Patnogen	Crop Tested &	Trial No.	State	Formulation	NO. ADD.	Application Interval	Applicat	tion Rate	Cont	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	tox ?	Status	Notes
		Sequence				P. P. S	(Days)	fl oz/	g a.i./	Leaves	Fruit	Increase) F - (-)		UTC (%)			
		No.		DIEC				acre	ha			(%)						
CROP GROUP 13: BERRIES AND SMALL FRUITS: BLUEBERRIES Alternaria Fruit Alternaria spp. Blueberries CR-2012-049 MI CX-10440 5 10 - 39 6.5 25 NA 31 NA Preventative No 48.5 Rot #1 CX-10440 5 10 - 39 6.5 25 NA 31 NA Preventative No 48.5														Na	DDAD	Dra hamiaat		
Rot	Atternaria spp.	#1	CER-2012-049	///	CA-10440	5	10 - 39	0.5	25	NA	21	NA	Preventative	NO	40.5	INU	7:SMF014	treatment.
								13.0	50	NA	51	NA						Post-harvest
Gray Mold	Botrytis cinerea	Blueberries	CER-2015-009	OR	Oso + Kinetic	12	Typically 6-	5.6	22	NA	72	NA	Preventative	No	7.8	No	PDMR	
		#1			(sticker/ spreader:		8										10:SMF027	
					6 fl oz/100	7	13-15	5.6	22	NA	87	NA						
Image: Second																		
Mummyberry	Monilinia	Blueberries	CER-2015-008	OR	Oso + Induce	9	4 - 8	5.6	21.6	NA NA	80 21 3	NA NA	Preventative	No	34.8	No	PDMR	
manniyberiy	vaccinii-	#1		ÖN	(wetter/	í		5.0	21.0		21.5	101	and curative	110	51.0	110	10:SMF026	
	corymbosi				sticker; 6 fl oz/100													
					gal)													
		Blueberries	CER-2015-143	MI	Oso + LI 700	5	7 - 14	6.5	25	89	94	NA	Preventative	No	46.5	No	PDMR	
		#Z			(penetrant, acidifier:										mummies/ bush		10:SMF009	
					0.125% v/v)													
		Blueberries #3	KAK-2016- Blueberry-MI	MI	Oso	8	8 - 23	6.5	25	90.8	90.7	NA	Preventative and curative	No	57.8 shoot	No	PDMR (Planned fall	New data.
		<i>m</i> 5	blueberry mi					13	50	100	100	NA			bush		2018	
					Oso + LI 700			6.5	25	87.9	88.2	NA					publication)	
					(penetrant,												(1 01111331011)	
					0.125% v/v)													
		Blueberries	KAK-2016-	WA	Oso	6	10 - 16	6.5	25	83.0	84.3	NA	Preventative	No	17.8	No	Permission.	New data.
		#4	Conv					13	50	83.0	87.1	1			bush			
		Blueberries	KAK-2016-	WA	Oso	7	6 - 9	6.5	25	-64.4	17.8	NA	Preventative	No	45.0	No	Permission.	New data.
		#5	Blueberry-WA- Org					13	50	32.5	30.0	NA			(fruit)			Includes Oso with microbial
			015					15	50	52.5	50.0	INA.						pesticides.
		Blueberries	KAK-2017-	WA	Oso	7	5 - 11	6.5	25	NA	63	NA	Preventative	No	6.3	No	Permission.	New data.
		#0	Org					13	50	NA	68	NA						with microbial
			-															pesticides.
							Mean Conven-	5.6 - 6.5	21.6 - 25	88	77	NA						
							tional	13	20	91.5	93.6	NA						
							Mean	6.5	25	-64.4	40	NA						
							Organic	13	50	32.5	49	NA						

Cumi	ulative Summary	y of the Effic	cacy of the Po	lyoxin D Applie	Zinc Salt 5SC ed as a Foliar	: Suspe Spray	ension Conc to Growing	entrate Food Cr	Fungicide ops Using	e (EPA Ro Ground	eg. No. I Applica	68173-4) ation Equ	and Oso 5%S Jipment	C Fungi	cide (EPA F	Reg. No.	. 68173-4-70	051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	Me Contr	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES ANI	D SMALL FRU	JITS: CANEBER	RIES														
Botrytis Fruit Rot	Botrytis cinerea	Raspberries #1	IND-2015-rasp	WA	Oso	6	10	12	46	NA	51.1	NA	Preventative	No	19.0	No	Permission.	
		Raspberries #2	IND-2016- Rasp-WA	WA	Oso	6	9 - 12	12	46	NA	52.4	NA	Preventative	No	21.0	No	Permission.	New data.
		Raspberries #3	KAK-2017- Rasp-MI	MI	Oso	5	7 - 14	6.5	25	NA	81	NA	Preventative	No	53.3	No	PDMR (Planned fall	New data.
								13	50	NA	100	NA					2018 publication) (Permission)	
							Mean	12	46	NA	51.8	NA					(rennission)	
Powdery Mildew	Podosphaera	Blackberries	CER-2012-060	OR	CX-10440	3	12 - 14	3.75	12.5	NA	42	NA	Preventative	No	60.0	No	Certis data;	
-	aphanis	#1						6.5	25	NA	58	NA	_				not	
		Raspberries #1	KAK-2017- Rasp-MI	MI	Oso	5	7 - 14	6.5	25	97	NA	NA	Preventative	No	57.3	No	PDMR (Planned fall	New data.
								13	50	100	NA	NA					2018 publication) (Permission)	
							Mean	3.75	12.5	NA	42	NA					(1 C1111351011)	
								6.5	25	97	58	NA						
								13	50	100	NA	NA						
CROP GROUP	13: BERRIES ANI	D SMALL FRU	JITS: CRANBER	RIES														
Cottonball	Monilinia	Cranberries	IND-2014-165	WI	Tavano 5SC	2	14	6.5	25	NA	16	NA	Preventative	No	32	No	PDMR	City Point
	охусоссі	#1						6.5	25	NA	38	NA			21		9:SMF014	Warrens
		Cranberries	IND-2015-208	WI	Oso	2	9	6.5	25	NA	68.1	22.0	Preventative	No	16.6	No	PDMR	
		#2			Oso + X77 (non-ionic spreader; 0.25% v/v)	2	9	6.5	25	NA	54.8	17.3	Preventative	No	16.6	No	10:SMF007	
		Cranberries #3	11:SMF011 (2016; WI)	WI	Oso + X77 (non-ionic spreader; 0.25% v/v)	2	8	6.5	25	NA	66	17.0	Preventative	No	11.9	No	PDMR 11:SMF011	New data; City Point.
					Oso + X77 (non-ionic spreader; 0.25% v/v)	2	12	6.5	25	NA	46	6.53	Preventative	No	10.7	No		New data; Warrens.
							Mean	6.5	25	NA	48	15.7						

Cun	nulative Summary	of the Effic	cacy of the Po	lyoxin D Applie	Zinc Salt 5SC d as a Foliar :	Suspe Spray	ension Conc to Growing	entrate Food Cr	Fungicide ops Using	(EPA R Ground	eg. No. I Applica	68173-4) ation Equ	and Oso 5%S iipment	C Fungi	cide (EPA R	eg. No.	68173-4-70	051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	Me Cont	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
Fruit rot complex	Coleophoma empetri	Cranberries #1	IND-2014-166	WI	Tavano 5SC	2	9	6.5	25	NA	50	0	Preventative	No	18.1	No	PDMR 9:SMF015	
	Colletotrichum acutatum, Colletotrichum aloeosporioides	Cranberries #2a	CER-2015-104	WI	Oso + X77 (Non-ionic spreader; 0.25%)	2	19	6.5	25	NA	84.3	0	Preventative	No	23.6	No	PDMR 10:SMF008	Warrens
	, Phyllosticta				Oso	2	19	13	50	NA	60.6	-1.9	-					
	vaccinii, and Physalospora vaccinii, etc.	Cranberries #2b	CER-2015-104	WI	Oso + X77 (Non-ionic spreader; 0.25%)	2	14	6.5	25	NA	90.2	34.9	Preventative	No	45.0	No	PDMR 10:SMF008	Valley Junction
		Cranberries #2c	CER-2015-104	WI	Oso + X77 (Non-ionic spreader; 0.25%)	2	9	6.5	25	NA	68.5	2.1	Preventative	No	30.5	No	PDMR 10:SMF008	Plainfield
	0.25%) 13 50 NA 63.9 -2.4 Combarries CED 2045 404 VM 0 so 10																	
		Cranberries #2d	CER-2015-104	WI	Oso + X77 (Non-ionic spreader; 0.25%)	2	19	6.5	25	NA	78.4	29.0	Preventative	No	22.2	No	PDMR 10:SMF008	Oakdale
					Oso]		13	50	NA	81.1	29.5]					
		Cranberries #3	11:SMF012 (2016; WI)	WI	Oso + X77 (non-ionic spreader; 0.25% v/v)	2	11	6.5	25	NA	78.0	-84	Preventative	No	31.3	No	PDMR 11:SMF012	New data; Oakdale.
					Oso + X77 (non-ionic spreader; 0.25% v/v)	2	11	6.5	25	NA	87.2	68.8	Preventative	No	35.2	No	PDMR 11:SMF012	New data; Valley Junction.
					Oso + X77 (non-ionic spreader; 0.25% v/y)	2	14	6.5	25	NA	56.0	-19.0	Preventative	No	40.5	No	PDMR 11:SMF012	New data; Warrens.
					Oso + X77 (non-ionic spreader; 0.25% v/v)	2	11	6.5	25	NA	28.1	42.9	Preventative	No	61.6	No	PDMR 11:SMF012	New data; Mather.
					Oso + X77 (non-ionic spreader; 0.25% v/v)	2	14	6.5	25	NA	42.6	-15.2	Preventative	No	33.3	No	PDMR 11:SMF012	New data; Tomah.
							Mean	6.5	25	NA	66	6						
								13	30	NA	68.5	8.4						

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Cun	nulative Summary	y of the Effi	cacy of the Po	lyoxin D Applie	Zinc Salt 5SC ed as a Foliar	: Suspe Spray	ension Conc to Growing	entrate Food Cr	Fungicide	e (EPA R g Ground	eg. No. d Applica	68173-4 ation Eq) and Oso 5%S uipment	C Fungi	cide (EPA R	Reg. No	. 68173-4-70)051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	M Cont	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUI	P 13: BERRIES AN	D SMALL FR	JITS: GRAPES		•			•	•	•	•		•	1	•	1		
Black Rot	Guignardia bidwellii	Grapes #1	KAK-2016- Grape-MI	MI	Oso	7	10 - 16	6.5 13	25 50	NA NA	87 98	NA	Preventative	No	82.0	No	PDMR (Planned fall 2018 publication)	New data.
		Grapes #2	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	87	86	NA	Preventative	No	66.0	No	(Permission) PDMR (Planned fall 2018 publication) (Permission)	New data.
		Grapes #3	KAK-2016- Grape-PA	PA	Oso	6	9 - 12	13	50	NA	2.5	NA	Preventative	Yes	55.0	No	PDMR 11:SMF009	New data. Mummies in the trellis.
		Grapes #4	KAK-2017- Grape-PA	PA	Oso	7	9 - 11	13	50	NA	36.1	NA	Preventative	Yes	85.8	No	PDMR (Submitted)	New data. Mummies in the trellis.
Grape-PA Grape-PA Mean 6.5 25 NA 87 NA Mean Mean 6.5 25 NA 87 NA Mean Mean<															_			
Runsh Dat	Detentis sinces	C	CED 2012 002	64	Taurana F% CC	4	27 54	13	50	87	55.7	NA	Durantation	Nia	20.00	Na	Cantia datas	
	Bott ytts cinerea	Grapes #1	CER-2013-002	CA	Tavano 5% SC	4	37 - 30	13	50	NA	92.8	NA	Preventative	NO	30.00	NO	not not	
		Grapes #2	CER-2013-021	CA	Tavano 5% SC	6	18 - 21	6.5	25	NA	83.2	NA	Preventative and curative	No	20.8	No	Certis data; not	
								13	50	NA	/8.1						published.	
		Grapes #3	CER-2014-045	NY	Tavano 5% SC	4	13 - 43	6.5	25	NA	37	NA	Preventative and curative	No	76.3	No	Not published. Permission received.	
		Grapes #4	CER-2015-115	NY	OSO	4	14 - 41	6.5	25	NA	69	NA	Preventative	No	96	No	Not published. Permission received.	
		Grapes #5	CER-2015-140	MI	Oso 5%SC + Super Spread 90 (non-ionic surfactant; 0.125% v/v)	4	20 - 29	6.5	25	NA	56	NA	Preventative	No	25	No	PDMR 10:SMF011	
		Grapes #6	9:SMF001	CA	Tavano 5% SC	3	35	6.5	25	NA	61.1	NA	Preventative	No	22.8	No	PDMR 9:SMF001	New data.
							Mean	6.5	25	NA	66	NA						
								13	50	NA	85	NA						

Cumu	ulative Summary	/ of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe Sprav	ension Conce	entrate I Food Cri	Fungicide	(EPA R	eg. No. (68173-4)	and Oso 5%SO	C Fungi	cide (EPA R	eg. No.	68173-4-70	051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applicat	tion Rate	Control	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	(%)			UIC (%)			
Downy Mildew	Plasmopara viticola	Grapes #1	KAK-2016- Grape-MI	MI	Oso	7	7 - 16	6.5	25	92	NA	NA	Preventative	No	83.0	No	PDMR (Planned fall	New data.
								13	50	99	NA	NA					publication) (Permission)	
		Grapes #2	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	NA	95	NA	Preventative	No	78.0	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
							Mean	6.5	25	92	NA	NA						
								13	50	99	95	NA						
Phomopsis Fruit Rot	Phomopsis viticola	Grapes #1	KAK-2016- Grape-MI	MI	Oso	7	10 - 16	6.5	25	Rachis: 6.8	67	NA	Preventative	No	57.0	No	PDMR (Planned	New data.
								13	50	9.6	96	NA					fall 2018) (Permission)	
		Grapes #2	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	NA	97	NA	Preventative	No	88.0	No	PDMR (Planned fall 2018) (Permission)	New data.
							Mean			Rachis:	Fruit:	NA						
								6.5	25	6.8	67							
								13	50	9.6	97	NA						

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Cum	ulative Summary	of the Effic	cacy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	(EPA R	eg. No. (58173-4)	and Oso 5%S	C Fungi	cide (EPA R	eg. No.	68173-4-70	051)
Disease	Pathogen	Crop	Trial No.	State	Formulation ¹	No.	Application	Applica	ops Using tion Rate	Ground	an Applica	Mean	Application	Inocu-	Max. Pest	Phyto-	Publication	Notes
		Tested & Sequence No.				App.	Interval (Days)	fl oz/ acre	g a.i./ ha	Cont Leaves	rol (%) Fruit	Yield Increase (%)	Type(s)	lated?	Pressure in UTC (%)	tox ?	Status	
Powdery mildew	Erysiphe necator	Grapes #1	CER-2011-013	CA	CX-10440	8	10 - 11	3.75 7.5	14 29	78.1 80.4	78.6 68.8	NA	Preventative and curative	No	70.3	No	Certis data; not published	
		Grapes #2	CER-2012-069	CA	CX-10440	8	9 - 11	13	50	NA	96.67	NA	Preventative and curative	No	30.00	No	Certis data; not published.	Wine was analyzed.
		Grapes #3	CER-2013-021	CA	Tavano	5	18 - 21	6.5	25	NA	44.2	NA	Preventative	No	100	No	Certis data;	
								13	50	NA	73.6	NA					published.	
		Grapes #4	CER-2015-019	OR	Oso + Sylguard (silicone surfactant; 0.025% v/v)	6	13 - 15	6.5	25	86.1	47.9	NA	Preventative and curative	No	87.5	No	Certis data; not published.	
		Grapes #5	CER-2015-140	MI	Oso 5%SC + Super Spread 90 (non-ionic surfactant; 0.125% v/v)	4	20 - 29	6.5	25	55	56	NA	Preventative	No	37	No	PDMR 10:SMF011	
		Grapes #6	KAK-2016- Grape-MI	MI	Oso	7	10 - 16	6.5	25	90	88	NA	Preventative	No	63.0	No	PDMR (Planned	New data.
								13	50	99	99						fall 2018) (Permission)	
		Grapes #7	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	97	99	NA	Preventative	No	85.0	No	PDMR (Planned fall 2018) (Permission)	New data.
		Grapes #8	KAK-2017- Grape-PA	PA	Oso	7	9 - 11	13	50	81	84	NA	Preventative	No	98.0	No	PDMR (Planned fall 2018) (Permission)	New data.
							Mean	3.75	14	78.1	78.6	NA						
								7.5	25 - 29	70	01	NА						
								13	50	92	90	NA						

Cum	Cumulative Summary of the Efficacy of the Polyoxin D Zinc Salt 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051) Applied as a Foliar Spray to Growing Food Crops Using Ground Application Equipment sease Pathogen Crop Trial No. State Formulation No. Application Application Rate Mean Application Inocu- Max. Pest Phyto- Publication Notes																	
Disease	Pathogen	Crop	Trial No.	State	Formulation ¹	No.	Application	Applica	tion Rate		a Applica lean	Mean	Application	Inocu	Max. Pest	Phyto-	Publication	Notes
		Sequence No.				App.	(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)	Type(s)	lated?	UTC (%)	tox ?	Status	
CROP GROUP	13: BERRIES AN	D SMALL FRU	ITS: STRAWB	RRIES			•	•	•			•				•		
Anthracnose Fruit Rot	Colletotrichum acutatum	Strawberries #1	KAK-2016- SBerry-MI	MI	Oso	7	6 - 9	6.5	25	NA	Field: 80	4-day post- harvest: 273	Preventative	No	27.0	No	PDMR (Planned fall 2018) (Permission)	New data.
								13	50	NA	85	233						
	Colletotrichum acutatum and	Strawberries #2	KAK-2017- SBerry-Ml	MI	Oso	5	7 - 14	13	50	NA	4-day post- harvest: 90	NA	Preventative	No	10.0	No	PDMR (Planned fall 2018) (Permission)	New data.
	Colletotrichum							13	50	NA	88	NA			43.0	1		
	dematium						Mean	6.5	25	NA	80	273						
							mean	13	50	NA	88	233						
Gray mold	Botrytis cinerea	Strawberries	CER-2012-070	CA	CX-10440	5	7 - 8	3.75	14	40.22	NA	NA	Preventative	No	17.79	No	Certis data;	
		#1						6.5	25	25.44	NA	NA	and curative				not published.	
		#1 Strawberries CER-2014-038 FL #2		Oso	14	7	6.5	25	NA	27.2	28.1	Preventative and curative	No	49.5	No	PDMR 9:SMF020		
		Strawberries #3	Adaskaveg, 2013	CA	Tavano	NR	NR	NR	NR	Moder- ate and Vari- able	NA	NA	Not reported	NR	NR	NR	Internet (Adaskaveg)	
		Strawberries	KAK-2016-	MD	Oso	9	5 - 8	6.5	25	NA	61.1	-1.88	Preventative	No	14.4	No	PDMR	New data.
		#4	SBerry-MD					13	50	NA	69.4	18.5					11:SMF020	No soil fumigation.
		Strawberries #5	KAK-2016- SBerry-MI	MI	Oso	7	6 - 9	6.5	25	NA	85	4-day post- harvest: 273	Preventative	No	39.0	No	PDMR (Planned fall 2018 publication)	New data.
								13	50	NA	86	233					(Permission)	
		Strawberries #6	KAK-2017- SBerry-MI	MI	Oso	5	7 - 14	13	50	NA	94	4-day post- harvest: 2350	Preventative	No	53.5	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
							Mean	3.75	14	40.2	NA	NA						
								6.5	25	NA	43	15						
								13	50	NA	90	4-day post- harvest: 1292						

Cum	Cumulative Summary of the Efficacy of the Polyoxin D Zinc Salt 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051) Applied as a Foliar Spray to Growing Food Crops Using Ground Application Equipment Disease Pathogen Crops Trial No. 5 State Formulation Application Application Rate Mean Application Lincols Max Peet Phytos Publication Notes																	
	1			Applie	d as a Foliar	Spray	to Growing	Food Cr	ops Using	Ground	I Applica	ation Equ	ipment	I				
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation '	No. App.	Application Interval	Applica	tion Rate	Me Conti	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication	Notes
		Sequence					(Days)	fl oz/	g a.i./	Leaves	Fruit	Increase	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		UTC (%)		blatab	
		No.			-			acre	ha			(%)	_					
Leather rot	Phytophthora cactorum	Strawberries #1	KAK-2016- SBerry-Ml	MI	Oso	7	6 - 9	6.5	25	NA	84	4-day post- harvest: 273	Preventative	No	31.0	No	PDMR (Planned fall 2018 publication)	New data.
								13	50	NA	98	233					(Permission)	
		Strawberries #2	KAK-2017- SBerry-MI	MI	Oso	5	7 - 14	13	50	NA	81	4-day post- harvest: 2350	Preventative	No	56.8	No	PDMR (Planned fall 2018 publication; permission)	New data.
							Mean	6.5	25	NA	84	4-day post- harvest: 273						
	N <i>i</i>		KAK 2017		0	-	()	13	50	NA	90	1292	D:		20.5		DDUD	N
Phomopsis Leaf Spot and Fruit Rot	Phomopsis obscurans	strawberries #1	KAK-2016- SBerry-MI	MI	Uso	/	6-9	6.5	25	98	NA	4-day post- harvest: 240	Preventative	NO	39.5	NO	PDMR (Planned fall 2018 publication)	New data.
								13	50	100	NA	273					(Permission)	
		Strawberries #2	KAK-2017- SBerry-MI	MI	Oso	5	7 - 14	13	50	83	80	4-day post- harvest: 2350	Preventative	No	35.1	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
							Mean	6.5	25	98	NA	4-day post- harvest: 240						
								13	50	92	80	1312						
Powdery	Sphacelotheca sp.	Strawberries	CER-2013-008	CA	CX-10440	7	7 - 10	6.5	25	94	NA	NA	Preventative	No	70	No	Certis data;	
mildew		# I						13	50	80	NA						published	
		Strawberries	CER-2012-070	CA	CX-10440	5	7 - 8	3.75	14	26.31	NA	NA	Preventative	No	100	No	Certis data;	
		#2						6.5	25	23.75	NA		and curative				published.	
		Strawberries #3	CER-2013-008	CA	CX-10440	7	6 - 43	6.5 13	25 50	93.5 80	NA	NA	Preventative and curative	No	70	No	Certis data; not published.	
							Mean	3 75	14	26 31	NA	NA						
							mean	6.5	25	70	NA	NA						
								13	50	80	NΛ	NA	1					

Cumu	ulative Summary	of the Effic	acv of the Po	lvoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	(EPA R	eg. No.	68173-4)	and Oso 5%S	C Fungi	cide (EPA R	leg. No.	68173-4-70	051)
	,			Applie	d as a Foliar S	Spray	to Growing	Food Cr	ops Using	Ground	I Applica	tion Equ	ipment	5	,	5		,
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	Me Conti	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
	OP GROUP 19: HERBS AND SPICES																	
CROP GROUP	P GROUP 19: HERBS AND SPICES																	
Downy Mildew	OP GROUP 19: HERBS AND SPICES vny Mildew Peronospora Basil #1 IND-2015-218 NY Oso 1 NA 13 50 52 NA NA Preventative No 100 No PDMR New data. belbahrii 0																	
1. "Vegg "Oso "CX-1 NR. Not r	gieturbo 5SC Suspe 5%SC Fungicide" a 10440" is the Certis reported.	nsion Concentr nd "Tavano 5% USA, L.L.C. fo	ate Fungicide" i SC Fungicide" ar rmulation code	s Kaken's e Certis U for Polyox	EPA registered I SA, L.L.C. suppl in D Zinc Salt 55	orand n ementa C Fung	ame for Polyc al distributor icide.	oxin D Zino orand nam	: Salt 5SC F nes for Poly	ungicide. oxin D Zi	nc Salt 5S	C Fungicid	e.					
Preventative and Curative:	d curative: 1	Freatments incl Disease was cor	lude at least one ofirmed to be pro	e applicati esent befo	on after disease ore the first trea	was ol tment	oserved. was applied.											

STEP 2: Identification of OMRI-List Alternative Products, Efficacy Data, Product Hazards, and Restrictions

METHODOLOGY

Polyoxin D Zinc Salt 5SC Formulation

The first row of each table below in highlighted in yellow and is based upon the data from Step 1. Mean percent control values are based upon mean control values for each trial <u>separately</u>, then averaged to determine the mean for the available trials for each crop/diseases combination.

<u>Identification of EPA Registered OMRI-Listed Alternative Products for Crop Groups 13 and 19</u> The initial identification of EPA registered OMRI-listed alternative products, was achieved using the Cornell University Extension documents, when available:

- 2015 Organic Production and IPM Guide for Blueberries;
- 2015 Organic Production and IPM Guide for Grapes;
- 2016 Organic Production and IPM Guide for Raspberries and Blackberries; and
- 2016 Organic Production and IPM Guide for Strawberries.

The final identification was determined via manual inspection of EPA registered labels for OMRI-listed products. There are many "me-too" copper and sulfur products. Some products are possibly omitted, but the commercially most significant products are believed to have been identified.

The manual inspection of each label included confirmation of the label claim (e.g., suppression vs control) for each crop/disease combination included in this petition addendum.

Efficacy data were reviewed and EPA's Pesticide Product Label System was consulted to identify recently EPA registered OMRI-listed products registered for identified uses.

Published Efficacy Data for OMRI-Listed Alternative Products

Plant Disease Management Reports (PDMR) is a low cost, subscription-based, on-line journal for the publication of efficacy trials. It is the journal of choice for most university efficacy researchers.

For each crop/disease combination, searches were conducted for the crop in combination with the disease. Separate searches were conducted for the crop (singular) and the crop (plural). For example, the search criteria for grapes / bunch rot (caused by Botrytis) included:

- "grape" and "Botrytis"; and
- "grapes" and "Botrytis".

Each article was then reviewed to determine if the article is applicable, *i.e.*,

- The trial included an untreated control; <u>and</u>
- One or more OMRI-listed EPA registered alternative for the crop/disease (pathogen) combination was included in the trial in the <u>absence</u> of other pesticide products.
 - Tank-mixes and treatment programs with other products were *excluded*.
 - Treatments of a single OMRI-listed pesticide product with, *e.g.*, a surfactant or sticker-spreader were *included*.

For each identified relevant Plant Disease Management Reports article and treatment, the data were summarized. Some trials include data for only a single percent control determination, while others contained more, e.g.:

- Incidence and severity; and/or
- Leaves and fruit.

For each trial, the *overall* mean (average) percent control was determined.

If the OMRI-listed alternative had <u>more</u> disease than the untreated control (treatment failure), then the percent control was reported and calculated as <u>0% control</u> instead of a negative percent control. This provided some bias in favor of the OMRI-listed alternatives but helps with visual comparisons of data sets.

Generally, the Plant Disease Management Reports articles report the data for only one trial location. When more than one trial location is reported in a single article, as in most of the articles regarding cranberries, <u>each trial location was treated separately</u> for the calculation of trial averages.

When an OMRI-listed alternative product was evaluated in more then one trial, the average percent control was determined used the <u>average</u> percent control for <u>each</u> trial. This gives equal weight to each trial and does not favor trials for which more data points were reported.

The mean percent control values are paired with the number of trials included in the calculation of the mean. Mean percent control values supported by a larger number of trials provide greater confidence to the calculated mean. Also higher mean values supported by a larger number of trials reflect greater *consistency* of disease control.

Efficacy Data for the Polyoxin D Zinc Salt 5SC Formulation

For efficacy trials of the polyoxin D zinc salt 5SC formulation (a.k.a. Oso), the selection criteria and method of calculation of averages were the same as above with the <u>exception</u> that <u>all</u> available data are considered, *i.e.*, published and unpublished data are included in the May 31, 2016 petition or this addendum. An example of included unpublished efficacy data are data from blueberry and raspberry trials that were developed by private (non-university affiliated) researchers.

Comparison of Average Percent Control

The average percent control for the polyoxin D zinc salt 5SC formulation and for the OMRI-listed alternatives are included in the summary tables below. To facilitate comparisons, the average percent control columns are color coded:

- <u>Green</u> indicates that the OMRI-listed alternative has similar, equal, or greater average percent control compared to Oso.
- <u>Orange</u> indicates that the OMRI-listed alternative provides less than similar percent control compared to Oso but generally more that 50% of the percent control provided by Oso.
- <u>*Red*</u> indicates that the OMRI-listed alternative provides substantially less control than Oso (0% control to approximately 50% of the control provided by Oso).
- <u>Brown</u> indicates that no relevant data were found in Plant Disease Management Reports.

Comparison of Hazards and Restrictions

Human and environmental hazard statements on the EPA registered label are summarized. Please note that products that are exempt from regulation as a pesticide under section 25(b) of FIFRA do not have uniform criteria for labels statements. Nonetheless, statements have been summarized based upon the commercial label. The statements are color coded:

- Red indicates:
 - EPA's highest hazard categories (*e.g.*, permanent injury);
 - EPA's highest environmental hazard category ("highly toxic"); and
 - Physical hazards that can result in injury (*e.g.*, fire).
- <u>Orange</u> indicates:
 - EPA's next most hazardous category for humans (e.g., severe but not permanent injury); and
 - EPA's next most hazardous category for environmental hazards ("toxic").
- <u>Blue</u> indicates critical temperature restrictions for use and/or storage for products with a live microorganism as the active ingredient. Please see the product label for details.

OMRI-Listed Product Comparison Table Header Row

OMRI-listed product comparison table header rows have a color background. There is <u>no meaning</u> to the color. Instead, the color is included as a visual clue to indicate a new table when the color is different. The color helps to visually link the summarized efficacy data with the corresponding list of OMRI-listed alternative products and the associated crop/disease combination.

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: BLUEBERRIES / Alternaria Fruit Rot (Alternaria spp.)

				Crop	Co Group 13:	mpaı Berri	ative Overvies and Small	ew of Efficacy, Haza Fruits: Blueberries	rds, and ⁄Alterna	Use Res ria Fruit	strictions t Rot (<i>Alte</i>	ernaria spp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	41	1	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain MBI 600	Serifel	71840-18	No data	NA	ΝΑ	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	No data	NA	NA	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria</i> <i>sachalinensis</i> extract	Regalia	84059-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.

					Co	mpai	ative Overvi	ew of Efficacy, Haza	rds, and	Use Res	strictions			
				Crop	Group 13:	Berri	es and Small	Fruits: Blueberries	/ Alterna	ria Fruit	t Rot (<i>Alte</i>	ernaria spp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Biological	Streptomyces Iydicus WYEC 108	Actinovate AG	73314-1	No data	NA	NA	Alternaria claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Alternaria control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	No data	NA	NA	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. B. C. D. E.	FRAC = Fung For Polyoxin Number of t PDMR = Plan <u>https://www</u> Mix-and-mat Complete la	icide Resistance D zinc salt (Oso rials included in t Disease Manag w.plantmanagen tch directions fo bel statement: F	Action Comm), from summ the calculatic ement Report <u>nentnetwork.c</u> r use. Label h Prolonged or fi	nittee. Proc arizes trials on of the mo s (on-line jo org/pub/tria nas a list of requently ro	ducts with s, publishe ean. purnal gen al/pdmr/ crops and epeated sk	the s d and erally a sep cin co	ame mode o d unpublished y used for pu parate list of pntact may ca	f action have the sar d. For OMRI-listed a blication of efficacy diseases with no cla ause allergic reactio	me FRAC ternative research im for sp ns in som	Code. es, from conduc ecific c e indivi	NC = Not c n Plant Dis cted at un crop/disea: iduals.	classified; no FRAC code h ease Management Report iversities). Preceded by se combinations.	nas been assigned. s (PDMR). F&N = Fungicides and 1	Nematicides.

G. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: BLUEBERRIES / Botrytis Blight (Botrytis cinerea)

				Cro	Co p Group 1	mpa 3: Be	rative Overvi rries and Sm	ew of Efficacy, Haza all Fruits: Blueberrie	irds, and s / Botry	Use Res tis Bligh	strictions ht (<i>Botryt</i>	is cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	суВ	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	80	1	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	58	1	5:SMF027	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data			Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade Max	264-1151	28	1	5:SMF001	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.

	Comparative Overview of Efficacy, Hazards, and Use Restrictions Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Blueberries / Botrytis Blight (Botrytis cinerea) s FRAC ^A Active Ingredient(s) Product EPA Reg. No. Efficacy ^B Label Claim PHI (Days) REI (Hrs) Hazards and Restrictions Noted on the Product Label													
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	0	1	7:SMF031	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Streptomyces lydicus WYEC 108	Actinovate AG	73314-1	No data	NA	NA	Botrytis claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.

				Cro	Co D Group 1	mpai 3: Be	ative Overvi	ew of Efficacy, Haza all Fruits: Blueberrie	rds, and s / Botrv	Use Res tis Bligh	strictions nt (<i>Botrvt)</i>	is cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution must have pH ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic Inorganic salt NC; salt Potassium silicate Sil-Matrix 82100-1 No data NA Control. 0 4 None. Moderate eye irritation None. Damages glass surfaces. Chemical instabilities. Synthetic Oxidizing NC; dioxide Hydrogen dioxide Oxidate 2.0 70299-2 No data NA Control. 0 Until dry None. Irreversible eye damage. May be fatal if and other beneficial instabilities. Chemical instabilities.														
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	No data	NA	NA	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Botrytis control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
A. F B. F C. F D. F. C G. F	FRAC = Fung For Polyoxin Number of t PDMR = Plar <u>https://www</u> Mix-and-ma Complete la EPA relative	gicide Resistance o D zinc salt (Osc rials included in nt Disease Manag w.plantmanagen tch directions fo abel statement: 1 e environmental	Action Comm), from summ the calculatic gement Report <u>nentnetwork.c</u> r use. Label h Prolonged or fi toxicity descri	ittee. Proo arizes trials on of the mo s (on-line jo rg/pub/tria as a list of requently ro ptors, lowe	ducts with s, publishe ean. ournal gen <u>al/pdmr/</u> crops and epeated sk est toxicity	the s d and erally a sep cin co	ame mode o I unpublished y used for pu parate list of intact may co ighest toxicit	f action have the sa d. For OMRI-listed a blication of efficacy diseases with no cla ause allergic reactio ty: Practically non-t	me FRAC Iternative research im for sp ns in som oxic < A	Code. es, from a conduc pecific c le indivi Moderate	NC = Not on Plant Dis cted at un rop/diseas duals. ely toxic	classified; no FRAC code l ease Management Report iversities). Preceded by se combinations. < Toxic < Highly toxic.	nas been assigned. s (PDMR). F&N = Fungicides and I	Nematicides.
Plant Disea <u>7:SMF031.</u> I 5:SMF001.	ase Manager J.W. Psche Regalia at 1 J.W. Psche	ment Reports cit eidt and J.P. Bas 2 gal/A beginnin eidt and J.P. Bas	sinette, Orego g at pre-bloon sinette, Orego	a summarie on State Uni n: <mark>No contr</mark> on State Uni	iversity. Frol. Less α	ungic <mark>liseas</mark> Nanag	ide Managem ie control the gement of <i>Bc</i>	nent of blueberry fru an the untreated cor htrytis fruit rot and n	it rots, 2 <mark>itrol.</mark> nummy b	012. erry, 20)10.			
<u>5:SMF027.</u> I	Gerenade Ma J.W. Psche Double Nick Double Nick Tr	ax at 3 lb/A + Nu eidt, J.P. Bassine el LC at 2 qt/A, el LC at 2 qt/A, rial mean: 57.7%	u-Film-P at 6 fl ette and L. A. beginning at f beginning at f control.	l oz/100 ga Jones, Oreg loral rosett loral rosett	l/A: 28% o gon State l e with 1 o e with 1 o	Jnive r 2 of r 2 of	ol of Botrytis rsity. Fungio oen blooms: oen blooms:	fruit rot. cide Management of 70.5% control of Bot 44.9% control of Bot	blueberr rytis blig rytis blig	y fruit r <mark>ht.</mark> <mark>ht.</mark>	ots, 2015.			

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OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: BLUEBERRIES / Mummyberry (Monilinia vaccinii-corymbosi)

				Crop Gro	Co Dup 13: Ber	mpai ries a	rative Overvi and Small Fru	ew of Efficacy, Haza uits: Blueberries / M	ards, and ummyber	Use Res ry (<i>Mor</i>	strictions <i>nilinia vac</i>	cinii-corymbosi)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	64	6	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	50	2	10:SMF026; 9:SMF038.	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata ASO	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	78	1	7:SMF013.	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade ASO	264-1152	21	2	2:SMF013; F&N 59:SMF023	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade Max	264-1151	41	2	5:SMF001; F&N 61: SMF023.	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade Optimum	264-1160	28	3	10:SMF026; 9:SMF038; 8:SMF003.	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.

				Crop Gro	Co oup 13: Ber	mpai ries a	rative Overvi and Small Fru	ew of Efficacy, Haza uits: Blueberries / M	rds, and ummyber	Use Res ry (<i>Mor</i>	strictions nilinia vac	cinii-corymbosi)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	Ρ5	Reynoutria sachalinensis extract	Regalia	84059-3	27	5	8:SMF003; 8:SMF023; 7:SMF005; 7:SMF007; 7:SMF030.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Streptomyces Iydicus WYEC 108	Actinovate AG	73314-1	No data	ΝΑ	NA	Monilinia claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Temporary eye and skin irritation	No FIFRA statements.	Storage temperature restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful is swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution must have pH ≥7.0.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	No data	NA	NA	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. B. C. D. E.	FRAC = Fung For Polyoxir Number of t PDMR = Plar <u>https://ww</u> Mix-and-ma Complete la	icide Resistance D zinc salt (Oso rials included in It Disease Manag w.plantmanagen tch directions fo ibel statement: 1	Action Comm), from summ the calculatic ement Report <u>nentnetwork.c</u> r use. Label f Prolonged or f	ittee. Proc arizes trials on of the m s (on-line ju org/pub/tria has a list of requently r	ducts with s, publishe ean. ournal gen al/pdmr/ crops and epeated sl	the s d and erally a sep kin co	ame mode o d unpublished y used for pu parate list of pntact may ca	f action have the sa d. For OMRI-listed a blication of efficacy diseases with no cla ause allergic reactio	me FRAC Iternative research im for sp ns in som	Code. es, from conduc ecific c e indivi	NC = Not on Plant Dis cted at un prop/disea	classified; no FRAC code l ease Management Report iversities). Preceded by se combinations.	nas been assigned. s (PDMR). F&N = Fungicides and I	Nematicides.

G. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

				Crop Gro	Co up 13: Ber	mpar ries a	ative Overvi and Small Fru	ew of Efficacy, Haza uits: Blueberries / M	ards, and ummybei	Use Re ry (<i>Mor</i>	strictions nilinia vacc	cinii-corymbosi)			
NOP	FRAC ^A	Active	Product	EPA Reg.	E	fficad	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label	
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical	
Plant Dise	ase Managei	ment Reports cita	ations and da	ta summarie	es:			•					•	<u>.</u>	
<u>10:SMF026</u>	5. J.W. Psch Double Nick Serenade Op of mummyb	neidt, J.P. Bassin <mark>el LC</mark> at 2 qt/A b oti at 20 oz/A be erries. <mark>Trial mea</mark>	nette, and S. H beginning at fl ginning at flo In: 6.3% contr	Heckert, Ore oral bud bre ral bud brea ol (n = 3).	egon State eak (8 app ak (8 appli	Univ licati catio	ersity. Evalı ons): <mark>No co</mark> ı ns): <mark>9.9% co</mark>	uation of various fun <mark>htrol</mark> of floral strikes <mark>ntrol</mark> of floral strikes	gicides f , vegeta s. <mark>No co</mark>	or mana tive stri <mark>ntrol</mark> of	agement of kes and mu vegetative	mummy berry, 2015. ummyberries (less disease strikes (less disease con	e control than untreat trol than untreated co	ed control). ntrol). <mark>8.9% control</mark>	
<u>9:SMF038.</u>	 <u>P:SMF038.</u> A. M.C. Schilder, J. M. Gillett, and W. Sysaks, Michigan State University. Evaluation of fungicides and biocontrol products for control of mummy berry in blueberries, 2014. <u>Serenade Optimum</u> at 20 oz/A + NuFilm P at 0.125% (v/v) beginning at green tip, apothecia present: 66% control of shoot strikes. 42% control on fruit. Trial mean: 54% control (n = 2). Double Nickel LC at 1.06 qt/A beginning at green tip, apothecia present: 100% control of shoot strikes. 98% control on fruit. Double Nickel LC at 2.1 qt/A beginning at green tip, apothecia present: 100% control of shoot strikes. 100% control on fruit. Trial mean: 99.5% control (n = 4). <u>3:SMF003.</u> J.W. Pscheidt, J.P. Bassinette, and J. Florance, Oregon State University. Evaluation of various products for management of mummy berry, 2013. <u>Serenade Optimum</u> at 16 oz/A + Nu-Film-P at 32 fl oz/100 gal/A beginning at floral bud break: 35% control of floral strikes and 10% control on fruit. Trial mean: 22.5% control (n = 2). 														
<u>8:SMF003.</u>	Double Nickel LC at 2.1 qt/A beginning at green tip, apothecia present: 100% control of shoot strikes. 100% control on fruit. Trial mean: 99.5% control (n = 4). :SMF003. J.W. Pscheidt, J.P. Bassinette, and J. Florance, Oregon State University. Evaluation of various products for management of mummy berry, 2013. Serenade Optimum at 16 oz/A + Nu-Film-P at 32 fl oz/100 gal/A beginning at floral bud break: 35% control of floral strikes and 10% control on fruit. Trial mean: 22.5% control (n = 2). Regalia at 1 gal/A beginning at floral bud break: 43% control of floral strikes and 38% control on fruit. Trial mean = 40.5% control (n = 2).														
8:SMF023.	F. Connel Regalia at 4	ly, Univ. of Geor qt/A beginning	gia. Mummy at green tip:	berry manag <mark>).7% contro</mark> l	gement in of mumm	rabbi ıyberı	teye bluebe ry incidence	rry with chemical ar	id organi	c fungic	ides, 2013.				
<u>7:SMF005.</u>	W. O. Clin Regalia at 2	e and B. K. Blood qt/A beginning /	dworth, North March 16, 201	Carolina St 2: <mark>3% contr</mark>	ate Univer <mark>ol</mark> of mum	sity. mybe	Fungicides rries per bus	for mummy berry an h.	d bluebe	rry rust	control on	'Rebel' in North Carolin	a, 2012.		
7:SMF007.	W. O. Clin Regalia at 2	e and B. K. Blooc Qt/A: <mark>Average 3</mark>	dworth, North <mark>86% (range 14</mark> 9	Carolina St <mark>% to 50%) co</mark>	ate Univer Introl of n	sity. umbe	Fungicides r of shoot st	for mummy berry co rrikes.	ntrol on	'Powde	rblue', 'Ve	rnon' and 'Ochlockonee'	in North Carolina, 201	2.	
<u>7:SMF013.</u>	A.M.C. Sch Optiva at 1	nilder, J. M. Gille lb/A + Nu Film P	ett, and W. Sy at 0.25%(v/v	saks, Michig) beginning	an State l at pink bu	Jniver d: <mark>79</mark>	rsity. Evalua <mark>.0% control</mark> c	nting fungicides and of shoot strikes and	biocontro <mark>76.3%</mark> cor	ol produ htrol of	icts for con mummies.	ntrol of mummyberry in b Trial mean: 77.7% contr	olueberries, 2012. <mark>rol (n = 2).</mark>		
<u>7:SMF030.</u>	J.W. Psche Regalia at 1	eidt and J.P. Bass gal/A beginning	sinette, Orego at floral bud	on State Uni break: <mark>71%</mark>	versity. E control o	valua f flora	ition of mate al strikes. <mark>5</mark> 8	erials for managemen <mark>8% control</mark> of vegeta	nt of mur tive strik	nmy be es. <mark>29</mark> %	rry, 2012. <mark>6 control</mark> or	n fruit. <mark>Trial mean: 52.7</mark> 9	% control (n = 3).		
<u>5:SMF001</u> .	J.W. Psche Serenade Ma	eidt and J.P. Bas ax at 3 lb/A + Nu	sinette, Orego I-Film-P at 6 f	on State Uni l oz/100 gal	versity. A I/A: <mark>19% c</mark>	lanag <mark>ontrol</mark>	ement of <i>Bo</i> of mummy	<i>trytis</i> fruit rot and n berry floral and veg	nummy b etative s	erry, 20 trikes.)10. <mark>19% contro</mark>	<mark>l</mark> of mummy berry fruit r	ot. Trial mean: 19% c	ontrol (n = 2).	
<u>2:SMF013.</u>	J.W. Psche Serenade AS control (n =	eidt and J.P. Bass 0 at 256 fl oz/A <mark>3).</mark>	sinette, Orego beginning at	on State Uni floral bud b	iversity. F preak: <mark>28%</mark>	ungic <mark>contr</mark>	idal control <mark>rol</mark> on floral	of mummy berry, 20 clusters. <mark>8% control</mark>	07 on shoot	s. <mark>No c</mark>	<mark>:ontrol</mark> on รู	green fruit (less effective	e than untreated contr	ol). <mark>Trial mean: 12%</mark>	
F&N Vol 6	<u>1: SMF023.</u> Serenade Ma	A.M.C. Schilder, ax at 3 lb/A begi	J. M. Gillett, nning at gree	and W. Sys n tip: <mark>95% c</mark>	aks, Michig <mark>control</mark> of s	gan St shoot	tate Universi strikes. <mark>31</mark> 9	ity. Evaluation of fu <mark>6 control</mark> on fruit. <mark>T</mark>	ngicides <mark>rial mea</mark> i	for cont n: 63% c	trol of mun <mark>:ontrol (n =</mark>	nmy berry in 'Rubel' blue 2).	eberries, 2005.		
F&N Vol 5	9:SMF023. Serenade (fe	A.M.C. Schilder, ormulation and r	J. M. Gillett, ate not specif	and W. Sysa fied; ASO as	iks, Michig <mark>sumed)</mark> be	an Sta ginni	ate Universit ng at early g	ty. Evaluation of fur green tip: <mark>16% contro</mark>	ngicides f <mark>ol</mark> of shoc	or cont t strike	rol of mum s. <mark>45% con</mark>	imy berry in blueberries, I <mark>trol</mark> on fruit. <mark>Trial mear</mark>	2003. n: 30.5% control (n = 2)		

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: CANEBERRIES / Botrytis Fruit Rot (Botrytis cinerea) (add citations)

				Crop	Co Group 13:	ompa Berri	rative Overvi ies and Small	ew of Efficacy, Haza Fruits: Caneberries	ards, and / Botryt	Use Res is Fruit I	strictions Rot (<i>Botry</i>	vtis cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	суВ	Label Claim	PHI	REI		Hazards and Restrict	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	65	3	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	ΝΑ	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152	14	4	F&N 58:SMF048; F&N 57;SMF31; F&N 57:SMF32; F&N 56:SMF38.	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	No data	NA	NA	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	Р5	<i>Reynoutria</i> <i>sachalinensis</i> extract	Regalia	84059-3	37	1	7:SMF008	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.

				Crop	Co Group 13:	mpai Berri	rative Overvi es and Small	ew of Efficacy, Haza Fruits: Caneberries	irds, and / Botryti	Use Res s Fruit I	strictions Rot (<i>Botry</i>	rtis cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Bio- chemical	Rhamnolipid biosurfactant	Zonix	72431-1	23	1	8:V2017	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative use only.	0	4	None.	Irreversible eye damage.	None.	Do not use at ambient temperatures over 80°F. Keep from overheating or freezing. Store out of direct sunlight.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Streptomyces Iydicus WYEC 108	Actinovate AG	73314-1	7	1	2:SMF003	Botrytis claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.

				Crop	Co Group 13:	mpar Berri	ative Overvi ies and Small	ew of Efficacy, Haza l Fruits: Caneberries	rds, and / Botryti	Use Res s Fruit I	strictions Rot (<i>Botry</i>	tis cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	No data	NA	NA	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution must have pH ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	9	1	2:SMF003	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. I B. I C. I D. I	FRAC = Fung For Polyoxin Number of t PDMR = Plan https://www Mix-and-mat	icide Resistance D zinc salt (Oso rials included in t Disease Manag w.plantmanagen tch directions fc	Action Comm), from summ the calculation gement Report <u>nentnetwork.c</u> pr use. Label 1	nittee. Proc arizes trials on of the me s (on-line jo org/pub/tria has a list of	Jucts with ;, publishe ean. ournal gen <u>al/pdmr/</u> crops and	the s d and erally a set	ame mode o 1 unpublished y used for pu parate list of	f action have the sau d. For OMRI-listed a ublication of efficacy	ne FRAC lternative research	Code. es, from conduc	NC = Not c n Plant Dis cted at un rop/disea:	classified; no FRAC code h ease Management Report iversities). Preceded by b se combinations.	nas been assigned. s (PDMR). F&N = Fungicides and I	Nematicides.

F. G. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

					Co	mpar	ative Overvi	ew of Efficacy, Haza	ords, and	Use Res	strictions			
	· · · · ·		•	Crop	Group 13:	Berri	es and Smal	Fruits: Caneberries	/ Botryti	s Fruit I	Rot (<i>Botryti</i>	s cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restr	ictions Noted on the Pro	duct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Disea	ase Managei	nent Reports cit	ations and da	ta summarie	s.		-				-			
<u>7:SMF008</u> .	A.M.C. Sch Regalia at 1 Regalia at 1 Regalia at 1 Regalia at 1 <mark>T</mark> i	ilder, J. M. Gille qt/acre + Nu Fil qt/acre + Nu Fil qt/acre + Nu Fil qt/acre + Nu Fil <mark>ial mean: 37% co</mark>	ett, and R. W. m P at 0.25%: m P at 0.25%: m P at 0.25%: m P at 0.25%: pontrol (n = 8).	Sysak, Mich 64% contro 64% contro 33% contro 51% contro	igan State ol of post-1 ol of post-1 ol of post-1 ol of post-1 ol of post-1	Univ harve harve harve harve	versity. Eval est Botrytis, est Botrytis, est Botrytis, est Botrytis,	uation of fungicides harvest 1. 21% contr harvest 1. 15% contr harvest 1. 17% contr harvest 1. 33% contr	for contr rol of pos rol of pos rol of pos rol of pos rol of pos	ol of fol t-harve t-harve t-harve t-harve	liar and frui st Botrytis, st Botrytis, st Botrytis, st Botrytis,	t diseases in red rasy harvest 2. harvest 2. harvest 2. harvest 2. harvest 2.	pberries, 2012.	
2:SMF003.	A.M.C. Sch Actinovate a Dxidate at 4	ilder, J. M. Gillet at 12 oz/acre: <mark>7</mark> I pt/acre: <mark>9% cor</mark>	tt, and R. W. <mark>% control</mark> of p <mark>ntrol</mark> of post-h	Sysak, Michi ost-harvest arvest Botry	gan State Botrytis fr ⁄tis fruit ro	Unive uit re ot inc	ersity. Evalu ot incidence cidence.	ation of fungicides fo	or control	of frui	t diseases o	f red raspberries, 20	07.	
<u>F&N 58:SM</u>	F048. P. R. Serenade (s Ti	Bristow and G. pecific formulati rial mean: 6% cor	E. Windom, W on not specifi ntrol (n = 2).	/ashington S ed; ASO ass	tate Unive umed) at 8	ersity 8.0 lb	y. Evaluation D/acre: <mark>8% c</mark>	n of fungicides for co <mark>ontrol</mark> of all fungi (m	ntrol of f ostly Boti	ruit rot rytis), f	and red ras resh market	pberry, 2002. . 4 <mark>% control</mark> of Botr	ytis, processing.	
<u>F&N 57:SM</u>	F <u>31.</u> P. R. Serenade AS Serenade AS Ti	Bristow and G. E O at 2 gal/A: 13 O at 2 gal/A: 25 Tal mean: 15% c	Windom, Wa 3% control of 1 5% control of 1 ontrol (n = 4)	ashington St Botrytis frui Botrytis frui	ate Univer t rot, fresh t rot, fresh	rsity. n mar n mar	Use of fung rket. <mark>5% cor</mark> rket. <mark>15% co</mark>	icides to control frui <mark>itrol</mark> of Botrytis fruit <mark>ontrol</mark> of Botrytis frui	it disease rot, proc t rot, pro	s of red essing. cessing	l raspberry,	2001.		
<u>F&N 57:SM</u>	<u>F32.</u> J. Del Serenade AS Ti	Francesco and G. O at 1.335 gal/a rial mean: 21% co	. Koskela, Ore acre: <mark>38% con</mark> ontrol (n = 2).	gon State U <mark>trol</mark> of Botry	niversity. /tis fruit ro	Eval ot inc	uation of fui tidence (July	ngicides for control c (2). <mark>4% control</mark> of B	of fruit ro otrytis fru	t on ras uit rot i	pberries, 20 ncidence (Ju	001. uly 9).		
F&N 56:SM	<u>F38</u> . P. R. Serenade (s Ti	Bristow and G. E pecific formulati rial mean: 12% co	. Windom, Wa on not specifi ontrol (n = 2).	ashington St ed; ASO ass	ate Univer <mark>umed</mark>) at 8	sity. 3 lb/a	Evaluation acre: <mark>7% co</mark> i	of fungicides for con <mark>htrol</mark> of Botrytis fruit	trol of ca rot, fres	ne and h marke	fruit disease et. <mark>16% con</mark>	es of red raspberry, <mark>trol</mark> of Botrytis fruit	1999. rot, post-harvest.	

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: CANEBERRIES / Powdery Mildew (Podosphaera aphanais)

				Crop G	Co roup 13: B	ompa errie	rative Overvi s and Small F	ew of Efficacy, Haza ruits: Caneberries /	ards, and Powdery	Use Res Mildew	strictions (<i>Podosph</i>	aera aphanis)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	74	2	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	Bacillus pumilis strain QST 2808	Sonata ASO	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	No data	NA	NA	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Bio- chemical	Rhamnolipid biosurfactant	Zonix	72431-1	No data			Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative use only.	0	4	None.	Irreversible eye damage.	None.	Do not use at ambient temperatures over 80°F. Keep from overheating or freezing. Store out of direct sunlight.

				Crop G	Co roup 13: B	mpai errie	rative Overvi s and Small F	ew of Efficacy, Haza ruits: Caneberries /	rds, and Powdery	Use Res Mildew	strictions 1 (<i>Podosph</i>	aera aphanis)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Biological	Streptomyces Iydicus WYEC	Actinovate	73314-1	No data	NA	NA	Powdery mildew claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.
Non- synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Eye and skin irritation. May cause dermal sensitization. ^F	None.	Do not expose to light.
Non- synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)	No data	NA	NA	General powdery mildew claim; not crop specific.	0	0	None.	Avoid contact with skin, eyes, and clothing.	No FIFRA statement.	None.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Non- synthetic	NC; Organic acid	Citric acid	Nuke Em	NA; 25(b)	No data	NA	NA	General mildew claim; not crop specific.	0	0	None.	No FIFRA statement.	No FIFRA statement.	Store away from direct sunlight.
Synthetic	M2	Sulfur	Acoidal	62562-4	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Cosavet-DF	70905-1	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Moderate eye irritation.	None.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Defend DF	62562-8	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.

				Crop G	Co roup 13: B	mpai errie:	rative Overvi s and Small F	ew of Efficacy, Haza ruits: Caneberries /	rds, and Powdery	Use Res Mildew	strictions ((<i>Podosph</i>	naera aphanis)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M2	Sulfur	Kumulus DF	51306- 352- 66330	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed. Avoid contact with eyes, skin, and clothing.	None.	Do not store above 104°F.
Synthetic	M2	Sulfur	Micro Sulf	55146-75	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Keep away from heat, sparks, or flames.
Synthetic	M2	Sulfur	Microthiol Disperss	70506- 187	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	None.	Do not store near flammable materials.
Synthetic	M2	Sulfur	Thiolux	34704- 1079	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Suspended dust ignites easily.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1	No data	NA	NA	General powdery mildew control claim.	1	4	None.	Harmful if swallowed.	None.	Chemical incompatibilities.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1	No data	NA	NA	General powdery mildew control claim. Preventative only.	0	4	None.	Moderate eye irritation.	None	Chemical incompatibilities.
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163- 324	No data	NA	NA	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.

				Crop G	Cc roup 13: B	ompai errie	rative Overvi s and Small F	ew of Efficacy, Haza ruits: Caneberries /	ards, and Powdery	Use Res / Mildew	strictions v (<i>Podosph</i>	naera aphanis)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22- 70051	No data	NA	ΝΑ	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2	No data	NA	NA	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Powdery mildew control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704- 849	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation. May cause dermal sensitization. ^F	Hazardous to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed.	Toxic to fish.	None.
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368	No data	NA	NA	Control.	0	12	Yes (with sulfur).	Harmful if absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Chemical incompatibilities.
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Aliphatic petroleum solvent	SuffOil-X	48813-1- 68539	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.

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	Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Caneberries / Powdery Mildew (<i>Podosphaera aphanis</i>)														
NOP	NOP FRAC A Active Product EPA Reg. Efficacy B Label Claim PHI REI Hazards and Restrictions Noted on the Product Label Status Code(s) Ingredient(s) No. Hazards Dupped Image: Code(s) Ingredient(s) Image: Code(s) Image: Code(s)														
Status	atus Code(s) Ingredient(s) No. Mean % n ^C PDMR ^D (Days) (Hrs) Phyto- Human Environmental ^G Physical Control Citations														
	Control Citations toxicity														
Α.	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned.														
В.	For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR).														
с.	Number of trials included in the calculation of the mean.														
D.	Number of thats included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides.														
	https://www	w.plantmanagem	entnetwork.c	rg/pub/tria	l/pdmr/	,	•	,				, ,	5		
	Search term	s included raspb	erry, raspberr	ies, blackb	erry, black	berri	es, caneberr	v, and caneberries i	n combir	ation w	ith "powde	ery mildew".			
E.	Mix-and-mat	tch directions for	use. Label h	as a list of	crops and	a sep	arate list of	diseases with no cla	im for sp	ecific c	, rop/diseas	e combinations.			
F.	Complete la	bel statement: P	rolonged or f	requently re	epeated sk	cin co	ntact may ca	use allergic reactio	ns in som	e indivi	duals.				
G.	EPA relative	environmental t	oxicity descri	ptors, lowe	, st toxicity	to hi	ghest toxicit	y: Practically non-t	oxic < ۸	oderate	ely toxic	< Toxic < Highly toxic.			
D.	Serenade fo	rmulation not sp	ecified.	• •			-				-	5,			
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OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: CRANBERRIES / Cottonball (Monilinia oxycocci)

There are no OMRI-listed products that are EPA registered for use on cranberries for treatment of cottonball.

				Cri	Co Group 1	mpar 3 · Br	rative Overvi erries and Sm	ew of Efficacy, Haza all Fruits: Cranberr	ards, and ies / Cott	Use Res	strictions Monilinia	axycocci)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E E	ffica	icy ^B	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	Interfect 19 Polyoxin D zinc salt Oso 68173-4 46 5 See Oso efficacy summary table. 0 4 None. May cause dermal sensitization. F Moderately toxic to fish and aquatic invertebrates. None. FRAC = Europicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified: no FRAC code has been assigned. None. None. </td													
A. B. C. D.	FRAC = Fung For Polyoxir Number of t PDMR = Plar	sicide Resistance D zinc salt (Oso rials included in Disease Manag	Action Comm), from summ the calculatic ement Report	nittee. Proc arizes trials on of the ma s (on-line ja	Jucts with 5, publishe ean. ournal gen	the s d and erall	same mode o d unpublished y used for pu	f action have the sa J. For OMRI-listed a blication of efficacy	me FRAC lternative research	Code. es, from	NC = Not o Plant Dis cted at un	classified; no FRAC code l ease Management Report iversities). Preceded by	has been assigned. s (PDMR). F&N = Fungicides and I	Nematicides.
E. F. G	https://www Mix-and-mai Complete la FPA relative	w.plantmanagem tch directions for bel statement: F environmental	<u>rentnetwork.c</u> r use. Label h Prolonged or f	ng/pub/trians a list of requently represented by the representation of the representatio	al/pdmr/ crops and epeated sl	a ser kin co	parate list of ontact may ca	diseases with no cla ause allergic reactic	aim for sp ins in som	ecific c ne indivi Moderati	rop/disea duals. ely toxic	se combinations.		

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: CRANBERRIES / Fruit Rot Complex (*Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, and *Physalospora vaccinii*, etc.)

					Co Crop (ompa Group	rative Overvi 13: Berries	ew of Efficacy, Haz and Small Fruits: Cr	ards, and anberries	Use Res / Fruit	strictions Rot Comp	lex			
		(Co	leophoma em	petri, Colle	etotrichum	acu	tatum, Colle	totrichum gloeospoi	rioides, Pl	hyllostic	cta vaccini	ii, and Physalospora vacci	<i>inii</i> , etc.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Prod	uct Label	
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical	
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	65	10	See Oso efficacy summary table.	Control (most pathogens).	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.	
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7	No data	NA	NA	Control.	0	24	Yes.	Irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.	
Synthetic	Image: synthetic with the synthetic														
Synthetic	with the comper substantial comper substantial Badge X2 80289-12 No data NA Control. 0 48 Yes. May be fatal if swallowed. Substantial eye injury. Toxic to fish and aquatic organisms. May damage aluminum. synthetic M1 Copper sulfate CS 2005 66675-3 No data NA Control. 0 48 Yes. Irreversible eye Toxic to fish and aluminum. Incompatible with														
Synthetic	with the second of the seco														
Synthetic	M1	Cupric hydroxide	Nu-Cup HB	42750- 132	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Damages aluminum.	
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4	No data	NA	NA	Control.	0	12	Yes.	Harmful if swallowed or absorbed through skin. Eye irritation.	None.	Water pH restrictions.	
Α.	FRAC = Fung	gicide Resistance	Action Comm	nittee. Pro	ducts with	the s	same mode o	of action have the sa	me FRAC	Code.	NC = Not o	classified; no FRAC code I	has been assigned.		
B.	For Polyoxir	n D zinc salt (Oso grials included in), from summ	arizes trials	s, publishe ean	d and	d unpublishe	d. For OMRI-listed a	lternativ	es, from	n Plant Dis	ease Management Report	s (PDMR).		
D.	PDMR = Plar	nt Disease Manag	ement Report	s (on-line j	ournal gen	erall	y used for pu	blication of efficacy	research	n conduc	cted at un	iversities). Preceded by	F&N = Fungicides and I	Nematicides.	
!	https://ww	w.plantmanagem	nentnetwork.c	org/pub/tri	al/pdmr/										
E. I	Mix-and-ma Complete la	tch directions for	r use. Label I Prolonged or f	has a list of frequently r	crops and	a se a se	parate list of	diseases with no cla	aim for sp	ecific c	rop/disea:	se combinations.			
G. I	EPA relative	environmental	toxicity descr	iptors, lowe	est toxicity	to h	ighest toxici	ty: Practically non-	coxic < N	Aoderate	ely toxic	< Toxic < Highly toxic.			
Plant Disea	ase Managei	ment Reports cit	ations and da	ta summario	es:										
2:SMF002.	P. McManu Champ at 5. Champ at 5. Ti	is and R. S. Perry 33 pt/A, applied 33 pt/A, applied rial mean: 7,3% of	y, University o I June 19 and I June 6 and J control (n = 3)	of Wisconsin 26, 2007: <mark>1</mark> July 9, 2007	. Evaluati <mark>0% and 12</mark> : <mark>No cont</mark>	on of <mark>2% co</mark> rol.	⁻ fungicides f <mark>ntrol.</mark> Disease cont	or control of cranbe rol was less than in	rry fruit i the untre	ot in W	isconsin, 2 ontrol.	2007.			

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: GRAPES / Black Rot (Guignardia bidwellii)

				C	Co Crop Group	ompa o 13:	rative Overvi Berries and S	ew of Efficacy, Haza Small Fruits: Grapes	ards, and / Black R	Use Re lot (<i>GL</i>	estrictions <i>lignardia</i> b	pidwellii)		
NOP	FRAC ^A	Active	Product	EPA Reg.	l	Effica	су ^в	Label Claim	PHI	REI		Hazards and Restriction	ons Noted on the Produ	ict Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	54	4	See Oso efficacy summary table.	Suppression.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data	NA	NA	Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	No data	NA	NA	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- Synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	8	3	8:SMF014; 7:SMF003; 6:SMF008.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Synthetic	M1	Basic copper sulfate	Basic Copper 53	45002-8	No data	NA	NA	Suppression.	0	24	Yes.	Substantial eye injury.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	50289-12	54	2	8:SMF014; 6:SMF008.	Control.	0	48	Yes.	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M1	Copper hydroxide	Champ WG	55146-1	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7	78	2	6:SMF008.	Control.	0	24	Yes.	Irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	32	3	3:SMF030; 3:SMF031; 2:SMF004.	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Skin irritation. Harmful if swallowed, inhaled or absorbed through skin.	Toxic to fish and aquatic organisms.	Incompatible with galvanized pipe and nylon equipment.

				c	Co rop Group	mpar 13:	ative Overvi Berries and S	ew of Efficacy, Haza mall Fruits: Grapes	rds, and / Black R	Use Re ot (<i>Gu</i>	estrictions <i>ignardia b</i>	nidwellii)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restriction	ons Noted on the Produ	ct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M1	Cupric hydroxide	NuCop 50 DF	45002-4	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin. May cause dermal sensitization.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cupric hydroxide	Nu-Cop HB	42750- 132	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4	No data	NA	NA	Control.	0	12	Yes.	Harmful if swallowed or absorbed through skin. Eye irritation.	None.	Water pH restrictions.
Synthetic	NC; oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	0	1	F&N 56:SMF19.	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. B. C. D. E. / F. (G.	FRAC = Fung For Polyoxir Number of t PDMR = Plar <u>https://ww</u> Mix-and-ma Complete la EPA relative	gicide Resistance n D zinc salt (Osc crials included in nt Disease Manag w.plantmanagen tch directions fo ubel statement: I e environmental	Action Comm b), from summ the calculation mentnetwork.co r use. Label h Prolonged or fi toxicity descri	hittee. Proc arizes trials on of the me s (on-line jo org/pub/tria has a list of requently re iptors, lowe	lucts with , publishe ean. ournal gen a <u>l/pdmr/</u> crops and epeated sk st toxicity	the s d and erally a sep sin co to h	ame mode o I unpublished / used for pu parate list of ntact may ca ighest toxicit	f action have the sa d. For OMRI-listed a blication of efficacy diseases with no cla ause allergic reactio cy: Practically non-t	me FRAC Iternative research im for sp ns in som oxic < A	Code. es, from condu ecific e indiv Nodera	NC = Not m Plant Di ucted at un crop/disea viduals. tely toxic	classified; no FRAC code l sease Management Report niversities). Preceded by ase combinations. < Toxic < Highly toxic.	nas been assigned. s (PDMR). F&N = Fungicides and 1	lematicides.
Plant Disea <u>8:SMF014.</u> I	ase Manager Grape/bla Regalia 5% a Regalia 5% a Tı	ment Reports cit ck rot. Bryan He at 6 quarts/A; w at 6 quarts/A; w rial mean: 23% c	ations and dat ed. Penn State <i>ithout</i> mummi <i>ith</i> mummies: ontrol (n = 2).	ta summarie e University es: <mark>46% con 0% control</mark>	es for <mark>non-</mark> . Evaluati <mark>trol</mark> on fru on fruit.	synth ion of it.	<mark>etic</mark> alternat	tives: gicides for control o	f black rc	ot and	powdery a	nd downy mildew of Conc	ord grapes, 2013.	
7:SMFF003	. Grape/bl Regalia 5% a Regalia 5% a	ack rot. Bryan H at 6 quarts/A, <i>w</i> at 6 quarts/A, <i>w</i>	led. Penn Sta <i>ithout</i> mummi <i>ith</i> mummies:	te Universit es: Insuffici <mark>No control</mark>	y. Evalua ent pest p . More dis	tion o ressu ease	of organic fu ire. than in the i	ngicides for control	of black r fruit.	rot and	l powdery	mildew of Concord grapes	, 2012.	
<u>6:SMF008</u> .	Grape/bla Regalia 5% a Regalia 5% a <mark>T</mark> i	ck rot. Bryan He at 6 quarts/A + N at 6 quarts/A + N rial mean: 1% co	ed. Penn State IuFilm P at 0.0 IuFilm P at 0.0 ntrol (n = 2).	e University 0625%; <i>with</i> 0625%; <i>with</i>	. Evaluati <i>out</i> mumm mummies	ion of nies: : <mark>1.8</mark> 5	f conventiona Insufficient p <mark>% control</mark> of o	al and organic fungic pest pressure. diseased clusters. <mark>N</mark>	ides for o <mark>o control</mark>	contro of dis	l of black i eased area	rot and powdery mildew o a on clusters.	f Concord grapes, 2011	

				(Co Trop Grour	mpar 13: I	ative Overvi Berries and S	ew of Efficacy, Haza Small Fruits: Grapes	rds, and / Black R	Use Re ot (<i>Gu</i>	estrictions <i>ignardia b</i>	pidwellii)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	fficad	су ^в	Label Claim	PHI	REI		Hazards and Restriction	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Disea	ase Manager	nent Reports cita	ations and dar	ta summarie	es for <mark>synt</mark>	hetic	alternatives	:						_
<u>8:SMF014.</u> B E E E	Bryan Hed, adge X2 1.7 adge X2 1.7 adge X2 1.7 adge X2 1.7 adge X2 1.7 Tr	, Penn State Univ '5 lb/A + lime 1.7 '5 lb/A + lime 1.7 '5 lb/A + lime 1.7 '5 lb/A + lime 1.7 ial mean: 43% co	versity. Evalu 75 lb/A, 5 or 1 75 lb/A, 5 or 1 75 lb/A + Nu-I 75 lb/A + Nu-I ntrol (n = 12)	ation of org more applic more applic Film-P, 5 or Film-P, 5 or	ganic fungi ations, dif ations, dif more app more app	cides feren feren licatio licatio	for control of t timings; w t timings; w ons, differen ons, differen	of black rot and pow <i>ithout</i> mummies: 64 <i>ith</i> mummies: 4%, 59 It timings; <i>without</i> n It timings; <i>with</i> mum	vdery and <mark>%, 77%, 8</mark> <mark>%, 15%, a</mark> nummies nmies: <mark>9</mark> %	downy 31%, an nd 22% : 66.5% % and 9	y mildew o <mark>d 90%</mark> con control o , and 71% % control	of Concord grapes, 2013. Itrol on fruit. n fruit. control on fruit. on fruit.		
6:SMF008. N N E	B. Hed and IuCop 50 WF IuCop 50 WF Nu adge X2 at Ba	I N. K. Ngugi, Per at 1 lb/A + Lime at 2 lb/A + Lime Cop 50 WP trial 1.75 lb/A + Lime dge X2 trial mea	nn State Univ e at 1 lb/A + e at 2 lb/A + mean: 77% co at 1.75 lb/A n: 64% contro	ersity. Eval Nufilm P at Nufilm P at ntrol (n = 4 + Nufilm P l (n = 2).	uation of 0.0625%: 0.0625%: 0.0625%:). at 0.0625%	conve 67% c 65% c 65% c	ntional and <mark>control</mark> of dis <mark>control</mark> of dis <mark>& control</mark> of	organic fungicides fo ;eased clusters; <mark>85%</mark> ;eased clusters; <mark>91%</mark> diseased clusters; <mark>7</mark> 5	or contro control c control c 5% contro	l of bla of disea of disea of disea of dis	ack rot and ased area. ased area. seased are	d powdery mildew of Conc	ord grapes, 2011.	
<u>3:SMF030.</u> C	Bryan Hed .ueva 1%; 6	, Penn State Univ applications beg	versity. Evalu inning interm	ation of org ediate pre-	3anic fungi bloom: <mark>39</mark> 5	cides <mark>% con</mark> t	for control (<mark>crol</mark> on fruit.	of black rot and pow	dery mil	dew, 2	008.			
<u>3:SMF031.</u> C	Bryan Hed, <mark>ueva</mark> 1%; 7 Ca Wo	, Penn State Univ applications begi ne inoculum plus ood inoculum onl <mark>Trial me</mark> a	versity. Evalu inning at imm s mummies: 2 ty: 0% control an: 12% contro	ation of alt ediate pre- <mark>3% control</mark> o on fruit. ol (n = 2).	ernative fi bloom. on fruit.	ungici	des of black	rot, powdery milde	w, and do	owny n	nildew of g	grapes, 2008.		
2:STF004. C C	Bryan Hed, ueva at 1 g ueva at 2 g Tr	Penn State Univ al/A; 4 applicatio al/A; 4 applicatio <mark>ial mean: 45% co</mark>	versity. Evalua ons beginning ons beginning ntrol (n =2).	Ition of orga June 6, 20 June 6, 20	anic fungic 17: <mark>45% co</mark> 17: <mark>44% co</mark>	ides f <mark>ntrol</mark> ntrol	^f or control of on fruit. on fruit.	f black rot and powc	dery mild	ew of (Concord g	rapes, 2007.		
<u>F&N Test 5</u> C	<u>6:SMF19.</u> M Xidate 27%	. Ellis <i>et al.</i> Ohi L at 128 fl oz/A;	io State Unive ; 7 applicatior	rsity. Evalu 1s: <mark>No contr</mark>	ations of f <mark>ol</mark> of leaf	ungic	ides for cont ions. <mark>No co</mark> i	rol of Grape Black R: <mark>htrol</mark> of fruit infectic	ot, 2000. ons. More	e disea	se than in	the untreated control.		

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: GRAPES / Bunch Rot (Botrytis cinerea)

					Co Crop Gro	ompa up 13	rative Overvi 8: Berries and	ew of Efficacy, Haza I Small Fruits: Grape	ards, and es / Buncl	Use Res h Rot (<i>B</i>	strictions Botrytis cii	nerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	суВ	Label Claim	PHI	REI		Hazards and Restrict	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	66	6	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	74	1	9:SMF001.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	95	1	9:SMF001.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data	NA	NA	Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	22	4	5:SMF010; F&N 61:SMF034; F&N 58:SMF026.	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.

					Co Crop Grou	mpar Jp 13	ative Overvi : Berries and	ew of Efficacy, Haza I Small Fruits: Grape	rds, and s / Bunch	Use Res n Rot (<i>B</i>	strictions Potrytis cir	nerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	39	4	6:SMF047; 5:SMF049; 5:SMF057; 2:SMF009.	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	32	1	9:SMF023.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	38	1	9:SMF023.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	23	4	10:SMF030; 9:SMF013; 9:SMS023; 8:SMF015.	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Streptomyces lydicus	Actinovate AG	73314-1	No data	NA	ΝΑ	Botrytis claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Biological	Ulacladium ouderansii strain U3	Zen-O-Spore	75747-2	No data	NA	NA	Control.	0	4	None.	Harmful if inhaled. Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live fungal spores. Store below 68°F.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.

					Co Crop Gro	mpai up 13	rative Overvi B: Berries and	ew of Efficacy, Haza 1 Small Fruits: Grane	ards, and s / Bunch	Use Res	strictions Botrytis cir	ierea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Temporary eye and skin irritation	No FIFRA statements.	Storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	20	1	F&N 55:SMF116	Control.	0	4	None.	Harmful is swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful is swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	26	2	5:SMF049; 5:SMF057.	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Botrytis control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	10	2	2:SMF036; F&N 61:SMF038	Control.	0	4	Yes. (with sulfur).	Harmful if swallowed.	Toxic to fish.	None.
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Aliphatic petroleum solvent	SuffOil-X	48 <mark>813-1-</mark> 68539	No data	NA	NA	Control.	0	4	Yes (with sulfur)	Harmful if swallowed. May cause dermal sensitization	Toxic to aquatic organisms.	None.

					Co	mpar	ative Overvi	ew of Efficacy, Haza	rds, and	Use Res	trictions			
					Crop Grou		: Berries and	Small Fruits: Grape	s / Bunch	n Rot (<i>B</i>	otrytis cir	erea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI	<u> </u>	Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	hetic NC; Petroleum oil Mineral oil TriTek 48813-1 No data NA Control. 0 4 Yes (with sulfur). Harmful if swallowed or absorbed through skin. Sensitization. Toxic to aquatic organisms. None.													
A. F B. F C. N	RAC = Fung for Polyoxin Number of ti	icide Resistance D zinc salt (Oso) rials included in	Action Comm), from summa the calculatio	ittee. Prode arizes trials, n of the me	ucts with t publishec an.	the sa I and	ame mode of unpublished	action have the san . For OMRI-listed all	ne FRAC (ternative	Code. N s, from	IC = Not c Plant Dise	lassified; no FRAC code h ase Management Reports	as been assigned. ; (PDMR).	
D. F	PDMR = Plan https://www	t Disease Manage v.plantmanagem	ement Reports entnetwork.o	s (on-line jo <mark>rg/pub/tria</mark>	urnal gene <mark>l/pdmr/</mark>	erally	used for put	olication of efficacy	research	conduc	ted at uni	versities). Preceded by F	&N = Fungicides and N	ematicides.
E. 1	۸ix-and-mat	ch directions for	use. Label h	as a list of c	rops and a	a sepa	arate list of	diseases with no clai	m for spe	ecific cr	op/diseas	e combinations.		
F. (Complete la	oel statement: P	rolonged or fr	equently re	peated ski	in cor	ntact may ca	use allergic reaction	is in some	e individ	luals.			
с г	- DA										1	Taula Iliable faula		

G. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

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					Co Crop Grou	mpar JD 13	ative Overvi : Berries and	ew of Efficacy, Haza I Small Fruits: Grape	ards, and es / Bunch	Use Re	strictions Botrytis cine	erea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Dise	ase Manager	nent Reports cit	ations and da	ta summarie	es for <mark>non-</mark>	synth	<mark>etic</mark> alterna	tives:			•		•	
<u>10:SMF030</u>). J.W. Psch Botector at	neidt and J. P. Ba 10 oz/A: <mark>80.1%, 6</mark>	assinette, Ore <mark>51.8%, 43.2%,</mark>	gon State U and 82.1% c	niversity. <mark>control</mark> of	Effic	acy of Fungi ence (9/13/2	cides for Manageme 2015, 9/22/2015, 9/	nt of Gra 28/2015)	pe Bune and Se	th Rot, 201 verity (9/28	5. 3/2015), respectively. <mark>1</mark>	rial mean: 66.8% cont	rol (n = 4).
<u>9:SMF001.</u> I I	T. T. Nguy Double Nicke Double Nicke	en, N.S. Morris, a el LC at 2 qt/A: el 55WDG at 20 o	and W. D. Gul <mark>93% and 96% (</mark> pz/A: <mark>70% and</mark>	oler, Univer <mark>control</mark> of Bo I 78% contro	sity of Cal otrytis bun <mark>I</mark> of Botryt	iforni ch ro is bu	a, Davis. Ma t (severity a nch rot (seve	anagement of Grape nd incidence, respe erity and incidence,	Botrytis ctively). respectiv	Bunch I <mark>Trial m</mark> rely). <mark>1</mark>	Rot with ex lean: 95% c Trial mean:	perimental, organic and ontrol (n = 2). 74% control (n = 2).	conventional fungicid	es, 2014.
<u>9:SMF013</u> . I	B. Hed, Pe Botector at !	ennsylvania State 5 oz/A: <mark>1.7% cor</mark>	University. I <mark>ntrol</mark> of Botryt	Evaluation o is incidence	f Leaf Ren e on cluste	noval rs.	, Botector, F <mark> 1.2% contro</mark>	oliar Nutrients, and <mark>l</mark> of Botrytis severity	Fungicid on clust	es for C ers. <mark>Tr</mark>	ontrol of B ial mean: 6	otrytis Bunch Rot of Gra .5% control (n = 2).	pes, 2014.	
9:SMF023.	L. J. Betti Regalia at 2 Serenade Op Botector at	ga, University of qt/A + Kinetic at timum at 1 lb/A 7 oz/A + Kinetic	California Co t 0.05%: <mark>29%</mark> + Kinetic at 0 at 0.05%: <mark>30</mark> 9	operative Ex <mark>control</mark> of B 0.05%: 26% 6 control of	xtension (S otrytis bur <mark>control</mark> of Botrytis bu	alina nch ro Botr unch	s). Evaluat ot incidence. ytis bunch ro rot incidence	tion of fungicides for 47% control of Bot ot incidence. 38% co e. 53% control of Bo	r the con rytis bund ontrol of otrytis bu	trol of I ch rot s Botrytis nch rot	Botrytis bur everity. Tr bunch rot severity.	nch rot of grape, 2014. ial mean: 38% control (n severity. Trial mean: 32 Frial mean: 42% control (u = 2). 2% control (n = 2). (n = 2).	
<u>8:SMF015</u> . I	B. Hed, Pe Botector at !	ennsylvania State 5 oz/A: <mark>16.7% co</mark>	University. I Introl of Botry	Evaluation o vtis bunch ro	f Leaf Ren ot incidend	noval :e. <mark>3</mark>	, ProGibb, V <mark>7.5% control</mark>	apor Gard, and Fung of Botrytis bunch ro	icides for t severit	r the Co y. <mark>Trial</mark>	ntrol of Bo mean: 27.	trytis Bunch Rot of Grap <mark>1% control (n = 2).</mark>	es, 2013.	
6:SMF047.	W. F. Wilc Gerenade Ma	ox and D. G. Rie <mark>x</mark> at 1.5 lb/A: <mark>3</mark>	gel, Cornell U <mark>6% control</mark> of	niversity. E Botrytis on	valuation clusters.	of fu <mark>34% c</mark>	ngicide prog <mark>ontrol</mark> of dis	rams for control of E eased area on cluste	Botrytis b ers. <mark>Trial</mark>	unch ro mean:	t of grapes 35% contro	, 2010. l (n = 2).		
<u>5:SMF010.</u>	I.S. Bay, J Gerenade (fo	. D. Eynard, and prmulation not sp	W. D. Gubler, becified; assur	, University ne ASO = lic	of Califorr <mark>Juid)</mark> at 4 (nia, D qt/A:	avis. Fungic <mark>39% and 30%</mark>	tide programs for co control of Botrytis	ntrol of E bunch ro	otrytis t incide	bunch rot o nce and se	of grape, 2010. verity, respectively. <mark>Tri</mark>	al mean: 35% control (n = 2).
5:SMF049.	A. M.C. Sc erenade Ma	hilder, J. M. Gill <mark>x</mark> at 3 lb/A + Nul	ett, and R. W Film-17 at 0.5	. Sysak, Mic pt/A: <mark>37%</mark>	higan Stato <mark>control</mark> of	e Uni Botr	versity. Eva ytis bunch ro	luation of fungicide ot.	programs	for co	ntrol of bun	ch rots and downy milde	ew in 'Vignoles' grape:	, 2008.
<u>5:SMF057.</u>	A. M.C. So Gerenade Ma	childer, J. M. Gill <mark>x</mark> at 3 lb/A + Nu	lett, and R. W -Film P at 0.5	'. Sysak, Mic pt/A: <mark>55%</mark>	chigan Stat <mark>control</mark> of	e Un Botry	iversity. Eva tis bunch ro	aluation of fungicide t.	program	s for co	ntrol of bu	nch rots in 'Vignoles' gra	apes, 2009.	
2:SMF009.	W. F. Wilc Gerenade Ma	ox and D. G. Ries <mark>x</mark> 2.0 lb + Biotun	gel, Cornell U e (adjuvant)	niversity.E at 0.13%: <mark>1</mark>	valuation <mark>3% control</mark>	of fu of Bo	ngicide prog otrytis bunch	rams for control of E n rot on clusters. <mark>45</mark>	Botrytis b <mark>% control</mark>	unch ro of infe	t of grapes cted cluste	, 2007. r area. <mark>Trial mean: 29%</mark>	control (n = 2).	
F&N 61:SA	<u>AF034.</u> W. F Gerenade (ur <mark>Tr</mark>	. Wilcox and D. (nspecified formu ial mean: 35% co	G. Riegel, Cor lation; assum ntrol (n = 2).	nell Univers e ASO = liqu	sity. Evalua <mark>id)</mark> at 4.0	ation qt/A	of fungicide + Biotune (a	programs for contro djuvant) at 0.125% (ol of Botr v/v): <mark>36</mark>	ytis bur <mark>% contr</mark>	ich rot of gi <mark>ol</mark> of Botryt	rapes, 2005. is on clusters. <mark>33% cont</mark>	<mark>rol</mark> of diseased area or	ı clusters.
<u>F&N 58:SA</u>	<u>AF026.</u> A. Ba Gerenade (fo Gerenade (fo	audoin, Virginia I prmulation not sp prmulation not sp	Polytechnic In pecified) at 6 pecified) at 6	stitute and lb/A, Stanaı lb/A, Linder	State Univ rdsville tri n trial: 18	versit al: <mark>N</mark> % cor	y. Evaluatio <mark>o control</mark> of Itrol of Botry	n of fungicides for c Botrytis incidence a ⁄tis incidence. 20% o	ontrol of nd severi control of	grape l ty. Mo Botryt	ounch and o re disease t is severity.	other late-season rots, 2 han in the untreated co Trial mean: 19% contro	002. ntrol. l (n =2).	

					Com Crop Group	nparat o 13: E	tive Overvie Berries and	ew of Efficacy, Haza Small Fruits: Grape	rds, and s / Bunch	Use Res n Rot (<i>B</i>	trictions otrytis cin	erea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	Eff	ficacy	/ ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	luct Label
Status	Code(s)	Ingredient(s)		No.	Mean % r Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Disea	ase Manager	nent Reports cita	ations and dat	ta summarie	es for <mark>synthe</mark>	<mark>etic</mark> al	lternatives							
<u>5:SMF049.</u> C	ant Disease Management Reports citations and data summaries for synthetic alternatives: <u>SMF049.</u> A. M.C. Schilder, J. M. Gillett, and R. W. Sysak, Michigan State University. Evaluation of fungicide programs for control of bunch rots and downy mildew in 'Vignoles' grapes, 2008. Oxidate at 1% (v/v)/A: 43% control of Botrytis bunch rot. <u>SMF057.</u> A. M.C. Schilder, J. M. Gillett, and R. W. Sysak, Michigan State University. Evaluation of fungicide programs for control of bunch rots in 'Vignoles' grapes, 2009. <u>Oxidate</u> at 1% (v/v)/A: 8.0% control of Botrytis bunch rot.													
<u>5:SMF057.</u> C	Oxidate at 1% (v/v)/A: <mark>43% control</mark> of Botrytis bunch rot. <u>SMF057</u> A. M.C. Schilder, J. M. Gillett, and R. W. Sysak, Michigan State University. Evaluation of fungicide programs for control of bunch rots in 'Vignoles' grapes, 2009. Oxidate at 1% (v/v)/A: 8.0% control of Botrytis bunch rot.													
<u>2:SMF036.</u> J	J. Hashim- MS Stylet-O	Buckey, Universi <mark>il</mark> at 1 gal/A: <mark>0%</mark>	ty of Californ control of po	ia (Bakersfie st-harvest E	eld). Evalua Botrytis bund	ation ch rot	of vineyard t. Untreate	fungicide applicati ed control has less d	ons to co isease.	ntrol po	stharvest	rot of table grapes, 2006		
F&N 61:SM J	<u>F038.</u> B. He <mark>MS Stylet-O</mark>	ed and J.W. Trav <mark>il</mark> at 2% (v/v), 2 t	ris, Penn State treatments wi	e Research a ith 2 applica	and Extensio ations each,	on Cei diffe	nters. Eval erent timing	uation of cultural m : <mark>0% and 39% contr</mark>	iethods a <mark>ol</mark> of Botr	nd oils f ytis bur	for improvinch rot.	ing control of Botrytis bu <mark>rial mean: 20% control (n</mark>	nch rot of grapes, 200 <mark>= 2).</mark>	5.
<u>F&N 55:110</u> A A	<u>6</u> . W. F. Wi rmicarb 100 rmicarb 100 <mark>Tri</mark>	lcox and D. G. R) at 2.5 lb/A: 20) at 4.8 lb/A: 20 al mean: 20% cor	iegel. Evalua <mark>% control</mark> of E <mark>% control</mark> of E <mark>ntrol (n = 2).</mark>	tion of fung Botrytis bung Botrytis bung	icide progra ch rot on clu ch rot on clu	ams fo usters usters	or control a s. s.	f Botrytis bunch rot	of grape	s, 1999.				
References	s with espec	ially low disease	e pressure in t	he untreate	ed control ar	re not	t summariz	ed (F&N 58:SMF035)	•					

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: GRAPES / Downy Mildew (Plasmopara viticola)

				Cro	Co Dp Group 1	mpa 3: Be	rative Overvi erries and Sm	ew of Efficacy, Haza all Fruits: Grapes /	rds, and Downy Mi	Use Res ildew (<i>F</i>	strictions Plasmopara	a viticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI	1	Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	95	2	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization.	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel LC	70051- 114	No data	NA	ΝΑ	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data	NA	NA	Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	Bacillus mycoides, isolate J	LifeGard WG	70051- 119	No data	NA	NA	No direct effect on plant pathogen; plant protectant; preventative.	0	4	None.	Harmful if inhaled. Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Store at temperatures below 77°F.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None	Spray solution pH restrictions.

				Cro	Co p Group 1	mpai 3: Be	rative Overvi erries and Sm	ew of Efficacy, Haza all Fruits: Grapes /	irds, and Downy Mi	Use Res Idew (<i>F</i>	strictions Plasmopara	a viticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	42	1	3:SMF031	Suppression only. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	37	1	8:SMF014.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Streptomyces lydicus	Actinovate AG	73314-1	No data	NA	NA	Downy mildew claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Downy mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Synthetic	M1	Basic copper sulfate	Basic Copper 53	45002-8	No data	NA	NA	Control.	0	24	Yes.	Substantial eye injury.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	80289-12	99 (with lime)	1	8:SMF014	Control.	0	48	Yes.	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M1	Copper hydroxide	Champ WG	55146-1	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.

				Cro	Co Group 1 ac	mpai 3: Be	ative Overvi rries and Sm	ew of Efficacy, Haza all Fruits: Grapes /	ards, and Downy Mi	Use Res ildew (<i>F</i>	strictions Plasmopara	a viticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7	No data	NA	NA	Control.	0	24	Yes.	Irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	93	1	3:SMF031	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Skin irritation. Harmful if swallowed, inhaled or absorbed through skin.	Toxic to fish and aquatic organisms.	Incompatible with galvanized pipe and nylon equipment.
Synthetic	M1	Copper sulfate pentahydrate	Copper Sulfate Crystals	56576-1	No data	NA	NA	Control.	0	24	Yes.	Corrosive. Causes eye damage. Skin irritation.	Toxic to fish.	None.
Synthetic	M1	Copper sulfate pentahydrate	Quimag Quimicos Arguila Copper Sulfate Crystals	73385-3	No data	NA	NA	Control.	0	24	Yes.	Irreversible eye damage. Maybe fatal if swallowed. RESTRICTED USE PESTICIDE.	Toxic to fish and aquatic invertebrates. ENDANGERED SPECIES RESTRICTIONS.	Possible incompatibility with aluminum, rubber, etc.
Synthetic	M1	Cupric hydroxide	NuCop 50 DF	45002-4	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cupric hydroxide	Nu-Cop HB	42750- 132	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4	No data	NA	NA	Control.	0	12	Yes.	Harmful if swallowed or absorbed through skin. Eye irritation.	None.	Water pH restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Downy mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Not for use in California.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank- mix restrictions.

				Cro	Co 20 Group 1	mpar 3: Be	ative Overvi rries and Sm	ew of Efficacy, Haza all Fruits: Grapes /	irds, and Downy Mi	Use Res ildew (<i>P</i>	strictions Plasmopara	a viticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful is swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	ΝΑ	Downy mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Not for use in California.	0	1	None.	Harmful is swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	92 (leaves)	1	5:SMF049.	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Downy mildew control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
A. F	RAC = Fung	icide Resistance	Action Commi	ittee. Prod	ucts with	the sa	ame mode of	faction have the sar	ne FRAC	Code. N	NC = Not c	lassified; no FRAC code h	as been assigned.	
В. F С N	or Polyoxin Jumber of tu	D zinc salt (Oso) rials included in), from summa	irizes trials, n of the me	, published	I and	unpublished	I. For OMRI-listed al	ternative	s, from	Plant Dise	ease Management Reports	(PDMR).	
D. P	'DMR = Plan'	t Disease Manage	ement Reports	i (on-line jo	urnal gene	erally	used for put	blication of efficacy	research	conduc	ted at uni	versities). Preceded by F	&N = Fungicides and N	ematicides.
r <u>h</u>	ttps://www	v.plantmanagem	entnetwork.or	rg/pub/tria	<u>l/pdmr/</u>		arata list of	diagona with no clas	m for an	o cific cu	on / diagon	a combinations		
E. // F. C	inc-and-matic complete lal	bel statement: P	rolonged or fr	equently re	epeated sk	in cor	ntact mav ca	use allergic reaction	in for spe is in some	e indivio	duals.	e compinations.		
G. E	PA relative	environmental t	oxicity descrip	ptors, lowes	st toxicity	to hi	ghest toxicity	y: Practically non-to	oxic < M	oderate	ely toxic	< Toxic < Highly toxic.		
8:SMF014.	B. Hed, P	enn State Unive	rsity. Evaluat	ion of organ	nic fungicio	des fo	or control of	black rot and powde	ery and d	owny m	ildew of C	oncord grapes, 2013.		
B	adge X2 at	1.75 lb/A + lime	at 1.75 lb/A,	different a	pplication	timir	1gs: 96%, 99%	<mark>6, 100%, and 100% cc</mark>	<mark>ntrol</mark> of o	downy n	nildew on	grapes (fruit).		
В	adge X2 at	1.75 lb/A + lime	at 1.75 lb/A -	+ Nu-Film-P	at 0.0625	%, dif	ferent appli	cation timings: <mark>100%</mark>	and 100	% contro	<mark>ol</mark> of down	y mildew on grapes (fruit).	
	Ba	age XZ trial mea	n: 99% control	l (n = 6).										
5:SMF049.	A. Schilde	r, <i>et al.</i> Michiga	n State Univer	sity. Evalu	ation of fu	ıngici	de programs	for control of bunch	n rots and	d downy	mildew ir	1 'Vignoles' grapes, 2008.		
C	vxidate 1% (v/v): <mark>92% contro</mark>	<mark>I</mark> on grape lea	ves.										
<u>3:SMF031.</u>	B. Hed. Pe	enn State Univ. E	Evaluation of a	alternative formulation	fungicides	for c	ontrol of bla	ck rot, powdery mile	dew, and	downy	mildew of	grapes, 2008.		
C	ueva 1%: <mark>9</mark> :	3% control of dov	wny mildew on	i grapes (fri	uit).	icu, 1	new assumed							

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: GRAPES / Phomopsis (Phomopsis viticola)

					Cc Crop Grou	mpai p 13:	rative Overvi Berries and	ew of Efficacy, Haza Small Fruits: Grapes	rds, and / Phomo	Use Res psis (<i>Ph</i>	strictions nomopsis v	riticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	суВ	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	71	2	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data	NA	NA	Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151	No data	NA	NA	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.

				C	Co Crop Grou	pmpai p 13:	Berries and S	ew of Efficacy, Haza Small Fruits: Grapes	rds, and / Phomo	Use Res psis (<i>Ph</i>	strictions nomopsis v	iticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Temporary eye and skin irritation	No FIFRA statements.	Storage temperature restrictions.
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	80289-12	No data	NA	NA	Control.	0	48	Yes.	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M1	Copper hydroxide	Champ WG	55146-1	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	No data	NA	NA	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Skin irritation. Harmful if swallowed, inhaled or absorbed through skin.	Toxic to fish and aquatic organisms.	Incompatible with galvanized pipe and nylon equipment.
Synthetic	M1	Cupric hydroxide	Nu Cop 50 DF	45002-4	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cupric hydroxide	Nu Cop HB	42750- 132	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cuprous oxide	Nordox	48142-4	No data	NA	NA	Control.	0	12	Yes.	Harmful if swallowed or absorbed through skin. Eye irritation.	None.	Water pH restrictions.
Synthetic	M2	Sulfur	Acoidal	62562-4	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Defend DF	62562-8	No data	NA	ΝΑ	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Kumulus DF	51306- 352- 66330	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed. Avoid contact with eyes, skin, and clothing.	None.	Do not store above 104°F.

				(Co Crop Group	mpar o 13:	ative Overvi Berries and S	ew of Efficacy, Haza Small Fruits: Grapes	rds, and / Phomo	Use Res psis (<i>Ph</i>	trictions	iticola)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restriction	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M2	Sulfur	Micro Sulf	55146-75	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Keep away from heat, sparks, or flames.
Synthetic	M2	Sulfur	Microthiol Disperss	70506- 187	23	1	4:SMF047	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	None.	Do not store near flammable materials.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Phomopsis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Phomopsis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
A. F B. F C. N D. F E. M F. C G. E <u>4:SMF047.</u>	RAC = Fung for Polyoxin lumber of tr DMR = Plani ttps://www Nix-and-mat omplete lab PA relative W. F. Wilco Nicrothiol Di	icide Resistance D zinc salt (Oso rials included in t Disease Manage v.plantmanagem ch directions for bel statement: P environmental t ox et al., Cornel isperse at 5 lb/A	Action Comm), from summa the calculatio ement Reports entnetwork.o use. Label h rolonged or fr oxicity descri l University. ; 4 applicatior	ittee. Prod arizes trials n of the me s (on-line jo rg/pub/tria as a list of o requently re ptors, lowes Evaluation o ns beginning	ucts with t , published an. urnal gene <u>l/pdmr/</u> crops and a peated sk st toxicity of fungicid g at 1-inch	the sa d and erally a sep in con to hi e pro shoo	ame mode of unpublished used for pul arate list of ntact may ca ghest toxicity grams for co ts:	action have the san For OMRI-listed al Dication of efficacy diseases with no clai use allergic reaction y: Practically non-to ntrol of Phomopsis i	ne FRAC (cernative research m for spe s in some oxic < M n grapes,	Code. N s, from conduc ecific cr e indivic oderate 2008.	NC = Not cl Plant Dise ted at univ op/disease duals. Ny toxic Results:	assified; no FRAC code h ase Management Reports versities). Preceded by F e combinations.	as been assigned. (PDMR). &N = Fungicides and N	ematicides.
	She Ra	oot infections: chis infections: Trial me	13% control of 13% control of an: 23% contro	incidence. incidence. ol (n = 4).	40% contr 26% contr	<mark>rol</mark> of rol of	severity. girdling.							

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: GRAPES / Powdery Mildew (Erisyphe necator)

				Cr	Co ′ op Group	mpa 13: B	rative Overvi erries and Sr	iew of Efficacy, Haza nall Fruits: Grapes /	ards, and Powdery	Use Res Mildew	strictions (<i>Erisyphe</i>	e necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су	Label Claim	PHI	REI		Hazards and Restrict	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations	-	(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	79	8	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data			Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	ΝΑ	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	Bacillus mycoides, isolate J	LifeGard WG	70051- 119	No data			No direct effect on plant pathogen; plant protectant; preventative.	0	4	None.	Harmful if inhaled. Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Store at temperatures below 77°F.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.

				Cre	Co 1 op Group	ompai 13: Be	rative Overvi erries and Sn	iew of Efficacy, Haza nall Fruits: Grapes /	ards, and Powdery	Use Res Mildew	strictions • (<i>Erisyphe</i>	necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	cy ^B	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	34	3	3:SMF031; 1:SMF005.	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	1	1	6:SMF048.	Control. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	26	4	8:SMF014; 6:SMF049; 4:SMF054; 4:SMF055.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1	6	2	4:SMF054; 4:SMF055.	Powdery mildew claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses:</u> Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Eye and skin irritation. May cause dermal sensitization. ^F	None.	Do not expose to light.
Non- synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)	No data	NA	NA	General powdery mildew claim; not crop specific	0	0	None.	Avoid contact with skin, eyes, and clothing.	No FIFRA statement.	None.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.

				Cre	Co 1 Op Group	mpai 13: Be	rative Overvi erries and Sm	ew of Efficacy, Haza nall Fruits: Grapes /	ards, and Powdery	Use Res Mildew	strictions (<i>Erisyphe</i>	e necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	суВ	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Non- synthetic	NC; Organic acid	Citric acid	Nuke Em	NA; 25(b)	No data	NA	NA	General mildew claim; not crop specific.	0	0	None.	No FIFRA statement.	No FIFRA statement.	Store away from direct sunlight.
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7	62	1	6:SMF008	Control.	0	24	Yes.	Irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper hydroxide	Champ WG	55146-1	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper hydroxide	Nu-Cop HB	42750- 132	No data	NA	ΝΑ	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Copper hydroxide, Copper oxychloride	Badge X2	80289-12	50	2	8:SMF014 6:SMF008	Control.	0	48	Yes.	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	19	4	6:SMF048; 3:SMF030; 3:SMF031; 2:SMF004.	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3	No data	NA	NA	Control.	0	48	Yes.	Irreversible eye damage. Skin irritation. Harmful if swallowed, inhaled or absorbed through skin.	Toxic to fish and aquatic organisms.	Incompatible with galvanized pipe and nylon equipment.
Synthetic	M1	Copper sulfate pentahydrate	Copper Sulfate Crystals	56576-1	No data	NA	NA	Control. Dormant only.	0	24	Yes.	Corrosive. Causes eye damage. Skin irritation.	Toxic to fish.	None.
Synthetic	M1	Cupric hydroxide	Nu-Cop 50 DF	45002-4	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	M1	Cuprous oxide	Nordox	48142-4	No data	NA	NA	Control.	0	12	Yes.	Harmful if swallowed or absorbed through skin. Eye irritation.	None.	Water pH restrictions.

				Cr	Co OD Group	ompa 13: B	rative Overvi erries and Sn	iew of Efficacy, Haz nall Fruits: Grapes /	ards, and Powderv	Use Res Mildew	strictions (<i>Erisvphe</i>	e necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.		Effica	icy ^B	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	luct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M2	Sulfur	Acoidal	62562-4	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Cosavet-DF	70905-1	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Moderate eye irritation.	None.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Defend DF	62562-8	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Kumulus DF	51306- 352- 66330	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed. Avoid contact with eyes, skin, and clothing.	None.	Do not store above 104°F.
Synthetic	M2	Sulfur	Micro Sulf	55146-75	88	1	6:SMF025	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Keep away from heat, sparks, or flames.
Synthetic	M2	Sulfur	Microthiol Disperss	70506- 187	40	6	6:SMF044; 6:SMF048; 6:SMF049; 4:SMF046; 4:SMF054; 4:SMF055.	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	None.	Do not store near flammable materials.
Synthetic	M2	Sulfur	Thiolux	34704- 1079	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Suspended dust ignites easily.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1	No data	NA	NA	General powdery mildew control claim.	1	4	None.	Harmful if swallowed.	None.	Chemical incompatibilities.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70871-1- 68539	0	1	3:SMF030.	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	1	4	None.	Harmful if swallowed. Moderate eye irritation	None.	Chemical incompatibilities.

				Cro	Co Group 1 do	mpai 13: Be	erries and Sm	ew of Efficacy, Haza hall Fruits: Grapes /	ards, and Powderv	Use Res Mildew	strictions (<i>Erisvphe</i>	necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1	No data	NA	NA	General powdery mildew control claim. Preventative only.	0	4	None.	Moderate eye irritation.	None	Chemical incompatibilities.
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163- 324	No data	NA	NA	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22- 70051	No data	NA	NA	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2	No data	NA	NA	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Powdery mildew control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704- 849	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation. May cause dermal sensitization. ^F	Hazardous to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed.	Toxic to fish.	None.
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368	No data	NA	NA	Control.	0	12	Yes (with sulfur).	Harmful if absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Chemical incompatibilities.
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	SuffOil-X	48813-1- 68539	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.

				Cri	Comparative Over op Group 13: Berries and S	view of Efficacy, Haz mall Fruits: Grapes /	ards, and Powdery	Use Re Mildew	strictions (<i>Erisyphe</i>	necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	Efficacy ^B	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % n ^C PDMR ^D Control Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
A. B. C. D. E. F. G.	FRAC = Fung For Polyoxin Number of tr PDMR = Plan <u>https://www</u> Wix-and-mat Complete lal EPA relative	icide Resistance D zinc salt (Oso) rials included in t t Disease Manage <u>v.plantmanagem</u> ch directions for bel statement: P environmental t	Action Comm), from summa the calculatio ement Reports <u>entnetwork.o</u> use. Label h 'rolonged or fi coxicity descri	ittee. Prod arizes trials, n of the me s (on-line jo rg/pub/tria ias a list of c requently re ptors, lowe	ucts with the same mode of , published and unpublisher an. urnal generally used for pu <u>l/pdmr/</u> crops and a separate list of speated skin contact may of st toxicity to highest toxic	of action have the sa d. For OMRI-listed a ublication of efficacy f diseases with no cla ause allergic reactio ty: Practically non-t	me FRAC Iternative research im for sp ns in som oxic < <i>N</i>	Code. 1 es, from conduc ecific cu e indivio loderate	NC = Not c Plant Dise ted at univ rop/diseas duals. ely toxic	lassified; no FRAC code h base Management Reports versities). Preceded by F e combinations. < Toxic < Highly toxic.	as been assigned. s (PDMR). F&N = Fungicides and N	lematicides.
Plant Dise <u>8:SMF014</u> <u>6:SMF048</u>	ase Manager B, Hed, Pe Regalia at 6 W. F. Wilc Gerenade Ma	nent Reports cita nn State Univers qt/A: 61% contr ox and D. G. Rie ax: 0% control on	ations and dai ity. Evaluatic ol of powdery gel, Cornell U leaves. <mark>0% c</mark>	ta summarie on of organie mildew on niversity. E ^r ontrol on le	S for non-synthetic altern c fungicides for control of fruit. valuation of fungicide pros af area. 0% control on clu	atives: black rot and powde grams for control of g sters. <mark>5% control</mark> on	ry and do rapevine cluster ar	wny mil powder rea. <mark>Tri</mark>	dew on Co y mildew, al mean: 1	ncord grapes, 2013. 2010. <mark>% control (n = 4).</mark>		
<u>6:SMF049.</u> <u>4:SMF054</u> .	W. F. Wilc Regalia at 2 W. F. Wilc Regalia Max	ox and D. G. Rieg qt/A + Cohere at ox and D. G. Rie at 0.25% + NuFil	gel, Cornell U t 0.031% (v/v) gel, Cornell U m at 0.03%:	niversity. Ev : 0% control niversity. E 0% control	valuation of fungicide prog <mark>l</mark> on leaves. 24% control o Evaluation of fungicide pro on leaves. 25% control on	rams for control of g n leaf area. <mark>0% contr</mark> grams for control of g leaf area. <mark>0% contro</mark>	rapevine <mark>ol</mark> on clu grapevine l on clusto	powder sters. <mark>1</mark> powde ers. <mark>3%</mark>	y mildew, <mark>2% control</mark> ry mildew, <mark>control</mark> or	2010. on cluster area. Trial m 2009. cluster area. Trial mear	ean: 9% control (n = 4) n: 2% control (n = 4).	
<u>4:SMF055</u>	Actinovate a W. F. Wilc Regalia Max Actinovate a Actinovate a Actinovate Actinovate	t 12 oz/A: 0% cc ox and D. G. Rie at 0.25% + NuFili t 6 oz/A: 0% cor t 12 oz/A: 0% cc tinovate trial me	ontrol on leave gel, Cornell U m at 0.03%: ntrol on leave ontrol on leave ean: 10% cont	es. 4% cont niversity. E 0% control c s. 6% contr es. 2% cont rol (n = 8).	rol on leaf area. 0% contr Evaluation of fungicide pro on leaves. 56% control on ol on leaf area. 0% contro rol on leaf area. 0% contr	ol on clusters. <mark>1% co</mark> grams for control of leaf area. <mark>0% contro l</mark> on clusters. <mark>48% co ol</mark> on clusters. <mark>24% c</mark>	ntrol on o powdery i l on clusto ntrol on o ontrol on	cluster a mildew ers. <mark>819</mark> cluster a cluster	area. <mark>Tria</mark> on Rosette <mark>& control</mark> c area. area.	. mean: 1% control (n = 4 • grapes, 2009. n cluster area. <mark>Trial me</mark>). an: 34% control (n = 4)	
<u>3:SMF030</u>	B. Hed an Gerenade (fo	d J. W. Travis, P prmulation not sp	enn State Uni cified; ASO	versity. Eva assumed) at	aluation of organic fungici t 1% + NuFilm P 0.12%: <mark>1%</mark>	des for control of bla <mark>control</mark> on leaves. <mark>32</mark>	ck rot and <mark>% control</mark>	d powde on leat	ery mildew ⁷ area. <mark>Tri</mark>	of Concord grapes, 2008 al mean: 17% control (n =	3. = 2).	
<u>3:SMF031</u>	B. Hed an Gerenade (fo	d J. W. Travis, P ormulation not sp	enn State Uni cified; ASO	versity. Eva assumed) at	aluation of alternative fun t 1% + NuFilm P 0.12%: <mark>75</mark> ′	gicides for control of <mark>6 control.</mark>	black rot	, powde	ery mildew	y, and downy mildew of g	rapes, 2008.	
<u>1:SMF005</u>	W. F. Wilc Serenade (fo 4).	ox and D. G. Ries rmulation not sp	gel, Cornell U pecified; ASO	niversity. E assumed) at	Evaluation of fungicide pro t 4 qt/A: <mark>0% control</mark> on lea	grams for control of gives. <mark>18% control</mark> on	grapevine leaf area	powde . <mark>26% c</mark>	ry mildew, <mark>ontrol</mark> on c	2006. Lusters. 14% control on e	cluster area. <mark>Trial me</mark>	an: 14% control (n =

					Co	mpara	ative Overvi	ew of Efficacy, Haza	ards, and	Use Res	strictions			
		T		Cr	op Group 1	13: Ber	rries and Sm	hall Fruits: Grapes /	Powdery	Mildew	(Erisyphe n	necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	fficac	<u>y P</u>	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		NO.	Mean % Control	n۲	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Dise	ase Managei	ment Reports cit	ations and da	ta summarie	es for <mark>synt</mark>	<mark>hetic</mark> a	alternatives	:						
8.5ME014	R Hed Pe	onn State Univers	sity Evaluati	on of organi	c fungicid	es for i	control of h	lack rot and powder	v and do	wny mil	dew on Con	cord grapes 2013		
0.5/11 014	Badge X2 at	1.75 lb/A + lime	at 1.75 lb/A,	, different a	pplication	timing	gs: <mark>34%, 44</mark>	%, 55%, and 58% con	trol of po	wdery	mildew on f	ruit		
	Badge X2 at	1.75 lb/A + lime	at 1.75 lb/A	+ Nu-Film-P	at 0.0625	%, diff	erent appli	cation timings: <mark>47%</mark>	and 54%	control	of powdery	mildew on fruit.		
	Ir	ial mean: 40% co	ntrol (n = 6).											
6:SMF008	B. Hed and	d H. K. Ngugi, Pe	enn State Univ	ersity. Eva	luation of	conver	ntional and	organic fungicides f	or contro	l of bla	ck rot and p	owdery mildew of Conc	ord grapes, 2011.	
	NuCop 50 W	Pat 1 lb/A + Lim	e at 1 lb/A +	NuFilm P at	0.0625%:	<mark>86% с</mark>	ontrol of po	wdery mildew on fr	uit. 33%	control	of powdery	mildew on leaves.		
	vucop 50 wi Tr	ial mean: 62% (n	= 4	NUFILM P at	0.0625%:	/ 3% C	<mark>ontrol</mark> of po	owdery mildew on fr	uit. <mark>36%</mark>	CONTROL	of powdery	mildew on leaves.		
	Badge X2 at	1.75 lb/A + Lime	e at 1075 lb/A	+ NuFilm P	at 0.0625	%: <mark>69</mark> %	<mark>% control</mark> of	powdery mildew or	fruit. <mark>4</mark>	9% cont	<mark>rol</mark> of powde	ery mildew on leaves.	Trial mean: 59	% (n = 2).
6:SMF025	N. O. Halb	rendt. H.K. Ngu	gi. and J. M. H	Halbrendst.	Penn State	e Unive	ersity. Perf	ormance of organic	and conv	entiona	l programs f	for powdery mildew ma	nagement on wine gra	pes in PA. 2011.
	Nicro Sulf at	5 lb/A: <mark>10.0%, 9</mark>	99.7%, 94.7%,	and 99.7% c	ontrol on	leaves	(incidence	and severity, respe	ctively; C	hambou	ucin and Tra	minette, respectively).		
	vicro Sulf at	5 lb/A: 100%, 10	00%, 100%, an	<mark>d 100%</mark> cont	rol on clu	sters (i	incidence a	nd severity, respect	ively; Ch	ambouc	in and Tram	inette, respectively).		
	11	iat illeall. 66% (il	= 0).											
6:SMF044	W. F. Wilc	ox and D. G. Rie	gel, Cornell U	Iniversity.	Evaluation	of fun	igicide prog	rams for control of g	rapevine	powde	ry mildew, 2	2011.		
	Microthiol 80	DF at 5.0 lb/A:	0% control or	1 leaves. 82	% control	on lea [.]	f area. 0% of area 12	<mark>control</mark> on clusters. % control on cluster	86% cont	trol on o	cluster area. n cluster are			
	Tr	ial mean: 46% (n	i = 8).	in icaves. u		Con tes			3. <mark>72/0 C</mark>	<mark>oncioc</mark> o	in cluster and			
(.C. 450 40				L. S								010		
0:5MFU48	Microthiol 80	ODF at 5.0 lb/A:	0% control on	leaves. 62	valuation (<mark>% control</mark> d	or rung on leaf	f area. 0% c	ontrol of control of g	51% cont	powaer <mark>rol</mark> on c	y mildew, z luster area.	010.		
	Microthiol 80	DDF at 10.0 lb/A:	: <mark>0% control</mark> o	n leaves. 7	1% control	on lea	af area. 14%	<mark>6 control</mark> on clusters	. <mark>90% co</mark>	<mark>ntrol</mark> or	cluster are	a.		
	Tr Luova at 1 (ial mean: 36% (n	= 8). trol on loover	71% cont	ol on loof	araa	1º control	on clustors <mark>56% co</mark>	ntrol on a	-luctor -				
	Lueva at 1.0 Tr	ial mean: 33% (n	$\frac{1}{4}$ = 4).	. <mark>/ 1% COILL</mark>	<mark>ol</mark> on lear	area.	4% CONTION	on clusters. 30% CO	ntrot on c	Luster	area.			
6:SMF049	W. F. Wilc	ox and D. G. Rie	gel, Cornell U	niversity. E	valuation (of fung on leaf	gicide progra farea 0% c	ams for control of g	apevine	powder	y mildew, 2 Juster area	010.		
	Microthiol 80	DF at 10.0 lb/A:	: 0% control o	n leaves. 7	7% control	on lea	af area. 0%	control on clusters.	41% conc	trol on	cluster area			
	Tr	ial mean: 25% (n	= 8).											
5:SMF053	A. M. C. S	childer. J. M. Gi	illett. <i>et al. I</i>	∧ichigan Sta	te Univers	itv. Ev	valuation of	fungicides for cont	rol of pov	wderv m	nildew in 'Cl	nardonnav' grapes, 200	8.	
	JMS Stylet O	il 1 gal/A: 12% o	overall contro	l.						,,				
4.2WE046	W F Wilc	ovand D. G. Rie	ael Cornell I	Iniversity I	Valuation	of fun	gicide prog	rams for control of r	owdervu	mildow	on Chardon	nav granes 2008		
<u>-1.5/11 0-10</u>	Microthiol 80	DF at 5.0 lb/A:	5% control or	i leaves. 76	% control	on lea	if area. 14%	control on clusters	. <mark>90% co</mark> i	ntrol on	cluster area	a.		
	Microthiol 80	DDF at 10.0 lb/A:	: 17% control	on leaves.	91% contr	<mark>ol</mark> on le	eaf area. <mark>3</mark>	<mark>6% control</mark> on cluste	ers. <mark>71% (</mark>	<mark>control</mark>	on cluster a	rea.		
	Tr	1al mean: 50% (n	= 8).											
4:SMF054	W. F. Wilc	ox and D. G. Rie	gel, Cornell U	Iniversity.	Valuation	of fun	igicide prog	rams for control of g	rapevine	powde	ry mildew, 2	2009.		
	Microthiol 80	ODF at 5.0 lb/A:	0% control or	1 leaves. 70	% control	on lea	f area. 0%	control on clusters.	4% contr	ol on cl	uster area.			
	Tr	ial mean: 31% (n	. = 8).	ni leaves. o		un te	ai died. <mark>U</mark> %	Control on clusters	7 3/0 COI		cluster die	a.		

				Cr	Comparative Overvi op Group 13: Berries and Sm	ew of Efficacy, Haza all Fruits: Grapes /	ards, and Powdery	Use Res Mildew	strictions (<i>Erisyphe</i>	necator)				
NOP	FRAC ^A	Active	Product	EPA Reg.	Efficacy ^B	Label Claim	PHI	REI	1	Hazards and Restricti	ions Noted on the Proc	Juct Label		
Status	Code(s)	Ingredient(s)		No.	Mean % n ^C PDMR ^D Control Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical		
4:SMF055. N N	 <u>SMF030.</u> B. Hed and J. W. Travis, Penn State University. Evaluation of organic fungicides for control of black rot and powdery mildew of Concord grapes, 2008. 													
3:SMF030.	 <u>SMF030.</u> B. Hed and J. W. Travis, Penn State University. Evaluation of organic fungicides for control of black rot and powdery mildew of Concord grapes, 2008. <u>Cueva</u> at 1%: 0% control. More disease than in the untreated control. Milstop at 2.5 lb/A and 5 lb/A: 0% control. Same as the untreated control. SMF031. B. Hed and J. W. Travis, Penn State University. Evaluation of alternative fungicides for control of black rot, powdery mildew, and downy mildew of grapes, 2008. 													
<u>5.5Mi 051.</u>	ueva at 1%:	0% control. Mo	ore disease th	an in the ur	itreated control.		JIACK TOL,	, powde	iry mildew,		apes, 2000.			
2:SMF004.	B. Hed and ueva at 1 ga ueva at 2 ga Tri	I J. W. Travis, Pe al/A: <mark>26% and 39</mark> al/A: <mark>60% and 43</mark> al mean: 43% (n	enn State Univ <mark>9% control</mark> (fr <mark>7% control</mark> (fr = 4).	versity. Eva uit and rach uit and rach	lluation of organic fungicide his, respectively). his, respectively).	s for control of blac	k rot and	l powde	ry mildew o	of Concord grapes, 2007.				
Older stud	ies are not o	cited and summa	arized.											

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OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: STRAWBERRIES / Anthracnose Fruit Rot (Colletotrichum acutatum)

			C	rop Group	Co 13: Berries	mpa and	rative Overvi Small Fruits:	ew of Efficacy, Haza Strawberries / Anth	nrds, and nracnose	Use Res Fruit Ro	strictions ot (<i>Colleta</i>	otrichum acutatum)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	icy ^B	Label Claim	PHI	REI		Hazards and Restrict	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	86	2	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Control. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria</i> <i>sachalinensis</i> extract	Regalia	84059-3	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.

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			с	rop Group	Co 13: Berries	ompa s and	rative Overvi Small Fruits	iew of Efficacy, Haza : Strawberries / Antl	ards, and aracnose	Use Res Fruit Ro	strictions ot (<i>Colletc</i>	otrichum acutatum)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	Effica	суВ	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1	12	4	9:SMF007; 3:SMF019; 3:SMF023; 2:SMF045.	Anthracnose claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses:</u> Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Synthetic	M1	Copper octanoate	Cueva	67702-25- 70051	No data	NA	NA	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Anthracnose control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Anthracnose control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.

					Co	mpar	ative Overvi	ew of Efficacy, Haza	rds, and	Use Res	strictions			
		I	C	rop Group	13: Berries	and	Small Fruits:	Strawberries / Anth	nracnose	Fruit Ro	ot (<i>Colleto</i>	otrichum acutatum)		
NOP	FRAC A	Active	Product	EPA Reg.	E	ffica	zyĎ	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Anthracnose control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
A. F B. F C. M D. F E. M F. C G. E	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. <u>https://www.plantmanagementnetwork.org/pub/trial/pdmr/</u> Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.													
Plant Dise <u>9:SMF007.</u>	ase Manager J. Mertely	ment Reports cit	ations and dat	ta summario	es: oducts for	anthi	racnose and	Botrytis fruit rot cor	itrol in ai	nnual st	rawberry,	2013-14.		
<u>3:SMF019.</u>	M. Rahmar M. Rahmar Actinovate V	n et al. North Ca VTEC at 108 (uni	arolina State L ts?)/: <mark>15% con</mark>	cnose incid Iniv. Evalua <mark>trol</mark> of Anth	ence. ation of fu nracnose ir	ngicio ncider	des to contro າce.	ol anthracnose fruit i	rot on str	awberry	y cultivar (Chandler, 2008.		
<u>3:SMF023.</u>	H. Su and Actinovate a	W.D. Dubler. Ur t 6 oz/A: <mark>28% co</mark>	niversity of Ca Introl of Anthr	lifornia. Fu acnose inci	ungicide co dence.	ontrol	of Botrytis a	and anthracnose frui	t rot on s	strawbe	rry in Calii	fornia, 2008–trial II.		
2:SMF045.	J. Mertely Actinovate a	et al. Univ. Of t 12 oz/A: <mark>7% co</mark>	Florida. Evalua Introl of Anthr	ation of fun acnose inci	gicides to dence.	conti	ol anthracno	ose fruit rot in annua	al strawb	erry, 20	07-08.			

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES AND SMALL FRUITS: STRAWBERRIES / Gray Mold (Botrytis cinerea)

				Cr	Co op Group	mpar 13: B	ative Overvi erries and Sr	ew of Efficacy, Haza nall Fruits: Strawber	rds, and ries / Gr	Use Res ay Mold	strictions (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	61	5	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel LC	70051- 114	2	2	9:SMF021; 9:SMF035.	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data	NA	ΝΑ	Control. Preventative only. Not for use in California.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	0	1	9:SMF021.	Suppression only. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade Max	264-1151	19	1	F&N 59:SMF030.	Suppression only. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.

				с	Co rop Group	ompa 13: E	rative Overvi Berries and Si	ew of Efficacy, Haza nall Fruits: Strawbe	ards, and rries / Gr	Use Res ay Mold	strictions I (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.		Effica	icy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	luct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	16	5	11:SMF002; 10:SMF040; 9:SMF021; 9:SMF035; 8:SMF028.	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	2	2	11:SMF022; 9:SMF035.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Bio- chemical	Rhamnolipid biosurfactant	Zonix	72431-1	No data			Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative use only.	0	4	None.	Irreversible eye damage.	None.	Do not use at ambient temperatures over 80°F. Keep from overheating or freezing. Store out of direct sunlight.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	ΝΑ	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Gliocladium catenulatum strain J1446	Prestop	64137-11	0	1	11:SMF022	Botrytis claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	0	None.	Harmful if swallowed. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live organism. Store refrigerated. Tank-mix restrictions.
Non- synthetic	NC; Biological	Streptomyces lydicus	Actinovate AG	73314-1	17	3	11:SMF002; 9:SMF021; 3:SMF014.	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses:</u> Control vs suppression only is not specified. <u>Greenhouse uses:</u> Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.

				C	Co rop Group	mpai 13: B	rative Overvi Serries and Si	ew of Efficacy, Haza nall Fruits: Strawbe	ards, and rries / Gr	Use Res ay Mold	strictions I (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	суВ	Label Claim	PHI	REI		Hazards and Restrict	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Eye and skin irritation. May cause dermal sensitization. ^F	None.	Do not expose to light.
Non- synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Temporary eye and skin irritation	No FIFRA statements.	Storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	0	1	9:SMF035.	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful is swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Botrytis control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful is swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	4	3	9:SMF021; F&N 59:SMF033; F&N 59:SMF048.	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.

				Cr	Co rop Group	mpai 13: B	ative Overvi erries and Sr	ew of Efficacy, Haza nall Fruits: Strawber	rds, and ries / Gr	Use Res ay Mold	strictions (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Botrytis control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed.	Toxic to fish.	None.
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.

A. FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned.

B. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR).

C. Number of trials included in the calculation of the mean.

D. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. <u>https://www.plantmanagementnetwork.org/pub/trial/pdmr/</u>

E. Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations.

F. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

G. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

				Cr	Comparative Overvi op Group 13: Berries and Sr	ew of Efficacy, Haza nall Fruits: Strawber	rds, and ries / Gr	Use Res ay Mold	strictions I (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	Efficacy ^B	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Proc	luct Label
Status	Code(s)	Ingredient(s)		No.	Mean % n ^C PDMR ^D Control Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Dise	ase Manager	nent Reports cita	ations and da	ta summarie	es for <mark>non-synthetic</mark> alterna	tives.	-	-				
11:SMF002	2. R. C. Bran Actinovate S Actinovate S Gerenade Op	ntley, K.L. Ivors, P at 6 oz/A: No P at 12 oz/A: No ntimum at 20 oz/	and G. J. Ho control of Bo control of B control of B A: No contro	lmes, Califo trytis fruit r otrytis fruit <mark>l</mark> of Botrytis	rnia Polytechnic State University of incidence for the season rot incidence for the season fruit rot season fruit rot season fruit rot season fruit season fruit rot season fruit season f	ersity. Evaluation or n. season.	fbiofung	icides fo	or Botrytis	fruit rot management or	n strawberries, 2016.	
<u>11:SMF022</u> I I	. L. Cordov Regalia at 52 Prestop WG	'a, A. Zuniga, <i>et</i> ! fl oz/A: <mark>3% cont</mark> at 12.5 oz/A: <mark>No</mark>	<i>al.</i> , Universit trol of Botryti control of Bc	y of Florida. Is fruit rot fo Itrytis fruit I	Evaluation of biorational p or the season. rot for the season. Botrytis	roducts for control of fruit rot incidence v	of Botryti vas highe	is fruit r er than i	rot in annu in the untro	al strawberry, 2016-17. eated control.		
10:SMF040). L. Cordov Gerenade Op Gerenade Op Tri	a, J. Mertely, an timum at 16 oz/. timum at 16 oz/. ial mean: 50% co	ıd N.A. Peres, A weekly: <mark>38</mark> A twice week ntrol (n = 2).	University <mark>% control</mark> of ly: <mark>62% con</mark>	of Florida. Evaluation of bi Botrytis incidence on fruit trol of Botrytis incidence or	orational products fo during the growing s n fruit during the gro	or contro season. owing sea	l of Bot Ison.	rytis fruit ı	rot in annual strawberry,	2015-2016.	
9:SMF021.	L. Cordova Actinovate 6 Double Nicke Regalia at 2 Gerenade AS Gerenade Op	, J. Mertely, and oz/A: No contro al (formulation no qt/A: 9% contro O at 4 qt/A: No otimum at 1 lb/A	I N.A. Peres, ol of Botrytis ot specified; l of Botrytis f control of Bo : 5% control	University o Fruit rot. <i>N</i> LC assumed ruit rot for f trytis fruit r of Botrytis f	f Florida. Evaluation of bio ore Botrytis than in the unt at 1.5 qt/A : <mark>4% control</mark> of the season. ot. More Botrytis than in th ruit rot for the season.	rational products for created control for t Botrytis fruit rot fo ne untreated control	r control ne seasor r the sea for the s	of Botry 1. son. season.	ytis fruit ro	ot in annual strawberry, 2	2014-2015.	
<u>9:SMF035.</u> [A. M. Schil Double Nicke Gerenade Op Regalia at 2	der. J. M. Gillett <mark>LC</mark> at 1 gal/acr timum at 20 oz/, qt/acre: No cor	:, and R. W. S re: <mark>No contro</mark> A + NuFilm P <mark>ntrol.</mark> More p	ysak, Michig <mark>L.</mark> More pos at 0.125% (v ost-harvest	an State University. Evalua t-harvest Botrytis than in th //v): No control. More post Botrytis than in the untreat	ation of organic fung ne untreated control t-harvest Botrytis th red control.	icides fo an in the	r contro untreat	ol of strawl	berry foliar and fruit dise I.	eases, 2014.	
8:SMF028.	L. Cordova erenade Op	., A. Zuniga, <i>et a</i> / <mark>timum</mark> at 20 fl o:	./., University z/A: <mark>13% conf</mark>	of Florida. <mark>.rol</mark> of Botry	Evaluation of products for t tis at peak period. 34% cor	he control of Botryt I <mark>trol</mark> of Botrytis for s	is fruit ro eason. <mark>T</mark>	ot in anr <mark>Trial me</mark>	nual strawb an: 24% co	perry, 2013-14. ntrol (n = 2).		
<u>3:SMF014.</u>	J. Mertley Actinovate a	, T. Seijo, <i>et al.</i> , .t 12 oz/A at 7-da	University of ay intervals:	Florida. Ev 2% control	valuation of fungicides for c of Botrytis incidence. (6% i	ontrol of Botrytis an ncidence in the untr	d other f eated co	ruit rot ntrol; lo	s in annual ow disease	strawberry, 2007-08. pressure.)		
F&N 59:SA	<u>NF030.</u> A. M Gerenade (fo	. Schilder. J. M. Irmulation not sp	Gillett, and R ecified; Max	. W. Sysak, assumed ba	Michigan State University. <mark>sed upon units)</mark> at 8 lb/A: <mark>4</mark>	Evaluation of fungic <mark>9%, 9.1% and No con</mark>	ides for (<mark>trol</mark> (at 3	control harves	of foliar ar t times).	nd fruit diseases of straw <mark>Trial mean = 19% control</mark>	berry, 2003. (n = 3).	
Data for t	rials with ve	ry low disease pr	ressure in the	untreated	control are not summarized	(F&N 60:SMF021, 1:	SMF028).					

				Cı	Co rop Group	mpar 13: B	ative Overvie erries and Sn	ew of Efficacy, Haza nall Fruits: Strawbe	ards, and rries / Gr	Use Res ay Mold	strictions I (<i>Botrytis</i>	cinerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	fficad	cy ^B	Label Claim	PHI	REI		Hazards and Restric	tions Noted on the Prod	duct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Dise	ase Manager	nent Reports cita	ations and da	ta summarie	es for <mark>synt</mark> l	hetic	alternatives							
 <u>9:SMF021.</u> L. Cordova, J. Mertely, and N. A. Peres, University of Florida. Evaluation of biorational products for control of Botrytis fruit rot in annual strawberry, 2014-2015. Oxidate at 128 fl oz/A: No control of Botrytis fruit rot incidence for the season. More disease than in the untreated control. <u>9:SMF035.</u> A. M. Schilder. J. M. Gillett, and R. W. Sysak, Michigan State University. Evaluation of organic fungicides for control of strawberry foliar and fruit diseases, 2014. <u>Cueva at 1 gal/acre: No control.</u> More post-harvest Botrytis than in the untreated control. 														
<u>F&N 59:SM</u> (I <u>F033.</u> W. W Dxidate at 11	/. Turechek, N.A 28 fl oz/A: <mark>No c</mark>	. Werner, and <mark>ontrol post-h</mark> a	1 M.C. Heide arvest. Mor	enreich, Co e Botrytis	ornell than [;]	University.	Evaluation of fungi ated control.	cides for	control	of Botrytis	s fruit rot on strawberry	, 2003.	
<u>F&N 59:SM</u> (I <u>F048</u> . F. J. <mark>)xidate</mark> at 12	Louws and J. G. 28 fl oz/100 gal :	. Driver, North and 128 fl oz/	۱ Carolina S 300 gal: <mark>11</mark> /	tat Univers <mark>% control</mark> (sity. of Bot	Evaluation o crytis.	f fungicides for ant	hracnose	fruit roi	t and gray	mold management, 200	13.	
Data for tr	rials with ve	ry low disease pr	ressure in the	untreated	control are	e not	summarized	(F&N 60:SMF021, 1	:SMF028).					

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: STRAWBERRIES / Leather Rot (Phytophthora cactorum)

Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Strawberries / Leather Rot (<i>Phytophthora cactorum</i>)														
NOP	FRAC ^A Active Product EPA Reg. Efficacy ^B			cy ^B	Label Claim	PHI	REI	Hazards and Restrictions Noted on the Product Label						
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	86	2	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	BM2	Trichoderma asperellum, Trichoderma gamsii	Bio-Tam	80289-9	No data.	NA	ΝΑ	Phytophthora control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative only.	0	1	None.	Harmful if absorbed through skin or swallowed.	Toxic to beneficial beetle species.	Use and storage temperature restrictions.15- month shelf-life.
Non- synthetic	BM2	<i>Trichoderma harzianum</i> strain R-22, <i>Trichoderma</i> <i>virens</i> strain G41	Rootshield Plus+ Granules	68539-10	No data.	NA	NA	Phytophthora control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative only.	0	0	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live spores. Use temperature restrictions. Store refrigerated.
Non- synthetic	BM2	Trichoderma harzianum strain R-22, Trichoderma virens strain G41	Rootshield Plus+ WP	68539-9	No data.	NA	NA	Phytophthora control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative only.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live spores. Use temperature restrictions. Store refrigerated.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Non- synthetic	NC; Biological	Gliocladium catenulatum	Prestop	64137-11	No data.	NA	NA	Soil treatment only.	0	0	None.	Harmful if swallowed. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live organism. Store refrigerated. Tank-mix restrictions.
					Com	parative Overvi	ew of Efficacy, Haza	rds, and	Use Res	strictions				
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	Crop Group 13: Berries and Small Fruits: Strawberries / Leather Rot (<i>Phytophthora cactorum</i>)													
NOP	FRAC ^A	Active	Product	EPA Reg.	Eff	cacy ^B	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Prod	luct Label	
Status	Code(s)	Ingredient(s)		No.	Mean % n	C PDMR D	1	(Days)	(Hrs)	Phyto-	Human	Environmental ^G	Physical	
	Control Citations toxicity													
A. F	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned.													
B. F	For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR).													
C. N	lumber of tr	ials included in t	the calculatio	n of the me	an.									
D. F	PDMR = Plant	t Disease Manage	ement Reports	; (on-line jo	urnal genera	lly used for put	olication of efficacy	research	conduc	ted at univ	versities). Preceded by F	F&N = Fungicides and N	Nematicides.	
<u>h</u>	https://www	.plantmanagem	entnetwork.o	rg/pub/tria	<u>l/pdmr/</u>									
E. A	Aix-and-mat	ch directions for	use. Label h	as a list of o	crops and a s	eparate list of	diseases with no cla	im for sp	ecific cr	op/disease	e combinations.			
F. C	Complete lat	pel statement: P	rolonged or fr	equently re	peated skin	contact may ca	use allergic reaction	ns in som	e indivio	duals.				
G. E	PA relative	environmental t	oxicity descrip	otors, lowes	st toxicity to	highest toxicity	y: Practicaly non-to	xic < Mo	oderate	y toxic <	Toxic < Highly toxic.			

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: STRAWBERRIES / Phomopsis Leaf Spot (Blight) (Phomopsis obscurans)

			Cr	op Group 1	Co B: Berries a	ompai and S	rative Overvi mall Fruits: !	ew of Efficacy, Haza Strawberries / Phom	ords, and opsis Lea	Use Res of Spot (strictions Blight) (<i>P</i>	homopsis obscurans)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	91	2	See Oso efficacy summary table.		0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	P5	<i>Reynoutria sachalinensis</i> extract	Regalia	84059-3	54	1	9:SMF035	Control.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	94	1	9:SMF035	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M1	Cupric hydroxide	Nu-Cop 50 DF	45002-4	No data	NA	NA	Control.	1	24	Yes.	Irreversible eye damage. Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Phomopsis control claim. Leaf vs fruit not specified. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Phomopsis control claim. Leaf vs fruit not specified. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.

					Com	parative Overvi	ew of Efficacy, Haza	rds, and	Use Res	trictions					
			Cr	op Group 13	: Berries an	d Small Fruits: S	trawberries / Phom	opsis Lea	f Spot (I	Blight) (<i>Ph</i>	nomopsis obscurans)				
NOD		Activo	Droduct	EDA Bog	Eff	icacy ^B	Label Claim	рш	DEI	· J -/ (Hazards and Rostricti	ions Noted on the Dree	luct Labol	_	
NUP	FRAC	ACLIVE	Product	LPA Reg.	EII	icacy	Laber Claim		KEI (II)		Hazal us allu Resti Icti				
Status	Code(s)	ingredient(s)		NO.	Mean % r	יר PDMR		(Days)	(Hrs)	Phyto-	Human	Environmental ^G	Physical		
	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned.														
A. F	FRAC = Function Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned.														
B. F	For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR).														
C. N	For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean.														
D. F	PDMR = Plant	t Disease Manage	ement Reports	s (on-line jo	urnal genera	ally used for put	lication of efficacy	research	conduct	ted at univ	versities). Preceded by F	F&N = Fungicides and I	Nematicides.		
ł	https://www	v.plantmanagem	entnetwork.o	rg/pub/tria	l/pdmr/						· · ·	C C			
E. 7	Aix-and-mate	ch directions for	use. Label h	as a list of o	crops and a	separate list of (diseases with no cla	m for sp	ecific cr	op/disease	e combinations.				
F. (Complete lat	oel statement: P	rolonged or fi	requently re	peated skin	contact may ca	use allergic reactior	is in some	e individ	luals.					
G. E	PA relative	environmental t	oxicity descri	ptors, lowes	st toxicity to	highest toxicity	: Practically non-to	oxic < M	oderate	ly toxic 🛛	< Toxic < Highly toxic.				
Plant Dise	ase Manager	nent Reports cit	ations and da	ta summarie	es:										
9:SMF035.	A. Schilder	<i>et al.</i> , Michigan	State Univer	sity. Evalua	tion of orga	nic fungicides f	or control of strawb	erry folia	r and fri	uit disease	s. 2014.				
F	Regalia at 2	at/A: 54% contro	of Phomons	is leaf bligh	t.	ine rangieldes i		, iona		and ansease	,				
	ueva at 1 g	$A \cdot \frac{94\%}{2}$ contro	of Phomonsi	is leaf hlight											
	uc vu at i ga		^c or i nomops	is icui bligin	•										

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: STRAWBERRIES / Phomopsis Fruit Rot (Soft Rot) (Phomopsis obscurans)

				Crop Grou	Co up 13: Beri	mpai ies a	rative Overvi nd Small Fru	ew of Efficacy, Haza its: Strawberries / P	rds, and homopsis	Use Res Fruit R	strictions ot (<i>Phoma</i>	opsis obscurans)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	80	1	See Oso efficacy summary table.		0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	NC; Biological	Aureobasidium pullulans strains DSM 14940 and DSM 14941	Botector	86174-3	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if swallowed or absorbed through skin. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live yeast-like fungus. Use and storage temperature restrictions. Not compatible with many fungicides.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Phomopsis control claim. Leaf vs fruit not specified. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	No data	NA	NA	Phomopsis control claim. Leaf vs fruit not specified. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
A. F B. F C. N D. F E. A F. C G. E	RAC = Fung or Polyoxin lumber of tr PDMR = Plan https://www hix-and-mat complete lal PA relative	cicide Resistance D zinc salt (Oso) rials included in t Disease Manage <u>v.plantmanagem</u> ch directions for pel statement: P environmental t	Action Commi , from summa the calculatio ement Reports <u>entnetwork.or</u> use. Label h rolonged or fr oxicity descrif	ittee. Prod arizes trials n of the me s (on-line jo rg/pub/tria as a list of o equently re ptors, lowe	ucts with , published an. ournal gene <u>l/pdmr/</u> crops and epeated sk st toxicity	the s d and erally a sep in co to hi	ame mode of unpublished used for pul arate list of ntact may ca ghest toxicit	action have the san For OMRI-listed al olication of efficacy diseases with no clai use allergic reactior y: Practically non-to	ne FRAC (ternative research m for spe is in some oxic < M	Code. N es, from conduc ecific cr e individ oderate	NC = Not c Plant Dise ted at uni rop/diseas duals. ely toxic	lassified; no FRAC code h ease Management Reports versities). Preceded by F e combinations. < Toxic < Highly toxic.	as been assigned. (PDMR). "&N = Fungicides and N	lematicides.

OMRI-LISTED ALTERNATIVES: CROP GROUP 13: BERRIES: STRAWBERRIES / Powdery Mildew (Podosphaera aphanis)

			Crop (Group 13: B	Cc erries and	mpai Sma	rative Overvi Il Fruits: Stra	ew of Efficacy, Haza wberries / Powdery	irds, and Mildew (Use Res Podospl	strictions haera aph	anis, Sphacelotheca sp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	66	3	See Oso efficacy summary table.		0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	No data	NA	ΝΑ	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain MBI 600	Serifel	71840-18	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>pumilus</i> strain QST 2808	Sonata	264-1153	No data	NA	NA	Control. Preventative only.	0	4	None.	Harmful if inhaled. May cause dermal sensitization. ^F Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Spray solution pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade ASO	264-1152	No data	NA	NA	Suppression only. Preventative only.	0	4	None.	Harmful if inhaled.	None.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Max	264-1151	2	1	3:SMF016.	Suppression only. Preventative only.	0	4	None.	May cause dermal sensitization. ^F	None.	None.
Non- synthetic	44	<i>Bacillus</i> <i>subtilis</i> strain QST 713	Serenade Optimum	264-1160	No data	NA	NA	Suppression only. Preventative only. Not for use in California.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.

			Crop C	Group 13: Be	Co erries and	mpar Smal	ative Overvi l Fruits: Stra	ew of Efficacy, Haza wberries / Powdery	rds, and Mildew (Use Res Podosph	strictions haera apha	anis, Sphacelotheca sp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Non- synthetic	NC; Bio- chemical	Rhamnolipid biosurfactant	Zonix	72431-1	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Preventative use only.	0	4	None.	Irreversible eye damage.	None.	Do not use at ambient temperatures over 80°F. Keep from overheating or freezing. Store out of direct sunlight.
Non- synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1	No data	NA	NA	Powdery mildew claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	No data	NA	NA	Powdery mildew control. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	4	Yes.	Moderate eye irritation.	Toxic to fish, aquatic organisms, and bees.	Temperature restrictions. Storage restrictions.
Non- synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Eye and skin irritation. May cause dermal sensitization. ^F	None.	Do not expose to light.
Non- synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)	No data	NA	NA	General powdery mildew claim; not crop specific.	0	0	None.	Avoid contact with skin, eyes, and clothing.	No FIFRA statement.	None.
Non- synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	No data	NA	NA	Control.	0	0	None.	Temporary eye and skin irritation	No FIFRA statements.	Storage temperature restrictions.
Non- synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	No data	NA	NA	Control.	0	0	Yes.	Harmful if swallowed.	Toxic to bees.	Not for use near heat or open flames.
Non- synthetic	NC; Botanical oil	Soybean oil	Golden Pest Spray	57538-11	No data	NA	NA	Control.	0	4	Yes.	Harmful if swallowed, absorbed through skin, or inhaled. Moderate eye irritation	None.	Temperature restrictions on use.

			(rop (Group 13: B	Co erries and	mpai Smal	ative Overvi	ew of Efficacy, Haza wherries / Powdery	ards, and	Use Res	strictions	anis Spharolotherasp)		
NOP		Active	Product	FPA Reg		ffica	$\frac{1}{cv^B}$	Label Claim		REI		Hazards and Restricti	ons Noted on the Prod	luct Label
Status	Code(s)	Ingredient(s)	rioduct	No.	Mean % Control	n ^c	PDMR ^D Citations	Laber Claim	(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	No data	NA	NA	Control.	0	4	Yes.	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	M2	Sulfur	Acoidal	62562-4	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Cosavet-DF	70905-1	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Moderate eye irritation.	None.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Defend DF	62562-8	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	Toxic to fish and aquatic organisms.	Suspended dust ignites easily.
Synthetic	M2	Sulfur	Kumulus DF	51306- 352- 66330	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed. Avoid contact with eyes, skin, and clothing.	None.	Do not store above 104°F.
Synthetic	M2	Sulfur	Micro Sulf	55146-75	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Keep away from heat, sparks, or flames.
Synthetic	M2	Sulfur	Microthiol Disperss	70506- 187	64	4	3:SMF016; 2:SMF042; F&N 61:SMF009; F&N 60:SMF006.	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin.	None.	Do not store near flammable materials.
Synthetic	M2	Sulfur	Thiolux	34704- 1079	No data	NA	NA	Control.	0	24	Yes.	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Suspended dust ignites easily.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541	No data	NA	NA	Control.	0	4	None.	Harmful if swallowed. Moderate eye irritation.	None.	Avoid contamination by pesticides and fertilizers. Final spray solution pH must be ≥7.0.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1	23	1	F&N 56:SMF47	General powdery mildew control claim.	1	4	None.	Harmful if swallowed.	None.	Chemical incompatibilities.

			Crop (Group 13: B	Co erries and	mpai Smal	rative Overvi Il Fruits: Stra	ew of Efficacy, Haza wberries / Powdery	ards, and Mildew (Use Res Podospl	strictions haera apha	anis, Sphacelotheca sp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70871-1- 68539	No data	NA	NA	Powdery mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims.	1	4	None.	Harmful if swallowed. Moderate eye irritation	None.	Chemical incompatibilities.
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1	No data	NA	NA	General powdery mildew control claim. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Chemical incompatibilities.
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163- 324	No data	NA	NA	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22- 70051	No data	NA	NA	Control.	0	12	Yes.	Substantial eye injury. Skin irritation.	Harmful to aquatic invertebrates	If water has high mineral content, check for compatibility.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2	10	1	2:SMF042	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1	No data	NA	NA	Powdery mildew control claim for all agricultural crops. Preventative only.	0	Until dry	None.	Irreversible eye damage and skin burns. May be fatal if absorbed through skin. Harmful if swallowed.	Toxic to birds, mammals, fish, and aquatic life.	Chemical instabilities. Strong oxidizing agent. Storage restrictions.
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704- 849	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation. May cause dermal sensitization. ^F	Hazardous to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed.	Toxic to fish.	None.
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368	No data	NA	NA	Control.	0	12	Yes (with sulfur).	Harmful if absorbed through skin. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Chemical incompatibilities.
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.

			Crop (Group 13: B	Co erries and	mpar Smal	ative Overvi l Fruits: Stra	ew of Efficacy, Haza wberries / Powdery	rds, and Mildew (Use Res Podospł	trictions haera apha	anis, Sphacelotheca sp.)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су В	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Petroleum oil	Mineral oil	SuffOil-X	48813-1- 68539	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1	No data	NA	NA	Control.	0	4	Yes (with sulfur).	Harmful if swallowed or absorbed through skin. May cause dermal sensitization. ^F	Toxic to aquatic organisms.	None.
A. F B. F C. N D. F E. A F. C G. E	RAC = Fungi or Polyoxin lumber of tr DMR = Plant ttps://www lix-and-mat omplete lat PA relative	cide Resistance D zinc salt (Oso) ials included in Disease Manage Content of the sease Manage Content of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the sease of the	Action Comm , from summa the calculatio ement Reports <u>entnetwork.o</u> use. Label h rolonged or fr oxicity descrip	ittee. Prod rizes trials, n of the me (on-line jo rg/pub/tria as a list of o equently re otors, lowes	ucts with t published an. urnal gene l/pdmr/ crops and a peated ski t toxicity	he sa I and rally a sep in coi to his	ume mode of unpublished used for pub arate list of utact may ca ghest toxicity	action have the san . For OMRI-listed al plication of efficacy diseases with no clai use allergic reaction y: Practically non-to	ne FRAC (ternative research m for spe is in some oxic < M	Code. N s, from conduct ecific cr e indivic oderate	NC = Not c Plant Dise ted at univ op/diseas duals. Ny toxic	lassified; no FRAC code h base Management Reports versities). Preceded by F e combinations. < Toxic < Highly toxic.	as been assigned. ; (PDMR). ?&N = Fungicides and N	ematicides.
Plant Dise <u>3:SMF016.</u> S	ase Manager J. Mertely, erenade Ma Nicrothiol Di	nent Reports cit T. Seijo, <i>et al.,</i> x at 1 lb/A: <mark>No</mark> s <mark>perss</mark> 80 WP at	ations and dat University of <mark>control</mark> of pov 7.5 lb/A: <mark>81%</mark>	a summarie Florida. Ev vdery milde <mark>and 95% co</mark>	es: aluation of w on fruit <mark>ntrol</mark> of po	f fung (mor wder	ticides to con e disease tha y mildew on	ntrol powdery milde an in the untreated fruit. <mark>26%, 30%, 33</mark>	w on ann control). <mark>%, and 60</mark>	ual stra <mark>No con</mark> <mark>% contr</mark>	wberry, 20 <mark>trol</mark> and <mark>5</mark> ol of powo	007-08. <mark>% control</mark> of powdery mil Jery mildew on leaves. N	dew on leaves. <mark>Mean o</mark> lean control: 54% (n =	control: 2% (n = 3. 6).
2:SMF042. ^ (J. Mertely, Aicrothiol Di Dxidate at 84	T. Seijo, <i>et al.</i> , sperss 80WP at 7 4 fl oz/A: 10% c	University of 7.5 lb/A: 71% ontrol of powe	Florida. Ev <mark>control</mark> of p dery mildew	valuation o bowdery m v on fruit.	of fun ildev	gicides to co / on fruit.	ntrol powdery milde	ew on anr	iual stra	awberry, 2	006-07.		
<u>F&N 61:SM</u>	<u>F009.</u> J. Me Aicrothiol Di	ertely, T. Seijo, sperss <mark>80 WP at</mark>	<i>et al.</i> , Univer 7.5 lb/A: 12%	sity of Flori control of	da. Evalua powdery n	ation nilde	of fungicides w on foliage.	to control powdery 71% control of pow	mildew dery mild	on annu dew on	ial strawbe fruit. <mark>Mea</mark>	erry, 2004-05. an control: 41% (n = 5).		
F&N 60:SM	<u>F006.</u> J. Me Aicrothiol Di	ertely, T. Seijo, sperss 80 WP at	and N. A. Pere 7.5 lb/A: 90%	es, Univers control of	ity of Flori powdery n	da. nilde	Evaluation of wincidence	fungicides to contro on fruit.	ol powde	ry milde	ew on anni	ual strawberry, 2003-04.		
F&N 56:SM	<u>F47.</u> D. E. I aligreen 82	Legard, C. L. Xia WP at 3 lb/A at 3	io, et al., Univ 7-day interval	versity of Fl s: <mark>23% cont</mark>	orida. Eva <mark>ol</mark> of powo	luati dery i	on of fungici nildew.	des to control powd	ery milde	w of sti	rawberry,	2000		

OMRI-LISTED ALTERNATIVES: CROP GROUP 19: HERBS AND SPICES: BASIL / Downy Mildew (Peronospora belbahrii)

					Co Crop Grou	mpai 19:	rative Overvi Herbs and S	ew of Efficacy, Haza pices : Basil / Down	rds, and Mildew	Use Res	strictions	bahrii)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	52	1	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel 55	70051- 108	40	1	11:V030	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel LC	70051- 114	No data	NA	ΝΑ	Suppression only. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3	14	6	9:V001; 7:V015; 6:V059; 6:V099; 5:V098; 5:V155.	Control. Preventative only.	0	4	None.	Moderate eye irritation.	None.	Avoid freezing.
Non- synthetic	NC; Biological	Streptomyces Iydicus WYEC	Actinovate	73314-1	No data	ΝΑ	NA	Downy mildew claim. Mix-and-match directions for use. ^E No specific crop/disease claims. <u>Field uses</u> : Control vs suppression only is not specified. <u>Greenhouse uses</u> : Suppression only.	0	1 or until dry	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Live bacterium. Use and storage temperature restrictions.
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	No data	NA	NA	Downy mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Not for use in California.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.

					Co	mpar	ative Overvi	ew of Efficacy, Haza	rds, and	Use Res	strictions			
					Crop Grou	p 19:	Herbs and S	pices : Basil / Downy	Mildew	(Perond	ospora bell	bahrii)		
NOP	FRAC ^	Active	Product	EPA Reg.	E	ffica	cy ^b	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1- 68539	13	2	7:V045; 6:V073.	Downy mildew control claim. Mix-and-match directions for use. ^E No specific crop/disease claims. Not for use in California.	0	1	None.	Harmful if swallowed. Moderate eye irritation.	None.	Mild alkaline solution; tank-mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2	20	1	6:V073	Control.	0	Until dry	None.	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. F B. F C. N D. F E. M	RAC = Fungi for Polyoxin lumber of tr DMR = Plant https://www Aix-and-mate complete lat	cide Resistance D zinc salt (Oso ials included in Disease Manage <u>Uplantmanagem</u> ch directions for pel statement: P	Action Commi), from summa the calculation ement Reports entnetwork.or use. Label ha prolonged or fro	ttee. Prod rizes trials, n of the me (on-line jo rg/pub/tria as a list of o equently re	ucts with a published an. urnal gene <u>l/pdmr/</u> crops and a peated sk	the sa d and erally a sep in cor	ame mode of unpublished used for pub arate list of ntact may ca	action have the san For OMRI-listed al dication of efficacy diseases with no clai use allergic reactior	ne FRAC (cernative research m for spe s in some	Code. N s, from conduc ecific cr e indivio	NC = Not cl Plant Dise ted at univ rop/disease duals.	assified; no FRAC code h ase Management Reports versities). Preceded by F e combinations.	as been assigned. (PDMR). ÆN = Fungicides and N	lematicides.

G. EPA relative environmental toxicity descriptors, lowest toxicity to highest toxicity: Practically non-toxic < Moderately toxic < Toxic < Highly toxic.

					Co Crop Grou	mpar p 19:	ative Overvi Herbs and S	ew of Efficacy, Haza pices : Basil / Down	rds, and v Mildew	Use Res (<i>Peron</i> d	strictions ospora bel	bahrii)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient(s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Plant Dise	ase Manager	nent Reports Cit	ations and da	ta summari	es for <mark>non</mark>	synth	n <mark>etic</mark> alterna	tives:			-			-
<u>11:V030</u> . I	M. T. McGra Double Nicke	th and Z. F. Sext el 55 at 3 lb/acre	ton, Cornell L e, August 2, 20	niversity. 016: <mark>41.9%,</mark>	Evaluation <mark>25.9%, an</mark>	of bi <mark>d 52.8</mark>	opesticides a <mark>8% control</mark> o	and an organic coppe f incidence. <mark>Trial m</mark>	er fungici <mark>ean: 40.2</mark>	de for c <mark>% contr</mark>	lowny mila ol (n = 3).	dew in sweet basil, 2016.		
<u>9:V001.</u> S	. B. Scheufe Regalia at 4	l et al., Univ. of qt/A: <mark>0.8% contr</mark>	Massachusett <mark>ol</mark> of downy n	s. Evaluati nildew on b	on of copp asil.	er fu	ngicides for	management of basi	l downy r	nildew	in organic	systems, 2014.		
<u>7:V015.</u> A	N.T. McGrath Regalia at 0.	i and K. A Lamar 5%: <mark>15.6% contro</mark>	sh, Cornell Ur <mark>ol</mark> of downy m	niversity. E ildew on ba	valuation sil leaves.	of fur	igicides for r	nanaging downy milo	dew in ba	sil, 201	2.			
<u>6:V059.</u> Z I	. Mercha et <mark>Regalia</mark> SC at	al., Univ. Of Flo 1%: <mark>10.3% and 2</mark>	rida, Evaluat <mark>26.0% control</mark>	ion of biolo of downy m	gicals and ildew seve	biora erity (tionals for c on basil leav	ontrol of basil down es in two different e	y mildew experimer	under g nts. <mark>Tri</mark>	greenhouse <mark>al mean:</mark> 1	e conditions, 2010. 18% control (n = 2).		
<u>6:V099.</u> A	N.T. McGrath Regalia (1%):	and L.K. Hunsb <mark>28.4% control</mark> o	erger, Cornel f downy milde	University w incidenc	Evaluati e on basil.	on of	biopesticide	s for managing dowr	ny mildev	/ in basi	il, 2011.			
<u>5:V098.</u> A	N.T. McGrath Regalia (1% v	and L.K. Nunsb v/v): <mark>No control</mark> (erger, Cornel of downy milo	University. Iew on basil	Evaluatio . Disease	on of sever	biopesticide rity exceede	s for managing dowr d that in the untreat	ny mildew ted contro	/ in basi ol.	il, 2010.			
<u>5:V155.</u> R	. N. Raid, U Regalia (1% v	niversity of Flori v/v)/A: <mark>23% cont</mark>	da. Evaluatic <mark>rol</mark> of downy i	n of Regalia nildew seve	a, alone ar erity.	nd in i	tank-mixture	e, for control of basi	l downy r	nildew,	Fall 2010.			
Plant Dise	ase Manager	nent Reports Cit	ations and da	ta summari	es for <mark>synt</mark>	hetic	alternatives	5:						
<u>7:V045.</u> J	.E. Allen and <mark>Ailstop</mark> at 2.	d M. Saska, Unive 5 lb/A, 5 or 6 ap	ersity of Conn plication beg	ecticut. Ba nning Augu	sil downy st 2 or 3, 2	milde 2012:	ew control u: <mark>0% to 2% co</mark> i	sing organic fungicid <mark>ntrol</mark> of downy milde	es and ni w on bas	trogen i il. <mark>Tria</mark>	fertilizatio <mark>l mean: 1</mark> %	on rate, 2012. <mark>6 control (n = 2).</mark>		
<u>6:V073.</u> J	.E. Allen and <mark>Ailstop</mark> at 2. Dxidate at 0.	d A. Patrie, Univ 5 lb/A, 5 applica .6 gal/A with Yuo	ersity of Conr itions: <mark>16.8% a</mark> cca Ag-Aide a	ecticut. Ev and 33.8% c t 0.125% (v/	aluation o <mark>ontrol</mark> of c 'v)/A: <mark>13.9</mark>	f orga Iowny <mark>9% an</mark> g	nic control mildew on <mark>d 25.8%</mark> cont	products for basil do basil. <mark>Trial mean: 2!</mark> rol of down mildew	wny mild <mark>5.3% cont</mark> on basil.	ew, 201 rol (n = Trial m	1. 2). ean: 19.9%	6 control (n = 2).		

STEP 3: Identification of Relative Efficacy for Non-Synthetic and Synthetic OMRI-Listed Alternative Products

METHODOLOGY

The tables from Step 2 were reviewed to separately quantify for non-synthetic and synthetic OMRI-listed alternative products the number of OMRI-listed products for each crop/disease combination having:

- Mean efficacy comparable to greater than the polyoxin D zinc salt 5SC formulation (a.k.a. Oso);
- Mean efficacy less than comparable to Oso but more than 50% to mean efficacy of Oso;
- Mean efficacy less than 50% of the mean efficacy of Oso; and
- No efficacy data published in Plant Disease Management Reports (going back to 2000).

Products with mean efficacy comparable or greater than the polyoxin D zinc salt 5SC formulation were identified for further consideration.

		(Overview of E	fficacy Comp	arisons of	Oso to OM	RI-Liste	d Alternatives				
Disease				E	PA Register	red, OMRI-	Listed A	Iternative Products	5			
(Pathogen)			Non-Syn	thetic					Synthe	etic		
	F (Mode Non-Cl	RAC Codes es of Action) or assified Al Type	Numl	per of Alterna	tive Produc	ts	(Moo Non-C	FRAC Codes les of Action) or Classified Al Type	Num	ber of Alterna	tive Product	S
	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data
Crop Group 13: Blueberries												
Alternaria fruit rot (<i>Alternaria</i> spp.)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil.	0	0	0	9	1	Oxidizing agent.	0	0	0	1
Botrytis blight (<i>Botrytis cinerea</i>)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil.	0	1	2	11	2	Inorganic salt; Oxidizing agent.	0	0	0	6
Mummyberry (Monilinia vaccinii- corymbosi)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil.	1 (Optiva)	2	3	5	2	Inorganic salt; Oxidizing agent.	0	0	0	2

			Overview of E	Efficacy Comp	arisons of	Oso to OM	RI-Liste	ed Alternatives				
Disease				E	PA Register	ed, OMRI-	Listed A	Iternative Product	S			
(Pathogen)			Non-Syn	thetic					Synthe	etic		
	F (Mode) Non-Cl	RAC Codes es of Action) or assified Al Type	Num	ber of Alterna	tive Produc	ts	(Moo Non-0	FRAC Codes des of Action) or Classified AI Type	Nun	iber of Alterna	ative Product	LS .
	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data
Crop Group 13: Caneberries		-						_				
Botrytis fruit rot (<i>Botrytis cinerea</i>)	5	44 (<i>Bacillus</i>); P5 (Regalia); Biochemical; Biological; Botanical oil.	0	1	3	8	3	M1 (copper); Inorganic salt; Oxidizing agent.	0	0	1	4
Powdery mildew (<i>Podosphaera aphanais</i>)	6	44 (<i>Bacillus</i>); P5 (Regalia); Biochemical; Biological; Botanical oil; Organic acid.	0	0	0	11	5	M2 (sulfur); Inorganic salt; Organic salt; Oxidizing agent; Petroleum oil.	0	0	0	22
Crop Group 13: Cranberries												
Cottonball (<i>Monilinia oxycocci</i>)	0	No applicable.	0	0	0	0	0	No applicable.	0	0	0	0
Fruit rot complex (Coleophoma empetri, Colletotrichum acutatum, Colletotrichum gloeosporioides, Phyllosticta vaccinii, and Physalospora vaccinii, etc.)	0	No applicable.	0	0	0	0	1	M1 (copper).	0	0	1	5

			Overview of I	Efficacy Comp	arisons of	Oso to ON	IRI-Liste	ed Alternatives				
Disease				E	PA Register	ed, OMRI-	Listed A	Iternative Product	S			
(Pathogen)			Non-Syr	nthetic					Synthe	etic		
	F (Mode Non-Cl	RAC Codes es of Action) or lassified AI Type	Num	ber of Alterna	tive Produc	ts	(Moo Non-0	FRAC Codes des of Action) or Classified AI Type	Nun	nber of Alterna	ative Product	ts
	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data
Crop Group 13: Grapes		-						-				
Black rot (Guignardia bidwellii)	3	44 (<i>Bacillus</i>); P5 (Regalia); Botanical oil	0	0	1	3	1	M1(copper).	2 (Badge X2, Nu-Cop 50 WP)	1	1	6
Bunch rot (<i>Botrytis cinerea</i>)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil	2 (Double Nickel 55 and LC)	2	3	9	3	Inorganic salt; Oxidizing agent; Petroleum oil.	0	0	3	6
Downy mildew (<i>Plasmopara viticola</i>)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil	0	1	1	10	3	M1 (copper); Inorganic salt; Oxidizing agent.	3 (Badge X2, Cueva, Oxidate)	0	0	13
Phomopsis fruit rot (Phomopsis viticola)	3	44 (<i>Bacillus</i>); P5 (Regalia); Botanical oil	0	0	0	10	3	M1 (copper); M2 (sulfur); Inorganic salt	0	0	1	13
Powdery mildew (<i>Erisyphe necator</i>)	5	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil; Organic acid.	0	0	4	14	6	M1 (copper); M2 (sulfur); Inorganic salt; Organic salt; Oxidizing agent; Petroleum oil	1 (Micro Sulf)	3	2	24

			Overview of E	Efficacy Comp	parisons of	Oso to OM	RI-Liste	ed Alternatives				
Disease				E	PA Register	red, OMRI-	Listed A	Alternative Product	S			
(Pathogen)			Non-Syn	thetic					Synth	etic		
	F (Mode Non-Cl	RAC Codes es of Action) or assified Al Type	Num	ber of Alterna	tive Produc	:ts	(Moo Non-(FRAC Codes des of Action) or Classified AI Type	Nun	nber of Altern	ative Produc	ts
	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data	Total	FRAC Code ^A	Mean Efficacy Comparable to or Greater than Oso	Mean Efficacy Less than Comparable to Oso to 50% Oso	Mean Efficacy Less than 50% Oso	No Efficacy Data
Crop Group 13: Strawberries												
Anthracnose fruit rot (<i>Colletotrichum</i> <i>acutatum</i>)	4	44 (<i>Bacillus</i>); P5 (Regalia); Biological; Botanical oil.	0	0	1	9	3	M1 (copper); Inorganic salt; Oxidizing agent.	0	0	0	5
Gray mold (<i>Botrytis cinerea</i>)	5	44 (<i>Bacillus</i>); P5 (Regalia); Biochemical; Biological; Botanical oil.	0	0	7	11	4	M1 (copper); Inorganic salt; Oxidizing agent; Petroleum oil.	0	0	2	6
Leather rot (Phytophthora cactorum)	2	BM2; Biological.	0	0	0	5	0	No applicable.	0	0	0	0
Phomopsis leaf spot (blight) (Phomopsis obscurans)	2	P5 (Regalia); Biological.	0	1	0	1	2	M1 (copper); Inorganic salt.	1 (Cueva)	0	0	3
Phomopsis fruit rot (Soft rot) (Phomopsis obscurans)	1	Biological.	0	0	0	1	1	Inorganic salt.	0	0	0	2
Powdery mildew (Podosphaera aphanis)	4	44 (<i>Bacillus</i>); Biochemical; Biological; Botanical oil.	0	0	1	14	6	M1 (copper); M2 (sulfur); Inorganic salt; Organic salt; Oxidizing agent; Petroleum oil.	1 (Microthiol Disperss)	1	1	20
Crop Group 19: Basil		-						-				
Downy mildew (<i>Peronospora belbahrii</i>)	3	44 (<i>Bacillus</i>); P5 (Regalia); Biological	0	1	1	2	2	Inorganic salt; Oxidizing agent.	0	0	2	1
A. Examples of active i Biochemical: Biological: Spore). Botanical oil: BM2: Inorganic salt: Organic acid: Organic salt: Oxidizing agent: Petroleum oil:	ngredier <i>Rhamno</i> <i>Aureoba</i> Cinnam <i>Trichoa</i> Potassiu Citric ad Insectic Hydroge Aliphati	nts with listed FR blipdi biosurfacta asidium pullulan on oil, Clove oil, derma spp. (Bio-T um bicarbonate a cid. idal soap and Po en dioxide, Hydro c petroleum solv	AC Code or no ant (Zonix). s (Botector), d Corn oil, Cott am and Roots and Potassium tassium salts d ogen peroxide rent and Miner	ot classified a Gliocladium ca con seed oil, C hield). silicate. of fatty acids. , and Peroxya ral oil.	ctive ingrec a <i>tenulatum</i> Garlic oil, No cetic acid.	lient types (Prestop) eem oil, R	: Strepto	omyces lydicus (Act y oil, and Thyme oi	inovate), and l.	Ulacladium ot	uderansii (Ze	n-O-

<u>CONCLUSIONS</u>: Based upon <u>disease economic significant and efficacy data alone</u>, there is organic grower need for the polyoxin D zinc salt 5SC formulation for treatment of:

- <u>Blueberries</u> for control of:
 - Alternaria blight (*Alternaria* spp.); and
 - Botrytis blight (Botrytis cinerea);
- <u>Caneberries</u> for control of:
 - Botrytis fruit rot (*Botrytis cinerea*); and
 - Powdery mildew (Podosphaera aphanais);
- <u>Cranberries</u> for control of:
 - Cottonball (Monilinia oxycocci); and
 - Fruit rot complex (*Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, and *Physalospora vaccinii*, etc.);
- <u>Grapes</u> for control of:
 - Phomopsis fruit rot (*Phomopsis viticola*);
- <u>Strawberries</u> for control of:
 - Anthracnose fruit rot (*Colletotrichum acutatum*);
 - Gray mold (*Botrytis cinerea*);
 - Leather rot (*Phytophthora cactorum*); and
 - Phomopsis fruit rot (soft rot) (*Phomopsis obscurans*); and
- Basil for control of:
 - Downy mildew (Peronospora belbahrii).

Please note:

- For scheduling reasons, this analysis is limited to berries and small fruits and basil. Similar results are anticipated if other crop/disease combinations were analyzed.
- There is no EPA registered, OMRI-listed alternative for treatment of cranberries for control of cottonball (*Monilinia oxycocci*).

STEP 4: <u>Further Consideration of OMRI-listed Products with Comparable or Greater Mean Efficacy Compared to the Polyoxin D Zinc Salt</u> <u>5SC Formulation</u>

METHODOLOGY

Step 3 summarizes disease/crop combinations for which one or more OMRI-listed products has comparable for superior efficacy based upon he mean of trial means. These OMRI-listed alternatives were noted in Step 2 using a *green background* to indicate comparable or superior mean trial efficacy.

For each crop/disease combination with an OMRI-listed identified in Step 2 and Step 3 as comparable or superior to that of the polyoxin D zinc salt 5SC formulation:

- The relevant table from Step 2 was copied and reduced in scope to focus on OMRI-listed alternative products with comparable or greater than that for the polyoxin D zinc salt.
 - Rows with efficacy information highlighted with a green background were retained.
 - All other rows for OMRI-listed alternatives (less than comparable efficacy or no data) were deleted.
 - Summaries of the data published in PDMR for the subject OMRI-listed alternatives were retained. Others were deleted.
- Table 1 was copied and reduced in scope to focus on crop/disease combinations with one or more OMRI-listed alternative products with comparable or greater than that for the polyoxin D zinc salt 5SC formulation.
 - Rows for the crop/disease combination under consideration were retained.
 - Rows for other crop/disease combinations were deleted.

The reduced scope tables from Step 2 and Step 1 are provided below.

Step 4 examined and provided commentary on:

- The *individual* efficacy trial results for the trials in the reduced scope Step 1 tables; and
- Phytotoxicity, human hazards, and environmental hazards label statements summarized in the reduced scope Step 2 tables.

BLUEBERRIES / Mummyberry (Monilinia vaccinii-corymbosi)

Please see the tables below.

								From Step 2:						
				Crop Cro	Co 12: Por	mpar	ative Overvi	ew of Efficacy, Haza	rds, and	Use Res	strictions	cinil corumboci		
NOP		Active	Product	FPA Pog		ffica		Label Claim	иннтурет рнт		iiiiiia vaco	Hazards and Postricti	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient (s)	FIOUUCU	No.				Laber Claim	(Davs)	(Hrs)	Dhute			
Status	0000(3)	ingredient (5)		110.	Mean % Control	n	Citations		(Dujs)	(113)	toxicity	Human	Environmental	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	64	6	See Oso efficacy summary table.	Control.	0	4	None	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Optiva	264-1160	78	1	7:SMF013.	Suppression only. Preventative only.	0	4	None	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
A. F B. F C. N D. F E. A	subtilis strain QST 713 Image: Strain QST 713 Preventative only. irritation. May cause dermal sensitization. F FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. https://www.plantmanagementnetwork.org/pub/trial/pdmr/ Mix-and-match directions for use Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations.													
F. C	omplete lat	pel statement: P	rolonged or fr	equently re	peated sk	in coi	ntact may ca	use allergic reactior	ns in some	e indivio	duals.			
G. E	PA relative	toxicity descript	ors, lowest to	xicity to hi	ghest toxic	tity:	Practically n	iontoxic < Moderate	ely toxic	< Toxi	c < Highl	y toxic.		
Plant Dise	ase Manager	nent Reports cit	ations and dat	a summarie	es:									
7:SMF013.	A.M.C. Sch <mark>)ptiva</mark> at 1 ll	ilder, J. M. Gille b/A + Nu Film P	ett, and W. Sys at 0.25%(v/v)	saks, Michig beginning a	an State L It pink buc	Inive I: <mark>79.</mark>	rsity. Evalua <mark>0% control</mark> o	ting fungicides and f shoot strikes and 7	biocontro <mark>6.3%</mark> con	ol produ trol of n	icts for coi nummies.	ntrol of mummyberry in b Trial mean: 77.7% contr	olueberries, 2012. <mark>ol (n = 2).</mark>	

C	Jativa Cumanan	, of the Effic	a av af tha Dal		Zine Calt ECC	C		From Ste	p 1:		~~ N.~ /	(0472 4)		C Europi	sida (EDA D	ar Na	(9472 4 70	064)
Cumu	lative Summary	or the Erric	acy of the Po	Applie	d as a Foliar	Suspe Sprav	to Growing	Food Cro	ons Using	Ground	eg. NO. (Applica	tion Eq.	inment	C Fungio	cide (EPA R	eg. No.	001/3-4-70	051)
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applicat	tion Rate	Cont	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES ANI	D SMALL FRU	IITS: BLUEBER	RIES	-			•		-							-	
Mummyberry	Monilinia vaccinii- corymbosi	Blueberries #1	CER-2015-008	OR	Oso + Induce (wetter/ sticker; 6 fl oz/100 gal)	9	4 - 8	5.6	21.6	NA	21.3	NA	Preventative and curative	No	34.8	No	PDMR 10:SMF026	
		Blueberries #2	CER-2015-143	MI	Oso + LI 700 (penetrant, acidifier; 0.125% v/v)	5	7 - 14	6.5	25	89	94	NA	Preventative	No	46.5 mummies/ bush	No	PDMR 10:SMF009	
		Blueberries	KAK-2016- Blueborn - MI	MI	Oso	8	8 - 23	6.5	25	90.8	90.7	NA	Preventative	No	57.8 shoot	No	PDMR (Plannod fall	New data.
		#J	Dlueberry-Mi					13	50	100	100	NA	and curative		bush		2018	
					Oso + Ll 700 (penetrant, acidifier; 0.125% v/v)			6.5	25	87.9	88.2	NA					publication) (Permission)	
		Blueberries	KAK-2016-	WA	Oso	6	10 - 16	6.5	25	83.0	84.3	NA	Preventative	No	17.8	No	Permission.	New data.
		#4	Blueberry-WA- Conv					13	50	83.0	87.1				bush			
		Blueberries #5	KAK-2016- Blueberry-WA-	WA	Oso	7	6 - 9	6.5	25	-64.4	17.8	NA	Preventative	No	45.0 (fruit)	No	Permission.	New data. Includes Oso
			Org					13	50	32.5	30.0	NA						with microbial pesticides.
		Blueberries	KAK-2017-	WA	Oso	7	5 - 11	6.5	25	NA	63	NA	Preventative	No	6.3	No	Permission.	New data.
		#0	Org					13	50	NA	68	NA						with microbial
							Mean Conven-	5.6 - 6.5	21.6 - 25	88	77	NA						posticideor
							tional	13	20	91.5	93.6	NA	1					
						1	Mean	6.5	25	-64.4	40	NA				_		
1 "\\oar	inturbe ECC Support	aion Concentr	ata Europiaida" ia	Kakania	DA registered b	rand n	Organic	13 via D Zina	50	32.5	49	NA						
". vegg "Oso ! "CX-1 NR. Not re Preventative and Curative:	5%SC Fungicide" ar 0440" is the Certis eported.	Treatments inc Disease was co	SC Fungicide "IS SC Fungicide" are rmulation code f	e Certis US or Polyoxi e applicati	ion after disease	ementa C Fungi e was ol	l distributor t cide. oserved.	brand name	es for Poly	oxin D Zir	nc Salt 5SC	E Fungicide	2.					

Comparison with Optiva (Non-Synthetic)

A *single trial* with Optiva demonstrated 78% control of blueberry/mummyberry.

Six trials with Oso provided a mean of 64% control of blueberry/mummyberry. This 64% control value includes:

- One trial (CER-2015-008) which was conducted at a rate that was *below* the minimum application rate permitted by the label; and
- Two trials (KAK-2016-Blueberry-WA-Org and KAK-2017-Blueberry-WA-Org) for which the other treatments were organic products that provided inferior disease control. It is believed that the poor control of the nearby organic product sub-plots facilitated re-infection of the Oso treated sub-plot and reduced the control observed in the Oso sub-plot.

Please note that three trials (CER-2015-143, KAK-2016-Blueberry-MI, and KAK-2016-Blueberry-WA-Conv) provided 91.5%, 92.9% and 84.4% mean control of blueberry/mummyberry, respectively. The currently available data do not include a side-by-side comparison of Oso and Optiva. However, Kaken is optimistic that a side-by-side trial would demonstrate superior control of blueberry/mummyberry by Oso compared to Optiva.

Kaken also notes that the label for Optiva specifies that the product needs to be used <u>preventatively</u>, *i.e.*, before disease is present. The Oso labels does not have this restriction. Furthermore, 100% control of blueberry/mummyberry was observed in Trial No. KAK-2016-Blueberry-MI which included <u>curative</u> applications, *i.e.*, Oso was applied <u>after</u> disease was observed in the untreated control.

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic blueberry growers:

- Competitive efficacy for control of mummyberry;
- A treatment option <u>after</u> mummyberry is first observed;
- Competitive worker and environmental safety;
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

GRAPES / Black Rot (Guignardia bidwellii)

Please see the tables below.

				C	Co rop Group	mpar 13:	ative Overvi Berries and S	From Step 2: ew of Efficacy, Haza mall Fruits: Grapes	ırds, and / Black R	Use Res ot (<i>Gui</i> g	strictions gnardia bi	dwellii)			
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Produ	uct Label	
Status	Code(s)	Ingredient (s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical	
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	54	4	See Oso efficacy summary table.	Suppression.	0	4	None	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.	
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	50289-12	54	2	8:SMF014; 6:SMF008.	Control.	0	48	Yes	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.	
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7	78	2	6:SMF008.	Control.	0	24	Yes	Irreversible eye damage. Harmful if swallowed, absorbed through skin, or inhaled. May cause dermal sensitization. ^F	Toxic to fish and aquatic organisms.	Damages aluminum.	
A. F B. F C. N D. P E. M F. C G. E	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. https://www.plantmanagementnetwork.org/pub/trial/pdmr/ Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. EPA relative toxicity descriptors, lowest toxicity: 0 highest toxicity: Practically nontoxic < Moderately toxic < Toxic < Highly toxic.														
Plant Disea	ase Manager	nent Reports cit	ations and dat	a summarie	es for <mark>synt</mark>	hetic	alternatives	:	,		5	, 			
<u>8:SMF014.</u> B B B B	Bryan Hed adge X2 1.7 adge X2 1.7 adge X2 1.7 adge X2 1.7 Tri	Penn State Univ 5 lb/A + lime 1. 5 lb/A + lime 1. 5 lb/A + lime 1. 5 lb/A + lime 1. al mean: 43% co	versity. Evalu 75 lb/A, 5 or 1 75 lb/A, 5 or 1 75 lb/A + Nu-f 75 lb/A + Nu-f ntrol (n = 12).	ation of org more applic nore applic Film-P, 5 or Film-P, 5 or	anic fungi ations, dif ations, dif more app more app	cides ferer ferer licati licati	for control of timings; what timings; what timings; what timings; who ons, differer ons, differer	of black rot and pow <i>ithout</i> mummies: 64 <i>ith</i> mummies: 4%, 59 It timings; <i>without</i> r It timings; <i>with</i> mun	/dery and <mark>%, 77%, 8</mark> %, 15%, a nummies nmies: <mark>9</mark>	downy 1%, and nd 22% (: 66.5%, % and 9%	mildew of <mark>190%</mark> cont control on and 71% o % control o	⁷ Concord grapes, 2013. rol on fruit. fruit. control on fruit. on fruit.			
<u>6:SMF008.</u> N N	B. Hed and luCop 50 WF luCop 50 WF Nu adge X2 at Ba	I N. K. Ngugi, Pe P at 1 lb/A + Lim P at 2 lb/A + Lim Cop 50 WP trial 1.75 lb/A + Lime dge X2 trial mea	nn State Unive e at 1 lb/A + e at 2 lb/A + mean: 77% co at 1.75 lb/A n: 64% contro	ersity. Eval Nufilm P at Nufilm P at ntrol (n = 4 + Nufilm P a l (n = 2).	uation of 0.0625%: 0.0625%: 1. at 0.0625%	conve 67% (65% (52)	entional and control of dis control of dis % control of	organic fungicides fo seased clusters; <mark>85%</mark> seased clusters; <mark>91%</mark> diseased clusters; <mark>7</mark> !	or contro control c control c 5% contro	l of blac of diseas of diseas <mark>l</mark> of dise	ck rot and sed area. sed area. eased area	powdery mildew of Conce	ord grapes, 2011.		

							F	rom Ste	p 1:									
Cumu	ulative Summary	of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	nsion Conce	entrate	Fungicide	e (EPA Re	eg.No.(68173-4)	and Oso 5%S	C Fungi	cide (EPA R	eg. No.	68173-4-70	(051)
		-	-	Applie	d as a Foliar	Spray	to Growing	Food Cr	ops Using	Ground	l Applica	tion Equ	ipment				-	-
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	Me Contr	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES AND	D SMALL FRU	IITS: GRAPES															
Black Rot	Guignardia bidwellii	Grapes #1	KAK-2016- Grape-MI	MI	Oso	7	10 - 16	6.5	25	NA	87	NA	Preventative	No	82.0	No	PDMR (Planned fall	New data.
								13	50	NA	98						2018 publication) (Permission)	
		Grapes #2	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	87	86	NA	Preventative	No	66.0	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
		Grapes #3	KAK-2016- Grape-PA	PA	Oso	6	9 - 12	13	50	NA	2.5	NA	Preventative	Yes	55.0	No	PDMR 11:SMF009	New data. Mummies in the trellis.
		Grapes #4	KAK-2017- Grape-PA	PA	Oso	7	9 - 11	13	50	NA	36.1	NA	Preventative	Yes	85.8	No	PDMR (Submitted)	New data. Mummies in the trellis.
							Mean	6.5	25	NA	87	NA						
								13	50	87	55.7	NA						
1. "Vegg "Oso ! "CX-1 NR. Not re Preventative and	gieturbo 5SC Susper 5%SC Fungicide" an 0440" is the Certis eported. d curative: Ti	nsion Concentra nd "Tavano 5% USA, L.L.C. fo reatments incl	ate Fungicide" is 5C Fungicide" are rmulation code f ude at least one	Kaken's I Certis U or Polyoxi applicatio	EPA registered b SA, L.L.C. supple in D Zinc Salt 5S on after disease	orand na emental C Fungio was ob:	ame for Polyo l distributor b cide. served.	kin D Zinc rand nam	Salt 5SC Fi es for Polyo	ungicide. oxin D Zin	ic Salt 5SC	C Fungicide	2.					
curative:	D	isease was con	mmed to be pre	esent defo	re the first trea	tment v	vas applied.											

Comparison with Badge X2 and Nu-Cop 50 WP (Synthetic)

Oso provided mean 54% control of grape/black rot in 4 trials. Badge X2 also provided mean 54% control on two trials, and Nu-Cop 50 WP provided mean 78% control in 2 trials.

Please note the following:

- Two trials conducted in Michigan (KAK-2016-Grape-MI and KAK-2017-Grape-MI) provided mean 93% control and 87% control of grape/black rot, respectively. <u>No mummies</u> were tied into the trellis to serve as inoculum. Naturally occurring inoculum was the source of disease. The dilution water was tap water (<u>not softened</u>).
- Two trials conducted in Pennsylvania (KAK-2016-Grape-PA and KAK-2017-Grape-PA) had disappointing results with only 2.35% control and 36.1% control, respectively. In the two Pennsylvania trials, *mummies* were tied into the trellis to serve as inoculum. The dilution water was *softened* tap water. Both the 2016 and 2017 trials were conducted during a local drought.
- Research strategies to better understand how to achieve dependable control of grape/black rot are under discussion.
- Black rot control is a high priority for organic grape growers. Many organic grape growers in Pennsylvania, New York, and nearby areas in Canada have converted back to convention production because of the high crop losses in organic vineyards due to black rot and insufficient organic black rot control options.

- Badge X2 and Nu-Cop 50 WP are the two OMRI-listed products with comparable or better control of black rot compared to Oso.
 - There are no available side-by-side trials for comparison of the efficacy with the polyoxin D zinc salt 5SC formulation.
 - Both Badge X2 and Nu-Cop 50 WP:
 - Are copper products with the same mode of action.
 - Have significantly higher hazards to humans (may be fatal is swallowed; irreversible eye damage) than the polyoxin D zinc salt 5SC formulation.
 - Have higher toxicity to fish as aquatic organisms (toxic) than the polyoxin D zinc salt 5SC formulation (moderately toxic).
- No phytotoxicity has been observed for Oso. The Badge X2 label has phytotoxicity warning statements.

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic grape growers:

Competitive efficacy for control of black rot;

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- Greater crop, worker, and environmental safety;
- An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
- Reduced (EPA's minimum) personal protective equipment requirement;
- Greater flexibility in growing the crop (0-day PHI instead of 1-day; 4-hour worker re-entry interval instead of 48-hours or 24-hours);
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

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GRAPES / Bunch Rot (Botrytis cinerea)

Please see the tables below.

Serenade Optimum is retained in the reduce table from Step 2 based upon efficacy data from an unpublished trial summarized in the May 31, 2016 petition.

								From Step 2:						
					Cc Crop Gro	mpai up 13	ative Overvi : Berries and	ew of Efficacy, Haza I Small Fruits: Grape	rds, and s / Buncl	Use Res	strictions Potrvtis cir	nerea)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI		Hazards and Restrict	ions Noted on the Prod	uct Label
Status	Code(s)	Ingredient (s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	66	6	See Oso efficacy summary table.	Control.	0	4	None.	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel 55	70051- 108	74	1	9:SMF001.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus amylo- liquefaciens</i> strain D747	Double Nickel LC	70051- 114	95	1	9:SMF001.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	<i>Bacillus subtilis</i> strain QST 713	Serenade Optimum	264-1160	32	1	9:SMF023.	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	None.
A. F B. F C. N D. F E. M F. C G. E Plant Dise	RAC = Fung For Polyoxin Number of tr PDMR = Plan https://www Mix-and-mat Complete lal PA relative ase Manager	cide Resistance D zinc salt (Oso) ials included in Disease Manage <u>A plantmanagem</u> ch directions for bel statement: P toxicity descript nent Reports cit	Action Comm , from summa the calculatio ement Report: <u>entnetwork.o</u> use. Label h rolonged or fr cors, lowest to ations and da	ittee. Prod arizes trials on of the me s (on-line jo rg/pub/tria as a list of requently re oxicity to hi ta summarie	ucts with , published an. burnal gene <u>l/pdmr/</u> crops and epeated sk ghest toxid es for non-	the sa d and erally a sep in co city: synth	ame mode of unpublished used for pub arate list of ntact may ca Practically n netic alternat	action have the sar . For OMRI-listed al olication of efficacy diseases with no cla use allergic reaction nontoxic < Moderat	ne FRAC ternative research im for sp in som ely toxic	Code. N es, from conduc ecific cr e indivio < Toxi	IC = Not c Plant Dise ted at uni rop/diseas duals. c < Highl	lassified; no FRAC code h ease Management Reports versities). Preceded by f e combinations. y toxic.	as been assigned. s (PDMR). F&N = Fungicides and N	vematicides.
9:SMF001.	T. T. Nguy Double Nicke	en, N.S. Morris, el LC at 2 gt/A:	and W. D. Gul <mark>93% and 96% (</mark>	bler, Univer <mark>control</mark> of B	sity of Cal otrytis bur	iforn ich ro	ia, Davis. Ma ot (severity a	anagement of Grape nd incidence, respe	Botrytis ctively).	Bunch R Trial m	ot with executive contract of the second sec	xperimental, organic and control (n = 2).	conventional fungicid	es, 2014.

Double Nickel 55WDG at 20 oz/A: 70% and 78% control of Botrytis bunch rot (severity and incidence, respectively). Trial mean: 74% control (n = 2).

							I	From Ste	p 1:									
Cumi	ulative Summary	of the Effic	acy of the Po	yoxin D	Zinc Salt 5SC	Suspe	ension Conc	entrate	Fungicide	e (EPA Re	eg.No.(68173-4)	and Oso 5%S	C Fungio	cide (EPA R	eg. No.	68173-4-70	051)
	T	1	1	Applie	d as a Foliar !	Spray	to Growing	Food Cr	ops Using	Ground	l Applica	tion Equ	ipment	-	1		1	•
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation '	No. App.	Application Interval	Applica	tion Rate	Me Contr	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES AND) SMALL FRU	IITS: GRAPES															
Bunch Rot	Botrytis cinerea	Grapes #1	CER-2013-002	CA	Tavano 5% SC	4	37 - 56	6.5	25	NA	89.0	NA	Preventative	No	30.00	No	Certis data;	
								13	50	NA	92.8						not published.	
		Grapes #2	CER-2013-021	CA	Tavano 5% SC	6	18 - 21	6.5	25	NA	83.2	NA	Preventative	No	20.8	No	Certis data;	
								13	50	NA	78.1	1	and curative				not published	
		Grapes #3	CER-2014-045	NY	Tavano 5% SC	4	13 - 43	6.5	25	NA	37	NA	Preventative and curative	No	76.3	No	Not published. Permission	
		Grapes #4	CER-2015-115	NY	oso	4	14 - 41	6.5	25	NA	69	NA	Preventative	No	96	No	Not published. Permission received.	
		Grapes #5	CER-2015-140	MI	Oso 5%SC + Super Spread 90 (non-ionic surfactant; 0.125% v/v)	4	20 - 29	6.5	25	NA	56	NA	Preventative	No	25	No	PDMR 10:SMF011	
		Grapes #6	9:SMF001	CA	Tavano 5% SC	3	35	6.5	25	NA	61.1	NA	Preventative	No	22.8	No	PDMR 9:SMF001	New data.
							Mean	6.5	25	NA	66	NA						
								13	50	NA	85	NA						
1. "Vegg "Oso "CX-1	gieturbo 5SC Susper 5%SC Fungicide" ar 0440" is the Certis	nsion Concentr nd "Tavano 5% USA, L.L.C. fo	ate Fungicide" is SC Fungicide" are rmulation code f	Kaken's I Certis U or Polyoxi	EPA registered b SA, L.L.C. supple in D Zinc Salt 550	rand na ementa 2 Fungi	ame for Polyo: l distributor b cide.	kin D Zinc rand nam	Salt 5SC Fi es for Polye	ungicide. oxin D Zin	ic Salt 5SC	C Fungicide	2.					
NK. NOT R	eportea.																	
Preventative and Curative:	d curative: T D	reatments incl isease was con	ude at least one ifirmed to be pre	applications applications applications application app	on after disease are the first treat	was ob ment w	served. was applied.											

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The polyoxin D zinc salt 5SC formulation provided 66% mean control of grape/bunch rot in 6 trials.

- Individual trial means were 90.9%, 80.7%, 37%, 69%, 56%, and 61.1% control of grape bunch rot in trial numbers CER-2013-002, CER-20123-021, CER-2014-045, CER-2015-115, CER-2015-140, and 9:SMF-001, respectively.
- Trial numbers CER-2013-002, CER-20123-021, CER-2014-045, CER-2015-115 are <u>not</u> published.
- Trial numbers CER-2015-140 and 9:SMF-001 are published.

Comparison with Serenade Optimum (Non-Synthetic)

Trial number CER-2013-002 (not published) was summarized in the May 31, 2016 petition and includes direct comparison of Tavano 5%SC (containing 5% polyoxin D zinc salt) with Serenade Optimum.

- Tavano applied at 13 fl oz/acre had numerically <u>superior</u> control grape bunch rot incidence compared to Serenade Optimum (98.1% control vs 93.3% control). Both products provided 87.5% control of grape bunch rot disease severity.
- Serenade Optimum is required to be applied preventatively. Oso can be applied after disease is first observed.

Comparison with Double Nickel LC (Non-Synthetic):

Direct comparisons of the efficacy of polyoxin D zinc salt 5SC formulation (a.k.a. Tavano) with Double Nickel LC are included in three trials:

Trial No.	Treatment	Rate/acre	Label	Bunch Rot	Incidence	Bunch Rot	Severity	Publication
			Range	Percent	Percent Control	Percent	Percent Control	
CER-2014-045	Untreated control			76.3 a		31.6 a		Not published; summarized in the May 31,
	Tavano 5SC	6.5 fl oz	6.5 - 13	60.0 a-f	21	14.9 b-e	53	2016 petition
	Double Nickel LC	2.0 qt	0.5 - 6	62.5 a-d	18	14.8 b-e	54	
CER-2015-115	Untreated control			96 a		44 ab		Not published; summarized in the May 31,
	Tavano 5SC	6.5 fl oz	6.5 - 13	50 gh	50	12 d-f	88	2016 petition
	Double Nickel LC	1 qt	0.5 - 6	86 a-d	14	23 de	77	
	Double Nickel LC	2 qt	0.5 - 6	48 h	53	11 ef	89	
9:SMF001	Untreated control			22.8a		4.4 a		PDMR 9:SMF001
	Tavano 5SC	6.5 fl oz	6.5 - 13	4.0 cd	82.5	1.5 bc	59.1	
	Double Nickel LC	2 qt	0.5 - 6	1.0 d	95.6	0.3 bc	93.2	

For trials with direct comparison of the polyoxin D zinc salt 5SC formulation (a.k.a. Tavano) with Double Nickel LC, the efficacy of the polyoxin D zinc salt 5SC formulation applied at the minimum label rate of 6.5 fl oz/acre was:

- Statistically *superior* to Double Nickle LC at 1 qt/acre (1 trial); and
- Statistically <u>equivalent</u> to Double Nickle LC at 2 qt/acre (each of 3 trials).

Double Nickle LC is required to be applied preventatively. Oso can be applied after disease is first observed.

Comparison with Double Nickel 55 (Non-Synthetic):

Direct comparisons of the efficacy of polyoxin D zinc salt 5SC formulation (a.k.a. Tavano) with Double Nickel 55 are included in one trial (9:SMF001):

Trial No.	Treatment	Rate/acre	Label	Bunch Rot	Incidence	Bunch Rot	Severity	Publication
			Range	Percent	Percent Control	Percent	Percent Control	
9:SMF001	Untreated control			22.8a		4.4 a		PDMR 9:SMF001
	Tavano 5SC	6.5 fl oz	6.5 - 13	4.0 cd	82.5	1.5 bc	59.1	
	Double Nickel 55	20 oz	0.3 - 3 lb = 4.8 - 48 oz	5.0 cd	78.1	1.3 bc	70.5	

In this direct comparison of the polyoxin D zinc salt 5SC formulation (a.k.a. Tavano) with Double Nickel 55, the efficacy of the polyoxin D zinc salt 5SC formulation applied at the <u>minimum</u> label rate of 6.5 fl oz/acre was statistically <u>equivalent</u> to that of the Double Nickel applied at 20 oz/acre (approximately the <u>middle</u> of the application rate range on the label).

Double Nickle 55 is required to be applied preventatively. Oso can be applied after disease is first observed.

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic grape growers:

- Competitive or superior efficacy for control of bunch rot;
- A treatment option *after* bunch rot is first observed;
- Competitive worker and environmental safety;
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

GRAPES / Downy Mildew (*Plasmopara viticola*)

Please see the tables below.

	From Step 2: Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Grapes / Downy Mildew (<i>Plasmonara viticala</i>)													
NOD		Activo	Product		p Group 1	3: Be	erries and Sm	all Fruits: Grapes /	Downy M	Idew (P	Plasmopara	a viticola)	ons Noted on the Dred	uct Labol
Status	Code(s)	Ingredient (s)	FIODUCE	No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	95	2	See Oso efficacy summary table.	Control.	0	4	None	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	80289-12	99 (with lime)	1	8:SMF014	Control.	0	48	Yes	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M1	Copper octanoate	Cueva	67702-2- 70051	93	1	3:SMF031	Control.	0	4	Yes	Harmful if swallowed or absorbed through skin.	Toxic to fish and aquatic organisms.	Do not store below 4°C (39°F). Tank- mix restrictions.
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2	92 (leaves)	1	5:SMF049.	Control.	0	Until dry	None	Irreversible eye damage. May be fatal if swallowed. Skin irritation.	Highly toxic to bees and other beneficial insects. Toxic to fish.	Chemical instabilities. Strong oxidizing agent. Use and storage temperature restrictions.
A. F B. F C. N D. P E. M F. C G. E	 FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. <u>https://www.plantmanagementnetwork.org/pub/trial/pdmr/</u> Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. 													
8:SMF014. B 5:SMF049. C	 <u>SMF014.</u> B. Hed, Penn State University. Evaluation of organic fungicides for control of black rot and powdery and downy mildew of Concord grapes, 2013. Badge X2 at 1.75 lb/A + lime at 1.75 lb/A, different application timings: 96%, 99%, 100%, and 100% control of downy mildew on grapes (fruit). Badge X2 at 1.75 lb/A + lime at 1.75 lb/A + Nu-Film-P at 0.0625%, different application timings: 100% and 100% control of downy mildew on grapes (fruit). Badge X2 trial mean: 99% control (n = 6). <u>SMF049.</u> A. Schilder, <i>et al.</i> Michigan State University. Evaluation of fungicide programs for control of bunch rots and downy mildew in 'Vignoles' grapes, 2008. Oxidate 1% (v/v): 92% control on grape leaves. 													
<u>3:SMF031.</u> C	B. Hed. P Lueva 1%: <mark>9</mark> 3	enn State Univ. E <mark>3% control</mark> of dov	Evaluation of a vny mildew or	alternative grapes (fru	fungicides uit).	for c	ontrol of bla	ck rot, powdery mil	dew, and	downy	mildew of	grapes, 2008.		

							F	rom Ste	p 1:									
Cumi	ulative Summary	y of the Effic	acy of the Po	lyoxin D	Zinc Salt 5SC	Suspe	ension Conce	entrate	Fungicide	(EPA R	eg. No.	68173-4)	and Oso 5%S	C Fungi	cide (EPA R	eg. No.	68173-4-70	051)
				Applie	d as a Foliar :	Spray	to Growing	Food Cr	ops Using	Ground	Applica	ation Equ	ipment					
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	Application Rate		Mean Control (%)		Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES AN	D SMALL FRU	IITS: GRAPES															
Downy Mildew	Plasmopara viticola	Grapes #1	KAK-2016- Grape-MI	MI	Oso	7	7 - 16	6.5	25	92	NA	NA	Preventative	No	83.0	No	PDMR (Planned fall	New data.
								13	50	99	NA	NA				2018 publication) (Permission)		
		Grapes #2	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	NA	95	NA	Preventative	No	78.0	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
							Mean	6.5	25	92	NA	NA						
								13	50	99	95	NA						
1. "Vegg "Oso "CX-1 NR. Not re	gieturbo 5SC Susper 5%SC Fungicide" ar 0440" is the Certis eported.	nsion Concentra nd "Tavano 5% USA, L.L.C. fo	ate Fungicide" i SC Fungicide" ar rmulation code i	s Kaken's I e Certis US for Polyoxi	EPA registered b SA, L.L.C. supple n D Zinc Salt 5S	ementa C Fungi	ame for Polyo: I distributor b icide.	kin D Zinc rand nam	Salt 5SC Fi es for Polyo	Ingicide. Dxin D Zin	c Salt 550	2 Fungicide	2.					
Curative:		isease was con	firmed to be pro	esent befo	re the first treat	tment	was applied.											

Based upon the mean of two trials, the polyoxin D zinc salt 5SC formulation provided comparable efficacy for the efficacy of downy mildew of grapes (95% control) compared to Badge X2 with lime (99% control), Cueva (93% control), and Oxidate (92% control).

Comparison to Badge X2, Cueva, and Oxidate (Synthetic)

The polyoxin D zinc salt 5SC formulation is a reduced risk product compared to Badge X2, Cueva, and Oxidate.

- <u>Badge X2</u> is phytotoxic, has higher human toxicity (may be fatal if swallowed), and has higher environmental toxicity (toxic fish and aquatic organisms).
- <u>Cueva</u> has a phytotoxicity warning on its label ("may cause some copper toxicity on some plant species"), has higher acute toxicity (harmful if swallowed or absorbed through skin, and has higher environmental toxicity (toxic to fish and aquatic organisms).
- <u>Oxidate</u> is significantly more toxic to humans and environment. Oxidate causes irreversible eye damage and may be fatal if swallowed. Oxidate is highly toxic to bees and other beneficial insects and is toxic to fish.

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic grape growers:

- Competitive or superior efficacy for control of downy mildew;
- An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
- Greater to significantly greater crop, worker, and environmental safety;
- Reduced (EPA's minimum) personal protective equipment requirement;
- Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

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GRAPES / Powdery Mildew (Erisyphe necator)

Please see the tables below.

Rows for Double Nickel LC, Stargus, Lifegard WG, and Badge X2 are retained in the table from Step 2 to facilitate comparisons with these products based upon unpublished data.

					_		_	From Step 2:						
				Cre	Co 1 Op Group	mpai 13: Be	rative Overvi erries and Sm	ew of Efficacy, Haza nall Fruits: Grapes /	rds, and Powdery	Use Res Mildew	strictions (<i>Erisyphe</i>	necator)		
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	су ^в	Label Claim	PHI	REI		Hazards and Restricti	ons Noted on the Prod	uct Label
Status	Code(s)	Ingredient (s)		No.	Mean % Control	n ^c	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	79	8	See Oso efficacy summary table.	Control.	0	4	None	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.
Non- synthetic	44	Bacillus amylo- liquefaciens strain D747	Double Nickel LC	70051- 114	No data	NA	NA	Control. Preventative only.	0	4	None.	Moderate eye irritation. May cause dermal sensitization. ^F	None.	Water pH restrictions.
Non- synthetic	44	Bacillus amylo- liquefaciens strain F727	Stargus	84059-28	No data			Control. Preventative only.	0	4	None.	Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Not for sale or use after 18 months from the date of manufacture. Avoid freezing.
Non- synthetic	44	Bacillus mycoides, isolate J	LifeGard WG	70051- 119	No data			No direct effect on plant pathogen; plant protectant; preventative.	0	4	None.	Harmful if inhaled. Moderate eye irritation. Respirator required; repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.	None.	Store at temperatures below 77°F.
Synthetic	M1	Copper hydroxide, Copper oxychloride	Badge X2	80289-12	50	2	8:SMF014 6:SMF008	Control.	0	48	Yes.	May be fatal if swallowed. Substantial eye injury.	Toxic to fish and aquatic organisms.	May damage aluminum.
Synthetic	M2	Sulfur	Micro Sulf	55146-75	88	1	6:SMF025	Control.	0	24	Yes	Harmful if swallowed, inhaled, or absorbed through skin. Eye irritation.	None.	Keep away from heat, sparks, or flames.

	From Step 2: Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Grapes / Powdery Mildew (<i>Erisyphe necator</i>)													
NOP	FRAC A Active Product EPA Reg. Efficacy B Label Claim PHI REI Hazards and Restrictions Noted on the Product Label													Juct Label
Status	tus Code(s) Ingredient (s) No. Mean % n ^C PDMR ^D Control Citations (Days) (Hrs) Phyto- Human Environmental ^G Physical												Physical	
A. F B. F D. F E. <i>F</i> G. F	FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). Number of trials included in the calculation of the mean. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. https://www.plantmanagementnetwork.org/pub/trial/pdmr/ Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. FPA relative toxicity descriptors, lowest toxicity: Diset toxicity: Practically nontoxic < Moderately toxic < Toxic < Highly toxic.													
Plant Dise <u>6:SMF025.</u> / /	 Lant Disease Management Reports citations and data summaries for synthetic alternatives: <u>:SMF025.</u> N. O. Halbrendt, H.K. Ngugi, and J. M. Halbrendst, Penn State University. Performance of organic and conventional programs for powdery mildew management on wine grapes in PA, 2011. Micro Sulf at 5 lb/A: 10.0%, 99.7%, 94.7%, and 99.7% control on leaves (incidence and severity, respectively; Chamboucin and Traminette, respectively). Micro Sulf at 5 lb/A: 100%, 100%, and 100% control on clusters (incidence and severity, respectively; Chamboucin and Traminette, respectively). Trial mean: 88% (n = 8). 													

Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applica	tion Rate	Me Conti	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES ANI	D SMALL FRU	JITS: GRAPES															
Powdery mildew	Erysiphe necator	Grapes #1	CER-2011-013	CA	CX-10440	8	10 - 11	3.75 7.5	14 29	78.1 80.4	78.6 68.8	NA	Preventative and curative	No	70.3	No	Certis data; not published	
		Grapes #2	CER-2012-069	CA	CX-10440	8	9 - 11	13	50	NA	96.67	NA	Preventative and curative	No	30.00	No	Certis data; not published.	Wine was analyzed.
		Grapes #3	CER-2013-021	CA	Tavano	5	18 - 21	6.5	25	NA	44.2	NA	Preventative	No	100	No	Certis data;	
								13	50	NA	73.6	NA	and curative				not published	
		Grapes #4	CER-2015-019	OR	Oso + Sylguard (silicone surfactant; 0.025% v/v)	6	13 - 15	6.5	25	86.1	47.9	NA	Preventative and curative	No	87.5	No	Certis data; not published.	
		Grapes #5	CER-2015-140	MI	Oso 5%SC + Super Spread 90 (non-ionic surfactant; 0.125% v/v)	4	20 - 29	6.5	25	55	56	NA	Preventative	No	37	No	PDMR 10:SMF011	
		Grapes #6	KAK-2016- Grape-MI	MI	Oso	7	10 - 16	6.5	25	90	88	NA	Preventative	No	63.0	No	PDMR (Planned	New data.
								13	50	99	99						fall 2018) (Permission)	
		Grapes #7	KAK-2017- Grape-MI	MI	Oso	7	11 - 20	13	50	97	99	NA	Preventative	No	85.0	No	PDMR (Planned fall 2018) (Permission)	New data.
		Grapes #8	KAK-2017- Grape-PA	PA	Oso	7	9 - 11	13	50	81	84	NA	Preventative	No	98.0	No	PDMR (Planned fall 2018) (Permission)	New data.
							Mean	3.75	14	78.1	78.6	NA						
								6.5 - 7.5	25 - 29	78	61	NA						
								13	50	92	90	NA						
1. "Vegg "Oso "CX-1 NR. Not re Preventative and	ieturbo 5SC Susper 5%SC Fungicide" ar 0440" is the Certis eported. I curative: T	nsion Concentr nd "Tavano 5% USA, L.L.C. fo Treatments incl	rate Fungicide" is SC Fungicide" are ormulation code f lude at least one	Kaken's e Certis U or Polyox applicati	EPA registered bi SA, L.L.C. supple in D Zinc Salt 5SC	rand n menta Fungi was of	ame for Polyo Il distributor b icide.	xin D Zinc orand nam	Salt 5SC Fi es for Poly	ungicide. Dixin D Zin	ic Salt 5SC	Fungicide	2.					

The polyoxin D zinc salt 5SC formulation provided mean 79% control powdery mildew in grapes based upon <u>8 efficacy trials</u>. Individual trial means were 76.5%, 96.67%, 58.9%, 67%, 56%, 94%, 98%, and 83% control in trial numbers CER-2011-013, CER-2012-069, CER-2013-021, CER-2015-019, CER-2015-140, KAK-2016-Grape-MI, KAK-2017-Grape-MI, and KAK-2017-Grape-PA, respectively.

Comparison with Micro Sulf (Synthetic)

In a single trial, Micro Sulf provided mean 88% control of powdery mildew on grapes. This is:

- Within the range of the 8 trials for Oso; and
- Less than the 96.67%, 94%, and 98% control by Oso observed in trial numbers CER-2012-069, KAK-2016-Grape-MI, and KAK-2017-Grape-MI.

The polyoxin D zinc salt 5 SS formulation:

- Is not phytotoxic, whereas Micro Sulf is phytotoxic.
- Has lower mammalian toxicity. Micro Sulf is harmful if swallowed, inhaled, or absorbed through skin and causes eye irritation.

Other OMRI-Listed Alternatives

For the first 6 listed trials, no OMRI-listed alternatives were included in the trial.

Two trials which are not yet published for which summaries are included in this document each include direct comparisons of the polyoxin D zinc salt 5SC formulation to two OMRI-listed products:

- Trial No. KAK-2017-Grape-MI includes Lifegard WG and Stargus; and
- Trial No. KAK-2017-Grape-PA includes Double Nickel LC and Badge X2 with lime.

Comparison with Lifegard WG and Stargus (Non-Synthetic)

In Trial No. KAK-2017-Grape-MI, the polyoxin D zinc salt 5SC formulation provided:

- Statistically <u>equivalent</u> control of powdery mildew on grapes <u>leaves</u> compared to Lifegard WG and Stargus (97%, 94%, and 96% control, respectively); and
- Statistically *superior* control of powdery mildew on grapes *clusters* compared to Lifegard WG and Stargus (99%, 97%, and 97% control, respectively).

For both Lifeguard WG and Stargus:

- The US EPA registration is limited to preventative use only; and
- Applicators are required to wear a respirator.

The polyoxin D zinc salt 5SC formulation does not have either of these limitations.

Comparison with Double Nickel LC (Non-Synthetic)

In Trial No. KAK-2017-Grape-PA, the polyoxin D zinc salt 5SC formulation provided:

- Numerically <u>superior</u> control of powdery mildew on grape <u>leaves</u> (81%) compared to Double Nickel LC at 1.5 qt/acre and 3 qt/acre (56% and 39%), respectively; and
- Numerically <u>superior</u> control of powdery mildew on grape <u>clusters</u> (84%) compared to Double Nickel LC at 1.5 qt/acre and Double Nickel LC at 3 qt/acre (24%, and 17%, respectively).

Double Nickel is required to be used preventatively. Oso can be applied after disease is first observed.

Comparison with Badge X2 Tank-Mixed with Lime (Synthetic)

In Trial No. KAK-2017-Grape-PA, the polyoxin D zinc salt 5SC formulation provided:

- Statistically <u>equivalent</u> control of powdery mildew on grape <u>leaves</u> (81%) compared to Badge X2 tank-mixed with lime (97%); and
- Numerically <u>superior</u> control of powdery mildew on grape <u>clusters</u> (84%) compared to Badge X2 tank-mixed with lime (59%).

The polyoxin D zinc salt 5SC formulation is a reduced risk product relative to Badge X2. The polyoxin D zinc salt 5SC formulation:

- Is not phytotoxic, whereas Badge X2 is phytotoxic.
- Is practically non-toxic in all acute toxicity categories, whereas Badge X2 is harmful if swallowed, inhaled, or absorbed through skin and is an eye irritant. This difference is partially off-set by the polyoxin D zinc salt 5SC formulation's moderate toxicity to fish and aquatic organisms and no similar label statement for Badge X2.

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic grape growers:

- Competitive or superior efficacy for control of powdery mildew;
- A treatment option *after* powdery mildew is first observed;
- An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
- Competitive or superior crop, worker, and environmental safety;
- Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
- Increased applicator comfort (no respirator is required as is required for Lifegard WG and Stargus);
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

STRAWBERRIES / Phomopsis Leaf Spot (Blight) (Phomopsis obscurans)

Please see the tables below.

					From Step 2: Comparative Overview of Efficacy, Hazards, and Use Restrictions													
	Comparative Overview of Efficacy, Hazards, and Use Restrictions Crop Group 13: Berries and Small Fruits: Strawberries / Phomopsis Leaf Spot (Blight) (<i>Phomopsis obscurans</i>)																	
NOP	FRAC ^A	Active	Product	EPA Reg.	E	ffica	cy ^B	Label Claim	PHI	REI	(2.13.10) (//	Hazards and Restricti	ons Noted on the Prod	uct Label				
Status	Code(s)	Ingredient (s)		No.	Mean % Control	n ^C	PDMR ^D Citations		(Days)	(Hrs)	Phyto- toxicity	Human	Environmental ^G	Physical				
Synthetic	19	Polyoxin D zinc salt	Oso	68173-4	91	2	See Oso efficacy summary table.		0	4	None	May cause dermal sensitization. ^F	Moderately toxic to fish and aquatic invertebrates.	None.				
Synthetic	nthetic M1 Copper octanoate Cueva 67702-2- 94 1 9:SMF035 Control. 0 4 Yes Harmful if swallowed or aquatic organisms. Do not store below 4°C (39°F). Tank-																	
A. F B. F C. N D. F E. A F. C	 A. FRAC = Fungicide Resistance Action Committee. Products with the same mode of action have the same FRAC Code. NC = Not classified; no FRAC code has been assigned. 3. For Polyoxin D zinc salt (Oso), from summarizes trials, published and unpublished. For OMRI-listed alternatives, from Plant Disease Management Reports (PDMR). C. Number of trials included in the calculation of the mean. D. PDMR = Plant Disease Management Reports (on-line journal generally used for publication of efficacy research conducted at universities). Preceded by F&N = Fungicides and Nematicides. https://www.plantmanagementnetwork.org/pub/trial/pdmr/ E. Mix-and-match directions for use. Label has a list of crops and a separate list of diseases with no claim for specific crop/disease combinations. F. Complete label statement: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. F. PA relative toricity descriptors. Lowert toricity to bighest toricity. Practically nontrovic of Moderately toric of Highly toric. 																	
Plant Disea 9:SMF035.	Plant Disease Management Reports citations and data summaries: <u>9:SMF035</u> . A. Schilder <i>et al.</i> , Michigan State University. Evaluation of organic fungicides for control of strawberry foliar and fruit diseases, 2014. Cueva at 1 gal/A: 94% control of Phomopsis leaf blight.																	
6	From Step 1:																	
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Cumu	Cumulative Summary of the Efficacy of the Polyoxin D Zinc Salt 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051) Applied as a Foliar Spray to Growing Food Crops Using Ground Application Equipment																	
Disease	Pathogen	Crop Tested &	Trial No.	State	Formulation ¹	No. App.	Application Interval	Applicat	tion Rate	Me Contr	ean rol (%)	Mean Yield	Application Type(s)	Inocu- lated?	Max. Pest Pressure in	Phyto- tox ?	Publication Status	Notes
		Sequence No.					(Days)	fl oz/ acre	g a.i./ ha	Leaves	Fruit	Increase (%)			UTC (%)			
CROP GROUP	13: BERRIES AND) SMALL FRU	ITS: STRAWBE	ERRIES														
Phomopsis Leaf Spot and Fruit Rot	Phomopsis obscurans	Strawberries #1	KAK-2016- SBerry-MI	MI	Oso	7	6 - 9	6.5	25	98	NA	4-day post- harvest: 240	Preventative	No	39.5	No	PDMR (Planned fall 2018 publication)	New data.
								13	50	100	NA	273					(Permission)	
		Strawberries #2	KAK-2017- SBerry-MI	MI	Oso	5	7 - 14	13	50	83	80	4-day post- harvest: 2350	Preventative	No	35.1	No	PDMR (Planned fall 2018 publication) (Permission)	New data.
							Mean	6.5	25	98	NA	4-day post- harvest: 240						
1. "Vegg "Oso 5 "CX-11 NR. Not re	Image: Not reported. Image: Not reported is the cert is																	
Preventative and Curative:	i curative: Ti D	eatments incluses incluses incluses incluses incluses inclusion inclusin inclusion inc	ude at least one firmed to be pre	applications applications applications application app	on after disease re the first treat	was ob: tment v	served. vas applied.											

The mean control of strawberry Phomopsis leaf spot (blight) for the polyoxin D zinc salt 5SC formulation based upon two trials is 91%. Mean control was 99% and 83% based upon Trial Numbers KAK-2016-SBerry-MI and KAK-2017-SBerry-MI, respectively. Summaries of both of these trials are included in this document. Both trials are not yet published. Trial Numbers KAK-2016-SBerry-MI and KAK-2017-SBerry-MI do <u>not</u> included data on any OMRI-listed products that are EPA registered for use on strawberries for treatment of Phomopsis.

Comparison with Cueva (Synthetic)

Cueva provided 94% control of strawberry phomopsis leaf spot in a single published efficacy trial. This is between the 83% and 99% control seen for the polyoxin D zinc salt 5SC formulation.

The polyoxin D zinc salt 5SC formulation is a reduced risk product compared to Cueva. Cueva has a phytotoxicity warning on its label ("may cause some copper toxicity on some plant species"), has higher acute toxicity (harmful if swallowed or absorbed through skin, and has higher environmental toxicity (toxic to fish and aquatic organisms).

<u>CONCLUSION</u>: The polyoxin D zinc salt 5SC formulation offers organic strawberry growers:

- Competitive efficacy for control of Phomopsis leaf spot;
- A treatment option <u>after</u> Phomopsis leaf spot is first observed;
- Competitive or superior crop, worker, and environmental safety;
- A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
- Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

OVERALL CONCLUSION

Based upon *disease significance and efficacy data alone*, there is *organic grower need* for the polyoxin D zinc salt 5SC formulation (a.k.a. Oso) for treatment of:

- <u>Blueberries</u> for control of:
 - Alternaria blight (Alternaria spp.); and
 - Botrytis blight (*Botrytis cinerea*);
- <u>Caneberries</u> for control of:
 - Botrytis fruit rot (*Botrytis cinerea*); and
 - Powdery mildew (Podosphaera aphanais);
- <u>Cranberries</u> for control of:
 - Cottonball (Monilinia oxycocci); and
 - Fruit rot complex (*Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, and *Physalospora vaccinii*, etc.);
- Grapes for control of:
 - Phomopsis fruit rot (*Phomopsis viticola*);
- <u>Strawberries</u> for control of:
 - Anthracnose fruit rot (*Colletotrichum acutatum*);
 - Gray mold (*Botrytis cinerea*);
 - Leather rot (*Phytophthora cactorum*; and
 - Phomopsis fruit rot (soft rot) (*Phomopsis obscurans*); and
- Basil for control of:
 - Downy mildew (Peronospora belbahrii).

OMRI-listed alternatives initially identified as having comparable or superior efficacy and therefore identified for more detailed comparisons were:

- Blueberries/mummyberry (Monilinia vaccinii-corymbosi): Optiva;
- Grapes black rot (Guignardia bodwellii): Badge X2 and Nu-Cop 50 WP;
- Grapes/bunch rot (Botrytis cinerea): Double Nickel 55 and Double Nickel LC;
- <u>Grapes/downy mildew (*Plasmopara viticola*)</u>: Badge X2, Cueva, and Oxidate;
- Grapes/powdery mildew (Erysiphe necator): Micro Sulf, Lifegard WG and Stargus;
 and
- <u>Strawberries/Phomopsis leaf spot (Phomopsis obscurans)</u>: Cueva.

Based upon <u>efficacy data and other considerations</u>, there is <u>organic grower need</u> for the polyoxin D zinc salt 5SC formulation (a.k.a. Oso) for treatment of:

- <u>Blueberries for control of mummyberry (*Monilinia vaccinii-corymbosi*). Compared to Optiva, the polyoxin D zinc salt 5SC formulation offers organic blueberry growers:</u>
 - Competitive efficacy for control of mummyberry;
 - Competitive worker and environmental safety;
 - A treatment option <u>after</u> mummyberry is first observed;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

- <u>Grapes for the control of black rot (*Guignardia bodwellii*)</u>. Compared to Badge X2 and Nu-Cop 50 WP, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive efficacy for control of black rot;
 - Greater crop, worker, and environmental safety;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop (0-day PHI instead of 1-day; 4-hour worker re-entry interval instead of 48-hours or 24-hours);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grapes for the control of bunch rot (*Botrytis cinerea*)</u>. Compared to Double Nickel 55 and Double Nickel LC, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of bunch rot;
 - A treatment option <u>after</u> bunch rot is first observed;
 - Competitive worker and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grapes for the control of downy mildew (*Plasmopara viticola*)</u>. Compared to Badge X2, Cueva, and Oxidate, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of downy mildew;
 - Greater to significantly greater crop, worker, and environmental safety;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4hour worker re-entry interval instead of 48 hours (Badge X2)];
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grapes for control of powdery mildew (*Erysiphe necator*)</u>. Compared to Micro Sulf, Lifegard WG, Stargus, and Serifel, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of powdery mildew;
 - A treatment option *after* powdery mildew is first observed;
 - Competitive or superior crop, worker, and environmental safety;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4hour worker re-entry interval instead of 48 hours (Badge X2)];
 - Increased applicator comfort (no respirator is required as is required for Lifegard WG and Stargus);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

- <u>Strawberries for control of Phomopsis leaf spot (Phomopsis obscurans)</u>. Compared to Cueva, the polyoxin D zinc salt 5SC formulation offers organic strawberry growers:
 - Competitive efficacy for control of Phomopsis leaf spot;
 - A treatment option *after* Phomopsis leaf spot is first observed;
 - Competitive or superior crop, worker, and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

Please note:

- For scheduling reasons, this analysis is limited to berries and small fruits and basil. Similar results are anticipated if other crop/disease combinations were analyzed.
- There is no EPA registered, OMRI-listed alternative for treatment of cranberries for control of cottonball (*Monilinia oxycocci*).

COMPATIBILITY WITH OMRI-LISTED FUNGICIDES

ACTINOVATE, REGALIA, AND NOVASOURCE'S LIME-SULFUR

Blueberry/mummyberry trial #5 (Trial No. KAK-2016-Blueberry-WA-Org) is summarized above and is provided again below because it provides examples of how Oso can be an important addition to treatment programs with OMRI-listed products.

a. <u>Design</u>

Blueberry / Mummyber	ry (<i>Monilinia vaccii</i>	nii-corymbosi) #5: ⁻ Design	Trial No. KAK-2016-I	Blueberry-WA-Org:			
Title:	Organic Mummy Washington 2016	Berry & Botrytis Co	ontrol in Blueberries	s of Western			
Author and affiliation:	Alan Schreiber						
	Agricultural Deve	elopment Group, Ir	nc.				
Publication:	Not published; p	ermission received	•				
Location:	Mt. Vernon, Was	hington					
Crop:	Highbush Bluebe	rry (variety: Reka)					
Disease name:	Mummy berry						
Pathogen:	Monilinia vaccin	ii-corymbosi					
Test plot design:	Randomized com	plete block					
Number of replicates:	4	4					
Application equipment:	Rears OverRo	Rears OverRo					
Spray volume:	100 gallons/acre						
Application type(s):	Preventative						
Number of applications:	7						
Chronology:	Application Dates	Application Interval	Growth Stage	Evaluation Dates			
	02/27/2016		Veg Bud	05/03/2016			
	03/07/2016	9 days	Veg Tip	06/23/2016			
	03/16/2016	9 days	Pre Bud				
	03/25/2016	9 days	Pink Bud				
	03/31/2016	6 days	10% Bloom				
	04/08/2016	9 days	30% Bloom				
	04/15/2016	7 days	50% Bloom				

b. <u>Results</u>

		Blu	eberries / Mummyberry (<i>Monil</i> Trial No. KAK-2016-Bluebe	<i>inia va</i> rry-WA	<i>ccinii-coryn</i> -Org: Resul	<i>nbosi</i>) #5: ts			
Treatment	Rate/ Acre	g a.i./ ha	Active Ingredient	FRA C Code	Appl Code	Incide Leaf Strik (05/03)	ence es/Plot) /2016)	Incide (Infected (06/23/	nce Fruit) 2016)
						Measured	Percent Control	Measured	Percent Control
Untreated control			Not Applicable			16.0 abc		45.0 a	
Oso 5%SC	6.5 fl oz	25	Polyoxin D zinc salt	19	ABCDEF	26.3 a	-64.4	37.0 a	17.8
Oso 5%SC	13 fl oz	50	Polyoxin D zinc salt	19	ABCDEF	10.8 c	32.5	31.5 a	30.0
Fracture	20 fl oz		Banda de Lupinus albus doce (BLAD)	M12	ABCDEFG	21.0 abc	-31.3	39.8 a	11.6
Zen-O-Spore	4 lb		<i>Ulocladium oudemansii</i> (U3 Strain)	NC	ABCDEFG	18.0 abc	-12.5	32.5 a	27.8
Actinovate AG	12 oz		<i>Streptomyces lydicus</i> WYEC 108	NC	ABCDEFG	16.8 abc	-5.0	39.0 a	13.3
Double Nickel LC	1 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	ABCDEFG	12.8 bc	20.0	33.5 a	25.6
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ABCDEFG	12.0 c	25.0	39.0 a	13.3
NovaSource's Lime-Sulfur	2% v/v		Calcium polysulfide	M2	ABCD	9.8 c	38.8	36.0 a	20.0
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	BDF	25.3 ab	-58.1	24.3 a	46.0
Actinovate AG	12 oz		Streptomyces lydicus WYEC 108	NC	ACEG				
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	BDF	20.8 abc	-30.0	32.8 a	27.1
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ACEG				
Actinovate AG	12 oz		<i>Streptomyces lydicus</i> WYEC 108	NC	ACEG				
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	EFG	15.8 abc	1.3	29.3 a	34.9
NovaSource's Lime-Sulfur	2% v/v		Calcium polysulfide	M2	ABCD				
Oso 5%SC	13 fl oz		Polyoxin D zinc salt	19	ACEG	21.5 abc	-34.4	25.8 a	42.7
Regalia	2 qt		Reynoutria sachalinensis extract	P5	BDF				
Actinovate AG	12 oz		<i>Streptomyces lydicus</i> WYEC 108	NC	ACEG	22.0 abc	-37.5	39.0 a	13.3
Regalia	2 qt		<i>Reynoutria sachalinensis</i> extract	P5	ACEG				
Double Nickel LC	1 qt		<i>Bacillus amyloliquefaciens</i> str. D747	44	BDF				
Zen-O-Spore	4 lb		<i>Ulocladium oudemansii</i> (U3 Strain)	NC	BDF				
Freatment means followed by the same letter are not statistically different according to Bartlett's X2 test at P = 0.05.									

The first application was made on February 27, 2016. Based upon feedback from Washington State University plant pathologists, this was prior to ascospore release (i.e., prior to crop infection). Therefore, the treatments were applied preventatively.

The researcher described the mummyberry pressure as moderate.

No phytotoxicity was reported.

c. <u>Discussion</u>

Used alone:

- Actinovate (containing *Streptomyces lydicus* WYEC 108; no FRAC Code; biological);
- Regalia (containing *Reynoutria sachalinensis* extract; FRAC Code P5), and
- NovaSource's Lime-Sulfur (containing calcium polysulfide; FRAC Code M2)

each provided control of mummyberry fruit infections (fruit strikes) on blueberries that was better than the untreated control.

<u>Oso enhanced the performance of Actinovate, Regalia, and NovaSource's Lime-Sulfur</u> in the treatment of blueberries for control of mummyberry.

When Oso was used in combination with:

- <u>Actinovate</u>, better control of blueberry/ mummyberry fruit strikes (46.0 % control) was achieved than when Actinovate was used alone (13.3% control).
- <u>Regalia</u>, better control of blueberry/ mummyberry fruit strikes (42.7% control) was achieved than when Regalia was used alone (13.3% control).
- <u>Regalia and Actinovate</u>, better control of blueberry/ mummyberry fruit strikes (27.1% control) was achieved than when Regalia was used alone (13.3% control) and when Actinovate was used alone (also 13.3% control).
- <u>NovaSource's Lime-Sulfur</u>, better control of blueberry/mummyberry fruit strikes (34.9% control) was achieved than when NovaSource's Lime-Sulfur was used alone (20.0% control).

DOUBLE NICKEL LC

a. <u>Design</u>

Powdery Mildew (Sph	naerotheca	fuliginea) / Squash: Trial No. CER-2014-064: Design				
Title:	CER-201	CER-2014-064				
Author and affiliation:	Gary Clo	bud				
Publication:	Not pub	lished. Certis data. Permission.				
Location:	Quitmar	n, GA				
Crop:	Squash (Yellow crook neck)				
Disease name:	Powdery	/ mildew				
Pathogen:	Sphaero	theca fuliginea				
Application codes and dates:	А	06/21/2014				
	В	06/28/2014				
	С	07/04/2014				
	D	07/11/2014				
	E	07/18/2014				
	F	07/25/2014				
	G	08/01/2014				
	Н	08/08/2014				

b. <u>Results</u>

Po	Powdery Mildew (Sphaerotheca fuliginea) / Squash: Trial No. CER-2014-064: Results								
Treatment	Rate/ Acre	g a.i./	Active IngredientFRACApp.Yield (lb)Yield (CodeCode08/08/201408/15/2		Yield (lb) 08/08/2014		(lb) /2014		
		ha				Measured	Percent Increase	Measured	Percent Increase
Untreated control			Not Applicable			5.38 b		8.78 a	
Double Nickel ^A	1 qt		<i>Bacillus amyloliquefaciens</i> strain 747	44	A-H	5.59 b	3.9	8.18 a	-6.8
Double Nickel ^A	1 qt		<i>Bacillus amyloliquefaciens</i> strain 747	44	ACEG	6.99 b	29.9	9.83 a	12.0
Oso	6.5 fl oz	25	Polyoxin D zinc salt	19	BDFH	12.48 a	132.0	12.00 a	36.7
Double Nickel ^A	1 qt		<i>Bacillus amyloliquefaciens</i> strain 747	44	ACEG				

Treatment means followed by the same letter are not statistically different according to the Student-Newman-Keuls test at P = 0.05.

A. The formulation (55 vs LC) was not specified. LC (liquid concentrate) is inferred based upon the units (quarts/acre) of the application rates.

c. <u>Discussion</u>

Yellow crook neck squash plants were treated using three different treatment patterns:

- Eight Double Nickel LC applications at 7-day intervals;
- Four Double Nickel LC applications at 14-day intervals; and
- Eight applications total at 7-day intervals, with Double Nickel LC applied first and then alternated with Oso for the balance of the treatment program.

The largest yield increases relative to the untreated control were obtained when Double Nickle LC applications were alternated with Oso applications (132.0% increase for harvest 1 and 36.7% increase for harvest 2).

<u>Therefore, Oso enhanced the performance of Double Nickel LC</u> in the treatment of squash for control of powdery mildew.

NOT RECOMMENDED FOR USE WITH TRICHODERMA SPECIES

Polyoxin D zinc salt stops the growth of sensitive fungi. Therefore, Kaken does not recommend the use of polyoxin D zinc salt as a tank-mix partner or as part of the treatment program with products containing *Trichoderma* species:

- <u>Bio-Tam</u> (EPA Reg. No. 80289-9) contains at least:
 - 5 million *Trichoderma asperellem* (ICC 012) colony forming units ; and
 - 5 million Trichoderma gamsii (ICC 080) colony forming units

and is registered for control of *Phytophthora* which is the genus that causes leather rot of strawberries.

- <u>Rootshield Plus WP</u> (EPA Reg. No. 68539-9) contains at least:
 - 10 million *Trichoderma harzianum* Rifai strain T-22 colony forming unit per gram dry weight; and
 - 5.3 million *Trichoderma virens* strain G-41 colony forming unit per gram dry weight

and is registered for control of *Phytophthora* which is the genus that causes leather rot of strawberries.

- <u>Rootshield Plus Granules</u> (EPA Reg. No. 68539-10) contains at least:
 - 10 million *Trichoderma harzianum* Rifai strain T-22 colony forming unit per gram dry weight; and
 - 5.3 million *Trichoderma virens* strain G-41 colony forming unit per gram dry weight

and is registered for control of *Phytophthora* which is the genus that causes leather rot of strawberries.

RESISTANCE MANAGEMENT

The following text is from US EPA PR Notice 2017-1 regarding resistance management.

<u>"What causes pesticide resistance; how does it happen?</u>

In general, pesticide resistance occurs when genetic or behavioral changes enable pest individuals to tolerate or survive what would otherwise be lethal doses of a pesticide and then spread those changes through the larger pest population. These changes are usually biochemical in nature (e.g., genes allowing metabolic detoxification of a pesticide occur as a result of random mutation, and these in turn allow pest individuals to survive repeated and/or lower dose applications of a given pesticide). If a pesticide is not rotated with other chemicals with different modes of action over several applications, and/or if that pesticide is not used at a dose that is lethal enough to kill almost all of the pest population, then the genes responsible for the resistant trait can spread quickly through the population (i.e., pesticide susceptible individuals are killed off, but resistant ones that are not challenged by pesticides with different modes of action can then mate with one another and make the resistance trait more common over time)."

Generally, how common / widespread is pesticide resistance?

Resistance appears to be generally increasing in the U.S. and worldwide. For example, globally the number of unique herbicide-resistant weed species has risen from one in 1957 to over 440 in 2014 (www.weedscience.org). Between 1908 and 2012, the number of insecticide-resistant arthropod species has risen from one to 574 (www.pesticideresistance.org). Interested readers can find a list of resistant plant pathogens (as well as several other documents relevant to fungicide resistance) at http://www.frac.info/publications/downloads. This is a website maintained by the Fungicide Resistance Action Committee (FRAC). For insecticides (both within the U.S. and globally), there is a publicly available, searchable database of refereed publications that report

resistance at http://www.pesticideresistance.org/index.php (maintained by Michigan State University). While the genetics of any individual pest population plays a role, a major human factor that fosters resistance development is a lack of understanding of resistance-management options available to crop producers who use pesticides routinely.

What are the concepts that guide resistance-management strategies?

EPA supports broader efforts at developing comprehensive resistance-management strategic plans that may take into account local conditions, soil management, crop rotation, cultural approaches and other factors. Resistance-management labeling will provide pesticide users with easy access to important information regarding target-site resistance, the cornerstone of most resistance-management programs. Development of pesticide resistance is influenced by a number of factors. One important factor that fosters pesticide resistance is the repeated use of pesticides with the same mode of action on the same pest population. Thus, an important proactive pesticide resistance-management strategy is to rotate pesticides with different modes of action to control target pests in any given location. This approach may delay the development of one important type of resistance, target site resistance, without resorting to increased rates and frequency of application, and may prolong the useful life of pesticides.

If pesticides are used in a manner that facilitates the development and/or spread of resistance in target pest populations, pesticide users are likely to increase their use of multiple pesticides in attempts to manage pests that are becoming less susceptible to each pesticide application. This in turn would increase loading of pesticides in the environment, with the potential for unintended consequences such as increased impacts on non-target wildlife and increased exposure to humans. Without appropriate actions to manage resistance evolution, target pests would eventually show widespread resistance that no management tactic could adequately address, thus leading to potentially significant crop losses. Pesticide users look to product labeling as a primary source for their use instructions, and resistance-management guidance on labeling could significantly and immediately assist users to avoid or delay the spread of resistance in pests.

The agency has found pesticide resistance to be an adverse effect in that it can increase pesticide use and create unnecessary economic losses. The lack of appropriate resistance-management guidance on labeling may become a factor that could strongly influence EPA's regulatory conclusions on the risks and benefits of a pesticide."

Polyoxin D zinc salt has a unique, non-toxic mode of action. No other active ingredient registered for use in North America has the same mode of action (FRAC Code 19). Polyoxin D zinc salt can play an important role in resistance management programs. Polyoxin D zinc salt, if accepted by the National Organic Program, will be a new resistance management tool for organic growers.

UPDATED JUSTIFICATION FOR APPROVAL UNDER §205.601

The information below expands upon and clarifies information in the September 12, 2012 NOP Technical Report for polyoxin D zinc salt.

IDENTIFICATION OF THE PETITIONED SUBSTANCE

Active Ingredient

The petitioned substance is <u>*limited*</u> to polyoxin D zinc salt which is a 1:1 complex of polyoxin D and zinc. The CAS number for polyoxin D zinc salt is 146659-78-1.

Fourteen polyoxins have been identified and have been designated polyoxin A through polyoxin N. Polyoxin A through polyoxin N each have a <u>different</u> chemical structure. The petitioned substance does <u>not</u> include all polyoxins. Specifically, the petitioned substance does <u>not</u> include:

- Polyoxin A through C;
- Polyoxin E though N;
- Polyoxin A through C in combination with zinc; and/or
- Polyoxin E though N in combination with zinc.

The properties of polyoxins vary with the chemical structures. Kaken Pharmaceutical Co., Ltd. markets Polyoxin Complex in Asia. Polyoxin Complex contains multiple polyoxins and has significantly different efficacy compared to polyoxin D zinc salt.

Formulation

The 5% suspension concentrate formulation of polyoxin D zinc salt is the <u>only</u> formulation proposed for use in organic agriculture. The inert ingredients have been specifically selected for use in organic formations. The 5% suspension concentrate is registered by Kaken as Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 67183-4) and is marketed in the United States by Certis USA L.L.C. as Oso 5%SC Fungicide (EPA Reg. No. 67183-4-70051).

Please note that the 11.3% water dispersible granular (WDG) formulation is <u>not</u> proposed for use in organic agriculture. The 11.3% WDG formulation has inert ingredients that are <u>not</u> compatible with organic agriculture.

CHARACTERIZATION OF THE PETITIONED SUBSTANCE

Polyoxin D zinc salt is used exclusively for the protection of plants against sensitive fungal plant pathogens.

Neither polyoxin D nor polyoxin D zinc salt are antibiotics. Polyoxin D and polyoxin D zinc salt have never been used or proposed for use as pharmaceuticals for use in human or veterinary medicine. Based upon screening data, polyoxin D has <u>no commercially viable efficacy</u> against tested common human or veterinary pathogens (bacteria, fungi, and yeast).

STATUS

US EPA Label: Use on Growing Crops

The most recent VEGGIETURBO 5SC Suspension Concentrate Fungicide label was stamped "Accepted" by the US EPA on January 3, 2018. Please see Appendix 1. Please note that the directions for use have been restructured so that they are in crop group number order instead of alphabetical order.

US EPA Label: Post-Harvest Use

The US EPA has issued a registration for Polyoxin D Zinc Salt 5-SC Post-Harvest (EPA Reg. No. 68173-5) for post-harvest use on pome fruits, pomegranates, and stone fruits. However, the product launch has been delayed for the development of large scale efficacy trial data to confirm and/or refine the directions for use.

Residue Authorizations

The US EPA has established a tolerance exemption for residues of polyoxin D zinc salt for all crops (preharvest and post-harvest) treated according to good agricultural practice (40 CFR §180.1285).

Crops grown in the United States and treated with polyoxin D zinc salt according to the US EPA registered label may be exported to:

- Canada;
- Mexico;
- New Zealand;
- South Korea; and
- Taiwan.

These countries have enacted regulations that are similar to EPA's tolerance exemption. Numerical maximum residue limits (MRLs) have not been established.

Kaken is pursuing additional imported crop authorizations for polyoxin D zinc salt that are similar to the US EPA's tolerance exemption. Applications to permit importation of crop commodities treated with polyoxin D zinc salt are pending or in preparation. The list of pending applications include the European Union.

No CODEX MRL has been proposed or accepted. The CODEX system does <u>not</u> have a provision for the concept of an MRL exemption. Only numerical MRLs may be established in the CODEX system.

International Authorizations for Use in Organic Agriculture

No application for international authorization for use in organic agriculture has been approved or is pending.

Polyoxin D zinc salt was first registered for use in Canada during 2017. During 2018, Engage Agro will be launching sales of the polyoxin D zinc salt 5SC formulation in Canada under the Diplomat brand name. Kaken will be investigating opportunities for organic use in Canada.

EVALUATION QUESTIONS FOR SUBSTANCES TO BE USED IN ORGANIC CROP PRODUCTION

1. What category of OFPA does this substance fall under?

Polyoxin D zinc salt is proposed as a substance described in 7 USC 6517 (c)(1)(B)(i) as "a toxin derived from bacteria."

Kaken Pharmaceutical Co., Ltd. (Kaken) proposes to <u>amend 7 CFR §205.601(i) to add polyoxin D</u> <u>zinc salt</u> as a synthetic substance allowed for use in organic crop production as plant disease control. ^^

2. Describe the most prevalent process used to manufacture or formulate the petitioned substance.

Active Ingredient Production

Polyoxin D is produced via a fermentation process using a naturally occurring, non-GMO microorganism. Polyoxin D is a naturally occurring substance.

Polyoxin D is highly water soluble. To reduce its water solubility, polyoxin D is converted to polyoxin D zinc salt using a very simple chemical reaction.

Kaken purchases and does not control the production process for the starting material containing zinc that is used to convert polyoxin D to polyoxin D zinc. Therefore, Kaken cannot assert that the zinc source is derived from native mined zinc (or from recycled zinc). Nonetheless, Kaken can confirm that detailed chemical analyses of multiple routine production batches of Polyoxin D Zinc Salt Technical confirm that no toxicologically significant heavy metals are present at or above the level of detection.

Polyoxin D zinc salt has been classified as a synthetic substance. During the spring 2013 public hearing, Dr. Davis, a former chair of the NOSB Crops Subcommittee, described polyoxin D zinc salt as a "naturally derived fermentation product with a twist."

5SC Formulation Production

The polyoxin D zinc salt 5SC formulation is produced via a blending process in which Polyoxin D Zinc Salt Technical is blended with inert ingredients that are each approved for use in organic agriculture. No chemical reactions occur via the formulation process.

3. Is the substance synthetic? Discuss whether the petitioned substance is formulated or manufactured by a chemical process, or created by a naturally occurring biological process.

During its April 2013 public hearing, the National Organic Standards Board classified polyoxin D zinc salt as a synthetic substance. Please see the answer to question 2 above for addition information.

4. Describe the persistence or concentration of the petitioned substance and/or its byproducts in the environment.

As noted in the September 23, 2012 Technical Report, "Data reviewed by the EPA indicate that polyoxin D zinc salt degrades within 2-3 days of application, with a low toxicity profile [73 FR 69559]."

Neither polyoxin D zinc salt nor its by-products will persist or concentrate in the environment.

5. Describe the toxicity and mode of action of the substance and its breakdown products and any contaminants. Describe the persistence and areas of concentration in the environment of the substance and its breakdown products.

	Timeline						
1997/08/20	US EPA issued the first registration of Polyoxin D Zinc Salt Technical.						
2012/09/12	US EPA issued the tolerance exemption of all crops. Additional mammalian toxicology and environmental degradation data on TGAI were accepted by EPA.						
2012/09/23	NOP Technical Evaluation Report for polyoxin D zinc salt is issued.						
2012/09/27	US EPA issued the first registration of Veggieturbo 5SC Suspension Concentrate Fungicide.						

The Technical Evaluation Report for Polyoxin D zinc salt was issued 4 days <u>before</u> Veggieturbo 5SC Suspension Concentrate Fungicide was first registered by the US EPA and did <u>not</u> consider data summaries included in the petition regarding Polyoxin D Zinc Salt 5SC Fungicide (EPA Reg. No. 67183-4).

Toxicity of Polyoxin D Zinc Salt Technical

Toxicity data submitted to and accepted by the US EPA and previously summarized for NOP but <u>not</u> included in the September 23, 2012 Technical Report for polyoxin D zinc salt are summarized below.

Assay	Polyoxin D Zino	: Salt Technical				
	US EPA Comment	Meaning	Ref.			
Developmental Toxicity (Teratology) (rabbit)	Maternal NOEL > 800 mg/kg/day. Pup NOEL > 800 mg/kg/day.	Does not cause birth defects in rabbits.	BRAD.			
Developmental Toxicity (Teratology) (rat)	NOAEL > 1000 mg/kg/day.	Does not cause birth defects in rats.	EPA Review 05/11/2012.			
Mutagenicity (<i>in vivo</i> mouse micronucleus test)	No mutagenic effects. No chromosomal mutations. No systemic toxicity. <i>In vitro</i> effects seen in earlier studies could <u>not</u> be replicated in the <i>in vivo</i> (whole animal) test.	Definitive study. Does not cause generic damage.	EPA Review 05/11/2012.			
Two-Generation Reproduction	No reproductive effects at the limit dose.	Does not adversely effect reproduction.	EPA Review 05/11/2012.			
lmmunotoxicity (mouse)	Low immunotoxicity.	Does not adversely effect the immune system.	EPA Review 05/11/2012.			
BRAD = US Environmental Protection Agency Office of Pesticide Programs Biopesticide Registration Action Document: Polyoxin D Zinc Salt (1997).						

The US EPA stated on pages 56131-56132 of the September 12, 2012 Federal Register,

"Relevant data and information submitted for the previous tolerance exemption (73 FR 69560) and for this expansion of the tolerance exemption indicate that polyoxin D zinc salt has negligible acute, subchronic, chronic, and developmental toxicity. Moreover, polyoxin D zinc salt is defined by its fungistatic non-toxic mode of action, and demonstrates no significant mammalian effect. Therefore, the Agency concludes that there is a reasonable certainty that no harm will result to the U.S. population, including infants and children, from aggregate exposure to the residues of polyoxin D zinc salt. This includes all anticipated dietary exposures and all other exposures for which there is reliable information. EPA has arrived at this conclusion because <u>the data and information available on polyoxin D zinc salt do not demonstrate toxic potential to mammals</u>. Thus, there are no threshold effects of concern and, as a result, an additional margin of safety is not necessary." (Emphasis added.)

Assay	Veggieturbo 5SC Suspension Concentrate Fungicide					
	End-Point	EPA Category/ Description	Ref.			
Acute oral (rats)	LD ₅₀ > 5000 mg/kg (females)	IV: Practically non-toxic.	EPA Review 09/07/2012.			
Acute dermal (rats)	LD ₅₀ > 5050 mg/kg (males, females, and combined)	IV: Practically non-toxic.	EPA Review 09/07/2012.			
Acute inhalation (rats; 4 hour)	LC ₅₀ > 2.20 mg/L (males, females, and combined)	IV: Practically non-toxic.	EPA Review 09/07/2012.			
Primary eye irritation (rabbits)	Maximum average score was 4 one hour after test material installation. No irritation in any eyes at 24 hours after treatment.	IV: Practically non-toxic.	EPA Review 09/07/2012.			
Primary dermal irritation (rabbits)	The primary index was 0.3 at 72 hours. Product is slightly irritating.	IV: Practically non-toxic.	EPA Review 09/07/2012.			
Dermal sensitization (Guinea pigs)	The test substance produced very faint to faint erythema in 15 to 20 test animals, but no reaction in any Naive control animals after treatment.	No applicable EPA toxicity category. Label statement: Mild dermal sensitizer.	EPA Review 09/07/2012.			

Toxicity of Veggieturbo 5SC Suspension Concentrate Fungicide

The acute toxicity of Veggieturbo 5SC Suspension Concentrate Fungicide is so low (all Category IV) that the US EPA does not require a first aid statement for Veggieturbo 5SC Suspension Concentrate Fungicide.

Mode of Action

Worldwide, polyoxin D zinc salt is produced and registered exclusively by Kaken Pharmaceutical Co., Ltd. (Kaken). This does <u>not</u> make Polyoxin D zinc salt an antibiotic. Polyoxin D and polyoxin D zinc salt are <u>not</u> antibiotics. They have <u>never</u> been marketed for use as pharmaceuticals for use in human medicine or in veterinary medicine. Based upon screening data, polyoxin D has <u>no commercially viable efficacy</u> against tested common human or veterinary pathogens (bacteria, fungi, and yeast).

6. Describe any environmental contamination that would result from the petitioned substance's manufacture, use, misuse, or disposal.

Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051) are both registered for terrestrial use only on crops. Intentional misuse involving direct application to water could harm fish and aquatic invertebrates. Risk to fish and aquatic invertebrates from registered uses is low due to the low application rates and rapid environmental degradation.

7. Describe any known chemical interactions between the petitioned substance and other substances used in organic crop production. Describe any environmental or human health effects from these chemical interactions.

Actinovate, Regalia and NovaSource's Lime-Sulfur

In Trial No. KAK-2016-Blueberry-WA-Org, the following products, used alone, each provided control of mummyberry fruit infections (fruit strikes) on blueberries that was better than the untreated control:

- Actinovate (containing *Streptomyces lydicus* WYEC 108; no FRAC Code; biological);
- Regalia (containing *Reynoutria sachalinensis* extract; FRAC Code P5), and
- NovaSource's Lime-Sulfur (containing calcium polysulfide; FRAC Code M2).

<u>Oso enhanced the performance of Actinovate, Regalia, and NovaSource's Lime-Sulfur</u> in the treatment of blueberries for control of mummyberry.

When Oso was used in combination with:

- <u>Actinovate</u>, better control of blueberry/ mummyberry fruit strikes (46.0 % control) was achieved than when Actinovate was used alone (13.3% control).
- <u>Regalia</u>, better control of blueberry/ mummyberry fruit strikes (42.7% control) was achieved than when Regalia was used alone (13.3% control).
- <u>Regalia and Actinovate</u>, better control of blueberry/ mummyberry fruit strikes (27.1% control) was achieved than when Regalia was used alone (13.3% control) and when Actinovate was used alone (also 13.3% control).
- <u>NovaSource's Lime-Sulfur</u>, better control of blueberry/mummyberry fruit strikes (34.9% control) was achieved than when NovaSource's Lime-Sulfur was used alone (20.0% control).

Double Nickel (containing Bacillus amyloliquefaciens str 747)

In Trial No. CER-2014-064, yellow crook neck squash plants were treated using three different treatment patterns:

- Eight Double Nickel applications at 7-day intervals;
- Four Double Nickel applications at 14-day intervals; and
- Eight applications total at 7-day intervals, with Double Nickel applied first and then alternated with Oso for the balance of the treatment program.

The largest yield increases relative to the untreated control were obtained when Double Nickle applications were alternated with Oso applications (132.0% increase for harvest 1 and 36.7% increase for harvest 2).

<u>Therefore, Oso enhanced the performance of Double Nickel</u> in the treatment of squash for control of powdery mildew.

Trichoderma (Bio-Tam and RootShield)

Polyoxin D zinc salt stops the growth of sensitive fungi. Therefore, Kaken does not recommend the use of polyoxin D zinc salt as a tank-mix partner or as part of the treatment program with products containing *Trichoderma* species [(Bio-Tam (EPA Reg. No. 80289-9), Rootshield Plus WP (EPA Reg. No. 68539-9) and Rootshield Plus Granules (EPA Reg. No. 68539-10)].

8. Describe any effects of the petitioned substance on biological or chemical interactions in the agro-ecosystem, including physiological effects on soil organisms, and crops.

Veggieturbo 5SC Suspension Concentrate Fungicide and Oso 5%SC Fungicide are each registered for foliar application to treatment of the above ground plant parts. Neither product is registered for application to the soil.

A special study described in the May 31, 2016 petition was conducted specifically for NOP and determined that the polyoxin D zinc salt 5SC formulation does <u>not</u> adversely effects beneficial soil organisms, including beneficial soil fungi.

In addition, polyoxin D zinc salt has been determined to not adversely effect earth worms. These data are also summarized in the May 31, 2016 petition.

9. Discuss and summarize findings on whether the petitioned substance may be harmful to the environment.

Please see the Kaken's above responses to items 4, 5, and 6.

- Neither polyoxin D zinc salt nor its by-products will persist or concentrate in the environment.
- The data and information available on polyoxin D zinc salt do not demonstrate toxic potential to mammals.
- The acute toxicity of Veggieturbo 5SC Suspension Concentrate Fungicide is so low (all Category IV) that the US EPA does not require a first aid statement for Veggieturbo 5SC Suspension Concentrate Fungicide.
- Polyoxin D and polyoxin D zinc salt are <u>not</u> antibiotics. They have <u>never</u> been marketed for use as pharmaceuticals for use in human medicine or in veterinary medicine.
- Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051) are both registered for terrestrial use only on crops. Intentional misuse involving direct application to water could harm fish and aquatic invertebrates. Risk to fish and aquatic invertebrates from registered uses is low due to the low application rates and rapid environmental degradation.

In addition, polyoxin D zinc salt does <u>not</u> adversely effect honey bees, ladybird beetles, or other beneficial insects.

10. Describe and summarize any reported effects on human health from use of the petitioned substance.

Kaken is not aware of any reported adverse effects on human health resulting from the use of polyoxin zinc D zinc salt or any of its formulations.

11. Describe all natural (non-synthetic) substances or products which may be used in place of a petitioned substance. Provide a list of allowed substances that may be used in place of the petitioned substance.

A list and brief description of the non-synthetic and synthetic products that may be used in place of the petitioned substance for use on Crop Group 13 and Crop Group 19 is provided below. For more detailed descriptions, please see the Evaluation of Organic Grower Needs, Step 2, Identification of OMRI-List Alternative Products, Efficacy Data, Product Hazards, and Restrictions beginning on page 127 of this addendum.

Please note that none on the listed alternatives have the same mode of action as polyoxin D zinc salt. As such, none of the listed alternatives is a true replacement for polyoxin D zinc salt. Instead, the listed products are EPA registered for the same crop/disease combination and are OMRI-listed.

US EPA Registered OMRI-Listed Alternatives ¹								
	Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051)							
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.				
Crop Group 13	: Berries and Small Fr	uits: Blueberries / Alternaria Fruit Rot (Ali	ternaria spp.)					
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18				
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153				
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160				
Non-synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3				
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC 108	Actinovate AG	73314-1				
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2				
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2				
Crop Group 13	: Berries and Small Fr	uits: Blueberries / Botrytis Blight (Botrytis	cinerea)					
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114				
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28				
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18				
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153				
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160				
Non-synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3				
Non-synthetic	NC; Biological	<i>Aureobasidoium pullulans</i> strains DSM 14940 and DSM 19941	Botector	86174-3				
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC 108	Actinovate AG	73314-1				
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2				
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539				
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1				
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2				
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1				
Crop Group 13	: Berries and Small Fr	uits: Blueberries / Mummyberry (<i>Monilinia</i>	vaccinii-corymbosi)					
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114				
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18				
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata ASO	264-1153				
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160				
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3				
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC 108	Actinovate AG	73314-1				
Non-synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541				
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2				

US EPA Registered OMRI-Listed Alternatives ¹							
to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and							
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.			
Crop Group 13	: Berries and Small Fr	uits: Caneberries / Botrytis Fruit Rot (<i>Botr</i>	ytis cinerea)				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108			
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18			
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153			
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152			
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151			
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160			
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3			
Non-synthetic	NC; Biochemical	Rhamnolipid biosurfactant	Zonix	72431-1			
Non-synthetic	NC; Biological	<i>Aureobasidium pullulans</i> strains DSM 14940 and DSM 14941	Botector	86174-3			
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC 108	Actinovate AG	73314-1			
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2			
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)			
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051			
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1			
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541			
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539			
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2			
Crop Group 13	: Berries and Small Fr	uits: Caneberries / Powdery Mildew (Podos	sphaera aphanis)				
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18			
Non-synthetic	44	Bacillus pumilis strain QST 2808	Sonata ASO	264-1153			
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151			
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3			
Non-synthetic	NC; Biochemical	Rhamnolipid biosurfactant	Zonix	72431-1			
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1			
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2			
Non-synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)			
Non-synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)			
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)			
Non-synthetic	NC; Organic acid	Citric acid	Nuke Em	NA; 25(b)			
Synthetic	M2	Sulfur	Acoidal	62562-4			
Synthetic	M2	Sulfur	Cosavet-DF	70905-1			
Synthetic	M2	Sulfur	Defend DF	62562-8			
Synthetic	MZ			51306-352-66330			
Synthetic	MZ		Micro Sult	55146-75			
Synthetic	MZ		Microthiol Disperss	10506-18/			
Synthetic	MZ	Sultur	I niolux	34704-1079			
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1			
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1			
Synthetic	NC; Inorganic salt	Potassium bicarbonate		108/0-1-68539			
Synthetic	NC; Inorganic salt	Potassium dicardonate	O	0900-041			
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1			
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163-324			
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22-70051			
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2			
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1			

US EPA Registered OMRI-Listed Alternatives ¹						
	to Veggieturbo 55 C	SC Suspension Concentrate Fungicide (EPA Iso 5%SC Fungicide (EPA Reg. No. 68173-4-7	Reg. No. 68173-4) and 70051)	1		
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.		
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704-849		
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1		
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368		
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9		
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1		
Synthetic	NC; Petroleum oil	Aliphatic petroleum solvent	SuffOil-X	48813-1-68539		
Crop Group 13	: Berries and Small Fr	uits: Cranberries / Cottonball (Monilinia o	хусоссі)			
No alternative	S					
Crop Group 13	: Berries and Small Fr	uits: Cranberries / Fruit Rot Complex (Cole	eophoma empetri, Co	lletotrichum		
acutatum, Col	letotrichum gloeospo	rioides, Phyllosticta vaccinii, and Physalos	pora vaccinii, etc.)	i		
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7		
Synthetic	M1	Copper hydroxide	Champ WG	55146-1		
Synthetic	M1	Copper hydroxide, Copper oxychloride	Badge X2	80289-12		
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3		
Synthetic	M1	Cupric hydroxide	Nu-Cup HB	42750-132		
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4		
Crop Group 13	: Berries and Small Fr	uits: Grapes / Black Rot (<i>Guignardia bidwe</i>	ellii)	i		
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28		
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151		
Non- Synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3		
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)		
Synthetic	M1	Basic copper sulfate	Basic Copper 53	45002-8		
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	50289-12		
Synthetic	M1	Copper hydroxide	Champ WG	55146-1		
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7		
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051		
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3		
Synthetic	M1	Cupric hydroxide	NuCop 50 DF	45002-4		
Synthetic	M1	Cupric hydroxide	Nu-Cop HB	42750-132		
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4		
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2		
Crop Group 13	: Berries and Small Fr	uits: Grapes / Bunch Rot (Botrytis cinerea)				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108		
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114		
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28		
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18		
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153		
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160		
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152		
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151		
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160		
Non-synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3		
Non-synthetic	NC; Biological	<i>Aureobasidium pullulans</i> strains DSM 14940 and DSM 14941	Botector	86174-3		
Non-synthetic	NC; Biological	Streptomyces lydicus	Actinovate AG	73314-1		
Non-synthetic	NC; Biological	Ulacladium ouderansii strain U3	Zen-O-Spore	75747-2		

US EPA Registered OMRI-Listed Alternatives ¹								
to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and								
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	FPA Reg No				
Non-synthetic	NC: Botanical oil	Neem oil	Trilogy	70051-2				
Non-synthetic	NC: Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA: 25(b)				
Non-synthetic	NC: Botanical oil	Rosemary oil. Clove oil. Thyme oil	Sporatec	NA: 25(b)				
Synthetic	NC: Inorganic salt	Potassium bicarbonate	Agricure	70870-1				
Synthetic	NC: Inorganic salt	Potassium bicarbonate	EcoMate Armicarb	5905-541				
- ,			0					
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539				
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2				
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1				
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1				
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9				
Synthetic	NC; Petroleum oil	Aliphatic petroleum solvent	SuffOil-X	48813-1-68539				
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1				
Crop Group 13	: Berries and Small Fr	uits: Grapes / Downy Mildew (Plasmopara	viticola)					
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114				
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28				
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18				
Non-synthetic	44	Bacillus mycoides, isolate J	LifeGard WG	70051-119				
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152				
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151				
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3				
Non-synthetic	NC; Biological	Streptomyces lydicus	Actinovate AG	73314-1				
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2				
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)				
Synthetic	M1	Basic copper sulfate	Basic Copper 53	45002-8				
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	80289-12				
Synthetic	M1	Copper hydroxide	Champ WG	55146-1				
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7				
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051				
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3				
Synthetic	M1	Copper sulfate pentahydrate	Copper Sulfate Crystals	56576-1				
Synthetic	M1	Copper sulfate pentahydrate	Quimag Quimicos Arguila Copper Sulfate Crystals	73385-3				
Synthetic	M1	Cupric hydroxide	NuCop 50 DF	45002-4				
Synthetic	M1	Cupric hydroxide	Nu-Cop HB	42750-132				
Synthetic	M1	Cuprous oxide	Nordox 75 WG	48142-4				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541				
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539				
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate 2.0	70299-2				
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1				

US EPA Registered OMRI-Listed Alternatives ¹					
to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and					
NOP Status FRAC ^A Code(s) Active Ingredient(s) Product FPA Reg. No. 66173-4-70031)					
Crop Group 13	: Berries and Small Fr	uits: Grapes / Phomopsis (Phomopsis vitico	pla)		
Non-synthetic	44	Bacillus amvloliquefaciens strain D747	Double Nickel 55	70051-108	
Non-synthetic	44	Bacillus amvloliquefaciens strain D747	Double Nickel LC	70051-114	
Non-synthetic	44	Bacillus amvloliquefaciens strain F727	Stargus	84059-28	
Non-synthetic	44	Bacillus amvloliquefaciens strain MBI 600	Serifel	71840-18	
Non-synthetic	44	Bacillus pumilus strain OST 2808	Sonata	264-1153	
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152	
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151	
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160	
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3	
Non-synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)	
Synthetic	M1	Copper oxychloride, Copper hydroxide	Badge X2	80289-12	
Synthetic	M1	Copper hydroxide	Champ WG	55146-1	
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051	
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3	
Synthetic	M1	Cupric hydroxide	Nu Cop 50 DF	45002-4	
Synthetic	M1	Cupric hydroxide	Nu Cop HB	42750-132	
Synthetic	M1	Cuprous oxide	Nordox	48142-4	
Synthetic	M2	Sulfur	Acoidal	62562-4	
Synthetic	M2	Sulfur	Defend DF	62562-8	
Synthetic	M2	Sulfur	Kumulus DF	51306-352-66330	
Synthetic	M2	Sulfur	Micro Sulf	55146-75	
Synthetic	M2	Sulfur	Microthiol Disperss	70506-187	
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539	
Crop Group 13	: Berries and Small Fr	uits: Grapes / Powdery Mildew (Erisyphe n	ecator)		
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108	
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114	
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28	
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18	
Non-synthetic	44	Bacillus mycoides, isolate J	LifeGard WG	70051-119	
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153	
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160	
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152	
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151	
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160	
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3	
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1	
Non-synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)	
Non-synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)	
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2	
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)	
Non-synthetic	NC; Organic acid	Citric acid	Nuke Em	NA; 25(b)	

US EPA Registered OMRI-Listed Alternatives ¹ to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051)				
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.
Synthetic	M1	Copper hydroxide	Nu-Cop 50 WP	42002-7
Synthetic	M1	Copper hydroxide	Champ WG	55146-1
Synthetic	M1	Copper hydroxide	Nu-Cop HB	42750-132
Synthetic	M1	Copper hydroxide, Copper oxychloride	Badge X2	80289-12
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051
Synthetic	M1	Copper sulfate pentahydrate	CS 2005	66675-3
Synthetic	M1	Copper sulfate pentahydrate	Copper Sulfate Crystals	56576-1
Synthetic	M1	Cupric hydroxide	Nu-Cop 50 DF	45002-4
Synthetic	M1	Cuprous oxide	Nordox	48142-4
Synthetic	M2	Sulfur	Acoidal	62562-4
Synthetic	M2	Sulfur	Cosavet-DF	70905-1
Synthetic	M2	Sulfur	Defend DF	62562-8
Synthetic	M2	Sulfur	Kumulus DF	51306-352-66330
Synthetic	M2	Sulfur	Micro Sulf	55146-75
Synthetic	M2	Sulfur	Microthiol Disperss	70506-187
Synthetic	M2	Sulfur	Thiolux	34704-1079
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70871-1-68539
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163-324
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22-70051
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704-849
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9
Synthetic	NC; Petroleum oil	Mineral oil	SuffOil-X	48813-1-68539
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1
Crop Group 13	: Berries and Small Fr	uits: Strawberries / Anthracnose Fruit Rot	(Colletotrichum acut	atum)
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160
Non-synthetic	P5	Reynoutria sachalinensis extract	Regalia	84059-3
Non-synthetic	NC; Biological	Aureobasidoium pullulans strains DSM 14940 and DSM 19941	Botector	86174-3
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)

US EPA Registered OMRI-Listed Alternatives ¹ to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and Oso 5%SC Fungicide (EPA Reg. No. 68173-4-70051)				
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.
Synthetic	M1	Copper octanoate	Cueva	67702-25-70051
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1
Crop Group 13	: Berries and Small Fr	uits: Strawberries / Gray Mold (Botrytis ci	nerea)	
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114
Non-synthetic	44	Bacillus amyloliquefaciens strain F727	Stargus	84059-28
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153
Non-synthetic	44	Bacillus subtilis strain QST 713	Optiva	264-1160
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160
Non-synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3
Non-synthetic	NC; Biochemical	Rhamnolipid biosurfactant	Zonix	72431-1
Non-synthetic	NC; Biological	<i>Aureobasidoium pullulans</i> strains DSM 14940 and DSM 19941	Botector	86174-3
Non-synthetic	NC; Biological	Gliocladium catenulatum	Prestop	64137-11
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1
Non-synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)
Non- Synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2
Synthetic	M1	Copper octanoate	Cueva	67702-25-70051
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9
Crop Group 13: Berries and Small Fruits: Strawberries / Leather Rot (<i>Phytophthora cactorum</i>)				
Non-synthetic	BM2	Trichoderma asperellum, Trichoderma gamsii	Bio-Tam	80289-9
Non-synthetic	BM2	<i>Trichoderma harzianum</i> strain R-22, <i>Trichoderma virens</i> strain G41	Rootshield Plus+ Granules	68539-10
Non-synthetic	BM2	<i>Trichoderma harzianum</i> strain R-22, <i>Trichoderma virens</i> strain G41	Rootshield Plus+ WP	68539-9
Non-synthetic	NC; Biological	<i>Aureobasidium pullulans</i> strains DSM 14940 and DSM 14941	Botector	86174-3
Non-synthetic	NC; Biological	Gliocladium catenulatum	Prestop	64137-11

US EPA Registered OMRI-Listed Alternatives ¹				
to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and				
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	FPA Reg No
Crop Group 13	Berries and Small Fr	uits: Strawberries / Phomonsis Leaf Spot (I	Rlight) (Phomonsis of	erans)
Non-synthetic		Pevpoutria sachalinensis extract	Pegalia	84059-3
Non-synthetic		Aurophasidojum pullulars strains DSM	Botector	86174-3
Non-synthetic		14940 and DSM 19941	Dotector	00174-3
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051
Synthetic	M1	Cupric hydroxide	Nu-Cop 50 DF	45002-4
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539
Crop Group 13	: Berries and Small Fr	uits: Strawberries / Phomopsis Fruit Rot (<i>F</i>	Phomopsis obscurans)	
Non-synthetic	NC; Biological	<i>Aureobasidoium pullulans</i> strains DSM 14940 and DSM 19941	Botector	86174-3
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539
Crop Group 13	: Berries and Small Fr	uits: Strawberries / Powdery Mildew (Pode	osphaera aphanis, Sph	acelotheca sp.)
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114
Non-synthetic	44	Bacillus amyloliquefaciens strain MBI 600	Serifel	71840-18
Non-synthetic	44	Bacillus pumilus strain QST 2808	Sonata	264-1153
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade ASO	264-1152
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Max	264-1151
Non-synthetic	44	Bacillus subtilis strain QST 713	Serenade Optimum	264-1160
Non-synthetic	NC; Biochemical	Rhamnolipid biosurfactant	Zonix	72431-1
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1
Non-synthetic	NC; Botanical oil	Neem oil	Trilogy	70051-2
Non-synthetic	NC; Botanical oil	Cinnamon oil	Cinnerate	NA; 25(b)
Non-synthetic	NC; Botanical oil	Garlic oil, Cottonseed oil, Corn oil	Mildew Cure	NA; 25(b)
Non-synthetic	NC; Botanical oil	Clove oil, Rosemary oil, Peppermint oil	BacStop	NA; 25(b)
Non-synthetic	NC; Botanical oil	Rosemary oil, Clove oil, Thyme oil	Sporatec	NA; 25(b)
Non-synthetic	NC; Botanical oil	Soybean oil	Golden Pest Spray	57538-11
Synthetic	M1	Copper octanoate	Cueva	67702-2-70051
Synthetic	M2	Sulfur	Acoidal	62562-4
Synthetic	M2	Sulfur	Cosavet-DF	70905-1
Synthetic	M2	Sulfur	Defend DF	62562-8
Synthetic	M2	Sulfur	Kumulus DF	51306-352-66330
Synthetic	M2	Sulfur	Micro Sulf	55146-75
Synthetic	M2	Sulfur	Microthiol Disperss	70506-187
Synthetic	M2	Sulfur	Thiolux	34704-1079
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	EcoMate Armicarb O	5905-541
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Kaligreen	70231-1
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70871-1-68539
Synthetic	NC; Inorganic salt	Potassium silicate	Sil-Matrix	82100-1
Synthetic	NC; Organic salt	Potassium salts of fatty acids	M-Pede	10163-324
Synthetic	NC; Organic salt	Insecticidal soap	Des-X	67702-22-70051
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2
Synthetic	NC; Oxidizing agent	Hydrogen peroxide, Hydrogen dioxide	Perpose Plus	86729-1

US EPA Registered OMRI-Listed Alternatives ¹ to Veggieturbo 5SC Suspension Concentrate Fungicide (EPA Reg. No. 68173-4) and					
	Ĺ	JSO 5%SC FUNGICIDE (EPA Reg. NO. 68173-4-	70051)		
NOP Status	FRAC ^A Code(s)	Active Ingredient(s)	Product	EPA Reg. No.	
Synthetic	NC; Petroleum oil	Mineral oil	Glacial Spray Liquid	34704-849	
Synthetic	NC; Petroleum oil	Mineral oil	JMS Stylet Oil	65564-1	
Synthetic	NC; Petroleum oil	Mineral oil	Omni Supreme Spray	5905-368	
Synthetic	NC; Petroleum oil	Mineral oil	PureSpray Green	69526-9	
Synthetic	NC; Petroleum oil	Mineral oil	SuffOil-X	48813-1-68539	
Synthetic	NC; Petroleum oil	Mineral oil	TriTek	48813-1	
Crop Group 19	Crop Group 19: Herbs and Spices : Basil / Downy Mildew (Peronospora belbahrii)				
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel 55	70051-108	
Non-synthetic	44	Bacillus amyloliquefaciens strain D747	Double Nickel LC	70051-114	
Non-synthetic	Р5	Reynoutria sachalinensis extract	Regalia	84059-3	
Non-synthetic	NC; Biological	Streptomyces lydicus WYEC	Actinovate	73314-1	
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Agricure	70870-1	
Synthetic	NC; Inorganic salt	Potassium bicarbonate	Milstop	70870-1-68539	
Synthetic	NC; Oxidizing agent	Hydrogen dioxide, Peroxyacetic acid	Oxidate	70299-2	
1. Botector (FPA Reg. No. 86174-3), based upon the January 5, 2018 FPA accepted label, is approved by NOP for use					

 <u>Botector</u> (EPA Reg. No. 86174-3), based upon the January 5, 2018 EPA accepted label, is approved by NOP for use in organic production. No OMRI listing is noted. Nonetheless, Botector is included in the above table. <u>Fracture</u> (EPA Reg. No. 84876-1-279) is a biopesticide but is <u>not</u> currently OMRI-listed based upon information on the Internet.

For alternative products for other crop/disease combinations, please see the May 31, 2016 petition Overview of OMRI-Listed Alternatives section beginning on page 50.

Though the list of US EPA registered OMRI-listed alternatives is long, <u>the list of US EPA</u> registered OMRI-listed alternatives with comparable or superior efficacy is short.

Based upon <u>disease significance and efficacy data alone</u>, there is <u>organic grower need</u> for the polyoxin D zinc salt 5SC formulation (a.k.a. Oso) for treatment of:

- <u>Blueberries</u> for control of Alternaria blight (*Alternaria* spp.) and Botrytis blight (*Botrytis cinerea*);
- <u>Caneberries</u> for control of Botrytis fruit rot (*Botrytis cinerea*) and powdery mildew (*Podosphaera aphanais*);
- <u>Cranberries</u> for control of cottonball (Monilinia oxycocci) and fruit rot complex (*Coleophoma empetri, Colletotrichum acutatum, Colletotrichum gloeosporioides, Phyllosticta vaccinii,* and *Physalospora vaccinii,* etc.);
- <u>Grapes</u> for control of Phomopsis fruit rot (*Phomopsis viticola*);
- <u>Strawberries</u> for control of anthracnose fruit rot (*Colletotrichum acutatum*), gray mold (*Botrytis cinerea*), leather rot (*Phytophthora cactorum*), and Phomopsis fruit rot (soft rot) (*Phomopsis obscurans*); and
- <u>Basil</u> for control of downy mildew (*Peronospora belbahrii*).

OMRI-listed alternatives initially identified as having comparable or superior efficacy and therefore identified for more detailed comparisons were:

- <u>Blueberries/mummyberry (*Monilinia vaccinii-corymbosi*)</u>: Optiva;
- <u>Grapes black rot (*Guignardia bodwellii*)</u>: Badge X2 and Nu-Cop 50 WP;
- <u>Grapes/bunch rot (Botrytis cinerea)</u>: Double Nickel 55 and Double Nickel LC;
- <u>Grapes/downy mildew (*Plasmopara viticola*)</u>: Badge X2, Cueva, and Oxidate;
- <u>Grapes/powdery mildew (*Erysiphe necator*)</u>: Micro Sulf, Lifegard WG and Stargus; and
- <u>Strawberries/Phomopsis leaf spot (Phomopsis obscurans)</u>: Cueva.

Based upon <u>efficacy data and other considerations</u>, there is <u>organic grower need</u> for the polyoxin D zinc salt 5SC formulation (a.k.a. Oso) for treatment of:

- <u>Blueberries for control of mummyberry (Monilinia vaccinii-corymbosi)</u>.
 Compared to Optiva, the polyoxin D zinc salt 5SC formulation offers organic blueberry growers:
 - Competitive efficacy for control of mummyberry;
 - Competitive worker and environmental safety;
 - A treatment option *after* mummyberry is first observed;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- Grapes for the control of black rot (*Guignardia bodwellii*). Compared to Badge X2 and Nu-Cop 50 WP, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive efficacy for control of black rot;
 - Greater crop, worker, and environmental safety;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop (0-day PHI instead of 1-day; 4hour worker re-entry interval instead of 48-hours or 24-hours);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grapes for the control of bunch rot (*Botrytis cinerea*)</u>. Compared to Double Nickel 55 and Double Nickel LC, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of bunch rot;
 - A treatment option <u>after</u> bunch rot is first observed;
 - Competitive worker and environmental safety;
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

- <u>Grapes for the control of downy mildew (*Plasmopara viticola*)</u>. Compared to Badge X2, Cueva, and Oxidate, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of downy mildew;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Greater to significantly greater crop, worker, and environmental safety;
 - Reduced (EPA's minimum) personal protective equipment requirement;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Grapes for control of powdery mildew (*Erysiphe necator*)</u>. Compared to Micro Sulf, Lifegard WG and Stargus, the polyoxin D zinc salt 5SC formulation offers organic grape growers:
 - Competitive or superior efficacy for control of powdery mildew;
 - A treatment option *after* powdery mildew is first observed;
 - An opportunity to reduce the amount of copper applied to their vineyards and thereby reduce the negative effects of copper on soil;
 - Competitive or superior crop, worker, and environmental safety;
 - Greater flexibility in growing the crop [0-day PHI instead of 1-day PHI; 4-hour worker re-entry interval instead of 48 hours (Badge X2)];
 - Increased applicator comfort (no respirator is required as is required for Lifegard WG and Stargus);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.
- <u>Strawberries for control of Phomopsis leaf spot (Phomopsis obscurans)</u>. Compared to Cueva, the polyoxin D zinc salt 5SC formulation offers organic strawberry growers:
 - Competitive efficacy for control of Phomopsis leaf spot;
 - A treatment option *after* Phomopsis leaf spot is first observed;
 - Competitive or superior crop, worker, and environmental safety;
 - Increased applicator comfort (no respirator is required as for Serifel);
 - A reduced risk product with a new non-toxic mode of action for use in resistance management and integrated pest management (IPM); and
 - Opportunities for export of the treated crop to Canada, Mexico, New Zealand, South Korea, Taiwan, and a growing list of additional countries.

Please note:

- For scheduling reasons, this analysis is limited to berries and small fruits and basil. Similar results are anticipated if other crop/disease combinations were analyzed.
- There is no EPA registered, OMRI-listed alternative for treatment of cranberries for control of cottonball (*Monilinia oxycocci*).

Please also note:

- The polyoxin D zinc salt 5SC formulation has been demonstrated to *improve* the performance of:
 - Double Nickel LC (containing *Bacillus amyloliquefaciens* strain D747; FRAC Code 44).
 - Actinovate (containing *Streptomyces lydicus* WYEC 108; no FRAC Code; biological);
 - Regalia (containing *Reynoutria sachalinensis* extract; FRAC Code P5); and
 - NovaSource's Lime-Sulfur (containing calcium polysulfide; FRAC Code M2).
- Polyoxin D zinc salt stops the growth of sensitive fungi. Therefore, Kaken does not recommend the use of polyoxin D zinc salt as a tank-mix partner or as part of the treatment program with products containing *Trichoderma* species [(Bio-Tam (EPA Reg. No. 80289-9), Rootshield Plus WP (EPA Reg. No. 68539-9) and Rootshield Plus Granules (EPA Reg. No. 68539-10)].

12. Describe any alternative practices that would make the use of the petitioned substance unnecessary.

For all uses of the polyoxin D zinc salt 5SC formulation included in this addendum with at least one OMRI-listed alternative product for the specified crop/disease combination, excluding strawberry/leather rot, there are OMRI-listed <u>synthetic</u> alternative products. Therefore, with the exception of strawberry/leather rot, NOP has determined that cultural practices alone are <u>not</u> sufficient to address organic grower needs.

CRITERIA

7 USC §6517(c)(1) states:

"<u>Exemption for prohibited substances in organic production and handling operations</u> The National List may provide for the use of substances in an organic farming or handling operation that are otherwise prohibited under this chapter only if—

- (A) the Secretary determines, in consultation with the Secretary of Health and Human Services and the Administrator of the Environmental Protection Agency, that the use of such substances—
 - (i) would not be harmful to human health or the environment;
 - (ii) is necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products; and
 - (iii) is consistent with organic farming and handling."

Kaken proposed that polyoxin D zinc salt:

- Would not be harmful to human health or the environment;
- Is necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products;
- Is consistent with organic farming and handling; and
- Therefore qualifies for addition to 7 CFR \$205.601(i) as a synthetic substance allowed for use in organic crop production as plant disease control.

LEVEL PLAYING FIELD

Kaken proposes that the National Organic Standards Board and the National Organic Program should have a level playing field when considering proposed additions to the list of synthetic substances allowed for use in organic crop production. The criteria used in the evaluation of polyoxin D zinc salt should be no more restrictive than those applied to the synthetic substances currently listed in 7 CFR \$205.601(i) as permitted in organic agriculture for use on crops as plant disease control.

APPENDIX 1: VEGGIETURBO 5SC SUSPENSION CONCENTRATE FUNGICIDE EPA ACCEPTED LABEL (JANUARY 3, 2018)
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068173-00004.20171218.Changes_IMPLEMENTED.pdf VEGGIETURBO 5SC (EPA File Symbol 68173-4) • Page 2 of 23 December 18, 2017 Proposed Master Label Fast-Track Amendment Based upon the May 16, 2017 EPA accepted label. Updated resistance management. Cucurbit, stone fruit, and grape/berries new disease claims and new/edited application details. "Not for use in California" statements added (artichoke, banana/plantain, ginseng, sugar beets).

[Back Panel]

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS & DOMESTIC ANIMALS

Caution. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Avoid contact with skin and clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

Optional Statements (EPA Category IV toxicity for acute oral, acute dermal, acute inhalation, eye irritation and dermal irritation)			
	FIRST AID		
IF ON SKIN OR CLOTHING:	 Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. 		
IF IN EYES:	 Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for further treatment advice. 		
IF SWALLOWED:	 Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything to an unconscious person. 		
IF INHALED:	 Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice. 		
Have the product treatment.	Have the product container or label with you when calling a poison control center or doctor, or going for treatment.		

HOTLINE NUMBER: 1-800-255-3924

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All mixers, loaders, applicators and other handlers must wear:

- Long-sleeved shirt and long pants;
- Socks;
- Shoes; and
- Chemical-resistant gloves.

Follow manufacturer's instructions for cleaning and maintaining PPE. If no instructions are available, use detergent and hot water for washables. Keep and wash PPE separately from other laundry.

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides, the handler PPE requirements may be reduced or modified as specified in the WPS.

USER SAFETY RECOMMENDATIONS

Users should:

- Remove clothing/PPE immediately if pesticides get inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

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ENVIRONMENTAL HAZARDS

[For 1 liter, 1 gallon and 2.5 gallon containers:]

For terrestrial use. This pesticide is moderately toxic to aquatic invertebrates and fish. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash water or rinsate. Do not allow runoff into lakes, streams, ponds or public waterways. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Observe the most restrictive labeling limitations and precautions of all products used in mixtures.

[For 1000 liter container:]

For terrestrial use. This pesticide is moderately toxic to aquatic invertebrates and fish. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash water or rinsate. Do not allow runoff into lakes, streams, ponds or public waterways. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Observe the most restrictive labeling limitations and precautions of all products used in mixtures. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

GENERAL INFORMATION

VEGGIETURBO 5SC can be applied as a preventative or curative treatment in conjunction with good management practices.

VEGGIETURBO 5SC can be used alone or, when diseases not specified on this label are present or expected, in combination and/or rotation with other appropriately labeled fungicides as a tool for integrated disease management in labeled agricultural crops. See "Mixing and Handling Instructions" below for additional information.

Preharvest Interval (PHI) = 0 days. VEGGIETURBO 5SC is exempt from the requirement for residue tolerance and therefore can be applied up to and including the day of harvest.

RESISTANCE MANAGEMENT RECOMMENDATIONS

This product contains a Group 19 fungicide. Any fungal population may contain individuals naturally resistant to this product and other Group 19 fungicides. A gradual or total loss of pest control may occur over time if these fungicides are used repeatedly in the same fields. Appropriate resistance management strategies should be followed. To delay fungicide resistance, take one or more of the following steps:

- Rotate the use of this product or other Group 19 fungicides within a growing season sequence with different groups that control the same pathogens. Avoid application of more than the specified maximum number of applications and 2 consecutive sprays of this product or other fungicides in the same group in a season.
- Use tank mixtures with fungicide from a different group that are equally effective on the target pest when such use is permitted. Use at least the minimum application rate as labeled by the manufacturer.
- Adopt an integrated disease management program for fungicide use that includes scouting, uses historical
 information related to pesticide use, and crop rotation, and which considers host plant resistance, impact of
 environmental conditions on disease development, disease thresholds, as well as cultural, biological and other
 chemical control practices.
- Where possible, make use of predictive disease models to effectively time fungicide applications. Note that using predictive models alone is not sufficient to manage resistance.
- Monitor treated fungal populations for resistance development.
- Contact your local extension specialist or certified crop advisor for any additional pesticide resistance management and/or IPM recommendations for specific crops and pathogens.
- For further information or to report suspected resistance contact your pesticide distributor or university extension specialist.

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DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

For any requirements specific to your State or Tribe, consult the State or Tribal agency responsible for pesticide regulation.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

AGRICULTURAL USE REQUIREMENTS

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

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours unless wearing appropriate PPE.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil or water is: coveralls, socks, shoes, and chemical-resistant gloves.

MIXING AND APPLICATION INSTRUCTIONS

VEGGIETURBO 5SC may be applied by ground or aerial spray equipment, as a soil drench, or by chemigation through sprinklers or drip irrigation. See the table below for information on application methods and timing for specific crops and diseases.

For spray application, mix VEGGIETURBO 5SC in water and apply as a spray to foliage, fruit, or other above-ground plant parts. For optimum control of labeled diseases, apply in sufficient volume of water to provide thorough coverage with minimal run-off.

See "Chemigation Instructions" below for information about applying VEGGIETURBO 5SC through irrigation systems.

[For 1 quart, 1 gallon and 2.5 gallon containers:]

- Mixing instructions for VEGGIETURBO 5SC:
 - Shake well before use.
 - Fill tank with water to ½ of the intended final volume.
 - Start agitation of the spray tank.
 - Add the appropriate amount of product to the tank according to the rates in this label.
 - Agitate to ensure thorough mixing while adding the remaining required water.
 - Do not allow the mixture to stand without agitation.
 - Mix only the amount of solution needed to treat the desired area.

[For 1000 Liter container:] Thoroughly agitate product when product is in use.

When tank mixing VEGGIETURBO 5SC with other products, observe all precautions and limitations on each separate product label.

068173-00004.20171218.Changes_IMPLEMENTED.pdf VEGGIETURBO 5SC (EPA File Symbol 68173-4) • Page 5 of 23 December 18, 2017 Proposed Master Label Fast-Track Amendment Based upon the May 16, 2017 EPA accepted label. Updated resistance management. Cucurbit, stone fruit, and grape/berries new disease claims and new/edited application details. "Not for use in California" statements added (artichoke, banana/plantain, ginseng, sugar beets).

When planning to mix this product with others, it advisable to conduct a "jar test" to determine the physical compatibility of this product with the others. Using a quart jar, add the products (with agitation) to approximately one quart of water in the proportions they will appear in the final mixture. Add dry formulations first, followed by flowables, then emulsifiable concentrates like VEGGIETURBO 5SC last. After thorough mixing, allow this mixture to stand for 5 minutes. If the combination remains mixed or can be readily remixed, it is physically compatible. Once compatibility has been proven, use the same sequence for adding required ingredients to the tank.

To assess the potential for phytotoxicity, test tank mixtures on a small number of plants prior to more widespread application.

If more applications or shorter intervals than indicated in the table below are needed to maintain disease control, alternate VEGGIETURBO 5SC with other fungicides having different modes of action to avoid or slow development of pathogen resistance. See "Resistance Management Recommendations" above for more information.

Use of an adjuvant may enhance spray coverage of dense crop canopy, or plants that are difficult to wet due to waxy or hairy surfaces. Use only adjuvants that are labeled for such uses. Refer to "Mixing and Application Instructions" above for information on testing physical compatibility of VEGGIETURBO 5SC with other products.

BANDED (IN-FURROW) APPLICATION

Use the table below to determine the correct application rate in fluid ounces of product per 1,000 row feet based on row spacing and desired rate per acre. Mix the required amount of VEGGIETURBO 5SC in water and apply as banded spray (4" to 6" wide) or seedline drench centered over the planting furrow. Apply to soil immediately before seeding or directly over seeds in the furrow just before they are covered with soil. The volume of water required per acre or per 1,000 row feet will depend on the application equipment used. Consult your local cooperative extension service if you need assistance calibrating band spraying equipment.

Rates for banded (in-furrow) application: Find desired application rate in the left column. Read across the line to the correct row spacing indicated at the top to find the number of fluid ounces per 1000 row feet that will provide the desired application rate per acre.

Fluid	Fluid ounces per 1000 row feet														
0Z.	Space between rows (inches)														
acre	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
6.50	0.15	0.17	0.20	0.22	0.25	0.27	0.30	0.32	0.35	0.37	0.40	0.42	0.45	0.47	0.50
13.00	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	0.99

CHEMIGATION INSTRUCTIONS

GENERAL INFORMATION:

- Apply this product only through pressurized irrigation systems such as sprinkler irrigation including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move; or drip (trickle) irrigation systems. Do not apply this product through any other type of irrigation system.
- · Crop injury or lack of effectiveness can result from non-uniform distribution of treated water.
- If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts.
- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place.
- A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.
- Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
- Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, back
 flow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide
 introduction. As an option to the RPZ, the water from the public water system should be discharged into a
 reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the
 outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter
 of the fill pipe.

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- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection.
- The pesticide injection pipeline must contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Do not apply when wind speed favors drift beyond the area intended for treatment.
- Dilute the product in water following the label mixing directions. It may be premixed in a supply tank with water, fertilizer or other appropriate tank-mixed agricultural chemicals. Agitation is necessary. Apply to moderately moist soils. Use volumes that thoroughly wet the soil but that do not cause significant runoff or excessive drip from pots. Application should be continuous in sufficient water to apply the recommended rate evenly to the entire treated area.
- Remove scale, pesticide residues, and other foreign matter from the chemical supply tank and injector system and flush with clean water before use. Failure to provide a clean tank, free of scale or residues may reduce effectiveness of this product.

DRIP (TRICKLE) AND MICRO-IRRIGATION CHEMIGATION:

- The system must contain a functional check valve, vacuum relief valve and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Dilute the product in water following the label mixing directions. It may be premixed in a supply tank with water, fertilizer, or other appropriate tank-mixed agricultural chemicals. Agitation is necessary. Apply to moderately moist soils. Use volumes that thoroughly wet the soil but that do not cause significant runoff or excessive drip from pots. Application should be continuous in sufficient water to apply the recommended rate evenly to the entire treated area.

SPRINKLER CHEMIGATION:

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

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- Dilute the product in water following the label mixing directions. It may be premixed in a supply tank with water, fertilizer or other appropriate tank-mixed agricultural chemicals. Agitation is necessary. Apply to moderately moist soils. Use volumes that thoroughly wet the soil but that do not cause significant runoff or excessive drip from pots. Application should be continuous in sufficient water to apply the recommended rate evenly to the entire treated area.
- Do not apply when wind speed favors drift beyond the area intended for treatment.

CROP GROUP 1: ROOT AND TUBER VEGETABLES: Carrots and Parsnips				
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION		
Alternaria leaf blight (Alternaria dauci)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Begin applications soon after plant emergence and repeat on 7-14 day interval as long as conditions favor disease development.		
Cercospora leaf blight (<i>Cercospora carotae</i>)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Apply as a foliar spray in sufficient water to achieve thorough coverage of all above- ground		
Powdery mildew (Erysiphe polygoni)		plant parts. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.		
Rhizoctonia crown rot and leaf blight (<i>Rhizoctonia solani</i>)				
A rate of 6.5 fl. oz./acre may be us disease pressure, or in a tank mix	ed for preventative application with other fungicides for resi	ons before onset of visible disease, in periods of low stance management. Otherwise, use a rate of 13.0		

fl. oz./acre.

CROP GROUP 1: ROOT AND TUBER VEGETABLES: Ginseng †					
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION			
Alternaria blight (Alternaria panax)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as foliar spray every 7-10 days beginning within 2 weeks after plant emergence, prior to disease development (consult local extension			
Botrytis blight (<i>Botrytis cinerea</i>)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	service for advice on timing against these diseases). Continue throughout the season as needed to maintain control.			
Cylindrocarpon root rot (Cylindrocarpon destructans)		Apply as soil drench every 14-28 days, beginning within 2 weeks after plant emergence.			
Rhizoctonia root and crown rot (<i>Rhizoctonia solani</i>)					
A rate of 6.5 fl. oz./acre may be use	A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low				

disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.

Not for use in California.

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CROP GROUP 1: ROOT AND TUBER VEGETABLES: Potatoes						
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION				
Black scurf (<i>Rhizoctonia solani</i>)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre) Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Apply as banded spray in-furrow at planting, either just before placement of seed pieces or over seed pieces before covering with soil. See additional instructions under BANDED (IN-FURROW) APPLICATION.				
Early blight (Alternaria solani) Late blight (Phytophthora infestans)*		Apply as a foliar spray in sufficient water to provide thorough coverage of all foliage. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information. Begin as a preventative application and continue on a 7-14 day interval as needed to maintain control.				
White mold (<i>Sclerotinia sclerotiorum</i>)		Apply in 30 - 50 gallons of water per acre as a directed spray toward soil surface, lower leaves, and stems. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.				

* Suppression only. A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.

CR	OP GROUP 1: ROOT AND TU Sugar Beet †	BER VEGETABLES:
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Cercospora leaf spot (<i>Cercospora beticola</i>)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre) Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Begin applications at first sign of disease symptoms and repeat on 7-14 day interval as long as conditions favor disease development. Apply as a foliar spray in sufficient water to achieve thorough coverage of all above- ground plant parts. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.
Rhizoctonia crown and root rot (<i>Rhizoctonia solani</i>)		Apply as banded spray or drench in seed furrow at planting. See additional instructions below for banded application rates. Can also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information. Make subsequent applications at 7-14 day intervals either through chemigation, or as a spray/drench directed at the base of each plant.

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Chive, Daylily, Elegans hosta, Fritillaria, Garlic, Kurrat, Lady's leek, Leek, Lily, Onion, Shallot, Cultivars, varieties, and/or hybrids of these					
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION			
Alternaria blight and Purple blotch (<i>Alternaria</i> spp.)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre) Do not apply more than	Apply as foliar preventative spray (ground, aerial, or through overhead sprinklers) before disease onset and continue at 7-14 day intervals as needed to maintain control. Coverage may be enhanced by			
Botrytis leaf blight /Leaf spot/Neck rot (<i>Botrytis</i> spp.)	4.2 oz. a.i./acre/season (6 appl. at max. rate).	use of a spray adjuvant.			
Downy mildew (<i>Peronospora</i> spp.)*					
Rust (Puccinia alii or Puccinia porri)					

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CROP GROUP 4: LEAFY VEGETABLES (EXCEPT BRASSICA VEGETABLES):				
Amaranth, Arugula (garden rocket), Asparagus chicory, Beet greens (spinach beet), Borage, Catalogna,				
Celery, Chard, Chaya, Chicory, Colocasia, Corn salad (mâche), Dandelion, Endive, Escarole, Fenugreek,				
Garden cress, Ground-elder, Kailan, Lettuce (Head, Leaf, Iceberg, Romaine), Mizuna, Purslane, Radichetta,				
Radicchio, Sorrel, Spinach, Spin	ach beet (beet greens), Spr	ing greens (Spring mix), Stinging nettle, Tatsoi,		
Tropaeolum (Nasturtium), Tu	rnip greens, Watercress (Na	sturtium), Water spinach (ong choy), Yarrow		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION		
Alternaria leaf spot	6.5 - 13.0 fl. oz./acre	Begin applications soon after plant emergence or		
(Alternaria spp.)	(0.42 - 0.72 oz. a.i./acre)	transplanting and repeat on 7-14 day interval as long as conditions favor disease development.		
Downy mildew	Do not apply more than			
(Bremia lactucae and	4.2 oz. a.i./acre/season	Apply as a foliar spray in sufficient water to		
Peronospora spp.)*	(6 appl. at max. rate).	achieve thorough coverage of all above- ground plant parts.		
Powdery mildew				
(Golovinomyces (Erysiphe)				
cichoracearum)				
White rust				
(Albugo occidentalis)				
Botrytis damping off		Apply as banded spray (4-6" wide) over the seed		
(Botrytis spp.)		furrow at planting or transplanting. See additional		
× 5 11 /		instructions under BANDED (IN-FURROW)		
		APPLICATION.		
Botrytis leaf blight,		Begin preventative foliar applications when		
Botrytis rot		conditions favor disease development and continue		
(Botrytis spp.)		at 7-14 day intervals as long as needed to maintain		
		control.		
Bottom rot		Apply in 30 - 50 gallons of water per acre as a		
(Rhizoctonia solani)		directed spray toward soil surface and lower		
		leaves.		
		Pagin applications at head formation before		
		begin applications at near formation, before		
		as needed to maintain control.		
Lettuce drop		Apply in 30 - 50 gallons of water per acre as a		
(Sclerotinia spp.)		directed spray toward soil surface and lower		
(0010101		leaves.		
		Make first application to direct-seeded lettuce		
		immediately after emergence. For transplanted		
		lettuce, make first application immediately after		
		transplanting. In both cases, apply prior to disease		
		development. Apply again if soil is disturbed by		
		cultivation or thinning and conditions continue to		
		ravor disease development.		

Suppression only.

 May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.

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CROP GROUP 5: BRASSICA (COLE) LEAFY VEGETABLES: Broccoli, Broccoli raab, Brussels Sprouts, Cabbage, Chinese broccoli, Chinese Cabbage (Bok Choi, Napa, Gai choy), Cauliflower, Cavalo broccolo, Collards, Kale, Kohlrabi, Mizuna, Mustard Greens, Mustard spinach, Pape greens					
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION			
Alternaria leaf spot (Alternaria spp.)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a foliar spray in sufficient water to attain thorough coverage. Use of an adjuvant may enhance spray coverage, especially of waxy leaves.			
Anthracnose (<i>Colletotrichum</i> spp.)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Begin preventive sprays when conditions favor disease development, and continue on a 7-14 day			
Gray mold (Botrytis cinerea)		spray interval as needed.			
White spot (<i>Cercosporella</i> spp.)					
Bottom rot (<i>Rhizoctonia solani</i>)		Apply in 30 - 50 gallons of water per acre as a directed spray toward soil surface and lower leaves.			
Sclerotinia rot (Sclerotinia sclerotiorum)		Begin applications at head formation, before leaves contact the ground. Repeat every 7-14 days as needed to maintain control.			
A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.					

Bean (Lupines spp.), Bean (<i>Phase</i> bean, Runner bean, Snap be Asparagus bean, Blackeyed pea, Southern pea, Urd bean, Yar Jackbean, Lablab bean (hyacinth pea, Field pea, Garden pea, G	OP 6: LEGUME VEGETABLES solus spp., including Field b an, Tepary bean, Wax bean Catjang, Chinese longbean, dlong bean) Broad bean (Fa bean), Lentil, Pea (<i>Pisum</i> sj reen pea, Snow pea, Sugar	ean, Kidney bean, Lima bean, Navy bean, Pinto), Bean (<i>Vigna</i> spp., including Adzuki bean, Cowpea, Crowder pea, Moth bean, Mung bean, Iva bean), Chickpea (Garbanzo bean), Guar, pp., including Dwarf pea, Edible pod pea, English snap pea), Pigeon pea, Soybean, Sward bean.
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Asian Soybean Rust (Phakopsora pachyrhizi)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Begin applications at first sign of disease symptoms and repeat on 7-14 day interval as long as conditions favor disease development.
Gray mold (<i>Botrytis cinerea</i>)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Apply as a foliar spray in sufficient water to achieve thorough coverage of all above- ground
Powdery mildew (<i>Erysiphe pisi</i>)		plant parts. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.
Stem rot / White mold (Sclerotinia sclerotiorum)		Apply in 30 - 50 gallons of water per acre as a directed spray toward soil surface, lower leaves, and stems. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.
A rate of 6.5 fl. oz./acre may be use disease pressure, or in a tank mix v fl. oz./acre.	ed for preventative application vith other fungicides for resis	ons before onset of visible disease, in periods of low stance management. Otherwise, use a rate of 13.0

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CROP GROUP 8: FRUITING VEGETABLES:		
Eggplant, Ground	Icherry, Peppers (all types),	Tomatillo, Tomatoes (all types)
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Anthracnose (<i>Colletotrichum</i> spp.)*	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a preventative foliar spray when conditions favor disease development. Repeat application at 7-14 day intervals as needed during
Early blight (Alternaria solani)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max_rate)	infection periods. Mix in sufficient water to attain thorough coverage of foliage and fruit (if present).
Gray mold/Botrytis rot (<i>Botrytis</i> spp.)		
Late blight* (Phytophthera infestans)		
Leaf mold (Fulvia (Cladosporium) fulvum, also known as Passalora fulva)		
Powdery mildew (<i>Leveillula, Oidiopsis, Erysiphe</i> , and <i>Sphaerotheca</i> spp.)		
Target spot (Corynespora cossiicola)*		
Southern blight (<i>Sclerotium rolfsil</i>)*		See additional instructions under BANDED (IN- FURROW) APPLICATION.
Verticillium wilt (<i>Verticillium dahliae</i>)*		Can also be applied through surface (not buried) drip or overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.
		Make subsequent applications at 7-14 day intervals either through surface drip or overhead sprinkler irrigation, or as a spray/drench directed at the base of each plant.

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CROP GROUP 9: CUCURBIT VEGETABLES:

Chayote (fruit), Chinese waxgourd (Chinese preserving melon), Citron melon, Cucumber, Gherkin, Gourd (edible, including hyotan, cucuzza, hechima, Chinese okra), *Momordica* spp. (includes balsam apple, balsam pear, bitter melon, Chinese cucumber), Muskmelon (includes true cantaloupe, cantaloupe, casaba, crenshaw melon, golden pershaw melon, honeydew melon, honey balls, mango melon, Persian melon, pineapple melon, Santa Claus melon, and snake melon), Pumpkin, Squash (including acorn squash, butternut squash, calabaza, crookneck squash, hubbard squash, scallop squash, spaghetti squash, straightneck squash, vegetable marrow, zucchini), Watermelon, Hybrids and varieties of these

DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Anthracnose (Colletotrichum orbiculare)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Mix in sufficient volume of water for good spray coverage (typically 50-100 gallons per acre).
Downy mildew (Pseudoperonospora cubensis)*	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Begin preventive sprays when conditions favor disease development, and continue on a 7-14 day spray interval as needed.
Early blight (<i>Alternaria</i> sp.)		For <i>Downy mildew</i> , begin preventive sprays when conditions favor disease development, and continue on a 5-8 day spray interval as needed.
Gray mold (<i>Botrytis</i> sp.)		
Gummy stem blight (<i>Didymella bryoniae</i> and <i>Phoma cucurbitacearum</i>)		
Powdery mildew (<i>Erysiphe</i> and <i>Sphaerotheca</i> spp. and <i>Podosphaera xanthii</i>)		
Scab (<i>Cladosporium</i> sp.)		
Target leaf spot/Corynespora leaf spot/ Corynespora blight (Corynespora crassiicola)		
Southern blight (<i>Sclerotium rolfsii</i>)		See additional instructions under BANDED (IN- FURROW) APPLICATION.
		Can also be applied through surface (not buried) drip or overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.
		Make subsequent applications at 7-14 day intervals either through surface drip or overhead sprinkler irrigation, or as a spray/drench directed at the base of each plant.

* Suppression only.

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Calamondin, Citron, Citrus hybr Lime, Mand	CROP GROUP 10: CITRI ids (Chironja, Tangelo, Tang arin (Tangerine), Orange, Pu	JS FRUITS: jor), Clementine, Grapefruit, Kumquat, Lemon, ummelo, Sutsuma mandarin
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Alternaria brown spot (Alternaria alternata)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre) Do not apply more than	Apply as preventative foliar spray before disease development, when spring flush is ½ to ½ expanded. If needed, make second application to fully expanded flush.
Botrytis rot (<i>Botrytis cinerea</i>)	4.2 oz. a.i./acre/season (6 appl. at max. rate).	Begin preventative applications during bloom when rain or fog is expected. Repeat every 7-14 days as long as conditions favoring disease persist.
Septoria spot (<i>Septoria citri</i>)		Apply as a preventative spray in late fall or early winter, just before or after the first rain. Additional applications may be necessary during seasons of heavy rainfall.
A rate of 6.5 fl. oz./acre may be us disease pressure, or in a tank mix fl. oz./acre.	ed for preventative application with other fungicides for resi	ons before onset of visible disease, in periods of low stance management. Otherwise, use a rate of 13.0

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CROP GROUP 11: POME FRUITS: Apple, Crabapple, Loquat, Mayhaw, Pear, Quince		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Alternaria leaf spot (Alternaria mali)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as foliar spray in sufficient water to attain thorough coverage of foliage and fruit.
Leaf blotch (<i>Diplocarpon mali</i>) Powdery mildew	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	For <i>Powdery mildew</i> control, begin as preventative and repeat on 7-14 day interval as needed. Use in an alternating program with a sterol inhibitor (DMI) fungicide.
(Podospnaera leucotricna, Phyllactinia mali)		For <u>Scab suppression</u> , begin sprays at green tip and continue every 7-10 days as needed.
Scab (Venturia spp.)*		
disease pressure, or in a tank mix v fl. oz./acre. Alternaria rot	6.5 fl. oz./acre	stance management. Otherwise, use a rate of 13.0 Begin applications prior to disease development
Alternaria rot	6.5 fl. oz./acre	Begin applications prior to disease development.
(Alternaria tenuis)	(0.42 - 0.36 oz. a.i./acre)	Repeat at 7-10 day interval as needed.
Bitter rot (Glomerella cingulata)	Do not apply more than 2.16 oz. a.i./acre/season (6 appl. at max_rate).	May be applied from green-tip to day of harvest.
Cedar apple rust** (Gymnosporangium juniperi-virginianae)	(**************************************	
Flyspeck (<i>Schizothyrium pomi</i> , formerly <i>Microthyriella rubi</i>)		
Sooty blotch (<i>Gloeodes pomigena</i>)		
White rot** (Botryosphaeria dothidea)		
** Suppression only.		

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CROP GROUP 12: STONE FRUITS: Apricot (including Japanese), Capulin, Cherry (including Black, Nanking, Sweet, Tart), Jujube (Chinese), Nectarine, Peach, Plum (including American, Beach, Canada, Cherry, Chickasaw, Damson, Japanese, Klamath, prune), Plumcot, Sloe, Cultivars, varieties, and/or hybrids of these.		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Botrytis blossom blight (<i>Botrytis cinerea</i>)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as foliar spray in sufficient water to attain thorough coverage of foliage and fruit.
Leaf curl (<i>Taphrina demormans</i>)*	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	For <u>Botrytis blossom blight</u> control, apply at full bloom if wet weather occurs during bloom.
Monilinia brown rot blossom blight Monilinia brown rot fruit rot (<i>Monilinia</i> sp.)		For <i>Leaf curl suppression and <u>Scab</u> suppression, apply preventatively at bud swell. Repeat on 14-28 day intervals as needed.</i>
Powdery mildew (<i>Podosphaera</i> spp., <i>Sphaerotheca pannosa</i>) Scab		For <u>Monilinia brown rot blossom blight and fruit</u> <u>rot</u> control, apply preventatively when conditions favor disease development. Repeat on 7-14 day interval as needed. For preventative control of post-harvest brown rot fruit rot, apply at 6.5 fl. oz./acre up to 3 days pre-harvest.
(Cladosporium carpophilum)*		For <u>Powdery mildew</u> control, begin as preventative and repeat on 7-14 day interval as needed. Use in an alternating program with a sterol inhibitor (DMI) fungicide.

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Alternaria leaf spot and fruit rot (Alternaria spp.)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a foliar spray in sufficient water to provide thorough coverage. Can also be applied through overhead sprinkler irrigation. See
Anthracnose leaf & fruit rot (<i>Colletotrichum</i> spp.)*	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	"Chemigation Instructions" for additional information.
Gray mold/fruit rot/Botrytis blight (<i>Botrytis cinerea</i>)		Begin as a preventative application and continue on a 7-14 day interval as needed to maintain control. For control of <i>Botrytis</i> and other fruit diseases, begin applications at flowering.
Powdery mildew (Sphaerotheca macularis, Erysiphe spp.)		
Yellow rust (<i>Phragmidium rubi-idaei</i>)		

Suppression only.

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CROP GROUP 13-07: BERRIES AND SMALL FRUITS: Blueberries, highbush and lowbush		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Alternaria leaf spot and fruit rot (Alternaria spp.)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a foliar spray in sufficient water to provide thorough coverage. Can also be applied through overhead sprinkler irrigation. See
Anthracnose leaf & fruit rot (<i>Colletotrichum</i> spp.)*	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	"Chemigation Instructions" for additional information.
Gray mold/fruit rot/Botrytis blight (<i>Botrytis cinerea</i>)		Begin as a preventative application and continue on a 7-14 day interval as needed to maintain control.
Mummyberry (Monilinia vaccinii-corymbosi)		For control of <i><u>Botrytis and other fruit diseases,</u> begin applications at flowering.</i>
Powdery mildew (<i>Sphaerotheca macularis</i> , <i>Erysiphe</i> spp.)		For control of <i><u>Mummyberry</u>, begin applications at early green tip.</i>
* Suppression only.		

A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.

CROP GROUP 13-07: BERRIES AND SMALL FRUITS: Cranberries		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Cottonball (Monilinia oxycocci)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a foliar spray in sufficient water to provide thorough coverage. Can also be applied through overhead sprinkler irrigation. See
Cranberry Fruit Rot Complex (Allantophompsis sp., Botrytis cinerea	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max_rate)	"Chemigation Instructions" for additional information.
Colletotrichum acutatum, Colletotrichum gloeosporioides, Colooppaga ampotri		For <u>Cottonball</u> , begin as a preventative application at 10% bloom. Continue on a 7-14 day interval as needed to maintain control.
<i>Ecoloephoma empetri,</i> <i>Fusicoccum putrefaciens,</i> <u>Glomerella cingulata*,</u> Phomopsis vaccinii, Physalospora vaccinii, Phyllosticta vaccinii)		For <u>Cranberry fruit rot complex</u> , begin as a preventative application at 40% bloom. Continue on a 7-14 day interval as needed to maintain control. For best performance, apply in 20 gallons water/acre.

* Suppression only.

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CROP GROUP 13-07: BERRIES AND SMALL FRUITS: Grapes: For pre-harvest use on all grapes		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Black rot (Guignardia bidwellii)*	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	For <u>Black rot</u> suppression, begin as a preventative spray when shoots are 3-5 inches long. Repeat every 7-14 days as needed to maintain control.
Downy mildew	Do not apply more than	, ,
(Plasmopara viticola)	4.2 oz. a.i./acre/season (6 appl. at max. rate).	For <u>Downy mildew</u> and <u>Phomopsis fruit rot</u> , begin as a preventative spray when shoots are 3-5 inches
Gray mold/bunch rot (<i>Botrytis cinerea</i>)		long. Repeat every 7-14 days as needed to maintain control.
<u>Phomopsis fruit rot</u> (<i>Phomopsis viticola</i>)		For <u>Gray mold / Bunch rot</u> , begin application at early bloom. Apply a maximum of 6 applications per season at a minimum of 7-day intervals. For
Powdery mildew (Erysiphe (Uncinula) necator)		optimal control, include application at version as one of the 6 applications.
		For <i>Powdery mildew</i> , begin as a preventative spray and repeat every 14 days as needed to maintain control.
A rate of 6.5 fl. oz./acre may be us disease pressure, or in a tank mix of fl. oz./acre. * Suppression only.	ed for preventative applicati with other fungicides for resi	ons before onset of visible disease, in periods of low stance management. Otherwise, use a rate of 13.0

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CROP GROUP 13-07: BERRIES AND SMALL FRUITS: Strawberries		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Alternaria leaf spot and fruit rot (Alternaria spp.)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Apply as a foliar spray in sufficient water to provide thorough coverage. Can also be applied through overhead sprinkler irrigation. See
Anthracnose fruit rot (Colletotrichum acutatum, C. dematium)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	"Chemigation Instructions" for additional information.
Common leaf spot (<i>Mycosphaerella fragariae</i>)		<i>Leaf spot, Gray mold, Leather rot, Phomopsis leaf</i> spot and fruit rot, Powdery mildew, and Tan brown rot, begin as a preventative application and
Gray mold/fruit rot/Botrytis blight (<i>Botrytis cinerea</i>)		continue on a 7-14 day interval as needed to maintain control.
Leather rot (Phytophthora cactorum)		application and continue on a 7-10 day spray interval as needed to maintain control.
Phomopsis leaf spot and fruit rot (Phomopsis obscurans)		For control of fruit diseases, begin applications at flowering.
Powdery mildew (<i>Sphaerotheca macularis,</i> <i>Erysiphe</i> spp.)		
Rhizopus soft rot (<i>Rhizopus</i> sp. and <i>Mucor</i> sp.)		
Tan brown rot (<i>Hainesia lythri</i>)		
A rate of 6.5 fl. oz./acre may be use disease pressure, or in a tank mix w	ed for preventative application with other fungicides for resistence of the second s	ons before onset of visible disease, in periods of low stance management. Otherwise, use a rate of 13.0

fl. oz./acre.

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CROP CROUP 19: HERBS AND SPICES T:

Allspice, angelica, anise, anise, star, annatto (seed), balm, basil, borage, burnet, camomile, caper buds, caraway, caraway, black, cardamom, cassia bark, cassia buds, catnip, celery seed, chervil (dried), chive, chive, Chinese, cinnamon, clary, clove buds, coriander leaf (cilantro or Chinese parsley), coriander seed (cilantro), costmary, cilantro (leaf), culantro (seed), cumin, curry (leaf), dill (dillweed), dill (seed), fennel

(common), fennel, Florence (seed), fenugreek, grains of paradise, horehound, hyssop, juniper berry, lavender, lemongrass, lovage (leaf), lovage (seed), mace, marigold, marjoram, mustard (seed), nasturtium, nutmeg, parsley (dried), pennyroyal, pepper, black, pepper, white, poppy (seed), rosemary, rue, saffron, sage, savory, summer and winter, sweet bay, tansy, tarragon, thyme, vanilla, wintergreen, woodruff, and

worntwood.		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Downy mildew (Peronospora spp. and others)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Begin preventive sprays when conditions favor disease development, and continue on a 7-10 day spray interval as needed.
Powdery mildew (<i>Oidium</i> spp. and others)	Do not apply more than 2.2 oz. a.i./acre/season (6 appl. at max. rate).	

Not for use in California.

Product may harm herbs and spices, especially new leaves. Do not apply to herbs and spices without prior testing on a small number of plants.

A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.

CROP GROUP 24: TROPICAL AND SUBTROPICAL FRUIT, INEDIBLE PEEL: Bananas and Plantains *		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Black Sigatoka leaf streak (<i>Mycosphaerella fijiensis</i> Morelet)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Begin applications when leaves first appear and repeat on a 7-21 day interval or as needed.
Yellow Sigatoka leaf spot (Mycosphaerella musicola)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Apply in sufficient water to obtain thorough coverage of foliage.
		For improved control, product may be tank- mixed with other fungicides registered for control of Sigatoka at label rates.
		When conditions are conducive to rapid disease development and/or heavy disease pressure, higher application rates and rotational spray programs with other fungicides registered for control of Sigatoka are recommended.

For use in Hawaii and Puerto Rico only.

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MISCELLANEOUS COMMODITIES (NO CROP GROUP): Artichokes (Chinese and Jerusalem) †		
DISEASES/PATHOGENS	RATES	ADDITIONAL INFORMATION
Gray mold/Botrytis rot (<i>Botrytis cinerea</i>)	6.5 - 13.0 fl. oz./acre (0.42 - 0.72 oz. a.i./acre)	Begin applications at first sign of disease symptoms and repeat on 7-14 day interval as long as conditions favor disease development
Powdery mildew (Leveillula taurica, Erysiphe cichoracearum)	Do not apply more than 4.2 oz. a.i./acre/season (6 appl. at max. rate).	Apply as a foliar spray in sufficient water to achieve thorough coverage of all above- ground plant parts. May also be applied through overhead sprinkler irrigation. See "Chemigation Instructions" for additional information.

A rate of 6.5 fl. oz./acre may be used for preventative applications before onset of visible disease, in periods of low disease pressure, or in a tank mix with other fungicides for resistance management. Otherwise, use a rate of 13.0 fl. oz./acre.

† Not for use in California.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store in dry place away from food or feed.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING:

[Containers \leq 5 gallons:]

Nonrefillable container. Do not reuse or refill this container. Completely empty container into application equipment. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling or reconditioning (if available), or puncture and dispose of in a sanitary landfill or by incineration, if allowed by State and local authorities. If burned, stay out of smoke.

[Containers > 5 gallons:]

Nonrefillable container. Do not reuse or refill this container. Completely empty container into application equipment. Triple rinse or pressure rinse container (or equivalent) promptly after emptying. *Triple rinse as follows:* Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two or more times. *Pressure rinse as follows:* Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling or reconditioning (if available), or puncture and dispose of in a sanitary landfill or by incineration, if allowed by State and local authorities. If burned, stay out of smoke.

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WARRANTY

Kaken Pharmaceutical Co., Ltd. warrants that the material contained herein conforms to the description on the label and is reasonably fit for the purpose referred to in the directions for use. Timing and method of application, weather, watering practices, nature of soil, the disease problem, condition of the crop, incompatibility with other influencing factors in the use of this product are beyond the control of the seller. Buyer assumes all risks of use, storage, or handling of this material not in strict accordance with directions given herein. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, NO OTHER EXPRESSED OR IMPLIED WARRANTY OF THE FITNESS OR MERCHANTABILITY IS MADE.

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Label Version No.