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(54) **Title:** AN AGRICULTURAL COMPOSITION

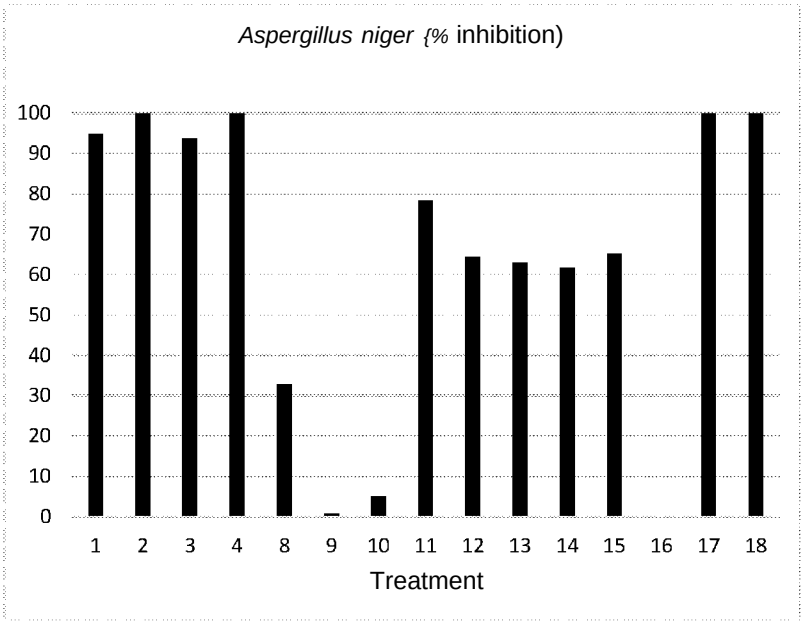

FIG. 1

(57) Abstract: This disclosure generally relates to an agricultural composition including an anti-pathogenic compound and a chemical activator, wherein the fungicide and chemical activator provide a synergistic interaction in the control of pathogens typically found in plants crop, trees, fruits, vegetables, leaves, stems, roots, seeds, flowers, animals, equipment, stockyards, feedlots, bams, animal housing units, farm tools, farm buildings, storage areas, or food contact areas.

WO 2020/144589 A2

[Continued on next page]

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AN AGRICULTURAL COMPOSITION

FIELD OF DISCLOSURE

[0001] The present disclosure relates to an agricultural composition comprising an anti-pathogenic compound and a chemical activator wherein the anti-pathogenic compound and chemical activator provide for synergistic interaction in controlling plant pathogens. Particularly, the agricultural composition according to this disclosure is used to control populations of fungi and/or bacteria.

BACKGROUND OF THE INVENTION

[0002] Commercial farming of both plant crops and livestock may be very susceptible to disease causing pathogens, which when left uncontrolled may provide for food insecurity (by destroying crops and/or livestock) and/or pose a health risk to consumers. Pathogens typically include, but are not limited to, fungicides and bactericides. Pathogens often proliferate due to unsuitable agricultural and/or animal husbandry practices and/or due to environmental factors such as high temperature and humidity that promote fast microorganism reproduction. Providing effective control of pathogens in agriculture and animal husbandry is imperative to ensure ongoing food security. Effective control of pathogens has been hampered by increased resistance to usual control measures or treatments using conventional bactericides or fungicides. Such bactericidal and/or fungicidal resistance poses a significant problem in the control and/or treatment and/or removal of pathogens from agricultural produce.

[0003] In recent years, there has also been a move toward providing environmentally friendly agricultural compositions that may control and/or treat and/or reduce and/or remove pathogen populations from plant crops and animals. Consumers have become more conscious about purchasing food goods that have been grown, cultivated or produced in an environmentally friendly manner typically utilizing organic and/or biodegradable and/or human and animal safe products. As such, farmers and the agrochemicals sector have needed to develop environmentally friendly agricultural compositions that are stable and provide anti-pathogenic properties when administered to a seed and/or plant and/or an animal, or part thereof.

[0004] There remains a need to provide for new and innovative agricultural compositions to control pathogen populations, and/or there remains a need to control and/or treat disease caused by said pathogens. Broadly, there remains a need to at least ameliorate disadvantages known in the prior art.

SUMMARY OF THE INVENTION

[0005] Broadly, and in accordance with a first aspect of this disclosure there is provided an agricultural composition comprising:

an anti-pathogenic compound including potassium sorbate; and

a chemical activator including an acid and at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid.

[0006] The chemical activator may further include an anionic surfactant and/or a nonionic surfactant.

[0007] The anti-pathogenic compound may be a fungicide, bactericide, insecticide, pesticide or a combination thereof. Typically, the anti-pathogenic may be a fungicide. The anti-pathogenic compound may itself provide a composition comprising one or more individual chemical compounds.

[0008] The agricultural composition may be provided as a concentrate. The anti-pathogenic compound and chemical activator may be admixed together to provide the agricultural composition (in concentrated form) which may be further diluted with water to facilitate application when in use.

[0009] Alternatively, or additionally, the anti-pathogenic compound and/or the chemical activator may each be diluted in water providing aqueous solutions of anti-pathogenic compound and chemical activator before admixing said aqueous solutions to provide a diluted agricultural composition according to this disclosure. Typically, the potassium sorbate stays dissociated in a sorbic acid form when diluted and in use.

[0010] Alternatively, or additionally, the anti-pathogenic compound may be diluted with water to yield a stable diluted solution of nonactivated anti-pathogenic compound; and thereafter the chemical activator may be diluted in the stable diluted solution of nonactivated anti-pathogenic compound to provide a diluted agricultural composition according to this disclosure.

[0011] It is to be understood that other dilution chemistries may also be employed as an alternative, or in addition to, utilizing water. For example, possible diluents may be, but are not limited to, at least one of the following group: glycols, methanol, ethanol, monoethylene glycol, and propylene glycol, or the like.

[0012] The at least one (C_1-C_8) alkyl ester an (C_{12} - C_{16}) alkyl acid may be selected from, but not limited to, the group comprising: synthetic, linear or branched, saturated or unsaturated, modified or unmodified, wherein the alkyl ester may be selected from, but not limited to, the group comprising: methyl esters, ethyl esters, propyl esters, butyl esters, isopropyl ester, isobutyl ester, isopentyl ester, 2-ethylhexyl esters or components thereof.

[0013] The at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid may be selected from, but not limited to, the group comprising: isobutyl laurate, isopentyl laurate, methyl laurate, 2-ethylhexyl laurate, 2-ethylhexyl palmitate, isopropyl laurate, isopropyl myristate, isopropyl palmitate, and combinations thereof.

[0014] The at least one (C_1-C_{18}) alkyl ester may be derived from an (C_{12} - C_{16}) alkyl acid, such as, but not limited to the group comprising: alkanoic acids such as lauric acid, tridecylic acid, myristic acid, pentadecanoic acid, palmitic acid and combinations thereof.

[0015] The anionic surfactant may be at least one selected from, but not limited to, the group comprising: (C_6 - C_{18}) alkyl benzene sulfonic acid salts, calcium dodecylbenzene sulfonate, sodium dodecylbenzene sulfonate, triethanolamine dodecylbenzene sulfonate, (C_6-C_{18}) alkyl ether sulfates, (C_6-C_{18}) alkyl ethoxylated ether sulfates, sodium lauryl polyoxyethylene ether sulfate, (C_6 - C_{18}) alkyl sulfates, (C_6 - Ci8) alkyl phosphate esters, (C_6 - C_{18}) alkoxylated sulfates, (C_6 - C_{18}) alkoxylated phosphate esters, xylene sulfonate salts, cumene sulfonate salts, naphthalene sulfonates, alkylnaphthalene sulfonates, condensated alkylnaphahalene sulfonates, and combinations thereof.

[0016] The nonionic surfactant may be at least one selected from, but not limited to, the group comprising: natural or synthetic alkoxylated alcohols, preferably ethoxylated and/or propoxylated alcohols, further preferably ethoxylated and/or propoxylated fatty alcohols or fatty acids, further preferably containing from 8 to 22 carbon atom; short ethoxylated and/or propoxylated chain alcohols, preferably short ethoxylated and/or propoxylated fatty alcohols; ethoxylated fatty acids; alkoxylated sorbitan fatty esters, ethoxylated sorbitan fatty esters; alkoxylated sorbitol fatty esters, ethoxylated sorbitol fatty esters, polyoxyethylene sorbitan monolaurate, polyoxyethylene sorbitan monopalmitate, polyoxyethylene sorbitan monostearate; (C_8 - C_{22}) alkoxylated fatty alcohols, (C_8 - C_{22}) ethoxylated fatty alcohols, (C_8 - C_{22}) propoxylated fatty alcohols, (Cs - C_{22}) ethoxylated and propoxylated fatty alcohols, alkyl(poly)glycosides, straight chain (C_4-C_{10}) alkyl(poly)glycosides, branched chain (C_4-C_{10}) alkyl(poly)glycosides; and combinations thereof.

[0017] Some alkoxylated alcohols contemplated for use include those based on branched alcohols, such as the Guerbet alcohols, e.g. 2-propylheptanol and 2-ethylhexanol, and C_{10}- OXO- alcohol or C_{13} OXO-alcohol, i.e. an alcohol mixture whose main component is formed by at least one branched C_{10}-alcohol or C_{13}-alcohol, and the alcohols commercially available as Exxal alcohols from Exxon Mobile Chemicals and Neodol alcohols from Shell Chemicals.

[0018] The nonionic surfactant may be ethoxylated alcohol having a degree of ethoxylation of from 1 to 50, preferably from 2 to 30.

[0019] The acid of the chemical activator may be at least one of various acids used in agrochemical technologies. Preferably, the acid may be an aqueous citric acid solution of between about 1 to about 99 percent citric acid, preferably about 50% citric acid solution.

[0020] The anti-pathogenic compound (in concentrated form) may have a pH range of between about 7.0 to about 10.0, and the chemical activator (in concentrated form) may have a pH range of between 0.0 and about 3.0. In use, the anti-pathogenic compound (in concentrate form) and the chemical activator

(in concentrate form) may be admixed and/or diluted, wherein a resulting stable tank mix of the diluted agricultural composition provides a pH of between about 4 and about 6.

[0021] In a concentrated form of the agricultural composition, the anti-pathogenic compound (typically a fungicide) typically comprises water as a diluent such that the potassium sorbate may comprises 35 to 55 wt. % of the anti-pathogenic compound (typically a fungicide), and the chemical activator typically further comprises water as a diluent such that the citric acid may comprise 30 to 55 wt.% of the chemical activator, the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid may comprise 0.5 to 5 wt. % of the chemical activator, the anionic surfactant may comprise 1 to 5 wt. % of the chemical activator, and the nonionic surfactant may comprise 3 to 10 wt. % of the chemical activator.

[0022] The anti-pathogenic compound (in its concentrated form) may further comprise urea wherein the urea is 1 to 5 wt. % of the anti-pathogenic compound. It is to be understood that the chemical activator may also further comprise urea in certain embodiments.

[0023] The agricultural composition may further comprise at least one compound selected from the group: insecticides, fungicides, herbicides, desiccants, defoliants, acaricides, nutrients, miticides, bactericides, biocides, ovicides, nematicides, insect growth regulators, plant growth regulators, and combinations thereof.

[0024] The agricultural composition may further comprise at least one additive selected from, but not limited to, the following group: nutrients, stimulants, growth agents, sugars, amino-acids, micronutrients (including fertilizers and hormones), preservatives, clarifiers, anti-freezing agents, hydrotropes, stabilizers, antioxidants, acidifiers, chelates, complexing agents, dyes, rheology modifiers, antifoams, anti-drift, water, oil(s), other solvents and combinations thereof.

[0025] The oil may be a natural compound, modified by esterification or transesterification, such as an alkyl fatty acid ester, e.g., methyl esters, ethyl esters, propyl esters, butyl esters, 2-ethylhexyl esters or dodecyl esters, and is preferably a glycol or glycerol fatty acid, such as (CIO - C22) fatty acid esters, such as from vegetables oils, preferably oil-yielding plants species such as soybean, com, sunflower, rapeseed oil, cottonseed oil, linseed oil, palm oil, safflower, coconut oil, castor oil, olive oil, canola oil among others pure or mixed with an essential or edible oil extracted from a variety of plants or parts of plants such as frees, shrubs, leaves, flowers, grasses, fluids, herbs, fruits and seeds, or mixed with each other that are combined with one or more oils.

[0026] In further embodiments, the oil may be a natural compound, such as an essential oil, a citrus oil, a component of a citrus oil, a terpene oil, wherein the terpene oil comprises a D-limonene or one or more terpene containing natural oils, wherein the one or more terpene containing natural oils contains at least 50% of a terpene selected from the group comprising: orange oil, grapefruit oil, lemon oil, lime oil, tangerine oil, pine oil, pure, combined with other oils or combinations thereof.

[0027] Alternatively, or additionally, the oil may be a natural oil, a synthetic oil, a linear compound, a branched compound, a saturated oil, an unsaturated oil, an aliphatic compound, a cyclic compound, a modified oil, an unmodified oil, an alkylated vegetable oil, an essential oil, an edible oil, an oil extracted from a plant, an oil extracted from a part of a plant, an oil extracted from a free, an oil extracted from a shrub, an oil extracted from a leaf, an oil extracted from a flower, an oil extracted from a grass, an oil extracted from a plant fluid, an oil extracted from an herb, an oil extracted from a fruit, an oil extracted from a seed, a pure oil, a mixture of oils and combinations thereof.

[0028] The agricultural composition wherein the anti-pathogenic compound and the chemical activator may be admixed in water, at a weight ratio of 1:0.4 (anti-pathogenic compound: chemical activator) to 1:2.0 (anti-pathogenic compound: chemical activator). In certain embodiments of the disclosure the anti-pathogenic compound is admixed with water, and thereafter the chemical activator is admixed therein.

[0029] In a preferred example embodiment of this disclosure there is provided an agricultural composition (in a concentrated form) comprising:

an anti-pathogenic compound including potassium sorbate; and

a chemical activator including an acid, at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid, an anionic surfactant, and a nonionic surfactant,

wherein the anti-pathogenic compound further comprises water as a diluent such that the potassium sorbate comprises 35 to 55 wt. % of the anti-pathogenic compound, the anti-pathogenic compound having a pH range of between about 7.0 to about 10.0, and

wherein the chemical activator further comprises water as a diluent such that the acid comprises 30 to 55 wt.% of the chemical activator, the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid comprises 0.5 to 5 wt. % of the chemical activator, the anionic surfactant comprises 1 to 5 wt. % of the chemical activator, and the nonionic surfactant comprises 3 to 10 wt. % of the chemical activator, the chemical activator having a pH range of between 0.0 and about 3.0.

[0030] It is to be understood that this preferred example embodiment of the agricultural composition is in its concentrated form, and both the anti-pathogenic compound and the chemical activator are provided in their concentrated forms. These concentrated forms may further be diluted with water or other solvent chemistries prior to application thereof in use.

[0031] In use, the anti-pathogenic compound (in concentrate form) and the chemical activator (in concentrate form) may be admixed and/or diluted, wherein a resulting stable tank mix of the diluted agricultural composition provides a pH of between about 4 and about 6. The tank mix is then applied onto, or adjacent to, a plant or part thereof.

[0032] In a specific preferred example embodiment of this disclosure there is provided an

agricultural composition comprising:

an anti-pathogenic compound including potassium sorbate; and

a chemical activator including an acid, at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid, an anionic surfactant, and a nonionic surfactant,

wherein the anti-pathogenic compound may further comprise water as a diluent and urea such that the potassium sorbate comprises 35 to 55 wt. % of the anti-pathogenic compound and the urea comprises 1 to 5 wt. % of the anti-pathogenic, the anti-pathogenic compound having a pH range of between about 7.0 to about 10.0, and

wherein the chemical activator may further comprise water as a diluent, and

wherein the acid is citric acid such that the citric acid comprises 30 to 55 wt.% of the chemical activator,

wherein the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid is isopropyl myristate and/or isopropyl laurate such the isopropyl myristate and/or isopropyl laurate comprises 0.5 to 5 wt. % of the chemical activator,

wherein the anionic surfactant is sodium lauryl ether sulfate such that the sodium lauryl ether sulfate comprises 1 to 5 wt. % of the chemical activator, and

wherein the nonionic surfactant is a fatty alcohol ethoxylate such that the fatty alcohol ethoxylated comprises 3 to 10 wt. % of the chemical activator, the chemical activator having a pH range of between 0.0 and about 3.0.

[0033] It is to be understood that this specific preferred example embodiment of the agricultural composition is in its concentrated form, and both the anti-pathogenic compound and the chemical activator are provided in their concentrated forms. These concentrated forms may further be diluted with water or other solvent chemistries prior to application thereof in use.

[0034] In use, the anti-pathogenic compound (in concentrate form) and the chemical activator (in concentrate form) may be admixed and/or diluted, wherein a resulting stable tank mix of the diluted agricultural composition provides a pH of between about 4 and about 6. The tank mix is then applied onto, or adjacent to, a plant or part thereof.

[0035] It is to be understood that the composition according this disclosure may be packaged and sold in a single container including both the anti-pathogenic compound and the chemical activator in their concentrated form. In use, a user may dilute the composition prior to application to an agricultural crop.

[0036] Alternatively, or additionally, the composition according to this disclosure may be packaged and sold in two separate containers, a first container for the anti-pathogenic compound in its concentrated form, and a second container for the chemical activator in its concentrated form. The anti-pathogenic compound and chemical activator of the first and second container may then each be diluted prior to

application to an agricultural crop.

[0037] In accordance with a second aspect of this disclosure there is provided a method of manufacturing the agricultural composition of the first aspect of this disclosure herein above, the method comprising the step of admixing the anti-pathogenic compound and the chemical activator providing the agricultural composition of the first aspect of this disclosure.

[0038] The step of admixing may include diluting each of the anti-pathogenic compound (in concentrated form) and the chemical activator (in concentrated form) in water before admixing the diluted anti-pathogenic compound and the diluted chemical activator.

[0039] Alternatively, or additionally, the step of admixing may include admixing the anti-pathogenic compound (in concentrated form) together with the chemical activator (in concentrated form), and thereafter diluted the admixture in water to provide the diluted agricultural composition.

[0040] Alternatively, or additionally, the step of admixing may include diluting the anti-pathogenic compound with water to yield a stable diluted solution of nonactivated anti-pathogenic compound; and thereafter diluting the chemical activator in the stable diluted solution of nonactivated anti-pathogenic compound to provide the diluted agricultural composition.

[0041] In a particular example embodiment of the method, the step of admixing may include:

(i) diluting the anti-pathogenic compound with water at a ratio by weight of anti-pathogenic compound to water of from about 1:100 to about 1:10 to yield a stable diluted solution of nonactivated anti-pathogenic compound; and thereafter

(ii) diluting the chemical activator with water containing the diluted solution of nonactivated anti-pathogenic compound at a ratio by weight of anti-pathogenic compound to the chemical activator of from about 1:0.4 to about 1:2 to yield a stable tank mix having a pH range of between about 4.0 to about 6.0,

therein providing for the diluted agricultural composition.

[0042] In accordance with a third aspect of this disclosure there is provided the agricultural composition of the first aspect of this disclosure described herein above for use in the control of pathogens and/or in the treatment of disease caused by said pathogens. The pathogens may be at least one selected from the group: *Aspergillus niger, Botrytis cinerea, Colletotrichum floriniae, Fusarium moniliforme, Fusarium oxysporum, Macrophomina phaseolina, Verticillium dahlia, Xanthomonas arhoricola pv., Plasmopara viticola, Acetohacter spp., Erysiphe necator, and Guignardia bidwellii.*

[0043] In accordance with a fourth aspect of this disclosure there is provided a method of controlling and/or treating pathogens and/or a method of treating disease caused by said pathogens, the method comprising the steps of applying the agricultural composition of the first aspect of this disclosure described herein above onto, or adjacent to, a plant or seed. The pathogens may be at least one selected

from the group: *Aspergillus niger, Botrytis cinerea, Colletotrichum fioriniae, Fusarium moniliforme, Fusarium oxysporum, Macrophomina phaseolina, Verticillium dahlia, Xanthomonas arhoricola pv., Plasmopara viticola, Acetohacter spp., Erysiphe necator, and Guignardia bidwellii.*

[0044] The method wherein the composition is diluted to provide the diluted agricultural composition, preferably diluted in water, before application onto, or adjacent to, a plant or seed.

[0045] The method wherein the application onto, or adjacent to, a plant or seed, is via an at least one apparatus selected from the group comprising: air assisted sprayers, conventional sprayers, ultra-low volumes equipment such as aerial, electrostatic, foggers and misting spray equipment and chemigation systems, pivots, sprinklers, and combinations thereof.

[0046] The method wherein the application may be to pre-harvested or post-harvested plants selected from, but not limited to, the group comprising: plants, trees, fruits, vegetables, leaves, stems, roots, seeds, or flowers, animals, equipment, stockyards, feedlots, bams, animal housing units, farm tools, farm buildings, storage areas, or food contact areas, such that in use fungal and/or bacterial pathogens that cause disease are controlled.

[0047] The method extends to application of the agricultural composition, preferably the diluted agricultural composition, to an animal to control fungal and/or bacterial pathogens that cause disease.

[0048] The method further extends to application of the agricultural composition, preferably the diluted agricultural composition, to equipment, stockyards, feedlots, bams, animal housing units, tools, buildings, storage areas, or food contact areas to control fungal and/or bacterial pathogens that cause disease.

[0049] In certain embodiments of the method, the agricultural composition, preferably the diluted agricultural composition, may be prepared in a mixing tank, a spray tank, a container, or an inline irrigation system prior to application and/or use.

BRIEF DESCRIPTION OF THE FIGURES

[0050] FIG 1 graphically shows a percentage inhibition of *Aspergillus niger* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0051] FIG 2 graphically shows a percentage inhibition of *Botrytis cinerea* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0052] FIG 3 graphically shows a percentage inhibition of *Colletotrichum fioriniae* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0053] FIG 4 graphically shows a percentage inhibition of *Fusarium moniliforme* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0054] FIG 5 graphically shows a percentage inhibition of *Fusarium oxysporum* after exposure

to (or treatment with) compositions of this disclosure and other compounds;

[0055] FIG 6 graphically shows a percentage inhibition of *Macrophomina phaseolina* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0056] FIG 7 graphically shows a percentage inhibition of *Verticillium dahlia* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0057] FIG 8 graphically shows a percentage inhibition of *Xanthomonas arhoricola pv. juglandis* after exposure to (or treatment with) compositions of this disclosure and other compounds;

[0058] FIG 9 shows average percent severity for leaves of each treatment at the evaluation dates. Within each category, values followed by the same letter indicate no significant difference as determined by ANOVA (α=0.10). ORO-159 fungicides were brought to pH 5 - 5.2 by using OR-278-C (i.e. the fungicide and chemical activator were admixed to provide agricultural compositions according to this disclosure)

[0059] FIG 10 shows average percent incidence and severity for clusters of each treatment at the evaluation dates. Within each category, values followed by the same letter indicate no significant difference as determined by ANOVA (α=0. 10).

[0060] FIG 11 shows yield in tons per acre for each treatment. Values followed by the same letter indicate no significant difference as determined by ANOVA (α=0. 10).

[0061] FIG 12 shows Brix, pH, and titratable acidity for each treatment.

DETAILED DESCRIPTION

[0062] The content of the Summary herein above is repeated entirely by way of reference thereto and is not repeated to avoid repetition.

[0063] The production and use of an agricultural composition including an anti-pathogenic compound (typically potassium sorbate) and a chemical activator adjuvant are provided. Typically, the anti-pathogenic compound and chemical activator are manufactured as concentrates which are then admixed to provide the agricultural composition. The anti-pathogenic compound and/or chemical activator may be diluted prior to admixture. Alternatively, the anti-pathogenic compound and chemical activator may be admixed and diluted thereafter. The agricultural composition is typically diluted with water providing a stable tank mix of diluted agricultural composition prior to use and application onto, or adjacent to, agricultural crops to control pathogen populations and/or control and/or treat disease related to said pathogens. The disclosure extends to application of the agricultural composition to, or adjacent to, animals, buildings, equipment and the like. The agricultural composition according to this disclosure is stable prior to and when in use.

[0064] The anti-pathogenic compound according to this disclosure typically includes potassium

sorbate dissolved in water and is stable as a concentrate and is stable in a tank mix. The anti-pathogenic compound is provided as a composition including more than one chemical compound. The concentrated stable organic anti-pathogenic compound may comprise: potassium sorbate in an amount of between 35.0 to 50.0 wt. %; urea in an amount of between 1.0 to 3.0 wt.%; and water as the diluent to 100 wt.%, wherein the organic anti-pathogenic compound concentrate has a pH range of 7.0 to 10.0.

[0065] The chemical activator (a pH adjuster and adjuvant when in use) according to this disclosure typically includes combining at least one solvent from the family of esters from the group of (C_1-C_8) alkyl esters (typically derived from an (C_{12} - (C_{16}) alkyl acid); one or more anionic surfactants; one or more nonionic surfactants, a citric acid aqueous solution and water. Oil and/or other additives may be further added in certain embodiments. The chemical activator is stable as a concentrate and is stable in a tank mix. The chemical activator adjuvant concentrate having a pH of less than 3.0.

[0066] When the anti-pathogenic compound (in concentrate form) and the chemical activator (in concentrate form) are admixed and diluted the resulting tank mix of diluted agricultural composition provides a pH of between about 4 and about 6. The tank mix is then applied onto, or adjacent to, a plant or part thereof.

Definitions

[0067] The term “adjuvant” as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to an agent that modifies the effect of other agents and more particularly used to enhance the effectiveness of pesticides such as herbicides, insecticides, fungicides and other agents.

[0068] The term “stable” as used herein is a broad term, combined or related with the term “emulsion”, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to the emulsion stability, i.e. the ability of an emulsion to resist change in its properties over time so that the size of the droplets in emulsion does not change significantly with time, more specifically during the time of an application to the targets mixed with water, it is thus to be given its ordinary meaning that is customary to a person skilled in the art. The term “stable” as used herein is a broad term, combined or related with the term “accelerated storage stability”, means that the formulation keep similar performance in terms of physico-chemical properties after samples be stored during 15 days in at least 3 conditions: room temperature (around 20°C); cold temperature (0°C or 5°C); hot temperature (54°C). Storage stability tests were conducted according Method CIPAC MT 36.

[0069] The term “solvents” as used herein is a broad term, and is to be given its ordinary

and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to compounds with some characteristics of solvency for other compounds or means, that can be polar or non- polar, linear or branched, cyclic or aliphatic, aromatic, naphthenic and that includes but is no limited to: alcohols, esters, diesters, ketones, acetates, terpenes, sulfoxides, glycols, paraffins, hydrocarbons, anhydrides, heterocyclics, among others.

[0070] Whenever a group is described as being "optionally substituted" that group may be unsubstituted or substituted with one or more of the indicated substituents. Likewise, when a group is described as being "unsubstituted or substituted" if substituted, the substituent(s) may be selected from one or more the indicated substituents. If no substituents are indicated, it is meant that the indicated "optionally substituted" or "substituted" group may be substituted with one or more group(s) individually and independently selected from alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, cycloalkynyl, aryl, heteroaryl, heteroalicyclyl, aralkyl, heteroaralkyl, (heteroalicyclyl)alkyl, hydroxy, protected hydroxyl, alkoxy, aryloxy, acyl, mercapto, alkylthio, arylthio, cyano, halogen, thiocarbonyl, O- carbamyl, N-carbamyl, O-thiocarbamyl, N-thiocarbamyl, C-amido, N-amido, S-sulfonamido, N-sulfonamido, C-carboxy, protected C-carboxy, O-carboxy, isocyanato, thiocyanato, isothiocyanato, nitro, silyl, sulfenyl, sulfmyl, sulfonyl, haloalkyl, haloalkoxy, trihalomethanesulfonyl, trihalomethanesulfonamido, an amino, a mono-substituted amino and a di-substituted amino group, and protected derivatives thereof.

[0071] The term "alkyl" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to a straight chain or branched, acyclic or cyclic, unsaturated or saturated aliphatic hydrocarbon containing 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29,30, 31, 32, 33, 34, 35, 36 or more carbon atoms, while the term "lower alkyl" has the same meaning as alkyl but contains 1, 2, 3, 4, 5, or 6 carbon atoms. Representative saturated straight chain alkyls include methyl, ethyl, n-propyl, n-butyl, n-pentyl, n-hexyl, and the like; while saturated branched alkyls include isopropyl, sec-butyl, isobutyl, tert-butyl, isopentyl, and the like. Unsaturated alkyls contain at least one double or triple bond between adjacent carbon atoms (referred to as an "alkenyl" or "alkynyl," respectively). Representative straight chain and branched alkenyls include ethylenyl, propylenyl, 1-butenyl, 2-butenyl, isobutylenyl, 1-pentenyl, 2-pentenyl, 3-methyl-l-butenyl, 2-methyl-2-butenyl, 2,3-dimethyl-2-butenyl, and the like; while representative straight chain and branched alkynyls include acetylenyl, propynyl, 1-butynyl, 2-butynyl, 1-pentynyl, 2-pentynyl, 3-methyl-l butynyl, and the like. Typical alkyl groups include, but are in no way limited to, methyl, ethyl, propyl, isopropyl, butyl,

isobutyl, tertiary butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, henatriacontyl, dotriacontyl, tritriacontyl, tetratriacontyl, pentatriacontanyl, and hexatriacontanoic. The alkyl group may be substituted or unsubstituted.

[0072] The term "alkoxy" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to an alkyl moiety attached through an oxygen bridge (i.e., -O-alkyl) such as methoxy, ethoxy, and the like.

[0073] The term "thioalkyl" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to an alkyl moiety attached through a sulfur bridge (i.e., -S-alkyl) such as methylthio, ethylthio, and the like.

[0074] The term "alcohol" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as described herein incorporating one or more hydroxy groups, or being substituted by or functionalized to include one or more hydroxy groups.

[0075] The term "ester" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as described herein incorporating one or more ester groups, e.g., monoester, diester, triester, or polyester, or being substituted by or functionalized to include one or more ester groups. Esters include but are not limited to fatty acid esters.

[0076] The term "acetates" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as described herein incorporating one or more acetate groups, such as salts, esters or other compounds incorporating a CH3COO- moiety.

[0077] The term "terpenes" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as derived from resins of plants such as conifers or citrus, or to synthetically produced compounds having the same structures as plant derived terpenes. Terpenes can include hydrocarbons as well as terpenoids containing additional

functional groups, as well as essential oils. Terpenes can include compounds having a formula $(C5H8)n$ where n is the number of linked isoprene units (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more).

[0078] The term "terpene containing natural oil" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to a natural oil containing at least 50% of a terpene selected from but not exclusively from the group consisting of citrus oil, orange oil, grapefruit oil, lemon oil, lime oil, tangerine oil, and pine oil or components thereof.

[0079] The term "sulfoxides" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as described herein incorporating one or more sulfmyl (SO) groups, or being substituted by or functionalized to include one or more sulfmyl groups.

[0080] The term "glycols" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and can include diols, e.g., polyalkylene glycols such as polyethylene glycols (polymers having the formula $H(OCH_2CH_2)nOH$ where n is greater than three), polypropylene glycols, or glycols incorporating monomers comprising longer hydrocarbon chains.

[0081] The term "paraffins" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to heavier alkanes, such as alkanes forming a liquid or wax at room temperature, as well as functionalized paraffins, e.g., chlorinated paraffins, and mineral or synthetic oils comprising hydrocarbons. Room temperature as used herein refers to ambient conditions, e.g., in a climate controlled building, for example, approximately 20°C.

[0082] The term "hydrocarbons" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound comprising only carbon and hydrogen atoms. A functionalized or substituted hydrocarbon has one or more substituents as described elsewhere herein.

[0083] The term "anhydrides" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to any compound as described herein incorporating one or more anhydride groups (of formula $(RC(O))_2O$), or being substituted by or functionalized to include one or more anhydride groups.

[0084] The term "sulfonic acid" as used herein is a broad term, and is to be given its ordinary

and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to, for example formic, acetic, succinic, lactic, malic, tartaric, citric, ascorbic, nicotinic, methanesulfonic, ethanesulfonic, p-toluensulfonic, salicylic or naphthalene sulfonic acid. Sulfonic acids can include hydrocarbyl sulfonic acids, such as aryl sulfonic acids, alkyl benzene sulfonic acid, among other.

[0085] The term "vegetable oil" as used herein is a broad term, and is to be given its ordinary and customary meaning to a person of ordinary skill in the art (and is not to be limited to a special or customized meaning), and refers without limitation to oleaginous fatty acid constituents of vegetable matter, e.g., saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, etc. The vegetable oil can be functionalized, e.g., alkoxylated, hydroxylated, aminated, etc. A functionalized vegetable oil is a derivative of a vegetable oil or other fatty substance, or a substance having a similar composition regardless of the origin of the substance. In some embodiments, the functionalized vegetable oil is epoxidized unsaturated triglyceride. Epoxidized unsaturated triglyceride is a tri-ester of glycerine. The glycerine bonds to three linear or branched carboxylic acids, wherein at least one of the carboxylic acids comprises an epoxide moiety. For example, the epoxidized unsaturated triglyceride may be a derivative of an unsaturated fatty acid triglyceride such as a vegetable or animal fat or oil, wherein at least one of the C=C moieties of the parent unsaturated fatty acid triglyceride is replaced with an epoxide moiety (i.e. a three-membered ring containing an oxygen). If the parent unsaturated fatty acid triglyceride has more than one C=C moiety, one, part, or all of the C=C moieties may be replaced by epoxide moieties. When the term "vegetable oil" is used herein, it is understood to include animal fats, or oils of synthetic origin, having a same chemical structure as a vegetable oil. Examples of vegetable or animal fats or oils include coconut oil, com oil, cottonseed oil, olive oil, palm oil, peanut oil, rapeseed oil, canola oil, safflower oil, sesame oil, soybean oil, sunflower oil, castor oil, tallow oil, or the like.

[0086] As used herein, the abbreviations for any compound, is, unless indicated otherwise, in accord with its common usage, recognized abbreviations, or the IUPAC-IUB Commission on Biochemical Nomenclature (See, Biochem. 11:942-944 (1972)).

[0087] Any percentages, ratios or other quantities referred to herein are on a weight basis, unless otherwise indicated.

[0088] The cyclic systems referred to herein include fused ring, bridged ring, and spiro ring moieties, in addition to isolated monocyclic moieties.

EXAMPLES

[0089] The examples here below are not to be considered as limiting to the disclosure. The broad disclosures made in the Summary and Detailed Description herein above are repeated by way of reference.

Method of preparation of the organic anti-pathogenic compound liquid concentrate

[0090] The anti-pathogenic compound typically comprises an aqueous solution of potassium sorbate, and in certain embodiments may further comprise urea. The anti-pathogenic compound is typically organic and may be manufactured in a concentrate form before being added to the chemical activator to provide the agricultural composition according to this disclosure. The anti-pathogenic compound concentrate and/or the chemical activator concentrate may be diluted and/or admixed to provide the diluted agricultural composition. For the purpose of illustration, the method for preparing the organic anti-pathogenic concentrate as used in the non-limiting examples includes the steps admixing in a vessel potassium sorbate in granular form with water to form a first solution, such that the potassium sorbate is between about 20.0 wt.% to about 60 wt. %, preferably between about 35.0 wt.% to about 50.0 wt. %, of the first solution, and water is between about 25 wt.% to about 75 wt.%, preferably between about 50 wt.% to about 65% wt. %, of the first solution. In a typical example embodiment, and to obviate doubt, between about 35.0g to about 50.0g potassium sorbate is added to between about 50.0g to about 65g of water and stirred until all the potassium sorbate is dissolved to provide the anti-pathogenic compound according to this disclosure. In a particular embodiment, the method may further include the step of adding urea (technical grade) to the first solution to form a second solution such that urea is between about 0.1 wt.% to about 10 wt. %, preferably between about 2.0 wt.% to about 5.0 wt.%, of the second solution. The first and/or second solutions are continuously stirred until the potassium sorbate and/or urea are completely dissolved in the water to provide the anti-pathogenic compound. Heating is not necessarily required but may advantageously be employed depending on the physical state and characteristics of each compound, mainly because urea is endothermic during dissociation. Other additives may be added to the second solution for specific purposes, such as clarifiers, anti-foaming agents, anti-freezing agents, hydrotropes, UV stabilizers, colorants, nutrients, amino-acids, sea extract, anti-drift agents, anti-freezing agents, and even water or other solvent, and/or other additives as are typically employed in fungicides compositions. This method of preparation described above provides a concentrate form of the anti-pathogenic compound according to the first aspect of this disclosure.

Method of preparation of the pH adjuster and activator adjuvant concentrate

[0091] The chemical activator according to this disclosure may also be termed a pH adjuster and/or an adjuvant when in use. For the purpose of illustration, the method for preparing the chemical

activator as used in the non-limiting examples includes the steps of admixing into a vessel containing water an nonionic surfactant such a fatty alcohol ethoxylated from between about 5 wt. % and 30 wt. %, preferably between about 15.0 to about 25.0 wt. %, then adding one or more anionic surfactant(s) such as a sodium lauryl ether sulfate from between about 1.0 wt. % to about 15 wt. %, preferably between about 7.0 to about 10.0 wt.%, then adding one or more solvents from the group of an (C_1-C_{8-8}) alkyl ester of an (C_{12} - C_{16}) alkyl acid such as isopropyl myristate from between about 0.1 wt.% to about 10 wt. %, preferably between about 0.5 to about 5.0 wt.%, then adding citric acid 50% in water solution from between about 20 wt. % to about 60 wt. %, preferably between about 30.0 to about 55.0 wt. %. The method to prepare is stirring the mixture into a clean vessel until a complete dissolution. In a typical example embodiment, and to obviate doubt, the following were admixed and stirred with between 50g and 65g of water to form the chemical activator: one or more nonionic surfactants such a fatty alcohol ethoxylated from 15.0g to 25.Og, one or more anionic surfactants such as a sodium lauryl ether sulfate from 7.0g to lO.Og, one or more solvents form the group of an (C_1-C_{8-8}) alkyl ester of an (C_{12} - C_{16}) alkyl acid such as isopropyl myristate from 0.5g to 5.0g, citric acid 50% in water solution from 30.0g to 55.Og. Heating is not necessarily required but may advantageously be employed depending on the physical state and characteristics of each compound during dissociation or emulsifying process. Other additives can be used for specific purposes, such as clarifiers, anti-foaming agents, anti-freezing agents, hydrotropes, UV stabilizers, colorants, nutrients, amino-acids, sea extract, anti-drift agents, anti-freezing agents, and even water or other solvent, and/or other additives as are typically employed in adjuvant compositions. This method of preparation described above provides a concentrate form of the chemical activator according to the first aspect of this disclosure.

Preparing the agricultural compositions

[0092] Two different liquid organic anti-pathogenic compounds and two different chemical activators were prepared according to some of the embodiments. The organic anti-pathogenic compound concentrates are indicated by ORO-159-A, ORO-159-B and ORO-159-G. The chemical activator concentrates are indicated by ORO-097-V, ORO-278-C, ORO-278-E. The details of the specific embodiments of each are described in Table 1 and Table 2. Various components were employed in the different formulations, including: potassium sorbate granules provides active ingredient for the anti-pathogenic compound (and is fungicidal); alcohol ethoxylated, POE-6 - nonionic surfactant; triethanolamine dodecylbenzene sulfonate - anionic surfactant; sodium lauryl ether sulfate - anionic surfactant; polyoxyethylene sorbitan monolaurate - anionic surfactant; Isopropyl myristate - alkyl ester

of alkyl acid; isopropyl laurate - alkyl ester of alkyl acid; methyl laurate - alkyl ester of alkyl acid; citric acid 50% - acidifier ; urea prills - stabilizer; humic acid - chelating agent.

Table 1: Anti-pathogenic compounds made according the present disclosure

Compound	ORO-159-A	ORO-159-B	ORO-159-G
	Amount (weight/wt. %) (measured in grams)		
Water	58.0	53.0	55.0
Potassium Sorbate Granules	35.0	44.0	40.0
Urea Prills	3.00	2.00	2.00
Humic Acid	2.00	-	2.00
Other additives	2.00	1.00	1.00
TOTAL	100.00	100.00	100.00
FORMULATION TYPE	Soluble liquid	Soluble liquid	Soluble liquid

Table 2 : Chemical activators made according the present disclosure

Compound	ORO-097-V	ORO-278-C	ORO-278-E
	Amount (wt. %) (measured in grams)		
Water	32.0	48.8	40.2
Citric Acid 50% solution	50.0	40.0	45.0
Isopropyl Myristate	-	1.0	-
Isopropyl Laurate	1.5	-	-
Methyl Laurate	-	-	2.0
Alcohol Ethoxylated 6 POE	10.5	6.0	-
Triethanolamine Alkyl Benzene Sulfonate	-	-	2.8
Sodium lauryl ether sulfate	3.5	2.2	-
Polyoxyethylene sorbitan monolaurate	-	-	7.00
Urea Pills	1.5	1.0	2.0
Other additives	1.0	1.0	1.0
TOTAL	100.00	100.0	100.00
FORMULATION TYPE	Microemulsion	Microemulsion	Microemulsion

Physico-chemical and accelerated stability tests

[0093] Samples of products of certain embodiments were compared to commercially available products and analyzed to determine their physical chemical characteristics and their behavior when diluted in water - pH, solubility; and into the pure adjuvant, pH, solubility, stability described on CIPAC Handbook F - Collaborative International Pesticide Analytical Ltd, 1994, reprint in 2007, the contents of which are hereby incorporated by reference in their entirety. It was analyzed and confirmed that

agricultural compositions prepared according to the embodiments exhibited stability in accelerated storage stability testing, and all samples were stable even in room temperature, cold (14 days @ 0°C) or hot conditions (14 days @ 54°C).

Table 3: Physical and chemical and accelerated stability tests results for fungicides and chemical activators according to the present disclosure

ANALYSIS	ORO-159-A (anti-pathogenic –	ORO-159-B (anti-pathogenic –	ORO-159-G (anti-pathogenic –	ORO-097-V (activator)	ORO-278-C (activator)	ORO-278-E (activator)
Appearance (product)	Black	Amber	Black	Clear	Clear	Clear
Density @ 20°C	1.082	1.091	1.085	1.120	1.077	1.091
pH (product)	8.10	8.40	8.320	1.72	1.67	1.56
pH (1% v/v)	7.50	7.70	7.70	1.60	1.95	1.90
Potassium sorbate assay (wt.%)	40.5	46.8	43.2	-	-	-
Viscosity @ 25°C	11 Cp	10 Cp	10 Cp	14 Cp	12 Cp	13 Cp
Appearance (solution at 1.0% - distillated	Clear	Clear	Clear	Clear	Clear	Clear
Accelerated Storage Procedure Method CIPAC MT 46 (14 days at 0°, 20° and 54°C)	Stable	Stable	Stable	Stable	Stable	Stable

Disease bio-efficacy screening

[0094] Samples of the agricultural compositions of certain embodiments were evaluated in a disease bio-efficacy screening at University of California Davis/Keamey Agricultural Research and Extension Center in comparison with other products and samples to evaluate pH effect, adjuvancy effect and efficacy against most common or applicable plant pathogens in vitro. Sample identification is shown in Tables 4 and 5.

Table 4: Samples identification - agricultural compositions according the present disclosure

Treatment	1	2	3	4	8	9	10
Fungicide	OR-159 B	OR-159 B	OR-159 B	OR-159 B	OR-159 G	OR-159 G	OR-159 G
Dosage (%v/v)	0.5	1	0.5	1	0.5	1	2
Chemical Activator (Adjuvant)	OR-278-C	OR-278-C	OR-097-V	OR-097-V	Citric Acid 50%	Citric Acid 50%	Citric Acid 50%
Dosage Adj. (%v/v)	0.25	0.5	0.25	0.5	Adjust pH to 5	Adjust pH to 5	Adjust pH to 5

Table 5: Samples identification - comparison products and reference

Treatment	11	12	13	14	15	17	18	19
Code	EXP. I *	EXP. II **	PREV-AM®	PREV-AM®	EXP.III ***	EXP.IV ****	EXP.IV	Untreated (UTC)
Dosage (%v/v)	0.25	0.25	0.25	0.4	0.25	1	0.5	-
Adjuvant	-	-	-	-	-	-	-	-
Dosage Adj. (%v/v)	-	-	-	-	-	-	-	-

* - EXP. I (Natural Oil based commercial product Transformer®) ** - EXP. II (Natural Oil based commercial product Oroboost®) *** - EXP. Ill (Natural Oil based Wetcit®) **** - EXP. IV (commercial product Cropbiolife®) All commercially available products have known anti-fungal properties.

[0095] Growth inhibition was measured using potato dextrose agar (PDA) amended with the test compounds to compare colony growth of several fungi. Plain (unamended) PDA plates served as controls.

Cultures of *Aspergillus niger, Botrytis cinerea, Colletotrichum fioriniae, Fusarium moniliforme, F. oxysporum, Macrophomina phaseolina, VerticiIlium dahlia, andXanthomonas arhoricola pv.juglandis* were grown on acidified potato dextrose agar. The amended and control plates were inoculated with mycelial plugs (5 mm diameter), then incubated at 25°C until the colonies in the controls neared the edge of the plates for each species. At that time, colony radius was measured and percent inhibition was calculated for each test compound in relation to the radius of control plates.

Table 6. Summary percent growth inhibition of various agricultural compositions and comparative products against a number of important plant pathogens.

	% inhibition in relation to untreated control															
Treatment	*Aspergillus niger*		*Botrytis cinerea*		*Colletotrichum fioriniae*		*Fusarium moniliforme*		*Fusarium oxysporum*		*Macrophomina phaseolina*		*Verticilliu m dahliae*		*Xanthomonas arboricola pv. juglandis*	
1	94.81	a	90.88	b	84.94	b	100	a	100	a	100	a	100	a	100	a
2	100	a	100	a	97.22	a	100	a	100	a	100	a	100	a	100	a
3	93.78	a	95.43	ab	84.41	b	100	a	100	a	100	a	100	a	100	a
4	100	a	100	a	100	a	100	a	100	a	100	a	100	a	100	a
8	32.9	d	29.51	h	31.48	e	27.63	g	28.09	ef	78.05	c	54.06	e	66.18	b
9	0.73	e	34	gh	1.61	g	24.15	h	25.97	fg	83.32	bc	39.08	f	68.54	b
10	5.14	e	38.06	g	4.19	g	37.31	f	33.72	e	100	a	52.87	e	100	a
11	78.28	b	58.74	d	72.87	c	51.51	e	58.68	d	55.61	d	80.34	cd	58.25	b
12	64.45	c	48.86	ef	59.97	d	54.76	d	58.74	d	4.82	e	84.27	bc	59.39	B
13	62.93	c	45.54	f	73.91	c	78.55	c	70.92	c	88.11	bc	89.57	b	25.61	C
14	61.61	c	51.23	e	77.66	c	84.09	b	72.76	bc	89.54	ab	88.29	b	26.51	C
15	65.12	c	44.13	f	76.44	c	82.9	b	78.74	b	85.98	bc	74.64	d	7.73	D
17	100	a	100	a	100	a	100	a	100	a	100	a	100	a	100	A
18	100	a	100	a	100	a	100	a	100	a	100	a	5.69	g	100	A

Values with same letter are not significantly different. Comparisons are made within pathogens only, not between pathogens.

[0096] The results of these *in vitro* tests showed that some of these compounds are very effective in inhibiting the growth of some of the tested pathogens. For instance, treatments, OR-159B at 0.5% mixed with OR-278-C at 0.25% , OR-159-B at 1% mixed with OR-278-C at 0.25% (Treatments 1 and 2) and OR-159-B at 0.5% mixed with OR-097-V at 0.25% and OR-159-B at 1% mixed with OR-097-V at 0.5% (Treatments 3 and **4)** had a significantly greater inhibition against **all 8 plant pathogens** tested. *Fusarium moniliforme, F. oxysporum, Macrophomina phaseolina, Verticillium dahlia, and Xanthomonas arhoricola pv. juglandis* were inhibited totally.

[0097] The OR-159-G at 0.5%, OR-159-G at 1% rate, and OR-159-G at 2% rate and each mixed with 50% citric acid (Treatment 8, 9, &10) showed very little inhibition against *A. niger* or *C. floriniae* (Treatments 9 & 10), but some significant inhibition against *B. cinerea, F. moniliforme, F. oxysporum, M. phaseolina, V. dahlia,* and V. *arhoricola* pv.*juglandis.* The OR-159-G at2%rate (Treatment 10) resulted in 100% inhibition ofM *phaseolina* and *X. arhoricola* pv.*juglandis* (Table 6).

[0098] With one or two exceptions, all the other treatments (Treatments 11 to 15 and 17 and 18) inhibited the majority of the fungi from 44% to 100%. Exp. I, Exp. II and Exp. Ill are based on volatile natural oil and do not perform satisfactorily. Exp. IV is commercially available product. Treatments 13 and 14 are the reference product PREV-AM® based on Orange Oil and Sodium tetraboratehydrate decahydrate and had performance inferior to showed by products according this disclosure (treatments 1to 4).

[0099] The results obtained from this study are very promising because the majority of the compounds tested here can significantly inhibit a large number of serious plant pathogens. This indicates that after registration of these compounds, growers would have materials that could be effective against multiple important pathogens. The comparison per pathogen is showed at FIG. 1to FIG. 8.

[0100] f is clear that there are a synergistic relationship between OR-159 fungicide and the chemical activator adjuvants that results in a significantly improvements in control, compared at OR-159 when only acidified with citric acid. OR-159-B mixed with OR-278-C and OR-159-B mixed with OR-097-V showed a very synergistic and very promising treatment that can be very helpful in disease controls. The inclusion of the chemical activator shows improved anti-pathogenic properties to the fungicide. This is surprising and unexpected.

pH challenging test

[0101] Samples of products of certain embodiments were evaluated in a pH challenging test and their behavior when diluted in distillated water (DI water), CIPAC A water (20 ppm of hardness), CIPAC D water (342 ppm of hardness) and ASTM water of 1000 ppm - pH was measured in pure water for three specific pHs - 4.00, 7.00 and 9.00 and before adding the organic fungicide as per this disclosure and before

adding the chemical activator (adjuvant/pH adjuster).

Table 7: pH challenging test using organic fungicide and chemical activator adjuvant made according to this present disclosure

Products	pH (@25ºC)	pH (@25ºC)	pH (@25ºC)
DI water	4.00	7.00	9.00
OR-159-B (@ 1%)	7.45	7.21	8.8
OR-278-C (@ 1%)	4.55	4.40	4.50
CIPAC A water - 20 ppm	4.00	7.00	9.00
OR-159-B (@ 1%)	7.62	7.78	8.67
OR-278-C (@ 1%)	4.33	4.50	4.56
CIPAC D water - 342 ppm	4.00	7.00	9.00
OR-159-B (@ 1%)	7.80	8.01	8.61
OR-278-C (@ 1%)	4.3	4.53	4.57
ASTM water - 1000 ppm	4.00	7.00	9.00
OR-159-B (@ 1%)	7.74	8.08	8.4
OR-278-C (@ 1%)	4.30	4.47	4.45

[0102] Samples of agricultural compositions as per this disclosure showed stable behavior even diluted in soft water and hard water, low pH to high pH. The organic fungicide made according the present disclosure showed high solubility and stability - all solution were clear. After adding the pH adjuster and activator adjuvant made according the present disclosure over the solution containing the organic fungicide all tests showed very stable and similar final pH around 4.30 to 4.56 proving the high capacity from the adjuvant to adjust the pH, does not matter the initial pH or quality of the water, with all solution showing a clear and completely solubility of products what will contribute to the activity of dissociated sorbic acid anions.

[0103] Samples of commercially available products including from Oro Agri® the following products (WETCIT®) Adjuvant based on Alcohol Ethoxylated and Orange Oil, (OROBOOST®) Organic adjuvant based on Alcohol Ethoxylated and from other companies used as a reference of treatment the following product (SERENADE ® OPTI) a fungicide and bactericide from Bayer® based on QST 713 strain of Bacillus subtilis. All samples evaluated were stable even room temperature, in cold (14 days @ 0°C) or hot conditions (14 days @ 54°C) - according CIPAC MT 46 test.

Table 8: Physical and chemical results from Oro Agri® commercially available products and reference product from Bayer®

ANALYSIS	WETCIT®	OROBOOST®	SERENATE® OPTI
Appearance (product)	Green Liquid	Clear Golden Liquid	Brown powder
Density @ 20°C	1.020	0.923	-
pH (product)	5.80	4.55	-
pH (0.5% v/v)	5.60	4.08	6.88
Viscosity @ 25°C	25 cP	19 cP	-
Appearance (solution at 0.25% - distillated water)	Clear	Clear	Brown turbid solution
Emulsion Stability (CIPAC MT 36) 1% v/v 2 hours @ 30°C Water CIPAC A and D	No cream and No Oil	No cream and No Oil	-
Emulsion Stability Method CIPAC MT 36 1% v/v 24h30 hours re-emulsified at 30°C Water CIPAC A and D	No cream and No Oil	No cream and No Oil	-
Accelerated Storage Procedure Method CIPAC MT 46 (14 days at 0, 20 and 54°C)	Stable	Stable	-

Field trials to evaluate products made according the invention

[0104] The objective of this trial was to evaluate several Oro Agri products and adjuvants on control of powdery mildew on wine grapes in Washington. Powdery mildew incidence and severity were the measured variables, along with phytotoxicity.

[0105] Methods summary: The trial was established on an eleven-year-old block of Chardonnay wine grapes in Grandview, Washington. The soil series is Shano silt loam, a fertile soil with loess parent material. The trial area was drip-irrigated and maintained with fertility and pesticides according to grower standard practice. Plots consisted of five vines with one-vine buffers. Treatments were replicated four times, arranged in a randomized complete block design. Treatments included eight fungicide tank mixes in distilled water, along with untreated check (Table 9).

Table 9: Trials products list and rates applied for each treatment

Products	Rate	Notes
OR-159-B	0.25% v/v	Brought to pH 5 - 5.2 by using OR-278-C (i.e. the fungicide and chemical activator were admixed to provide agricultural compositions according to this disclosure)
OR-159-B	0.5% v/v	
OR-159-B	1 % v/v	
OR-159-B	2 % v/v	
Serenade Opti	20 oz/ac	Serenade Opti: 26.2% strain of *Bacillus subtilis*
Serenade Opti + **Oroboost**	20 oz/ac + 0.25% v/v	
Serenade Opti + **Wetcit**	20 oz/ac + 0.25% v/v	
Untreated	N/A	No fungicides applied

[0106] Applications were made on a 10-day interval for the duration of the season, for a total of ten applications. A Stihl SR 200 backpack mist blower was used to apply products. Spray volume was 50 gal/ac first, 100 gal/ac second, and 150 gal/ac for the remainder of the season.

[0107] To encourage powdery mildew growth, the trial area was inoculated with conidial inoculum two weeks post-bloom. Infected leaves collected from a site about 10 miles away were cut and then washed in distilled water containing 0.1% Tween 20. This suspension was applied to all plots with a Stihl SR 200 backpack mist blower, sprayed to coverage.

[0108] Phytotoxicity ratings were made in-season before every application. Twenty-five clusters from each plot were rated for incidence and severity as well. The middle vine from each plot was harvested. Clusters were weighed. A subsample of bunches from each plot was packaged in coolers with ice packs and shipped overnight to a Fresno State University viticulture laboratory for further quality analysis. pH, brix, and titratable acidity were measured. Statistical analyses were performed in SAS 9.4 under ANOVA with Tukey-Kramer modification and an alpha of 0.10.

[0109] Recorded leaf powdery mildew incidence averaged 99-100% in all plots. Mildew severity on untreated leaves was also high, nearly 75%. All product treatments statistically reduced severity relative to untreated (FIG 9). The grower standard Serenade Opti did not control leaf mildew severity well, with nearly half the leaf on average showing symptoms. Addition of surfactants did improve efficacy, with Oroboost® leading to 25% lower severity. OR-159-B applications showed a rate response, with the exception of 1% numerically out-performing 2%. OR-159-B at 2%, OR-159-B at 1%, and Serenade® Opti

+ Wetcit® were not statistically separated and were the most effective products trialed in terms of reduced leaf disease severity.

[0110] Berry mildew incidence was very high at the time of evaluation. Severity in the untreated plots averaged 37%, and all treatments statistically reduced cluster mildew severity (FIG 10). The same trend in OR-159-B treatments observed in leaf disease severity was seen in cluster disease; a rate response was clear, except the 1% rate numerically out-performed the 2% rate. Clusters receiving Serenade Opti treatment had a high mildew severity rating, and the addition of Oroboost® did not appear to help. However, Wetcit® acted as an effective adjuvant, reducing cluster severity by 31% compared to grower standard alone. Overall, OR-159-B at 1% and 2%, followed by Serenade® Opti + Wetcit®, were clearly the most effective treatments in lowering cluster disease severity.

[0111] Yield was moderate for wine grapes, low enough to maintain berry quality (FIG 11). Increasing OR-159-B rate did correspond to higher grape tonnage, with the 2% rate resulting in the highest average yield in the trial. Serenade® Opti alone resulted in a lower yield than when combined with an adjuvant. The poorest plot was untreated plots at 5.5 ton/ac. These results did not closely mirror the powdery mildew severity results, so other factors like fruit set likely played a larger role in yield than disease pressure. Additionally, no differences between treatment yield were statistically significant. Replicates 3 and 4 were higher yielding than the other two blocks.

[0112] Conclusion a) Inoculation proved effective in inducing powdery mildew infection, as visible signs emerged about ten days after the inoculate spray. Disease then progressed well, with powdery mildew visible on stems and vines, along with leaves and berries. Excellent spray coverage was achieved throughout the 10-day spray interval program. Phytotoxicity due to any Oro-Agri product application was not observed at any time during the season, remembering that OR-159-B was applied using a pH adjuster adjuvant OR-278-C that showed consistency to reduce the pH in a ratio around 1:1 with OR-159-B.

[0113] Conclusion b) Leaf powdery mildew pressure was high, with untreated plots rated at 100% incidence and 74% severity, on average. All products decreased powdery mildew severity on leaves. OR-159-B at 1% and 2% (always with activator OR-278-C), Serenade® Opti + Wetcit® were not statistically separated and led to the lowest leaf severity percentages (about 34%).

[0114] Conclusion c) All treatments contained nearly 100% disease incidence on clusters. As expected, severity was highest in untreated control plots, over 36%. Like leaves, every treatment decreased powdery mildew severity on clusters. Again, OR-159-B at 1% was numerically the top performer and was not significant different from OR-159-B at 2% (which in turn was not statistically separated from Serenade® Opti + Wetcit®).

[0115] Conclusion d) Considering percent control relative to untreated, no treatments were statistically different. Numerically, OR-159-B at 1% provided the greatest control - 54% on leaves and

68% on clusters - with OR-159-B at 2% closely following. Overall, OR-159-B showed promise as a powdery mildew control agent at 1% or even 2%. However, the severity ratings under this treatment (33% on leaves and 10% on berries) may not be high enough for commercial acceptance. Wetcit® was clearly effective as an adjuvant, statistically increasing performance of grower standard Serenade® Opti.

[0116] Conclusion e) No statistical differences between treatment yields were found. Yields increased with increasing rates of OR-159-B, culminating in a trial-high 8.3 ton/ac under OR-159-B at 2%. Yields were higher in Serenade® Opti + adjuvant versus Serenade Opti alone. However, yields did not correspond with powdery mildew ratings. Grape quality was acceptable, with no statistical differences between treatments (FIG. 12).

*Field trials - evaluation of fungicides for control of foliar and fruit diseases of wine grapes (Chancellor - **Vitis lambrusca)** 2019 - Trevor Nichols Research Center in Fennville - Michigan State University, East Lansing -MI*

[0117] The experiment was conducted in a mature 'Chancellor' ***(Vitis lambrusca)*** vineyard at the Trevor Nichols Research Center in Fennville, ML Vines were spaced at 6 x 10 ft and were cordon trained and hand pruned. Treatments were applied to 3-vine plots and were replicated four times in a randomized complete block design. Sprays were applied using a research sprayer equipped with six 5-gal tanks, a 12-volt 3.8-gpm diaphragm pump set at 55 psi, and an XR TeeJet 8002VS nozzle on a 5-ft spray boom. Spray volume was 40 gpa through 23 Jul, then 50 gpa for the remainder of the season.

[0118] Spray dates and approximate phenological stages were as follows: 1 Jun 2019 (3 in. shoots), 15 Jun 2019 (6 - 12 in. shoots), 25 Jun (bloom), 1 Jul 2019 (1st post-bloom), 9 Jul 2019 (2nd post-bloom), 16 Jul 2019 (3rd post-bloom), and 23 Jul 2019 (4th post-bloom), 6 Aug 2019 (5th post-bloom), 20 Aug 2019 (preharvest, °Brix 14.3). Rainfall between spray dates was 2.5 1, 1.63, 0.07, 0, 0.09, 1.77, 1.13, and 1.44 in., respectively. Downy mildew on leaves was rated 13 Sep 2019, sour bunch rot on clusters was rated 14 Sep 2019; powdery mildew on leaves and clusters was rated 16 Sep 2019.

[0119] In all cases, diseases were visually rated on 25 randomly selected leaves and/or clusters from the center vine in each plot. Incidence was calculated as % leaves or clusters with disease, and severity was calculated as % area symptomatic on diseased plant parts only. Overall severity was calculated as (incidence x severity)/ 100. Bracketed values denote percent control relative to the untreated check. Plots were monitored throughout the season for signs of phytotoxicity but none was observed. Results reported are shown in the Tables 10 to 12 below:

Table 10: Summary of results of ***(%)*** incidence ***(%)*** severity. ***(%)*** overall severity and ***(%)*** control of Downy mildew ***(Plasmopara viticola)*** on leaves - comparative of treatments performances

Treatment, rate/A	Application timing[z]	Downy mildew on leaves (rated 13 Sep 2019)						
		Incidence (%)		Severity (%)		Overall severity (%)		Control [%][y]
Untreated		84.0	a[x]	47.9[w]	A	40.3[w]	A	
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8, 9	54.0	B	17.3	B	9.6	b	[76.2]
Prev-Am® 0.4%	1, 2, 3, 4, 5, 6, 7, 8, 9	53.0	B	13.4	C	7.3	bc	[81.9]
Fracture 24.4 fl oz + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	50.0	Bc	11.6	C	5.9	cd	[85.4]
Pristine 8 oz OR-159-B 1% + OR 278-C 1%	1, 3, 5, 7, 9 2, 4, 6, 8,	50.0	Bc	6.9	de	3.4	de	[91.6]
Pristine 8 oz	1, 2, 3, 4, 5, 6, 7, 8, 9	49.0	Bc	14.3	C	7.2	bc	[82.1]
OR-159-B 1% + OR 278-C 1%	1, 2, 3, 4, 5, 6, 7, 8, 9	48.0	Bc	12.45	C	6.0	cd	[85.1]
OR-159-B 2% + OR-278-C 2%	1, 2, 3, 4, 5, 6, 7, 8, 9	45.0	C	7.6	d	3.4	de	[91.6]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG 10 oz Vangard WG + Pristine 23 oz Pristine 23 oz OR-159-B 2% + OR-278-C 2% + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	35.0	D	4.4	e	1.5	E	[96.3]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG10 oz Vangard WG + Pristine 23 oz Pristine 23 oz Fracture 24.4 fl oz + Nufilm P 0.125% + Mustang Max 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8, 9	34.0	D	5.7	de	2.0	E	[95.0]

[z]Spray dates: 1 = 1 Jun (3 in. shoots), 2 = 15 Jun (6 - 12 in. shoots), 3 = 25 Jun (bloom), 4 = 1 Jul (1st post-bloom), 5 = 9 Jul (2nd post-bloom), 6 = 16 Jul (3rd post-bloom), and 7 = 23 Jul (4th post-bloom), 8 = 6 Aug (5th post-bloom), 9 = 20 Aug (preharvest, °Brix 14.3).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected LSD test ($P \leq 0.05$).

[w]Data did not pass variance check; some assumptions of the ANOVA may have been violated.

Table 11: Summary of results of *(%)* incidence *(%)* severity. *(%)* overall severity and *(%)* control of Sour bunch rot *(Acetobacter spp.)* on cluster - comparative of treatments performances

Treatment, rate/A	Application timing[z]	Sour bunch rot on cluster (rated 14 Sep 2019)						
		Incidence (%)		Severity (%)		Overall severity (%)		Control [%][y]
Untreated		88.0	a[x]	53.0	a	46.7[w]	A	
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8, 9	69.0	B	26.0	b	17.8	B	[61.9]
PrevAm® 0.4%	1, 2, 3, 4, 5, 6, 7, 8, 9	65.0	Bc	24.3	b	15.7	B	[66.4]
OR-159-B 1% + OR 278-C 1%	1, 2, 3, 4, 5, 6, 7, 8, 9	54.0	De	16.3	c	8.9	C	[80.9]
OR-159-B 2% + OR-278-C 2%	1, 2, 3, 4, 5, 6, 7, 8, 9	57.0	Cd	8.7	d	4.9	d	[89.5]
Fracture 24.4 fl oz + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	46.0	Ef	10.5	cd	4.8	de	[89.7]
Pristine 8 oz	1, 2, 3, 4, 5, 6, 7, 8, 9	43.0	F	10.1	d	4.4	de	[90.6]
Pristine 8 oz OR-159-B 1% + OR 278-C 278 1%	1, 3, 5, 7, 9 2, 4, 6, 8,	42.0	f	6.3	d	2.7		[94.2]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG 10 oz Vangard WG + Pristine 23 oz Pristine 23 oz OR-159-B 2% + OR-278-C 2% + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	31.0	g	6.4	d	2.0	f	[95.7]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG 10 oz Vangard WG + Pristine 23 oz Pristine 23 oz Fracture 24.4 fl oz + Nufilm P 0.125% + Mustang Max 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8, 9	22.0	g	5.2	d	1.3	f	[97.2]

[z]Spray dates: 1 = 1 Jun (3 in. shoots), 2 = 15 Jun (6 - 12 in. shoots), 3 = 25 Jun (bloom), 4 = 1 Jul (1st post-bloom), 5 = 9 Jul (2nd post-bloom), 6 = 16 Jul (3rd post-bloom), and 7 = 23 Jul (4th post-bloom), 8 = 6 Aug (5th post-bloom), 9 = 20 Aug (preharvest, °Brix 14.3).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected LSD test ($P \leq 0.05$).

[w]Data reported are actual means; statistical analysis was performed on square-root(x) transformed data.

Table 12: Summary of results of *(%)* incidence *(%)* severity. *(%)* overall severity and *(%)* control of Powdery mildew *(Ervsiphe necator)* on leaves - comparative of treatments performances

Treatment, rate/A	Application timing[z]	Powdery mildew on leaves (rated 16 Sep 2019)						
		Incidence (%)		Severity (%)		Overall severity (%)		Control [%][x]
Untreated		58.0	a[x]	56.1	A	32.1	a	
OR-159 0.5% + OR-278 0.5%	1, 2, 3, 4, 5, 6, 7, 8, 9	43.0	b	11.2	B	4.8	b	[85.0]
PrevAm® 0.4%	1, 2, 3, 4, 5, 6, 7, 8, 9	39.0	b	9.8	Bc	3.8	b	[88.2]
OR-159-B 1% + OR 278-C 1%	1, 2, 3, 4, 5, 6, 7, 8, 9	39.0	b	8.0	Bcd	3.1	bc	[90.3]
Fracture 24.4 fl oz + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	35.0	b	9.7	Bc	3.5	bc	[89.1]
Pristine 8 oz	1, 2, 3, 4, 5, 6, 7, 8, 9	33.0	b	12.4	B	4.1	b	[87.2]
Pristine 8 oz OR-159-B 1% + OR 278 278-C 1%	1, 3, 5, 7, 9 2, 4, 6, 8,	33.0	b	11.0	B	3.9	b	[87.9]
OR-159-B 2% + OR-278-C 2%	1, 2, 3, 4, 5, 6, 7, 8, 9	17.0	c	6.9	Bcd	1.2	cd	[96.3]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG 10 oz Vangard WG + Pristine 23 oz Pristine 23 oz OR-159-B 2% + OR-278-C 2% + Nufilm P 0.125%	1, 2, 3, 4, 5, 6, 7, 8, 9	11.0	c	4.7	Cd	0.5	d	[98.4]
Manzate Max 0.56 gal Abound F 15.5 fl oz Sovran 50 WG 6.4 oz Rovral 4F 1.5 pt Rovral 4F 1.5 pt + Vangard WG 10 oz Vangard WG + Pristine 23 oz Pristine 23 oz Fracture 24.4 fl oz + Nufilm P 0.125% + Mustang Max 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8, 9	11.0	c	3.4	D	0.5	d	[98.4]

[z]Spray dates: 1 = 1 Jun (3 in. shoots), 2 = 15 Jun (6 - 12 in. shoots), 3 = 25 Jun (bloom), 4 = 1 Jul (1st post-bloom), 5 = 9 Jul (2nd post-bloom), 6 = 16 Jul (3rd post-bloom), and 7 = 23 Jul (4th post-bloom), 8 = 6 Aug (5th post-bloom), 9 = 20 Aug (preharvest, °Brix 14.3).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected LSD test ($P \leq 0.05$).

[0120] **Conclusions:** For three diseases rated, there were several differences between the fungicide treatments and the industry standard of Manzate/Sovran/Rovral/Vangard/Fracture/Mustang Max which provided the most control across all three diseases.

[0121] **Conclusion a)** Sour bunch rot (*Acetobacter spp.)* pressure was very high due to 2019 weather conditions. All fungicide treatments provided 62-97% control as compared to the UTC and several treatments were significantly different from each other.

[0122] **Conclusion b)** The most effective treatments at controlling Sour bunch rot *(Acetobacter spp.),* apart from the industry standard, were Manzate/Sovran/Rovral/Vangard/OR-159-B 2% + OR-278-C 2% and Pristine/OR-159-B 2% + OR-278-C 2%.

[0123] **Conclusion c)** Downy mildew (*Plasmopara viticola)* disease pressure on the leaves was also high. All fungicide treatments again significantly reduced disease 76-95% on leaves. The industry standard, Manzate/Sovran/Rovral/Vangard/Fracture/Mustang Max and Manzate/Sovran/Rovral/Vangard/OR-159-B 2% + OR-278-C 2% performed somewhat better than the other treatments.

[0124] **Conclusion d)** Powdery mildew (*Erysiphe necator)* was also rated on the leaves and the clusters. All treatments effectively controlled disease well and were comparable to ratings of sour bunch rot and downy mildew and provided significant control (i.e. 85-98% on leaves and 90-99% on clusters) as compared to the UTC.

Field trials - evaluation of fungicides for control of foliar and fruit diseases Niagara (Vitis interspecific hybrid "Niagara") grapes, 2019 - Clarksville Research Center in Clarksville - Michigan State University, East Lansing - MI

[0125] The experiment was conducted in a mature vineyard at the Clarksville Research Center in Clarksville. Vines were spaced at 7 x 9 ft and were cordon trained on a 2-wire trellis and hand pruned. Treatments were applied to 4-vine plots and were replicated 4 times in a randomized complete block design. Sprays were applied using a research sprayer equipped with six 5-gal tanks, a 12-volt 3.8-gpm diaphragm electric pump set at 55 psi, and an XR TeeJet 8002VS nozzle on a 5-ft spray boom. Spray volume was 40 gpa-

[0126] Spray dates and approximate phenological stages were as follows: 8 Jun 2019 (4-6 in. shoot), 19 Jun 2019 (12-16 in. shoot), 26 Jun (bloom), 3 Jul (1st post-bloom), 10 Jul 2019 (2nd post-bloom), 24 Jul 2019 (3rd post-bloom), 7 Aug 2019 (4th post-bloom), 2 1 Aug 2019 (5th post-bloom). Rainfall totals between sprays were: 1.63, 2.66, 0.68, 0.21, 1.36, 0.97, and 1.45 in., respectively.

[0127] On 19 Sep 2019, black rot (*Guignardia bidwellii)* was rated on the clusters; on 19 Sep 2019, downy mildew (*Plasmopara viticola*) was rated on the leaves; on 1 Oct 2019, phomopsis fruit rot

(Phosmopsis viticola) was rated on the clusters; on 1 Oct 2019, powdery mildew *(Erysiphe necator*) was rated on the leaves and clusters. In each case, 25 randomly selected leaves or clusters from the center vines in each plot were used for the ratings. Disease evaluation was incidence (% leaves or clusters infected) and severity (% area infected on diseased samples only). Overall severity in each case was calculated as (incidence x severity)/l 00. The vines were monitored for signs of phytotoxicity throughout the season.

[0128] Results reported are shown in the Tables 13 to 16 below:

Table 13: Summary of results of *(%)* incidence *(%)* severity. *(%)* overall severity and *(%)* control of Black rot *(Guisnardia bidwellii)* on clusters - comparative of treatments performances

		Black rot on clusters (rated 19 Sep 2019)						
Treatment, rate/A	Application timing[z]	Incidence (%)		Severity (%)		Overall severity (%)		Control [%][y]
Untreated		85.0	a[x]	62.2	a	53.0	A	
Kaligreen 2.5 lb	1, 2, 3, 4, 5, 6, 7, 8	89.0	a	44.8	b	40.0	B	[24.5]
Microthiol Disperss 3 lb	1, 2, 3, 4, 5, 6, 7, 8	89.0	a	48.0	b	42.8	B	[19.2]
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8	70.0	b	21.1	cd	14.9	cd	[73.6]
Prev-Am® 0.4%	1, 2, 3, 4, 5, 6, 7, 8	68.0	bc	20.8	cd	14.1	cd	[73.4]
Revus 8 fl oz	1, 2, 3, 4, 5, 6, 7, 8	60.0	d	15.8	de	9.7	de	[81.7]
OR-159-B 1% + OR-278-C 1%	1, 2, 3, 4, 5, 6, 7, 8	57.0	d	14.1	ef	8.1	ef	[84.9]
Quintec 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8	45.0	e	14.3	ef	6.6	efg	[87.5]
OR-159-B 2% + OR278-C 2%	1, 2, 3, 4, 5, 6, 7, 8	38.0	f	8.9	fg	3.5	fg	[93.4]
Manzate Pro-Stick 3 lb Abound 12 fl oz Revus Top 7 fl oz Pristine 12 oz	1, 2, 3, 4, 5, 6, 7, 8	26.0	g	5.9	g	1.7	g	[96.8]

[z]Spray dates and phonological stages are as follows: 1 = 8 Jun (4-6 in. shoot), 2 = 19 Jun (12-16 in. shoot), 3 = 26 Jun (bloom), 4 = 3 Jul (1st post-bloom), 5 = 10 Jul (2nd post-bloom), 6 = 24 Jul (3rd post-bloom), 7 = 7 Aug (4th post-bloom), 8 = 21 Aug (5th post-bloom).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected test ($P \leq 0.05$).

Table 14: Summary of results of *(%)* incidence *(%)* severity. *(%)* overall severity and *(%)* control of Phomopsis fuit rot *(Phomopsis viticola)* on clusters - comparative of treatments performances

		Phomopsis on clusters (rated 9 Oct 2019)			
Treatment, rate/A	Application timing[z]	Incidence (%)	Severity (%)	Overall severity (%)	Control [%][y]
Untreated		88.0 a[x]	52.5 a	46.2 a	
Microthiol Disperss 3 lb	1, 2, 3, 4, 5, 6, 7, 8	81.0 b	32.7 b	26.6 b	[42.4]
Kaligreen 2.5 lb	1, 2, 3, 4, 5, 6, 7, 8	71.0 c	27.4 c	19.5 c	[57.8]
Revus 8 fl oz	1, 2, 3, 4, 5, 6, 7, 8	67.0 cd	19.7 d	13.2 d	[71.4]
OR-159-B 1% + OR-278-C 1%	1, 2, 3, 4, 5, 6, 7, 8	64.0 de	15.7 de	10.1 de	[78.1]
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8	63.0 de	18.7 d	11.8 d	[74.5]
Quintec 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8	62.0 de	19.7 d	12.2 d	[73.6]
Prev-Am® 0.4%	1, 2, 3, 4, 5, 6, 7, 8	59.0 ef	19.7 d	11.6 d	[74.9]
OR-159-B 2% + OR-278-C 2%	1, 2, 3, 4, 5, 6, 7, 8	54.0 f	12.3 e	6.6 e	[85.7]
Manzate Pro-Stick 3 lb Abound 12 fl oz Revus Top 7 fl oz Pristine 12 oz.....	1, 2, 3, 4, 6, 8 5, 7,	27.0 g	6.6 f	1.9 f	[95.9]

[z]Spray dates and phonological stages are as follows: 1 = 8 Jun (4-6 in. shoot), 2 = 19 Jun (12-16 in. shoot), 3 = 26 Jun (bloom), 4 = 3 Jul (1st post-bloom), 5 = 10 Jul (2nd post-bloom), 6 = 24 Jul (3rd post-bloom), 7 = 7 Aug (4th post-bloom), 8 = 21 Aug (5th post-bloom).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected test ($P \leq 0.05$).

Table 15: Summary of results of *(%)* incidence *(%)* severity, *(%)* overall severity and *(%)* control of Downy mildew *(Plasmopara viticola)* on leaves - comparative of treatments performances

		Downy mildew on leaves (rated 1 Oct 2019)						
Treatment, rate/A	Application timing[z]	Incidence (%)		Severity (%)		Overall severity (%)		Control [%][y]
Untreated		91.0	a[x]	60.0	a	54.6[w]	a	
Kaligreen 2.5 lb	1, 2, 3, 4, 5, 6, 7, 8	87.0	a	40.0	b	34.9	b	[36.1]
Microthiol Disperss 3 lb	1, 2, 3, 4, 5, 6, 7, 8	86.0	a	34.8	c	30.6	b	[44.0]
Prev-Am® 0.4%	1, 2, 3, 4, 5, 6, 7, 8	48.0	b	10.7	d	5.2	c	[90.5]
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8	45.0	b	10.7	d	5.1	c	[90.7]
OR-159-B 1% + OR-278-C 1%	1, 2, 3, 4, 5, 6, 7, 8	44.0	bc	6.9	de	3.1	cd	[94.3]
OR-159-B 2% + OR-278-C 2%	1, 2, 3, 4, 5, 6, 7, 8	27.0	ef	4.8	e	1.3	ef	[97.6]
Revus 8 fl oz	1, 2, 3, 4, 5, 6, 7, 8	26.0	ef	4.4	e	1.2	f	[97.8]
Quintec 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8	20.0	ef	4.0	e	0.8	f	[98.5]
Manzate Pro-Stick 3 lb Abound 12 fl oz Revus Top 7 fl oz Pristine 12 oz	1, 2, 3, 4, 6, 8 5, 7,	19.0	f	3.9	e	0.8	f	[98.5]

[z]Spray dates and phonological stages are as follows: 1 = 8 Jun (4-6 in. shoot), 2 = 19 Jun (12-16 in. shoot), 3 = 26 Jun (bloom), 4 = 3 Jul (1st post-bloom), 5 = 10 Jul (2nd post-bloom), 6 = 24 Jul (3rd post-bloom), 7 = 7 Aug (4th post-bloom), 8 = 21 Aug (5th post-bloom).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected test ($P \leq 0.05$).

[w]Values shown are actual means. Statistical analysis was performed on Square root(x) transformed data.

Table 16: Summary of results of *(%)* incidence *(%)* severity. *(%)* overall severity and *(%)* control of Powdery mildew *(Erysiphe necator)* on clusters - comparative of treatments performances

Treatment, rate/A	Application timing[z]	Powdery mildew on clusters (rated 10 Oct 2019)			
		Incidence (%)	Severity (%)	Overall severity (%)	Control [%][y]
Untreated		63.0 a[x]	48.9 A	30.9 a	
Microthiol Disperss 3 lb	1, 2, 3, 4, 5, 6, 7, 8	32.0 b	6.6 B	2.2 b	[92.9]
Kaligreen 2.5 lb	1, 2, 3, 4, 5, 6, 7, 8	27.0 b	5.8 B	1.6 bc	[94.8]
OR-159 0.5% + OR-278 0.5%	1, 2, 3, 4, 5, 6, 7, 8	20.0 c	5.6 B	1.1 bc	[96.4]
Prev-Am® 0.4%	1, 2, 3, 4, 5, 6, 7, 8	20.0 c	5.7 B	1.1 bc	[96.4]
OR-159 1% + OR-278 1%	1, 2, 3, 4, 5, 6, 7, 8	14.0 c	2.3 C	0.3 c	[99.0]
OR-159 2% + OR278 2%	1, 2, 3, 4, 5, 6, 7, 8	6.0 d	2.1 C	0.2 c	[99.4]
Quintec 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8	4.0 d	2.3 C	0.1 c	[99.7]
Revus 8 fl oz	1, 2, 3, 4, 5, 6, 7, 8	1.0 d	0.5 C	0.02 c	[99.9]
Manzate Pro-Stick 3 lb Abound 12 fl oz Revus Top 7 fl oz Pristine 12 oz	1, 2, 3, 4, 5, 6, 7, 8	1.0 d	0.5 C	0.02 c	[99.9]

[z]Spray dates and phonological stages are as follows: 1 = 8 Jun (4-6 in. shoot), 2 = 19 Jun (12-16 in. shoot), 3 = 26 Jun (bloom), 4 = 3 Jul (1st post-bloom), 5 = 10 Jul (2nd post-bloom), 6 = 24 Jul (3rd post-bloom), 7 = 7 Aug (4th post-bloom), 8 = 21 Aug (5th post-bloom).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected test ($P \leq 0.05$).

Table 17: Summary of results of ***(%)*** incidence ***(%)*** severity. ***(%)*** overall severity and ***(%)*** control of Powdery mildew ***(Erysiphe necator)*** on leaves - comparative of treatments performances

Treatment, rate/A	Application timing[z]	Powdery mildew on leaves (rated 10 Oct 2019)						
		Incidence (%)		Severity (%)		Overall severity (%)		Control [%][y]
Untreated		68.0	a[x]	52.7	a	35.9	a	
Microthiol Disperss 3 lb	1, 2, 3, 4, 5, 6, 7, 8	41.0	b	10.7	b	4.4	b	[87.7]
Kaligreen 2.5 lb	1, 2, 3, 4, 5, 6, 7, 8	39.0	b	9.9	b	3.9	b	[89.1]
OR-159-B 0.5% + OR-278-C 0.5%	1, 2, 3, 4, 5, 6, 7, 8	35.0	bc	8.2	bc	2.9	bc	[91.9]
Prev-Am® 4%	1, 2, 3, 4, 5, 6, 7, 8	34.0	bc	11.8	b	4.0	b	[88.9]
OR-159-B 1% + OR-278-C 1%	1, 2, 3, 4, 5, 6, 7, 8	27.0	C	5.1	cd	1.5	cd	[95.8]
OR-159-B 2% + OR278-C 2%	1, 2, 3, 4, 5, 6, 7, 8	16.0	D	2.5	D	0.5	cd	[98.6]
Quintec 4 fl oz	1, 2, 3, 4, 5, 6, 7, 8	11.0	de	2.8	d	0.4	d	[98.9]
Revus 8 fl oz	1, 2, 3, 4, 5, 6, 7, 8	3.0	E	1.2	d	0.1	d	[99.7]
Manzate Pro-Stick 3 lb Abound 12 fl oz Revus Top 7 fl oz Pristine 12 oz	1, 2, 3, 4, 6, 8 5, 7,	5.0	E	1.3	d	0.1	d	[99.7]

[z]Spray dates and phonological stages are as follows: 1 = 8 Jun (4-6 in. shoot), 2 = 19 Jun (12-16 in. shoot), 3 = 26 Jun (bloom), 4 = 3 Jul (1st post-bloom), 5 = 10 Jul (2nd post-bloom), 6 = 24 Jul (3rd post-bloom), 7 = 7 Aug (4th post-bloom), 8 = 21 Aug (5th post-bloom).

[y]Bracketed values denote percent control relative to the untreated check.

[x]Column means followed by the same letter are not significantly different according to Fisher's Protected test ($P \leq 0.05$).

[0129] **Conclusions:** Phomopsis fruit rot (***Phosmopsis viticola***) and black rot (***Guignardia bidwellii)*** disease pressure on the cluster in this trial was high. Powdery mildew (***Erysiphe necator***) and downy mildew (***Plasmopara viticola***) disease pressure was moderate to high, respectively in this trial.

[0130] **Conclusion a)** Phomopsis fruit rot ***{Phosmopsis viticola)*** and black rot ***{Guignardia bidwellii)*** disease - All treatments significantly reduced disease as compared to the untreated control.

[0131] **Conclusion b)** The industry standard of Manzate/Abound/Revus Top/Pristine was statistically the best treatment reducing disease between 96-97%.

[0132] **Conclusion c)** Treatments of OR-159-B at 2%, OR-159-B at 1%, OR-159-B at 0.5% and Prev-am at 0.4% were also very effective at controlling the diseases. Microthiol disperse and Kaligreen were the least effective at controlling disease (between 19-58% control).

[0133] Conclusion d) Powdery and downy mildew was significantly reduced using several of the treatments. The most effective treatment was Manzate/Abound/Revus Top/Pristine reducing powdery mildew by 100% and downy mildew by 99%.

[0134] Conclusion e) Very little control was observed in Kaligreen and Microthiol disperse treatments for both powdery and downy mildew.

[0135] Conclusion f) Treatments of OR-159-B at 2%, OR-159-B at 1%, OR-159-B at 0.5% and Prev-Am® at 0.4% were also very effective at controlling both powdery and downy mildew.

[0136] Conclusion g) Phytotoxicity in the form of leaf bum was observed only in the Microthiol Disperse treatment.

[0137] Unless otherwise defined, all terms (including technical and scientific terms) are to be given their ordinary and customary meaning to a person of ordinary skill in the art, and are not to be limited to a special or customized meaning unless expressly so defined herein. It should be noted that the use of particular terminology when describing certain features or aspects of the disclosure should not be taken to imply that the terminology is being re-defined herein to be restricted to include any specific characteristics of the features or aspects of the disclosure with which that terminology is associated. Terms and phrases used in this application, and variations thereof, especially in the appended claims, unless otherwise expressly stated, should be construed as open ended as opposed to limiting. As examples of the foregoing, the term 'including' should be read to mean 'including, without limitation,' 'including but not limited to,' or the like; the term 'comprising' as used herein is synonymous with 'including,' 'containing,' or 'characterized by,' and is inclusive or open-ended and does not exclude additional, unrecited elements or method steps; the term 'having' should be interpreted as 'having at least;' the term 'includes' should be interpreted as 'includes but is not limited to;' the term 'example' is used to provide exemplary instances of the item in discussion, not an exhaustive or limiting list thereof; adjectives such as 'known', 'normal', 'standard', and terms of similar meaning should not be construed as limiting the item described to a given time period or to an item available as of a given time, but instead should be read to encompass known, normal, or standard technologies that may be available or known now or at any time in the future; and use of terms like 'preferably,' 'preferred,' 'desired,' or 'desirable,' and words of similar meaning should not be understood as implying that certain features are critical, essential, or even important to the structure or function of the invention, but instead as merely intended to highlight alternative or additional features that may or may not be utilized in a particular embodiment of the invention. Likewise, a group of items linked with the conjunction 'and' should not be read as requiring that each and every one of those items be present in the grouping, but rather should be read as 'and/or' unless expressly stated otherwise. Similarly, a group of items linked with the conjunction 'or' should not be read as requiring mutual

exclusivity among that group, but rather should be read as 'and/or' unless expressly stated otherwise.

[0138] Where a range of values is provided, it is understood that the upper and lower limit, and each intervening value between the upper and lower limit of the range is encompassed within the embodiments.

[0139] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity. The indefinite article "a" or "an" does not exclude a plurality. A single processor or other unit may fulfill the functions of several items recited in the claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

[0140] It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to embodiments containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation *is* explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system

having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.)· It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B."

[0141] All numbers expressing quantities of ingredients, reagents, reaction conditions, and so forth used in the specification are to be understood as being modified in all instances by the term 'about.' Accordingly, unless indicated to the contrary, the numerical parameters set forth herein are approximations that may vary depending upon the desired properties sought to be obtained. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of any claims in any application claiming priority to the present application, each numerical parameter should be construed in light of the number of significant digits and ordinary rounding approaches.

[0142] The agricultural composition according to this disclosure provides for an environmentally friendly, stable, and effective anti-pathogen. The synergistic interactions between the anti-pathogenic compound (exemplified herein as a fungicide) and the chemical activator of the agricultural composition were unexpected and surprising. The agricultural composition allows easy dosage and easy use in any type of soft or hard, acidic or alkaline water and allows organic treatment. Further, the composition allows for use, alone or in combination with other pathogen treatment protocols in pre-harvest or post-harvest plant crops, seeds, flowers, fruits, vegetables, trees, animals, equipment, cleaning tools, greenhouses, other spaces on the farm or industrial facilities.

[0143] Furthermore, although the foregoing has been described in some detail by way of illustrations and examples for purposes of clarity and understanding, it is apparent to those skilled in the art that certain changes and modifications may be practiced. Therefore, the description and examples should not be construed as limiting the scope of the invention to the specific embodiments and examples described herein, but rather to also cover all modification and alternatives coming with the true scope and spirit of the invention.

WHAT IS CLAIMED IS:

1. An agricultural composition comprising

an anti-pathogenic compound including potassium sorbate; and

a chemical activator including an acid and at least one (C_1-C_8) alkyl ester of an (C_{12}- C_{16}) alkyl acid.

2. The agricultural composition of claim 1, wherein the chemical activator further comprises an anionic surfactant and/or a nonionic surfactant.

3. The agricultural composition of claim 1, wherein the at least one (C_1-C_8) alkyl ester is selected from the group consisting of: methyl esters, ethyl esters, propyl esters, butyl esters, isopropyl esters, isobutyl esters, isopentyl esters, 2-ethylhexyl esters, and combinations thereof.

4. The agricultural composition of claim 3, wherein the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid is selected from the group consisting of: isobutyl laurate, isopentyl laurate, methyl laurate, 2-ethylhexyl laurate, 2-ethylhexyl palmitate, isopropyl laurate, isopropyl myristate, isopropyl palmitate, and combinations thereof.

5. The agricultural composition of claim 2, wherein the anionic surfactant is selected from the group consisting of: (C_6 - C_{18}) alkyl benzene sulfonic acid salts, calcium dodecylbenzene sulfonate, sodium dodecylbenzene sulfonate, triethanolamine dodecylbenzene sulfonate, (C_6-C is) alkyl ether sulfates, (C_6 - C_{18}) alkyl ethoxylated ether sulfates, sodium lauryl ether sulfate, sodium lauryl polyoxyethylene ether sulfate, (C_6-C_{18}) alkyl sulfates, (C_6-C_{18}) alkyl phosphate esters, (C_6-C_{18}) alkoxylated sulfates, (C_6 - C_{18}) alkoxylated phosphate esters, xylene sulfonate salts, cumene sulfonate salts, naphthalene sulfonates, alkylnaphthalene sulfonates, condensated alkylnaphahalene sulfonates, and combinations thereof.

6. The agricultural composition of claim 2, wherein the nonionic surfactant is selected from the group consisting of: natural or synthetic alkoxylated alcohols, preferably ethoxylated and/or propoxylated alcohols, further preferably ethoxylated and/or propoxylated fatty alcohols or fatty acids, further preferably containing from 8 to 22 carbon atom; short ethoxylated and/or propoxylated chain alcohols, preferably short ethoxylated and/or propoxylated fatty alcohols; ethoxylated fatty acids; alkoxylated sorbitan fatty esters, ethoxylated sorbitan fatty esters; alkoxylated sorbitol fatty esters, ethoxylated sorbitol fatty esters, polyoxyethylene sorbitan

monolaurate, polyoxyethylene sorbitan monopalmitate, polyoxyethylene sorbitan monostearate; (C_8-C_{22}) alkoxylated fatty alcohols, (C_8-C_{22}) ethoxylated fatty alcohols, (C_8-C_{22}) propoxylated fatty alcohols, (C_8-C_{22}) ethoxylated and propoxylated fatty alcohols, alkyl(poly)glycosides, straight chain (C_4-C_{10}) alkyl(poly)glycosides, branched chain (C_4-C_{10}) alkyl(poly)glycosides; and combinations thereof.

7. The agricultural composition of claim 6, wherein the nonionic surfactant is ethoxylated alcohol having a degree of ethoxylation of from 1 to 50.

8. The agricultural composition of claim 1, wherein the acid of the chemical activator is an aqueous citric acid solution of between 1 to 99 percent citric acid, preferably 50% citric acid solution.

9. The agricultural composition of claim 2, wherein the anti-pathogenic compound is in a concentrated form comprising water as a diluent such that the potassium sorbate comprises 35 to 55 wt. % of the anti-pathogenic compound, and wherein the chemical activator is in a concentrated form comprising water as a diluent such that the acid comprises 30 to 55 wt.% of the chemical activator, the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid comprises 0.5 to 5 wt. % of the chemical activator, the anionic surfactant comprises 1 to 5 wt. % of the chemical activator, and the nonionic surfactant comprises 3 to 10 wt. % of the chemical activator.

10. The agricultural composition of claim 9, wherein the anti-pathogenic compound further comprises urea such that the urea is 1 to 5 wt. % of the anti-pathogenic compound.

11. The agricultural composition according to claim 9, wherein the concentrate pathogenic compound has a pH range of between 7.0 to 10.0, and wherein the concentrate chemical activator has a pH range of between 0.0 and 3.0, such that in use, the concentrate anti-pathogenic compound and the concentrate chemical activator are admixed and/or diluted, providing a stable tank mix of diluted agricultural composition providing a pH of between 4 and 6.

12. The agricultural composition of claim 1, further comprising at least one additive selected from the group consisting of: nutrients, stimulants, growth agents, sugars, amino-acids, micronutrients (including fertilizers and hormones), preservatives, clarifiers, anti-freezing agents, hydrotropes, stabilizers, antioxidants, acidifiers, chelates, complexing agents, dyes, rheology modifiers, antifoams, anti-drift, water, oil(s), other solvents and combinations thereof.

13. The agricultural composition of claim 2, wherein the anti-pathogenic compound is in a concentrated form comprising water as a diluent and urea such that the potassium sorbate comprises 35 to 55 wt. % of the anti-pathogenic compound and the urea comprises 1 to 5 wt. % of the anti-pathogenic compound, the concentrate anti-pathogenic compound having a pH range of between 7.0 to 10.0, and

wherein the chemical activator is in a concentrated form comprising water as a diluent, and

wherein the acid is citric acid such that the citric acid comprises 30 to 55 wt.% of the chemical activator,

wherein the at least one (C_1-C_8) alkyl ester of an (C_{12} - C_{16}) alkyl acid is isopropyl myristate and/or isopropyl laurate such the isopropyl myristate and/or isopropyl laurate comprises 0.5 to 5 wt. % of the chemical activator,

wherein the anionic surfactant is sodium lauryl ether sulfate such that the sodium lauryl ether sulfate comprises 1 to 5 wt. % of the chemical activator, and

wherein the nonionic surfactant is a fatty alcohol ethoxylate such that the fatty alcohol ethoxylated comprises 3 to 10 wt. % of the chemical activator, the concentrate chemical activator having a pH range of between 0.0 and 3.0,

such that in use, the concentrate anti-pathogenic compound and the concentrate chemical activator are admixed and/or diluted, providing a stable tank mix of diluted agricultural composition providing a pH of between 4 and 6.

14. A method of manufacturing the agricultural composition of claim 1, the method comprising the step of admixing the anti-pathogenic compound and chemical activator of claim 1 in water.

15. The method of claim 14, wherein the step of admixing further includes:

(i) diluting the anti-pathogenic compound of claim 1 with water at a ratio by weight of anti-pathogenic compound to water of from about 1:100 to about 1:10 to yield a stable diluted solution of nonactivated anti-pathogenic compound; and thereafter

(ii) diluting the chemical activator with the stable diluted solution of nonactivated anti-pathogenic compound at a ratio by weight of anti-pathogenic compound to the chemical activator of from about 1:0.4 to about 1:2 to yield a stable tank mix of diluted agricultural composition having a pH range of between 4.0 to 6.0.

16. The agricultural composition of claim 1 and/or the diluted agricultural composition of claim 11 for use in the control of agricultural pathogens and/or in the treatment of disease caused by said agricultural pathogens.

17. A method of controlling agricultural pathogens, the method comprising the steps of applying the agricultural composition of claim 1 and/or the diluted agricultural composition of claim 11 onto, or adjacent to pre-harvested or post-harvested trees, plants, fruits, flowers , roots, or seeds.

18. The method of claim 17, wherein the application onto, or adjacent to a tree, a plant, fruits, flowers, roots or seed, is via an apparatus selected from the group: air assisted sprayers, conventional sprayers, ultra-low volumes equipment such as aerial, electrostatic, foggers and misting spray equipment and chemigation systems, pivots, sprinklers, and combinations thereof.

19. The method of claim 18, further comprising the step of applying the agricultural composition of claim 1 and/or the diluted agricultural composition of claim 11 onto, or adjacent to, animals, equipment, stockyards, feedlots, bams, animal housing units, tools, buildings, storage areas, or food contact areas to control fungal and/or bacterial pathogens that cause disease.

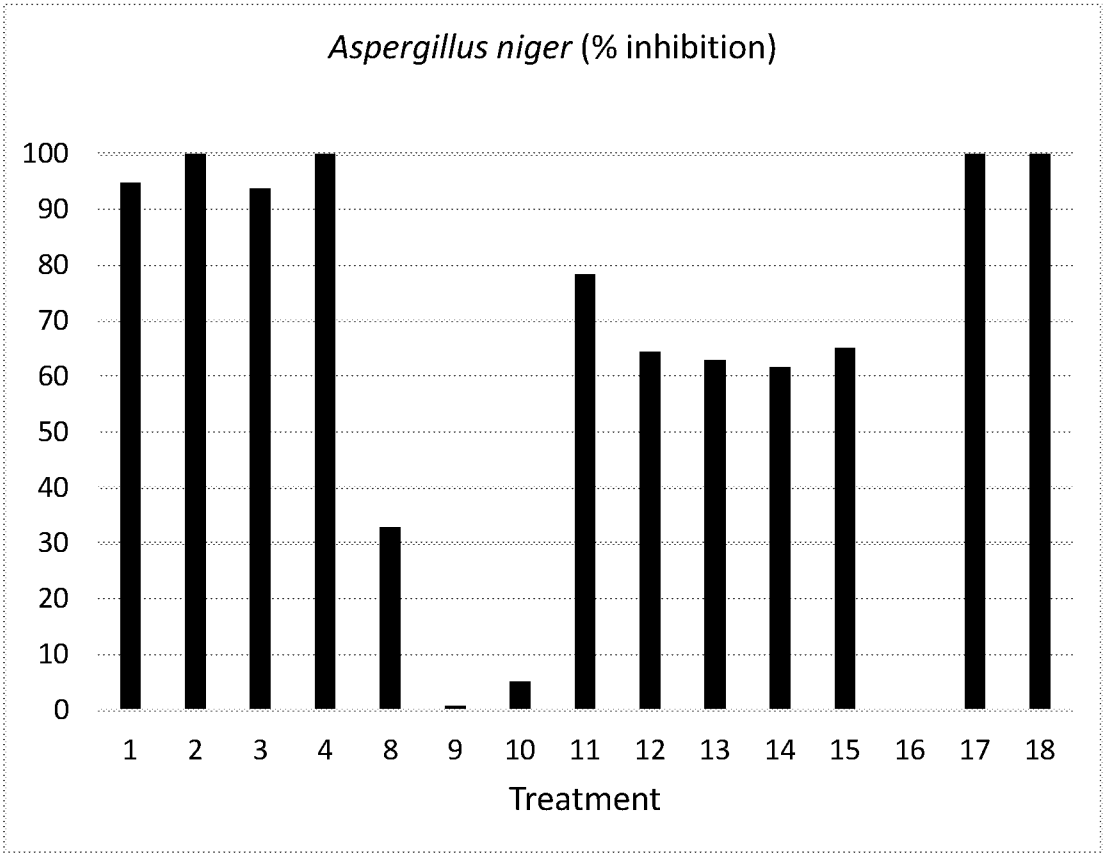
Aspergillus niger (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 1

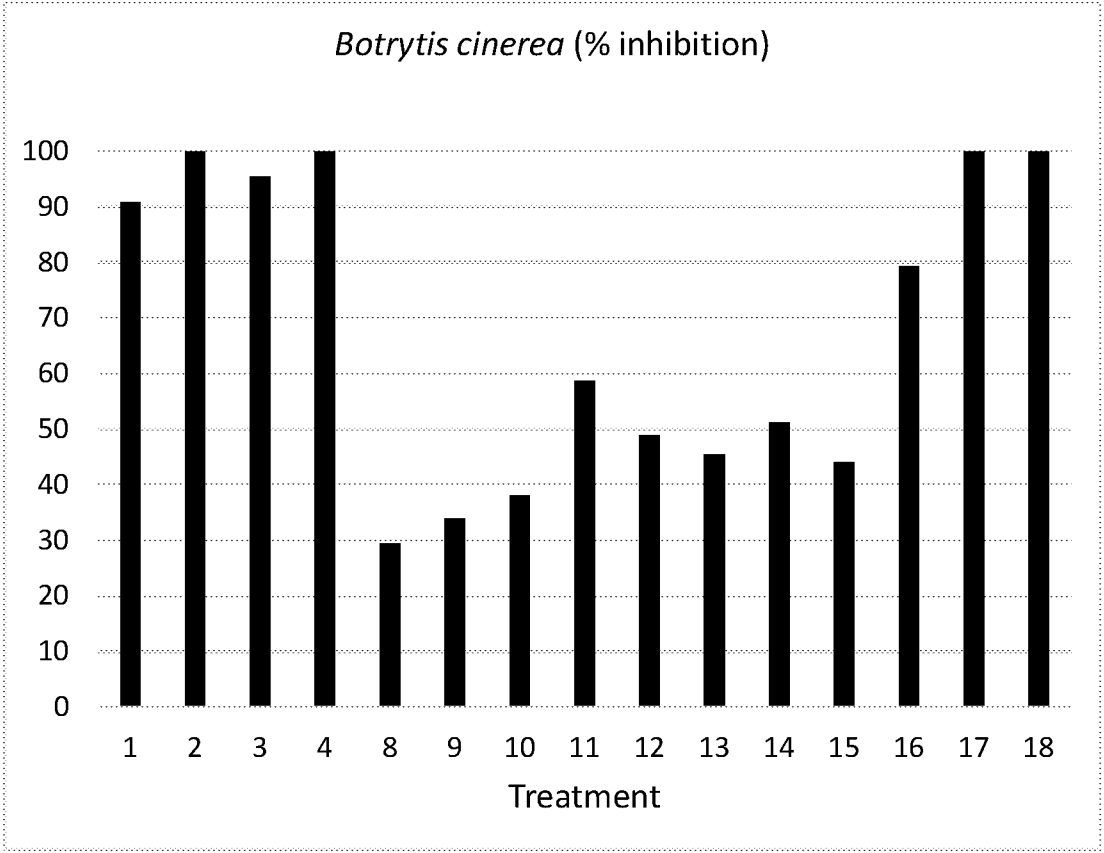
Botrytis cinerea (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 2

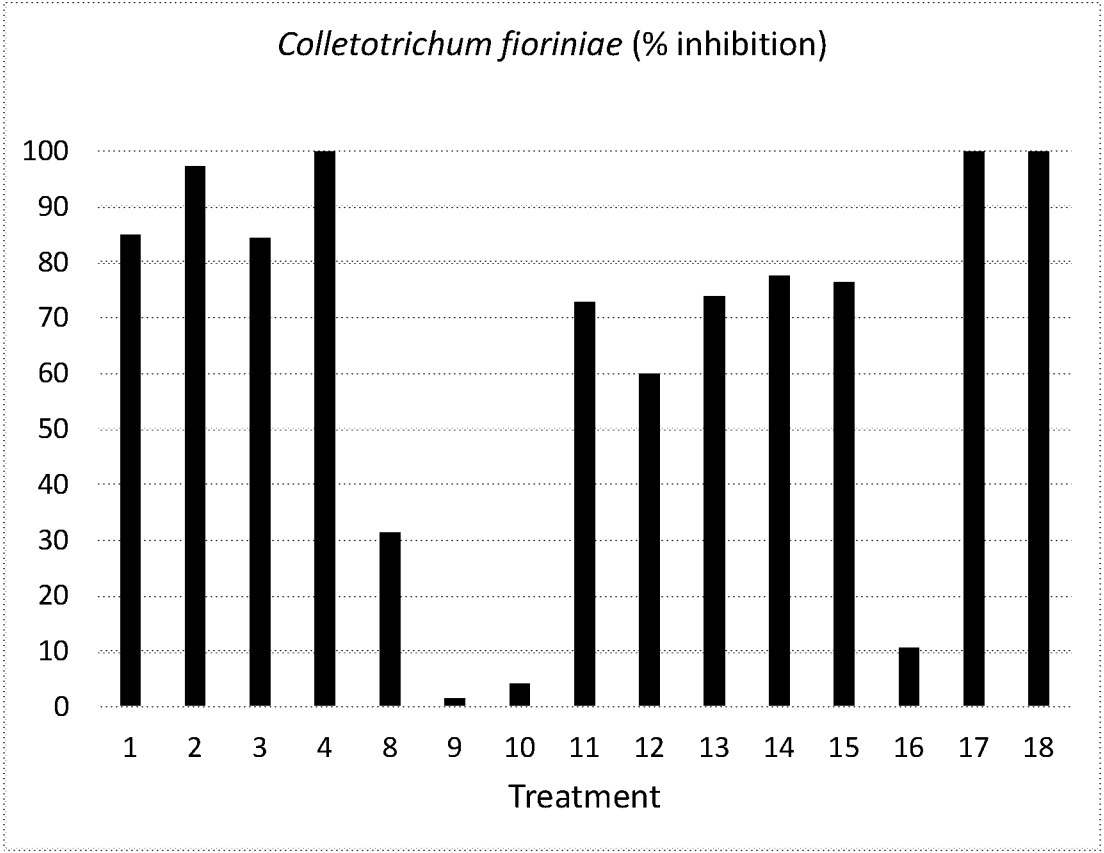
Colletotrichum fioriniae (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 3

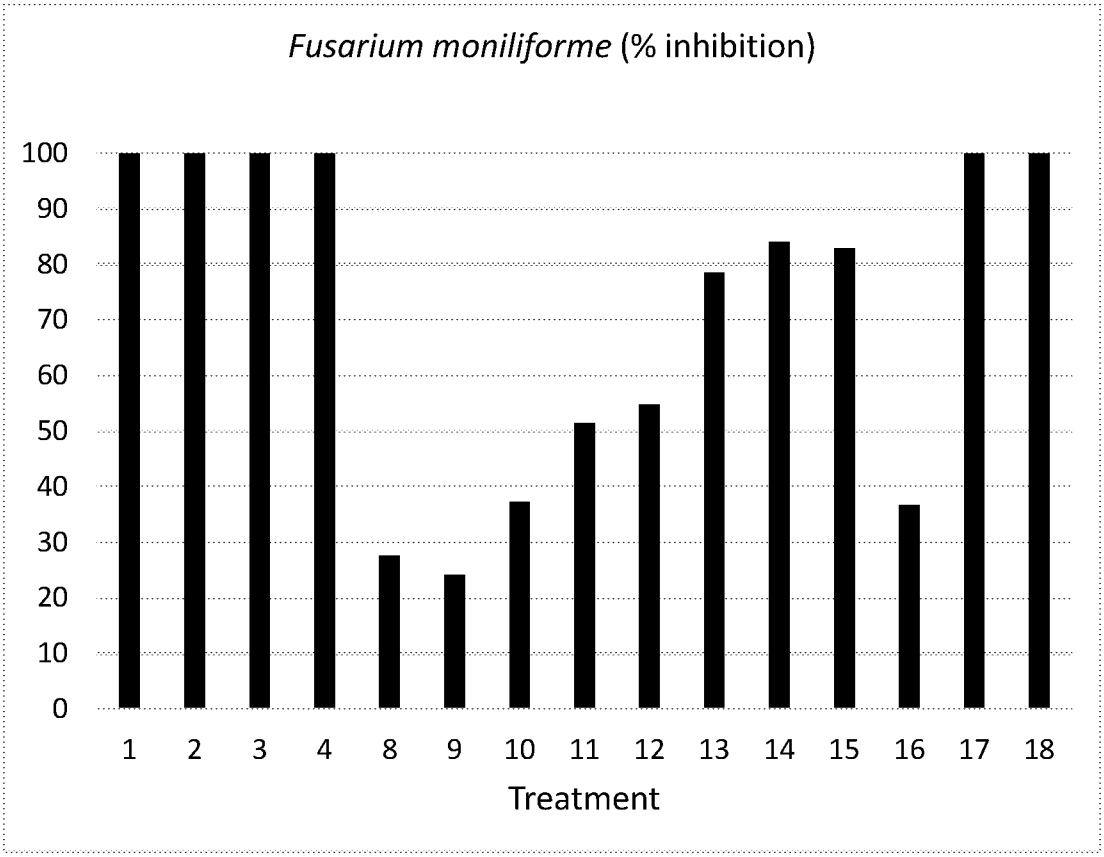
Fusarium moniliforme (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 4

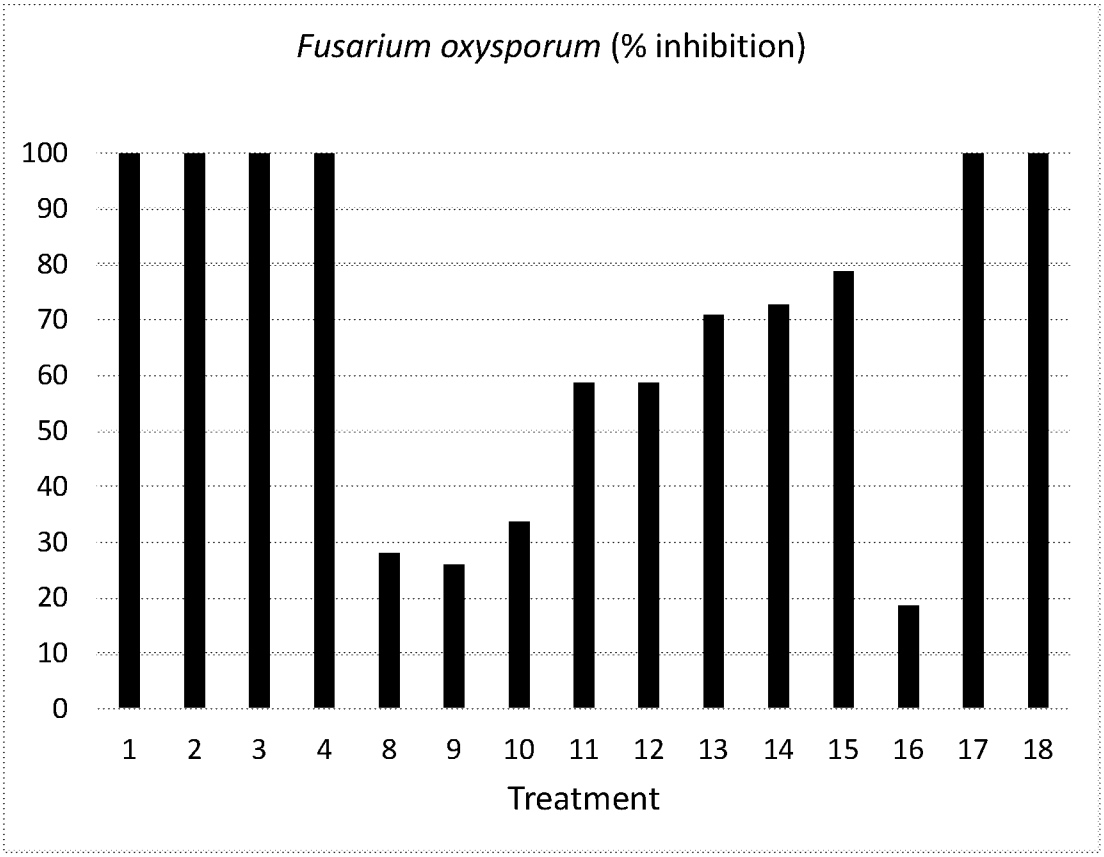
Fusarium oxysporum (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 5

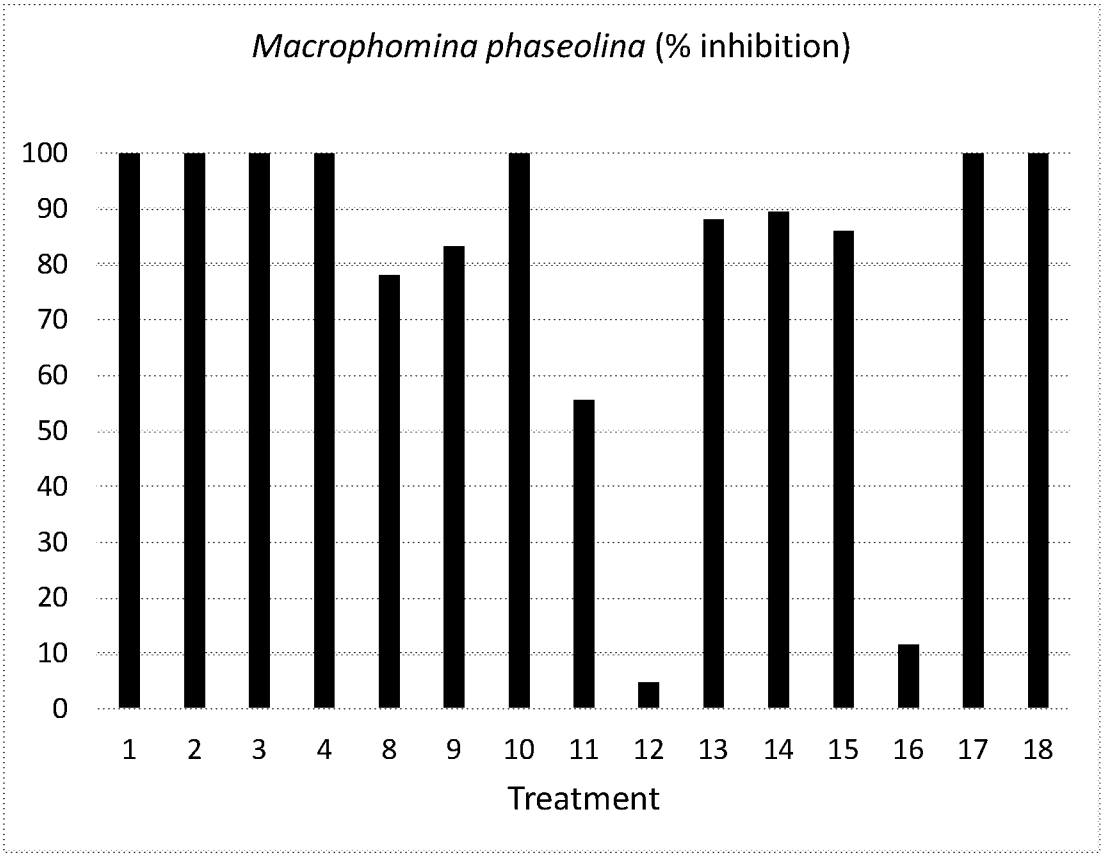
Macrophomina phaseolina (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 8 9 10 11 12 13 14 15 16 17 18
Treatment

FIG. 6

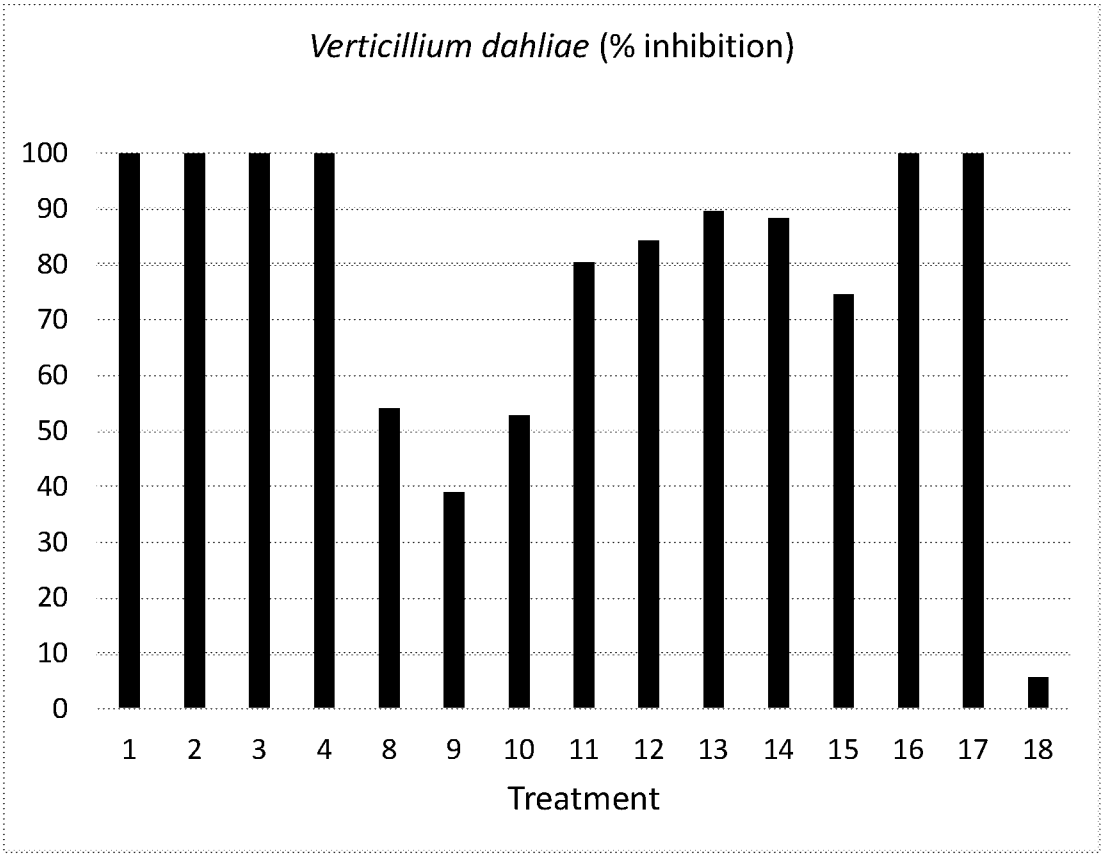
Verticillium dahliae (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 7

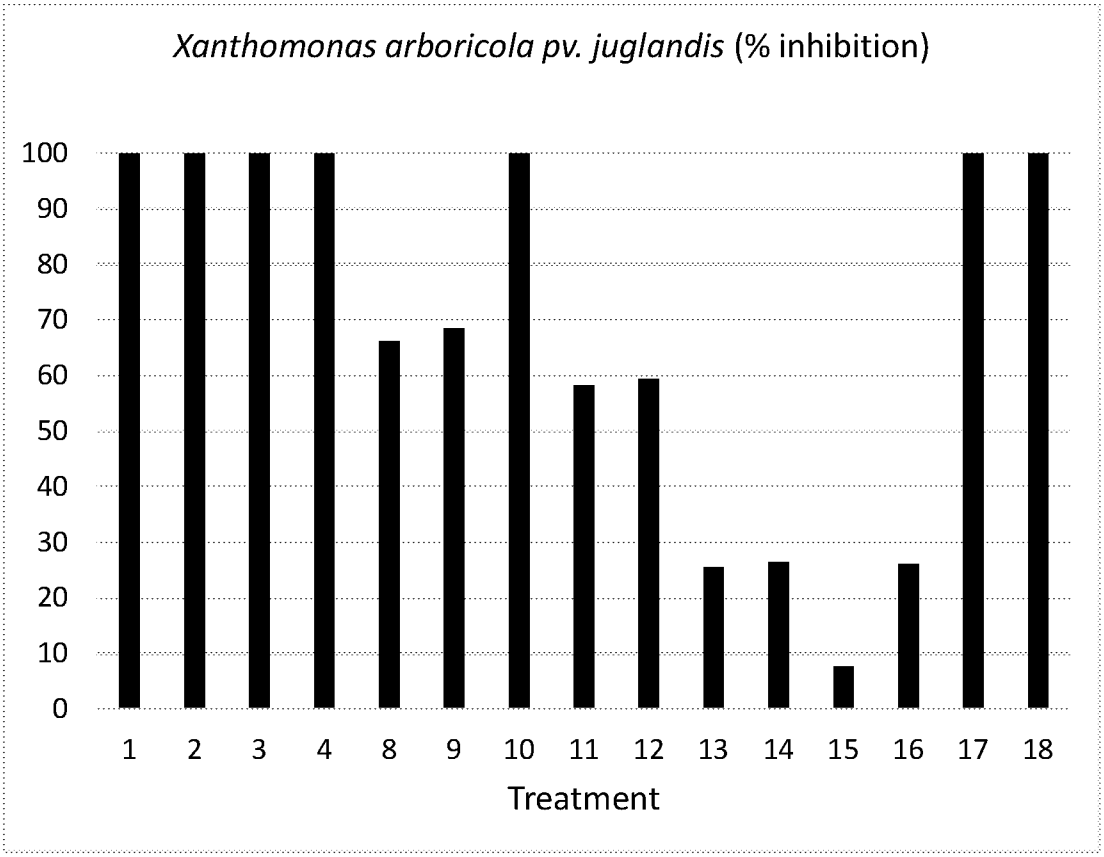
Xanthomonas arboricola pv. juglandis (% inhibition)
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
8
9
10
11
12
13
14
15
16
17
18
Treatment

FIG. 8

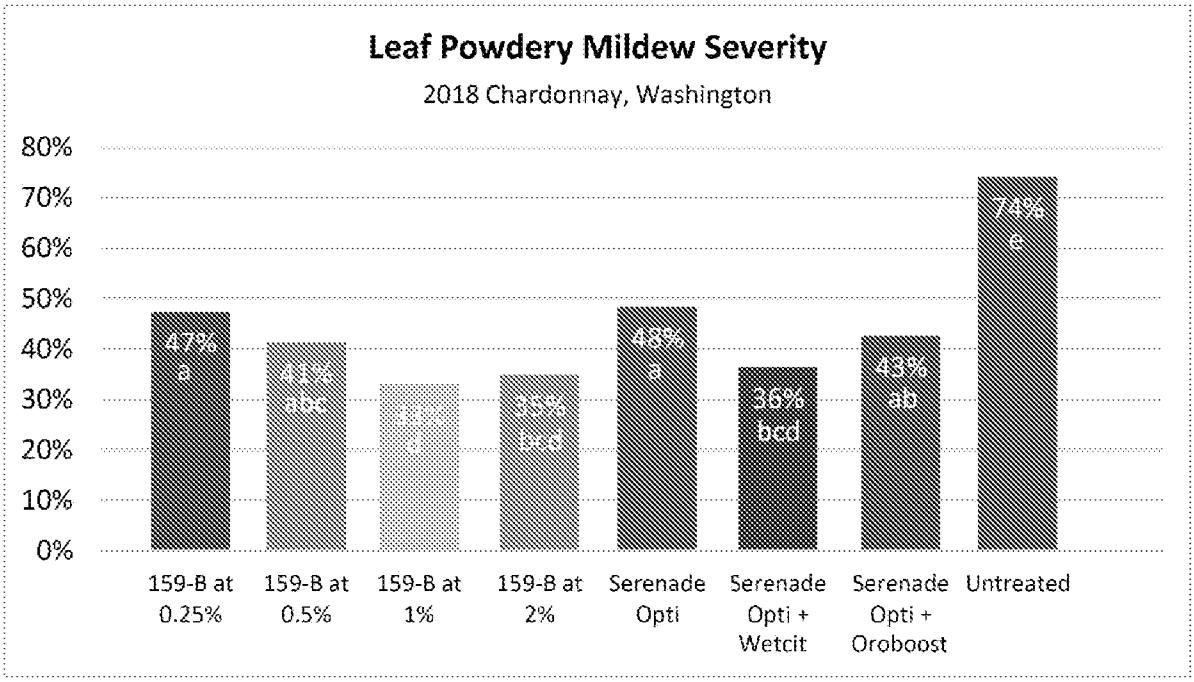
Leaf Powdery Mildew Severity
2018 Chardonnay, Washington
80%
70%
60%
50%
40%
30%
20%
10%
0%
47% a
41% abc
33% bcd
48% a
36% bcd
43% ab
74% e
159-B at 0.25%
159-B at 0.5%
159-B at 1%
159-B at 2%
Serenade Opti
Serenade Opti + Wetcit
Serenade Opti + Oroboost
Untreated

FIG. 9

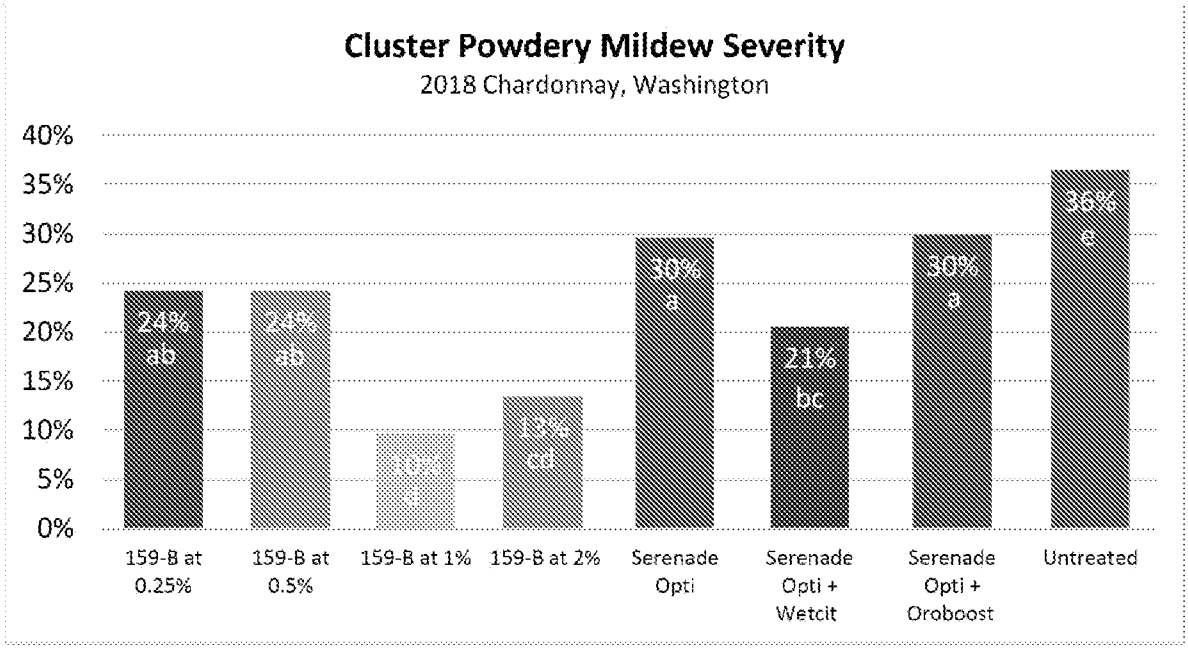
Cluster Powdery Mildew Severity
2018 Chardonnay, Washington
40%
35%
30%
25%
20%
15%
10%
5%
0%
24% ab
24% ab
10% d
13% cd
30% a
21% bc
30% a
36% a
159-B at 0.25%
159-B at 0.5%
159-B at 1%
159-B at 2%
Serenade Opti
Serenade Opti + Wetcit
Serenade Opti + Oroboost
Untreated

FIG. 10

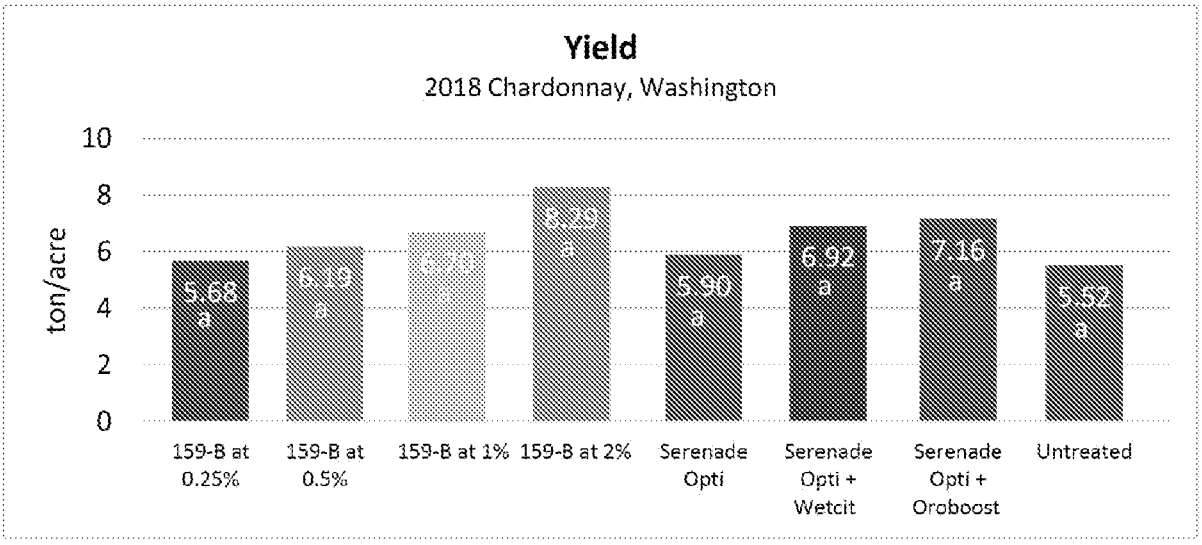
Yield
2018 Chardonnay, Washington
ton/acre
10
8
6
4
2
0
5.68 a
6.19 a
6.79 a
5.90 a
6.92 a
7.16 a
5.52 a
159-B at 0.25%
159-B at 0.5%
159-B at 1%
159-B at 2%
Serenade Opti
Serenade Opti + Wetcit
Serenade Opti + Oroboost
Untreated

FIG. 11

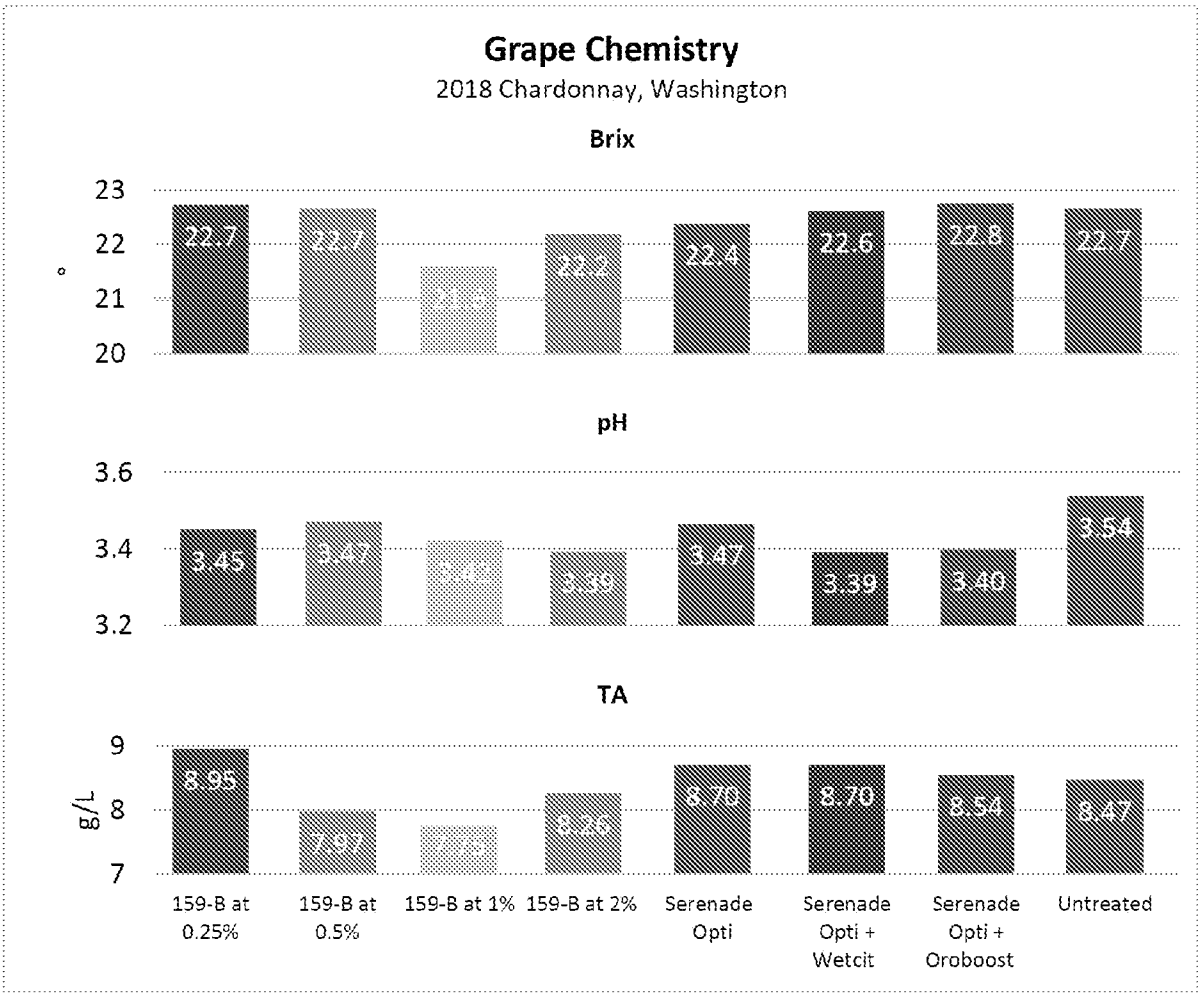
Grape Chemistry
2018 Chardonnay, Washington
Brix
°
23
22
21
20
22.7
22.7
22.2
22.4
22.6
22.8
22.7
pH
3.6
3.4
3.2
3.45
3.47
3.39
3.47
3.39
3.40
3.54
TA
g/L
9
8
7
8.95
7.97
8.26
8.70
8.70
8.54
8.47
159-B at 0.25%
159-B at 0.5%
159-B at 1%
159-B at 2%
Serenade Opti
Serenade Opti + Wetcit
Serenade Opti + Oroboost
Untreated

FIG. 12