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(54) Title: FUNGICIDE COMPOSITION

(57) Abstract: An aqueous suspension-concentrate (SC) composition comprising: at least 400g/L of epoxiconazole; a comb-graft copolymer surfactant having a poly-(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone, and a surfactant selected from the group consisting of ethoxylated and propoxylated fatty alcohols.

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Fungicide Composition

Field

[0001] This invention relates to aqueous suspension concentrate formulations of the fungicide epoxiconazole. In particular, the invention relates to highly loaded suspension concentrate formulations that comprise epoxiconazole.

Background

[0002] Epoxiconazole has the IUPAC designation (2RS,3SR)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1H-1,2,4-triazole). It is a triazole fungicide that inhibits the metabolism of fungi that infest crop plants.

[0003] Suspension concentrate (SC) formulations of epoxiconazole have been provided on a commercial basis by Bayer, CropSmart, Adama and BASF – these formulations have contained a loading of about 125g/L of epoxiconazole active agent.

[0004] This loading of 125 g/L epoxiconazole in a SC formulation is significantly less than the loading of other commercially available triazole fungicides. For example, the fungicide flutriafole is widely commercially available as a suspension concentrate comprising about 500g/L of active agent.

[0005] Australian patent 201610158 describes a highly loaded SC flutriafole formulation (example 1). Flutriafole is a triazole fungicide quite similar to epoxiconazole.

[0006] The inventors of the instant invention have used the parameters of the formulation of example 1 in AU 201610158 and have replaced flutriafole with epoxiconazole in the formulation. The resultant formulation was not viable, based on the fact that the SC mill-base had an undesirably high viscosity. This shows that flutriafole prior art (and presumably prior art related to other triazole active agents) cannot be used in a straightforward way to prepare analogous epoxiconazole formulations.

[0007] Different SC formulation stability behaviour between different triazole active agents can be explained in part by recognising the importance of Ostwald ripening as a formulation failure mechanism.

[0008] Ostwald ripening (or Ostwald maturation) involves the growth of larger crystalline moieties at the expense of smaller crystalline moieties in a suspension concentrate. This leads to the formation of larger suspended particles (or larger suspended particle aggregates caused by bridging crystallisation), and the SC formulation may fail because of the settling-out of active agent moieties in a spray tank or in storage, and/or because the blocking of spray nozzle orifices.

[0009] In some pesticides the adverse effects of Ostwald ripening may be ameliorated by using formulation adjuvants that act as crystal habit modifiers (and impede the formation of long crystals). The ability to provide crystal habit modification of an active agent and the required nature of the crystal habit modifier for a particular active may be critically dependent on fine details of crystal morphology and crystal growth kinetics, and these events are notoriously difficult to predict from active agent structure.

[0010] It is also desirable to provide such epoxiconazole compositions that do not rely on organic/aromatic solvent components and allow these components, which may provide a health risk, to be minimised or omitted.

Summary of Invention

[0011] Accordingly we provide an aqueous suspension-concentrate (SC) composition comprising

at least 400g/L, preferably at least 450 g/L, of a epoxiconazole;

comb-graft copolymer surfactant having a poly-(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone; and

a surfactant selected from the group consisting of ethoxylated and propoxylated fatty alcohols

[0012] The aqueous suspension-concentrate may optionally further comprise one or more additional surfactants. A preferred additional surfactant is an ethoxylated and propoxylated lower alkanol. The lower alkanol is distinct from fatty alcohol which typically comprises a C_{10} to C_{24} carbon atom chain. The preferred lower-alkanols are C_1 to C_6 lower alkanols and particularly butanol (C_4).

[0013] Another surfactant which may optionally be present instead ethoxylated and propoxylated lower alkanol of, or in addition thereto, is a surfactant comprising a fatty alkyl chain and polyethoxylate group. Examples of such surfactants may be selected from the group consisting of fatty alcohol ethoxylates, fatty acid ethoxylates, fatty amine ethoxylates and fatty amide ethoxylates.

Detailed Description

[0014] In this specification, "(meth)acrylate" is a general term for acrylic acid and methacrylic acid and their esters such as methyl esters and may be either one or more of them.

[0015] The terms tank mix and tank mixing refer to the mix formed and method involved in mixing of components such as adjuvants, particularly surfactants for use as wetters, in the tank at the time of preparing a diluted mixture of the epoxiconazole suspension concentrate composition for spray application.

[0016] In this specification the word "comprise" and variations of the word, such as "comprising" and "comprises" is not intended to exclude other additives, components, integers or steps.

[0017] Without wishing to be bound by theory, it is believed that the surfactant component including the comb-graft copolymer surfactant and ethoxylated and propoxylated fatty alcohol provide an effective crystal habit modifier for the epoxiconazole that inhibits crystal growth of the larger epoxiconazole particles and so inhibits Ostwald ripening. The efficacy of the surfactant component, which may include one or more surfactants, is greater than the efficacy of other surfactants and unexpectedly the combination of surfactants allows a much higher loading of the epoxiconazole than is otherwise achieved due at least in part to the superior inhibition of composition destabilisation by Ostwald ripening.

[0018] The aqueous suspension-concentrate (SC) composition comprises

at least 400g/L, preferably at least 450 g/L, of epoxiconazole;

surfactant selected from the group consisting of comb-graft copolymer having a poly(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone;

surfactant selected from the group consisting of an ethoxylated and propoxylated fatty alcohol and optionally one or more surfactants selected from the group consisting of:

(i) an ethoxylated and propoxylated lower alcohol; and

(ii) a surfactant having a fatty alkyl chain and polyethoxylate group.

[0019] In a preferred set of embodiments the surfactant component of the composition comprises:

surfactant selected from the group consisting of comb-graft copolymers having a (meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone;

surfactant selected from the group consisting of ethoxylated and propoxylated fatty alcohols; and

an ethoxylated and propoxylated lower alcohol, particularly ethoxylated and propoxylated butyl alkanol.

[0020] The invention relates to suspension-concentrates of epoxiconazole which has the IUPAC chemical name (2*RS*,3*SR*)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1*H*-1,2,4-triazole.

[0021] The amount of the epoxiconazole is at least 400 g/L, preferably at least 450 g/L, such as at least 480g/L or at least 500 g/L. Typically the loading of epoxiconazole is no more than 650 g/L, such as no more than 600 g/L or no more than 550 g/L.

[0022] The suspension-concentrate comprises a comb-graft copolymer having a poly-(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone. In one embodiment the comb-graft copolymer is a polyoxyethylene/(meth)acrylic acid copolymer.

[0023] One example of such copolymer is the Atlox® 4913 which contains approximately one third of the polymethyl methacrylate-polyethylene oxide graft copolymer, one third water and one third propylene glycol. In one aspect the graft copolymer contains about 36.6% methyl methacrylate, 1.9% methacrylic acid, both

grafted with methoxypoly(ethylene glycol) 750 methacrylate (61.5%). A further example is Tersperse® 2500 which comprises about 35 wt% of the relevant comb-graft copolymer.

[0024] The comb-graft copolymer is typically present in the suspension-concentrate composition in an amount of at least 3 g/L, such as at least 5 g/L or at least 10 g/L. The comb-graft copolymer is typically present in an amount of no more than 50 g/L such as no more than 45 g/L. Accordingly in some embodiments the comb-graft copolymer is present in an amount of 3 g/L to 50 g/L, 5 g/L to 40 g/L or 5 g/L to 30 g/L. In one embodiment, the amount of comb-graft copolymer surfactant in the suspension-concentrate is 3 g/L to 32 g/L (corresponding to 10-90 g/L of a 35% solution of the surfactant in a carrier solution). The concentration of comb-graft copolymer surfactant in the suspension-concentrate may be 7g/L to 14 g/L (corresponding to 20g/L to 40 g/L of a 35% solution of the surfactant in a carrier solution). In another embodiment, the concentration of comb-graft copolymer surfactant in the suspension-concentrate is about 10 g/L (corresponding to 30 g/L of a 35% solution of the surfactant in a carrier solution).

[0025] The suspension-concentrate composition comprises an ethoxylated and propoxylated fatty alcohol. The fatty alcohol are ethoxylated as well as meing propoxylated. Thus the ethoxylated and propoxylated fatty alcohol contain a polymer containing ethyleneoxy (EO) and propyleneoxy (PO) monomer units and a fatty alcohol forming an ether with the EO-PO copolymer. The fatty alcohol portion of the surfactant is typically a fatty aliphatic alcohol which may be straight or branched chain aliphatic group. The aliphatic group, typically alky, generally contains 10 to 24 carbon atoms, preferably from 12 to 20 carbon atoms, particularly 14 to 18 carbon atoms such as 16 to 18 carbon atoms. Such surfactants may be of formula I.

$$R\text{-(ethylene oxide)}_x\text{-(propylene oxide)}_y\text{–OH} \qquad (I)$$

where R is typically fatty aliphatic of from 10 to 24 carbon atoms, preferably from 12 to 20 carbon atoms, particularly 14 to 18 carbon atoms such as 16 to 18 and x and y represent the number of ethylene oxide and propylene oxide derived monomer units respectively.

[0026] Examples of suitable ethoxylated and propoxylated fatty alcohol include Antarox® 65A9P which is believed to be an ethoxylated and propoxylated cetyl (C16) alcohol available as 100% liquid.

[0027] The amount of ethoxylated and propoxylated fatty alcohol may be at least 1 g/L such as at least 2 g/L or at least 3 g/L. The amount of ethoxylated and propoxylated fatty alcohol is typically no more than 50 g/L such as no more than 30 g/L or no more than 20 g/L.

[0028] In one embodiment the amount of ethoxylated and propoxylated fatty alcohol in the suspension-concentrate is in the range 1g/L to 20 g/L, preferably in the range 2g/L to10 g/L, more preferably in the range 3g/L to 6 g/L.

[0029] The ratio of ethylene oxide to propylene oxide derived units in the ethoxylated and propoxylated fatty alcohol will, together with the chain length of the fatty group, control the water miscibility and hydrophilic-lipophilic balance of the surfactant. The ratio of EO to PO moieties in the ethoxylated and propoxylated fatty alcohol may be in the range 2:50 to 50:2, preferably in the range 10:50 to 50:10, more preferably in the range 20:50 to 50:20.

[0030] The suspension-concentrate comprises a surfactant component comprising both comb graft copolymer surfactant and ethoxylated and propoxylated fatty alcohol surfactant. In one embodiment the ratio of comb-graft copolymer surfactant (net of carrier solvent) to ethoxylated and propoxylated fatty alcohol surfactant in the suspension-concentrate is in the range 30:1 to 0.8:1, preferably in the range 10:1 to 1:1, more preferably in the range 5:1 to 5:3.

[0031] The suspension-concentrate composition may, and preferably will, comprise an ethoxylated and propoxylated lower alkanol. The lower alkanol is generally a C_1 to C_6 alcohol and in particular butyl alcohol (C_4). The ethoxylated and propoxylated lower alkanol may have formula I where R is lower alkyl, particularly butyl.

[0032] The amount of the ethoxylated and propoxylated lower alkanol surfactant may be up to 90 g/L such as 2 g/K to 80 g/L or 10 g/L to 70 g/L. In one embodiment the amount of ethoxylated and propoxylated lower alkanol surfactant in the

suspension-concentrate is in the range 20g/L to 90 g/L, preferably in the range 40g/L to 70 g/L, more preferably in the range 45g/L to 60 g/L, even more preferably about 50 g/L.

[0033] An example of a commercially useful surfactant composition is the product Tersperse® 4894 which comprises a blend of 80 wt% ethoxylated and propoxylated lower alkanol and about 20 wt% ethoxylated fatty alcohol based on the weight of the surfactant components. Thus the product contributes to both of the optional surfactant types.

[0034] In one set of embodiments the ratio of EO to PO moieties in the ethoxylated and propoxylated lower alkanol surfactant is in the range 2:50 to 50:2, preferably in the range 10:50 to 50:10, more preferably in the range 10:50 to 50:10 and still more preferably in the range 20:50 to 50:20.

[0035] Specific example ethoxylated and propoxylated lower alkanol include polyoxyethylene (17) polyoxypropylene (17) monobutyl ether, polyoxyethylene (27) polyoxypropylene (24) monobutyl ether, polyoxyethylene (3) polyoxypropylene (2) monobutyl ether, polyoxyethylene (35) polyoxypropylene (28) monobutyl ether, polyoxyethylene (36) polyoxypropylene (36) monobutyl ether, polyoxyethylene (45) polyoxypropylene (33) monobutyl ether, polyoxyethylene (5) polyoxypropylene (3) monobutyl ether, polyoxypropylene (17) polyoxyethylene (17) monobutyl ether, polyoxypropylene (2) polyoxyethylene (3) monobutyl ether, polyoxypropylene (24) polyoxyethylene (27) monobutyl ether, polyoxypropylene (28) polyoxyethylene (35) monobutyl ether, polyoxypropylene (3) polyoxyethylene (5) monobutyl ether, polyoxypropylene (33) polyoxyethylene (45) monobutyl ether and polyoxypropylene (36) polyoxyethylene (36) monobutyl ether.

[0036] Another surfactant which may optionally be present in addition is surfactant comprising a fatty alkyl chain and ethoxylate group. Examples of such surfactants may be selected from the group consisting of fatty alcohol ethoxylates, fatty acid ethoxylates, fatty amine ethoxylates and fatty amide alkoxylates. A range of such surfactants will be known to those skilled in the art and are readily available from commercial sources. One such group of surfactants are of formula II.

$$R(OC_2H_4)_nOH \quad (II)$$

where R is the alkyl group and n is the number of ethoxylate units.

[0037] The amount of these additional surfactants having a fatty alkyl chain and polyethoxylate group may be up to 100 g/L but is typically no more than 65 g/L such as 2 g/L to 100 g/L or 5 g/L to 65 g/L, such as 10 g/L to 65 g/L, of suspension-concentrate composition. In one set of embodiments the suspension-concentrate contains an amount of surfactant having a fatty alkyl chain and polyethoxylate group in the range of 8 g/L to 30g/L, preferably in the range 10 g/L to 13 g/L.

[0038] The surfactant having a fatty alkyl chain and polyethoxylate group typically comprises a fatty alkyl (such as R in the formula $R(OC_2H_4)_nOH$) which is a C_{10}-C_{20} fatty alkyl moiety, preferably a C_{12}-C_{18} alkyl moiety, more preferably a C_{12}-C_{16} alkyl moiety.

[0039] The number of (ethyleneoxy) EO groups (OC_2H_4) in the surfactant having a fatty alkyl chain and ethoxylate group may, for example, be in the range 1-50, preferably in the range 4-30, such as in the range 6-20, or in the range 7-14.

[0040] In one set of embodiments, the ratio of ethoxylated and propoxylated lower alkanol to surfactant having a fatty alkyl chain and polyethoxylate group is in the range 15:1 to 1:1, preferably in the range 10:1 to 10:4, more preferably about 10:2.

[0041] In one embodiment, the combined weight of ethoxylated and propoxylated lower alkanol plus fatty-alcohol ethoxylate in the composition is in the range 20 g/L 100 g/L, preferably in the range 50g/L to 70 g/L, more preferably about 65 g/L.

[0042] The composition of the invention may comprise an anti-freeze agent such as glycerol and the concentration of anti-freeze agent in the suspension-concentrate is typically up to 150 g/L such as in the range 30g/L to 150 g/L, preferably in the range 60-100 g/L, more preferably about 80 g/L.

[0043] In one embodiment the composition of the invention comprises an agent to modify the rheology of the composition, such as an additive chosen from the group consisting of polymeric thickeners and clays. Examples of clay thickener include smectite clay may, for example, be present in an amount of 2 g/L to 15 g/l, preferably in the range 3 g/L to 10 g/L, such as about 5 g/L of the suspension-concentrate.

[0044] The rheology modifying agent may be a carbohydrate polymer, preferably a polysaccharide gum, such as xanthan gum, and may be present in an amount of 0.3 g/L to 2 g/L, preferably 0.6 g/L to 1 g/L such as about 0.8g/L. The xanthan gum may be derived from arrange of sources such as derived from *Xanthomonas campestris.*

[0045] The invention also provides the use of a composition as defined in any of claims 1 to 5 for protecting plants or the loci thereof against fungi.

[0046] The invention further provides a method of protecting plants or the site of plants from fungi, comprising spray application of the suspension-concentrate composition to the plants or the site of plants optionally following dilution of the suspension concentrate. It is particularly preferred that the diluted composition is tank mixed with a spray tank adjuvant that provides spreading, absorption, penetration and/or retention of the active agent. . These are known in the art from commercial sources and an example of a suitable tank mix is a liquid alcohol alkoxylate non-ionic surfactant surfactant available under the trade name WETSPRAY, a liquid alcohol alkoxylate surfactant provided at a concentration of 1000g/L by ADAMA, Australia.

[0047] Examples of control of fungi may for example be leaf rust, stripe rust, septoria nodorum blotch and powdery mildew of wheat, leaf rust, net form of net blotch, leaf scald and powdery mildew of barley and leaf spot and leaf speckle in bananas. The composition may also be used in seed treatment.

[0048] The composition is, for example, useful in protecting plants against leaf blotch (*Septoria tritici*) and rust (*Puccinia triticina*).

[0049] The invention will now be described with reference to the following examples. It is to be understood that the examples are provided by way of illustration of the invention and that they are in no way limiting to the scope of the invention.

Examples

[0050] **Example 1:** SC composition according to the invention: Epoxiconazole 500 g/L.

[0051] A composition of the invention containing 500g/L epoxiconazole SC (designated as COMPOSITION 1) was prepared by combining the components shown in Table 2 in accordance with the procedure of Example 2.

[0052] **Table 2 – Composition 1**

Component	CAS. No	Chemical name	Concentration (g/L)	Function
Epoxiconazole (98%)*	133855-98-8	(2RS,3SR)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1H-1,2,4-triazole	510	Active ingredient
TERSPERSE® 4894	Proprietary	Proprietary blend	65	Dispersant
Atlox® 4913	Proprietary	Acrylic copolymer solution (35% solids)	30 (10.5 g solids)	Dispersant
Antarox® 65A9P	68002-96-0	Alcohols C16-18, ethoxylated propoxylated	4	Wetting agent
Glycerol	56-81-5	Propan-1,2,3-triol	80	Anti-freeze
Rhodoline® DF691	Proprietary	Proprietary blend	5	Antifoam
Veegum® Ultra	12199-37-0	Smectite clay	5	Rheology modifying agent
Kelzan® AP	11138-66-2	Xanthan gum	0.8	Viscosity modifying agent
Acticide® BW20	2634-33-5	1,2-benzisolthiazolin-3(2H)-one	1.0	Biocide
Water	7732-18-5	Water	445.2	Diluent
			1146	

[0053] Note: Tersperse 4894 comprises about 20% C12-C16 ethoxylate and 80% butyl EO-PO copolymer.

[0054] **Example 2**

[0055] **Formulation method for COMPOSITION 1** Equipment

- Paddle mixer *(Dispermat® N1)*
- Silverson® high shear batch mixer
- 70L stainless steel vessel
- 1,000L stainless steel mixing vessel
- 1,200-1,500L stainless steel mixing vessel

[0056] Composition process

[0057] A typical manufacturing batch size would be 1,000L.

Step 1. To prepare the mill base blend (which will later be fed to the mill) fill a 1,000L stainless steel mixing vessel with approximately 80% of the water required. Mix with the Silverson® high shear batch mixer to form a vortex and gradually add Veegum® Ultra, Rhodoline® DF691, TERSPERSE® 4894, Atlox® 4913, Antarox® 65A9P, Acticide® BW20 and 50% of required glycerol *(leaving a sufficient amount for the dispersion of Kelzan® AP)*. Mix until homogeneous or for another 15 minutes, whichever is longer.

Step 2. Gradually add epoxiconazole technical material to the 1,000L vessel whilst constantly mixing. Continue mixing until the technical is uniformly dispersed or for another 15 minutes, whichever is longer.

Step 3. Continue mixing slowly, to avoid settling of active ingredient whilst the liquid contents are passed through a suitable bead mill to produce a particle size of dV90<10μm *(in the pilot plant a Dyno-mill MULTI-LAB was used).* The milled intermediate is collected in a 1,200-1,500L stainless steel mixing vessel. The milled intermediate must be stirred after it exits the mill to avoid settling.

Note 1. The milled intermediate is de-aerated if required, as it is very difficult to remove air bubbles once the thickener is added in later steps. Deaeration can be achieved by letting it sit or with gentle stirring to encourage the air bubbles

to come to the top. If necessary, the stirring can take place in a hot box and the stirring can take place under partial vacuum.

Step 4. Gradually add the remaining glycerol into the 70L stainless steel vessel. Add the Kelzan® AP and disperse using a paddle mixer *(the Dispermat® was used in the pilot plant).*

Step 5. Gradually add the Kelzan® AP dispersion to the 1,200-1,500L vessel whilst mixing and continue mixing until homogeneous or for another 30 minutes, whichever is longer.

Note 2. Avoid aerating the product by fully submerging the mixer head in the bulk liquid.

[0058] **Example 3**

[0059] Product Testing

[0060] A number of tests are undertaken on the final product candidate (Table 3).

[0061] **Table 3**. Tests to be undertaken on the final product

Test method	**Specification**
Appearance (colour, odour, physical state)	White to off-white liquid suspension
Specific gravity (g/mL)	1.12 – 1.17
pH(1%)	6.5 – 7.5
Viscosity (cP) (LV spindle 2, 20RPM)	300 – 600
Particle size (µm)	D(v, 0.5) < 5 D(v, 0.9) < 10
Active ingredient concentration (g/L)	475 – 525

[0062] Physical and Chemical Properties of the Product

[0063] **Table 4**. Properties of product candidate COMPOSITION 1

Test Method	**Data**
Appearance (colour, odour, physical state)	Off-white liquid suspension
Specific gravity (g/mL) (CIPAC MT3)	1.16
pH (1%) (CIPAC MT75.3)	7.15
Viscosity (cP) (CIPAC MT192) (LV spindle 2, 20RPM)	496.5
Particle size distribution (µm) (CIPAC MT187)	D(v, 0.5): 2.07 D(v, 0.9): 6.04
Suspensibility on dilution with water (%) (CIPAC MT184)	95.1
Spontaneity of dispersions (%) (CIPAC MT160)	95.9
Wet sieve test (%) (CIPAC MT185)	0.03
Pourability (%) (CIPAC MT148.1)	2.1
Persistent foam (mL) (CIPAC MT47.2)	60
Low temperature stability (CIPAC MT39.3)	Off-white liquid suspension
Packaging Stability *(HDPE)*	No changes to bottle, labels and closure.
Flash Point (CIPAC MT12.1)	n/a
Flammability	n/a
Explosive properties	n/a
Oxidising properties	n/a
Corrosive hazard	n/a
Dangerous goods classification	Provided by the client

[0064] **Table 5**. Storage Stability

Test Method	CIPAC Method	Specification	1 week at 0°C	Ambient	2 weeks at 54°C
Appearance	Visual	White to off-white liquid suspension	White liquid suspension	White liquid suspension	White liquid suspension
pH (1%)	MT75.3	6.5 – 7.5	7.00	7.15	6.76
Viscosity (cP) (LV spindle 2, 20RPM)	MT192	300 – 600	478.5	496.5	352.5
Particle size distribution (µm)	MT187	D(v, 0.5) < 5 D(v, 0.9) < 10	D(v, 0.5): 2.07 D(v, 0.9): 6.01	D(v, 0.5): 2.07 D(v, 0.9): 6.04	D(v, 0.5): 2.14 D(v, 0.9): 6.10
Suspensibility on dilution with water (%)	MT184	60 – 105%	96.0	95.1	95.0
Spontaneity of dispersions (%)	MT160	60 – 105%	95.5	95.9	96.8
Wet sieve test (%)	MT185	<2% retained on a 75µm sieve	0.03	0.03	0.04
Pourability (%)	MT148.1	<5% residue	2.6	2.1	1.8
Persistent foam (mL)	MT47.2	<60mL after one minute	60	60	60
Low temperature stability	MT39.3	White to off-white liquid suspension	Off-white liquid suspension	n/a	n/a
Packaging stability *(HDPE)*	Observation of packaging stability	No changes to bottle, labels and closure	No changes to bottle, labels and closure	No changes to bottle, labels and closure	No changes to bottle, labels and closure

[0065] **Example 4a**: Bioefficacy (Virginia trial)

[0066] **4a Summary**

[0067] One small plot replicated field trial was conducted between September and December 2016 to evaluate COMPOSITION 1 for the control of Septoria in wheat. The trial was conducted near Virginia in the Northern Adelaide Plains region of South Australia, Australia. The commercially available OPUS composition (OPUS 125 provided by BASF) contained epoxiconazole active agent at 125g/L. By contrast the composition of the invention COMPOSITION 1 contained epoxiconazole active agent at 500 g/L).

[0068] The following treatments were evaluated:

[0069] **Table 6**

No.	Product/ Formulation	Rate of Product mL/ha	Active Ingredient	Dosage A.I. g per ha	Application Timing
1	Untreated	-	-	-	-
2	OPUS	250	epoxiconazole	31.3	A
3	OPUS	500	epoxiconazole	62.5	A
8	COMPOSITION 1	63	epoxiconazole	31.5	A
9	COMPOSITION 1	125	epoxiconazole	62.5	A
10	COMPOSITION 1	500	epoxiconazole	250	A
11	COMPOSITION 1 WETSPRAY 1000	63 200 mL/100 L	epoxiconazole non-ionic surfactant	31.5 200 g/100 L	A A

[0070] Treatments were applied using a gas powered hand boom incorporating two Agrotop AM 110 01 nozzles per metre. At an application speed of 1.5 metres/second and a pressure of 300 kPa, treatments were applied in a total volume of 90 L/ha and a medium quality. The treatments were applied at BBCH 37-38.

[0071] The trial was established as a randomised complete block design with four replicates. Plot size was 10 metres x 2 metres.

[0072] The target pest species was Septoria (Mycosphaerella graminicola). The Septoria population was established prior to the first application with low to moderate levels of severity present.

[0073] Detailed assessments were conducted at 14, 21, 28 and 42 days after application A (DAA), and commercial harvest. These included incidence and severity of Septoria, green leaf retention (GLR), crop vigour, phytotoxicity and yield.

[0074] All treatments reduced the severity of Septoria initially compared to the untreated control.

[0075] COMPOSITION 1 applied alone reduced the severity of Septoria at 14 DAA, with only COMPOSITION 1 + WETSPRAY providing significant reduction in severity by the conclusion of the trial at 42 DAA.

[0076] WETSPRAY was a liquid alcohol alkoxylate surfactant provided at a concentration of 1000g/L by ADAMA, Australia.

[0077] COMPOSITION 1 reduced the severity of Septoria infection to an equivalent or better level compared to where OPUS was applied.

[0078] All treatments were found safe to use on wheat var. Mace.

[0079] 4a: Site Details and Experimental Design

[0080] **Table 7**

Location	Virginia, South Australia
Crop	Wheat
Variety	Mace
Sowing Rate	80 kg/ha
Field Type	Commercial
Soil Type	Brown sandy loam, pH: 7.6
Site History	Wheat 2012-2014
Sowing Date	28 May 2016
Planting Details and	Direct drill with 25 cm row spacing
Design	Randomised complete block
Replicates	Four
Plot Size	10 m x 2 m
Buffers	0.5 m between plots

Crop Management/Maintenance	Dual Gold PSPE and standard commercial management
Temperature and Rainfall	Over the duration of the trial average daily minimum and maximum temperatures were recorded. September received above average rainfall with a total of 111.2 mm for the month. October also received above average rainfall with 54.6 mm. November was slightly drier, with below average rainfall of 20.6 mm. December was an extremely unusual month with above average rainfall of 90 mm. The minimum temperature over the duration of the trial was received on 23 September 2016 with 3.9°C. The maximum temperature over the duration of the trial was received on 17 November with 35.8°C. Full weather details, as recorded at station 023083 are presented in the appendices.

[0081] **4a: Table 8 - Target pathogen**

Common Name	Causal Agent	Disease Level
Septoria	*Mycosphaerella graminicola*	Due to the favourable climatic conditions for Septoria at the trial site, the disease was already present prior to the first application with a low-moderate severity. As the trial progressed, seasonal conditions were favourable to the spread and development of the disease in the crop, with a moderate to high severity observed by the conclusion of the trial.

[0082] **4a: Application Schedule (see summary section 4a above).**

[0083] **4a: Table 9- Application timing and spray volume**

Application Timing and Spray Volume			
A	BBCH 37-38	Spray Volume	90 L/ha

[0084] **4a: Table 10 - Treatment Method**

Equipment	Gas powered hand boom
Method	Broadcast
Application Speed	1.5 m/s
Nozzles	Four 110 01 Agrotop AM
Nozzle Spacing	50 cm
Pressure	300 kPa
Application Volume	90 L/ha
Spray Quality	Medium
Boom Height From Target	50 cm
Number of Applications, Interval Between Applications	One
Application Timing	BBCH 37-38

[0085] **4a: Table 11 - Application Details**

Date	07-Sep-16
Time of Day	1200-1500 hours
Temperature	24.1□C
Relative Humidity	48%
Cloud Cover	10%
Wind (Speed and Direction)	5-10 km/hr, NE
Crop Growth Stage (BBCH and Description)	BBCH 37-38. Septoria was present at a low to moderate severity.
Mixing Observations	Nil
Compatibility Observations	Nil

[0086] **4a: Table 12 - Evaluations**

Date	Visit Timing	Activity Code	Application Timing (Stage / Description)	Evaluation Description *	Evaluation Timing (Stage / Description)
07-Sep-16	1	A1	BBCH 37-38	-	
21-Sep-16	2	EV1	-	1, 2, 3, 4	14DAA
28-Sep-16	3	EV2	-	1, 2, 3, 4	21DAA
05-Oct-16	4	EV3	-	1, 2, 3, 4	28DAA
19-Oct-16	5	EV4	-	1, 2, 3, 4, 5	42DAA
09-Dec-16	6	EV5	-	6	NCH

* See Evaluation table below for description

[0087] **Table 13 - Evaluation**

<table>
<tr><th>No.</th><th>Evaluation</th></tr>
<tr><td>1</td><td>• Septoria incidence was assessed by scoring the top four leaves (flag, F-1, F-2 and F -3) of 20 plants in each plot.
• The leaves were scored using the following scale: 0= no disease, 1=disease.
• The mean of these scores was then calculated for each leaf (flag, F-1, F-2 and F-3) and presented as % incidence.</td></tr>
<tr><td>2</td><td>• Septoria severity was assessed by scoring the top four leaves (flag, F-1, F-2 and F -3) of 20 plants in each plot.
• The leaves were scored using a rating of 1 to 100 where 1 = no disease lesions, 50 = half the leaf covered in lesions and 100 = the whole leaf covered in lesions.
• The mean of these scores was then calculated for each leaf (flag, F-1, F-2 and F-3) and presented as % severity.</td></tr>
<tr><td>3</td><td>• Phytotoxicity as percentage of total leaf area affected by chlorosis and/or necrosis.
• Other symptoms or plot differences observed recorded using a scale appropriate to sym ptom.
• All trial plots inspected for symptoms of phytotoxicity on leaves and on fruit in exposed bunches.
• If symptoms present, rated using a 0-100 arithmetic scale where:
<table>
<tr><th>Ratin g</th><th>Effec ts</th></tr>
<tr><td>0</td><td>Nil.</td></tr>
<tr><td>5</td><td>Very little damage, just noticeable.</td></tr>
<tr><td>10</td><td>Slight or temporary damage – symptoms negligible.</td></tr>
<tr><td>20</td><td>Moderate damage – symptoms obvious.</td></tr>
<tr><td>30</td><td>Moderate damage – symptoms very obvious but recovery expected.</td></tr>
<tr><td>40</td><td>Substantial damage. Some damage probably irreversible.</td></tr>
<tr><td>50</td><td>Majority of plants damaged, many irreversibly.</td></tr>
<tr><td>60</td><td>Nearly all plants damaged, many irreversibly. Some plants killed.</td></tr>
<tr><td>70</td><td>Severe damage – substantial number of plants killed.</td></tr>
<tr><td>80</td><td>Very severe damage. Majority of plants killed. Surviving plants show sev ere damage.</td></tr>
<tr><td>90</td><td>Few plants surviving. Remainder show very severe damage.</td></tr>
<tr><td>100</td><td>Complete loss of crop.</td></tr>
</table>
• A rating of 30-40 should be considered commercially unacceptable.</td></tr>
<tr><td>4</td><td>• Crop vigour was assessed by subjectively comparing the vigour of each plot to the untreated control in the same rep, on a 0-100 scale with the UTC assigned a value</td></tr>
</table>

	of 100.
5	• Green Leaf Retention was obtained for each plot by utilising a Trimble Green Seeker a nd walking the length of the plot holding the Trimble Green Seeker over the plants.
6	• Grain yield and quality at harvest

[0088] **4a: RESULTS AND DISCUSSION - Epoxiconazole Trial Data 4a (Virginia)**

[0089] **Table 14** shows the Mean Severity (% leaf damage) of Septoria per tr

no	treatment	Rate, ml/ha	ingredients	Dose, epoxicon per ha	14 DAA	42 DAA
1	untreated	-	-	-	58 d	99 d
2	OPUS	250	epoxicon	31.3	28 bc	95 bcd
3	OPUS	500	epoxicon	62.5	39 c	97 cd
8	Composition 1	63	epoxicon	31.5	9.4 ab	93 bcd
9	Composition 1	125	epoxicon	62.5	25 abc	93 bcd
10	Composition 1	500	epoxicon	250	22 abc	96 bcd
11	*Composition 1 plus Wetspray 1000	63 Plus 200ml/100L	Epoxicon plus Nonionic surfactant	31.5	22 abc	91 abc

Means with letter in common are not significantly different

DAA = days after application

[0090] *The only treatment which was significantly different 42 DAA was treatment 11 “Composition 1 plus Wetspray 1000”. Differences were observed in the severity of Septoria. All treatments significantly lowered the severity of Septoria compared to the untreated control at 14 DAA.

[0091] COMPOSITION 1 applied alone or with WETSPRAY provided equivalent or better control to OPUS in terms of severity of Septoria throughout the trial.

[0092] There were no statistical differences in green leaf retention, crop vigour, yield or grain quality observed in this trial.

[0093] No symptoms of phytotoxicity were observed throughout the trial.

[0094] **Example 4b: Bioefficacy (Barry trial)**

[0095] **4b: Summary**

[0096] One small plot replicated field trial was conducted between November 2016 and January 2017 to evaluate COMPOSITION 1 for the control of stripe rust in wheat. The trial was conducted near Barry in the Central Tablelands region of New South Wales, Australia. The commercially available OPUS formulation (OPUS 125 provided by BASF) contained epoxiconazole active agent at 125 g/L.

[0097] **Table 15** - The following treatments were evaluated:

No.	Product/Formulation	Rate of Product	Dosage A.I.	Application Timing
1	Untreated	-	-	-
2	OPUS	250 mL/ha	31.3 g/ha	A
3	OPUS	500 mL/ha	62.5 g/ha	A
8	COMPOSITION 1	63 mL/ha	31.5 g/ha	A
9	COMPOSITION 1	125 mL/ha	62.5 g/ha	A
10	COMPOSITION 1	500 mL/ha	250 g/ha	A
11	COMPOSITION 1 WETSPRAY1000	63 mL/ha 200 mL/100 L	31.5 g/ha 200 g/100 L	A A

[0098] Treatments were applied using a motorised hand-held boom incorporating two Turbo Twinjet Flat Fan nozzles per metre. At an application speed of 2.0 m/s and a pressure of 200 kPa, treatments were applied in a total volume of 104 L/ha and a coarse quality. The treatments were applied once, at BBCH-14/16.

[0099] The trial was established as a randomised complete block design with four replicates. Plot size was 10 metres x 2.5 metres.

[0100] The target disease was stripe rust (*Puccinia striiformis*). The site was selected for an expected high disease pressure, and at the pre-spray assessment, 36% of Y-1, 68% of Y-2 and 28% of Y-3 tillers were affected.

[0101] Detailed assessments were conducted at pre-spray, 19 and 30 days after treatment (DAT) and at harvest. These included crop safety, disease incidence and severity, final crop yield and grain quality.

[0102] COMPOSITION 1 provided very high control of stripe rust in wheat at all application rates when applied with WETSPRAY 1000, or alone. WETSPRAY was a liquid alcohol alkoxylate surfactant provided at a concentration of 1000 g/L by ADAMA Australia.

[0103] COMPOSITION 1 provided equivalent control of stripe rust compared to OPUS 125.

[0104] No symptoms of crop phytotoxicity were observed as a result of the treatments applied in this trial and all treatments significantly improved the vigour of the crop at 19 DAT. An improvement in crop yield was observed where Composition 1 was applied alone, at all application rates.

[0105] 4b: **Table 16** - Site Details and Experimental Design

Location	Barry, New South Wales, Australia
Crop	Wheat
Variety	Wedgetail
Field Type	Commercial field
Soil Type	Red brown clay loam, pH 5.6
Site History	Long-term fallow
Sowing Date	19-August-2016
Planting Details and Sowing Rate	Hege cone seeder with knife point tynes and press wheels, 80 kg seed/ha at a depth of 3 cm
Design	Randomised complete block
Replicates	Four
Plot Size	10 m x 2.5 m
Buffers	1 m each side
Irrigation Details	Dryland
Crop Management/Maintenance	Roundup CT, 2 L/ha pre-sowing DAP, 80 kg/ha banded at sowing
Seasonal Conditions	Average rainfall and temperatures were recorded during the trial period, with multiple high-rainfall events, which were conducive to the development of stripe rust.

Temperature and Rainfall	Full weather details in appendices, as recorded at Orange {Station 063303} approximately 33.0 km from the trial site.

[0106] **4b: Table 17 -Target pathogen**

Common Name	Fungus	Disease Level	Disease Incidence at Application
Stripe rust	*Puccinia striiformis* f.sp. *tritici*	Moderate-high disease pressure throughout the trial	0% on youngest leaf 36% on Y-1 68% Y-2 28 % Y-3

[0107] **4b: Application Schedule (see summary section 4b above)**

[0108] **4b: Table 18 - Application timing and spray volume**

Application Timing (Letter/Number) and Spray Volume		
A	BBCH-14/16	Spray Volume 104 L/ha

[0109] **4b: Table 19 - Sowing Method**

Date	16-Aug-2016
Equipment	Hege cone seeder with knife point tynes and press wheels
Sowing Rate	80 kg/ha
Row Spacing	25 cm
Fertiliser Rate and Method	DAP, 80 kg/ha, banded at sowing
Pesticide Rate and Method	Roundup CT, 2 L/ha, broadcast pre-sowing
Soil Surface Condition at Planting	Direct drilled into fallow
Soil Moisture at Planting	Dry at surface, good moisture deeper in profile
Days to Germination	10 days
Next Rainfall After Planting	0.2 mm, 24 hours after planting

[0110] **4b: Table 20 - Treatment Method**

Equipment	Motorised hand held boom
Method	Broadcast

Application Speed	2.0 m/s
Nozzles	Turbo Twinjet 11002 flat fan
Nozzle Spacing	50 cm
Pressure	200 kPa
Application Volume	104 L/ha
Spray Quality	Coarse
Boom Height From Target	50 cm
Number of Applications, Interval Between Applications	One
Application Timing	BBCH-14/16
Incorporation	Nil

[0111] **4b: Table 21 - Application Details**

Date	09-Nov-16
Time of Day	1400-1540 hours
Temperature	18 °C
Relative Humidity	55 %
Cloud Cover	80 %
Wind (Speed and Direction)	4 km/hr, W
Crop Growth Stage (BBCH and Description)	BBCH-14/16 (4-6 leaves unfolded)
Mixing Observations	Nil
Compatibility Observations	Nil

[0112] **4b: Table 22 - Evaluations**

Date	Visit Timing	Activity Code	Application Timing (Stage / Description)	Evaluation Description *	Evaluation Timing (Stage / Description)
08-Nov-16	1	EV1		1	Pre-spray
09-Nov-16	2	A1	BBCH-14/16		
28-Nov-16	3	EV2		1, 2, 3	19 DAT
09-Dec-16	4	EV3		1	30 DAT
24-Jan-16	5	EV4		4	Harvest

* See Evaluation table below for description

[0113] **Table 23**

<table>
<tr><th>No.</th><th>Evaluation Description</th></tr>
<tr><td>1</td><td>• Stripe rust incidence and severity. Top four leaves (youngest, Y-1, Y-2 and Y-3) from 25 tillers per plot assessed for incidence (%) and severity (% leaf area damage)</td></tr>
<tr><td>2</td><td>• Phytotoxicity as percentage of total leaf area affected by chlorosis and/or necrosis.
• Other symptoms or plot differences observed recorded using a scale appropriate to symptom.
• If symptoms present, rated using a 0-100 arithmetic scale where:
<table>
<tr><th>Rating</th><th>Effects</th></tr>
<tr><td>0</td><td>Nil.</td></tr>
<tr><td>5</td><td>Very little damage, just noticeable.</td></tr>
<tr><td>10</td><td>Slight or temporary damage – symptoms negligible.</td></tr>
<tr><td>20</td><td>Moderate damage – symptoms obvious.</td></tr>
<tr><td>30</td><td>Moderate damage – symptoms very obvious but recovery expected.</td></tr>
<tr><td>40</td><td>Substantial damage. Some damage probably irreversible.</td></tr>
<tr><td>50</td><td>Majority of plants damaged, many irreversibly.</td></tr>
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<tr><td>80</td><td>Very severe damage. Majority of plants killed. Surviving plants show severe damage.</td></tr>
<tr><td>90</td><td>Few plants surviving. Remainder show very severe damage.</td></tr>
<tr><td>100</td><td>Complete loss of crop.</td></tr>
</table>
A rating of 30-40 should be considered commercially unacceptable.</td></tr>
<tr><td>3</td><td>• Crop vigour on a 0-100 linear scale, where 0 = no crop and 100 = the most vigorous plot within each replicate.</td></tr>
<tr><td>4</td><td>• Final crop yield, harvested by a Kingaroy Engineering Works small plot harvester. Yield presented as kg/ha. Grain quality was also assessed, including 1000 seed weight, grain moisture, hectolitre weight, screenings and protein.</td></tr>
</table>

[0114] **4b: RESULTS AND DISCUSSION - Epoxiconazole Trial Data 4b: Barry Trial**

[0115] **Table 24 (i) Mean Severity (% lead area damage) of Septoria per treatment (ii)Mean crop yield**

no	treatment	Rate, ml/ha	ingredients	Dose, epoxicon per ha	30 DAA Youngest leaf % damage	Crop yield Kg/ha
1	untreated	-	-	-	2.1 b	703 b
2	OPUS	250	epoxicon	31.3	0.0 a	797 a
3	OPUS	500	epoxicon	62.5	0.0 a	797 a
8	Composition 1	63	epoxicon	31.5	0.0 a	859 a
9	Composition 1	125	epoxicon	62.5	0.0 a	836 a
10	Composition 1	500	epoxicon	250	0.0 a	844 a
11	Composition 1 plus Wetspray 1000	63 Plus 200ml/100L	Epoxicon plus Nonionic surfactant	31.5	0.0 a	781 ab

Means with letter in common are not significantly different

DAA = days after application

[0116] **4b: Disease Control**

[0117] All treatments significantly, and similarly, reduced the incidence and severity of stripe rust at 30 DAT during this trial.

[0118] **4b: Crop Safety**

[0119] No detrimental effects to the vigour or yield of the crop were observed as a result of the treatments applied. An improvement in crop yield was recorded where all treatments were applied.

[0120] **Example 5 (Comparative Example) Formulation of Epoxyconazole using the method of Australian Patent Application AU 201610158**

[0121] Preparation of a suspensiuon concentrate composition of epoxiconazole was attempted using the general formulation of Australian patent application AU 201610158 relating to flutriafole as set out in Table 25.

[0122] **Table 25**

component	description	Conc g/L	function
Epoxiconazole 98%	Triazole fungicide	510	Active ingredient
Tersperse 4894	Surfactant package	34.5	dispersant
Atlox 4913	Comb-graft 30% solution	23 (7.1g solids)	dispersant
Tersperse 2700	Sodium salt of acid resin copolymer	6.9	dispersant
glycerol		69	Anti-freeze
Gensil	polydimethylsiloxane	6.5	antifoam
Veegum	Smectite clay	4.0	Flow modifier
Rhodopol 23	Xanthan gum	1.5	Flow modifier
Acticide BW20	benzisolthiazolinone	1.4	biocide
tartrazine		2.5	Colouring agent
water		486.7	

[0123] **Preparation Method** - Standard practice for manufacture of a suspension concentrate involves charging all the active ingredient required for a batch of mill base all at once.

[0124] The standard method of preparing a batch of product is as follows: Surfactants, rheology modifier, antifoam, biocide and partial quantity of anti-freeze are dissolved/dispersed into water (typically 80% required). Active ingredient epoxiconazole is charged to vessel with agitation. This blend is milled to appropriate particle size by passing through the mill. The final step is the thickening step where a xanthan gum – antifreeze dispersion is blended into the milled base with top up of water.

[0125] The typical mill used for reduction of particle size is a bead mill e.g. Dyno-mill. The mixer used is a standard paddle type mixer.

[0126] Results:

[0127] The sample prepared using the standard method of preparation was not of a milling consistency. The sample was a thick paste. Additional water was added (to 90% water required) and the product significantly reduced in viscosity.

[0128] However, the mill base quickly settles, and the rheology was dilatant (shear thickening) which is not a pumpable viscosity. The mill base should be of a pumpable viscosity and rheology to be introduced into the mill.

CLAIMS

1. An aqueous suspension-concentrate (SC) composition comprising:

at least 400g/L of epoxyconazole;

a comb-graft copolymer surfactant having a poly-(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone, and

a surfactant selected from the group consisting of ethoxylated and propoxylated fatty alcohols

2. The aqueous suspension-concentrate of claim 1, wherein the amount of epoxiconazole is at least 450 g/L of suspension-concentrate.

3. The aqueous suspension-concentrate of any one of the previous claims, wherein the comb-graft copolymer is present in the suspension-concentrate composition in an amount of at least 3 g/L.

4. The aqueous suspension-concentrate of any one of the previous claims, wherein the comb-graft copolymer is present in the suspension-concentrate composition in an amount of 3 g/L to 40 g/L.

5. The aqueous suspension-concentrate of any one of the previous claims, wherein the ethoxylated and propoxylated fatty alcohol surfactant comprises a fatty alcohol of from 12 to 20 carbon atoms.

6. The aqueous suspension-concentrate of any one of the previous claims, wherein the amount of ethoxylated and propoxylated fatty alcohol is at least 1 g/L.

7. The aqueous suspension-concentrate of any one of the previous claims, wherein the amount of ethoxylated and propoxylated fatty alcohol is 1 g/L to 50 g/L.

8. The aqueous suspension-concentrate of any one of the previous claims, wherein the amount of ethoxylated and propoxylated fatty alcohol in the suspension-concentrate is 1g/L to 20 g/L.

9. The aqueous suspension-concentrate of any one of the previous claims, wherein the ethoxylated and propoxylated fatty alcohol has a ratio of EO to PO moieties in the range 10:50 to 50:10.

10. The aqueous suspension-concentrate of any one of the previous claims, wherein the ratio of comb-graft copolymer surfactant to ethoxylated and propoxylated fatty alcohol surfactant in the suspension-concentrate is in the range 30:1 to 0.8:1, preferably in the range 10:1 to 1:1.

11. The aqueous suspension-concentrate of any one of the previous claims further comprising an ethoxylated and propoxylated C_1 to C_6 alkanol.

12. The aqueous suspension-concentrate of claim 13 wherein in the ethoxylated and propoxylated C_1 to C_6 alkanol the C_1 to C_6 alkanol is butanol.

13. The aqueous suspension-concentrate of any one of the previous claims comprising an ethoxylated and propoxylated butanol in an amount of 2 g/L to 80 g/L.

14. The aqueous suspension-concentrate of any one of claims 13 or claim 15, wherein the ethoxylated and propoxylated C_1 to C_6 alkanol comprises a ratio of EO to PO moieties in the range 2:50 to 50:2, preferably in the range 10:50 to 50:10, more preferably in the range 10:50 to 50:10 and still more preferably in the range 20:50 to 50:20.

15. The aqueous suspension-concentrate of any one of the previous claims further comprising a surfactant having a fatty alkyl chain and polyethoxylate group selected from the group consisting of fatty alcohol ethoxylates, fatty acid ethoxylates, fatty amine ethoxylates and fatty amide ethoxylates.

16. The aqueous suspension-concentrate of any one of claim 17, wherein the surfactant having a fatty alkyl chain and polyethoxylate group is present in an amount of 2 g/L to 100 g/L of suspension-concentrate composition.

17. The aqueous suspension-concentrate of claim 17 or claim 18, wherein the surfactant having a fatty alkyl chain and ethoxylate group has a number of

(ethyleneoxy) EO groups (OC_2H_4) in the surfactant in the range 1-50, preferably in the range 4-30, such as in the range 6-20, or in the range 7-14.

18. The aqueous suspension-concentrate of any one of the previous claims comprising:

at least 400g/L of epoxiconazole;

5 g/L to 40 g/L comb-graft copolymer having a poly-(meth)acrylate backbone and pendant polyoxyethylene moieties attached to the backbone;

1 g/L to 50 g/L of ethoxylated and propoxylated fatty alcohol; and

at least one surfactant selected from the group consisting of:

(i) 2 g/L to 80 g/L ethoxylated and propoxylated butanol; and

(ii) 2 g/L to 100 g/L of surfactant having a fatty alkyl chain and polyethoxylate group selected from the group consisting of fatty alcohol ethoxylates, fatty acid ethoxylates, fatty amine ethoxylates, fatty amide alkoxylates and mixtures thereof.

19. The aqueous suspension-concentrate of any one of the previous claims comprising a rheology modifying agent selected from clays and polysaccharide gums.

20. A method of protecting plants or the site of plants from fungi comprising spray application of the suspension-concentrate composition of any one of the previous claims to the plants or the site of plants optionally following dilution of the suspension-concentrate.

21. A method according to claim 20 wherein the diluted composition is tank-mixed with a tank-mix adjuvant which provides one or more of spreading, absorption, penetration and retention of the active agent.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2020/050757

A. CLASSIFICATION OF SUBJECT MATTER

A01N 25/04 (2006.01) A01N 25/30 (2006.01) A01N 43/653 (2006.01) A01P 3/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PATENW, REGISTRY, CAPLUS, AGRICOLA, CABA, IPC/CPC marks: A01N25/[04,30], A01N46/653, A01P3/00, keywords: epoxiconazol, fung, 1338-55-98-8, 135319-73-2, polymethyl, methacrylate, polyethylene, glycol, comb, graft, copolymer, polyoxyethylene, polyoxypropylene, fatty, al[k,l]yl, ethoxy, propoxy, EO, PO, tersperse, atlox, antarox, lutensol, atplus, dehydrol, syntatol, synperonic, tergitol, surfonic, surfynol, lacramul, pluronic, butanol, alcohol, alkanol, [alk,eth,prop]oxylate, suspension concentrate, SC, +acryl+, visco, ostwald, cryst, and the like terms, Applicant/Inventor Search carried out in PATENW and Internal Databases provided by IP Australia

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"D" document cited by the applicant in the international application

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 August 2020	28 August 2020

Name and mailing address of the ISA/AU

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Telephone No. +61262833130

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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