ABSTRACT

A NOVEL FUNGICIDAL COMBINATION

The present invention relates to a novel synergistic fungicidal combination comprising of a strobilurin, an azole, and a peptide optionally along with other excipients. The combination of the present invention is used in the prevention and treatment of fungicidal infection in plants. The combination of the present invention also enhances the greenness of the foliage and sheath of the crops and provides resistance against the fungal pathogens.

We Claim:

1. A fungicidal combination comprising a strobilurin, an azole and a peptide optionally along with other excipients.

2. The combination as claimed in claim 1, wherein the strobilurin is selected from the group of azoxystrobin, kresoximmethyl, picoxystrobin, fluoxastrobin, oryzastrobin, dimoxystrobin, pyraclostrobin and treifloxystrobin.

3. The combination as claimed in claims 1 or 2, wherein the strobilurin is azoxystrobin (methyl (α*E*)-2-(2-{[6-(2-cyanophenoxy) pyrimidin-4-yl] oxy} phenyl)-α-(methoxy methylene) benzeneacetate.

4. The combination as claimed in claim 1, wherein the azole is selected from the group of clotrimazole, ketoconazole, voriconazole and epoxiconazole.

5. The combination as claimed in claim 1 or 4, wherein the azole is epoxiconazole; (2*RS*,3*SR*)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1*H*-1,2,4-triazole.

6. The combination as claimed in claim 1, wherein the peptide is selected from the group of aliphatic nitrogen fungicides, amide fungicides and acylamino fungicides.

7. The combination as claimed in claim 1 or 6, wherein the peptide is a Soy protein (80%) also known as Amino(W).

8. The combination as claimed in claim 1, wherein the excipients are selected from the group of antifreeze agent, defoamer, antibacterial, thickener, demineralized water, organic solvent, emulsifier, surfactant, binder, filler and coloring agents.

9. The combination as claimed in claim 8, wherein the antifreeze agent is selected from the group of monoethylene glycol, diethylene glycol and polypropylene glycol, preferably polypropylene glycol.

10. The combination as claimed in claim 8, wherein the surfactant is selected from the group of derivatives of alkyl aryl ethoxy ethanol and mixtures thereof.

11. The combination as claimed in claim 10, wherein the surfactant is a mixture of derivates of Amine salt of phosphate tristyryl phenol ethoxylate and Tristyryl phenol ethoxylate potassium salt.

12. The combination as claimed in claim 8, wherein the defoamer is dimethyl polysiloxane.

13. The combination as claimed in claim 8, wherein the antibacterial is selected from the group of Formaldehyde, proxelgxl and 1-2-benzisophiazolin-3-1formaldehyde, preferably the antibacterial is formaldehyde.

14. The combination as claimed in claim 8, wherein the thickener is Xanthan gum.

15. The combination as claimed in any of the preceding claims wherein the strobilurin is present in an amount ranging from 1 to 20% based on the weight of the fungicidal combination.

16. The combination as claimed in any of the preceding claims wherein the azole is present in an amount ranging from 1 to 20% based on the weight of the fungicidal combination.

17. The combination as claimed in any of the preceding claims wherein the peptide is present in an amount ranging from 0.1 to 10% based on the weight of the fungicidal combination.

18. The combination as claimed in any of the preceding claims wherein the amount of antifreeze agent is in the range of 4-8%, the amount of surfactant is in the range of 3-7%, the amount of defoamer is in the range of 0.1 -0.3%, the amount of antibacterial is in the range of 0.1 -0.3% and the amount of thickener is in the range of 0.1 -0.3%, with respect to the weight of fungicidal combination.

19. The combination as claimed in any of the preceding claims wherein the combination is used as a fungicide in cereals comprising rice, wheat, millet, maize, barley, sorghum, oats, triticale and Rye.

20. The combination as claimed in any of the preceding claims as and when used to control sheath blight disease of rice crop plants.

21. The combination as claimed in any of the preceding claims wherein the combination is in the form of suspension concentrate, emulsion concentrate or granules, preferably the combination is a suspension concentrate.

Dated, this 3rd day of December, 2013.

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FIELD OF THE INVENTION

The present invention generally relates to fungicidal combination. Particularly the invention relates to stable, synergistic fungicidal combinations and a process for preparation thereof.

BACKGROUND OF THE INVENTION

Strobilurins and azoles are independently known for their action as fungicides in prevention and control of various infestations of cereal crops, fruit trees, vegetables etc. and are found to have potent antifungal activity against a broad range of fungi species such as *Alternaria solani, Phytophthora Infestans, Septoria lycopersici, Botrylis cinerea, Phytophtora nicotinae, Alternaria Alternata Septoria tritici, Puccinia triticina, Mycosphaerella fijiensis, Mycosphaerella musicola , Puccinia hordei, Puccinia recondite, Puccinia coronate, Septoria nodorum, Giberella zeae, Pyrenophora teres, Erysiphe graminis Cladosporium spp, Puccinia striiformis etc.*

CN102405912 discloses a composition comprising Azoxystrobin and Epoxiconazole in a ratio by weight in the range of about 10:1 to 1:10. However the composition is only suitable for banana leaf spot disease and has the problem of resistance.

CN102150658 discloses bactericide composition which is characterized in that the active ingredient of the bactericide composition comprises azoxystrobin and epoxiconazole, however the combination range is too broad and unworkable.

Combination of the class of Strobilurins and azoles are known and reported in certain prior arts such as CN102047890, CN101946775 and WO2007031487. These combinations disclosed in prior art are found in the form of wettable powders, water dispersible granules, aqueous suspensions, aqueous emulsions, suspending agents, water dispersible powders, water emulsions and microemulsions, but the specific selection of molecule is not suggested by these prior arts. The compositions have their inherent disadvantages.

Hence, there is still a need for new compositions which are broad spectrum, having higher fungicidal activity and less toxicity. Accordingly, there is a need for a novel, stable and safe combinations comprising strobilurins and azoles in addition with a synergistic component.

OBJECT OF THE INVENTION

An object of the present invention is to provide a novel fungicidal combination.

SUMMARY OF INVENTION

The present invention relates to a novel, stable, synergistic and safe fungicidal combination of a strobilurin, an azole and a peptide. The combination of the present invention is present as a suspension concentrate, emulsion concentrate and granules; preferably the combination is a suspension concentrate. The present invention also pertains to the use of such combination for prevention and treatment of fungicidal infection in plants.

DETAIL DESCRIPTION OF THE INVENTION

The present invention provides a novel, stable and synergistic fungicidal combination. The novel combination of the present invention comprises a strobilurin, an azole, and a peptide optionally along with other excipients.

The strobilurin may be selected from the group comprising azoxystrobin, kresoximmethyl, picoxystrobin, fluoxastrobin, oryzastrobin, dimoxystrobin, pyraclostrobin and treifloxystrobin . Preferably the strobilurin is a azoxystrobin also known as methyl (α*E*)-2-(2-{[6-(2-cyanophenoxy) pyrimidin-4-yl]oxy}phenyl)-α-(methoxymethylene) benzeneacetate.

The strobilurin may be present in an amount ranging from 1 to 20% w/w based on the weight of the fungicidal combination.

The azole may be selected from the group comprising clotrimazole, ketoconazole, voriconazole and epoxiconazole. Preferably the azole is a epoxiconazole also known as (2*RS*, 3SR)-1-[3-(2-chlorophenyl)-2,3-epoxy-2-(4-fluorophenyl)propyl]-1*H*-1,2,4-triazole.

The azole may be present in an amount ranging from 1 to 20% w/w based on the weight of the fungicidal combination.

The peptide may be selected from the group comprising aliphatic nitrogen fungicides, amide fungicides, acylamino fungicides. Preferably the peptide is a Soy protein (80%) also known as Amino (W).

Amino-acid (W) is a protein extract from Soy, which is a mixture of Amino-acids as provided below. The percentage of amino-acid however may be varying after every extraction. Amino-acid(W) is a white powder with the amino acids:-

Aspartic, Threonine, Serine, Glutamic acid, Proline, Glycine, Valine, Cystine, Isoleucine, Methionine, Tyrosine, Phenylalanine, Lysine, Histidine, Arginine and Alanine.

The peptide may be present in an amount ranging from 0.1 to 10% based on the weight of the fungicidal combination.

The excipients may include antifreeze agent, defoamer, antibacterial, thickener, demineralized water, organic solvent, emulsifier, surfactant, binder, filler and coloring agents.

Antifreeze agent may be selected from the group comprising Monoethylene glycol, Diethylene glycol and polypropylene glycol.

The antifreeze agent may be present in an amount ranging from about 4% to about 8% (w/w) based on the weight of fungicidal combination; preferably, the antifreeze agent is polypropylene glycol.

Surfactants may be selected from the group consisting of derivatives of alkyl aryl ethoxy ethanol and mixtures thereof.

The Surfactants may be present in an amount ranging from about 3% to about 7% (w/w) based on the weight of fungicidal combination. Preferably, the Surfactant is a mixture of derivatives of alkyl aryl ethoxy ethanol; preferably the surfactant is a mixture of Derivatives of Amine salt of phosphate tristyryl phenol ethoxylate and Tristyryl phenol ethoxylate potassium salt.

The defoamer may be present in an amount ranging from about 0.1 to about 0.3% (w/w) based on the weight of fungicidal combination; preferably the defoamer is dimethyl polysiloxane.

Anti bacterial may be selected from the group consisting of Formaldehyde, proxelgxl and 1-2-benzisophiazolin-3-1, preferably the antibacterial is formaldehyde.

The antibacterial may be present in an amount ranging from about 0.1 to about 0.3% (w/w) based on the weight of the fungicidal combination. The thickener may be present in an amount ranging from about 0.1 to about 0.3% (w/w) based on the weight of the fungicidal combination; preferably the thickener is Xanthan gum.

In another aspect, the invention also envisages that the combination of the present invention is present in a liquid suspension concentrate.

The present invention also provides a process for the preparation of the combination of the present invention, comprising the steps of:

I. diluting mixture of surfactants & anti freezing agent in demineralized water (D.M.Water);

II. solubilizing the mixture of step I by high shear mixing;

III. adding Azoxystrobin and defoamer to the mixture of step II and mixing to make it homogeneous;

IV. adding Epoxyconazole and soy protein to the mixture of step III and mixing to obtain a homogeneous mass;

V. subjecting the homogeneous mass obtained in step IV to grinding in a Sand Mill to obtain a mean particle size of below 5 micron;

VI. adding 2% water solution of xanthan gum under slow stirring to the mixture of step V followed by mixing to obtain the homogeneous combination of the present invention.

[2% gum solution is prepared by adding 10g D.M. water to 0.2g of formaldehyde sol. followed by adding xanthan gum under slow stirring].

In an aspect, the combination of present invention is used to protect many fruit, vegetable, nut and field crops against a wide spectrum of fungal infestations of rice, wheat, grape chilly, and pea. The combination of the present invention is effective against various pests and diseases as shown in Table 1.

TABLE 1: PESTS & DISEASES CONTROLLED BY THE PRESENT INVENTION

	DISEASES	**CAUSAL ORGANISM**
RICE	Sheath Blight	Rhizoctonia solani
	Sheath rot	Sarocladium oryzae
	Stem rot	Sclerotium oryzae
	Aggregate sheath spot	Rhizoctonia oryzae sativae
	False smut	Ustilaginoidea virens
WHEAT	Brown/Leaf rust	Puccinia recondite f.sp. tritici
	Stripe rust/yellow rust	Puccinia striformis
	Powdery mildew	Erysiphe graminis f.sp.tritici
	Alternaria leaf blight	Alternaria triticana
CHILLY	Anthracnose & Fruit rot	Colletotrichum capsici Colletotrichum gloesporiodides
PEA	Alternaria blight	Alternaria alternate
	Downy mildew	Peronospora viciae
	Grey mold	Botrytis cinerea
	Rust	Uromyces fabae
GRAPES	Powdery mildew	Uncinula necator
	Downy mildew	Plasmopara viticola
	Alternaria rot	Alternaria alternata
	Botrytis	Botrytis cinerea
	Anthracnose & Bird eye rot	Sphaceloma ampelinum

It is observed that when the novel formulation is administered, azoxystrobin and epoxiconazole acts synergistically with the Soy protein and substantially enhances the effect of mixture in removal of the disease complex in rice crop. The present invention also

provides a process of removal of Sheath Blight disease in Rice crop by administering a therapeutically effective amount of the combination of the present invention. Moreover, the present invention also provides methods of reducing the risk of developing resistance of fungi towards the combination.

Not being limited by the theory, the present invention provides a novel combination comprising azoxystrobin, epoxiconazole and peptide. Synergistic effect is observed when azoxystrobin and epoxiconazole is combined with the peptide and formulated. The amino acids in the peptide function acts as a micronutrient and acts synergistically alongwith azoxystrobin & epoxiconazole in improving immune system of the plant resulting in prevention of further infection from pathogenic strains. However, the best results are obtained when the peptide (soy protein) is in the range of 0.1-1%. Excess amount of peptide in the biological system will affect the basic parts like plant cell itself which will lead to adverse effect on the physiology of plant & finally leads to phytotoxicity.

The combination of the present invention demonstrates that azoxystrobin, epoxiconazole and peptide along with excipients acts synergistically in terms of stability, efficacy and substantially enhances the effect of mixture in removal of rust or any fungicidal infestations. It is known that the mixture of Azoxystrobin and Epoxiconazole helps in fighting against Fungus. However, it has been observed that when soyprotein is added to the mixture of Azoxystrobin and Epoxiconazole it enhances protein synthesis in the meristamatic tissues. The enhanced protein synthesis enhances greenness of the foliage and sheath of the crops which further increases photosynthetic responsible pigments and that in turn results in accelerated photosynthetic reaction. Hence the plants get strength and durability. Amino acids are building blocks for plants development, peptides increases the absorption of applied nutrients in plant tissues.

The Peptide acts as Nutrient, SAR enhancer, Phytoalexin enhancer and Immune system enhancer. Addition of peptide to the mixture of Azoxystrobin and Epoxiconazole improves SAR i.e Systemic acquired resistance in plants & induces the synthesis of Phytoalexin in such a way that the plants resistance is strengthened against attacks from fungus.

ADVANTAGES

1. The combination of the present invention has no phytotoxic effect on crops.
2. The combination of the present invention is stable and acts synergistically in terms of stability, efficacy and substantially enhances the effect of mixture in removal any fungicidal infestations.
3. The combination of the present invention has broad spectrum pesticidal activity and is effective against a large number of diseases.
4. The combination of the present invention results in enhancement of foliage greenness, width and shining of the grains.
5. Addition of peptide to the mixture of Azoxystrobin and Epoxiconazole improves SAR i.e Systemic acquired resistance in plants & induces the synthesis of Phytoalexin in such a way that the plants resistance is strengthened against attacks from fungus.

The following examples further illustrate the invention and its unique characteristics in elaborate manner. However the following examples are not intended to limit the scope of the invention in any way.

EXAMPLE: 1 Illustrative combination of the present invention

Table 1: Formulation of the present invention

Various combinations of the present invention were formulated. The various ingredients of the combination as formulated in the present invention are presented here below at Table

Ingredient	**F1** (SC)	**F2** (SC)	**F3** (SC)	**F4** (SC)
Azoxystrobin Technical	14.50g	14.00g	2.50g	18.00g
Epoxiconazole Technical (Basis of)	9.50g	9.00 g	13.00g	4.50g
Soy protein(80%)	00.125g	0.10 g	6.50g	0.20g

(Amino(W))				
Antifreeze Agent(propylene glycol)	5.00g	8.0g	4.00g	6.50g
mixture of surfactants	4.00g	4.50g	7.00g	5.00g
defoamer (dimethyl polysiloxane)	0.20g	0.30g	0.20g	0.10g
Anti bacterial (formaldehyde)	0.20g	0.25g	0.10g	0.30g
Thickener (Xanthan Gum)	0.20g	0.25g	0.10g	0.30g
D.M.Water	66.275g	64.60g	66.60g	65.10g
Total Quantity	100g			

Soy protein(80%), Amino(W) is a mixture of amino acids as provided in the table below.

Table 2: Composition of Soy Protein (80%)

PROFILE OF AMINO ACID (W)

Appearance: white powder

Item	Result	Cas No.	Item	Result	Cas No.
Aspartic	4.006	56-84-8	Threonine	3.432	72-19-5
Serine	4.118	56-45-1	Glutamic acid	9.132	56-86-0
Proline	3.982	147-85-3	Glycine	2.897	56-40-6
Valine	3.919	72-18-4	Cystine	2.865	56-40-6
Isoleucine	1.89	72-32-5	Methionine	0.189	63-68-3
Tyrosine	1.256	60-18-4	Phenylalanine	1.672	63-91-2
Lysine	1.462	56-84-1	Histidine	0.892	71-00-1

Arginine	5.064	74-79-3			
Alanine	2.098	56-41-7	Total amino acids content	48.87%	

Moisture content<4.871% conclusion: Qualified

EXAMPLE 2: Illustrative preparations of suspension concentrate of the present invention

PREPARATION METHOD:

The mixture of surfactants & anti freezing agent as listed in Table 1 were first diluted in D.M.Water, and solubilized by high shear mixing, then was added Azoxystrobin and defoamer and was mixed to make the solution homogeneous. Epoxyconazole and Soy protein (80%) was then added to the mixture and mixed to make homogeneous mass. The above mixed mass was subjected to grinding in *Sand Mill.* Grinding was carried out until a mean particle size of below 5 microns was obtained.

Preparation of 2% gum solution – 10g of D.M water was added to 0.2g of formaldehyde solution and to it was further added xanthan gum under slow stirring

To the ground mixture prepared above, 2% water solution of xanthan gum was added under slow stirring. After mixing all the components till the mixture became homogeneous, the mixture was tested to check for quality parameter.

EXAMPLE 3: Illustrative biological tests of the present invention

The combinations of the present invention as prepared by example 2 were tested for the effects in ***Kharif*** crop on rice crop. The test was conducted on Swarna Masuri variety of Rice crop plants in Melna (West Bengal). The plants were present in a plot size of 150 sq m, having a gap of 10 cm between the plant and 20 cm between the rows with randomized block design at a temperature 25°C with relative humidity of 87%. The combination of the present invention was calculated and added to the required volume of water (375 Lit/Ha) for spraying. The spray tank was filled with ½ the quantity of clean required volume of water and then the measured combination of the present invention (according to the dose) was added followed by the rest half quantity of water. The solution was stirred well and thorough coverage of the plants was ensured. Knapsack sprayer fitted with boom alongwith flat fan

nozzle was used to apply the fungicidal solution. This application was carried such that the 1st application was done after 20 days after transplanting and repeated at 20 days interval. 3 replications and 6 treatments were given to the rice crop.

Studies were carried out to evaluate Bio-efficacy and phytotoxicity of Novel Fungicide, CCP-1409 SC ((Azoxystrobin 14% + Epoxiconazole 9% + Soy protein 0.1%) against Sheath Blight disease in Rice crop.

TABLE 3: Treatment details of Swarna Masuri variety of Rice Crop plants

Treatments	Treatment details	Dose a.i./acre	Dose/acre
T-1	Untreated	-	-
T-2	Azoxystrobin 23% SC	46 g	200 ml
T-3	Epoxiconazole 12.5% EC	30 g	240 ml
T-4	CCP-1409 SC	21 g + 13.5 g	150 ml
T-5	CCP-1409 SC	28 g + 18 g	200 ml
T-6	CCP-1409 SC	35 g + 22.5 g	250 ml
T-7	CCP-1409 SC + 0.1% Soy protein(SP)	21 g + 13.5 g+0.15g	150 ml
T-8	CCP-1409 SC + 0.1% Soy protein	28 g + 18 g+0.20g	200 ml
T-9	CCP-1409 SC + 0.1% Soy protein	35 g + 22.5 g+0.25g	250 ml

Table 3 refers to the treatment of test plants with individual components as well as with the combination of the present invention. CCP-1409 SC+ Soy protein 0.1% refers to Azoxystrobin 14% + Epoxiconazole 9% + Soy protein 0.1%.

(A) Bio efficacy studies:

(i) 30 hills /spot and 3 spots/plot were observed and each disease was visually rated as per the ratings below. The per cent disease index was calculated as per given formula.

The disease was observed before every spray and 15 days after last application. Disease assessment was done as per rating scale of 0 to 9 given by Table 4.

Percent Disease Index (PDI) = $\frac{\text{Sum of all the numerical disease rating}}{\text{Total No. of leaves (25) x Maximum disease grade in scale (9)}} \times 100$

Percent disease control = $\frac{C - T}{C} \times 100$

Wherein C = Control plot/Untreated

T = Treated plot

(ii) Scale for measurement of bio-efficacy

Table 4 : Scale for sheath blight

Grade	RLH (%) Position
0	0
1	< 20
3	20-30
5	31-45
7	46-65
9	>65

Table-5 Effect of fungicidal treatments on Sheath disease in Rice

Treatment details	Dose/ acre	PDI and % Control over untreated					
		7 DAA	% Control	15 DAA	% Control	21 DAA	% Control
Untreated	-	7.53	-	20.99	-	26.67	-
Azoxystrobin 23% SC	200 ml	0.37	95.08	3.09	85.29	6.30	76.39
Epoxiconazole 12.5% EC	240 ml	0.25	96.72	3.33	84.12	6.85	74.31
CCP-1409 SC	150 ml	0.25	96.72	0.49	97.65	5.31	80.09
CCP-1409 SC	200 ml	0.00	100.00	0.00	100.00	1.36	94.91
CCP-1409 SC	250 ml	0.00	100.00	0.00	100.00	0.37	95.61

CCP-1409 SC+0.1% SP	150 ml	0.20	97.34	0.35	98.33	4.40	83.50
CCP-1409 SC+0.1% SP	200 ml	0.00	100.00	0.00	100.00	1.10	95.87
CCP-1409 SC+0.1% SP	250 ml	0.00	100.00	0.00	100.00	0.32	98.80

Note: CCP-1409 SC = Azoxystrobin 14% + Epoxiconazole 9% + Soy protein 0.1% DAA :days of application

Results of Table 5 show that maximum per cent control of sheath blight disease was observed to be 95.87% and 98.80% with application of Novel fungicides CCP-1409 SC+ 0.1% **SP** (Azoxystrobin 14% + Epoxiconazole 9% + Soy protein(SP) 0.1%) @ 200 and 250 ml per acre, respectively after 21 days of application. While application of CCP-1409 SC (Azoxystrobin 14% + Epoxiconazole 9%) without Soy protein @ 200 and 250 ml per acre showed 94.91 % and 95.61% respectively after 21 days of application.

Table-6: Effect of fungicidal treatments on Av. Number of tillers 1000 grain weight and yield per acre

Treatment details	Dose/ acre	Av.Tillers (25Hills)	% Increase	1000 grain weight	% Increase	Plot yield Kg (200sqm)	% In-crease
Untreated	-	15.65	-	22.74	-	100.50	-
Azoxystrobin 23% SC	200 ml	17.25	9.27	23.15	1.77	108.25	7.39
Epoxiconazole12.5% EC	240 ml	18.35	14.71	23.35	2.61	108.80	7.62
CCP-1409 SC	150 ml	17.40	10.05	23.05	1.34	107.20	6.25
CCP-1409 SC	200 ml	18.50	15.40	23.55	3.43	107.55	6.55
CCP-1409 SC	250 ml	18.90	17.19	23.90	4.85	108.25	7.15
CCP-1409 SC+0.1% SP	150 ml	19.17	18.36	25.15	9.58	113.45	11.41
CCP-1409 SC+0.1% SP	200 ml	20.40	23.28	25.40	10.47	113.90	11.76
CCP-1409 SC+0.1% SP	250 ml	20.75	24.57	25.99	12.50	114.05	11.88

Note: CCP-1409 SC = Azoxystrobin 14% + Epoxiconazole 9%, AA - Soy protein

Table 6 shows that application of CCP-1409 + 0.1%Soy protein @ 200 – 250 ml per acre showed 20.40-20.75% enhancement of number of tillers with good recovery or curing of blight incidence on crop. While in CCP-1409 SC without soy protein, the increase in the

average number of tillers (observed from 25 hills) is only 18.50-18.90% after recovery of crop with good immunity against biotic factors. Further it was observed that the novel fungicide CCP-1409 with Soy protein 0.1% also produced bolder grains as evident from the 1000 grain weight data. The 1000 grain weight in the CCP-1409 + 1% Soy protein treated plot showed an increase of 10.47 – 12.50 % while the 1000 grain weight of the CCP -1409 (with-out Soy protein) showed only 3.43 – 4.85 % increase over the check.

Both the treatments showed enhancement of foliage greenness, width and shining of grains.

(B) **Evaluation of Phytotoxicity**

Visual observations were recorded at 3, 7 and 10 days after application (DAA) of testing products. The parameters were observed leaf injury on tip/surface, necrosis, vein clearing, epinasty, hyponasty and wilting. The score scale (1-10) followed for leaf injury on tips/surface is given.

Table 7: Phytotoxicity symptoms scoring and rating for leaf injury on tip/surface

Leaf injury on tips/surface	Rating
0 %	0
1-10%	1
11-20%	2
21-30%	3
31-40%	4
41-50%	5
51-60%	6
61-70%	7
71-80%	8
81-90%	9
91-100%	10

Table 8 shows the phytotoxic effect of the compositions and the individual components applied to the test plants T1- T7.

DAA - Days after application, L- Leaf injury on tips/surface, N-Necrosis, V- Vein clearing, E- Epinasty, H- Hyponasty, W-wilting

Table-8.a Phytotoxic effect of various treatments on wheat crop after 3 DAA

Treatment details	Dose/ac	3 DAA					
		L	N	V	E	H	W
Untreated	-	-	-	-	-	-	-
Azoxystrobin 23% SC	200 ml	0	0	0	0	0	0
Epoxiconazole 12.5% EC	240 ml	0	0	0	0	0	0
CCP-1409 SC	150 ml	0	0	0	0	0	0
CCP-1409 SC	200 ml	0	0	0	0	0	0
CCP-1409 SC	250 ml	0	0	0	0	0	0
CCP-1409 SC	300 ml	0	0	0	0	0	0

DAA – Days after application, L- Leaf injury on tips/surface, N-Necrosis, V- Vein clearing, E- Epinasty, H- Hyponasty, W-wilting

It is clear from the table 8 that no phytotoxicity was observed in all the treatments on 3, 7 and 10 days after application on wheat. There was no phytotoxicity to the wheat crop due to repeated application of CCP-1409 SC.

Table-8.b Phytotoxic effect of various treatments on wheat crop after 7 DAA

Treatment details	Dose/ac	7 DAA					
		L	N	V	E	H	W
Untreated	-	-	-	-	-	-	-
Azoxystrobin 23% SC	200 ml	0	0	0	0	0	0
Epoxiconazole 12.5% EC	240 ml	0	0	0	0	0	0
CCP-1409 SC	150 ml	0	0	0	0	0	0

CCP-1409 SC	**200 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**250 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**300 ml**	*0*	*0*	*0*	*0*	*0*	*0*

DAA – Days after application,

L- Leaf injury on tips/surface, N-Necrosis, V- Vein clearing, E- Epinasty, H- Hyponasty, W-wilting

Table-8.c Phytotoxic effect of various treatments on wheat crop after 10 DAA

Treatment details	**Dose/ac**	**10 DAA**					
		L	**N**	**V**	**E**	**H**	**W**
Untreated	-	-	-	-	-	-	-
Azoxystrobin 23% SC	**200 ml**	*0*	*0*	*0*	*0*	*0*	*0*
Epoxiconazole 12.5% EC	**240 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**150 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**200 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**250 ml**	*0*	*0*	*0*	*0*	*0*	*0*
CCP-1409 SC	**300 ml**	*0*	*0*	*0*	*0*	*0*	*0*

DAA – Days after application,

L- Leaf injury on tips/surface, N-Necrosis, V- Vein clearing, E- Epinasty, H- Hyponasty, W-wilting

The above phytotoxicity data shows that no internal reactions (burning of plants, destruction of plants, yellowing of plants) and antagonistic activity took place even after mixing two components along with peptide (soy protein) in the hydrolytic condition. Therefore, the mixture of the present invention does not cause any phytotoxic effect in the plant.

Hence, the above results show that CCP-1409 SC + Soy protein 0.1%) (Azoxystrobin 14% + Epoxiconazole 9% + Soy protein 0.1%) @ 200 to 250 ml per acre provided maximum per cent Sheath Blight disease control 95.87% to 98.80% on Rice without any phytotoxicity and these treatments also showed incremental yields with curing and recovering of disease affected plants. CCP -1409 + 0.1% Soy protein at initial disease level also showed percent increase in the no. of tillers and with enhancement of foliage greenness, ultimately resulting to higher yield and bolder grains as compared with CCP-1409 without soy protein.