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(54) Title: SYNERGISTIC HERBICIDAL FORMULATIONS, PROCESS FOR PREPARING THEREOF

(57) Abstract: The present invention relates to synergistic herbicidal compositions comprising combination of two or more herbicides. The present invention also relates to herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac and 2,4-Dichlorophenoxy acetic acid derivatives or combinations thereof. The present invention also relates to herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said additional herbicides are selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt) or combinations thereof. The present invention also relates to a process for the preparation of herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides.

SYNERGISTIC HERBICIDAL FORMULATIONs, PROCESS FOR PREPARING THEREOF

FIELD OF THE INVENTION

The present invention relates to synergistic herbicidal compositions comprising combination of two or more herbicides.

The present invention also relates to herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac and 2,4-Dichlorophenoxy acetic acid derivatives or combinations thereof.

The present invention also relates to herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said additional herbicides are selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt) or combinations thereof.

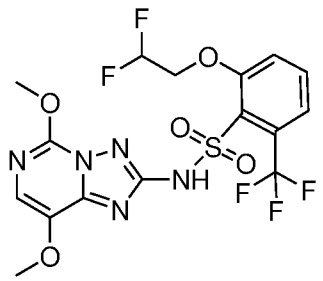
The present invention also relates to a process for the preparation of herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides.

BACKGROUND OF THE INVENTION

Penoxsulam is a triazolopyrimidine sulfonamide, which is a post germination herbicide having a broad spectrum used in paddy field, belongs to an herbicide group called ALS (acetolactate synthase) inhibitors. It can control and kill Echinochloa crusgalli and annual Cyperus weeds effectively, and it also effective against a variety of leafy weeds. Penoxsulam has the broadest herbicide controlling spectrum among the herbicides used in paddy field, it is characterized by a long lasting period and a soil activity against Echinochloa crusgalli and a lot of leafy weeds and Cyperus weeds. However, as penoxsulam is a strong acetolactate synthase inhibitor, its

herbicidal effect shows slowly, and it takes time for the weeds to die gradually. In addition, penoxsulam exhibits poor effect against certain leafy weeds and resistant Echinochloa crusgalli. Penoxsulam was received a reduced risk designation by the United States Environmental Protection Agency (USEPA), conditional registration in September 2004, and is scheduled for release in 2005.

Penoxsulam is chemically known as 2-(2,2-difluoroethoxy)-N-(5,8-dimethoxy [1,2,4]-triazolo[1,5-c]pyrimidin-2-yl)-6-(trifluoromethyl)benzenesulfonamide, and has the following structure:



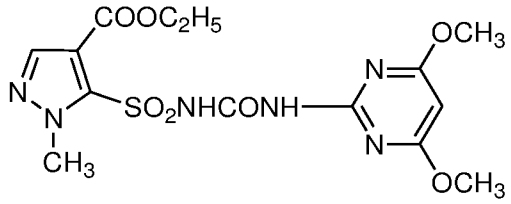
Penoxsulam is the active ingredient of Granite (trademark of Dow AgroSciences LLC), a herbicide designed for postemergence control of annual grasses, sedges, and broadleaf weeds in rice culture. Penoxsulam herbicide is to be used as a foliar spray on dry-seeded rice crops, or as either a foliar spray or a granular formulation on water-seeded rice crops in order to control broadleaf weeds, aquatic plants, and certain grasses.

Penoxsulam comes in liquid and granular formulations. Foliar application is recommended for use of the liquid formulation of penoxsulam on both dry- and water-seeded crops.

Pyrazosulfuron ethyl is a new sulfonylurea herbicide for rice, being developed and launched in major rice production countries. The herbicidal activity is derived by inhibition of acetolactate synthase (ALS) which is essential for synthesis of amino acids. Pyrazosulfuron ethyl is a chemical compound from the group of the sulfonylureas, and an herbicide which discovered in 1982 and 1990 by Nissan Chemical Corporation.

Pyrazosulfuron-ethyl is chemically known as ethyl-5-[({[(4,6-

dimethoxypyrimidin-2-yl)amino]carbonyl}amino)sulfonyl]-1- methyl-1 H -pyrazol-4-carboxylate and has the following structure:



Pyrazosulfuron-ethyl is under the tradenames AGREEN and Sirius used as systemic herbicide in rice cultivation. It acts by inhibiting acetolactate synthase.

Pyrazosulfuron Ethyl is selective systemic herbicide, absorbed by roots and/or leaves and translocated to the meristem, acts by inhibiting biosynthesis of the essential amino acids valine and isoleucine, hence stopping cell division and plant growth.

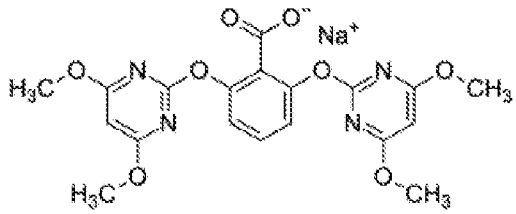
Bispyribac sodium is a broad-spectrum, post emergence contact herbicide which controls grass and broadleaf weeds. Bispyribac sodium acts by inhibition of the plant enzyme acetolactate synthetase (ALS).

Bispyribac sodium is formulated as a wettable powder or water soluble granule, packaged in water soluble bags, and applied as broadcast or surface sprays using ground or aerial sprayers.

Bispyribac sodium is registered for use to control grasses and broad-leaf weeds, with the mode of action being inhibition of acetolactate synthase.

Bispyribac sodium is registered for use on rice, and non-agricultural sites including ornamental lawns; turf, including canals, drainage ditches, marshes, lakes ponds and reservoirs.

Bispyribac sodium is chemically known as sodium 2,6-bis[(4,6-dimethoxypyrimidin-2-yl)oxy)benzoate and has the following structure:



Phenoxy herbicides (or "phenoxies") are a family of chemicals related to the growth hormone indoleacetic acid (IAA). When sprayed on broad-leaf plants they induce rapid, uncontrolled growth ("growing to death"). When sprayed on monocotyledonous (grass) crops such as wheat or corn, they selectively kill broad-leaf weeds, leaving the crops relatively unaffected. The wide variety of phenoxies in use today can be grouped into the phenoxyacetic, phenoxybutyric and phenoxypropionic subtypes, the latter containing the aryloxyphenoxypropionic subtype with the greatest number of commercial variants. Chemically, they are carboxylic acids, typically applied in an ester or salt form.

The esters are 2,4-DEE (2,4-Dichlorophenoxy)acetic acid ethyl ester); 2,4-D 2-ethylhexyl ester (EHE) and the salt forms are 2.4-D sodium (sodium 2,4-Dichlorophenoxy)acetate); 2.4-D dimethyl-amine salt (DMA salt) .

US 4,906,285 A claims Bispyribac or its salts, and its composition and the herbicidal activity.

US 5,858,924 A claims Penoxsulam and its herbicidal compositions.

WO 2013/186695 A1 discloses formulation comprising nanoparticle comprising a polymer-associated herbicide compound with an average diameter of between about 1 nm and about 500 nm; and the polymer is a polyelectrolyte, and a dispersant or a wetting agent.

US 10,492,489 B2 generically enables combination of different active ingredients. However, the specific compositions of Penoxsulam and Pyrazosulfuron ethyl combination are not disclosed.

WO 2020/061708 A1 discloses synergistic pesticidal compositions and methods for delivery of pesticidal active ingredients. This patent discloses Penoxsulam and Pyrazosulfuron and a C_4-C_{10} saturated or unsaturated aliphatic acid or an agriculturally compatible salt thereof. However, this application does not disclose water dispersible granules containing combination of Penoxsulam and Pyrazosulfuron.

CN 101310599 A discloses mixed herbicide contains Penoxsuam and

Pyrazosulfuron-ethyl and the effective components of the mixed herbicide are as follows according to percentage by weight: 0.1 percent to 50 percent of the Penoxsuam and 0.2 percent to 50 percent of the Pyrazosulfuron-ethyl.

Mathew *et al.*, *Indian Journal of Agricultural Sciences*, 2013, 83(12), 1420-1422 discloses the use of Penoxsulam and Pyrazosulfuron ethyl for weed control in direct seeded puddle rice (Oryza sativa). The Penoxsulam suspension concentrate and Pyrazosulfuron ethyl wettable powder were sprayed on paddy rice and efficacy has been determined. Both the products have shown good results on paddy rice in controlling weeds such as grasses, sedges and broad leaved weeds. However, the specific WDG compositions of Penoxsulam and Pyrazosulfuron ethyl combination are not disclosed.

Water dispersible granules (WDGs) are a solid, non-dusty granular formulation which disperses or dissolves quickly when added to water in the spray tank to give a fine particle suspension. They provide a system for delivering solid active ingredients to a target organism. They allow for the production of highly-concentrated formulations which are wettable and easily disintegrated on contact with water.

Though, conventionally each of these active ingredients are used individually, combination product is not approved which has applications compared to the mono product. Hence, there is increased interest in the use of active ingredients in combination to give synergistic results.

Accordingly, there is a need in the art to provide herbicidal compositions of combinations which environmentally safer and stable herbicidal / insecticidal / acaricidal compositions having two or more active ingredients with different physical and chemical properties, which are environmentally safe, easy and effective combination formulation of two active with enhanced efficacy and stable product during storage.

It was surprisingly and unexpectedly found by the present inventors that a selective combination composition of two or more active ingredients comprising

Penoxsulam and additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, possesses enhanced efficacy, improved penetration and long duration control of phytopathogens as compared to its other traditional formulations with long storage stability across a wide temperature range and having no adverse impact on photosynthetic activity in plant and fruit quality.

OBJECTIVE OF INVENTION

The main objective of the present invention is to provide synergistic herbicidal composition comprising combination of two or more herbicides.

Another objective of the present invention is to provide herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac and 2,4-Dichlorophenoxy)acetic acid derivatives or combinations thereof.

Another objective of the present invention is to provide herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said additional herbicides are selected from Pyrazosulfuron or its derivative, Bispyribac and 2,4-Dichlorophenoxyacetic acid derivatives (2,4-DEE and 2,4-D sodium salt) or combinations thereof.

Another objective of the present invention is to provide a process for the preparation of herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides.

SUMMARY OF INVENTION

Accordingly, the present invention provides a synergistic herbicidal composition comprising combination of two or more herbicides.

In one embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac and 2,4-

Dichlorophenoxyacetic acid derivatives or combinations thereof.

In one embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said additional herbicides are selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt) or combinations thereof.

In one embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 80% (w/w) of additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt),

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In one embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said herbicidal composition is in the form of water dispersible granule (WDG) or wettable powder (WP).

In another embodiment, the present invention provides a herbicidal composition comprising combination Penoxsulam and Pyrazosulfuron ethyl, wetting agent, dispersing agent and other agrochemical auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising combination Penoxsulam and Pyrazosulfuron ethyl, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said other agrochemical auxiliaries are selected from defoamers, inert fillers, rheology modifier and buffers.

In another embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam and Pyrazosulfuron ethyl at a weight in the ratio of 1 : 0.5 to 1 : 1 of first active ingredient to the second active ingredient, more preferably in the ratio of 9 : 6, wetting agent, dispersing agent and other agrochemical auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of sodium alkyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20% (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of wetting agent,

1% to 10% (w/w) of dispersing agent,

10 to 30% (w/w) of disintegrating agent,

0.1% to 1% (w/w) of defoamer, and

20% to 70% (w/w) of inert fillers.

In another embodiment, the present invention provides a herbicidal

composition comprising:

1% to 20% (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of sodium alkyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate,

10 to 30% (w/w) of ammonium sulphate,

0.1% to 1% (w/w) of polydimethylsiloxane, and

20% to 70% (w/w) of aluminium silicate.

In another embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam and Bispyribac at a weight in the ratio of 10 : 1 to 1 : 10 of first active ingredient to the second active ingredient, more preferably in the ratio of 1 : 1.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

1% to 10% (w/w) of dialkyl naphthalene sulphonate sodium salt,

1% to 10% (w/w) of sodium salt of methyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20% (w/w) of Penoxsulam as first active ingredient,

1% to 20% (w/w) of Bispyribac sodium,

1% to 10% (w/w) of dialkyl naphthalene sulphonate sodium salt,

1% to 10% (w/w) of sodium salt of methyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate,

1% to 30% (w/w) of ammonium sulphate,

10% to 30% (w/w) of lactose monohydrate, and

20% to 70% (w/w) of aluminium silicate.

In another embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam, Bispyribac sodium and 2,4-Dichlorophenoxy acetic acid derivative.

In another embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam, Bispyribac sodium and 2,4-Dichlorophenoxy acetic acid derivative, wherein said 2,4-Dichlorophenoxy acetic acid derivative is selected from Dichlorophenoxy acetic acid ethyl ester or 2,4-Dichlorophenoxy acetic acid sodium salt.

In another embodiment, the present invention provides a herbicidal composition comprising combination of Penoxsulam, Bispyribac sodium and 2,4-Dichlorophenoxy acetic acid derivative, wetting agents, dispersing agents and other agrochemical auxiliaries, wherein said 2,4-Dichlorophenoxy acetic acid derivative is selected from Dichlorophenoxy acetic acid ethyl ester or 2,4- Dichlorophenoxy acetic acid sodium salt.

In another embodiment, the present invention provides composition comprising combination of Penoxsulam, Bispyribac and 2,4-2,4-Dichlorophenoxy acetic acid derivative at a weight in the ratio 1 : 1 : 25 of first active ingredient to the second active ingredient and third active ingredient.

In another embodiment, the present invention provides a herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

30% to 60% (w/w) of 2,4-Dichlorophenoxy acetic acid derivative,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

In another embodiment, the present invention provides a herbicidal water dispersible granule composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

30% to 60% (w/w) of 2,4-Dichlorophenoxy acetic acid ethyl ester,

1% to 10% (w/w) of tristyrylphenol ethoxylate,

1% to 10% (w/w) of calcium dodecylbenzene sulfonate,

1% to 10% (w/w) of polyalkoxylated butyl ether,

1% to 10% (w/w) of hectorite clay, and

10% to 60% (w/w) of methyl soyate.

In another embodiment, the present invention provides a herbicidal wettable powder composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

30% to 60% (w/w) of 2,4- Dichlorophenoxy acetic acid sodium salt,

1% to 10% (w/w) of alkylnaphthalene sulfonate (ANS) condensate blend,

1% to 10% (w/w) of phenol sulfonic acid-formaldehyde,

1% to 10% (w/w) of sodium polyalkylnaphthalene sulphonate,

1% to 10% (w/w) of silicon dioxide,

0.1% to 1% (w/w) of oxalic acid, and

10% to 60% (w/w) of aluminium silicate.

In another embodiment, the present invention provides a process for preparing herbicidal water dispersible granule composition comprising the steps of:

a. blending all the active ingredients, wetting agent, dispersing agent along with other auxiliaries to a homogenous mixture,

b. milling the blended mixture to obtain particles of size in the range of 10-15 µ,

c. mixing the milled material with water to make a dough, and

d. extruding the material obtained in step (c) and drying the granules.

In another embodiment, the present invention provides a process for preparing herbicidal water dispersible granule composition comprising the steps of:

a. blending Penoxsulam and Pyrazosulfuron ethyl, sodium alkyl naphthalene sulfonate, sodium salt of naphthalene sulfonate condensate, ammonium sulphate, polydimethylsiloxane and aluminium silicate to obtain a homogenous mixture,

b. milling the blended mixture to obtain particles of size in the range of 10-15 µ,

c. mixing the milled material with water to make a dough, and

d. extruding the material obtained in step (c) and drying the granules to obtain water-dispersible granules.

In another embodiment, the present invention provides a process for preparing herbicidal water dispersible granule composition comprising the steps of:

a. blending Penoxsulam and Bispyribac sodium, dialkyl naphthalene sulphonate sodium salt, sodium salt of methyl naphthalene sulfonate, sodium salt of naphthalene sulfonate condensate, ammonium sulphate, lactose monohydrate and aluminium silicate to obtain a homogenous mixture,

b. milling the blended mixture to obtain particles of size in the range of 10-15 µ,

c. mixing the milled material with water to make a dough, and

d. extruding the material obtained in step (c) and drying the granules to obtain water-dispersible granules.

In another embodiment, the present invention provides a process for preparing herbicidal water dispersible granule composition comprising the steps of:

a. blending all the active ingredients, a rheology modifier, dispersing agent and other agrochemical auxiliaries to homogenization at a temperature in the range of 30 to 50 °C,

b. milling the homogenised mixture to obtain particles of size in the range of 15-20 μ,

c. stirring the milled mixture, and cooling to room temperature, and

d. collecting the sample.

In another embodiment, the present invention provides a process for preparing herbicidal water dispersible granule composition comprising the steps of:

a. blending Penoxsulam, Bispyribac sodium, 2,4-Dichlorophenoxy acetic acid derivative, tristyrylphenol ethoxylate, calcium dodecylbenzene sulfonate, polyalkoxylated butyl ether, hectorite clay and methyl soyate to homogenization at a temperature in the range of 30 to 50 °C,

b. milling the homogenised mixture to obtain particles of size in the range of 15-20 μ,

c. stirring the milled mixture, and cooling to room temperature, and

d. collecting the sample.

In another embodiment, the present invention provides a process for preparing herbicidal wettable powder composition comprising the steps of:

a. blending active agents and all agrochemical auxiliaries for 45 mins,

b. milling the mixture to obtain particles of size of D_{90} ~ 10 microns,

c. collecting the sample.

In another embodiment, the present invention provides a process for preparing herbicidal wettable powder composition comprising the steps of:

a. blending Penoxsulam, Bispyribac sodium, 2,4- Dichlorophenoxy acetic acid sodium salt, wetting agent, dispersing agent and other agrochemical auxiliaries for 45 mins,

b. milling the mixture to obtain particles of size of D_{90} ~ 10 microns, and

c. collecting the sample.

DETAILED DESCRIPTION OF THE INVENTION

The term "comprising", which is synonymous with "including", "containing", or "characterized by" here is defined as being inclusive or open-ended, and does not exclude additional, unrecited elements or method steps, unless the context clearly requires otherwise.

The present invention provides WDG composition comprising combination of Penoxsulam and Pyrazosulfuron ethyl in a ratio of 1 : 0.5 to 1 : 1 of first active ingredient to the second active ingredient, more preferably in the ratio of 9 : 6. However, variables of the ratios of each of the active ingredients can be used and the selection of the particular amount is dependent upon many factors including, for example, type of formulations, the crop, disease sought to be controlled and environmental conditions. The selection of the proper quantity of active agent to be applied, however, is within the expertise of one skilled in the art.

The present invention provides WDG composition comprising combination of Bispyribac, Penoxsulam in a ratio of 10 : 1 to 1 : 10 of first active ingredient to the second active ingredient, more preferably in the ratio of 1 : 1. However, variables of the ratios of each of the active ingredients can be used and the selection of the particular amount is dependent upon many factors including, for example, type of formulations, the crop, disease sought to be controlled and environmental conditions. The selection of the proper quantity of active agent to be applied, however, is within the expertise of one skilled in the art.

The present invention provides composition comprising combination of Bispyribac, Penoxsulam and 2,4-Dichlorophenoxy acetic acid derivative in a ratio of 1 : 1 : 25 of first active ingredient to the second active ingredient and third active ingredient. However, variables of the ratios of each of the active ingredients can be used and the selection of the particular amount is dependent upon many factors

including, for example, type of formulations, the crop, disease sought to be controlled and environmental conditions. The selection of the proper quantity of active agent to be applied, however, is within the expertise of one skilled in the art.

The combination compositions of the present invention can be used on a paddy rice, dry-seeded rice crops. This product is also used as a foliar application in labeled crops.

The composition of the present invention could be applied to plants, seeds, fruits, soil as preventive and curative state.

The wetting agent is a compound that facilitates rapid wetting of the powder when added to the water. The wetting agent employed in the formulation composition is selected from the group consisting of non-ionic surfactants, anionic surfactant and a mixture of anionic and non-ionic surfactant and polymeric surfactant.

The wetting agent as used herein is selected from and not limited to polycondensation product of naphthalene sulfonic acid, which is alkyl naphthalene sulphonate sodium salt, dialkyl naphthalene sulphonate sodium salt (Supragil WP), alkylnaphthalene sulfonate (ANS) condensate blend (Morwet EFW), sodium alkyl naphthalene sulfonate (Morwet 3028), polyalkyl naphthalene sulphonate, Aqarius BP14332 Yellow IH, salts of alkylphenol condensates, salts of sulphonated lignins, salts of poly acid resin copolymers, salts of polyphenol formaldehyde resins, salts of polyarylether sulphates such as tristyrylphenolethoxylate sulphate salts, alkoxylated alkylphenols and alcohols as well as block copolymers of ethyleneoxide, linear alcohol derivative (Geropon L wet), tristyrylphenol ethoxylate (Sophrophor BSU), polyethyleneglycol nonylphenyl ether ammonium sulfate (Dispersol PS) and propylene oxide. Preferred wetting agent used in the composition of the present invention is sodium alkyl naphthalene sulfonate (Morwet 3028), linear alcohol derivative (Geropon L wet), tristyrylphenol ethoxylate (Sophrophor BSU), polyethyleneglycol nonylphenyl ether ammonium sulfate (Dispersol PS), dialkyl

naphthalene sulphonate sodium salt (Supragil WP) and alkylnaphthalene sulfonate condensate blend (Morwet EFW).

The wetting agent is present in the composition in a range of about 1 to 10%, more preferably 2 to 8% of the total weight of the composition.

The wetting agent may also be used as a dispersing agent.

The compositions of the present invention contain dispersing agents selected from and not limited to sodium lignosulphonates, Sodium lauryl sulphate, sodium naphthalene sulphonate formaldehyde condensates, Sodium polyalkylnaphthalene sulphonate (Dispersol BB4), sodium polycarboxylate (Geropon T 36), sodium methyl oleoyltaurate (Geropon T 77), phenol sulfonic acid-formaldehyde-polycondensation as sodium salt (Tamol FBPP), sodium salt of methyl naphthalene sulfonate (Supragil MNS 90), phenol sulfonic acid-formaldehyde-polycondensation as sodium salt (Dispersol PSR19), calcium dodecylbenzene sulfonate (Rhodocal 60 BR), polyalkoxylated butyl ether (Ethylan NS 500 LQ), phenol sulfonic acid-formaldehyde (Tamol DN), tristyrylphenol ethoxylate phosphate esters, aliphatic alcohol ethoxylates, alky ethoxylates; EO-PO block copolymers, and graft copolymers, Acrylate copolymer (Agrilan 789), polycarboxylates, alkyl naphthalene sulfonates (such as Morwet IP, Morwet EFW), sodium salt of naphthalene sulfonate condensate (Morwet D-425), phenol sulphonic acid condensates, alkyl sulfonates, alkenyl sylfonates, mixture of alkyl sulfonates and alkenyl sylfonates (Lissapol D), alkyl suflosuccinates (Geropon), L-Wet, methyl oleyltaurates and poly vinyl alcohols.

The dispersing agent is present in the composition in a range of about 1 to 10%, more preferably 2 to 8% of the total weight of the composition.

The disintegrating agents as used in the present invention are selected from and not limited to microcrystalline cellulose, crosslinked PVP, ammonium sulphate, sodium sulphate, sodium citrate, polycarboxylates, sodium phenyl sulphonates, sodium starch glycolate, sodium lignin sulfonate, sodium lauryl sulfate, combinations of carbonates with solid acids, agar, starch, hydroxypropylstarch,

sodium alginate, carboxymethyl starch ether, gum arabic, gum tragacanth, gelatin, casein, crystalline cellulose, carboxymethylcellulose calcium, Tween, Pluronic, sodium laurate, carboxylic resins, potassium chloride, sodium chloride, urea, anionic surfactants, calcium chloride, magnesium chloride, aluminum chloride, glucose, lactose, sodium glutamate, sodium inosinate, dextrin, blend of sulphonates (sodium, calcium, potassium, magnesium or mixture thereof). Preferred disintegrating agent is ammonium sulphate.

The disintegrating agents present in the composition of the present invention are in the range of 10% to 30%, more preferably 10% to 25% of the total weight of the composition.

The defoamer as used herein is selected from and not limited to absorbed polydimethyl siloxane, stearates, silicones (SILFOAM®, SILFAR®, PULPSIL® and WACKER® AK) and ethoxylates. The defoamer is preferably polydimethyl siloxane (Rhodosil EP-6703).

The defoamer is present in the composition in a range of about 0.1 to 1%, more preferably 0.1 to 0.5% of the total weight of the composition.

The inert fillers as used in the present invention are includes but are not limited to natural minerals such as ammonium sulphate, calcite, talc, china clay series, and montmorillonite or attapulgite clays including various forms of Bentonite, Kaolin, lactose, starches, calcium carbonate, calcium sulphate, calcium phosphate, sodium tripoly phosphate (STPP), woodflours, activated carbon, sugars, diatomaceous earth, cereal flours, fine-grain inorganic solids, and the like. Clays and inorganic solids which may be used include calcium bentonite, perlite, mica, vermiculite, silicas, quartz powder, montmorillonite and mixtures thereof. Sugars which may be useful include dextrin and maltodextrin. Cereal flours include wheat flour, oat flour and barley flour and a mixture thereof. Preferred inert filler is china clay. Highly disperse silica or highly disperse absorptive polymers may also be used to improve physical properties.

The inert fillers are present in the composition in a range of about 20 to 70%,

more preferably 20 to 55% of the total weight of the composition.

The compositions of the present invention contain a rheology modifier which is selected from the group consisting of hydrophobic and hydrophilic fumed and precipitated silica particles, gelling clays including bentonite, hectorite, laponite, attapulgite, sepiolite, smectite, hydrophobically/organophilic modified bentonite, hectorite, hydrogenated castor oil (trihydroxystearin) or castor oil organic derivatives.

Preferred rheological modifiers are for example organically modified hectorite clays such as Bentone® 38 and SD3. organically modified bentonite clays, such as Bentone® 34, SD1 and SD2, organically modified sepeolite such as Pangel® B20, hydrophilic silica such as Aerosil® 200, hydrophobic silica such as Aerosil® R972, R974 and R812S, attapulgite such as Attagel® 50, or organic rheological modifiers based on modified castor oil such as Thixcin® R and Thixatrol® ST.

The rheology modifier is present in the composition in a range of about 1 to 10%, more preferably 1 to 6% of the total weight of the composition.

The compositions of the present invention contain buffers which are selected from the group consisting of acids and bases or combinations thereof. The buffers are selected from citric acid, malic acid, oxalic acid, NaOH, sodium citrate, phosphate buffer etc.

The buffers are present in the composition in a range of about 0.01 to 1%, more preferably 0.1 to 0.5% of the total weight of the composition.

The water dispersible granule composition according to the invention can comprise from 0.5 to 20 wt% of adjuvants commonly used in this field and well known to those expert in the art, such as antidrift agents, adhesives, penetrants, stickers and spreaders.

The water dispersible granule compositions of the present invention can be diluted with water or water solutions of agronomic compounds before use to produce a sprayable composition which is used in treating plants or increasing plant growth. Dilution in water usually results in suspensions, emulsions, suspoemulsions or

solutions of the agrochemical active ingredient at a concentration of at least 0.001 g/l.

A particular mode of administering the composition of the present invention is the administration to the aboveground parts of plants, in particular to the leaves thereof (leaf-application). The number of applications and the administered doses are chosen in accordance with the biological and climatic conditions of life of the causative agent. The antifungal compositions though, can also be applied to the soil and get into the plants through the root system (systemic activity), in case the locus of the plants is sprayed with a liquid composition or if the components are added to the soil in a solid formulation e.g. in the form of granulate (soil application).

As examples of the wide variety of culture plants in which the combinations of present invention can be used, there may be named for example cereals, e.g. wheat, barley, rye, oats, rice, sorghum and the like; beets, e.g. sugar beet and fodder beet; pome and stone fruit and berries, e.g. apples, pears, plums, peaches, almonds, cherries, strawberries, raspberries and blackberries; leguminous plants, e.g. beans, lentils, peas, soy beans; oleaginous plants, e.g. rape, mustard, poppy, olive, sunflower, coconut, castor-oil plant, cocoa, ground-nuts; cucurbitaceae, e.g. pumpkins, gherkins, melons, cucumbers, squashes; fibrous plants, e.g. cotton, flax, hemp, jute; citrus fruit, e.g. orange, lemon, grapefruit, mandarin; vegetables, e.g. spinach, lettuce, asparagus, brassicaceae such as cabbages and turnips, carrots, onions, tomatoes, potatoes, hot and sweet peppers; laurel-like plants, e.g. avocado, cinnamon, camphor tree; or plants such as maize, tobacco, nuts, coffee, sugar-cane, tea, vines, hops, bananas, rubber plants, as well as ornamental plants, e.g. flowers, shrubs, deciduous trees and evergreen trees such as conifers. This enumeration of culture plants is given with the purpose of illustrating the invention and not to delimiting it thereto.

When using the active compound combinations according to the invention, the application rate can be varied within a relatively wide range, depending on the kind of application. For the treatment of parts of plants, the active-compound

combination application rates are generally between 0.1 and 10000 g/ha, preferably between 100 and 2500 g/ha. For seed dressing, the active compound combination application rates are generally between 0.001 and 50 g per kilogram of seed, preferably between 0.01 and 20 g per kilogram of seed. For the treatment of the soil, the active-compound combination application rates are generally between 0.1 and 10000 g/ha preferably between 1 and 5000 g/ha.

Although the invention has been described above with reference to the disclosed embodiments, those skilled in the art will readily appreciate that the specific embodiments detailed are only illustrative of the invention. It should be understood that various modifications can be made without departing from the spirit of the invention. Accordingly, the invention is limited only by the claims.

The following examples describes the nature of the invention which are given only for the purpose of illustrating the present invention in more detail and are not limitative and relate to solutions, which have been particularly effective on bench scale.

EXAMPLES

Example 1: Composition of Penoxsulam 9% and Pyrazosulfuron-ethyl 6% WDG:

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1.	Penoxsulam technical (a) 99.1% (b) 9%	9.08
2.	Pyrazosulfuron-ethyl (a) 97.1% (b) 6%	6.18
3.	Sodium alkyl naphthalene sulfonate (Morwet 3028).	3.0
4.	Sodium salt of naphthalene sulfonate condensate (Morwet D-425)	5.0
5.	Ammonium sulphate	25.0
6.	Polydimethylsiloxane (Rhodosil EP-6703)	0.5
8.	Aluminium silicate (China clay)	QS

	Total	**100**

Manufacturing process:

Penoxsulam and Pyrazosulfuron ethyl, sodium alkyl naphthalene sulfonate, sodium salt of naphthalene sulfonate condensate, ammonium sulphate, polyorganosiloxane and china clay were blended to form homogenous mixture. Blended mixture was milled to obtain particles of size in the range of 10-15 µ. Milled material was mixed with water to make dough. Obtained material was extruded and dried the granules to obtain water-dispersible granules.

Example 2: Composition of Bispyribac sodium 5% + Penoxsulam 5% (WDG)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac sodium technical (a) 98% (b)5%	5.10
2	Penoxsulam technical (a) 97.2% (b)5%	5.14
3	Dialkyl naphthalene sulphonate sodium salt (Supragil WP)	2.0
4	Sodium salt of methyl naphthalene sulfonate (Supragil MNS 90)	3.0
5	Sodium salt of naphthalene sulfonate condensate (Morwet D-425)	3.0
6	Ammonium sulphate	10.0
7	Lactose monohydrate	20.0
8	Aluminium silicate (China clay)	QS

Manufacturing process

All the raw materials were weighed and the mixture was mixed in a ribbon blender for 15 minutes. The mixture was passed through air jet milling instrument, Inlet pressure - 4kg/cm^2 and grinding pressure - 6kg/ cm2 for milling the sample. Water

was added to the milled material to make a dough. The dough was extruded through a Basket extruder and dried. The dried granules were collected and packed.

Example 3: Composition of Bispyribac sodium 2.0 % + Penoxsulam 2.0 % + 2,4-DEE 50%(WDG)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac Na @98 % (b) 2.0 %	2.08
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4-DEE @96 (b) 50 %	52.08
4	Hectorite clay (Bentone 38)	2.0
5	Tristyrylphenol ethoxylate (Sophrophor BSU)	5.0
6	Calcium dodecylbenzene sulfonate (Rhodocal 60 BR)	5.0
7	Polyalkoxylated butyl ether (Ethylan NS 500 LQ)	5.0
8	Methyl Soyate	26.82
Total		**100.0**

Manufacturing process

All the raw materials were weighed, dispensed and the mixture was mixed in a homogenizer for 60 to 120 minutes at a temperature of 30 to 50 °C. The mixture was milled to obtain the desired particle size (D90 ~ 20 micro) and stirred for another 4 hours. The oil suspension was cooled and collected.

Example 4: Bispyribac Na 2.0 % + Penoxsulam 2.0 % + 2,4 Na 50 % (WP)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac Na @98 % (b) 2.0 %	2.04
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4-D sodium salt (2,4 D Na @ 95 % (b) 50 %)	52.63

4	Alkylnaphthalene sulfonate (ANS) condensate blend (Morwet EFW)	4.0
5	Phenol sulfonic acid-formaldehyde (Tamol DN)	2.0
6	Sodium polyalkylnaphthalene sulphonate (Dispersol BB4)	2.0
7	Silicon dioxide	1.5
8	Oxalic acid	0.2
9	Aluminium silicate (China clay)	33.61
	Total	**100.0**

Manufacturing process

The composition of the present invention is prepared by a process which comprises: All the raw materials were weighed in the sigma blender and start mixing at 30 rpm for 45 mins. The mixture was milled through jet mill to obtain the desired particle size (D90 ~ 10 micro). Collect the sample and post blend for 45 min. to obtain the final homogeneous formulation product.

Compositions of examples 5-8 were also prepared using the similar method used for the preparation of example 4 composition.

Example 5: Bispyribac Na 2.0 % + Penoxsulam 2.0 % + 2,4 Na 50 % (WP)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac Na @98 % (b) 2.0 %	2.04
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4,D sodium salt (2,4 D Na @ 95 % (b) 50 %)	52.63
4	Sodium alkyl naphthalene sulfonate (Morwet 3028)	4.0
5	Phenol sulfonic acid-formaldehyde-	2.0

	polycondensation as sodium salt (Tamol FBPP)	
6	Acrylate copolymer (Agrilan 789)	2.0
7	Silicon dioxide,	1.5
8	Oxalic acid	0.2
9	Aluminium silicate (China clay)	33.61
Total		**100.0**

Example 6: Bispyribac Na 2.0 % + Penoxsulam 2.0 % + 2,4 Na 50 % (WP)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac Na @98 % (b) 2.0 %	2.04
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4,D sodium salt (2,4 D Na @ 95 % (b) 50 %)	52.63
4	Dialkyl naphthalene sulphonate sodium salt (Supragil WP)	4.0
5	Sodium salt of methyl naphthalene sulfonate (Supragil MNS 90)	2.0
6	Phenol sulfonic acid-formaldehyde-polycondensation as sodium salt (Dispersol PSR19)	2.0
7	Silicon dioxide	1.5
8	Oxalic acid	0.2
9	Aluminium silicate (China clay)	33.61
Total		**100.0**

Example 7: Bispyribac Na 2.0 % + Penoxsulam 2.0 % + 2,4 Na 50 % (WP)

S. No.	Ingredients/Raw Materials	Quantity(% w/w)
1	Bispyribac Na @98 % (b) 2.0 %	2.04
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4,D sodium salt (2,4 D Na @ 95 % (b) 50 %)	52.63

4	Linear alcohol derivative (Geropon L wet)	4.0
5	Sodium polycarboxylate (Geropon T 36)	2.0
6	Sodium methyl oleoyltaurate (Geropon T 77)	2.0
7	Silicon dioxide,	1.5
8	Oxalic acid	0.2
9	Aluminium silicate (China clay)	33.61
Total		**100.0**

Example 8: Bispyribac Na 2.0 % + Penoxsulam 2.0 % + 2,4 Na 50 % (WP)

S. No.	**Ingredients/Raw Materials**	**Quantity(% w/w)**
1	Bispyribac Na @98 % (b) 2.0 %	2.04
2	Penoxsulam @ 99 (b) 2.0 %	2.02
3	2,4,D sodium salt (2,4 D Na @ 95 % (b) 50 %)	52.63
4	Polyethyleneglycol nonylphenyl ether ammonium sulfate (Dispersol PS)	4.0
5	Sodium lignosulphonate	2.0
6	Sodium lauryl sulphate	2.0
7	Silicon dioxide,	1.5
8	Oxalic acid	0.2
9	Aluminium silicate (China clay)	33.61
Total		**100.0**

Field Trials for Pyrazosulfuron + Penoxsulam:

Weeds were reported to reduce rice yields by 12 to 98%, depending on type method of rice establishment. Rice yield losses due to uncontrolled weed growth and weed competition were least (12%) in transplanted rice and highest in aerobic direct-seeded rice. Traditionally, weed control in India has been largely dependent on

manual weeding. However, increased labour scarcity and costs are encouraging farmers to adopt to use herbicides.

The field studies were conducted to compare the weed controlling activity of the combination of Pyrazosulfuron and Penoxsulam. This active ingredients in the combination belongs to different chemical family but have same site of action (inhibition of acetolactate synthase). The combination has the potential of controlling the cross-spectrum weeds (broad leaf weeds, grassy weeds, and sedges) in rice. Both the molecules are safe to transplanted & direct seeded rice when applied in pre-emergence (0-3 days after transplanting) and delayed pre-emergence (up to 8 days after transplanting) application timing.

The weed control activity of the individual herbicides of the invention and their combinations were evaluated on weeds such as *Cyperus difformis*, *Cyperus rotundus*, *Echinochloa colonum*, *Eragrostis Pilosa*, *Monochoria vaginalis* and *Ludwigia parviflora*. Trials were conducted with randomized block design with net plot size of 5m x 6m. Each trial was replicated four times and conducted under GEP guidelines. Spraying was done with manual operated backpack knapsack sprayer with 300 L of water spray volume per hectare at delayed pre-emergence (up to 8 DAT) application timing. Such field trials were carried out at various locations to generate independent data, the locations were chosen randomly across India. The percent insect control and % disease control, the synergism was calculated and it was observed that the percentage of pesticidal control for the combination is greater than the expected percentage.

Table 1: Weed control in *Cyperus rotundus* and *Cyperus difformis*

Active	**Dose (GAH)**	**% Weed Control of *Cyperus rotundus***	**% Weed Control of *Cyperus difformis***
Pyrazosulfuron WP	18	60	70
Penoxsulam SC	27	40	50

Pyrazosulfuron + Penoxsulam (Example No. 1)	18 + 27	95	100

Table 1 demonstrates synergy on weeds using the combination of Pyrazosulfuron and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application.

The results in table 1 clearly demonstrate synergy between Pyrazosulfuron and Penoxsulam against weeds like, *Cyperus rotundus* and *Cyperus difformis*.

Table 2: Weed control in *Echinochloa colonum* and *Eragrostis pilosa*

Active	**Dose (GAH)**	**% Weed Control of *Echinochloa colonum***	**% Weed Control of *Eragrostis pilosa***
Pyrazosulfuron WP	18	20	20
Penoxsulam SC	27	70	60
Pyrazosulfuron + Penoxsulam (Example No. 1)	18 + 27	95	90

Table 2 demonstrates synergy on weeds using the combination of Pyrazosulfuron and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application.

The results in table 2 clearly demonstrates efficacy of Pyrazosulfuron and Penoxsulam against weeds like *Echinochloa colonum* and *Eragrostis Pilosa*.

Table 3: Weed control in *Monochoria vaginalis* and *Ludwigia parviflora*

Table 3 demonstrates synergy on weeds using the combination of Pyrazosulfuron and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application.

Active	**Dose (GAH)**	**% Weed Control of *Monochoria vaginalis***	**% Weed Control of *Ludwigia parviflora***
Pyrazosulfuron WP	18	70	65
Penoxsulam SC	27	40	35
Pyrazosulfuron + Penoxsulam (Example No. 1)	18 + 27	100	100

The results in table 3 clearly demonstrates efficacy of Pyrazosulfuron and Penoxsulam against weeds like, *Monochoria vaginalis* and *Ludwigia parviflora*.

Field Trials Data for Penoxsulam + Bispyribac sodium

The field studies were conducted to compare the weed controlling activity of the combination of Bispyribac sodium and Penoxsulam. The active ingredients, Bispyribac sodium and Penoxsulam belongs to different chemical family but have same site of action (inhibition of acetolactate synthase). The combination has the potential of controlling the cross-spectrum weeds (broad leaf weeds, grassy weeds, and sedges) in rice. Both the molecules are safe to transplanted & direct seeded rice when applied in post-emergence (10 - 15 days after transplanting) application timing.

The weed control activity of the individual herbicides of the invention and their combinations were evaluated on weeds such as *Cyperus difformis*, *Cyperus rotundus*, *Echinochloa colonum*, *Eragrostis Pilosa*, *Monochoria vaginalis* and *Ludwigia parviflora*. Trials were conducted with randomized block design with net plot size of 5m x 6m. Each trial was replicated four times and conducted under GEP

guidelines. Spraying was done with manual operated backpack knapsack sprayer with 300 L of water spray volume per hectare at post-emergence (10 - 15 days after transplanting) application timing. Such field trials were carried out at various locations to generate independent data, the locations were chosen randomly across India.

Visual observations were recorded on percent weed control for individual weeds on whole plot basis at 15 days after application. These observations are to be taken from entire plot.

The herbicide tank mix combinations, application rates, plant species tested, and results are given in the following tables:

Table 4: Table 4 demonstrates synergy on weeds using the combination of Bispyribac sodium and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application. The target weeds were ***Cyperus rotundus*** and ***Cyperus difformis*** and the results are recorded in the tables 4 below.

Active	Dose (GAH)	% Weed Control of *Cyperus rotundus*	% Weed Control of *Cyperus difformis*
Bispyribac sodium SC	30	70	50
Penoxsulam SC	30	60	60
Bispyribac sodium + Penoxsulam (Example No. 2)	30 + 30	95	90

The results in table 4 clearly demonstrates synergy between Bispyribac sodium and Penoxsulam against weeds like, ***Cyperus rotundus*** and ***Cyperus difformis***.

Table 5: Table 5 demonstrates synergy on weeds using the combination of Bispyribac sodium and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of

application. The target weeds were ***Echinochloa colonum*** and ***Eragrostis pilosa*** and the results are recorded in the tables 5 below.

Active	Dose (GAH)	% Weed Control of *Echinochloa colonum*	% Weed Control of *Eragrostis pilosa*
Bispyribac sodium SC	30	70	80
Penoxsulam SC	30	80	75
Bispyribac sodium + Penoxsulam(Example No. 2)	30 + 30	100	100

The results in table 5 clearly demonstrates efficacy of Bispyribac sodium and Penoxsulam against weeds like ***Echinochloa colonum and Eragrostis Pilosa***.

Table 6: Table 6 demonstrates synergy on weeds using the combination of Bispyribac sodium and Penoxsulam. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application. The target weeds were ***Monochoria vaginalis*** and ***Ludwigia parviflora*** and the results are recorded in the tables 6 below.

Active	Dose (GAH)	% Weed Control of *Monochoria vaginalis*	% Weed Control of *Ludwigia parviflora*
Bispyribac sodium SC	30	60	80
Penoxsulam SC	30	70	75
Bispyribac sodium + Penoxsulam (Example No. 2)	30 + 30	95	100

The results in table 6 clearly demonstrates efficacy of Bispyribac sodium and Penoxsulam against weeds like, ***Monochoria vaginalis*** and ***Ludwigia parviflora***.

Field Trials Data for (Bispyribac sodium + Penoxsulam + 2,4-DEE):

The field studies were conducted to compare the weed controlling activity of the combination of Bispyribac sodium + Penoxsulam + 2,4-D EE. This active ingredients, Bispyribac sodium & Penoxsulam in the combination belongs to different chemical family but have same site of action (inhibition of acetolactate synthase) and 2,4-D EE belongs to chemical family Phenoxy-carboxylic-acids with "Synthetic auxin" mode of action. The combination has the potential of controlling the cross-spectrum weeds (broad leaf weeds, grassy weeds, and sedges) in rice. Both the molecules are safe to transplanted & direct seeded rice when applied in post-emergence (15 - 20 days after transplanting) application timing.

Visual observations were recorded on percent weed control for individual weeds on whole plot basis at 15 days after application. These observations are to be taken from entire plot.

The herbicide tank mix combinations, application rates, plant species tested, and results are given in the following tables:

Table 7: Table 7 demonstrates synergy on weeds using the combination of Bispyribac sodium + Penoxsulam + 2,4-D EE. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application. The target weeds were ***Cyperus rotundus*** and ***Cyperus difformis*** and the results are recorded in the tables 7 below.

Active	**Dose (GAH)**	**% Weed Control of *Cyperus rotundus***	**% Weed Control of *Cyperus difformis***
Bispyribac sodium SC	30	70	50
Penoxsulam SC	30	60	60
2,4-D EE EC	750	60	60
Bispyribac sodium + Penoxsulam + 2,4-D EE	30 + 30 +	100	100

(Example 3)	750		

The results in table 7 clearly demonstrates synergy between Bispyribac sodium + Penoxsulam + 2,4-D EE against weeds like, *Cyperus rotundus* and *Cyperus difformis*.

Table 8: Table 8 demonstrates synergy on weeds using the combination of Bispyribac sodium + Penoxsulam + 2,4-D EE. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of application. The target weeds were ***Echinochloa colonum*** and ***Eragrostis pilosa*** and the results are recorded in the tables 8 below.

Active	**Dose (GAH)**	**% Weed Control of *Echinochloa colonum***	**% Weed Control of *Eragrostis pilosa***
Bispyribac sodium SC	30	70	80
Penoxsulam SC	30	80	75
2,4-D EE EC	750	0	0
Bispyribac sodium + Penoxsulam + 2,4-D EE (Example 3)	30 + 30 + 750	100	100

The results in table 8 clearly demonstrates efficacy of Bispyribac sodium + Penoxsulam + 2,4-D EE against weeds like ***Echinochloa colonum and Eragrostis Pilosa***.

Table 9: Table 9 demonstrates synergy on weeds using the combination of Bispyribac sodium + Penoxsulam + 2,4-D EE. The field trials were carried out in India at various locations. The percentage efficacy was calculated after 15 days of

application. The target weeds were ***Monochoria vaginalis*** and ***Ludwigia parviflora*** and the results are recorded in the tables 9 below.

Active	**Dose (GAH)**	**% Weed Control of *Monochoria vaginalis***	**% Weed Control of *Ludwigia parviflora***
Bispyribac sodium SC	30	60	80
Penoxsulam SC	30	70	75
2,4-D EE EC	750	75	70
Bispyribac sodium + Penoxsulam + 2,4-D EE (Example 3)	30 + 30 + 750	100	100

The results in table 9 clearly demonstrates efficacy of Bispyribac sodium + Penoxsulam + 2,4-D EE against weeds like, *Monochoria vaginalis* and *Ludwigia parviflora*.

WE CLAIM:

1. A herbicidal composition comprising combination of Penoxsulam and one or more additional herbicides, wetting agent, dispersing agent and other agrochemical auxiliaries, wherein said additional herbicides are selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt) or combinations thereof.

2. The herbicidal composition as claimed in claim 1, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 80% (w/w) of additional herbicides selected from Pyrazosulfuron or its derivative, Bispyribac, 2,4-Dichlorophenoxy acetic acid derivatives (2,4-DEE and 2,4-D sodium salt),

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

3. The herbicidal composition as claimed in claim 1, wherein said herbicidal composition is in the form of water dispersible granule (WDG) or wettable powder (WP).

4. The herbicidal composition as claimed in claim 1, wherein said other agrochemical auxiliaries are selected from defoamers, inert fillers, rheology modifier and buffers.

5. The herbicidal composition as claimed in claims 2 and 3, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

6. The herbicidal composition as claimed in claim 5, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Pyrazosulfuron ethyl,

1% to 10% (w/w) of sodium alkyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate, and

0.1% to 70% (w/w) of other additives / auxiliaries.

7. The herbicidal composition as claimed in claims 2 and 3, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

8. The herbicidal composition as claimed in claim 7, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

1% to 10% (w/w) of dialkyl naphthalene sulphonate sodium salt,

1% to 10% (w/w) of sodium salt of methyl naphthalene sulfonate,

1% to 10% (w/w) of sodium salt of naphthalene sulfonate condensate, and

0.1% to 70% (w/w) of other additives / auxiliaries.

9. The herbicidal composition as claimed in claims 2-4, wherein said herbicidal composition comprising:

1% to 20 % (w/w) of Penoxsulam,

1% to 20% (w/w) of Bispyribac sodium,

30% to 60% (w/w) of 2,4-Dichlorophenoxy acetic acid derivative,

1% to 10% (w/w) of wetting agents,

1% to 10% (w/w) of dispersing agents, and

0.1% to 70% (w/w) of other additives / auxiliaries.

10. A process for the preparation of herbicidal water dispersible granule composition as claimed in claims 2 and 3, wherein said process comprising the steps of:

a. blending all the active ingredients, wetting agent, dispersing agent along with other auxiliaries to a homogenous mixture,

b. milling the blended mixture to obtain particles of size in the range of 10-15 µ,

c. mixing the milled material with water to make a dough, and

d. extruding the material obtained in step (c) and drying the granules.

11. A process for the preparation of herbicidal water dispersible granule composition as claimed in claims 2 and 3, wherein said process comprising the steps of:

a. blending all the active ingredients, a rheology modifier, dispersing agent and other agrochemical auxiliaries to homogenization at a temperature in the range of 30 to 50 °C,

b. milling the homogenised mixture to obtain particles of size in the range of 15-20 µ,

c. stirring the milled mixture, and cooling to room temperature, and

d. collecting the sample.

12. A process for the preparation of herbicidal wettable powder composition as claimed in claims 2 and 3, wherein said process comprising the steps of:

a. blending active agents and all agrochemical auxiliaries for 45 mins,

b. milling the mixture to obtain particles of size of D_{90} ~ 10 microns,

c. collecting the sample.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2021/056688

A. CLASSIFICATION OF SUBJECT MATTER
A01N43/00,A01N47/00,A01P13/00 Version=2021.01

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)

A01N, A01P

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)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN101310599A (BEIJING YOLOO PESTICIDE CO LTD [CN]) 26 NOVEMBER 2008 (26/11/2008) abstract; examples 1-5; claims 1-9	1-6, 10-12
Y	abstract; examples 1-5; claims 1-9	7-9
X	CN102165956A (GUANGDONG ZHONGXUN AGRICULTURAL TECHNOLOGY CO LTD [CN]) 31 AUGUST 2011 (31/08/2011) abstract; claims 1-4	1, 7-12
Y	abstract; claims 1-4	2-6
Y	CN103210933A (GUANGDONG ZHONGXUN AGRICULTURAL TECHNOLOGY CO LTD [CN]) 24 JULY 2013 (24/07/2013) abstract; claims 1-4	1-12
Y	CN109221192A (ANHUI SENFON BIOCHEMICAL CO LTD) 18 JANUARY 2019 (18/01/2019) abstract; claims 1-9	1-12

☐ Further documents are listed in the continuation of Box C. ☐ 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
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Date of the actual completion of the international search	Date of mailing of the international search report
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