

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:	PCT/IB2018/058897
International filing date:	13 November 2018 (13.11.2018)
Document type:	Certified copy of priority document
Document details:	Country/Office: IN
	Number: 201731041263
	Filing date: 17 November 2017 (17.11.2017)
Date of receipt at the International Bureau:	06 December 2018 (06.12.2018)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-bis)

IB18/58897



INTELLECTUAL
PROPERTY INDIA

पेटेंट/डिजाइन/व्यापार
चिह्न/भौगोलिक उपदर्शन



सत्यमेव जयते

भारत सरकार

GOVERNMENT OF INDIA

वाणिज्य एवं उद्योग मंत्रालय

MINISTRY OF COMMERCE & INDUSTRY

पेटेंट कार्यालय

THE PATENT OFFICE

जिस किसी से संबन्धित हो

TO WHOMSOEVER IT MAY CONCERN

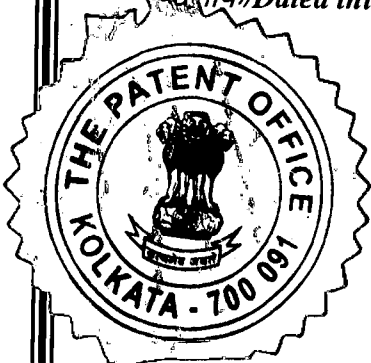
मैं, अधोहस्ताक्षरी जो पेटेंट अधिनियम, 1970 की धारा 73(3) के तहत महानियंत्रक एकस्व, अभिकल्प एवं व्यापार चिह्न की ओर से प्रमाणपत्र हस्ताक्षर व जारी करने के लिए प्राधिकृत अधिकारी हूँ, एतद्वारा यह प्रमाणित करता(ती) हूँ कि निम्नलिखित पेटेंट आवेदन के संबंध में फाइल दस्तावेज़(जों) की सही प्रतिलिपि इसके साथ संलग्न है:

I, the undersigned, being an officer duly authorized to sign and issue the certificate on behalf of the Controller General of Patents, Designs and Trademarks in accordance with the provisions of Section 73(3) of the Patents Act, 1970, hereby certify that annexed hereto is a True Copy of the document(s) as filed in connection with the following Patent Application:

- क) आवेदन संख्या/a) Application Number: **201731041263.**
ख) फाइल करने की तारीख/ b) Date of Filing **17th November, 2017**
ग) अनुरोधित दस्तावेज़(जों) का नाम:
C) Name of the document(s) requested: **Provisional Specification with Form 2 and Form 1.**

यह प्रमाणपत्र पेटेंट अधिनियम, 1970 की धारा 147(1) के अधीन मुझमें निहित शक्तियों के तहत जारी किया गया है। This certificate is issued under the powers vested in me U/S 147(1) of The Patents Act, 1970.

दिनांक/Dated this.....26th day of ...November...2018



Sharmishta Ghosh

नियंत्रक पेटेंट व डिजाइन/ Controller of Patents and Designs
(प्राधिकृत हस्ताक्षरी/ Authorised Signatory)

FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

&

The Patents Rules, 2003

PROVISIONAL SPECIFICATION

(See section 10; rule 13)

5

10

**1. Title of the invention - NOVEL COMBINATIONS OF
DEFOLIANTS**

15

2. Applicant(s)

20

(a) NAME : **UPL LTD**

(b) NATIONALITY : **An Indian Company**

25

(c) ADDRESS : **Agrochemical Plant, Durgachak Haldia – 721
602, Midnapore Dist. West Bengal, India**

30

3. PREAMBLE TO THE DESCRIPTION

35 The following specification describes the invention

FIELD OF THE INVENTION:

- 5 The present invention relates to combination of defoliant. More specifically, the present invention relates to synergistic combination of defoliant for the purpose of eliminating weeds and/or acting as a defoliant and/or a herbicide.

BACKGROUND OF THE INVENTION:

- 10 The presence of excessive foliage and weeds at the end of the crops cycle can be a major hindrance during harvesting. Excessive foliage can also mean using more herbicide to clear the way for the next crop. The removal of foliage and some weeds from commercially important crops such as cotton, soybean, legumes, potato etc. is essential for a good harvest. In certain crops, defoliation and no presence of weeds are important
- 15 specially if hand harvested, since it makes it easier to, for example harvest the fruit, or pick bolls of cotton.

- Defoliation is also important for mechanical pickers or harvesters, since the defoliated plants are free from leaves and weeds which could clog spindles of mechanical pickers
- 20 or add to the trash generated, which must be separated from the desired plant portion being harvested. In addition, defoliation gives a better view to the operator of the mechanical picker allowing better maneuverability to position the picker more easily.

- Defoliation also prevents the spread of disease in crops such as beans, where the fungal
- 25 disease on the foliar part could spread to the beans, thereby decreasing the quality and quantity of harvested produce. Many fungal diseases such as Rust, Bacterial blight, Bean common mosaic virus, Bronzing and sunscald, Alternaria leaf spot, Angular leaf spot, Anthracnose etc. may be controlled in this manner.

The ideal time to apply a defoliant is when a plant reaches maturity. The main objective is to strip the plant of its leaves, but leave the fruits intact. It is also important that application of the defoliant prevent regrowth of the foliage. Defoliants are generally applied to crop plants when crop is about to reach the harvesting stage.

5

A good defoliant is one that causes minimal damage to the fruit whilst stripping the foliage away from the plant. A number of compounds, are known to be defoliants, such as pentachlorophenol, sodium chlorate, magnesium chlorate, magnesium chlorate hexahydrate, calcium cyanamide, sodium 3, 6-endoxohexahydrophthalate, etc.

10

Magnesium chlorate is a potent defoliant. It is currently sold as magnesium chlorate hexahydrate and as magnesium chloride-sodium chlorate, which are mixed together in aqueous solution, to form magnesium chlorate hexahydrate.

15 Very few combinations of Magnesium chlorate are known in the art. **CN106259438A** (Zhang Xudong) teaches combinations of magnesium chlorate and thidiazuron. However, this combination only teaches use on cotton with limited success and high dosage.

20 There is therefore a need in the art for combinations that have advantageous properties such as a defoliant combination that is synergistic, helps in defoliation, shows minimal to zero damage to the fruit, improves yield, reduces dosage of defoliant, thus causing minimal damage to the environment.

25 Embodiments of the present invention may therefore ameliorate one or more of the above mentioned problems:

Objects of the invention:

Therefore, one object of the present invention is to provide a synergistic defoliant and/or
30 herbicidal combination.

Another object of the present invention is to provide a synergistic combination of defoliants that improve yield of the crop.

- 5 Another object of the present invention is to provide a method of improving yield of a crop by application of a synergistic combination of a defoliant combination.

Another object of the present invention is to provide a method of controlling weeds at a locus by application of a synergistic herbicidal/defoliant combination.

10

Another object of the present invention is to provide a composition comprising a synergistic herbicidal/defoliant combination.

15

Some or all these and other objects of the invention can be achieved by way of the invention described hereinafter.

Summary of the invention:

20

A combination comprising a metal chlorate and an herbicide.

A method of controlling weeds at a locus, the method comprising applying a combination comprising a metal chlorate and at least one herbicide to the locus.

25

A composition comprising a metal chlorate, at least an herbicide and at least one agrochemically acceptable excipient.

A method of defoliating plants at a locus, said method comprising applying to the locus a combination comprising a metal chlorate and at least one herbicide.

A method of defoliating plants at a locus, said method comprising applying to the locus a composition comprising a metal chlorate, at least one herbicide and at least one agrochemically acceptable excipient.

5 **Detailed Description of the invention:**

Surprisingly, it has been found by the present inventors that the combination of specific herbicides, with a metal chlorate results in a synergistic defoliation at the locus of the desirable crop plants.

10 The term herbicide, as used herein, shall mean an active ingredient that kills, controls or otherwise adversely modifies the growth of undesirable plants. As used herein, a herbicidally effective or vegetation controlling amount is an amount of active ingredient that causes a "herbicidal effect," i.e., an adversely modifying effect and includes deviations from natural development, killing, regulation, desiccation, retardation. The
15 terms "plants" and "vegetation" include, but are not limited to, germinant seeds, emerging seedlings, plants emerging from vegetative propagules, and established vegetation. The term "locus" as used herein shall denote the vicinity of a desired crop in which weed control, typically selective weed control is desired. The locus includes the vicinity of desired crop plants wherein the weed infestation has either emerged or is yet
20 to emerge. The term crop shall include a multitude of desired crop plants or an individual crop plant growing at a locus. The term defoliant shall mean a compound that when applied at the locus of a plant cause only the leaves of a plant to abscise, or fall off.

25 Thus an aspect of the present invention may provide synergistic combination comprising a metal chlorate and at least one co-herbicide.

In an embodiment, the metal chlorate defoliant may be selected from the group consisting of sodium chlorate, magnesium chlorate, calcium chlorate, calcium-magnesium chlorate and potassium chlorate.

30

In an embodiment, the metal chlorate defoliant is magnesium chlorate.

In an embodiment the co-herbicide may be selected from, but not limited to, herbicides selected from those belonging to glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides, acetyl CoA carboxylase inhibitor herbicides and mixtures thereof.

10 In an embodiment, the glutamine synthetase inhibitor herbicides are glyphosate and its salts and esters and the like.

In an embodiment, the EPSP synthase inhibitor herbicides are glufosinate and its salts and esters, bialaphos and the like.

15 In an embodiment, the protoporphyrinogen oxidase-inhibiting herbicides are selected from
acifluorfen, aclonifen, bifenox, chlomethoxyfen, chlornitrofen, ethoxyfen, fluorodifen, fluoroglycofen, fluoronitrofen, fomesafen, furyloxyfen, halosafen, lactofen, nitrofen, nitrofluorfen, oxyfluorfen, cinidon, flumiclorac, flumioxazin, profluzol, pyrazogyl,
20 oxadiargyl, oxadiazon, pentoxazone, fluazolate, benzfendizone, butafenacil, fluthiacetmethyl, thidiazimin, azafenidin, carfentrazone, sulfentrazone, flufenpyr, pyraflufen-ethyl, saflufenacil, and agrochemically acceptable salts and esters thereof.

25 In an embodiment, photosystem-II inhibitor herbicides may be selected from but not limited to Desmedipham, Phenmedipham, Pyrazon, Ametryn, Atrazine, Prometon, Prometryn, Propazine, Simazine, Hexazinone, Metribuzin, Bromacil, Terbacil, Propanil, Fluometuron, Linuron, Tebuthiuron, Bentazon, Bromoxynil, Pyridate and agrochemically acceptable salts and esters thereof.

In an embodiment, acetyl CoA carboxylase inhibitor herbicides may be selected from Cyhalofop, Diclofop, Fenoxaprop, Fluazifop-P-butyl, Quizalofop, Haloxifop, Clethodim, Sethoxydim, Tralkoxydim, Pinoxaden and agrochemically acceptable salts and esters thereof.

5

In an embodiment, the preferred co-herbicides of the present invention may be selected from glyphosate, glufosinate, carfentrazone, flumioxazine, acifluorfen, bentazone, and haloxifop.

10 In an embodiment, the present invention may provide synergistic combination comprising a metal chlorate and at least one co-herbicide selected from herbicides which belong to glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides, acetyl CoA carboxylase inhibitor herbicides and mixtures thereof.

15

The synergistic combination may be applied to the locus of the plant being defoliated in an agrochemically effective amount. The selection of the appropriate effective amounts depends on the density of foliage, weather patterns, crop health and many other factors, which may be made conveniently by a person skilled in the art. The effective amounts of
20 these defoliant in the synergistic combination of the present invention is not particularly limiting.

Synergistic compositions in accordance with the present invention may further comprise a third active ingredient, such as herbicides, pesticides, fungicide, growth regulators, boll
25 openers fertilizers, other desiccants, and the like.

The target crops on which the synergistic combination of the present invention may be applied may be selected from but not limited to cotton, soybean, Swiss chard, sugar beet, carrot, kidney bean, peas, eggplant, potato, flax, sweet potato, morning glory, broad
30 bean, tobacco, tomato, peanut, rape, Chinese cabbage, turnip, cabbage rapeseed,

cucumber, pumpkin, sunflower, rice, corn, wheat, barley, oats, rye, sorghum, millet, sugar cane, pineapple, asparagus, green onion, leek, alfalfa, fruit trees, vines.

An aspect of the present invention may provide synergistic compositions comprising a
5 metal chlorate and at least one co-herbicide.

In an embodiment the co-herbicide may be selected from but not limited to herbicides selected from herbicides which belong to glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides,
10 photosystem-II inhibitor herbicides, acetyl CoA carboxylase inhibitor herbicides and mixtures thereof.

In an embodiment, the glutamine synthetase inhibitor herbicides are glyphosate and its salts and esters and the like.

- 15

In an embodiment, the EPSP synthase inhibitor herbicides are glufosinate and its salts and esters, bialaphos and the like.

In an embodiment, the protoporphyrinogen oxidase-inhibiting herbicides are selected
20 from

acifluorfen, aclonifen, bifenox, chlomethoxyfen, chlornitrofen, ethoxyfen, fluorodifen, fluoroglycofen, fluoronitrofen, fomesafen, furyloxyfen, halosafen, lactofen, nitrofen, nitrofluorfen, oxyfluorfen, cinidon, flumiclorac, flumioxazin, proflumazone, pyrazogyl, oxadiargyl, oxadiazon, pentoxazone, flumazone, benzofenazone, butafenacil, fluthiacet-
25 methyl, thidiazimin, azafenidin, carfentrazone, sulfentrazone, flufenpyr, pyraflufen-ethyl, saflufenacil, and agrochemically acceptable salts and esters thereof.

In an embodiment, photosystem-II inhibitor herbicides may be selected from but not limited to Desmedipham, Phenmedipham, Pyrazon, Ametryn, Atrazine, Prometon,
30 Prometryn, Propazine, Simazine, Hexazinone, Metribuzin, Bromacil, Terbacil, Propanil,

Fluometuron, Linuron, Tebuthiuron, Bentazon, Bromoxynil, Pyridate and agrochemically acceptable salts and esters thereof.

In an embodiment, acetyl CoA carboxylase inhibitor herbicides may be selected from
5 Cyhalofop, Diclofop, Fenoxaprop, Fluazifop-P-butyl, Quizalofop, Haloxyfop, Clethodim, Sethoxydim, Tralkoxydim, Pinoxaden and agrochemically acceptable salts and esters thereof.

In an embodiment, the preferred co-herbicides of the present invention may be selected
10 from glyphosate, glufosinate, carfentrazone, flumioxazine, acifluorfen, bentazone, and haloxyfop.

In an embodiment, the present invention may provide synergistic compositions comprising a metal chlorate, at least one co-herbicide and an adjuvant thereof.

15

In an embodiment, the present invention provides a combination comprising:

- (a) a metal chlorate defoliant selected from the group consisting of sodium chlorate, magnesium chlorate, calcium chlorate, calcium-magnesium chlorate and potassium chlorate; and
- 20 (b) a herbicide selected from glyphosate, glufosinate, carfentrazone, flumioxazine, acifluorfen, bentazone, and haloxyfop.

In an embodiment, the present invention provides a combination comprising sodium chlorate and glyphosate.

25

In an embodiment, the present invention provides a combination comprising sodium chlorate and glufosinate.

In an embodiment, the present invention provides a combination comprising sodium
30 chlorate and flumioxazine.

In an embodiment, the present invention provides a combination comprising sodium chlorate and acifluorfen.

- 5 In an embodiment, the present invention provides a combination comprising sodium chlorate and bentazone.

In an embodiment, the present invention provides a combination comprising sodium chlorate and haloxyfop.

10

In an embodiment, the present invention provides a combination comprising magnesium chlorate and glyphosate.

15

In an embodiment, the present invention provides a combination comprising magnesium chlorate and glufosinate.

In an embodiment, the present invention provides a combination comprising magnesium chlorate and flumioxazine.

20

In an embodiment, the present invention provides a combination comprising magnesium chlorate and acifluorfen.

In an embodiment, the present invention provides a combination comprising magnesium chlorate and bentazone.

25

In an embodiment, the present invention provides a combination comprising magnesium chlorate and haloxyfop.

30

In an embodiment, the present invention provides a combination comprising calcium chlorate and glyphosate.

In an embodiment, the present invention provides a combination comprising calcium chlorate and glufosinate.

- 5 In an embodiment, the present invention provides a combination comprising calcium chlorate and flumioxazine.

In an embodiment, the present invention provides a combination comprising calcium chlorate and acifluorfen.

10

In an embodiment, the present invention provides a combination comprising calcium chlorate and bentazone.

In an embodiment, the present invention provides a combination comprising calcium chlorate and haloxyfop.

15

In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and glyphosate.

- 20 In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and glufosinate.

In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and flumioxazine.

25

In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and acifluorfen.

In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and bentazone.

30

In an embodiment, the present invention provides a combination comprising calcium-magnesium chlorate and haloxyfop.

- 5 In an embodiment, the present invention provides a combination comprising potassium chlorate and glyphosate.

In an embodiment, the present invention provides a combination comprising potassium chlorate and glufosinate.

10

In an embodiment, the present invention provides a combination comprising potassium chlorate and flumioxazine.

15

In an embodiment, the present invention provides a combination comprising potassium chlorate and acifluorfen.

In an embodiment, the present invention provides a combination comprising potassium chlorate and bentazone.

20

In an embodiment, the present invention provides a combination comprising potassium chlorate and haloxyfop.

In an embodiment, the present invention provides a combination comprising magnesium chlorate, bentazone and haloxyfop.

25

In an embodiment, the present invention provides a combination comprising magnesium chlorate, flumioxazin and haloxyfop.

30

In an embodiment, the present invention provides a combination comprising magnesium chlorate and carfentrazone.

In an embodiment, the present invention provides a combination comprising magnesium chlorate, carfentrazone and haloxyfop.

- 5 In an embodiment, the present invention provides a combination comprising magnesium chlorate, acifluorfen and haloxyfop.

In an embodiment, the present invention provides a combination comprising magnesium chlorate and diquat.

10

In an embodiment, the composition of the present invention may contain agriculturally acceptable adjuvants, carriers, diluents, emulsifiers, fillers, anti-foaming agents, thickening agents, anti-freezing agents, freezing agents etc. The compositions may be either solid or liquids. They can be solids, such as, for example, dusts, granules, water-dispersible granules, microcapsules or wettable powders, or liquids, such as, for example, emulsifiable concentrates, solutions, emulsions or suspensions, ZC formulations. They can also be provided as a pre-mix or tank mixes.

15

20

Suitable agricultural adjuvants and carriers may include, but are not limited to, crop oil concentrates; methylated seed oils, emulsified methylated seed oil, nonylphenol ethoxylate; benzylcocoalkyldimethyl quaternary ammonium salt; blend of petroleum hydrocarbon, alkyl esters, organic acid, and anionic surfactant; C9-C11 alkylpolyglycoside; phosphated alcohol ethoxylate; natural primary alcohol (C12-C16) ethoxylate; di-sec-butylphenol EO-PO block copolymer; polysiloxane-methyl cap; nonylphenol ethoxylate, urea ammonium nitrate; tridecyl alcohol (synthetic) ethoxylate (8EO); tallow amine ethoxylate ; PEG(400) dioleate-99, alkyl sulfates, such as diethanolammonium lauryl sulfate; alkylarylsulfonate salts, such as calcium dodecylbenzenesulfonate; alkylphenol-alkylene oxide addition products, such as nonylphenol-C18 ethoxylate; alcohol-alkylene oxide addition products, such as tridecyl alcohol-C16 ethoxylate; soaps, such as sodium stearate; alkyl-naphthalene-sulfonate

25

30

salts, such as sodium dibutyl naphthalenesulfonate; dialkyl esters of sulfosuccinate salts, such as sodium di(2-ethylhexyl)sulfosuccinate; sorbitol esters, such as sorbitol oleate; quaternary amines, such as lauryl trimethylammonium chloride; polyethylene glycol esters of fatty acids, such as polyethylene glycol stearate; block copolymers of ethylene oxide and propylene oxide; salts of mono and dialkyl phosphate esters; vegetable or seed oils such as soybean oil, rapeseed/canola oil, olive oil, castor oil, sunflower seed oil, coconut oil, corn oil, cottonseed oil, linseed oil, palm oil, peanut oil, safflower oil, sesame oil, tung oil and the like; and esters of the above vegetable oils, and in certain embodiments, methyl esters.

10

Suitable liquid carriers that may be employed in a composition of the present invention may include water or organic solvents. The organic solvents include, but are not limited to, petroleum fractions or hydrocarbons such as mineral oil, aromatic solvents, paraffinic oils, and the like; vegetable oils such as soybean oil, rapeseed oil, olive oil, castor oil, sunflower seed oil, coconut oil, corn oil, cottonseed oil, linseed oil, palm oil, peanut oil, safflower oil, sesame oil, tung oil and the like; esters of the above vegetable oils; esters of monoalcohols or dihydric, trihydric, or other lower polyalcohols (4-6 hydroxy containing), such as 2-ethyl hexyl stearate, n-butyl oleate, isopropyl myristate, propylene glycol dioleate, di-octyl succinate, di-butyl adipate, di-octyl phthalate and the like; esters of mono, di and polycarboxylic acids and the like. Organic solvents include, but are not limited to toluene, xylene, petroleum naphtha, crop oil, acetone, methyl ethyl ketone, cyclohexanone, trichloroethylene, perchloroethylene, ethyl acetate, amyl acetate, butyl acetate, propylene glycol monomethyl ether and diethylene glycol monomethyl ether, methyl alcohol, ethyl alcohol, isopropyl alcohol, amyl alcohol, ethylene glycol, propylene glycol, glycerine, N-methyl-2-pyrrolidinone, N,N-dimethyl alkylamides, dimethyl sulfoxide.

25

Solid carriers that may be employed in the compositions of the present invention may include but are not limited to attapulgit, pyrophyllite clay, silica, kaolin clay, kieselguhr, chalk, diatomaceous earth, lime, calcium carbonate, bentonite clay, Fuller's earth, talc,

30

cottonseed hulls, wheat flour, soybean flour, pumice, wood flour, walnut shell flour, lignin, cellulose etc.

5 Generally the metal chlorate and the co-herbicide may be applied at levels sufficient to defoliate or inhibit regrowth of the plants. In one embodiment the weight ratio of the amount of the metal chlorate applied to the plants to the amount of co-herbicide applied to the plants is from about 1:200 to about 200:1. In one embodiment the weight ratio is from about 1:80 to about 80:1, preferably from about 1 to about 50:0.05 to about 50. In another embodiment the weight ratio is from about 1 to about 10:0.05 to about 10, 10 preferably from about 1 to about 5:0.05 to about 5.

In an embodiment the application rate of the metal chlorate is from about 0.03 to about 0.5, preferably from about 0.06 to about 0.25, lb/acre. The application rate of the co-herbicide is from about 0.005 to about 10 lb/acre, from about 0.005 to about 5 lb/acre, 15 from about 0.01 to about 5 lb/acre, or from about 0.01 to about 1 lb/acre.

The time of application of the synergistic defoliant composition of the present invention may vary to some extent with the weather conditions and the growing conditions of crops, but is generally the time when the vegetative growth of crop plants to be treated 20 ends and the maturation stage is about to begin. This time may vary from crop to crop.

In an aspect, the present invention may provide a synergistic combination of defoliants comprising:

- 25 (a) magnesium chlorate;
- (b) a co-herbicide selected from at least one herbicide selected from glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides; and
- (c) at least one acetyl CoA carboxylase inhibitor herbicide.

30

Thus, in an embodiment the present invention may provide synergistic combinations of defoliant comprising:

(a) magnesium chlorate;

(b) a co-herbicide selected from at least one herbicide selected from glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides; and

(c) haloxyfop.

10 In an embodiment, the constituent defoliant of the combination of the present invention may be admixed in ratio of (1-80): (1-80): (1-80) of magnesium chlorate, co-herbicide and acetyl CoA carboxylase inhibitor herbicide respectively.

In an aspect, the present invention may provide a method of defoliating plants close to harvest comprising applying to the locus of the plant synergistic combination comprising a metal chlorate and at least one co-herbicide.

In an aspect the present invention may provide a method of defoliating plants close to harvest comprising applying to the locus of the plants synergistic combinations comprising magnesium chlorate and a co-herbicide selected from glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides, acetyl CoA carboxylase inhibitor herbicides and mixtures thereof.

25 The present synergistic defoliant composition of the present invention exerts an excellent herbicidal effect on weeds at the pre- plant burndown stage. Therefore, for effective exertion of the herbicidal activity, the composition is applied to plots to be planted with useful plants before planting or post-harvest land, fallow fields, ridges, farm roads, water channels, developed pasture land, cemeteries, parks, roads, playgrounds, clear spaces surrounding buildings, reclaimed land, sides of railway tracks, forests, etc. In this case,

treatment before the early post-emergence stage of weeds is the most economically effective, but the time of treatment is not limited thereto, and it is also possible to control weeds at the growing stage.

5 Thus, in an aspect, the present invention may provide a method of controlling weeds and plants in pre plant burndown, said method comprising applying to the locus of the weeds and plants, a synergistic combination comprising a metal chlorate and a co-herbicide selected from glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides, acetyl CoA carboxylase inhibitor herbicides and mixtures thereof.

The method of control of the present invention may be carried out by spraying the suggested tank mixes, or the individual herbicides may be formulated as a kit-of-parts containing various components that may be mixed as instructed prior to spraying.

15

Thus, an embodiment the present invention may provide a kit of parts comprising a metal chlorate and a co-herbicide in a co-pack that can then be tank mixed before application.

Surprisingly, it has been found by the present inventors that the metal chlorate and co-herbicides when applied individually, was ineffective in the defoliation, but demonstrated excellent synergistic control when applied together. The combination of a metal chlorate and a co-herbicide synergistically provided effective defoliation at particular locus, without loss of yield. The current invention therefore provides advantageous methods of defoliation. The present method also provides a broader spectrum for defoliant, thus providing a broader spectrum of control at lower use rates.

25

EXAMPLES:

SYNERGY STUDIES

Studies were conducted to compare the defoliation activity of the combination of magnesium chlorate, with herbicides selected from classes of glutamine synthetase inhibitor herbicides, EPSP synthase inhibitor herbicides, protoporphyrinogen oxidase-inhibiting herbicides, photosystem-II inhibitor herbicides; and acetyl CoA carboxylase inhibitor herbicide and compare its observed efficacy with the "expected" efficacy when magnesium chlorate and co-herbicide were applied separately. Any difference between the observed and "expected" efficacy could be attributed to synergy between the two compounds in the defoliation of plants. The expected efficacy of a combination of magnesium chlorate and co-herbicide was calculated using the well-established Colby method.

In the Colby method, the expected (or predicted) response of a combination of herbicides is calculated by taking the product of the observed response for each individual component of the combination when applied alone divided by 100 and subtracting this value from the sum of the observed response for each component when applied alone. An unexpected enhancement in efficacy of the combination is then determined by comparing the observed response of the combination to the expected (or predicted) response as calculated from the observed response of each individual component alone. If the observed response of the combination is greater than the expected (or predicted) response, or stated conversely, if the difference between the observed and expected response is greater than zero, then the combination is said to be synergistic or unexpectedly effective. (Colby, S. R., Weeds, 1967(15), p. 20-22) The Colby method requires only a single dose of each herbicide applied alone and the mixture of both doses. The formula used to calculate the expected efficacy (EE) which was compared with the observed efficacy (OE) to determine the efficacy of the present invention is explained hereinbelow:

$$EE = (B \text{ efficacy} + A \text{ efficacy} - (B \text{ efficacy} \times A \text{ efficacy}) / 100)$$

The present inventors have adopted the Colby method to calculate synergy of the combination of defoliant. The % defoliation of individual defoliant was calculated and compared to the expected and observed defoliation efficacy.

The defoliation activity of the individual defoliant of the invention and their combinations were evaluated on multiple crops including wheat, soybean and cotton. The trial was carried out in Randomized Complete Block (RCB) method, all field trials were conducted using this method. Each trial were replicated four times and conducted under 5
GEP guidelines. Application volumes were varied for each mixture. Such field trials were carried out at various locations so as to generate independent data, the locations were chosen randomly across Brazil.

Examples 1: Magnesium Chlorate and Glufosinate:

10 Field trials were carried out to test the synergy of the combination magnesium chlorate and glufosinate-ammonium which is a ESPS inhibitor herbicide. The field trials were carried out at various locations in Brazil during spring. The percentage efficacy was calculated after 60 days of applications. The target crop for defoliation was wheat *and the results are recorded in the table below:*

15 **Table 1:**

Dose		Defoliation in <i>Triticum aesti</i> at 3 DAA	
Treatment	Dosage (mL/Ha)	Expected	Actual
Untreated check	-	-	0.00
Magnesium chlorate	3000	-	68
Glufosinate ammonium	1500	-	78
Magnesium chlorate + Glufosinate ammonium	3000 + 1500	92.96	94
Observed – Expected defoliation efficacy		1.04	

While the foregoing written description of the invention enables one of ordinary skill to make and use what is considered presently to be the best mode thereof, those of ordinary skill will understand and appreciate the existence of variations, combinations, and equivalents of the specific embodiment, method, and examples herein. The invention
5 should therefore not be limited by the above described embodiment, method, and examples, but by all embodiments and methods within the scope and spirit of the invention.

Dated this the 17th day of November 2017

10



Dr. Sanchita Ganguli
Of S. MAJUMDAR & CO.
Applicant's Agent

FORM 1 THE PATENTS ACT, 1970 (39 of 1970) and The Patents Rules, 2003 APPLICATION FOR GRANT OF PATENT [See section 7, 54 & 135 and sub-rule (1) of rule 20]				(FOR OFFICE USE ONLY)	
		Application No :			
		Filing Date :			
		Amount of Fee Paid :			
		CBR No :			
		Signature :			
1. APPLICANT'S REFERENCE / IDENTIFICATION NO. (AS ALLOTTED BY OFFICE)					
2. TYPE OF APPLICATION [Please tick (✓) at the appropriate category]					
Ordinary (✓)		Convention ()		PCT-NP ()	
Divisional ()	Patent of Addition ()	Divisional ()	Patent of Addition ()	Divisional ()	Patent of Addition ()

3A. APPLICANT(S)

Name in Full	Nationality	Country of Residence	Address of the Applicant	
UPL LTD	An Indian Company	India	House No.	Agrochemical Plant
			Street	Durgachak Haldia
			City	Midnapore
			State	West Bengal
			Country	India
			Pin code	721 602

3B. CATEGORY OF APPLICANT [Please tick (✓) at the appropriate category]

Natural Person ()	Other than Natural Person		
	Small Entity ()	Startup ()	Others (✓)

4. INVENTOR(S) [Please tick (✓) at the appropriate category]

Are all the inventor(s) same as the applicant(s) named above ?	YES ()	NO (✓)
--	---------	--------

If "No", furnish the details of the inventor(s)

Name in Full	Nationality	Country of Residence	Address of the Inventor	
GONGORA, Vicente, Amadeu	A Brazilian Citizen	Brazil	House No.	United Phosphorus do Brasil Ltda,
			Street	Avenida Jandira, 257, Cjt 142/143, Indianopolis,
			City	Sao Paulo - SP,
			State	
			Country	Brazil
			Pin code	
MARCANDALLI, Luiz, Henrique	A Brazilian Citizen	Brazil	House No.	United Phosphorus do Brasil Ltda,
			Street	Avenida Jandira, 257, Cjt 142/143, Indianopolis,
			City	Sao Paulo - SP,
			State	
			Country	Brazil
			Pin code	
FABRI, Carlos, Eduardo	A Brazilian Citizen	Brazil	House No.	United Phosphorus do Brasil Ltda,
			Street	Avenida Jandira, 257, Cjt 142/143, Indianopolis,
			City	Sao Paulo - SP,
			State	
			Country	Brazil
			Pin code	
SHROFF, Jaidev Rajnikant	A British Citizen	Dubai U.A.E.	House No.	206, Swiss Tower, Cluster Y
			Street	Jumeirah Lake Towers, P.O. Box: 33421
			City	
			State	
			Country	Dubai - U.A.E.
			Pin code	
SHROFF, Vikram Rajnikant	A British Citizen	Dubai U.A.E.	House No.	206, Swiss Tower, Cluster Y
			Street	Jumeirah Lake Towers, P.O. Box: 33421
			City	
			State	
			Country	Dubai - U.A.E.
			Pin code	

5. TITLE OF THE INVENTION: NOVEL COMBINATIONS OF DEFOLIANTS

6. AUTHORISED REGISTERED PATENT AGENT(S)	IN/PA No.	625
	Name	Dr. Sanchita Ganguli
	Mobile No.	9331827882
7. ADDRESS FOR SERVICE OF APPLICANT IN INDIA	Name	S. MAJUMDAR & CO.
	Postal Address	5 Harish Mukherjee Road, Kolkata - 700 025, West Bengal, India
	Telephone No.	(033) 2455 7484 / 85 / 86
	Mobile No.	9331827882
	Fax No.	(033) 2455 7487 / 88
	E-mail ID	cal@patentindia.com

8. IN CASE OF APPLICATION CLAIMING PRIORITY OF APPLICATION FILED IN CONVENTION COUNTRY, PARTICULARS OF CONVENTION APPLICATION

COUNTRY	APPLICATION NUMBER	FILING DATE	NAME OF THE APPLICANT	TITLE OF THE INVENTION	IPR (as classified in the convention country)

9. IN CASE OF PCT NATIONAL PHASE APPLICATION, PARTICULARS OF INTERNATIONAL APPLICATION FILED UNDER PATENT COOPERATION TREATY (PCT)

International application number	International filing date as allotted by the receiving office

10. IN CASE OF DIVISIONAL APPLICATION FILED UNDER SECTION 16, PARTICULARS OF ORIGINAL (FIRST) APPLICATION

Original (first) application number	Date of filing of Original (first) application

11. IN CASE OF PATENT OF ADDITION FILED UNDER SECTION 54, PARTICULARS OF MAIN APPLICATION OR PATENT

Main application / patent Number	Date of filing of main application

12. DECLARATIONS

(i) Declaration by the inventor(s)

(In case the applicant is an assignee : the inventor(s) may sign herein below or the applicant may upload the assignment or enclose the assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period).

We, the above named inventor(s) are the true & first inventor(s) for this invention and declare that the applicant(s) herein are our assignee or legal representative.

(a) Date _____

(b) Signature(s) of the inventor(s):

(c) Name of the inventor: **GONGORA, Vicente, Amadeu**

(a) Date _____

(b) Signature(s) of the inventor(s):

(c) Name of the inventor: **MARCANDALLI, Luiz, Henrique**

(a) Date _____

(b) Signature(s) of the inventor(s):

(c) Name of the inventor: **FABRI, Carlos, Eduardo**

(a) Date _____

(b) Signature(s) of the inventor(s):

(c) Name of the inventor: **SHROFF, Jaidev Rajnikant**

- (a) Date _____
(b) Signature(s) of the inventor(s):
(c) Name of the inventor: **SHROFF, Vikram Rajnikant**

(ii) Declaration by the applicant(s) in the convention country

~~(In case the applicant in India is different than the applicant in the convention country: the applicant in the convention country may sign herein below or applicant in India may upload the assignment from the applicant in the convention country or enclose the said assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period)~~

~~I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative~~

- (a) Date _____
(b) Signature(s)
(c) Name(s) of the Signatory:-

(iii) Declaration by the applicant(s):

I/We, the applicant(s) hereby declare(s) that :

- ☐ We are in possession of the above-mentioned invention
- ☐ The provisional specification relating to the invention is filed with this application.
- ☒ The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by us before the grant of patent to us.
- ☐ There is no lawful ground of objection(s) to the grant of the Patent to us.
- ☒ We are the true & first inventor(s).
- ☐ We are the assignee or legal representative of true & first inventor(s).
- ☒ The application or each of the applications, particulars of which are given in Paragraph-8, was the first application in convention country/countries in respect of my/our invention.
- ☒ I/We claim the priority from the above mentioned application(s) filed in convention country/ countries and state that no application for protection in respect of the invention had been made in a convention country before that date by me/us or by any person from which I/we derive the title.
- ☒ My/Our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in Paragraph-9.
- ☒ The application is divided out of my/our application particulars of which is given in Para-10 and pray that this application may be treated as deemed to have been filed on (DD/MM/YYYY) under Section 16 of the Act.
- ☒ The said invention is an improvement in or modification of the invention particulars of which are given in Paragraph-11.

13. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION

- (a) Form 2

Item	Details	Fee	Remarks
Provisional specification)#	No. of pages (20)		
No. of claims	No. of claims and no. of pages		
Abstract	No. of pages		
No. of Drawing(s)	No. of drawings () and No. of pages ()		

In case of a complete specification, if the applicant desires to adopt the drawings filed with his provisional specification as the drawings or part of the drawings for the complete specification under rule 13(4), the number of such pages filed with the provisional specification are required to be mentioned here.

(b)

(a) Form -2 with provisional specification (2 copies). No. of pages **20**

(b) Statement and undertaking on Form 3

(c) General Power of Attorney in our favour.

(d) Fee for excess pages exceeding 30 = NIL

(e) Fee for application

= Rs. 8,000.00

Fee Rs. 8000/-

We hereby declare that to the best of our knowledge, information and belief the fact and matters stated herein are correct and we request that a patent may be granted to us for the said invention.

Dated this 17th day of November 2017

Sanchita Ganguli

Dr. Sanchita Ganguli
of S. MAJUMDAR & CO.
Applicants' Agent

To
The Controller of Patents
The Patent Office,
At Kolkata

Note:-

* Repeat boxes in case of more than one entry.

* To be signed by the applicant(s) or by authorized registered patent agent otherwise where mentioned.

* Tick (✓)/cross (x) whichever is applicable/not applicable in declaration in paragraph - 12.

* Name of the inventor and applicant should be given in full, family name in the beginning.

*Strike out the portion which is/are not applicable.

*For fee: See First Schedule