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(54) **Title:** HERBICIDAL COMBINATIONS

(57) **Abstract:** The present invention discloses herbicidal combinations for controlling undesirable plants. The present invention more specifically relates to a synergistic combination of herbicides, compositions and method for controlling weeds.

HERBICIDAL COMBINATIONS

Field of the invention

The present invention relates to herbicidal combinations for controlling undesirable plants.

- 5 The present invention more specifically relates to a synergistic combination of herbicides for controlling weeds.

Background of the invention

- 10 Weed control is an essential part of crop protection. Agriculturalists usually control or suppress weed growth by using herbicides at various stages before and after plant growth depending on the weed type and the level of infestation.

- The increasing level of resistance has led to the use of combinations of herbicides that have different modes of action, which allows for broader spectrum of control and allow for resistance management. Combinations used currently do not effectively handle resistant and persistent weeds. There is therefore a continuous need in the art for improved combinations with enhanced efficacy and broader spectrum of weed control that delay the onset of resistance.

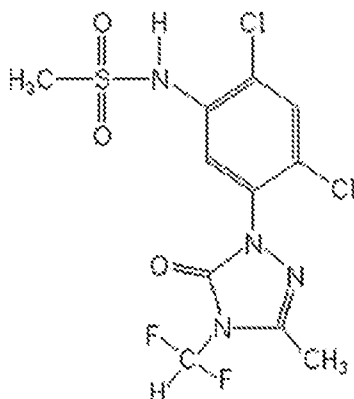
- 20 PPO inhibitor herbicides are mostly used to control broadleaf plants and have some activity on grasses. They have a limited translocation in plants and are used to control weeds in field crops, vegetables, tree fruits and vines, small fruits, nurseries, lawns, etc. PPO inhibitors usually burn plant tissues within hours or days of exposure, making them an excellent tool to control unwanted weeds both pre and post emergent.

- 25 Sulfentrazone is PPO inhibitor herbicide that is used for pre-emergent use to control a wide range of broadleaf, grasses and sedges in soybean as well as other crops. Combination of carfentrazone ethyl with other herbicides are known from US8822380 B2 (Walter et.al) or WO2015026923A2 (Degenhardt et.al.). Walter et al teach a combination comprising sulfentrazone in combination with quinclorac in a specific synergistic ratio. Degenhardt et.al teaches a combination comprising sulfentrazone, propyzamide and ethalfluralin.
- 30

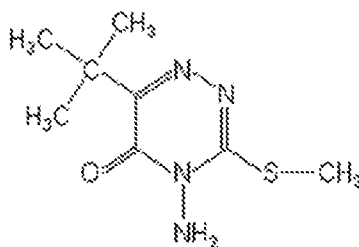
Metribuzin is a triazinone herbicide and its activity is due to interference with photosystem II electron transport in plant chloroplasts. A selective contact herbicide, metribuzin is used for control of both pre and post emergent weeds in cereals as well as other crops. Combinations of metribuzin are known in the art. For example, US5990048 A (Dahmen et.al) teaches combinations of metribuzin and sulfosulfuron.

There remains a need for improved herbicidal combinations that can effectively control weeds thereby improving yield and plant health, with reduced phytotoxicity. Weeds might not be controlled with double combinations of herbicides, let alone a single broad-spectrum herbicide such as glyphosate. There is also a need for herbicidal combination that gives good residual control, while at the same time ensuring complete control of weeds as well as control a larger spectrum of burndown weeds.

Sulfentrazone is a PPO inhibitor herbicide. Its chemical name is N-[2,4-dichloro-5-[4-(difluoromethyl)-4,5-dihydro-3-methyl-5-oxo-1H-1,2,4-triazol-1-yl] phenyl]-methane sulfonamide and has the chemical structure:



Metribuzin is a photosystem II inhibitor herbicide. Its chemical name is 4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one and has the chemical structure:



Sulfentrazone and Metribuzin together are usually effective in the control of pre-emergent weeds as well as burndown weeds. However, there is not much in the way of residual control and control of resistant weeds. There is therefore, a need in the art, for an herbicidal
5 combination which offers a broader spectrum of weed control, which can attain near complete control of weeds at lower use rates, and which gives good residual control.

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

10

Objects of the invention:

Therefore, one object of the present invention is to provide a synergistic herbicidal combination.

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

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

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Yet another object of the present invention is to provide a method of increasing yield in a crop by application of a synergistic herbicidal combination.

Another object of the present invention is to provide a method of improving the plant health
25 by application of a synergistic herbicidal combination.

Another object of the present invention is to provide a synergistic herbicidal combination which offers a broader and more complete spectrum of weed control.

Another object of the present invention is to provide a synergistic herbicidal combination which provides a better control of weeds at lower use rates, and which gives good residual control.

Another object of the present invention is to provide a synergistic herbicidal combination which is synergistic and thus helps in resistance management.

10

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

Summary of the invention:

15 In one aspect the present invention relates to a herbicidal combination comprising:

- (a) at least one triazolone herbicide;
- (b) a photosystem II inhibitor herbicide; and
- (c) an ALS inhibitor herbicide

20 In another aspect the present invention relates to a herbicidal combination comprising:

- (a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thienicarbazone;
- (b) a photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzenofenap,

fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In another aspect, the present invention provides a herbicidal combination comprising (a) sulfentrazone; (b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In yet another aspect the present invention provides a method of controlling weeds at a locus, the method comprising applying, to the locus, a combination comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

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In another aspect the present invention provides a method of controlling weeds at a locus, the method comprising applying, to the locus, a combination comprising a) sulfentrazone;

(b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In another aspect the present invention provides a composition comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In another aspect the present invention provides a composition comprising:

- a) sulfentrazone;
- b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and

their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In another aspect the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters;
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and
- d) at least one agrochemically acceptable excipient.

In another aspect the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone,

flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and (d) at least one agrochemically acceptable excipient.

In another aspect the present invention provides a method of controlling weeds at a locus,
5 said method comprising applying a composition comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thienicarbazone;
- b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin,
10 ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters;
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone,
15 diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and
- d) at least one agrochemically acceptable excipient.

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In another aspect the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and
25 esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone,
30 flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and (d) at least one agrochemically acceptable excipient.

Detailed Description of the invention:

The inventors have surprisingly found that at least one triazolone herbicide, when added to the combination of photosystem II inhibitor herbicides and either an ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide resulted in an unexpected synergy.

The term herbicide, as used herein, shall mean an active ingredient that kills, controls or otherwise adversely modifies the growth of 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, or retardation. The 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 to emerge. The term crop shall include a multitude of desired crop plants or an individual crop plant growing at a locus.

Thus, an aspect of the present invention relates to a herbicidal combination comprising (a) at least one triazolone herbicide, at least one photosystem II inhibitor herbicide and either an ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide.

Thus, in an aspect, the present invention provides a herbicidal combination comprising:

- (a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- (b) a photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone,

diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

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In an embodiment, the preferred triazolone herbicide is sulfentrazone.

Thus, in an embodiment, the present invention provides a herbicidal combination comprising (a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from
10 ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from
15 aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an embodiment, the preferred triazolone herbicide is carfentrazone.

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Thus, in an embodiment, the present invention provides a herbicidal combination comprising (a) carfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from
25 imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon,
30 pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an aspect, the present provides a method of controlling weeds at a locus by applying, to the locus, a combination of the present invention.

Thus, in an aspect, the present invention provides a method of controlling weeds at a locus,
5 the method comprising applying, to the locus, a combination comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin,
10 hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone,
15 diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

20 In an embodiment, the preferred triazolone herbicide is sulfentrazone.

Thus, in this embodiment, the present invention provides a method of controlling weeds at a locus, the method comprising applying, to the locus, a combination comprising a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione,
25 amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione,
30 topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an embodiment, the preferred triazolone herbicide is carfentrazone.

Thus, in this embodiment, the present invention provides a method of controlling weeds at
5 a locus, the method comprising applying, to the locus, a combination comprising a)
carfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione,
amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin
and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone
10 herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin,
imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen,
clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione,
topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap,
fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole,
pyrazolynate, pyrazoxyfen and tefuryltrione.

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In another aspect, the present invention provides a composition comprising the
combinations of the present invention.

Thus, in this aspect, the present invention provides a composition comprising:

- 20 a) at least one triazolone herbicide selected from the group consisting of
amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone,
propoxycarbazone, sulfentrazone and thienicarbazone;
- b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin,
ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin
25 and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from
imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and
their salts and esters or a bleacher herbicide selected from aclonifen, clomazone,
diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione,
30 topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon,
benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole,
norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an embodiment, the preferred triazolone herbicide is sulfentrazone.

Thus, in this embodiment, the present invention provides a composition comprising:

- 5 a) sulfentrazone;
- b) a photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from
10 imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole,
15 norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an embodiment, the preferred triazolone herbicide is carfentrazone.

Thus, in this embodiment, the present invention provides a composition comprising:

- 20 a) carfentrazone;
- b) a photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, metamitron, metribuzin, trifludimoxazin and their salts and esters; and
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from
25 imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole,
30 norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

In an embodiment, the compositions of the present invention comprise at least one agrochemically acceptable excipient.

Thus, in this embodiment, the present invention provides a composition comprising (a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, metamiltron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acetonifin, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzenofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; (d) at least one agrochemically acceptable excipient.

15

In an aspect, the present provides a method of controlling weeds at a locus by applying, to the locus, a composition of the present invention.

Thus, in this aspect, the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising:

- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
- b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, metamiltron, metribuzin, trifludimoxazin and their salts and esters;
- c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acetonifin, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzenofenap,

fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and

d) at least one agrochemically acceptable excipient.

5 In an embodiment, the preferred triazolone herbicide is sulfentrazone.

Thus, in this embodiment, the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin,
10 hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinifen, sulcotrione, tembotrione, topramezone,
15 bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and (d) at least one agrochemically acceptable excipient.

In an embodiment, the preferred triazolone herbicide is carfentrazone.

20

Thus, in this embodiment, the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising a) carfentrazone; (b) an photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and
25 esters; (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from acifluorfen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinifen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone,
30 flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione; and (d) at least one agrochemically acceptable excipient.

Each of the aspect described above may have one or more embodiments.

In each of these embodiments, apart from the triazolone herbicide, the embodiments may include the preferred photosystem II herbicide and a preferred imidazolinone herbicide or
5 a preferred bleacher herbicide according to the present invention.

Each of the embodiments described hereinafter may apply to one or all the aspects described hereinabove. These embodiments are intended to be read as being preferred features of one or all the aspects described hereinabove. Each of the embodiments described
10 hereinafter applies to each of the aspects described hereinabove individually.

In an embodiment, the present invention provides preferred combinations, compositions and methods thereof. The methods of the invention include a method of controlling weeds at a locus by applying to the locus the combination or the composition, or a method of
15 increasing yield in a crop by application of the combination or composition, or a method of improving the plant health by application at the locus of the plant the combination or the composition. The embodiments described herein describe the preferred embodiments of all these possible combinations, compositions and methods of the invention.

20 Thus, an embodiment of the present invention may include the preferred selection of:

- a) the triazolone herbicide is selected from the group consisting of carfentazone, flucarbazone, and sulfentrazone; and
- b) the photosystem II inhibitor herbicide selected from hexazinone, metamiltron, and metribuzin; and
- 25 c) the ALS inhibitor herbicide selected from imazamox, imazapic, imazapyr, and imazethapyr; or
- d) the bleacher herbicide selected from clomazone, diflufenican, mesotrione, and tembotrione.

30 Alternatively, an embodiment of the present invention may include the preferred selection as tabulated below, which are to be construed as exemplary embodiments according to any

aspect, described hereinabove, of the present invention. These embodiments are exemplary embodiments only and do not limit the present invention.

Table 1:

Embodiment No.	Preferred triazolone herbicide	Preferred photosystem II inhibitor herbicide	Preferred ALS inhibitor herbicide	Preferred bleacher herbicide
1	Carfentrazone	Hexazinone	Imazamox	-
2	Carfentrazone	Hexazinone	Imazapic	-
3	Carfentrazone	Hexazinone	Imazapyr	-
4	Carfentrazone	Hexazinone	Imazethapyr	-
5	Carfentrazone	Hexazinone	-	Clomazone
6	Carfentrazone	Hexazinone	-	Diflufenican
7	Carfentrazone	Hexazinone	-	Mesotrione
8	Carfentrazone	Hexazinone	-	Tembotrione
9	Carfentrazone	Metamitron	Imazamox	-
10	Carfentrazone	Metamitron	Imazapic	-
11	Carfentrazone	Metamitron	Imazapyr	-
12	Carfentrazone	Metamitron	Imazethapyr	-
13	Carfentrazone	Metamitron	-	Clomazone
14	Carfentrazone	Metamitron	-	Diflufenican
15	Carfentrazone	Metamitron	-	Mesotrione
16	Carfentrazone	Metamitron	-	Tembotrione
17	Carfentrazone	Metribuzin	Imazamox	-
18	Carfentrazone	Metribuzin	Imazapic	-
19	Carfentrazone	Metribuzin	Imazapyr	-
20	Carfentrazone	Metribuzin	Imazethapyr	-
21	Carfentrazone	Metribuzin	-	Clomazone
22	Carfentrazone	Metribuzin	-	Diflufenican
23	Carfentrazone	Metribuzin	-	Mesotrione

24	Carfentrazone	Metribuzin	-	Tembotrione
25	Flucarbazone	Hexazinone	Imazamox	-
26	Flucarbazone	Hexazinone	Imazapic	-
27	Flucarbazone	Hexazinone	Imazapyr	-
28	Flucarbazone	Hexazinone	Imazethapyr	-
29	Flucarbazone	Hexazinone	-	Clomazone
30	Flucarbazone	Hexazinone	-	Diflufenican
31	Flucarbazone	Hexazinone	-	Mesotrione
32	Flucarbazone	Hexazinone	-	Tembotrione
33	Flucarbazone	Metamitron	Imazamox	-
34	Flucarbazone	Metamitron	Imazapic	-
35	Flucarbazone	Metamitron	Imazapyr	-
36	Flucarbazone	Metamitron	Imazethapyr	-
37	Flucarbazone	Metamitron	-	Clomazone
38	Flucarbazone	Metamitron	-	Diflufenican
39	Flucarbazone	Metamitron	-	Mesotrione
40	Flucarbazone	Metamitron	-	Tembotrione
41	Flucarbazone	Metribuzin	Imazamox	-
42	Flucarbazone	Metribuzin	Imazapic	-
43	Flucarbazone	Metribuzin	Imazapyr	-
44	Flucarbazone	Metribuzin	Imazethapyr	-
45	Flucarbazone	Metribuzin	-	Clomazone
46	Flucarbazone	Metribuzin	-	Diflufenican
47	Flucarbazone	Metribuzin	-	Mesotrione
48	Flucarbazone	Metribuzin	-	Tembotrione
49	Sulfentrazone	Hexazinone	Imazamox	-
50	Sulfentrazone	Hexazinone	Imazapic	-
51	Sulfentrazone	Hexazinone	Imazapyr	-
52	Sulfentrazone	Hexazinone	Imazethapyr	-
53	Sulfentrazone	Hexazinone	-	Clomazone

54	Sulfentrazone	Hexazinone	-	Diflufenican
55	Sulfentrazone	Hexazinone	-	Mesotrione
56	Sulfentrazone	Hexazinone	-	Tembotrione
57	Sulfentrazone	Metamitron	Imazamox	-
58	Sulfentrazone	Metamitron	Imazapic	-
59	Sulfentrazone	Metamitron	Imazapyr	-
60	Sulfentrazone	Metamitron	Imazethapyr	-
61	Sulfentrazone	Metamitron	-	Clomazone
62	Sulfentrazone	Metamitron	-	Diflufenican
63	Sulfentrazone	Metamitron	-	Mesotrione
64	Sulfentrazone	Metamitron	-	Tembotrione
65	Sulfentrazone	Metribuzin	Imazamox	-
66	Sulfentrazone	Metribuzin	Imazapic	-
67	Sulfentrazone	Metribuzin	Imazapyr	-
68	Sulfentrazone	Metribuzin	Imazethapyr	-
69	Sulfentrazone	Metribuzin	-	Clomazone
70	Sulfentrazone	Metribuzin	-	Diflufenican
71	Sulfentrazone	Metribuzin	-	Mesotrione
72	Sulfentrazone	Metribuzin	-	Tembotrione

An embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) metribuzin; and (c) at least one ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicycloporyne, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

10

A preferred embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) metribuzin; and (c) at least one ALS inhibitor herbicide

selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters.

A preferred embodiment of the present invention may be a herbicidal combination
5 comprising a) sulfentrazone; (b) metribuzin; and (c) imazamox and its salts and esters.

Another embodiment of the present invention may be a herbicidal combination comprising
a) sulfentrazone; (b) metribuzin; and (c) at least one bleacher herbicide selected from
aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione,
10 tembotrione, topramezone, bicyclopypyrone, amitrole, beflubutamid, benzobicyclon,
benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon,
pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

A preferred embodiment of the present invention may be a herbicidal combination
15 comprising a) sulfentrazone; (b) metribuzin; and (c) diflufenican.

Another preferred embodiment of the present invention may be a herbicidal combination
comprising a) sulfentrazone; (b) metribuzin; and (c) clomazone.

20 Another embodiment of the present invention may be a herbicidal combination comprising
a) sulfentrazone; (b) metribuzin; and (c) at least one bleacher herbicide selected from
mesotrione, sulcotrione, tembotrione and tefuryltrione.

Another embodiment of the present invention may be a herbicidal combination comprising
25 a) sulfentrazone; (b) metribuzin; and (c) at least one bleacher herbicide selected from
picolinafen or aclonifen.

Another embodiment of the present invention may be a herbicidal combination comprising
a) sulfentrazone; (b) metatriton; and (c) at least one ALS inhibitor herbicide selected from
30 imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr,
imazaquin, imazethapyr and their salts and esters or at least one bleacher herbicide selected
from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione,

tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

- 5 Another embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) metamitron; and (c) at least one bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon,
10 pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

- Another embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) hexazinone; and (c) at least one ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr,
15 imazaquin, imazethapyr and their salts and esters or at least one bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

- 20 Another embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) hexazinone; and (c) at least one bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon,
25 benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

- A preferred embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) hexazinone; and (c) isoxaflutole.

- 30 Another embodiment of the present invention may be a herbicidal combination comprising a) sulfentrazone; (b) trifludimoxazin; and (c) at least one ALS inhibitor herbicide selected

from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or at least one bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, 5 beflubutamid, benzobicyclon, benzo fenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

Alternatively, an embodiment of the present invention may include the preferred selection as tabulated below in table 2, which are to be construed as exemplary embodiments according to any aspect, described hereinabove, of the present invention. These 10 embodiments are exemplary embodiments only and do not limit the present invention.

Table 2

73	Sulfentrazone	Metribuzin	Imazamethabenz
74	Sulfentrazone	Metribuzin	Imazamox
75	Sulfentrazone	Metribuzin	Imazapic
76	Sulfentrazone	Metribuzin	Imazapyr
77	Sulfentrazone	Metribuzin	Imazaquin
78	Sulfentrazone	Metribuzin	Imazethapyr
79	Sulfentrazone	Metribuzin	Aclonifen
80	Sulfentrazone	Metribuzin	Clomazone
81	Sulfentrazone	Metribuzin	Diflufenican
82	Sulfentrazone	Metribuzin	Isoxaflutole
83	Sulfentrazone	Metribuzin	Mesotrione
84	Sulfentrazone	Metribuzin	Picolinafen
85	Sulfentrazone	Metribuzin	Sulcotrione
86	Sulfentrazone	Metribuzin	Tembotrione
87	Sulfentrazone	Metribuzin	Topramezone
88	Sulfentrazone	Metribuzin	Bicyclopyrone
89	Sulfentrazone	Metribuzin	Amitrole
90	Sulfentrazone	Metribuzin	Beflubutamid
91	Sulfentrazone	Metribuzin	Benzobicyclon

92	Sulfentrazone	Metribuzin	Benzofenap
93	Sulfentrazone	Metribuzin	Fluridone
94	Sulfentrazone	Metribuzin	Flurochloridone
95	Sulfentrazone	Metribuzin	Flurtamone
96	Sulfentrazone	Metribuzin	Isoxachlortole
97	Sulfentrazone	Metribuzin	Norflurazon
98	Sulfentrazone	Metribuzin	Pyrasulfotole
99	Sulfentrazone	Metribuzin	Pyrazolynate
100	Sulfentrazone	Metribuzin	Pyrazoxyfen
101	Sulfentrazone	Metribuzin	Tefuryltrione
102	Sulfentrazone	Ametridione	Imazamethabenz
103	Sulfentrazone	Ametridione	Imazamox
104	Sulfentrazone	Ametridione	Imazapic
105	Sulfentrazone	Ametridione	Imazapyr
106	Sulfentrazone	Ametridione	Imazaquin
107	Sulfentrazone	Ametridione	Imazethapyr
108	Sulfentrazone	Ametridione	Aclonifen
109	Sulfentrazone	Ametridione	Clomazone
110	Sulfentrazone	Ametridione	Di flufenican
111	Sulfentrazone	Ametridione	Isoxaflutole
112	Sulfentrazone	Ametridione	Mesotrione
113	Sulfentrazone	Ametridione	Picolinafen
114	Sulfentrazone	Ametridione	Sulcotrione
115	Sulfentrazone	Ametridione	Tembotrione
116	Sulfentrazone	Ametridione	Topramezone
117	Sulfentrazone	Ametridione	Bicyclopyrone
118	Sulfentrazone	Ametridione	Amitrole
119	Sulfentrazone	Ametridione	Beflubutamid
120	Sulfentrazone	Ametridione	Benzobicyclon
121	Sulfentrazone	Ametridione	Benzofenap

122	Sulfentrazone	Ametridione	Fluridone
123	Sulfentrazone	Ametridione	Flurochloridone
124	Sulfentrazone	Ametridione	Flurtamone
125	Sulfentrazone	Ametridione	Isoxachlortole
126	Sulfentrazone	Ametridione	Norflurazon
127	Sulfentrazone	Ametridione	Pyrasulfotole
128	Sulfentrazone	Ametridione	Pyrazolynate
129	Sulfentrazone	Ametridione	Pyrazoxyfen
130	Sulfentrazone	Ametridione	Tefuryltrione
131	Sulfentrazone	Amibuzin	Imazamethabenz
132	Sulfentrazone	Amibuzin	Imazamox
133	Sulfentrazone	Amibuzin	Imazapic
134	Sulfentrazone	Amibuzin	Imazapyr
135	Sulfentrazone	Amibuzin	Imazaquin
136	Sulfentrazone	Amibuzin	Imazethapyr
137	Sulfentrazone	Amibuzin	Aclonifen
138	Sulfentrazone	Amibuzin	Clomazone
139	Sulfentrazone	Amibuzin	Diflufenican
140	Sulfentrazone	Amibuzin	Isoxaflutole
141	Sulfentrazone	Amibuzin	Mesotrione
142	Sulfentrazone	Amibuzin	Picolinafen
143	Sulfentrazone	Amibuzin	Sulcotrione
144	Sulfentrazone	Amibuzin	Tembotrione
145	Sulfentrazone	Amibuzin	Topramezone
146	Sulfentrazone	Amibuzin	Bicyclopyrone
147	Sulfentrazone	Amibuzin	Amitrole
148	Sulfentrazone	Amibuzin	Beflubutamid
149	Sulfentrazone	Amibuzin	Benzobicyclon
150	Sulfentrazone	Amibuzin	Benzofenap
151	Sulfentrazone	Amibuzin	Fluridone

152	Sulfentrazone	Amibuzin	Flurochloridone
153	Sulfentrazone	Amibuzin	Flurtamone
154	Sulfentrazone	Amibuzin	Isoxachlortole
155	Sulfentrazone	Amibuzin	Norflurazon
156	Sulfentrazone	Amibuzin	Pyrasulfotole
157	Sulfentrazone	Amibuzin	Pyrazolynate
158	Sulfentrazone	Amibuzin	Pyrazoxyfen
159	Sulfentrazone	Amibuzin	Tefuryltrione
160	Sulfentrazone	Ethiozin	Imazamethabenz
161	Sulfentrazone	Ethiozin	Imazamox
162	Sulfentrazone	Ethiozin	Imazapic
163	Sulfentrazone	Ethiozin	Imazapyr
164	Sulfentrazone	Ethiozin	Imazaquin
165	Sulfentrazone	Ethiozin	Imazethapyr
166	Sulfentrazone	Ethiozin	Aclonifen
167	Sulfentrazone	Ethiozin	Clomazone
168	Sulfentrazone	Ethiozin	Di flufenican
169	Sulfentrazone	Ethiozin	Isoxaflutole
170	Sulfentrazone	Ethiozin	Mesotrione
171	Sulfentrazone	Ethiozin	Picolinafen
172	Sulfentrazone	Ethiozin	Sulcotrione
173	Sulfentrazone	Ethiozin	Tembotrione
174	Sulfentrazone	Ethiozin	Topramezone
175	Sulfentrazone	Ethiozin	Bicyclopyrone
176	Sulfentrazone	Ethiozin	Amitrole
177	Sulfentrazone	Ethiozin	Beflubutamid
178	Sulfentrazone	Ethiozin	Benzobicyclon
179	Sulfentrazone	Ethiozin	Benzofenap
180	Sulfentrazone	Ethiozin	Fluridone
181	Sulfentrazone	Ethiozin	Flurochloridone

182	Sulfentrazone	Ethiozin	Flurtamone
183	Sulfentrazone	Ethiozin	Isoxachlortole
184	Sulfentrazone	Ethiozin	Norflurazon
185	Sulfentrazone	Ethiozin	Pyrasulfotole
186	Sulfentrazone	Ethiozin	Pyrazolynate
187	Sulfentrazone	Ethiozin	Pyrazoxyfen
188	Sulfentrazone	Ethiozin	Tefuryltrione
189	Sulfentrazone	Hexazinone	Imazamethabenz
190	Sulfentrazone	Hexazinone	Imazamox
191	Sulfentrazone	Hexazinone	Imazapic
192	Sulfentrazone	Hexazinone	Imazapyr
193	Sulfentrazone	Hexazinone	Imazaquin
194	Sulfentrazone	Hexazinone	Imazethapyr
195	Sulfentrazone	Hexazinone	Aclonifen
196	Sulfentrazone	Hexazinone	Clomazone
197	Sulfentrazone	Hexazinone	Diflufenican
198	Sulfentrazone	Hexazinone	Isoxaflutole
199	Sulfentrazone	Hexazinone	Mesotrione
200	Sulfentrazone	Hexazinone	Picolinafen
201	Sulfentrazone	Hexazinone	Sulcotrione
202	Sulfentrazone	Hexazinone	Tembotrione
203	Sulfentrazone	Hexazinone	Topramezone
204	Sulfentrazone	Hexazinone	Bicyclopyrone
205	Sulfentrazone	Hexazinone	Amitrole
206	Sulfentrazone	Hexazinone	Beflubutamid
207	Sulfentrazone	Hexazinone	Benzobicyclon
208	Sulfentrazone	Hexazinone	Benzofenap
209	Sulfentrazone	Hexazinone	Fluridone
210	Sulfentrazone	Hexazinone	Flurochloridone
211	Sulfentrazone	Hexazinone	Flurtamone

212	Sulfentrazone	Hexazinone	Isoxachlortole
213	Sulfentrazone	Hexazinone	Norflurazon
214	Sulfentrazone	Hexazinone	Pyrasulfotole
215	Sulfentrazone	Hexazinone	Pyrazolynate
216	Sulfentrazone	Hexazinone	Pyrazoxyfen
217	Sulfentrazone	Hexazinone	Tefuryltrione
218	Sulfentrazone	Isomethiozin	Imazamethabenz
219	Sulfentrazone	Isomethiozin	Imazamox
220	Sulfentrazone	Isomethiozin	Imazapic
221	Sulfentrazone	Isomethiozin	Imazapyr
222	Sulfentrazone	Isomethiozin	Imazaquin
223	Sulfentrazone	Isomethiozin	Imazethapyr
224	Sulfentrazone	Isomethiozin	Aclonifen
225	Sulfentrazone	Isomethiozin	Clomazone
226	Sulfentrazone	Isomethiozin	Diflufenican
227	Sulfentrazone	Isomethiozin	Isoxaflutole
228	Sulfentrazone	Isomethiozin	Mesotrione
229	Sulfentrazone	Isomethiozin	Picolinafen
230	Sulfentrazone	Isomethiozin	Sulcotrione
231	Sulfentrazone	Isomethiozin	Tembotrione
232	Sulfentrazone	Isomethiozin	Topramezone
233	Sulfentrazone	Isomethiozin	Bicyclopyrone
234	Sulfentrazone	Isomethiozin	Amitrole
235	Sulfentrazone	Isomethiozin	Beflubutamid
236	Sulfentrazone	Isomethiozin	Benzobicyclon
237	Sulfentrazone	Isomethiozin	Benzofenap
238	Sulfentrazone	Isomethiozin	Fluridone
239	Sulfentrazone	Isomethiozin	Flurochloridone
240	Sulfentrazone	Isomethiozin	Flurtamone
241	Sulfentrazone	Isomethiozin	Isoxachlortole

242	Sulfentrazone	Isomethiozin	Norflurazon
243	Sulfentrazone	Isomethiozin	Pyrasulfotole
244	Sulfentrazone	Isomethiozin	Pyrazolynate
245	Sulfentrazone	Isomethiozin	Pyrazoxyfen
246	Sulfentrazone	Isomethiozin	Tefuryltrione
247	Sulfentrazone	Metamitron	Imazamethabenz
248	Sulfentrazone	Metamitron	Imazamox
249	Sulfentrazone	Metamitron	Imazapic
250	Sulfentrazone	Metamitron	Imazapyr
251	Sulfentrazone	Metamitron	Imazaquin
252	Sulfentrazone	Metamitron	Imazethapyr
253	Sulfentrazone	Metamitron	Aclonifen
254	Sulfentrazone	Metamitron	Clomazone
255	Sulfentrazone	Metamitron	Di flufenican
256	Sulfentrazone	Metamitron	Isoxaflutole
257	Sulfentrazone	Metamitron	Mesotrione
258	Sulfentrazone	Metamitron	Picolinafen
259	Sulfentrazone	Metamitron	Sulcotrione
260	Sulfentrazone	Metamitron	Tembotrione
261	Sulfentrazone	Metamitron	Topramezone
262	Sulfentrazone	Metamitron	Bicyclopyrone
263	Sulfentrazone	Metamitron	Amitrole
264	Sulfentrazone	Metamitron	Beflubutamid
265	Sulfentrazone	Metamitron	Benzobicyclon
266	Sulfentrazone	Metamitron	Benzofenap
267	Sulfentrazone	Metamitron	Fluridone
268	Sulfentrazone	Metamitron	Flurochloridone
269	Sulfentrazone	Metamitron	Flurtamone
270	Sulfentrazone	Metamitron	Isoxachlortole
271	Sulfentrazone	Metamitron	Norflurazon

272	Sulfentrazone	Metamitron	Pyrasulfotole
273	Sulfentrazone	Metamitron	Pyrazolynate
274	Sulfentrazone	Metamitron	Pyrazoxyfen
275	Sulfentrazone	Metamitron	Tefuryltrione
276	Sulfentrazone	Trifludimoxazin	Imazamethabenz
277	Sulfentrazone	Trifludimoxazin	Imazamox
278	Sulfentrazone	Trifludimoxazin	Imazapic
279	Sulfentrazone	Trifludimoxazin	Imazapyr
280	Sulfentrazone	Trifludimoxazin	Imazaquin
281	Sulfentrazone	Trifludimoxazin	Imazethapyr
282	Sulfentrazone	Trifludimoxazin	Aclonifen
283	Sulfentrazone	Trifludimoxazin	Clomazone
284	Sulfentrazone	Trifludimoxazin	Diflufenican
285	Sulfentrazone	Trifludimoxazin	Isoxaflutole
286	Sulfentrazone	Trifludimoxazin	Mesotrione
287	Sulfentrazone	Trifludimoxazin	Picolinafen
288	Sulfentrazone	Trifludimoxazin	Sulcotrione
289	Sulfentrazone	Trifludimoxazin	Tembotrione
290	Sulfentrazone	Trifludimoxazin	Topramezone
291	Sulfentrazone	Trifludimoxazin	Bicyclopyrone
292	Sulfentrazone	Trifludimoxazin	Amitrole
293	Sulfentrazone	Trifludimoxazin	Beflubutamid
294	Sulfentrazone	Trifludimoxazin	Benzobicyclon
295	Sulfentrazone	Trifludimoxazin	Benzofenap
296	Sulfentrazone	Trifludimoxazin	Fluridone
297	Sulfentrazone	Trifludimoxazin	Flurochloridone
298	Sulfentrazone	Trifludimoxazin	Flurtamone
299	Sulfentrazone	Trifludimoxazin	Isoxachlortole
300	Sulfentrazone	Trifludimoxazin	Norflurazon
301	Sulfentrazone	Trifludimoxazin	Pyrasulfotole

302	Sulfentrazone	Trifludimoxazin	Pyrazolynate
303	Sulfentrazone	Trifludimoxazin	Pyrazoxyfen
304	Sulfentrazone	Trifludimoxazin	Tefuryltrione

The combinations may be applied to the locus of the weeds in an herbicidally effective amount. The selection of the appropriate effective amounts depends on the density of weed infestation, weather patterns, crop health and many other factors, which may be made
5 conveniently by a person skilled in the art. The effective amounts of these herbicides in the synergistic combination of the present invention is not particularly limiting.

In an embodiment, the combination of the present invention may be combined with at least one other active ingredient selected from the group consisting of herbicides, insecticides,
10 fungicides, biological agents, plant growth activators, fertilizers or combinations thereof.

Thus, in an embodiment, the combination of the present invention may be combined with yet another herbicide. Exemplary herbicides that may be combined with the combination of the present invention may be selected from, but not limited to, herbicides belonging to
15 classes such as ACCase inhibitors, ALS inhibitors, EPSP synthase inhibitors, synthetic auxins, auxin transport inhibitors, HPPD inhibitors, lipid synthesis inhibitors, long chain fatty acid inhibitors, as well as herbicides with unknown modes of action.

In an embodiment, the total amount of triazolone herbicide in the composition may typically be in the range of 0.1 to 99% by weight, preferably 0.2 to 90% by weight. The
20 total amount of the photosystem II inhibitor herbicide in the composition may be in the range of 0.1 to 99% by weight. The total amount of the ALS inhibitor selected from imidazolinone herbicide or bleacher herbicide in the composition may be in the range of 0.1 to 10% by weight.

25

In an embodiment, the constituent herbicides of the combination of the present invention may be admixed in ratio of (1-80): (1-80): (1-10) of sulfentrazone, the photosystem II

inhibitor herbicide and the ALS inhibitor herbicide selected from imidazolinone herbicides or the bleacher herbicide respectively.

In an aspect, the present invention may provide herbicidal combinations comprising
5 sulfentrazone, at least one photosystem II inhibitor herbicide, at least one ALS inhibitor herbicide selected from an imidazolinone herbicide or at least one bleacher herbicide and their salts and esters thereof and a herbicidal safener.

In an embodiment, the safener may be selected from benoxacor, BPCMS, cloquintocet,
10 cyometrinil, cyprosulfamide, dichlormid, dicyclonon, dietholate, fenchlorazole, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen, jiecaowan, Jiecaoxi, mefenpyr, mephenate, metcamifen, naphthalic anhydride, oxabetrinil and their salts and esters.

The herbicidal combination of the present invention maybe used to target weeds among the
15 crops such corn, rice, wheat, barley, rye, oat, sorghum, cotton, soybean, peanut, buckwheat, beet, rapeseed, sunflower, sugar cane, tobacco, etc.; vegetables: solanaceous vegetables such as eggplant, tomato, pimento, pepper, potato, etc., cucurbit vegetables such as cucumber, pumpkin, zucchini, water melon, melon, squash, etc., cruciferous vegetables such as radish, white turnip, horseradish, kohlrabi, Chinese cabbage, cabbage, leaf mustard,
20 broccoli, cauliflower, etc., asteraceous vegetables such as burdock, crown daisy, artichoke, lettuce, etc, liliaceous vegetables such as green onion, onion, garlic, and asparagus, ammiaceous vegetables such as carrot, parsley, celery, parsnip, etc., chenopodiaceous vegetables such as spinach, Swiss chard, etc., lamiaceous vegetables such as Perilla frutescens, mint, basil, etc, strawberry, sweet potato, Dioscorea japonica, colocasia, etc.,
25 flowers, foliage plants, turf grasses, fruits: pome fruits such apple, pear, quince, etc, stone fleshy fruits such as peach, plum, nectarine, Prunus mume, cherry fruit, apricot, prune, etc., citrus fruits such as orange, lemon, rime, grapefruit, etc., nuts such as chestnuts, walnuts, hazelnuts, almond, pistachio, cashew nuts, macadamia nuts, etc. berries such as blueberry, cranberry, blackberry, raspberry, etc., vines, kaki fruit, olive, plum, banana, oil palm,
30 coffee, date palm, coconuts, etc. , trees other than fruit trees; tea, mulberry, flowering plant, trees such as ash, birch, dogwood, Eucalyptus, Ginkgo biloba, lilac, maple, Quercus,

poplar, Judas tree, Liquidambar formosana, plane tree, zelkova, Japanese arborvitae, fir wood, hemlock, juniper, Pinus, Picea, and Taxus cuspidate, etc.

Thus, in another aspect, the present invention provides a method of controlling weeds at a locus, the method comprising applying a combination comprising sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide to the locus.

Thus, embodiments of the present invention may provide a method of controlling weeds at a locus, said method comprising application of synergistic combination of sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide and optionally a fourth active ingredient.

In an embodiment, the fourth active ingredient may be selected from herbicide, insecticide, fungicide, biological agent, plant growth activator, fertilizers and combinations thereof.

The target weeds may be selected from

Urticaceae weeds: *Urtica urens*

Polygonaceae weeds: *Polygonum convolvulus*, *Polygonum lapathifolium*, *Polygonum pennsylvanicum*, *Polygonum persicaria*, *Polygonum longisetum*, *Polygonum aviculare*, *Polygonum arenastrum*, *Polygonum cuspidatum*, *Rumex japonicus*, *Rumex crispus*, *Rumex obtusifolius*, *Rumex acetosa*; Portulacaceae weeds: *Portulaca oleracea*; Caryophyllaceae weeds: *Stellaria media*, *Cerastium holsteoides*, *Cerastium glomeratum*, *Spergula arvensis*, *Silene gallica*

Molluginaceae weeds: *Mollugo verticillata*; Chenopodiaceae weeds: *Chenopodium album*, *Chenopodium ambrosioides*, *Kochia scoparia*, *Salsola kali*, *Atriplex* spp.; Amaranthaceae weeds: *Amaranthus retroflexus*, *Amaranthus viridis*, *Amaranthus lividus*, *Amaranthus spinosus*, *Amaranthus hybridus*, *Amaranthus palmeri*, *Amaranthus rudis*, *Amaranthus patulus*, *Amaranthus tuberculatus*, *Amaranthus blitoides*, *Amaranthus deflexus*, *Amaranthus quitensis*, *Alternanthera philoxeroides*, *Alternanthera sessilis*, *Alternanthera*

- tenella; Papaveraceae weeds: *Papaver rhoeas*, *Argemone Mexicana*; Brassicaceae weeds: *Raphanus raphanistrum*, *Raphanus sativus*, *Sinapis arvensis*, *Capsella bursa-pastoris*, *Brassica juncea*, *Brassica campestris*, *Descurainia pinnata*, *Rorippa islandica*, *Rorippa sylvestris*, *Thlaspi arvense*, *Myagrum rugosum*, *Lepidium virginicum*, *Coronopus*
- 5 *didymus*; Dinebra weeds: *Dinebra Americana*, *Dinebra aquatic*, *Dinebra aristidoides*, *Dinebra bromoides*, *Dinebra calycina*, *Dinebra caudata*, *Dinebra chinensis*, *Dinebra chloride*, *Dinebra chondrosioides*, *Dinebra coerulescens*, *Dinebra cristata*, *Dinebra curtispindula*, *Dinebra decipiens*, *Dinebra divaricate*, *Dinebra divaricatissima*, *Dinebra dura*, *Dinebra guineensis*, *Dinebra hirsute*, *Dinebra hirta*, *Dinebra juncifolia*, *Dinebra*
- 10 *ligulata*, *Dinebra lima*, *Dinebra melicoides*, *Dinebra nealleyi*, *Dinebra neesii*, *Dinebra panicea*, *Dinebra panicoides*, *Dinebra pubescens*, *Dinebra repens*, *Dinebra scabra*, *Dinebra secunda*, *Dinebra simoniana*, *Dinebra southwoodii*, *Dinebra squarrosa*, *Dinebra srilankensis*, *Dinebra tuaensis*, *Dinebra verticillate*, *Dinebra retroflexa*. *Dinebra haareri*, *Dinebra marquisensis*, *Dinebra perrieri*, *Dinebra polycarpha*, *Dinebra somalensis*
- 15 *Capparaceae* weeds: *Cleome affinis*; *Fabaceae* weeds: *Aeschynomene indica*, *Aeschynomene rudis*, *Sesbania exaltata*, *Cassia obtusifolia*, *Cassia occidentalis*, *Desmodium tortuosum*, *Desmodium adscendens*, *Trifolium repens*, *Pueraria lobata*, *Vicia angustifolia*, *Indigofera hirsuta*, *Indigofera truxillensis*, *Vigna sinensis*; *Oxalidaceae* weeds: *Oxalis corniculata*, *Oxalis stricta*, *Oxalis oxyptera*; *Geraniaceae* weeds: *Geranium carolinense*, *Erodium cicutarium*; *Euphorbiaceae* weeds: *Euphorbia helioscopia*, *Euphorbia maculata*, *Euphorbia humistrata*, *Euphorbia esula*, *Euphorbia heterophylla*, *Euphorbia brasiliensis*, *Acalypha australis*, *Croton glandulosus*, *Croton lobatus*, *Phyllanthus corcovadensis*, *Ricinus communis*; *Malvaceae* weeds: *Abutilon theophrasti*, *Sida rhombifolia*, *Sida cordifolia*, *Sida spinosa*, *Sida glaziovii*, *Sida santaremnensis*, *Hibiscus*
- 25 *trionum*, *Anoda cristata*, *Malvastrum coromandelianum*
- Sterculiaceae* weeds: *Waltheria indica*; *Violaceae* weeds: *Viola arvensis*, *Viola tricolor*; *Cucurbitaceae* weeds: *Sicyos angulatus*, *Echinocystis lobata*, *Momordica charantia*; *Lythraceae* weeds: *Lythrum salicaria*; *Apiaceae* weeds: *Hydrocotyle sibthorpioides*;
- 30 *Sapindaceae* weeds: *Cardiospermum halicacabum*; *Primulaceae* weeds: *Anagallis arvensis*; *Asclepiadaceae* weeds: *Asclepias syriaca*, *Ampelamus albidus*; *Rubiaceae* weeds: *Galium aparine*, *Galium spurium* var. *echinospermon*, *Spermacoce latifolia*, *Richardia brasiliensis*,

- Borreria alata; Convolvulaceae weeds: Ipomoea nil, Ipomoea hederacea, Ipomoea purpurea, Ipomoea hederacea var. integruscula, Ipomoea lacunosa, Ipomoea triloba, Ipomoea acuminata, Ipomoea hederifolia, Ipomoea coccinea, Ipomoea quamoclit, Ipomoea grandifolia, Ipomoea aristolochiaefolia, Ipomoea cairica, Convolvulus arvensis, Calystegia
- 5 hederacea, Calystegia japonica, Merremia hedeacea, Merremia aegyptia, Merremia cissoides, Jacquemontia tamnifolia; Boraginaceae weeds: Myosotis arvensis; Lamiaceae weeds: Lamium purpureum, Lamium amplexicaule, Leonotis nepetaefolia, Hyptis suaveolens, Hyptis lophanta, Leonurus sibiricus, Stachys arvensis; Solanaceae weeds:
- 10 Datura stramonium, Solanum nigrum, Solanum americanum, Solanum ptycanthum, Solanum sarrachoides, Solanum rostratum, Solanum aculeatissimum, Solanum sisymbriifolium, Solanum carolinense, Physalis angulata, Physalis subglabrata, Nicandra physaloides; Scrophulariaceae weeds: Veronica hederaefolia, Veronica persica, Veronica arvensis; Plantaginaceae weeds: Plantago asiatica; Asteraceae weeds: Xanthium pensylvanicum, Xanthium occidentale, Helianthus annuus, Matricaria chamomilla,
- 15 Matricaria perforata, Chrysanthemum segetum, Matricaria matricarioides, Artemisia princeps, Artemisia vulgaris, Artemisia verlotorum, solidago altissima, Taraxacum officinale, Galinsoga ciliata, Galinsoga parviflora, Senecio vulgaris, Senecio brasiliensis, Senecio grisebachii, Conyza bonariensis, Conyza canadensis, Ambrosia artemisiaefolia, Ambrosia trifida, Bidens pilosa, Bidens frondosa, Bidens subalternans, Cirsium arvense,
- 20 Cirsium vulgare, Silybum marianum, Carduus nutans, Lactuca serriola, Sonchus oleraceus, Sonchus asper, Wedelia glauca, Melampodium perfoliatum, Emilia sonchifolia, Tagetes minuta, Blainvillea latifolia, Tridax procumbens, Porophyllum ruderales, Acanthospermum australe, Acanthospermum hispidum, Cardiospermum halicacabum, Ageratum conyzoides, Eupatorium perfoliatum, Eclipta alba, Erechtites hieracifolia, Gamochaeta spicata,
- 25 Gnaphalium spicatum, Jaegeria hirta, Parthenium hysterophorus, Siegesbeckia orientalis, Soliva sessilis; Liliaceae weeds: Allium canadense, Allium vineale; Commelinaceae weeds: Commelina communis, Commelina bengharensis, Commelina erecta; Poaceae weeds: Echinochloa crus-galli, Setaria viridis, Setaria faberi, Setaria glauca, Setaria geniculata, Digitaria ciliaris, Digitaria sanguinalis, Digitaria horizontalis, Digitaria
- 30 insularis, Eleusine indica, Poa annua, Alopecurus aequalis, Alopecurus myosuroides, Avena fatua, Sorghum halepense, Sorghum vulgare, Agropyron repens, Lolium multiflorum, Lolium perenne, Lolium rigidum, Bromus secalinus, Bromus tectorum,

Hordeum jubatum, Aegilops cylindrica, Phalaris arundinacea, Phalaris minor, Apera spica-
venti, Panicum dichotomiflorum, Panicum texanum, Panicum maximum, Brachiaria
platyphylla, Brachiaria ruziziensis, Brachiaria plantaginea, Brachiaria decumbens,
Brachiaria brizantha, Brachiaria humidicola, Cenchrus echinatus, Cenchrus pauciflorus,
5 Eriochloa villosa, Pennisetum setosum, Chloris gayana, Eragrostis pilosa, Rhynchelitrum
repens, Dactyloctenium aegyptium, Ischaemum rugosum, Oryza sativa, Paspalum notatum,
Paspalum maritimum, Pennisetum clandestinum, Pennisetum setosum, Rottboellia
cochinchinensis; Cyperaceae weeds: Cyperus microiria, Cyperus iria, Cyperus odoratus,
Cyperus rotundus, Cyperus esculentus, Kyllinga gracillima, Equisetaceae weeds:
10 Equisetum arvense, Equisetum palustre, Trianthema weeds and the like.

In an embodiment, the individual components of the combination of the present invention
may be applied to the locus either simultaneously or sequentially, such that sulfentrazone,
a photosystem II inhibitor herbicide and either a ALS inhibitor herbicide selected from
15 imidazolinone herbicides or a bleacher herbicide may be applied in a tank mix or as a pre-
mixed composition.

In an embodiment, combination of the present invention may be applied either pre-or post-
emergent. In a preferred embodiment, the combination of the present invention may be used
20 pre-emergent, and pre-plant. The advantage of the combination is surprisingly good
residual effects, and quick burndown of the weeds when applied pre-plant or pre-emergent,
and of course, a synergistic complementation between the herbicides of the combination.

The method of control of the present invention may be carried out by spraying the suggested
25 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.

In an embodiment the present invention provides a kit-of-parts comprising:

- a) a first container comprising sulfentrazone;
- 30 b) a second container comprising a photosystem II inhibitor herbicide and a ALS
inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide
- c) an instruction manual instructing an user to admix the contents of two containers.

In an embodiment, the components of the present invention may be packaged such that sulfentrazone, a photosystem II inhibitor herbicide and either a ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide may be packaged separately
5 and then tank mixed before the spraying.

In another embodiment, the components of the present invention may be packaged such that sulfentrazone, a photosystem II inhibitor herbicide and either a ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide may be packaged
10 separately, whereas other additives are packaged separately, such that the two maybe tank mixed at the time of spraying.

In another embodiment, the components of the present invention may be packaged as composition such that the photosystem II inhibitor herbicide and the either a ALS inhibitor
15 herbicide selected from imidazolinone herbicides or a bleacher herbicide are formulated into one composition and other additives and sulfentrazone is packaged separately, such that the two maybe tank mixed at the time of spraying.

Therefore, in another aspect, the present invention provides a composition comprising
20 sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide, and at least one agrochemically acceptable excipient.

In an embodiment, the composition of the present invention may contain agriculturally
25 acceptable excipient/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
30 also be provided as a pre-mix or tank mixes.

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
5 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
10 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 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;
15 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
20 in certain embodiments, methyl esters.

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,
25 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
30 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.

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Solid carriers that may be employed in the compositions of the present invention may include but are not limited to attapulgite, pyrophyllite clay, silica, kaolin clay, kieselguhr, chalk, diatomaceous earth, lime, calcium carbonate, bentonite clay, Fuller's earth, talc, cottonseed hulls, wheat flour, soybean flour, pumice, wood flour, walnut shell flour, lignin, cellulose etc.

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Thus, in another aspect, the present invention provides a method of controlling weeds at a locus, said method comprising applying a composition comprising sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide and at least one agrochemically acceptable excipient.

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In an aspect, the present invention provides a method of improving yield of the crop grown at a locus, said method comprising applying a composition comprising sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide and at least one agrochemically acceptable excipient.

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In an aspect, the present invention provides, methods of improving plant health, said method comprising applying a composition comprising sulfentrazone, at least one photosystem II inhibitor herbicide and either at least one ALS inhibitor herbicide selected from imidazolinone herbicides or at least one bleacher herbicide and at least one agrochemically acceptable excipient at the locus of the plant.

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Surprisingly, it has been found by the present inventors that sulfentrazone, a photosystem II inhibitor herbicide and either a ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide when applied individually, was ineffective in the control

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- of weeds, but demonstrated excellent synergistic control on weeds when applied together. The combination controlled the weed both pre and post emergently. The combination of sulfentrazone, a photosystem II inhibitor herbicide and either a ALS inhibitor herbicide selected from imidazolinone herbicides or a bleacher herbicide was found to efficiently control broadleaf weeds, sedges, and grasses a locus. The current invention therefore provides advantageous methods of controlling weeds both pre and post emergently. The present method also provides a broader spectrum of controlling weeds that helps in resistance management, thus preventing the weed from becoming resistant to either of the herbicides whilst providing a broader spectrum of control at lower use rates.

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Example 1:

	Dosage	% control of <i>Greenfox tail in Soybean</i>					
		14DAA		28 DAA		45 DAA	
Active	Rate Unit	Expected	Actual	Expected	Actual	Expected	Actual
Untreated	-	-	0	-	0	-	0
Clomazone	32 Fl oz/A	-	85	-	56.7	-	32.9
Metribuzin	12 Fl oz/A	-	63.4	-	39.9	-	22.7
Sulfentrazone	7.7 Fl oz/A	-	68.5	-	46.6	-	29.7
Clomazone + Metribuzin + Sulfentrazone	32 + 7.7 + 12 Fl oz/A	67.43	99	83.42	98.7	65.57	98.1
Observed – Expected efficacy		31.57		15.28		32.53	

- Conclusion:** From the above table it is evident that the triple combination is not only effective and synergistic in controlling the Greenfox tail weed but also persistence in providing the control for longer duration of time.

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Example 2:

	Dosage	% control of <i>Palmer amaranth in Soybean</i>					
		14DAA		28 DAA		45 DAA	
Active	Rate Unit	Expected	Actual	Expected	Actual	Expected	Actual

Untreated	-	-	0	-	0	-	0
Clomazone	32 Fl oz/A	-	60	-	43.3	-	16.4
Metribuzin	12 Fl oz/A	-	65	-	50	-	36.1
Sulfentrazone	7.7 Fl oz/A	-	80	-	62	-	39.4
Clomazone + Metribuzin + Sulfentrazone	32 + 7.7 + 12 Fl oz/A	86.28	98.7	93	98.5	77	98.1
Observed – Expected efficacy		12.42		5.5		21.1	

Conclusion: From the above table it is evident that the triple combination is not only effective and synergistic in controlling the Palmer amaranth weed but also persistence in providing the control for longer duration of time.

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Example 3:

		% control of <i>Tall morning glory</i> in Soybean					
	Dosage	14DAA		28 DAA		45 DAA	
Active	Rate Unit	Expected	Actual	Expected	Actual	Expected	Actual
Untreated	-	-	0	-	0	-	0
Clomazone	32 Fl oz/A	-	53.3	-	30	-	13
Metribuzin	12 Fl oz/A	-	53.3	-	39.6	-	16.4
Sulfentrazone	7.7 Fl oz/A	-	66.7	-	42.8	-	22.5
Clomazone + Metribuzin + Sulfentrazone	32 + 7.7 + 12 Fl oz/A	90	92.7	82.42	91	46.32	89.4
Observed – Expected efficacy		2.7		8.58		43.08	

Conclusion: From the above table it is evident that the triple combination is not only effective and synergistic in controlling the Tall morning glory weed but also persistence in providing the control for longer duration of time.

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CLAIMS

1. A herbicidal combination comprising:
 - 5 (a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
 - (b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin
10 and their salts and esters; and
 - (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from
15 aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.
- 20 2. The combination as claimed in claim 1 comprises (a) sulfentrazone; (b) an photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and (c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr,
25 imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.
- 30 3. The combination as claimed in claim 1 comprises a) sulfentrazone; (b) metribuzin; and (c) at least one ALS inhibitor herbicide selected from imidazolinone herbicide

selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters.

4. The combination as claimed in claim 1 comprises a) sulfentrazone; (b) metribuzin;
5 and (c) at least one bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.
- 10 5. A herbicidal combination comprising
- i. a) sulfentrazone; (b) metribuzin; and (c) diflufenican;
 - ii. a) sulfentrazone; (b) metribuzin; and (c) imazamox;
 - iii. a) sulfentrazone; (b) metribuzin; and (c) clomazone;
 - 15 iv. a) sulfentrazone; (b) hexazinone; and (c) isoxaflutole.;
6. A herbicidal composition comprising
- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone,
20 propoxycarbazone, sulfentrazone and thiencarbazone;
 - b) at least one photosystem II inhibitor herbicide selected from ametrifone, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
 - c) at least one ALS inhibitor herbicide selected from imidazolinone herbicide
25 selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone,
30 flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.
 - d) at least one agrochemically acceptable excipient.

7. The composition as claimed in claim 6 comprises
- a) sulfentrazone;
 - b) a photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
 - c) an ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.
8. A method of controlling weeds at a locus, wherein said method comprises applying to the locus, a combination comprising:
- a) at least one triazolone herbicide selected from the group consisting of amicarbazone, bencarbazone, carfentazone, flucarbazone, ipfencarbazone, propoxycarbazone, sulfentrazone and thiencarbazone;
 - b) at least one photosystem II inhibitor herbicide selected from ametridione, amibuzin, ethiozin, hexazinone, isomethiozin, Metamitron, metribuzin, trifludimoxazin and their salts and esters; and
 - c) at least one ALS inhibitor herbicide selected from imidazolinone herbicide selected from imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr and their salts and esters or a bleacher herbicide selected from aclonifen, clomazone, diflufenican, isoxaflutole, mesotrione, picolinafen, sulcotrione, tembotrione, topramezone, bicyclopyrone, amitrole, beflubutamid, benzobicyclon, benzofenap, fluridone, flurochloridone, flurtamone, isoxachlortole, norflurazon, pyrasulfotole, pyrazolynate, pyrazoxyfen and tefuryltrione.

9. A kit-of-parts comprising:

- a) a first container comprising sulfentrazone;
- b) a second container comprising a photosystem II inhibitor herbicide and a
ALS inhibitor herbicide selected from imidazolinone herbicides or a
bleacher herbicide
- c) an instruction manual instructing an user to admix the contents of two
containers.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2019/051794

A. CLASSIFICATION OF SUBJECT MATTER

**A01N 43/653 (2006.01) A01N 43/80 (2006.01) A01N 43/707 (2006.01) A01N 43/64 (2006.01) A01N 43/40 (2006.01)
A01N 43/50 (2006.01) A01P 13/00 (2006.01)**

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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

PATENW, REGISTRY, CAPLUS, AGRICOLA, BIOSIS, CABA, CROPU etc databases searched using registry marks, IPC/CPC Marks and keywords {A01N43/64, +CARBAZONE, HERBICIDE etc} covering the full scope of the claims. Applicant and inventor search carried out in Espace and Google Scholar.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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

☒ Further documents are listed in the continuation of Box C ☒ See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 8 May 2019		Date of mailing of the international search report 08 May 2019	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Ravi Ananthkrishnan AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262850744	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/IB2019/051794
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015/044150 A2 (BASF AGROCHEMICAL PRODUCTS B.V. ET AL) 02 April 2015 See Claims 1 & 5; Table 2, Page 19; Lines 28-39; Page 8. Formulations 7-11, Page 15	1-9
X	Vangessel M.J. "Control of Perennial Weed Species As Seedlings With Soil-Applied Herbicides," Weed Technology, 1999, Volume 13:425-428. See Abstract; Table 1, Page 426	1-9
X	Loyd M. Wax et al; "Weed Control In Reduced Tillage And Chemical Fallow Soybean" Research Report North Central Weed Scientific Society, 1995, Vol. 52, Pages 408-09. See Para 1, Page 408; Table, Page 409.	1-9
X	Yenish J P. et al; "Weed Control In Dry Pea (<i>Pisum sativum</i>) Under Conventional And No-Tillage Systems," Weed Technology 2002, Volume 16:88-95 See Abstract; Tables 2 & 3, Page 91	1-9
X	Schmidt L. A. et al; "Management of Acetolactate Synthase (ALS)-Resistant Common Cocklebur (<i>Xanthium Strumarium</i>)in Soybean, Weed Technology, 2004, Volume 18:665-674 See Abstract; Tables 2 & 3, Page 91	1-9
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P,X	WO 2019/030097 A2 (BASF SE) 14 February 2019 See Example 559	1, 2, 8 & 9

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/IB2019/051794	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
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		ZA 201109049 B	29 May 2013
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End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(revised January 2019)			