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(72) Inventeurs/Inventors:
DEPREZ, NICHOLAS RYAN, US;
SHARPE, PAULA LOUISE, US;
REDDY, RAVISEKHARA POCHIMIREDDY, IN;
DEBERGH, JOHN ROBBINS, US

(73) Propriétaire/Owner:
FMC CORPORATION, US

(74) Agent: TORYS LLP

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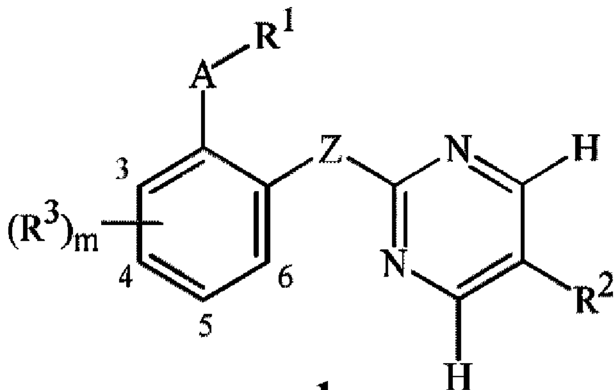

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(57) Abrégé/Abstract:
Disclosed are compounds of Formula (1), including all stereoisomers, N-oxides, and salts thereof, wherein A, Z, R^1, R^2, R^3 and m are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula (1) and methods for controlling undesired vegetation comprising contacting the undesired vegetation or its environment with an effective amount of a compound or a composition of the invention.

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(71) Applicant: **E I DU PONT DE NEMOURS AND COMPANY** [US/US]; Chestnut Run Plaza, 974 Centre Road, P.O. Box 2915, Wilmington, Delaware 19805 (US).

(72) Inventors: **DEPREZ, Nicholas Ryan**; 3903 Cindy Drive, Newark, Delaware 19701 (US). **SHARPE, Paula Louise**; 14 Dunswell Drive, Middletown, Delaware 19709 (US). **REDDY, Ravisekhara Pochimireddy**; 502 Saibrundavan Apt, DLR Enclave, Madhavapuri Colony, Sainikpuri, Andhra Pradesh, Secunderabad 500094 (IN). **DEBERGH, John Robbins**; 409 Spring Hollow Drive, Middletown, Delaware 19709 (US).

(74) Agent: **COATS, Reed A.**; E.I. du Pont de Nemours and Company, Legal Patent Records Center, Chestnut Run Plaza 721/2340, 974 Centre Road, PO Box 2915, Wilmington, Delaware 19805 (US).

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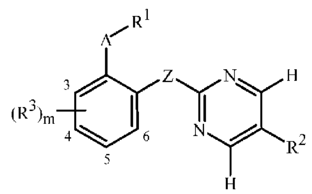
(54) **Title**: 2-(PHENYLOXY OR PHENYLTHIO)PYRIMIDINE DERIVATIVES AS HERBICIDES



(1)

(57) **Abstract**: Disclosed are compounds of Formula (1), including all stereoisomers, *N*-oxides, and salts thereof, wherein A, Z, R^1, R^2, R^3 and m are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula (1) and methods for controlling undesired vegetation comprising contacting the undesired vegetation or its environment with an effective amount of a compound or a composition of the invention.

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TITLE

2-(PHENYLOXY OR PHENYLTHIO)PYRIMIDINE DERIVATIVES AS HERBICIDES

FIELD OF THE INVENTION

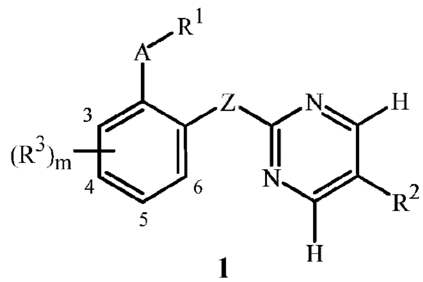
This invention relates to certain pyrimidinyloxy benzene derivatives, their *N*-oxides, salts and compositions, and methods of their use for controlling undesirable vegetation.

BACKGROUND OF THE INVENTION

The control of undesired vegetation is extremely important in achieving high crop efficiency. Achievement of selective control of the growth of weeds especially in such useful crops as rice, soybean, sugar beet, maize, potato, wheat, barley, tomato and plantation crops, among others, is very desirable. Unchecked weed growth in such useful crops can cause significant reduction in productivity and thereby result in increased costs to the consumer. The control of undesired vegetation in noncrop areas is also important. Many products are commercially available for these purposes, but the need continues for new compounds that are more effective, less costly, less toxic, environmentally safer or have different sites of action.

SUMMARY OF THE INVENTION

This invention is directed to compounds of Formula 1 (including all all geometric and stereoisomers), *N*-oxides, and salts thereof, agricultural compositions containing them and their use as herbicides:



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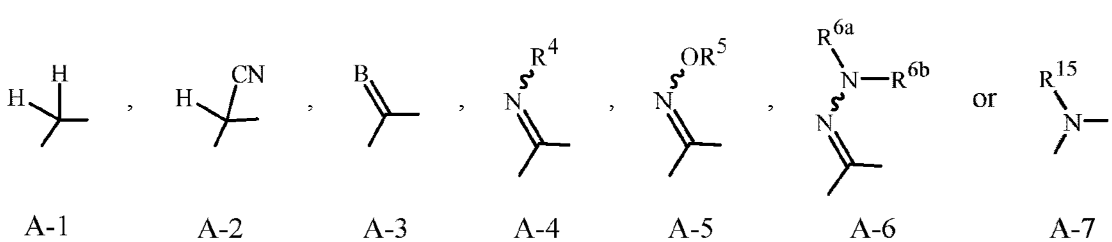
wherein

A is;



B is O or S;

R^1 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_6 halocycloalkylalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_3–C_6 cycloamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkenylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl, C_2–C_6 haloalkylthioalkyl, benzyl, -N(R^7)(OR^8), -ON(R^{9a})(R^{9b}) or -N(R^7)N(R^{9a})(R^{9b});

Z is O or S;

R^2 is halogen, cyano, nitro, C_1–C_6 alkoxy, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 cycloalkyl or -SO_nR^{10};

each R^3 is independently halogen, cyano, nitro, CHO, C(=O)NH_2, C(=S)NH_2, SO_2NH_2, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_3–C_7 cycloalkylcarbonyl, C_2–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_2–C_4 alkylthioalkyl, -C(=O)N(R^{11a})(R^{11b}), -C(=NOR^{12})H, -C(=N(R^{13}))H or -SO_nR^{14};

m is 0, 1, 2 or 3;

each n is independently 0, 1 or 2;

R^4 is H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 haloalkylthioalkyl or benzyl;

each R^{6a} and R^{6b} is independently H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^7 is H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^8 is H, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl or C_2–C_6 cyanoalkyl;

each R^{9a} and R^{9b} is independently H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^{10} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino;

each R^{11a} is independently C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{11b} is independently H, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{12} is independently H or C_1–C_4 alkyl;

each R^{13} is independently H, amino, C_1–C_4 alkyl or C_1–C_4 alkylamino;

each R^{14} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino; and

R^{15} is H or C_1–C_6 alkyl;

provided that

(i) when A is A-1 then R^1 is other than H, C_1–C_6 alkyl or C_2–C_6 alkenyl;

(ii) when A is A-6, then R^1 is other than C_1–C_6 alkylsulfonyl;

(iii) when A is A-1, R^2 is Cl and R^3 is 3-Br, then R^1 is other than C_2 alkylthio, C_2 alkylsulfinyl or C_2 alkylsulfonyl; and

(iv) the compound of Formula **1** is other than methyl 2-[(5-chloro-2-pyrimidinyl)oxy]benzoate (CAS Registry No. 854215-38-6), methyl 2-[(5-bromo-2-pyrimidinyl)oxy]benzoate (CAS Registry No. 1086397-52-5), 1-[2-[(5-bromo-2-pyrimidinyl)oxy]phenyl]-ethanone (CAS Registry No. 1147704-06-0) and 2-[(5-bromo-2-pyrimidinyl)oxy]-benzeneacetonitrile (CAS Registry No. 138193-83-6).

More particularly, this invention pertains to a compound of Formula **1** (including all stereoisomers), an *N*-oxide or a salt thereof. This invention also relates to a herbicidal composition comprising a compound of the invention (i.e. in a herbicidally effective amount) and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents. This invention further relates to a method for controlling the growth of undesired vegetation comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of the invention (e.g., as a composition described herein).

This invention also includes a herbicidal mixture comprising (a) a compound selected from Formula **1**, *N*-oxides, and salts thereof, and (b) at least one additional active ingredient selected from (b1) through (b16); and salts of compounds of (b1) through (b16), as described below.

DETAILS OF THE INVENTION

As used herein, the terms "comprises," "comprising," "includes," "including," "has," "having," "contains", "containing," "characterized by" or any other variation thereof, are intended to cover a non-exclusive inclusion, subject to any limitation explicitly indicated. For example, a composition, mixture, process or method that comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such composition, mixture, process or method.

The transitional phrase "consisting of" excludes any element, step, or ingredient not specified. If in the claim, such would close the claim to the inclusion of materials other than those recited except for impurities ordinarily associated therewith. When the phrase "consisting of" appears in a clause of the body of a claim, rather than immediately following the preamble, it limits only the element set forth in that clause; other elements are not excluded from the claim as a whole.

The transitional phrase "consisting essentially of" is used to define a composition or method that includes materials, steps, features, components, or elements, in addition to those literally disclosed, provided that these additional materials, steps, features, components, or elements do not materially affect the basic and novel characteristic(s) of the claimed invention. The term "consisting essentially of" occupies a middle ground between "comprising" and "consisting of".

Where applicants have defined an invention or a portion thereof with an open-ended term such as "comprising," it should be readily understood that (unless otherwise stated) the description should be interpreted to also describe such an invention using the terms "consisting essentially of" or "consisting of."

Further, unless expressly stated to the contrary, "or" refers to an inclusive or and not to an exclusive or. For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

Also, the indefinite articles "a" and "an" preceding an element or component of the invention are intended to be nonrestrictive regarding the number of instances (i.e. occurrences) of the element or component. Therefore "a" or "an" should be read to include one or at least one, and the singular word form of the element or component also includes the plural unless the number is obviously meant to be singular.

As referred to herein, the term "seedling", used either alone or in a combination of words means a young plant developing from the embryo of a seed.

As referred to herein, the term "broadleaf" used either alone or in words such as "broadleaf weed" means dicot or dicotyledon, a term used to describe a group of angiosperms characterized by embryos having two cotyledons.

In the above recitations, the term "alkyl", used either alone or in compound words such as "alkylthio" or "haloalkyl" includes straight-chain or branched alkyl, such as, methyl, ethyl, *n*-propyl, *i*-propyl, or the different butyl, pentyl or hexyl isomers. "Alkenyl" includes straight-chain or branched alkenes such as ethenyl, 1-propenyl, 2-propenyl, and the different butenyl, pentenyl and hexenyl isomers. "Alkenyl" also includes polyenes such as 1,2-propadienyl and 2,4-hexadienyl. "Alkynyl" includes straight-chain or branched alkynes such as ethynyl, 1-propynyl, 2-propynyl and the different butynyl, pentynyl and hexynyl isomers. "Alkynyl" can also include moieties comprised of multiple triple bonds such as 2,5-hexadiynyl.

"Alkoxy" includes, for example, methoxy, ethoxy, *n*-propyloxy, isopropyloxy and the different butoxy, pentoxy and hexyloxy isomers. "Alkoxyalkyl" denotes alkoxy substitution on alkyl. Examples of "alkoxyalkyl" include CH_3OCH_2, $CH_3OCH_2CH_2$, $CH_3CH_2OCH_2$, $CH_3CH_2CH_2CH_2OCH_2$ and $CH_3CH_2OCH_2CH_2$. "Alkoxyalkoxy" denotes alkoxy substitution on alkoxy. Examples of "alkoxyalkoxy" include CH_3OCH_2O, $(CH_3)_2CHOCH_2O$, $CH_3OCH_2CH_2O$ and $CH_3CH_2OCH_2CH_2CH_2O$. "Alkenyloxy" includes straight-chain or branched alkenyloxy moieties. Examples of "alkenyloxy" include $H_2C{=}CHCH_2O$, $(CH_3)_2C{=}CHCH_2O$, $(CH_3)CH{=}CHCH_2O$, $(CH_3)CH{=}C(CH_3)CH_2O$ and $CH_2{=}CHCH_2CH_2O$. "Alkynyloxy" includes straight-chain or branched alkynyloxy moieties. Examples of "alkynyloxy" include $HC{\equiv}CCH_2O$, $CH_3C{\equiv}CCH_2O$ and $CH_3C{\equiv}CCH_2CH_2O$. "Alkylthio" includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers. "Alkylsulfinyl" includes both enantiomers of an alkylsulfinyl group. Examples of "alkylsulfinyl" include $CH_3S(O)$-, $CH_3CH_2S(O)$-, $CH_3CH_2CH_2S(O)$-, $(CH_3)_2CHS(O)$- and the different butylsulfinyl, pentylsulfinyl and hexylsulfinyl isomers. Examples of "alkylsulfonyl" include $CH_3S(O)_2$-, $CH_3CH_2S(O)_2$-, $CH_3CH_2CH_2S(O)_2$-, $(CH_3)_2CHS(O)_2$-, and the different butylsulfonyl, pentylsulfonyl and hexylsulfonyl isomers. "Alkylthioalkyl" denotes alkylthio substitution on alkyl. Examples of "alkylthioalkyl" include CH_3SCH_2, $CH_3SCH_2CH_2$, $CH_3CH_2SCH_2$, $CH_3CH_2CH_2CH_2SCH_2$ and $CH_3CH_2SCH_2CH_2$. "Cyanoalkyl" denotes an alkyl group substituted with one cyano group. "Cyanoalkoxy" denotes an alkoxy group substituted with one cyano group. "Cyanoalkoxyalkyl" denotes an alkoxyalkyl group substituted with one cyano group. Examples of "cyanoalkyl" include $NCCH_2$, $NCCH_2CH_2$ and $CH_3CH(CN)CH_2$. The term "hydroxyalkyl" denotes an alkyl group substituted with one hydroxy group. Examples of "hydroxyoalkyl" include $HOCH_2$-, $HOCH_2CH_2$- and $CH_3CH(OH)CH_2$-. The term "nitroalkyl" denotes an alkyl group substituted with one nitro group. Examples of "nitroalkyl" include O_2NCH_2-, $O_2NCH_2CH_2$- and $CH_3CH(NO_2)CH_2$-. "Alkylamino", "dialkylamino", "alkenylthio", "alkenylsulfinyl", "alkenylsulfonyl", "alkynylthio", "alkynylsulfinyl", "alkynylsulfonyl", and the like, are defined analogously to the above examples.

"Cycloalkyl" includes, for example, cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. The term "alkylcycloalkyl" denotes alkyl substitution on a cycloalkyl moiety and includes, for example, ethylcyclopropyl, *i*-propylcyclobutyl, 3-methylcyclopentyl and 4-methylcyclohexyl. The term "cycloalkylalkyl" denotes cycloalkyl substitution on an alkyl moiety. Examples of "cycloalkylalkyl" include cyclopropylmethyl, cyclopentylethyl, and other cycloalkyl moieties bonded to straight-chain or branched alkyl groups. The term "cycloalkylalkoxy" denotes cycloalkyl substitution on an alkoxy moiety. The term "cycloalkylcarbonyl" denotes cycloalkyl substitution bonded through a carbonyl moiety. Examples of "cycloalkylcarbonyl" include *c*-Pr(C=O)-, cyclopentyl(C=O)-. The term "cycloalkylsulfonyl" denotes cycloalkyl substitution bonded through a sulfonyl moiety. Examples of "cycloalkylsulfonyl" include *c*-Pr(S=O_2)-, cyclopentyl(S=O_2)-. The term "cycloalkylthio" denotes cycloalkyl substitution bonded through a sulfer atom. Examples of "cycloalkylthio" include *c*-Pr(S)-, cyclopenty(S)-. Examples of "cycloalkylalkoxy" include cyclopropylmethoxy, cyclopentylethoxy. The term "cycloalkoxy" denotes cycloalkyl linked through an oxygen atom such as cyclopentyloxy and cyclohexyloxy. The term "cycloamino" denotes a cyclic amine moiety bonded through nitrogen. Examples of "cycloamino" include -N[$CH_2CH_2CH_2$] (i.e. azetidine) and -N[$CH_2CH_2CH_2CH_2$], (i.e. pyrrolidine).

The term "halogen", either alone or in compound words such as "haloalkyl", or when used in descriptions such as "alkyl substituted with halogen" includes fluorine, chlorine, bromine or iodine. Further, when used in compound words such as "haloalkyl", or when used in descriptions such as "alkyl substituted with halogen" said alkyl may be partially or fully substituted with halogen atoms which may be the same or different. Examples of "haloalkyl" or "alkyl substituted with halogen" include F_3C, $ClCH_2$, CF_3CH_2 and CF_3CCl_2. The terms "halocycloalkyl", "haloalkoxy", "haloalkylthio", "haloalkylsulfinyl", "haloalkylsulfonyl", "haloalkenyl", "haloalkynyl", "haloalkoxyalkoxy", "alkoxyhaloalkyl" and the like, are defined analogously to the term "haloalkyl". Examples of halocycloalkyl include *c*-Pr(2-Cl), *c*-Bu(2,2-di-Br) and *c*-Hex(3,5-di-Cl). Examples of "haloalkoxy" include CF_3O-, CCl_3CH_2O-, $HCF_2CH_2CH_2O$- and CF_3CH_2O-. Examples of "haloalkylthio" include CCl_3S-, CF_3S-, CCl_3CH_2S- and $ClCH_2CH_2CH_2S$-. Examples of "haloalkylsulfinyl" include $CF_3S(O)$-, $CCl_3S(O)$-, $CF_3CH_2S(O)$- and $CF_3CF_2S(O)$-. Examples of "haloalkylsulfonyl" include $CF_3S(O)_2$-, $CCl_3S(O)_2$-, $CF_3CH_2S(O)_2$- and $CF_3CF_2S(O)_2$-. Examples of "haloalkenyl" include $(Cl)_2C{=}CHCH_2$- and $CF_3CH_2CH{=}CHCH_2$-. Examples of "haloalkynyl" include $HC{\equiv}CCHCl$-, $CF_3C{\equiv}C$-, $CCl_3C{\equiv}C$- and $FCH_2C{\equiv}CCH_2$-. Examples of "haloalkoxyalkoxy" include CF_3OCH_2O-, $ClCH_2CH_2OCH_2CH_2O$-, $Cl_3CCH_2OCH_2O$- as well as branched alkyl derivatives.

Examples of "alkoxyhaloalkyl" include $CH_3OCF_2CH_2$-, $CH_3CH_2OCH_2CCl_2$-, $CF_3CH_2CH_2OCH_2$- as well as branched alkyl derivatives.

The term "haloalkenyloxy" refers to a haloalkenyl group bonded through oxygen. Examples of "haloalkenyloxy" include $(Cl)_2C{=}CHCH_2O$- and $CF_3CH_2CH{=}CHCH_2O$-. The term "haloalkylamino" refers to a haloalkyl group bonded through a nitrogen atom (i.e. as a secondary amine). Examples of "haloalkylamino" include CF_3NH-, CCl_3CH_2NH-, $HCF_2CH_2CH_2NH$- and CF_3CH_2NH-. The term "haloalkylcarbonyl" refers to a haloalkyl group bonded through a carbonyl moiety. Examples of "haloalkylcarbonyl" include $CH_2ClC({=}O)$-, $CH_3CHClCH_2C({=}O)$- and $(CH_3)_2CCl({=}O)$-. The term "haloalkylthioalkyl" refers to a haloalkylthio group bonded through an alkyl moiety. Examples of "haloalkylthioalkyl" include CCl_3SCH_2-, CF_3SCH_2-, $CCl_3CH_2SCH_2$- and $ClCH_2CH_2CH_2SCH_2$-. The term "haloalkynyloxy" refers to a haloalkynyl group bonded through an oxygen atom. Examples of "haloalkynyloxy" include $HC{\equiv}CCHClO$-, $CF_3C{\equiv}CO$-, $CCl_3C{\equiv}CO$- and $FCH_2C{\equiv}CCH_2O$- haloalkynyloxy. The term "haloalkoxyalkyl" refers to a haloalkoxy group bonded through an alkyl moiety. Examples of "haloalkoxyalkyl" include CF_3OCH_2-, $ClCH_2CH_2OCH_2CH_2$-, $Cl_3CCH_2OCH_2$- as well as branched alkyl derivatives. The term "halocycloalkoxy" refers to a halocycloalkyl group bonded through an oxygenatom. Examples of "halocycloalkoxy" include *c*-Pr(2-Cl) CH_2O- and *c*-Bu(1-Cl) CH_2CH_2O-. The term "halodialkylamino" indicate two haloalkyl groups bonded through nitrogen. Examples of "halodialkylamino" include $(CH_2Cl)_2N$-, $(CH_2CH_2Cl)_2N$- and $(CH_2CH_2Cl)(CH_2Br)N$-.

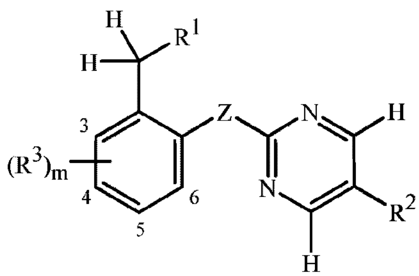
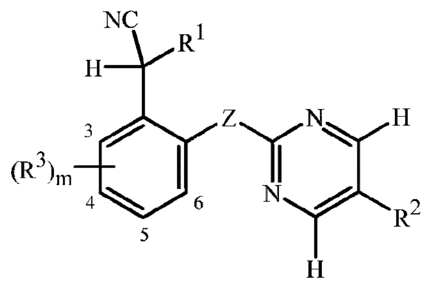
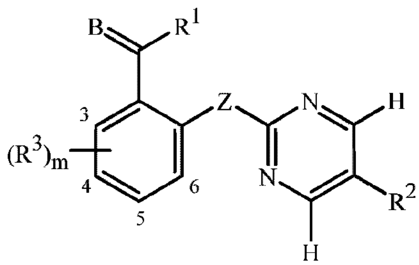
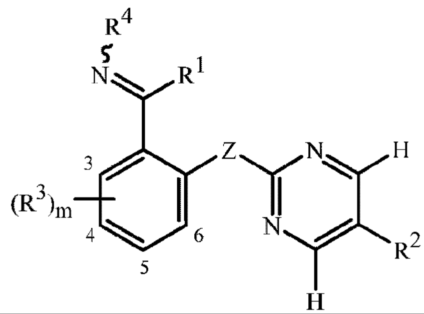
"Alkylcarbonyl" denotes a straight-chain or branched alkyl moieties bonded to a C(=O) moiety. Examples of "alkylcarbonyl" include $CH_3C({=}O)$-, $CH_3CH_2CH_2C({=}O)$- and $(CH_3)_2CHC({=}O)$-. Examples of "alkoxycarbonyl" include $CH_3OC({=}O)$-, $CH_3CH_2OC({=}O)$-, $CH_3CH_2CH_2OC({=}O)$-, $(CH_3)_2CHOC({=}O)$- and the different butoxy- or pentoxycarbonyl isomers. Examples of "alkylcarbonyloxy" incude $CH_3C({=}O)O$-, $CH_3CH_2CH_2C({=}O)O$- and $(CH_3)_2CHC({=}O)O$-

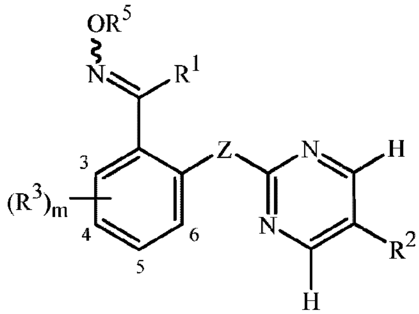
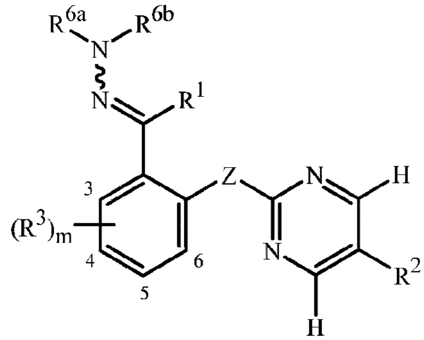
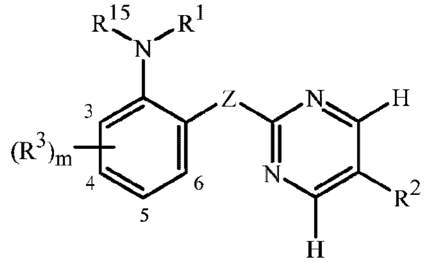
The total number of carbon atoms in a substituent group is indicated by the "C_i–C_j" prefix where i and j are numbers from 1 to 10. For example, C_1-C_4 alkylsulfonyl designates methylsulfonyl through butylsulfonyl; C_2 alkoxyalkyl designates CH_3OCH_2-; C_3 alkoxyalkyl designates, for example, $CH_3CH(OCH_3)$-, $CH_3OCH_2CH_2$- or $CH_3CH_2OCH_2$-; and C_4 alkoxyalkyl designates the various isomers of an alkyl group substituted with an alkoxy group containing a total of four carbon atoms, examples including $CH_3CH_2CH_2OCH_2$- and $CH_3CH_2OCH_2CH_2$-.

When a compound is substituted with a substituent bearing a subscript that indicates the number of said substituents can exceed 1, said substituents (when they exceed 1) are independently selected from the group of defined substituents, e.g., $(R^3)_m$, where m is 0, 1, 2 or 3). Further, when the subscript indicates a range, e.g. $(R)_{i-j}$, then the number of substituents may be selected from the integers between i and j inclusive. When a group contains a substituent which can be hydrogen, for example (R^1 or R^4), then when this substituent is taken as hydrogen, it is recognized that this is equivalent to said group being unsubstituted. When a variable group is shown to be optionally attached to a position, for example $(R^3)_m$ wherein m may be 0, then hydrogen may be at the position even if not recited in the variable group definition. When one or more positions on a group are said to be "not substituted" or "unsubstituted", then hydrogen atoms are attached to take up any free valency.

Unless otherwise indicated, a "ring" or "ring system" as a component of Formula **1** is carbocyclic or heterocyclic. The term "ring system" denotes two or more fused rings. The term "ring member" refers to an atom or other moiety (e.g., C(=O), C(=S), S(O) or $S(O)_2$) forming the backbone of a ring or ring system.

A compound of Formula **1** in the Summary of the Invention can alternatively be represented by the following:

	
1-A-1	**1-A-2**
	
1-A-3	**1-A-4**

	
1-A-5	**1-A-6**
	
and	**1-A-7**

The terms “carbocyclic ring”, “carbocycle” or “carbocyclic ring system” denote a ring or ring system wherein the atoms forming the ring backbone are selected only from carbon. Unless otherwise indicated, a carbocyclic ring can be a saturated, partially unsaturated, or fully unsaturated ring. When a fully unsaturated carbocyclic ring satisfies Hückel’s rule, then said ring is also called an “aromatic ring”. “Saturated carbocyclic” refers to a ring having a backbone consisting of carbon atoms linked to one another by single bonds; unless otherwise specified, the remaining carbon valences are occupied by hydrogen atoms.

The terms “heterocyclic ring”, “heterocycle” or “heterocyclic ring system” denote a ring or ring system in which at least one atom forming the ring backbone is not carbon, e.g., nitrogen, oxygen or sulfur. Typically a heterocyclic ring contains no more than 4 nitrogens, no more than 2 oxygens and no more than 2 sulfurs. Unless otherwise indicated, a heterocyclic ring can be a saturated, partially unsaturated, or fully unsaturated ring. When a fully unsaturated heterocyclic ring satisfies Hückel’s rule, then said ring is also called a “heteroaromatic ring” or “aromatic heterocyclic ring”. Unless otherwise indicated, heterocyclic rings and ring systems can be attached through any available carbon or nitrogen by replacement of a hydrogen on said carbon or nitrogen.

“Aromatic” indicates that each of the ring atoms is essentially in the same plane and has a *p*-orbital perpendicular to the ring plane, and that $(4n + 2)$ π electrons, where n is a positive integer, are associated with the ring to comply with Hückel’s rule. The term "aromatic ring system" denotes a carbocyclic or heterocyclic ring system in which at least one ring of the ring system is aromatic. The term "aromatic carbocyclic ring system" denotes a carbocyclic ring system in which at least one ring of the ring system is aromatic. The term "aromatic heterocyclic ring system" denotes a heterocyclic ring system in which at least one ring of the ring system is aromatic. The term "nonaromatic ring system" denotes a carbocyclic or heterocyclic ring system that may be fully saturated, as well as partially or fully unsaturated, provided that none of the rings in the ring system are aromatic. The term "nonaromatic carbocyclic ring system" in which no ring in the ring system is aromatic. The term "nonaromatic heterocyclic ring system" denotes a heterocyclic ring system in which no ring in the ring system is aromatic.

The term "optionally substituted" in connection with the heterocyclic rings refers to groups which are unsubstituted or have at least one non-hydrogen substituent that does not extinguish the biological activity possessed by the unsubstituted analog. As used herein, the following definitions shall apply unless otherwise indicated. The term "optionally substituted" is used interchangeably with the phrase "substituted or unsubstituted" or with the term "(un)substituted." Unless otherwise indicated, an optionally substituted group may have a substituent at each substitutable position of the group, and each substitution is independent of the other.

A wide variety of synthetic methods are known in the art to enable preparation of aromatic and nonaromatic heterocyclic rings and ring systems; for extensive reviews see the eight volume set of *Comprehensive Heterocyclic Chemistry*, A. R. Katritzky and C. W. Rees editors-in-chief, Pergamon Press, Oxford, 1984 and the twelve volume set of *Comprehensive Heterocyclic Chemistry II*, A. R. Katritzky, C. W. Rees and E. F. V. Scriven editors-in-chief, Pergamon Press, Oxford, 1996.

Compounds of this invention can exist as one or more stereoisomers. The various stereoisomers include enantiomers, diastereomers, atropisomers and geometric isomers. Stereoisomers are isomers of identical constitution but differing in the arrangement of their atoms in space and include enantiomers, diastereomers, cis-trans isomers (also known as geometric isomers) and atropisomers. Atropisomers result from restricted rotation about single bonds where the rotational barrier is high enough to permit isolation of the isomeric species. One skilled in the art will appreciate that one stereoisomer may be more active and/or may exhibit beneficial effects when enriched relative to the other stereoisomer(s) or when separated from the other stereoisomer(s). Additionally, the skilled artisan knows how to separate, enrich, and/or to selectively prepare said stereoisomers. The compounds of the invention may be present as a mixture of stereoisomers, individual stereoisomers or as an optically active form. For a comprehensive discussion of all aspects of stereoisomerism, see Ernest L. Eliel and Samuel H. Wilen, *Stereochemistry of Organic Compounds*, John Wiley & Sons, 1994.

Compounds of this invention can exist as one or more conformational isomers due to restricted rotation about the amide bond (e.g., C(=A)–R^1 wherein R^1 is alkylamino) in Formula **1**. This invention comprises mixtures of conformational isomers. In addition, this invention includes compounds that are enriched in one conformer relative to others.

Compounds of Formula **1** typically exist in more than one form, and Formula **1** thus include all crystalline and non-crystalline forms of the compounds they represent. Non-crystalline forms include embodiments which are solids such as waxes and gums as well as embodiments which are liquids such as solutions and melts. Crystalline forms include embodiments which represent essentially a single crystal type and embodiments which represent a mixture of polymorphs (i.e. different crystalline types). The term "polymorph" refers to a particular crystalline form of a chemical compound that can crystallize in different crystalline forms, these forms having different arrangements and/or conformations of the molecules in the crystal lattice. Although polymorphs can have the same chemical composition, they can also differ in composition due the presence or absence of co-crystallized water or other molecules, which can be weakly or strongly bound in the lattice. Polymorphs can differ in such chemical, physical and biological properties as crystal shape, density, hardness, color, chemical stability, melting point, hygroscopicity, suspensibility, dissolution rate and biological availability. One skilled in the art will appreciate that a polymorph of a compound of Formula **1** can exhibit beneficial effects (e.g., suitability for preparation of useful formulations, improved biological performance) relative to another polymorph or a mixture of polymorphs of the same compound of Formula **1**. Preparation and isolation of a particular polymorph of a compound of Formula **1** can be achieved by methods known to those skilled in the art including, for example, crystallization using selected solvents and temperatures. For a comprehensive discussion of polymorphism see R. Hilfiker, Ed., *Polymorphism in the Pharmaceutical Industry*, Wiley-VCH, Weinheim, 2006.

One skilled in the art will appreciate that not all nitrogen-containing heterocycles can form *N*-oxides since the nitrogen requires an available lone pair for oxidation to the oxide; one skilled in the art will recognize those nitrogen-containing heterocycles which can form *N*-oxides. One skilled in the art will also recognize that tertiary amines can form *N*-oxides. Synthetic methods for the preparation of *N*-oxides of heterocycles and tertiary amines are very well known by one skilled in the art including the oxidation of heterocycles and tertiary amines with peroxy acids such as peracetic and *m*-chloroperbenzoic acid (MCPBA), hydrogen peroxide, alkyl hydroperoxides such as *t*-butyl hydroperoxide, sodium perborate, and dioxiranes such as dimethyldioxirane. These methods for the preparation of *N*-oxides have been extensively described and reviewed in the literature, see for example: T. L. Gilchrist in *Comprehensive Organic Synthesis*, vol. 7, pp 748–750, S. V. Ley, Ed., Pergamon Press; M. Tisler and B. Stanovnik in *Comprehensive Heterocyclic Chemistry*, vol. 3, pp 18–20, A. J. Boulton and A. McKillop, Eds., Pergamon Press; M. R. Grimmett and

B. R. T. Keene in *Advances in Heterocyclic Chemistry*, vol. 43, pp 149–161, A. R. Katritzky, Ed., Academic Press; M. Tisler and B. Stanovnik in *Advances in Heterocyclic Chemistry*, vol. 9, pp 285–291, A. R. Katritzky and A. J. Boulton, Eds., Academic Press; and G. W. H. Cheeseman and E. S. G. Werstiuk in *Advances in Heterocyclic Chemistry*, vol. 22, pp 390–392, A. R. Katritzky and A. J. Boulton, Eds., Academic Press.

One skilled in the art recognizes that because in the environment and under physiological conditions salts of chemical compounds are in equilibrium with their corresponding nonsalt forms, salts share the biological utility of the nonsalt forms. Thus a wide variety of salts of a compound of Formula **1** are useful for control of undesired vegetation (i.e. are agriculturally suitable). The salts of a compound of Formula **1** include acid-addition salts with inorganic or organic acids such as hydrobromic, hydrochloric, nitric, phosphoric, sulfuric, acetic, butyric, fumaric, lactic, maleic, malonic, oxalic, propionic, salicylic, tartaric, 4-toluenesulfonic or valeric acids. When a compound of Formula **1** contains an acidic moiety such as a carboxylic acid or phenol, salts also include those formed with organic or inorganic bases such as pyridine, triethylamine or ammonia, or amides, hydrides, hydroxides or carbonates of sodium, potassium, lithium, calcium, magnesium or barium. Accordingly, the present invention comprises compounds selected from Formula **1**, *N*-oxides and agriculturally suitable salts thereof.

Embodiments of the present invention as described in the Summary of the Invention include:

Embodiment 1. A compound of Formula **1** including all all geometric and stereoisomers, *N*-oxides, and salts thereof, agricultural compositions containing them and their use as herbicides.

Embodiment 2. A compound of Embodiment 1 wherein A is A-1, A-2, A-3 or A-5.

Embodiment 3. A compound of Embodiment 2 wherein A is A-1, A-2 or A-5.

Embodiment 4. A compound of Embodiment 3 wherein A is A-1 or A-2.

Embodiment 5. A compound of Embodiment 1 wherein A is A-1 or A-3.

Embodiment 6. A compound of Embodiment 1 wherein A is A-1.

Embodiment 7. A compound of Embodiment 1 wherein A is A-2.

Embodiment 8. A compound of Embodiment 1 wherein A is A-3.

Embodiment 9. A compound of Embodiment 1 wherein A is A-4.

Embodiment 10. A compound of Embodiment 1 wherein A is A-5.

Embodiment 11. A compound of Embodiment 1 wherein A is A-6.

Embodiment 12. A compound of Embodiment 1 wherein A is A-7.

Embodiment 13. A compound of any one of Embodiments 1, 2, 5 or 8 wherein B is O.

Embodiment 14. A compound of Formula **1** or any one of Embodiments 1 through 14 either alone or in combination, wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6

cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_6 halocycloalkylalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkenylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl, C_2–C_6 haloalkylthioalkyl, benzyl, -N(R^7)(OR^8), -ON(R^{9a})(R^{9b}) or -N(R^7)N(R^{9a})(R^{9b}).

Embodiment 15. A compound of Embodiment 14 wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_6 halocycloalkylalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkenylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl.

Embodiment 16. A compound of Embodiment 15 wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio.

Embodiment 17. A compound of Embodiment 16 wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio.

Embodiment 18. A compound of Embodiment 17 wherein R^1 is $C_1–C_6$ alkyl, $C_2–C_6$ alkenyl, $C_2–C_6$ alkynyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy, $C_3–C_6$ alkenyloxy, $C_3–C_6$ alkynyloxy, $C_1–C_6$ haloalkoxy, $C_3–C_6$ haloalkenyloxy, $C_1–C_6$ alkylthio, $C_1–C_6$ haloalkylthio or $C_1–C_6$ alkenylthio.

Embodiment 19. A compound of Embodiment 17 wherein R^1 is $C_1–C_6$ alkyl, $C_2–C_6$ alkenyl, $C_2–C_6$ alkynyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy, $C_3–C_6$ alkenyloxy, $C_3–C_6$ alkynyloxy or $C_3–C_6$ haloalkenyloxy.

Embodiment 20. A compound of Embodiment 19 wherein R^1 is $C_1–C_6$ alkyl, $C_2–C_6$ alkenyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy or $C_1–C_6$ haloalkoxy.

Embodiment 21. A compound of Embodiment 20 wherein R^1 is $C_1–C_6$ alkyl, $C_1–C_6$ haloalkyl, $C_1–C_6$ alkoxy or $C_1–C_6$ haloalkoxy.

Embodiment 22. A compound of Embodiment 21 wherein R^1 is $C_1–C_6$ alkyl.

Embodiment 23. A compound of Embodiment 21 wherein R^1 is $C_1–C_6$ haloalkyl.

Embodiment 24. A compound of Embodiment 21 wherein R^1 is $C_1–C_6$ alkoxy.

Embodiment 25. A compound of Embodiment 21 wherein R^1 is $C_2–C_6$ haloalkoxy.

Embodiment 26. A compound of Embodiment 21 wherein R^1 is $C_4–C_6$ alkyl, $C_3–C_6$ haloalkyl, $C_3–C_6$ alkoxy or $C_3–C_6$ haloalkoxy.

Embodiment 27. A compound of Embodiment 26 wherein when A is A-3 then R^1 is $C_3–C_6$ haloalkyl.

Embodiment 28. A compound of Embodiment 26 wherein when A is A-1 then R^1 is $C_4–C_6$ haloalkyl.

Embodiment 29. A compound of Embodiment 28 wherein when A is A-1 then R^1 is $C_4–C_5$ haloalkyl.

Embodiment 30. A compound of Embodiment 29 wherein when A is A-1 then R^1 is $CH_2CH_2CH_2CF_3$.

Embodiment 31. A compound of Embodiment 29 wherein when A is A-1 then R^1 is $CH_2CH_2CF_2CF_3$.

Embodiment 32. A compound of Embodiment 19 wherein when A is A-3 then R^1 is $C_4–C_6$ haloalkenyloxy.

Embodiment 33. A compound of Embodiment 26 wherein when A is A-3 then R^1 is $C_4–C_5$ haloalkoxy.

Embodiment 34. A compound of Embodiment 23 wherein R^1 is $CH_2CH_2CH_2CH_2CH_2CF_3$.

Embodiment 35. A compound of Embodiment 23 wherein R^1 is $CH_2CH_2CH_2CH_2CF_3$.

Embodiment 36. A compound of Embodiment 23 wherein R^1 is $CH_2CH_2CH_2CF_3$.

Embodiment 37. A compound of Embodiment 23 wherein R^1 is $CH_2CH_2CF_3$.

Embodiment 38. A compound of Embodiment 25 wherein R^1 is $OCH_2CH_2CH_2CH_2CF_3$.

Embodiment 39. A compound of Embodiment 25 wherein R^1 is $OCH_2CH_2CH_2CF_3$.

Embodiment 40. A compound of Embodiment 25 wherein R^1 is $OCH_2CH_2CF_3$.

Embodiment 41. A compound of Embodiment 25 wherein R^1 is $OCH_2CF_2CF_3$.

Embodiment 42. A compound of any one Embodiments 1 through 13 wherein R^1 is other than H.

Embodiment 43. A compound of any one Embodiments 1 through 14 wherein R^1 is other than benzyl (unsubstituted).

Embodiment 44. A compound of any one Embodiments 1 through 22 wherein R^1 is other than CH_3, CH_2CH_3 or $CH_2CH_2CH_3$.

Embodiment 45. A compound of any one Embodiments 1 through 20 or wherein R^1 is other than $CH_2CH{=}CH_2$, $CH{=}CHCH_3$, $C({=}CH_2)CH_3$ or $CH{=}C(CH_3)_2$

Embodiment 46. A compound of Embodiment 1 wherein R^1 is other than propen-2-yl, propen-1-yl, *n*-propyl, ethyl, 1-methylethen-2-yl or 2-methylpropen-1-yl (i.e. R^1 is other than $CH_2CH{=}CH_2$, $CH_2CH_2CH_3$, $CH{=}CHCH_3$, CH_2CH_3, $C({=}CH_2)CH_3$ or $CH{=}C(CH_3)_2$.

Embodiment 47. A compound of any one Embodiments 1 through 22 or 24 wherein R^1 is other than OCH_3.

Embodiment 48. A compound of Formula **1** or any one of Embodiments 1 through 47 either alone or in combination, wherein Z is O.

Embodiment 49. A compound of Formula **1** or any one of Embodiments 1 through 48 either alone or in combination, wherein R^2 is halogen, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

Embodiment 50. A compound of Embodiment 49 wherein R^2 is halogen or C_1–C_4 alkyl.

Embodiment 51. A compound of Embodiment 50 wherein R^2 is halogen or CH_3.

Embodiment 52. A compound of Embodiment 51 wherein R^2 is halogen.

Embodiment 53. A compound of Embodiment 52 wherein R^2 is F, Cl or Br.

Embodiment 54. A compound of Embodiment 53 wherein R^2 is Cl.

Embodiment 55. A compound of Formula **1** or any one of Embodiments 1 through 54 either alone or in combination, wherein m is 0, 1 or 2.

Embodiment 56. A compound of Embodiment 55 wherein m is 0 or 1.

Embodiment 57. A compound of Embodiment 56 wherein m is 1.

Embodiment 58. A compound of Embodiment 57 wherein m is 1, at the 3, 4 or 6-position.

Embodiment 59. A compound of Embodiment 58 wherein m is 1, at the 3 or 4-position.

Embodiment 60. A compound of Embodiment 59 wherein m is 0 (i.e. each of the 3-, 4-, 5- and 6-positions are unsubtituted by R^3).

Embodiment 61. A compound of Formula **1** or any one of Embodiments 1 through 60 either alone or in combination, wherein each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_4 haloalkenyloxy, C_3–C_4 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl, $-C(=O)N(R^{11a}R^{11b})$, $-C(=NOR^{12})H$ or $-SO_nR^{14}$.

Embodiment 62. A compound of Embodiment 61 wherein each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl or $-SO_nR^{14}$.

Embodiment 63. A compound of Embodiment 62 wherein each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

Embodiment 64. A compound of Embodiment 63 wherein each R^3 is independently halogen, cyano, C_1–C_3 alkyl or C_1–C_3 haloalkyl.

Embodiment 65. A compound of Embodiment 64 wherein each R^3 is independently halogen, cyano, C_1–C_2 alkyl or C_1–C_2 haloalkyl.

Embodiment 66. A compound of Embodiment 65 wherein each R^3 is independently halogen, cyano, CH_3, CH_2CH_3 or CF_3.

Embodiment 67. A compound of Embodiment 66 wherein each R^3 is independently halogen, cyano or CF_3.

Embodiment 68. A compound of Embodiment 67 wherein each R^3 is independently F, Cl, Br or cyano.

Embodiment 69. A compound of Embodiment 68 wherein each R^3 is independently Br or cyano.

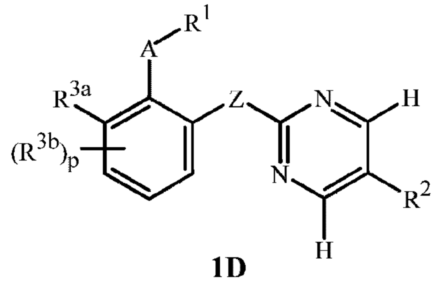
Embodiment 70. A compound of Embodiment 69 wherein each R^3 is independently halogen or cyano.

Embodiment 71. A compound of Embodiment 70 wherein each R^3 is independently cyano.

Embodiment 72. A compound of Embodiment 70 wherein each R^3 is independently halogen.

Embodiment 73. A compound of Embodiment 72 wherein each R^3 is independently Br.

Embodiment 74. A compound of Formula **1** or any one of Embodiments 1 through 73 either alone or in combination, wherein m is at least 1 and one R^3 is located at the 3-position (i.e. adjacent to the $-AR^1$ group) represented by the compound of Formula **1D**



1D

wherein A, R^1, R^2 and Z are as defined in the Summary of the Invention or in any one of Embodiments 1 through 59;

R^{3a} is as defined for R^3 in any one of Embodiments 61 through 73;

R^{3b} is as defined for R^3 in any one of Embodiments 61 through 73; and

p is is 0 or 1.

Embodiment 75. A compound of Embodiment 74 wherein p is 1; R^{3a} is halogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl or C_1–C_3 alkoxy; and R^{3b} is halogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl or C_1–C_3 alkoxy.

Embodiment 76. A compound of Embodiment 75 wherein p is 0 and R^{3a} is halogen, cyano, C_1–C_3 alkyl, C_1–C_3 haloalkyl or C_1–C_3 alkoxy.

Embodiment 77. A compound of Embodiment 76 wherein R^{3a} is halogen or cyano.

Embodiment 78. A compound of Embodiment 77 wherein R^{3a} is Br or cyano.

Embodiment 79. A compound of Formula **1** or any one of Embodiments 1 through 28 either alone or in combination, wherein R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl.

Embodiment 80. A compound of Embodiment 79 wherein R^5 is C_1–C_6 alkyl or C_1–C_6 haloalkyl.

Embodiment 81. A compound of Embodiment 1 wherein when A is A-5, then R^3 is in the 4-, 5- or 6- position.

Embodiment 82. A compound of Embodiment 1 wherein when A is A-3, B is O, R^3 is 3-Br then R^1 is other then 3-bromopropane.

Embodiment 83. A compound of Embodiment 1 wherein when A is A-3, R^3 is halogen at the 3-position.

Embodiment 84. A compound of Embodiment 1 wherein when A is A-1, R^3 is cyano at the 3-position.

Embodiment 85. A compound of Embodiment 1 wherein R^1 is other than C_3–C_6 cycloamino.

Embodiment 86. A compound of Embodiment 1 wherein each R^{11a} is independently C_1–C_2 alkyl C_1–C_2 haloalkyl.

Embodiment 87. A compound of Embodiment 1 wherein each R^{11b} is independently C_1–C_2 alkyl or C_1–C_2 haloalkyl.

Embodiment 88. A compound of Embodiment1 wherein each R^{12} is independently H or C_1–C_3 alkyl.

Embodiment 89. A compound of Embodiment 1 wherein each R^{14} is independently C_1–C_3 alkyl or C_1–C_3 haloalkyl.

Embodiment 90. A compound of Embodiment 1 wherein each R^{14} is independently C_1–C_3 alkyl.

Embodiment 91. A compound of Embodiment 1 wherein m is 1, 2 or 3.

Embodiment 92. A compound of Embodiment 1 wherein m is 1 or 2.

Embodiments of this invention, including Embodiments 1–92 above as well as any other embodiments described herein, can be combined in any manner, and the descriptions of variables in the embodiments pertain not only to the compounds of Formula **1** but also to the starting compounds and intermediate compounds useful for preparing the compounds of Formula **1**. In addition, embodiments of this invention, including Embodiments 1–92 above as well as any other embodiments described herein, and any combination thereof, pertain to the compositions and methods of the present invention.

Combinations of Embodiments 1–92 are illustrated by:

Embodiment A. A compound of Formula **1** wherein

A is A-1, A-2, A-3 or A-5;

R^1 is R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_6 halocycloalkylalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio,

C_3–C_8 cycloalkylthio, C_1–C_6 alkenylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl;

R^2 is halogen, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_4 haloalkenyloxy, C_3–C_4 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl, -C(=O)N($R^{11a}R^{11b}$), -C(=NOR^{12})H or -SO_nR^{14};

R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl;

R^{11a} is C_1–C_2 alkyl C_1–C_2 haloalkyl;

R^{11b} is C_1–C_2 alkyl or C_1–C_2 haloalkyl;

R^{12} is H or C_1–C_3 alkyl; and

R^{14} is C_1–C_3 alkyl or C_1–C_3 haloalkyl.

Embodiment B. A compound of Embodiment A wherein

A is A-1, A-2 or A-5;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

R^2 is halogen or C_1–C_4 alkyl;

each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl or -SO_nR^{14};

R^5 is C_1–C_6 alkyl or C_1–C_6 haloalkyl;

each R^{14} is independently C_1–C_3 alkyl; and

m is 0, 1 or 2.

Embodiment C. A compound of Embodiment B wherein

A is A-1 or A-2;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

R^2 is halogen or CH_3; and

each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

Embodiment D. A compound of Embodiment C wherein

A is A-1;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

Z is O;

R^2 is halogen;

each R^3 is independently halogen, cyano, C_1–C_3 alkyl or C_1–C_3 haloalkyl; and

m is 1 or 2.

Embodiment E. A compound of Embodiment C wherein

A is A-2;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy or C_1–C_6 haloalkoxy;

Z is O;

R^2 is F, Cl or Br;

each R^3 is independently halogen, cyano, C_1–C_2 alkyl or C_1–C_2 haloalkyl; and

m is 0 or 1.

Embodiment F. A compound of Embodiment A wherein

A is A-3;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

R^2 is halogen or C_1–C_4 alkyl;

each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl; and

m is 1 or 2.

Embodiment G. A compound of Embodiment F wherein

B is O;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6

haloalkenyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

Z is O;

R^2 is halogen or CH_3;

each R^3 is independently halogen, cyano, C_1–C_3 alkyl or C_1–C_3 haloalkyl; and

m is 1 or 2.

Specific embodiments include compounds of Formula **1** selected from the group consisting of:

3,3,3-trifluoropropyl 2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 15);

3,3,3-trifluoro-1-methylpropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 16);

propyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 13);

4,4,4-trifluorobutyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 20);

2-propen-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 22);

3-buten-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 21);

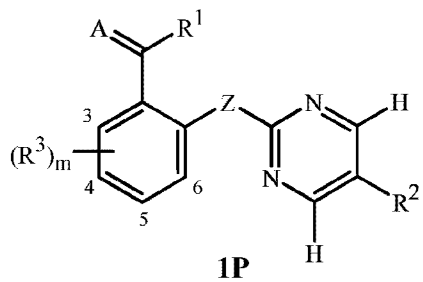
2,2,3,3,3-pentafluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 23);

3,3,3-trifluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 26);

1-[2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]phenyl]-4,4,4-trifluoro-1-butanone (Compound 107); and

3-[(5-chloro-2-pyrimidinyl)oxy]-2-(5,5,5-trifluoropentyl)benzonitrile (Compound 73).

Embodiments of the present invention as described in the Summary of the Invention include (where Formula **1P** as used in the following Embodiments includes *N*-oxides and salts thereof):



1P

Embodiment P1. A compound of Formula **1P** wherein A is H_2, O, S or $N(OR^5)$.

Embodiment P2. A compound of Embodiment P1 wherein A is H_2, O or $N(OR^5)$.

Embodiment P3. A compound of Embodiment P2 wherein A is O or $N(OR^5)$.

Embodiment P4. A compound of Embodiment P3 wherein A is O.

Embodiment P5. A compound of Embodiment P3 wherein A is $N(OR^5)$.

Embodiment P6. A compound of Formula **1P** or any one of Embodiments P1 through P5 either alone or in combination, wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_3–C_6 cycloamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl, C_2–C_6 haloalkylthioalkyl, benzyl, -NR^7OR^8, -$ON(R^{9a}R^{9b})$ or -$NR^7N(R^{9a}R^{9b})$.

Embodiment P7. A compound of Embodiment P6 wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_3–C_6 cycloamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl.

Embodiment P8. A compound of Embodiment P7 wherein R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy or C_3–C_6 cycloalkoxy.

Embodiment P9. A compound of Embodiment P8 wherein R^1 is C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy or C_3–C_6 cycloalkoxy.

Embodiment P10. A compound of Formula **1P** or any one of Embodiments P1 through P9 either alone or in combination, wherein Z is O.

Embodiment P11. A compound of Formula **1P** or any one of Embodiments P1 through P10 either alone or in combination, wherein R^2 is halogen, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

Embodiment P12. A compound of Embodiment P11 wherein R^2 is halogen or C_1–C_4 alkyl.

Embodiment P13. A compound of Embodiment P12 wherein R^2 is halogen or CH_3.

Embodiment P14. A compound of Embodiment P13 wherein R^2 is halogen.

Embodiment P15. A compound of Embodiment P14 wherein R^2 is F, Cl or Br.

Embodiment P16. A compound of Formula **1P** or any one of Embodiments P1 through P15 either alone or in combination, wherein m is 0, 1 or 2.

Embodiment P17. A compound of Embodiment P16 wherein m is 0 or 1.

Embodiment P18. A compound of Embodiment P17 wherein m is 1.

Embodiment P19. A compound of Embodiment P17 wherein m is 0 (i.e. the 3-, 4-, 5- and 6-positions are unsubtituted by R^3).

Embodiment P20. A compound of Formula **1P** or any one of Embodiments P1 through P19 either alone or in combination, wherein each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_4 haloalkenyloxy, C_3–C_4 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl, $-C(=O)N(R^{11a}R^{11b})$, $-C(=NOR^{12})H$ or $-SO_nR^{14}$.

Embodiment P21. A compound of Embodiment P20 wherein each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl or $-SO_nR^{14}$.

Embodiment P22. A compound of Embodiment P21 wherein each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

Embodiment P23. A compound of Embodiment P22 wherein each R^3 is independently halogen or cyano.

Embodiment P24. A compound of Embodiment P23 wherein each R^3 is independently cyano.

Embodiment P25. A compound of Embodiment P23 wherein each R^3 is independently halogen.

Embodiment P26. A compound of Embodiment P23 wherein each R^3 is independently Br.

Embodiment P27. A compound of Formula **1P** or any one of Embodiments P1 through P26 either alone or in combination, wherein m is 1 and R^3 is located at the 3-position (i.e. adjacent to the $C(=A)R^1$ group).

Embodiment P28. A compound of Formula **1P** or any one of Embodiments P1 through P26 either alone or in combination, wherein m is 2 and R^3 is located at the 3- and the 6-position (i.e. adjacent to the $C(=A)R^1$ group and the Z(pyrimidine group).

Embodiment P29. A compound of Formula **1P** or any one of Embodiments P1 through P28 either alone or in combination, wherein R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl.

Embodiment P30. A compound of Embodiment P29 wherein R^5 is C_1–C_6 alkyl, or C_1–C_6 haloalkyl.

Embodiments of this invention, including Embodiments P1–P30 above as well as any other embodiments described herein, can be combined in any manner, and the descriptions of variables in the embodiments pertain not only to the compounds of Formula **1P** but also to the starting compounds and intermediate compounds useful for preparing the compounds of Formula **1P**. In addition, embodiments of this invention, including Embodiments P1–P30 above as well as any other embodiments described herein, and any combination thereof, pertain to the compositions and methods of the present invention.

Combinations of Embodiments P1–P30 are illustrated by:

Embodiment PA. A compound of Formula **1P** wherein

A is H_2, O, S or $N(OR^5)$;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_3–C_6 cycloamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio,

C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl;

Z is O;

R^2 is halogen, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl or $-SO_nR^{14}$; and

m is 0, 1 or 2.

Embodiment PB. A compound of Embodiment PA wherein

A is H_2, O or $N(OR^5)$;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy or C_3–C_6 cycloalkoxy;

R^2 is halogen or C_1–C_4 alkyl;

each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl; and

m is 0 or 1.

Embodiment PC. A compound of Embodiment PB wherein

A is O or $N(OR^5)$;

R^1 is C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy or C_3–C_6 cycloalkoxy;

R^2 is halogen or CH_3;

R^3 is independently halogen or cyano; and

R^5 is C_1–C_6 alkyl, or C_1–C_6 haloalkyl.

Embodiment PD. A compound of Embodiment PC wherein

A is O;

R^2 is halogen; and

each R^3 is independently halogen.

Specific embodiments include compounds of Formula **1** selected from the group consisting of:

3,3,3-trifluoropropyl 2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate

(Compound 15),
3,3,3-trifluoro-1-methylpropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 16),
propyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 13),
4,4,4-trifluorobutyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 20),
2-propen-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 22),
3-buten-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 21),
2,2,3,3,3-pentafluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 23), and
3,3,3-trifluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 26).

This invention also relates to a method for controlling undesired vegetation comprising applying to the locus of the vegetation herbicidally effective amounts of the compounds of the invention (e.g., as a composition described herein). Of note as embodiments relating to methods of use are those involving the compounds of embodiments described above. Compounds of the invention are particularly useful for selective control of weeds in crops such as wheat, barley, maize, soybean, sunflower, cotton, oilseed rape and rice, and specialty crops such as sugarcane, citrus, fruit and nut crops.

Also noteworthy as embodiments are herbicidal compositions of the present invention comprising the compounds of embodiments described above.

This invention also includes a herbicidal mixture comprising (a) a compound selected from Formula **1**, *N*-oxides, and salts thereof, and (b) at least one additional active ingredient selected from (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b6) photosystem I electron diverters, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b8) glutamine synthetase (GS) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors, (b10) auxin transport inhibitors, (b11) phytoene desaturase (PDS) inhibitors, (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors, (b13) homogentisate solanesyltransferase (HST) inhibitors, (b14) cellulose biosynthesis inhibitors, (b15) other herbicides including mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, hydantocidin, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, (b16) herbicide safeners, and salts of compounds of (b1) through (b16).

"Photosystem II inhibitors" (b1) are chemical compounds that bind to the D-1 protein at the Q_B-binding niche and thus block electron transport from Q_A to Q_B in the chloroplast thylakoid membranes. The electrons blocked from passing through photosystem II are transferred through a series of reactions to form toxic compounds that disrupt cell membranes and cause chloroplast swelling, membrane leakage, and ultimately cellular destruction. The Q_B-binding niche has three different binding sites: binding site A binds the triazines such as atrazine, triazinones such as hexazinone, and uracils such as bromacil, binding site B binds the phenylureas such as diuron, and binding site C binds benzothiadiazoles such as bentazon, nitriles such as bromoxynil and phenyl-pyridazines such as pyridate. Examples of photosystem II inhibitors include ametryn, amicarbazone, atrazine, bentazon, bromacil, bromofenoxim, bromoxynil, chlorbromuron, chloridazon, chlorotoluron, chloroxuron, cumyluron, cyanazine, daimuron, desmedipham, desmetryn, dimefuron, dimethametryn, diuron, ethidimuron, fenuron, fluometuron, hexazinone, ioxynil, isoproturon, isouron, lenacil, linuron, metamitron, methabenzthiazuron, metobromuron, metoxuron, metribuzin, monolinuron, neburon, pentanochlor, phenmedipham, prometon, prometryn, propanil, propazine, pyridafol, pyridate, siduron, simazine, simetryn, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn and trietazine.

"AHAS inhibitors" (b2) are chemical compounds that inhibit acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS), and thus kill plants by inhibiting the production of the branched-chain aliphatic amino acids such as valine, leucine and isoleucine, which are required for protein synthesis and cell growth. Examples of AHAS inhibitors include amidosulfuron, azimsulfuron, bensulfuron-methyl, bispyribac-sodium, cloransulam-methyl, chlorimuron-ethyl, chlorsulfuron, cinosulfuron, cyclosulfamuron, diclosulam, ethametsulfuron-methyl, ethoxysulfuron, flazasulfuron, florasulam, flucarbazone-sodium, flumetsulam, flupyrsulfuron-methyl, flupyrsulfuron-sodium, foramsulfuron, halosulfuron-methyl, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, imazosulfuron, iodosulfuron-methyl (including sodium salt), iofensulfuron (2-iodo-*N*-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide), mesosulfuron-methyl, metazosulfuron (3-chloro-4-(5,6-dihydro-5-methyl-1,4,2-dioxazin-3-yl)-*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-1-methyl-1*H*-pyrazole-5-sulfonamide), metosulam, metsulfuron-methyl, nicosulfuron, oxasulfuron, penoxsulam, primisulfuron-methyl, propoxycarbazone-sodium, propyrisulfuron (2-chloro-*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-6-propylimidazo[1,2-*b*]pyridazine-3-sulfonamide), prosulfuron, pyrazosulfuron-ethyl, pyribenzoxim, pyriftalid, pyriminobac-methyl, pyrithiobac-sodium, rimsulfuron, sulfometuron-methyl, sulfosulfuron, thiencarbazone, thifensulfuron-methyl, triafamone (*N*-[2-[(4,6-dimethoxy-1,3,5-triazin-2-yl)carbonyl]-6-

fluorophenyl]-1,1-difluoro-*N*-methylmethanesulfonamide), triasulfuron, tribenuron-methyl, trifloxysulfuron (including sodium salt), triflusulfuron-methyl and tritosulfuron.

"ACCase inhibitors" (b3) are chemical compounds that inhibit the acetyl-CoA carboxylase enzyme, which is responsible for catalyzing an early step in lipid and fatty acid synthesis in plants. Lipids are essential components of cell membranes, and without them, new cells cannot be produced. The inhibition of acetyl CoA carboxylase and the subsequent lack of lipid production leads to losses in cell membrane integrity, especially in regions of active growth such as meristems. Eventually shoot and rhizome growth ceases, and shoot meristems and rhizome buds begin to die back. Examples of ACCase inhibitors include alloxydim, butroxydim, clethodim, clodinafop, cycloxydim, cyhalofop, diclofop, fenoxaprop, fluazifop, haloxyfop, pinoxaden, profoxydim, propaquizafop, quizalofop, sethoxydim, tepraloxydim and tralkoxydim, including resolved forms such as fenoxaprop-P, fluazifop-P, haloxyfop-P and quizalofop-P and ester forms such as clodinafop-propargyl, cyhalofop-butyl, diclofop-methyl and fenoxaprop-P-ethyl.

Auxin is a plant hormone that regulates growth in many plant tissues. "Auxin mimics" (b4) are chemical compounds mimicking the plant growth hormone auxin, thus causing uncontrolled and disorganized growth leading to plant death in susceptible species. Examples of auxin mimics include aminocyclopyrachlor (6-amino-5-chloro-2-cyclopropyl-4-pyrimidinecarboxylic acid) and its methyl and ethyl esters and its sodium and potassium salts, aminopyralid, benazolin-ethyl, chloramben, clacyfos, clomeprop, clopyralid, dicamba, 2,4-D, 2,4-DB, dichlorprop, fluroxypyr, halauxifen (4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-2-pyridinecarboxylic acid), halauxifen-methyl (methyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-2-pyridinecarboxylate), MCPA, MCPB, mecoprop, picloram, quinclorac, quinmerac, 2,3,6-TBA, triclopyr, and methyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoro-2-pyridinecarboxylate.

"EPSP synthase inhibitors" (b5) are chemical compounds that inhibit the enzyme, 5-enol-pyruvylshikimate-3-phosphate synthase, which is involved in the synthesis of aromatic amino acids such as tyrosine, tryptophan and phenylalanine. EPSP inhibitor herbicides are readily absorbed through plant foliage and translocated in the phloem to the growing points. Glyphosate is a relatively nonselective postemergence herbicide that belongs to this group. Glyphosate includes esters and salts such as ammonium, isopropylammonium, potassium, sodium (including sesquisodium) and trimesium (alternatively named sulfosate).

"Photosystem I electron diverters" (b6) are chemical compounds that accept electrons from Photosystem I, and after several cycles, generate hydroxyl radicals. These radicals are extremely reactive and readily destroy unsaturated lipids, including membrane fatty acids and chlorophyll. This destroys cell membrane integrity, so that cells and organelles "leak", leading to rapid leaf wilting and desiccation, and eventually to plant death. Examples of this second type of photosynthesis inhibitor include diquat and paraquat.

"PPO inhibitors" (b7) are chemical compounds that inhibit the enzyme protoporphyrinogen oxidase, quickly resulting in formation of highly reactive compounds in plants that rupture cell membranes, causing cell fluids to leak out. Examples of PPO inhibitors include acifluorfen-sodium, azafenidin, benzfendizone, bifenox, butafenacil, carfentrazone, carfentrazone-ethyl, chlomethoxyfen, cinidon-ethyl, fluazolate, flufenpyr-ethyl, flumiclorac-pentyl, flumioxazin, fluoroglycofen-ethyl, fluthiacet-methyl, fomesafen, halosafen, lactofen, oxadiargyl, oxadiazon, oxyfluorfen, pentoxazone, profluazol, pyraclonil, pyraflufen-ethyl, saflufenacil, sulfentrazone, thidiazimin, trifludimoxazin (dihydro-1,5-dimehyl-6-thioxo-3-[2,2,7-trifluoro-3,4-dihydro-3-oxo-4-(2-propyn-1-yl)-2*H*-1,4-benzoxazin-6-yl]-1,3,5-triazine-2,4(1*H*,3*H*)-dione) and tiafenacil (methyl *N*-[2-[[2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-1(2*H*)-pyrimidinyl]-4-fluorophenyl]thio]-1-oxopropyl]-β-alaninate).

"GS inhibitors" (b8) are chemical compounds that inhibit the activity of the glutamine synthetase enzyme, which plants use to convert ammonia into glutamine. Consequently, ammonia accumulates and glutamine levels decrease. Plant damage probably occurs due to the combined effects of ammonia toxicity and deficiency of amino acids required for other metabolic processes. The GS inhibitors include glufosinate and its esters and salts such as glufosinate-ammonium and other phosphinothricin derivatives, glufosinate-P ((2*S*)-2-amino-4-(hydroxymethylphosphinyl)butanoic acid) and bilanaphos.

"VLCFA elongase inhibitors" (b9) are herbicides having a wide variety of chemical structures, which inhibit the elongase. Elongase is one of the enzymes located in or near chloroplasts which are involved in biosynthesis of VLCFAs. In plants, very-long-chain fatty acids are the main constituents of hydrophobic polymers that prevent desiccation at the leaf surface and provide stability to pollen grains. Such herbicides include acetochlor, alachlor, anilofos, butachlor, cafenstrole, dimethachlor, dimethenamid, diphenamid, fenoxasulfone (3-[[(2,5-dichloro-4-ethoxyphenyl)methyl]sulfonyl]-4,5-dihydro-5,5-dimethylisoxazole), fentrazamide, flufenacet, indanofan, mefenacet, metazachlor, metolachlor, naproanilide, napropamide, napropamide-M ((2R)-*N*,*N*-diethyl-2-(1-naphthalenyloxy)propanamide), pethoxamid, piperophos, pretilachlor, propachlor, propisochlor, pyroxasulfone, and thenylchlor, including resolved forms such as S-metolachlor and chloroacetamides and oxyacetamides.

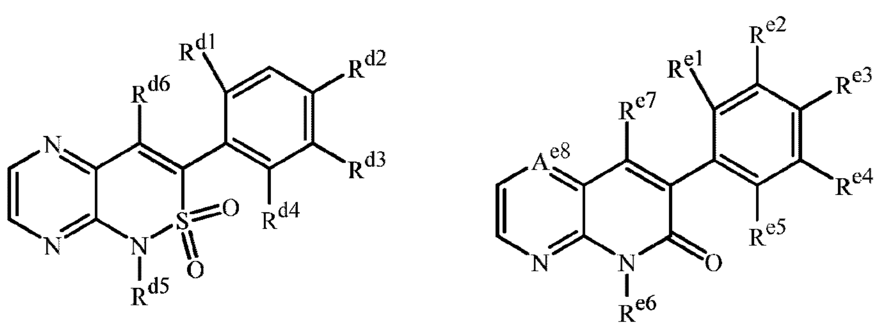
"Auxin transport inhibitors" (b10) are chemical substances that inhibit auxin transport in plants, such as by binding with an auxin-carrier protein. Examples of auxin transport inhibitors include diflufenzopyr, naptalam (also known as *N*-(1-naphthyl)phthalamic acid and 2-[(1-naphthalenylamino)carbonyl]benzoic acid).

"PDS inhibitors" (b11) are chemical compounds that inhibit carotenoid biosynthesis pathway at the phytoene desaturase step. Examples of PDS inhibitors include beflubutamid, diflufenican, fluridone, flurochloridone, flurtamone norflurzon and picolinafen.

"HPPD inhibitors" (b12) are chemical substances that inhibit the biosynthesis of synthesis of 4-hydroxyphenyl-pyruvate dioxygenase. Examples of HPPD inhibitors include benzobicyclon, benzofenap, bicyclopyrone (4-hydroxy-3-[[2-[(2-methoxyethoxy)methyl]-6-(trifluoromethyl)-3-pyridinyl]carbonyl]bicyclo[3.2.1]oct-3-en-2-one), fenquinotrione (2-[[8-chloro-3,4-dihydro-4-(4-methoxyphenyl)-3-oxo-2-quinoxalinyl]carbonyl]-1,3-cyclohexanedione), isoxachlortole, isoxaflutole, mesotrione, pyrasulfotole, pyrazolynate, pyrazoxyfen, sulcotrione, tefuryltrione, tembotrione, tolpyralate (1-[[1-ethyl-4-[3-(2-methoxyethoxy)-2-methyl-4-(methylsulfonyl)benzoyl]-1H-pyrazol-5-yl]oxy]ethyl methyl carbonate), topramezone, 5-chloro-3-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-1-(4-methoxyphenyl)-2(1*H*)-quinoxalinone, 4-(2,6-diethyl-4-methylphenyl)-5-hydroxy-2,6-dimethyl-3(2*H*)-pyridazinone, 4-(4-fluorophenyl)-6-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-2-methyl-1,2,4-triazine-3,5(2*H*,4*H*)-dione, 5-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-2-(3-methoxyphenyl)-3-(3-methoxypropyl)-4(3*H*)-pyrimidinone, 2-methyl-*N*-(4-methyl-1,2,5-oxadiazol-3-yl)-3-(methylsulfinyl)-4-(trifluoromethyl)benzamide and 2-methyl-3-(methylsulfonyl)-*N*-(1-methyl-1*H*-tetrazol-5-yl)-4-(trifluoromethyl)benzamide.

"HST inhibitors" (b13) disrupt a plant's ability to convert homogentisate to 2-methyl-6-solanyl-1,4-benzoquinone, thereby disrupting carotenoid biosynthesis. Examples of HST inhibitors include haloxydine, pyriclor, cyclopyrimorate (6-chloro-3-(2-cyclopropyl-6-methylphenoxy)-4-pyridazinyl 4-morpholinecarboxylate), 3-(2-chloro-3,6-difluorophenyl)-4-hydroxy-1-methyl-1,5-naphthyridin-2(1*H*)-one, 7-(3,5-dichloro-4-pyridinyl)-5-(2,2-difluoroethyl)-8-hydroxypyrido[2,3-*b*]pyrazin-6(5*H*)-one and 4-(2,6-diethyl-4-methylphenyl)-5-hydroxy-2,6-dimethyl-3(2*H*)-pyridazinone.

HST inhibitors also include compounds of Formulae **A** and **B**.



A **B**

wherein R^{d1} is H, Cl or CF_3; R^{d2} is H, Cl or Br; R^{d3} is H or Cl; R^{d4} is H, Cl or CF_3; R^{d5} is CH_3, CH_2CH_3 or CH_2CHF_2; and R^{d6} is OH, or -OC(=O)-*i*-Pr; and R^{e1} is H, F, Cl, CH_3 or CH_2CH_3; R^{e2} is H or CF_3; R^{e3} is H, CH_3 or CH_2CH_3; R^{e4} is H, F or Br; R^{e5} is Cl,

CH_3, CF_3, OCF_3 or CH_2CH_3; R^{e6} is H, CH_3, CH_2CHF_2 or C≡CH; R^{e7} is OH, -OC(=O)Et, -OC(=O)-*i*-Pr or -OC(=O)-*t*-Bu; and A^{e8} is N or CH.

"Cellulose biosynthesis inhibitors" (b14) inhibit the biosynthesis of cellulose in certain plants. They are most effective when applied preemergence or early postemergence on young or rapidly growing plants. Examples of cellulose biosynthesis inhibitors include chlorthiamid, dichlobenil, flupoxam, indaziflam (N^2-[(1*R*,2*S*)-2,3-dihydro-2,6-dimethyl-1*H*-inden-1-yl]-6-(1-fluoroethyl)-1,3,5-triazine-2,4-diamine), isoxaben and triaziflam.

"Other herbicides" (b15) include herbicides that act through a variety of different modes of action such as mitotic disruptors (e.g., flamprop-M-methyl and flamprop-M-isopropyl), organic arsenicals (e.g., DSMA, and MSMA), 7,8-dihydropteroate synthase inhibitors, chloroplast isoprenoid synthesis inhibitors and cell-wall biosynthesis inhibitors. Other herbicides include those herbicides having unknown modes of action or do not fall into a specific category listed in (b1) through (b14) or act through a combination of modes of action listed above. Examples of other herbicides include aclonifen, asulam, amitrole, bromobutide, cinmethylin, clomazone, cumyluron, daimuron, difenzoquat, etobenzanid, fluometuron, flurenol, fosamine, fosamine-ammonium, dazomet, dymron, ipfencarbazone (1-(2,4-dichlorophenyl)-*N*-(2,4-difluorophenyl)-1,5-dihydro-*N*-(1-methylethyl)-5-oxo-4*H*-1,2,4-triazole-4-carboxamide), metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid, pyributicarb and 5-[[(2,6-difluorophenyl)methoxy]methyl]-4,5-dihydro-5-methyl-3-(3-methyl-2-thienyl)isoxazole.

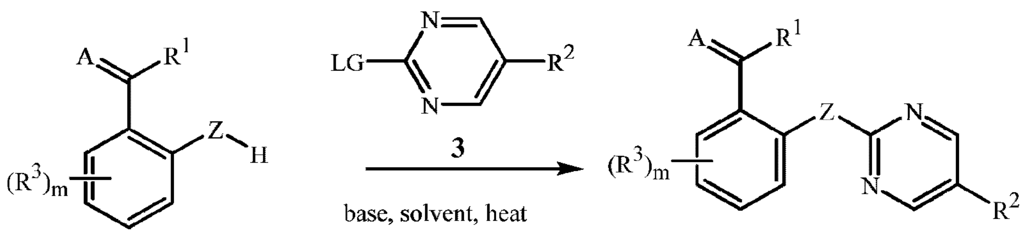
"Herbicide safeners" (b16) are substances added to a herbicide formulation to eliminate or reduce phytotoxic effects of the herbicide to certain crops. These compounds protect crops from injury by herbicides but typically do not prevent the herbicide from controlling undesired vegetation. Examples of herbicide safeners include but are not limited to benoxacor, cloquintocet-mexyl, cumyluron, cyometrinil, cyprosulfamide, daimuron, dichlormid, dicyclonon, dietholate, dimepiperate, fenchlorazole-ethyl, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen-ethyl, mefenpyr-diethyl, mephenate, methoxyphenone, naphthalic anhydride, oxabetrinil, *N*-(aminocarbonyl)-2-methylbenzenesulfonamide and *N*-(aminocarbonyl)-2-fluorobenzenesulfonamide, 1-bromo-4-[(chloromethyl)sulfonyl]benzene, 2-(dichloromethyl)-2-methyl-1,3-dioxolane (MG 191), 4-(dichloroacetyl)-1-oxa-4-azospiro[4.5]decane (MON 4660), 2,2-dichloro-1-(2,2,5-trimethyl-3-oxazolidinyl)-ethanone and 2-methoxy-*N*-[[4-[[(methylamino)carbonyl]amino]phenyl]sulfonyl]-benzamide.

An embodiment of the present invention is a herbicidal mixture comprising (a) a compound of Formula **1**, and (b) at least one additional active ingredient selected from (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors and (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors.

The compounds of Formula **1** can be prepared by general methods known in the art of synthetic organic chemistry. One or more of the following methods and variations as described in Schemes 1–10 can be used to prepare the compounds of Formula **1**. The definitions of (A, Z, R^1, R^2, R^3, R^4, R^5, R^{6a} and R^{6b}) in the compounds of Formulae **1**–**17** below are as defined above in the Summary of the Invention unless otherwise noted. Compounds of Formulae **1a**–**1b** are various subsets of the compounds of Formula **1**, and all substituents for Formulae **1a**–**1b** are as defined above for Formula **1** unless otherwise noted.

As shown in Scheme 1 a compound of Formula **1** can be prepared by nucleophilic substitution by heating a compound of Formula **2** in a suitable solvent, such as acetonitrile, tetrahydrofuran or *N,N*-dimethylformamide in the presence of a base such as potassium or cesium carbonate, with a compound of Formula **3** (wherein LG is halogen or SO_2Me). The reaction is typically conducted at temperatures ranging from 20 to 110 °C.

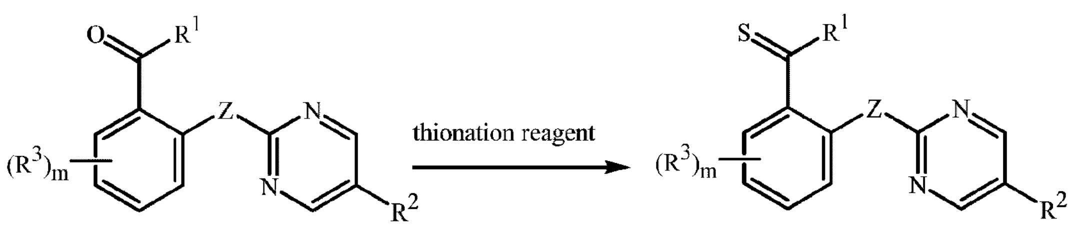
Scheme 1



2 **1**

As shown in Scheme 2, compounds of Formula **1b** (wherein A is S) can be prepared by reacting compounds of Formula **1a** (wherein A is A-3 and B is O) with a thionation reagent such as Lawesson's reagent, tetraphosphorus decasulfide or diphosphorus pentasulfide in a solvent such as tetrahydrofuran or toluene. Typically, the reaction is carried out at temperatures ranging from 0 to 115 °C.

Scheme 2

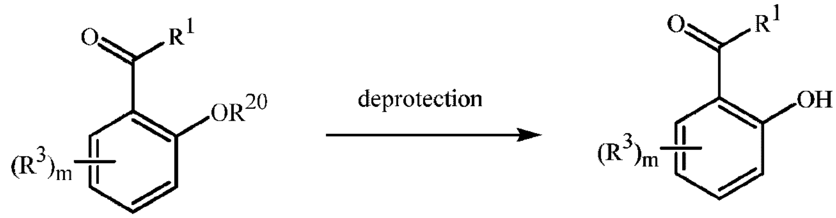


1a **1b**

As shown in Scheme 3, a compound of Formula **2a** (wherein A is A-3, B is O and Z is O) can be prepared by deprotection of a compound of Formula **4** (wherein R^{20} is CH_3 or

$C(=O)CH_3$) with a suitable deprotecting agent. Suitable methoxy (i.e. when R^{20} is CH_3) deprotecting reagents such as BBr_3, $AlCl_3$ and HBr in acetic acid can be used in the presence of solvents such as toluene, dichloromethane and dichloroethane at a temperature of from – 80 to 120 °C. Suitable acetoxy (i.e. when R^{20} is $C(=O)CH_3$) deprotecting agents include potassium carbonate in methanol or ammonium acetate in aqueous methanol at room temperature can be used as discussed in Das, et al., *Tetrahedron* **2003**, *59*, 1049–1054 and methods cited therein. Alternatively, a compound of Formula **4** can be combined with Amberlyst 15© in methanol (as discussed in Das, et al. *Tet. Lett.* **2003**, *44*, 5465–5468) or combined with sodium acetate in ethanol (as discussed in Narender, T., et al. *Synthetic Communications* **2009**, *39*(11), 1949–1956) to obtain a compound of Formula **2a**. Other useful phenolic protecting groups suitable for use in preparing a compound of Formula **2a** can be found in Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 4th ed.; Wiley: Hoboken, New Jersey, 1991.

Scheme 3



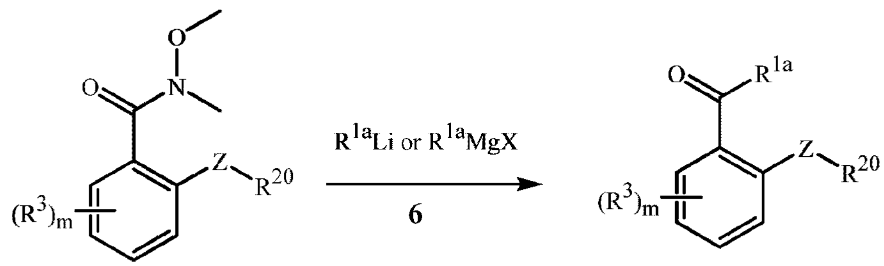
4

2a

wherein R^{20} is CH_3 or $COCH_3$

As shown in Scheme 4 compounds of Formula **5** (wherein R^{1a} is alkyl, alkenyl, or alkynyl) can be prepared by reaction of organometallic reagents such as organomagnesium or organolithium reagents of Formula **6** with amides of the Formula 7. This reaction is typically carried out in a solvent such as tetrahydrofuran or diethyl ether at temperatures ranging from -78 to 25 °C. To those skilled in the art, Amides such as Formula 7 are commonly referred to as a 'Weinreb Amide' and this type of transformation is commonly referred to as the 'Weinreb-Nahm ketone synthesis.' See *Synthesis* **2008**, *23*, 3707-3738 and references cited therein.

Scheme 4

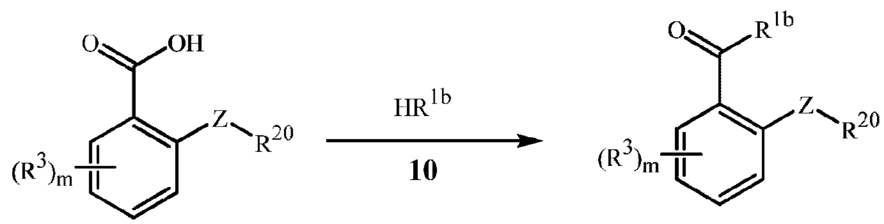


7 5

wherein R^{20} is CH_3 or $COCH_3$ and R^{1a} is alkyl, alkenyl or alkynyl

As shown in Scheme 5 compounds of Formula **8** can be prepared by reaction of acids of Formula **9** with alkylamines, alcohols or thiols of Formula **10** (wherein R^{1b} is alkoxy, alkylthio or alkylamino) in the presence of a dehydrative coupling reagent such as propylphosphonic anhydride, dicyclohexylcarbodiimide, *N*-(3-dimethylaminopropyl)-*N'*-ethylcarbodiimide, *N,N'*-carbonyldiimidazole, 2-chloro-l,3-dimethylimidazolium chloride or 2-chloro-l-methylpyridinium iodide. Polymer-supported reagents, such as polymer-supported cyclohexylcarbodiimide, are also suitable. These reactions are typically run at temperatures ranging from 0–60 °C in a solvent such as dichloromethane, acetonitrile, *N,N*-dimethylformamide or ethyl acetate in the presence of a base such as triethylamine, *N,N*-diisopropylamine, or 1,8-diazabicyclo[5.4.0]undec-7-ene. See *Organic Process Research & Development* **2009**, *13*, 900–906 for coupling conditions employing propylphosphonic anhydride.

Scheme 5

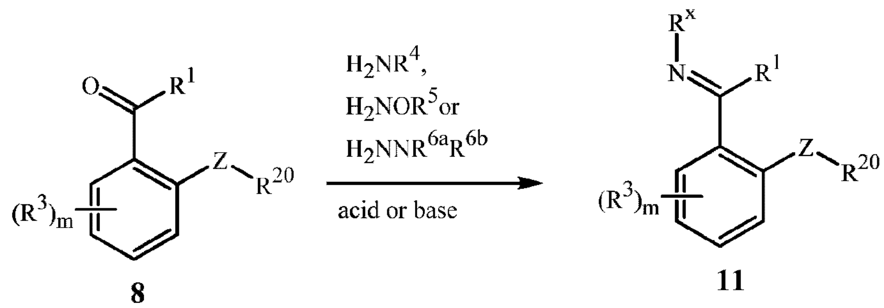


9 8

wherein R^{20} is CH_3 or $COCH_3$ and R^{1b} is alkoxy, thioalkyl or alkylamino

In Scheme 6 a compounds of Formula **11** (wherein R^x is R^4, OR^5 or $NR^{6a}R^{6b}$) can readily be prepared by condensation of an organoamine, organohydroxylamine, or organohydrazine with a compound of Formula **8**, typically in the presence of either an acid or base. Reactions are typically run in solvents such as methanol, ethanol, dichloromethane, or toluene at temperatures ranging from 20 – 110 °C. Suitable acids for the reactions include, but are not limited to, inorganic acids such as hydrochloric acids and organic acids such as acetic acid and trifluoroacetic acid. Suitable bases for the reaction include, but are not limited to, hydroxides such as sodium hydroxide, carbonates such as sodium and potassium carbonate, and organic bases such as sodium acetate and pyridine.

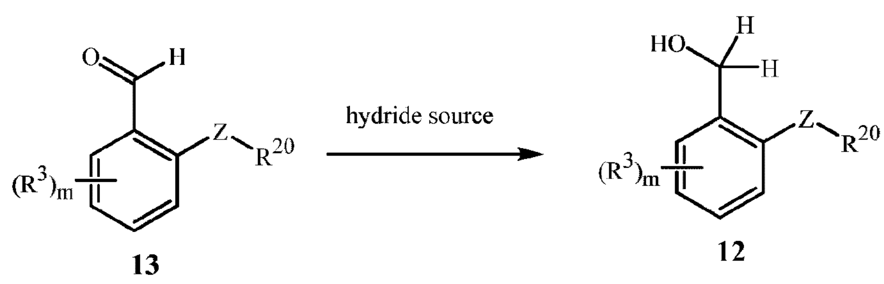
Scheme 6



wherein R^{20} is CH_3 or $COCH_3$ and R^x is R^4, OR^5 or $NR^{6a}R^{6b}$

As shown in Scheme 7 benzylic alcohols of Formula **12** can be prepared by reduction of aldehydes of Formula **13** by a wide variety of methods well known to those skilled in the art. Suitable reducing agents for the reaction include, but are not limited to, sodium borohydride, lithium aluminum hydride, and diisobutylaluminium hydride. A variety of solvents are also suitable for this reaction and include, but are not limited to, methanol, ethanol, and tetrahydrofuran with typically reaction temperatures ranging from -10 °C to 25 °C.

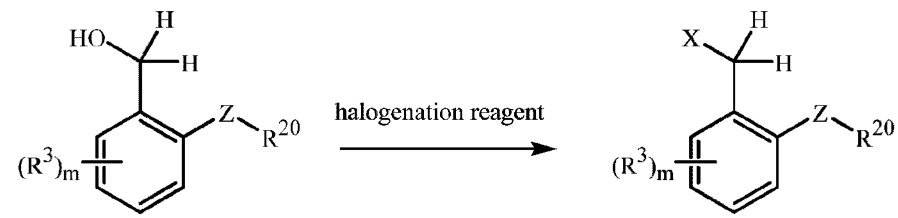
Scheme 7



wherein R^{20} is CH_3 or $COCH_3$

As shown in Scheme 8 benzylic halides of Formula **14** (wherein X is Cl, Br or I) can be prepared by substitution of alcohol with a halide on compounds of Formula **12** by a wide variety of methods well known to those skilled in the art. One such method employs thionyl chloride, optionally with *N*,*N*-dimethyl formamide, in solvents including, but not limited to dichloromethane, toluene, chloroform and no solvent at temperatures typically between 0 – 80 °C. Alternatively compounds of the Formula **14** can be prepared from benzyl alcohols of the Formula **12** employing a phosphorus reagent and a halide regent. A typical phosphorus reagent is triphenyl phosphine and halide reagents include, but are not limited to, carbon tetrahalide, *N*-halosuccinimide, dihalide, and tetrahalomethane. Solvents suitable for this reaction include, but are not limited to, dichloromethane, tetrahydrofuran, and acetonitrile and typical reaction temperatures range from –78 – 50 °C. This latter reaction is well known to those skilled in the art and is referred to as an 'Appel Reaction'. For examples see Smith, M. B.; March, J. *March's Advanced Organic Chemistry*, 6th ed., pages 576-580; John Wiley & Sons: Hoboken, New Jersey and references therein.

Scheme 8

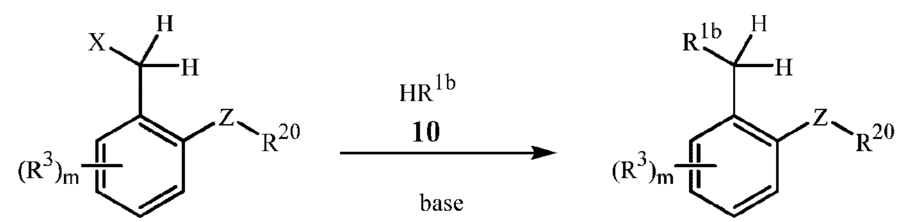


12 **14**

wherein R^{20} is CH_3 or $COCH_3$ and X is Cl, Br or I

In Scheme 9 a benzylic heterateroatom containing compound of Formula **15** (wherein R^{1b} is alkoxy, alkylthio or alkylamino) can readily be prepared by those skilled in the art by a displacement reaction with a compound of the Formula **14** using an appropriate heteroalkyl reagent of Formula **10** (alcohol, alkylamine, or thiol), typically in the presence of a base. Suitable solvents for the reaction include, but are not limited to, tetrahydrofuran, *N,N*-dimethylformamide, acetonitrile, toluene and dichloromethane. Suitable bases for the reaction include, but are not limited to, hydroxides such as sodium hydroxide and potassium hydroxide, hydride bases such as sodium hydride, carbonate bases such as sodium and potassium carbonate, and organic bases such as triethylamine and *N,N*-diethylisopropylamine. Additionally this reaction can be optionally substituted with an iodide, for example sodium iodide or tetrabutylammonium iodide.

Scheme 9

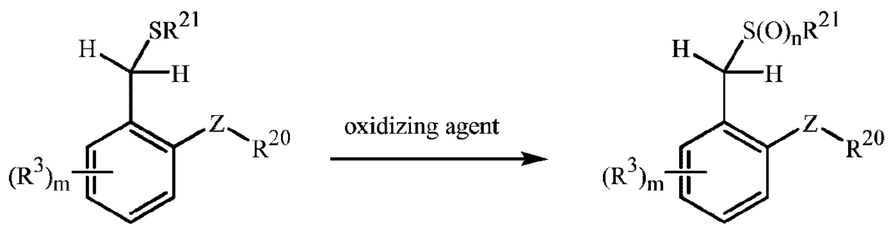


14 **15**

wherein R^{20} is CH_3 or $COCH_3$ and R^{1b} is alkoxy, alkylthio or alkylamino

As shown in Scheme 10 sulfone (n = 1) and sulfoxides (n = 2) of the Formula **16** can be readily prepared by the oxidation of a compound of Formula **17** (wherein A is A-1 and R^{21} is alkyl or haloalkyl) by a wide variety of methods well known to those skilled in the art. Suitable reagents for this reaction include but are not limited to, dihydrogen peroxide, 3-chloro-benzenecarboxylic acid, sodium periodate, and Oxone. Typical solvents for this reaction include dichloromethane, methanol, tetrahydrofuran, and acetic acid and a typical reaction temperature range between –78 to 50 °C. The sulfur is first oxidized to the sulfoxide (n = 1) followed by oxidation to the sulfone (n = 2). Careful monitoring reaction progress with well-established analytical methods (i.e. thin layer chromotagraphy, nuclear magnetic resonance, etc.) allows for selection of the sulfoxide or sulfone.

Scheme 10

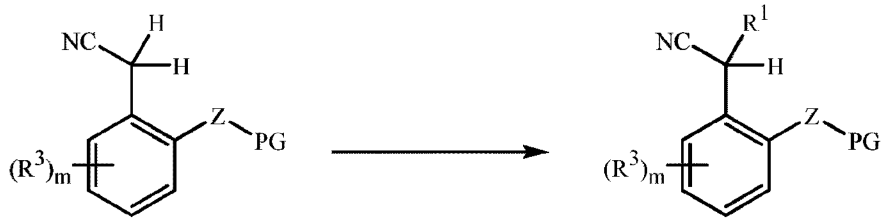


17 **16**

wherein R^{20} is CH_3 or $COCH_3$ and R^{21} is alkyl or haloalkyl

In Scheme 11 a compound of Formula **18** can readily be prepared by alkylation of a compound of Formula **19**. This can be accomplished using an appropriate alkylating reagent in the presence of an appropriate base. Suitable solvents for this reaction generally include polar solvents including but not limited to *N,N*-dimethylformamide, dimethyl sulfoxide, acetonitrile, or tetrahydrofuran. Suitable bases generally include but are not limited to sodium hydride, sodium amide, sodium hydroxide, and lithium diisopropyl amide. Reaction temperatures range from 0 °C to 100 °C as described in synthesis Example 5.

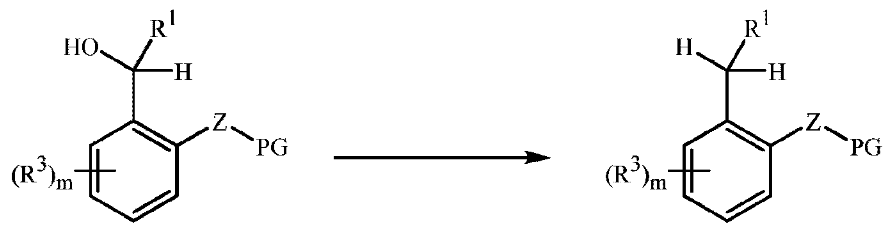
Scheme 11



19 **18**

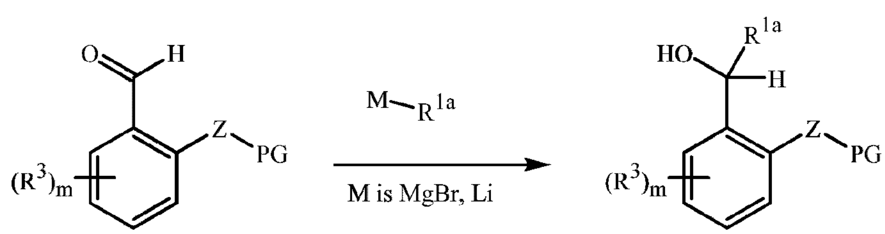
As shown in Scheme 12 a compound of Formula **20** can be prepared through deoxygenation of a compound of Formula **21**. One method utilizes a transition metal catalyst in the presence of a hydride source optionally in the presence of an acid utilizing a number of solvents including methanol and ethanol. A typical transition metal catalyst is palladium on carbon, and standard hydride sources include hydrogen gas, either at atmospheric or elevated pressure, or ammonium formate. Acids utilized for this reaction can include hydrochloric acid, sulfuric acid, and *para*-toluenesulfonic acid. An example of this reaction can be found in *J. Med. Chem.* **1992**, *35*, 1818. A second method employs a hydride source in combination with an acid. Typical hydride sources include triethylsilane and sodium borohydride, in combination with Brönsted acids such as trifluoroacetic acid and acetic acid, or Lewis acids such as boron trifluoride etherate. The solvent for these reactions can be the acid alone or as a mixture with a number of other common solvents such as dichloromethane or acetonitrile. An example of this reaction can be found in US 2007/0003539 or in Step B of synthesis Example 6.

Scheme 12



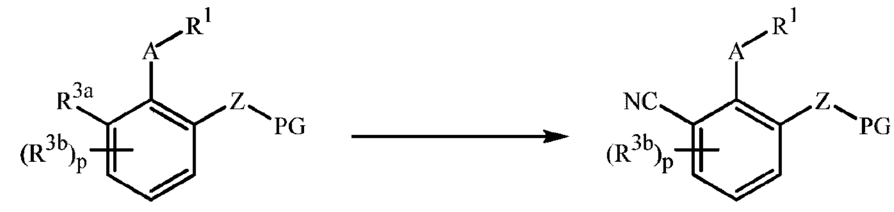
As shown in Scheme 13 a compound of Formula **22** (where R^{1a} is alkyl, alenyl, or alkynyl) can be prepared by reaction of organometallic reagents such as organomagnesium or organolithium reagents with aldehydes of the Formula **23**. This reaction is typically carried out in a solvent such as tetrahydrofuran or diethyl ether at temperatures ranging from –78 to 25 °C. An example of this reaction can be found in *Synlett*, **2016**, *27*, 789 or as described in Step A of synthesis Example 6.

Scheme 13



As shown in Scheme 14, compounds of Formula **25** can be prepared by a transition metal catalyzed coupling of a cyano group with a compound of Formula **24** (R^{3a} = Br or I). Conditions for this reaction generally include a cyanide source and a copper catalyst or palladium catalyst with a co-catalyst. This reaction is typically carried out with a copper(I) halide in the presence of a ligand such as 2-(methylamino)ethylamine or *trans-N,N'*-dimethylcyclohexane-1,2-diamine with a metal cyanide salt. This reaction can be utilized in a range of polar aprotic solvents such as *N*,*N*-dimethylformamide, tetrahydrofuran, acetonitrile, *N*-methyl-2-pyrrolidone or toluene at temperatures ranging from 100 to 210 °C. This reaction is known to those skilled in the art as the Rosenmund-von Braun reaction. Similar conditions can be utilized with copper(I) cyanide with or without the presence of added ligand and cyanide source. The analogous coupling can be affected by using a palladium catalyst such as tetrakis(triphenylphosphine)palladium, palladium diacetate, or tris(dibenzylideneacetone)dipalladium with optional phosphine ligands and a co-catalyst such as zinc cyanide. These reactions can be carried out in a range of polar aprotic solvents such as *N*,*N*-dimethylformamide, *N*-methyl-2-pyrrolidone, acetonitrile and 1,4-dioxane at temperatures ranging from 80 to 150 °C. Alternatively a palladium co-catalyst such as copper(I) halide and a cyanide salt can be used in place of the zinc cyanide under similar conditions. An example of this reaction can be found in *J. Am. Chem. Soc.* **2003**, *125*, 2890 and as described in Step C of synthesis Example 6.

Scheme 14



Compounds of Formulae **24**, **22** and **20** can readily be converted to a compound of Formula **1** using the methods discussed for Scheme 3 and Scheme 1; by deprotection of the PG group and subsequent alkylation with a compound of Formula **3**. It is recognized by one skilled in the art that various functional groups can be converted into others to provide different compounds of Formula **1**. For a valuable resource that illustrates the interconversion of functional groups in a simple and straightforward fashion, see Larock, R. C., *Comprehensive Organic Transformations: A Guide to Functional Group Preparations, 2nd Ed.*, Wiley-VCH, New York, 1999. For example, intermediates for the preparation of compounds of Formula **1** may contain aromatic nitro groups, which can be reduced to amino groups, and then be converted via reactions well known in the art such as the Sandmeyer reaction, to various halides, providing compounds of Formula **1**. The above reactions can also in many cases be performed in alternate order

It is recognized that some reagents and reaction conditions described above for preparing compounds of Formula **1** may not be compatible with certain functionalities present in the intermediates. In these instances, the incorporation of protection/deprotection sequences or functional group interconversions into the synthesis will aid in obtaining the desired products. The use and choice of the protecting groups will be apparent to one skilled in chemical synthesis (see, for example, Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 2nd ed.; Wiley: New York, 1991). One skilled in the art will recognize that, in some cases, after the introduction of a given reagent as depicted in any individual scheme, it may be necessary to perform additional routine synthetic steps not described in detail to complete the synthesis of compounds of Formula **1**. One skilled in the art will also recognize that it may be necessary to perform a combination of the steps illustrated in the above schemes in an order other than that implied by the particular presented to prepare the compounds of Formula **1**.

One skilled in the art will also recognize that compounds of Formula **1** and the intermediates described herein can be subjected to various electrophilic, nucleophilic, radical, organometallic, oxidation, and reduction reactions to add substituents or modify existing substituents.

Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present invention to its fullest extent. The following non-limiting Examples are illustrative of the invention. Steps in the following Examples illustrate a procedure for each step in an overall synthetic transformation, and the starting material for each step may not have necessarily been prepared by a particular preparative run whose procedure is described in other Examples or Steps. Percentages are by weight except for chromatographic solvent mixtures or where otherwise indicated. Parts and percentages for chromatographic solvent mixtures are by volume unless otherwise indicated. ^{1}H NMR spectra are reported in ppm downfield from tetramethylsilane; "s" means singlet, "d" means doublet, "t" means triplet, "q" means quartet, "m" means multiplet, "dd" means doublet of doublets, "dt" means doublet of triplets, and "br s" means broad singlet. Mass spectra (MS) are reported as the molecular weight of the highest isotopic abundance parent ion (M+1) formed by addition of H+ (molecular weight of 1) to the molecule, or (M–1) formed by the loss of H+ (molecular weight of 1) from the molecule, observed by using liquid chromatography coupled to a mass spectrometer (LCMS) using either atmospheric pressure chemical ionization (AP+) where "amu" stands for unified atomic mass units.

EXAMPLE 1

Preparation of 2-[(5-chloro-2-pyrimidinyl)oxy]-*N*-(2,2,2-trifluoroethyl)benzamide (Compound 28)

Step A: Preparation of 2-methoxy-*N*-(2,2,2-trifluoroethyl)benzamide

A solution of 2,2,2-Trifluoroethylamine (1.28 g, 12.89 mmoles) and triethylamine (4.1 mL, 29.31 mmoles) in dichloromethane (30 mL) was cooled to 0 °C. The reaction mixture was treated with a solution of 2-methoxybenzoyl chloride (2.0 g, 11.72 mmoles) in in dichloromethane (8 mL) at a temperature below 5 °C. The reaction mixture was allowed to slowly warm to room temperature. De-ionized water was added and the mixture partitioned. The aqueous phase was extracted with dichloromethane. The combined organic phases were washed with 1N HCl and saturated aqueous sodium chloride solution and dried with magnesium sulfate and concentrated under vacuum to a white solid. The solid was filtered from hexanes to obtain the title compound (2.24 g) as a solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, 2H), 7.49 (t, 1H), 7.10 (t, 1H), 7.00 (d, 1H), 4.10 (q, 2H), 3.99 (s, 3H).

Step B: Preparation of 2-hydroxy-*N*-(2,2,2-trifluoroethyl)benzamide

A solution of 2-methoxy-*N*-(2,2,2-trifluoroethyl)benzamide (i.e. the product of Step A) (1.0 g, 4.28 mmoles) in anhydrous dichloromethane (20 mL) was cooled with an ice-water bath to 0 °C. The solution was treated with 1 M boron tribromide solution (4.72 mL, 4.72 mmoles) in dichloromethane dropwise and stirred for 3 hours. The reaction mixture was then poured into ice-water and partitioned. The aqueous phase was extracted with dichloromethane and then ethyl acetate. The combined organic phases were washed with saturated aqueous sodium chloride solution, dried with magnesium sulfate and concentrated under vacuum to a solid. The solid was filtered from hexanes to obtain the title compound (475 mg) as a solid.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 (t, 1H), 7.40 (d, 1H), 7.01 (d, 1H), 6.89 (t, 1H), 6.53 (bs, 1H), 4.13 (m,2 H).

Step C: Preparation of 2-[(5-chloro-2-pyrimidinyl)oxy]-*N*-(2,2,2-trifluoroethyl)-benzamide

To a solution of 2-hydroxy-*N*-(2,2,2-trifluoroethyl)benzamide (i.e. the product of Step B) (100 mg, 0.456 mmoles) in acetonitrile (3 mL) was added 2,5-dichloropyrimidine (71 mg, 0.48 mmoles) and potassium carbonate (190 mg, 1.37 mmoles). The reaction mixture was heated to 80 °C for 12 hours. The reaction was partitioned between water and ethyl acetate, the organic phase was separated, dried with magnesium sulfate, and concentrated under vacuum. The residue was purified by chromatography on silica gel with a 5 gram Bond elut column, eluting with 20% ethyl acetate/hexanes to afford the title compound, a compound of the present invention, as an oil (0.30 g).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (s, 2H), 7.65 (d, 1H), 7.48 (t, 1H), 7.31 (t, 1H), 7.21 (bs, 1H), 7.00 (d, 1H), 4.75 (q, 2H).

EXAMPLE 2

Preparation of 3-buten-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 21)

Step A: Preparation of 3-butenyl 2-bromo-6-hydroxybenzoate

To a stirred solution of 2-bromo-6-hydroxybenzoic acid (0.200 g, 0.921 mmol) in dry dichloromethane (3 mL) was added oxalyl chloride (94.8 μL, 1.11 mml) and 2 drops of *N,N'*-dimethylformamide. The reaction mixture was stirred at room temperature for 3 hours. The reaction mixture was then concentrated under vacuum and the residue was dissolved in dry dichloromethane (3 mL) and treated with 3-buten-1-ol (86.9 μL, 1.01 mmol) and 3 drops of triethylamine. The reaction mixture was stirred at room temperature for 18 hours. The reaction mixture was concentrated under vacuum onto Celite® diatomaceous earth filter aid and purified by column chromatography on silica gel, eluting with 0 to 20% ethyl acetate in hexanes to afford the title compound (0.117 g).

^{1}H NMR (500 MHz, $CDCl_3$) δ 10.96 (s, 1H), 7.24–7.17 (m, 2H), 6.98–6.93 (m, 1H), 5.95–5.87 (m, 1H), 5.22–5.18 (m, 1H), 5.15–5.12 (m, 1H), 4.47 (t, 2H), 2.62–2.57 (m, 2H).

Step B: Preparation of 3-buten-1-yl 2-bromo-6[(5-chloro-2-pyrimidinyl)oxy]benzoate

To a stirred solution of 3-butenyl 2-bromo-6-hydroxybenzoate (i.e. the product of Step A) (0.117 g, 0.431 mmol) and 5-chloro-2-(methylsulfonyl)-pyrimidine (i.e. 5-chloro-2-methylsulfonylpyrimidine) (99.8 mg, 0.518 mmol) in *N,N'*-dimethylformamide (2 mL) was added potassium carbonate (85.9 mg, 0.646 mmol). The reaction mixture was stirred at room temperature for 18 hours. The reaction mixture was then filtered through a pad of Celite® diatomaceous earth filter aid and the filtrate was concentrated under vacuum. The crude residue was purified by column chromatography on silica gel, eluting with 0 to 30% ethyl acetate in hexanes to afford the title compound, a compound of the present invention, as a solid (0.104 g).

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.48 (s, 2H), 7.53 (dd, 1H), 7.35 (t, 1H), 7.17 (dd, 1H), 5.75–5.65 (m, 1H), 5.11–4.99 (m, 2H), 4.29 (t, 2H), 2.39–2.34 (m, 2H).

EXAMPLE 3

Preparation of 3,3,3-trifluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate (Compound 26)

Step A: Preparation of 3,3,3-trifluoropropyl 2-bromo-6-hydroxybenzoate

To a stirred solution of 2-bromo-6-hydroxybenzoic acid (0.500 g, 2.30 mmol) and molecular sieves in 3,3,3-trifluoropropan-1-ol (15 mL) was added concentrated sulfuric acid (0.300 mL). The reaction mixture was heated at 78 °C for 24 hours. The reaction mixture was cooled to room temperature and filtered through a small pad of Celite® diatomaceous earth filter aid. The filtrate was diluted with ethyl acetate and washed with water, and saturated aqueous sodium chloride solution. The organic phase was separated, dried over magnesium sulfate and concentrated under vacuum. The crude material was purified by column chromatography on silica gel, eluting with 0 to 20% ethyl acetate in hexanes to afford the title compound (0.268 g).

^{1}H NMR (500 MHz, $CDCl_3$) δ 10.79 (s, 1H), 7.26–7.20 (m, 2H), 7.00–6.94 (m, 1H), 4.63 (t, 2H), 2.70 (m, 2H).

Step B: Preparation of 3,3,3-trifluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)-oxy]benzoate

To a stirred solution of 3,3,3-trifluoropropyl 2-bromo-6-hydroxybenzoate (i.e. the product of Step A) (0.124 g, 0.396 mmol) and 5-chloro-2-(methylsulfonyl)-pyrimidine (i.e. 5-chloro-2-methylsulfonylpyrimidine) (95.1 mg, 0.475 mmol) in *N,N'*-dimethylformamide (2 mL) was added potassium carbonate (82.1 mg, 0.594 mmol). The reaction was stirred at room temperature for 18 hours. The reaction mixture was filtered through a pad of Celite® diatomaceous earth filter aid and filtrate was concentrated under vacuum. The crude material was purified by column chromatography on silica gel, eluting with 0 to 30% ethyl acetate in hexanes to afford the title compound, a compound of the present invention, as a solid (55.0 mg).

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.49 (s, 2H), 7.54 (dd, 1H), 7.38 (t, 1H), 7.20 (dd, 1H), 4.46 (t, 2H), 2.50 (m, 2H).

EXAMPLE 4

Preparation of 1-[2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]phenyl]-4,4,4-trifluoro-1-butanone (Compound 107)

Step A: Preparation of 2-chloro-6-methoxy-α-(3,3,3-trifluoropropyl)benzenemethanol

A reaction flask was charged with 1.92 g (79.18 mmol) of magnesium, a catalytic amount of iodine, and 50 mL of diethyl ether. The mixture was heated to reflux and 1,1,1-trifluoro-3-iodo-propane (10.64 g, 47.51 mmol) was added over 30 min. The mixture was allowed to cool to room temperature and transferred to a second reaction flask charged with 2-chloro-6-methoxy-benzaldehyde (6.75 g, 39.59 mmol) and 75 mL of tetrahydrofuran at –78 °C. The reaction mixture was allowed to warm to room temperature, quenched with 1 N hydrochloric acid, and partitioned between diethyl ether and brine. The organic phase was dried over $MgSO_4$, filtered, and concentrated to provide 9.4 g of crude product that was used in the subsequent step without purification.

Step B: Preparation of 1-(2-chloro-6-methoxyphenyl)-4,4,4-trifluoro-1-butanone

To a solution of 2-chloro-6-methoxy-α-(3,3,3-trifluoropropyl)benzenemethanol (i.e. the crude material obtained in Step A, 9.4 g) in 175 mL of acetone was added 15.7 mL (42 mmol) of 2.64 M Jones reagent over 15 min. The reaction mixture was stirred for an additional 30 min., quenched with 0.5 mL of isopropanol, and partitioned between diethyl ether and water. The organic phase was dried over $MgSO_4$, filtered, and concentrated. The crude material was purified by silica gel chromatography eluting with a hexane:ethyl acetate gradient to provide 7.0 g of the title compound.

^{1}H NMR ($CDCl_3$) δ 7.32–7.24 (m, 1H), 7.00 (d, 1H), 6.84 (d, 1H), 3.82 (s, 3H), 3.09–3.01 (m, 2H), 2.64–2.51 (m, 2H).

Step C: Preparation of 1-(2-chloro-6-hydroxyphenyl)-4,4,4-trifluoro-1-butanone

To a solution of 1-(2-chloro-6-methoxyphenyl)-4,4,4-trifluoro-1-butanone (i.e. the product from Step B, 3.5 g, 13.2 mmol) of in 100 mL of dichloromethane was added boron tribromide (1.0 M in dichloromethane, 15.79 mL) at 0 °C. The reaction solution was stirred for 2 h while warming to room temperature, which was then poured into ice cold dilute aqueous hydrochloric acid, and extracted with dichloromethane. The organic phase was dried over $MgSO_4$, filtered, and concentrated. The crude material was purified by silica gel chromatography eluting with a gradient of hexanes/ethyl acetate to provide 2.6 g of the title compound.

^{1}H NMR ($CDCl_3$) δ 11.88 (s, 1H), 7.35–7.30 (m, 1H), 7.01–6.98 (m, 1H), 6.96–6.92 (m, 1H), 3.55–3.49 (m, 2H), 2.65–2.53 (m, 2H).

Step D: Preparation of 1-[2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]phenyl]-4,4,4-trifluoro-1-butanone

A reaction flask was charged with 1-(2-chloro-6-hydroxyphenyl)-4,4,4-trifluoro-1-butanone (i.e. the product obtained in Step C, 2.6 g, 10.3 mmol), 5-chloro-2-(methylsulfonyl)-pyrimidine (2.7 g, 14.0 mmol), potassium carbonate (1.7 g, 12.36 mmol), and 50 mL of isopropanol. The reaction mixture was heated to 50 °C for 1 h, poured into dilute ice cold aqueous hydrochloric acid, and extracted with diethyl ether repeatedly. The combined organic extracts were washed with brine, dried over $MgSO_4$, filtered, and concentrated. The crude material was purified by silica gel chromatography eluting with a gradient of hexanes/ethyl acetate to provide 3.0 g of the title compound, a compound of the invention.

^{1}H NMR ($CDCl_3$) δ 8.49 (s, 2H), 7.45–7.40 (m, 1H), 7.37–7.33 (m, 1H), 7.15–7.11 (m, 1H), 3.14–3.08 (m, 2H), 2.57–2.46 (m, 2H).

EXAMPLE 5

Preparation of 2-[(5-chloro-2-pyrmidinyl)oxy]-α-pentylbenzeneacetonitrile (Compound 141)

Step A: Preparation of 2-methoxy-α-pentylbenzeneacetonitrile

To a solution of 2-methoxy-benzeneacetonitrile (500 mg, 3.39 mmol) in dimethylsulfoxide (5 mL) was added aqueous sodium hydroxide (50%, 0.75 mL) followed by 1-bromopentane (559 mg, 0.458 mL, 3.76 mmol) and the reaction mixture was stirred at ambient temperature for 18 h. The reaction mixture was partitioned between ethyl acetate and water, the organic phase was washed with water (3 ×). The organic phase was dried over $MgSO_4$ and concentrated under vacuum. The resulting residue was purified by chromatography on silica gel eluting with a gradient of 0 to 50% ethyl acetate in hexanes to afford the desired product in quantitative yield.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38–7.41 (m, 1H), 7.27–7.31 (m, 1H), 6.96–7.01 (m, 1H), 6.87–6.91 (m, 1H), 4.15–4.20 (m, 1H), 3.85 (s, 3H), 1.77–1.90 (m, 2H), 1.41–1.58 (m, 2H), 1.27–1.37 (m, 4H), 0.84–0.94 (m, 3H).

Step B: Preparation of 2-hydroxy-α-pentylbenzeneacetonitrile

To a solution of 2-methoxy-α-pentylbenzeneacetonitrile (i.e. the product of Step A, 440 mg, 2.02 mmol) in dichloromethane (10 mL) at 0 °C was added boron tribromide (1.0 M in dichloromethane, 10 mL, 10 mmol) and the reaction was allowed to warm to room temperature over 18 h. The reaction mixture was quenched with a saturated solution of sodium carbonate, the phases were separated and the organic layer was dried over $MgSO_4$. The solvent was removed under vacuum and purified by chromatography on silica gel, eluting with a gradient of 0 to 50% ethyl acetate in hexanes to afford the desired product (232 mg)

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35–7.39 (m, 1H), 7.15–7.20 (m, 1H), 6.93–6.98 (m, 1H), 6.76–6.79 (m, 1H), 5.28–5.40 (bs, 1H), 4.14–4.20 (m, 1H), 1.84–1.93 (m, 2H), 1.42–1.58 (m, 2H), 1.25–1.38 (m, 4H), 0.85–0.91 (m, 3H).

Step C: Preparation of 2-[(5-chloro-2-pyrmidinyl)oxy]-α-pentylbenzeneacetonitrile

To a solution of 2-hydroxy-α-pentylbenzeneacetonitrile (208 mg, 1.02 mmol) in *N,N'*-dimethylformamide (2.0 mL) was added potassium carbonate (169 mg, 1.22 mmol) followed by 5-chloro-2-(methylsulfonyl)-pyrimidine (137 mg, 1.07 mmol) and the reaction was heated to 35 °C for 5 h. The reaction was partitioned between ethyl acetate and water. The organic phase was washed with water (3 ×), followed by drying over $MgSO_4$ and concentrating. The resulting residue was purified by chromatography on silica gel eluting with a gradient of 0 to 30% ethyl acetate in hexanes to afford the title product, a compound of the invention (171 mg).

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.51 (s, 2H), 7.56–7.58 (m, 1H), 7.38–7.42 (m, 1H), 7.31–7.35 (m, 1H), 7.12–7.15 (m, 1H), 3.99–4.03 (m, 1H), 1.80–1.96 (m, 2H), 1.36–1.55 (m, 2H), 1.20–1.28 (m, 4H), 0.81–0.87 (m, 3H).

EXAMPLE 6

Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-(5,5,5-trifluoropentyl)benzonitrile (Compound 73)

Step A: Preparation of 2-bromo-6-methoxy-α-(4,4,4-trifluorobutyl)benzenemethanol

To magnesium metal shavings (0.254 g, 10.5 mmol, 1.5 eq.) in dry diethyl ether (2 mL) was added a crystal of iodine. The mixture was warmed to 35 °C and stirred for 15 min. To this mixture was added 1-bromo-4,4,4-trifluorobutane (1.30 mL, 10.5 mmol, 1.5 eq.) over 30 min. The reaction mixture continued to stir at 35 °C until all the magnesium was consumed. The resulting Grignard reagent was taken up by syringe. In separate reaction vial 2-bromo-6-methoxy-benzaldehyde (1.50 g, 6.97 mmol, 1.0 eq.) was dissolved in dry tetrahydrofuran (20 mL) and cooled to 0 °C. The previously prepared Grignard reagent was added dropwise to the aldehyde. The reaction mixture was stirred at room temperature for 18 h. The reaction was quenched with 1 N hydrochloric acid and diluted with ethyl acetate. The organic layer was separated, dried and concentrated. The crude material was purified by column chromatography, eluting with a gradient of 0 to 20% ethyl acetate in hexanes to afford the desired product (2.15 g).

^{1}H NMR (500MHz, $CDCl_3$) δ 7.21–7.16 (m, 1H), 7.09 (t, 1H), 6.90–6.87 (m, 1H), 5.17–5.09 (m, 1H), 3.90 (s, 3H), 3.72 (d, 1H), 2.24–2.10 (m, 2H), 2.02–1.75 (m, 3H), 1.73–1.61 (m, 1H).

Step B: Preparation of 1-bromo-3-methoxy-2-(5,5,5-trifluoropentyl)benzene

To a stirred solution of 2-bromo-6-methoxy-α-(4,4,4-trifluorobutyl)benzenemethanol (i.e. the product of Step A, 2.15 g, 6.58 mmol, 1.0 eq.) in dry dichloromethane (22 mL) was added triethylsilane (4.20 mL, 26.3 mmol, 4.0 eq.). After stirring for 15 min. trifluoroacetic acid (2.01 mL, 26.3 mmol, 4.0 eq.) was added and the reaction was heated to 40 °C. After 2 h, another 4.0 eq. of trifluoroacetic acid was added and the reaction mixture was stirred at 40 °C for another 18 h. The reaction was cooled to room temperature and concentrated onto Celite® diatomaceous earth filter aid for purification by column chromatography, eluting with a gradient of 0 to 10% ethyl acetate in hexanes to afford the desired product (1.82 g).

^{1}H NMR (500MHz, $CDCl_3$) δ 7.20–7.12 (m, 1H), 7.07–7.00 (m, 1H), 6.81–6.78 (m, 1H), 3.81 (s, 3H), 2.85–2.78 (m, 2H), 2.20–2.07 (m, 2H), 1.69–1.55 (m, 4H)

Step C: Preparation of 3-methoxy-2-(5,5,5-trifluoropentyl)benzonitrile

A solution of 1-bromo-3-methoxy-2-(5,5,5-trifluoropentyl)benzene (i.e. the product of Step B, 1.82 g, 5.86 mmol, 1.0 eq.) in *N,N*-dimethylformamide (20 mL) was deoxygenated by bubbling N_2 through the reaction mixture for ~10 min. To this mixture was added copper(I) cyanide (1.57 g, 17.6 mmol, 3.0 eq.). The reaction was refluxed at 160 °C under nitrogen for 18 h. The reaction was cooled to ambient temperature and filtered through a pad of Celite® diatomaceous earth filter aid. The filtrate was diluted with ethyl acetate and washed several times with water, then once with brine. The organic layer was dried and concentrated in vacuo. The crude material was purified by column chromatography, eluting with 0 to 30% ethyl acetate in hexanes to afford the desired product (1.38 g).

^{1}H NMR (500MHz, $CDCl_3$) δ 7.29–7.24 (m, 1H), 7.22–7.19 (m, 1H), 7.08–7.04 (m, 1H), 3.86 (s, 3H), 2.94–2.82 (m, 2H), 2.24–2.07 (m, 2H), 1.75–1.60 (m, 4H).

Step D: Preparation of 3-hydroxy-2-(5,5,5-trifluoropentyl)benzonitrile

A solution of 3-methoxy-2-(5,5,5-trifluoropentyl)benzonitrile (i.e. the product of Step C, 1.38 g, 5.36 mmol, 1.0 eq.) in dichloroethane (17 mL) was treated with boron tribromide

(1.0 M in dichloromethane, 10.7 mL, 10.7 mmol, 2.0 eq.). The reaction mixture was heated to 60 °C for 18 h. The reaction was cooled to ambient temperature and quenched with saturated aqueous sodium bicarbonate. The organic phase was separated, dried and concentrated onto Celite® diatomaceous earth filter aid for purification by column chromatography, eluting with a gradient of 0 to 30% ethyl acetate in hexanes to afford the desired product (1.16 g).

^{1}H NMR (500MHz, $CDCl_3$) δ 7.25–7.21 (m, 1H), 7.19–7.15 (m, 1H), 6.98–6.95 (m, 1H), 5.05–5.01 (m, 1H), 2.92–2.86 (m, 2H), 2.20–2.08 (m, 2H), 1.78–1.62 (m, 4H).

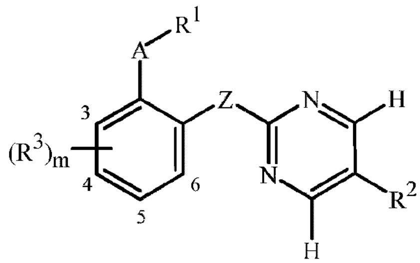
Step E: Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-(5,5,5-trifluoropentyl)benzonitrile

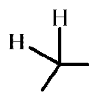
A mixture of 3-hydroxy-2-(5,5,5-trifluoropentyl)benzonitrile (i.e. the product of Step D, 1.16 g, 4.79 mmol, 1.0 eq.), 5-chloro-2-(methylsulfonyl)-pyrimidine (1.11 g, 5.75 mmol, 1.2 quiv) and potassium carbonate (0.993 g, 7.18 mmol, 1.5 eq.) in *N,N*-dimethylformamide (16 mL) was stirred at room temperature for 18 h. The reaction mixture was heavily diluted with ethyl acetate and washed several times with water, then once with brine. The organic phase was dried and concentrated onto Celite® diatomaceous filter aid for purification by column chromatography, eluting with a gradient of 0 to 30% ethyl acetate in hexanes to afford the desired product (1.65 g).

^{1}H NMR (500MHz, $CDCl_3$) δ 8.52–8.48 (m, 2H), 7.61–7.56 (m, 1H), 7.42–7.36 (m, 1H), 7.35–7.31 (m, 1H), 2.87–2.78 (m, 2H), 2.16–2.00 (m, 2H), 1.74–1.64 (m, 2H), 1.63–1.54 (m, 2H).

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 585 can be prepared. The following abbreviations are used in the Tables which follow: *t* means tertiary, *s* means secondary, *n* means normal, *i* means iso, *c* means cyclo, Me means methyl, Et means ethyl, Pr means propyl, Bu means butyl, *i*-Pr means isopropyl, Bu means butyl, *c*-Pr cyclopropyl, Ph means phenyl, OMe means methoxy, OEt means ethoxy, SMe means methylthio, NHMe methylamino, -CN means cyano, S(O)Me means methylsulfinyl, and $S(O)_2Me$ means methylsulfonyl.

Table 1





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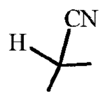

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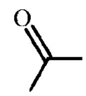

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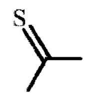


A-3B

R^2 = F, $(R^3)_m$ = 3-F, Z = O and A = A-3A

R^1	R^1
butyl	3,3,4,4,4-pentafluorobutoxy
tert-butyl	2,2,3,3,3-pentafluoropropoxy
ethyl	3,3,4,4-tetrafluorobutoxy
hexyl	2,2,3,3-tetrafluoropropoxy
isobutyl	3,3,3-trichloropropoxy
isopentyl	4,4,4-trifluorobutoxy
methyl	2,2,2-trifluoroethoxy
pentyl	6,6,6-trifluorohexoxy
propyl	4,4,4-trifluoro-2-methyl-butoxy
benzyl	3,3,3-trifluoropropoxy
allyl	4-bromobut-3-ynoxy
3-buten-1-yl	4-chlorobut-3-ynoxy
3-methyl-2-buten-1-yl	3-chloroprop-2-ynoxy
3-methyl-3-buten-1-yl	4,4-difluorobut-2-ynoxy
4-methyl-3-penten-1-yl	5,5,5-trifluoropent-2-ynoxy
3-penten-1-yl	5,5,5-trifluoropent-3-ynoxy
3-butyn-1-yl	cyclobutylmethoxy
4-methyl-2-pentyn-1-yl	cyclohexoxy
3-pentyn-1-yl	cyclopentoxy
2-propyn-1-yl	2-cyclopropylethoxy
5-hexyn-1-yl	cyclopropylmethoxy
4-pentyn-1-yl	(2-bromo-2-chloro-cyclopropyl)methoxy
3-bromopropyl	(2,2-dibromocyclopropyl)methoxy

R^1	R^1
3-chlorobutyl	(2,2-dichloro-1-methyl-cyclopropyl)methoxy
3-chloropropyl	(3,3-difluorocyclobutyl)methoxy
4,4-difluorobutyl	2-(2,2-difluorocyclopropyl)ethoxy
2,2-difluoroethyl	(2,2-difluorocyclopropyl)methoxy
3,3-difluoropropyl	2-chloroethoxymethyl
3,3,4,4,4-pentafluorobutyl	2,3-dichloro-5-methoxy-pentyl
2,2,3,3,3-pentafluoropropyl	3,3-difluoro-5-methoxy-pentyl
3,3,4,4-tetrafluorobutyl	2-isopropoxyethyl
2,2,3,3-tetrafluoropropyl	2-methoxyethyl
3,3,3-trichloropropyl	5-methoxypentyl
4,4,4-trifluorobutyl	2-methoxypropyl
2,2,2-trifluoroethyl	1,1,2,2-tetrafluoroethoxymethyl
6,6,6-trifluorohexyl	2,2,2-trifluoroethoxymethyl
4,4,4-trifluoro-2-methyl-butyl	2-(trifluoromethoxy)ethyl
3,3,3-trifluoropropyl	2-isopropoxyethoxy
4-bromo-3-buten-1-yl	4-methoxybutoxy
2-chloroallyl	2-methoxyethoxy
3-chloroallyl	2-methoxypropoxy
3-chloro-3-buten-1-yl	4-cyanobutyl
4-chloro-3-buten-1-yl	3-cyano-1,2-dimethyl-propyl
5,5-difluoro-3-penten-1-yl	2-cyanoethyl
4,4,4-trifluoro-2-buten-1-yl	3-cyano-2-methyl-propyl
5,5,5-trifluoro-3-methyl-2-penten-1-yl	cyanomethyl
5,5,5-trifluoro-3-penten-1-yl	5-cyanopentyl
4-bromo-3-butyn-1-yl	3-cyanopropyl
3-butyn-1-yl	4-cyanobutoxy
4-chloro-3-butyn-1-yl	3-cyano-1,2-dimethyl-propoxy
3-chloro-2-propyn-1-yl	2-cyanoethoxy
4,4-difluoro-2-butyn-1-yl	cyanomethoxy
5,5,5-trifluoro-1-methyl-2-pentyn-1-yl	3-cyano-2-methyl-propoxy
5,5,5-trifluoro-2-pentyn-1-yl	5-cyanopentoxy
5,5,5-trifluoro-3-pentyn-1-yl	3-cyanopropoxy
2-cyclobutylethyl	2-(cyanomethoxy)ethyl
cyclohexyl	3-(cyanomethoxy)-2-methyl-propyl
cyclopentylmethyl	cyanomethoxymethyl
2-cyclopropylethyl	1,2-dimethyl-3-nitro-propyl
3-cyclopropylpropyl	4-hydroxybutyl

R^1	R^1
(2,2-dimethylcyclopropyl)methyl	3-hydroxy-1,2-dimethyl-propyl
(1-methylcyclopropyl)methyl	2-hydroxyethyl
(2-methylcyclopentyl)methyl	3-hydroxy-2-methyl-propyl
(2-bromo-2-chloro-cyclopropyl)methyl	hydroxymethyl
(2,2-dibromocyclopropyl)methyl	5-hydroxypentyl
2-(2,2-dichloro-1-methyl-cyclopropyl)ethyl	3-hydroxypropyl
(2,2-dichloro-1-methyl-cyclopropyl)methyl	2-methyl-3-nitro-propyl
2-(3,3-difluorocyclobutyl)ethyl	4-nitrobutyl
2-(2,2-difluorocyclopropyl)ethyl	2-nitroethyl
(2,2-difluorocyclopropyl)methyl	nitromethyl
butyl(methyl)amino	5-nitropentyl
dimethylamino	3-nitropropyl
ethyl(propyl)amino	butylthio
isopropyl(methyl)amino	tert-butylthio
isopropyl(propyl)amino	1,3-dimethylbutylthio
methyl(propyl)amino	3,3-dimethylbutylthio
2-chloroethyl(2,2,2-trifluoroethyl)amino	ethylthio
3-chloropropyl(methyl)amino	isopentylthio
methyl(2,2,2-trifluoroethyl)amino	methylthio
methyl(3,3,3-trifluoropropyl)amino	pentylthio
butylamino	propylthio
3-chloropropylamino	3-bromopropylthio
isopentylamino	3-chlorobutylthio
propylamino	3-chloropropylthio
3,3,3-trifluoropropylamino	2,2-difluoroethylthio
1-piperidyl	3,3,3-trichloropropylthio
1-pyrrolidinyl	4,4,4-trifluorobutylthio
butoxy	2,2,2-trifluoroethylthio
tert-butoxy	6,6,6-trifluorohexylthio
1,3-dimethylbutoxy	3,3,3-trifluoropropylthio
3,3-dimethylbutoxy	cyclobutylmethylthio
ethoxy	cyclohexylthio
hexyl	cyclopentylthio
isopentyloxy	2-cyclopropylethylthio
methoxy	cyclopropylmethylthio
propoxy	2-chloroethylthiomethyl
allyloxy	2,3-dichloro-5-methylthio-pentyl

R^1	R^1
3-butenoxy	3,3-difluoro-5-methylthio-pentyl
3-methyl-2-butenoxy	2-isopropylthioethyl
3-methyl-3-butenoxy	2-methylthioethyl
4-methyl-3-pentenoxy	5-methylthiopentyl
4-bromo-3-butenoxy	2-methylthiopropyl
2-chloroallyloxy	1,1,2,2-tetrafluoroethylthiomethyl
3-chloroallyloxy	2,2,2-trifluoroethylthiomethyl
3-chloro-3-butenoxy	2-(trifluoromethylthio)ethyl
4-chloro-3-butenoxy	bis(2-chloroethyl)aminooxy
5,5-difluoro-3-pentenoxy	cyanomethoxy(methyl)amino
4,4,4-trifluoro-2-butenoxy	diethylamino(methyl)amino
5,5,5-trifluoro-3-methyl-2-pentenoxy	ethoxy(methyl)amino
5,5,5-trifluoro-3-pentenoxy	ethoxy(2,2,2-trifluoroethyl)amino
3-butynoxy	ethylamino(methyl)amino]
5-hexynoxy	ethylamino(2,2,2-trifluoroethyl)amino
4-methyl-2-pentynoxy	ethyl(methyl)amino]-(2,2,2-trifluoroethyl)amino
3-pentynoxy	ethyl(3,3,3-trifluoropropyl)amino]-methyl-amino
4-pentynoxy	isobutyl(methyl)amino]oxy
2-propynoxy	2-methoxyethoxy(methyl)amino
3-bromopropoxy	methyl(propyl)amino]oxy
3-chlorobutoxy	methyl(2,2,2-trifluoroethoxy)amino
3-chloropropoxy	methyl(2,2,2-trifluoroethyl)amino]oxy
4,4-difluorobutoxy	methyl(3,3,3-trifluoropropoxy)amino
2,2-difluoroethoxy	methyl-(3,3,3-trifluoropropylamino)amino
3,3-difluoropropoxy	

The present disclosure also includes Tables 2 through 292. Each Table is constructed in the same manner as Table 1 above, except that the row heading in Table 1 (i.e. "R^2 = F, $(R^3)_m$ = 3-F, Z = O and A = A-3A") is replaced with the respective row heading shown below. For example, the first entry in Table 2 is a compound of Formula **1** wherein R^2 is Cl, $(R^3)_m$ is 3-F, Z is O, A is A-3A and R^1 is butyl. Tables 3 through 292 are constructed similarly.

	Header Row					Header Row			
Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
2	Cl	3-F	O	A-3A	147	F	5-Cl	O	A-3B
3	Br	3-F	O	A-3A	148	Cl	5-Cl	O	A-3B
4	I	3-F	O	A-3A	149	Br	5-Cl	O	A-3B
5	CF_3	3-F	O	A-3A	150	I	5-Cl	O	A-3B

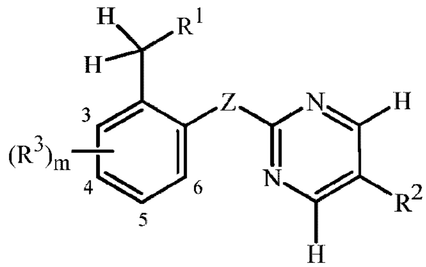
Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
		Header Row					Header Row		
6	OMe	3-F	O	A-3A	151	CF_3	5-Cl	O	A-3B
7	Me	3-F	O	A-3A	152	OMe	5-Cl	O	A-3B
8	F	3-Cl	O	A-3A	153	Me	5-Cl	O	A-3B
9	Cl	3-Cl	O	A-3A	154	F	6-Cl	O	A-3B
10	Br	3-Cl	O	A-3A	155	Cl	6-Cl	O	A-3B
11	I	3-Cl	O	A-3A	156	Br	6-Cl	O	A-3B
12	CF_3	3-Cl	O	A-3A	157	I	6-Cl	O	A-3B
13	OMe	3-Cl	O	A-3A	158	CF_3	6-Cl	O	A-3B
14	Me	3-Cl	O	A-3A	159	OMe	6-Cl	O	A-3B
15	F	3-Br	O	A-3A	160	Me	6-Cl	O	A-3B
16	Cl	3-Br	O	A-3A	161	F	3-Br, 4-F	O	A-3B
17	Br	3-Br	O	A-3A	162	Cl	3-Br, 4-F	O	A-3B
18	I	3-Br	O	A-3A	163	Br	3-Br, 4-F	O	A-3B
19	CF_3	3-Br	O	A-3A	164	I	3-Br, 4-F	O	A-3B
20	OMe	3-Br	O	A-3A	165	CF_3	3-Br, 4-F	O	A-3B
21	Me	3-Br	O	A-3A	166	OMe	3-Br, 4-F	O	A-3B
22	F	3-I	O	A-3A	167	Me	3-Br, 4-F	O	A-3B
23	Cl	3-I	O	A-3A	168	F	3-F, 4-F	O	A-3B
24	Br	3-I	O	A-3A	169	Cl	3-F, 4-F	O	A-3B
25	I	3-I	O	A-3A	170	Br	3-F, 4-F	O	A-3B
26	CF_3	3-I	O	A-3A	171	I	3-F, 4-F	O	A-3B
27	OMe	3-I	O	A-3A	172	CF_3	3-F, 4-F	O	A-3B
28	Me	3-I	O	A-3A	173	OMe	3-F, 4-F	O	A-3B
29	F	3-CN	O	A-3A	174	Me	3-F, 4-F	O	A-3B
30	Cl	3-CN	O	A-3A	175	F	3-Cl, 4-F	O	A-3B
31	Br	3-CN	O	A-3A	176	Cl	3-Cl, 4-F	O	A-3B
32	I	3-CN	O	A-3A	177	Br	3-Cl, 4-F	O	A-3B
33	CF_3	3-CN	O	A-3A	178	I	3-Cl, 4-F	O	A-3B
34	OMe	3-CN	O	A-3A	179	CF_3	3-Cl, 4-F	O	A-3B
35	Me	3-CN	O	A-3A	180	OMe	3-Cl, 4-F	O	A-3B
36	F	3-CF_3	O	A-3A	181	Me	3-Cl, 4-F	O	A-3B
37	Cl	3-CF_3	O	A-3A	182	F	3-Br	S	A-3B
38	Br	3-CF_3	O	A-3A	183	Cl	3-Br	S	A-3B
39	I	3-CF_3	O	A-3A	184	Br	3-Br	S	A-3B
40	CF_3	3-CF_3	O	A-3A	185	I	3-Br	S	A-3B
41	OMe	3-CF_3	O	A-3A	186	CF_3	3-Br	S	A-3B

	Header Row					Header Row			
Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
42	Me	3-CF_3	O	A-3A	187	OMe	3-Br	S	A-3B
43	F	4-Cl	O	A-3A	188	Me	3-Br	S	A-3B
44	Cl	4-Cl	O	A-3A	189	F	3-Cl	S	A-3B
45	Br	4-Cl	O	A-3A	190	Cl	3-Cl	S	A-3B
46	I	4-Cl	O	A-3A	191	Br	3-Cl	S	A-3B
47	CF_3	4-Cl	O	A-3A	192	I	3-Cl	S	A-3B
48	OMe	4-Cl	O	A-3A	193	CF_3	3-Cl	S	A-3B
49	Me	4-Cl	O	A-3A	194	OMe	3-Cl	S	A-3B
50	F	5-Cl	O	A-3A	195	Me	3-Cl	S	A-3B
51	Cl	5-Cl	O	A-3A	196	Cl	3-F	O	A-1
52	Br	5-Cl	O	A-3A	197	Br	3-F	O	A-1
53	I	5-Cl	O	A-3A	198	I	3-F	O	A-1
54	CF_3	5-Cl	O	A-3A	199	CF_3	3-F	O	A-1
55	OMe	5-Cl	O	A-3A	200	OMe	3-F	O	A-1
56	Me	5-Cl	O	A-3A	201	Me	3-F	O	A-1
57	F	6-Cl	O	A-3A	202	F	3-Cl	O	A-1
58	Cl	6-Cl	O	A-3A	203	Cl	3-Cl	O	A-1
59	Br	6-Cl	O	A-3A	204	Br	3-Cl	O	A-1
60	I	6-Cl	O	A-3A	205	I	3-Cl	O	A-1
61	CF_3	6-Cl	O	A-3A	206	CF_3	3-Cl	O	A-1
62	OMe	6-Cl	O	A-3A	207	OMe	3-Cl	O	A-1
63	Me	6-Cl	O	A-3A	208	Me	3-Cl	O	A-1
64	F	3-Br, 4-F	O	A-3A	209	F	3-Br	O	A-1
65	Cl	3-Br, 4-F	O	A-3A	210	Cl	3-Br	O	A-1
66	Br	3-Br, 4-F	O	A-3A	211	Br	3-Br	O	A-1
67	I	3-Br, 4-F	O	A-3A	212	I	3-Br	O	A-1
68	CF_3	3-Br, 4-F	O	A-3A	213	CF_3	3-Br	O	A-1
69	OMe	3-Br, 4-F	O	A-3A	214	OMe	3-Br	O	A-1
70	Me	3-Br, 4-F	O	A-3A	215	Me	3-Br	O	A-1
71	F	3-F, 4-F	O	A-3A	216	F	3-I	O	A-1
72	Cl	3-F, 4-F	O	A-3A	217	Cl	3-I	O	A-1
73	Br	3-F, 4-F	O	A-3A	218	Br	3-I	O	A-1
74	I	3-F, 4-F	O	A-3A	219	I	3-I	O	A-1
75	CF_3	3-F, 4-F	O	A-3A	220	CF_3	3-I	O	A-1
76	OMe	3-F, 4-F	O	A-3A	221	OMe	3-I	O	A-1
77	Me	3-F, 4-F	O	A-3A	222	Me	3-I	O	A-1

Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
78	F	3-Cl, 4-F	O	A-3A	223	F	3-CN	O	A-1
79	Cl	3-Cl, 4-F	O	A-3A	224	Cl	3-CN	O	A-1
80	Br	3-Cl, 4-F	O	A-3A	225	Br	3-CN	O	A-1
81	I	3-Cl, 4-F	O	A-3A	226	I	3-CN	O	A-1
82	CF_3	3-Cl, 4-F	O	A-3A	227	CF_3	3-CN	O	A-1
83	OMe	3-Cl, 4-F	O	A-3A	228	OMe	3-CN	O	A-1
84	Me	3-Cl, 4-F	O	A-3A	229	Me	3-CN	O	A-1
85	F	3-Br	S	A-3A	230	F	3-CF_3	O	A-1
86	Cl	3-Br	S	A-3A	231	Cl	3-CF_3	O	A-1
87	Br	3-Br	S	A-3A	232	Br	3-CF_3	O	A-1
88	I	3-Br	S	A-3A	233	I	3-CF_3	O	A-1
89	CF_3	3-Br	S	A-3A	234	CF_3	3-CF_3	O	A-1
90	OMe	3-Br	S	A-3A	235	OMe	3-CF_3	O	A-1
91	Me	3-Br	S	A-3A	236	Me	3-CF_3	O	A-1
92	F	3-Cl	S	A-3A	237	F	4-Cl	O	A-1
93	Cl	3-Cl	S	A-3A	238	Cl	4-Cl	O	A-1
94	Br	3-Cl	S	A-3A	239	Br	4-Cl	O	A-1
95	I	3-Cl	S	A-3A	240	I	4-Cl	O	A-1
96	CF_3	3-Cl	S	A-3A	241	CF_3	4-Cl	O	A-1
97	OMe	3-Cl	S	A-3A	242	OMe	4-Cl	O	A-1
98	Me	3-Cl	S	A-3A	243	Me	4-Cl	O	A-1
99	Cl	3-F	O	A-3B	244	F	5-Cl	O	A-1
100	Br	3-F	O	A-3B	245	Cl	5-Cl	O	A-1
101	I	3-F	O	A-3B	246	Br	5-Cl	O	A-1
102	CF_3	3-F	O	A-3B	247	I	5-Cl	O	A-1
103	OMe	3-F	O	A-3B	248	CF_3	5-Cl	O	A-1
104	Me	3-F	O	A-3B	249	OMe	5-Cl	O	A-1
105	F	3-Cl	O	A-3B	250	Me	5-Cl	O	A-1
106	Cl	3-Cl	O	A-3B	251	F	6-Cl	O	A-1
107	Br	3-Cl	O	A-3B	252	Cl	6-Cl	O	A-1
108	I	3-Cl	O	A-3B	253	Br	6-Cl	O	A-1
109	CF_3	3-Cl	O	A-3B	254	I	6-Cl	O	A-1
110	OMe	3-Cl	O	A-3B	255	CF_3	6-Cl	O	A-1
111	Me	3-Cl	O	A-3B	256	OMe	6-Cl	O	A-1
112	F	3-Br	O	A-3B	257	Me	6-Cl	O	A-1
113	Cl	3-Br	O	A-3B	258	F	3-Br, 4-F	O	A-1

Header Row					Header Row				
Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
114	Br	3-Br	O	A-3B	259	Cl	3-Br, 4-F	O	A-1
115	I	3-Br	O	A-3B	260	Br	3-Br, 4-F	O	A-1
116	CF_3	3-Br	O	A-3B	261	I	3-Br, 4-F	O	A-1
117	OMe	3-Br	O	A-3B	262	CF_3	3-Br, 4-F	O	A-1
118	Me	3-Br	O	A-3B	263	OMe	3-Br, 4-F	O	A-1
119	F	3-I	O	A-3B	264	Me	3-Br, 4-F	O	A-1
120	Cl	3-I	O	A-3B	265	F	3-F, 4-F	O	A-1
121	Br	3-I	O	A-3B	266	Cl	3-F, 4-F	O	A-1
122	I	3-I	O	A-3B	267	Br	3-F, 4-F	O	A-1
123	CF_3	3-I	O	A-3B	268	I	3-F, 4-F	O	A-1
124	OMe	3-I	O	A-3B	269	CF_3	3-F, 4-F	O	A-1
125	Me	3-I	O	A-3B	270	OMe	3-F, 4-F	O	A-1
126	F	3-CN	O	A-3B	271	Me	3-F, 4-F	O	A-1
127	Cl	3-CN	O	A-3B	272	F	3-Cl, 4-F	O	A-1
128	Br	3-CN	O	A-3B	273	Cl	3-Cl, 4-F	O	A-1
129	I	3-CN	O	A-3B	274	Br	3-Cl, 4-F	O	A-1
130	CF_3	3-CN	O	A-3B	275	I	3-Cl, 4-F	O	A-1
131	OMe	3-CN	O	A-3B	276	CF_3	3-Cl, 4-F	O	A-1
132	Me	3-CN	O	A-3B	277	OMe	3-Cl, 4-F	O	A-1
133	F	3-CF_3	O	A-3B	278	Me	3-Cl, 4-F	O	A-1
134	Cl	3-CF_3	O	A-3B	279	F	3-Br	S	A-1
135	Br	3-CF_3	O	A-3B	280	Cl	3-Br	S	A-1
136	I	3-CF_3	O	A-3B	281	Br	3-Br	S	A-1
137	CF_3	3-CF_3	O	A-3B	282	I	3-Br	S	A-1
138	OMe	3-CF_3	O	A-3B	283	CF_3	3-Br	S	A-1
139	Me	3-CF_3	O	A-3B	284	OMe	3-Br	S	A-1
140	F	4-Cl	O	A-3B	285	Me	3-Br	S	A-1
141	Cl	4-Cl	O	A-3B	286	F	3-Cl	S	A-1
142	Br	4-Cl	O	A-3B	287	Cl	3-Cl	S	A-1
143	I	4-Cl	O	A-3B	288	Br	3-Cl	S	A-1
144	CF_3	4-Cl	O	A-3B	289	I	3-Cl	S	A-1
145	OMe	4-Cl	O	A-3B	290	CF_3	3-Cl	S	A-1
146	Me	4-Cl	O	A-3B	291	OMe	3-Cl	S	A-1
					292	Me	3-Cl	S	A-1

Table 293



R^2 = F, $(R^3)_m$ = 3-F and Z = O

R^1	R^1
butylsulfinyl	3,3-difluoropropoxy
tert-butylsulfinyl	ethylsulfonyl
1,3-dimethylbutylsulfinyl	isopentylsulfonyl
3,3-dimethylbutylsulfinyl	methylsulfonyl
ethylsulfinyl	pentylsulfonyl
isopentylsulfinyl	propylsulfonyl
methylsulfinyl	3-bromopropylsulfonyl
pentylsulfinyl	3-chlorobutylsulfonyl
propylsulfinyl	3-chloropropylsulfonyl
3-bromopropylsulfinyl	2,2-difluoroethylsulfonyl
3-chlorobutylsulfinyl	3,3,3-trifluoropropylsulfonyl
3-chloropropylsulfinyl	3,3,3-trichloropropylsulfonyl
2,2-difluoroethylsulfinyl	4,4,4-trifluorobutylsulfonyl
3,3,3-trifluoropropylsulfinyl	2,2,2-trifluoroethylsulfonyl
3,3,3-trichloropropylsulfinyl	6,6,6-trifluorohexylsulfonyl
4,4,4-trifluorobutylsulfinyl	cyclobutylmethylsulfonyl
2,2,2-trifluoroethylsulfinyl	cyclohexylsulfonyl
6,6,6-trifluorohexylsulfinyl	cyclopentylsulfonyl
1,3-dimethylbutylsulfonyl	2-cyclopropylethylsulfonyl
3,3-dimethylbutylsulfonyl	cyclopropylmethylsulfonyl

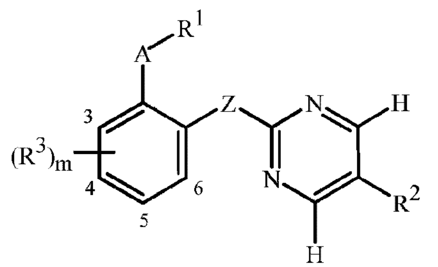
The present disclosure also includes Tables 294 through 390. Each Table is constructed in the same manner as Table 293 above, except that the row heading in Table 293 (i.e. "R^2 = F, $(R^3)_m$ = 3-F and Z = O") is replaced with the respective row heading shown below. For example, the header row in Table 294 is "R^2 = Cl, $(R^3)_m$ = 3-F and Z = O" and the first entry in Table 294 is a compound of Formula **1** wherein R^1 = butylsulfinyl, R^2 = Cl, $(R^3)_m$ = 3-F and Z = O. Tables 295 through 390 are constructed similarly.

Table	Header Row R^2	$(R^3)_m$	Z	Table	Header Row R^2	$(R^3)_m$	Z

Table	R^2	$(R^3)_m$	Z	Table	R^2	$(R^3)_m$	Z
	Header Row				Header Row		
294	Cl	3-F	O	343	Cl	5-Cl	O
295	Br	3-F	O	344	Br	5-Cl	O
296	I	3-F	O	345	I	5-Cl	O
297	CF_3	3-F	O	346	CF_3	5-Cl	O
298	OMe	3-F	O	347	OMe	5-Cl	O
299	Me	3-F	O	348	Me	5-Cl	O
300	F	3-Cl	O	349	F	6-Cl	O
301	Cl	3-Cl	O	350	Cl	6-Cl	O
302	Br	3-Cl	O	351	Br	6-Cl	O
303	I	3-Cl	O	352	I	6-Cl	O
304	CF_3	3-Cl	O	353	CF_3	6-Cl	O
305	OMe	3-Cl	O	354	OMe	6-Cl	O
306	Me	3-Cl	O	355	Me	6-Cl	O
307	F	3-Br	O	356	F	3-Br, 4-F	O
308	Cl	3-Br	O	357	Cl	3-Br, 4-F	O
309	Br	3-Br	O	358	Br	3-Br, 4-F	O
310	I	3-Br	O	359	I	3-Br, 4-F	O
311	CF_3	3-Br	O	360	CF_3	3-Br, 4-F	O
312	OMe	3-Br	O	361	OMe	3-Br, 4-F	O
313	Me	3-Br	O	362	Me	3-Br, 4-F	O
314	F	3-I	O	363	F	3-F, 4-F	O
315	Cl	3-I	O	364	Cl	3-F, 4-F	O
316	Br	3-I	O	365	Br	3-F, 4-F	O
317	I	3-I	O	366	I	3-F, 4-F	O
318	CF_3	3-I	O	367	CF_3	3-F, 4-F	O
319	OMe	3-I	O	368	OMe	3-F, 4-F	O
320	Me	3-I	O	369	Me	3-F, 4-F	O
321	F	3-CN	O	370	F	3-Cl, 4-F	O
322	Cl	3-CN	O	371	Cl	3-Cl, 4-F	O
323	Br	3-CN	O	372	Br	3-Cl, 4-F	O
324	I	3-CN	O	373	I	3-Cl, 4-F	O
325	CF_3	3-CN	O	374	CF_3	3-Cl, 4-F	O
326	OMe	3-CN	O	375	OMe	3-Cl, 4-F	O
327	Me	3-CN	O	376	Me	3-Cl, 4-F	O
328	F	$3\text{-}CF_3$	O	377	F	3-Br	S
329	Cl	$3\text{-}CF_3$	O	378	Cl	3-Br	S

Header Row				Header Row			
Table	R^2	$(R^3)_m$	Z	Table	R^2	$(R^3)_m$	Z
330	Br	3-CF_3	O	379	Br	3-Br	S
331	I	3-CF_3	O	380	I	3-Br	S
332	CF_3	3-CF_3	O	381	CF_3	3-Br	S
333	OMe	3-CF_3	O	382	OMe	3-Br	S
334	Me	3-CF_3	O	383	Me	3-Br	S
335	F	4-Cl	O	384	F	3-Cl	S
336	Cl	4-Cl	O	385	Cl	3-Cl	S
337	Br	4-Cl	O	386	Br	3-Cl	S
338	I	4-Cl	O	387	I	3-Cl	S
339	CF_3	4-Cl	O	388	CF_3	3-Cl	S
340	OMe	4-Cl	O	389	OMe	3-Cl	S
341	Me	4-Cl	O	390	Me	3-Cl	S
342	F	5-Cl	O				

Table 391



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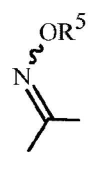
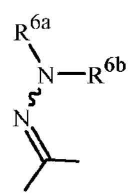
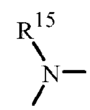


A-5



A-6



A-7

R^2 = F, $(R^3)_m$ = 3-F and Z = O

A	A
A = A-4; R^4 = 3-bromopropyl	A = A-5; R^5 = 4-chloro-3-butyn-1-yl
A = A-4; R^4 = tert-butyl)	A = A-5; R^5 = 3-chloro-2-propyn-1-yl
A = A-4; R^4 = 3-chlorobutyl	A = A-5; R^5 = 4,4-difluoro-2-butyn-1-yl
A = A-4; R^4 = 3-chloropropyl	A = A-5; R^5 = 5,5,5-trifluoro-1-methyl-2-pentyn-1-yl
A = A-4; R^4 = 4,4-difluorobutyl	A = A-5; R^5 = 5,5,5-trifluoro-2-pentyn-1-yl
A = A-4; R^4 = 2,2-difluoroethyl	A = A-5; R^5 = 5,5,5-trifluoro-3-pentyn-1-yl

A
A = A-4; R^4 = 3,3-difluoropropyl
A = A-4; R^4 = ethyl
A = A-4; R^4 = hexyl
A = A-4; R^4 = isobutyl
A = A-4; R^4 = isopentyl
A = A-4; R^4 = methyl
A = A-4; R^4 = 3,3,4,4,4-pentafluorobutyl
A = A-4; R^4 = 2,2,3,3,3-pentafluoropropyl
A = A-4; R^4 = pentyl
A = A-4; R^4 = propyl
A = A-4; R^4 = 3,3,4,4-tetrafluorobutyl
A = A-4; R^4 = 2,2,3,3-tetrafluoropropyl
A = A-4; R^4 = 3,3,3-trichloropropyl
A = A-4; R^4 = 4,4,4-trifluorobutyl
A = A-4; R^4 = 2,2,2-trifluoroethyl
A = A-4; R^4 = 6,6,6-trifluorohexyl
A = A-4; R^4 = 4,4,4-trifluoro-2-methyl-butyl
A = A-4; R^4 = 3,3,3-trifluoropropyl
A = A-4; R^4 = 3-bromopropyl
A = A-5; R^5 = butyl
A = A-5; R^5 = tert-butyl
A = A-5; R^5 = ethyl
A = A-5; R^5 = hexyl
A = A-5; R^5 = isobutyl
A = A-5; R^5 = isopentyl
A = A-5; R^5 = pentyl
A = A-5; R^5 = propyl
A = A-5; R^5 = benzyl)
A = A-5; R^5 = allyl
A = A-5; R^5 = 3-buten-1-yl
A = A-5; R^5 = 3-methy-2-lbuten-1-yl
A = A-5; R^5 = 3-methyl-3-buten-1-yl
A = A-5; R^5 = 4-methyl-3-penten-1-yl
A = A-5; R^5 = 3-penten-1-yl
A = A-5; R^5 = 3-butyn-1-yl
A = A-5; R^5 = 4-methyl-2-pentyn-1-yl
A = A-5; R^5 = 3-pentyn-1-yl

A
A = A-5; R^5 = 2-cyclobutylethyl
A = A-5; R^5 = cyclohexyl
A = A-5; R^5 = cyclopentylmethyl
A = A-5; R^5 = 2-cyclopropylethyl
A = A-5; R^5 = 3-cyclopropylpropyl
A = A-5; R^5 = (2,2-dimethylcyclopropyl)methyl
A = A-5; R^5 = (1-methylcyclopropyl)methyl
A = A-5; R^5 = (2-methylcyclopentyl)methyl
A = A-5; R^5 = (2-bromo-2-chloro-cyclopropyl)methyl
A = A-5; R^5 = (2,2-dibromocyclopropyl)methyl
A = A-5; R^5 = 2-(2,2-dichloro-1-methyl-cyclopropyl)ethyl
A = A-5; R^5 = (2,2-dichloro-1-methyl-cyclopropyl)methyl
A = A-5; R^5 = 2-(3,3-difluorocyclobutyl)ethyl
A = A-5; R^5 = 2-(2,2-difluorocyclopropyl)ethyl
A = A-5; R^5 = (2,2-difluorocyclopropyl)methyl
A = A-5; R^5 = 2-chloroethoxymethyl
A = A-5; R^5 = 2,3-dichloro-5-methoxy-pentyl
A = A-5; R^5 = 3,3-difluoro-5-methoxy-pentyl
A = A-5; R^5 = 2-isopropoxyethyl
A = A-5; R^5 = 2-methoxyethyl
A = A-5; R^5 = 5-methoxypentyl
A = A-5; R^5 = 2-methoxypropyl
A = A-5; R^5 = 1,1,2,2-tetrafluoroethoxymethyl
A = A-5; R^5 = 2,2,2-trifluoroethoxymethyl
A = A-5; R^5 = 2-(trifluoromethoxy)ethyl
A = A-5; R^5 = 4-cyanobutyl
A = A-5; R^5 = 3-cyano-1,2-dimethyl-propyl
A = A-5; R^5 = 2-cyanoethyl
A = A-5; R^5 = 3-cyano-2-methyl-propyl
A = A-5; R^5 = cyanomethyl
A = A-5; R^5 = 5-cyanopentyl
A = A-5; R^5 = 3-cyanopropyl
A = A-5; R^5 = 2-(cyanomethoxy)ethyl
A = A-5; R^5 = 3-(cyanomethoxy)-2-methyl-propyl
A = A-5; R^5 = cyanomethoxymethyl
A = A-5; R^5 = 1,2-dimethyl-3-nitro-propyl
A = A-5; R^5 = 4-hydroxybutyl

A	A
A = A-5; R^5 = 2-propyn-1-yl	A = A-5; R^5 = 3-hydroxy-1,2-dimethyl-propyl
A = A-5; R^5 = 5-hexyn-1-yl	A = A-5; R^5 = 3-hydroxy-2-methyl-propyl
A = A-5; R^5 = 4-pentyn-1-yl	A = A-5; R^5 = hydroxymethyl
A = A-5; R^5 = 3-bromopropyl	A = A-5; R^5 = 5-hydroxypentyl
A = A-5; R^5 = 3-chlorobutyl	A = A-5; R^5 = 3-hydroxypropyl
A = A-5; R^5 = 3-chloropropyl	A = A-5; R^5 = 2-methyl-3-nitro-propyl
A = A-5; R^5 = 4,4-difluorobutyl	A = A-5; R^5 = 4-nitrobutyl
A = A-5; R^5 = 2,2-difluoroethyl	A = A-5; R^5 = 2-nitroethyl
A = A-5; R^5 = 3,3-difluoropropyl	A = A-5; R^5 = nitromethyl
A = A-5; R^5 = 3,3,4,4,4-pentafluorobutyl	A = A-5; R^5 = 5-nitropentyl
A = A-5; R^5 = 2,2,3,3,3-pentafluoropropyl	A = A-5; R^5 = 3-nitropropyl
A = A-5; R^5 = 3,3,4,4-tetrafluorobutyl	A = A-5; R^5 = 2-chloroethylthiomethyl
A = A-5; R^5 = 2,2,3,3-tetrafluoropropyl	A = A-5; R^5 = 2,3-dichloro-5-methylthio-pentyl
A = A-5; R^5 = 3,3,3-trichloropropyl	A = A-5; R^5 = 3,3-difluoro-5-methylthio-pentyl
A = A-5; R^5 = 4,4,4-trifluorobutyl	A = A-5; R^5 = 2-isopropylthioethyl
A = A-5; R^5 = 2,2,2-trifluoroethyl	A = A-5; R^5 = 2-methylthioethyl
A = A-5; R^5 = 6,6,6-trifluorohexyl	A = A-5; R^5 = 5-methylthiopentyl
A = A-5; R^5 = 4,4,4-trifluoro-2-methyl-butyl	A = A-5; R^5 = 2-methylthiopropyl
A = A-5; R^5 = 3,3,3-trifluoropropyl	A = A-5; R^5 = 1,1,2,2-tetrafluoroethylthiomethyl
A = A-5; R^5 = 4-bromo-3-buten-1-yl	A = A-5; R^5 = 2,2,2-trifluoroethylthiomethyl
A = A-5; R^5 = 2-chloroallyl	A = A-5; R^5 = 2-(trifluoromethylthio)ethyl
A = A-5; R^5 = 3-chloroallyl	A = A-6; R^{6a} = Me); R^{6b} = butyl
A = A-5; R^5 = 3-chloro-3-buten-1-yl	A = A-6; R^{6a} = Me; R^{6b} = tert-butyl
A = A-5; R^5 = 4-chloro-3-buten-1-yl	A = A-6; R^{6a} = Me; R^{6b} = ethyl
A = A-5; R^5 = 5,5-difluoro-3-penten-1-yl	A = A-6; R^{6a} = Me; R^{6b} = Isobutyl
A = A-5; R^5 = 4,4,4-trifluoro-2-buten-1-yl	A = A-6; R^{6a} = Me; R^{6b} = propyl
A = A-5; R^5 = 5,5,5-trifluoro-3-methyl-2-penten-1-yl	A = A-6; R^{6a} = ethyl)(; R^{6b} = ethyl
A = A-5; R^5 = 5,5,5-trifluoro-3-penten-1-yl	A = A-6; R^{6a} = Me; R^{6b} = 3,3,3-trifluoropropyl
A = A-5; R^5 = 4-bromo-3-butyn-1-yl	A = A-6; R^{6a} = Me; R^{6b} = 2,2,3,3,3-pentafluoropropyl
A = A-5; R^5 = 3-butyn-1-yl	A = A-6; R^{6a} = 3,3,3-trifluoropropyl; R^{6b} = 3,3,3-trifluoropropyl
A = A-7; R^{15} = isopentyl	A = A-7; R^{15} = ethyl
A = A-7; R^{15} = pentyl	A = A-7; R^{15} = hexyl
A = A-7; R^{15} = propyl	A = A-7; R^{15} = isobutyl
A = A-7; R^{15} = H	A = A-7; R^{15} = methyl

The present disclosure also includes Tables 392 through 585. Each Table is constructed in the same manner as Table 391 above, except that the row heading in Table 391 (i.e. "R^2 = F, $(R^3)_m$ = 3-F and Z = O") is replaced with the respective row heading shown below. For example, the header row in Table 392 is "R^2 = Cl, $(R^3)_m$ = 3-F and Z = O" and the first entry in Table 392 is a compound of Formula **1** wherein R^1 = 3-bromopropyl, R^2 = Cl, $(R^3)_m$ = 3-F and Z = O. Tables 392 through 585 are constructed similarly.

	Header Row				Header Row		
Table	R^2	$(R^3)_m$	Z	Table	R^2	$(R^3)_m$	Z
392	Cl	3-F	O	489	Cl	3-F	O
393	Br	3-F	O	490	Br	3-F	O
394	I	3-F	O	491	I	3-F	O
395	CF_3	3-F	O	492	CF_3	3-F	O
396	OMe	3-F	O	493	OMe	3-F	O
397	Me	3-F	O	494	Me	3-F	O
398	F	3-Cl	O	495	F	3-Cl	O
399	Cl	3-Cl	O	496	Cl	3-Cl	O
400	Br	3-Cl	O	497	Br	3-Cl	O
401	I	3-Cl	O	498	I	3-Cl	O
402	CF_3	3-Cl	O	499	CF_3	3-Cl	O
403	OMe	3-Cl	O	500	OMe	3-Cl	O
404	Me	3-Cl	O	501	Me	3-Cl	O
405	F	3-Br	O	502	F	3-Br	O
406	Cl	3-Br	O	503	Cl	3-Br	O
407	Br	3-Br	O	504	Br	3-Br	O
408	I	3-Br	O	505	I	3-Br	O
409	CF_3	3-Br	O	506	CF_3	3-Br	O
410	OMe	3-Br	O	507	OMe	3-Br	O
411	Me	3-Br	O	508	Me	3-Br	O
412	F	3-I	O	509	F	3-I	O
413	Cl	3-I	O	510	Cl	3-I	O
414	Br	3-I	O	511	Br	3-I	O
415	I	3-I	O	512	I	3-I	O
416	CF_3	3-I	O	513	CF_3	3-I	O
417	OMe	3-I	O	514	OMe	3-I	O
418	Me	3-I	O	515	Me	3-I	O
419	F	3-CN	O	516	F	3-CN	O
420	Cl	3-CN	O	517	Cl	3-CN	O

Header Row				Header Row			
Table	R^2	$(R^3)_m$	Z	Table	R^2	$(R^3)_m$	Z
421	Br	3-CN	O	518	Br	3-CN	O
422	I	3-CN	O	519	I	3-CN	O
423	CF_3	3-CN	O	520	CF_3	3-CN	O
424	OMe	3-CN	O	521	OMe	3-CN	O
425	Me	3-CN	O	522	Me	3-CN	O
426	F	3-CF_3	O	523	F	3-CF_3	O
427	Cl	3-CF_3	O	524	Cl	3-CF_3	O
428	Br	3-CF_3	O	525	Br	3-CF_3	O
429	I	3-CF_3	O	526	I	3-CF_3	O
430	CF_3	3-CF_3	O	527	CF_3	3-CF_3	O
431	OMe	3-CF_3	O	528	OMe	3-CF_3	O
432	Me	3-CF_3	O	529	Me	3-CF_3	O
433	F	4-Cl	O	530	F	4-Cl	O
434	Cl	4-Cl	O	531	Cl	4-Cl	O
435	Br	4-Cl	O	532	Br	4-Cl	O
436	I	4-Cl	O	533	I	4-Cl	O
437	CF_3	4-Cl	O	534	CF_3	4-Cl	O
438	OMe	4-Cl	O	535	OMe	4-Cl	O
439	Me	4-Cl	O	536	Me	4-Cl	O
440	F	5-Cl	O	537	F	5-Cl	O
441	Cl	5-Cl	O	538	Cl	5-Cl	O
442	Br	5-Cl	O	539	Br	5-Cl	O
443	I	5-Cl	O	540	I	5-Cl	O
444	CF_3	5-Cl	O	541	CF_3	5-Cl	O
445	OMe	5-Cl	O	542	OMe	5-Cl	O
446	Me	5-Cl	O	543	Me	5-Cl	O
447	F	6-Cl	O	544	F	6-Cl	O
448	Cl	6-Cl	O	545	Cl	6-Cl	O
449	Br	6-Cl	O	546	Br	6-Cl	O
450	I	6-Cl	O	547	I	6-Cl	O
451	CF_3	6-Cl	O	548	CF_3	6-Cl	O
452	OMe	6-Cl	O	549	OMe	6-Cl	O
453	Me	6-Cl	O	550	Me	6-Cl	O
454	F	3-Br, 4-F	O	551	F	3-Br, 4-F	O
455	Cl	3-Br, 4-F	O	552	Cl	3-Br, 4-F	O
456	Br	3-Br, 4-F	O	553	Br	3-Br, 4-F	O

Table	Header Row R^2	$(R^3)_m$	Z	Table	Header Row R^2	$(R^3)_m$	Z
457	I	3-Br, 4-F	O	554	I	3-Br, 4-F	O
458	CF_3	3-Br, 4-F	O	555	CF_3	3-Br, 4-F	O
459	OMe	3-Br, 4-F	O	556	OMe	3-Br, 4-F	O
460	Me	3-Br, 4-F	O	557	Me	3-Br, 4-F	O
461	F	3-F, 4-F	O	558	F	3-F, 4-F	O
462	Cl	3-F, 4-F	O	559	Cl	3-F, 4-F	O
463	Br	3-F, 4-F	O	560	Br	3-F, 4-F	O
464	I	3-F, 4-F	O	561	I	3-F, 4-F	O
465	CF_3	3-F, 4-F	O	562	CF_3	3-F, 4-F	O
466	OMe	3-F, 4-F	O	563	OMe	3-F, 4-F	O
467	Me	3-F, 4-F	O	564	Me	3-F, 4-F	O
468	F	3-Cl, 4-F	O	565	F	3-Cl, 4-F	O
469	Cl	3-Cl, 4-F	O	566	Cl	3-Cl, 4-F	O
470	Br	3-Cl, 4-F	O	567	Br	3-Cl, 4-F	O
471	I	3-Cl, 4-F	O	568	I	3-Cl, 4-F	O
472	CF_3	3-Cl, 4-F	O	569	CF_3	3-Cl, 4-F	O
473	OMe	3-Cl, 4-F	O	570	OMe	3-Cl, 4-F	O
474	Me	3-Cl, 4-F	O	571	Me	3-Cl, 4-F	O
475	F	3-Br	S	572	F	3-Br	S
476	Cl	3-Br	S	573	Cl	3-Br	S
477	Br	3-Br	S	574	Br	3-Br	S
478	I	3-Br	S	575	I	3-Br	S
479	CF_3	3-Br	S	576	CF_3	3-Br	S
480	OMe	3-Br	S	577	OMe	3-Br	S
481	Me	3-Br	S	578	Me	3-Br	S
482	F	3-Cl	S	579	F	3-Cl	S
483	Cl	3-Cl	S	580	Cl	3-Cl	S
484	Br	3-Cl	S	581	Br	3-Cl	S
485	I	3-Cl	S	582	I	3-Cl	S
486	CF_3	3-Cl	S	583	CF_3	3-Cl	S
487	OMe	3-Cl	S	584	OMe	3-Cl	S
488	Me	3-Cl	S	585	Me	3-Cl	S

The present disclosure also includes Tables 586 through 684. Each Table is constructed in the same manner as Table 1 above, except that the row heading in Table 1 (i.e. "R^2 = F, $(R^3)_m$ = 3-F, Z = O and A = A-4") is replaced with the respective row heading shown below. For example, the first entry in Table 586 is a compound of Formula **1** wherein

R^2 is Cl, $(R^3)_m$ is 3-F, Z is O, A is A-3A and R^1 is butyl. Tables 587 through 684 are constructed similarly.

Header Row

Table	R^2	$(R^3)_m$	Z	A	Table	R^2	$(R^3)_m$	Z	A
586	F	3-F	O	A-4	620	CF_3	3-CN	O	A-2
587	F	3-F	O	A-1	621	OMe	3-CN	O	A-2
588	F	3-F	O	A-2	622	Me	3-CN	O	A-2
589	Cl	3-F	O	A-2	623	F	3-CF_3	O	A-2
590	Br	3-F	O	A-2	624	Cl	3-CF_3	O	A-2
591	I	3-F	O	A-2	625	Br	3-CF_3	O	A-2
592	CF_3	3-F	O	A-2	626	I	3-CF_3	O	A-2
593	OMe	3-F	O	A-2	627	CF_3	3-CF_3	O	A-2
594	Me	3-F	O	A-2	628	OMe	3-CF_3	O	A-2
595	F	3-Cl	O	A-2	629	Me	3-CF_3	O	A-2
596	Cl	3-Cl	O	A-2	630	F	4-Cl	O	A-2
597	Br	3-Cl	O	A-2	631	Cl	4-Cl	O	A-2
598	I	3-Cl	O	A-2	632	Br	4-Cl	O	A-2
599	CF_3	3-Cl	O	A-2	633	I	4-Cl	O	A-2
600	OMe	3-Cl	O	A-2	634	CF_3	4-Cl	O	A-2
601	Me	3-Cl	O	A-2	635	OMe	4-Cl	O	A-2
602	F	3-Br	O	A-2	636	Me	4-Cl	O	A-2
603	Cl	3-Br	O	A-2	637	F	5-Cl	O	A-2
604	Br	3-Br	O	A-2	638	Cl	5-Cl	O	A-2
605	I	3-Br	O	A-2	639	Br	5-Cl	O	A-2
606	CF_3	3-Br	O	A-2	640	I	5-Cl	O	A-2
607	OMe	3-Br	O	A-2	641	CF_3	5-Cl	O	A-2
608	Me	3-Br	O	A-2	642	OMe	5-Cl	O	A-2
609	F	3-I	O	A-2	643	Me	5-Cl	O	A-2
610	Cl	3-I	O	A-2	644	F	6-Cl	O	A-2
611	Br	3-I	O	A-2	645	Cl	6-Cl	O	A-2
612	I	3-I	O	A-2	646	Br	6-Cl	O	A-2
613	CF_3	3-I	O	A-2	647	I	6-Cl	O	A-2
614	OMe	3-I	O	A-2	648	CF_3	6-Cl	O	A-2
615	Me	3-I	O	A-2	649	OMe	6-Cl	O	A-2
616	F	3-CN	O	A-2	650	Me	6-Cl	O	A-2
617	Cl	3-CN	O	A-2	651	F	3-Br, 4-F	O	A-2
618	Br	3-CN	O	A-2	652	Cl	3-Br, 4-F	O	A-2
619	I	3-CN	O	A-2	653	Br	3-Br, 4-F	O	A-2

Table	R^2	$(R^3)_m$	Z	A
654	I	3-Br, 4-F	O	A-2
655	CF_3	3-Br, 4-F	O	A-2
656	OMe	3-Br, 4-F	O	A-2
657	Me	3-Br, 4-F	O	A-2
658	F	3-F, 4-F	O	A-2
659	Cl	3-F, 4-F	O	A-2
660	Br	3-F, 4-F	O	A-2
661	I	3-F, 4-F	O	A-2
662	CF_3	3-F, 4-F	O	A-2
663	OMe	3-F, 4-F	O	A-2
664	Me	3-F, 4-F	O	A-2
665	F	3-Cl, 4-F	O	A-2
666	Cl	3-Cl, 4-F	O	A-2
667	Br	3-Cl, 4-F	O	A-2
668	I	3-Cl, 4-F	O	A-2
669	CF_3	3-Cl, 4-F	O	A-2
670	OMe	3-Cl, 4-F	O	A-2
671	Me	3-Cl, 4-F	O	A-2
672	F	3-Br	S	A-2
673	Cl	3-Br	S	A-2
674	Br	3-Br	S	A-2
675	I	3-Br	S	A-2
676	CF_3	3-Br	S	A-2
677	OMe	3-Br	S	A-2
678	Me	3-Br	S	A-2
679	F	3-Cl	S	A-2
680	Cl	3-Cl	S	A-2
681	Br	3-Cl	S	A-2
682	I	3-Cl	S	A-2
683	CF_3	3-Cl	S	A-2
684	OMe	3-Cl	S	A-2

A compound of this invention will generally be used as a herbicidal active ingredient in a composition, i.e. formulation, with at least one additional component selected from the group consisting of surfactants, solid diluents and liquid diluents, which serves as a carrier. The formulation or composition ingredients are selected to be consistent with the physical properties of the active ingredient, mode of application and environmental factors such as soil type, moisture and temperature.

Useful formulations include both liquid and solid compositions. Liquid compositions include solutions (including emulsifiable concentrates), suspensions, emulsions (including microemulsions, oil-in -water emulsions, flowable concentrates and/or suspoemulsions) and the like, which optionally can be thickened into gels. The general types of aqueous liquid compositions are soluble concentrate, suspension concentrate, capsule suspension, concentrated emulsion, microemulsion, oil-in-water emulsion, flowable concentrate and suspo-emulsion. The general types of nonaqueous liquid compositions are emulsifiable concentrate, microemulsifiable concentrate, dispersible concentrate and oil dispersion.

The general types of solid compositions are dusts, powders, granules, pellets, prills, pastilles, tablets, filled films (including seed coatings) and the like, which can be water-dispersible ("wettable") or water-soluble. Films and coatings formed from film-forming solutions or flowable suspensions are particularly useful for seed treatment. Active ingredient can be (micro)encapsulated and further formed into a suspension or solid formulation; alternatively the entire formulation of active ingredient can be encapsulated (or "overcoated"). Encapsulation can control or delay release of the active ingredient. An emulsifiable granule combines the advantages of both an emulsifiable concentrate formulation and a dry granular formulation. High-strength compositions are primarily used as intermediates for further formulation.

Sprayable formulations are typically extended in a suitable medium before spraying. Such liquid and solid formulations are formulated to be readily diluted in the spray medium, usually water, but occasionally another suitable medium like an aromatic or paraffinic hydrocarbon or vegetable oil. Spray volumes can range from about from about one to several thousand liters per hectare, but more typically are in the range from about ten to several hundred liters per hectare. Sprayable formulations can be tank mixed with water or another suitable medium for foliar treatment by aerial or ground application, or for application to the growing medium of the plant. Liquid and dry formulations can be metered directly into drip irrigation systems or metered into the furrow during planting.

The formulations will typically contain effective amounts of active ingredient, diluent and surfactant within the following approximate ranges which add up to 100 percent by weight.

	Weight Percent		
	Active Ingredient	Diluent	Surfactant
Water-Dispersible and Water-soluble Granules, Tablets and Powders	0.001–90	0–99.999	0–15
Oil Dispersions, Suspensions, Emulsions, Solutions (including Emulsifiable Concentrates)	1–50	40–99	0–50
Dusts	1–25	70–99	0–5
Granules and Pellets	0.001–99	5–99.999	0–15
High Strength Compositions	90–99	0–10	0–2

Solid diluents include, for example, clays such as bentonite, montmorillonite, attapulgite and kaolin, gypsum, cellulose, titanium dioxide, zinc oxide, starch, dextrin, sugars (e.g., lactose, sucrose), silica, talc, mica, diatomaceous earth, urea, calcium carbonate, sodium carbonate and bicarbonate, and sodium sulfate. Typical solid diluents are described in Watkins et al., *Handbook of Insecticide Dust Diluents and Carriers*, 2nd Ed., Dorland Books, Caldwell, New Jersey.

Liquid diluents include, for example, water, *N*,*N*-dimethylalkanamides (e.g., *N*,*N*-dimethylformamide), limonene, dimethyl sulfoxide, *N*-alkylpyrrolidones (e.g., *N*-methylpyrrolidinone), alkyl phosphates (e.g., triethyl phosphate), ethylene glycol, triethylene glycol, propylene glycol, dipropylene glycol, polypropylene glycol, propylene carbonate, butylene carbonate, paraffins (e.g., white mineral oils, normal paraffins, isoparaffins), alkylbenzenes, alkylnaphthalenes, glycerine, glycerol triacetate, sorbitol, aromatic hydrocarbons, dearomatized aliphatics, alkylbenzenes, alkylnaphthalenes, ketones such as cyclohexanone, 2-heptanone, isophorone and 4-hydroxy-4-methyl-2-pentanone, acetates such as isoamyl acetate, hexyl acetate, heptyl acetate, octyl acetate, nonyl acetate, tridecyl acetate and isobornyl acetate, other esters such as alkylated lactate esters, dibasic esters, alkyl and aryl benzoates and γ-butyrolactone, and alcohols, which can be linear, branched, saturated or unsaturated, such as methanol, ethanol, *n*-propanol, isopropyl alcohol, *n*-butanol, isobutyl alcohol, *n*-hexanol, 2-ethylhexanol, *n*-octanol, decanol, isodecyl alcohol, isooctadecanol, cetyl alcohol, lauryl alcohol, tridecyl alcohol, oleyl alcohol, cyclohexanol, tetrahydrofurfuryl alcohol, diacetone alcohol, cresol and benzyl alcohol. Liquid diluents also include glycerol esters of saturated and unsaturated fatty acids (typically C_6–C_{22}), such as plant seed and fruit oils (e.g., oils of olive, castor, linseed, sesame, corn (maize), peanut, sunflower, grapeseed, safflower, cottonseed, soybean, rapeseed, coconut and palm kernel), animal-sourced fats (e.g., beef tallow, pork tallow, lard, cod liver oil, fish oil), and mixtures thereof. Liquid diluents also include alkylated fatty acids (e.g., methylated, ethylated, butylated) wherein the fatty acids may be obtained by hydrolysis of glycerol esters from plant and animal sources, and can be purified by distillation. Typical liquid diluents are described in Marsden, *Solvents Guide*, 2nd Ed., Interscience, New York, 1950.

The solid and liquid compositions of the present invention often include one or more surfactants. When added to a liquid, surfactants (also known as "surface-active agents") generally modify, most often reduce, the surface tension of the liquid. Depending on the nature of the hydrophilic and lipophilic groups in a surfactant molecule, surfactants can be useful as wetting agents, dispersants, emulsifiers or defoaming agents.

Surfactants can be classified as nonionic, anionic or cationic. Nonionic surfactants useful for the present compositions include, but are not limited to: alcohol alkoxylates such as alcohol alkoxylates based on natural and synthetic alcohols (which may be branched or linear) and prepared from the alcohols and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof; amine ethoxylates, alkanolamides and ethoxylated alkanolamides; alkoxylated triglycerides such as ethoxylated soybean, castor and rapeseed oils; alkylphenol alkoxylates such as octylphenol ethoxylates, nonylphenol ethoxylates, dinonyl phenol ethoxylates and dodecyl phenol ethoxylates (prepared from the phenols and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); block polymers prepared from ethylene oxide or propylene oxide and reverse block polymers where the terminal blocks are prepared from propylene oxide; ethoxylated fatty acids; ethoxylated fatty esters and oils; ethoxylated methyl esters; ethoxylated tristyrylphenol (including those prepared from ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); fatty acid esters, glycerol esters, lanolin-based derivatives, polyethoxylate esters such as polyethoxylated sorbitan fatty acid esters, polyethoxylated sorbitol fatty acid esters and polyethoxylated glycerol fatty acid esters; other sorbitan derivatives such as sorbitan esters; polymeric surfactants such as random copolymers, block copolymers, alkyd peg (polyethylene glycol) resins, graft or comb polymers and star polymers; polyethylene glycols (pegs); polyethylene glycol fatty acid esters; silicone-based surfactants; and sugar-derivatives such as sucrose esters, alkyl polyglycosides and alkyl polysaccharides.

Useful anionic surfactants include, but are not limited to: alkylaryl sulfonic acids and their salts; carboxylated alcohol or alkylphenol ethoxylates; diphenyl sulfonate derivatives; lignin and lignin derivatives such as lignosulfonates; maleic or succinic acids or their anhydrides; olefin sulfonates; phosphate esters such as phosphate esters of alcohol alkoxylates, phosphate esters of alkylphenol alkoxylates and phosphate esters of styryl phenol ethoxylates; protein-based surfactants; sarcosine derivatives; styryl phenol ether sulfate; sulfates and sulfonates of oils and fatty acids; sulfates and sulfonates of ethoxylated alkylphenols; sulfates of alcohols; sulfates of ethoxylated alcohols; sulfonates of amines and amides such as *N,N*-alkyltaurates; sulfonates of benzene, cumene, toluene, xylene, and dodecyl and tridecylbenzenes; sulfonates of condensed naphthalenes; sulfonates of naphthalene and alkyl naphthalene; sulfonates of fractionated petroleum; sulfosuccinamates; and sulfosuccinates and their derivatives such as dialkyl sulfosuccinate salts.

Useful cationic surfactants include, but are not limited to: amides and ethoxylated amides; amines such as *N*-alkyl propanediamines, tripropylenetriamines and dipropylenetetramines, and ethoxylated amines, ethoxylated diamines and propoxylated amines (prepared from the amines and ethylene oxide, propylene oxide, butylene oxide or mixtures thereof); amine salts such as amine acetates and diamine salts; quaternary ammonium salts such as quaternary salts, ethoxylated quaternary salts and diquaternary salts; and amine oxides such as alkyldimethylamine oxides and bis-(2-hydroxyethyl)-alkylamine oxides.

Also useful for the present compositions are mixtures of nonionic and anionic surfactants or mixtures of nonionic and cationic surfactants. Nonionic, anionic and cationic surfactants and their recommended uses are disclosed in a variety of published references including *McCutcheon's Emulsifiers and Detergents*, annual American and International Editions published by McCutcheon's Division, The Manufacturing Confectioner Publishing Co.; Sisely and Wood, *Encyclopedia of Surface Active Agents*, Chemical Publ. Co., Inc., New York, 1964; and A. S. Davidson and B. Milwidsky, *Synthetic Detergents*, Seventh Edition, John Wiley and Sons, New York, 1987.

Compositions of this invention may also contain formulation auxiliaries and additives, known to those skilled in the art as formulation aids (some of which may be considered to also function as solid diluents, liquid diluents or surfactants). Such formulation auxiliaries and additives may control: pH (buffers), foaming during processing (antifoams such polyorganosiloxanes), sedimentation of active ingredients (suspending agents), viscosity (thixotropic thickeners), in-container microbial growth (antimicrobials), product freezing (antifreezes), color (dyes/pigment dispersions), wash-off (film formers or stickers), evaporation (evaporation retardants), and other formulation attributes. Film formers include, for example, polyvinyl acetates, polyvinyl acetate copolymers, polyvinylpyrrolidone-vinyl acetate copolymer, polyvinyl alcohols, polyvinyl alcohol copolymers and waxes. Examples of formulation auxiliaries and additives include those listed in *McCutcheon's Volume 2: Functional Materials*, annual International and North American editions published by McCutcheon's Division, The Manufacturing Confectioner Publishing Co.; and PCT Publication WO 03/024222.

The compound of Formula **1** and any other active ingredients are typically incorporated into the present compositions by dissolving the active ingredient in a solvent or by grinding in a liquid or dry diluent. Solutions, including emulsifiable concentrates, can be prepared by simply mixing the ingredients. If the solvent of a liquid composition intended for use as an emulsifiable concentrate is water-immiscible, an emulsifier is typically added to emulsify the active-containing solvent upon dilution with water. Active ingredient slurries, with particle diameters of up to 2,000 μm can be wet milled using media mills to obtain particles with average diameters below 3 μm. Aqueous slurries can be made into finished suspension concentrates (see, for example, U.S. 3,060,084) or further processed by spray drying to form water-dispersible granules. Dry formulations usually require dry milling processes, which produce average particle diameters in the 2 to 10 μm range. Dusts and powders can be prepared by blending and usually grinding (such as with a hammer mill or fluid-energy mill). Granules and pellets can be prepared by spraying the active material upon preformed granular carriers or by agglomeration techniques. See Browning, "Agglomeration", *Chemical Engineering*, December 4, 1967, pp 147–48, *Perry's Chemical Engineer's Handbook*, 4th Ed., McGraw-Hill, New York, 1963, pages 8–57 and following, and WO 91/13546. Pellets can be prepared as described in U.S. 4,172,714. Water-dispersible and water-soluble granules can be prepared as taught in U.S. 4,144,050, U.S. 3,920,442 and DE 3,246,493. Tablets can be prepared as taught in U.S. 5,180,587, U.S. 5,232,701 and U.S. 5,208,030. Films can be prepared as taught in GB 2,095,558 and U.S. 3,299,566.

For further information regarding the art of formulation, see T. S. Woods, "The Formulator's Toolbox – Product Forms for Modern Agriculture" in *Pesticide Chemistry and Bioscience, The Food–Environment Challenge*, T. Brooks and T. R. Roberts, Eds., Proceedings of the 9th International Congress on Pesticide Chemistry, The Royal Society of Chemistry, Cambridge, 1999, pp. 120–133. See also U.S. 3,235,361, Col. 6, line 16 through Col. 7, line 19 and Examples 10–41; U.S. 3,309,192, Col. 5, line 43 through Col. 7, line 62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132, 138–140, 162–164, 166, 167 and 169–182; U.S. 2,891,855, Col. 3, line 66 through Col. 5, line 17 and Examples 1–4; Klingman, *Weed Control as a Science*, John Wiley and Sons, Inc., New York, 1961, pp 81–96; Hance et al., *Weed Control Handbook*, 8th Ed., Blackwell Scientific Publications, Oxford, 1989; and *Developments in formulation technology*, PJB Publications, Richmond, UK, 2000.

In the following Examples, all percentages are by weight and all formulations are prepared in conventional ways. Compound numbers refer to compounds in Index Table A. Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present invention to its fullest extent. The following Examples are, therefore, to be construed as merely illustrative, and not limiting of the disclosure in any way whatsoever. Percentages are by weight except where otherwise indicated.

Example A

High Strength Concentrate

Compound 1	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%

Example B

Wettable Powder

Compound 1	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example C

Granule

Compound 1	10.0%
attapulgite granules (low volatile matter, 0.71/0.30 mm; U.S.S. No. 25–50 sieves)	90.0%

Example D

Extruded Pellet

Compound 1	25.0%
anhydrous sodium sulfate	10.0%
crude calcium ligninsulfonate	5.0%
sodium alkylnaphthalenesulfonate	1.0%
calcium/magnesium bentonite	59.0%

Example E

Emulsifiable Concentrate

Compound 1	10.0%

polyoxyethylene sorbitol hexoleate	20.0%
C_6-C_{10} fatty acid methyl ester	70.0%

Example F

Microemulsion

Compound 1	5.0%
polyvinylpyrrolidone-vinyl acetate copolymer	30.0%
alkylpolyglycoside	30.0%
glyceryl monooleate	15.0%
water	20.0%

Example G

Suspension Concentrate

Compound 1	35%
butyl polyoxyethylene/polypropylene block copolymer	4.0%
stearic acid/polyethylene glycol copolymer	1.0%
styrene acrylic polymer	1.0%
xanthan gum	0.1%
propylene glycol	5.0%
silicone based defoamer	0.1%
1,2-benzisothiazolin-3-one	0.1%
water	53.7%

Example H

Emulsion in Water

Compound 1	10.0%
butyl polyoxyethylene/polypropylene block copolymer	4.0%
stearic acid/polyethylene glycol copolymer	1.0%
styrene acrylic polymer	1.0%
xanthan gum	0.1%
propylene glycol	5.0%
silicone based defoamer	0.1%
1,2-benzisothiazolin-3-one	0.1%
aromatic petroleum based hydrocarbon	20.0
water	58.7%

Example I

Oil Dispersion

Compound 1	25%
polyoxyethylene sorbitol hexaoleate	15%
organically modified bentonite clay	2.5%
fatty acid methyl ester	57.5%

The present disclosure also includes Examples A through I above except "Compound 1" is replaced with "Compound 2", "Compound 3", "Compound 4", "Compound 5", "Compound 6", "Compound 7", "Compound 8", "Compound 9", "Compound 10", "Compound 11", "Compound 12", "Compound 13", "Compound 14", "Compound 15", "Compound 16", "Compound 17", "Compound 18", "Compound 19", "Compound 20", "Compound 21", "Compound 22", "Compound 23", "Compound 24", "Compound 25", "Compound 26", "Compound 27", "Compound 28", "Compound 29", "Compound 30", "Compound 31", "Compound 32", "Compound 33", "Compound 34", "Compound 35", "Compound 36", "Compound 37", "Compound 38", "Compound 39", "Compound 40", "Compound 41", "Compound 42", "Compound 43", "Compound 44", "Compound 45", "Compound 46", "Compound 47", "Compound 48", "Compound 49", "Compound 50", "Compound 51", "Compound 52", "Compound 53", "Compound 54", "Compound 55", "Compound 56", "Compound 57", "Compound 58", "Compound 59", "Compound 60", "Compound 61", "Compound 62", "Compound 63", "Compound 64", "Compound 65", "Compound 66", "Compound 67", "Compound 68", "Compound 69", "Compound 70", "Compound 71", "Compound 72", "Compound 73", "Compound 74", "Compound 75", "Compound 76", "Compound 77", "Compound 78", "Compound 79", "Compound 80", "Compound 81", "Compound 82", "Compound 83", "Compound 84", "Compound 85", "Compound 86", "Compound 87", "Compound 88", "Compound 89", "Compound 90", "Compound 91", "Compound 92", "Compound 93", "Compound 94", "Compound 95", "Compound 96", "Compound 97", "Compound 98", "Compound 99", "Compound 100", "Compound 101", "Compound 102", "Compound 103", "Compound 104", "Compound 104", "Compound 106", "Compound 107", "Compound 108", "Compound 109", "Compound 110", "Compound 111", "Compound 112", "Compound 113", "Compound 114", "Compound 115", "Compound 116", "Compound 117", "Compound 118", "Compound 119", "Compound 120", "Compound 121", "Compound 122", "Compound 123", "Compound 124", "Compound 125", "Compound 126", "Compound 127", "Compound 128", "Compound 129", "Compound 130", "Compound 131", "Compound 132", "Compound 133", "Compound 134", "Compound 135", "Compound 136", "Compound 137", "Compound 138", "Compound 139", "Compound 140", "Compound 141", "Compound 142", "Compound 143", "Compound 144", "Compound 145" or "Compound 146".

Test results indicate that the compounds of the present invention are highly active preemergent and/or postemergent herbicides and/or plant growth regulants. The compounds of the inention generally show highest activity for postemergence weed control (i.e. applied after weed seedlings emerge from the soil) and preemergence weed control (i.e. applied before weed seedlings emerge from the soil). Many of them have utility for broad-spectrum pre- and/or postemergence weed control in areas where complete control of all vegetation is desired such as around fuel storage tanks, industrial storage areas, parking lots, drive-in theaters, air fields, river banks, irrigation and other waterways, around billboards and highway and railroad structures. Many of the compounds of this invention, by virtue of selective metabolism in crops versus weeds, or by selective activity at the locus of physiological inhibition in crops and weeds, or by selective placement on or within the environment of a mixture of crops and weeds, are useful for the selective control of grass and broadleaf weeds within a crop/weed mixture. One skilled in the art will recognize that the preferred combination of these selectivity factors within a compound or group of compounds can readily be determined by performing routine biological and/or biochemical assays. Compounds of this invention may show tolerance to important agronomic crops including, but is not limited to, alfalfa, barley, cotton, wheat, rape, sugar beets, corn (maize), sorghum, soybeans, rice, oats, peanuts, vegetables, tomato, potato, perennial plantation crops including coffee, cocoa, oil palm, rubber, sugarcane, citrus, grapes, fruit trees, nut trees, banana, plantain, pineapple, hops, tea and forests such as eucalyptus and conifers (e.g., loblolly pine), and turf species (e.g., Kentucky bluegrass, St. Augustine grass, Kentucky fescue and Bermuda grass). Compounds of this invention can be used in crops genetically transformed or bred to incorporate resistance to herbicides, express proteins toxic to invertebrate pests (such as *Bacillus thuringiensis* toxin), and/or express other useful traits. Those skilled in the art will appreciate that not all compounds are equally effective against all weeds. Alternatively, the subject compounds are useful to modify plant growth.

As the compounds of the invention have both preemergent and postemergent herbicidal activity, to control undesired vegetation by killing or injuring the vegetation or reducing its growth, the compounds can be usefully applied by a variety of methods involving contacting a herbicidally effective amount of a compound of the invention, or a composition comprising said compound and at least one of a surfactant, a solid diluent or a liquid diluent, to the foliage or other part of the undesired vegetation or to the environment of the undesired vegetation such as the soil or water in which the undesired vegetation is growing or which surrounds the seed or other propagule of the undesired vegetation.

A herbicidally effective amount of the compounds of this invention is determined by a number of factors. These factors include: formulation selected, method of application, amount and type of vegetation present, growing conditions, etc. In general, a herbicidally effective amount of compounds of this invention is about 0.001 to 20 kg/ha with a preferred range of about 0.004 to 1 kg/ha. One skilled in the art can easily determine the herbicidally effective amount necessary for the desired level of weed control.

In one common embodiment, a compound of the invention is applied, typically in a formulated composition, to a locus comprising desired vegetation (e.g., crops) and undesired vegetation (i.e. weeds), both of which may be seeds, seedlings and/or larger plants, in contact with a growth medium (e.g., soil). In this locus, a composition comprising a compound of the invention can be directly applied to a plant or a part thereof, particularly of the undesired vegetation, and/or to the growth medium in contact with the plant.

Plant varieties and cultivars of the desired vegetation in the locus treated with a compound of the invention can be obtained by conventional propagation and breeding methods or by genetic engineering methods. Genetically modified plants (transgenic plants) are those in which a heterologous gene (transgene) has been stably integrated into the plant's genome. A transgene that is defined by its particular location in the plant genome is called a transformation or transgenic event.

Genetically modified plant cultivars in the locus which can be treated according to the invention include those that are resistant against one or more biotic stresses (pests such as nematodes, insects, mites, fungi, etc.) or abiotic stresses (drought, cold temperature, soil salinity, etc.), or that contain other desirable characteristics. Plants can be genetically modified to exhibit traits of, for example, herbicide tolerance, insect-resistance, modified oil profiles or drought tolerance. Useful genetically modified plants containing single gene transformation events or combinations of transformation events are listed in Exhibit C. Additional information for the genetic modifications listed in Exhibit C can be obtained from publicly available databases maintained, for example, by the U.S. Department of Agriculture.

The following abbreviations, T1 through T37, are used in Exhibit C for traits. A "-" means the entry is not available; "tol." means "tolerance" and "res." means resistance.

Trait	Description	Trait	Description	Trait	Description
T1	Glyphosate tol.	T15	Cold tol.	T27	High tryptophan
T2	High lauric acid oil	T16	Imidazolinone herb. tol.	T28	Erect leaves semidwarf
T3	Glufosinate tol.	T17	Modified alpha-amylase	T29	Semidwarf
T4	Phytate breakdown	T18	Pollination control	T30	Low iron tol.
T5	Oxynil tol.	T19	2,4-D tol.	T31	Modified oil/fatty acid
T6	Disease res.	T20	Increased lysine	T32	HPPD tol.
T7	Insect res.	T21	Drought tol.	T33	High oil
T9	Modified flower color	T22	Delayed ripening/senescence	T34	Aryloxyalkanoate tol.
T11	ALS Herbicide tol.	T23	Modified product quality	T35	Mesotrione tol.
T12	Dicamba tol.	T24	High cellulose	T36	Reduced nicotine
T13	Anti-allergy	T25	Modified starch/carbohydrate	T37	Modified product
T14	Salt tol.	T26	Insect & disease resist.		

Exhibit C

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Alfalfa	J101	MON-00101-8	T1	cp4 epsps (aroA:CP4)
Alfalfa	J163	MON-ØØ163-7	T1	cp4 epsps (aroA:CP4)
Canola*	23-18-17 (Event 18)	CGN-89465-2	T2	te

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Canola*	23-198 (Event 23)	CGN-89465-2	T2	te
Canola*	61061	DP-Ø61Ø61-7	T1	gat4621
Canola*	73496	DP-Ø73496-4	T1	gat4621
Canola*	GT200 (RT200)	MON-89249-2	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	GT73 (RT73)	MON-ØØØ73-7	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	HCN10 (Topas 19/2)	-	T3	bar
Canola*	HCN28 (T45)	ACS-BNØØ8-2	T3	pat (syn)
Canola*	HCN92 (Topas 19/2)	ACS-BNØØ7-1	T3	bar
Canola*	MON88302	MON-883Ø2-9	T1	cp4 epsps (aroA:CP4)
Canola*	MPS961	-	T4	phyA
Canola*	MPS962	-	T4	phyA
Canola*	MPS963	-	T4	phyA
Canola*	MPS964	-	T4	phyA
Canola*	MPS965	-	T4	phyA
Canola*	MS1 (B91-4)	ACS-BNØØ4-7	T3	bar
Canola*	MS8	ACS-BNØØ5-8	T3	bar
Canola*	OXY-235	ACS-BNØ11-5	T5	bxn
Canola*	PHY14	-	T3	bar
Canola*	PHY23	-	T3	bar
Canola*	PHY35	-	T3	bar
Canola*	PHY36	-	T3	bar
Canola*	RF1 (B93-101)	ACS-BNØØ1-4	T3	bar
Canola*	RF2 (B94-2)	ACS-BNØØ2-5	T3	bar
Canola*	RF3	ACS-BNØØ3-6	T3	bar
Bean	EMBRAPA 5.1	EMB-PV051-1	T6	ac1 (sense and antisense)
Brinjal #	EE-1	-	T7	cry1Ac
Cotton	19-51a	DD-Ø1951A-7	T11	S4-HrA
Cotton	281-24-236	DAS-24236-5	T3,T7	pat (syn); cry1F
Cotton	3006-210-23	DAS-21Ø23-5	T3,T7	pat (syn); cry1Ac
Cotton	31707	-	T5,T7	bxn; cry1Ac
Cotton	31803	-	T5,T7	bxn; cry1Ac
Cotton	31807	-	T5,T7	bxn; cry1Ac
Cotton	31808	-	T5,T7	bxn; cry1Ac
Cotton	42317	-	T5,T7	bxn; cry1Ac
Cotton	BNLA-601	-	T7	cry1Ac
Cotton	BXN10211	BXN10211-9	T5	bxn; cry1Ac

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Cotton	BXN10215	BXN10215-4	T5	bxn; cry1Ac
Cotton	BXN10222	BXN10222-2	T5	bxn; cry1Ac
Cotton	BXN10224	BXN10224-4	T5	bxn; cry1Ac
Cotton	COT102	SYN-IR102-7	T7	vip3A(a)
Cotton	COT67B	SYN-IR67B-1	T7	cry1Ab
Cotton	COT202	-	T7	vip3A
Cotton	Event 1	-	T7	cry1Ac
Cotton	GMF Cry1A	GTL-GMF311-7	T7	cry1Ab-Ac
Cotton	GHB119	BCS-GH005-8	T7	cry2Ae
Cotton	GHB614	BCS-GH002-5	T1	2mepsps
Cotton	GK12	-	T7	cry1Ab-Ac
Cotton	LLCotton25	ACS-GH001-3	T3	bar
Cotton	MLS 9124	-	T7	cry1C
Cotton	MON1076	MON-89924-2	T7	cry1Ac
Cotton	MON1445	MON-01445-2	T1	cp4 epsps (aroA:CP4)
Cotton	MON15985	MON-15985-7	T7	cry1Ac; cry2Ab2
Cotton	MON1698	MON-89383-1	T7	cp4 epsps (aroA:CP4)
Cotton	MON531	MON-00531-6	T7	cry1Ac
Cotton	MON757	MON-00757-7	T7	cry1Ac
Cotton	MON88913	MON-88913-8	T1	cp4 epsps (aroA:CP4)
Cotton	Nqwe Chi 6 Bt	-	T7	-
Cotton	SKG321	-	T7	cry1A; CpTI
Cotton	T303-3	BCS-GH003-6	T3,T7	cry1Ab; bar
Cotton	T304-40	BCS-GH004-7	T3,T7	cry1Ab; bar
Cotton	CE43-67B	-	T7	cry1Ab
Cotton	CE46-02A	-	T7	cry1Ab
Cotton	CE44-69D	-	T7	cry1Ab
Cotton	1143-14A	-	T7	cry1Ab
Cotton	1143-51B	-	T7	cry1Ab
Cotton	T342-142	-	T7	cry1Ab
Cotton	PV-GHGT07 (1445)	-	T1	cp4 epsps (aroA:CP4)
Cotton	EE-GH3	-	T1	mepsps
Cotton	EE-GH5	-	T7	cry1Ab
Cotton	MON88701	MON-88701-3	T3,T12	Modified dmo; bar
Cotton	OsCr11	-	T13	Modified Cry j
Flax	FP967	CDC-FL001-2	T11	als
Lentil	RH44	-	T16	als
Maize	3272	SYN-E3272-5	T17	amy797E
Maize	5307	SYN-05307-1	T7	ecry3.1Ab
Maize	59122	DAS-59122-7	T3,T7	cry34Ab1; cry35Ab1; pat

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Maize	676	PH-000676-7	T3,T18	pat; dam
Maize	678	PH-000678-9	T3,T18	pat; dam
Maize	680	PH-000680-2	T3,T18	pat; dam
Maize	98140	DP-098140-6	T1,T11	gat4621; zm-hra
Maize	Bt10	-	T3,T7	cry1Ab; pat
Maize	Bt176 (176)	SYN-EV176-9	T3,T7	cry1Ab; bar
Maize	BVLA430101	-	T4	phyA2
Maize	CBH-351	ACS-ZM004-3	T3,T7	cry9C; bar
Maize	DAS40278-9	DAS40278-9	T19	aad-1
Maize	DBT418	DKB-89614-9	T3,T7	cry1Ac; pinII; bar
Maize	DLL25 (B16)	DKB-89790-5	T3	bar
Maize	GA21	MON-00021-9	T1	mepsps
Maize	GG25	-	T1	mepsps
Maize	GJ11	-	T1	mepsps
Maize	Fl117	-	T1	mepsps
Maize	GAT-ZM1	-	T3	pat
Maize	LY038	REN-00038-3	T20	cordapA
Maize	MIR162	SYN-IR162-4	T7	vip3Aa20
Maize	MIR604	SYN-IR604-5	T7	mcry3A
Maize	MON801 (MON80100)	MON801	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON802	MON-80200-7	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON809	PH-MON-809-2	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON810	MON-00810-6	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON832	-	T1	cp4 epsps (aroA:CP4); goxv247
Maize	MON863	MON-00863-5	T7	cry3Bb1
Maize	MON87427	MON-87427-7	T1	cp4 epsps (aroA:CP4)
Maize	MON87460	MON-87460-4	T21	cspB
Maize	MON88017	MON-88017-3	T1,T7	cry3Bb1; cp4 epsps (aroA:CP4)
Maize	MON89034	MON-89034-3	T7	cry2Ab2; cry1A.105
Maize	MS3	ACS-ZM001-9	T3,T18	bar; barnase
Maize	MS6	ACS-ZM005-4	T3,T18	bar; barnase
Maize	NK603	MON-00603-6	T1	cp4 epsps (aroA:CP4)
Maize	T14	ACS-ZM002-1	T3	pat (syn)
Maize	T25	ACS-ZM003-2	T3	pat (syn)
Maize	TC1507	DAS-01507-1	T3,T7	cry1Fa2; pat
Maize	TC6275	DAS-06275-8	T3,T7	mocry1F; bar
Maize	VIP1034	-	T3,T7	vip3A; pat
Maize	43A47	DP-043A47-3	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Maize	40416	DP-040416-8	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Maize	32316	DP-032316-8	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Maize	4114	DP-004114-3	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Melon	Melon A	-	T22	sam-k
Melon	Melon B	-	T22	sam-k
Papaya	55-1	CUH-CP551-8	T6	prsv cp
Papaya	63-1	CUH-CP631-7	T6	prsv cp
Papaya	Huanong No. 1	-	T6	prsv rep
Papaya	X17-2	UFL-X17CP-6	T6	prsv cp
Plum	C-5	ARS-PLMC5-6	T6	ppv cp
Canola**	ZSR500	-	T1	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR502	-	T1	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR503	-	T1	cp4 epsps (aroA:CP4); goxv247
Rice	7Crp#242-95-7	-	T13	7crp
Rice	7Crp#10	-	T13	7crp
Rice	GM Shanyou 63	-	T7	cry1Ab; cry1Ac
Rice	Huahui-1/TT51-1	-	T7	cry1Ab; cry1Ac
Rice	LLRICE06	ACS-OS001-4	T3	bar
Rice	LLRICE601	BCS-OS003-7	T3	bar
Rice	LLRICE62	ACS-OS002-5	T3	bar
Rice	Tarom molaii + cry1Ab	-	T7	cry1Ab (truncated)
Rice	GAT-OS2	-	T3	bar
Rice	GAT-OS3	-	T3	bar
Rice	PE-7	-	T7	Cry1Ac
Rice	7Crp#10	-	T13	7crp
Rice	KPD627-8	-	T27	OASA1D
Rice	KPD722-4	-	T27	OASA1D
Rice	KA317	-	T27	OASA1D
Rice	HW5	-	T27	OASA1D
Rice	HW1	-	T27	OASA1D
Rice	B-4-1-18	-	T28	Δ OsBRI1
Rice	G-3-3-22	-	T29	OSGA2ox1
Rice	AD77	-	T6	DEF
Rice	AD51	-	T6	DEF
Rice	AD48	-	T6	DEF
Rice	AD41	-	T6	DEF
Rice	13pNasNa800725atAprt1	-	T30	HvNAS1; HvNAAT-A; APRT
Rice	13pAprt1	-	T30	APRT
Rice	gHvNAS1-gHvNAAT-1	-	T30	HvNAS1; HvNAAT-A; HvNAAT-B
Rice	gHvIDS3-1	-	T30	HvIDS3

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Rice	gHvNAAT1	-	T30	HvNAAT-A; HvNAAT-B
Rice	gHvNAS1-1	-	T30	HvNAS1
Rice	NIA-OS006-4	-	T6	WRKY45
Rice	NIA-OS005-3	-	T6	WRKY45
Rice	NIA-OS004-2	-	T6	WRKY45
Rice	NIA-OS003-1	-	T6	WRKY45
Rice	NIA-OS002-9	-	T6	WRKY45
Rice	NIA-OS001-8	-	T6	WRKY45
Rice	OsCr11	-	T13	Modified Cry j
Rice	17053	-	T1	cp4 epsps (aroA:CP4)
Rice	17314	-	T1	cp4 epsps (aroA:CP4)
Rose	WKS82 / 130-4-1	IFD-52401-4	T9	5AT; bp40 (f3'5'h)
Rose	WKS92 / 130-9-1	IFD-52901-9	T9	5AT; bp40 (f3'5'h)
Soybean	260-05 (G94-1, G94-19, G168)	-	T9	gm-fad2-1 (silencing locus)
Soybean	A2704-12	ACS-GM005-3	T3	pat
Soybean	A2704-21	ACS-GM004-2	T3	pat
Soybean	A5547-127	ACS-GM006-4	T3	pat
Soybean	A5547-35	ACS-GM008-6	T3	pat
Soybean	CV127	BPS-CV127-9	T16	csr1-2
Soybean	DAS68416-4	DAS68416-4	T3	pat
Soybean	DP305423	DP-305423-1	T11,T31	gm-fad2-1 (silencing locus); gm-hra
Soybean	DP356043	DP-356043-5	T1,T31	gm-fad2-1 (silencing locus); gat4601
Soybean	FG72	MST-FG072-3	T32,T1	2mepsps; hppdPF W336
Soybean	GTS 40-3-2 (40-3-2)	MON-04032-6	T1	cp4 epsps (aroA:CP4)
Soybean	GU262	ACS-GM003-1	T3	pat
Soybean	MON87701	MON-87701-2	T7	cry1Ac
Soybean	MON87705	MON-87705-6	T1,T31	fatb1-A (sense & antisense); fad2-1A (sense & antisense); cp4 epsps (aroA:CP4)
Soybean	MON87708	MON-87708-9	T1,T12	dmo; cp4 epsps (aroA:CP4)
Soybean	MON87769	MON-87769-7	T1,T31	Pj.D6D; Nc.Fad3; cp4 epsps (aroA:CP4)
Soybean	MON89788	MON-89788-1	T1	cp4 epsps (aroA:CP4)
Soybean	W62	ACS-GM002-9	T3	bar
Soybean	W98	ACS-GM001-8	T3	bar
Soybean	MON87754	MON-87754-1	T33	dgat2A
Soybean	DAS21606	DAS-21606	T34,T3	Modified aad-12; pat
Soybean	DAS44406	DAS-44406-6	T1,T3,T34	Modified aad-12; 2mepsps; pat

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Soybean	SYHT04R	SYN-0004R-8	T35	Modified avhppd
Soybean	9582.814.19.1	-	T3,T7	cry1Ac, cry1F, PAT
Squash	CZW3	SEM-ØCZW3-2	T6	cmv cp, zymv cp, wmv cp
Squash	ZW20	SEM-0ZW20-7	T6	zymv cp, wmv cp
Sugar Beet	GTSB77 (T9100152)	SY-GTSB77-8	T1	cp4 epsps (aroA:CP4); goxv247
Sugar Beet	H7-1	KM-000H71-4	T1	cp4 epsps (aroA:CP4)
Sugar Beet	T120-7	ACS-BV001-3	T3	pat
Sugar Beet	T227-1	-	T1	cp4 epsps (aroA:CP4)
Sugarcane	NXI-1T	-	T21	EcbetA
Sunflower	X81359	-	T16	als
Pepper	PK-SP01	-	T6	cmv cp
Tobacco	C/F/93/08-02	-	T5	bxn
Tobacco	Vector 21-41	-	T36	NtQPT1 (antisense)
Sunflower	X81359	-	T16	als
Wheat	MON71800	MON-718ØØ-3	T1	cp4 epsps (aroA:CP4)

* Argentine (*Brassica napus*), ** Polish (*B. rapa*), # Eggplant

Although most typically, compounds of the invention are used to control undesired vegetation, contact of desired vegetation in the treated locus with compounds of the invention may result in super-additive or synergistic effects with genetic traits in the desired vegetation, including traits incorporated through genetic modification. For example, resistance to phytophagous insect pests or plant diseases, tolerance to biotic/abiotic stresses or storage stability may be greater than expected from the genetic traits in the desired vegetation.

An embodiment of the present invention is a method for controlling the growth of undesired vegetation in genetically modified plants that exhibit traits of glyphosate tolerance, glufosinate tolerance, ALS herbicide tolerance, dicamba tolerance, imidazolinone herbicide tolerance, 2,4-D tolerance, HPPD tolerance and mesotrione tolerance, comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of Formula **1**.

Compounds of this invention can also be mixed with one or more other biologically active compounds or agents including herbicides, herbicide safeners, fungicides, insecticides, nematocides, bactericides, acaricides, growth regulators such as insect molting inhibitors and rooting stimulants, chemosterilants, semiochemicals, repellents, attractants, pheromones, feeding stimulants, plant nutrients, other biologically active compounds or entomopathogenic bacteria, virus or fungi to form a multi-component pesticide giving an even broader spectrum of agricultural protection. Mixtures of the compounds of the invention with other herbicides can broaden the spectrum of activity against additional weed species, and suppress the proliferation of any resistant biotypes. Thus the present invention also pertains to a composition comprising a compound of Formula **1** (in a herbicidally effective amount) and at least one additional biologically active compound or agent (in a biologically effective amount) and can further comprise at least one of a surfactant, a solid diluent or a liquid diluent. The other biologically active compounds or agents can be formulated in compositions comprising at least one of a surfactant, solid or liquid diluent. For mixtures of the present invention, one or more other biologically active compounds or agents can be formulated together with a compound of Formula **1**, to form a premix, or one or more other biologically active compounds or agents can be formulated separately from the compound of Formula **1**, and the formulations combined together before application (e.g., in a spray tank) or, alternatively, applied in succession.

A mixture of one or more of the following herbicides with a compound of this invention may be particularly useful for weed control: acetochlor, acifluorfen and its sodium salt, aclonifen, acrolein (2-propenal), alachlor, alloxydim, ametryn, amicarbazone, amidosulfuron, aminocyclopyrachlor and its esters (e.g., methyl, ethyl) and salts (e.g., sodium, potassium), aminopyralid, amitrole, ammonium sulfamate, anilofos, asulam, atrazine, azimsulfuron, beflubutamid, benazolin, benazolin-ethyl, bencarbazone, benfluralin, benfuresate, bensulfuron-methyl, bensulide, bentazone, benzobicyclon, benzofenap, bicyclopyrone, bifenox, bilanafos, bispyribac and its sodium salt, bromacil, bromobutide, bromofenoxim, bromoxynil, bromoxynil octanoate, butachlor, butafenacil, butamifos, butralin, butroxydim, butylate, cafenstrole, carbetamide, carfentrazone-ethyl, catechin, chlomethoxyfen, chloramben, chlorbromuron, chlorflurenol-methyl, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clacyfos, clefoxydim, clethodim, clodinafop-propargyl, clomazone, clomeprop, clopyralid, clopyralid-olamine, cloransulam-methyl, cumyluron, cyanazine, cycloate, cyclopyrimorate, cyclosulfamuron, cycloxydim, cyhalofop-butyl, 2,4-D and its butotyl, butyl, isoctyl and isopropyl esters and its dimethylammonium, diolamine and trolamine salts, daimuron, dalapon, dalapon-sodium, dazomet, 2,4-DB and its dimethylammonium, potassium and sodium salts, desmedipham, desmetryn, dicamba and its diglycolammonium, dimethylammonium, potassium and sodium salts, dichlobenil, dichlorprop, diclofop-methyl, diclosulam, difenzoquat metilsulfate, diflufenican, diflufenzopyr, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dimethenamid-P, dimethipin, dimethylarsinic acid and its sodium salt, dinitramine, dinoterb, diphenamid, diquat dibromide, dithiopyr, diuron, DNOC, endothal, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethiozin, ethofumesate, ethoxyfen, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenoxaprop-P-ethyl, fenoxasulfone, fenquinotrione, fentrazamide, fenuron, fenuron-TCA, flamprop-methyl, flamprop-M-isopropyl, flamprop-M-methyl, flazasulfuron, florasulam, fluazifop-butyl, fluazifop-P-butyl, fluazolate, flucarbazone, flucetosulfuron, fluchloralin, flufenacet, flufenpyr, flufenpyr-ethyl, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluoroglycofen-ethyl, flupoxam, flupyrsulfuron-methyl and its sodium salt, flurenol, flurenol-butyl, fluridone, flurochloridone, fluroxypyr, flurtamone, fluthiacet-methyl, fomesafen, foramsulfuron, fosamine-ammonium, glufosinate, glufosinate-ammonium, glufosinate-P, glyphosate and its salts such as ammonium, isopropylammonium, potassium, sodium (including sesquisodium) and trimesium (alternatively named sulfosate), halauxifen, halauxifen-methyl, halosulfuron-methyl, haloxyfop-etotyl, haloxyfop-methyl, hexazinone, hydantocidin, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazaquin-ammonium, imazethapyr, imazethapyr-ammonium, imazosulfuron, indanofan, indaziflam, iofensulfuron, iodosulfuron-methyl, ioxynil, ioxynil octanoate, ioxynil-sodium, ipfencarbazone, isoproturon, isouron, isoxaben, isoxaflutole, isoxachlortole, lactofen, lenacil, linuron, maleic hydrazide, MCPA and its salts (e.g., MCPA-dimethylammonium, MCPA-potassium and MCPA-sodium, esters (e.g., MCPA-2-ethylhexyl, MCPA-butotyl) and thioesters (e.g., MCPA-thioethyl), MCPB and its salts (e.g., MCPB-sodium) and esters (e.g., MCPB-ethyl), mecoprop, mecoprop-P, mefenacet, mefluidide, mesosulfuron-methyl, mesotrione, metam-sodium, metamifop, metamitron, metazachlor, metazosulfuron, methabenzthiazuron, methylarsonic acid and its calcium, monoammonium, monosodium and disodium salts, methyldymron, metobenzuron, metobromuron, metolachlor, S-metolachlor, metosulam, metoxuron, metribuzin, metsulfuron-methyl, molinate, monolinuron, naproanilide, napropamide, napropamide-M, naptalam, neburon, nicosulfuron, norflurazon, orbencarb, orthosulfamuron, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, oxaziclomefone, oxyfluorfen, paraquat dichloride, pebulate, pelargonic acid, pendimethalin, penoxsulam, pentanochlor, pentoxazone, perfluidone, pethoxamid, pethoxyamid, phenmedipham, picloram, picloram-potassium, picolinafen, pinoxaden, piperophos, pretilachlor, primisulfuron-methyl, prodiamine, profoxydim, prometon, prometryn, propachlor, propanil, propaquizafop, propazine, propham, propisochlor, propoxycarbazone, propyrisulfuron, propyzamide, prosulfocarb, prosulfuron, pyraclonil, pyraflufen-ethyl, pyrasulfotole, pyrazogyl, pyrazolynate, pyrazoxyfen, pyrazosulfuron-ethyl, pyribenzoxim, pyributicarb, pyridate, pyriftalid, pyriminobac-methyl, pyrimisulfan, pyrithiobac, pyrithiobac-sodium, pyroxasulfone, pyroxsulam, quinclorac, quinmerac, quinoclamine, quizalofop-ethyl, quizalofop-P-ethyl, quizalofop-P-tefuryl, rimsulfuron, saflufenacil, sethoxydim, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron-methyl, sulfosulfuron, 2,3,6-TBA, TCA, TCA-sodium, tebutam, tebuthiuron, tefuryltrione, tembotrione, tepraloxydim, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thiencarbazone, thifensulfuron-methyl, thiobencarb, tiafenacil, tiocarbazil, tolpyralate, topramezone, tralkoxydim, tri-allate, triafamone, triasulfuron, triaziflam, tribenuron-methyl, triclopyr, triclopyr-butotyl, triclopyr-triethylammonium, tridiphane, trietazine, trifloxysulfuron, trifludimoxazin, trifluralin, triflusulfuron-methyl, tritosulfuron, vernolate, 3-(2-chloro-3,6-difluorophenyl)-4-hydroxy-1-methyl-1,5-naphthyridin-2(1*H*)-one, 5-chloro-3-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-1-(4-methoxyphenyl)-2(1*H*)-quinoxalinone, 2-chloro-*N*-(1-methyl-1*H*-tetrazol-5-yl)-6-(trifluoromethyl)-3-pyridinecarboxamide, 7-(3,5-dichloro-4-pyridinyl)-5-(2,2-difluoroethyl)-8-hydroxypyrido[2,3-*b*]pyrazin-6(5*H*)-one), 4-(2,6-diethyl-4-methylphenyl)-5-hydroxy-2,6-dimethyl-3(2*H*)-pyridazinone), 5-[[(2,6-difluorophenyl)methoxy]methyl]-4,5-dihydro-5-methyl-3-(3-methyl-2-thienyl)isoxazole (previously methioxolin), 4-(4-fluorophenyl)-6-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-2-methyl-1,2,4-triazine-3,5(2*H*,4*H*)-dione, methyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoro-2-pyridinecarboxylate, 2-methyl-3-(methylsulfonyl)-*N*-(1-methyl-1*H*-tetrazol-5-yl)-4-(trifluoromethyl)benzamide and 2-methyl-*N*-(4-methyl-1,2,5-oxadiazol-3-yl)-3-(methylsulfinyl)-4-(trifluoromethyl)benzamide. Other herbicides also include bioherbicides such as *Alternaria destruens* Simmons, *Colletotrichum gloeosporiodes* (Penz.) Penz. & Sacc., *Drechsiera monoceras* (MTB-951), *Myrothecium verrucaria* (Albertini & Schweinitz) Ditmar: Fries, *Phytophthora palmivora* (Butl.) Butl. and *Puccinia thlaspeos* Schub.

Compounds of this invention can also be used in combination with plant growth regulators such as aviglycine, *N*-(phenylmethyl)-1*H*-purin-6-amine, epocholeone, gibberellic acid, gibberellin A_4 and A_7, harpin protein, mepiquat chloride, prohexadione calcium, prohydrojasmon, sodium nitrophenolate and trinexapac-methyl, and plant growth modifying organisms such as *Bacillus cereus* strain BP01.

General references for agricultural protectants (i.e. herbicides, herbicide safeners, insecticides, fungicides, nematocides, acaricides and biological agents) include *The Pesticide Manual, 13th Edition*, C. D. S. Tomlin, Ed., British Crop Protection Council, Farnham, Surrey, U.K., 2003 and *The BioPesticide Manual, 2nd Edition*, L. G. Copping, Ed., British Crop Protection Council, Farnham, Surrey, U.K., 2001.

For embodiments where one or more of these various mixing partners are used, the mixing partners are typically used in the amounts similar to amounts customary when the mixture partners are used alone. More particularly in mixtures, active ingredients are often applied at an application rate between one-half and the full application rate specified on product labels for use of active ingredient alone. These amounts are listed in references such as *The Pesticide Manual* and *The BioPesticide Manual*. The weight ratio of these various mixing partners (in total) to the compound of Formula **1** is typically between about 1:3000 and about 3000:1. Of note are weight ratios between about 1:300 and about 300:1 (for example ratios between about 1:30 and about 30:1). One skilled in the art can easily determine through simple experimentation the biologically effective amounts of active ingredients necessary for the desired spectrum of biological activity. It will be evident that including these additional components may expand the spectrum of weeds controlled beyond the spectrum controlled by the compound of Formula **1** alone.

In certain instances, combinations of a compound of this invention with other biologically active (particularly herbicidal) compounds or agents (i.e. active ingredients) can result in a greater-than-additive (i.e. synergistic) effect on weeds and/or a less-than-additive effect (i.e. safening) on crops or other desirable plants. Reducing the quantity of active ingredients released in the environment while ensuring effective pest control is always desirable. Ability to use greater amounts of active ingredients to provide more effective weed control without excessive crop injury is also desirable. When synergism of herbicidal active ingredients occurs on weeds at application rates giving agronomically satisfactory levels of weed control, such combinations can be advantageous for reducing crop production cost and decreasing environmental load. When safening of herbicidal active ingredients occurs on crops, such combinations can be advantageous for increasing crop protection by reducing weed competition.

Of note is a combination of a compound of the invention with at least one other herbicidal active ingredient. Of particular note is such a combination where the other herbicidal active ingredient has different site of action from the compound of the invention. In certain instances, a combination with at least one other herbicidal active ingredient having a similar spectrum of control but a different site of action will be particularly advantageous for resistance management. Thus, a composition of the present invention can further comprise (in a herbicidally effective amount) at least one additional herbicidal active ingredient having a similar spectrum of control but a different site of action.

Compounds of this invention can also be used in combination with herbicide safeners such as allidochlor, benoxacor, cloquintocet-mexyl, cumyluron, cyometrinil, cyprosulfonamide, daimuron, dichlormid, dicyclonon, dietholate, dimepiperate, fenchlorazole-ethyl, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen-ethyl, mefenpyr-diethyl, mephenate, methoxyphenone naphthalic anhydride (1,8-naphthalic anhydride), oxabetrinil, *N*-(aminocarbonyl)-2-methylbenzenesulfonamide, *N*-(aminocarbonyl)-2-fluorobenzenesulfonamide, 1-bromo-4-[(chloromethyl)sulfonyl]benzene (BCS), 4-(dichloroacetyl)-1-oxa-4-azospiro[4.5]decane (MON 4660), 2-(dichloromethyl)-2-methyl-1,3-dioxolane (MG 191), ethyl 1,6-dihydro-1-(2-methoxyphenyl)-6-oxo-2-phenyl-5-pyrimidinecarboxylate, 2-hydroxy-*N*,*N*-dimethyl-6-(trifluoromethyl)pyridine-3-carboxamide, and 3-oxo-1-cyclohexen-l-yl 1-(3,4-dimethylphenyl)-l,6-dihydro-6-oxo-2-phenyl-5-pyrimidinecarboxylate, 2,2-dichloro-1-(2,2,5-trimethyl-3-oxazolidinyl)-ethanone and 2-methoxy-*N*-[[4-[[(methylamino)carbonyl]amino]phenyl]sulfonyl]-benzamide to increase safety to certain crops. Antidotally effective amounts of the herbicide safeners can be applied at the same time as the compounds of this invention, or applied as seed treatments. Therefore an aspect of the present invention relates to a herbicidal mixture comprising a compound of this invention and an antidotally effective amount of a herbicide safener. Seed treatment is particularly useful for selective weed control, because it physically restricts antidoting to the crop plants. Therefore a particularly useful embodiment of the present invention is a method for selectively controlling the growth of undesired vegetation in a crop comprising contacting the locus of the crop with a herbicidally effective amount of a compound of this invention wherein seed from which the crop is grown is treated with an antidotally effective amount of safener. Antidotally effective amounts of safeners can be easily determined by one skilled in the art through simple experimentation.

Compounds of the invention cans also be mixed with: (1) polynucleotides including but not limited to DNA, RNA, and/or chemically modified nucleotides influencing the amount of a particular target through down regulation, interference, suppression or silencing of the genetically derived transcript that render a herbicidal effect; or (2) polynucleotides including but not limited to DNA, RNA, and/or chemically modified nucleotides influencing the amount of a particular target through down regulation, interference, suppression or silencing of the genetically derived transcript that render a safening effect.

Of note is a composition comprising a compound of the invention (in a herbicidally effective amount), at least one additional active ingredient selected from the group consisting of other herbicides and herbicide safeners (in an effective amount), and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

Preferred for better control of undesired vegetation (e.g., lower use rate such as from synergism, broader spectrum of weeds controlled, or enhanced crop safety) or for preventing the development of resistant weeds are mixtures of a compound of this invention with a herbicide selected from the group 2,4-D, acetochlor, alachlor, atrazine, bromoxynil, bentazon, bicyclopyrone, carfentrazone-ethyl, cloransulam-methyl, dicamba, dimethenamid-p, florasulam, flufenacet, flumioxazin, flupyrsulfuron-methyl, fluroxypyr-meptyl, glyphosate, halauxifen-methyl, isoxaflutole, MCPA, mesotrione, metolachlor, metsulfuron-methyl, nicosulfuron, pyrasulfotole, pyroxasulfone, pyroxsulam, rimsulfuron, saflufenacil, tembotrione, thifensulfuron-methyl, topramazone and tribenuron.

Table A1 lists specific combinations of a Component (a) with Component (b) illustrative of the mixtures, compositions and methods of the present invention. Compound 13 in the Component (a) column is identified in Index Table A. The second column of Table A1 lists the specific Component (b) compound (e.g., "2,4-D" in the first line). The third, fourth and fifth columns of Table A1 lists ranges of weight ratios for rates at which the Component (a) compound is typically applied to a field-grown crop relative to Component (b) (i.e. (a):(b)). Thus, for example, the first line of Table A1 specifically discloses the combination of Component (a) (i.e. Compound 13 in Index Table A) with 2,4-D is typically applied in a weight ratio between 1:192 – 6:1. The remaining lines of Table A1 are to be construed similarly.

TABLE A1

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	2,4-D	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Acetochlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Acifluorfen	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Aclonifen	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
13	Alachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Ametryn	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Amicarbazone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Amidosulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
13	Aminocyclopyrachlor	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
13	Aminopyralid	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Amitrole	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Anilofos	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Asulam	1:960 – 2:1	1:320 – 1:3	1:120 – 1:14
13	Atrazine	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Azimsulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
13	Beflubutamid	1:342 – 4:1	1:114 – 2:1	1:42 – 1:5
13	Benfuresate	1:617 – 2:1	1:205 – 1:2	1:77 – 1:9
13	Bensulfuron-methyl	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Bentazone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Benzobicyclon	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Benzofenap	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
13	Bicyclopyrone	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Bifenox	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
13	Bispyribac-sodium	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Bromacil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Bromobutide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Bromoxynil	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Butachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Butafenacil	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Butylate	1:1542 – 1:2	1:514 – 1:5	1:192 – 1:22
13	Carfenstrole	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Carfentrazone-ethyl	1:128 – 9:1	1:42 – 3:1	1:16 – 1:2

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Chlorimuron-ethyl	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Chlorotoluron	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Chlorsulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
13	Cincosulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Cinidon-ethyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Cinmethylin	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Clacyfos	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Clethodim	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
13	Clodinafop-propargyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Clomazone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Clomeprop	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
13	Clopyralid	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Cloransulam-methyl	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
13	Cumyluron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Cyanazine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Cyclopyrimorate	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Cyclosulfamuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Cycloxydim	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Cyhalofop	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Daimuron	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Desmedipham	1:322 – 4:1	1:107 – 2:1	1:40 – 1:5
13	Dicamba	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Dichlobenil	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
13	Dichlorprop	1:925 – 2:1	1:308 – 1:3	1:115 – 1:13
13	Diclofop-methyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Diclosulam	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Difenzoquat	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Diflufenican	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
13	Diflufenzopyr	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
13	Dimethachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Dimethametryn	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Dimethenamid-P	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Dithiopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Diuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	EPTC	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Esprocarb	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
13	Ethalfluralin	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Ethametsulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Ethoxyfen	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Ethoxysulfuron	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Etobenzanid	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
13	Fenoxaprop-ethyl	1:120 – 10:1	1:40 – 4:1	1:15 – 1:2
13	Fenoxasulfone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Fenquinotrione	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Fentrazamide	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Flazasulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Florasulam	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
13	Fluazifop-butyl	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Flucarbazone	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Flucetosulfuron	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Flufenacet	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
13	Flumetsulam	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
13	Flumiclorac-pentyl	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Flumioxazin	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Fluometuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Flupyrsulfuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
13	Fluridone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Fluroxypyr	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Flurtamone	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
13	Fluthiacet-methyl	1:48 – 42:1	1:16 – 14:1	1:3 – 3:1
13	Fomesafen	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Foramsulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
13	Glufosinate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Glyphosate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Halosulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Halauxifen	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Halauxifen methyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Haloxyfop-methyl	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Hexazinone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Hydantocidin	1:1100 – 16:1	1:385 – 8:1	1:144 – 4:1

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Imazamox	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
13	Imazapic	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Imazapyr	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Imazaquin	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Imazethabenz-methyl	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
13	Imazethapyr	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
13	Imazosulfuron	1:27 – 42:1	1:9 – 14:1	1:3 – 3:1
13	Indanofan	1:342 – 4:1	1:114 – 2:1	1:42 – 1:5
13	Indaziflam	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Iodosulfuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
13	Ioxynil	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Ipfencarbazone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Isoproturon	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Isoxaben	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Isoxaflutole	1:60 – 20:1	1:20 – 7:1	1:7 – 2:1
13	Lactofen	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Lenacil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Linuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	MCPA	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	MCPB	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Mecoprop	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Mefenacet	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Mefluidide	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Mesosulfuron-methyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
13	Mesotrione	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Metamifop	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Metazachlor	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Metazosulfuron	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Methabenzthiazuron	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Metolachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Metosulam	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Metribuzin	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Metsulfuron-methyl	1:2 – 560:1	1:1 – 187:1	3:1 – 35:1
13	Molinate	1:1028 – 2:1	1:342 – 1:3	1:128 – 1:15
13	Napropamide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Napropamide-M	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Naptalam	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Nicosulfuron	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
13	Norflurazon	1:1152 – 1:1	1:384 – 1:3	1:144 – 1:16
13	Orbencarb	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
13	Orthosulfamuron	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Oryzalin	1:514 – 3:1	1:171 – 1:2	1:64 – 1:8
13	Oxadiargyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Oxadiazon	1:548 – 3:1	1:182 – 1:2	1:68 – 1:8
13	Oxasulfuron	1:27 – 42:1	1:9 – 14:1	1:3 – 3:1
13	Oxaziclomefone	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Oxyfluorfen	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Paraquat	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Pendimethalin	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Penoxsulam	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Penthoxamid	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Pentoxazone	1:102 – 12:1	1:34 – 4:1	1:12 – 1:2
13	Phenmedipham	1:102 – 12:1	1:34 – 4:1	1:12 – 1:2
13	Picloram	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Picolinafen	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Pinoxaden	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Pretilachlor	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Primisulfuron-methyl	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Prodiamine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Profoxydim	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Prometryn	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Propachlor	1:1152 – 1:1	1:384 – 1:3	1:144 – 1:16
13	Propanil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Propaquizafop	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
13	Propoxycarbazone	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Propyrisulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Propyzamide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Prosulfocarb	1:1200 – 1:2	1:400 – 1:4	1:150 – 1:17
13	Prosulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
13	Pyraclonil	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Pyraflufen-ethyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
13	Pyrasulfotole	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
13	Pyrazolynate	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
13	Pyrazosulfuron-ethyl	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Pyrazoxyfen	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
13	Pyribenzoxim	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Pyributicarb	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Pyridate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Pyriftalid	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
13	Pyriminobac-methyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
13	Pyrimisulfan	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Pyrithiobac	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
13	Pyroxasulfone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Pyroxsulam	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
13	Quinclorac	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Quizalofop-ethyl	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Rimsulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
13	Saflufenacil	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Sethoxydim	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
13	Simazine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Sulcotrione	1:120 – 10:1	1:40 – 4:1	1:15 – 1:2
13	Sulfentrazone	1:147 – 8:1	1:49 – 3:1	1:18 – 1:3
13	Sulfometuron-methyl	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
13	Sulfosulfuron	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
13	Tebuthiuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Tefuryltrione	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
13	Tembotrione	1:31 – 37:1	1:10 – 13:1	1:3 – 3:1
13	Tepraloxydim	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Terbacil	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Terbuthylazine	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
13	Terbutryn	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Thenylchlor	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
13	Thiazopyr	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
13	Thiencarbazone	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
13	Thifensulfuron-methyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1

Component (a) (Compound 13)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
13	Tiafenacil	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Thiobencarb	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Tolpyralate	1:31 – 37:1	1:10 – 13:1	1:3 – 3:1
13	Topramzone	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
13	Tralkoxydim	1:68 – 17:1	1:22 – 6:1	1:8 – 2:1
13	Triafamone	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
13	Triallate	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
13	Triasulfuron	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
13	Triaziflam	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
13	Tribenuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
13	Triclopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
13	Trifloxysulfuron	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
13	Trifludimoxazin	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
13	Trifluralin	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
13	Triflusulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
13	Tritosulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1

Table A2 is constructed the same as Table A1 above except that entries below the "Component (a)" column heading are replaced with the respective Component (a) Column Entry shown below. Compound 15 in the Component (a) column is identified in Index Table A. Thus, for example, in Table A2 the entries below the "Component (a)" column heading all recite "Compound 15" (i.e. Compound 15 identified in Index Table A), and the first line below the column headings in Table A2 specifically discloses a mixture of Compound 15 with 2,4-D. Tables A3 through A146 are constructed similarly.

Table Number	Component (a) Column Entries	Table Number	Component (a) Column Entries
A2	Compound 15	A13	Compound 5
A3	Compound 16	A14	Compound 6
A4	Compound 21	A15	Compound 7
A5	Compound 22	A16	Compound 8
A6	Compound 23	A17	Compound 9
A7	Compound 24	A18	Compound 10
A8	Compound 27	A19	Compound 11
A9	Compound 1	A20	Compound 12
A10	Compound 2	A21	Compound 14
A11	Compound 3	A22	Compound 17
A12	Compound 4	A23	Compound 18

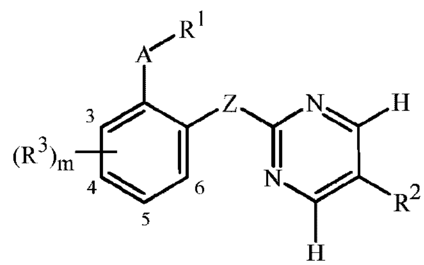
Table Number	Component (a) Column Entries	Table Number	Component (a) Column Entries
A24	Compound 19	A61	Compound 61
A25	Compound 20	A62	Compound 62
A26	Compound 25	A63	Compound 63
A27	Compound 26	A64	Compound 64
A28	Compound 28	A65	Compound 65
A29	Compound 29	A66	Compound 66
A30	Compound 30	A67	Compound 67
A31	Compound 31	A68	Compound 68
A32	Compound 32	A69	Compound 69
A33	Compound 33	A70	Compound 70
A34	Compound 34	A71	Compound 71
A35	Compound 35	A72	Compound 72
A36	Compound 36	A73	Compound 73
A37	Compound 37	A74	Compound 74
A38	Compound 38	A75	Compound 75
A39	Compound 39	A76	Compound 76
A40	Compound 40	A77	Compound 77
A41	Compound 41	A78	Compound 78
A42	Compound 42	A79	Compound 79
A43	Compound 43	A80	Compound 80
A44	Compound 44	A81	Compound 81
A45	Compound 45	A82	Compound 82
A46	Compound 46	A83	Compound 83
A47	Compound 47	A84	Compound 84
A48	Compound 48	A85	Compound 85
A49	Compound 49	A86	Compound 86
A50	Compound 50	A87	Compound 87
A51	Compound 51	A88	Compound 88
A52	Compound 52	A89	Compound 89
A53	Compound 53	A90	Compound 90
A54	Compound 54	A91	Compound 91
A55	Compound 55	A92	Compound 92
A56	Compound 56	A93	Compound 93
A57	Compound 57	A94	Compound 94
A58	Compound 58	A95	Compound 95
A59	Compound 59	A96	Compound 96
A60	Compound 60	A97	Compound 97

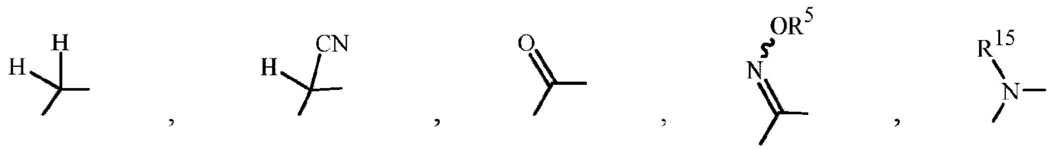
Table Number	Component (a) Column Entries
A98	Compound 98
A99	Compound 99
A100	Compound 100
A101	Compound 101
A102	Compound 102
A103	Compound 103
A104	Compound 104
A105	Compound 104
A106	Compound 106
A107	Compound 107
A108	Compound 108
A109	Compound 109
A110	Compound 110
A111	Compound 111
A112	Compound 112
A113	Compound 113
A114	Compound 114
A115	Compound 115
A116	Compound 116
A117	Compound 117
A118	Compound 118
A119	Compound 119
A120	Compound 120
A121	Compound 121
A122	Compound 122
A123	Compound 123
A124	Compound 124
A125	Compound 125
A126	Compound 126
A127	Compound 127
A128	Compound 128
A129	Compound 129
A130	Compound 130
A131	Compound 131
A132	Compound 132
A133	Compound 133
A134	Compound 134
A135	Compound 135
A136	Compound 136
A137	Compound 137
A138	Compound 138
A139	Compound 139
A140	Compound 140
A141	Compound 141
A142	Compound 142
A143	Compound 143
A144	Compound 144
A145	Compound 145
A146	Compound 146

The compounds of the present invention are useful for the control of weed species that are resistant to herbicides with the AHAS-inhibitor or (b2) [chemical compound that inhibits acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS)] mode of action.

The following Tests demonstrate the control efficacy of the compounds of this invention against specific weeds. The weed control afforded by the compounds is not limited, however, to these species. See Index Tables A-C for compound descriptions. The following abbreviations are used in the Index Tables which follow: *t* is tertiary, *s* is secondary, *n* is normal, *i* is iso, *c* is cyclo, Me is methyl, Et is ethyl, Pr is propyl, *i*-Pr is isopropyl, Bu is butyl, *c*-Pr is cyclopropyl, *t*-Bu is *tert*-butyl, Ph is phenyl, OMe is methoxy, OEt is ethoxy, SMe is methylthio, TFP is trifluoropropyl (i.e. $-CH_2CH_2CF_3$), Bn is benzyl and -CN is cyano. The abbreviation “Cmpd. No.” stands for “Compound Number”. The abbreviation "Ex." stands for "Example" and is followed by a number indicating in which example the compound is prepared. Mass spectra are reported with an estimated precision within ±0.5 Da as the molecular weight of the highest isotopic abundance parent ion (M+1) formed by addition of H^+ (molecular weight of 1) to the molecule. The presence of molecular ions containing one or more higher atomic weight isotopes of lower abundance (e.g., ^{37}Cl, ^{81}Br) is not reported. The alternate molecular ion peaks (e.g., M+2 or M+4) that occur with compounds containing multiple halogens are not reported. The reported M+1 peaks were observed by mass spectrometry using atmospheric pressure chemical ionization (AP^+) or electrospray ionization (ESI).

INDEX TABLE A





A-1, A-2, A-3A, A-5, A-7

Z = O

Cmpd. No.	A	R^1	R^2	R^3	M.S.(AP+) or m.p.
1	A-3A	$OCH_2CH(CH_3)_2$	Cl	3-Br	*
2	A-3A	$OCH_2C(Cl){=}CH_2$	Cl	3-Br	*
3	A-3A	$OCH_2C(CH_3){=}CH_2$	Cl	3-Br	*
4	A-3A	$OCH_2CF_2CF_3$	Br	3-F	447
5	A-3A	$OCH_2CF_2CF_3$	Cl	3-F	401
6	A-3A	OCH_2(cyclo-pentyl)	Cl	3-Br	411
7	A-3A	OCH_2CH_2CN	Cl	3-Br	382
8	A-3A	OCH_2(cyclo-butyl)	Cl	3-Br	397
9	A-3A	OCH_2(cyclo-propyl)	Cl	3-Br	393
10	A-3A	OCH_2(2,2-di-F-cyclo-propyl)	Cl	3-Br	419
11	A-3A	$OCH_2CH{=}C(CH_3)_2$	Cl	3-Br	397
12	A-3A	CH_3	Cl	3-Br	*

Cmpd. No.	A	R^1	R^2	R^3	M.S.(AP+) or m.p.
13	A-3A	$OCH_2CH_2CH_3$	Cl	3-Br	*
14	A-3A	$OC(CH_3)_3$	Cl	3-Br	*
15	A-3A	$OCH_2CH_2CF_3$	Cl	3-Cl	381
16	A-3A	$OCH(CH_3)CH_2CF_3$	Cl	3-Br	439
17	A-3A	$OCH_2CH_2CF_3$	Cl	(m = 0)	347
18	A-3A	$N(CH_3)CH_2CH(CH_3)(CF_3)$	Cl	3-Br	452
19	A-3A	$N(CH_3)CH_2CH_2CF_3$	Cl	3-Br	438
20	A-3A	$OCH_2CH_2CH_2CF_3$	Cl	3-Br	*
21 (Ex. 2)	A-3A	$OCH_2CH_2CH{=}CH_2$	Cl	3-Br	*
22	A-3A	$OCH_2CH{=}CH_2$	Cl	3-Br	369
23	A-3A	$OCH_2CF_2CF_3$	Cl	3-Br	461
24	A-3A	$N(CH_3)OCH_2CF_3$	Br	3-Br	484
25	A-3A	$N(CH_3)OCH_2CF_3$	Cl	3-Br	440
26 (Ex. 3)	A-3A	$OCH_2CH_2CF_3$	Cl	3-Br	425
27	A-3A	$NHCH_2CF_3$	Br	(m = 0)	*
28 (Ex. 1)	A-3A	$NHCH_2CF_3$	Cl	(m = 0)	*
29	A-3A	CH_2Cl	Cl	(m = 0)	283 (65–70)
30	A-3A	$OCH_2CH_2CF_3$	Cl	3-CN	372
31	A-3A	OCH_2CF_3	CN	3-Br	*
32	A-3A	OCH_2CF_3	Cl	3-CN	358
33	A-3A	$OCH_2CH_2CF_3$	Br	3-Br	467
34	A-3A	OCH_2CF_3	Br	3-Br	455
35	A-3A	OCH_2CF_3	Cl	3-Br	411
36	A-3A	$OCH(CH_2Cl)_2$	Cl	3-Br	439
37	A-3A	$OCH_2CH(CH_3)CH{=}CH_2$	Cl	3-Br	397
38	A-3A	$OCH_2CH_2C{\equiv}CH$	Cl	3-Br	381
39	A-3A	OCH_2CN	Cl	3-CN	315
40	A-3A	OCH_2CN	Cl	3-Br	*
41	A-3A	$OCH_2CH_2CF_3$	Br	3-F	409
42	A-3A	$OCH_2CH_2CF_3$	Cl	3-F	365
43	A-3A	$OC(CH_3)_3$	Cl	3-F	325
44	A-3A	O(cyclo-pentyl)	Cl	3-Br	397
45	A-3A	OCH_2CCl_3	Cl	3-Br	459
46	A-3A	OCH_2CH_2Cl	Cl	3-Br	391
47	A-3A	OCH_2CF_3	Br	3-F	396
48	A-3A	OCH_2CF_3	Cl	3-F	351

Cmpd. No.	A	R^1	R^2	R^3	M.S.(AP+) or m.p.
49	A-3A	OCH_2CN	Cl	3-F	308 (80–83)
50	A-3A	*E*-$OCH_2CH{=}CHCF_3$	Cl	3-Br	437
51	A-3A	CH_3	Cl	3-OMe	279
52	A-3A	CH_3	Cl	(m = 0)	249
55	A-5; R^5 is Me	CH_3	Cl	(m = 0)	278
56	A-5; R^5 is *i*-Pr	CH_3	Cl	(m = 0)	306
57	A-5; R^5 is *i*-Pr	H	Cl	(m = 0)	292
58	A-5; R^5 is Bn	CH_3	Cl	(m = 0)	354
59	A-5; R^5 is *t*-Bu	CH_3	Cl	(m = 0)	320
60	A-5; R^5 is H	CH_3	Cl	(m = 0)	264
61	A-3A	$OCH_2C(Br){=}CH_2$	Cl	3-Br	87–91
62	A-1	OCH_2CF_3	Cl	3-Br	63–66
63	A-1	$OCH_2CF_2CF_3$	Cl	3-Br	49–53
64	A-3A	$OCH_2CH_2CF_3$	Cl	4-CN	117–120
65	A-3A	$OCH_2CH_2CH_2CF_3$	Cl	3-CF_3	429
66	A-1	$OCH_2CH_2CF_3$	Cl	3-Br	63–67
67	A-3A	$CH_2CH_2CH_3$	Cl	3-CN	85–88
68	A-3A	$CH_2CH_2CH_2CH_3$	Cl	3-CN	98–102
69	A-5; R^5 is *i*-Pr	CH_3	Cl	3-CN	80–84
70	A-3A	$SCH_2CH_2CH_3$	Cl	3-Br	387
71	A-3A	$SCH_2CH_2CF_3$	Cl	3-Br	121–125
72	A-1	$CH_2CH_2CF_3$	Cl	3-CN	342
73	A-1	$(CH_2)_3CF_3$	Cl	3-CN	356
74	A-1	$O(CH_2)_3CF_3$	Cl	3-Br	425
75	A-3A	$CH_2CH_2CH_3$	Cl	3-Br	88–92
76	A-5; R^5 is *i*-Pr	CH_3	Cl	3-F	62–66
77	A-3A	$(CH_2)_3CF_3$	Cl	3-Br	423
78	A-3A	O(*c*-Bu)	Cl	3-Br	100–103
79	A-3A	$(CH_2)_3CH_3$	Cl	3-Br	77–81
80	A-1	$O(CH_2)_2CF_3$	Cl	3-CN	358
81	A-1	$O(CH_2)_3CF_3$	Cl	3-CN	372
82	A-3A	$(CH_2)_4CF_3$	Cl	3-Br	437
83	A-3A	SCH_2CH_3	Cl	3-Br	373
84	A-3A	$OCH(CH_3)CH_2CH_3$	Cl	3-Br	385
85	A-3A	SCH_2CF_3	Cl	3-Br	90–93
86	A-1	$(CH_2)_2CH_3$	Cl	3-CN	288

Cmpd. No.	A	R^1	R^2	R^3	M.S.(AP+) or m.p.
87	A-1	$(CH_2)_3CH_3$	Cl	3-CN	302
88	A-3A	$O(CH_2)_2CF_3$	Cl	4-Cl	87–90
89	A-1	$(CH_2)_2CF_3$	Cl	3-Br	395
90	A-3A	$OCH_2CH_2C(=CH_2)CH_3$	Cl	3-Br	397
91	A-3A	$SCH_2CH=CH_2$	Cl	3-Br	385
92	A-3A	$(CH_2)_2CF_3$	Cl	3-Br	409
93	A-3A	$NH(CH_2)_2CF_3$	Cl	3-Br	424
94	A-3A	$O(CH_2)_2CF_3$	Cl	4-Br	88–91
95	A-5; R^5 is Et	CH_3	Cl	3-Br	370
96	A-3A	$O(CH_2)_2C(CH_3)_3$	Cl	3-Br	413
97	A-3A	$OCH_2CHClCH_2Cl$	Cl	3-Br	439
98	A-5; R^5 is TFP	CH_3	Cl	3-Br	*
99	A-3A	$O(CH_2)_2CF_3$	Cl	3-CH_3	51–53
100	A-3A	$O(CH_2)_3CH_3$	Cl	3-Br	385
101	A-3A	$O(CH_2)_4CH_3$	Cl	3-Br	399
102	A-3A	$OCH_2CH_2CH_2CH_2Br$	Cl	3-Br	449
103	A-3A	$OCH_2CF_2CHF_2$	Cl	3-Br	443
104	A-5; R^5 is *i*-Pr	CH_3	Cl	3-Cl	340
105	A-5; R^5 is *i*-Pr	CH_3	Cl	3-Br	384
106	A-1	OCH_2CH_3	Cl	3-Br	343
107 (Ex. 4)	A-3A	$(CH_2)_2CF_3$	Cl	3-Cl	**
108	A-3A	$OCH_2C\equiv CH$	Cl	3-Br	108–112
109	A-3A	$(CH_2)_4CF_3$	Cl	3-CN	384
110	A-3A	$CH_2CH_2CF_2CF_3$	Cl	3-Br	459
111	A-3A	$CH_2CH_2CF_2CF_3$	Cl	3-CN	406
112	A-3A	$O(CH_2)_2CF_3$	Cl	3-OCH_3	109–113
113	A-3A	$O(CH_2)_2CF_3$	Cl	3-CF_3	415
114	A-2	$(CH_2)_3CH_3$	Cl	3-Br	380
115	A-3A	$O(CH_2)_2CF_3$	Cl	3-O-*i*-Pr	405
116	A-3A	$O(CH_2)_2CF_3$	Cl	3-OCH_2CH_3	391
117	A-3A	$O(CH_2)_2CF_3$	Cl	3-OCH_2CF_3	445
118	A-2	$(CH_2)_2CH_3$	Cl	3-Br	366
119	A-3A	*cis*-$OCH_2CCl=CCl$	Cl	3-Br	114–117
120	A-3A	*trans*-$OCH_2CCl=CCl$	Cl	3-Br	84–88
121	A-1	$(CH_2)_4CF_3$	Cl	3-Br	423
122	A-1	$(CH_2)_2CF_3$	Cl	3-Cl	351

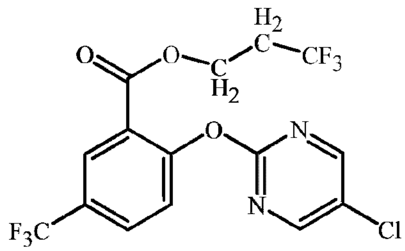
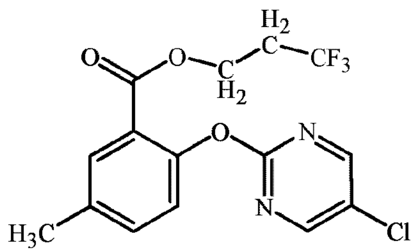
Cmpd. No.	A	R^1	R^2	R^3	M.S.(AP+) or m.p.
123	A-3A	$O(CH_2)_2$*c*-Pr	Cl	3-Br	397
124	A-1	$(CH_2)_4CF_3$	Cl	3-Cl	379
125	A-3A	$(CH_2)_3CF_3$	Cl	3-CF_3	413
126	A-7; R^{15} is Me	$(CH_2)_3CF_3$	Cl	3-CN	371
127	A-3A	*cis*-$OCH_2C{=}C(CH_3)Cl$	Cl	3-Br	59–63
128	A-3A	*trans*-$OCH_2C{=}C(CH_3)Cl$	Cl	3-Br	82–86
129	A-2	$(CH_2)_3CH_3$	Cl	(m = 0)	302
130	A-3A	$(CH_2)_3CH_3$	Cl	3-CF_3	359
131	A-1	OCH_2CF_3	Cl	3-CN	344
132	A-1	$OCH_2CF_2CF_3$	Cl	3-CN	70–73
133	A-3A	$(CH_2)_3CF_3$	Cl	3-CN	94–96
134	A-1	$(CH_2)_3CF_3$	Cl	3-CH_2CH_3	359
135	A-1	$(CH_2)_3CF_3$	Cl	3-*c*-Pr	371
136	A-3A	$(CH_2)_2CH_3$	Cl	3-CF_3	345
137	A-1	$(CH_2)_3CF_3$	Cl	3-Cl	365
138	A-1	$(CH_2)_3CF_3$	Cl	3-Br	409
139	A-3A	H	Cl	3-Cl	*
140	A-2	H	Cl	(m = 0)	*
141 (Ex. 5)	A-2	$(CH_2)_4CH_3$	Cl	(m = 0)	**
142	A-3A	$(CH_2)_2CF_3$	Cl	3-CN	354
143	A-3A	$(CH_2)_3CF_3$	Cl	3-Cl	379
144	A-2	$(CH_2)_3CF_3$	Cl	(m = 0)	356
145	A-2	$(CH_2)_4CF_3$	Cl	(m = 0)	370
146	A-7; R^{15} is H	$(CH_2)_3CF_3$	Cl	3-CN	358

* See Index Table C for ^{1}H NMR data.

** See Synthesis Example for ^{1}H NMR data.

E indicates E stereochemistry of double bond

INDEX TABLE B

INCode	Cmpd	Structure	M.S.(AP+) or m.p.
TLU08	53		415 (80–83)
TKV38	54		361 (78–81)

INDEX TABLE C

Cmpd	^1H NMR ($CDCl_3$ solution unless indicated otherwise)
1	8.48 (s, 2H), 7.53 (dd, 1H), 7.35 (t, 1H), 7.18 (dd, 1H), 4.02 (d, 2H), 1.98–1.83 (m, 1H), 0.89 (d, 6H).
2	8.48 (m, 2H), 7.55 (dd, 1H), 7.38 (t, 1H), 7.26 (s, 1H), 7.20 (dd, 1H), 5.55–5.46 (m, 1H), 5.38 (m, 1H), 4.80-4.78 (m, 2H).
3	8.47 (s, 2H), 7.54 (dd, 1H), 7.36 (t, 1H), 7.19 (dd, 1H), 4.99–4.93 (m, 1H), 4.91–4.89 (m, 1H), 4.63 (s, 2H), 1.71 (s, 3H).
12	8.48 (s, 2H), 7.51 (dd, 1H), 7.32 (t, 1H), 7.15 (dd, 1H), 2.55 (s, 3H).
13	8.49 (s, 2H), 7.53 (dd, 1H), 7.35 (t, 1H), 7.18 (dd, 1H), 4.20 (t, 2H), 1.58–1.67 (m, 2H), 0.82–0.93 (m, 3H).
14	8.49 (s, 2H), 7.51 (dd, 0.95 Hz, 1H), 7.32 (t, 1H), 7.16 (dd, 1H), 1.43 (s, 9 H).
20	8.49 (s, 2H), 7.54 (dd, 1H), 7.37 (t, 1H), 7.20 (dd, 1H), 4.31 (t, 2H), 2.20–2.04 (m, 2H), 1.93–1.85 (m, 2H).
21	8.48 (s, 2H), 7.53 (dd, 1H), 7.35 (t, 1H), 7.17 (dd, 1H), 5.75–5.67 (m, 1H), 5.09–5.05 (m, 1H), 5.03–5.00 (m, 1H), 4.29 (t, 2H), 2.39–2.34 (m, 2H).
27	8.37 (s, 2H), 7.64 (d, 1H), 7.46 (t, 1H), 7.32 (t, 1H), 7.19 (bs, 1H), 7.00 (d, 1H), 4.75 (q, 2H).
28	8.30 (s, 2H), 7.65 (d, 1H), 7.48 (t, 1H), 7.31 (t, 1H), 7.21 (bs, 1H), 7.00 (d, 1H), 4.75 (q, 2H).
31	8.81 (s, 2H), 7.63 (dd, 1H), 7.45 (t, 1H), 7.22 (dd, 1H), 4.58 (q, 2H).
40	8.50 (s, 2H), 7.57 (dd, 1H), 7.43 (t, 1H), 7.24 (dd, 1H), 4.87 (s, 2H).
99	500 MHz) 8.47 (s, 2H) 7.53–7.56 (m, 1H) 7.29–7.33 (m, 1H) 7.14–7.18 (m, 1H) 4.19 (t, 2H) 2.26–2.36 (m, 2H) 2.09 (s, 3H).
139	10.39 (s, 1H), 8.46 (s, 2H), 7.62–7.56 (m, 1H), 7.47–7.42 (m, 1H), 7.22–7.17 (m, 1H).

140 (500 MHz) 8.49 (s, 2H), 7.54–7.58 (m, 1H), 7.40–7.45 (m, 1H), 7.30–7.36 (m, 1H), 7.16–7.20 (m, 1H), 3.72 (s, 2H).

[1]H NMR data are in ppm downfield from tetramethylsilane. Couplings are designated by (s)-singlet, (d)-doublet, (t)-triplet, (m)-multiplet, (dd)-doublet of doublets, (dt)-doublet of triplets, (br s)-broad singlet

BIOLOGICAL EXAMPLES OF THE INVENTION

TEST A

Seeds of plant species selected from barnyardgrass (*Echinochloa crus-galli*), kochia (*Kochia scoparia*), ragweed (common ragweed, *Ambrosia elatior*), Italian ryegrass (*Lolium multiflorum*), large (Lg) crabgrass (*Digitaria sanguinalis*), giant foxtail (*Setaria faberii*), morningglory (*Ipomoea* spp.), pigweed (*Amaranthus retroflexus*), velvetleaf (*Abutilon theophrasti*), wheat (*Triticum aestivum*), and corn (*Zea mays*) were planted into a blend of loam soil and sand and treated preemergence with a directed soil spray using test chemicals formulated in a non-phytotoxic solvent mixture which included a surfactant.

At the same time, plants selected from these crop and weed species and also blackgrass (*Alopecurus myosuroides*), and galium (catchweed bedstraw, *Galium aparine*) were planted in pots containing the same blend of loam soil and sand and treated with postemergence applications of test chemicals formulated in the same manner. Plants ranged in height from 2 to 10 cm and were in the one- to two-leaf stage for the postemergence treatment. Treated plants and untreated controls were maintained in a greenhouse for approximately 10 days, after which time all treated plants were compared to untreated controls and visually evaluated for injury. Plant response ratings, summarized in Table A, are based on a 0 to 100 scale where 0 is no effect and 100 is complete control. A dash (–) response means no test result.

Table A	Compounds					
1000 g ai/ha	12	55	56	57	58	59
Postemergence						
Barnyardgrass	80	0	50	20	40	0
Blackgrass	50	–	–	–	–	–
Corn	20	0	30	20	30	20
Crabgrass, Large	–	0	40	30	80	10
Foxtail, Giant	70	10	70	20	60	10
Galium	80	–	–	–	–	–
Kochia	80	–	–	–	–	–
Morningglory	–	–	–	10	30	0
Pigweed	100	0	60	40	100	30
Ragweed	60	–	–	–	–	–
Ryegrass, Italian	50	–	–	–	–	–

Velvetleaf	–	10	100	–	90	–
Wheat	0	0	10	20	20	30

Table A						Compounds								
500 g ai/ha	6	7	8	9	10	11	13	14	15	16	17	18	20	21
Postemergence														
Barnyardgrass	40	90	40	90	100	20	100	40	100	90	0	0	100	100
Blackgrass	30	80	20	80	90	20	70	70	100	90	0	0	50	80
Corn	10	70	20	50	60	10	90	10	90	60	20	0	40	60
Crabgrass, Large	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Foxtail, Giant	50	100	60	90	100	20	100	60	100	90	0	0	100	100
Galium	90	100	90	100	100	20	100	100	100	100	0	0	90	90
Kochia	90	100	80	90	100	40	100	70	100	100	0	10	100	100
Morningglory	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pigweed	90	100	90	100	100	60	100	100	100	100	40	20	100	100
Ragweed	30	90	40	10	50	0	20	0	40	30	0	0	40	40
Ryegrass, Italian	40	70	30	50	60	0	100	70	90	30	0	0	40	90
Velvetleaf	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wheat	10	20	0	50	40	0	30	40	100	20	0	0	20	40

Table A						Compounds								
500 g ai/ha	22	23	24	25	26	27	28	30	31	32	33	34	35	39
Postemergence														
Barnyardgrass	100	50	10	10	100	0	20	20	0	0	100	20	80	0
Blackgrass	90	50	0	30	100	–	–	30	0	0	90	70	80	0
Corn	50	20	0	20	100	0	0	70	0	0	90	30	30	0
Crabgrass, Large	–	–	–	–	–	0	0	–	–	–	–	–	–	–
Foxtail, Giant	100	80	0	10	100	0	0	100	0	0	100	80	100	0
Galium	90	100	20	50	100	–	–	100	0	0	100	100	100	0
Kochia	100	100	0	50	100	–	–	100	0	0	100	90	100	0
Morningglory	–	–	–	–	–	0	0	–	–	–	–	–	–	–
Pigweed	100	100	10	60	100	0	20	100	0	30	100	100	100	0
Ragweed	30	10	0	20	60	–	–	0	0	0	40	0	0	0
Ryegrass, Italian	60	70	0	0	80	–	–	0	0	0	80	0	40	0
Velvetleaf	–	–	–	–	–	0	30	–	–	–	–	–	–	–
Wheat	30	10	0	10	90	0	0	30	0	0	60	0	20	0

Table A						Compounds								
500 g ai/ha	40	41	42	47	48	49	61	64	65	72	73	75	78	79
Postemergence														

Barnyardgrass	20	0	0	0	30	0	100	0	70	100	100	100	100	100
Blackgrass	20	0	0	0	20	0	100	0	40	50	100	60	60	90
Corn	20	0	30	0	0	0	40	0	20	60	60	90	60	90
Crabgrass, Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foxtail, Giant	40	0	0	0	20	0	100	0	90	100	100	100	80	80
Galium	40	0	0	0	10	0	100	0	70	100	100	100	100	100
Kochia	100	60	60	0	0	0	-	0	-	100	100	100	100	100
Morningglory	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pigweed	100	90	90	0	40	0	100	0	100	100	100	100	90	100
Ragweed	0	10	0	0	0	0	30	0	30	30	30	40	30	40
Ryegrass, Italian	0	0	0	0	0	0	80	0	0	40	100	70	30	90
Velvetleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheat	20	0	0	0	0	0	30	0	0	40	90	70	30	30

Table A				Compounds					
500 g ai/ha	83	84	85	91	106	125	130	136	139
Postemergence									
Barnyardgrass	90	40	20	100	100	90	100	80	0
Blackgrass	40	0	0	30	20	90	90	100	0
Corn	30	40	40	50	10	30	50	50	0
Crabgrass, Large	-	-	-	-	-	-	-	-	-
Foxtail, Giant	80	60	60	100	70	90	90	90	0
Galium	20	40	90	90	10	100	100	100	0
Kochia	90	70	80	100	-	100	100	100	0
Morningglory	-	-	-	-	-	-	-	-	-
Pigweed	70	70	70	100	20	100	100	100	0
Ragweed	0	0	0	20	0	40	60	60	0
Ryegrass, Italian	0	0	0	30	0	90	90	70	20
Velvetleaf	-	-	-	-	-	-	-	-	-
Wheat	0	20	20	30	0	30	30	20	0

Table A						Compounds								
125 g ai/ha	1	2	3	4	5	6	7	8	9	10	11	13	15	16
Postemergence														
Barnyardgrass	30	40	60	0	0	10	30	10	20	20	10	80	90	10
Blackgrass	20	30	30	0	0	10	30	0	30	20	0	30	90	20
Corn	20	20	30	0	0	0	10	0	20	10	0	30	50	20
Foxtail, Giant	60	60	80	0	0	10	50	30	20	30	20	80	90	20
Galium	70	90	70	0	0	60	100	60	70	100	10	100	100	90

Kochia	30	90	40	0	0	40	100	40	50	90	0	100	100	80
Pigweed	70	80	100	0	0	60	100	50	100	90	10	90	100	90
Ragweed	10	0	0	0	0	10	40	10	0	10	0	0	20	10
Ryegrass, Italian	0	20	30	0	0	0	20	0	0	10	0	0	60	10
Wheat	0	0	0	0	0	0	0	0	10	0	0	20	20	20

Table A						Compounds								
125 g ai/ha	17	18	19	20	21	22	23	24	25	26	30	31	32	33
Postemergence														
Barnyardgrass	0	0	0	30	70	60	10	0	0	100	0	0	0	80
Blackgrass	0	0	0	30	60	60	10	0	0	100	10	0	0	60
Corn	0	0	0	30	30	30	10	0	0	60	30	0	0	30
Foxtail, Giant	0	0	0	50	70	80	30	0	0	100	60	0	0	100
Galium	0	0	0	10	80	30	90	10	20	100	60	0	0	100
Kochia	0	0	0	90	90	90	80	0	10	100	100	0	0	100
Pigweed	20	10	10	100	80	100	100	0	30	100	100	0	20	100
Ragweed	0	0	0	0	0	0	0	0	10	30	0	0	0	30
Ryegrass, Italian	0	0	0	0	0	0	10	0	0	70	0	0	0	30
Wheat	0	0	0	0	0	0	0	0	0	40	0	0	0	20

Table A						Compounds								
125 g ai/ha	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Postemergence														
Barnyardgrass	0	10	0	30	60	0	0	0	0	10	0	20	30	0
Blackgrass	10	40	0	30	0	0	10	0	0	0	0	0	0	0
Corn	30	20	0	10	10	0	20	0	20	0	0	20	10	0
Foxtail, Giant	20	40	0	40	90	0	10	0	0	0	0	20	40	0
Galium	50	60	0	40	80	0	30	0	0	40	0	100	70	0
Kochia	60	90	0	40	60	0	70	20	30	10	0	50	90	0
Pigweed	100	100	60	80	100	0	70	90	80	40	0	100	100	0
Ragweed	0	0	0	0	10	0	0	0	0	0	0	10	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A						Compounds								
125 g ai/ha	48	49	50	51	53	54	61	62	63	64	65	66	67	68
Postemergence														
Barnyardgrass	0	0	20	0	0	0	100	40	10	0	30	100	0	30
Blackgrass	0	0	20	0	0	0	30	40	0	0	20	100	0	30
Corn	0	0	10	0	0	0	20	30	30	0	10	70	0	20

Foxtail, Giant	0	0	70	0	0	0	60	40	30	0	40	100	0	30
Galium	0	0	90	10	0	0	60	80	30	0	20	100	0	60
Kochia	0	0	90	0	0	0	–	100	50	0	–	50	0	40
Pigweed	20	0	100	0	0	0	40	90	60	0	90	100	0	90
Ragweed	0	0	0	0	0	0	10	0	0	0	10	20	0	20
Ryegrass, Italian	0	0	20	0	0	0	20	0	0	0	0	50	0	0
Wheat	0	0	0	0	0	0	0	0	0	0	0	30	0	0

Table A							Compounds							
125 g ai/ha	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Postemergence														
Barnyardgrass	70	30	40	80	90	40	90	0	90	60	90	90	50	100
Blackgrass	30	20	30	30	50	30	40	0	50	20	50	90	40	40
Corn	20	10	20	50	30	20	80	0	30	40	80	60	40	30
Foxtail, Giant	30	30	40	70	100	70	90	0	90	50	80	90	70	100
Galium	60	70	90	80	100	80	80	90	100	70	90	90	80	100
Kochia	40	70	50	100	100	40	100	0	100	70	100	70	50	100
Pigweed	80	20	70	100	100	100	100	30	100	80	100	100	100	100
Ragweed	0	20	20	10	20	10	30	0	0	0	30	30	10	40
Ryegrass, Italian	0	20	20	10	80	20	40	0	60	0	90	50	10	60
Wheat	0	0	0	10	20	10	20	0	10	20	20	40	0	30

Table A							Compounds							
125 g ai/ha	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Postemergence														
Barnyardgrass	0	0	0	40	100	0	90	30	30	100	0	0	30	10
Blackgrass	0	0	0	20	70	0	60	0	20	50	0	0	10	10
Corn	20	10	10	30	50	0	20	10	20	40	0	0	10	20
Foxtail, Giant	0	0	0	30	90	0	50	60	30	100	0	0	60	10
Galium	30	30	30	70	70	0	80	20	70	100	0	0	40	20
Kochia	30	30	30	100	100	0	90	50	60	100	0	0	0	0
Pigweed	30	30	30	40	60	0	90	50	100	100	0	0	20	10
Ragweed	0	0	0	0	0	0	10	0	0	20	0	0	0	0
Ryegrass, Italian	0	0	0	20	30	0	30	0	0	50	0	0	0	0
Wheat	0	0	0	40	30	0	20	0	20	20	0	0	0	0

Table A							Compounds							
125 g ai/ha	97	98	99	100	101	102	103	104	105	106	107	108	109	110
Postemergence														
Barnyardgrass	20	10	80	50	20	0	30	0	0	40	90	10	0	60

Blackgrass	20	10	80	40	0	0	10	20	10	0	90	0	0	50
Corn	10	10	50	10	0	0	20	10	0	0	60	20	20	50
Foxtail, Giant	60	20	90	70	20	0	70	10	0	10	90	10	0	90
Galium	100	50	70	70	40	0	100	30	20	0	90	40	30	100
Kochia	40	0	40	80	20	0	100	10	10	-	90	40	20	100
Pigweed	50	90	40	70	60	0	100	40	30	10	100	50	60	100
Ragweed	20	10	30	0	0	0	0	0	0	0	30	0	20	0
Ryegrass, Italian	30	0	50	20	10	0	0	0	0	0	80	0	0	20
Wheat	0	10	30	0	0	0	0	0	0	0	30	0	0	20

Table A						Compounds								
125 g ai/ha	111	112	113	114	115	116	117	118	119	120	121	122	123	124
Postemergence														
Barnyardgrass	0	10	40	10	0	10	10	10	0	0	40	50	50	60
Blackgrass	0	30	40	10	20	0	10	0	0	0	30	60	50	60
Corn	0	0	20	20	10	10	10	10	20	0	10	20	10	20
Foxtail, Giant	0	30	50	20	0	20	10	10	0	0	70	40	50	70
Galium	0	80	80	80	20	60	100	30	90	30	80	60	100	90
Kochia	0	30	100	80	0	10	50	60	30	0	80	80	90	80
Pigweed	0	70	100	100	40	50	70	60	100	20	100	100	100	100
Ragweed	0	40	20	20	0	0	20	10	10	0	50	10	10	20
Ryegrass, Italian	0	0	30	10	0	0	0	0	0	0	20	20	20	20
Wheat	0	0	20	10	0	0	0	0	0	0	10	0	0	10

Table A						Compounds								
125 g ai/ha	125	126	127	128	129	130	131	132	133	134	135	136	137	138
Postemergence														
Barnyardgrass	30	0	30	20	100	90	10	50	30	20	10	30	60	90
Blackgrass	30	0	20	20	80	50	0	30	0	20	20	50	30	90
Corn	10	0	20	10	20	20	30	30	20	10	20	20	10	60
Foxtail, Giant	50	0	50	20	100	40	20	50	30	20	20	30	60	90
Galium	100	0	90	80	90	100	50	60	50	40	80	40	100	100
Kochia	100	0	60	60	100	100	90	70	20	60	60	80	100	100
Pigweed	100	10	30	50	70	100	80	90	50	80	90	100	100	100
Ragweed	30	0	0	0	0	30	0	0	0	10	10	20	40	60
Ryegrass, Italian	20	0	0	0	60	20	20	0	0	10	10	10	30	100
Wheat	20	0	10	10	10	30	20	20	0	10	0	10	10	40

Table A				Compounds				
125 g ai/ha	139	140	141	142	143	144	145	146

Postemergence								
Barnyardgrass	0	0	20	0	70	90	80	90
Blackgrass	0	0	10	0	80	90	60	90
Corn	0	0	20	10	30	80	50	80
Foxtail, Giant	0	0	40	0	70	90	70	90
Galium	0	0	60	20	100	100	80	100
Kochia	0	30	60	10	100	100	90	100
Pigweed	0	20	70	20	100	100	100	70
Ragweed	0	0	20	20	50	10	20	30
Ryegrass, Italian	0	0	10	0	80	80	40	70
Wheat	0	0	0	0	20	60	30	20

Table A						Compounds								
31 g ai/ha	1	2	3	4	5	19	36	37	38	43	44	45	46	50
Postemergence														
Barnyardgrass	20	30	20	0	0	0	0	0	10	0	0	20	0	0
Blackgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corn	0	10	0	0	0	0	0	0	0	0	0	0	0	10
Foxtail, Giant	30	30	30	0	0	0	0	0	40	0	0	20	0	20
Galium	50	60	40	0	0	0	0	10	50	20	0	50	50	60
Kochia	20	50	0	0	0	0	0	0	30	0	0	20	30	60
Pigweed	40	60	70	0	0	10	0	20	80	10	0	80	60	80
Ragweed	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A						Compounds								
31 g ai/ha	51	53	54	62	63	66	67	68	69	70	71	74	76	77
Postemergence														
Barnyardgrass	0	0	0	20	0	40	0	10	10	0	0	10	0	30
Blackgrass	0	0	0	0	0	10	0	10	10	0	10	10	0	20
Corn	0	0	0	0	10	20	0	10	0	10	10	10	0	10
Foxtail, Giant	0	0	0	0	0	30	0	20	20	0	10	20	0	30
Galium	0	0	0	30	0	30	0	20	40	30	30	20	0	90
Kochia	0	0	0	60	20	20	0	20	20	20	10	20	0	100
Pigweed	0	0	0	50	20	40	0	20	40	10	30	60	0	100
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A 31 g ai/ha Postemergence	Compounds 80	81	82	86	87	88	89	90	92	93	94	95	96	97
Barnyardgrass	30	10	30	20	40	0	30	0	40	0	0	0	0	10
Blackgrass	30	10	40	0	10	0	20	0	10	0	0	0	0	0
Corn	10	10	20	30	40	0	10	0	10	0	0	0	0	10
Foxtail, Giant	30	20	30	10	40	0	20	10	50	0	0	0	0	10
Galium	60	30	90	30	30	0	30	0	90	0	0	10	0	100
Kochia	50	30	80	90	100	0	80	30	100	0	0	0	0	-
Pigweed	80	50	100	30	40	0	90	10	100	0	0	10	0	20
Ragweed	10	0	40	0	0	0	10	0	0	0	0	0	0	10
Ryegrass, Italian	0	0	40	0	0	0	10	0	0	0	0	0	0	20
Wheat	0	0	10	30	20	0	0	0	0	0	0	0	0	0

Table A 31 g ai/ha Postemergence	Compounds 98	99	100	101	102	103	104	105	107	108	109	110	111	112
Barnyardgrass	0	30	10	10	0	0	0	0	40	0	0	30	0	0
Blackgrass	0	30	0	0	0	0	0	0	50	0	0	0	0	0
Corn	0	0	10	0	0	20	0	0	30	10	10	20	0	0
Foxtail, Giant	0	50	20	0	0	10	0	0	70	0	0	30	0	0
Galium	10	20	20	10	0	70	10	10	90	20	0	70	0	60
Kochia	0	20	60	0	0	70	0	0	90	20	0	100	0	0
Pigweed	30	10	30	20	0	90	10	10	100	20	20	90	0	40
Ragweed	0	10	0	0	0	0	0	0	20	0	0	0	0	20
Ryegrass, Italian	0	0	0	0	0	0	0	0	20	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A 31 g ai/ha Postemergence	Compounds 113	114	115	116	117	118	119	120	121	122	123	124	126	127
Barnyardgrass	10	0	0	0	0	0	0	0	20	10	10	10	0	10
Blackgrass	0	0	0	0	0	0	0	0	20	20	10	20	0	10
Corn	10	10	0	0	10	0	10	0	10	10	10	10	0	10
Foxtail, Giant	10	0	0	0	0	0	0	0	10	10	20	30	0	10
Galium	40	50	20	30	60	10	10	0	70	30	90	70	0	60
Kochia	80	20	0	0	20	30	30	0	20	80	50	50	0	10
Pigweed	90	50	10	40	30	40	70	0	80	70	70	70	0	20
Ragweed	0	0	0	0	0	0	0	0	20	0	0	10	0	0

Ryegrass, Italian	0	0	0	0	0	0	0	0	10	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	10	0	0	10	0	0

Table A							Compounds							
31 g ai/ha	128	129	131	132	133	134	135	137	138	140	141	142	143	144
Postemergence														
Barnyardgrass	0	20	0	30	10	0	0	20	90	0	10	0	20	40
Blackgrass	0	20	0	0	0	10	0	10	40	0	0	0	30	50
Corn	10	20	20	20	0	10	10	10	30	0	10	0	10	20
Foxtail, Giant	10	20	0	30	10	10	10	10	90	0	20	0	30	60
Galium	20	30	20	20	30	10	50	40	70	0	40	0	90	40
Kochia	10	40	40	40	0	20	10	90	90	0	50	0	90	90
Pigweed	20	20	50	60	30	40	40	80	100	0	40	0	100	90
Ragweed	0	0	0	0	0	0	0	10	30	0	0	0	20	10
Ryegrass, Italian	0	0	0	0	0	0	0	10	30	0	0	0	20	30
Wheat	0	0	0	0	0	0	0	0	20	0	0	0	10	10

Table A	Compounds	
31 g ai/ha	145	146
Postemergence		
Barnyardgrass	30	30
Blackgrass	40	30
Corn	30	20
Foxtail, Giant	50	30
Galium	40	70
Kochia	70	70
Pigweed	90	60
Ragweed	10	0
Ryegrass, Italian	10	0
Wheat	10	20

Table A			Compounds			
1000 g ai/ha	12	55	56	57	58	59
Preemergence						
Barnyardgrass	80	0	90	50	90	20
Corn	–	0	0	0	20	0
Crabgrass, Large	–	0	100	100	100	80
Foxtail, Giant	100	0	100	90	100	30
Kochia	0	–	–	–	–	–
Morningglory	–	–	–	0	0	0
Pigweed	100	0	100	60	50	30
Ragweed	80	–	–	–	–	–
Ryegrass, Italian	40	–	–	–	–	–
Velvetleaf	–	0	90	20	20	0
Wheat	–	0	0	0	20	0

Table A							Compounds							
500 g ai/ha	6	7	8	9	10	11	13	14	15	16	17	18	20	21
Preemergence														
Barnyardgrass	60	100	100	90	100	30	100	60	100	100	0	0	100	100
Corn	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Crabgrass, Large	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Foxtail, Giant	100	100	100	100	100	100	100	100	100	100	0	0	100	100
Kochia	0	100	0	100	100	0	100	70	100	80	0	10	100	100

Morningglory	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pigweed	70	100	60	100	100	20	100	100	100	100	10	40	100	100
Ragweed	0	50	0	0	0	0	0	10	10	0	0	0	0	0
Ryegrass, Italian	70	30	30	30	30	0	90	20	90	20	0	0	90	90
Velvetleaf	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wheat	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table A						Compounds								
500 g ai/ha	22	23	24	25	26	27	28	30	31	32	33	34	35	39
Preemergence														
Barnyardgrass	100	70	30	30	100	0	20	0	0	0	100	90	90	0
Corn	–	–	–	–	–	0	0	–	–	–	–	–	–	–
Crabgrass, Large	–	–	–	–	–	0	50	–	–	–	–	–	–	–
Foxtail, Giant	100	100	20	60	100	0	20	100	0	0	100	100	100	0
Kochia	100	50	0	50	100	–	–	100	0	0	100	40	80	0
Morningglory	–	–	–	–	–	0	0	–	–	–	–	–	–	–
Pigweed	100	100	90	80	100	0	80	100	0	30	100	100	100	0
Ragweed	0	10	0	0	20	–	–	0	0	0	20	0	0	0
Ryegrass, Italian	90	40	0	0	100	–	–	0	0	0	100	0	30	0
Velvetleaf	–	–	–	–	–	0	20	–	–	–	–	–	–	–
Wheat	–	–	–	–	–	0	0	–	–	–	–	–	–	–

Table A						Compounds								
500 g ai/ha	40	41	42	47	48	49	61	64	65	72	73	75	78	79
Preemergence														
Barnyardgrass	50	0	0	0	10	0	100	0	100	100	100	100	100	100
Corn	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Crabgrass, Large	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Foxtail, Giant	100	0	0	0	10	0	100	0	100	100	100	100	100	100
Kochia	90	30	0	0	0	0	100	0	90	100	100	100	60	100
Morningglory	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pigweed	100	40	30	0	0	0	100	0	100	100	100	100	100	100
Ragweed	0	80	0	0	0	0	20	0	80	10	50	10	0	90
Ryegrass, Italian	0	0	0	0	0	0	80	0	30	30	90	100	20	100
Velvetleaf	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Wheat	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table A				Compounds					
500 g ai/ha	83	84	85	91	106	125	130	136	139
Preemergence									

Barnyardgrass	90	90	10	100	100	100	100	100	0
Corn	-	-	-	-	-	-	-	-	-
Crabgrass, Large	-	-	-	-	-	-	-	-	-
Foxtail, Giant	100	100	70	100	100	100	100	100	0
Kochia	0	0	0	100	90	100	100	100	0
Morningglory	-	-	-	-	-	-	-	-	-
Pigweed	90	100	60	100	70	100	100	100	0
Ragweed	0	0	0	0	0	40	90	80	0
Ryegrass, Italian	0	0	0	80	10	100	100	100	0
Velvetleaf	-	-	-	-	-	-	-	-	-
Wheat	-	-	-	-	-	-	-	-	-

Table A						Compounds								
125 g ai/ha	1	2	3	4	5	6	7	8	9	10	11	13	15	16
Preemergence														
Barnyardgrass	30	50	80	0	0	10	50	30	40	40	0	100	100	30
Foxtail, Giant	70	100	100	0	0	60	90	100	100	100	40	100	100	90
Kochia	40	70	40	0	0	0	50	0	70	90	0	90	100	90
Pigweed	70	90	100	0	0	10	100	10	100	100	0	100	100	90
Ragweed	0	0	0	0	0	0	-	0	0	0	0	0	0	0
Ryegrass, Italian	0	10	30	0	0	0	0	0	10	10	0	10	40	0

Table A						Compounds								
125 g ai/ha	17	18	19	20	21	22	23	24	25	26	30	31	32	33
Preemergence														
Barnyardgrass	0	0	0	100	100	40	20	0	0	100	0	0	0	100
Foxtail, Giant	0	0	0	100	100	100	70	0	10	100	100	0	0	100
Kochia	0	0	20	30	40	30	0	0	0	100	90	0	0	60
Pigweed	0	10	20	100	100	100	100	0	40	100	100	0	30	100
Ragweed	0	0	0	0	0	0	0	0	0	20	0	0	0	0
Ryegrass, Italian	0	0	0	30	30	30	0	0	0	70	0	0	0	40

Table A						Compounds								
125 g ai/ha	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Preemergence														
Barnyardgrass	0	70	0	30	90	0	0	0	0	40	0	0	20	0
Foxtail, Giant	70	100	0	70	100	0	20	0	0	60	40	10	100	0
Kochia	20	30	0	0	40	0	60	30	0	100	0	0	70	0
Pigweed	40	100	0	0	100	0	40	30	0	90	0	70	100	0
Ragweed	0	0	0	0	0	0	0	50	0	0	0	0	0	0

Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A	Compounds													
125 g ai/ha	48	49	50	51	53	54	61	62	63	64	65	66	67	68
Preemergence														
Barnyardgrass	0	0	10	0	0	0	50	70	100	0	30	100	0	70
Foxtail, Giant	0	0	100	0	0	0	100	100	90	0	100	100	0	80
Kochia	0	0	0	0	0	0	90	70	0	0	60	40	0	30
Pigweed	0	0	90	0	0	0	100	90	90	0	100	100	0	80
Ragweed	0	0	0	0	0	0	0	0	0	0	0	100	0	0
Ryegrass, Italian	0	0	0	0	0	0	30	10	0	0	10	30	0	0

Table A	Compounds													
125 g ai/ha	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Preemergence														
Barnyardgrass	90	20	10	90	100	60	100	70	100	60	100	100	90	100
Foxtail, Giant	70	60	100	90	100	100	100	70	100	90	100	100	100	100
Kochia	30	0	0	90	100	100	80	0	100	20	80	100	90	80
Pigweed	100	0	40	100	100	90	100	50	100	80	100	100	100	100
Ragweed	0	0	0	0	10	0	0	0	0	0	30	20	0	60
Ryegrass, Italian	0	0	0	10	50	20	80	0	70	0	90	50	20	80

Table A	Compounds													
125 g ai/ha	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Preemergence														
Barnyardgrass	30	0	0	90	100	0	90	40	90	100	0	0	70	0
Foxtail, Giant	90	0	0	50	100	0	50	70	70	100	0	0	50	0
Kochia	0	0	0	100	90	0	50	0	20	90	0	0	0	0
Pigweed	30	0	0	100	100	0	100	0	40	100	0	0	40	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	20	20	0	20	0	0	80	0	0	0	0

Table A	Compounds													
125 g ai/ha	97	98	99	100	101	102	103	104	105	106	107	108	109	110
Preemergence														
Barnyardgrass	10	30	100	100	10	0	50	30	30	0	100	30	20	100
Foxtail, Giant	70	40	100	100	40	0	60	40	20	80	100	80	40	100
Kochia	0	0	80	0	0	0	70	0	0	30	100	10	0	100
Pigweed	20	0	90	60	0	0	100	40	20	30	100	70	60	100
Ragweed	0	0	10	0	0	0	0	0	0	0	20	0	0	0

Ryegrass, Italian	0	0	30	0	0	0	0	0	0	0	80	0	0	70

Table A	Compounds													
125 g ai/ha	111	112	113	114	115	116	117	118	119	120	121	122	123	124
Preemergence														
Barnyardgrass	0	80	90	20	0	0	0	0	20	0	30	90	70	80
Foxtail, Giant	0	70	100	90	0	30	20	20	90	0	100	40	100	100
Kochia	0	50	60	10	0	0	0	0	0	0	0	70	10	10
Pigweed	0	100	100	30	0	70	30	50	100	0	0	90	80	100
Ragweed	0	0	0	80	0	0	0	50	0	0	0	0	0	0
Ryegrass, Italian	0	0	40	0	0	0	0	0	0	0	0	30	20	20

Table A	Compounds													
125 g ai/ha	125	126	127	128	129	130	131	132	133	134	135	136	137	138
Preemergence														
Barnyardgrass	100	0	60	50	100	100	100	100	30	80	40	100	90	100
Foxtail, Giant	100	0	100	100	100	100	90	100	90	90	50	100	100	100
Kochia	100	0	30	0	100	100	100	60	10	10	0	100	70	100
Pigweed	100	0	70	30	100	100	100	100	100	50	20	100	100	100
Ragweed	20	0	0	0	0	20	0	0	0	0	0	80	0	0
Ryegrass, Italian	70	0	10	10	60	80	20	30	0	20	10	20	20	100

Table A	Compounds							
125 g ai/ha	139	140	141	142	143	144	145	146
Preemergence								
Barnyardgrass	0	0	60	0	100	100	80	100
Foxtail, Giant	0	0	100	0	100	100	100	100
Kochia	0	40	20	0	100	100	40	80
Pigweed	0	10	90	0	-	100	100	100
Ragweed	50	0	30	0	0	10	30	0
Ryegrass, Italian	0	10	10	0	70	70	50	50

Table A	Compounds	
31 g ai/ha	145	146
Preemergence		
Barnyardgrass	40	20
Foxtail, Giant	90	80
Kochia	0	60
Pigweed	100	60
Ragweed	0	0
Ryegrass, Italian	10	0

Table A	Compounds													
31 g ai/ha	1	2	3	4	5	19	36	37	38	43	44	45	46	50
Preemergence														
Barnyardgrass	20	10	60	0	0	0	0	0	20	0	0	0	0	0
Foxtail, Giant	30	70	70	0	0	0	0	20	30	0	0	0	40	50
Kochia	0	30	0	0	0	0	0	0	0	100	0	0	0	0
Pigweed	20	40	50	0	0	0	0	0	60	30	0	0	50	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A	Compounds													
31 g ai/ha	51	53	54	62	63	66	67	68	69	70	71	74	76	77
Preemergence														
Barnyardgrass	0	0	0	30	40	90	0	10	70	0	0	10	0	20
Foxtail, Giant	0	0	0	30	10	70	0	10	40	0	40	40	0	100
Kochia	0	0	0	20	0	0	0	0	0	0	0	0	0	80
Pigweed	0	0	0	60	0	20	0	20	40	0	0	20	0	100
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A	Compounds													
31 g ai/ha	80	81	82	86	87	88	89	90	92	93	94	95	96	97
Preemergence														
Barnyardgrass	60	10	50	0	70	0	20	0	70	0	0	10	0	0
Foxtail, Giant	90	30	90	0	60	0	10	10	100	0	0	0	0	40
Kochia	100	0	70	10	30	0	10	0	90	0	0	0	0	0
Pigweed	100	100	90	20	40	0	10	0	100	0	0	0	0	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	30	0	0	0	0	0

Table A	Compounds													
31 g ai/ha	98	99	100	101	102	103	104	105	107	108	109	110	111	112
Preemergence														
Barnyardgrass	0	70	40	0	0	0	0	0	90	10	0	40	0	0
Foxtail, Giant	0	90	50	0	0	10	0	0	100	10	0	80	0	0
Kochia	0	40	0	0	0	0	0	0	90	0	0	10	0	0
Pigweed	0	50	0	0	0	40	0	0	100	0	0	40	0	60
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	30	0	0	0	0	10

Table A	Compounds													
31 g ai/ha	113	114	115	116	117	118	119	120	121	122	123	124	126	127
Preemergence														
Barnyardgrass	0	0	0	0	0	0	0	0	0	30	20	10	0	20
Foxtail, Giant	60	10	0	0	0	0	50	0	30	0	40	60	0	30
Kochia	10	0	70	0	0	0	0	0	20	10	0	0	0	0
Pigweed	100	0	0	50	0	20	20	0	0	40	0	40	0	0
Ragweed	0	20	20	30	0	100	0	0	0	0	0	0	0	0

Ryegrass, Italian	10	0	0	0	0	0	0	0	10	0	0	0	0	0

Table A						Compounds								
31 g ai/ha	128	129	131	132	133	134	135	137	138	140	141	142	143	144
Preemergence														
Barnyardgrass	20	70	0	30	0	0	0	0	70	0	0	0	20	80
Foxtail, Giant	30	100	0	40	0	10	0	70	90	0	10	0	100	100
Kochia	0	30	10	10	0	0	0	0	50	0	10	0	100	90
Pigweed	0	90	90	70	70	0	0	10	80	0	0	0	-	100
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	20	0	0	0	0	0	0	10	10	0	0	20	20

<u>TEST B</u>

Plant species in the flooded paddy test selected from rice (*Oryza sativa*), sedge, umbrella (small-flower umbrella sedge, *Cyperus difformis*), ducksalad (*Heteranthera limosa*), and barnyardgrass (*Echinochloa crus-galli*) were grown to the 2-leaf stage for testing. At time of treatment, test pots were flooded to 3 cm above the soil surface, treated by application of test compounds directly to the paddy water, and then maintained at that water depth for the duration of the test. Treated plants and controls were maintained in a greenhouse for 13 to 15 days, after which time all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table B, are based on a scale of 0 to 100 where 0 is no effect and 100 is complete control. A dash (–) response means no test result.

Table B						Compounds								
250 g ai/ha	1	2	3	4	5	6	7	8	9	10	11	12	13	18
Flood														
Barnyardgrass	0	0	0	0	0	0	0	0	20	0	0	0	0	0
Ducksalad	20	30	30	0	0	0	0	0	75	80	0	0	70	0
Rice	0	0	0	0	0	0	0	0	0	0	0	0	30	0
Sedge, Umbrella	80	100	100	0	0	0	0	70	75	80	0	0	75	0

Table B						Compounds								
250 g ai/ha	19	20	21	22	23	24	25	26	30	33	35	36	37	38
Flood														
Barnyardgrass	0	0	30	0	0	0	0	60	0	0	0	0	0	0
Ducksalad	0	30	70	40	30	0	0	100	40	80	50	0	0	40
Rice	0	0	0	0	15	0	0	20	0	0	0	0	0	0
Sedge, Umbrella	0	40	100	50	95	0	0	100	0	95	60	0	0	30

Table B						Compounds								
250 g ai/ha	43	44	45	46	47	48	49	50	51	53	54	56	57	58

Flood														
Barnyardgrass	0	0	0	0	0	20	20	0	15	0	0	0	0	0
Ducksalad	0	0	0	75	0	0	0	65	0	0	0	0	0	0
Rice	0	0	0	10	0	20	20	0	15	0	0	0	0	0
Sedge, Umbrella	0	30	0	80	0	0	0	80	0	0	0	0	0	0

Table B						Compounds								
250 g ai/ha	61	62	63	64	65	66	67	68	69	70	71	74	75	76
Flood														
Barnyardgrass	20	40	45	0	0	30	0	0	0	0	0	40	40	0
Ducksalad	100	100	100	0	70	100	0	0	75	70	90	100	95	85
Rice	0	0	25	0	0	0	0	0	20	0	0	0	35	10
Sedge, Umbrella	100	90	100	0	85	95	0	0	80	80	95	100	95	70

Table B						Compounds								
250 g ai/ha	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Flood														
Barnyardgrass	15	20	60	75	45	35	0	0	0	40	50	0	40	0
Ducksalad	85	70	90	100	100	100	80	0	0	100	100	0	95	30
Rice	0	15	45	55	0	30	0	0	0	20	35	20	40	0
Sedge, Umbrella	100	80	100	100	100	95	80	0	0	100	100	0	95	60

Table B						Compounds								
250 g ai/ha	91	92	93	94	95	96	97	98	99	100	101	102	103	104
Flood														
Barnyardgrass	0	25	0	0	0	0	0	0	60	40	0	0	0	0
Ducksalad	100	100	0	0	30	0	70	0	100	90	0	80	95	75
Rice	20	0	0	0	0	0	0	0	40	0	0	0	20	0
Sedge, Umbrella	95	100	0	0	0	0	75	0	90	70	0	80	95	75

Table B						Compounds								
250 g ai/ha	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Flood														
Barnyardgrass	0	0	50	0	0	25	0	20	65	0	0	30	0	0
Ducksalad	40	0	95	80	0	75	0	100	80	40	0	75	20	0
Rice	0	0	35	0	0	25	0	40	20	0	0	70	0	0
Sedge, Umbrella	0	0	95	60	0	90	0	100	90	90	0	90	60	50

Table B						Compounds								
250 g ai/ha	119	120	121	122	123	124	125	126	127	128	129	130	131	132
Flood														

Barnyardgrass	0	0	50	80	40	45	45	90	40	20	45	55	15	45
Ducksalad	100	0	0	100	95	100	70	0	90	90	90	40	80	90
Rice	0	0	35	40	35	40	35	0	15	15	40	35	15	45
Sedge, Umbrella	90	0	70	100	95	100	90	0	90	85	80	98	90	80

Table B						Compounds								
250 g ai/ha	133	134	135	136	137	138	139	140	141	142	143	144	145	146
Flood														
Barnyardgrass	0	0	0	45	75	50	0	0	20	0	50	70	50	40
Ducksalad	0	95	85	60	95	100	30	0	70	0	90	100	100	100
Rice	30	20	20	35	50	45	0	0	10	0	40	35	30	35
Sedge, Umbrella	0	95	85	80	95	85	0	0	50	0	90	100	100	85

TEST C

Seeds of plant species selected from blackgrass (*Alopecurus myosuroides*), ryegrass, Italian (Italian ryegrass, *Lolium multiflorum*), wheat (winter wheat, *Triticum aestivum*), galium (catchweed bedstraw, *Galium aparine*), corn (*Zea mays*), crabgrass, large (large crabgrass, *Digitaria sanguinalis*), foxtail, giant (giant foxtail, *Setaria faberii*), johnsongrass (*Sorghum halepense*), lambsquarters (*Chenopodium album*), morningglory (*Ipomoea coccinea*), nutsedge, yellow (yellow nutsedge, *Cyperus esculentus*), pigweed (*Amaranthus retroflexus*), ragweed (common ragweed, *Ambrosia elatior*), soybean (*Glycine max*), barnyardgrass (*Echinochloa crus-galli*), oilseed rape (*Brassica napus*), pigweed, palmer (palmer pigweed, *Amaranthus palmeri*), waterhemp (common waterhemp, *Amaranthus rudis*), velvetleaf (*Abutilon theophrasti*), kochia (*Kochia scoparia*), surinam grass (*Brachiaria decumbens*), nightshade (eastern black nightshade, *Solanum ptycanthum*), wild poinsettia (*Euphorbia heterophylla*), windgrass (*Apera spica-venti*), and oat, wild (wild oat *Avena fatua*), were planted into a blend of loam soil and sand or a silt loam soil and treated preemergence with test chemicals formulated in a non-phytotoxic solvent mixture which included a surfactant.

At the same time, plants selected from these crop and weed species and also chickweed (common chickweed, *Stellaria media*), buckwheat, wild (wild buckwheat, *Polygonum convolvulus*), wild mustard (*Sinapis arvensis*), field poppy (*Papaver rhoeas*), field violet (*Viola arvensis*), geranium, cutleaf (cutleaf geranium, *Geranium dissectum*), Canada thistle (*Cirsium arvense*), and speedwell (bird's-eye speedwell, *Veronica persica*), were planted in pots containing Sunshine Redi-Earth® planting medium comprising spaghnum peat moss, vermiculite, starter nutrients and dolomitic limestone and treated with postemergence applications of test chemicals formulated in the same manner. Plants ranged in height from 2 to 18 cm (1- to 4-leaf stage) for postemergence treatments. Treated plants and controls were maintained in a greenhouse for 13 to 15 d, after which time all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table C, are based on a scale of 0 to 100 where 0 is no effect and 100 is complete control. A dash (–) response means no test result.

Plant species in the flooded paddy test consisted of rice (*Oryza sativa*), sedge, umbrella (small-flower umbrella sedge *Cyperus difformis*), ducksalad (*Heteranthera limosa*), and barnyardgrass (*Echinochloa crus-galli*) grown to the 2-leaf stage for testing. At time of treatment, test pots were flooded to 3 cm above the soil surface, treated by application of test compounds directly to the paddy water, and then maintained at that water depth for the duration of the test.

Table C	Compounds													
125 g ai/ha	7	15	16	20	21	22	23	26	33	35	72	73	75	77
Postemergence														
Barnyardgrass	10	20	20	20	20	10	20	30	25	15	10	30	-	30
Blackgrass	5	10	5	10	5	5	20	35	20	10	30	35	30	25
Buckwheat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	85	-
Canada Thistle	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Chickweed	50	90	80	75	80	60	85	98	85	50	98	85	98	100
Corn	15	20	20	20	20	15	10	25	30	20	20	15	20	25
Crabgrass, Large	15	25	25	15	35	25	25	65	15	10	50	60	25	30
Field Poppy	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Field Violet	-	-	-	-	-	-	-	-	-	-	-	-	100	-
Foxtail, Giant	15	35	35	25	15	25	30	25	20	20	20	25	25	70
Galium	40	95	55	98	80	70	80	95	85	60	98	98	80	98
Geranium, Cutleaf	-	-	-	-	-	-	-	-	-	-	-	-	65	-
Johnsongrass	-	-	-	-	-	-	20	25	20	10	10	20	70	-
Kochia	20	95	90	100	90	50	85	95	95	90	100	100	98	100
Lambsquarters	55	95	60	85	85	75	80	98	90	70	85	98	90	90
Morningglory	55	90	75	70	70	50	35	85	65	60	70	75	65	80
Mustard, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	98	-
Nutsedge, Yellow	5	20	20	10	10	5	10	10	10	5	15	30	5	15
Oat, Wild	5	10	10	5	5	5	5	35	30	0	10	10	35	15
Oilseed Rape	5	0	70	60	30	80	35	80	95	65	65	50	95	85
Pigweed	70	98	50	95	90	95	85	100	100	98	100	100	-	100
Pigweed, Palmer	-	-	-	-	-	-	-	-	-	-	-	-	85	-
Poinsettia, Wild	-	-	-	-	-	-	-	-	-	-	-	-	80	-
Ragweed	25	65	40	60	55	50	50	90	60	20	75	65	60	70

Ryegrass, Italian	30	5	5	5	15	5	5	10	30	5	15	20	5	10
Soybean	70	90	50	60	60	75	35	75	55	35	70	60	85	65
Speedwell	–	–	–	–	–	–	–	–	–	–	–	–	100	–
Surinam Grass	–	–	–	–	–	–	–	–	–	–	–	–	20	–
Velvetleaf	40	85	50	70	70	85	40	80	75	40	70	75	75	65
Waterhemp	65	–	–	98	85	80	95	100	100	95	90	100	95	100
Wheat	5	0	0	5	0	0	0	10	5	0	5	5	10	30
Windgrass	–	–	–	–	–	–	–	–	–	–	–	–	5	–

Table C						Compounds								
125 g ai/ha	79	80	82	89	92	107	110	125	130	136	137	138	143	144
Postemergence														
Barnyardgrass	–	–	60	–	20	–	30	10	20	10	40	–	20	10
Blackgrass	30	25	45	45	20	60	25	30	30	15	40	65	40	15
Buckwheat, Wild	90	95	100	85	–	100	80	98	80	80	90	100	100	95
Canada Thistle	100	85	98	85	–	90	95	90	98	85	100	95	100	90
Chickweed	98	90	90	100	100	100	90	98	90	80	100	100	100	85
Corn	20	25	25	20	20	30	15	20	20	20	25	30	30	25
Crabgrass, Large	65	30	20	90	35	60	60	20	20	30	70	95	30	25
Field Poppy	100	85	100	100	–	100	100	100	100	90	100	100	100	100
Field Violet	90	95	90	100	–	100	100	98	100	100	85	100	100	90
Foxtail, Giant	40	15	20	20	50	25	25	25	30	25	35	65	25	40
Galium	95	90	90	90	100	95	90	90	80	75	85	85	95	90
Geranium, Cutleaf	65	60	60	55	–	75	60	55	60	45	35	60	75	40
Johnsongrass	85	5	30	85	–	98	15	25	15	15	25	90	20	5
Kochia	98	80	95	95	100	98	100	98	98	90	98	98	100	90
Lambsquarters	100	85	90	100	85	100	98	100	95	80	90	100	95	85
Morningglory	30	60	75	55	85	95	50	75	55	35	20	65	65	60
Mustard, Wild	–	90	100	–	–	100	100	100	100	100	100	100	100	95
Nightshade	100	75	100	95	–	100	98	90	90	80	90	98	90	90
Nutsedge, Yellow	5	5	10	5	20	5	5	10	5	5	5	30	25	10
Oat, Wild	35	5	50	30	5	45	55	15	15	10	10	70	20	35
Oilseed Rape	100	70	95	100	70	98	95	95	98	80	100	100	100	85
Pigweed	–	–	–	–	100	–	–	–	–	–	–	–	–	–
Pigweed, Palmer	85	60	98	85	–	100	95	85	65	70	70	98	100	80
Poinsettia, Wild	85	75	75	90	–	90	90	85	75	75	75	90	75	60
Ragweed	65	35	55	25	70	45	60	55	50	35	30	75	55	15
Ryegrass, Italian	30	5	25	10	30	50	20	15	15	10	10	35	20	20

Soybean	65	95	40	70	75	95	35	70	95	40	40	55	65	65
Speedwell	100	100	95	100	–	100	95	98	98	85	100	100	100	95
Surinam Grass	35	25	25	20	–	35	25	20	20	10	20	35	20	25
Velvetleaf	90	55	75	70	85	90	75	30	75	70	70	75	70	65
Waterhemp	98	90	95	95	100	100	95	90	85	75	75	100	90	75
Wheat	15	15	30	15	10	30	15	25	30	5	20	35	30	15
Windgrass	30	30	35	35	–	50	30	35	35	30	45	50	40	30

Table C						Compounds								
62 g ai/ha	7	15	16	20	21	22	23	26	33	35	72	73	75	77
Postemergence														
Barnyardgrass	15	20	20	10	20	10	10	20	10	10	10	20	–	25
Blackgrass	0	10	0	5	5	0	15	15	10	10	10	40	10	20
Buckwheat, Wild	–	–	–	–	–	–	–	–	–	–	–	–	80	–
Canada Thistle	–	–	–	–	–	–	–	–	–	–	–	–	75	–
Chickweed	30	90	50	65	50	65	50	85	85	45	90	90	90	100
Corn	10	20	15	10	15	5	5	20	25	20	10	15	15	20
Crabgrass, Large	20	25	25	15	25	25	20	25	10	15	10	25	15	30
Field Poppy	–	–	–	–	–	–	–	–	–	–	–	–	80	–
Field Violet	–	–	–	–	–	–	–	–	–	–	–	–	98	–
Foxtail, Giant	10	20	30	10	20	15	25	10	10	10	20	20	10	25
Galium	10	95	55	80	75	60	55	95	80	55	5	75	70	95
Geranium, Cutleaf	–	–	–	–	–	–	–	–	–	–	–	–	35	–
Johnsongrass	–	–	–	–	–	–	15	20	20	10	10	20	10	–
Kochia	25	95	80	100	90	85	55	90	95	60	100	100	90	100
Lambsquarters	30	75	40	70	65	70	65	98	80	65	75	90	70	70
Morningglory	40	85	40	70	40	35	60	65	75	60	40	85	20	90
Mustard, Wild	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nightshade	–	–	–	–	–	–	–	–	–	–	–	–	85	–
Nutsedge, Yellow	5	5	10	5	5	5	5	10	5	0	10	20	0	15
Oat, Wild	5	5	5	5	5	0	10	15	25	0	5	5	40	10
Oilseed Rape	0	100	60	50	50	55	50	75	55	50	0	98	80	70
Pigweed	60	95	85	98	90	70	70	98	98	90	85	100	–	100
Pigweed, Palmer	–	–	–	–	–	–	–	–	–	–	–	–	95	–
Poinsettia, Wild	–	–	–	–	–	–	–	–	–	–	–	–	80	–
Ragweed	20	50	10	55	45	50	40	55	50	10	40	60	50	35
Ryegrass, Italian	30	10	0	10	0	0	5	10	5	5	10	10	10	10
Soybean	40	80	50	55	60	35	70	65	30	35	40	75	85	70

Speedwell	–	–	–	–	–	–	–	–	–	–	–	–	100	–
Surinam Grass	–	–	–	–	–	–	–	–	–	–	–	–	20	–
Velvetleaf	35	60	30	40	60	55	35	75	65	35	40	70	70	55
Waterhemp	60	–	–	90	90	85	85	98	100	90	90	100	90	100
Wheat	5	0	0	5	0	0	0	5	0	0	0	5	0	10
Windgrass	–	–	–	–	–	–	–	–	–	–	–	–	10	–

Table C						Compounds								
62 g ai/ha	79	80	82	89	92	107	110	125	130	136	137	138	143	144
Postemergence														
Barnyardgrass	–	–	10	–	15	–	20	5	10	10	20	–	10	10
Blackgrass	20	5	40	30	5	20	20	15	20	10	15	10	15	15
Buckwheat, Wild	85	75	100	75	–	75	95	75	75	90	98	100	100	80
Canada Thistle	70	75	85	85	–	90	98	90	98	85	98	90	90	90
Chickweed	95	75	90	85	100	98	95	90	80	75	90	100	85	85
Corn	20	15	25	15	15	20	20	15	15	20	15	25	20	20
Crabgrass, Large	70	10	30	85	25	30	25	15	10	10	40	85	15	20
Field Poppy	100	85	100	100	–	98	100	100	100	80	100	100	90	90
Field Violet	85	90	90	100	–	98	95	98	95	95	85	100	98	80
Foxtail, Giant	25	10	10	10	25	20	25	10	10	10	40	30	10	30
Galium	85	85	85	80	100	90	75	80	85	60	75	80	80	85
Geranium, Cutleaf	55	35	40	50	–	60	40	55	45	50	30	55	60	35
Johnsongrass	60	5	10	10	–	35	10	10	10	10	10	80	10	5
Kochia	90	80	95	80	100	95	100	95	95	85	98	95	100	90
Lambsquarters	90	80	85	100	50	100	95	95	85	80	85	95	90	70
Morningglory	30	55	30	25	65	80	60	50	65	20	20	65	50	50
Mustard, Wild	–	80	100	100	–	95	100	98	100	85	100	100	100	80
Nightshade	95	70	95	95	–	98	95	85	85	70	90	100	90	75
Nutsedge, Yellow	5	5	20	0	10	5	5	5	5	0	10	10	5	10
Oat, Wild	45	10	40	40	5	35	45	15	15	10	10	50	10	30
Oilseed Rape	98	65	95	90	50	95	85	90	95	80	90	95	95	70
Pigweed	–	–	–	–	98	–	–	–	–	–	–	–	–	–
Pigweed, Palmer	70	70	98	80	–	100	98	80	45	70	50	90	80	40
Poinsettia, Wild	80	70	85	80	–	90	80	75	60	70	65	75	70	50
Ragweed	75	15	60	10	60	35	60	45	55	30	30	35	55	25
Ryegrass, Italian	25	5	20	5	10	20	15	10	10	5	5	30	10	15
Soybean	65	90	35	65	70	95	50	65	75	50	45	60	55	50
Speedwell	98	100	95	100	–	100	90	98	98	80	100	100	85	95

Surinam Grass	30	15	25	20	-	20	15	10	15	10	10	25	10	20
Velvetleaf	80	30	50	40	60	75	70	60	65	35	15	50	65	50
Waterhemp	95	85	98	90	90	100	90	75	75	55	70	100	75	75
Wheat	10	0	10	10	5	10	15	20	15	5	10	20	15	10
Windgrass	30	20	30	50	-	50	35	10	35	30	30	35	35	15

Table C						Compounds								
31 g ai/ha	7	13	15	16	20	21	22	23	26	33	35	72	73	75
Postemergence														
Barnyardgrass	5	10	15	10	10	10	5	10	10	5	5	5	15	-
Blackgrass	0	5	5	0	5	0	0	5	15	5	0	10	5	5
Buckwheat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	60
Canada Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	75
Chickweed	5	70	80	20	60	50	60	50	80	55	40	85	80	85
Corn	10	5	10	15	10	5	5	5	25	25	10	15	20	15
Crabgrass, Large	5	15	20	15	10	20	15	10	20	5	10	10	10	10
Field Poppy	-	-	-	-	-	-	-	-	-	-	-	-	-	80
Field Violet	-	-	-	-	-	-	-	-	-	-	-	-	-	98
Foxtail, Giant	5	25	30	20	10	10	10	35	10	10	10	30	25	10
Galium	0	50	60	50	60	80	25	55	80	70	35	80	70	70
Geranium, Cutleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	40
Johnsongrass	-	-	-	-	-	-	-	15	20	10	5	10	10	10
Kochia	30	30	95	50	95	50	80	50	90	95	40	100	100	85
Lambsquarters	25	55	75	50	80	60	70	55	90	70	40	85	80	55
Morningglory	25	30	75	30	65	25	10	55	60	65	50	65	75	15
Mustard, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	80
Nutsedge, Yellow	0	5	0	5	5	0	0	0	10	5	0	10	15	0
Oat, Wild	0	5	5	5	0	0	0	5	10	10	0	5	5	35
Oilseed Rape	0	35	95	35	50	40	40	5	75	45	30	60	80	80
Pigweed	40	70	90	75	95	75	70	75	98	95	70	85	85	-
Pigweed, Palmer	-	-	-	-	-	-	-	-	-	-	-	-	-	90
Poinsettia, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	70
Ragweed	20	5	40	10	50	10	35	35	55	30	5	50	55	10
Ryegrass, Italian	0	0	5	0	5	0	0	0	5	5	0	5	5	10
Soybean	25	35	45	35	65	40	40	30	55	65	25	70	70	65
Speedwell	-	-	-	-	-	-	-	-	-	-	-	-	-	95
Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	15

Velvetleaf	20	25	50	25	50	60	40	35	55	50	30	50	60	35
Waterhemp	70	–	–	–	95	85	75	90	98	80	80	80	98	90
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Windgrass	–	–	–	–	–	–	–	–	–	–	–	–	–	5

Table C							Compounds							
31 g ai/ha	77	79	80	82	89	92	107	110	125	130	136	137	138	143
Postemergence														
Barnyardgrass	25	–	–	10	–	10	–	10	5	5	5	10	–	10
Blackgrass	20	10	5	35	15	10	20	15	20	5	10	10	35	15
Buckwheat, Wild	–	80	70	70	75	–	75	85	65	90	60	75	80	85
Canada Thistle	–	65	75	85	80	–	85	90	85	75	75	85	80	85
Chickweed	80	90	75	85	95	100	90	95	75	75	65	55	85	80
Corn	15	25	10	20	15	20	20	20	10	20	10	15	20	20
Crabgrass, Large	25	25	15	30	60	10	10	20	10	10	5	20	65	5
Field Poppy	–	98	75	85	95	–	98	100	95	100	85	95	100	90
Field Violet	–	75	85	70	100	–	98	95	98	85	90	70	95	80
Foxtail, Giant	20	20	10	10	10	20	10	10	10	10	20	20	20	10
Galium	98	80	75	75	75	85	80	75	70	80	65	70	80	85
Geranium, Cutleaf	–	50	35	30	35	–	35	30	30	35	25	25	35	50
Johnsongrass	–	65	5	20	10	–	10	10	5	5	5	10	25	5
Kochia	100	80	75	95	75	100	85	100	90	85	80	90	85	100
Lambsquarters	75	85	75	75	75	60	85	90	98	90	75	75	90	90
Morningglory	85	20	35	40	15	85	60	50	45	25	15	15	55	70
Mustard, Wild	–	–	80	95	–	–	90	90	95	90	95	85	100	100
Nightshade	–	95	65	80	90	–	90	85	75	80	75	80	80	85
Nutsedge, Yellow	10	5	0	10	0	10	5	5	5	0	0	0	0	5
Oat, Wild	5	60	0	40	10	5	40	30	10	10	5	10	55	10
Oilseed Rape	70	98	60	95	95	50	80	60	85	85	80	95	85	80
Pigweed	98	–	–	–	–	90	–	–	–	–	–	–	–	–
Pigweed, Palmer	–	80	35	80	75	–	95	95	85	65	55	45	80	75
Poinsettia, Wild	–	75	65	65	60	–	75	65	65	70	65	65	60	65
Ragweed	40	20	10	35	5	40	35	50	35	45	20	35	30	50
Ryegrass, Italian	5	30	0	15	5	15	35	10	5	10	5	5	5	10
Soybean	50	70	75	60	40	40	40	40	60	55	40	30	55	40
Speedwell	–	90	100	85	100	–	100	95	70	85	80	80	100	80
Surinam Grass	–	25	10	20	10	–	25	20	10	10	5	10	20	10
Velvetleaf	50	75	35	45	35	50	65	40	35	45	50	15	35	55

Waterhemp	98	95	80	95	70	85	98	90	80	75	70	60	98	80
Wheat	0	5	0	10	10	0	5	5	5	5	5	5	5	10
Windgrass	–	35	5	35	10	–	15	25	15	15	10	10	15	35

Table C	Compound
31 g ai/ha	144
Postemergence	
Barnyardgrass	5
Blackgrass	10
Buckwheat, Wild	55
Canada Thistle	60
Chickweed	55
Corn	15
Crabgrass, Large	25
Field Poppy	80
Field Violet	65
Foxtail, Giant	10
Galium	70
Geranium, Cutleaf	20
Johnsongrass	5
Kochia	90
Lambsquarters	75
Morningglory	20
Mustard, Wild	70

Table C	Compound
31 g ai/ha	144
Postemergence	
Nightshade	75
Nutsedge, Yellow	0
Oat, Wild	30
Oilseed Rape	35
Pigweed	–
Pigweed, Palmer	35
Poinsettia, Wild	35
Ragweed	15
Ryegrass, Italian	10
Soybean	30
Speedwell	70
Surinam Grass	20
Velvetleaf	30
Waterhemp	60
Wheat	5
Windgrass	10

Table C	Compounds													
16 g ai/ha	7	13	15	16	20	21	22	23	26	33	35	72	73	75
Postemergence														
Barnyardgrass	5	10	20	5	10	10	5	10	10	5	5	5	10	–
Blackgrass	0	0	0	0	5	0	0	0	10	5	0	5	10	0
Buckwheat, Wild	–	–	–	–	–	–	–	–	–	–	–	–	–	45
Canada Thistle	–	–	–	–	–	–	–	–	–	–	–	–	–	70
Chickweed	5	40	35	20	60	40	20	5	55	50	5	65	80	60
Corn	5	10	15	5	5	5	5	5	20	20	5	10	10	10
Crabgrass, Large	5	5	30	10	10	10	10	10	10	5	10	10	15	10
Field Poppy	–	–	–	–	–	–	–	–	–	–	–	–	–	70
Field Violet	–	–	–	–	–	–	–	–	–	–	–	–	–	80
Foxtail, Giant	5	10	25	10	10	10	10	10	10	5	5	30	15	10
Galium	0	65	70	45	70	55	10	50	55	50	35	80	70	40

Geranium, Cutleaf	–	–	–	–	–	–	–	–	–	–	–	–	–	30
Johnsongrass	–	–	–	–	–	–	–	0	10	10	0	5	5	5
Kochia	0	30	90	40	95	60	50	5	90	90	5	100	98	75
Lambsquarters	5	50	70	40	65	65	65	25	75	60	50	75	75	50
Morningglory	5	20	65	5	75	10	5	10	65	55	40	75	70	5
Mustard, Wild	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nightshade	–	–	–	–	–	–	–	–	–	–	–	–	–	75
Nutsedge, Yellow	0	5	0	0	0	0	0	0	5	5	0	5	5	0
Oat, Wild	0	0	5	0	0	0	0	5	10	5	0	5	5	5
Oilseed Rape	0	0	45	15	50	30	35	5	40	35	20	50	5	60
Pigweed	35	75	90	50	85	85	60	60	75	95	80	80	90	–
Pigweed, Palmer	–	–	–	–	–	–	–	–	–	–	–	–	–	75
Poinsettia, Wild	–	–	–	–	–	–	–	–	–	–	–	–	–	65
Ragweed	10	5	30	20	30	10	5	15	40	40	0	35	50	5
Ryegrass, Italian	10	0	0	0	0	0	0	0	5	0	0	5	5	0
Soybean	25	30	45	15	25	30	40	20	65	25	25	60	45	50
Speedwell	–	–	–	–	–	–	–	–	–	–	–	–	–	90
Surinam Grass	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Velvetleaf	5	20	50	20	20	40	50	10	30	25	40	40	40	30
Waterhemp	35	–	–	–	75	75	75	80	95	90	65	85	85	85
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Windgrass	–	–	–	–	–	–	–	–	–	–	–	–	–	0

Table C							Compounds							
16 g ai/ha	77	79	80	82	89	92	107	110	125	130	136	137	138	143
Postemergence														
Barnyardgrass	15	–	–	10	–	10	–	10	5	5	5	10	–	5
Blackgrass	5	20	0	30	10	5	5	10	10	5	5	5	5	10
Buckwheat, Wild	–	75	70	80	70	–	45	85	70	35	50	70	70	75
Canada Thistle	–	55	75	85	80	–	80	65	80	75	65	75	80	85
Chickweed	80	95	60	55	65	100	80	60	70	75	55	70	75	80
Corn	15	15	15	20	15	10	10	10	10	10	5	10	15	15
Crabgrass, Large	10	10	10	10	55	20	10	10	10	5	5	10	35	5
Field Poppy	–	85	70	50	90	–	80	85	90	100	65	85	100	80
Field Violet	–	70	75	60	100	–	95	80	90	80	85	65	90	75
Foxtail, Giant	10	10	5	10	10	10	10	10	10	10	10	20	10	20
Galium	75	75	70	50	75	80	75	60	65	75	50	55	65	75
Geranium, Cutleaf	–	45	30	30	35	–	25	5	25	25	15	10	30	30

Johnsongrass	-	40	5	5	5	-	20	5	5	5	5	5	10	5
Kochia	95	75	55	80	70	100	80	95	85	80	80	85	75	98
Lambsquarters	55	75	50	70	70	40	80	75	70	75	55	55	65	75
Morningglory	50	10	25	25	5	20	20	30	20	10	10	10	10	15
Mustard, Wild	-	-	75	95	100	-	85	90	90	98	85	100	100	100
Nightshade	-	90	60	85	75	-	75	75	50	75	70	60	75	65
Nutsedge, Yellow	5	0	0	10	0	0	5	0	5	0	0	0	0	0
Oat, Wild	0	15	0	25	15	5	5	20	5	5	5	5	10	10
Oilseed Rape	10	80	50	70	60	5	65	60	80	70	65	90	70	85
Pigweed	95	-	-	-	-	85	-	-	-	-	-	-	-	-
Pigweed, Palmer	-	60	30	75	55	-	90	75	40	35	50	20	75	45
Poinsettia, Wild	-	30	65	40	55	-	70	40	65	55	40	15	30	55
Ragweed	40	30	5	40	0	35	25	40	5	25	20	20	0	20
Ryegrass, Italian	0	5	0	5	5	10	5	5	5	5	0	5	5	5
Soybean	25	60	60	25	35	30	50	40	25	40	30	20	35	30
Speedwell	-	85	90	75	95	-	100	60	55	80	75	75	95	80
Surinam Grass	-	25	10	20	10	-	10	15	5	10	5	5	20	5
Velvetleaf	35	30	30	35	20	35	60	50	20	25	20	10	10	35
Waterhemp	95	95	80	65	70	80	95	85	75	65	70	40	98	75
Wheat	0	5	0	5	0	0	5	5	5	10	0	5	5	5
Windgrass	-	20	0	10	10	-	5	20	10	10	5	10	0	30

Table C	Compound
16 g ai/ha	144
Postemergence	
Barnyardgrass	5
Blackgrass	10
Buckwheat, Wild	70
Canada Thistle	90
Chickweed	50
Corn	15
Crabgrass, Large	10
Field Poppy	60
Field Violet	60
Foxtail, Giant	5
Galium	50
Geranium, Cutleaf	15
Johnsongrass	5
Nightshade	65
Nutsedge, Yellow	0
Oat, Wild	20
Oilseed Rape	35
Pigweed	-
Pigweed, Palmer	25
Poinsettia, Wild	30
Ragweed	10
Ryegrass, Italian	5
Soybean	30
Speedwell	60
Surinam Grass	10
Velvetleaf	25

Kochia	85
Lambsquarters	40
Morningglory	30
Mustard, Wild	70
Waterhemp	35
Wheat	5
Windgrass	10

Table C	Compound
8 g ai/ha	13
Postemergence	
Barnyardgrass	5
Blackgrass	0
Chickweed	5
Corn	5
Crabgrass, Large	5
Foxtail, Giant	5
Galium	5
Kochia	5
Lambsquarters	60
Morningglory	5
Nutsedge, Yellow	0
Oat, Wild	0
Oilseed Rape	0
Pigweed	60
Ragweed	5
Ryegrass, Italian	0
Soybean	20
Velvetleaf	15
Wheat	0

Table C	Compound
4 g ai/ha	13
Postemergence	
Barnyardgrass	5
Blackgrass	0
Chickweed	5
Corn	5
Crabgrass, Large	5
Foxtail, Giant	5
Galium	10
Kochia	0
Lambsquarters	30
Morningglory	5
Nutsedge, Yellow	0
Oat, Wild	0
Oilseed Rape	0
Pigweed	30
Ragweed	5
Ryegrass, Italian	0
Soybean	15
Velvetleaf	15
Wheat	0

Table C	Compounds													
125 g ai/ha	15	16	20	21	26	30	33	61	72	73	75	77	79	80
Preemergence														
Barnyardgrass	100	75	85	98	100	25	100	65	100	100	100	100	95	100
Blackgrass	80	10	100	90	90	0	90	5	100	100	75	100	90	90
Corn	25	10	30	20	40	5	10	0	60	50	5	35	30	20
Crabgrass, Large	100	100	100	100	100	98	100	90	100	100	98	100	98	98
Foxtail, Giant	100	100	100	90	98	75	100	65	100	100	98	100	98	100
Galium	-	-	95	100	100	85	95	15	100	100	0	98	5	98
Johnsongrass	-	-	-	-	98	15	35	20	100	95	70	-	70	60

Kochia	–	–	–	–	–	–	–	30	–	–	100	–	100	100
Lambsquarters	95	50	90	70	95	55	85	60	100	100	70	98	85	98
Morningglory	60	25	10	10	95	35	40	0	95	75	10	65	60	75
Nightshade	–	–	–	–	–	–	–	75	–	–	80	–	95	90
Nutsedge, Yellow	50	0	10	0	45	5	5	0	0	10	20	30	0	35
Oat, Wild	–	–	–	–	–	–	–	5	–	–	5	–	40	30
Oilseed Rape	100	100	50	100	100	100	100	10	100	65	40	100	95	100
Pigweed	100	95	100	100	100	100	100	–	100	100	–	100	–	–
Pigweed, Palmer	–	–	–	–	–	–	–	75	–	–	100	–	90	98
Poinsettia, Wild	–	–	–	–	–	–	–	0	–	–	35	–	40	85
Ragweed	20	0	0	0	50	0	50	30	45	25	5	45	30	20
Ryegrass, Italian	50	5	70	90	95	5	85	5	100	100	15	90	35	25
Soybean	55	5	10	0	–	60	30	10	90	40	50	25	5	85
Surinam Grass	–	–	–	–	–	–	–	25	–	–	80	–	85	98
Velvetleaf	100	75	50	100	100	40	100	5	100	95	25	100	75	100
Waterhemp	100	100	98	98	100	100	100	100	100	100	98	100	100	100
Wheat	5	0	5	0	15	10	5	10	80	70	10	0	15	15
Windgrass	–	–	–	–	–	–	–	70	–	–	100	–	100	100

Table C				Compounds						
125 g ai/ha	82	89	92	107	125	130	136	138	143	144
Preemergence										
Barnyardgrass	90	100	100	100	–	–	–	95	–	95
Blackgrass	5	90	100	90	90	85	95	90	75	30
Corn	5	10	40	45	5	25	5	5	20	30
Crabgrass, Large	98	98	100	100	100	100	100	98	100	100
Foxtail, Giant	98	85	100	98	100	100	100	100	100	100
Galium	80	0	–	95	80	90	90	5	80	55
Johnsongrass	85	60	–	80	75	85	70	60	80	70
Kochia	95	90	–	100	98	98	98	80	90	100
Lambsquarters	70	65	100	95	95	95	80	70	95	75
Morningglory	10	20	70	85	50	10	30	10	25	20
Nightshade	85	85	–	90	–	–	–	80	–	100
Nutsedge, Yellow	0	0	50	0	5	0	5	0	5	70
Oat, Wild	5	10	–	65	55	60	45	30	5	10
Oilseed Rape	50	15	100	98	80	95	98	20	98	90
Pigweed	–	–	100	–	–	–	–	–	–	–
Pigweed, Palmer	100	98	–	100	100	85	100	100	100	100

Poinsettia, Wild	20	40	-	70	30	45	50	50	25	80
Ragweed	30	50	60	50	35	10	40	10	5	10
Ryegrass, Italian	5	40	95	90	85	70	65	80	45	60
Soybean	0	10	60	45	20	30	40	5	20	60
Surinam Grass	35	75	-	98	65	80	100	75	50	60
Velvetleaf	10	60	100	98	65	85	65	50	70	45
Waterhemp	100	100	100	100	100	100	100	98	100	100
Wheat	0	5	20	35	5	0	10	10	0	5
Windgrass	90	100	-	100	100	100	100	100	100	90

Table C						Compounds								
62 g ai/ha	15	16	20	21	26	30	33	61	72	73	75	77	79	80
Preemergence														
Barnyardgrass	100	30	30	90	100	10	95	50	80	100	80	98	75	70
Blackgrass	50	5	85	55	90	0	70	0	98	100	80	90	75	70
Corn	10	0	0	5	25	0	10	10	20	40	0	20	5	5
Crabgrass, Large	100	90	98	98	100	80	100	75	100	100	98	100	100	100
Foxtail, Giant	100	90	90	95	98	65	98	60	75	100	65	100	80	85
Galium	-	-	80	5	95	60	60	10	90	100	5	98	70	75
Johnsongrass	-	-	-	-	80	0	25	0	70	80	30	-	50	55
Kochia	-	-	-	-	-	-	-	5	-	-	90	-	90	100
Lambsquarters	85	20	10	25	95	30	80	50	90	90	35	100	70	95
Morningglory	35	25	5	5	85	10	25	0	55	60	20	35	10	40
Nightshade	-	-	-	-	-	-	-	50	-	-	75	-	80	85
Nutsedge, Yellow	5	0	0	0	15	0	5	0	0	0	0	0	0	0
Oat, Wild	-	-	-	-	-	-	-	5	-	-	0	-	5	10
Oilseed Rape	100	60	50	75	100	100	85	0	80	50	10	100	70	70
Pigweed	100	50	100	98	100	100	100	-	100	100	-	100	-	-
Pigweed, Palmer	-	-	-	-	-	-	-	70	-	-	95	-	90	100
Poinsettia, Wild	-	-	-	-	-	-	-	0	-	-	35	-	10	40
Ragweed	30	5	0	0	60	0	40	5	40	10	0	40	20	5
Ryegrass, Italian	15	5	30	15	85	0	30	0	45	85	5	35	30	5
Soybean	40	0	0	0	35	10	-	20	15	25	10	15	5	40
Surinam Grass	-	-	-	-	-	-	-	60	-	-	35	-	50	60
Velvetleaf	100	50	5	70	85	10	55	5	55	75	35	70	20	70
Waterhemp	100	85	100	95	100	100	100	90	100	100	98	100	95	100
Wheat	0	0	0	0	5	0	0	5	30	30	10	0	5	0
Windgrass	-	-	-	-	-	-	-	40	-	-	100	-	100	100

Table C	Compounds									
62 g ai/ha	82	89	92	107	125	130	136	138	143	144
Preemergence										
Barnyardgrass	20	90	98	100	-	-	-	80	-	70
Blackgrass	5	85	100	90	60	60	60	80	80	40
Corn	0	0	35	15	5	5	5	5	0	5
Crabgrass, Large	90	100	100	100	100	100	100	98	100	100
Foxtail, Giant	90	60	100	98	98	98	70	85	100	100
Galium	0	0	-	90	30	90	50	5	80	50
Johnsongrass	40	30	-	70	60	70	35	50	50	40
Kochia	90	85	-	100	90	65	85	80	90	100
Lambsquarters	20	0	100	85	60	35	25	25	95	65
Morningglory	0	5	60	40	10	20	5	0	5	10
Nightshade	40	65	-	80	-	-	-	80	-	90
Nutsedge, Yellow	0	0	5	0	0	0	0	0	0	60
Oat, Wild	5	30	-	30	10	35	5	5	5	10
Oilseed Rape	5	0	100	85	50	40	70	5	80	5
Pigweed	-	-	100	-	-	-	-	-	-	-
Pigweed, Palmer	100	90	-	100	100	100	100	100	100	100
Poinsettia, Wild	0	20	-	40	25	10	25	5	20	40
Ragweed	20	5	60	50	5	5	0	0	0	0
Ryegrass, Italian	5	15	55	70	40	60	35	20	30	0
Soybean	0	5	70	35	0	10	15	0	15	30
Surinam Grass	25	65	-	98	40	65	10	65	35	70
Velvetleaf	0	25	100	98	60	75	15	20	40	15
Waterhemp	100	100	100	100	100	100	100	100	100	98
Wheat	0	0	0	15	0	5	0	5	0	0
Windgrass	80	65	-	100	90	100	85	100	100	80

Table C	Compounds													
31 g ai/ha	13	15	16	20	21	26	30	33	61	72	73	75	77	79
Preemergence														
Barnyardgrass	40	85	15	5	55	75	15	40	0	90	80	60	60	60
Blackgrass	0	0	0	40	35	90	0	10	0	98	98	5	15	10
Corn	10	0	0	0	0	0	0	0	0	20	20	0	15	0
Crabgrass, Large	85	100	75	50	75	100	35	98	10	100	100	85	100	98
Foxtail, Giant	95	100	25	50	80	98	30	95	50	80	100	25	100	70
Galium	-	-	-	0	0	90	10	60	0	75	10	0	0	0

Johnsongrass	-	-	-	-	-	50	0	5	0	65	40	0	-	5
Kochia	-	-	-	-	-	-	-	-	5	-	-	50	-	90
Lambsquarters	15	70	20	5	30	85	25	60	15	80	90	10	60	10
Morningglory	5	20	0	0	0	10	10	0	0	40	10	0	20	10
Nightshade	-	-	-	-	-	-	-	-	60	-	-	75	-	65
Nutsedge, Yellow	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Oat, Wild	-	-	-	-	-	-	-	-	0	-	-	0	-	0
Oilseed Rape	50	100	50	0	0	85	55	80	0	80	20	0	55	0
Pigweed	60	100	0	55	55	100	95	100	-	100	95	-	100	-
Pigweed, Palmer	-	-	-	-	-	-	-	-	50	-	-	100	-	85
Poinsettia, Wild	-	-	-	-	-	-	-	-	0	-	-	40	-	0
Ragweed	10	10	0	0	0	30	0	35	0	0	0	0	0	0
Ryegrass, Italian	0	5	0	0	10	75	0	30	0	45	35	5	30	10
Soybean	5	10	0	0	0	10	-	-	20	0	0	0	5	0
Surinam Grass	-	-	-	-	-	-	-	-	10	-	-	30	-	30
Velvetleaf	70	85	5	0	40	30	0	30	5	60	30	5	30	5
Waterhemp	100	100	60	85	75	100	100	100	75	100	100	95	100	98
Wheat	5	0	0	0	0	20	0	0	0	0	0	0	0	5
Windgrass	-	-	-	-	-	-	-	-	5	-	-	45	-	80

Table C						Compounds					
31 g ai/ha	80	82	89	92	107	125	130	136	138	143	144
Preemergence											
Barnyardgrass	30	5	35	85	85	-	-	-	40	-	40
Blackgrass	10	0	15	80	90	60	30	35	50	75	10
Corn	5	0	0	15	0	0	0	0	0	0	0
Crabgrass, Large	80	70	98	100	98	98	100	85	95	100	98
Foxtail, Giant	40	80	5	100	98	85	70	65	80	98	85
Galium	5	0	0	-	60	5	50	0	0	30	50
Johnsongrass	30	5	40	-	30	5	10	25	0	25	10
Kochia	95	50	60	-	100	60	65	80	75	80	90
Lambsquarters	70	20	0	100	75	30	30	30	35	10	40
Morningglory	20	0	0	40	0	10	5	0	0	0	0
Nightshade	70	20	75	-	60	-	-	-	50	-	65
Nutsedge, Yellow	0	0	0	5	0	0	0	0	0	0	20
Oat, Wild	0	0	10	-	5	0	15	0	0	0	5
Oilseed Rape	80	0	0	100	40	5	10	5	0	5	0
Pigweed	-	-	-	100	-	-	-	-	-	-	-

Pigweed, Palmer	85	85	70	–	100	100	75	75	60	100	100
Poinsettia, Wild	30	0	0	–	10	0	0	5	0	5	5
Ragweed	0	0	0	55	30	10	0	20	0	0	0
Ryegrass, Italian	0	0	5	5	35	30	35	30	10	20	0
Soybean	20	0	5	40	20	0	0	0	0	0	0
Surinam Grass	50	10	35	–	60	20	50	25	65	10	5
Velvetleaf	55	0	20	75	75	5	10	5	25	10	0
Waterhemp	100	50	85	100	98	100	100	100	85	98	98
Wheat	0	0	0	0	10	0	0	0	5	0	–
Windgrass	60	30	50	–	100	85	70	30	100	85	30

Table C						Compounds								
16 g ai/ha	13	15	16	20	21	26	30	33	61	72	73	75	77	79
Preemergence														
Barnyardgrass	10	10	0	0	10	40	10	20	0	25	15	5	20	5
Blackgrass	0	0	0	0	5	45	0	0	0	60	5	0	5	5
Corn	5	0	0	0	0	0	0	0	0	5	0	0	0	0
Crabgrass, Large	60	95	5	5	20	98	0	75	0	100	98	65	98	65
Foxtail, Giant	0	100	5	35	20	95	5	60	0	55	98	0	95	40
Galium	–	–	–	10	–	5	80	0	0	5	5	0	0	0
Johnsongrass	–	–	–	–	–	55	0	0	0	5	0	0	–	0
Kochia	–	–	–	–	–	–	–	–	0	–	–	0	–	5
Lambsquarters	50	60	0	0	0	70	10	25	5	65	85	0	50	0
Morningglory	5	20	10	0	0	20	0	0	0	10	0	0	10	20
Nightshade	–	–	–	–	–	–	–	–	60	–	–	40	–	30
Nutsedge, Yellow	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oat, Wild	–	–	–	–	–	–	–	–	0	–	–	0	–	0
Oilseed Rape	0	30	0	0	0	80	10	50	0	5	0	0	0	0
Pigweed	5	98	0	55	5	100	90	80	–	100	90	–	85	–
Pigweed, Palmer	–	–	–	–	–	–	–	–	40	–	–	70	–	75
Poinsettia, Wild	–	–	–	–	–	–	–	–	0	–	–	10	–	0
Ragweed	0	10	0	0	0	20	0	55	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	35	0	0	0	10	30	0	0	0
Soybean	5	0	0	0	0	–	0	15	–	0	0	0	5	0
Surinam Grass	–	–	–	–	–	–	–	–	0	–	–	0	–	5
Velvetleaf	20	60	0	0	10	0	0	5	0	10	0	0	10	10
Waterhemp	80	90	10	30	70	100	85	100	50	100	65	75	95	100
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Windgrass	–	–	–	–	–	–	–	–	0	–	–	5	–	60

Table C	Compounds										
16 g ai/ha	80	82	89	92	107	125	130	136	138	143	144
Preemergence											
Barnyardgrass	10	5	5	35	65	–	–	–	20	–	10
Blackgrass	5	0	5	45	60	5	30	0	10	5	5
Corn	0	0	0	0	0	0	5	0	0	5	0
Crabgrass, Large	55	60	75	100	98	35	98	50	75	70	85
Foxtail, Giant	5	20	0	100	60	30	50	25	35	20	70
Galium	0	0	0	–	5	0	0	0	0	0	0
Johnsongrass	5	0	0	–	10	5	10	10	0	5	0
Kochia	70	0	60	–	100	5	10	50	5	30	70
Lambsquarters	30	30	0	90	30	10	35	25	0	5	50
Morningglory	5	0	0	10	0	0	0	0	0	0	0
Nightshade	55	5	10	–	30	–	–	–	40	–	35
Nutsedge, Yellow	0	0	0	0	0	0	5	0	0	0	0
Oat, Wild	0	0	5	–	0	5	0	0	0	0	0
Oilseed Rape	35	0	0	85	5	0	0	5	0	0	0
Pigweed	–	–	–	100	–	–	–	–	–	–	–
Pigweed, Palmer	100	55	65	–	100	90	85	95	40	65	85
Poinsettia, Wild	5	0	0	–	0	0	0	0	0	5	0
Ragweed	0	0	0	30	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	5	10	0	15	5	0	5	0
Soybean	0	0	0	0	0	0	0	0	0	0	0
Surinam Grass	10	40	10	–	15	5	10	0	30	5	10
Velvetleaf	30	0	10	50	40	10	5	0	5	0	0
Waterhemp	95	60	70	100	100	70	50	65	75	85	98
Wheat	0	0	0	0	5	0	0	0	0	0	0
Windgrass	5	40	60	–	80	20	30	0	70	25	0

Table C	Compound
8 g ai/ha	13
Preemergence	
Barnyardgrass	0
Blackgrass	0
Corn	0
Crabgrass, Large	30
Foxtail, Giant	0

Table C	Compound
4 g ai/ha	13
Preemergence	
Barnyardgrass	0
Blackgrass	0
Corn	0
Crabgrass, Large	25
Foxtail, Giant	0

Lambsquarters	5
Morningglory	0
Nutsedge, Yellow	0
Oilseed Rape	0
Pigweed	10
Ragweed	0
Ryegrass, Italian	0
Soybean	0
Velvetleaf	10
Waterhemp	10
Wheat	0

Lambsquarters	0
Morningglory	0
Nutsedge, Yellow	0
Oilseed Rape	0
Pigweed	5
Ragweed	0
Ryegrass, Italian	0
Soybean	0
Velvetleaf	5
Waterhemp	5
Wheat	0

Table C	Compounds			
250 g ai/ha	61	66	92	119
Flood				
Barnyardgrass	40	80	40	25
Ducksalad	90	95	100	50
Rice	20	20	15	0
Sedge, Umbrella	85	95	100	90

Table C	Compounds				
125 g ai/ha	61	62	66	92	119
Flood					
Barnyardgrass	20	20	25	20	0
Ducksalad	90	75	85	95	40
Rice	20	10	0	15	0
Sedge, Umbrella	85	65	85	90	80

Table C	Compounds				
62 g ai/ha	61	62	66	92	119
Flood					
Barnyardgrass	0	0	0	0	0
Ducksalad	75	40	80	60	0
Rice	20	0	0	15	0
Sedge, Umbrella	80	60	75	60	55

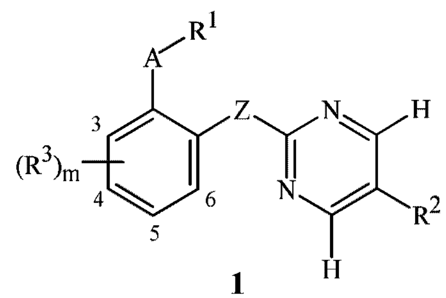
Table C	Compounds				
31 g ai/ha	61	62	66	92	119
Flood					
Barnyardgrass	0	0	0	0	0
Ducksalad	50	0	40	30	0
Rice	20	0	0	10	0
Sedge, Umbrella	80	0	40	20	0

Table C	Compound
16 g ai/ha	62
Flood	
Barnyardgrass	0
Ducksalad	0
Rice	0
Sedge, Umbrella	0

CLAIMS

What is claimed is:

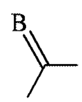
1. A compound selected from the group consisting of Formula **1**, *N*-oxides and salts thereof,



1

wherein

A is



A-3;

B is O or S;

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_3–C_6 halocycloalkylalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 alkylamino, C_1–C_6 haloalkylamino, C_2–C_{10} dialkylamino, C_2–C_{10} halodialkylamino, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 haloalkynyloxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_4–C_8 halocycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkenylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl;

Z is O or S;

R^2 is halogen, cyano, nitro, C_1–C_6 alkoxy, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 cycloalkyl or $-SO_nR^{10}$;

each R^3 is independently halogen, cyano, nitro, CHO, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_3–C_7 cycloalkylcarbonyl, C_2–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_2–C_4 alkylthioalkyl, $-C(=O)N(R^{11a})(R^{11b})$, $-C(=NOR^{12})H$, $-C(=N(R^{13}))H$ or $-SO_nR^{14}$;

m is 0, 1, 2 or 3;

each n is independently 0, 1 or 2;

R^{10} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino;

each R^{11a} is independently C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{11b} is independently H, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{12} is independently H or C_1–C_4 alkyl;

each R^{13} is independently H, amino, C_1–C_4 alkyl or C_1–C_4 alkylamino; and

each R^{14} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino; and

provided that the compound of Formula **1** is other than methyl 2-[(5-chloro-2-pyrimidinyl)oxy]benzoate, methyl 2-[(5-bromo-2-pyrimidinyl)oxy]benzoate, methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate and 1-[2-[(5-bromo-2-pyrimidinyl)oxy]phenyl]-ethanone.

2. The compound of Claim 1 wherein

R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_3–C_6 cycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;

R^2 is halogen or C_1–C_4 alkyl;

each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl; and

m is 1 or 2.

3. The compound of Claim 2 wherein
B is O;
R^1 is C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_1–C_6 alkoxy, C_3–C_6 alkenyloxy, C_3–C_6 alkynyloxy, C_1–C_6 haloalkoxy, C_3–C_6 haloalkenyloxy, C_2–C_6 cyanoalkyl, C_2–C_6 cyanoalkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio or C_1–C_6 alkenylthio;
Z is O;
R^2 is halogen or CH_3;
each R^3 is independently halogen, cyano, C_1–C_3 alkyl or C_1–C_3 haloalkyl.

4. The compound of Claim 3 wherein
R^1 is C_1–C_6 haloalkyl.

5. The compound of claim 4, wherein R^2 is halogen and each R^3 is independently halogen or cyano.

6. The compound of Claim 1 selected from the group consisting of
3,3,3-trifluoropropyl 2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
3,3,3-trifluoro-1-methylpropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
propyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
4,4,4-trifluorobutyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
2-propen-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
3-buten-1-yl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
2,2,3,3,3-pentafluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate;
3,3,3-trifluoropropyl 2-bromo-6-[(5-chloro-2-pyrimidinyl)oxy]benzoate; and
1-[2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]phenyl]-4,4,4-trifluoro-1-butanone.

7. The compound that is 1-[2-chloro-6-[(5-chloro-2-pyrimidinyl)oxy]phenyl]-4,4,4-trifluoro-1-butanone.

8. A herbicidal composition comprising a compound of any one of Claims 1 to 7 and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

9. A herbicidal composition comprising a compound of any one of Claims 1 to 7 or methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate, at least one additional active ingredient selected from the group consisting of other herbicides and herbicide safeners, and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

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10. A herbicidal composition comprising (a) a compound of any one of Claims 1 to 7 or methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate, and (b) at least one additional active ingredient selected from the group consisting of (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b6) photosystem I electron diverters, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b8) glutamine synthetase (GS) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors, (b10) auxin transport inhibitors, (b11) phytoene desaturase (PDS) inhibitors, (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors, (b13) homogentisate solanesyltransferase (HST) inhibitors, (b14) cellulose biosynthesis inhibitors, (b15) other herbicides selected from the group consisting of mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, hydantocidin, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, (b16) herbicide safeners, and salts of compounds of (b1) through (b16).

11. A herbicidal composition comprising (a) a compound of any one of Claims 1 to 7 or methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate, and (b) at least one additional active ingredient selected from the group consisting of (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors and (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors.

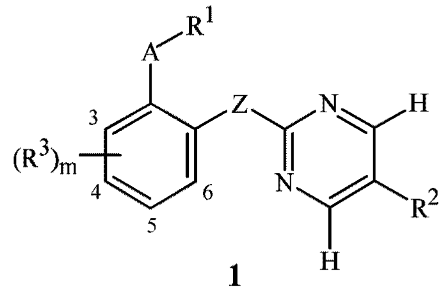
12. A herbicidal composition comprising (a) a compound of any one of Claims 1 to 7 or methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate, and (b) at least one additional active ingredient selected from the group consisting of 2,4-D, acetochlor, alachlor, atrazine, bromoxynil, bentazon, bicyclopyrone, carfentrazone-ethyl, cloransulam-methyl, dicamba, dimethenamid-p, florasulam, flufenacet, flumioxazin, flupyrsulfuron-methyl, fluroxypyr-meptyl, glyphosate, halauxifen-methyl, isoxaflutole, MCPA, mesotrione, metolachlor, metsulfuron-methyl, nicosulfuron, pyrasulfotole, pyroxasulfone, pyroxsulam, rimsulfuron, saflufenacil, tembotrione, thifensulfuron-methyl, topramazone and tribenuron.

13. A method for controlling the growth of undesired vegetation comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of any one of Claims 1 to 7 or methyl 5-nitro-2-[(5-bromo-2-pyrimidinyl)oxy]benzoate.

Date Reçue/Date Received 2023-07-12

14. The method according to Claim 13, wherein the undesired vegetation is growing in a crop of genetically modified plants that exhibit traits of glyphosate tolerance, glufosinate tolerance, ALS herbicide tolerance, dicamba tolerance, imidazolinone herbicide tolerance, 2,4-D tolerance, HPPD tolerance and mesotrione tolerance.

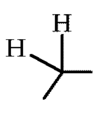
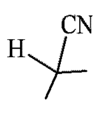
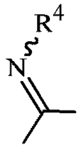
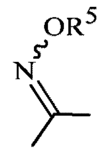
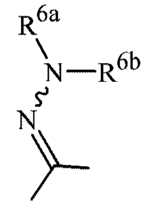
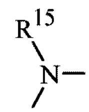
15. A compound selected from the group consisting of Formula **1**, *N*-oxides and salts thereof,



1

wherein

A is;

 ,  ,  ,  ,  or 

A-1 A-2 A-4 A-5 A-6 A-7

R^1 is C_1–C_6 haloalkyl;

Z is O or S;

R^2 is halogen, cyano, nitro, C_1–C_6 alkoxy, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_3–C_6 cycloalkyl or $-SO_nR^{10}$;

each R^3 is independently halogen, cyano, CHO, $C(=O)NH_2$, $C(=S)NH_2$, SO_2NH_2, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_3–C_7 cycloalkylcarbonyl, C_2–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy, C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_4–C_8 cycloalkylalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 alkoxyalkoxy, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl,

C_2–C_6 cyanoalkoxy, C_2–C_4 alkylthioalkyl, -C(=O)N(R^{11a})(R^{11b}), -C(=NOR^{12})H, -C(=N(R^{13}))H or -SO_nR^{14};

m is 0, 1, 2 or 3;

each n is independently 0, 1 or 2;

R^4 is H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_4–C_8 cycloalkylalkyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 alkoxyhaloalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_1–C_6 hydroxyalkyl, C_1–C_6 nitroalkyl, C_2–C_6 alkylthioalkyl, C_2–C_6 haloalkylthioalkyl or benzyl;

each R^{6a} and R^{6b} is independently H, C_1–C_6 alkyl or C_1–C_6 haloalkyl;

R^{10} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino;

each R^{11a} is independently C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{11b} is independently H, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^{12} is independently H or C_1–C_4 alkyl;

each R^{13} is independently H, amino, C_1–C_4 alkyl or C_1–C_4 alkylamino;

each R^{14} is independently C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_1–C_6 alkylamino or C_2–C_{10} dialkylamino; and

R^{15} is H or C_1–C_6 alkyl.

16. The compound of Claim 15 wherein

A is A-1, A-2, or A-5;

R^2 is halogen, C_1–C_4 alkyl or C_1–C_4 haloalkyl;

each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_4–C_8 alkylcycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_2–C_4 alkoxy, C_3–C_4 alkenyloxy, C_3–C_4 alkynyloxy, C_1–C_4 haloalkoxy,
C_3–C_6 cycloalkoxy, C_3–C_6 halocycloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_4 alkylcarbonyloxy, C_2–C_6 cyanoalkyl,
-C(=O)N($R^{11a}R^{11b}$), -C(=NOR^{12})H or -SO_nR^{14};

R^5 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_1–C_6 haloalkyl, C_2–C_6 haloalkenyl, C_2–C_6 haloalkynyl, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl, C_3–C_7 cyanoalkoxyalkyl, C_2–C_6 alkylthioalkyl or C_2–C_6 haloalkylthioalkyl;

R^{11a} is C_1–C_2 alkyl or C_1–C_2 haloalkyl;
R^{11b} is C_1–C_2 alkyl or C_1–C_2 haloalkyl;
R^{12} is H or C_1–C_3 alkyl; and
R^{14} is C_1–C_3 alkyl or C_1–C_3 haloalkyl.

17. The compound of Claim 16 wherein
R^2 is halogen or C_1–C_4 alkyl;
each R^3 is independently halogen, cyano, CHO, C_1–C_4 alkyl, C_2–C_4 alkenyl, C_2–C_4 alkynyl, C_1–C_4 haloalkyl, C_2–C_4 haloalkenyl, C_2–C_4 haloalkynyl, C_3–C_6 cycloalkyl, C_3–C_6 halocycloalkyl, C_2–C_6 alkylcarbonyl, C_2–C_6 haloalkylcarbonyl, C_2–C_6 alkoxycarbonyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_6 alkoxyalkyl, C_2–C_6 haloalkoxyalkyl, C_2–C_6 cyanoalkyl or $-SO_nR^{14}$;
R^5 is C_1–C_6 alkyl or C_1–C_6 haloalkyl;
each R^{14} is independently C_1–C_3 alkyl; and
m is 0, 1 or 2.

18. The compound of Claim 17 wherein
A is A-1 or A-2;
R^2 is halogen or CH_3; and
each R^3 is independently halogen, cyano, C_1–C_4 alkyl or C_1–C_4 haloalkyl.

19. The compound of Claim 18 wherein
A is A-1;
Z is O;
R^2 is halogen;
each R^3 is independently halogen, cyano, C_1–C_3 alkyl or C_1–C_3 haloalkyl; and
m is 1 or 2.

20. The compound of Claim 19 wherein each R^3 is independently halogen or cyano.

21. The compound of Claim 18 wherein
A is A-2;
Z is O;
R^2 is F, Cl or Br;
each R^3 is independently halogen, cyano, C_1–C_2 alkyl or C_1–C_2 haloalkyl; and
m is 0 or 1.

22. A compound selected from the group consisting of a compound of Formula 1 as defined in Claim 15 wherein:

A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-CN;
A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-CN;
A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-Br;
A is A-1, R^1 is $(CH_2)_4CF_3$, R^2 is Cl and R^3 is 3-Br;
A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-Cl;
A is A-1, R^1 is $(CH_2)_4CF_3$, R^2 is Cl and R^3 is 3-Cl;
A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-Cl; and
A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-Br.

23. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-CN.

24. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-CN.

25. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-Br.

26. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_4CF_3$, R^2 is Cl and R^3 is 3-Br.

27. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_2CF_3$, R^2 is Cl and R^3 is 3-Cl.

28. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_4CF_3$, R^2 is Cl and R^3 is 3-Cl.

29. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-Cl.

30. The compound of claim 22, wherein A is A-1, R^1 is $(CH_2)_3CF_3$, R^2 is Cl and R^3 is 3-Br.

31. A herbicidal composition comprising a compound of any one of Claims 15 to 30 and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

32. A herbicidal composition comprising a compound of any one of Claims 15 to 30, at least one additional active ingredient selected from the group consisting of other herbicides and herbicide safeners, and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

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33. A herbicidal composition comprising (a) a compound of any one of Claims 15 to 30, and (b) at least one additional active ingredient selected from the group consisting of (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b6) photosystem I electron diverters, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b8) glutamine synthetase (GS) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors, (b10) auxin transport inhibitors, (b11) phytoene desaturase (PDS) inhibitors, (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors, (b13) homogentisate solanesyltransferase (HST) inhibitors, (b14) cellulose biosynthesis inhibitors, (b15) other herbicides selected from the group consisting of mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, hydantocidin, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, (b16) herbicide safeners, and salts of compounds of (b1) through (b16).

34. A herbicidal composition comprising (a) a compound of any one of Claims 15 to 30, and (b) at least one additional active ingredient selected from the group consisting of (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors and (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors.

35. A herbicidal composition comprising (a) a compound of any one of Claims 15 to 30, and (b) at least one additional active ingredient selected from the group consisting of 2,4-D, acetochlor, alachlor, atrazine, bromoxynil, bentazon, bicyclopyrone, carfentrazone-ethyl, cloransulam-methyl, dicamba, dimethenamid-p, florasulam, flufenacet, flumioxazin, flupyrsulfuron-methyl, fluroxypyr-meptyl, glyphosate, halauxifen-methyl, isoxaflutole, MCPA, mesotrione, metolachlor, metsulfuron-methyl, nicosulfuron, pyrasulfotole, pyroxasulfone, pyroxsulam, rimsulfuron, saflufenacil, tembotrione, thifensulfuron-methyl, topramazone and tribenuron.

36. A method for controlling the growth of undesired vegetation comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of any one of Claims 15 to 30.

37. A method for controlling the growth of undesired vegetation in crops of genetically modified plants that exhibit traits selected from the group consisting of glyphosate tolerance, glufosinate tolerance, ALS herbicide tolerance, dicamba tolerance, imidazolinone herbicide

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tolerance, 2,4-D tolerance, HPPD tolerance and mesotrione tolerance, comprising contacting the vegetation or its environment with a herbicidally effective amount of a compound of any one of Claims 15 to 30.

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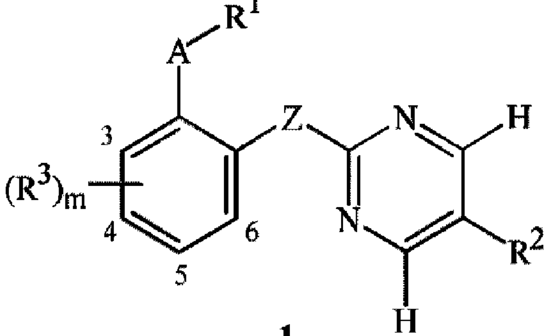

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