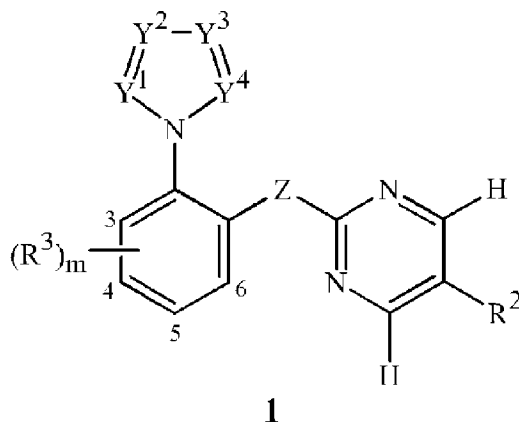




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(54) Titre : COMPOSES HERBICIDES DE PYRIMIDINYOXYBENZENE SUBSTITUES
(54) Title: HERBICIDAL SUBSTITUTED PYRIMIDINYOXY BENZENE COMPOUNDS



(57) **Abrégé/Abstract:**

Disclosed are compounds of Formula 1, including all stereoisomers, N-oxides, and salts thereof,

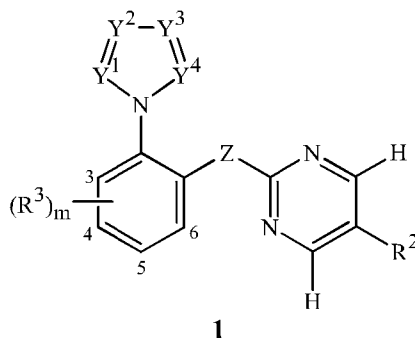
(see formula 1)

wherein each Y¹, Y², Y³, Y⁴, Z, R², m and R³ are as defined in the disclosure.

Also disclosed are compositions containing a compound 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.

HERBICIDAL SUBSTITUTED PYRIMIDINYLOXY BENZENE COMPOUNDS

Disclosed are compounds of Formula 1, including all stereoisomers, *N*-oxides, and salts thereof,



Also disclosed are compositions containing a compound of Formula 1 and methods
10 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.

TITLE

HERBICIDAL SUBSTITUTED PYRIMIDINYLOXY BENZENE COMPOUNDS

FIELD OF THE INVENTION

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

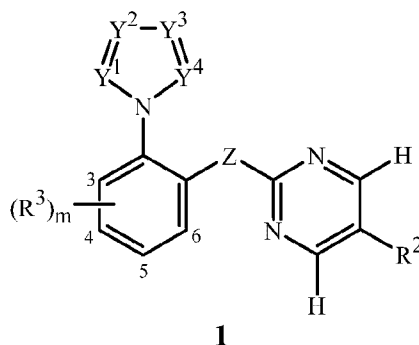
BACKGROUND OF THE INVENTION

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
 10 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
 15 compounds that are more effective, less costly, less toxic, environmentally safer or have
 different sites of action.

JP 61236766 A discloses certain carbon-linked pyrimidinyloxy benzene derivatives as
 herbicides. The substituted pyrimidinyloxy benzene compounds of the present invention are
 not disclosed in this publication.

20 SUMMARY OF THE INVENTION

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



25 wherein
 each Y¹, Y², Y³ and Y⁴ is independently N or CR¹, provided no more than 3 of Y¹,
 Y², Y³ and Y⁴ are N;
 Z is O or S;

- each R^1 is independently hydrogen, halogen, cyano, nitro, SF_5 , 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_8 alkylaminocarbonyl, C_3 - C_{10} dialkylaminocarbonyl, 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_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, SO_nR^{1A} , $Si(CH_3)_3$ or $B(-OC(R^{1B})_2C(R^{1B})_2O-)$; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{1C} ; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{1C} on carbon atom ring members and R^{1D} on nitrogen atom ring members;
- R^2 is halogen, cyano, nitro, C_1 - C_4 alkoxy, C_1 - C_4 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, SO_nR^{2A} , C_1 - C_4 haloalkyl or C_3 - C_6 cycloalkyl;
- m is 0, 1, 2 or 3;
- each R^3 is independently halogen, cyano, hydroxy, nitro, amino, 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_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_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, $Si(CH_3)_3$, $C\equiv CSi(CH_3)_3$, $C(=O)N(R^{3A})(R^{3B})$, $C(=NOR^{3C})H$, $C(=NR^{3D})H$, SO_nR^{3E} ; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F} ; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F}

on carbon atom ring members and R^{3G} on nitrogen atom ring members; or pyrimidinylloxy;

each n is independently 0, 1 or 2;

each R^{1A}, R^{2A} and R^{3E} is independently C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkylamino or C₂-C₆ dialkylamino;

each R^{1B} is independently H or C₁-C₄ alkyl;

each R^{1C} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy;

each R^{1D} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;

each R^{3A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl;

each R^{3B} is independently H, C₁-C₄ alkyl or C₁-C₄ haloalkyl;

each R^{3C} is independently H or C₁-C₄ alkyl;

each R^{3D} is independently H, amino, C₁-C₄ alkyl or C₁-C₄ alkylamino;

each R^{3F} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy; and

each R^{3G} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;

provided when i) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Cl, then R³ is other than 5-CF₃, 5-CN or 5-NO₂; ii) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Br, then R³ is other than 5-CF₃; and iii) Y¹ is N; Y² is CCH₃; Y³ is CCl; Y⁴ is CCl; and R² is Cl, then m is other than 0.

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).

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.

5 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.

10 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
15 “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.”

20 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
25 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
30 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.

As used herein, the term “alkylating agent” refers to a chemical compound in which a carbon-containing radical is bound through a carbon atom to a leaving group such as halide
35 or sulfonate, which is displaceable by bonding of a nucleophile to said carbon atom. Unless otherwise indicated, the term “alkylating” does not limit the carbon-containing radical to alkyl; the carbon-containing radicals in alkylating agents include the variety of carbon-bound substituent radicals specified for R¹ and R³.

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 CH₃OCH₂, CH₃OCH₂CH₂, CH₃CH₂OCH₂, CH₃CH₂CH₂CH₂OCH₂ and CH₃CH₂OCH₂CH₂. “Alkylthio” includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers. “Alkylthioalkoxy” denotes alkylthio substitution on alkoxy. “Cyanoalkyl” denotes an alkyl group substituted with one cyano group. “Examples of “cyanoalkyl” include NCCH₂, NCCH₂CH₂ and CH₃CH(CN)CH₂. “Cyanoalkoxy” denotes an alkoxy group substituted with one cyano group.

“Cycloalkyl” includes, for example, cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. 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 F₃C, ClCH₂, CF₃CH₂ and CF₃CCl₂. The term “haloalkoxy” is defined analogously to the term “haloalkyl”. Examples of “haloalkoxy” include CF₃O-, CCl₃CH₂O-, HCF₂CH₂CH₂O- and CF₃CH₂O-. “Alkylcarbonyl” denotes a straight-chain or branched alkyl moieties bonded to a C(=O) moiety. Examples of “alkylcarbonyl” include CH₃C(=O)-, CH₃CH₂CH₂C(=O)- and (CH₃)₂CHC(=O)-. Examples of “alkoxycarbonyl” include CH₃OC(=O)-, CH₃CH₂OC(=O)-, CH₃CH₂CH₂OC(=O)-, (CH₃)₂CHOC(=O)- and the different butoxy- or pentoxycarbonyl isomers.

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 6. For example, C₁-C₄ alkylsulfonyl designates methylsulfonyl through butylsulfonyl; C₂ alkoxyalkyl designates CH₃OCH₂-; C₃ alkoxyalkyl designates, for example, CH₃CH(OCH₃)-, CH₃OCH₂CH₂- or CH₃CH₂OCH₂-; and C₄ alkoxyalkyl designates the various isomers of an alkyl group substituted with an

alkoxy group containing a total of four carbon atoms, examples including $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCH}_2-$ and $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_2-$.

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., $(\text{R}^3)_m$, m is 0, 1, 2, 3 or 4. Further, when the subscript indicates a range, e.g. $(\text{R})_{i-j}$, 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^3B , R^3C or R^3D 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 $(\text{R}^3)_m$ 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 (e.g., $-\text{Y}^1=\text{Y}^2-\text{Y}^3=\text{Y}^4-$) is heterocyclic. The term “ring member” refers to an atom or other moiety (e.g., $\text{C}(\text{R}^1)$, N) forming the backbone of a ring or ring system.

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.

When $-\text{Y}^1=\text{Y}^2-\text{Y}^3=\text{Y}^4-$ taken together with the nitrogen atom to which both ends are attached, it is a 5-membered nitrogen-containing heterocyclic ring, it is attached to the remainder of Formula 1 only through the indicated nitrogen ring atom.

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.

Preferably the compositions of this invention have at least a 50% enantiomeric excess; more preferably at least a 75% enantiomeric excess; still more preferably at least a 90% enantiomeric excess; and the most preferably at least a 94% enantiomeric excess of the more active isomer. Of particular note are enantiomerically pure embodiments of the more active isomer.

Compounds of Formula 1 can comprise additional chiral centers. For example, substituents and other molecular constituents such as R^2 and R^3 may themselves contain chiral centers. This invention comprises racemic mixtures as well as enriched and essentially pure stereoconfigurations at these additional chiral centers.

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.

5 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

10 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,

15 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

20 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,

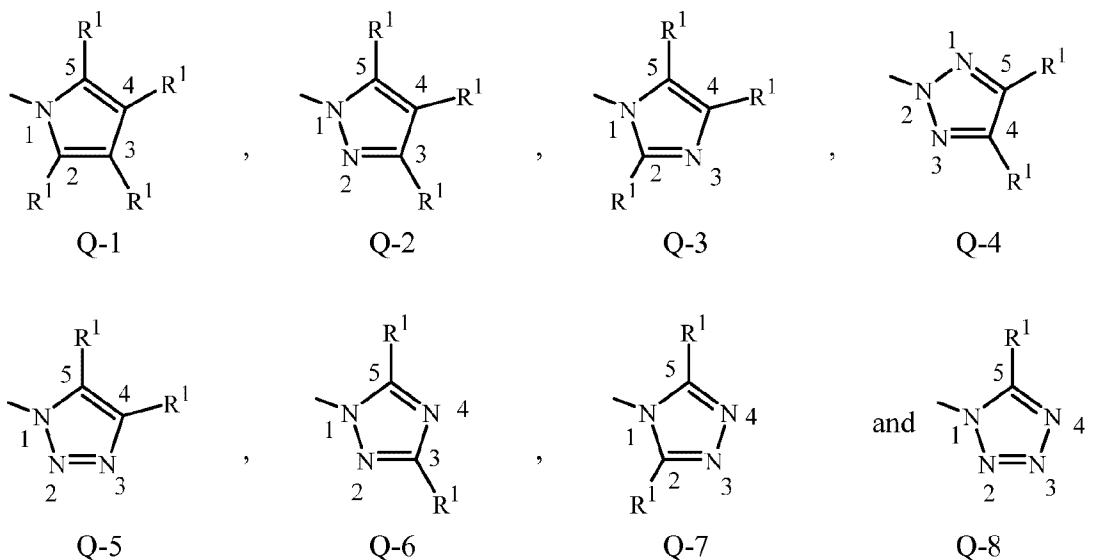
25 phosphoric, sulfuric, acetic, butyric, fumaric, lactic, maleic, malonic, oxalic, propionic, salicylic, tartaric, 4-toluenesulfonic or valeric acids. When a compound of Formula 1 contains an acidic moiety such as a carboxylic acid or phenol, salts also include those formed with organic or inorganic bases such as pyridine, triethylamine or ammonia, or amides, hydrides, hydroxides or carbonates of sodium, potassium, lithium, calcium, magnesium or

30 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 the following (where Formula 1 as used in the following Embodiments includes *N*-oxides and salts thereof) and reference to "a compound of Formula 1" includes the

35 definitions of substituents specified in the Summary of the Invention unless further defined in the Embodiments:

Embodiment 1. A compound of Formula 1 wherein $-Y^1=Y^2-Y^3=Y^4-$ including the nitrogen to which Y^1 and Y^4 are both attached is selected from



Embodiment 2. A compound of Embodiment 1 wherein $-Y^1=Y^2-Y^3=Y^4-$ including the nitrogen to which Y^1 and Y^4 are both attached is selected from Q-2, Q-3, Q-4 and Q-5.

Embodiment 3. A compound of Embodiment 2 wherein $-Y^1=Y^2-Y^3=Y^4-$ including the nitrogen to which Y^1 and Y^4 are both attached is selected from Q-2 and Q-5.

Embodiment 4. A compound of Embodiment 3 wherein $-Y^1=Y^2-Y^3=Y^4-$ including the nitrogen to which Y^1 and Y^4 are both attached is Q-2.

Embodiment 4a. A compound of Embodiment 4 wherein R^1 is hydrogen in the 3 and 5 positions and R^1 is other than hydrogen in the 4 position.

Embodiment 5. A compound of Embodiment 3 wherein $-Y^1=Y^2-Y^3=Y^4-$ including the nitrogen to which Y^1 and Y^4 are both attached is Q-5.

Embodiment 5a. A compound of Embodiment 5 wherein R^1 is hydrogen in the 5 position and R^1 is other than hydrogen in the 4 position.

Embodiment 6. A compound of Formula 1 or any one of Embodiments 1 through 5a either alone or in combination, wherein Z is O.

Embodiment 7. A compound of Formula 1 or any one of Embodiments 1 through 6 either alone or in combination, wherein each R^1 is independently hydrogen, halogen, cyano, SF_5 , 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_2 - C_6 alkylcarbonyl, C_2 - C_6 haloalkylcarbonyl, C_2 - C_6 alkoxy carbonyl, 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_2 - C_6 alkoxyalkyl, C_2 - C_6 haloalkoxyalkyl, C_2 - C_6 cyanoalkyl, C_2 - C_4 alkylthioalkyl, SO_nR^{1A} , $Si(CH_3)_3$ or $B(-OC(R^{1B})_2C(R^{1B})_2O-)$.

Embodiment 8. A compound of Embodiment 7 wherein each R¹ is independently hydrogen, halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylthioalkyl or SO_nR^{1A}.

Embodiment 9. A compound of Embodiment 8 wherein each R¹ is independently hydrogen, halogen, cyano, C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy or SO_nR^{1A}.

Embodiment 10. A compound of Embodiment 9 wherein each R¹ is independently hydrogen, halogen, C₁-C₄ alkyl, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy.

Embodiment 11. A compound of Embodiment 10 wherein each R¹ is independently hydrogen, halogen, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy.

Embodiment 11a. A compound of Embodiment 11 wherein each R¹ is independently hydrogen, halogen or C₁-C₄ haloalkyl.

Embodiment 12. A compound of Formula 1 or any one of Embodiments 1 through 11a either alone or in combination, wherein wherein R² is halogen, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

Embodiment 13. A compound of Embodiment 12 wherein R² is halogen or C₁-C₄ alkyl.

Embodiment 14. A compound of Embodiment 13 wherein R² is halogen or CH₃.

Embodiment 15. A compound of Embodiment 14 wherein R² is halogen.

Embodiment 16. A compound of Embodiment 15 wherein R² is F, Cl or Br.

Embodiment 17. A compound of Formula 1 or any one of Embodiments 1 through 16 either alone or in combination, wherein m is 0, 1 or 2.

Embodiment 18. A compound of Embodiment 17 wherein m is 0 or 1.

Embodiment 19. A compound of Embodiment 18 wherein m is 1.

Embodiment 20. A compound of Embodiment 18 wherein m is 0 (i.e. the 3-, 4-, 5- and 6-positions are unsubstituted by R³).

Embodiment 21. A compound of Formula 1 or any one of Embodiments 1 through 20 either alone or in combination, wherein each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C(=O)N(R^{3A})(R^{3B}), C(=NOR^{3C})H,

SO_nR^{3E}; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members.

Embodiment 22. A compound of Embodiment 21 wherein each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxycarbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ cyanoalkyl, SO_nR^{3E}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members.

Embodiment 23. A compound of Embodiment 22 wherein each R³ is independently halogen, cyano, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxycarbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl or C₂-C₆ haloalkoxyalkyl.

Embodiment 24. A compound of Embodiment 23 wherein each R³ is independently halogen, cyano, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

Embodiment 25. A compound of Embodiment 24 wherein each R³ is independently halogen or cyano.

Embodiment 26. A compound of Formula 1 or any one of Embodiments 1 through 25 either alone or in combination, wherein each R³ is attached to the remainder of Formula 1 at the 3-, 4- or 6-position.

Embodiment 27. A compound of Embodiment 26 wherein each R³ is attached to the remainder of Formula 1 at the 3- or 4-position.

Embodiment 28. A compound of Embodiment 27 wherein R³ is attached to the remainder of Formula 1 at the 3-position.

Embodiment 29. A compound of Formula 1 or any one of Embodiments 1 through 28 either alone or in combination, wherein each R^{1A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl.

Embodiment 30. A compound of Embodiment 29 wherein each R^{1A} is independently C₁-C₄ haloalkyl.

Embodiment 31. A compound of Formula 1 or any one of Embodiments 1 through 30 either alone or in combination, wherein each R^{3E} is independently C_1 - C_4 alkyl.

Embodiment 32. A compound of Formula 1 or any one of Embodiments 1 through 31 either alone or in combination, wherein each R^{3A} is independently C_1 - C_4 alkyl.

5 Embodiment 33. A compound of Formula 1 or any one of Embodiments 1 through 32 either alone or in combination, wherein each R^{3B} is independently H or C_1 - C_4 alkyl.

Embodiment 34. A compound of Formula 1 or any one of Embodiments 1 through 33 either alone or in combination, wherein each R^{3C} is independently H or C_1 - C_4 alkyl.

10 Embodiment 35. A compound of Formula 1 or any one of Embodiments 1 through 34 either alone or in combination, wherein each R^{3D} is independently H or C_1 - C_4 alkyl.

Embodiment 36. A compound of Formula 1 or any one of Embodiments 1 through 35 either alone or in combination, wherein each n is independently 0 or 2.

Embodiment 37. A compound of Embodiment 36 wherein n is 2.

Embodiment 38. A compound of Embodiment 36 wherein n is 0.

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

Embodiment 1P. A compound of Formula 1 (including all stereoisomers), *N*-oxides, and salts thereof, agricultural compositions containing them and their use as herbicides as described in the Summary of the Invention.

Embodiment 2P. A compound of Embodiment 1 wherein each Y^1 and Y^4 is independently N or CR^1 ; and each Y^2 and Y^3 is CR^1 ; or each Y^1 and Y^3 is independently N or CR^1 ; and each Y^2 and Y^4 is CR^1 .

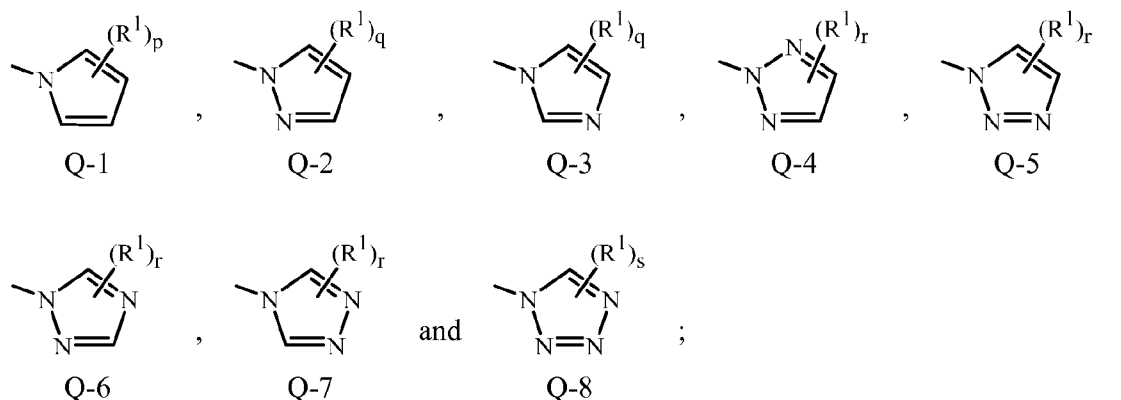
Embodiment 3P. A compound of Embodiment 2 wherein Y^1 is N or CR^1 ; and each Y^2 , Y^3 and Y^4 is CR^1 .

Embodiment 4P. A compound of Embodiment 2 wherein Y^3 is N; and each Y^1 , Y^2 and Y^4 is CR^1 .

Embodiment 5P. A compound of Embodiment 3 wherein Y^1 is N; and each Y^2 , Y^3 and Y^4 is CR^1 .

Embodiment 6P. A compound of Embodiment 5 wherein Y^1 is N; and each Y^2 and Y^4 is CH; and Y^3 is CR^1 .

35 Embodiment 7P. A compound of Embodiment 1 wherein $-Y^1=Y^2-Y^3=Y^4-$ (including the nitrogen to which Y^1 and Y^4 are both attached) is selected from



p is 0, 1, 2, 3 or 4;

q is 0, 1, 2 or 3;

r is 0, 1 or 2; and

s is 0 or 1.

5 Embodiment 8P. A compound of Embodiment 7 wherein $-Y^1=Y^2-Y^3=Y^4-$ (including the nitrogen to which Y^1 and Y^4 are both attached) is selected from Q-2, Q-3 and Q-4; q is 0, 1 or 2; and r is 0 or 1.

Embodiment 9P. A compound of Embodiment 8 wherein $-Y^1=Y^2-Y^3=Y^4-$ (including the nitrogen to which Y^1 and Y^4 are both attached) is selected from Q-2 and Q-3; and q is 1 or 2.

10 Embodiment 10P. A compound of Embodiment 9 wherein $-Y^1=Y^2-Y^3=Y^4-$ (including the nitrogen to which Y^1 and Y^4 are both attached) is Q-2.

Embodiment 11P. A compound of Embodiment 10 wherein $-Y^1=Y^2-Y^3=Y^4-$

(including the nitrogen to which Y^1 and Y^4 are both attached) is Q-2; and q is 1.

15 Embodiment 12P. A compound of any one of Embodiments 7 through 11 wherein each n is independently 0 or 2.

Embodiment 13P. A compound of Embodiment 12 wherein n is 2.

Embodiment 14P. A compound of Embodiment 12 wherein n is 0.

20 Embodiment 15P. A compound of any one of Embodiments 1 through 14 wherein Z is O.

Embodiment 16P. A compound of any one of Embodiments 1 through 15 wherein R^1 is halogen, cyano, CHO, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, C_1 - C_4 alkoxy, C_3 - C_4 alkenyloxy, C_3 - C_4 alkynyloxy, C_1 - C_4 haloalkyl, C_1 - C_4 haloalkoxy, C_2 - C_4 alkoxyalkyl, C_2 - C_4 alkylthioalkyl or SO_nR^{1A} .

25 Embodiment 17P. A compound of Embodiment 16 wherein R^1 is halogen, cyano, C_1 - C_4 alkyl, C_1 - C_4 alkoxy, C_1 - C_4 haloalkyl or SCF_3 .

Embodiment 18P. A compound of Embodiment 17 wherein R^1 is halogen, C_1 - C_4 alkyl or C_1 - C_4 haloalkyl.

Embodiment 19P. A compound of Embodiment 18 wherein R^1 is halogen or C_1 - C_4 haloalkyl.

Embodiment 20P. A compound of any one of Embodiments 1 through 19 wherein R^2 is halogen, C_1 - C_4 alkyl or C_1 - C_4 haloalkyl.

5 Embodiment 21P. A compound of Embodiment 20 wherein R^2 is halogen or C_1 - C_4 alkyl.

Embodiment 22P. A compound of Embodiment 21 wherein R^2 is halogen or CH_3 .

Embodiment 23P. A compound of Embodiment 22 wherein R^2 is halogen.

Embodiment 24P. A compound of Embodiment 23 wherein R^2 is F, Cl or Br.

10 Embodiment 25P. A compound of any one of Embodiments 1 through 24 wherein m is 0, 1 or 2.

Embodiment 26P. A compound of Embodiment 25 wherein m is 0 or 1.

Embodiment 27P. A compound of Embodiment 26 wherein m is 1.

15 Embodiment 28P. A compound of any one of Embodiments 1 through 24 wherein m is 0 (i.e. the 3-, 4-, 5- and 6-positions are unsubstituted by R^3).

Embodiment 29P. A compound of any one of Embodiments 1 through 27 wherein each R^3 is independently halogen, cyano, hydroxy, nitro, amino, CHO, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, $C(=O)N(R^{3A})(R^{3B})$, $C(=NOR^{3C})H$, $C(=N)(R^{3D})H$, C_1 - C_4 alkoxy, C_2 - C_4 cyanoalkoxy, C_2 - C_4 alkylcarbonyl, C_2 - C_4 alkoxy carbonyl, C_2 - C_4 alkylcarbonyloxy, C_2 - C_4 alkoxyalkyl, C_1 - C_4 haloalkyl, C_1 - C_4 haloalkoxy, SO_nR^{3E} or C_3 - C_6 cycloalkyl.

20 Embodiment 30P. A compound of Embodiment 29 wherein each R^3 is independently halogen, cyano, amino, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, C_1 - C_4 alkoxy, C_2 - C_4 alkoxy carbonyl, C_2 - C_4 alkylcarbonyloxy, C_2 - C_4 alkoxyalkyl or C_1 - C_4 haloalkyl.

Embodiment 31P. A compound of Embodiment 30 wherein each R^3 is independently halogen, cyano, amino or C_1 - C_4 alkyl.

Embodiment 32P. A compound of Embodiment 31 wherein each R^3 is independently cyano.

30 Embodiment 33P. A compound of any one of Embodiments 1 through 27 or 29 through 32 wherein each R^3 is attached to the remainder of Formula 1 at the 3-, 4- or 6-position.

Embodiment 34P. A compound of Embodiments 33 wherein each R^3 is attached to the remainder of Formula 1 at the 3- or 4-position.

35 Embodiment 35P. A compound of Embodiment 34 wherein R^3 is attached to the remainder of Formula 1 at the 3-position.

Embodiment 36P. A compound of any one of Embodiments 1 through 16 or 20 through 25 wherein R^{1A} is C_1 - C_4 alkyl or C_1 - C_4 haloalkyl.

Embodiment 37P. A compound of Embodiment 36 wherein R^{1A} is C_1 - C_4 haloalkyl.

Embodiment 38P. A compound of any one of Embodiments 1 through 29 or 33

through 37 wherein R^{3E} is C_1 - C_4 alkyl.

Embodiment 39P. A compound of any one of Embodiments 1 through 38 wherein R^{3A}
5 is C_1 - C_4 alkyl.

Embodiment 40P. A compound of any one of Embodiments 1 through 39 wherein R^{3B}
is H or C_1 - C_4 alkyl.

Embodiment 41P. A compound of any one of Embodiments 1 through 40 wherein R^{3C}
is H or C_1 - C_4 alkyl.

10 Embodiment 42P. A compound of any one of Embodiments 1 through 41 wherein R^{3D}
is H or C_1 - C_4 alkyl.

Embodiments of this invention, including Embodiments 1-38 and 1P-42P above as
well as any other embodiments described herein, can be combined in any manner, and the
15 descriptions of variables in the embodiments pertain not only to the a compound 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 1-38 and 1P-42P above as well as any other embodiments described herein,
and any combination thereof, pertain to the compositions and methods of the present
20 invention.

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

each Y^1 , Y^2 , Y^3 and Y^4 is independently N or CR^1 , provided no more than 3 of Y^1 ,
 Y^2 , Y^3 and Y^4 are N;

Z is O or S;

25 R^1 is halogen, cyano, CHO, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, C_1 - C_4 alkoxy,
 C_3 - C_4 alkenyloxy, C_3 - C_4 alkynyloxy, C_1 - C_4 haloalkyl, C_1 - C_4 haloalkoxy,
 C_2 - C_4 alkoxyalkyl, C_2 - C_4 alkylthioalkyl, SO_nR^{1A} , C_3 - C_6 cycloalkyl, phenyl or
pyridyl;

R^2 is halogen, cyano, nitro, C_1 - C_4 alkoxy, C_1 - C_4 alkyl, C_2 - C_6 alkenyl, C_2 - C_6 alkynyl,
30 SO_nR^{2A} or C_1 - C_4 haloalkyl;

m is 0, 1, 2 or 3;

each R^3 is independently halogen, cyano, hydroxy, nitro, amino, CHO, C_1 - C_4 alkyl,
 C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, $C(=O)N(R^{3A})(R^{3B})$, $C(=NOR^{3C})H$,
 $C(=N)(R^{3D})H$, C_1 - C_4 alkoxy, C_2 - C_4 cyanoalkoxy, C_2 - C_4 alkylcarbonyl, C_2 - C_4
35 alkoxy carbonyl, C_2 - C_4 alkylcarbonyloxy, C_2 - C_4 alkoxyalkyl, C_1 - C_4 haloalkyl,
 C_1 - C_4 haloalkoxy, SO_nR^{3E} or C_3 - C_6 cycloalkyl; or phenyl optionally substituted
with cyano, halogen or C_1 - C_4 alkyl;

each n is independently 0, 1 or 2;

each R^{1A}, R^{2A} and R^{3E} is independently C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkylamino or C₂-C₆ dialkylamino;

R^{3A} is C₁-C₄ alkyl or C₁-C₄ haloalkyl;

R^{3B} is H, C₁-C₄ alkyl or C₁-C₄ haloalkyl;

5 R^{3C} is H or C₁-C₄ alkyl; and

R^{3D} is H or C₁-C₄ alkyl

provided when i) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Cl, then R³ is other than 5-CF₃, 5-CN and 5-NO₂; ii) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Br, then R³ is other than 5-CF₃; and iii) Y¹ is N; Y² is CCH₃; Y³ is CCl; Y⁴ is CCl; and R² is Cl, then m is other than 0.

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Embodiment AA. A compound of Embodiment A or a compound of Formula 1 as described in the Summary of the Invention wherein

each Y¹, Y², Y³ and Y⁴ is independently N or CR¹, provided no more than 3 of Y¹, Y², Y³ and Y⁴ are N;

15

Z is O or S;

each R¹ is independently hydrogen, halogen, cyano, nitro, SF₅, CHO, C(=O)NH₂, C(=S)NH₂, SO₂NH₂, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₄-C₈ cycloalkylalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxycarbonyl, C₃-C₇ cycloalkylcarbonyl, C₂-C₈ alkylaminocarbonyl, C₃-C₁₀ dialkylaminocarbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₄-C₈ cycloalkylalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ alkoxyhaloalkyl, C₂-C₆ alkoxyalkoxy, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C₂-C₆ cyanoalkoxy, C₂-C₄ alkylthioalkyl, SO_nR^{1A}, Si(CH₃)₃ or B(-OC(R^{1B})₂C(R^{1B})₂O-); or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{1C}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{1C} on carbon atom ring members and R^{1D} on nitrogen atom ring members;

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R² is halogen, cyano, nitro, C₁-C₄ alkoxy, C₁-C₄ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, SO_nR^{2A}, C₁-C₄ haloalkyl or C₃-C₆ cycloalkyl;

m is 0, 1, 2 or 3;

each R³ is independently halogen, cyano, hydroxy, nitro, amino, CHO, C(=O)NH₂, C(=S)NH₂, SO₂NH₂, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄

haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₄-C₈ cycloalkylalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₃-C₇ cycloalkylcarbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₄-C₈ cycloalkylalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ alkoxyhaloalkyl, C₂-C₆ alkoxyalkoxy, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C₂-C₆ cyanoalkoxy, C₂-C₄ alkylthioalkyl, Si(CH₃)₃, C≡Si(CH₃)₃, C(=O)N(R^{3A})(R^{3B}), C(=NOR^{3C})H, C(=NR^{3D})H, SO_nR^{3E}; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; or pyrimidinyloxy;

each n is independently 0, 1 or 2;

each R^{1A}, R^{2A} and R^{3E} is independently C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkylamino or C₂-C₆ dialkylamino;

each R^{1B} is independently H or C₁-C₄ alkyl;

each R^{1C} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy;

each R^{1D} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;

each R^{3A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl;

each R^{3B} is independently H, C₁-C₄ alkyl or C₁-C₄ haloalkyl;

each R^{3C} is independently H or C₁-C₄ alkyl;

each R^{3D} is independently H, amino, C₁-C₄ alkyl or C₁-C₄ alkylamino;

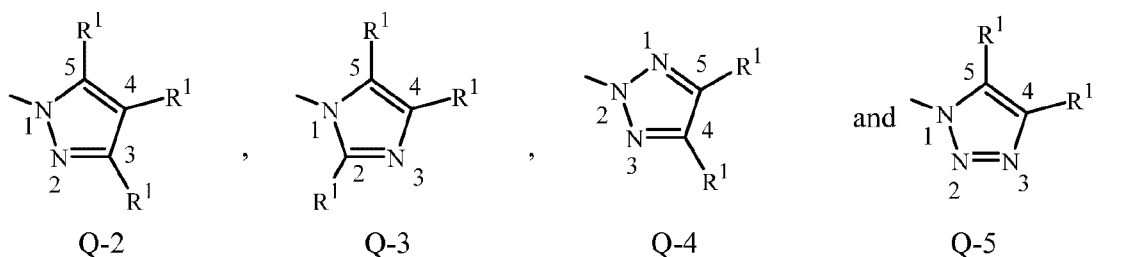
each R^{3F} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy; and

each R^{3G} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;

provided when i) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Cl, then R³ is other than 5-CF₃, 5-CN or 5-NO₂; ii) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Br, then R³ is other than 5-CF₃; and iii) Y¹ is N; Y² is CCH₃; Y³ is CCl; Y⁴ is CCl; and R² is Cl, then m is other than 0.

Embodiment A. A compound of Embodiment AA wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is selected from



Z is O;

each R¹ is independently hydrogen, halogen, cyano, SF₅, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ cyanoalkyl, C₂-C₄ alkylthioalkyl, SO_nR^{1A}, Si(CH₃)₃ or B(-OC(R^{1B})₂C(R^{1B})₂O-);

R² is halogen, C₁-C₄ alkyl or C₁-C₄ haloalkyl;

each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C(=O)N(R^{3A})(R^{3B}), C(=NOR^{3C})H, SO_nR^{3E}; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; and

m is 0, 1 or 2.

Embodiment B. A compound of Embodiment A wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is selected from Q-2 and Q-5.

each R¹ is independently hydrogen, halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₁-C₄

alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylthioalkyl or SO_nR^{1A};

R² is halogen or C₁-C₄ alkyl;

- 5 each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ cyanoalkyl, SO_nR^{3E}; or a
10 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; and

- 15 m is 0 or 1.

Embodiment C. A compound of Embodiment B wherein

each R¹ is independently hydrogen, halogen, cyano, C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy or SO_nR^{1A};

R² is halogen or CH₃;

- 20 each R³ is independently halogen, cyano, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl or C₂-C₆ haloalkoxyalkyl; and
each R^{1A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl.

- 25 Embodiment D. A compound of Embodiment C wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is Q-2;

each R¹ is independently hydrogen, halogen, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy;

and

each R³ is independently halogen, cyano, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

- 30 Embodiment E. A compound of Embodiment C wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is Q-5;

each R¹ is independently hydrogen, halogen, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy;

and

each R³ is independently halogen, cyano, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

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

5-chloro-2-[2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine
(Compound 2),

5-bromo-2-[2-(4-chloro-1*H*-pyrazol-1-yl)phenoxy]pyrimidine (Compound 5),
2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-chloropyrimidine (Compound 7),
2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-fluoropyrimidine (Compound 10),
5-bromo-2-[2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine
(Compound 18),
2-(4-bromo-1*H*-pyrazol-1-yl)-3-[(5-chloro-2-pyrimidinyl)oxy]benzonitrile
(Compound 52),
2-[2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenoxy]-5-chloropyrimidine (Compound
54),
3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-
yl]benzonitrile (Compound 58),
3-[(5-bromo-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-
yl]benzonitrile (Compound 59),
5-chloro-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]-3-
fluorophenoxy]pyrimidine (Compound 141),
5-chloro-2-[2-[4-(trifluoromethyl)-1*H*-1,2,3-triazol-1-yl]phenoxy]pyrimidine
(Compound 166),
5-chloro-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]phenoxy]pyrimidine
(Compound 147),
3-[(5-fluoro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-
yl]benzonitrile (Compound 79),
2-[2-(4-bromo-1*H*-pyrazol-1-yl)-3-fluorophenoxy]-5-chloropyrimidine
(Compound 178),
3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(2,2,2-trifluoroethoxy)-1*H*-pyrazol-1-
yl]benzonitrile (Compound 274),
5-chloro-2-[2-[4-(2,2,2-trifluoroethoxy)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine
(Compound 138),
2-[2-(4-bromo-1*H*-pyrazol-1-yl)-3-(difluoromethyl)phenoxy]-5-chloropyrimidine
(Compound 194),
3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(difluoromethyl)-1*H*-pyrazol-1-
yl]benzonitrile (Compound 253),
3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-imidazol-1-
yl]benzonitrile (Compound 252),
5-bromo-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]-3-
fluorophenoxy]pyrimidine (Compound 305) and
5-chloro-2-[3-fluoro-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine.

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

Embodiment Ap. A compound of the Summary of the Invention wherein

- each Y^1 and Y^4 is independently N or CR^1 ; and each Y^2 and Y^3 is CR^1 ; or
 5 each Y^1 and Y^3 is independently N or CR^1 ; and each Y^2 and Y^4 is CR^1 ;
 R^1 is halogen, cyano, CHO, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, C_1 - C_4 alkoxy, C_3 - C_4 alkenyloxy, C_3 - C_4 alkynyloxy, C_1 - C_4 haloalkyl, C_1 - C_4 haloalkoxy C_2 - C_4 alkoxyalkyl, C_2 - C_4 alkylthioalkyl or SO_nR^{1A} ;
 R^2 is halogen, C_1 - C_4 alkyl or C_1 - C_4 haloalkyl;
 10 m is 0, 1 or 2;
 each R^3 is independently halogen, cyano, hydroxy, nitro, amino, CHO, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, $C(=O)N(R^{3A})(R^{3B})$, $C(=NOR^{3C})H$, $C(=N)(R^{3D})H$, C_1 - C_4 alkoxy, C_2 - C_4 cyanoalkoxy, C_2 - C_4 alkylcarbonyl, C_2 - C_4 alkoxyalkyl, C_2 - C_4 alkoxyalkoxy, C_2 - C_4 alkoxyalkyl, C_1 - C_4 haloalkyl,
 15 C_1 - C_4 haloalkoxy, SO_nR^{3E} or C_3 - C_6 cycloalkyl;
 each R^3 is attached to the remainder of Formula 1 at the 3-, 4- or 6-position;
 each n is independently 0 or 2;
 R^{1A} is C_1 - C_4 alkyl or C_1 - C_4 haloalkyl;
 R^{3E} is C_1 - C_4 alkyl;
 20 R^{3A} is C_1 - C_4 alkyl;
 R^{3B} is H or C_1 - C_4 alkyl;
 R^{3C} is H or C_1 - C_4 alkyl; and
 R^{3D} is H or C_1 - C_4 alkyl.

Embodiment Bp. A compound of Embodiment A wherein

- 25 Y^1 is N or CR^1 ; and each Y^2 , Y^3 and Y^4 is CR^1 ;
 Z is O;
 R^1 is halogen, cyano, C_1 - C_4 alkyl, C_1 - C_4 alkoxy, C_1 - C_4 haloalkyl or SCF_3 ;
 R^2 is halogen or C_1 - C_4 alkyl;
 m is 0 or 1;
 30 each R^3 is independently halogen, cyano, amino, C_1 - C_4 alkyl, C_2 - C_4 alkenyl, C_2 - C_4 alkynyl, C_1 - C_4 alkoxy, C_2 - C_4 alkoxyalkyl, C_2 - C_4 alkoxyalkoxy, C_2 - C_4 alkoxyalkyl or C_1 - C_4 haloalkyl; and
 each R^3 is attached to the remainder of Formula 1 at the 3- or 4-position.

Embodiment Cp. A compound of Embodiment B wherein

- 35 Y^1 is N; and each Y^2 , Y^3 and Y^4 is CR^1 ;
 R^1 is halogen, C_1 - C_4 alkyl or C_1 - C_4 haloalkyl;
 R^2 is halogen or CH_3 ;
 m is 1;

R³ is independently halogen, cyano, amino or C₁-C₄ alkyl; and

R³ is attached to the remainder of Formula 1 at the 3-position.

Embodiment Dp. A compound of Embodiment B wherein

Y¹ is N; and each Y² and Y⁴ is CH; and Y³ is CR¹;

5 R¹ is halogen or C₁-C₄ haloalkyl;

R² is halogen; and

m is 0.

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

- 10 5-chloro-2-[2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine Compound 2);
- 5-bromo-2-[2-(4-chloro-1*H*-pyrazol-1-yl)phenoxy]pyrimidine (Compound 5);
- 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-chloropyrimidine Compound 7);
- 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-fluoropyrimidine (Compound 10);
- 15 5-bromo-2-[2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine (Compound 18);
- 2-(4-bromo-1*H*-pyrazol-1-yl)-3-[(5-chloro-2-pyrimidinyl)oxy]benzonitrile (Compound 52);
- 2-[2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenoxy]-5-chloropyrimidine (Compound 54);
- 20 3[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile (Compound 58); and
- 3-[(5-bromo-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile (Compound 59).

25 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 grass and broadleaf weeds in crops such as wheat, barley, maize, soybean, sunflower, cotton, oilseed

30 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

35 selected from (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics and (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, 5 cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, and (b16) herbicide safeners; and salts of compounds of (b1) through (b16).

10 “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 15 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, 20 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, metabromuron, metoxuron, metribuzin, monolinuron, neburon, pentanochlor, phenmedipham, prometon, 25 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 30 and isoleucine, which are required for DNA 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, 35 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, pyriithiobac-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.

“ACCCase 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 alloxymid, butoxydim, clethodim, clodinafop, cycloxydim, cyhalofop, diclofop, fenoxaprop, fluazifop, haloxyfop, pinoxaden, profoxydim, propaquizafop, quizalofop, sethoxydim, tepraloxymid 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 (5-enol-pyruvylshikimate-3-phosphate) 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, benzfendazole, bifenox, butafenacil, carfentrazone, carfentrazone-ethyl, chlomethoxyfen, cinidon-ethyl, fluazolate, flufenpyr-ethyl, flumiclorac-pentyl, flumioxazin, fluoroglyphofen-ethyl, fluthiacet-methyl, fomesafen, halosafen, lactofen, oxadiargyl, oxadiazon, oxyfluorfen, pentoxazone, proflunazone, pyraclostrobin, pyraflufen-ethyl, saflufenacil, sulfentrazone, thidiazimin, 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) and 3-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propyn-1-yl)-2*H*-1,4-benzoxazin-6-yl]dihydro-1,5-dimethyl-6-thioxo-1,3,5-triazine-2,4(1*H*,3*H*)-dione.

“GS (glutamine synthase) 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 (very long chain fatty acid) 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 ((2*R*)-*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.

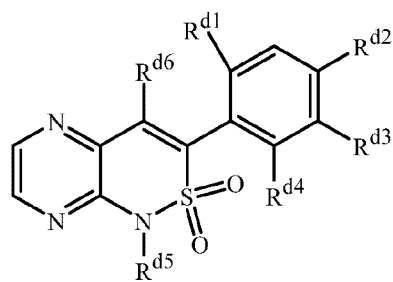
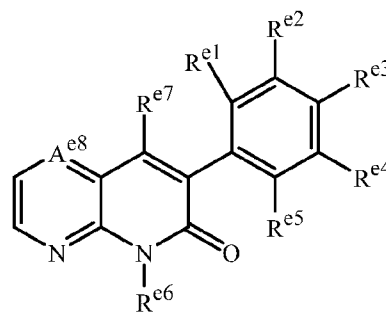
“Auxin transport inhibitors” (b10) are chemical substances that inhibit auxin transport in plants, such as by binding with an auxin-carrier protein. Examples of auxin transport inhibitors include diflufenzopyr, naptalam (also known as *N*-(1-naphthyl)phthalamic acid and 2-[(1-naphthalenylamino)carbonyl]benzoic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

“PDS (phytoene desaturase 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 (4-hydroxyphenyl-pyruvate dioxygenase) 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), fenquinotrine (2-[[8-chloro-3,4-dihydro-4-(4-methoxyphenyl)-3-oxo-2-quinoxalanyl]carbonyl]-1,3-cyclohexanedione), isoxachlortole, isoxaflutole, mesotrione, pyrasulfotol, pyrazolynate, pyrazoxyfen, sulcotrione, tefuryltrione, tembotrione, 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 (homogentisate solanesyltransferase) inhibitors (b13) disrupt a plant's ability to convert homogentisate to 2-methyl-6-solan-1,4-benzoquinone, thereby disrupting carotenoid biosynthesis. Examples of HST inhibitors include haloxydine, pyriclor, 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 CF₃; R^{d2} is H, Cl or Br; R^{d3} is H or Cl; R^{d4} is H, Cl or CF₃; R^{d5} is CH₃, CH₂CH₃ or CH₂CHF₂; and R^{d6} is OH, or -OC(=O)-*i*-Pr; and R^{e1} is H, F, Cl, CH₃ or CH₂CH₃; R^{e2} is H or CF₃; R^{e3} is H, CH₃ or CH₂CH₃; R^{e4} is H, F or Br; R^{e5} is Cl, CH₃, CF₃, OCF₃ or CH₂CH₃; R^{e6} is H, CH₃, CH₂CHF₂ 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 using a pre-application or early post-application 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, cyclopyrimorate (6-chloro-3-(2-cyclopropyl-6-methylphenoxy)-4-pyridazinyl 4-morpholinecarboxylate), 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, oxaziclonofone, pelargonic acid, pyributicarb and 5-[(2,6-difluorophenyl)methoxy]methyl]-4,5-dihydro-5-methyl-3-(3-methyl-2-thienyl)isoxazole.

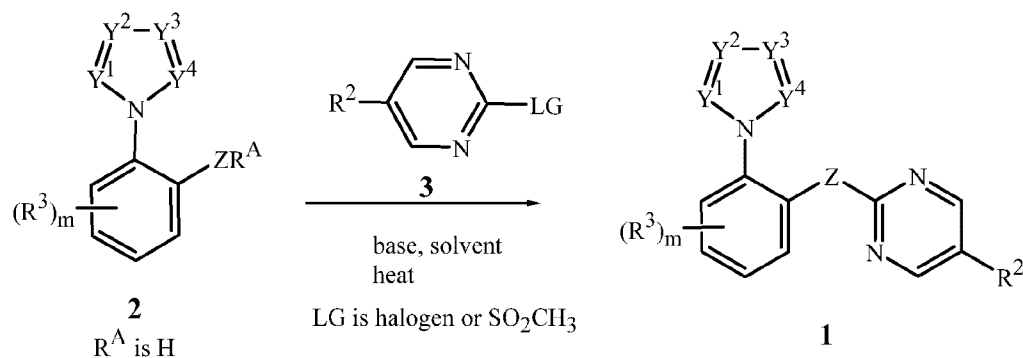
“Herbicide safeners” (b16) are substances added to a herbicide formulation to eliminate or reduce phytotoxic effects of the herbicide to certain crops. These compounds protect crops from injury by herbicides but typically do not prevent the herbicide from controlling undesired vegetation. Examples of herbicide safeners include but are not limited to benoxacor, cloquintocet-mexyl, cumyluron, cyometrinil, cyprosulfamide, daimuron,

dichlormid, dicyclonon, 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).

One or more of the following methods and variations as described in Schemes 1–14 can be used to prepare a compound of Formula 1. The definitions of Y¹, Y², Y³, Y⁴, R¹, R² and R³ in the compounds of Formulae 1–14 below are as defined above in the Summary of the Invention unless otherwise noted. Compounds of Formulae 1A through 1H, 2A through 2L, 4A and 6A are various subsets of a compound of Formulae 1, 2, 4 and 6, and all substituents for Formulae 1, 2, 4 and 6 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, (where LG is halogen or SO₂Me). The reaction is typically conducted at temperatures ranging from 50 to 110 °C.

Scheme 1

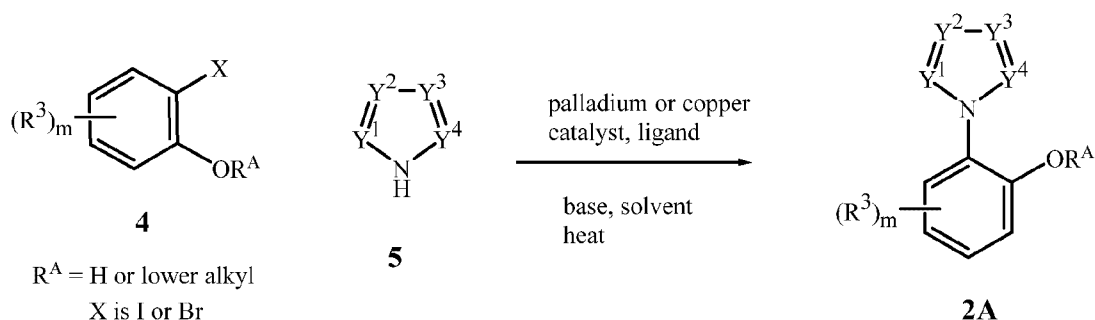


As shown in Scheme 2, a compound of Formula 2A (i.e. a compound of Formula 2 wherein Z is O; and R^A is H or lower alkyl) can be prepared using a Buchwald copper(I) catalyzed carbon-nitrogen bond forming reaction in the presence of a ligand such as ethylene diamine or cyclohexane diamine by heating a compound of Formula 4 (wherein X is I or Br) in a suitable solvent, such as toluene, 1,4-dioxanes or *N,N*-dimethylformamide in the presence of a base such as potassium carbonate, cesium carbonate or tribasic potassium phosphate, with a compound of Formula 5. The reaction is typically conducted at about 110 °C as described for copper-catalyzed carbon-nitrogen bond formation methods using diamine ligands found in Surry and Buchwald, *Chemical Science* **2010**, 1, 13–31. One skilled in the art can prepare a compound of Formula 5 by means found in *Comprehensive*

Heterocyclic Chemistry, Part II, 1996, parts 2, 3 & 4, Pergamon Press, publisher, edited by Alan. R. Katritzky & Charles W. Reese and CHC, Part I, 1984 and series of *The Chemistry of Heterocyclic Compounds*, 1981, publisher John Wiley & sons and Interscience Publishers Inc, 1953.

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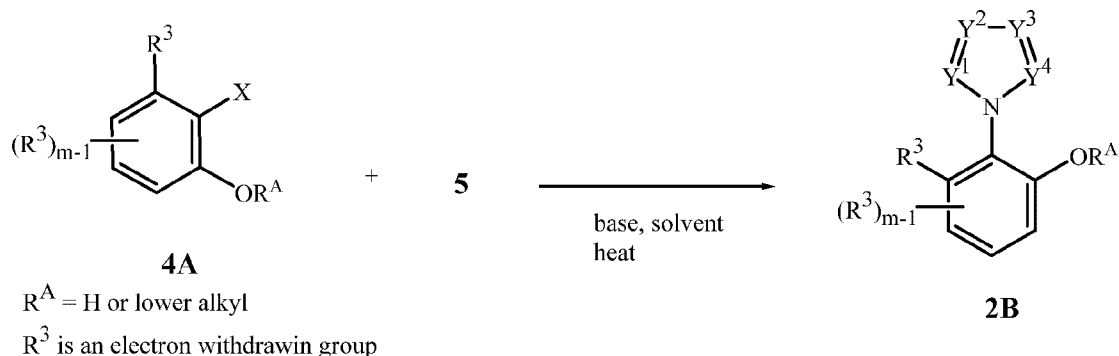
Scheme 2



Phosphine ligands can also be employed for palladium-catalyzed amination reactions to prepare a compound of Formula **2A**. A review of suitable ligands, bases, solvents, catalysts and substrates for use with NH-containing heterocycles (i.e. a compound of Formula **5**) can be found in Surry and Buchwald, *Chemical Science* **2011**, 2, 27–50 and references cited therein. In particular, conditions for pyrazoles and imidazoles with aryl or heteroaryl halides using a palladium catalyst such as $Pd_2(dba)_3$, with ligands such as 2-di-*t*-butylphosphino-2',4',6'-triisopropylbiphenyl (i.e. *t*-Bu-X-Phos) or 2-di-*t*-butylphosphino-3,4,5,6-tetramethyl-2',4',6'-triisopropylbiphenyl (i.e. Me₄-*t*-Bu-X-Phos) with bases such as $Na^+O-t-Bu$ or K_3PO_4 in solvents such as toluene or 1,4-dioxane at temperatures ranging from 60 to 105 °C are described. Alternative synthetic strategies can also be found in Sorokin, *Mini-Reviews in Organic Chemistry* **2008**, 5, 323-330; Bellina and Rossi, *Advanced Synthesis & Catalysis* **2010**, 352, 1223-1276, and Beletskaya and Cheprakov, *Organometallics* **2012**, 31, 7753-7808.

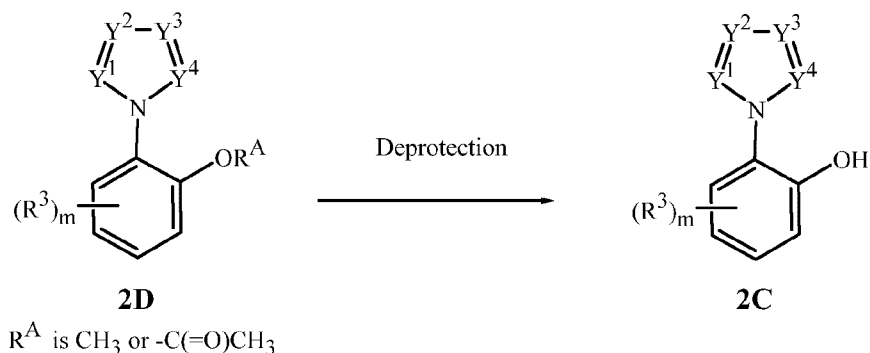
As shown in Scheme 3, a compound of Formula **2B** (i.e. a compound of Formula **2** wherein Z is O; and R^A is H or lower alkyl) can also be prepared by direct nucleophilic displacement by heating a compound of Formula **4A**, (i.e. a compound of Formula **4** wherein X is F or Cl; and R^3 is an electron withdrawing group) in a suitable solvent such as *N,N*-dimethylformamide, *N,N*-dimethylacetamide or *N*-methylpyrrolidinone and in the presence of a base such as potassium or cesium carbonate with a compound of Formula **5**. The reaction is typically conducted at temperatures ranging from 120 to 160 °C but the transformation can be accomplished at higher or lower temperatures depending on the nature of the R^3 substituents.

Scheme 3



As shown in Scheme 4, a compound of Formula **2C** (i.e. a compound of Formula **2** where Z is O) can be prepared by deprotection of a compound of Formula **2D** (i.e. a compound of Formula **2A** wherein Z is O ; and R^A is CH_3 or $-C(=O)CH_3$) with a suitable deprotecting agent. Suitable methoxy (i.e. when R^A 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^A 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 Biswanath Das, *Tetrahedron* **2003**, 59, 1049–1054 and methods cited therein. Alternatively, a compound of Formula **2D** can be combined with Amberlyst 15© in methanol (as discussed in Biswanath Das, *Tet. Lett.* **2003**, 44, 5465–5468) or combined with sodium acetate in ethanol (as discussed in T. Narender, et al. *Synthetic Communications* **2009**, 39(11), 1949–1956. Other useful phenolic protecting groups suitable for use in preparing a compound of Formula **2C** can be found in Greene, T. W.; Wuts, P. G. M. *Protective Groups in Organic Synthesis*, 4th ed.; Wiley: Hoboken, New Jersey, 1991).

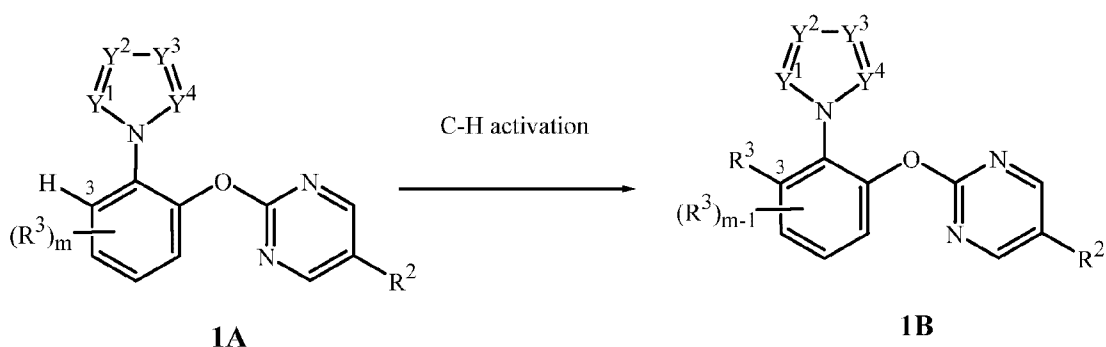
Scheme 4



As shown in Scheme 5, a compound of Formula **1B**, (i.e. a compound of Formula **1** where Z is O ; and m is 1 at the 3-position) can be prepared by “C-H activation” of a compound of Formula **1A** (a compound of Formula **1** wherein Z is O ; and m is 0). For

example, palladium(II) acetate along with either an *N*-halosuccinimide, $\text{PhI}(\text{OAc})_2$, *N*-fluoropyridinium tetrafluoroborate, or a lower alkyl boronic acid can be used to introduce the R^3 variable as I, Br, Cl, -OAc, F, and lower alkyl substituents respectively. These methods are detailed in reviews of selective activation of C-H bonds in *Chemical Reviews* **2010**, *110*, 575-1211 and references cited therein. Methods for “C-H activation” can also be found in Wencel-Delord et al., *Nature Chemistry* **2013**, *5*, 369-375 and a series of reviews of “C-H activation” in *Accounts of Chemical Research* **2012**, *45*, 777-958 and references cited therein.

Scheme 5

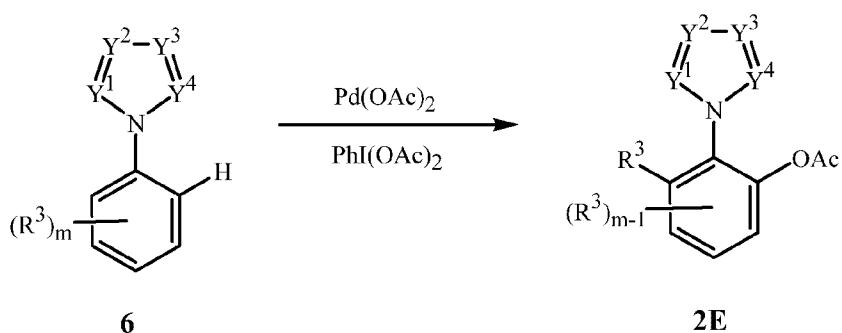


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Chemistry based on “C-H activation” can also be used to prepare a compound of Formulae **2E** (i.e. a compound of Formula **2** wherein Z is O; R^A is -C(O)CH₃; and m is 1 at the 3-position) as shown in Scheme 6 utilizing palladium(II) acetate and (diacetoxyiodo)benzene as described above for Scheme 5. A compound of Formula **2E** can subsequently be converted via methods disclosed in Schemes 1 and 4 to provide a compound of Formula **1**.

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Scheme 6

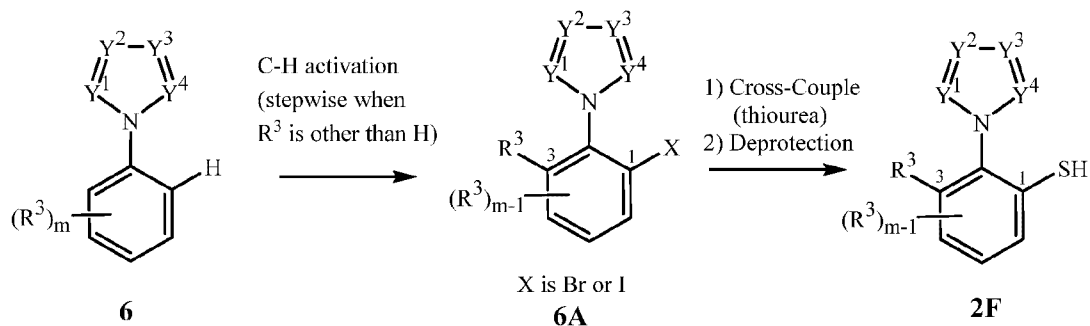


Similarly, chemistry based on “C-H activation” can be used to prepare a compound of Formulae **2F** (i.e. a compound of Formula **2A** wherein Z is S) as shown in Scheme 7. A compound of Formula **6** can first be converted to a compound of Formula **6A** (i.e. a compound of Formula **6** wherein the *ortho* “H” is X; and X is Br or I) by utilizing a stepwise introduction of substituents using “C-H activation”. Iodides and bromides of Formula **6A**

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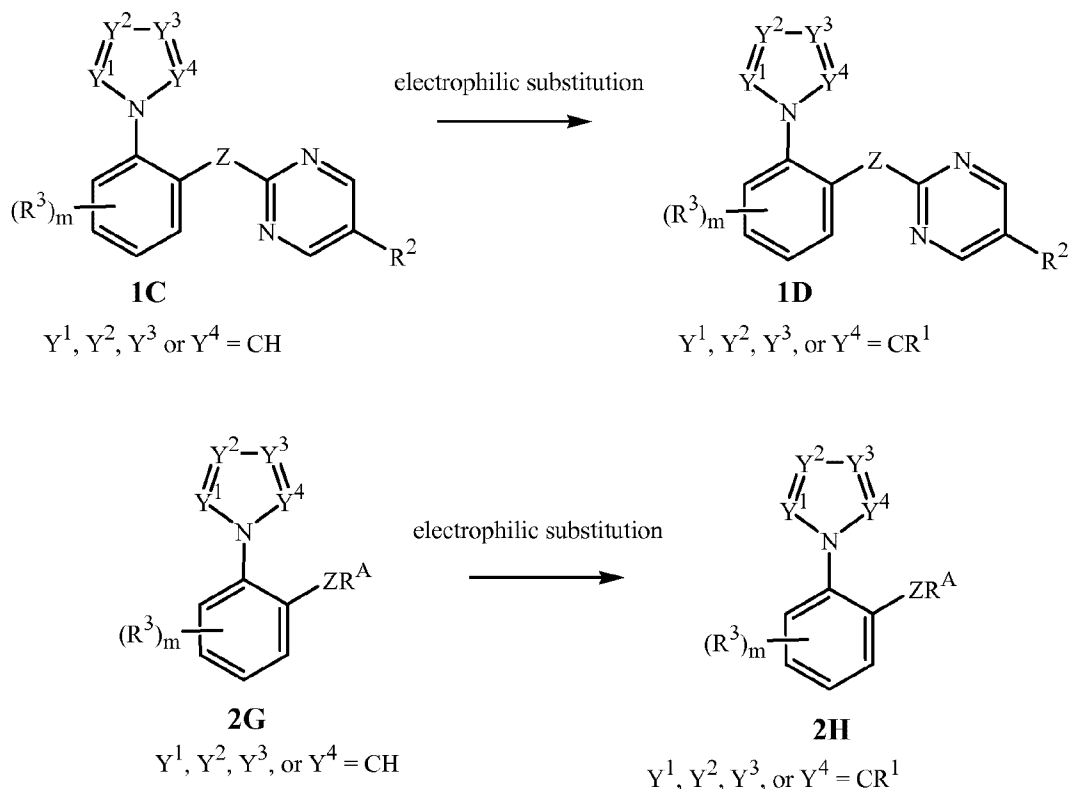
can then be further functionalized by copper mediated cross-coupling with thiourea as described in Qi, Junsheng, *Chin. J. Chem.* **2010**, 28, 1441–1443 to provide the aryl thiol after acidic deprotection. Palladium catalyzed cross-coupling reactions of aryl halides can give protected thiols that can, in turn, be deprotected under either acidic conditions or basic conditions (e.g. cesium fluoride) to provide a compound of Formula **2F**. These conditions are discussed in Organ, Michael G., *Angew. Chem. Int. Ed.* **2012**, 51, 3314–3322 and the references cited therein. Also, relevant conditions can be found in Takashiro Itoh, *J. Org. Chem.* **2006**, 71, 2203–2206. A compound of Formula **2F** can then be converted via methods disclosed in Schemes 1 and 4 to provide a compound of Formula **1**. Compounds of Formula **6** are commercially available or can be synthesized by methods described in *Heterocycles* **2007**, 71, 1467-1502 and the references within. See also Lamberth, *Org. Prep. Proced. Internat.* **2002**, 34, 98-102.

Scheme 7



As shown in Scheme 8, functionalization of the $-Y^1=Y^2-Y^3=Y^4-$ moiety (i.e the 5-membered heterocycle connected to the remainder of Formula **1** through a nitrogen atom) may also be accomplished by means of electrophilic substitution when any one (or all) of Y^1 , Y^2 , Y^3 and Y^4 is CH, to prepare a compound of Formula **1D** (i.e. a compound of Formula **1** wherein Z is O; and any one (or all) of R^1 is other than H). Similarly, a compound of Formula **2H** (a compound of Formula **2A** wherein Z is O; and R^A is CH_3 or $-(\text{C}=\text{O})\text{CH}_3$). Reagents capable of electrophilic substitution such as *N*-halosuccinimides, sulfonyl halides and elemental halogens can be used in compatible solvents such as *N,N*-dimethylformamide or acetonitrile at temperatures from 20 to 120 °C to introduce substituents at reactive positions of the $-Y^1=Y^2-Y^3=Y^4-$ moiety.

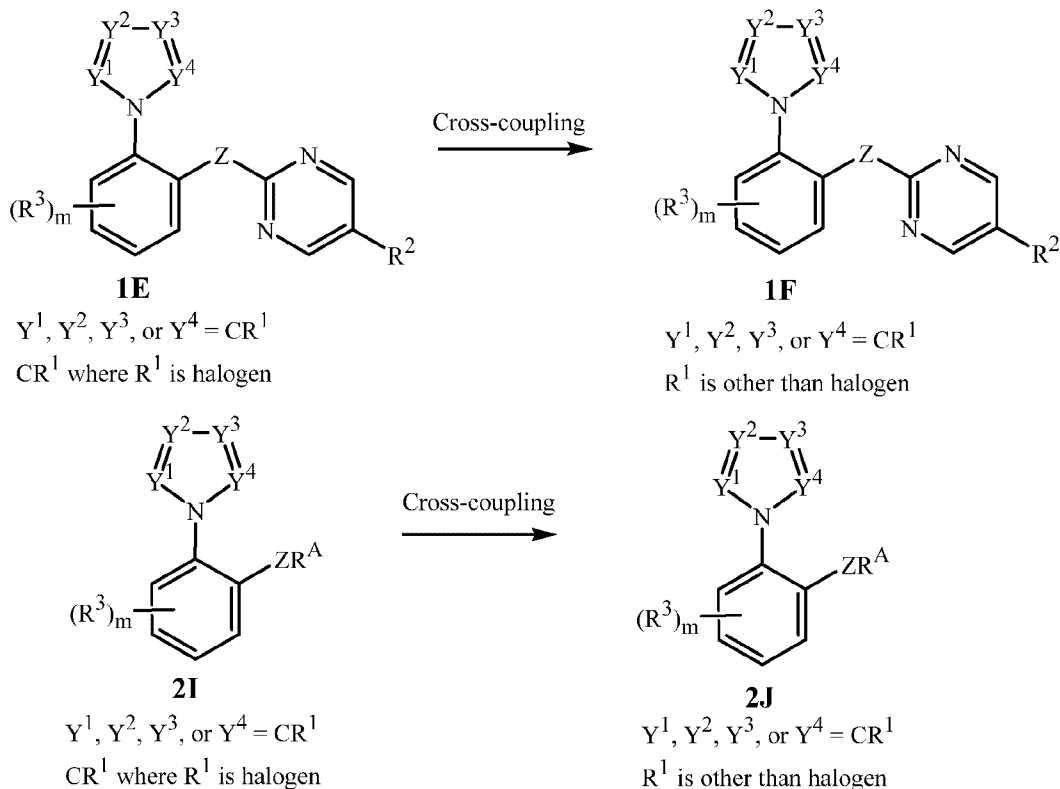
Scheme 8



As shown in Scheme 9, functionalization of the $-Y^1=Y^2-Y^3=Y^4-$ moiety (i.e. the 5-membered heterocycle connected to the remainder of Formula **1** through nitrogen) may also be accomplished by means of suitable cross-coupling methods as described in V. Snieckus et al., *Angew. Chem. Int. Ed.* **2012**, 51, 5062–5086 or *Accounts of Chemical Research* **2008**, 41, 11, 1439–1564 and references cited therein. These methods involve selection of an appropriate catalyst and reagent system for converting the R^1 substituent (i.e. when any one of Y^1, Y^2, Y^3 and Y^4 is CR^1 ; and R^1 is halogen) utilizing cross-coupling methods to prepare compounds of Formula **1F** (i.e. a compound of Formula **1** wherein Z is O; and R^1 is other than halogen) or **2J** (wherein Z is O; and R^A is a suitable protecting group such as CH_3 or $-C(=O)CH_3$). Reagents capable of electrophilic substitution such as *N*-halosuccinimides, sulfonyl halides and halogens can be used in compatible solvents such as *N,N*-dimethylformamide or acetonitrile at a temperature from 20 to 120 °C to introduce substituents in reactive positions of the $-Y^1=Y^2-Y^3=Y^4-$ moiety. The CR^1 substituents on the $-Y^1=Y^2-Y^3=Y^4-$ moiety may be introduced either before or after the coupling reaction used to form the *N*-heterocyclic bond discussed in Schemes 2 and 3. For palladium-catalyzed cross coupling reactions suitable for use with these types of heterocycles see Gribble and Li Eds., *Palladium in Heterocyclic Chemistry* Volume 1, Pergamon Press, 2000, Gribble and Li, Eds., *Palladium in Heterocyclic Chemistry* Volume 2, Pergamon Press, 2007

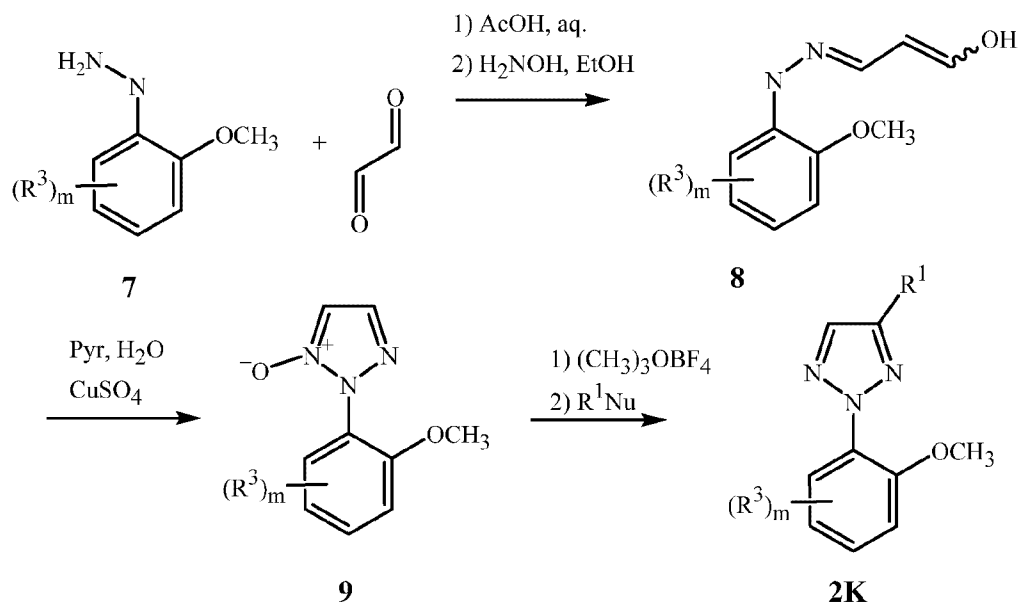
and deMeijere and Diederich Eds., *Metal-Catalyzed Cross-Coupling Reactions*, Second Edition, John Wiley and Sons, 2004.

Scheme 9



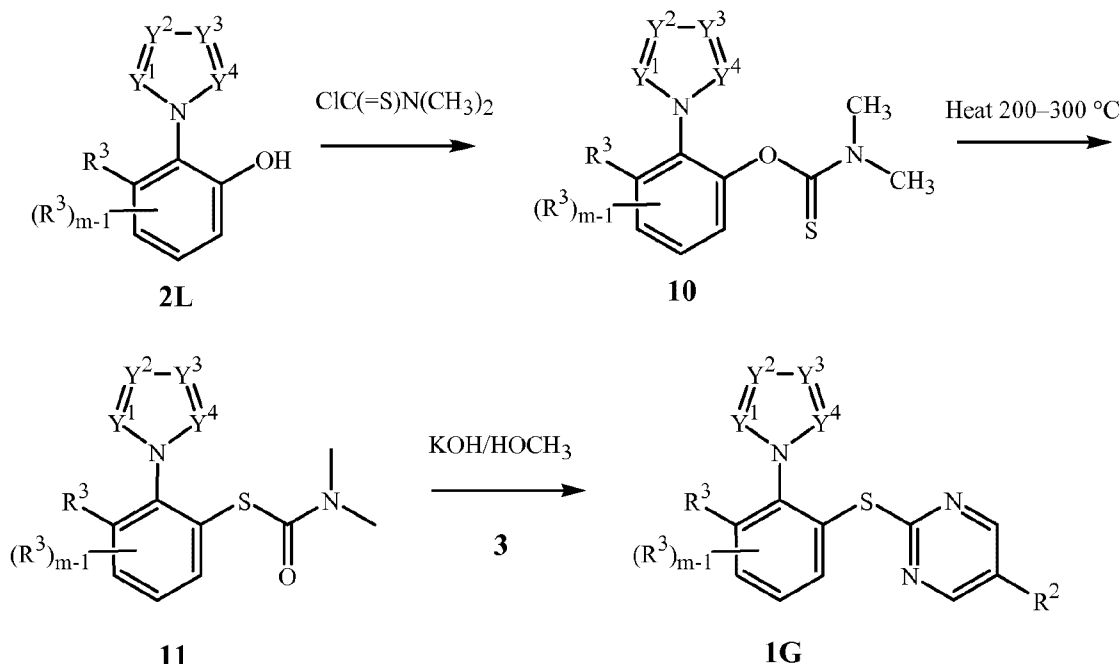
- 5 Products of Formula **2K** (a compound of Formula **2** wherein Y^1 is N, Y^2 is CR^1 , Y^3 is CR^1 and Y^4 is N) can be prepared by the methods shown in Scheme 10. Phenyl hydrazines of Formula **7** can be reacted with glyoxal in acetic acid followed by hydroxyl amine in ethanol to form arylhydrazone oxime intermediates of Formula **8**. Reaction of a compound of Formula **8** in pyridine with a copper salt such as copper sulphate provides the
- 10 2-aryltriazole-1-oxide intermediates of Formula **9**. Treatment of a compound of Formula **9** with trimethyloxonium tetrafluoroborate yields a 1-methoxy-2-phenyltriazolium salts that can react with R^1 nucleophiles (for example halides, cyanides or alkoxides) to produce a compound of Formula **2K**, (i.e. a compound of Formula **2** wherein Z is O and R^A is a suitable protecting group such as benzyl or CH_3). This route can also be used for substituted
- 15 dicarbonyl compounds or their monooximes in place of glyoxal which result in compounds of Formula **9** where R^1 can be various alkyls after reduction of the N-oxide. For specific examples of this sequence with a variety of dicarbonyl compounds and nucleophiles, see M. Begtrup in *J. Chem. Society, Perkin Trans. 1* **1981**, 503–513 and *Bull. Soc. Chim. Belg.* **1997**, 106, 717–727.

Scheme 10



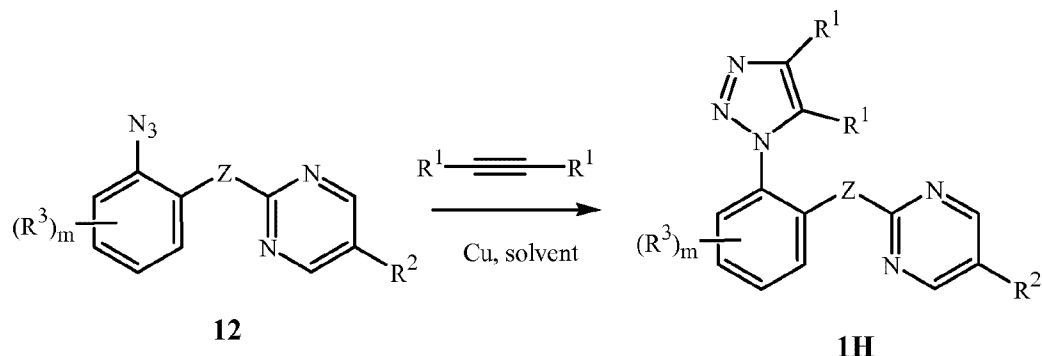
In Scheme 11, the phenol, **2L** is reacted with *N,N*-dimethyl thiocarbamoyl chloride in *N,N*-dimethylformamide in the presence of a strong tertiary amine base such as
 5 *1,4*-diazabicyclo[2.2.2]octane or *N*-methymorpholine for acidic phenols (for less-acidic phenols, prior deprotonation with sodium hydride may be advantageous) to form the *O*-aryl *N,N*-dimethylthiocarbamate of Formula **10**. Newman-Kwart rearrangement of a compound of Formula **10** at temperatures ranging from 200 to -300 °C provides the intermediate *S*-aryl dimethylthiocarbamate of Formula **11**. A one-pot deprotection of a compound of Formula
 10 **11** is readily achieved using 10% aqueous sodium hydroxide or methanolic potassium hydroxide to afford the corresponding aryl thiol. Subsequent reaction with a compound of Formula **3** at or slightly above room temperature provides the product **1G** (i.e. a compound of Formula **1** wherein Z is S. Methods for the Newman-Kwart rearrangements are found in Lloyd-Jones, Guy C., *Synthesis* **2008**, 661-689.

Scheme 11



As shown in Scheme 12 compounds of Formula **1H** (compound of Formula 1 wherein Y^1 is N, Y^2 is N, Y^3 is CR^1 and Y^4 is CR^1) can be prepared by the coupling of an alkyne with an azide of Formula **12**. This type of reaction is commonly referred to as ‘click chemistry’ and well known to those skilled in the art. A review of suitable conditions and catalysts for the coupling of alkynes with azides (i.e. a compound of Formula **12**) can be found in Meldal and Tornøe in *Chemical Reviews* **2008**, *108*, 2952-3015 and references cited therein. Suitable conditions generally include a copper catalyst with ligands such as halides and ascorbate in a variety of organic solvents such as *tert*-butanol, methanol, dimethylsulfoxide, dimethyl formamide in addition to water. The regioselectivity of this coupling can be dependent upon the nature of R^1 however this can be controlled with the choice of reaction conditions such as metalating a terminal alkyne. Also note that the two R^1 groups on the alkyne need not be identical. For an example see Krasinski, Fokin, and Sharpless in *Organic Letters*, **2004**, *6*, 1237-1240.

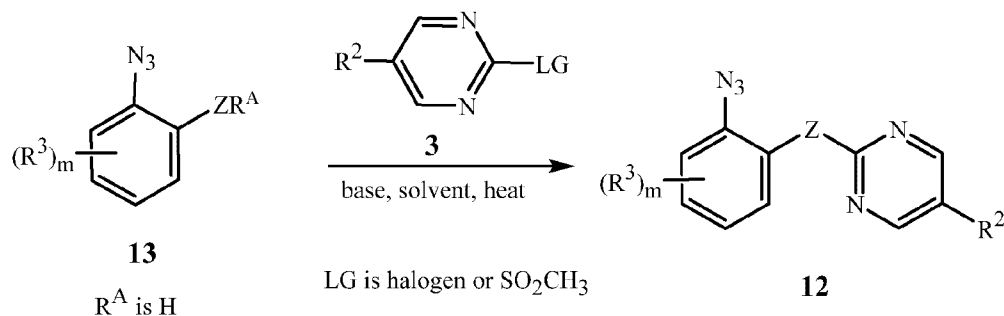
Scheme 12



As shown in Scheme 13, a compound of Formula **12** can be prepared using the same methods as described in Scheme 1.

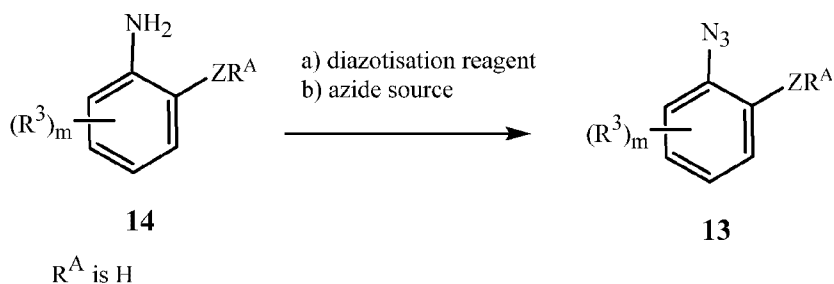
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Scheme 13



As shown in Scheme 14 compounds of Formula **13** can be prepared by diazotisation of an amine of Formula **14** followed by substitution with azide using methods well known to those skilled in the art. Descriptions of how this transformation can be achieved are described in Wu, Zhao, Lan, Cao, Liu, Jinag, and Li in *The Journal of Organic Chemistry* **2012**, 77, 4261-4270 or in Barral, Moorhouse, and Moses in *Organic Letters* **2007**, 9, 1809-1811. Examples of suitable reagents for diazotization include sodium nitrite and *tert*-butyl nitrite, and suitable examples of azide sources include sodium azide and trimethylsilyl azide.

Scheme 14



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It is recognized by one skilled in the art that various functional groups can be converted into others to provide different a compound 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 a compound 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 a compound 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 a compound 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*, 4th ed.; Wiley: Hoboken, New Jersey, 1991). One skilled in the art will recognize that, in some cases, after the introduction of a given reagent as it is depicted in any individual scheme, it may be necessary to perform additional routine synthetic steps not described in detail to complete the synthesis of a compound 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 a compound of Formula 1.

One skilled in the art will also recognize that a compound 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 Examples are, therefore, to be construed as merely illustrative, and not limiting of the disclosure in any way whatsoever. 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. ¹H NMR spectra are reported in ppm downfield from tetramethylsilane in CDCl₃; “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 “bs” means broad singlet.

SYNTHESIS EXAMPLE 1

Preparation of 5-chloro-2-[2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine
(Compound 2)

Step A: Preparation of 1-(2-methoxyphenyl)-3-(trifluoromethyl)-1*H*-pyrazole

2-Iodoanisole (1.43 g, 6.12 mmol) and 3-(trifluoromethyl)-1*H*-pyrazole (1.0 g, 7.4 mmol) were combined in 3 mL of *p*-dioxane under a nitrogen atmosphere. Powdered potassium carbonate (1.78 g, 12.9 mmol), copper(I) iodide (12 mg, 0.0612 mmol) and *trans*-1,2-diaminocyclohexane (70 mg, 0.61 mmol) were added and the resulting mixture was heated at reflux for 18 h. The reaction mixture was cooled and then diluted with de-ionized water and ethyl acetate and the layers separated. The aqueous layer was extracted with ethyl acetate (2X). The combined organic layers were washed with a saturated aqueous solution of EDTA, brine, then dried over MgSO₄, filtered and concentrated to give 2.2 g of oil. Column chromatography through 40 g silica gel using a gradient of hexanes to 11% ethyl acetate in hexanes provided 0.25 g of the title compound as an oil.

¹H NMR δ 8.05 (s, 1H), 7.72 (d, 1H), 7.38 (t, 1H), 7.05–7.12 (m, 2H), 6.67 (s, 1H), 3.89 (s, 3H).

Step B: Preparation of 2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenol

1-(2-Methoxyphenyl)-3-(trifluoromethyl)-1*H*-pyrazole (i.e. the product of Step A) (0.21 g, 0.87 mmol) was dissolved in 4.4 mL of dichloromethane under a nitrogen atmosphere. A solution of 1 M solution of boron tribromide in dichloromethane (0.96 mL, 0.96 mmol) was then added dropwise at room temperature. The resulting brown solution was stirred at room temperature for three hours. The solution was then poured into an ice and de-ionized water mixture. The mixture was diluted with dichloromethane and the aqueous layer separated. The aqueous layer was extracted with dichloromethane. The combined organic layers were washed with brine, dried over MgSO₄, filtered and concentrated to give 150 mg of the title compound as a solid.

¹H NMR δ 10.12 (bs, 1H), 8.04 (d, 1H), 7.40 (d, 1H), 7.28 (t, 1H), 7.15 (d, 1H), 6.97 (t, 1H), 6.78 (d, 1H).

Step C: Preparation of 5-chloro-2-[2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine

2-[3-(Trifluoromethyl)-1*H*-pyrazol-1-yl]phenol (i.e. the product of Step B), (70 mg, 0.31 mmol) and 2,5-dichloro-pyrimidine (50 mg, 0.337 mmol) were combined in 2 mL of acetonitrile under a nitrogen atmosphere. Powdered potassium carbonate (128 mg, 0.920 mmol) was added and the resulting mixture was heated at reflux for 18 h. The reaction was cooled and diluted with de-ionized water and ethyl acetate. The aqueous layer was separated and extracted twice with ethyl acetate. The combined organic layers were washed with

brine, dried over MgSO₄, filtered and concentrated to give 100 mg of a solid. The solid was filtered from hexanes to give 23 mg of the title compound, a compound of the invention.

¹H NMR δ 8.39 (s, 2H), 7.93 (s, 1H), 7.81 (d, 1H), 7.48 (t, 1H), 7.42 (t, 1H), 7.35 (d, 1H), 6.58 (s, 1H).

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SYNTHESIS EXAMPLE 2

Preparation of 5-chloro-2-[2-(1*H*-pyrazol-1-yl)phenoxy]pyrimidine (Compound 12)

Step A: Preparation of 2-(1*H*-pyrazol-1-yl)-phenol

2-Iodophenol (13.4 g, 60.9 mmol) and 1*H*-pyrazole (5.0 g, 74 mmol) were dissolved in 30 mL of *p*-dioxane and 30 mL of toluene under a nitrogen atmosphere. Powdered potassium carbonate (21.0 g, 152 mmol) was added and the reaction mixture was sparged with nitrogen for ten minutes. Copper(I) iodide (2.9 g, 15.22 mmol) and *trans* 1,2-diaminocyclohexane (3.66 mL, 30.4 mmol) were added sequentially, then the reaction mixture was heated at reflux for 18 h. The cooled reaction mixture was diluted with de-ionized water and ethyl acetate and saturated aqueous EDTA. The aqueous layer separated and extracted twice with ethyl acetate. The combined organic layers were washed twice with saturated aqueous EDTA solution, brine, then dried over MgSO₄, filtered and concentrated to give 13 g of a brown solid. Chromatography through 120 gram of silica eluting with 10% ethyl acetate in hexanes provided 5.08 g of the title compound as a liquid.

¹H NMR δ 10.12 (s, 1H), 8.04 (d, 1H), 7.39 (d, 1H), 7.26 (t, 1H), 7.15 (d, 1H), 6.97 (t, 1H), 6.79 (d, 1H).

Step B: Preparation of 5-chloro-2-[2-(1*H*-pyrazol-1-yl)phenoxy]pyrimidine

The title compound was prepared in the same fashion as described in Example 1, Step C, using 2-(1*H*-pyrazol-1-yl)-phenol (5.08 g, 31.7 mmol) in place of 2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]-phenol to give 7.88 g of the title compound, a compound of the invention, as a solid.

¹H NMR δ 8.37 (s, 2H), 7.90 (d, 1H), 7.82 (d, 1H), 7.58 (d, 1H), 7.43 (t, 2H), 7.32 (d, 1H), 6.31 (s, 1H).

SYNTHESIS EXAMPLE 3

Preparation of 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-chloropyrimidine (Compound 7)

Step A: Preparation of 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-chloropyrimidine

To 5-chloro-2-[2-(1*H*-pyrazol-1-yl)phenoxy]pyrimidine (i.e. the product of Example 2, Step B) (7.88 g, 28.9 mmol) dissolved in 40 mL of *N,N*-dimethylformamide under a nitrogen atmosphere was added *N*-bromosuccinimide (5.66 g, 31.8 mmol). The resulting mixture was heated at 80 °C for 18 h. The cooled reaction mixture was diluted with de-ionized water and diethyl ether and the layers separated. The aqueous layer was extracted twice with diethyl ether. The combined organic layers were washed (3X) with de-ionized

water, brine then concentrated to give 10.98 g of a solid. The solid was filtered from hexanes to give 8.92 g of the title compound, a compound of the invention.

^1H NMR δ 8.41 (s, 2H), 7.94 (s, 1H), 7.77 (d, 1H), 7.55 (s, 1H), 7.42 (m, 2H), 7.32 (d, 1H).

SYNTHESIS EXAMPLE 4

- 5 Preparation of 3-[(5-chloro-2-pyrimidinyl-oxy)]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]-benzonitrile (Compound 58)

Step A: Preparation of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile

- To a solution of 2-fluoro-3-hydroxybenzonitrile (0.92 g, 6.7 mmol) and 4-(trifluoromethyl)-1*H*-pyrazole (1.0 g, 7.3 mmol) dissolved in 14 mL of *N,N*-dimethylacetamide under a nitrogen atmosphere was added powdered potassium carbonate (2.78 g, 20.1 mmol). The resulting mixture was then heated at 153 °C for 18 h. The cooled reaction mixture was diluted with de-ionized water and ethyl acetate and the layers separated. The aqueous layer was extracted (4X) with ethyl acetate, and the combined organic layers were washed (3X) with de-ionized water followed by brine. The combined organic layers were dried over MgSO_4 , filtered and concentrated to give 1.58 g of an oil. Chromatography through 40 g of silica gel eluting with a gradient of 20 to 40% ethyl acetate in hexanes to give 1.37 g of a solid. The solid was filtered from hexanes to give 680 mg of the title compound.

^1H NMR δ 9.86 (bs, 1H), 8.64 (s, 1H), 8.07 (s, 1H), 7.40 (m, 2H), 7.37 (m, 1H).

- 20 Step B: Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile

- To a stirred mixture of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile (i.e. the product of Example 4, Step A) (0.15 g, 0.592 mmol) and 2,5-dichloropyrimidine (0.10 g, 0.65 mmol) in 1.5 mL of *N,N*-dimethylformamide under a nitrogen atmosphere was added powdered potassium carbonate (0.25 g, 1.77 mmol). The resulting mixture was heated to 100 °C for approximately 1 h. The cooled reaction mixture was diluted with de-ionized water and diethyl ether and the layers were separated. The aqueous layer was extracted twice with diethyl ether, combined and washed (3X) with de-ionized water followed by brine, then dried over sodium sulfate, filtered and concentrated to provide 0.23 g of oil which solidified on standing. The solid was filtered from hexanes and diethyl ether to yield 154 mg of the title compound, a compound of the invention.

^1H NMR δ 8.40 (s, 2H), 8.05 (s, 1H), 7.85 (s, 1H), 7.77 (d, 1H), 7.62–7.65 (m, 2H).

SYNTHESIS EXAMPLE 5

- 35 Preparation of 2-[2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenoxy]-5-chloropyrimidine (Compound 54)

Step A: Preparation of 1,2-ethanedione 1-[2-(2-methoxyphenyl)hydrazone] 2-oxime

To a stirred solution of 40% glyoxal (8.06 mL, 70.2 mmol, 1.7 eq.) in water (275 mL) was added a solution of 2-methoxyphenylhydrazine hydrochloride (7.22 g, 41.3 mmol, 1.0 eq.) in 50% acetic acid (18 mL). The reaction was stirred at 23 °C for 2 h. A brown precipitate formed and was collected by filtration. The precipitate was dissolved in ethanol (82 mL) and 50% aq. hydroxylamine (5.06 mL, 82.6 mmol, 2.0 eq.) was added to the solution. The reaction mixture was stirred at 23 °C for 2 h, then concentrated in vacuo to a volume of about 5 mL and then diluted with water. The mixture was extracted with ethyl acetate (3 X 50 mL) and the combined organic layers dried and concentrated in vacuo to afford the crude title compound (4.40 g) which was used directly in the next step without further purification.

Step B: Preparation of 2-(2-methoxyphenyl)-2H-1,2,3-triazole 1-oxide

To a stirred solution of 1,2-ethanedione 1-[2-(2-methoxyphenyl)hydrazone] 2-oxime (4.40 g, 22.8 mmol, 1.0 eq.) in pyridine (100 mL) was added a solution of CuSO₄ · 5H₂O (11.4 g, 45.5 mmol, 2.0 eq.) in water (55 mL). The reaction mixture was heated to reflux at 100 °C for 18 h. The reaction mixture was cooled to ambient temperature and acidified with concentrated hydrochloric acid until a green precipitate formed. The mixture was filtered through a plug of Celite® diatomaceous filter aid. The aqueous layer was separated and extracted with ethyl acetate (2 x 50 mL). The combined organic layers were washed with aqueous 1 N hydrochloric acid and then with brine. The organic layer was dried and concentrated in vacuo to afford the crude title compound (2.80 g) which required no further purification.

¹H NMR δ 7.74 (d, 1H), 7.55 (t, 1H), 7.46 (s, 1H), 7.43 (d, 1H), 7.15–7.06 (m, 2H), 3.85 (s, 3H).

Step C: Preparation of 4-bromo-2-(2-methoxyphenyl)-2H-1,2,3-triazole 3-oxide

2-(2-Methoxyphenyl)-2H-1,2,3-triazole 1-oxide (i.e. the product from Example 5, Step B) (0.500 g, 2.61 mmol, 1.0 eq.) dissolved in a 1:1 mixture of chloroform (5 mL) and water (5 mL) was cooled to 0 °C. Sodium carbonate (0.387 g, 3.65 mmol, 1.4 eq.) was added, followed by the addition of bromine (0.336 mL, 6.52 mmol, 2.5 eq.). The reaction mixture was stirred at 23 °C for 48 h, then quenched with saturated aqueous sodium thiosulfate and extracted with dichloromethane (3 x 10 mL). The organic layers were combined, dried and concentrated in vacuo. The crude residue was purified by chromatography on silica gel, eluting with ethyl acetate in hexanes, to afford the title compound (0.250 g).

¹H NMR δ 7.79 (s, 1H), 7.66–7.50 (m, 1H), 7.40 (dd, 1H), 7.14–7.05 (m, 2H), 3.84 (s, 3H).

Step D: Preparation of 4-bromo-2-(2-methoxyphenyl)-2*H*-1,2,3-triazole

A stirred mixture of 4-bromo-2-(2-methoxyphenyl)-2*H*-1,2,3-triazole 3-oxide (i.e. the product from Example 5, Step C) (0.250 g, 0.926 mmol, 1.0 eq.) and phosphorus trichloride (0.242 mL, 2.78 mmol, 3.0 eq.) was heated to reflux at 80 °C for 2 h, then cooled to 0 °C and diluted with dichloromethane (10 mL). Methanol (5 mL) was added dropwise, followed by the addition of water (15 mL). The aqueous layer was separated and extracted with dichloromethane (2 x 10 mL). The combined organic layers were dried and concentrated. The crude residue was purified by chromatography on silica gel, eluting with 0 to 30% ethyl acetate in hexanes, to afford the title compound (0.170 g) as a white solid.

¹H NMR δ 7.79 (s, 1H), 7.49 (d, 1H), 7.44 (t, 1H), 7.10–6.95 (m, 2H), 3.87 (s, 3H).

Step E: Preparation of 2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenol

To a solution of 4-bromo-2-(2-methoxyphenyl)-2*H*-1,2,3-triazole (i.e. the product of Example 5, Step D) (0.150 g, 0.590 mmol, 1.0 eq.) in dichloromethane at 0 °C was added a 1.0 M solution of boron tribromide in dichloromethane (2.95 mL, 2.95 mmol, 5.0 equiv).

The reaction mixture was warmed to ambient temperature and stirred for 2 h. The reaction as cooled to 0 °C and slowly quenched with a saturated aqueous solution of sodium bicarbonate (5 mL). The biphasic mixture was stirred at room temperature for 1 h. The phases were separated and the aqueous layer was extracted with dichloromethane (2 x 10 mL). The combined organic layers were dried and concentrated in vacuo. The crude residue was purified by chromatography on silica gel, eluting with 0 to 30% ethyl acetate in hexanes, to afford the title compound (0.135 g) as a white solid.

¹H NMR δ 9.98 (s, 1H), 8.05 (dd, 1H), 7.81 (s, 1H), 7.30–7.23 (m, 1H), 7.14 (dd, 1H), 7.01–6.98 (m, 1H).

Step F: Preparation of 2-[2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenoxy]-5-chloropyrimidine

To a solution of 2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenol (i.e. the product from Example 5, Step E) (0.115 g, 0.479 mmol, 1.0 eq.) in acetonitrile was added 2,5-dichloropyrimidine (71.4 mg, 0.479 mmol, 1.0 eq.) and potassium carbonate (79.4 mg, 5.75 mmol, 1.2 eq.). The reaction mixture was heated at 80 °C overnight. After cooling to room temperature, the reaction mixture was filtered through a plug of Celite® diatomaceous filter aid and rinsed with ethyl acetate. The filtrate was concentrated onto Celite® diatomaceous filter aid and purified by chromatography on silica gel, eluting with 0 to 25% ethyl acetate in hexanes, to afford the title compound (135 mg).

¹H NMR δ 8.43 (s, 2H), 7.93 (dd, 1H), 7.61 (s, 1H), 7.56–7.48 (m, 1H), 7.47–7.41 (m, 1H), 7.38 (dd, 1H).

SYNTHESIS EXAMPLE 6

Preparation of 5-chloro-2-[2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine
(Compound 80)Step A: Preparation of 1-phenyl-1*H*-pyrazole-4-carboxaldehyde

5 A solution of 1-phenylpyrazole (2.0g, 13.87 mmoles) in TFA (17mL) was stirred under a nitrogen atmosphere and treated with hexamethylene tetramine (2.92 g, 20.81 mmoles). The reaction was refluxed overnight, and then cooled and poured into saturated sodium bicarbonate aqueous solution to adjust the pH to 7. The aqueous phase was extracted three times with ethyl acetate. The combined organic phases were washed with brine, dried over
10 MgSO₄, filtered and concentrated to 2.78 g of crude oil. Flash column chromatography on silica gel with a 40 gram Isco MPLC column using 10-20% EtOAc-Hexanes gradient provided 0.72 g of the title compound.

¹H NMR δ 9.98 (s, 1H), 8.44(s, 1H), 8.17 (s, 1H), 7.70 (m, 2H), 7.5 (m,2H), 7.4 (m,1H).

Step B: Preparation of 1-phenyl-4-(difluoromethyl)-1*H*-pyrazole

15 1-Phenyl-1*H*-pyrazole-4-carboxaldehyde (i.e. the product from Example 6, Step A), (529 mg, 3.07 mmoles) was heated neat in DeoxyFluor® (1.0mL, 5.22mmoles) at 80°C under a nitrogen atmosphere overnight. The reaction mixture was cooled and then diluted with saturated sodium bicarbonate aqueous solution. The aqueous phase was extracted three times with dichloromethane. The combined organic phases were washed with brine, dried
20 over MgSO₄, filtered and concentrated to 0.86g of crude oil. Flash column chromatography on silica gel with a 12 gram Isco MPLC column using 10-20% EtOAc-Hexanes gradient provided 0.49 g of the title compound.

¹H NMR δ 8.09 (s, 1H), 7.85 (s, 1H), 7.68 (d, 2H), 7.49 (t, 2H), 7.35 (t,1H), 6.79 (t,1H).

Step C: Preparation of 2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]phenol 1-acetate

25 1-Phenyl-4-(difluoromethyl)-1*H*-pyrazole (i.e. the product from Example 6, Step B), (0.49 g, 2.52 mmoles) was stirred in 19 mL of acetic acid. The mixture was treated with iodobenzene diacetate (0.89 g, 2.78 mmoles) and palladium acetate (28 mg, 0.126 mmoles) and heated to 100°C for three hours. The mixture was cooled and concentrated from toluene to give 0.68 grams of crude oil. Flash column chromatography on silica gel with a 12 gram
30 Isco MPLC column using 20% EtOAc-Hexanes provided 0.41 g of the title compound.

¹H NMR δ 7.93 (s, 1H), 7.85 (s, 1H), 7.61 (d, 1H), 7.44 (t, 1H), 7.38 (t,1H), 7.25 (d, 1H), 6.78 (t,1H), 2.218 (s, 3H).

Step D: Preparation of 2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]phenol

35 2-[4-(Difluoromethyl)-1*H*-pyrazol-1-yl]phenol 1-acetate (i.e. the product from Example 6, Step C), (0.41g, 1.626 mmoles) was dissolved in 13 mL of methanol under a nitrogen atmosphere. The mixture was treated with 3 mL of de-ionized water and then ammonium acetate (1.0g, 13.0 mmoles). The mixture was stirred at room temperature

overnight. The mixture was concentrated under vacuum and then partitioned between water and EtOAc. The phases were separated and the aqueous phase was extracted with EtOAc. The combined organic phases were washed with brine, dried over Na₂SO₄, filtered and concentrated to give 0.3 g solid. The crude product was treated with hexanes and filtered to yield 166 mg of the title compound.

¹H NMR δ 8.18 (s, 1H), 7.87 (s, 1H), 7.36 (d, 1H), 7.23 (t, 1H), 7.13 (d, 1H), 6.96 (t, 1H), 6.82 (t, 1H).

Step E: Preparation of 5-chloro-2-[2-[4-(difluoromethyl)-1H-pyrazol-1-yl]phenoxy]-pyrimidine

The title compound was prepared in the same fashion as described in Example 1, Step C, using 2-[4-(difluoromethyl)-1H-pyrazol-1-yl]phenol (i.e. the product from Example 6, Step D), (161 mg, 0.766 mmoles) in place of 2-[3-(trifluoromethyl)-1H-pyrazol-1-yl]-phenol to give 170 mg of the title compound, a compound of the present invention, as a solid.

¹H NMR δ 8.40 (s, 2H), 8.08 (s, 1H), 7.80 (d, 1H), 7.72 (s, 1H), 7.41-7.50 (m, 2H), 7.33 (d, 1H), 6.67 (t, 1H).

SYNTHESIS EXAMPLE 7

Preparation of 3-(5-chloropyrimidin-2-yl)oxy-2-[4-(difluoromethyl)-1H-pyrazol-1-yl]benzonitrile (Compound 253)

Step A: Preparation of 5-chloro-2-[2-[4-(difluoromethyl)-1H-pyrazol-1-yl]-3-iodophenoxy]pyrimidine

5-Chloro-2-[2-[4-(difluoromethyl)-1H-pyrazol-1-yl]phenoxy]-pyrimidine (i.e. the product from Example 6, Step E), (285 mg, 0.883 mmoles) was dissolved in 6.3 mL of acetic acid. The mixture was treated with palladium acetate (10 mg, 0.044 mmoles) and N-iodosuccinimide (220 mg, 0.971 mmoles) and then heated at 100°C for four hours. The mixture was cooled and then concentrated under vacuum from toluene. The resultant mixture was partitioned in saturated NaHCO₃ aqueous solution and EtOAc. The phases were separated and the aqueous phase was extracted with EtOAc. The combined organic phases were washed with saturated aqueous NaHCO₃, brine, dried over MgSO₄, filtered and concentrated to a crude oil. Flash column chromatography on silica gel with a 12 gram Isco MPLC column using 10 to 20% EtOAc-Hexanes gradient provided 0.46 g of the title compound.

¹H NMR δ 8.39 (s, 2H), 7.89 (d, 1H), 7.71 (s, 1H), 7.64 (s, 1H), 7.27-7.33 (m, 2H), 7.69 (t, 1H).

Step B: Preparation of 3-(5-chloropyrimidin-2-yl)oxy-2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile

5-Chloro-2-[2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]-3-iodophenoxy]pyrimidine (i.e. the product from Example 7, Step A), (0.23 g, 0.513 mmol) was dissolved in 2.85 mL of N,N-dimethylacetamide. The mixture was treated with copper(I)cyanide (0.07 g, 0.770 mmol) and heated at 130 °C overnight. The mixture was cooled and then diluted with EtOAc. The mixture was filtered thru a celite pad and rinsed with EtOAc. The filtrate was washed twice with saturated EDTA aqueous solution, once with brine, dried over MgSO₄, filtered and concentrated to 0.29 g crude oil. Flash column chromatography on silica gel with a 12 gram Isco MPLC column using Hexanes to 40% EtOAc-Hexanes gradient provided 0.13 g. The solid was triturated with hexanes and some Et₂O to give 56 mg of the title compound, a compound of the present invention, as a solid.

¹H NMR δ 8.39 (s, 2H), 7.94 (s, 1H), 7.78 (s, 1H), 7.76 (d, 1H), 7.61 (m, 2H), 6.68 (t, 1H).

SYNTHESIS EXAMPLE 8

Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethylthio)-1-pyrazolyl]benzonitrile (Compound 134)

Step A: Preparation of 1-phenyl-4-(trifluoromethylthio)-1*H*-pyrazol-5-amine

1-phenyl-1*H*-pyrazol-5-amine (5.0 g, 31.41 mmol) was dissolved in 25 mL of dichloromethane under a nitrogen atmosphere. The mixture was cooled to 0°C and treated with 2 mL of pyridine. Trifluoromethylsulfenyl chloride (3 mL) was condensed into a gas addition funnel before adding over 40 minutes at a temperature ≤ 5°C. An additional 1 mL of trifluoromethylsulfenyl chloride was added. The reaction mixture was allowed to warm to ambient temperature, diluted with dichloromethane, and washed twice with saturated NaHCO₃ aqueous solution, brine, dried over MgSO₄ and concentrated to give 8 grams of solid. The crude solid was treated with hexanes and filtered to give 6.98 g of the title solid.

¹H NMR δ 7.50-7.58 (m, 5H), 7.41 (t, 1H), 4.40 (bs, 2H).

Step B: Preparation of 1-phenyl-4-(trifluoromethylthio)-1*H*-pyrazole

1-Phenyl-4-(trifluoromethylthio)-1*H*-pyrazol-5-amine (i.e. the product from Example 8, Step A), (1.0 g, 3.86 mmol) was dissolved in 19 mL of THF under a nitrogen atmosphere. The mixture was treated with isopentyl nitrite (1.036 mL, 7.71 mmol) and then heated at 68 °C overnight. The reaction mixture was cooled and concentrated to 1.7 g of liquid. The mixture was taken up in hexanes and concentrated to 1.2 g of solid. The solid was taken up in hexanes and filtered off to give 218 mg of the title compound as a solid. The filtrate was concentrated for Flash column chromatography on silica gel with a 12 gram Isco MPLC column using Hexanes to give 0.8 g of the title compound as a solid.

¹H NMR δ 8.16 (s, 1H), 7.85 (s, 1H), 7.70 (d, 2H), 7.49 (t, 2H), 7.36 (t, 1H).

Step C: Preparation of 2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenol 1-acetate

The title compound was prepared in the same fashion as described in Example 6, Step C, using 1-phenyl-4-(trifluoromethylthio)-1*H*-pyrazole (i.e. the product from Example 8, Step B) (0.21 g, 0.819 mmoles) in place of 1-phenyl-4-(difluoromethyl)-1*H*-pyrazole to give
5 0.43 g of the title compound.

¹H NMR δ 8.00 (s, 1H), 7.85 (s, 1H), 7.63 (d, 1H), 7.46 (t, 1H), 7.39 (t, 1H), 7.27 (d, 1H), 2.20 (s, 3H).

Step D: Preparation of 2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenol

The title compound was prepared in the same fashion as described in Example 6, Step
10 D, using 2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenol 1-acetate (i.e. the product from Example 8, Step C) (0.21 g, 0.819 mmoles) in place of 2-[4-(Difluoromethyl)-1*H*-pyrazol-1-yl]phenol 1-acetate to give 0.10 g of the title compound,

¹H NMR δ 8.22 (s, 1H), 7.89 (s, 1H), 7.37 (d, 1H), 7.25 (t, 1H), 7.14 (d, 1H), 6.96 (t, 1H).

Step E: Preparation of 5-chloro-2-[2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine

15

The title compound was prepared in the same fashion as described in Example 1, Step C, using 2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenol (i.e. the product from Example 8, Step D) (0.4 g, 1.537 mmoles) in place of (2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]-phenol), to give 114 mg of the title compound,

20 ¹H NMR δ 8.37 (s, 2H), 8.14 (s, 1H), 7.80 (d, 1H), 7.71 (s, 1H), 7.41-7.50 (2xt, 1H each), 7.35 (d, 1H).

Step F: Preparation of 5-chloro-2-[3-iodo-2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine

The title compound was prepared in the same fashion as described in Example 7, Step
25 A, using 5-chloro-2-[2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenoxy]-pyrimidine (i.e. the product from Example 8, Step E) (0.29 g, 0.778 mmoles) in place of 5-Chloro-2-[2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]-pyrimidine, to give 270 mg of the title compound.

¹H NMR δ 8.38 (s, 2H), 7.91 (d, 1H), 7.72 (d, 2H), 7.28-7.37 (m, 2H).

Step G: Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]benzonitrile

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The title compound was prepared in the same fashion as described in Example 7, Step B, using 5-chloro-2-[3-iodo-2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenoxy]-pyrimidine (i.e. the product from Example 8, Step F) (0.26 g, 0.521 mmoles) in place of 5-Chloro-2-[2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]-3-iodophenoxy]pyrimidine, to give 103
35 mg of the title compound, a compound of the present invention.

¹H NMR δ 8.36 (s, 2H), 8.01 (s, 1H), 7.78 (s&d, 2H), 7.63 (2x t, 2H).

SYNTHESIS EXAMPLE 9

Preparation of 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]-benzonitrile (Compound 143)

5-Chloro-2-[2-[4-(trifluoromethylthio)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine (i.e. the product from Example 8, Step E) (80 mg, 0.214 mmoles) was dissolved in acetone under a nitrogen atmosphere. The mixture was treated with water and Oxone® (0.20 g, 0.322 mmoles) and then stirred at room temperature overnight. The mixture was concentrated under vacuum and diluted with water and dichloromethane. The phases were separated and the aqueous phase was extracted twice with dichloromethane. The combined organic phases were washed 1x brine, dried over MgSO₄, and concentrated to 0.13 g crude oil. Flash column chromatography on silica gel with a 12 gram Isco MPLC column using Hexanes to 40% EtOAc-Hexanes gradient to give 50 mg of the title compound as a solid.

¹H NMR δ 8.43 (s, 1H), 8.40(s,2H), 8.01 (s, 1H), 7.82 (d, 1H), 7.53 (t, 1H), 7.46 (t, 1H), 7.37 (d, 1H).

SYNTHESIS EXAMPLE 10

Preparation of 5-chloro-2-[2-(4-cyclopropyl-1*H*-1,2,3-triazol-1-yl)phenoxy]pyrimidine (Compound 160)

Step A: Preparation of 2-azidophenol

To a solution of *tert*-butyl nitrite (4.91 mL, 41.2 mmol, 1.5 equiv) and 2-aminophenol (3.00 g, 27.5 mmol, 1.0 equiv) in acetonitrile (92 mL) at 0 °C was added azidotrimethylsilane (4.38 mL, 33.0 mmol, 1.2 equiv), dropwise. The reaction was removed from the ice bath and stirred at ambient temperature for 2 h. The reaction mixture was concentrated under vacuum onto Celite® and purified by column chromatography, eluting with 0 to 10% ethyl acetate in hexanes to afford the title product (3.55 g).

¹H NMR δ 7.11 - 7.03 (m, 2H), 6.97 - 6.90 (m, 2H), 5.35 (s, 1H).

Step B: Preparation of 5-chloro-2-(2-azidophenoxy)pyrimidine

To a solution of 2-azidophenol (i.e. the product from Example 10, Step A) (3.55 g, 26.2 mmol, 1.0 equiv) and 2,5-dichloropyrimidine (3.91 g, 26.2 mmol, 1.0 equiv) in acetonitrile (87 mL) was added powdered potassium carbonate (4.35 g, 31.4 mmol, 1.2 equiv). The reaction mixture was heated to 70 °C for 4 h. The mixture was cooled to ambient temperature and filtered through a small pad of Celite®. The filtrate was concentrated under vacuum and purified by column chromatography on silica gel, eluting with 0 to 30% ethyl acetate in hexanes to afford the title product (4.44 g).

¹H NMR δ 8.48 (s, 2H), 7.37 - 7.29 (m, 1H), 7.25 - 7.17 (m, 3H).

Step C: Preparation of 5-chloro-2-[2-(4-cyclopropyl-1*H*-1,2,3-triazol-1-yl)phenoxy]pyrimidine

To a solution of 5-chloro-2-(2-azidophenoxy)pyrimidine (i.e. the product from Example 10, Step B) (0.437 g, 1.76 mmol, 1.0 equiv) and cyclopropylacetylene (0.179 mL, 2.12 mmol, 1.2 equiv) in *tert*-butanol (3 mL) and water (3 mL) was added CuSO₄·5H₂O (43.9 mg, 0.176 mmol, 0.1 equiv) and sodium L-ascorbate (34.9 mg, 0.176 mmol, 0.1 equiv). The reaction was stirred at ambient temperature for 18 h. The reaction mixture was filtered through a small pad of Celite®. The filtrate was concentrated under vacuum and 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 (0.461 g).
¹H NMR δ 8.39 (s, 2H), 7.83 (dd, *J*=8.0, 1.7 Hz, 1H), 7.71 (s, 1H), 7.53 - 7.49 (m, 1H), 7.47 - 7.41 (m, 1H), 7.35 (dd, *J*=8.2, 1.4 Hz, 1H) 1.95 - 1.87 (m, 1H), 0.95 - 0.90 (m, 2H), 0.85 - 0.78 (m, 2H).

SYNTHESIS EXAMPLE 11

15 Preparation of 2-[3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]-1,3,4-oxadiazole (Compound 298)

Step A: Preparation of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzoic acid

A solution of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile (i.e. the product from Example 4, Step A) (1.25 g, 4.94 mmol) in mixture of acetic acid (6 mL) and concentrated sulfuric acid (6 mL) was heated at 105 °C for 35 minutes. The reaction mixture was poured into 200 g of ice and water. The slurry was saturated with sodium chloride. After stirring at room temperature for 3 hr, the solid was collected by filtration, washed with water and dried under a stream of nitrogen under vacuum to give 0.9 g of the title compound as a tan solid.

¹H NMR (DMSO-*d*₆) δ 8.5 (s, 1H), 8.02 (s, 1H), 7.41 (t, 1H), 7.26 (d, 1H), 7.22 (d, 1H).

Step B: Preparation of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzoic acid methyl ester

To a solution of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzoic acid (i.e. the product from Example 11, Step A) (670 mg, 2.45 mmol) in mixture of methanol (3 mL) and dichloromethane (3 mL) was slowly added a solution of trimethylsilyldiazomethane (2.4 mL of 2M solution in hexane). After stirring for a few minutes at room temperature, the solvent was evaporated off under a stream of nitrogen and the reaction mixture was purified by medium pressure liquid chromatography on 40g of silica gel eluted with a gradient of 0-60% ethyl acetate in hexane to give 530 mg of the title compound as a solid.

¹H NMR δ 8.20 (bs, 1H), 8.00 (s, 1H), 7.88 (s, 1H), 7.45 (d, 1H), 7.37 (t, 1H), 7.25 (d, 1H).

Step C: Preparation of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzo-hydrazide

A solution of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzoic acid methyl ester (i.e. the product from Example 11, Step B) (376 mg, 1.31 mmol) and hydrazine hydrate (1.5 ml) in ethanol (4 ml) was heated at 78 °C for 2.5 days. The reaction was diluted with 80 mL of ethyl acetate and washed with 40 mL of water. The ethyl acetate phase was filtered through a Varian Chem Elut celite tube and concentrated to a crude solid. This was triturated with dichloromethane, filtered, and collected to yield 240 mg of the title compound as a solid.

¹H NMR (DMSO-*d*₆) δ 10.4 (bs, 1H), 9.35 (s, 1H), 8.42 (s, 1H), 7.96 (s, 1H), 7.35 (t, 1H), 7.12 (d, 1H), 6.92 (d, 1H), 4.21 (bs, 2H).

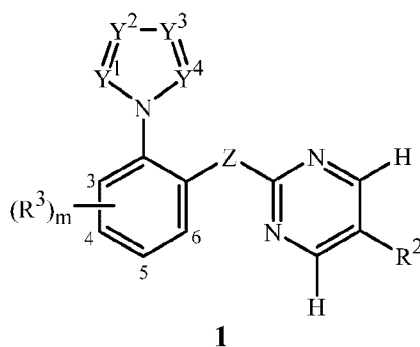
Step D: Preparation of 2-[3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenyl]-1,3,4-oxadiazole

A solution of 3-hydroxy-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzo-hydrazide (i.e. the product from Example 11, Step C) (189 mg, 0.66 mmol), toluenesulfonic acid hydrate (22 mg) in triethylorthoformate (6 mL) was heated at 120 °C for 27 hr. The solvent was evaporated off under a stream of nitrogen and the crude reaction was purified by MPLC on 12 g of silica gel eluted with a gradient of 0-80% ethyl acetate in hexane to give 104 mg of the intermediate phenol, which treated with dichloropyrimidine (166 mg) and cesium carbonate (617 mg) in acetonitrile (5 ml) at 48 °C for 18 hr. After evaporation, the crude reaction mixture was combined with an earlier batch (55 mg phenol intermediate, 80 mg dichloropyrimidine, 260 mg cesium carbonate) and purified by medium pressure liquid chromatography on 24 g silica gel eluted with 0-80% ethyl acetate in hexane to give 120 mg of the title compound, a compound of the present invention, as a solid.

¹H NMR δ 8.41 (s, 2H), 8.32 (s, 1H), 8.12 (s, 1H), 7.90 (s, 1H), 7.72 (m, 3H), 7.55 (d, 1H).

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 1584 can be prepared. The following abbreviations are used in the Tables which follow: *i* means iso, *c* means cyclo, Me means methyl, Et means ethyl, Pr means propyl, Bu means butyl, *i*-Pr means isopropyl, *c*-Pr cyclopropyl, *c*-Bu means cyclobutyl, Ph means phenyl, OCH₃ means methoxy, OEt means ethoxy, -CN means cyano, -NO₂ means nitro, S(O)Me means methylsulfinyl, and S(O)₂CH₃ means methylsulfonyl.

Table 1



$R^2 = \text{Cl}$; $Z = \text{O}$; and $R^3 = \text{H}$ ($m=0$)

Y^1, Y^2, Y^3 and Y^4

$Y^1=\text{CH}, Y^2=\text{CCF}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{CCH}_3, Y^2=\text{CH}, Y^3=\text{CCH}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CBr}, Y^3=\text{CBr}$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CCHF}_2, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CCF}_3, Y^3=\text{CCF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CCl}, Y^3=\text{CCl}$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CCH}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{CH}, Y^2=\text{CCH}_3, Y^3=\text{CCH}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{CCF}_3, Y^2=\text{CH}, Y^3=\text{CCF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CCF}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CBr}, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CF}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CCH}_3$
 $Y^1=\text{N}, Y^2=\text{CHF}_2, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CCl}, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCl}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CCH}_2\text{CH}_3$
 $Y^1=\text{N}, Y^2=\text{COCH}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{COCHF}_2, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{COCF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CCN}$
 $Y^1=\text{N}, Y^2=\text{CC}(=\text{O})\text{OCH}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CF}, Y^3=\text{CH}$ and $Y^4=\text{CF}$
 $Y^1=\text{N}, Y^2=\text{CCF}_3, Y^3=\text{CH}$ and $Y^4=\text{CCF}_3$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CPh}$
 $Y^1=\text{N}, Y^2=\text{CCF}_3, Y^3=\text{CH}$ and $Y^4=\text{CCH}_3$

Y^1, Y^2, Y^3 and Y^4

$Y^1=\text{N}, Y^2=\text{CBr}, Y^3=\text{CBr}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCHO}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCH}_2\text{CF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{C}(i\text{-Pr})$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{C}(\text{CHC}=\text{CH})$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CSCHF}_2$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CSO}_2\text{CF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCH}_2\text{SCH}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CF}, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCH}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CCF}_3$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CBr}$
 $Y^1=\text{N}, Y^2=\text{CCl}, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCH}_2\text{CH}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CCHF}_2$
 $Y^1=\text{N}, Y^2=\text{COCF}_3, Y^3=\text{CH}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCN}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{COCF}_3$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{COCHF}_2$
 $Y^1=\text{N}, Y^2=\text{CCH}_3, Y^3=\text{CH}$ and $Y^4=\text{CCH}_3$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CPh}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CH}$ and $Y^4=\text{CC}(=\text{O})\text{OCH}_3$
 $Y^1=\text{N}, Y^2=\text{CBr}, Y^3=\text{CH}$ and $Y^4=\text{CBr}$
 $Y^1=\text{N}, Y^2=\text{CCF}_3, Y^3=\text{CCF}_3$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{COCF}_2\text{CF}_2\text{H}$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{C}(n\text{-Pr})$ and $Y^4=\text{CH}$
 $Y^1=\text{N}, Y^2=\text{CH}, Y^3=\text{CCCH}$ and $Y^4=\text{CH}$

Y¹, Y², Y³ and Y⁴

Y¹=N, Y²=CH, Y³=CCHF₂ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CSCF₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CSO₂CH₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=COCH₂CHCH₂ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CCHF₂ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=Cl and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CH and Y⁴=CCl
 Y¹=N, Y²=CCN, Y³=CH and Y⁴=CH
 Y¹=N, Y²=CH, Y³=COCH₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=COCHF₂ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CH and Y⁴=COCF₃
 Y¹=N, Y²=CPh, Y³=CH and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CC(=O)OCH₃ and Y⁴=CH
 Y¹=N, Y²=CCl, Y³=CH and Y⁴=CCl
 Y¹=N, Y²=CCHF₂, Y³=CH and Y⁴=CCHF₂
 Y¹=N, Y²=CCH₃, Y³=CCH₃ and Y⁴=CH
 Y¹=N, Y²=CCl, Y³=CCl and Y⁴=CH
 Y¹=N, Y²=CCH₃, Y³=CH and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CCF₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CBr and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CH and Y⁴=CF
 Y¹=N, Y²=CCH₂CH₃, Y³=CH and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CCF₂CF₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=COCH₂CF₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=C(c-Pr) and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CCHCH₂ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=COCH₂CCH and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CSOCH₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=CCH₂OCH₃ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CF and Y⁴=CH
 Y¹=CH, Y²=N, Y³=Cl and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCHF₂ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCF₃ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CBr and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCH₂CH₃ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCH₂CF₃ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCl and Y⁴=CH

Y¹, Y², Y³ and Y⁴

Y¹=CH, Y²=N, Y³=CCH₃ and Y⁴=CH
 Y¹=CH, Y²=N, Y³=CCHO and Y⁴=CH
 Y¹=CH, Y²=N, Y³=COCH₃ and Y⁴=CH
 Y¹=N, Y²=CH, Y³=N and Y⁴=CH
 Y¹=N, Y²=CF₃, Y³=N and Y⁴=CH
 Y¹=N, Y²=CCl, Y³=N and Y⁴=CH
 Y¹=N, Y²=CBr, Y³=N and Y⁴=CBr
 Y¹=N, Y²=CCH₃, Y³=N and Y⁴=CH
 Y¹=N, Y²=CF, Y³=N and Y⁴=CH
 Y¹=N, Y²=CCl, Y³=N and Y⁴=CCl
 Y¹=N, Y²=CHF₂, Y³=N and Y⁴=CH
 Y¹=N, Y²=CBr, Y³=N and Y⁴=CH
 Y¹=N, Y²=CPh, Y³=N and Y⁴=CH
 Y¹=N, Y²=N, Y³=CH and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCF₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=Cl and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₃F and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCl and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCHF₂ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CBr and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CF and Y⁴=CH
 Y¹=N, Y²=N, Y³=CPh and Y⁴=CH
 Y¹=N, Y²=N, Y³=COCF₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=COCHF₂ and Y⁴=CH
 Y¹=N, Y²=N, Y³=COCH₂F and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₂CF₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=C(*i*-Pr) and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₂C≡CH and Y⁴=CH
 Y¹=N, Y²=N, Y³=CSCHF₂ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CSO₂CF₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₂SCH₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₂CH₃ and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCN and Y⁴=CH
 Y¹=N, Y²=N, Y³=COCH₂CN and Y⁴=CH
 Y¹=N, Y²=N, Y³=CCH₂CN and Y⁴=CH
 Y¹=N, Y²=N, Y³=C(*n*-Pr) and Y⁴=CH

Y ¹ , Y ² , Y ³ and Y ⁴	Y ¹ , Y ² , Y ³ and Y ⁴
Y ¹ =N, Y ² =N, Y ³ =CC≡CH and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(3-CF ₃ -Ph) and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =CCH=CH ₂ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(3,5-di-F-Ph) and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =CC≡CCH ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(3,5-di-Cl-Ph) and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =CSCF ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(3,5-di-Br-Ph) and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =CSO ₂ CH ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(C=O)CH ₃ and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =COCH ₂ CHCH ₂ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(C=CH ₂)CH ₃ and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =COCH ₂ CH ₂ CF ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =C(C=NOH)CH ₃ and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =COCH ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =N, Y ³ =CSi(CH ₃) ₃ and Y ⁴ =CH
Y ¹ =N, Y ² =N, Y ³ =CCF ₂ CF ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =CH, Y ³ =CH and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =COCH ₂ CF ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =CCH ₃ , Y ³ =CH, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =COCH ₂ C≡CH and Y ⁴ =CH	Y ¹ =N, Y ² =CF, Y ³ =CH, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =CSOCH ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =CPh, Y ³ =C, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =CCH ₂ OCH ₃ and Y ⁴ =CH	Y ¹ =N, Y ² =CCl, Y ³ =CCl, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(Cyclohexyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CCHF ₂ , Y ³ =CH and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(Cyclopentyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CBr, Y ³ =CH and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(Cyclopropyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CCF ₃ , Y ³ =CCF ₃ and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(3-thiophenyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CCF ₃ , Y ³ =CH, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(2-thiophenyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CCl, Y ³ =CH, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(3-pyridyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CCH ₃ , Y ³ =CCH ₃ , and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(2-pyridyl) and Y ⁴ =CH	Y ¹ =N, Y ² =CBr, Y ³ =CBr, and and Y ⁴ =N
Y ¹ =N, Y ² =N, Y ³ =C(4-pyridyl) and Y ⁴ =CH	

The present disclosure also includes Tables 2 through 1584. Each Table is constructed in the same manner as Table 1 above, except that the row heading in Table 1 (i.e. “R² = Cl; Z = O; and R³ = H (m = 0).”) is replaced with the respective row heading shown below.

Table	Header Row	Table	Header Row
2	R ² = F, Z = O, R ³ = H (m=0)	13	R ² = F, Z = O, R ³ = 3-CH ₂ F
3	R ² = F, Z = O, R ³ = 3-F	14	R ² = F, Z = O, R ³ = 3-CHO
4	R ² = F, Z = O, R ³ = 3-Cl	15	R ² = F, Z = O, R ³ = 3-Me
5	R ² = F, Z = O, R ³ = 3-Br	16	R ² = F, Z = O, R ³ = 3-Et
6	R ² = F, Z = O, R ³ = 3-I	17	R ² = F, Z = O, R ³ = 3-Ethynyl
7	R ² = F, Z = O, R ³ = 3-CN	18	R ² = F, Z = O, R ³ = 3-Ethenyl
8	R ² = F, Z = O, R ³ = 3-NO ₂	19	R ² = F, Z = O, R ³ = 3-SO ₂ Me
9	R ² = F, Z = O, R ³ = 3-OMe	20	R ² = F, Z = O, R ³ = 3-OAc
10	R ² = F, Z = O, R ³ = 3-OCF ₃	21	R ² = F, Z = O, R ³ = 3- <i>c</i> -Pr
11	R ² = F, Z = O, R ³ = 3-CF ₃	22	R ² = F, Z = O, R ³ = 3- <i>i</i> -Pr
12	R ² = F, Z = O, R ³ = 3-CHF ₂	23	R ² = F, Z = O, R ³ = 3-Ph

Table	Header Row
24	$R^2 = F, Z = S, R^3 = 3-F$
25	$R^2 = F, Z = S, R^3 = 3-Cl$
26	$R^2 = F, Z = S, R^3 = 3-Br$
27	$R^2 = F, Z = S, R^3 = 3-I$
28	$R^2 = F, Z = S, R^3 = 3-CN$
29	$R^2 = F, Z = S, R^3 = 3-NO_2$
30	$R^2 = F, Z = S, R^3 = 3-OMe$
31	$R^2 = F, Z = S, R^3 = 3-OCF_3$
32	$R^2 = F, Z = S, R^3 = 3-CF_3$
33	$R^2 = F, Z = S, R^3 = 3-CHF_2$
34	$R^2 = F, Z = S, R^3 = 3-CH_2F$
35	$R^2 = F, Z = S, R^3 = 3-CHO$
36	$R^2 = F, Z = S, R^3 = 3-Me$
37	$R^2 = F, Z = S, R^3 = 3-Et$
38	$R^2 = F, Z = S, R^3 = 3-Ethynyl$
39	$R^2 = F, Z = S, R^3 = 3-Ethenyl$
40	$R^2 = F, Z = S, R^3 = 3-SO_2Me$
41	$R^2 = F, Z = S, R^3 = 3-OAc$
42	$R^2 = F, Z = S, R^3 = 3-c-Pr$
43	$R^2 = F, Z = S, R^3 = 3-i-Pr$
44	$R^2 = F, Z = S, R^3 = 3-Ph$
45	$R^2 = F, Z = O, R^3 = 4-F$
46	$R^2 = F, Z = O, R^3 = 4-Cl$
47	$R^2 = F, Z = O, R^3 = 4-Br$
48	$R^2 = F, Z = O, R^3 = 4-I$
49	$R^2 = F, Z = O, R^3 = 4-CN$
50	$R^2 = F, Z = O, R^3 = 4-NO_2$
51	$R^2 = F, Z = O, R^3 = 4-OMe$
52	$R^2 = F, Z = O, R^3 = 4-OCF_3$
53	$R^2 = F, Z = O, R^3 = 4-CF_3$
54	$R^2 = F, Z = O, R^3 = 4-CHF_2$
55	$R^2 = F, Z = O, R^3 = 4-CH_2F$
56	$R^2 = F, Z = O, R^3 = 4-CHO$
57	$R^2 = F, Z = O, R^3 = 4-Me$
58	$R^2 = F, Z = O, R^3 = 4-Et$
59	$R^2 = F, Z = O, R^3 = 4-Ethynyl$
60	$R^2 = F, Z = O, R^3 = 4-Ethenyl$

Table	Header Row
61	$R^2 = F, Z = O, R^3 = 4-SO_2Me$
62	$R^2 = F, Z = O, R^3 = 4-OAc$
63	$R^2 = F, Z = O, R^3 = 4-c-Pr$
64	$R^2 = F, Z = O, R^3 = 4-i-Pr$
65	$R^2 = F, Z = O, R^3 = 4-Ph$
66	$R^2 = F, Z = O, R^3 = 5-F$
67	$R^2 = F, Z = O, R^3 = 5-Cl$
68	$R^2 = F, Z = O, R^3 = 5-Br$
69	$R^2 = F, Z = O, R^3 = 5-I$
70	$R^2 = F, Z = O, R^3 = 5-CN$
71	$R^2 = F, Z = O, R^3 = 5-NO_2$
72	$R^2 = F, Z = O, R^3 = 5-OMe$
73	$R^2 = F, Z = O, R^3 = 5-OCF_3$
74	$R^2 = F, Z = O, R^3 = 5-CF_3$
75	$R^2 = F, Z = O, R^3 = 5-CHF_2$
76	$R^2 = F, Z = O, R^3 = 5-CH_2F$
77	$R^2 = F, Z = O, R^3 = 5-CHO$
78	$R^2 = F, Z = O, R^3 = 5-Me$
79	$R^2 = F, Z = O, R^3 = 5-Et$
80	$R^2 = F, Z = O, R^3 = 5-Ethynyl$
81	$R^2 = F, Z = O, R^3 = 5-Ethenyl$
82	$R^2 = F, Z = O, R^3 = 5-SO_2Me$
83	$R^2 = F, Z = O, R^3 = 5-OAc$
84	$R^2 = F, Z = O, R^3 = 5-c-Pr$
85	$R^2 = F, Z = O, R^3 = 5-i-Pr$
86	$R^2 = F, Z = O, R^3 = 5-Ph$
87	$R^2 = F, Z = O, R^3 = 6-F$
88	$R^2 = F, Z = O, R^3 = 6-Cl$
89	$R^2 = F, Z = O, R^3 = 6-Br$
90	$R^2 = F, Z = O, R^3 = 6-I$
91	$R^2 = F, Z = O, R^3 = 6-CN$
92	$R^2 = F, Z = O, R^3 = 6-NO_2$
93	$R^2 = F, Z = O, R^3 = 6-OMe$
94	$R^2 = F, Z = O, R^3 = 6-OCF_3$
95	$R^2 = F, Z = O, R^3 = 6-CF_3$
96	$R^2 = F, Z = O, R^3 = 6-CHF_2$
97	$R^2 = F, Z = O, R^3 = 6-CH_2F$

Table	Header Row
98	$R^2 = F, Z = O, R^3 = 6\text{-CHO}$
99	$R^2 = F, Z = O, R^3 = 6\text{-Me}$
100	$R^2 = F, Z = O, R^3 = 6\text{-Et}$
101	$R^2 = F, Z = O, R^3 = 6\text{-Ethinyl}$
102	$R^2 = F, Z = O, R^3 = 6\text{-Ethenyl}$
103	$R^2 = F, Z = O, R^3 = 6\text{-SO}_2\text{Me}$
104	$R^2 = F, Z = O, R^3 = 6\text{-OAc}$
105	$R^2 = F, Z = O, R^3 = 6\text{-}i\text{-Pr}$
106	$R^2 = F, Z = O, R^3 = 6\text{-}i\text{-Pr}$
107	$R^2 = F, Z = O, R^3 = 6\text{-Ph}$
108	$R^2 = F, Z = O, R^3 = 3,4\text{-di-F}$
109	$R^2 = F, Z = O, R^3 = 3,5\text{-di-F}$
110	$R^2 = F, Z = O, R^3 = 3,6\text{-di-F}$
111	$R^2 = F, Z = O, R^3 = 4,5\text{-di-F}$
112	$R^2 = F, Z = O, R^3 = 3,4\text{-di-Cl}$
113	$R^2 = F, Z = O, R^3 = 3,5\text{-di-Cl}$
114	$R^2 = F, Z = O, R^3 = 3,6\text{-di-Cl}$
115	$R^2 = F, Z = O, R^3 = 4,5\text{-di-Cl}$
116	$R^2 = F, Z = O, R^3 = 3,4\text{-di-Br}$
117	$R^2 = F, Z = O, R^3 = 3,5\text{-di-Br}$
118	$R^2 = F, Z = O, R^3 = 3,6\text{-di-Br}$
119	$R^2 = F, Z = O, R^3 = 4,5\text{-di-Br}$
120	$R^2 = F, Z = O, R^3 = 3,4\text{-di-CN}$
121	$R^2 = F, Z = O, R^3 = 3,5\text{-di-CN}$
122	$R^2 = F, Z = O, R^3 = 3,6\text{-di-CN}$
123	$R^2 = F, Z = O, R^3 = 4,5\text{-di-CN}$
124	$R^2 = F, Z = O, R^3 = 3,4\text{-di-Me}$
125	$R^2 = F, Z = O, R^3 = 3,5\text{-di-Me}$
126	$R^2 = F, Z = O, R^3 = 3,6\text{-di-Me}$
127	$R^2 = F, Z = O, R^3 = 4,5\text{-di-Me}$
128	$R^2 = F, Z = O, R^3 = 3,4\text{-di-OMe}$
129	$R^2 = F, Z = O, R^3 = 3,5\text{-di-OMe}$
130	$R^2 = F, Z = O, R^3 = 3,6\text{-di-OMe}$
131	$R^2 = F, Z = O, R^3 = 4,5\text{-di-OMe}$
132	$R^2 = F, Z = O, R^3 = 3,4\text{-di-CF}_3$
133	$R^2 = F, Z = O, R^3 = 3,5\text{-di-CF}_3$
134	$R^2 = F, Z = O, R^3 = 3,6\text{-di-CF}_3$

Table	Header Row
135	$R^2 = F, Z = O, R^3 = 4,5\text{-di-CF}_3$
136	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 4\text{-Me}$
137	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 4\text{-F}$
138	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 4\text{-Br}$
139	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 4\text{-OMe}$
140	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 4\text{-CF}_3$
141	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 6\text{-Me}$
142	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 6\text{-F}$
143	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 6\text{-Br}$
144	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 6\text{-OMe}$
145	$R^2 = F, Z = O, R^3 = 3\text{-CN}, 6\text{-CF}_3$
146	$R^2 = \text{Br}, Z = O, R^3 = \text{H} (m=0)$
147	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-F}$
148	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Cl}$
149	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Br}$
150	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-I}$
151	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-CN}$
152	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-NO}_2$
153	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-OMe}$
154	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-OCF}_3$
155	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-CF}_3$
156	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-CHF}_2$
157	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-CH}_2\text{F}$
158	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-CHO}$
159	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Me}$
160	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Et}$
161	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Ethinyl}$
162	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Ethenyl}$
163	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-SO}_2\text{Me}$
164	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-OAc}$
165	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-}i\text{-Pr}$
166	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-}i\text{-Pr}$
167	$R^2 = \text{Br}, Z = O, R^3 = 3\text{-Ph}$
168	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-F}$
169	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Cl}$
170	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Br}$
171	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-I}$

Table	Header Row
172	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-CN}$
173	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-NO}_2$
174	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-OMe}$
175	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-OCF}_3$
176	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-CF}_3$
177	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-CHF}_2$
178	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
179	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-CHO}$
180	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Me}$
181	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Et}$
182	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Ethyneyl}$
183	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
184	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
185	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-OAc}$
186	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
187	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
188	$R^2 = \text{Br}, Z = \text{S}, R^3 = 3\text{-Ph}$
189	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-F}$
190	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Cl}$
191	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Br}$
192	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-I}$
193	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-CN}$
194	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-NO}_2$
195	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-OMe}$
196	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-OCF}_3$
197	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-CF}_3$
198	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-CHF}_2$
199	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
200	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-CHO}$
201	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Me}$
202	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Et}$
203	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Ethyneyl}$
204	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
205	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
206	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-OAc}$
207	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
208	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$

Table	Header Row
209	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4\text{-Ph}$
210	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-F}$
211	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Cl}$
212	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Br}$
213	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-I}$
214	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-CN}$
215	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-NO}_2$
216	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-OMe}$
217	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-OCF}_3$
218	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-CF}_3$
219	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-CHF}_2$
220	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
221	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-CHO}$
222	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Me}$
223	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Et}$
224	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Ethyneyl}$
225	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
226	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
227	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-OAc}$
228	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
229	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
230	$R^2 = \text{Br}, Z = \text{O}, R^3 = 5\text{-Ph}$
231	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-F}$
232	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Cl}$
233	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Br}$
234	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-I}$
235	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-CN}$
236	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-NO}_2$
237	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-OMe}$
238	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-OCF}_3$
239	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-CF}_3$
240	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-CHF}_2$
241	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
242	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-CHO}$
243	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Me}$
244	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Et}$
245	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Ethyneyl}$

Table	Header Row
246	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
247	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
248	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-OAc}$
249	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
250	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
251	$R^2 = \text{Br}, Z = \text{O}, R^3 = 6\text{-Ph}$
252	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-F}$
253	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-F}$
254	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-F}$
255	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-F}$
256	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
257	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
258	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
259	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
260	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
261	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
262	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
263	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
264	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
265	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
266	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
267	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
268	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
269	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
270	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
271	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
272	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
273	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
274	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
275	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
276	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
277	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
278	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
279	$R^2 = \text{Br}, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
280	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
281	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
282	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$

Table	Header Row
283	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
284	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
285	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
286	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
287	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
288	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
289	$R^2 = \text{Br}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
290	$R^2 = \text{Cl}, Z = \text{O}, R^3 = \text{H} (m=0)$
291	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-F}$
292	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Cl}$
293	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Br}$
294	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-I}$
295	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-CN}$
296	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-NO}_2$
297	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-OMe}$
298	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-OCF}_3$
299	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-CF}_3$
300	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-CHF}_2$
301	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
302	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-CHO}$
303	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Me}$
304	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Et}$
305	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
306	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
307	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
308	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-OAc}$
309	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
310	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
311	$R^2 = \text{Cl}, Z = \text{O}, R^3 = 3\text{-Ph}$
312	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-F}$
313	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-Cl}$
314	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-Br}$
315	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-I}$
316	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-CN}$
317	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-NO}_2$
318	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-OMe}$
319	$R^2 = \text{Cl}, Z = \text{S}, R^3 = 3\text{-OCF}_3$

Table	Header Row
320	$R^2 = Cl, Z = S, R^3 = 3-CF_3$
321	$R^2 = Cl, Z = S, R^3 = 3-CHF_2$
322	$R^2 = Cl, Z = S, R^3 = 3-CH_2F$
323	$R^2 = Cl, Z = S, R^3 = 3-CHO$
324	$R^2 = Cl, Z = S, R^3 = 3-Me$
325	$R^2 = Cl, Z = S, R^3 = 3-Et$
326	$R^2 = Cl, Z = S, R^3 = 3-Ethynyl$
327	$R^2 = Cl, Z = S, R^3 = 3-Ethenyl$
328	$R^2 = Cl, Z = S, R^3 = 3-SO_2Me$
329	$R^2 = Cl, Z = S, R^3 = 3-OAc$
330	$R^2 = Cl, Z = S, R^3 = 3-c-Pr$
331	$R^2 = Cl, Z = S, R^3 = 3-i-Pr$
332	$R^2 = Cl, Z = S, R^3 = 3-Ph$
333	$R^2 = Cl, Z = O, R^3 = 4-F$
334	$R^2 = Cl, Z = O, R^3 = 4-Cl$
335	$R^2 = Cl, Z = O, R^3 = 4-Br$
336	$R^2 = Cl, Z = O, R^3 = 4-I$
337	$R^2 = Cl, Z = O, R^3 = 4-CN$
338	$R^2 = Cl, Z = O, R^3 = 4-NO_2$
339	$R^2 = Cl, Z = O, R^3 = 4-OMe$
340	$R^2 = Cl, Z = O, R^3 = 4-OCF_3$
341	$R^2 = Cl, Z = O, R^3 = 4-CF_3$
342	$R^2 = Cl, Z = O, R^3 = 4-CHF_2$
343	$R^2 = Cl, Z = O, R^3 = 4-CH_2F$
344	$R^2 = Cl, Z = O, R^3 = 4-CHO$
345	$R^2 = Cl, Z = O, R^3 = 4-Me$
346	$R^2 = Cl, Z = O, R^3 = 4-Et$
347	$R^2 = Cl, Z = O, R^3 = 4-Ethynyl$
348	$R^2 = Cl, Z = O, R^3 = 4-Ethenyl$
349	$R^2 = Cl, Z = O, R^3 = 4-SO_2Me$
350	$R^2 = Cl, Z = O, R^3 = 4-OAc$
351	$R^2 = Cl, Z = O, R^3 = 4-c-Pr$
352	$R^2 = Cl, Z = O, R^3 = 4-i-Pr$
353	$R^2 = Cl, Z = O, R^3 = 4-Ph$
354	$R^2 = Cl, Z = O, R^3 = 5-F$
355	$R^2 = Cl, Z = O, R^3 = 5-Cl$
356	$R^2 = Cl, Z = O, R^3 = 5-Br$

Table	Header Row
357	$R^2 = Cl, Z = O, R^3 = 5-I$
358	$R^2 = Cl, Z = O, R^3 = 5-CN$
359	$R^2 = Cl, Z = O, R^3 = 5-NO_2$
360	$R^2 = Cl, Z = O, R^3 = 5-OMe$
361	$R^2 = Cl, Z = O, R^3 = 5-OCF_3$
362	$R^2 = Cl, Z = O, R^3 = 5-CF_3$
363	$R^2 = Cl, Z = O, R^3 = 5-CHF_2$
364	$R^2 = Cl, Z = O, R^3 = 5-CH_2F$
365	$R^2 = Cl, Z = O, R^3 = 5-CHO$
366	$R^2 = Cl, Z = O, R^3 = 5-Me$
367	$R^2 = Cl, Z = O, R^3 = 5-Et$
368	$R^2 = Cl, Z = O, R^3 = 5-Ethynyl$
369	$R^2 = Cl, Z = O, R^3 = 5-Ethenyl$
370	$R^2 = Cl, Z = O, R^3 = 5-SO_2Me$
371	$R^2 = Cl, Z = O, R^3 = 5-OAc$
372	$R^2 = Cl, Z = O, R^3 = 5-c-Pr$
373	$R^2 = Cl, Z = O, R^3 = 5-i-Pr$
374	$R^2 = Cl, Z = O, R^3 = 5-Ph$
375	$R^2 = Cl, Z = O, R^3 = 6-F$
376	$R^2 = Cl, Z = O, R^3 = 6-Cl$
377	$R^2 = Cl, Z = O, R^3 = 6-Br$
378	$R^2 = Cl, Z = O, R^3 = 6-I$
379	$R^2 = Cl, Z = O, R^3 = 6-CN$
380	$R^2 = Cl, Z = O, R^3 = 6-NO_2$
381	$R^2 = Cl, Z = O, R^3 = 6-OMe$
382	$R^2 = Cl, Z = O, R^3 = 6-OCF_3$
383	$R^2 = Cl, Z = O, R^3 = 6-CF_3$
384	$R^2 = Cl, Z = O, R^3 = 6-CHF_2$
385	$R^2 = Cl, Z = O, R^3 = 6-CH_2F$
386	$R^2 = Cl, Z = O, R^3 = 6-CHO$
387	$R^2 = Cl, Z = O, R^3 = 6-Me$
388	$R^2 = Cl, Z = O, R^3 = 6-Et$
389	$R^2 = Cl, Z = O, R^3 = 6-Ethynyl$
390	$R^2 = Cl, Z = O, R^3 = 6-Ethenyl$
391	$R^2 = Cl, Z = O, R^3 = 6-SO_2Me$
392	$R^2 = Cl, Z = O, R^3 = 6-OAc$
393	$R^2 = Cl, Z = O, R^3 = 6-c-Pr$

Table	Header Row
394	$R^2 = Cl, Z = O, R^3 = 6-i-Pr$
395	$R^2 = Cl, Z = O, R^3 = 6-Ph$
396	$R^2 = Cl, Z = O, R^3 = 3,4-di-F$
397	$R^2 = Cl, Z = O, R^3 = 3,5-di-F$
398	$R^2 = Cl, Z = O, R^3 = 3,6-di-F$
399	$R^2 = Cl, Z = O, R^3 = 4,5-di-F$
400	$R^2 = Cl, Z = O, R^3 = 3,4-di-Cl$
401	$R^2 = Cl, Z = O, R^3 = 3,5-di-Cl$
402	$R^2 = Cl, Z = O, R^3 = 3,6-di-Cl$
403	$R^2 = Cl, Z = O, R^3 = 4,5-di-Cl$
404	$R^2 = Cl, Z = O, R^3 = 3,4-di-Br$
405	$R^2 = Cl, Z = O, R^3 = 3,5-di-Br$
406	$R^2 = Cl, Z = O, R^3 = 3,6-di-Br$
407	$R^2 = Cl, Z = O, R^3 = 4,5-di-Br$
408	$R^2 = Cl, Z = O, R^3 = 3,4-di-CN$
409	$R^2 = Cl, Z = O, R^3 = 3,5-di-CN$
410	$R^2 = Cl, Z = O, R^3 = 3,6-di-CN$
411	$R^2 = Cl, Z = O, R^3 = 4,5-di-CN$
412	$R^2 = Cl, Z = O, R^3 = 3,4-di-Me$
413	$R^2 = Cl, Z = O, R^3 = 3,5-di-Me$
414	$R^2 = Cl, Z = O, R^3 = 3,6-di-Me$
415	$R^2 = Cl, Z = O, R^3 = 4,5-di-Me$
416	$R^2 = Cl, Z = O, R^3 = 3,4-di-OMe$
417	$R^2 = Cl, Z = O, R^3 = 3,5-di-OMe$
418	$R^2 = Cl, Z = O, R^3 = 3,6-di-OMe$
419	$R^2 = Cl, Z = O, R^3 = 4,5-di-OMe$
420	$R^2 = Cl, Z = O, R^3 = 3,4-di-CF_3$
421	$R^2 = Cl, Z = O, R^3 = 3,5-di-CF_3$
422	$R^2 = Cl, Z = O, R^3 = 3,6-di-CF_3$
423	$R^2 = Cl, Z = O, R^3 = 4,5-di-CF_3$
424	$R^2 = Cl, Z = O, R^3 = 3-CN, 4-Me$
425	$R^2 = Cl, Z = O, R^3 = 3-CN, 4-F$
426	$R^2 = Cl, Z = O, R^3 = 3-CN, 4-Br$
427	$R^2 = Cl, Z = O, R^3 = 3-CN, 4-OMe$
428	$R^2 = Cl, Z = O, R^3 = 3-CN, 4-CF_3$
429	$R^2 = Cl, Z = O, R^3 = 3-CN, 6-Me$
430	$R^2 = Cl, Z = O, R^3 = 3-CN, 6-F$

Table	Header Row
431	$R^2 = Cl, Z = O, R^3 = 3-CN, 6-Br$
432	$R^2 = Cl, Z = O, R^3 = 3-CN, 6-OMe$
433	$R^2 = Cl, Z = O, R^3 = 3-CN, 6-CF_3$
434	$R^2 = I, Z = O, R^3 = H (m=0)$
435	$R^2 = I, Z = O, R^3 = 3-F$
436	$R^2 = I, Z = O, R^3 = 3-Cl$
437	$R^2 = I, Z = O, R^3 = 3-Br$
438	$R^2 = I, Z = O, R^3 = 3-I$
439	$R^2 = I, Z = O, R^3 = 3-CN$
440	$R^2 = I, Z = O, R^3 = 3-NO_2$
441	$R^2 = I, Z = O, R^3 = 3-OMe$
442	$R^2 = I, Z = O, R^3 = 3-OCF_3$
443	$R^2 = I, Z = O, R^3 = 3-CF_3$
444	$R^2 = I, Z = O, R^3 = 3-CHF_2$
445	$R^2 = I, Z = O, R^3 = 3-CH_2F$
446	$R^2 = I, Z = O, R^3 = 3-CHO$
447	$R^2 = I, Z = O, R^3 = 3-Me$
448	$R^2 = I, Z = O, R^3 = 3-Et$
449	$R^2 = I, Z = O, R^3 = 3-Ethynyl$
450	$R^2 = I, Z = O, R^3 = 3-Ethenyl$
451	$R^2 = I, Z = O, R^3 = 3-SO_2Me$
452	$R^2 = I, Z = O, R^3 = 3-OAc$
453	$R^2 = I, Z = O, R^3 = 3-c-Pr$
454	$R^2 = I, Z = O, R^3 = 3-i-Pr$
455	$R^2 = I, Z = O, R^3 = 3-Ph$
456	$R^2 = I, Z = S, R^3 = 3-F$
457	$R^2 = I, Z = S, R^3 = 3-Cl$
458	$R^2 = I, Z = S, R^3 = 3-Br$
459	$R^2 = I, Z = S, R^3 = 3-I$
460	$R^2 = I, Z = S, R^3 = 3-CN$
461	$R^2 = I, Z = S, R^3 = 3-NO_2$
462	$R^2 = I, Z = S, R^3 = 3-OMe$
463	$R^2 = I, Z = S, R^3 = 3-OCF_3$
464	$R^2 = I, Z = S, R^3 = 3-CF_3$
465	$R^2 = I, Z = S, R^3 = 3-CHF_2$
466	$R^2 = I, Z = S, R^3 = 3-CH_2F$
467	$R^2 = I, Z = S, R^3 = 3-CHO$

Table	Header Row
468	$R^2 = I, Z = S, R^3 = 3\text{-Me}$
469	$R^2 = I, Z = S, R^3 = 3\text{-Et}$
470	$R^2 = I, Z = S, R^3 = 3\text{-Ethyneyl}$
471	$R^2 = I, Z = S, R^3 = 3\text{-Ethenyl}$
472	$R^2 = I, Z = S, R^3 = 3\text{-SO}_2\text{Me}$
473	$R^2 = I, Z = S, R^3 = 3\text{-OAc}$
474	$R^2 = I, Z = S, R^3 = 3\text{-c-Pr}$
475	$R^2 = I, Z = S, R^3 = 3\text{-i-Pr}$
476	$R^2 = I, Z = S, R^3 = 3\text{-Ph}$
477	$R^2 = I, Z = O, R^3 = 4\text{-F}$
478	$R^2 = I, Z = O, R^3 = 4\text{-Cl}$
479	$R^2 = I, Z = O, R^3 = 4\text{-Br}$
480	$R^2 = I, Z = O, R^3 = 4\text{-I}$
481	$R^2 = I, Z = O, R^3 = 4\text{-CN}$
482	$R^2 = I, Z = O, R^3 = 4\text{-NO}_2$
483	$R^2 = I, Z = O, R^3 = 4\text{-OMe}$
484	$R^2 = I, Z = O, R^3 = 4\text{-OCF}_3$
485	$R^2 = I, Z = O, R^3 = 4\text{-CF}_3$
486	$R^2 = I, Z = O, R^3 = 4\text{-CHF}_2$
487	$R^2 = I, Z = O, R^3 = 4\text{-CH}_2\text{F}$
488	$R^2 = I, Z = O, R^3 = 4\text{-CHO}$
489	$R^2 = I, Z = O, R^3 = 4\text{-Me}$
490	$R^2 = I, Z = O, R^3 = 4\text{-Et}$
491	$R^2 = I, Z = O, R^3 = 4\text{-Ethyneyl}$
492	$R^2 = I, Z = O, R^3 = 4\text{-Ethenyl}$
493	$R^2 = I, Z = O, R^3 = 4\text{-SO}_2\text{Me}$
494	$R^2 = I, Z = O, R^3 = 4\text{-OAc}$
495	$R^2 = I, Z = O, R^3 = 4\text{-c-Pr}$
496	$R^2 = I, Z = O, R^3 = 4\text{-i-Pr}$
497	$R^2 = I, Z = O, R^3 = 4\text{-Ph}$
498	$R^2 = I, Z = O, R^3 = 5\text{-F}$
499	$R^2 = I, Z = O, R^3 = 5\text{-Cl}$
500	$R^2 = I, Z = O, R^3 = 5\text{-Br}$
501	$R^2 = I, Z = O, R^3 = 5\text{-I}$
502	$R^2 = I, Z = O, R^3 = 5\text{-CN}$
503	$R^2 = I, Z = O, R^3 = 5\text{-NO}_2$
504	$R^2 = I, Z = O, R^3 = 5\text{-OMe}$

Table	Header Row
505	$R^2 = I, Z = O, R^3 = 5\text{-OCF}_3$
506	$R^2 = I, Z = O, R^3 = 5\text{-CF}_3$
507	$R^2 = I, Z = O, R^3 = 5\text{-CHF}_2$
508	$R^2 = I, Z = O, R^3 = 5\text{-CH}_2\text{F}$
509	$R^2 = I, Z = O, R^3 = 5\text{-CHO}$
510	$R^2 = I, Z = O, R^3 = 5\text{-Me}$
511	$R^2 = I, Z = O, R^3 = 5\text{-Et}$
512	$R^2 = I, Z = O, R^3 = 5\text{-Ethyneyl}$
513	$R^2 = I, Z = O, R^3 = 5\text{-Ethenyl}$
514	$R^2 = I, Z = O, R^3 = 5\text{-SO}_2\text{Me}$
515	$R^2 = I, Z = O, R^3 = 5\text{-OAc}$
516	$R^2 = I, Z = O, R^3 = 5\text{-c-Pr}$
517	$R^2 = I, Z = O, R^3 = 5\text{-i-Pr}$
518	$R^2 = I, Z = O, R^3 = 5\text{-Ph}$
519	$R^2 = I, Z = O, R^3 = 6\text{-F}$
520	$R^2 = I, Z = O, R^3 = 6\text{-Cl}$
521	$R^2 = I, Z = O, R^3 = 6\text{-Br}$
522	$R^2 = I, Z = O, R^3 = 6\text{-I}$
523	$R^2 = I, Z = O, R^3 = 6\text{-CN}$
524	$R^2 = I, Z = O, R^3 = 6\text{-NO}_2$
525	$R^2 = I, Z = O, R^3 = 6\text{-OMe}$
526	$R^2 = I, Z = O, R^3 = 6\text{-OCF}_3$
527	$R^2 = I, Z = O, R^3 = 6\text{-CF}_3$
528	$R^2 = I, Z = O, R^3 = 6\text{-CHF}_2$
529	$R^2 = I, Z = O, R^3 = 6\text{-CH}_2\text{F}$
530	$R^2 = I, Z = O, R^3 = 6\text{-CHO}$
531	$R^2 = I, Z = O, R^3 = 6\text{-Me}$
532	$R^2 = I, Z = O, R^3 = 6\text{-Et}$
533	$R^2 = I, Z = O, R^3 = 6\text{-Ethyneyl}$
534	$R^2 = I, Z = O, R^3 = 6\text{-Ethenyl}$
535	$R^2 = I, Z = O, R^3 = 6\text{-SO}_2\text{Me}$
536	$R^2 = I, Z = O, R^3 = 6\text{-OAc}$
537	$R^2 = I, Z = O, R^3 = 6\text{-c-Pr}$
538	$R^2 = I, Z = O, R^3 = 6\text{-i-Pr}$
539	$R^2 = I, Z = O, R^3 = 6\text{-Ph}$
540	$R^2 = I, Z = O, R^3 = 3,4\text{-di-F}$
541	$R^2 = I, Z = O, R^3 = 3,5\text{-di-F}$

Table	Header Row
542	$R^2 = I, Z = O, R^3 = 3,6\text{-di-F}$
543	$R^2 = I, Z = O, R^3 = 4,5\text{-di-F}$
544	$R^2 = I, Z = O, R^3 = 3,4\text{-di-Cl}$
545	$R^2 = I, Z = O, R^3 = 3,5\text{-di-Cl}$
546	$R^2 = I, Z = O, R^3 = 3,6\text{-di-Cl}$
547	$R^2 = I, Z = O, R^3 = 4,5\text{-di-Cl}$
548	$R^2 = I, Z = O, R^3 = 3,4\text{-di-Br}$
549	$R^2 = I, Z = O, R^3 = 3,5\text{-di-Br}$
550	$R^2 = I, Z = O, R^3 = 3,6\text{-di-Br}$
551	$R^2 = I, Z = O, R^3 = 4,5\text{-di-Br}$
552	$R^2 = I, Z = O, R^3 = 3,4\text{-di-CN}$
553	$R^2 = I, Z = O, R^3 = 3,5\text{-di-CN}$
554	$R^2 = I, Z = O, R^3 = 3,6\text{-di-CN}$
555	$R^2 = I, Z = O, R^3 = 4,5\text{-di-CN}$
556	$R^2 = I, Z = O, R^3 = 3,4\text{-di-Me}$
557	$R^2 = I, Z = O, R^3 = 3,5\text{-di-Me}$
558	$R^2 = I, Z = O, R^3 = 3,6\text{-di-Me}$
559	$R^2 = I, Z = O, R^3 = 4,5\text{-di-Me}$
560	$R^2 = I, Z = O, R^3 = 3,4\text{-di-OMe}$
561	$R^2 = I, Z = O, R^3 = 3,5\text{-di-OMe}$
562	$R^2 = I, Z = O, R^3 = 3,6\text{-di-OMe}$
563	$R^2 = I, Z = O, R^3 = 4,5\text{-di-OMe}$
564	$R^2 = I, Z = O, R^3 = 3,4\text{-di-CF}_3$
565	$R^2 = I, Z = O, R^3 = 3,5\text{-di-CF}_3$
566	$R^2 = I, Z = O, R^3 = 3,6\text{-di-CF}_3$
567	$R^2 = I, Z = O, R^3 = 4,5\text{-di-CF}_3$
568	$R^2 = I, Z = O, R^3 = 3\text{-CN, 4-Me}$
569	$R^2 = I, Z = O, R^3 = 3\text{-CN, 4-F}$
570	$R^2 = I, Z = O, R^3 = 3\text{-CN, 4-Br}$
571	$R^2 = I, Z = O, R^3 = 3\text{-CN, 4-OMe}$
572	$R^2 = I, Z = O, R^3 = 3\text{-CN, 4-CF}_3$
573	$R^2 = I, Z = O, R^3 = 3\text{-CN, 6-Me}$
574	$R^2 = I, Z = O, R^3 = 3\text{-CN, 6-F}$
575	$R^2 = I, Z = O, R^3 = 3\text{-CN, 6-Br}$
576	$R^2 = I, Z = O, R^3 = 3\text{-CN, 6-OMe}$
577	$R^2 = I, Z = O, R^3 = 3\text{-CN, 6-CF}_3$
578	$R^2 = Me, Z = O, R^3 = H (m=0)$

Table	Header Row
579	$R^2 = Me, Z = O, R^3 = 3\text{-F}$
580	$R^2 = Me, Z = O, R^3 = 3\text{-Cl}$
581	$R^2 = Me, Z = O, R^3 = 3\text{-Br}$
582	$R^2 = Me, Z = O, R^3 = 3\text{-I}$
583	$R^2 = Me, Z = O, R^3 = 3\text{-CN}$
584	$R^2 = Me, Z = O, R^3 = 3\text{-NO}_2$
585	$R^2 = Me, Z = O, R^3 = 3\text{-OMe}$
586	$R^2 = Me, Z = O, R^3 = 3\text{-OCF}_3$
587	$R^2 = Me, Z = O, R^3 = 3\text{-CF}_3$
588	$R^2 = Me, Z = O, R^3 = 3\text{-CHF}_2$
589	$R^2 = Me, Z = O, R^3 = 3\text{-CH}_2\text{F}$
590	$R^2 = Me, Z = O, R^3 = 3\text{-CHO}$
591	$R^2 = Me, Z = O, R^3 = 3\text{-Me}$
592	$R^2 = Me, Z = O, R^3 = 3\text{-Et}$
593	$R^2 = Me, Z = O, R^3 = 3\text{-Ethyneyl}$
594	$R^2 = Me, Z = O, R^3 = 3\text{-Ethenyl}$
595	$R^2 = Me, Z = O, R^3 = 3\text{-SO}_2\text{Me}$
596	$R^2 = Me, Z = O, R^3 = 3\text{-OAc}$
597	$R^2 = Me, Z = O, R^3 = 3\text{-}i\text{-Pr}$
598	$R^2 = Me, Z = O, R^3 = 3\text{-}i\text{-Pr}$
599	$R^2 = Me, Z = O, R^3 = 3\text{-Ph}$
600	$R^2 = Me, Z = S, R^3 = 3\text{-F}$
601	$R^2 = Me, Z = S, R^3 = 3\text{-Cl}$
602	$R^2 = Me, Z = S, R^3 = 3\text{-Br}$
603	$R^2 = Me, Z = S, R^3 = 3\text{-I}$
604	$R^2 = Me, Z = S, R^3 = 3\text{-CN}$
605	$R^2 = Me, Z = S, R^3 = 3\text{-NO}_2$
606	$R^2 = Me, Z = S, R^3 = 3\text{-OMe}$
607	$R^2 = Me, Z = S, R^3 = 3\text{-OCF}_3$
608	$R^2 = Me, Z = S, R^3 = 3\text{-CF}_3$
609	$R^2 = Me, Z = S, R^3 = 3\text{-CHF}_2$
610	$R^2 = Me, Z = S, R^3 = 3\text{-CH}_2\text{F}$
611	$R^2 = Me, Z = S, R^3 = 3\text{-CHO}$
612	$R^2 = Me, Z = S, R^3 = 3\text{-Me}$
613	$R^2 = Me, Z = S, R^3 = 3\text{-Et}$
614	$R^2 = Me, Z = S, R^3 = 3\text{-Ethyneyl}$
615	$R^2 = Me, Z = S, R^3 = 3\text{-Ethenyl}$

Table	Header Row
616	$R^2 = \text{Me}, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
617	$R^2 = \text{Me}, Z = \text{S}, R^3 = 3\text{-OAc}$
618	$R^2 = \text{Me}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
619	$R^2 = \text{Me}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
620	$R^2 = \text{Me}, Z = \text{S}, R^3 = 3\text{-Ph}$
621	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-F}$
622	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Cl}$
623	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Br}$
624	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-I}$
625	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-CN}$
626	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-NO}_2$
627	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-OMe}$
628	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-OCF}_3$
629	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-CF}_3$
630	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-CHF}_2$
631	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
632	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-CHO}$
633	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Me}$
634	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Et}$
635	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Ethyneyl}$
636	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
637	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
638	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-OAc}$
639	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
640	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
641	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4\text{-Ph}$
642	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-F}$
643	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Cl}$
644	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Br}$
645	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-I}$
646	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-CN}$
647	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-NO}_2$
648	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-OMe}$
649	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-OCF}_3$
650	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-CF}_3$
651	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-CHF}_2$
652	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$

Table	Header Row
653	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-CHO}$
654	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Me}$
655	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Et}$
656	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Ethyneyl}$
657	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
658	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
659	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-OAc}$
660	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
661	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
662	$R^2 = \text{Me}, Z = \text{O}, R^3 = 5\text{-Ph}$
663	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-F}$
664	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Cl}$
665	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Br}$
666	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-I}$
667	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-CN}$
668	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-NO}_2$
669	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-OMe}$
670	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-OCF}_3$
671	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-CF}_3$
672	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-CHF}_2$
673	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
674	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-CHO}$
675	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Me}$
676	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Et}$
677	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Ethyneyl}$
678	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
679	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
680	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-OAc}$
681	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
682	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
683	$R^2 = \text{Me}, Z = \text{O}, R^3 = 6\text{-Ph}$
684	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-F}$
685	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-F}$
686	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-F}$
687	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-F}$
688	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
689	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$

Table	Header Row
690	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
691	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
692	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
693	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
694	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
695	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
696	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
697	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
698	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
699	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
700	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
701	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
702	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
703	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
704	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
705	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
706	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
707	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
708	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
709	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
710	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
711	$R^2 = \text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
712	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
713	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
714	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$
715	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
716	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
717	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
718	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
719	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
720	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
721	$R^2 = \text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
722	$R^2 = \text{CN}, Z = \text{O}, R^3 = \text{H} (m=0)$
723	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-F}$
724	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Cl}$
725	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Br}$
726	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-I}$

Table	Header Row
727	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}$
728	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-NO}_2$
729	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-OMe}$
730	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-OCF}_3$
731	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CF}_3$
732	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CHF}_2$
733	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
734	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CHO}$
735	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Me}$
736	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Et}$
737	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Ethynyl}$
738	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
739	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
740	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-OAc}$
741	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
742	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
743	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-Ph}$
744	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-F}$
745	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Cl}$
746	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Br}$
747	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-I}$
748	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-CN}$
749	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-NO}_2$
750	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-OMe}$
751	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-OCF}_3$
752	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-CF}_3$
753	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-CHF}_2$
754	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
755	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-CHO}$
756	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Me}$
757	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Et}$
758	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Ethynyl}$
759	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
760	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
761	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-OAc}$
762	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
763	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$

Table	Header Row
764	$R^2 = \text{CN}, Z = \text{S}, R^3 = 3\text{-Ph}$
765	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-F}$
766	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Cl}$
767	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Br}$
768	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-I}$
769	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-CN}$
770	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-NO}_2$
771	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-OMe}$
772	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-OCF}_3$
773	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-CF}_3$
774	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-CHF}_2$
775	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
776	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-CHO}$
777	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Me}$
778	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Et}$
779	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Ethyneyl}$
780	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
781	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
782	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-OAc}$
783	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-c-Pr}$
784	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-i-Pr}$
785	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4\text{-Ph}$
786	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-F}$
787	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Cl}$
788	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Br}$
789	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-I}$
790	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-CN}$
791	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-NO}_2$
792	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-OMe}$
793	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-OCF}_3$
794	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-CF}_3$
795	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-CHF}_2$
796	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
797	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-CHO}$
798	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Me}$
799	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Et}$
800	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Ethyneyl}$

Table	Header Row
801	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
802	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
803	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-OAc}$
804	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-c-Pr}$
805	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-i-Pr}$
806	$R^2 = \text{CN}, Z = \text{O}, R^3 = 5\text{-Ph}$
807	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-F}$
808	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Cl}$
809	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Br}$
810	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-I}$
811	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-CN}$
812	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-NO}_2$
813	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-OMe}$
814	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-OCF}_3$
815	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-CF}_3$
816	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-CHF}_2$
817	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
818	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-CHO}$
819	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Me}$
820	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Et}$
821	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Ethyneyl}$
822	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
823	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
824	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-OAc}$
825	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-c-Pr}$
826	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-i-Pr}$
827	$R^2 = \text{CN}, Z = \text{O}, R^3 = 6\text{-Ph}$
828	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-F}$
829	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-F}$
830	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-F}$
831	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-F}$
832	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
833	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
834	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
835	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
836	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
837	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-Br}$

Table	Header Row
838	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
839	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
840	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
841	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
842	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
843	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
844	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
845	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
846	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
847	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
848	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
849	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
850	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
851	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
852	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
853	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
854	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
855	$R^2 = \text{CN}, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
856	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
857	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
858	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$
859	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
860	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
861	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
862	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
863	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
864	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
865	$R^2 = \text{CN}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
866	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = \text{H} (m=0)$
867	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-F}$
868	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Cl}$
869	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Br}$
870	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-I}$
871	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}$
872	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-NO}_2$
873	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-OMe}$
874	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-OCF}_3$

Table	Header Row
875	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CF}_3$
876	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CHF}_2$
877	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
878	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CHO}$
879	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Me}$
880	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Et}$
881	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Ethynyl}$
882	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
883	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
884	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-OAc}$
885	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
886	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-}i\text{-Pr}$
887	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-Ph}$
888	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-F}$
889	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Cl}$
890	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Br}$
891	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-I}$
892	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-CN}$
893	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-NO}_2$
894	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-OMe}$
895	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-OCF}_3$
896	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-CF}_3$
897	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-CHF}_2$
898	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
899	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-CHO}$
900	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Me}$
901	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Et}$
902	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Ethynyl}$
903	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
904	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
905	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-OAc}$
906	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
907	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-}i\text{-Pr}$
908	$R^2 = \text{NO}_2, Z = \text{S}, R^3 = 3\text{-Ph}$
909	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-F}$
910	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Cl}$
911	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Br}$

Table	Header Row
912	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-I}$
913	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-CN}$
914	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-NO}_2$
915	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-OMe}$
916	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-OCF}_3$
917	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-CF}_3$
918	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-CHF}_2$
919	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
920	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-CHO}$
921	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Me}$
922	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Et}$
923	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Ethynyl}$
924	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
925	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
926	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-OAc}$
927	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
928	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
929	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4\text{-Ph}$
930	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-F}$
931	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Cl}$
932	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Br}$
933	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-I}$
934	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-CN}$
935	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-NO}_2$
936	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-OMe}$
937	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-OCF}_3$
938	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-CF}_3$
939	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-CHF}_2$
940	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
941	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-CHO}$
942	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Me}$
943	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Et}$
944	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Ethynyl}$
945	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
946	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
947	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-OAc}$
948	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$

Table	Header Row
949	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
950	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 5\text{-Ph}$
951	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-F}$
952	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Cl}$
953	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Br}$
954	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-I}$
955	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-CN}$
956	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-NO}_2$
957	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-OMe}$
958	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-OCF}_3$
959	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-CF}_3$
960	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-CHF}_2$
961	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
962	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-CHO}$
963	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Me}$
964	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Et}$
965	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Ethynyl}$
966	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
967	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
968	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-OAc}$
969	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
970	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
971	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 6\text{-Ph}$
972	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-F}$
973	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-F}$
974	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-F}$
975	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-F}$
976	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
977	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
978	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
979	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
980	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
981	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
982	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
983	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
984	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
985	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-CN}$

Table	Header Row
986	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
987	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
988	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
989	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
990	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
991	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
992	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
993	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
994	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
995	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
996	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
997	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
998	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
999	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
1000	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
1001	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
1002	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$
1003	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
1004	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
1005	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
1006	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
1007	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
1008	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
1009	$R^2 = \text{NO}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
1010	$R^2 = \text{OMe}, Z = \text{O}, R^3 = \text{H} (m=0)$
1011	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-F}$
1012	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Cl}$
1013	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Br}$
1014	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-I}$
1015	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}$
1016	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-NO}_2$
1017	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-OMe}$
1018	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-OCF}_3$
1019	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CF}_3$
1020	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CHF}_2$
1021	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
1022	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CHO}$

Table	Header Row
1023	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Me}$
1024	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Et}$
1025	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Ethynyl}$
1026	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
1027	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
1028	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-OAc}$
1029	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-c-Pr}$
1030	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-i-Pr}$
1031	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-Ph}$
1032	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-F}$
1033	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Cl}$
1034	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Br}$
1035	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-I}$
1036	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-CN}$
1037	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-NO}_2$
1038	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-OMe}$
1039	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-OCF}_3$
1040	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-CF}_3$
1041	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-CHF}_2$
1042	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
1043	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-CHO}$
1044	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Me}$
1045	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Et}$
1046	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Ethynyl}$
1047	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
1048	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
1049	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-OAc}$
1050	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-c-Pr}$
1051	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-i-Pr}$
1052	$R^2 = \text{OMe}, Z = \text{S}, R^3 = 3\text{-Ph}$
1053	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-F}$
1054	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Cl}$
1055	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Br}$
1056	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-I}$
1057	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-CN}$
1058	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-NO}_2$
1059	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-OMe}$

Table	Header Row
1060	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-OCF}_3$
1061	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-CF}_3$
1062	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-CHF}_2$
1063	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
1064	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-CHO}$
1065	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Me}$
1066	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Et}$
1067	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Ethyne}$
1068	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
1069	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
1070	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-OAc}$
1071	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
1072	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
1073	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4\text{-Ph}$
1074	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-F}$
1075	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Cl}$
1076	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Br}$
1077	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-I}$
1078	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-CN}$
1079	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-NO}_2$
1080	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-OMe}$
1081	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-OCF}_3$
1082	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-CF}_3$
1083	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-CHF}_2$
1084	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
1085	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-CHO}$
1086	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Me}$
1087	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Et}$
1088	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Ethyne}$
1089	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
1090	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
1091	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-OAc}$
1092	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
1093	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
1094	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 5\text{-Ph}$
1095	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-F}$
1096	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Cl}$

Table	Header Row
1097	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Br}$
1098	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-I}$
1099	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-CN}$
1100	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-NO}_2$
1101	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-OMe}$
1102	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-OCF}_3$
1103	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-CF}_3$
1104	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-CHF}_2$
1105	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
1106	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-CHO}$
1107	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Me}$
1108	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Et}$
1109	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Ethyne}$
1110	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
1111	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
1112	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-OAc}$
1113	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
1114	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
1115	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 6\text{-Ph}$
1116	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-F}$
1117	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-F}$
1118	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-F}$
1119	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-F}$
1120	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
1121	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
1122	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
1123	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
1124	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
1125	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
1126	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
1127	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
1128	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
1129	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
1130	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
1131	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
1132	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
1133	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-Me}$

Table	Header Row
1134	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
1135	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
1136	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
1137	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
1138	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
1139	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
1140	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
1141	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
1142	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
1143	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
1144	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
1145	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
1146	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$
1147	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
1148	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
1149	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
1150	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
1151	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
1152	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
1153	$R^2 = \text{OMe}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
1154	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = \text{H (m=0)}$
1155	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-F}$
1156	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Cl}$
1157	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Br}$
1158	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-I}$
1159	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-CN}$
1160	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-NO}_2$
1161	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-OMe}$
1162	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-OCF}_3$
1163	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-CF}_3$
1164	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-CHF}_2$
1165	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
1166	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-CHO}$
1167	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Me}$
1168	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Et}$
1169	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
1170	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Ethenyl}$

Table	Header Row
1171	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
1172	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-OAc}$
1173	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-c-Pr}$
1174	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-i-Pr}$
1175	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 3\text{-Ph}$
1176	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-F}$
1177	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Cl}$
1178	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Br}$
1179	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-I}$
1180	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-CN}$
1181	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-NO}_2$
1182	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-OMe}$
1183	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-OCF}_3$
1184	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-CF}_3$
1185	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-CHF}_2$
1186	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
1187	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-CHO}$
1188	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Me}$
1189	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Et}$
1190	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
1191	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
1192	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
1193	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-OAc}$
1194	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-c-Pr}$
1195	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-i-Pr}$
1196	$R^2 = \text{CF}_3, Z = \text{S}, R^3 = 3\text{-Ph}$
1197	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-F}$
1198	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-Cl}$
1199	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-Br}$
1200	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-I}$
1201	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-CN}$
1202	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-NO}_2$
1203	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-OMe}$
1204	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-OCF}_3$
1205	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-CF}_3$
1206	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-CHF}_2$
1207	$R^2 = \text{CF}_3, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$

Table	Header Row
1208	$R^2 = CF_3, Z = O, R^3 = 4-CHO$
1209	$R^2 = CF_3, Z = O, R^3 = 4-Me$
1210	$R^2 = CF_3, Z = O, R^3 = 4-Et$
1211	$R^2 = CF_3, Z = O, R^3 = 4-Ethynyl$
1212	$R^2 = CF_3, Z = O, R^3 = 4-Ethenyl$
1213	$R^2 = CF_3, Z = O, R^3 = 4-SO_2Me$
1214	$R^2 = CF_3, Z = O, R^3 = 4-OAc$
1215	$R^2 = CF_3, Z = O, R^3 = 4-c-Pr$
1216	$R^2 = CF_3, Z = O, R^3 = 4-i-Pr$
1217	$R^2 = CF_3, Z = O, R^3 = 4-Ph$
1218	$R^2 = CF_3, Z = O, R^3 = 5-F$
1219	$R^2 = CF_3, Z = O, R^3 = 5-Cl$
1220	$R^2 = CF_3, Z = O, R^3 = 5-Br$
1221	$R^2 = CF_3, Z = O, R^3 = 5-I$
1222	$R^2 = CF_3, Z = O, R^3 = 5-CN$
1223	$R^2 = CF_3, Z = O, R^3 = 5-NO_2$
1224	$R^2 = CF_3, Z = O, R^3 = 5-OMe$
1225	$R^2 = CF_3, Z = O, R^3 = 5-OCF_3$
1226	$R^2 = CF_3, Z = O, R^3 = 5-CF_3$
1227	$R^2 = CF_3, Z = O, R^3 = 5-CHF_2$
1228	$R^2 = CF_3, Z = O, R^3 = 5-CH_2F$
1229	$R^2 = CF_3, Z = O, R^3 = 5-CHO$
1230	$R^2 = CF_3, Z = O, R^3 = 5-Me$
1231	$R^2 = CF_3, Z = O, R^3 = 5-Et$
1232	$R^2 = CF_3, Z = O, R^3 = 5-Ethynyl$
1233	$R^2 = CF_3, Z = O, R^3 = 5-Ethenyl$
1234	$R^2 = CF_3, Z = O, R^3 = 5-SO_2Me$
1235	$R^2 = CF_3, Z = O, R^3 = 5-OAc$
1236	$R^2 = CF_3, Z = O, R^3 = 5-c-Pr$
1237	$R^2 = CF_3, Z = O, R^3 = 5-i-Pr$
1238	$R^2 = CF_3, Z = O, R^3 = 5-Ph$
1239	$R^2 = CF_3, Z = O, R^3 = 6-F$
1240	$R^2 = CF_3, Z = O, R^3 = 6-Cl$
1241	$R^2 = CF_3, Z = O, R^3 = 6-Br$
1242	$R^2 = CF_3, Z = O, R^3 = 6-I$
1243	$R^2 = CF_3, Z = O, R^3 = 6-CN$
1244	$R^2 = CF_3, Z = O, R^3 = 6-NO_2$

Table	Header Row
1245	$R^2 = CF_3, Z = O, R^3 = 6-OMe$
1246	$R^2 = CF_3, Z = O, R^3 = 6-OCF_3$
1247	$R^2 = CF_3, Z = O, R^3 = 6-CF_3$
1248	$R^2 = CF_3, Z = O, R^3 = 6-CHF_2$
1249	$R^2 = CF_3, Z = O, R^3 = 6-CH_2F$
1250	$R^2 = CF_3, Z = O, R^3 = 6-CHO$
1251	$R^2 = CF_3, Z = O, R^3 = 6-Me$
1252	$R^2 = CF_3, Z = O, R^3 = 6-Et$
1253	$R^2 = CF_3, Z = O, R^3 = 6-Ethynyl$
1254	$R^2 = CF_3, Z = O, R^3 = 6-Ethenyl$
1255	$R^2 = CF_3, Z = O, R^3 = 6-SO_2Me$
1256	$R^2 = CF_3, Z = O, R^3 = 6-OAc$
1257	$R^2 = CF_3, Z = O, R^3 = 6-c-Pr$
1258	$R^2 = CF_3, Z = O, R^3 = 6-i-Pr$
1259	$R^2 = CF_3, Z = O, R^3 = 6-Ph$
1260	$R^2 = CF_3, Z = O, R^3 = 3,4-di-F$
1261	$R^2 = CF_3, Z = O, R^3 = 3,5-di-F$
1262	$R^2 = CF_3, Z = O, R^3 = 3,6-di-F$
1263	$R^2 = CF_3, Z = O, R^3 = 4,5-di-F$
1264	$R^2 = CF_3, Z = O, R^3 = 3,4-di-Cl$
1265	$R^2 = CF_3, Z = O, R^3 = 3,5-di-Cl$
1266	$R^2 = CF_3, Z = O, R^3 = 3,6-di-Cl$
1267	$R^2 = CF_3, Z = O, R^3 = 4,5-di-Cl$
1268	$R^2 = CF_3, Z = O, R^3 = 3,4-di-Br$
1269	$R^2 = CF_3, Z = O, R^3 = 3,5-di-Br$
1270	$R^2 = CF_3, Z = O, R^3 = 3,6-di-Br$
1271	$R^2 = CF_3, Z = O, R^3 = 4,5-di-Br$
1272	$R^2 = CF_3, Z = O, R^3 = 3,4-di-CN$
1273	$R^2 = CF_3, Z = O, R^3 = 3,5-di-CN$
1274	$R^2 = CF_3, Z = O, R^3 = 3,6-di-CN$
1275	$R^2 = CF_3, Z = O, R^3 = 4,5-di-CN$
1276	$R^2 = CF_3, Z = O, R^3 = 3,4-di-Me$
1277	$R^2 = CF_3, Z = O, R^3 = 3,5-di-Me$
1278	$R^2 = CF_3, Z = O, R^3 = 3,6-di-Me$
1279	$R^2 = CF_3, Z = O, R^3 = 4,5-di-Me$
1280	$R^2 = CF_3, Z = O, R^3 = 3,4-di-OMe$
1281	$R^2 = CF_3, Z = O, R^3 = 3,5-di-OMe$

Table	Header Row
1282	$R^2 = CF_3, Z = O, R^3 = 3,6\text{-di-OMe}$
1283	$R^2 = CF_3, Z = O, R^3 = 4,5\text{-di-OMe}$
1284	$R^2 = CF_3, Z = O, R^3 = 3,4\text{-di-CF}_3$
1285	$R^2 = CF_3, Z = O, R^3 = 3,5\text{-di-CF}_3$
1286	$R^2 = CF_3, Z = O, R^3 = 3,6\text{-di-CF}_3$
1287	$R^2 = CF_3, Z = O, R^3 = 4,5\text{-di-CF}_3$
1288	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 4-Me}$
1289	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 4-F}$
1290	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 4-Br}$
1291	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 4-OMe}$
1292	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 4-CF}_3$
1293	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 6-Me}$
1294	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 6-F}$
1295	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 6-Br}$
1296	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 6-OMe}$
1297	$R^2 = CF_3, Z = O, R^3 = 3\text{-CN, 6-CF}_3$
1298	$R^2 = CHF_2, Z = O, R^3 = H (m=0)$
1299	$R^2 = CHF_2, Z = O, R^3 = 3\text{-F}$
1300	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Cl}$
1301	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Br}$
1302	$R^2 = CHF_2, Z = O, R^3 = 3\text{-I}$
1303	$R^2 = CHF_2, Z = O, R^3 = 3\text{-CN}$
1304	$R^2 = CHF_2, Z = O, R^3 = 3\text{-NO}_2$
1305	$R^2 = CHF_2, Z = O, R^3 = 3\text{-OMe}$
1306	$R^2 = CHF_2, Z = O, R^3 = 3\text{-OCF}_3$
1307	$R^2 = CHF_2, Z = O, R^3 = 3\text{-CF}_3$
1308	$R^2 = CHF_2, Z = O, R^3 = 3\text{-CHF}_2$
1309	$R^2 = CHF_2, Z = O, R^3 = 3\text{-CH}_2\text{F}$
1310	$R^2 = CHF_2, Z = O, R^3 = 3\text{-CHO}$
1311	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Me}$
1312	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Et}$
1313	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Ethyneyl}$
1314	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Ethenyl}$
1315	$R^2 = CHF_2, Z = O, R^3 = 3\text{-SO}_2\text{Me}$
1316	$R^2 = CHF_2, Z = O, R^3 = 3\text{-OAc}$
1317	$R^2 = CHF_2, Z = O, R^3 = 3\text{-c-Pr}$
1318	$R^2 = CHF_2, Z = O, R^3 = 3\text{-i-Pr}$

Table	Header Row
1319	$R^2 = CHF_2, Z = O, R^3 = 3\text{-Ph}$
1320	$R^2 = CHF_2, Z = S, R^3 = 3\text{-F}$
1321	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Cl}$
1322	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Br}$
1323	$R^2 = CHF_2, Z = S, R^3 = 3\text{-I}$
1324	$R^2 = CHF_2, Z = S, R^3 = 3\text{-CN}$
1325	$R^2 = CHF_2, Z = S, R^3 = 3\text{-NO}_2$
1326	$R^2 = CHF_2, Z = S, R^3 = 3\text{-OMe}$
1327	$R^2 = CHF_2, Z = S, R^3 = 3\text{-OCF}_3$
1328	$R^2 = CHF_2, Z = S, R^3 = 3\text{-CHF}_2$
1329	$R^2 = CHF_2, Z = S, R^3 = 3\text{-CH}_2\text{F}$
1330	$R^2 = CHF_2, Z = S, R^3 = 3\text{-CHO}$
1331	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Me}$
1332	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Et}$
1333	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Ethyneyl}$
1334	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Ethenyl}$
1335	$R^2 = CHF_2, Z = S, R^3 = 3\text{-SO}_2\text{Me}$
1336	$R^2 = CHF_2, Z = S, R^3 = 3\text{-OAc}$
1337	$R^2 = CHF_2, Z = S, R^3 = 3\text{-c-Pr}$
1338	$R^2 = CHF_2, Z = S, R^3 = 3\text{-i-Pr}$
1339	$R^2 = CHF_2, Z = S, R^3 = 3\text{-Ph}$
1340	$R^2 = CHF_2, Z = O, R^3 = 4\text{-F}$
1341	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Cl}$
1342	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Br}$
1343	$R^2 = CHF_2, Z = O, R^3 = 4\text{-I}$
1344	$R^2 = CHF_2, Z = O, R^3 = 4\text{-CN}$
1345	$R^2 = CHF_2, Z = O, R^3 = 4\text{-NO}_2$
1346	$R^2 = CHF_2, Z = O, R^3 = 4\text{-OMe}$
1347	$R^2 = CHF_2, Z = O, R^3 = 4\text{-OCF}_3$
1348	$R^2 = CHF_2, Z = O, R^3 = 4\text{-CF}_3$
1349	$R^2 = CHF_2, Z = O, R^3 = 4\text{-CHF}_2$
1350	$R^2 = CHF_2, Z = O, R^3 = 4\text{-CH}_2\text{F}$
1351	$R^2 = CHF_2, Z = O, R^3 = 4\text{-CHO}$
1352	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Me}$
1353	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Et}$
1354	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Ethyneyl}$
1355	$R^2 = CHF_2, Z = O, R^3 = 4\text{-Ethenyl}$

Table	Header Row
1356	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
1357	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4\text{-OAc}$
1358	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
1359	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4\text{-}i\text{-Pr}$
1360	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4\text{-Ph}$
1361	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-F}$
1362	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Cl}$
1363	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Br}$
1364	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-I}$
1365	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-CN}$
1366	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-NO}_2$
1367	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-OMe}$
1368	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-OCF}_3$
1369	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-CF}_3$
1370	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-CHF}_2$
1371	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
1372	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-CHO}$
1373	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Me}$
1374	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Et}$
1375	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
1376	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
1377	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
1378	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-OAc}$
1379	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
1380	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-}i\text{-Pr}$
1381	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 5\text{-Ph}$
1382	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-F}$
1383	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Cl}$
1384	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Br}$
1385	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-I}$
1386	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-CN}$
1387	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-NO}_2$
1388	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-OMe}$
1389	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-OCF}_3$
1390	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-CF}_3$
1391	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-CHF}_2$
1392	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$

Table	Header Row
1393	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-CHO}$
1394	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Me}$
1395	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Et}$
1396	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
1397	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
1398	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
1399	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-OAc}$
1400	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
1401	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-}i\text{-Pr}$
1402	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 6\text{-Ph}$
1403	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-F}$
1404	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-F}$
1405	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-F}$
1406	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-F}$
1407	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
1408	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
1409	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
1410	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
1411	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
1412	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
1413	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
1414	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
1415	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
1416	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
1417	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
1418	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
1419	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
1420	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
1421	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
1422	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
1423	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
1424	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
1425	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
1426	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
1427	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
1428	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
1429	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$

Table	Header Row
1430	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
1431	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
1432	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
1433	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$
1434	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$
1435	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$
1436	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$
1437	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$
1438	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$
1439	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
1440	$R^2 = \text{CHF}_2, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
1441	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = \text{H} (m=0)$
1442	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-F}$
1443	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Cl}$
1444	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Br}$
1445	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-I}$
1446	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}$
1447	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-NO}_2$
1448	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-OMe}$
1449	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-OCF}_3$
1450	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CF}_3$
1451	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CHF}_2$
1452	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CH}_2\text{F}$
1453	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CHO}$
1454	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Me}$
1455	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Et}$
1456	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Ethyne}$
1457	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Ethenyl}$
1458	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-SO}_2\text{Me}$
1459	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-OAc}$
1460	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-c-Pr}$
1461	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-i-Pr}$
1462	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-Ph}$
1463	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-F}$
1464	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Cl}$
1465	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Br}$
1466	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-I}$

Table	Header Row
1467	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-CN}$
1468	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-NO}_2$
1469	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-OMe}$
1470	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-OCF}_3$
1471	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-CF}_3$
1472	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-CHF}_2$
1473	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-CH}_2\text{F}$
1474	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-CHO}$
1475	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Me}$
1476	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Et}$
1477	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Ethyne}$
1478	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Ethenyl}$
1479	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-SO}_2\text{Me}$
1480	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-OAc}$
1481	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-c-Pr}$
1482	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-i-Pr}$
1483	$R^2 = \text{SO}_2\text{Me}, Z = \text{S}, R^3 = 3\text{-Ph}$
1484	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-F}$
1485	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Cl}$
1486	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Br}$
1487	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-I}$
1488	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-CN}$
1489	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-NO}_2$
1490	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-OMe}$
1491	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-OCF}_3$
1492	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-CF}_3$
1493	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-CHF}_2$
1494	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-CH}_2\text{F}$
1495	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-CHO}$
1496	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Me}$
1497	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Et}$
1498	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Ethyne}$
1499	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Ethenyl}$
1500	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-SO}_2\text{Me}$
1501	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-OAc}$
1502	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-c-Pr}$
1503	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-i-Pr}$

Table	Header Row
1504	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4\text{-Ph}$
1505	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-F}$
1506	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Cl}$
1507	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Br}$
1508	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-I}$
1509	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-CN}$
1510	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-NO}_2$
1511	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-OMe}$
1512	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-OCF}_3$
1513	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-CF}_3$
1514	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-CHF}_2$
1515	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-CH}_2\text{F}$
1516	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-CHO}$
1517	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Me}$
1518	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Et}$
1519	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Ethyneyl}$
1520	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Ethenyl}$
1521	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-SO}_2\text{Me}$
1522	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-OAc}$
1523	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-c-Pr}$
1524	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-i-Pr}$
1525	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 5\text{-Ph}$
1526	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-F}$
1527	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Cl}$
1528	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Br}$
1529	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-I}$
1530	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-CN}$
1531	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-NO}_2$
1532	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-OMe}$
1533	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-OCF}_3$
1534	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-CF}_3$
1535	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-CHF}_2$
1536	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-CH}_2\text{F}$
1537	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-CHO}$
1538	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Me}$
1539	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Et}$
1540	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Ethyneyl}$

Table	Header Row
1541	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Ethenyl}$
1542	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-SO}_2\text{Me}$
1543	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-OAc}$
1544	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-c-Pr}$
1545	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-i-Pr}$
1546	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 6\text{-Ph}$
1547	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-F}$
1548	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-F}$
1549	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-F}$
1550	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-F}$
1551	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Cl}$
1552	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Cl}$
1553	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Cl}$
1554	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Cl}$
1555	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Br}$
1556	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Br}$
1557	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Br}$
1558	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Br}$
1559	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-CN}$
1560	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-CN}$
1561	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-CN}$
1562	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-CN}$
1563	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-Me}$
1564	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-Me}$
1565	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-Me}$
1566	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-Me}$
1567	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-OMe}$
1568	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-OMe}$
1569	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-OMe}$
1570	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-OMe}$
1571	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,4\text{-di-CF}_3$
1572	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,5\text{-di-CF}_3$
1573	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3,6\text{-di-CF}_3$
1574	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 4,5\text{-di-CF}_3$
1575	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Me}$
1576	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-F}$
1577	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-Br}$

Table	Header Row	Table	Header Row
1578	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-OMe}$	1583	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-OMe}$
1579	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 4\text{-CF}_3$	1584	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-CF}_3$
1580	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Me}$		
1581	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-F}$		
1582	$R^2 = \text{SO}_2\text{Me}, Z = \text{O}, R^3 = 3\text{-CN}, 6\text{-Br}$		

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.

5 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.

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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 ("wetable") 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.

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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 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

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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		
	<u>Active</u> <u>Ingredient</u>	<u>Diluent</u>	<u>Surfactant</u>
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

C₆–C₂₂), 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.,
 5 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
 10 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
 15 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
 20 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;
 25 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
 30 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
 35 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
5 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
10 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
15 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
20 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,
25 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),
30 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
35 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 AHigh Strength Concentrate

Compound 2	98.5%
silica aerogel	0.5%
synthetic amorphous fine silica	1.0%

Example BWettable Powder

Compound 5	65.0%
dodecylphenol polyethylene glycol ether	2.0%
sodium ligninsulfonate	4.0%
sodium silicoaluminate	6.0%
montmorillonite (calcined)	23.0%

Example CGranule

Compound 7	10.0%
attapulgite granules (low volatile matter, 0.71/0.30 mm; U.S.S. No. 25–50 sieves)	90.0%

Example DExtruded Pellet

Compound 10	25.0%
anhydrous sodium sulfate	10.0%
crude calcium ligninsulfonate	5.0%
sodium alkyl naphthalenesulfonate	1.0%
calcium/magnesium bentonite	59.0%

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Example EEmulsifiable Concentrate

Compound 18	10.0%
polyoxyethylene sorbitol hexoleate	20.0%
C ₆ –C ₁₀ fatty acid methyl ester	70.0%

Example FMicroemulsion

Compound 52	5.0%
polyvinylpyrrolidone-vinyl acetate copolymer	30.0%
alkylpolyglycoside	30.0%
glyceryl monooleate	15.0%
water	20.0%

Example GSuspension Concentrate

Compound 54	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 HEmulsion in Water

Compound 58	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 IOil Dispersion

Compound 59	25%
polyoxyethylene sorbitol hexaoleate	15%
organically modified bentonite clay	2.5%
fatty acid methyl ester	57.5%

Example JSuspoemulsion

Compound 2	10.0%
imidacloprid	5.0%
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	53.7%

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 invention 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.

Compounds of the invention are useful in treating all plants and plant parts. Plant varieties and cultivars 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 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 A. Additional information for the genetic modifications listed in Exhibit A 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 A for traits. A “-” means the entry is not available.

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

Exhibit A

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Alfalfa	J101	MON-00101-8	T1	cp4 epsps (aroA:CP4)

Alfalfa	J163	MON-00163-7	T1	cp4 epsps (aroA:CP4)
Canola*	23-18-17 (Event 18)	CGN-89465-2	T2	te
Canola*	23-198 (Event 23)	CGN-89465-2	T2	te
Canola*	61061	DP-061061-7	T1	gat4621
Canola*	73496	DP-073496-4	T1	gat4621
Canola*	GT200 (RT200)	MON-89249-2	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	GT73 (RT73)	MON-00073-7	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	HCN10 (Topas 19/2)	-	T3	bar
Canola*	HCN28 (T45)	ACS-BN008-2	T3	pat (syn)
Canola*	HCN92 (Topas 19/2)	ACS-BN007-1	T3	bar
Canola*	MON88302	MON-88302-9	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-BN004-7	T3	bar
Canola*	MS8	ACS-BN005-8	T3	bar
Canola*	OXY-235	ACS-BN011-5	T5	bxn
Canola*	PHY14	-	T3	bar
Canola*	PHY23	-	T3	bar
Canola*	PHY35	-	T3	bar
Canola*	PHY36	-	T3	bar
Canola*	RF1 (B93-101)	ACS-BN001-4	T3	bar
Canola*	RF2 (B94-2)	ACS-BN002-5	T3	bar
Canola*	RF3	ACS-BN003-6	T3	bar
Bean	EMBRAPA 5.1	EMB-PV051-1	T6	ac1 (sense and antisense)
Brinjal #	EE-1	-	T7	cry1Ac
Cotton	19-51a	DD-01951A-7	T11	S4-HrA
Cotton	281-24-236	DAS-24236-5	T3,T7	pat (syn); cry1F
Cotton	3006-210-23	DAS-21023-5	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
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	cry2Ac
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
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	FI117	-	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
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	13pNasNaatAprt1	-	T30	HvNAS1; HvNAAT-A; APRT
Rice	13pAprt1	-	T30	APRT
Rice	gHvNAS1-gHvNAAT- 1	-	T30	HvNAS1; HvNAAT-A; HvNAAT-B
Rice	gHvIDS3-1	-	T30	HvIDS3
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
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-ØZW20-7	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-71800-3	T1	cp4 epsps (aroA:CP4)

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

Treatment of genetically modified plants with compounds of the invention may result in super-additive or synergistic effects. For example, reduction in application rates, broadening of the activity spectrum, increased tolerance to biotic/abiotic stresses or enhanced storage stability may be greater than expected from just simple additive effects of the application of compounds of the invention on genetically modified plants.

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, bencarbazon, benfluralin, benfuresate, bensulfuron-methyl, bensulide, bentazone, benzobicyclon, benzofenap,

5 bicyclopypyrone, 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,

10 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, isooctyl and isopropyl esters and its dimethylammonium, diolamine and trolamine salts, daimuron, dalapon, dalapon-sodium,

15 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,

20 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,

25 fluazifop-P-butyl, fluazolate, flucarbazone, flucetosulfuron, fluchloralin, flufenacet, flufenpyr, flufenpyr-ethyl, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluoroglycofen-ethyl, flupoxam, flupyr-sulfuron-methyl and its sodium salt, flurenol, flurenol-butyl, fluridone, flurochloridone, fluroxypyr, flurtamone, fluthiacet-methyl, fomesafen, foramsulfuron, fosamine-ammonium, glufosinate, glufosinate-ammonium,

30 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, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazaquin-ammonium, imazethapyr, imazethapyr-ammonium, imazosulfuron, indanofan, indaziflam, iofensulfuron,

35 iodosulfuron-methyl, ioxynil, ioxynil octanoate, ioxynil-sodium, ipfencarbazon, 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,

5 methylaldymron, 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,

10 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,

15 pyrazogyl, pyrazolynate, pyrazoxyfen, pyrazosulfuron-ethyl, pyribenzoxim, pyributicarb, pyridate, pyriftalid, pyriminobac-methyl, pyrimisulfan, pyriothiobac, pyriothiobac-sodium, pyroxasulfone, pyroxsulam, quinclorac, quinmerac, quinochloramine, quizalofop-ethyl, quizalofop-P-ethyl, quizalofop-P-tefuryl, rimsulfuron, saflufenacil, sethoxydim, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron-methyl, sulfosulfuron, 2,3,6-

20 TBA, TCA, TCA-sodium, tebutam, tebuthiuron, tefuryltrione, tembotrione, tepraloxydim, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thiencarbazone, thifensulfuron-methyl, thiobencarb, tiafenacil, tiocarbazil, topramezone, tralkoxydim, tri-allate, triafamone, triasulfuron, triaziflam, tribenuron-methyl, triclopyr, triclopyr-butotyl, triclopyr-triethylammonium, tridiphane, trietazine, trifloxysulfuron, trifluralin,

25 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)-

30 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), 3-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propyn-1-yl)-2*H*-1,4-benzoxazin-6-yl]dihydro-1,5-dimethyl-6-thioxo-1,3,5-triazine-2,4(1*H*,3*H*)-dione, 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-

35 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 gloeosporioides (Penz.) Penz. & Sacc., *Drechslera 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
5 regulators such as aviglycine, *N*-(phenylmethyl)-1*H*-purin-6-amine, epocholeone, gibberellic acid, gibberellin A₄ and A₇, 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,
10 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
15 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
20 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
25 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
30 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
35 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
 5 such as allidochlor, benoxacor, cloquintocet-mexyl, cumyluron, cyometrinil, cyprosulfonamide, daimuron, dichlormid, dicyclonon, dietholate, dimepiperate, fenchlorazole-ethyl, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen-ethyl, mefenpyr-dithyl, mephenate, methoxyphenone naphthalic anhydride (1,8-naphthalic anhydride), oxabetrinil, *N*-(aminocarbonyl)-2-methylbenzenesulfonamide, *N*-(aminocarbonyl)-
 10 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-1-yl 1-(3,4-dimethylphenyl)-1,6-dihydro-6-oxo-2-
 15 phenyl-5-pyrimidinecarboxylate 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
 20 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
 25 effective amounts of safeners can be easily determined by one skilled in the art through simple experimentation.

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
 30 component selected from the group consisting of surfactants, solid diluents and liquid diluents.

Table A1 lists specific combinations of a Component (a) with Component (b) illustrative of the mixtures, compositions and methods of the present invention. Compound 2 in the Component (a) column is identified in Index Table A. The second
 35 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 2 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

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

<u>Component (a)</u> <u>(Compound #)</u>	<u>Component (b)</u>	<u>Typical</u> <u>Weight Ratio</u>	<u>More Typical</u> <u>Weight Ratio</u>	<u>Most Typical</u> <u>Weight Ratio</u>
2	Carfentrazone-ethyl	1:128 – 9:1	1:42 – 3:1	1:16 – 1:2
2	Chlorimuron-ethyl	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
2	Chlorotoluron	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
2	Chlorsulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
2	Cincosulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Cinidon-ethyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Cinmethylin	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
2	Clacyfos	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
2	Clethodim	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
2	Clodinafop-propargyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
2	Clomazone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Clomeprop	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
2	Clopyralid	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Cloransulam-methyl	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
2	Cumyluron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Cyanazine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Cyclopyrimorate	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Cyclosulfamuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Cycloxydim	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
2	Cyhalofop	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
2	Daimuron	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Desmedipham	1:322 – 4:1	1:107 – 2:1	1:40 – 1:5
2	Dicamba	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Dichlobenil	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
2	Dichlorprop	1:925 – 2:1	1:308 – 1:3	1:115 – 1:13
2	Diclofop-methyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Diclosulam	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
2	Difenzoquat	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
2	Diffufenican	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
2	Diffluenzopyr	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
2	Dimethachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
2	Dimethametryn	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Dimethenamid-P	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Dithiopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Diuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6

<u>Component (a)</u> <u>(Compound #)</u>	<u>Component (b)</u>	<u>Typical</u> <u>Weight Ratio</u>	<u>More Typical</u> <u>Weight Ratio</u>	<u>Most Typical</u> <u>Weight Ratio</u>
2	EPTC	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
2	Esprocarb	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
2	Ethalfuralin	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Ethametsulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Ethoxyfen	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
2	Ethoxysulfuron	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
2	Etobenzanid	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
2	Fenoxaprop-ethyl	1:120 – 10:1	1:40 – 4:1	1:15 – 1:2
2	Fenoxasulfone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
2	Fenquinotrione	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Fentrazamide	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Flazasulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Florasulam	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
2	Fluazifop-butyl	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Flucarbazone	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
2	Flucetosulfuron	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
2	Flufenacet	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
2	Flumetsulam	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
2	Flumiclorac-pentyl	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
2	Flumioxazin	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
2	Fluometuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Flupyr-sulfuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
2	Fluridone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
2	Fluroxypyr	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
2	Flurtamone	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
2	Fluthiacet-methyl	1:48 – 42:1	1:16 – 14:1	1:3 – 3:1
2	Fomesafen	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
2	Foramsulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
2	Glufosinate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
2	Glyphosate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
2	Halauxifen	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
2	Halauxifen-methyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
2	Halosulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Haloxypyr-methyl	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
2	Hexazinone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3

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

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

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

<u>Component (a)</u> <u>(Compound #)</u>	<u>Component (b)</u>	<u>Typical</u> <u>Weight Ratio</u>	<u>More Typical</u> <u>Weight Ratio</u>	<u>Most Typical</u> <u>Weight Ratio</u>
2	Tiafenacil	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	Thiobencarb	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
2	Topramezone	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
2	Tralkoxydim	1:68 – 17:1	1:22 – 6:1	1:8 – 2:1
2	Triallate	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
2	Triasulfuron	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
2	Triaziflam	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
2	Tribenuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
2	Triclopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
2	Trifloxysulfuron	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
2	Trifluralin	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
2	Triflusulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
2	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 2 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 7” (i.e. Compound 5 identified in Index Table A), and the first line below the column headings in Table A2 specifically discloses a mixture of Compound 5 with 2,4-D. Tables A3 through A20 are constructed similarly.

Table Number Component (a) Column Entries

A2	Compound 5
A3	Compound 7
A4	Compound 10
A5	Compound 18
A6	Compound 52
A7	Compound 54
A8	Compound 58
A9	Compound 59
A10	Compound 141
A11	Compound 166
A12	Compound 147
A13	Compound 79
A14	Compound 178
A15	Compound 274

Table Number	Component (a) Column Entries
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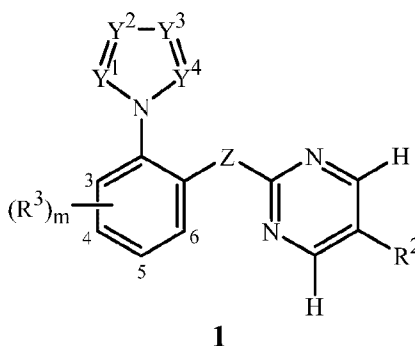
A16	Compound 138
A17	Compound 194
A18	Compound 253
A19	Compound 252
A20	Compound 305

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 consisting of aminocyclopyrachlor, diuron, hexazinone, nicosulfuron, chlorimuron-ethyl, metsulfuron-methyl, thifensulfuron-methyl and tribenuron.

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 for compound descriptions. The following abbreviations are used in the Index Table A which follow: *c* is cyclo, Me is methyl, Et is ethyl, Pr is propyl, *i*-Pr is isopropyl, *t*-Bu is tert-butyl, -CN is cyano, -NO₂ is nitro. The abbreviation "Ex." stands for "Example" and is followed by a number indicating in which example the compound is prepared.

Representative compounds of this invention prepared by the methods described herein are shown in Index Table A. See Index Table B for ¹H NMR data. For mass spectral data (AP⁺ (M+1)), the numerical value reported is the molecular weight of the parent molecular ion (M) formed by addition of H⁺ (molecular weight of 1) to the molecule to give a M+1 peak observed by mass spectrometry using atmospheric pressure chemical ionization (AP⁺). 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



Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
1	N	CCF ₃	CH	CH	O	Br	H (m is 0)	*
2	N	CCF ₃	CH	CH	O	Cl	H (m is 0)	*
3	N	CH	CCl	CH	O	Cl	H (m is 0)	*
4	N	CCF ₃	CH	CH	O	CF ₃	H (m is 0)	*
5	N	CH	CCl	CH	O	Br	H (m is 0)	*
6	N	CH	CCl	CH	O	CF ₃	H (m is 0)	*
7	N	CH	CBr	CH	O	Cl	H (m is 0)	*
8	N	CH	CBr	CH	O	Br	H (m is 0)	*
9	N	CH	CBr	CH	O	CH ₃	H (m is 0)	*
10	N	CH	CBr	CH	O	F	H (m is 0)	*
11	N	CH	CCl	CH	O	F	H (m is 0)	*
12	N	CH	CH	CH	O	Cl	H (m is 0)	*
13	N	CH	CH	CH	O	Br	H (m is 0)	*
14	N	CH	CH	CH	O	F	H (m is 0)	*
15	N	CH	CCl	CH	O	CH ₃	H (m is 0)	*
16	N	CH	CCF ₃	CH	O	Cl	H (m is 0)	*
17	N	CH	CCF ₃	CH	O	CF ₃	H (m is 0)	*
18	N	CH	CCF ₃	CH	O	Br	H (m is 0)	*
19	N	CBr	CBr	CH	O	Cl	H (m is 0)	*
20	N	CBr	CH	CH	O	Br	H (m is 0)	*
21	N	CBr	CH	CH	O	Cl	H (m is 0)	*
22	N	CH	CPh	CH	O	Cl	H (m is 0)	*
23	N	CH	CCH ₃	CH	O	Cl	H (m is 0)	*
24	N	CBr	CBr	CH	O	Br	H (m is 0)	*
25	N	CH	Cl	CH	O	Cl	H (m is 0)	*
26	N	CH	Cl	CH	O	C	H (m is 0)	*
27	N	CH	CCH=CHCH ₃	CH	O	Cl	H (m is 0)	*
28	N	CCF ₃	CH	CH	S	Cl	H (m is 0)	357
29	N	C(<i>t</i> -Bu)	CH	CH	O	Cl	H (m is 0)	*
30	N	C(<i>t</i> -Bu)	CH	CH	O	Br	H (m is 0)	*
31	N	CH	CCH=CH ₂	CH	O	Cl	H (m is 0)	*
32	N	CH	C(CH ₃)=CH ₂	CH	O	Cl	H (m is 0)	*
33	N	CH	CCN	CH	O	Cl	H (m is 0)	*
34	CH	N	CBr	CH	O	Cl	H (m is 0)	*
35	N	CH	CBr	CH	O	Cl	5-OCH ₃	323
36	N	CCH ₃	CH	CH	O	Cl	H (m is 0)	*

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
37	N	CCH ₃	CBr	CH	O	Cl	H (m is 0)	*
38	N	CCH ₃	Cl	CH	O	Cl	H (m is 0)	*
39	N	CCH ₃	CCl	CH	O	Cl	H (m is 0)	*
40	N	CH	CBr	CH	O	Cl	4-CH ₃	366
41	N	CH	CBr	CH	O	Cl	6-OCH ₃	382
42	N	CH	CBr	CH	O	Cl	4-OCH ₃	382
43	N	CH	CBr	CH	O	Br	4-OCH ₃	425
44	N	CH	CBr	CH	O	Cl	3-CH ₃	366
45	N	CH	CBr	CH	O	Br	3-CH ₃	411
46	N	CBr	N	CH	O	Cl	H (m is 0)	*
47	N	CH	CCF ₃	CH	O	F	H (m is 0)	*
48	N	CH	CBr	CH	O	Cl	4-CF ₃	420
49	N	CH	CH	CH	O	Cl	5-Cl	*
50	N	CH	CH	CH	O	Br	5-Cl	*
51	N	CH	CBr	CH	O	Cl	5-Cl	*
52	N	CH	CBr	CH	O	Cl	3-CN	376
53	N	CH	CBr	CH	O	Cl	4-F	124-127
54	N	CBr	CH	N	O	Cl	H (m is 0)	352
55	N	CCN	CH	N	O	Cl	H (m is 0)	299
56	N	CCN	CH	N	O	Br	H (m is 0)	*
57	N	CH	CBr	CH	O	Br	3-CN	422
58	N	CH	CCF ₃	CH	O	Cl	3-CN	*
59	N	CH	CCF ₃	CH	O	Br	3-CN	*
60	N	CH	CBr	CH	O	I	3-CN	470
61	N	CH	CBr	CH	O	Cl	3-CHO	379
62	N	CH	CBr	CH	O	F	3-CN	362
63	N	CH	CBr	CH	O	Cl	3-NO ₂	398
64	N	CH	CBr	CH	O	Cl	3-CF ₃	420
65	N	CH	CBr	CH	O	Cl	3-Br	*
66	N	CH	CBr	CH	O	Cl	3-I	*
67	N	CH	CBr	CH	O	Cl	3-O(C=O)CH ₃	*
68	N	CH	CBr	CH	O	Cl	3-OH	*
69	N	CH	CBr	CH	O	Cl	3-OCH ₂ CF ₃	*
70	N	CH	CBr	CH	O	Cl	3-OCH ₂ CN	406
71	N	CH	CCl	CH	O	Br	3-CN	378
72	N	CH	CCl	CH	O	Cl	3-CN	332

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
73	N	CH	CCl	CH	O	F	3-CN	316
74	CH	CBr	N	CH	O	Cl	3-CN	*
75	N	CH	CCl	CH	O	I	3-CN	424
76	N	CH	CBr	CH	O	CH ₃	3-CN	358
77	N	CH	CBr	CH	O	Br	3-CF ₃	465
78	N	CH	CBr	CH	O	Cl	3-OCF ₃	436
79	N	CH	CCF ₃	CH	O	F	3-CN	*
80	N	CH	CF ₂ H	CH	O	Cl	H (m is 0)	*
81	N	CH	CF ₂ H	CH	O	Br	H (m is 0)	*
82	N	CH	C(<i>t</i> -Bu)	CH	O	Cl	3-CN	354
83	N	CH	CBr	CH	O	Cl	3-CH ₂ F	384
84	N	N	COEt	CH	O	Cl	3-Br	398
85	N	CH	C(<i>i</i> -Pr)	CH	O	Cl	3-CN	340
86	N	CH	Cl	CH	O	F	3-CN	408
87	N	CH	Cl	CH	O	I	3-CN	516
88	N	CH	Cl	CH	O	Br	3-CN	470
89	N	CH	COEt	CH	O	F	3-CN	*
90	N	CH	CCN	CH	O	CH ₃	3-CN	303
91	N	CH	CCN	CH	O	I	3-CN	415
92	N	CH	COEt	CH	O	Cl	3-CN	342
93	N	CH	CCl	CH	O	F	3-CHO	319
94	N	CH	CCl	CH	O	F	3-CHF ₂	341
95	N	CH	CCH ₃	CH	O	Cl	3-CN	311
96	N	CH	CBr	CH	O	Cl	3-C(=O)CH ₃	395
97	N	CH	COCHF ₂	CH	O	Cl	3-CN	364
98	N	CH	COCHF ₂	CH	O	Cl	H (m is 0)	339
99	N	CH	COCH ₂ CHF ₂	CH	O	Cl	3-CN	*
100	CH	N	CH	CH	O	Cl	H (m is 0)	273
101	N	CH	COCHF ₂	CH	O	F	3- Cl	*
102	N	N	C(cyclohexyl)	CH	O	Cl	3-F	374
103	N	CH	CO(<i>i</i> -Pr)	CH	O	Cl	3-Cl	*
104	N	CH	CCF ₃	CH	O	Cl	3-I	467
105	N	CH	CCHF ₂	CH	O	Cl	3-I	*
106	N	N	C(cyclopentyl)	CH	O	Cl	3- F	360
107	N	N	CCH ₂ CH(Me) ₂	CH	O	Cl	3-F	348
108	N	N	CCH ₂ CH ₂ F	CH	O	Cl	3- F	338

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
109	N	CH	COCH ₂ CF ₃	CH	O	F	3-Cl	389
110	N	CH	COCH ₂ CF ₃	CH	O	Cl	3-Cl	*
111	N	CH	CCN	CH	O	F	3-CN	*
112	N	CH	CBr	CH	O	F	3-CHF ₂	386
113	N	CH	CBr	CH	O	CF ₃	3-CN	410
114	N	N	CC(=CH ₂)CH ₃	CH	O	Cl	3-Br	394
115	N	N	CC(=NOH)CH ₃	CH	O	Cl	3-Br	411
116	N	N	CCN	CH	O	Cl	3-Br	377
117	N	N	Cl	CH	O	Cl	3-Br	480
118	N	CH	CCF ₃	CH	O	F	3-CH ₂ F	357
119	N	CH	CCF ₃	CH	O	Cl	3-CH ₂ F	373
120	N	CH	CCF ₃	CH	O	Br	3-CH ₂ F	418
121	N	CH	COMe	CH	O	Cl	3-F	321
122	N	CH	COCHF ₂	CH	O	Cl	3-Br	418
123	N	N	CCH ₂ F	CH	O	Cl	H (m is 0)	306
124	CH	CH	CCHO	CH	O	Cl	H (m is 0)	*
125	N	CH	CBr	CH	O	Br	3-CH ₂ F	429
126	N	CH	COCH ₂ CF ₃	CH	O	F	3-F	*
127	N	CH	CO(<i>n</i> -Pr)	CH	O	Cl	3-F	349
128	N	CH	COCH ₂ CF ₃	CH	O	Cl	3-Br	450
129	N	N	CBr	CH	O	Cl	3-Br	432
130	N	CH	CBr	CH	O	<i>i</i> -Pr	3-CN	386
131	N	CH	CBr	CH	O	<i>n</i> -Pr	3-CN	384
132	N	CH	CSCF ₃	CH	O	Cl	H (m is 0)	*
133	N	CH	CSCF ₃	CH	O	Cl	3-I	*
134	N	CH	CSCF ₃	CH	O	Cl	3-CN	*
135	N	CH	CCN	CH	O	Br	3-CN	369
136	N	CH	Cl	CH	O	CH ₃	3-CN	404
137	N	CH	COMe	CH	O	Cl	3-CN	328
138	N	CH	COCH ₂ CF ₃	CH	O	Cl	H (m is 0)	371
139	N	N	CCHO	CH	O	Cl	3-F	320
140	N	CH	CCN	CH	O	Cl	3-Br	378
141	N	N	CCHF ₂	CH	O	Cl	3-F	342
142	N	CH	CBr	CH	O	Cl	3-SO ₂ CH ₃	429
143	N	CH	CS(O)CF ₃	CH	O	Cl	H (m is 0)	*
144	N	CH	CCN	CH	O	Cl	3-Cl	332

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
145	N	CH	CBr	CH	O	F	3-CHF ₂	368
146	N	CH	CBr	CH	O	Cl	3-CHF(CH ₃)	398
147	N	N	CCHF ₂	CH	O	Cl	H (m is 0)	324
148	N	CH	CO(<i>i</i> -Pr)	CH	O	Cl	3-Br	*
149	N	CH	CO(<i>i</i> -Pr)	CH	O	Cl	3-CN	356
150	N	CH	CO(<i>n</i> -Pr)	CH	O	Cl	3-CN	356
151	N	CH	CCN	CH	O	F	3-CH ₂ F	314
152	N	CH	Cl	CH	O	F	3-CH ₂ F	415
153	N	CH	CO(<i>n</i> -Pr)	CH	O	F	3-F	333
154	N	N	CCH ₂ F	CH	O	Cl	3-F	324
155	N	N	C(<i>c</i> -Pr)	CH	O	Cl	3-F	332
156	N	CH	CO(<i>i</i> -Pr)	CH	O	F	3-Br	*
157	N	CH	COCH ₂ CF ₃	CH	O	F	3-Br	*
158	N	CH	CO(<i>i</i> -Pr)	CH	O	F	3-CN	340
159	N	N	CH	CH	O	Cl	3-F	292
160	N	N	C(<i>c</i> -Pr)	CH	O	Cl	H (m is 0)	314
161	N	CH	CCF ₃	CH	O	Br	3-CHO	414
162	N	CH	CCF ₃	CH	O	F	3-CHO	353
163	N	CH	CCF ₃	CH	O	Br	3-CHF ₂	436
164	N	CH	CCF ₃	CH	O	F	3-CHF ₂	375
165	N	CH	CH	CH	O	Br	3-CN	342
166	N	N	CCF ₃	CH	O	Cl	H (m is 0)	342
167	N	CH	CCF ₃	CH	O	Cl	3-Cl	375
168	N	CH	CCF ₃	CH	O	Br	3-Cl	421
169	N	CH	CCl	CH	O	Cl	3-OMe	337
170	N	CH	CCF ₃	CH	O	Cl	3-CHF ₂	391
171	N	CH	CCF ₃	CH	O	Cl	3-CHO	369
172	N	CH	CBr	CH	O	I	3-CHO	472
173	N	CH	CBr	CH	O	I	3-CHF ₂	494
174	N	CH	CBr	CH	O	CN	3-CHO	371
175	N	CH	CBr	CH	O	CN	3-CHF ₂	393
176	N	CH	CH	CH	O	Cl	3-F	291
177	N	CH	CCl	CH	O	Cl	3-F	325
178	N	CH	CBr	CH	O	Cl	3-F	369
179	N	CH	Cl	CH	O	Cl	3-F	417
180	N	CH	CCF ₃	CH	O	CH ₃	3-CN	*

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
181	N	CH	Cl	CH	O	Cl	3-Cl	435
182	N	CH	Cl	CH	O	Cl	3-CHO	425
183	N	CH	Cl	CH	O	Br	3-CHO	472
184	N	CH	Cl	CH	O	Cl	3-CHF ₂	449
185	N	CH	Cl	CH	O	Br	3-CHF ₂	494
186	N	CH	COMe	CH	O	Cl	H (m is 0)	*
187	N	CH	COEt	CH	O	Cl	H (m is 0)	317
188	N	CH	CC≡CH	CH	O	Cl	H (m is 0)	297
189	N	CH	CC≡CMe	CH	O	Cl	H (m is 0)	311
190	N	CH	C(2-pyridinyl)	CH	O	Cl	H (m is 0)	350
191	N	CH	CCF ₃	CH	O	Cl	3-Br	419
192	N	CH	CCHF ₂	CH	O	Cl	3-Cl	358
193	N	CH	N	CH	O	Cl	3-CN	299
194	N	CH	CBr	CH	O	Cl	3-CHF ₂	402
195	N	CH	CBr	CH	O	Cl	3-Ph	428
196	N	CH	CBr	CH	O	Cl	4,5-diF	389
197	N	CH	CBr	CH	O	Cl	3-CH=CH ₂	392
198	N	CH	CBr	CH	O	Cl	3-C(Me)=CH ₂	392
199	N	CH	CBr	CH	O	Cl	3-C≡CH	377
200	N	CH	CCN	CH	O	Cl	3-CN	323
201	N	CH	CBr	CH	O	Cl	3-Br, 6-OMe	461
202	N	CH	CBr	CH	O	Cl	3-Br, 4-Me	445
203	N	CH	CBr	CH	O	Cl	3-CH=NOMe	*
204	N	CH	Cl	CH	O	Cl	3-CN	424
205	N	CH	CCl	CH	O	Cl	3-CHO	334
206	N	CH	CCl	CH	O	Br	3-CHO	380
207	N	CH	CBr	CH	O	Cl	3-I, 6-OMe	508
208	N	CH	CH	CH	O	Cl	3-CN	298
209	N	CH	CCl	CH	O	Cl	3-CHF ₂	358
210	N	CH	CCl	CH	O	Br	3-CHF ₂	402
211	N	CH	CBr	CH	O	Cl	3-CO ₂ Me	411
212	N	CH	CBr	CH	O	Cl	3-CN, 6-OMe	407
213	N	CH	CBr	CH	O	Cl	4-CN	*
214	N	CH	CBr	CH	O	CN	3-CN	369
215	N	CH	CBr	CH	O	C≡CH	3-CN	368
216	N	CH	CCl	CH	O	Cl	3-OC(=O)Me	365

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
217	N	N	CH	CH	O	Cl	H (m is 0)	274
218	N	CH	CBr	CH	O	OMe	3-CN	372
219	N	CH	CBr	CH	O	Cl	3-Cl	387
220	N	CH	CCl	CH	O	Cl	3-Cl	341
221	N	CH	CCl	CH	O	Cl	3-Br	387
222	N	N	Cl	CH	O	Cl	H (m is 0)	400
223	N	N	CBr	CH	O	Cl	H (m is 0)	354
224	N	N	CCl	CH	O	Cl	H (m is 0)	308
225	N	CH	CBr	CH	O	NO ₂	H (m is 0)	*
226	N	CH	CH	CH	O	CN	H (m is 0)	*
227	N	CH	CH	CH	O	OMe	H (m is 0)	*
228	N	CH	CCHF ₂	CH	O	F	H (m is 0)	307
229	N	CH	CCl	CH	O	Cl	3-OH	324
230	N	CH	CBr	CH	O	Br	3-CHO	425
231	N	CH	CBr	CH	O	Br	3-CHF ₂	447
232	N	CH	CCHF ₂	CH	O	Cl	3-Br	*
233	N	CH	CBr	CH	O	CN	H (m is 0)	*
234	N	CH	CBr	CH	O	OMe	H (m is 0)	*
235	N	CH	CBr	CH	O	Cl	3-CN	377
236	N	CH	CCN	CH	O	Cl	3-CHF ₂	348
237	N	CH	CCN	CH	O	Cl	3-CHO	326
238	N	CH	CBr	CH	O	Cl	3-CN, 5-F	395
239	N	CH	CBr	CH	O	Br	3-CN, 5-F	440
240	N	CH	CCN	CH	O	F	3-CHF ₂	332
241	N	CH	COCH ₂ CF ₃	CH	O	F	H (m is 0)	355
242	N	CH	CCN	CH	O	Cl	3-CH ₂ F	330
243	N	CH	CCN	CH	O	Br	3-CH ₂ F	375
244	N	CH	Cl	CH	O	Br	3-CH ₂ F	476
245	N	CH	Cl	CH	O	Cl	3-CH ₂ F	431
246	N	CH	CSCF ₃	CH	O	Br	H (m is 0)	417
247	N	CH	CSCF ₃	CH	O	F	H (m is 0)	357
248	N	CH	CCF ₃	CH	O	Cl	3-CO ₂ Me	399
249	N	CH	CCl	CH	O	F	3-CH ₂ F	322
250	N	CH	CCl	CH	O	Cl	3-CH ₂ F	340
251	N	CH	CCl	CH	O	Br	3-CH ₂ F	384
252	CH	N	CCF ₃	CH	O	Cl	3-CN	366

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
253	N	CH	CCHF ₂	CH	O	Cl	3-CN	348
254	N	CH	CO(<i>i</i> -Pr)	CH	O	Br	3-CN	*
255	N	CH	CCF ₃	CH	O	Cl	3-C(=O)NMe ₂	412
256	N	CH	CCF ₃	CH	O	Cl	3-C(=O)NHMe	398
257	N	CH	CCF ₃	CH	O	Cl	3-C(=O)NHEt	412
258	N	CH	COCHF ₂	CH	O	Cl	3-Cl	*
259	CH	N	CH	CBr	O	Cl	3-CHF ₂	402
260	CH	N	CMe	CH	O	Cl	3-CN	312
261	CH	N	CH	CH	O	Cl	3-CN	298
262	N	CH	CCF ₃	CH	O	Cl	3-C(=O)N(Me)Et	426
263	N	CH	CCF ₃	CH	O	Cl	3-C(=O)NEt ₂	440
264	N	CMe	CH	CMe	O	Cl	H (m is 0)	301
265	N	CMe	CH	CCF ₂	O	Cl	H (m is 0)	334
266	N	CCF ₃	CH	CMe	O	Cl	H (m is 0)	355
267	N	CCHF ₂	CH	CMe	O	Cl	H (m is 0)	337
268	N	CCHF ₂	CH	CCF ₂	O	Cl	H (m is 0)	121
269	CH	CH	CH	CH	O	Cl	H (m is 0)	*
270	N	CH	COCH ₂ CF ₃	CH	O	Cl	3-F	389
271	N	CH	COCHF ₂	CH	O	Cl	3-F	357
272	N	N	CCHO	CH	O	Cl	H (m is 0)	302
273	N	N	CCN	CH	O	Cl	3-CN	324
274	N	CH	COCH ₂ CF ₃	CH	O	Cl	3-CN	396
275	N	CH	CBr	CH	O	H	H (m is 0)	318
276	N	N	C(3-CF ₃ -Ph)	CH	O	Cl	3- F	436
277	N	N	C(3-thienyl)	CH	O	Cl	3- F	374
278	N	CH	CCF ₃	CH	O	Cl	3-C(=O)NH ₂	384
279	N	CH	CCF ₃	CH	O	Cl	3-[3-(1,2,4-oxadiazole)]	409
280	N	N	CC(=O)CH ₃	CH	O	Cl	3-Br	396
281	N	CH	CC(=O)NH ₂	CH	O	Cl	H (m is 0)	316
282	N	CH	CSO ₂ NH ₂	CH	O	Cl	H (m is 0)	352
283	N	CH	CSO ₂ NH(<i>t</i> -Bu)	CH	O	Cl	H (m is 0)	408
284	N	CH	C(3-CF ₃ -pyrazol-1-yl)	CH	O	Cl	3-CN	432
285	N	CH	CB(OCMe ₂ CMe ₂ O)	CH	O	Cl	3-CN	424
286	N	CH	C(4-pyridinyl)	CH	O	Cl	H (m is 0)	350
287	N	CH	CBr	CH	O	Cl	3-(2-oxazolyl)	419

Cmpd No.	Y ¹	Y ²	Y ³	Y ⁴	Z	R ²	(R ³) _m	mp or MS
288	N	CH	CBr	CH	O	Cl	3-CH=NNH ₂	394
289	N	CH	CBr	CH	O	Cl	3-CH=NNHMe	408
290	N	CH	CBr	CH	O	Cl	3-(3-pyridinyl)	429
291	N	CH	CBr	CH	O	Cl	3-(4-isoxazolyl)	419
292	N	CH	CCl	CH	O	Cl	3-C(=S)NH ₂	365
293	N	CH	CBr	CH	O	Cl	3-C≡CSi(Me) ₃	449
294	N	CH	CCO ₂ Et	CH	O	Br	3-CN	416
295	N	CH	CCl	CH	O	Cl	3-CH=NNH ₂	350
296	N	CH	CCl	CH	O	Cl	3-CH=NNHMe	363
297	N	N	CSi(Me) ₃	CH	O	Cl	H (m is 0)	346
298	N	CH	CCF ₃	CH	O	Cl	3-[2-(1,3,4-oxadiazole)]	409
299	N	CH	CCF ₃	CH	O	Cl	3-[5-(3-Me-1,2,4-oxadiazole)]	423
300	N	N	CSi(Me) ₃	CH	O	Cl	3-Br	*
301	N	CH	CCO ₂ Et	CH	O	Cl	3-CN	*
302	N	N	CCO ₂ Et	CH	O	Cl	H (m is 0)	346
303	N	N	C(3,5-diF-Ph)	CH	O	Cl	3-Br	466
304	N	CH	CNO ₂	CH	O	Cl	3-CN	343
305	N	N	CCHF ₂	CH	O	Br	3-F	386

* See Index Table B for ¹H NMR data.

INDEX TABLE B

No.	¹ H NMR Data (CDCl ₃ solution unless indicated otherwise) ^a
1	8.48 (s, 2H), 7.96 (s, 1H), 7.80 (d, 1H), 7.49 (t, 1H), 7.44 (t, 1H), 7.35 (d, 1H), 6.57 (s, 1H)
2	8.39 (s, 2H), 7.93 (s, 1H), 7.81 (d, 1H), 7.48 (t, 1H), 7.42 (t, 1H), 7.35 (d, 1H), 6.58 (s, 1H)
3	8.42 (s, 2H), 7.92 (s, 1H), 7.77 (d, 1H), 7.52 (s, 1H), 7.42 (m, 2H), 7.31 (d, 1H)
4	8.70 (s, 2H), 7.90 (s, 1H), 7.78 (d, 1H), 7.52 (t, 1H), 7.47 (t, 1H), 7.38 (d, 1H), 6.57 (s, 1H)
5	8.49 (s, 2H), 7.91 (s, 1H), 7.77 (d, 1H), 7.52 (s, 1H), 7.42 (m, 2H), 7.30 (d, 1H)
6	8.72 (s, 2H), 7.88 (s, 1H), 7.77 (d, 1H), 7.50 (s, 1H), 7.44–7.46 (m, 2H), 7.32 (d, 1H)
7	8.41 (s, 2H), 7.94 (s, 1H), 7.77 (d, 1H), 7.55 (s, 1H), 7.42 (m, 2H), 7.32 (d, 1H)
8	8.49 (s, 2H), 7.96 (s, 1H), 7.78 (d, 1H), 7.56 (s, 1H), 7.41–7.46 (m, 2H), 7.32 (d, 1H)
9	8.30 (s, 2H), 7.99 (s, 1H), 7.78 (d, 1H), 7.55 (s, 1H), 7.36–7.43 (m, 2H), 7.28 (d, 1H), 2.23 (s, 1H)
10	8.34 (s, 2H), 7.97 (s, 1H), 7.78 (d, 1H), 7.55 (s, 1H), 7.41–7.47 (m, 2H), 7.32 (d, 1H)
11	8.34 (s, 2H), 7.92 (s, 1H), 7.78 (d, 1H), 7.51 (s, 1H), 7.39–7.45 (m, 2H), 7.30 (d, 1H)
12	8.38 (s, 2H), 7.90 (s, 1H), 7.82 (d, 1H), 7.59 (s, 1H), 7.43 (m, 2H), 7.32 (d, 1H), 6.31 (s, 1H)
13	8.46 (s, 2H), 7.90 (s, 1H), 7.81 (d, 1H), 7.59 (s, 1H), 7.41 (m, 2H), 7.31 (d, 1H), 6.32 (s, 1H)

- 14 8.29 (s, 2H), 7.91 (s, 1H), 7.83 (d, 1H), 7.59 (s, 1H), 7.41 (m, 2H), 7.32 (d, 1H), 6.30 (s, 1H)
- 15 8.30 (s, 2H), 7.96 (s, 1H), 7.80 (d, 1H), 7.51 (s, 1H), 7.35–7.44 (m, 2H), 7.28 (d, 1H), 2.23 (s, 1H)
- 16 8.41 (s, 2H), 8.18 (s, 1H), 7.77 (m, 2H), 7.48 (t, 1H), 7.44 (t, 1H), 7.35 (d, 1H)
- 17 8.71 (s, 2H), 8.14 (s, 1H), 7.75 (m, 2H), 7.51 (t, 1H), 7.48 (t, 1H), 7.38 (d, 1H)
- 18 8.49 (s, 2H), 8.18 (s, 1H), 7.78 (m, 2H), 7.48 (t, 1H), 7.44 (t, 1H), 7.34 (d, 1H)
- 19 8.44 (s, 2H), 7.92 (s, 1H), 7.78 (d, 1H), 7.39–7.47 (m, 2H), 7.30 (d, 1H)
- 20 8.48 (s, 2H), 7.82 (s, 1H), 7.81 (d, 1H), 7.38–7.46 (m, 2H), 7.30 (d, 1H), 6.32 (s, 1H)
- 21 8.40 (s, 2H), 7.82 (s, 1H), 7.81 (d, 1H), 7.38–7.45 (m, 2H), 7.31 (d, 1H), 6.32 (s, 1H)
- 22 8.37 (s, 2H), 8.18 (s, 1H), 7.86 (s, 1H), 7.85 (d, 2H), 7.41–7.47 (m, 4H), 7.32–7.38 (m, 3H), 7.23 (d, 1H)
- 23 8.38 (s, 2H), 7.80 (d, 1H), 7.68 (s, 1H), 7.35–7.42 (m, 3H), 7.28 (d, 1H), 6.30 (s, 1H), 2.03 (s, 3H)
- 24 8.52 (s, 2H), 7.92 (s, 1H), 7.78 (d, 1H), 7.39–7.47 (m, 2H), 7.29 (d, 1H)
- 25 8.41 (s, 2H), 7.95 (s, 1H), 7.77 (d, 1H), 7.58 (s, 1H), 7.38–7.47 (m, 2H), 7.31 (d, 1H)
- 26 8.48 (s, 2H), 7.95 (s, 1H), 7.77 (d, 1H), 7.58 (s, 1H), 7.39–7.45 (m, 2H), 7.29 (d, 1H)
- 27 8.38 (s, 2H), 7.81 (s, 1H), 7.80 (d, 1H), 7.60 (s, 1H), 7.37–7.41 (m, 2H), 7.29 (m, 1H), 6.17 (d, 1H), 5.98 (d, 1H), 1.81 (d, 3H)
- 29 8.37 (s, 2H), 7.76 (d, 1H), 7.71 (s, 1H), 7.38 (m, 2H), 7.32 (d, 1H), 6.1 (s, 1H), 1.21 (s, 9H)
- 30 8.46 (s, 2H), 7.76 (d, 1H), 7.71 (s, 1H), 7.38 (m, 2H), 7.31 (d, 1H), 6.12 (s, 1H), 1.22 (s, 9H)
- 31 8.39 (s, 2H), 7.91 (s, 1H), 7.8 (d, 1H), 7.68 (s, 1H), 7.40 (m, 2H), 7.30 (d, 1H), 6.49 (m, 1H), 5.47 (dd, 1H), 5.08 (dd, 1H)
- 32 8.38 (s, 2H), 7.90 (d, 1H), 7.82 (s, 1H), 7.60 (d, 1H), 7.40 (m, 2H), 7.31 (d, 1H), 5.98 (dd, 1H), 5.63 (dd, 1H), 1.81 (t, 3H)
- 33 8.43 (s, 2H), 8.34 (s, 1H), 7.88 (s, 1H), 7.80 (d, 1H), 7.56 (t, 1H), 7.46 (t, 1H), 7.34 (d, 1H)
- 34 8.39 (s, 2H), 7.59 (s, 1H), 7.51 (m, 1H), 7.42 (d, 2H), 7.34 (d, 1H), 7.15 (s, 1H)
- 36 8.38 (s, 2H), 7.80 (m, 2H), 7.37 (m, 2H), 7.28 (d, 1H), 6.08 (s, 1H), 2.25 (s, 3H)
- 37 8.41 (s, 2H), 7.88 (s, 1H), 7.76 (d, 1H), 7.38 (m, 2H), 7.28 (d, 1H), 2.22 (s, 3H)
- 38 8.41 (s, 2H), 7.88 (s, 1H), 7.76 (d, 1H), 7.37–4.40 (m, 2H), 7.28 (d, 1H), 2.22 (s, 3H)
- 39 8.42 (s, 2H), 7.87 (s, 1H), 7.78 (d, 1H), 7.38 (m, 2H), 7.28 (d, 1H), 2.22 (s, 3H)
- 46 8.51 (s, 1H), 8.44 (s, 2H), 7.82 (d, 1H), 7.51 (t, 1H), 7.45 (t, 1H), 7.35 (d, 1H)
- 47 8.33 (s, 2H), 8.19 (s, 1H), 7.80 (s, 1H), 7.78 (d, 1H), 7.48 (t, 1H), 7.44 (t, 1H), 7.33 (d, 1H)
- 49 8.39 (s, 2H), 7.89 (d, 1H), 7.77 (d, 1H), 7.58 (s, 1H), 7.39 (d, 1H), 7.33 (s, 1H), 6.30 (d, 1H)
- 50 8.47 (s, 2H), 7.89 (d, 1H), 7.78 (d, 1H), 7.59 (s, 1H), 7.39 (d, 1H), 7.33 (s, 1H), 6.30 (d, 1H)
- 51 8.43 (s, 2H), 7.93 (s, 1H), 7.73 (d, 1H), 7.55 (s, 1H), 7.40 (d, 1H), 7.33 (s, 1H)
- 56 8.53 (s, 2H), 8.03 (s, 1H), 7.96 (dd, 1H), 7.65–7.54 (m, 1H), 7.50–7.47 (m, 1H), 7.41 (dd, 1H)
- 58 8.40 (s, 2H), 8.05 (s, 1H), 7.85 (s, 1H), 7.78 (d, 1H), 7.6–7.7 (m, 2H)
- 59 8.49 (s, 2H), 8.05 (s, 1H), 7.85 (s, 1H), 7.79 (d, 1H), 7.62–7.65 (m, 2H)
- 65 8.41 (s, 2H), 7.66–7.64 (m, 1H), 7.53 (s, 1H), 7.53 (s, 1H), 7.45–7.40 (m, 1H), 7.32–7.28 (m, 1H)
- 66 8.41 (s, 2H), 7.90–7.86 (m, 1H), 7.54 (d, 1H), 7.50 (d, 1H), 7.33–7.26 (m, 2H)

- 67 8.40 (s, 2H), 7.56 (s, 1H), 7.54–7.50 (m, 2H), 7.24 (dd, 1H), 7.22–7.18 (m, 1H), 2.13 (s, 3H)
- 68 10.06 (s, 1H), 8.43 (s, 2H), 8.16 (s, 1H), 7.64 (s, 1H), 7.26 (t, 1H), 7.04 (dd, 1H), 6.79 (dd, 1H)
- 69 8.40 (s, 2H), 7.55 (d, 1H), 7.53–7.45 (m, 3H), 7.08 (dd, 1H), 7.01 (dd, 1H), 4.32 (q, 3H)
- 74 8.39 (s, 2H), 7.76 (d, 1H), 7.66 (t, 1H), 7.60 (d, 1H), 7.55 (s, 1H), 7.11 (s, 1H)
- 79 8.32 (s, 2H), 8.05 (s, 1H), 7.84 (s, 1H), 7.77 (d, 1H), 7.63–7.65 (m, 2H)
- 80 8.40 (s, 2H), 8.08 (s, 1H), 7.80 (d, 1H), 7.72 (s, 1H), 7.41–7.50 (m, 2H), 7.33 (d, 1H), 6.67 (t, 1H)
- 81 8.48 (s, 2H), 8.08 (s, 1H), 7.80 (d, 1H), 7.72 (s, 1H), 7.42–7.47 (m, 2H), 7.33 (d, 1H), 6.67 (t, 1H)
- 89 8.30 (s, 2H), 7.72 (m, 1H), 7.47–7.60 (m, 2H), 7.40 (m, 2H), 3.89 (m, 2H), 1.34 (m, 3H)
- 99 8.39 (s, 2H), 7.73 (m, 1H), 7.52–7.61 (m, 2H), 7.49 (m, 1H), 7.46 (m, 1H), 5.83–6.13 (m, 2H), 4.03–4.09 (m, 2H)
- 101 8.30 (s, 2H), 7.44–7.50 (m, 4H), 7.28 (m, 1H), 6.32–6.47 (s, 1H)
- 103 8.38 (s, 2H), 7.38–7.51 (m, 2H), 7.30 (m, 1H), 7.25 (m, 1H), 7.15 (m, 1H), 4.03–4.18 (m, 1H), 1.25 (m, 6H)
- 105 8.39 (s, 2H), 7.89 (d, 1H), 7.71 (s, 1H), 7.64 (s, 1H), 7.27–7.33 (m, 2H), 7.69 (t, 1H)
- 110 8.40 (s, 2H), 7.48 (s, 1H), 7.47 (m, 1H), 7.39 (m, 1H), 7.29 (m, 1H), 7.25–7.27 (m, 1H), 4.20 (m, 2H)
- 111 7.60–7.65 (m, 1H), 7.65–7.72 (m, 1H), 7.79 (d, J=7.83 Hz, 1H), 7.96 (s, 1H), 8.21 (s, 1H), 8.36 (s, 2H)
- 124 9.74 (s, 1H), 8.35 (s, 2H), 7.40–7.53 (m, 4H), 7.33–7.36 (m, 1H), 6.91–6.94 (m, 1H), 6.61 (dd, 1H)
- 126 8.31 (s, 2H), 7.48 – 7.42 (m, 1H), 7.38 – 7.36 (m, 2H), 7.22 – 7.14 (m, 2H), 4.26 – 4.17 (m, 2H)
- 132 8.37 (s, 2H), 8.14 (s, 1H), 7.80 (d, 1H), 7.71 (s, 1H), 7.41–7.50 (2xt, 1H each), 7.35 (d, 1H)
- 133 8.38 (s, 2H), 7.91 (d, 1H), 7.72 (d, 2H), 7.28–7.37 (m, 2H)
- 134 8.36 (s, 2H), 8.01 (s, 1H), 7.78 (s+d, 2H), 7.63 (2xt, 2H)
- 143 8.43 (s, 1H), 8.40 (s, 2H), 8.01 (s, 1H), 7.82 (d, 1H), 7.53 (t, 1H), 7.46 (t, 1H), 7.37 (d, 1H)
- 148 8.38 (s, 2H), 7.68 – 7.56 (m, 1H), 7.44 – 7.33 (m, 1H), 7.31 – 7.27 (m, 2H), 7.15 – 7.11 (m, 1H), 4.16 – 4.05 (m, 1H), 1.27 – 1.24 (m, 6H)
- 156 8.38 (s, 2H), 7.68 – 7.56 (m, 1H), 7.44 – 7.33 (m, 1H), 7.31 – 7.27 (m, 2H), 7.15 – 7.11 (m, 1H), 4.16 – 4.05 (m, 1H), 1.27 – 1.24 (m, 6H)
- 157 8.32 (s, 2H), 7.73 – 7.54 (m, 1H), 7.43 – 7.36 (m, 2H), 7.31 – 7.27 (m, 2H), 4.26 – 4.17 (m, 2H)
- 180 8.28 (s, 2H), 8.08 – 7.99 (m, 1H), 7.84 (s, 1H), 7.78 – 7.72 (m, 1H), 7.67 – 7.57 (m, 2H), 2.42 – 2.07 (m, 4H)
- 186 8.39 (s, 2H), 7.80 – 7.77 (m, 1H), 7.61 – 7.60 (m, 1H), 7.40 – 7.36 (m, 2H), 7.36 – 7.33 (m, 1H), 7.32 – 7.27 (m, 1H), 3.70 (s, 3H)
- 203 3.95 (s, 3H), 7.31 (d, 1H), 7.51 (m, 1H), 7.53 (s, 1H), 7.57 (s, 1H), 7.69 (s, 1H), 7.94 (d, 1H), 8.40 (s, 2H)
- 213 7.42 (d, 1H), 7.61 (s, 1H), 7.67 (m, 1H), 8.05 (s, 1H), 8.2 (m, 1H), 8.45 (s, 2H)
- 225 9.24 (s, 2H), 7.87 (s, 1H), 7.73 (d, 1H), 7.49 (m, 3H), 7.32 (d, 1H)
- 226 8.69 (s, 2H), 7.82 (s, 1H), 7.75 (d, 1H), 7.54 (s, 1H), 7.45 (m, 2H), 7.35 (d, 1H), 6.30 (s, 1H)
- 227 8.12 (s, 2H), 7.98 (s, 1H), 7.85 (d, 1H), 7.59 (s, 1H), 7.38 (m, 2H), 7.29 (d, 1H), 6.29 (s, 1H), 3.82 (s, 3H)
- 232 8.39 (s, 2H), 7.71 (s, 1H), 7.65–7.69 (m, 2H), 7.45 (t, 1H), 7.32 (d, 2H), 6.68 (t, 1H)

- 233 8.73 (s,2H), 7.87 (s, 1H), 7.73 (d, 1H), 7.52 (s, 1H), 7.47 (m, 2H), 7.33 (d, 1H)
- 234 8.15 (s,2H), 8.00 (s, 1H), 7.79 (d, 1H), 7.56 (s, 1H), 7.38 (m, 2H), 7.28 (d, 1H), 3.85 (s,3H)
- 254 8.45 (s, 2H), 7.77 - 7.66 (m, 1H), 7.61 - 7.45 (m, 2H), 7.39 (s, 2H), 4.17 - 4.08 (m, 1H), 1.28 - 1.24 (m, 6H)
- 258 8.39 (s, 2H), 7.50 - 7.44 (m, 4H), 7.29 - 7.26 (m, 1H), 6.46 - 6.16 (m, 1H)
- 269 8.32 (s,2H), 7.28-7.47 (m,4H), 6.89 (t,2H), 6.13 (t,2H)
- 300 8.37 (s, 2H), 7.69 (dd, J=8.2, 1.3 Hz, 1H), 7.66 (s, 1H), 7.47 (t, J=8.2 Hz, 1H), 7.34 (dd, J= 8.3, 1.3 Hz, 1H), 0.30 (m, 9H)
- 301 8.48 - 8.37 (m, 2H), 8.22 (s, 1H), 8.04 (s, 1H), 7.85 - 7.71 (m, 1H), 7.68 - 7.57 (m, 2H), 4.36 - 4.24 (m, 2H), 1.41 - 1.26 (m, 3H)

^a ¹H NMR data are in ppm downfield from tetramethylsilane at 500 MHz. Couplings are designated by (s)-singlet, (d)-doublet, (t)-triplet, (m)-multiplet and (dd)-doublet of doublets.

BIOLOGICAL EXAMPLES OF THE INVENTION

TEST A

- 5 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
- 10 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
- 15 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
- 20 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	13	14	53	54	55	56	65	66	67	69	70	102	114
25	Postemergence														
	Barnyardgrass	90	90	20	90	30	10	30	100	80	20	50	80	50	100
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	40	-
	Corn	30	40	20	30	50	20	20	70	40	10	20	10	20	70

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

	Table A	Compounds													
	1000 g ai/ha	115	116	123	139	154	155	159	160	193	207	216	217	222	223
	Postemergence														
	Barnyardgrass	90	90	100	0	100	100	70	100	90	10	0	30	100	100
15	Blackgrass	-	-	90	0	90	100	50	100	-	-	-	-	-	-
	Corn	90	60	70	20	90	100	40	100	60	0	0	0	50	60
	Crabgrass, Large	90	100	-	-	-	-	-	-	80	40	40	60	100	100
	Foxtail, Giant	90	90	90	0	100	100	90	100	80	60	30	50	90	90
	Galium	-	-	100	10	100	100	90	100	-	-	-	-	-	-
20	Kochia	-	-	100	0	100	100	100	100	-	-	-	-	-	-
	Morningglory	100	100	-	-	-	-	-	-	90	30	40	90	100	100
	Pigweed	100	100	100	30	100	100	100	100	100	70	100	100	100	100
	Ragweed	-	-	100	0	100	100	80	100	-	-	-	-	-	-
	Ryegrass, Italian	-	-	90	0	90	100	30	90	-	-	-	-	-	-
25	Velvetleaf	100	100	-	-	-	-	-	-	90	30	100	100	100	100
	Wheat	90	50	70	0	80	90	30	100	20	0	0	20	40	70

	Table A	Compounds													
	1000 g ai/ha	224	229	248	255	256	257	262	263	276	280	281	282	283	297
	Postemergence														
30	Barnyardgrass	90	0	70	10	10	10	10	0	20	90	0	90	0	10
	Blackgrass	-	-	30	10	10	10	10	20	20	-	0	100	10	-
	Corn	50	0	80	0	0	0	0	0	10	50	10	50	0	0
	Crabgrass, Large	80	0	-	-	-	-	-	-	-	90	-	-	-	30
	Foxtail, Giant	90	0	100	10	10	10	10	0	20	90	0	60	0	10
35	Galium	-	-	100	10	30	30	10	10	20	-	60	30	30	-
	Kochia	-	-	90	50	30	60	30	10	40	-	70	90	10	-
	Morningglory	100	0	-	-	-	-	-	-	-	30	-	-	-	30

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	Pigweed	100	60	100	30	10	40	50	10	80	100	70	80	20	70
	Ragweed	-	-	50	10	10	30	10	0	30	-	70	100	20	-
	Ryegrass, Italian	-	-	50	0	0	0	0	0	0	-	0	80	0	-
	Velvetleaf	100	0	-	-	-	-	-	-	-	90	-	-	-	60
5	Wheat	60	0	20	0	0	0	0	0	0	40	0	0	0	0
	Table A	Compounds													
	1000 g ai/ha	298	299	300	302	303									
	Postemergence														
	Barnyardgrass	90	80	0	0	20									
10	Blackgrass	80	80	0	0	-									
	Corn	70	70	10	0	10									
	Crabgrass, Large	-	-	-	-	20									
	Foxtail, Giant	90	90	30	0	20									
	Galium	80	80	40	0	-									
15	Kochia	100	70	20	0	-									
	Morningglory	-	-	-	-	30									
	Pigweed	100	100	60	0	90									
	Ragweed	90	30	0	0	-									
	Ryegrass, Italian	70	70	0	0	-									
20	Velvetleaf	-	-	-	-	70									
	Wheat	40	20	0	0	0									
	Table A	Compounds													
	500 g ai/ha	1	2	3	4	5	6	7	8	9	10	11	15	16	17
	Postemergence														
25	Barnyardgrass	30	70	90	0	60	100	100	90	90	90	90	60	100	20
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	10	40	40	0	30	60	50	30	50	50	50	20	80	40
	Crabgrass, Large	50	60	80	0	80	100	100	90	80	80	90	60	100	90
	Foxtail, Giant	60	80	90	0	100	100	100	90	90	90	90	70	100	90
30	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	20	70	70	0	90	70	100	100	30	100	100	20	100	50
	Pigweed	100	100	100	20	100	100	100	100	90	100	100	100	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	70	60	100	0	100	100	100	100	100	100	100	100	100	100
	Wheat	0	0	0	0	40	90	50	20	30	60	20	10	80	50

Table A		Compounds													
500 g ai/ha		18	19	20	21	22	23	24	25	26	27	28	29	30	31
5	Postemergence														
	Barnyardgrass	100	20	30	40	70	40	0	100	90	10	10	0	10	50
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	90	30	30	30	30	60	0	40	30	10	20	0	0	20
	Crabgrass, Large	100	20	30	50	70	60	0	100	100	60	20	40	40	60
10	Foxtail, Giant	100	30	60	90	90	90	0	100	90	30	10	30	10	50
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	100	40	40	80	90	90	0	90	90	50	10	0	0	30
	Pigweed	100	90	100	100	100	100	60	100	100	70	30	50	30	70
15	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	60	70	80	100	100	0	100	100	70	30	40	30	100
	Wheat	50	0	20	20	0	20	0	60	30	0	0	0	0	0

[illegible][illegible]

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	Corn	30	90	0	0	0	20	90	90	100	100	30	0	90	30
	Crabgrass, Large	20	100	20	10	10	20	100	100	100	100	70	0	100	90
	Foxtail, Giant	20	100	20	10	0	10	100	100	100	100	80	0	100	80
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	50	100	30	20	30	20	100	80	100	100	50	0	100	80
	Pigweed	80	100	50	40	30	70	100	100	100	100	100	0	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Velvetleaf	40	100	10	30	10	60	100	100	100	100	100	30	100	100
	Wheat	0	100	0	0	0	0	100	30	100	100	10	0	100	10
	Table A	Compounds													
	500 g ai/ha	64	68	71	72	73	74	75	76	77	78	79	80	81	82
	Postemergence														
15	Barnyardgrass	100	0	90	100	90	90	70	100	70	50	100	100	100	20
	Blackgrass	-	0	-	-	-	-	-	-	-	-	-	-	-	50
	Corn	90	0	60	60	80	70	40	80	40	30	100	10	30	10
	Crabgrass, Large	100	-	100	100	100	90	70	100	90	100	100	100	90	-
	Foxtail, Giant	100	0	90	100	100	90	80	90	90	90	100	90	90	20
20	Galium	-	0	-	-	-	-	-	-	-	-	-	-	-	20
	Kochia	-	0	-	-	-	-	-	-	-	-	-	-	-	10
	Morningglory	80	-	90	100	100	100	60	90	100	90	100	100	100	-
	Pigweed	100	0	100	100	100	100	100	100	100	100	100	100	100	40
	Ragweed	-	0	-	-	-	-	-	-	-	-	-	-	-	10
25	Ryegrass, Italian	-	0	-	-	-	-	-	-	-	-	-	-	-	20
	Velvetleaf	100	-	100	100	100	100	70	100	100	100	100	100	100	-
	Wheat	30	0	40	50	50	50	0	10	30	20	90	80	60	30
	Table A	Compounds													
	500 g ai/ha	83	84	85	86	87	88	89	90	91	92	93	94	95	96
30	Postemergence														
	Barnyardgrass	100	100	90	100	20	80	90	100	10	100	0	90	80	30
	Blackgrass	100	100	80	100	50	100	90	70	30	-	-	-	-	-
	Corn	60	70	70	100	20	50	90	80	0	80	0	50	70	10
	Crabgrass, Large	-	-	-	-	-	-	-	-	-	90	0	90	90	30
35	Foxtail, Giant	100	100	90	100	60	80	90	90	10	90	0	90	80	20
	Galium	100	100	100	100	90	100	90	100	70	-	-	-	-	-
	Kochia	100	100	100	100	90	100	90	100	30	-	-	-	-	-

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	Morningglory	-	-	-	-	-	-	-	-	-	100	0	100	90	10
	Pigweed	100	100	100	100	100	100	100	100	50	100	0	100	100	40
	Ragweed	80	90	60	100	70	30	90	80	30	-	-	-	-	-
	Ryegrass, Italian	80	80	100	100	40	90	90	80	0	-	-	-	-	-
5	Velvetleaf	-	-	-	-	-	-	-	-	-	100	0	100	100	10
	Wheat	60	80	70	90	0	50	70	50	10	70	0	50	40	0
	Table A	Compounds													
	500 g ai/ha	97	98	111	112	113	117	129	130	131	132	134	135	136	137
	Postemergence														
10	Barnyardgrass	100	90	90	90	80	90	90	0	0	70	90	100	90	100
	Blackgrass	-	-	-	-	-	80	90	0	0	90	90	90	100	90
	Corn	90	70	90	70	60	50	50	0	0	50	60	80	60	80
	Crabgrass, Large	100	100	90	100	70	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	90	90	90	90	60	90	100	0	0	90	100	100	90	100
15	Galium	-	-	-	-	-	100	100	0	0	100	100	90	100	100
	Kochia	-	-	-	-	-	100	100	0	0	100	100	70	100	100
	Morningglory	100	100	90	100	30	-	-	-	-	-	-	-	-	-
	Pigweed	100	100	100	100	80	100	100	0	0	100	100	100	100	100
	Ragweed	-	-	-	-	-	100	90	0	0	30	60	100	100	100
20	Ryegrass, Italian	-	-	-	-	-	90	90	0	0	60	100	70	90	80
	Velvetleaf	100	100	100	100	80	-	-	-	-	-	-	-	-	-
	Wheat	70	60	80	70	60	70	70	0	0	60	70	60	50	70
	Table A	Compounds													
	500 g ai/ha	138	142	143	145	146	147	150	161	162	163	164	165	166	167
25	Postemergence														
	Barnyardgrass	100	0	80	100	60	90	-	0	10	100	100	0	100	100
	Blackgrass	90	0	90	100	70	100	100	-	-	-	-	-	-	-
	Corn	90	0	40	60	30	90	90	0	10	50	90	0	60	50
	Crabgrass, Large	-	-	-	-	-	-	-	0	10	90	100	10	100	90
30	Foxtail, Giant	100	0	100	100	80	90	100	0	0	90	100	20	90	90
	Galium	100	0	100	100	100	100	100	-	-	-	-	-	-	-
	Kochia	100	70	90	100	100	100	100	-	-	-	-	-	-	-
	Morningglory	-	-	-	-	-	-	-	0	10	100	100	20	100	100
	Pigweed	100	0	100	100	100	100	100	80	70	100	100	80	100	100
35	Ragweed	60	0	100	100	10	100	60	-	-	-	-	-	-	-
	Ryegrass, Italian	90	0	90	100	40	90	100	-	-	-	-	-	-	-
	Velvetleaf	-	-	-	-	-	-	-	20	50	100	100	30	100	100

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	Wheat	90	0	30	70	0	80	90	0	0	60	90	0	70	60
	Table A	Compounds													
	500 g ai/ha	168	170	171	172	173	174	175	176	177	178	179	180	181	182
	Postemergence														
5	Barnyardgrass	90	90	0	60	30	0	0	40	100	100	100	100	90	0
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	30	90	0	20	20	0	0	20	70	70	60	90	40	0
	Crabgrass, Large	90	90	0	30	40	0	0	40	100	100	100	90	90	0
	Foxtail, Giant	90	90	0	20	50	0	0	50	100	100	90	90	90	0
10	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	100	90	0	90	0	0	0	80	100	100	100	100	100	0
	Pigweed	100	100	100	100	100	0	0	100	100	100	100	100	100	90
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	100	70	100	70	0	0	90	100	100	100	100	100	30
	Wheat	50	70	0	0	0	0	0	10	90	80	60	80	30	0
	Table A	Compounds													
	500 g ai/ha	183	184	185	186	187	188	189	190	191	192	194	195	196	197
20	Postemergence														
	Barnyardgrass	0	90	80	70	90	90	90	10	90	90	90	20	50	60
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	0	70	20	30	70	50	40	20	40	60	60	20	40	10
	Crabgrass, Large	0	80	90	70	100	80	80	50	90	90	100	60	90	70
25	Foxtail, Giant	0	80	80	80	90	90	80	40	90	90	100	50	80	70
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	90	90	100	100	100	100	90	100	100	100	70	80	30
	Pigweed	50	100	100	100	100	100	100	100	100	100	100	80	100	60
30	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	30	90	100	90	100	100	100	80	100	100	100	100	100	100
	Wheat	0	90	40	60	60	30	50	0	40	50	60	0	10	0
	Table A	Compounds													
35	500 g ai/ha	198	199	200	201	202	203	204	205	206	208	209	210	211	212
	Postemergence														
	Barnyardgrass	50	80	90	10	0	70	90	0	0	0	100	40	50	0

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	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	50
	Corn	20	60	60	0	0	50	60	0	0	20	70	30	0	0
	Crabgrass, Large	90	90	90	30	50	80	100	0	0	20	90	70	50	-
	Foxtail, Giant	80	90	90	40	30	80	100	0	0	20	90	60	60	50
5	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	30
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	10
	Morningglory	70	60	100	20	20	70	100	0	0	80	90	30	100	-
	Pigweed	100	100	100	40	50	90	100	0	0	100	100	100	100	30
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	10
10	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	30
	Velvetleaf	100	100	100	70	70	90	100	20	20	60	100	80	90	-
	Wheat	10	30	60	0	0	20	70	0	0	0	70	0	0	30
	Table A	Compounds													
	500 g ai/ha	213	214	215	218	219	220	221	225	226	227	228	230	231	232
15	Postemergence														
	Barnyardgrass	10	0	30	70	100	100	100	10	0	0	90	20	90	90
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	30	0	20	40	70	70	50	0	0	0	10	0	90	90
	Crabgrass, Large	70	0	30	70	100	100	100	10	0	10	90	10	90	90
20	Foxtail, Giant	30	0	10	70	90	90	90	0	0	10	90	20	90	90
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	30	0	10	90	100	100	100	0	0	10	100	0	90	90
	Pigweed	100	0	80	100	100	100	100	0	10	60	100	60	100	100
25	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	20	0	50	100	100	100	100	0	10	90	100	30	100	100
	Wheat	0	0	0	20	70	60	30	0	0	0	70	0	50	50
	Table A	Compounds													
30	500 g ai/ha	233	234	235	236	237	238	239	240	252	273	274	275	284	285
	Postemergence														
	Barnyardgrass	20	70	0	100	0	100	80	100	100	90	100	0	90	30
	Blackgrass	-	-	-	-	-	-	-	100	100	80	-	-	70	-
	Corn	0	30	0	100	0	80	20	90	90	50	90	0	40	30
35	Crabgrass, Large	10	60	30	100	0	90	70	-	-	-	90	20	-	40
	Foxtail, Giant	20	70	30	100	0	90	70	100	100	90	90	30	90	60
	Galium	-	-	-	-	-	-	-	100	100	100	-	-	60	-

5	Kochia	-	-	-	-	-	-	-	60	100	100	-	-	100	-	
	Morningglory	0	60	30	100	0	60	40	-	-	-	100	50	-	40	
	Pigweed	50	100	100	100	70	100	100	100	100	100	100	90	100	100	
	Ragweed	-	-	-	-	-	-	-	100	90	90	-	-	20	-	
	Ryegrass, Italian	-	-	-	-	-	-	-	100	70	80	-	-	60	-	
	Velvetleaf	30	100	30	100	30	100	60	-	-	-	100	90	-	80	
	Wheat	0	20	0	100	0	60	0	90	90	50	80	0	20	20	
Table A		Compounds														
500 g ai/ha		287	288	289	290	291	292	293	294	295	296	301	304			
10	Postemergence															
	Barnyardgrass	0	10	20	0	40	90	10	60	0	0	0	0			
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-			
	Corn	0	10	10	10	10	80	20	40	0	10	0	0			
15	Crabgrass, Large	20	20	20	10	60	90	30	50	0	0	0	0			
	Foxtail, Giant	0	20	30	10	50	90	30	50	0	0	0	0			
	Galium	-	-	-	-	-	-	-	-	-	-	-	-			
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-			
20	Morningglory	20	40	50	10	40	100	30	30	40	20	0	0			
	Pigweed	50	100	100	20	70	100	90	90	70	100	30	50			
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-			
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-			
	Velvetleaf	20	30	40	30	60	100	80	60	30	30	0	0			
	Wheat	0	0	0	0	0	60	0	40	0	20	0	0			
	Table A		Compounds													
25	125 g ai/ha		1	2	3	4	5	6	7	8	9	10	11	15	16	17
	Postemergence															
	Barnyardgrass	10	30	10	0	10	40	90	30	30	40	10	0	60	0	
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
30	Corn	0	0	0	0	0	20	30	0	20	20	10	0	70	0	
	Crabgrass, Large	20	20	10	0	30	50	80	50	30	50	70	10	80	20	
	Foxtail, Giant	10	10	30	0	40	80	90	50	30	50	70	10	100	20	
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
35	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Morningglory	0	30	10	0	80	40	70	70	20	90	60	10	90	20	
	Pigweed	50	60	90	0	100	100	100	100	80	100	100	70	100	70	
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Table A		Compounds													
	500 g ai/ha		287	288	289	290	291	292	293	294	295	296	301	304		

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5	Barnyardgrass	0	30	0	0	0	0	90	90	100	100	20	0	90	30
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	0	40	0	0	0	0	90	30	100	60	0	0	70	0
	Crabgrass, Large	0	70	10	0	0	0	90	90	100	100	10	0	90	30
	Foxtail, Giant	0	80	0	0	0	0	90	80	100	100	20	0	90	20
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	20	80	20	0	20	10	100	90	100	90	10	0	90	30
	Pigweed	40	100	20	0	20	30	100	100	100	100	50	0	100	70
10	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	100	0	10	0	50	100	100	100	100	50	20	100	60
	Wheat	0	60	0	0	0	0	40	0	90	70	0	0	20	0
Table A		Compounds													
15	125 g ai/ha	64	71	72	73	74	75	76	77	79	80	81	82	83	84
	Postemergence														
	Barnyardgrass	60	80	90	90	90	30	60	40	100	70	50	0	90	70
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	10	100	80
20	Corn	30	30	50	40	30	0	10	20	80	70	50	0	40	20
	Crabgrass, Large	80	70	100	90	70	20	70	50	100	80	40	-	-	-
	Foxtail, Giant	80	80	90	90	80	10	60	50	100	80	50	0	90	100
	Galium	-	-	-	-	-	-	-	-	-	-	-	10	100	100
	Kochia	-	-	-	-	-	-	-	-	-	-	-	0	100	100
	Morningglory	60	70	90	90	80	50	60	70	100	90	50	-	-	-
25	Pigweed	100	100	100	100	100	70	90	100	100	100	100	10	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	0	70	50
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	0	50	50
	Velvetleaf	100	90	100	100	90	40	80	80	100	100	100	-	-	-
	Wheat	0	10	20	20	0	0	0	0	80	40	10	0	0	30
Table A		Compounds													
30	125 g ai/ha	85	86	87	88	89	90	91	92	93	94	95	96	97	98
	Postemergence														
	Barnyardgrass	90	90	20	60	40	90	0	90	0	20	50	10	90	80
	Blackgrass	70	90	40	70	40	50	0	-	-	-	-	-	-	-
35	Corn	30	50	20	30	60	0	0	50	0	30	10	0	60	40
	Crabgrass, Large	-	-	-	-	-	-	-	80	0	50	40	10	90	80
	Foxtail, Giant	70	90	20	50	80	80	10	80	0	70	40	0	90	80

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	Galium	90	100	60	100	90	90	40	-	-	-	-	-	-	-
	Kochia	70	100	50	80	80	90	10	-	-	-	-	-	-	-
	Morningglory	-	-	-	-	-	-	-	100	0	80	60	0	90	100
	Pigweed	80	100	60	100	90	100	10	100	0	100	100	10	100	100
5	Ragweed	50	90	50	10	30	60	10	-	-	-	-	-	-	-
	Ryegrass, Italian	60	80	30	50	0	30	0	-	-	-	-	-	-	-
	Velvetleaf	-	-	-	-	-	-	-	100	0	90	70	0	100	100
	Wheat	0	50	0	0	20	0	0	60	0	0	0	0	50	40
	Table A	Compounds													
10	125 g ai/ha	99	100	101	103	106	107	108	109	110	111	112	113	117	118
	Postemergence														
	Barnyardgrass	100	0	20	0	50	40	60	60	90	60	40	0	70	80
	Blackgrass	90	0	20	0	50	50	80	70	80	-	-	-	40	90
	Corn	90	0	20	0	20	20	30	40	50	30	30	10	30	50
15	Crabgrass, Large	-	-	-	-	-	-	-	-	-	60	60	20	-	-
	Foxtail, Giant	100	0	60	0	70	70	70	70	90	80	30	10	90	80
	Galium	100	10	60	0	70	80	90	90	90	-	-	-	100	90
	Kochia	100	0	100	0	50	20	90	60	100	-	-	-	100	100
	Morningglory	-	-	-	-	-	-	-	-	-	80	50	20	-	-
20	Pigweed	100	10	90	0	60	60	80	90	100	100	100	60	100	100
	Ragweed	60	0	20	0	50	40	30	30	50	-	-	-	50	80
	Ryegrass, Italian	60	0	0	0	0	0	20	10	60	-	-	-	50	100
	Velvetleaf	-	-	-	-	-	-	-	-	-	80	100	30	-	-
	Wheat	80	0	40	0	10	30	20	20	40	20	0	20	0	70
25	Table A	Compounds													
	125 g ai/ha	119	120	121	122	125	126	127	128	129	130	131	132	134	135
	Postemergence														
	Barnyardgrass	70	80	20	40	90	40	10	50	90	0	0	50	80	40
	Blackgrass	70	80	30	80	80	20	10	40	70	0	0	60	30	30
30	Corn	50	50	10	30	50	20	10	30	30	0	0	20	40	10
	Crabgrass, Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	80	70	30	60	80	50	20	60	90	0	0	60	70	70
	Galium	100	100	30	40	90	60	20	80	100	0	0	100	100	60
	Kochia	90	90	40	90	40	100	30	80	100	0	0	90	90	20
35	Morningglory	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pigweed	100	100	40	100	70	80	30	100	100	0	0	100	100	70
	Ragweed	50	50	40	30	10	50	10	20	80	0	0	10	50	60

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	Ryegrass, Italian	60	80	0	20	10	10	0	30	50	0	0	10	50	20
	Velvetleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wheat	60	20	0	10	20	10	0	10	0	0	0	0	0	10
	Table A	Compounds													
5	125 g ai/ha	136	137	138	140	141	142	143	144	145	146	147	148	149	150
	Postemergence														
	Barnyardgrass	30	0	80	70	100	0	0	90	70	10	90	30	70	100
	Blackgrass	20	20	50	70	100	0	0	90	80	20	100	10	80	100
	Corn	10	30	60	30	60	0	30	40	10	10	40	20	20	50
10	Crabgrass, Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	30	70	90	90	100	0	0	100	80	20	90	40	90	100
	Galium	80	70	90	90	100	0	30	90	100	50	100	60	100	90
	Kochia	70	80	90	100	100	0	30	100	60	70	100	30	70	70
	Morningglory	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Pigweed	80	70	100	100	100	0	70	100	100	100	100	50	100	100
	Ragweed	50	20	30	70	100	0	0	80	90	10	100	20	80	20
	Ryegrass, Italian	30	20	40	30	80	0	0	50	50	0	70	0	30	40
	Velvetleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wheat	0	30	50	0	80	0	0	20	40	0	50	0	0	30
20	Table A	Compounds													
	125 g ai/ha	151	152	153	156	157	158	161	162	163	164	165	166	167	168
	Postemergence														
	Barnyardgrass	60	30	0	10	80	80	0	0	30	70	0	90	70	50
	Blackgrass	50	90	0	20	50	60	-	-	-	-	-	-	-	-
25	Corn	40	30	0	10	40	30	0	0	30	40	0	50	40	20
	Crabgrass, Large	-	-	-	-	-	-	0	0	30	80	0	90	80	70
	Foxtail, Giant	40	40	0	10	80	70	0	0	50	90	10	90	90	70
	Galium	40	90	0	30	90	100	-	-	-	-	-	-	-	-
	Kochia	90	80	0	40	100	80	-	-	-	-	-	-	-	-
30	Morningglory	-	-	-	-	-	-	0	0	90	80	10	100	80	50
	Pigweed	70	90	0	20	100	50	50	30	100	100	30	100	100	100
	Ragweed	100	20	0	40	50	80	-	-	-	-	-	-	-	-
	Ryegrass, Italian	30	20	0	0	20	50	-	-	-	-	-	-	-	-
	Velvetleaf	-	-	-	-	-	-	10	10	100	100	10	100	100	90
35	Wheat	30	40	0	0	0	0	0	0	10	70	0	60	20	10
	Table A	Compounds													
	125 g ai/ha	169	170	171	172	173	174	175	177	178	179	180	181	182	183

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		Postemergence													
	Barnyardgrass	20	70	0	30	0	0	0	40	70	80	90	60	0	0
	Blackgrass	30	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Corn	0	80	0	0	0	0	0	40	30	30	70	40	0	0
	Crabgrass, Large	-	70	0	20	0	0	0	80	90	90	90	70	0	0
	Foxtail, Giant	40	70	0	0	10	0	0	80	90	80	90	70	0	0
	Galium	40	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	10	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Morningglory	-	60	0	80	0	0	0	90	70	70	100	90	0	0
	Pigweed	20	100	100	100	100	0	0	100	100	100	100	100	30	20
	Ragweed	60	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	-	70	40	90	60	0	0	100	100	100	100	100	30	20
	Wheat	0	30	0	0	0	0	0	20	40	30	40	0	0	0
15	Table A	Compounds													
	125 g ai/ha	184	185	186	187	188	189	190	191	192	194	195	196	197	198
	Postemergence														
	Barnyardgrass	60	50	20	80	30	10	0	50	60	80	0	10	20	30
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Corn	20	10	0	10	20	10	0	20	10	30	0	10	0	20
	Crabgrass, Large	70	60	40	60	50	30	10	50	50	90	40	30	30	60
	Foxtail, Giant	70	50	20	60	60	40	0	50	70	90	10	30	20	30
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Morningglory	60	70	60	70	40	50	30	80	80	90	30	20	0	60
	Pigweed	100	100	100	70	100	100	100	100	100	100	60	100	30	90
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	80	90	80	100	90	90	60	90	90	100	50	100	60	90
30	Wheat	30	0	0	20	0	20	0	20	0	30	0	0	0	0
	Table A	Compounds													
	125 g ai/ha	199	200	201	202	203	204	205	206	208	209	210	211	212	213
	Postemergence														
	Barnyardgrass	30	80	0	0	40	80	0	0	0	40	20	10	0	0
35	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	10	-
	Corn	20	50	0	0	30	50	0	0	0	30	10	0	0	0
	Crabgrass, Large	40	90	0	10	60	90	0	0	0	70	40	10	-	20

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	Foxtail, Giant	70	90	0	10	70	80	0	0	0	70	30	30	0	10
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	10	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Morningglory	40	90	20	0	20	80	0	0	20	50	20	90	-	20
5	Pigweed	80	100	20	30	70	100	0	0	30	100	100	90	20	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	20	-
	Velvetleaf	70	100	30	50	80	100	10	10	40	100	60	50	-	10
	Wheat	0	40	0	0	0	40	0	0	0	0	0	0	0	0
10	Table A	Compounds													
	125 g ai/ha	214	215	218	219	220	221	225	226	227	228	230	231	232	233
	Postemergence														
	Barnyardgrass	0	0	30	50	90	50	0	0	0	10	0	40	30	0
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Corn	0	0	0	20	40	10	0	0	0	50	0	20	30	0
	Crabgrass, Large	0	10	50	90	100	60	0	0	0	40	0	70	60	0
	Foxtail, Giant	0	0	20	70	80	50	0	0	0	50	0	70	70	0
	Galium	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Morningglory	0	10	70	70	50	90	0	0	0	80	0	30	80	0
	Pigweed	0	70	90	100	100	100	0	0	10	100	30	100	100	20
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	40	30	100	100	100	0	0	50	100	0	100	80	0
25	Wheat	0	0	0	0	10	0	0	0	0	0	0	20	20	0
	Table A	Compounds													
	125 g ai/ha	234	235	236	237	238	239	240	241	242	243	244	245	246	247
	Postemergence														
	Barnyardgrass	20	0	100	0	40	0	90	10	60	0	10	30	0	20
30	Blackgrass	-	-	-	-	-	-	90	20	90	30	30	70	0	40
	Corn	20	0	70	0	0	0	30	10	60	0	20	40	20	20
	Crabgrass, Large	20	10	80	0	60	10	-	-	-	-	-	-	-	-
	Foxtail, Giant	30	0	90	0	60	20	90	20	50	10	10	80	0	10
	Galium	-	-	-	-	-	-	100	60	30	10	100	100	70	30
35	Kochia	-	-	-	-	-	-	100	90	80	30	80	100	70	40
	Morningglory	40	30	80	0	40	40	-	-	-	-	-	-	-	-
	Pigweed	100	90	100	30	100	90	100	80	80	20	100	90	40	20

	Ragweed	-	-	-	-	-	-	100	30	50	20	0	20	0	0
	Ryegrass, Italian	-	-	-	-	-	-	40	0	30	0	0	20	0	0
	Velvetleaf	70	30	90	20	60	50	-	-	-	-	-	-	-	-
	Wheat	20	0	50	0	0	0	30	10	60	20	20	40	0	20
5	Table A	Compounds													
	125 g ai/ha	249	250	251	252	253	254	258	259	260	261	264	265	266	267
	Postemergence														
	Barnyardgrass	60	60	30	100	100	60	90	30	0	0	0	0	0	0
	Blackgrass	80	100	70	60	80	60	50	50	0	0	0	0	0	0
10	Corn	10	30	20	60	60	20	40	10	10	0	0	0	0	0
	Crabgrass, Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	60	80	60	100	100	60	70	40	0	10	0	0	0	0
	Galium	30	60	30	90	100	100	90	80	60	50	0	0	0	10
	Kochia	80	90	60	100	100	60	100	80	60	70	0	0	0	0
15	Morningglory	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pigweed	100	90	70	100	100	30	100	90	60	60	0	0	0	0
	Ragweed	70	100	20	70	80	20	50	70	40	30	0	0	0	0
	Ryegrass, Italian	0	0	10	40	50	20	20	10	0	0	0	0	0	0
	Velvetleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Wheat	0	0	0	30	30	30	50	0	0	0	0	0	0	0
	Table A	Compounds													
	125 g ai/ha	268	269	270	271	272	273	274	275	277	278	279	284	285	287
	Postemergence														
	Barnyardgrass	0	0	80	80	0	70	90	0	40	0	30	30	0	0
25	Blackgrass	0	0	40	80	0	60	-	-	50	0	40	30	-	-
	Corn	0	0	50	30	0	40	80	0	20	0	10	20	0	0
	Crabgrass, Large	-	-	-	-	-	-	90	0	-	-	-	-	10	10
	Foxtail, Giant	0	0	90	90	0	70	90	0	70	0	50	90	0	0
	Galium	0	0	90	100	0	80	-	-	100	10	80	20	-	-
30	Kochia	0	0	70	100	0	70	-	-	70	0	90	60	-	-
	Morningglory	-	-	-	-	-	-	90	10	-	-	-	-	30	10
	Pigweed	20	0	100	100	0	100	100	80	70	10	80	100	80	30
	Ragweed	10	0	20	80	0	40	-	-	60	10	40	20	-	-
	Ryegrass, Italian	0	0	30	30	0	50	-	-	50	0	50	20	-	-
35	Velvetleaf	-	-	-	-	-	-	100	60	-	-	-	-	30	10
	Wheat	0	0	30	40	0	10	70	0	0	0	30	20	0	0

Table A

Compounds

	125 g ai/ha	288	289	290	291	292	293	294	295	296	301	304			
	Postemergence														
5	Barnyardgrass	0	0	0	0	60	10	20	0	0	0	0			
	Blackgrass	-	-	-	-	-	-	-	-	-	-	-			
	Corn	0	0	0	0	50	0	0	0	0	0	0			
	Crabgrass, Large	10	0	0	10	60	20	0	0	0	0	0			
	Foxtail, Giant	10	0	0	0	70	20	10	0	0	0	0			
	Galium	-	-	-	-	-	-	-	-	-	-	-			
	Kochia	-	-	-	-	-	-	-	-	-	-	-			
10	Morningglory	20	20	0	30	90	10	20	40	20	0	0			
	Pigweed	90	100	10	30	100	60	60	40	30	0	30			
	Ragweed	-	-	-	-	-	-	-	-	-	-	-			
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-			
	Velvetleaf	20	10	10	50	70	60	50	30	30	0	0			
15	Wheat	0	0	0	0	10	0	0	0	0	0	0			
	Table A	Compounds													
	31 g ai/ha	99	100	101	103	106	107	108	109	110	118	119	120	121	122
	Postemergence														
20	Barnyardgrass	100	0	20	0	0	0	20	10	10	30	40	20	0	10
	Blackgrass	50	0	20	0	30	10	30	20	20	60	40	60	10	30
	Corn	20	0	10	0	0	0	20	10	10	10	10	10	0	10
	Foxtail, Giant	90	0	20	0	50	20	20	10	20	30	30	20	0	10
	Galium	90	0	40	0	50	30	70	50	40	70	70	90	10	20
	Kochia	100	0	70	0	0	0	70	40	90	60	70	60	20	50
25	Pigweed	100	0	90	0	50	40	50	70	100	70	70	60	10	70
	Ragweed	30	0	50	0	20	30	20	10	10	70	30	30	10	10
	Ryegrass, Italian	20	0	0	0	0	0	0	0	0	20	30	0	0	0
	Wheat	50	0	20	0	0	10	10	0	0	20	10	0	0	0
	Table A	Compounds													
30	31 g ai/ha	125	126	127	128	140	141	144	148	149	151	152	153	156	157
	Postemergence														
	Barnyardgrass	0	10	0	10	30	60	20	0	20	0	0	0	0	10
	Blackgrass	40	10	0	30	30	90	20	0	50	20	50	0	0	30
	Corn	20	0	0	0	20	30	20	0	0	0	20	0	0	0
35	Foxtail, Giant	0	10	0	20	30	90	20	10	20	0	0	0	0	10
	Galium	20	20	10	50	80	100	80	20	70	10	90	0	20	60
	Kochia	40	40	0	50	90	100	50	0	60	60	20	0	0	60

	Pigweed	30	50	20	80	90	100	80	50	60	20	0	0	10	90
	Ragweed	0	10	0	0	60	80	20	10	50	50	20	0	0	20
	Ryegrass, Italian	0	0	0	0	0	60	0	0	0	0	0	0	0	0
	Wheat	0	0	0	0	0	10	20	0	0	20	20	0	0	0
5	Table A	Compounds													
	31 g ai/ha	158	169	241	242	243	244	245	246	247	249	250	251	252	253
	Postemergence														
	Barnyardgrass	20	0	0	0	0	0	0	0	0	0	10	10	20	20
	Blackgrass	50	0	0	30	0	0	30	0	0	60	70	50	10	20
10	Corn	0	0	0	0	0	0	20	0	0	0	10	0	20	20
	Foxtail, Giant	20	0	0	0	0	0	0	0	0	0	10	30	20	20
	Galium	60	10	40	10	0	70	100	20	10	20	10	20	60	60
	Kochia	60	0	50	30	20	20	60	20	20	20	60	40	70	100
	Pigweed	40	10	40	30	10	20	0	20	10	60	60	60	80	90
15	Ragweed	60	10	10	20	20	0	0	0	0	10	50	10	20	20
	Ryegrass, Italian	20	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wheat	0	0	0	0	0	0	20	0	0	0	0	0	20	20
	Table A	Compounds													
	31 g ai/ha	254	258	259	260	261	264	265	266	267	268	269	270	271	272
20	Postemergence														
	Barnyardgrass	10	10	0	0	0	0	0	0	0	0	0	10	10	0
	Blackgrass	0	20	20	0	0	0	0	0	0	0	0	10	10	0
	Corn	10	10	0	0	0	0	0	0	0	0	0	20	20	0
	Foxtail, Giant	10	20	10	0	0	0	0	0	0	0	0	10	10	0
25	Galium	20	70	70	50	30	0	0	0	0	0	0	60	70	0
	Kochia	20	90	60	50	50	0	0	0	0	0	0	60	70	0
	Pigweed	10	80	70	50	30	0	0	0	0	0	0	60	70	0
	Ragweed	10	10	50	30	20	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
30	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Table A	Compounds													
	31 g ai/ha	277	278	279											
	Postemergence														
	Barnyardgrass	20	0	0											
35	Blackgrass	30	0	10											
	Corn	0	0	10											
	Foxtail, Giant	40	0	10											

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

Table A		Compounds				
1000 g ai/ha		298	299	300	302	303
Preemergence						
15	Barnyardgrass	100	90	20	0	0
	Corn	-	-	-	-	0
	Crabgrass, Large	-	-	-	-	60
	Foxtail, Giant	100	100	80	0	50
	Kochia	90	100	60	0	-
20	Morningglory	-	-	-	-	0
	Pigweed	100	100	100	0	80
	Ragweed	90	70	0	0	-
	Ryegrass, Italian	50	60	20	0	-
	Velvetleaf	-	-	-	-	0
25	Wheat	-	-	-	-	0

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	Velvetleaf	20	70	90	0	100	100	100	100	100	100	100	100	100	90
	Wheat	0	0	10	0	20	30	20	0	0	20	0	0	60	70
	Table A	Compounds													
	500 g ai/ha	18	19	20	21	22	23	24	25	26	27	28	29	30	31
5	Preemergence														
	Barnyardgrass	100	20	20	30	20	50	0	100	90	20	10	20	10	50
	Corn	10	0	0	0	0	20	0	30	10	0	0	0	0	0
	Crabgrass, Large	100	90	90	100	90	90	0	100	90	50	10	40	60	90
	Foxtail, Giant	100	90	80	100	90	90	0	100	90	40	10	20	30	90
10	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	40	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pigweed	100	100	90	100	90	100	0	90	90	20	40	0	0	60
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Velvetleaf	90	20	0	20	20	90	0	90	80	10	0	40	40	90
	Wheat	70	0	0	0	0	0	0	0	0	0	0	0	0	0
	Table A	Compounds													
	500 g ai/ha	32	33	34	35	36	37	38	39	40	41	42	43	44	45
	Preemergence														
20	Barnyardgrass	60	70	50	0	0	10	0	10	50	50	10	10	100	100
	Corn	0	0	0	0	0	0	0	0	0	0	0	0	20	20
	Crabgrass, Large	60	100	90	10	70	80	40	90	80	70	30	50	100	100
	Foxtail, Giant	70	100	100	10	20	30	20	50	60	80	20	20	100	100
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Morningglory	0	-	-	-	-	0	0	0	0	0	0	0	60	10
	Pigweed	40	100	100	20	20	0	0	0	50	100	20	20	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	70	100	80	20	20	10	10	20	70	70	60	50	100	100
30	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	20	0
	Table A	Compounds													
	500 g ai/ha	46	47	48	49	50	51	52	57	58	59	60	61	62	63
	Preemergence														
	Barnyardgrass	20	100	0	0	0	30	100	100	100	100	70	20	100	70
35	Corn	0	90	0	0	0	0	80	70	70	30	0	0	90	0
	Crabgrass, Large	100	100	80	20	40	90	100	100	100	100	100	20	100	100
	Foxtail, Giant	80	100	50	10	0	80	100	100	100	100	90	0	100	100

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	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	100	0	0	0	0	100	40	100	100	0	0	90	0
	Pigweed	90	100	0	0	0	80	100	100	100	100	100	30	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	100	0	20	0	0	100	100	100	100	40	0	100	20
	Wheat	0	40	0	0	0	0	80	50	90	40	0	0	80	0
	Table A	Compounds													
	500 g ai/ha	64	68	71	72	73	74	75	76	77	78	79	80	81	82
10	Preemergence														
	Barnyardgrass	100	0	100	100	100	100	70	100	90	80	100	100	70	30
	Corn	70	-	40	50	70	40	10	30	0	10	100	40	10	-
	Crabgrass, Large	90	-	100	100	100	100	100	100	100	100	100	100	100	-
	Foxtail, Giant	90	0	100	100	100	100	100	100	100	100	100	100	100	70
15	Kochia	-	0	-	-	-	-	-	-	-	-	-	-	-	0
	Morningglory	20	-	90	100	100	100	30	80	60	20	100	80	60	-
	Pigweed	100	30	100	100	100	100	100	100	100	100	100	0	0	60
	Ragweed	-	0	-	-	-	-	-	-	-	-	-	-	-	0
	Ryegrass, Italian	-	0	-	-	-	-	-	-	-	-	-	-	-	0
20	Velvetleaf	90	-	100	100	100	100	80	100	100	50	100	90	100	-
	Wheat	30	-	40	60	80	40	0	30	0	10	100	50	10	-
	Table A	Compounds													
	500 g ai/ha	83	84	85	86	87	88	89	90	91	92	93	94	95	96
	Preemergence														
25	Barnyardgrass	90	90	100	100	10	80	90	100	0	100	0	100	100	30
	Corn	-	-	-	-	-	-	-	-	-	40	0	30	40	0
	Crabgrass, Large	-	-	-	-	-	-	-	-	-	100	30	100	100	90
	Foxtail, Giant	100	100	100	100	70	100	90	100	30	100	0	100	100	60
	Kochia	100	100	100	100	60	100	100	100	90	-	-	-	-	-
30	Morningglory	-	-	-	-	-	-	-	-	-	100	0	90	100	0
	Pigweed	100	100	100	100	100	100	100	100	90	100	30	100	100	100
	Ragweed	50	40	60	100	20	60	70	80	0	-	-	-	-	-
	Ryegrass, Italian	60	20	40	60	0	30	10	30	30	-	-	-	-	-
	Velvetleaf	-	-	-	-	-	-	-	-	-	100	0	100	100	10
35	Wheat	-	-	-	-	-	-	-	-	-	80	0	30	10	0
	Table A	Compounds													
	500 g ai/ha	97	98	111	112	113	117	129	130	131	132	134	135	136	137

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

Table A		Compounds														
500 g ai/ha		138	142	143	145	146	147	150	161	162	163	164	165	166	167	
15	Preemergence															
	Barnyardgrass	100	0	100	100	90	100	100	10	50	100	100	20	100	100	
	Corn	-	-	-	-	-	-	-	0	0	10	60	0	30	40	
	Crabgrass, Large	-	-	-	-	-	-	-	0	10	100	100	90	100	100	
	Foxtail, Giant	100	0	100	100	100	100	100	0	0	100	100	90	100	100	
20	Kochia	100	50	100	100	100	100	100	-	-	-	-	-	-	-	
	Morningglory	-	-	-	-	-	-	-	0	0	70	100	-	100	100	
	Pigweed	100	0	100	100	100	100	100	100	100	100	100	90	100	100	
	Ragweed	60	20	20	80	100	100	70	-	-	-	-	-	-	-	
	Ryegrass, Italian	50	0	20	50	50	100	50	-	-	-	-	-	-	-	
25	Velvetleaf	-	-	-	-	-	-	-	20	50	100	100	20	100	100	
	Wheat	-	-	-	-	-	-	-	0	0	10	90	0	80	50	

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	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	90	100	70	0	0	0	0	90	100	100	80	100	40	0
	Wheat	20	20	0	0	0	0	0	0	50	40	30	80	10	0
	Table A	Compounds													
5	500 g ai/ha	183	184	185	186	187	188	189	190	191	192	194	195	196	197
	Preemergence														
	Barnyardgrass	0	100	80	100	100	100	90	10	100	100	100	0	40	70
	Corn	0	20	10	0	40	20	0	0	30	50	50	0	0	0
	Crabgrass, Large	0	100	100	100	100	100	100	90	100	100	100	70	100	90
10	Foxtail, Giant	0	100	100	100	100	100	100	80	100	100	100	80	90	80
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	90	30	20	50	90	30	20	70	100	100	10	0	0
	Pigweed	90	100	100	100	100	100	100	100	100	100	100	40	100	70
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	60	80	100	100	100	80	60	90	100	100	20	40	30
	Wheat	0	30	10	20	40	30	10	0	40	-	30	0	0	0
	Table A	Compounds													
	500 g ai/ha	198	199	200	201	202	203	204	205	206	208	209	210	211	212
20	Preemergence														
	Barnyardgrass	80	80	90	0	10	40	100	0	0	70	100	70	60	20
	Corn	0	0	50	0	0	0	30	0	0	0	20	0	0	-
	Crabgrass, Large	100	100	100	40	70	100	100	0	0	100	100	100	100	-
	Foxtail, Giant	100	100	100	50	70	100	100	0	0	90	100	100	100	50
25	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	40
	Morningglory	10	20	100	0	0	10	90	0	0	30	70	0	70	-
	Pigweed	100	100	100	0	0	100	100	10	50	100	100	100	100	90
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	20
30	Velvetleaf	80	90	100	0	0	40	100	10	0	50	90	60	90	-
	Wheat	0	0	50	0	0	0	60	0	0	20	20	0	0	-
	Table A	Compounds													
	500 g ai/ha	213	214	215	218	219	220	221	225	226	227	228	230	231	232
	Preemergence														
35	Barnyardgrass	10	0	10	70	90	100	90	0	0	0	100	0	100	100
	Corn	0	0	0	0	10	10	0	0	0	0	40	0	20	60
	Crabgrass, Large	100	0	80	100	100	100	100	0	0	10	100	0	100	100

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	Foxtail, Giant	100	0	50	100	100	100	100	0	0	10	100	0	100	90
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	10	0	0	10	10	40	10	0	0	0	80	0	30	90
	Pigweed	100	0	100	100	100	100	100	0	0	60	0	70	100	100
5	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	0	10	50	20	70	70	0	0	20	100	0	100	100
	Wheat	0	0	0	0	0	20	10	0	0	0	0	0	20	10

Table A		Compounds														
10	500 g ai/ha	233	234	235	236	237	238	239	240	252	273	274	275	284	285	
	Preemergence															
	Barnyardgrass	0	100	10	100	10	100	100	100	100	90	100	0	90	30	
	Corn	0	90	0	90	0	90	10	-	-	-	50	0	-	20	
	Crabgrass, Large	10	100	100	100	10	100	100	-	-	-	100	70	-	100	
15	Foxtail, Giant	0	90	100	100	0	100	100	100	100	90	100	70	90	100	
	Kochia	-	-	-	-	-	-	-	100	100	100	-	-	100	-	
	Morningglory	0	100	0	100	0	100	30	-	-	-	100	0	-	40	
	Pigweed	20	100	100	100	80	100	100	100	100	100	100	90	100	100	
	Ragweed	-	-	-	-	-	-	-	100	100	80	-	-	0	-	
20	Ryegrass, Italian	-	-	-	-	-	-	-	70	90	40	-	-	20	-	
	Velvetleaf	0	100	0	100	10	90	20	-	-	-	100	60	-	40	
	Wheat	0	0	0	100	0	30	20	-	-	-	80	0	-	20	

Table A		Compounds												
	500 g ai/ha	287	288	289	290	291	292	293	294	295	296	301	304	
25	Preemergence													
	Barnyardgrass	0	10	20	0	50	100	10	20	0	10	0	0	
	Corn	0	0	0	0	0	30	0	0	0	0	0	0	
	Crabgrass, Large	70	10	10	10	90	100	90	60	0	60	0	10	
	Foxtail, Giant	40	0	10	10	80	100	90	70	0	10	0	0	
30	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	
	Morningglory	0	0	0	0	0	90	0	0	0	0	0	0	
	Pigweed	100	90	100	0	90	100	80	100	60	90	0	0	
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	
35	Velvetleaf	0	10	10	0	60	100	0	70	0	10	0	0	
	Wheat	0	0	0	0	0	30	0	0	0	0	0	0	

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	125 g ai/ha	1	2	3	4	5	6	7	8	9	10	11	15	16	17
	Preemergence														
	Barnyardgrass	20	30	60	0	10	20	80	50	30	60	70	20	100	50
	Corn	0	0	0	0	0	0	0	0	0	0	0	0	10	0
5	Crabgrass, Large	50	80	90	0	90	90	100	80	90	100	90	40	100	40
	Foxtail, Giant	60	80	90	0	90	90	100	70	80	90	90	30	100	60
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	-	0	0	0	0	20	20	0	40	30	0	30	0
	Pigweed	60	90	90	0	100	100	90	90	100	100	90	90	100	100
10	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	30	70	0	90	100	100	100	80	100	90	60	100	70
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	20	0
	Table A	Compounds													
15	125 g ai/ha	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Preemergence														
	Barnyardgrass	90	0	0	20	0	20	0	90	30	0	0	0	0	20
	Corn	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crabgrass, Large	100	0	20	90	20	90	0	90	70	0	0	10	40	50
20	Foxtail, Giant	100	20	20	70	20	70	0	80	60	0	0	10	0	20
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pigweed	100	0	30	90	20	100	0	90	80	10	0	0	0	40
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	90	0	0	0	0	90	0	-	60	0	0	0	10	50
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Table A	Compounds													
	125 g ai/ha	32	33	34	35	36	37	38	39	40	41	42	43	44	45
30	Preemergence														
	Barnyardgrass	0	0	0	0	0	0	0	0	40	10	0	0	50	30
	Corn	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crabgrass, Large	0	90	70	0	0	10	0	10	60	30	10	10	90	90
	Foxtail, Giant	0	90	30	0	0	10	0	10	10	10	10	10	60	90
35	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	-	-	-	-	0	0	0	0	0	0	0	50	0
	Pigweed	0	100	80	0	0	0	0	0	0	70	0	0	100	100

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	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Velvetleaf	10	50	60	0	0	10	0	10	50	60	60	30	70	100
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Table A	Compounds													
	125 g ai/ha	46	47	48	49	50	51	52	57	58	59	60	61	62	63
	Preemergence														
	Barnyardgrass	0	20	0	0	0	20	90	60	100	80	0	0	60	0
	Corn	0	0	0	0	0	0	20	0	40	20	0	0	0	0
10	Crabgrass, Large	20	90	50	0	0	40	100	90	100	100	40	0	90	80
	Foxtail, Giant	0	100	10	0	0	20	100	80	100	100	20	0	90	20
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	0	0	0	0	0	90	0	100	80	0	0	0	0
	Pigweed	20	100	0	0	0	10	100	100	100	100	30	0	100	90
15	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	0	100	0	0	0	0	100	40	90	100	0	0	50	0
	Wheat	0	0	0	0	0	0	20	0	60	20	0	0	0	0
	Table A	Compounds													
20	125 g ai/ha	64	71	72	73	74	75	76	77	79	80	81	82	83	84
	Preemergence														
	Barnyardgrass	60	60	80	90	70	20	50	50	100	60	0	0	60	50
	Corn	0	30	30	20	0	0	20	0	80	0	0	-	-	-
	Crabgrass, Large	90	100	100	100	100	70	100	90	100	100	90	-	-	-
25	Foxtail, Giant	90	100	100	100	90	40	80	90	100	90	80	10	100	70
	Kochia	-	-	-	-	-	-	-	-	-	-	-	0	100	100
	Morningglory	0	90	80	90	70	20	0	10	100	30	0	-	-	-
	Pigweed	90	100	100	100	100	100	100	100	100	0	0	0	100	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	0	20	10
30	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	0	50	0
	Velvetleaf	40	70	90	100	70	40	90	60	100	80	50	-	-	-
	Wheat	0	20	20	0	0	0	0	0	70	10	10	-	-	-
	Table A	Compounds													
	125 g ai/ha	85	86	87	88	89	90	91	92	93	94	95	96	97	98
35	Preemergence														
	Barnyardgrass	20	80	0	60	60	70	0	60	0	80	50	0	80	50
	Corn	-	-	-	-	-	-	-	10	0	0	0	0	40	0

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Table A		Compounds													
125 g ai/ha		136	137	138	140	141	142	143	144	145	146	147	148	149	150
Preemergence															
5	Barnyardgrass	60	20	80	70	100	0	30	90	50	20	100	50	90	90
	Corn	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Crabgrass, Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	60	90	90	100	100	0	80	100	80	70	100	70	100	100
	Kochia	90	90	90	100	100	0	50	100	90	40	100	0	100	100
10	Morningglory	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pigweed	90	90	90	100	100	0	90	100	100	60	100	10	100	100
	Ragweed	80	30	30	70	100	0	0	100	50	0	90	0	60	30
	Ryegrass, Italian	0	0	0	0	80	0	0	20	10	0	10	0	20	20
	Velvetleaf	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheat		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table A		Compounds													
125 g ai/ha		151	152	153	156	157	158	161	162	163	164	165	166	167	168
Preemergence															
20	Barnyardgrass	60	70	0	30	80	70	0	10	50	90	0	90	80	50
	Corn	-	-	-	-	-	-	0	0	0	10	0	30	10	0
	Crabgrass, Large	-	-	-	-	-	-	0	0	100	100	50	100	100	100
	Foxtail, Giant	100	100	0	70	100	90	0	0	100	90	20	100	100	100
	Kochia	90	90	0	10	90	70	-	-	-	-	-	-	-	-
25	Morningglory	-	-	-	-	-	-	0	0	0	80	0	100	90	20
	Pigweed	90	90	0	0	90	70	90	100	100	100	60	100	100	100
	Ragweed	80	40	0	0	30	80	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	0	0	0	0	50	-	-	-	-	-	-	-	-
	Velvetleaf	-	-	-	-	-	-	10	10	20	100	10	100	80	70
Wheat		-	-	-	-	-	-	0	0	0	20	0	50	0	20
Table A		Compounds													
125 g ai/ha		169	170	171	172	173	174	175	177	178	179	180	181	182	183
Preemergence															
30	Barnyardgrass	50	90	20	0	0	0	0	70	90	20	100	50	0	0
	Corn	-	0	0	0	0	0	0	0	0	0	60	0	0	0
	Crabgrass, Large	-	100	0	0	20	0	0	100	100	100	100	100	0	0
	Foxtail, Giant	80	100	0	0	50	0	0	100	100	100	100	90	0	0
	Kochia	0	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Morningglory	-	20	0	0	0	0	0	20	10	10	90	0	0	0

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	Pigweed	80	100	90	0	80	0	0	100	100	100	100	100	90	20
	Ragweed	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	-	80	30	0	0	0	0	80	80	60	100	20	0	0
5	Wheat	-	20	0	0	0	0	0	0	0	0	20	0	0	0
	Table A	Compounds													
	125 g ai/ha	184	185	186	187	188	189	190	191	192	194	195	196	197	198
	Preemergence														
	Barnyardgrass	30	40	30	80	30	20	0	70	60	80	0	0	30	50
10	Corn	20	0	0	0	0	0	0	0	0	30	0	0	0	0
	Crabgrass, Large	100	90	100	100	90	90	20	100	100	100	-	60	40	80
	Foxtail, Giant	100	90	80	100	90	70	10	100	100	100	10	50	20	70
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Morningglory	0	10	0	0	10	0	0	50	30	60	0	0	0	0
15	Pigweed	100	100	100	100	100	100	100	100	100	100	0	90	50	100
	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	20	40	70	80	70	60	50	80	90	80	0	20	0	40
	Wheat	0	0	0	0	0	0	0	20	0	20	0	0	0	0
20	Table A	Compounds													
	125 g ai/ha	199	200	201	202	203	204	205	206	208	209	210	211	212	213
	Preemergence														
	Barnyardgrass	20	80	0	0	10	70	0	0	0	60	10	0	0	0
	Corn	0	40	0	0	0	0	0	0	0	0	0	0	-	0
25	Crabgrass, Large	100	100	20	40	100	100	0	0	20	100	100	80	-	10
	Foxtail, Giant	90	100	20	10	90	100	0	0	20	100	100	100	0	20
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Morningglory	0	90	0	0	0	90	0	0	0	10	0	20	-	0
	Pigweed	90	100	0	0	90	100	0	0	30	100	100	90	70	50
30	Ragweed	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-	-	0	-
	Velvetleaf	20	100	0	0	30	80	0	0	0	90	20	60	-	0
	Wheat	0	30	0	0	0	40	0	0	0	0	0	0	-	0
	Table A	Compounds													
35	125 g ai/ha	214	215	218	219	220	221	225	226	227	228	230	231	232	233
	Preemergence														
	Barnyardgrass	0	0	10	30	60	10	0	0	0	20	0	20	60	0

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	Wheat	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Table A	Compounds													
	125 g ai/ha	268	269	270	271	272	273	274	275	277	278	279	284	285	287
	Preemergence														
5	Barnyardgrass	0	0	100	100	0	70	90	0	0	0	10	60	0	0
	Corn	-	-	-	-	-	-	50	0	-	-	-	-	0	0
	Crabgrass, Large	-	-	-	-	-	-	100	0	-	-	-	-	80	0
	Foxtail, Giant	0	0	100	100	0	90	100	0	70	0	50	90	20	0
	Kochia	0	0	100	100	0	100	-	-	0	0	90	80	-	-
10	Morningglory	-	-	-	-	-	-	100	0	-	-	-	-	0	0
	Pigweed	0	0	100	100	0	100	100	80	60	10	100	100	80	0
	Ragweed	0	0	20	20	0	70	-	-	0	0	10	0	-	-
	Ryegrass, Italian	0	0	10	10	0	20	-	-	0	0	0	20	-	-
	Velvetleaf	-	-	-	-	-	-	100	20	-	-	-	-	10	0
15	Wheat	-	-	-	-	-	-	40	0	-	-	-	-	0	0
	Table A	Compounds													
	125 g ai/ha	288	289	290	291	292	293	294	295	296	301	304			
	Preemergence														
	Barnyardgrass	0	0	0	0	80	0	0	0	0	0	0			
20	Corn	0	0	0	0	20	0	0	0	0	0	0			
	Crabgrass, Large	0	0	0	50	100	40	30	0	0	0	0			
	Foxtail, Giant	0	0	0	20	100	20	30	0	0	0	0			
	Kochia	-	-	-	-	-	-	-	-	-	-	-			
	Morningglory	0	0	0	0	30	0	0	0	0	0	0			
25	Pigweed	20	20	0	60	100	20	100	20	0	0	0			
	Ragweed	-	-	-	-	-	-	-	-	-	-	-			
	Ryegrass, Italian	-	-	-	-	-	-	-	-	-	-	-			
	Velvetleaf	0	0	0	40	30	0	10	0	0	0	0			
	Wheat	0	0	0	0	10	0	0	0	0	0	0			
30	Table A	Compounds													
	31 g ai/ha	99	100	101	103	106	107	108	109	110	118	119	120	121	122
	Preemergence														
	Barnyardgrass	80	0	60	0	0	10	10	20	30	50	30	20	0	10
	Foxtail, Giant	100	0	70	0	30	30	20	70	100	80	90	50	10	50
35	Kochia	100	0	70	0	0	0	40	20	20	100	50	20	0	20
	Pigweed	100	0	90	0	10	0	90	100	100	100	100	100	60	80
	Ragweed	70	0	0	0	0	0	70	0	0	50	0	0	0	0

	Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	10	0	0	0
	Table A	Compounds													
	31 g ai/ha	125	126	127	128	140	141	144	148	149	151	152	153	156	157
	Preemergence														
5	Barnyardgrass	10	10	0	10	30	90	20	0	40	20	20	0	0	20
	Foxtail, Giant	20	50	10	60	50	100	70	10	60	100	10	0	0	70
	Kochia	20	40	0	0	60	100	70	0	70	80	20	0	0	60
	Pigweed	70	80	0	100	90	100	90	0	100	90	90	0	0	90
	Ragweed	0	0	0	0	30	90	0	0	0	20	20	0	0	–
10	Ryegrass, Italian	0	0	0	0	0	30	20	0	0	0	0	0	0	0
	Table A	Compounds													
	31 g ai/ha	158	169	241	242	243	244	245	246	247	249	250	251	252	253
	Preemergence														
	Barnyardgrass	10	10	10	20	0	0	0	0	0	0	10	30	70	50
15	Foxtail, Giant	60	30	50	100	0	0	60	0	0	0	30	50	70	70
	Kochia	50	0	50	30	0	0	0	0	0	0	90	10	80	90
	Pigweed	50	0	80	90	0	0	90	0	0	90	80	70	100	100
	Ragweed	40	0	0	50	0	0	0	0	0	0	–	0	20	20
	Ryegrass, Italian	30	0	0	0	0	0	0	0	0	0	0	0	20	20
20	Table A	Compounds													
	31 g ai/ha	254	258	259	260	261	264	265	266	267	268	269	270	271	272
	Preemergence														
	Barnyardgrass	20	50	10	0	0	0	0	0	0	0	0	20	20	0
	Foxtail, Giant	30	60	30	0	0	0	0	0	0	0	0	40	40	0
25	Kochia	20	90	20	0	0	0	0	0	0	0	0	80	70	0
	Pigweed	30	100	70	0	0	0	0	0	0	0	0	100	90	0
	Ragweed	0	0	10	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
	30	Table A	Compounds												
31 g ai/ha		277	278	279											
Preemergence															
Barnyardgrass		0	0	0											
Foxtail, Giant		30	0	40											
35	Kochia	0	0	40											
	Pigweed	30	0	90											
	Ragweed	0	0	0											

Ryegrass, Italian 0 0 0

TEST B

- Plant species in the flooded paddy test selected from rice (*Oryza sativa*), sedge, umbrella (small-flower umbrella sedge, *Cyperus difformis*), (*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	13	15	16
Flood															
15	Barnyardgrass	0	0	0	0	0	0	30	0	0	0	0	0	20	40
	Ducksalad	0	45	90	0	50	65	80	100	80	75	50	30	75	90
	Rice	0	0	0	0	10	15	20	30	0	0	0	0	20	40
	Sedge, Umbrella	0	0	75	0	50	55	75	80	60	50	0	0	85	90

Table B		Compounds													
250 g ai/ha		17	18	19	20	21	22	23	24	25	26	27	28	29	30
Flood															
	Barnyardgrass	0	30	0	20	25	20	20	0	20	0	0	0	0	0
	Ducksalad	75	90	40	60	40	65	80	0	85	80	75	35	0	0
	Rice	25	0	20	45	15	40	35	35	20	25	0	0	0	0
25	Sedge, Umbrella	90	90	30	75	70	80	70	60	85	80	75	0	0	0

Table B		Compounds													
250 g ai/ha		31	32	33	34	35	36	37	38	39	40	41	42	43	44
Flood															
	Barnyardgrass	0	0	10	20	0	0	0	0	0	20	0	0	0	20
30	Ducksalad	80	0	80	90	0	0	0	0	50	80	70	45	75	100
	Rice	25	15	0	30	0	0	0	0	0	15	0	15	0	45
	Sedge, Umbrella	30	0	20	90	0	0	0	30	30	80	70	0	0	90

Table B		Compounds													
250 g ai/ha		45	46	47	48	49	50	51	52	53	54	57	58	59	60
Flood															
35	Barnyardgrass	30	0	10	0	0	0	0	30	0	0	0	80	40	0

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	Ducksalad	85	0	95	0	0	0	40	70	75	0	60	90	80	0
	Rice	0	0	35	0	0	0	0	20	0	0	0	50	20	0
	Sedge, Umbrella	75	0	70	0	0	0	65	95	0	0	80	90	90	0
	Table B	Compounds													
5	250 g ai/ha	61	62	63	64	65	66	69	71	72	73	74	75	76	77
	Flood														
	Barnyardgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Ducksalad	0	80	0	70	95	30	0	0	75	70	40	60	70	40
	Rice	0	0	0	0	0	0	0	30	0	0	0	0	0	20
10	Sedge, Umbrella	0	80	0	80	95	0	0	70	85	85	70	50	75	70
	Table B	Compounds													
	250 g ai/ha	79	80	81	82	83	84	85	86	87	88	89	90	91	92
	Flood														
	Barnyardgrass	40	0	0	0	0	0	0	0	0	0	10	0	0	20
15	Ducksalad	95	100	90	30	45	50	30	75	0	25	95	40	0	95
	Rice	45	0	0	0	0	0	10	0	0	0	20	0	0	20
	Sedge, Umbrella	95	80	80	0	45	30	30	65	0	0	85	40	0	90
	Table B	Compounds													
	250 g ai/ha	93	94	95	96	97	98	99	100	101	103	106	107	108	109
20	Flood														
	Barnyardgrass	0	0	0	0	40	35	0	15	0	0	0	30	0	0
	Ducksalad	0	40	40	0	95	85	0	0	0	0	75	40	85	80
	Rice	0	0	0	0	0	15	0	0	0	0	0	0	35	0
	Sedge, Umbrella	0	30	50	0	90	85	0	0	0	0	90	70	80	85
25	Table B	Compounds													
	250 g ai/ha	110	111	112	113	114	115	116	117	118	119	120	121	122	123
	Flood														
	Barnyardgrass	45	0	0	0	0	0	0	0	50	40	0	20	0	35
	Ducksalad	95	70	90	0	50	70	60	40	90	95	95	45	80	80
30	Rice	0	0	0	0	0	0	0	0	60	25	0	0	0	0
	Sedge, Umbrella	95	75	85	0	30	20	30	20	95	95	95	0	75	40
	Table B	Compounds													
	250 g ai/ha	125	126	127	128	129	130	131	132	134	135	136	137	138	140
	Flood														
35	Barnyardgrass	0	0	0	0	0	0	0	0	0	30	20	0	0	20
	Ducksalad	70	65	60	85	65	0	0	0	30	70	70	30	90	80

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	Rice	0	0	0	0	0	0	0	0	0	0	15	0	0	0
	Sedge, Umbrella	70	20	0	85	65	0	0	0	30	75	70	0	75	80
	Table B	Compounds													
	250 g ai/ha	141	142	143	144	145	146	147	148	149	150	151	152	153	154
5	Flood														
	Barnyardgrass	100	0	0	0	20	20	35	0	0	0	0	0	0	20
	Ducksalad	100	0	40	95	75	40	80	40	70	90	70	60	30	80
	Rice	45	0	0	0	20	0	35	0	0	0	20	0	0	10
	Sedge, Umbrella	90	0	0	80	65	40	75	30	65	85	0	50	0	30
10	Table B	Compounds													
	250 g ai/ha	155	156	157	158	159	160	161	162	163	164	165	166	167	168
	Flood														
	Barnyardgrass	40	0	35	0	0	35	0	0	0	20	0	60	35	0
	Ducksalad	100	0	80	50	0	80	0	35	90	100	0	95	100	90
15	Rice	50	0	35	40	0	35	0	0	25	0	0	75	0	30
	Sedge, Umbrella	80	0	75	0	0	75	0	40	90	90	0	95	98	80
	Table B	Compounds													
	250 g ai/ha	169	170	171	172	173	174	175	177	178	179	180	181	182	183
	Flood														
20	Barnyardgrass	25	70	0	0	0	0	0	30	0	20	60	0	0	0
	Ducksalad	65	95	0	0	0	0	0	90	0	80	80	75	0	0
	Rice	15	50	0	0	0	0	0	15	0	0	40	0	0	0
	Sedge, Umbrella	75	90	0	0	0	0	0	100	0	85	80	85	0	0
	Table B	Compounds													
25	250 g ai/ha	184	185	186	187	188	189	190	191	192	193	194	195	196	197
	Flood														
	Barnyardgrass	0	0	0	0	30	0	0	40	0	0	0	0	20	0
	Ducksalad	100	95	0	65	90	70	0	95	90	0	98	20	85	0
	Rice	10	0	0	0	0	0	0	0	0	0	0	20	0	0
30	Sedge, Umbrella	95	90	0	50	90	70	0	95	85	0	95	30	70	65
	Table B	Compounds													
	250 g ai/ha	198	199	200	201	202	203	204	205	206	208	209	210	211	212
	Flood														
	Barnyardgrass	0	0	20	0	0	0	20	0	0	0	30	0	0	0
35	Ducksalad	25	70	95	40	30	90	70	0	0	0	75	75	0	0
	Rice	0	20	20	0	0	10	20	0	0	0	0	15	0	0

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	Sedge, Umbrella	20	70	85	20	10	90	90	0	0	0	60	60	0	0
	Table B	Compounds													
	250 g ai/ha	213	214	215	216	217	218	219	220	221	222	223	225	226	227
	Flood														
5	Barnyardgrass	0	0	0	0	0	0	0	0	0	0	35	0	0	0
	Ducksalad	0	0	0	0	0	50	100	100	0	50	90	0	0	0
	Rice	0	0	0	0	0	0	0	0	0	0	50	0	0	0
	Sedge, Umbrella	70	0	0	0	0	40	85	90	0	70	85	0	0	0
	Table B	Compounds													
10	250 g ai/ha	228	230	231	232	233	234	235	236	237	238	239	240	241	242
	Flood														
	Barnyardgrass	0	20	20	10	10	20	0	30	0	0	0	0	0	20
	Ducksalad	75	20	80	95	50	90	0	100	0	70	65	50	40	70
	Rice	0	35	30	35	20	20	0	0	0	0	30	0	0	0
15	Sedge, Umbrella	60	50	80	80	50	90	0	100	0	90	70	30	0	75
	Table B	Compounds													
	250 g ai/ha	243	244	245	246	247	248	249	250	251	252	253	254	258	259
	Flood														
	Barnyardgrass	0	0	0	0	0	0	0	0	0	40	40	0	60	0
20	Ducksalad	30	40	75	0	65	50	70	70	75	75	75	65	100	70
	Rice	0	0	0	0	0	15	0	0	0	0	25	0	30	0
	Sedge, Umbrella	0	0	60	0	50	70	60	35	40	80	85	60	95	75
	Table B	Compounds													
	250 g ai/ha	260	261	264	265	266	267	268	269	270	271	272	273	274	275
25	Flood														
	Barnyardgrass	0	0	0	0	0	0	0	0	35	0	0	0	65	15
	Ducksalad	0	0	0	0	0	0	0	0	100	90	0	75	95	30
	Rice	0	0	0	0	0	0	0	0	0	0	0	0	60	15
	Sedge, Umbrella	0	0	0	0	0	0	50	0	90	60	0	75	95	0
	Table B	Compounds													
	250 g ai/ha	277	278	279	280	282	284	285	287	288	289	290	291	292	293
	Flood														
	Barnyardgrass	0	0	75	10	0	0	0	0	0	0	0	0	20	0
	Ducksalad	80	0	90	30	0	80	0	0	0	0	0	0	45	80
35	Rice	0	0	50	10	0	0	0	0	0	0	0	0	20	0
	Sedge, Umbrella	80	0	90	10	0	85	0	0	0	0	0	0	75	80

Table B		Compounds							
250 g ai/ha		294	295	296	297	298	299	301	304
Flood									
	Barnyardgrass	0	0	0	0	0	20	0	0
5	Ducksalad	0	0	0	0	0	20	0	0
	Rice	0	0	0	0	0	15	0	0
	Sedge, Umbrella	0	0	0	0	30	70	0	0

TEST C

Seeds of plant species selected from blackgrass (*Alopecurus myosuroides*), Italian ryegrass (*Lolium multiflorum*), wheat, winter (winter wheat, *Triticum aestivum*), galium (catchweed bedstraw, *Galium aparine*), corn (*Zea mays*), large (Lg) crabgrass (*Digitaria sanguinalis*), giant foxtail (*Setaria faberii*), johnsongrass (*Sorghum halepense*), lambsquarters (*Chenopodium album*), morningglory (*Ipomoea coccinea*), yellow nutsedge (*Cyperus esculentus*), pigweed (*Amaranthus retroflexus*), ragweed (common ragweed, *Ambrosia elatior*), soybean (*Glycine max*), barnyardgrass (*Echinochloa crus-galli*), oilseed rape (*Brassica napus*), waterhemp (common waterhemp, *Amaranthus rudis*), kochia (*Kochia scoparia*), wild oat (*Avena fatua*), surinam grass (*Brachiaria decumbens*), foxtail, green (green foxtail, *Setaria viridis*), goosegrass (*Eleusine indica*), brome grass, downy (downy brome grass, *Bromus tectorum*), nightshade (eastern black nightshade, *Solanum ptycanthum*), cocklebur (common cocklebur, *Xanthium strumarium*), cupgrass, woolly (woolly cupgrass, *Eriochloa villosa*), bermudagrass (*Cynodon dactylon*), sunflower, (common oilseed sunflower, *Helianthus annuus*), Russian thistle (*Salsola kali*), and velvetleaf (*Abutilon theophrasti*) were planted into a blend of loam soil and sand 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 barley, winter (winter barley, *Hordeum vulgare*), windgrass (*Apera spica-venti*), chickweed (common chickweed, *Stellaria media*), deadnettle (henbit deadnettle, *Lamium amplexicaule*), and canarygrass (littleseed canarygrass, *Phalaris minor*) were planted in pots containing Redi-Earth[®] planting medium (Scotts Company, 14111 Scottslawn Road, Marysville, Ohio 43041) comprising sphagnum peat moss, vermiculite, wetting agent and starter nutrients 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 days, 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. 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 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.

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Table C		Compounds													
250 g ai/ha		5	7	10	16	25	47	52	57	58	59	62	72	73	74
Postemergence															
15	Barley	10	15	10	35	–	–	–	–	–	–	–	–	–	–
	Barnyardgrass	–	–	–	–	25	5	10	15	75	25	10	40	35	15
	Bermudagrass	35	70	50	55	–	–	–	–	–	–	–	–	–	–
	Blackgrass	45	50	75	70	85	40	25	30	55	40	50	15	25	5
	Bromegrass, Downy	10	10	15	5	–	–	–	–	–	–	–	–	–	–
20	Canarygrass	40	80	40	80	–	–	–	–	–	–	–	–	–	–
	Chickweed	45	98	98	90	98	50	95	80	100	98	90	80	80	50
	Cocklebur	65	80	100	80	–	–	–	–	–	–	–	–	–	–
	Corn	70	75	20	20	15	5	10	20	45	20	20	20	10	20
	Crabgrass, Large	20	20	35	85	30	10	40	30	85	40	35	60	20	20
25	Cupgrass, Woolly	30	25	15	30	–	–	–	–	–	–	–	–	–	–
	Deadnettle	90	100	95	–	–	–	–	–	–	–	–	–	–	–
	Foxtail, Giant	10	10	5	85	30	80	70	30	95	90	25	65	30	20
	Foxtail, Green	70	98	30	100	–	–	–	–	–	–	–	–	–	–
	Galium	95	98	95	–	90	65	90	95	95	90	95	95	70	65
30	Goosegrass	15	15	10	30	–	–	–	–	–	–	–	–	–	–
	Johnsongrass	10	10	10	10	15	5	10	20	85	85	15	25	25	25
	Kochia	100	100	98	100	100	60	95	100	100	100	95	95	90	90
	Lambsquarters	98	98	98	100	100	90	100	85	98	90	90	98	80	85
	Morningglory	90	–	85	85	–	75	100	95	98	95	90	90	85	85
35	Nutsedge, Yellow	15	20	5	20	10	10	30	15	15	10	15	10	5	0
	Oat, Wild	30	55	30	45	35	5	15	35	55	40	35	35	15	10
	Oilseed Rape	–	–	–	–	–	55	85	85	85	95	75	90	80	65
	Pigweed	100	100	100	100	98	70	95	95	100	98	80	95	90	80

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	Velvetleaf	80	85	70	75	50	70	70	40	60	55	75	65	55	50
	Waterhemp	-	-	-	-	90	100	75	80	90	90	75	90	75	75
	Wheat	10	10	5	35	10	0	5	10	25	20	5	10	0	0
	Windgrass	60	55	50	50	-	-	-	-	-	-	-	-	-	-
5	Table C	Compounds													
	125 g ai/ha	74	79	80	83	84	85	86	88	89	90	92	94	97	98
	Postemergence														
	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	20	5	5	15	5	5	10	5	10	10	10	15	15
10	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	0	35	40	20	20	10	10	10	5	15	35	5	40	20
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	50	90	70	70	50	40	80	90	60	50	70	70	90	85
15	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	15	15	5	10	5	10	10	10	5	5	5	5	15	20
	Crabgrass, Large	15	30	5	10	30	10	5	10	5	10	10	10	55	5
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Foxtail, Giant	10	20	5	40	50	15	25	40	10	20	10	10	15	10
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	65	80	95	60	95	75	80	95	55	85	80	80	90	80
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	25	40	5	10	0	10	5	10	5	5	5	5	5	10
25	Kochia	90	95	95	95	80	90	95	100	50	90	85	90	100	98
	Lambsquarters	75	95	55	80	80	70	85	75	55	60	75	85	98	98
	Morningglory	75	95	60	85	85	40	85	95	85	85	85	55	95	85
	Nutsedge, Yellow	0	5	5	5	-	10	5	10	5	10	5	10	5	5
	Oat, Wild	10	20	10	5	15	5	10	10	15	5	15	5	25	20
30	Oilseed Rape	40	50	90	80	60	15	45	45	60	40	70	80	80	98
	Pigweed	65	95	75	85	85	70	80	90	40	70	75	85	95	75
	Ragweed	40	70	45	70	80	65	85	60	70	65	55	45	70	40
	Ryegrass, Italian	0	20	5	5	0	5	5	0	5	0	35	5	15	25
	Soybean	75	90	80	90	90	90	75	65	95	60	95	80	95	90
35	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	50	70	75	65	90	55	65	55	40	60	60	40	70	90
	Waterhemp	60	90	90	90	70	60	75	90	60	75	80	70	95	85

[illegible]

Table C		Compounds													
125 g ai/ha		150	154	155	160	163	164	166	167	177	178	180	181	191	192
Postemergence															
5	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	20	10	5	5	5	15	10	10	10	20	10	15	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	10	0	5	15	15	15	60	30	35	60	30	25	10	10
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	70	60	90	70	95	90	95	80	85	80	80	85	98	60
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	10	0	10	5	10	5	15	15	10	10	10	5	10	5
	Crabgrass, Large	10	10	15	10	10	10	15	10	10	10	35	10	10	5
15	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	25	15	25	10	10	10	35	30	20	25	80	10	15	10
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	80	85	100	85	95	65	95	90	98	98	90	80	98	85
20	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	5	5	5	10	10	5	25	10	35	5	20	10	10
	Kochia	85	80	100	100	100	95	100	95	95	95	60	100	100	90
	Lambsquarters	80	70	98	95	95	65	98	100	90	98	85	100	95	90
	Morningglory	80	80	85	65	90	80	95	90	85	65	90	98	50	35
25	Nutsedge, Yellow	5	10	5	5	5	5	5	20	10	10	10	-	5	40
	Oat, Wild	5	0	25	0	20	15	50	35	30	30	30	5	10	5
	Oilseed Rape	50	80	80	60	80	60	98	70	90	98	55	100	50	60
	Pigweed	65	75	98	85	90	80	98	98	95	98	70	98	98	70
	Ragweed	65	90	85	70	60	55	80	55	60	65	70	45	35	45
30	Ryegrass, Italian	5	0	10	5	10	0	30	30	0	20	10	10	5	5
	Soybean	95	75	80	60	75	65	95	60	95	95	95	95	30	80
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	30	80	85	90	-	65	85	70	80	100	85	70	65	75
	Waterhemp	65	70	98	85	80	75	90	98	100	100	75	98	95	85
35	Wheat	25	5	35	5	5	0	20	5	5	0	5	5	0	5
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C		Compounds													
125 g ai/ha		194	200	204	220	221	223	228	232	236	240	245	253	258	273

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Postemergence														
5	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	15	10	5	15	10	5	5	20	10	20	5	20	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	30	10	10	50	5	0	40	25	20	5	5	10	10
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	70	95	98	80	50	60	50	60	50	55	100	90	95
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	25	15	20	10	10	5	5	15	10	15	5	25	20
	Crabgrass, Large	10	15	15	5	25	5	5	5	5	20	15	20	15
15	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	15	5	10	5	5	5	5	15	15	40	15	20	45
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	85	85	75	95	90	100	80	95	85	70	85	100	100
20	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	25	5	10	5	20	5	10	5	20	10	10	10	5
	Kochia	90	98	100	95	95	90	85	98	90	90	98	100	100
	Lambsquarters	90	85	90	75	65	95	65	75	90	90	98	95	90
	Morningglory	80	95	98	50	55	80	35	85	75	90	85	85	95
25	Nutsedge, Yellow	5	30	0	5	10	5	5	5	5	5	10	5	5
	Oat, Wild	40	25	15	50	30	5	5	20	5	0	5	10	15
	Oilseed Rape	85	50	85	90	80	85	85	60	65	60	80	80	98
	Pigweed	90	95	95	90	85	90	55	85	95	75	85	95	90
	Ragweed	50	55	35	25	10	75	45	60	75	75	60	80	75
30	Ryegrass, Italian	0	5	10	10	5	5	10	10	0	0	5	0	30
	Soybean	75	95	95	95	80	95	80	75	95	75	90	90	95
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	70	75	60	60	75	90	70	65	80	80	55	85	80
	Waterhemp	85	90	90	85	80	95	75	85	90	70	75	85	90
	Wheat	0	5	10	0	0	5	0	5	0	5	5	0	5
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C Compounds
 125 g ai/ha 274 284
 Postemergence
 Barley - -

Table C Compounds
 125 g ai/ha 274 284
 Postemergence
 Johnsongrass 10 20

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Barnyardgrass	15	15
Bermudagrass	-	-
Blackgrass	20	5
Bromegrass, Downy	-	-
Canarygrass	-	-
Chickweed	98	100
Cocklebur	-	-
Corn	15	20
Crabgrass, Large	60	10
Cupgrass, Woolly	-	-
Deadnettle	-	-
Foxtail, Giant	60	20
Foxtail, Green	-	-
Galium	98	85
Goosegrass	-	-

Kochia	100	100
Lambsquarters	98	98
Morningglory	95	85
Nutsedge, Yellow	10	0
Oat, Wild	30	5
Oilseed Rape	90	80
Pigweed	98	100
Ragweed	75	50
Ryegrass, Italian	35	5
Soybean	98	85
Surinam Grass	-	-
Velvetleaf	75	30
Waterhemp	98	98
Wheat	15	5
Windgrass	-	-

Table C		Compounds													
62 g ai/ha		5	7	10	16	25	47	52	57	58	59	62	65	72	73
Postemergence															
5	Barley	0	0	5	5	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	-	-	-	-	20	0	5	10	5	5	5	5	5	0
	Bermudagrass	0	5	5	15	-	-	-	-	-	-	-	-	-	-
	Blackgrass	5	10	5	30	50	0	5	15	15	10	5	40	10	0
	Bromegrass, Downy	5	5	5	5	-	-	-	-	-	-	-	-	-	-
10	Canarygrass	10	10	0	30	-	-	-	-	-	-	-	-	-	-
	Chickweed	15	-	30	65	90	5	60	50	95	70	50	70	65	50
	Cocklebur	50	45	55	55	-	-	-	-	-	-	-	-	-	-
	Corn	20	25	5	5	15	0	10	15	15	15	15	10	10	5
	Crabgrass, Large	15	5	5	20	20	5	15	5	20	10	5	5	10	10
15	Cupgrass, Woolly	10	20	5	15	-	-	-	-	-	-	-	-	-	-
	Deadnettle	50	98	60	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	5	5	0	10	15	25	50	10	40	45	10	10	10	5
	Foxtail, Green	40	-	0	30	-	-	-	-	-	-	-	-	-	-
	Galium	70	80	80	-	80	50	60	50	70	80	65	85	80	55
20	Goosegrass	5	5	5	10	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	0	-	5	5	5	5	5	15	35	5	5	5	5
	Kochia	55	98	40	80	98	10	90	90	95	100	90	98	90	85
	Lambsquarters	95	98	55	100	80	45	90	70	90	80	60	75	75	55

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	Morningglory	60	80	65	80	98	70	80	80	95	85	70	65	75	65
	Nutsedge, Yellow	5	15	5	5	10	0	5	5	5	5	5	5	0	0
	Oat, Wild	5	35	0	35	15	0	5	15	40	25	0	5	5	5
	Oilseed Rape	-	-	-	-	85	50	40	40	70	50	20	60	70	30
5	Pigweed	98	100	98	98	90	55	60	85	95	90	65	95	80	70
	Ragweed	45	55	50	30	65	50	45	40	45	25	40	25	40	35
	Ryegrass, Italian	5	10	0	15	-	0	5	5	5	10	0	0	5	0
	Soybean	90	98	75	85	80	45	90	85	95	85	85	60	80	70
	Surinam Grass	35	20	10	15	-	-	-	-	-	-	-	-	-	-
10	Velvetleaf	55	50	70	-	40	50	60	35	50	30	20	55	40	30
	Waterhemp	-	-	-	-	80	100	70	80	90	85	60	95	75	60
	Wheat	5	5	5	15	5	0	0	5	15	5	0	5	0	0
	Windgrass	40	55	10	40	-	-	-	-	-	-	-	-	-	-
	Table C	Compounds													
15	62 g ai/ha	74	79	80	83	84	85	86	88	89	90	92	94	97	98
	Postemergence														
	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	5	5	5	0	5	5	5	5	5	5	10	10	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Blackgrass	0	30	10	5	5	5	5	10	5	5	10	5	10	30
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	30	65	65	60	40	50	60	20	50	15	60	60	80	75
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Corn	10	5	5	5	0	10	5	10	5	5	5	35	10	5
	Crabgrass, Large	5	20	5	10	5	5	5	10	5	10	5	10	15	5
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	5	10	5	10	5	10	15	30	5	20	5	10	10	5
30	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	55	75	85	70	60	50	80	70	50	65	65	80	85	75
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	0	10	5	10	0	5	5	5	5	5	5	5	15	5
	Kochia	90	90	95	90	70	80	90	95	60	45	80	90	95	90
35	Lambsquarters	75	95	55	60	55	75	65	60	65	60	40	75	80	80
	Morningglory	75	95	60	75	85	25	85	85	55	75	90	75	85	65
	Nutsedge, Yellow	0	5	5	5	-	5	5	10	20	10	5	45	5	5

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	Oat, Wild	0	15	5	10	5	5	5	10	5	5	10	0	15	10
	Oilseed Rape	40	50	80	55	45	30	60	55	55	50	60	50	80	95
	Pigweed	60	95	65	75	80	70	65	85	35	45	55	80	85	75
	Ragweed	40	70	40	60	40	20	55	55	60	50	50	55	60	30
5	Ryegrass, Italian	0	10	20	5	0	0	5	10	5	5	5	0	5	5
	Soybean	65	85	75	70	90	65	70	95	90	75	90	85	90	60
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	35	70	65	50	70	45	65	40	25	60	50	65	75	70
	Waterhemp	60	80	70	70	70	70	60	85	30	65	75	75	90	80
10	Wheat	0	5	5	0	0	5	0	5	0	0	0	0	5	5
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table C		Compounds													
	62 g ai/ha	111	116	117	120	123	129	132	134	136	138	140	141	145	147
	Postemergence														
15	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	5	5	10	15	5	5	5	0	5	10	20	0	5
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	5	10	5	5	0	5	10	5	5	5	0	35	5	0
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	75	55	70	70	50	70	30	55	5	50	45	95	45	75
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	10	5	5	5	5	10	5	10	0	5	10	5	5	5
	Crabgrass, Large	10	15	20	10	5	5	5	10	5	15	15	10	5	10
25	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	35	40	40	10	20	5	5	5	5	10	20	45	25	20
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	90	80	70	30	85	55	65	85	55	65	90	98	55	90
30	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	0	5	5	10	5	5	5	0	5	5	10	0	5
	Kochia	90	90	100	95	70	95	85	95	60	95	85	100	85	95
	Lambsquarters	80	50	50	70	85	80	60	75	60	60	80	100	85	90
	Morningglory	80	60	90	35	55	80	75	85	50	65	75	95	50	75
35	Nutsedge, Yellow	5	-	5	10	10	5	0	10	5	5	5	15	5	0
	Oat, Wild	5	5	10	5	0	15	5	10	5	5	0	10	0	0
	Oilseed Rape	60	10	60	5	60	60	70	70	5	60	50	95	60	75

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	Pigweed	85	90	85	85	85	80	75	85	55	80	90	100	65	75
	Ragweed	70	25	35	25	70	40	10	55	45	40	60	98	35	75
	Ryegrass, Italian	0	5	0	0	0	20	5	5	0	0	0	5	0	0
	Soybean	80	60	50	30	65	85	35	65	75	65	65	90	35	85
5	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	75	60	30	35	80	40	40	50	10	20	45	100	60	85
	Waterhemp	80	80	85	80	80	65	65	60	35	75	80	100	55	85
	Wheat	0	5	5	0	0	0	0	5	5	0	0	5	0	10
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Table C	Compounds													
	62 g ai/ha	150	154	155	160	163	164	166	167	172	177	178	180	181	191
	Postemergence														
	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	10	5	5	5	5	10	10	5	10	5	5	10	15
15	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	10	0	5	5	5	5	45	5	0	5	20	5	15	5
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	65	10	75	80	80	80	90	70	70	55	65	70	80	80
20	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	10	0	5	5	10	5	10	10	0	10	10	5	5	10
	Crabgrass, Large	5	10	5	5	10	5	10	5	0	10	5	5	10	5
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Foxtail, Giant	20	5	15	5	10	10	10	10	5	10	5	10	25	10
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	75	80	98	95	85	80	90	70	10	85	85	60	70	98
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	0	5	0	5	5	5	15	10	5	15	0	5	15
30	Kochia	55	80	98	98	100	90	90	90	30	90	95	50	100	98
	Lambsquarters	35	60	98	70	85	40	95	98	0	75	85	75	100	75
	Morningglory	65	65	80	75	65	55	85	98	10	80	85	75	75	85
	Nutsedge, Yellow	15	10	5	5	5	5	5	5	5	5	5	10	5	5
	Oat, Wild	5	0	5	0	10	5	35	35	0	10	10	20	5	5
35	Oilseed Rape	45	50	50	60	60	55	95	85	0	90	90	40	60	50
	Pigweed	55	60	98	75	90	75	90	95	5	85	95	60	85	95
	Ragweed	35	100	70	60	35	60	60	30	0	55	30	80	30	30

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	Ryegrass, Italian	5	0	10	0	0	0	15	5	5	0	0	5	5	5
	Soybean	65	65	75	60	80	75	90	60	5	85	65	98	50	60
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	30	70	70	80	-	40	80	40	10	70	85	65	40	75
5	Waterhemp	35	65	80	70	85	65	90	85	5	95	90	70	85	95
	Wheat	5	0	15	5	0	0	35	5	0	0	0	0	0	0
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table C		Compounds													
	62 g ai/ha	192	194	200	204	220	221	222	223	228	232	236	240	245	253
10	Postemergence														
	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	10	5	5	10	10	5	15	5	5	10	5	10	5	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	5	20	5	5	40	5	60	5	0	5	5	0	5	0
15	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	70	70	75	95	80	60	100	50	50	50	65	55	80	90
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	5	-	10	20	10	10	0	5	0	10	5	5	5	5
20	Crabgrass, Large	5	10	5	10	5	5	5	5	5	5	5	5	10	15
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	5	10	5	5	10	5	5	5	0	5	15	20	20	25
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Galium	80	65	65	75	80	55	85	80	70	80	80	55	80	80
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	5	5	5	5	5	10	0	5	5	15	5	10	5
	Kochia	85	90	95	100	95	95	100	80	80	90	85	45	90	100
	Lambsquarters	90	80	80	80	55	50	75	75	75	70	75	75	80	80
30	Morningglory	35	80	80	65	40	50	70	70	25	55	70	75	65	75
	Nutsedge, Yellow	0	5	5	10	0	5	5	5	5	5	0	0	5	5
	Oat, Wild	5	15	15	15	35	10	30	0	0	5	5	0	5	10
	Oilseed Rape	60	40	55	70	85	60	20	80	60	5	30	55	50	10
	Pigweed	80	75	90	95	85	50	85	80	60	60	90	45	75	98
35	Ragweed	15	25	40	40	15	20	60	55	55	50	40	55	45	55
	Ryegrass, Italian	5	0	10	5	5	5	0	0	0	5	0	0	0	0
	Soybean	75	50	95	95	60	65	60	85	60	70	85	60	60	40

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5	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	65	45	50	40	65	45	50	80	60	30	85	45	35	70
	Waterhemp	65	80	98	90	75	80	90	85	60	70	90	55	85	80
	Wheat	5	0	0	5	0	0	5	0	0	0	0	5	0	0
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table C		Compounds				Table C		Compounds							
62 g ai/ha		258	273	274	284	62 g ai/ha		258	273	274	284				
Postemergence						Postemergence									
Barley		-	-	-	-	Johnsongrass		5	5	5	5				
Barnyardgrass		10	5	10	10	Kochia		100	80	100	100				
Bermudagrass		-	-	-	-	Lambsquarters		90	85	95	85				
Blackgrass		5	10	15	5	Morningglory		85	65	95	100				
Bromegrass, Downy		-	-	-	-	Nutsedge, Yellow		5	5	20	0				
Canarygrass		-	-	-	-	Oat, Wild		10	5	35	5				
Chickweed		90	35	90	100	Oilseed Rape		95	5	85	70				
Cocklebur		-	-	-	-	Pigweed		85	65	90	98				
Corn		10	5	10	10	Ragweed		50	55	40	55				
Crabgrass, Large		10	10	30	5	Ryegrass, Italian		0	5	30	5				
Cupgrass, Woolly		-	-	-	-	Soybean		70	90	90	40				
Deadnettle		-	-	-	-	Surinam Grass		-	-	-	-				
Foxtail, Giant		25	10	10	10	Velvetleaf		75	25	65	15				
Foxtail, Green		-	-	-	-	Waterhemp		80	65	95	85				
Galium		95	60	90	85	Wheat		5	0	5	5				
Goosegrass		-	-	-	-	Windgrass		-	-	-	-				
Table C						Compounds									
31 g ai/ha		5	7	10	16	25	47	52	57	58	59	62	65	72	73
Postemergence															
10	Barley	0	0	0	0	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	-	-	-	-	15	0	0	5	5	5	0	5	5	0
	Bermudagrass	0	0	0	10	-	-	-	-	-	-	-	-	-	-
	Blackgrass	0	5	5	5	5	0	5	10	10	5	0	10	10	0
	Bromegrass, Downy	5	5	5	0	-	-	-	-	-	-	-	-	-	-
15	Canarygrass	5	5	0	10	-	-	-	-	-	-	-	-	-	-
	Chickweed	5	80	5	40	80	5	40	50	95	40	50	50	50	50
	Cocklebur	25	35	45	50	-	-	-	-	-	-	-	-	-	-
	Corn	15	-	5	5	5	0	5	10	10	10	5	10	5	5
	Crabgrass, Large	5	5	5	10	15	5	5	5	5	10	5	5	5	5

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

Table C

Compounds

	31 g ai/ha	181	191	192	194	200	204	220	221	222	223	228	232	236	240
	Postemergence														
20	Barley	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Barnyardgrass	5	10	10	5	0	5	10	5	10	0	0	5	5	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	5	0	0	15	5	5	60	0	30	30	0	0	5	0
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Canarygrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chickweed	75	80	50	50	55	75	70	60	85	50	30	30	50	5
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	5	5	5	5	5	10	10	5	5	5	0	10	5	5
	Crabgrass, Large	5	5	10	10	5	5	5	5	5	5	5	5	5	5
30	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deadnettle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	10	10	5	10	5	5	5	5	5	5	0	5	50	35
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	65	80	80	60	60	70	70	55	85	80	50	70	75	40
35	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	5	10	10	-	5	5	0	5	10	0	0	0	25	5
	Kochia	100	95	45	90	80	90	90	80	100	85	60	85	80	45

5	Lambsquarters	100	60	25	60	80	85	50	60	65	75	40	60	85	45	
	Morningglory	20	85	50	50	85	60	50	40	45	45	10	80	45	65	
	Nutsedge, Yellow	0	0	5	5	5	0	0	0	5	5	0	5	0	0	
	Oat, Wild	5	5	0	5	15	20	25	5	10	0	0	0	0	0	
	Oilseed Rape	60	45	5	30	55	40	65	50	10	50	60	50	10	35	
	Pigweed	98	85	65	75	75	80	75	75	80	70	50	70	90	30	
	Ragweed	35	20	25	15	25	25	10	5	45	20	20	35	15	40	
	Ryegrass, Italian	0	0	0	0	5	5	0	0	0	0	0	0	0	0	
	Soybean	50	55	30	30	90	70	65	55	65	65	35	55	75	40	
10	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Velvetleaf	20	65	60	40	20	35	50	35	35	55	55	60	65	25	
	Waterhemp	85	85	50	80	70	85	70	70	90	60	45	65	70	25	
	Wheat	0	0	0	0	0	5	0	0	0	0	0	0	0	0	
	Windgrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	Table C	Compounds														
	31 g ai/ha	245	253	258	273	274	284									
	Postemergence															
20	Barley	-	-	-	-	-	-									
	Barnyardgrass	5	5	10	5	10	10									
	Bermudagrass	-	-	-	-	-	-									
	Blackgrass	0	0	5	5	5	5									
	Bromegrass, Downy	-	-	-	-	-	-									
	Canarygrass	-	-	-	-	-	-									
	Chickweed	60	70	50	30	70	65									
25	Cocklebur	-	-	-	-	-	-									
	Corn	5	5	5	5	10	5									
	Crabgrass, Large	5	5	5	5	5	5									
	Cupgrass, Woolly	-	-	-	-	-	-									
30	Deadnettle	-	-	-	-	-	-									
	Foxtail, Giant	35	45	20	40	10	10									
	Foxtail, Green	-	-	-	-	-	-									
	Galium	60	80	90	60	80	100									
	Goosegrass	-	-	-	-	-	-									
	Johnsongrass	5	5	5	0	5	5									
	Kochia	75	98	95	65	90	100									
35	Lambsquarters	70	80	65	40	95	70									
	Morningglory	30	75	85	65	85	70									

5	Nutsedge, Yellow	5	5	0	5	5	0
	Oat, Wild	0	0	5	5	-	5
	Oilseed Rape	50	60	85	0	80	70
	Pigweed	55	85	85	80	85	98
	Ragweed	40	45	50	55	60	55
	Ryegrass, Italian	0	0	0	5	5	5
	Soybean	60	60	75	70	70	35
10	Surinam Grass	-	-	-	-	-	-
	Velvetleaf	10	70	65	10	50	15
	Waterhemp	65	75	70	40	85	85
	Wheat	0	0	0	0	5	0
	Windgrass	-	-	-	-	-	-

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Table C

Compounds

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	Nutsedge, Yellow	0	0	5	5	5	5	5	0	0	0	0	5	0	0
	Oat, Wild	5	0	0	0	0	0	0	5	5	0	5	0	5	0
	Oilseed Rape	5	35	40	60	10	45	10	60	15	0	60	70	15	55
	Pigweed	40	50	25	80	80	80	50	80	80	10	75	80	10	85
5	Ragweed	30	10	35	50	10	10	20	35	10	0	10	20	35	5
	Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Soybean	65	35	40	5	40	35	40	40	20	0	45	50	85	35
	Velvetleaf	20	20	25	45	45	-	-	45	35	5	50	50	30	25
	Waterhemp	35	45	5	45	70	75	50	75	65	5	70	80	25	80
10	Wheat	5	0	0	5	0	0	0	5	0	0	0	0	0	0

	Table C	Compounds														
	16 g ai/ha	191	192	220	221	222	223	228	232	236	240	245	253	258	273	
15	Postemergence															
	Barnyardgrass	10	5	5	5	5	0	0	10	5	0	5	5	5	5	
	Blackgrass	0	0	0	0	5	0	0	10	0	0	0	0	0	5	
	Chickweed	10	45	65	20	60	35	10	5	40	5	5	60	50	10	
	Corn	5	0	5	0	5	5	0	5	5	0	5	5	5	5	
20	Crabgrass, Large	5	5	5	5	5	5	0	5	5	10	5	5	5	5	
	Foxtail, Giant	10	5	0	0	5	5	0	5	5	0	35	10	5	10	
	Galium	80	60	50	60	70	75	50	65	60	35	60	45	85	55	
	Johnsongrass	30	5	5	5	0	0	5	0	10	10	5	0	0	0	
	Kochia	85	30	90	90	85	70	30	85	30	40	45	80	90	70	
25	Lambsquarters	85	10	15	15	65	60	25	55	80	15	50	30	50	25	
	Morningglory	40	30	15	45	90	5	5	70	10	30	5	60	65	60	
	Nutsedge, Yellow	0	5	10	0	5	5	0	5	0	0	5	5	0	10	
	Oat, Wild	5	0	5	5	10	0	0	0	0	0	0	0	5	5	
	Oilseed Rape	10	10	50	40	5	10	40	5	30	30	40	5	70	0	
30	Pigweed	95	60	65	60	70	70	25	60	60	15	40	85	75	65	
	Ragweed	5	10	10	5	40	10	5	25	10	35	35	20	25	30	
	Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
	Soybean	40	30	40	30	55	60	25	30	60	30	40	40	50	60	
	Velvetleaf	50	35	30	35	40	30	15	35	55	10	5	30	55	5	
	Waterhemp	80	40	65	65	70	70	15	65	70	10	60	75	65	35	
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table C Compound
 16 g ai/ha 274
 Postemergence

Table C Compound
 16 g ai/ha 274
 Postemergence

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Barnyardgrass	5	Nutsedge, Yellow	10
Blackgrass	5	Oat, Wild	30
Chickweed	70	Oilseed Rape	60
Corn	5	Pigweed	95
Crabgrass, Large	5	Ragweed	50
Foxtail, Giant	5	Ryegrass, Italian	5
Galium	70	Soybean	45
Johnsongrass	5	Velvetleaf	30
Kochia	85	Waterhemp	70
Lambsquarters	85	Wheat	5
Morningglory	85		

Table C	Compounds				Table C	Compounds			
8 g ai/ha	115	152	172	222	8 g ai/ha	115	152	172	222
Postemergence					Postemergence				
Barnyardgrass	0	0	0	5	Nutsedge, Yellow	0	0	0	0
Blackgrass	0	0	0	0	Oat, Wild	0	0	0	5
Chickweed	5	5	0	10	Oilseed Rape	0	5	0	10
Corn	10	0	0	0	Pigweed	15	30	5	65
Crabgrass, Large	5	5	0	5	Ragweed	5	15	0	20
Foxtail, Giant	5	0	0	0	Ryegrass, Italian	0	0	0	0
Galium	5	15	0	65	Soybean	5	30	0	40
Johnsongrass	5	0	0	0	Velvetleaf	5	5	5	35
Kochia	0	10	0	60	Waterhemp	5	15	0	60
Lambsquarters	10	60	0	50	Wheat	0	0	0	0
Morningglory	0	0	0	40					

Table C	Compounds		Table C	Compounds	
4 g ai/ha	115	152	4 g ai/ha	115	152
Postemergence			Postemergence		
Barnyardgrass	0	0	Nutsedge, Yellow	0	0
Blackgrass	0	0	Oat, Wild	0	0
Chickweed	0	5	Oilseed Rape	0	5
Corn	5	0	Pigweed	10	10
Crabgrass, Large	0	5	Ragweed	5	15
Foxtail, Giant	5	0	Ryegrass, Italian	0	0

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	Johnsongrass	5	85	30	0	25	100	85	55	35	90	50	40	55	60
	Kochia	95	80	60	-	-	-	-	-	-	-	-	-	-	-
	Lambsquarters	80	80	50	100	100	100	100	100	98	100	100	100	100	100
	Morningglory	0	75	30	5	95	100	100	85	45	100	0	25	0	60
5	Nightshade	95	65	30	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	0	25	15	0	10	85	65	0	0	15	0	5	5	5
	Oat, Wild	5	90	50	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	-	-	-	98	100	100	100	100	95	95	98	100	90	100
	Pigweed	100	100	100	95	100	100	100	100	100	100	100	100	100	100
10	Ragweed	0	25	0	20	90	100	95	75	75	90	40	60	50	100
	Russian Thistle	-	80	0	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	30	5	5	55	90	85	10	5	90	30	5	0	30
	Soybean	40	90	65	20	85	95	90	55	60	75	60	60	40	75
	Sunflower	10	0	0	-	-	-	-	-	-	-	-	-	-	-
15	Surinam Grass	5	100	30	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	100	100	85	100	100	100	95	75	100	100	85	100	100
	Waterhemp	-	-	-	95	100	100	100	100	100	100	100	100	100	100
	Wheat	5	0	5	0	0	80	50	0	0	35	0	0	0	0
	Table C	Compounds													
20	62 g ai/ha	88	89	90	92	94	97	111	112	116	118	129	132	134	135
	Preemergence														
	Barnyardgrass	35	70	75	100	85	100	90	30	45	100	40	10	60	60
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	60	5	30	70	90	90	40	40	60	90	5	40	85	20
25	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	5	0	10	5	5	45	5	5	5	70	5	20	40	30
	Crabgrass, Large	100	100	98	100	100	100	100	100	100	85	100	98	98	100
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Foxtail, Giant	98	100	75	100	100	100	100	100	85	95	100	70	100	70
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	90	85	100	95	98	98	100	100	100	100	95	90	90	90
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	40	20	20	70	35	90	25	20	55	85	40	0	45	45
35	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lambsquarters	100	95	100	100	100	100	100	100	85	100	100	100	100	85
	Morningglory	40	95	55	98	40	100	85	65	20	100	45	5	35	80

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	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	5	10	5	50	55	60	15	15	10	25	5	15	0	15
	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	70	95	98	85	98	98	98	95	98	100	100	100	100	95
5	Pigweed	100	100	98	100	100	100	100	100	100	100	100	70	100	98
	Ragweed	5	75	100	50	10	85	100	35	45	100	60	40	55	65
	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	45	0	50	10	85	40	5	10	70	10	5	15	10
	Soybean	40	90	65	80	85	95	80	50	40	90	40	5	20	85
10	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	100	98	100	100	100	90	100	100	100	100	100	85	85
	Waterhemp	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Wheat	0	0	0	30	0	60	0	0	0	10	0	0	0	0
15	Table C	Compounds													
	62 g ai/ha	136	137	138	141	145	147	150	151	154	164	166	167	170	179
	Preemergence														
	Barnyardgrass	60	10	65	100	50	90	65	70	70	98	100	100	100	90
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Blackgrass	75	5	80	95	85	50	50	10	20	90	90	90	90	40
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	5	5	0	80	0	20	25	15	5	5	40	25	15	5
	Crabgrass, Large	100	98	100	100	100	100	100	98	100	100	100	100	100	98
25	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	80	60	100	100	75	100	100	80	85	100	100	100	98	100
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	30	10	90	100	90	98	90	-	95	95	95	100	100	98
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Johnsongrass	20	5	40	100	25	80	70	50	40	75	85	80	70	65
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lambsquarters	80	100	100	100	100	100	80	100	90	100	98	100	100	100
	Morningglory	10	45	10	100	0	95	45	10	50	85	98	50	40	35
	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Nutsedge, Yellow	10	5	25	70	0	15	25	5	5	20	35	10	15	10
	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	50	85	100	100	100	100	90	100	100	100	100	90	98	98

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	Pigweed	40	90	100	100	100	100	100	100	100	100	100	100	100	100
	Ragweed	20	80	5	100	100	98	25	85	95	75	95	15	55	0
	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	0	20	75	40	50	30	35	20	65	90	80	75	30
5	Soybean	50	80	90	90	90	95	45	85	80	65	95	90	45	45
	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	30	65	98	100	100	100	60	100	100	100	100	100	80	98
	Waterhemp	75	95	100	100	100	100	98	100	100	100	100	100	100	98
10	Wheat	0	0	5	40	0	0	5	0	0	30	60	5	20	0
Table C		Compounds													
	62 g ai/ha	180	187	194	200	204	236	240	250	252	253	258	270	273	274
	Preemergence														
	Barnyardgrass	100	65	85	100	95	98	60	50	100	100	90	90	25	100
15	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	90	30	50	95	80	90	95	70	90	90	90	70	5	90
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	30	5	0	5	0	10	5	0	40	35	45	20	45	85
20	Crabgrass, Large	100	100	98	100	100	100	100	98	100	100	100	100	95	100
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	100	85	90	100	98	100	100	100	100	98	100	100	75	100
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	100	90	90	100	100	100	100	70	90	100	100	95	95	98
25	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	75	30	25	98	80	60	10	35	80	60	75	40	55	95
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lambsquarters	100	98	100	98	98	100	100	100	100	100	98	100	100	100
	Morningglory	100	0	0	95	98	55	75	50	95	98	45	55	55	100
30	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	65	5	0	40	0	60	15	-	40	20	95	15	5	85
	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	100	90	30	98	95	100	100	100	100	100	100	100	80	95
	Pigweed	100	90	100	100	100	100	55	100	100	100	100	100	100	100
35	Ragweed	80	45	10	100	5	85	100	40	98	85	80	45	55	35
	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	50	0	20	70	35	45	0	5	60	35	25	10	0	90

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	Soybean	98	55	20	90	35	90	85	65	95	95	75	25	40	95
	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	95	75	100	85	100	80	100	100	100	100	98	85	100
5	Waterhemp	100	85	100	100	100	98	100	100	100	100	98	100	98	100
	Wheat	5	0	0	65	5	0	0	0	0	0	5	0	0	90

Table C Compound

62 g ai/ha 292

Preemergence

Barnyardgrass 85

Bermudagrass -

Blackgrass 90

Bromegrass, Downy -

Cocklebur -

Corn 10

Crabgrass, Large 100

Cupgrass, Woolly -

Foxtail, Giant 100

Foxtail, Green -

Galium 100

Goosegrass -

Johnsongrass 40

Kochia -

Lambsquarters 98

Table C Compound

62 g ai/ha 292

Preemergence

Morningglory 35

Nightshade -

Nutsedge, Yellow 0

Oat, Wild -

Oilseed Rape 98

Pigweed 100

Ragweed 35

Russian Thistle -

Ryegrass, Italian 10

Soybean 85

Sunflower -

Surinam Grass -

Velvetleaf 98

Waterhemp 100

Wheat 10

Table C

Compounds

31 g ai/ha 7 16 18 25 52 58 59 72 73 79 83 84 85 86

Preemergence

10 Barnyardgrass - - - 0 50 98 80 75 60 100 5 25 15 10

Bermudagrass 85 95 95 - - - - - - - - - - -

Blackgrass 5 85 10 0 - 90 5 50 0 90 5 5 5 20

Bromegrass, Downy 0 30 0 - - - - - - - - - - -

Cocklebur 0 0 - - - - - - - - - - -

15 Corn 0 0 0 0 5 60 - - 0 40 0 0 10 25

Crabgrass, Large 80 98 75 55 100 100 100 100 100 100 85 98 90 100

Cupgrass, Woolly 15 75 40 - - - - - - - - - - -

Foxtail, Giant 40 95 65 10 100 100 95 100 85 98 75 55 35 75

Foxtail, Green 50 90 85 - - - - - - - - - - -

[illegible]

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	Lambsquarters	100	80	98	98	85	98	100	100	95	100	40	55	100	85
	Morningglory	5	35	20	25	30	98	45	15	5	75	35	0	20	50
	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	0	5	0	5	0	20	0	5	5	5	0	0	0	0
5	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	100	80	80	80	98	85	90	90	5	100	85	85	45	95
	Pigweed	100	90	85	85	100	100	95	100	100	100	100	45	100	80
	Ragweed	0	55	60	5	0	35	50	0	5	100	20	10	25	55
	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Ryegrass, Italian	0	5	0	10	0	60	0	0	0	40	0	0	5	5
	Soybean	5	45	35	65	50	90	60	35	25	75	10	0	15	65
	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	98	70	65	90	100	95	60	70	70	100	70	85	35	45
15	Waterhemp	100	100	100	98	100	100	100	98	100	100	100	98	100	100
	Wheat	0	0	0	0	0	10	30	0	0	0	0	0	0	0
Table C		Compounds													
	31 g ai/ha	136	137	138	141	145	147	150	151	154	164	166	167	170	179
Preemergence															
20	Barneyardgrass	10	5	25	100	0	80	20	5	25	70	100	85	55	10
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	0	0	20	95	65	40	10	0	10	50	85	30	80	50
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Corn	0	5	0	20	0	0	0	5	0	5	25	5	5	5
	Crabgrass, Large	100	70	90	100	75	100	98	85	90	85	100	98	95	90
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	5	5	90	100	55	100	75	35	70	95	100	95	85	85
	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Galium	0	5	90	98	85	98	80	-	95	100	100	100	98	95
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	0	0	5	70	0	35	30	5	0	20	40	40	25	0
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lambsquarters	10	30	100	100	100	100	100	100	85	98	98	100	98	100
35	Morningglory	30	10	0	90	0	80	5	0	25	55	70	35	15	0
	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	0	0	5	30	0	5	0	0	5	5	10	10	0	0

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	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Oilseed Rape	0	60	100	100	100	100	5	100	100	98	100	80	80	95
	Pigweed	50	75	95	100	100	100	70	100	100	100	100	100	100	100
	Ragweed	25	25	5	100	75	100	-	70	85	10	65	30	25	5
5	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	0	0	0	45	5	35	5	0	5	40	40	40	10	10
	Soybean	30	40	55	85	45	80	35	65	70	25	90	70	10	10
	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Velvetleaf	-	25	80	100	100	100	10	100	100	100	100	85	55	75
	Waterhemp	40	100	100	100	100	98	50	100	95	100	100	100	100	98
	Wheat	0	0	0	5	0	0	0	0	0	5	15	0	10	0
Table C		Compounds													
	31 g ai/ha	180	187	194	200	204	236	240	250	252	253	258	270	273	274
15	Preemergence														
	Barnyardgrass	100	5	10	80	55	65	10	10	70	65	65	40	5	98
	Bermudagrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Blackgrass	50	20	20	80	75	50	10	10	50	10	20	10	0	90
	Bromegrass, Downy	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Cocklebur	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Corn	15	0	0	0	0	5	5	0	10	5	5	0	5	45
	Crabgrass, Large	100	55	95	100	100	100	100	85	100	98	100	100	85	100
	Cupgrass, Woolly	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Foxtail, Giant	100	30	80	100	98	100	55	80	60	85	95	50	25	100
25	Foxtail, Green	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Galium	80	90	90	100	60	100	95	5	85	90	100	90	0	95
	Goosegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Johnsongrass	55	0	5	45	40	40	5	5	20	35	15	15	10	60
	Kochia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	Lambsquarters	98	98	100	100	90	98	100	100	100	98	90	98	65	98
	Morningglory	55	0	0	85	35	0	45	15	75	70	30	0	10	98
	Nightshade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Nutsedge, Yellow	25	0	0	0	0	0	0	0	5	0	5	0	5	55
	Oat, Wild	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Oilseed Rape	95	85	30	98	85	98	98	100	100	98	100	100	10	95
	Pigweed	100	75	100	98	100	100	-	100	100	100	100	100	100	100
	Ragweed	80	45	-	75	0	75	70	35	85	100	60	10	10	20

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5	Russian Thistle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ryegrass, Italian	10	0	0	15	10	20	0	0	30	0	5	0	0	60
	Soybean	98	30	5	90	10	70	45	30	85	85	55	10	15	80
	Sunflower	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Surinam Grass	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Velvetleaf	100	50	45	100	60	100	75	100	100	100	85	70	10	98
	Waterhemp	100	60	100	100	98	98	75	100	100	100	100	100	98	100
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	60

Table C Compound

31 g ai/ha

292

Preemergence

Barnyardgrass

15

Bermudagrass

-

Blackgrass

70

Bromegrass, Downy

-

Cocklebur

-

Corn

5

Crabgrass, Large

100

Cupgrass, Woolly

-

Foxtail, Giant

100

Foxtail, Green

-

Galium

98

Goosegrass

-

Johnsongrass

5

Kochia

-

Lambsquarters

80

Table C Compound

31 g ai/ha

292

Preemergence

Morningglory

30

Nightshade

-

Nutsedge, Yellow

0

Oat, Wild

-

Oilseed Rape

80

Pigweed

100

Ragweed

35

Russian Thistle

-

Ryegrass, Italian

0

Soybean

40

Sunflower

-

Surinam Grass

-

Velvetleaf

35

Waterhemp

100

Wheat

0

Table C

Compounds

10	16 g ai/ha	83	84	85	86	88	89	90	92	94	97	111	112	116	118
	Preemergence														
	Barnyardgrass	5	0	0	5	5	5	0	5	5	35	5	0	0	20
	Blackgrass	0	0	0	0	0	0	5	0	5	0	20	0	0	35
15	Corn	0	0	5	0	5	0	0	0	5	0	5	0	0	10
	Crabgrass, Large	65	45	65	85	45	80	25	90	25	98	98	35	5	30
	Foxtail, Giant	5	5	20	35	5	5	5	30	5	60	15	15	0	25
	Galium	0	80	0	90	0	30	5	80	80	85	90	55	0	95
	Johnsongrass	0	0	15	10	0	0	5	0	0	10	0	0	0	0
	Lambsquarters	100	75	65	100	70	45	100	65	40	95	50	98	10	100

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	Morningglory	0	0	0	10	0	45	0	10	0	40	20	5	0	40
	Nutsedge, Yellow	0	0	0	0	0	0	35	5	0	10	0	0	0	0
	Oilseed Rape	75	50	0	25	10	80	60	80	85	85	60	65	0	98
	Pigweed	85	85	50	90	100	55	40	90	90	100	75	100	75	90
5	Ragweed	0	0	0	5	0	40	10	10	0	35	10	0	0	70
	Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Soybean	5	0	0	35	0	30	25	30	35	50	30	10	0	60
	Velvetleaf	60	50	35	20	15	20	35	30	40	40	60	65	20	100
	Waterhemp	75	100	55	100	98	80	85	95	80	100	100	90	100	85
10	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C		Compounds													
16 g ai/ha		129	132	134	135	136	137	138	141	145	147	150	151	154	164
Preemergence															
	Barnyardgrass	5	0	0	0	0	0	10	80	0	10	5	5	5	15
15	Blackgrass	0	0	0	0	0	0	5	80	0	0	0	0	0	0
	Corn	0	0	0	10	5	0	0	5	0	0	0	0	5	0
	Crabgrass, Large	75	65	60	60	35	10	100	100	70	98	70	5	75	75
	Foxtail, Giant	0	5	10	5	0	35	30	90	10	70	5	5	5	40
	Galium	50	0	0	0	0	5	90	98	0	90	0	-	80	75
20	Johnsongrass	0	0	20	0	0	0	0	30	0	10	0	0	0	5
	Lambsquarters	50	75	60	30	-	100	100	85	55	100	10	100	70	70
	Morningglory	5	25	5	50	20	25	0	75	0	40	0	0	10	10
	Nutsedge, Yellow	0	100	0	0	0	0	5	-	0	0	0	0	0	0
	Oilseed Rape	50	20	20	55	0	50	80	100	95	100	0	95	98	70
25	Pigweed	98	30	100	85	0	75	85	100	25	100	55	100	85	98
	Ragweed	0	10	0	40	0	45	0	85	20	75	0	55	75	0
	Ryegrass, Italian	0	0	0	0	0	0	0	40	0	0	0	0	0	0
	Soybean	10	0	0	20	20	10	20	65	35	85	0	35	50	0
	Velvetleaf	35	75	30	40	5	40	60	100	55	100	5	85	85	50
30	Waterhemp	100	85	85	75	0	100	100	100	95	100	20	95	100	85
	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C		Compounds													
16 g ai/ha		166	167	170	179	180	187	236	240	250	252	253	258	270	273
Preemergence															
35	Barnyardgrass	85	5	10	5	60	5	10	5	5	10	30	45	0	0
	Blackgrass	40	30	0	0	20	0	5	0	0	10	0	0	0	0
	Corn	0	0	0	0	5	0	0	5	0	10	0	0	0	0

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	Crabgrass, Large	100	75	25	55	100	5	90	75	75	60	85	100	50	90
	Foxtail, Giant	100	35	80	40	90	0	35	10	5	35	35	75	5	0
	Galium	98	98	95	90	80	30	90	5	0	80	70	80	70	0
	Johnsongrass	5	5	0	0	0	0	5	5	0	5	15	5	0	0
5	Lambsquarters	90	75	90	85	85	5	98	70	90	98	100	65	80	35
	Morningglory	15	30	0	10	35	0	0	15	0	45	40	10	0	5
	Nutsedge, Yellow	0	0	0	0	5	0	0	0	0	0	0	5	0	0
	Oilseed Rape	90	80	70	60	55	70	80	70	100	80	75	80	95	0
	Pigweed	100	100	100	100	85	45	100	5	85	98	100	100	100	55
10	Ragweed	50	15	85	0	20	55	15	10	15	40	35	0	0	10
	Ryegrass, Italian	5	5	5	0	5	0	0	0	0	0	0	0	0	0
	Soybean	60	10	5	0	90	5	35	40	-	65	40	35	0	5
	Velvetleaf	80	45	25	60	75	25	65	25	100	75	55	80	0	10
	Waterhemp	100	100	100	90	90	25	98	50	85	100	100	100	80	45
15	Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table C	Compounds
16 g ai/ha	274 292
Preemergence	
Barnyardgrass	90 0
Blackgrass	50 0
Corn	5 0
Crabgrass, Large	100 100
Foxtail, Giant	98 45
Galium	90 80
Johnsongrass	10 0
Lambsquarters	100 35
Morningglory	35 25
Nutsedge, Yellow	20 0
Oilseed Rape	80 70
Pigweed	100 100
Ragweed	10 25
Ryegrass, Italian	25 0
Soybean	35 5
Velvetleaf	80 15
Waterhemp	100 100
Wheat	20 0

Table C	Compound
8 g ai/ha	135
Preemergence	
Barnyardgrass	0
Blackgrass	0
Corn	5
Crabgrass, Large	45
Foxtail, Giant	0
Galium	0
Johnsongrass	0
Morningglory	5
Nutsedge, Yellow	0
Oilseed Rape	30
Pigweed	50
Ragweed	0
Ryegrass, Italian	0
Soybean	10
Velvetleaf	5
Waterhemp	55
Wheat	0

	Table C	Compound					Table C	Compound							
	2000 g ai/ha	80					500 g ai/ha	80							
	Flood						Flood								
	Barnyardgrass	0					Barnyardgrass	0							
	Ducksalad	80					Ducksalad	75							
	Rice	0					Rice	0							
	Sedge, Umbrella	85					Sedge, Umbrella	0							
	Table C	Compound													
	1000 g ai/ha	80													
	Flood														
	Barnyardgrass	0													
	Ducksalad	80													
	Rice	0													
	Sedge, Umbrella	60													
	Table C	Compounds													
	250 g ai/ha	3	8	18	25	26	34	40	59	62	65	80	81	89	97
	Flood														
	Barnyardgrass	0	0	20	0	0	10	15	40	40	0	0	0	20	0
5	Ducksalad	85	70	90	90	85	75	60	95	100	85	50	90	80	80
	Rice	0	10	10	0	0	0	0	20	25	0	0	0	0	0
	Sedge, Umbrella	70	85	90	85	85	70	75	95	100	85	0	90	70	80
	Table C	Compounds													
	250 g ai/ha	120	141	150	164	167	177	179	184	185	188	191	192	194	200
10	Flood														
	Barnyardgrass	85	20	0	0	0	0	0	0	0	0	20	0	0	25
	Ducksalad	90	100	75	95	80	95	95	75	40	60	80	75	100	80
	Rice	60	60	0	0	0	10	10	0	15	0	0	0	10	0
	Sedge, Umbrella	85	100	85	95	85	85	80	75	85	75	98	85	95	90
15	Table C	Compounds													
	250 g ai/ha	231	234	236	270										
	Flood														
	Barnyardgrass	0	0	20	60										
	Ducksalad	75	30	90	95										
20	Rice	0	0	20	30										
	Sedge, Umbrella	80	40	80	95										
	Table C	Compounds													

5	Flood																	
	Barnyardgrass	0	0	0	30	0												
	Ducksalad	30	0	40	60	40												
	Rice	0	0	0	0	0												
	Sedge, Umbrella	50	0	20	25	75												
10	Table C						Compounds											
	31 g ai/ha	3	8	18	25	26	34	40	59	62	65	81	97	120	141			
	Flood																	
	Barnyardgrass	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
	Ducksalad	0	0	80	0	0	0	0	50	30	0	30	0	0	65			
15	Rice	0	0	0	0	0	0	0	0	15	0	0	0	0	0			
	Sedge, Umbrella	0	0	70	0	0	0	50	60	0	50	0	60	0	0			
	Table C						Compounds											
	31 g ai/ha	150	164	167	177	179	184	185	188	191	192	194	200	203	231			
	Flood																	
20	Barnyardgrass	0	0	0	0	0	0	0	0	0	0	0	0	40	0			
	Ducksalad	0	0	0	20	20	0	0	0	30	0	65	0	0	0			
	Rice	0	0	0	0	0	0	0	0	0	0	10	0	0	0			
	Sedge, Umbrella	0	0	60	0	0	0	0	0	40	0	50	0	50	0			
	Table C						Compounds											
25	31 g ai/ha	234	236	270	293													
	Flood																	
	Barnyardgrass	0	0	0	0													
	Ducksalad	0	0	20	30													
	Rice	0	0	0	0													
	Sedge, Umbrella	0	0	0	60													

TEST D

- Seeds of plant species selected from bluegrass (annual bluegrass, *Poa annua*), blackgrass (*Alopecurus myosuroides*), canarygrass (littleseed canarygrass, *Phalaris minor*), chickweed (common chickweed, *Stellaria media*), galium (catchweed bedstraw, *Galium aparine*), brome grass, downy (downy brome grass, *Bromus tectorum*), field poppy (*Papaver rhoeas*), field violet (*Viola arvensis*), green foxtail (*Setaria viridis*), deadnettle (henbit deadnettle, *Lamium amplexicaule*), Italian ryegrass (*Lolium multiflorum*), kochia (*Kochia scoparia*), lambsquarters (*Chenopodium album*), oilseed rape (*Brassica napus*), pigweed (*Amaranthus retroflexus*), chamomile (scentless chamomile, *Matricaria inodora*), Russian thistle (*Salsola kali*), speedwell (bird's-eye speedwell, *Veronica persica*), spring barley

(*Hordeum vulgare*), spring wheat (*Triticum aestivum*), wild buckwheat (*Polygonum convolvulus*), wild mustard (*Sinapis arvensis*), wild oat (*Avena fatua*), wild radish (*Raphanus raphanistrum*), windgrass (*Apera spica-venti*), winter barley (*Hordeum vulgare*), and winter wheat (*Triticum aestivum*) were planted into a silt loam soil and treated preemergence with
 5 test chemicals formulated in a non-phytotoxic solvent mixture which included a surfactant.

At the same time, these species were planted in pots containing Redi-Earth[®] planting medium (Scotts Company, 14111 Scottslawn Road, Marysville, Ohio 43041) comprising sphagnum peat moss, vermiculite, wetting agent and starter nutrients and treated with
 10 postemergence applications of the test chemicals formulated in the same manner. Plants ranged in height from 2 to 18 cm (1- to 4-leaf stage). Treated plants and controls were maintained in a controlled growth environment for 7 to 21 days after which time all species were compared to controls and visually evaluated. Plant response ratings, summarized in
 Table D, 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.

15	Table D	Compounds						
	250 g ai/ha	3	7	18	52	58	59	284
	Postemergence							
	Barley, Spring	10	5	25	20	40	35	25
	Barley, Winter	0	0	20	20	50	25	25
20	Blackgrass	10	25	35	65	90	70	35
	Bluegrass	10	15	40	25	55	40	45
	Bromegrass, Downy	0	5	15	25	35	30	45
	Buckwheat, Wild	80	100	95	100	100	100	100
	Canarygrass	10	25	35	60	70	35	25
25	Chamomile	0	0	10	15	35	15	10
	Chickweed	40	80	95	90	100	95	100
	Deadnettle	20	40	100	100	100	100	100
	Field Poppy	0	60	100	100	100	100	100
	Field Violet	20	70	90	100	100	100	100
30	Foxtail, Green	10	20	25	75	80	80	85
	Galium	75	90	70	100	100	95	95
	Kochia	55	100	100	90	95	95	100
	Lambsquarters	85	100	95	95	90	95	100
	Mustard, Wild	85	98	100	100	100	100	100
35	Oat, Wild	0	25	25	35	55	50	35
	Oilseed Rape	95	100	100	95	95	100	100
	Pigweed	90	100	95	95	100	95	100

	Radish, Wild	75	-	100	90	95	85	100									
	Russian Thistle	20	70	100	-	-	-	95									
	Ryegrass, Italian	0	0	15	35	65	50	15									
	Speedwell	75	100	100	100	100	100	100									
5	Wheat, Spring	0	10	25	15	35	25	35									
	Wheat, Winter	0	10	20	25	40	20	25									
	Windgrass	10	25	10	40	90	45	30									
Table D		Compounds															
	125 g ai/ha	3	7	18	25	52	58	59	138	141	145	166	178	245	274		
10	Postemergence																
	Barley, Spring	0	5	15	15	15	30	20	15	25	10	45	10	30	35		
	Barley, Winter	0	0	15	5	15	25	15	10	35	15	35	10	20	30		
	Blackgrass	0	10	20	25	40	70	40	15	55	35	65	-	25	30		
	Bluegrass	0	10	40	55	15	45	20	10	40	45	65	55	30	30		
15	Bromegrass, Downy	0	5	20	30	20	35	25	5	45	25	50	20	30	40		
	Buckwheat, Wild	60	85	100	100	100	100	100	80	100	100	100	85	90	100		
	Canarygrass	0	10	20	40	50	50	35	15	55	35	55	35	35	30		
	Chamomile	0	0	10	5	20	35	10	0	20	10	15	5	40	25		
	Chickweed	30	60	60	100	85	100	95	55	100	80	90	75	98	80		
20	Deadnettle	10	30	90	55	70	100	100	25	100	85	70	65	100	70		
	Field Poppy	-	50	100	75	80	100	100	75	85	100	75	75	100	80		
	Field Violet	5	70	80	100	100	100	100	75	95	75	85	70	90	85		
	Foxtail, Green	0	10	20	20	40	65	50	30	100	50	35	35	45	45		
	Galium	45	80	65	90	95	100	95	75	98	75	90	80	98	85		
25	Kochia	25	100	100	100	90	95	95	75	100	75	95	85	90	95		
	Lambsquarters	80	90	95	95	75	95	80	60	98	85	95	85	95	95		
	Mustard, Wild	35	95	80	100	95	100	100	75	100	100	100	100	98	100		
	Oat, Wild	0	10	20	50	30	35	35	10	30	25	40	25	10	40		
	Oilseed Rape	90	100	100	55	85	95	75	75	100	95	100	90	75	75		
30	Pigweed	70	100	95	100	85	100	95	90	100	100	95	90	100	95		
	Radish, Wild	50	-	100	100	80	90	80	90	100	100	95	80	85	90		
	Russian Thistle	10	30	60	-	-	-	-	-	95	65	-	-	80	-		
	Ryegrass, Italian	0	0	10	15	20	50	40	5	25	15	40	15	20	35		
	Speedwell	60	100	100	100	100	100	100	75	100	100	100	100	100	100		
35	Wheat, Spring	0	10	20	20	10	20	20	15	35	15	35	5	20	25		
	Wheat, Winter	0	10	15	10	20	25	20	15	50	15	40	10	10	30		
	Windgrass	0	10	10	35	25	55	35	20	60	15	55	20	25	35		

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Table D		Compound					Table D		Compound								
125 g ai/ha		284					125 g ai/ha		284								
Postemergence							Postemergence										
Barley, Spring		20					Kochia		100								
Barley, Winter		20					Lambsquarters		100								
Blackgrass		30					Mustard, Wild		100								
Bluegrass		40					Oat, Wild		25								
Bromegrass, Downy		45					Oilseed Rape		100								
Buckwheat, Wild		100					Pigweed		100								
Canarygrass		25					Radish, Wild		100								
Chamomile		10					Russian Thistle		85								
Chickweed		90					Ryegrass, Italian		15								
Deadnettle		100					Speedwell		100								
Field Poppy		100					Wheat, Spring		30								
Field Violet		100					Wheat, Winter		20								
Foxtail, Green		50					Windgrass		30								
Galium		85															
Table D		Compounds															
62 g ai/ha		3	7	18	25	52	58	59	138	141	145	166	178	245	274		
Postemergence																	
5	Barley, Spring	0	0	10	10	15	20	20	10	25	5	30	5	20	30		
	Barley, Winter	0	0	10	5	10	15	15	5	25	15	25	5	20	25		
	Blackgrass	0	5	15	10	30	45	30	10	35	25	40	25	20	20		
	Bluegrass	0	0	30	50	20	35	15	5	35	30	55	35	15	30		
	Bromegrass, Downy	0	0	15	20	20	30	20	5	30	25	35	10	25	35		
10	Buckwheat, Wild	50	60	70	100	95	100	100	65	100	60	95	75	75	100		
	Canarygrass	0	5	15	25	35	40	30	10	35	25	50	20	25	25		
	Chamomile	0	0	5	5	15	25	10	0	15	10	10	5	45	25		
	Chickweed	25	20	45	75	70	90	75	40	95	35	80	65	95	70		
	Deadnettle	10	20	75	35	70	100	75	15	100	90	65	50	100	60		
15	Field Poppy	0	50	75	60	75	85	65	40	90	55	80	65	80	40		
	Field Violet	5	70	65	100	100	100	100	65	85	65	70	65	90	70		
	Foxtail, Green	0	0	15	15	20	40	35	20	45	20	20	30	35	25		
	Galium	40	70	70	75	80	100	80	75	98	40	80	75	90	75		
	Kochia	5	100	90	85	90	95	95	55	100	65	90	75	90	90		
20	Lambsquarters	60	80	90	95	75	90	85	60	95	85	95	75	85	95		
	Mustard, Wild	35	75	70	100	80	100	95	75	100	75	85	75	100	100		

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	Oat, Wild	0	0	15	40	35	35	30	5	15	15	35	25	10	35
	Oilseed Rape	80	95	100	60	65	85	65	75	100	75	95	80	60	65
	Pigweed	70	100	75	100	85	100	100	90	100	95	95	85	100	95
	Radish, Wild	40	-	100	100	70	70	70	80	100	98	95	70	55	70
5	Russian Thistle	10	30	50	-	-	-	-	-	85	55	-	-	70	-
	Ryegrass, Italian	0	0	5	10	5	20	10	0	20	10	25	5	20	35
	Speedwell	45	100	100	100	95	100	75	75	100	100	100	100	100	85
	Wheat, Spring	0	0	15	15	10	15	15	5	25	20	25	0	10	15
	Wheat, Winter	0	0	10	5	15	20	15	5	20	10	30	0	10	20
10	Windgrass	0	0	10	20	20	35	25	15	50	5	35	15	15	35

Table D Compound

62 g ai/ha

284

Postemergence

Barley, Spring

15

Barley, Winter

15

Blackgrass

25

Bluegrass

35

Bromegrass, Downy

40

Buckwheat, Wild

100

Canarygrass

20

Chamomile

0

Chickweed

85

Deadnettle

100

Field Poppy

70

Field Violet

85

Foxtail, Green

10

Galium

85

Table D

Compound

62 g ai/ha

284

Postemergence

Kochia

100

Lambsquarters

98

Mustard, Wild

100

Oat, Wild

25

Oilseed Rape

70

Pigweed

100

Radish, Wild

100

Russian Thistle

75

Ryegrass, Italian

10

Speedwell

75

Wheat, Spring

25

Wheat, Winter

25

Windgrass

20

Table D

Compounds

31 g ai/ha

3 7 18 25 52 58 59 138 141 145 166 178 245 274

Postemergence

Barley, Spring

0 0 5 5 10 15 10 10 20 0 20 5 20 25

15 Barley, Winter

0 0 10 0 10 10 10 5 20 15 15 0 15 20

Blackgrass

0 5 15 5 30 20 25 5 25 25 20 10 10 15

Bluegrass

0 0 25 35 15 25 15 5 20 10 40 30 20 25

Bromegrass, Downy

0 0 15 15 15 25 20 0 20 25 20 5 20 25

Buckwheat, Wild

10 30 55 85 80 90 80 70 100 30 95 75 70 85

20 Canarygrass

0 0 15 20 35 35 20 10 25 15 35 15 20 20

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	Chamomile	0	0	10	0	10	10	5	0	20	0	5	0	30	10
	Chickweed	0	10	40	65	60	70	70	20	90	30	65	60	75	65
	Deadnettle	10	10	65	35	65	80	70	5	100	85	60	45	100	45
	Field Poppy	0	20	75	25	60	80	70	35	95	25	60	55	95	40
5	Field Violet	5	20	80	75	100	100	100	50	75	45	65	60	80	75
	Foxtail, Green	0	0	10	10	15	20	20	20	20	15	15	20	20	20
	Galium	30	40	60	65	70	70	75	70	98	35	75	75	75	70
	Kochia	5	70	85	70	80	95	95	40	85	50	65	70	70	70
	Lambsquarters	20	70	50	80	80	75	90	60	95	70	90	70	80	80
10	Mustard, Wild	20	50	90	80	70	85	100	75	100	70	80	75	70	75
	Oat, Wild	0	0	10	35	20	30	25	0	10	10	30	25	0	30
	Oilseed Rape	80	80	70	75	55	55	65	70	95	60	65	65	45	55
	Pigweed	70	90	75	100	80	90	100	70	98	90	85	80	95	95
	Radish, Wild	30	-	90	60	65	65	35	65	95	100	70	65	45	70
15	Russian Thistle	10	0	5	-	-	-	-	-	40	55	-	-	75	-
	Ryegrass, Italian	0	0	5	5	5	10	10	0	15	0	20	0	10	25
	Speedwell	30	70	100	90	70	100	100	70	100	100	85	80	100	100
	Wheat, Spring	0	0	10	5	5	10	10	5	20	15	10	0	10	15
	Wheat, Winter	0	0	5	0	10	15	10	0	5	10	15	0	10	20
20	Windgrass	0	0	10	15	15	20	15	0	10	5	25	10	15	25

Table D Compound

31 g ai/ha

284

Postemergence

Barley, Spring

5

Barley, Winter

15

Blackgrass

20

Bluegrass

25

Bromegrass, Downy

30

Buckwheat, Wild

100

Canarygrass

20

Chamomile

0

Chickweed

80

Deadnettle

70

Field Poppy

65

Field Violet

100

Foxtail, Green

10

Galium

70

Table D Compound

31 g ai/ha

284

Postemergence

Kochia

100

Lambsquarters

85

Mustard, Wild

100

Oat, Wild

20

Oilseed Rape

65

Pigweed

100

Radish, Wild

75

Russian Thistle

65

Ryegrass, Italian

10

Speedwell

70

Wheat, Spring

15

Wheat, Winter

10

Windgrass

20

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Table D		Compounds										
16 g ai/ha		3	7	18	25	138	141	145	166	178	245	274
Postemergence												
5	Barley, Spring	50	0	5	0	10	10	0	10	0	10	20
	Barley, Winter	50	0	10	0	5	20	5	5	0	25	10
	Blackgrass	70	0	10	0	5	10	5	15	5	5	10
	Bluegrass	40	0	15	5	0	5	15	20	20	10	20
	Bromegrass, Downy	50	0	15	5	0	15	10	15	5	20	20
10	Buckwheat, Wild	50	20	60	80	65	100	10	70	65	70	65
	Canarygrass	30	0	10	10	5	10	0	20	5	0	15
	Chamomile	0	0	5	0	0	10	0	5	0	30	5
	Chickweed	40	10	15	60	20	70	15	55	55	45	65
	Deadnettle	10	10	50	15	5	100	85	40	40	100	50
15	Field Poppy	10	10	80	20	30	40	35	40	45	90	25
	Field Violet	20	10	55	100	25	45	30	60	50	25	-
	Foxtail, Green	10	0	10	5	20	15	5	10	15	10	15
	Galium	40	20	40	55	70	95	35	70	75	70	70
	Kochia	20	30	35	60	25	70	35	65	60	25	60
20	Lambsquarters	25	70	15	70	55	80	65	80	65	65	75
	Mustard, Wild	75	20	60	65	65	80	65	75	70	80	70
	Oat, Wild	70	0	10	20	5	5	5	25	20	0	20
	Oilseed Rape	90	75	35	100	70	75	55	60	60	30	40
	Pigweed	70	70	65	90	65	98	95	80	75	95	75
25	Radish, Wild	70	-	95	70	60	90	95	70	60	35	70
	Russian Thistle	0	0	10	-	-	40	25	-	-	55	-
	Ryegrass, Italian	60	0	5	0	5	5	0	10	0	0	15
	Speedwell	60	30	100	70	70	100	100	70	70	100	75
	Wheat, Spring	60	0	10	0	5	15	10	5	0	10	10
30	Wheat, Winter	65	0	5	0	0	5	5	5	0	5	10
	Windgrass	70	0	5	10	0	5	0	15	5	10	15

Table D		Compounds						
250 g ai/ha		3	7	18	52	58	59	284
Preemergence								
35	Barley, Spring	0	0	30	50	100	75	35
	Barley, Winter	20	-	25	35	100	80	20
	Blackgrass	0	15	100	95	100	85	65
	Bluegrass	40	40	100	60	100	85	25

[illegible]

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	Field Violet	85	70	85	60	100	100	100	75	100	100	100	100	100	100
	Foxtail, Green	10	0	95	50	100	100	100	100	100	85	100	95	35	100
	Galium	70	30	100	65	75	100	60	100	100	90	100	60	85	100
	Kochia	30	0	100	100	95	95	100	55	100	100	100	100	75	100
5	Lambsquarters	25	40	100	95	100	100	95	100	100	100	100	85	100	100
	Mustard, Wild	90	90	90	100	90	100	100	100	100	100	100	95	100	100
	Oat, Wild	0	10	5	15	0	60	20	0	98	75	75	25	15	25
	Oilseed Rape	100	100	100	70	100	100	100	65	100	100	100	100	100	75
	Pigweed	80	90	100	100	100	100	100	100	100	100	100	100	100	100
10	Radish, Wild	90	-	100	100	95	100	95	85	100	100	100	100	85	85
	Russian Thistle	40	0	40	-	-	-	-	-	100	50	-	-	70	-
	Ryegrass, Italian	0	0	25	10	5	100	60	10	75	65	85	20	40	70
	Speedwell	100	100	-	-	100	100	100	100	100	100	100	100	100	100
	Wheat, Spring	0	0	5	0	0	75	40	15	75	20	60	-	20	55
15	Wheat, Winter	0	5	5	0	25	50	5	5	60	20	25	-	30	35
	Windgrass	10	0	100	80	100	100	100	15	100	80	100	95	60	100

Table D Compound

125 g ai/ha 284

Preemergence

Barley, Spring 25

Barley, Winter 15

Blackgrass 35

Bluegrass 20

Bromegrass, Downy 0

Buckwheat, Wild 70

Canarygrass 35

Chamomile 100

Chickweed 20

Deadnettle 75

Field Poppy 100

Field Violet 100

Foxtail, Green 10

Galium 20

Table D Compound

125 g ai/ha 284

Preemergence

Kochia 100

Lambsquarters 100

Mustard, Wild 90

Oat, Wild 20

Oilseed Rape 10

Pigweed 100

Radish, Wild 0

Russian Thistle 20

Ryegrass, Italian 0

Speedwell 100

Wheat, Spring 20

Wheat, Winter 20

Windgrass 45

Table D

Compounds

62 g ai/ha 3 7 18 25 52 58 59 138 141 145 166 178 245 274

Preemergence

20 Barley, Spring 0 0 5 0 10 50 5 10 65 15 30 - 15 10

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	Barley, Winter	0	-	15	0	0	35	10	5	65	20	35	-	25	10
	Blackgrass	0	0	50	25	5	55	55	25	90	80	70	35	10	70
	Bluegrass	0	0	70	0	0	50	10	0	90	40	65	20	0	30
	Bromegrass, Downy	0	0	5	0	0	15	0	0	85	50	25	0	35	5
5	Buckwheat, Wild	0	75	80	25	50	100	100	55	100	80	100	100	25	100
	Canarygrass	0	0	65	20	0	55	15	20	100	75	70	60	15	60
	Chamomile	0	0	520	15	65	50	15	-	70	98	50	55	55	35
	Chickweed	0	10	-	100	100	100	100	100	100	100	95	85	100	100
	Deadnettle	40	10	55	5	75	100	100	20	98	70	100	75	0	100
10	Field Poppy	40	30	85	75	80	100	100	100	100	100	100	85	100	100
	Field Violet	80	20	85	30	95	100	85	70	100	100	100	90	100	100
	Foxtail, Green	10	0	50	20	60	100	100	20	100	25	100	5	0	100
	Galium	10	20	80	50	20	100	95	90	100	85	100	45	5	100
	Kochia	30	0	75	55	95	95	80	35	100	100	95	85	75	65
15	Lambsquarters	0	30	100	80	100	100	100	60	100	100	100	80	100	100
	Mustard, Wild	80	80	100	80	55	100	100	100	100	95	100	95	85	95
	Oat, Wild	0	0	0	0	0	25	0	0	80	55	55	10	20	15
	Oilseed Rape	70	25	100	60	80	100	60	50	100	100	100	-	30	65
	Pigweed	40	90	100	100	100	100	100	100	100	100	100	100	100	100
20	Radish, Wild	60	-	100	90	80	100	100	70	100	85	100	100	0	40
	Russian Thistle	30	0	25	-	-	-	-	-	75	30	-	-	30	-
	Ryegrass, Italian	0	0	20	10	0	35	5	0	70	25	60	15	20	50
	Speedwell	100	100	-	-	100	100	100	100	100	100	100	100	100	100
	Wheat, Spring	0	0	0	0	0	15	5	15	65	20	10	-	20	10
25	Wheat, Winter	0	0	5	0	0	20	5	5	60	10	0	-	20	5
	Windgrass	0	0	75	25	70	100	100	0	85	65	100	70	35	100

Table D Compound

62 g ai/ha

284

Preemergence

Barley, Spring

15

Barley, Winter

0

Blackgrass

10

Bluegrass

15

Bromegrass, Downy

0

Buckwheat, Wild

20

Canarygrass

25

Chamomile

100

Table D Compound

62 g ai/ha

284

Preemergence

Kochia

20

Lambsquarters

100

Mustard, Wild

15

Oat, Wild

0

Oilseed Rape

0

Pigweed

100

Radish, Wild

0

Russian Thistle

10

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200

Chickweed	15	Ryegrass, Italian	0
Deadnettle	45	Speedwell	100
Field Poppy	100	Wheat, Spring	10
Field Violet	100	Wheat, Winter	15
Foxtail, Green	5	Windgrass	35
Galium	20		

Table D		Compounds														
31 g ai/ha		3	7	18	25	52	58	59	138	141	145	166	178	245	274	
5	Preemergence															
	Barley, Spring	0	0	5	0	5	10	5	10	20	0	0	-	5	0	
	Barley, Winter	0	-	10	0	0	10	0	0	35	5	0	-	35	0	
	Blackgrass	0	0	5	15	5	20	25	0	65	15	55	10	0	30	
	Bluegrass	0	0	30	0	0	10	5	0	35	20	20	10	0	5	
10	Bromegrass, Downy	0	0	0	0	0	10	0	0	45	30	5	0	0	5	
	Buckwheat, Wild	0	0	70	10	10	100	60	35	100	25	95	55	0	100	
	Canarygrass	0	0	25	20	0	20	5	10	75	45	50	60	0	20	
	Chamomile	0	0	5	5	15	30	10	-	100	85	25	70	30	-	
	Chickweed	-	0	-	75	100	100	100	100	100	100	95	50	85	85	
15	Deadnettle	30	0	5	5	70	100	100	5	100	55	75	60	0	100	
	Field Poppy	-	0	70	70	95	95	95	100	100	100	100	70	100	100	
	Field Violet	80	0	70	25	75	100	65	25	100	90	100	-	95	100	
	Foxtail, Green	-	0	15	15	20	100	35	0	100	5	65	0	0	75	
	Galium	0	0	15	15	10	65	0	40	100	15	80	30	0	60	
20	Kochia	30	0	90	15	95	95	90	20	100	95	65	35	0	70	
	Lambsquarters	0	0	80	25	80	100	95	10	100	100	95	70	100	90	
	Mustard, Wild	80	20	85	0	20	90	15	65	100	100	95	35	80	25	
	Oat, Wild	0	0	0	0	0	15	0	0	65	15	30	0	5	0	
	Oilseed Rape	75	10	30	10	0	100	65	30	100	70	50	75	0	30	
25	Pigweed	0	30	100	95	100	100	100	25	100	100	100	100	100	100	
	Radish, Wild	20	-	100	20	30	100	95	85	98	75	80	90	0	5	
	Russian Thistle	0	0	10	-	-	-	-	-	50	15	-	-	10	-	
	Ryegrass, Italian	0	0	10	0	0	10	0	0	55	15	40	0	15	0	
	Speedwell	100	50	-	-	100	100	15	100	100	100	100	100	100	100	
30	Wheat, Spring	0	0	0	0	0	0	0	10	30	15	0	-	10	0	
	Wheat, Winter	0	0	0	0	0	0	0	5	20	0	0	-	15	0	
	Windgrass	0	0	20	5	50	100	70	0	70	35	75	75	15	90	

Table D Compound

Table D Compound

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31 g ai/ha	284
Preemergence	
Barley, Spring	10
Barley, Winter	0
Blackgrass	0
Bluegrass	0
Bromegrass, Downy	0
Buckwheat, Wild	10
Canarygrass	30
Chamomile	100
Chickweed	10
Deadnettle	35
Field Poppy	100
Field Violet	45
Foxtail, Green	10
Galium	20

31 g ai/ha	284
Preemergence	
Kochia	0
Lambsquarters	30
Mustard, Wild	15
Oat, Wild	0
Oilseed Rape	0
Pigweed	75
Radish, Wild	0
Russian Thistle	0
Ryegrass, Italian	0
Speedwell	0
Wheat, Spring	10
Wheat, Winter	15
Windgrass	20

Table D

Compounds

	16 g ai/ha	3	7	18	25	138	141	145	166	178	245	274
	Preemergence											
	Barley, Spring	0	0	0	0	10	15	5	0	-	0	0
5	Barley, Winter	0	-	0	0	0	15	0	0	-	0	0
	Blackgrass	0	0	0	20	0	40	0	10	5	0	10
	Bluegrass	0	0	10	0	0	15	0	5	0	0	0
	Bromegrass, Downy	0	0	0	0	0	30	15	5	0	0	0
	Buckwheat, Wild	0	0	10	10	60	100	0	60	15	25	10
10	Canarygrass	0	0	10	20	10	35	40	30	10	0	20
	Chamomile	-	0	5	0	-	90	30	5	0	25	5
	Chickweed	0	0	-	50	100	100	75	85	0	55	60
	Deadnettle	30	0	10	5	5	90	35	70	50	0	55
	Field Poppy	40	0	-	0	100	98	90	100	20	100	75
15	Field Violet	40	0	65	25	70	100	60	70	20	55	75
	Foxtail, Green	10	0	5	0	0	10	5	25	0	0	15
	Galium	0	0	0	20	25	75	10	65	10	0	0
	Kochia	0	0	15	15	20	85	5	35	0	0	0
	Lambsquarters	0	0	70	25	45	100	85	85	20	85	20
20	Mustard, Wild	30	20	80	0	55	90	90	65	25	80	15
	Oat, Wild	0	0	0	0	0	30	0	0	0	0	0

	Oilseed Rape	10	0	40	5	35	100	35	35	65	0	35
	Pigweed	0	0	30	60	0	98	100	100	75	98	70
	Radish, Wild	0	-	100	10	90	40	75	55	55	0	5
	Russian Thistle	0	-	-	-	-	15	0	-	-	5	-
5	Ryegrass, Italian	0	0	10	0	0	35	0	20	0	15	0
	Speedwell	100	20	50	-	70	100	35	100	100	5	100
	Wheat, Spring	0	0	0	0	0	25	15	0	-	5	0
	Wheat, Winter	0	0	0	0	0	15	0	0	-	10	0
	Windgrass	0	0	5	0	0	35	15	50	75	5	20

10

TEST E

Seeds of plant species selected from corn (*Zea mays*), soybean (*Glycine max*), velvetleaf (*Abutilon theophrasti*), lambsquarters (*Chenopodium album*), wild poinsettia (*Euphorbia heterophylla*), palmer pigweed (*Amaranthus palmeri*), waterhemp (common waterhemp, *Amaranthus rudis*), surinam grass (*Brachiaria decumbens*), large (Lg) crabgrass (*Digitaria sanguinalis*), Brazilian crabgrass (*Digitaria horizontalis*), fall panicum (*Panicum dichotomiflorum*), giant foxtail (*Setaria faberii*), green foxtail (*Setaria viridis*), goosegrass (*Eleusine indica*), johnsongrass (*Sorghum halepense*), ragweed (common ragweed, *Ambrosia elatior*), barnyardgrass (*Echinochloa crus-galli*), sandbur (southern sandbur, *Cenchrus echinatus*), arrowleaf sida (*Sida rhombifolia*), Italian ryegrass (*Lolium multiflorum*), dayflower (Virginia (VA) dayflower, *Commelina virginica*), field bindweed (*Convolvulus arvensis*), morningglory (*Ipomoea coccinea*), nightshade (eastern black nightshade, *Solanum ptycanthum*), kochia (*Kochia scoparia*), yellow nutsedge (*Cyperus esculentus*), cocklebur (common cocklebur, *Xanthium strumarium*), smartweed (ladythumb smartweed, and hairy beggarticks (*Bidens pilosa*), were planted into 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 from these crop and weed species and also horseweed (Canada horseweed, *Conyza canadensis*), waterhemp_RES1, (ALS & Triazine resistant common waterhemp, *Amaranthus rudis*), and waterhemp_RES2, (ALS & HPPD resistant common waterhemp, *Amaranthus rudis*) were planted in pots containing Redi-Earth® planting medium (Scotts Company, 14111 Scottslawn Road, Marysville, Ohio 43041) comprising sphagnum peat moss, vermiculite, wetting agent and starter nutrients were treated with postemergence applications of test chemicals formulated in the same manner.

Plants ranged in height from 2 to 18 cm for postemergence treatments (1- to 4-leaf stage). Treated plants and controls were maintained in a greenhouse for 14 to 21 days, after which time all species were compared to controls and visually evaluated. Plant response ratings,

summarized in Table E, 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 E		Compounds							
250 g ai/ha		5	10	16	25	58	59	200	
5	Postemergence								
	Arrowleaf Sida	85	85	90	95	98	90	98	
	Barnyardgrass	10	0	15	15	70	30	40	
	Beggarticks	70	80	60	50	95	95	95	
	Corn	0	0	15	15	15	15	25	
10	Crabgrass, Brazil	20	5	40	35	75	50	60	
	Dayflower, VA	75	75	40	75	100	100	70	
	Field Bindweed	40	50	60	70	80	80	95	
	Panicum, Fall	0	0	25	40	60	45	50	
	Pigweed, Palmer	98	95	–	100	100	100	100	
15	Poinsettia, Wild	50	60	80	70	90	80	90	
	Ryegrass, Italian	0	0	0	5	60	60	0	
	Sandbur	20	0	0	15	55	20	10	
	Smartweed	–	–	–	–	100	100	–	
	Soybean	95	95	95	98	100	98	98	
20	Waterhemp	98	95	90	100	100	100	100	
	Waterhemp_RES1	–	–	95	–	100	100	100	
	Waterhemp_RES2	95	90	85	–	100	100	100	

Table E		Compounds													
125 g ai/ha		5	7	10	16	25	52	58	59	65	72	79	181	191	200
25	Postemergence														
	Arrowleaf Sida	80	95	80	80	90	70	95	85	80	75	98	95	100	90
	Barnyardgrass	0	10	0	10	10	30	30	15	0	10	20	25	0	20
	Beggarticks	60	60	50	50	50	75	90	70	50	80	80	60	50	90
	Corn	0	5	0	10	10	25	10	10	10	10	15	15	15	20
30	Crabgrass, Brazil	10	30	0	30	20	40	55	25	15	20	30	30	20	50
	Dayflower, VA	40	90	50	30	70	60	90	70	20	60	50	60	10	60
	Field Bindweed	30	70	40	50	60	65	70	70	40	80	80	50	50	95
	Horseweed	–	–	–	–	–	–	–	–	–	–	30	5	–	–
	Kochia	–	–	–	–	–	80	–	–	–	–	75	90	–	–
35	Panicum, Fall	0	0	0	20	40	40	60	30	15	10	30	30	20	50
	Pigweed, Palmer	95	85	85	–	75	95	100	100	60	90	90	98	85	98
	Poinsettia, Wild	35	60	30	70	60	70	–	65	40	60	60	60	60	90

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5	Ragweed	-	-	-	-	-	60	-	-	-	-	60	50	-	-
	Ryegrass, Italian	0	0	0	0	0	10	35	25	0	5	0	20	0	0
	Sandbur	10	0	0	0	5	20	20	10	0	0	10	20	10	0
	Smartweed	-	100	-	-	-	-	100	100	-	-	-	-	-	-
	Soybean	80	98	90	95	80	95	95	95	98	95	95	95	95	95
	Waterhemp	95	90	95	90	85	95	100	90	95	98	100	98	95	95
	Waterhemp_RES1	-	90	-	75	-	-	95	95	98	95	100	95	95	100
	Waterhemp_RES2	90	95	80	70	-	90	95	95	98	90	95	100	100	100
Table E		Compounds					Table E		Compounds						
125 g ai/ha		223 274					125 g ai/ha		223 274						
Postemergence							Postemergence								
Arrowleaf Sida		90	85						Pigweed, Palmer		85	100			
Barnyardgrass		0	60						Poinsettia, Wild		60	70			
Beggarticks		85	95						Ragweed		-	-			
Corn		5	15						Ryegrass, Italian		0	40			
Crabgrass, Brazil		20	50						Sandbur		0	0			
Dayflower, VA		65	70						Smartweed		-	-			
Field Bindweed		50	75						Soybean		98	95			
Horseweed		-	-						Waterhemp		98	98			
Kochia		-	-						Waterhemp_RES1		95	100			
Panicum, Fall		0	20						Waterhemp_RES2		95	100			
Table E		Compounds													
10	62 g ai/ha	5	7	10	16	25	52	58	59	65	72	79	181	191	200
Postemergence															
Arrowleaf Sida		70	90	70	75	80	70	90	80	80	50	85	70	70	80
Barnyardgrass		0	10	0	0	10	20	20	10	0	0	10	15	0	0
Beggarticks		60	50	40	50	40	70	80	60	50	70	75	50	50	70
15	Corn	0	10	0	0	10	20	10	10	10	15	10	15	10	15
Crabgrass, Brazil		10	20	0	10	20	30	40	20	10	10	20	30	10	30
Dayflower, VA		10	70	40	15	60	50	75	50	10	50	50	40	10	40
Field Bindweed		30	50	30	40	50	65	70	65	40	70	80	40	40	90
Horseweed		-	-	-	-	-	-	-	-	-	-	20	5	-	-
20	Kochia	-	-	-	-	-	55	-	-	-	-	80	50	-	-
Panicum, Fall		0	50	0	10	30	10	40	20	0	10	30	50	10	20
Pigweed, Palmer		85	75	75	-	70	95	100	85	50	75	95	90	75	75
Poinsettia, Wild		30	60	30	60	50	50	-	60	20	55	50	50	50	70
Ragweed		-	-	-	-	-	55	-	-	-	-	50	30	-	-

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	Ryegrass, Italian	0	0	0	0	0	0	20	15	0	0	0	10	0	0
	Sandbur	0	0	0	0	0	25	10	0	0	0	0	10	0	0
	Smartweed	-	70	-	-	-	-	85	80	-	-	-	-	-	-
	Soybean	70	98	75	80	80	90	95	95	50	95	95	90	50	95
5	Waterhemp	90	90	85	85	80	75	95	90	75	80	85	95	90	95
	Waterhemp_RES1	-	95	-	60	-	-	95	90	90	75	75	90	90	90
	Waterhemp_RES2	80	90	75	60	-	95	90	90	95	80	90	98	95	90

Table E Compounds

62 g ai/ha 223 274

Postemergence

Arrowleaf Sida 80 75

Barnyardgrass 0 10

Beggarticks 75 70

Corn 0 10

Crabgrass, Brazil 10 35

Dayflower, VA 55 40

Field Bindweed 50 70

Horseweed - -

Kochia - -

Panicum, Fall 0 50

Table E Compounds

62 g ai/ha 223 274

Postemergence

Pigweed, Palmer 60 95

Poinsettia, Wild 50 70

Ragweed - -

Ryegrass, Italian 0 10

Sandbur 0 15

Smartweed - -

Soybean 98 95

Waterhemp 85 95

Waterhemp_RES1 70 90

Waterhemp_RES2 80 95

Table E

Compounds

31 g ai/ha 5 7 10 16 25 52 58 59 65 79 181 191 200 223

10 Postemergence

Arrowleaf Sida 60 80 50 70 70 60 80 70 60 75 75 70 80 70

Barnyardgrass 0 0 0 0 10 10 5 0 0 0 20 0 0 0

Beggarticks 40 40 30 30 30 60 65 60 40 50 40 40 60 60

Corn 0 0 0 0 10 10 10 5 10 0 5 10 10 0

15 Crabgrass, Brazil 5 10 0 0 10 30 20 15 10 10 20 10 15 10

Dayflower, VA 10 50 10 10 60 40 60 35 10 30 30 5 25 25

Field Bindweed 20 30 30 30 50 50 60 60 20 70 40 50 70 35

Horseweed - - - - - - - - - 0 0 - - -

Kochia - - - - - 50 - - - 70 60 - - -

20 Panicum, Fall - 15 0 0 30 10 30 20 5 35 20 5 10 0

Pigweed, Palmer 75 50 70 - 50 70 95 80 50 50 70 75 70 50

Poinsettia, Wild 20 30 20 60 50 40 - 50 20 40 50 50 80 40

Ragweed - - - - - 50 - - - 40 25 - - -

Ryegrass, Italian 0 0 0 0 0 0 10 0 0 0 - 5 0 0 0

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	Sandbur	0	0	0	0	0	10	10	0	0	0	15	0	0	0
	Smartweed	-	40	-	-	-	-	65	-	-	-	-	-	-	-
	Soybean	30	90	50	30	80	75	95	65	20	70	80	60	95	95
	Waterhemp	80	90	80	60	80	70	85	65	70	90	95	90	90	70
5	Waterhemp_RES1	-	80	-	50	-	-	80	80	85	60	95	80	80	80
	Waterhemp_RES2	70	80	60	50	-	90	90	85	90	80	95	95	90	80

Table E Compound

31 g ai/ha 274

Postemergence

Arrowleaf Sida 60

Barnyardgrass 20

Beggarticks 60

Corn 10

Crabgrass, Brazil 25

Dayflower, VA 20

Field Bindweed 50

Horseweed -

Kochia -

Panicum, Fall 20

Table E Compound

31 g ai/ha 274

Postemergence

Pigweed, Palmer 85

Poinsettia, Wild 70

Ragweed -

Ryegrass, Italian 10

Sandbur 10

Smartweed -

Soybean 75

Waterhemp 90

Waterhemp_RES1 80

Waterhemp_RES2 85

Table E

Compounds

16 g ai/ha 5 7 10 16 25 52 58 59 65 79 181 191 200 223

Postemergence

10 Arrowleaf Sida 60 75 40 50 60 50 70 65 50 65 60 60 60 60

Barnyardgrass 0 0 0 0 0 5 0 0 0 0 10 0 0 0

Beggarticks 30 35 10 30 20 30 60 50 35 40 40 20 50 50

Corn 0 0 0 0 0 10 5 5 0 0 5 0 10 0

Crabgrass, Brazil 0 0 0 0 10 15 10 15 0 0 20 10 10 0

15 Dayflower, VA 0 40 5 0 50 30 50 20 5 10 20 0 15 0

Field Bindweed 10 20 15 10 40 50 50 50 10 60 25 40 70 20

Horseweed - - - - - - - - - 0 0 - - -

Kochia - - - - - 40 - - - 50 35 - - -

Panicum, Fall 0 0 0 0 10 5 20 10 0 20 20 0 10 0

20 Pigweed, Palmer 60 60 60 - 50 60 90 75 20 50 80 40 40 25

Poinsettia, Wild 10 30 5 50 20 45 - 50 20 40 40 40 50 30

Ragweed - - - - - 40 - - - 30 20 - - -

Ryegrass, Italian 0 0 0 0 0 0 10 0 0 0 5 0 0 0

Sandbur 0 0 0 0 0 15 0 0 0 0 5 0 0 0

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	Smartweed	-	30	-	-	-	-	50	55	-	-	-	-	-	-
	Soybean	20	80	30	15	75	70	75	60	20	60	50	30	95	60
	Waterhemp	70	80	-	60	80	65	75	-	50	70	65	70	80	50
	Waterhemp_RES1	-	70	-	50	-	-	80	70	70	40	90	70	70	60
5	Waterhemp_RES2	60	75	50	25	-	80	80	75	80	75	85	90	90	75

Table E Compound

16 g ai/ha 274

Postemergence

Arrowleaf Sida 75

Barnyardgrass 10

Beggarticks 50

Corn 15

Crabgrass, Brazil 20

Dayflower, VA 10

Field Bindweed 50

Horseweed -

Kochia -

Panicum, Fall 15

Table E Compound

16 g ai/ha 274

Postemergence

Pigweed, Palmer 65

Poinsettia, Wild 65

Ragweed -

Ryegrass, Italian 5

Sandbur 0

Smartweed -

Soybean 35

Waterhemp 95

Waterhemp_RES1 75

Waterhemp_RES2 80

Table E Compounds

8 g ai/ha 7 65 191 223 274

Postemergence

10 Arrowleaf Sida 65 55 50 50 55

Barnyardgrass 0 0 0 0 5

Beggarticks 25 20 10 40 30

Corn 0 0 0 0 10

Crabgrass, Brazil 0 0 10 0 10

Dayflower, VA 10 5 0 0 5

15 Field Bindweed 15 0 20 20 60

Panicum, Fall 0 0 0 0 10

Pigweed, Palmer 40 10 20 15 70

Poinsettia, Wild 0 15 20 30 50

Ryegrass, Italian 0 0 0 0 0

20 Sandbur 0 0 0 0 0

Smartweed 15 - - - -

Soybean 60 15 20 30 20

Waterhemp 70 60 60 60 70

Waterhemp_RES1 65 65 50 30 60

	Waterhemp_RES2	70	75	70	60	75										
	Table E	Compounds														
	250 g ai/ha	16	18	52	58	59	72	73	89	180	200					
	Preemergence															
5	Arrowleaf Sida	98	95	100	100	100	100	100	100	85	100					
	Barnyardgrass	40	20	98	98	95	90	75	98	100	95					
	Beggarticks	0	0	65	100	25	30	75	95	90	95					
	Cocklebur	-	-	25	50	0	15	25	-	-	95					
	Corn	25	0	40	70	50	0	5	70	65	75					
10	Crabgrass, Brazil	100	100	100	100	100	100	100	100	100	100					
	Crabgrass, Large	100	100	100	100	100	100	100	100	100	100					
	Dayflower, VA	98	98	98	98	98	95	95	98	90	85					
	Field Bindweed	60	40	95	100	100	95	85	90	90	95					
	Foxtail, Giant	100	98	100	100	100	100	100	100	100	70					
15	Foxtail, Green	100	100	100	100	100	100	95	85	100	100					
	Goosegrass	95	98	100	100	98	100	100	50	100	90					
	Johnsongrass	40	-	98	100	100	98	85	100	80	75					
	Kochia	100	100	100	100	100	100	100	100	100	100					
	Lambsquarters	98	98	100	98	100	100	100	100	100	100					
20	Morningglory	95	35	98	100	100	35	60	100	100	98					
	Nightshade	100	100	100	100	100	100	100	100	100	100					
	Nutsedge, Yellow	35	10	50	80	50	50	30	35	75	70					
	Panicum, Fall	100	100	100	100	100	100	100	100	100	100					
	Pigweed, Palmer	-	-	100	100	100	100	100	100	90	100					
25	Poinsettia, Wild	100	50	100	100	100	70	85	85	98	95					
	Ragweed	65	0	70	85	50	95	80	90	100	95					
	Ryegrass, Italian	75	35	90	98	95	75	65	0	70	80					
	Sandbur	95	75	80	95	95	50	35	20	90	70					
	Smartweed	-	-	-	-	-	98	98	-	-	-					
30	Soybean	95	90	90	95	95	90	80	80	98	90					
	Surinam Grass	50	20	10	90	65	30	35	75	100	100					
	Velvetleaf	100	100	90	100	100	100	95	100	100	100					
	Waterhemp	100	100	100	100	100	100	100	100	100	100					
	Table E	Compounds														
35	125 g ai/ha	7	16	18	25	52	58	59	72	73	86	88	89	90	111	
	Preemergence															
	Arrowleaf Sida	80	95	85	65	80	100	100	100	100	100	35	100	90	98	

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	Barnyardgrass	0	10	5	0	75	95	75	35	20	30	0	70	40	35
	Beggarticks	0	0	0	50	40	15	0	5	50	70	0	80	30	80
	Cocklebur	0	-	-	-	-	0	-	0	-	-	-	-	-	-
	Corn	0	20	0	0	0	65	30	0	0	5	35	30	0	15
5	Crabgrass, Brazil	100	100	100	100	100	100	100	100	100	95	60	100	80	100
	Crabgrass, Large	98	80	100	95	100	100	100	100	100	98	95	100	98	100
	Dayflower, VA	65	70	95	40	70	98	85	65	65	65	60	80	0	20
	Field Bindweed	0	30	40	65	80	98	60	60	75	90	50	95	65	80
	Foxtail, Giant	90	100	95	80	100	100	100	98	95	100	25	65	50	100
10	Foxtail, Green	75	90	100	80	80	100	100	100	80	75	35	65	50	90
	Goosegrass	75	75	90	75	98	100	98	98	98	50	5	5	50	65
	Johnsongrass	50	25	80	60	70	95	75	95	35	65	15	50	15	70
	Kochia	95	100	100	85	100	100	100	100	98	100	50	100	100	95
	Lambsquarters	100	98	98	98	98	98	100	100	100	100	100	95	100	100
15	Morningglory	0	25	0	50	95	100	75	15	30	75	15	75	35	75
	Nightshade	98	100	100	98	98	100	100	98	98	98	0	100	80	95
	Nutsedge, Yellow	0	35	0	0	25	60	30	25	40	20	0	20	0	15
	Panicum, Fall	-	100	100	-	100	100	100	100	98	100	10	100	80	100
	Pigweed, Palmer	100	-	-	100	100	100	100	100	100	100	75	40	65	100
20	Poinsettia, Wild	0	50	0	40	50	100	20	70	65	65	0	70	75	85
	Ragweed	0	30	0	5	5	50	5	50	60	20	65	80	75	90
	Ryegrass, Italian	20	40	20	10	60	98	75	35	35	5	0	0	0	20
	Sandbur	35	70	5	15	35	90	50	35	30	10	10	10	0	0
	Smartweed	-	-	-	-	-	-	-	90	98	-	-	-	-	-
25	Soybean	50	90	90	30	60	75	50	70	70	60	20	60	35	70
	Surinam Grass	35	30	0	35	10	65	20	10	20	0	10	10	0	25
	Velvetleaf	100	100	100	80	85	100	100	65	70	80	65	90	85	75
	Waterhemp	100	100	100	100	100	100	100	100	100	100	100	80	100	100
	Table E	Compounds													
30	125 g ai/ha	138	145	151	164	167	170	179	180	200	250	292			
	Preemergence														
	Arrowleaf Sida	100	100	100	100	100	100	100	70	100	100	80			
	Barnyardgrass	60	0	75	65	75	75	20	100	60	25	40			
	Beggarticks	0	35	100	20	0	0	0	40	75	20	35			
35	Cocklebur	-	-	-	-	90	-	-	-	75	-	-			
	Corn	35	10	0	0	25	30	0	40	30	20	0			
	Crabgrass, Brazil	98	85	75	100	100	100	100	100	100	98	100			

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	Goosegrass	40	50	30	25	65	95	65	80	70	50	5	0	5	40
	Johnsongrass	40	0	0	25	30	95	60	40	20	65	15	10	0	15
	Kochia	50	65	80	35	65	100	100	98	98	100	35	75	100	95
	Lambsquarters	98	98	98	98	98	98	100	100	98	100	100	5	50	98
5	Morningglory	0	0	0	25	35	100	65	15	10	30	10	65	20	75
	Nightshade	98	100	98	98	75	100	90	100	90	0	-	80	80	80
	Nutsedge, Yellow	0	0	0	0	0	25	0	0	50	0	0	0	0	0
	Panicum, Fall	-	100	70	-	100	100	98	98	98	90	0	65	0	80
	Pigweed, Palmer	100	-	-	100	100	100	100	100	100	100	0	0	0	100
10	Poinsettia, Wild	-	50	0	0	25	90	10	15	35	20	0	40	70	70
	Ragweed	0	0	0	0	0	5	0	5	30	5	0	80	50	70
	Ryegrass, Italian	0	15	0	10	0	75	50	20	35	0	0	0	0	0
	Sandbur	0	20	0	5	10	75	30	30	20	10	0	10	0	0
	Smartweed	-	-	-	-	-	-	-	0	20	-	-	-	-	-
15	Soybean	40	60	60	0	0	60	-	25	25	35	20	30	30	40
	Surinam Grass	10	0	0	40	0	25	5	20	5	0	0	0	0	0
	Velvetleaf	98	85	100	80	75	90	75	40	60	50	20	65	60	60
	Waterhemp	100	100	100	100	100	100	100	100	100	100	35	70	20	80
	Table E Compounds														
20	62 g ai/ha	138	145	151	164	167	170	179	180	194	200	250	292		
	Preemergence														
	Arrowleaf Sida	40	100	100	100	100	90	100	30	100	70	60	5		
	Barnyardgrass	15	0	10	0	25	35	10	98	0	10	0	0		
	Beggarticks	0	30	95	20	0	0	0	20	0	35	0	15		
25	Cocklebur	-	-	-	-	100	-	-	-	-	-	-	-		
	Corn	15	0	0	0	15	10	0	15	0	30	0	0		
	Crabgrass, Brazil	90	50	70	75	75	100	65	100	98	100	5	100		
	Crabgrass, Large	98	35	60	75	100	98	75	98	95	65	0	90		
	Dayflower, VA	30	0	65	65	65	80	0	35	40	65	50	35		
30	Field Bindweed	40	0	20	30	0	20	0	25	40	40	0	30		
	Foxtail, Giant	30	20	60	60	100	100	65	100	75	0	15	80		
	Foxtail, Green	20	35	70	60	70	90	25	100	80	30	0	25		
	Goosegrass	50	0	70	20	75	75	35	90	75	60	0	50		
	Johnsongrass	35	0	35	10	30	25	20	50	50	25	0	20		
35	Kochia	90	0	90	75	65	90	25	20	35	95	0	70		
	Lambsquarters	100	100	100	98	100	100	95	100	100	80	0	25		
	Morningglory	0	20	0	35	40	35	10	15	0	50	0	15		

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	Nightshade	98	65	75	80	100	98	80	98	95	85	35	70		
	Nutsedge, Yellow	15	0	0	0	0	30	30	30	20	0	0	15		
	Panicum, Fall	100	90	100	30	100	98	75	100	100	95	0	90		
	Pigweed, Palmer	75	50	100	75	98	100	100	0	100	100	0	100		
5	Poinsettia, Wild	35	20	100	5	20	25	30	15	0	50	0	35		
	Ragweed	0	0	95	25	35	5	0	90	20	80	0	0		
	Ryegrass, Italian	0	0	10	30	10	35	15	0	0	20	0	0		
	Sandbur	10	0	0	0	20	30	15	20	20	5	0	0		
	Smartweed	-	-	-	-	-	-	-	-	90	-	-	-		
10	Soybean	-	65	-	15	20	30	25	70	20	35	15	40		
	Surinam Grass	20	0	35	20	0	15	0	25	0	70	0	10		
	Velvetleaf	90	95	100	100	65	65	100	80	25	80	75	35		
	Waterhemp	90	100	98	90	98	90	90	98	100	100	0	80		
	Table E	Compounds													
15	31 g ai/ha	7	16	18	25	52	58	59	72	73	86	88	89	90	111
	Preemergence														
	Arrowleaf Sida	25	35	5	35	40	100	50	40	40	5	40	50	50	50
	Barnyardgrass	0	0	0	0	0	40	20	0	0	0	0	0	0	0
	Beggarticks	0	0	0	35	0	0	0	0	5	0	0	35	5	30
20	Cocklebur	-	-	-	-	0	0	0	-	0	-	-	-	-	-
	Corn	0	0	0	0	0	5	0	0	0	0	0	0	0	0
	Crabgrass, Brazil	80	-	95	100	90	100	100	98	95	0	0	20	20	30
	Crabgrass, Large	70	0	0	20	35	100	95	80	30	0	35	35	40	35
	Dayflower, VA	0	0	0	25	0	20	5	0	0	0	0	0	0	0
25	Field Bindweed	0	0	0	60	0	20	5	5	15	10	0	35	50	15
	Foxtail, Giant	20	20	15	35	70	100	10	35	20	15	0	0	0	0
	Foxtail, Green	30	20	0	20	20	95	60	30	20	0	0	0	0	10
	Goosegrass	35	35	0	25	50	70	25	60	20	0	0	0	0	5
	Johnsongrass	0	0	0	-	0	35	0	0	20	0	0	0	0	0
30	Kochia	0	0	0	25	25	100	80	75	75	90	0	60	50	10
	Lambsquarters	75	80	90	50	75	98	98	90	65	65	50	20	75	80
	Morningglory	0	0	0	0	5	50	15	0	0	10	0	30	0	35
	Nightshade	98	98	95	98	0	98	50	65	80	0	0	-	10	50
	Nutsedge, Yellow	0	0	0	0	0	5	0	0	0	0	0	0	0	0
35	Panicum, Fall	-	80	50	-	0	98	75	65	40	35	0	0	0	5
	Pigweed, Palmer	85	-	-	100	100	100	100	100	75	0	0	0	0	20
	Poinsettia, Wild	0	0	0	0	0	15	0	5	30	10	0	20	35	30

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	Ragweed	0	0	0	0	0	0	0	0	5	0	0	65	50	50
	Ryegrass, Italian	0	0	0	0	0	35	0	15	20	0	0	0	0	0
	Sandbur	0	20	0	0	0	20	15	40	20	10	0	0	0	0
	Smartweed	-	-	-	-	-	-	-	0	0	-	-	-	-	-
5	Soybean	0	60	0	0	0	0	0	10	25	0	0	-	15	20
	Surinam Grass	0	0	0	65	0	0	0	20	0	0	0	0	0	0
	Velvetleaf	65	50	95	60	0	70	25	0	20	0	0	20	20	10
	Waterhemp	100	100	100	100	100	100	100	98	100	70	35	0	0	65
	Table E	Compounds													
10	31 g ai/ha	138	145	151	164	167	170	180	194	200	250	292			
	Preemergence														
	Arrowleaf Sida	0	100	80	100	65	10	15	35	20	20	5			
	Barnyardgrass	0	0	20	0	20	0	20	0	0	0	0			
	Beggarticks	0	0	65	0	0	0	10	0	10	0	15			
15	Cocklebur	-	-	-	-	0	-	-	-	0	-	-			
	Corn	0	0	0	0	0	20	0	0	5	0	0			
	Crabgrass, Brazil	40	0	35	20	20	100	90	65	85	0	40			
	Crabgrass, Large	70	0	5	35	65	70	90	85	35	0	20			
	Dayflower, VA	5	0	10	20	5	30	0	0	35	0	20			
20	Field Bindweed	20	0	0	0	0	0	10	0	10	0	5			
	Foxtail, Giant	0	0	25	20	0	25	75	25	0	0	5			
	Foxtail, Green	0	0	20	25	35	40	65	35	5	0	10			
	Goosegrass	30	0	0	5	60	40	70	40	5	0	20			
	Johnsongrass	0	0	0	0	10	15	0	0	15	0	15			
25	Kochia	75	0	80	0	40	30	0	5	60	0	0			
	Lambsquarters	50	100	100	75	98	98	98	80	65	0	0			
	Morningglory	0	0	0	65	25	10	0	0	20	0	0			
	Nightshade	0	0	30	50	98	50	75	95	10	0	5			
	Nutsedge, Yellow	10	0	0	0	0	20	0	0	0	0	0			
30	Panicum, Fall	25	0	60	0	65	20	95	80	75	0	0			
	Pigweed, Palmer	70	0	100	0	0	95	0	98	40	0	35			
	Poinsettia, Wild	25	0	60	0	0	20	10	10	50	0	5			
	Ragweed	0	0	90	0	15	0	70	0	0	0	0			
	Ryegrass, Italian	0	0	10	0	0	20	0	0	0	0	0			
35	Sandbur	0	0	0	0	0	0	0	20	0	0	20			
	Smartweed	-	-	-	-	-	-	-	0	-	-	-			
	Soybean	0	15	30	0	0	0	35	0	25	0	0			

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	Surinam Grass	0	0	0	0	0	0	10	0	5	0	0		
	Velvetleaf	70	90	95	50	20	60	35	5	35	75	30		
	Waterhemp	100	98	75	65	98	80	98	98	100	0	20		
	Table E	Compounds												
5	16 g ai/ha	7	16	18	25	52	58	59	72	73	86	88	90	111 138
	Preemergence													
	Arrowleaf Sida	0	5	0	20	35	80	50	20	5	0	30	20	40 0
	Barnyardgrass	0	0	0	0	0	20	0	0	0	0	0	0	0 0
	Beggarticks	0	0	0	20	0	0	0	0	5	0	0	0	20 0
10	Cocklebur	-	0	-	-	0	-	-	0	0	-	-	-	-
	Corn	0	0	0	0	0	0	0	0	0	0	0	0	0 0
	Crabgrass, Brazil	0	-	0	0	0	100	80	90	25	0	0	0	0 0
	Crabgrass, Large	0	0	0	15	0	75	5	50	0	0	0	30	15 0
	Dayflower, VA	0	0	0	35	0	5	0	0	0	0	0	0	0 0
15	Field Bindweed	0	0	0	60	0	0	0	0	0	0	0	35	15 0
	Foxtail, Giant	20	15	0	10	0	75	5	35	0	0	0	0	0 0
	Foxtail, Green	0	0	0	20	0	65	0	30	0	0	0	0	0 0
	Goosegrass	0	0	0	20	5	10	15	0	0	0	0	0	0 10
	Johnsongrass	0	0	0	0	0	-	0	0	0	0	0	0	0 0
20	Kochia	0	0	0	0	-	35	20	10	5	0	0	0	0 60
	Lambsquarters	0	50	80	0	0	98	98	0	10	0	75	5	50 0
	Morningglory	0	0	0	0	0	-	0	0	0	0	0	0	20 0
	Nightshade	65	0	0	0	0	90	0	0	65	0	-	10	65 0
	Nutsedge, Yellow	0	0	0	0	0	0	0	0	0	0	0	0	0 0
25	Panicum, Fall	-	0	0	-	0	95	50	0	0	0	0	0	0 0
	Pigweed, Palmer	95	-	-	70	25	100	35	95	0	-	0	0	10 0
	Poinsettia, Wild	0	0	0	0	0	5	0	15	0	0	0	10	15 0
	Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	25 0
	Ryegrass, Italian	0	0	0	0	0	30	0	0	0	0	0	0	0 0
30	Sandbur	0	0	0	0	0	0	0	25	10	0	0	0	0 0
	Smartweed	-	-	-	-	-	-	-	0	0	-	-	-	-
	Soybean	0	0	0	0	0	0	0	0	15	0	35	-	0 0
	Surinam Grass	0	0	0	50	0	0	0	20	0	0	0	0	0 0
	Velvetleaf	50	0	25	35	0	40	0	0	0	0	0	0	5 40
35	Waterhemp	100	100	100	100	80	98	100	95	65	0	20	0	0 0
	Table E	Compounds												
	16 g ai/ha	145	151	164	167	170	179	200	250	292				

	Preemergence									
	Arrowleaf Sida	35	60	40	65	0	20	20	0	0
	Barnyardgrass	0	0	0	20	0	0	0	0	0
	Beggarticks	0	65	0	0	0	0	0	0	0
5	Cocklebur	-	-	-	0	-	-	0	-	-
	Corn	0	0	0	0	0	0	0	0	0
	Crabgrass, Brazil	0	0	0	0	40	0	30	0	10
	Crabgrass, Large	0	0	35	0	0	0	5	0	0
	Dayflower, VA	0	0	0	0	30	0	0	0	20
10	Field Bindweed	0	0	0	0	0	0	5	0	0
	Foxtail, Giant	0	0	0	0	0	0	0	0	0
	Foxtail, Green	0	20	0	10	0	0	0	0	0
	Goosegrass	0	0	0	0	0	30	10	0	0
	Johnsongrass	0	0	0	10	15	0	0	0	15
15	Kochia	0	5	0	0	0	0	40	0	0
	Lambsquarters	0	98	65	40	0	0	0	0	0
	Morningglory	0	0	20	25	0	0	10	0	0
	Nightshade	0	0	60	0	0	0	0	0	0
	Nutsedge, Yellow	0	0	0	0	0	0	0	0	0
20	Panicum, Fall	0	80	0	0	0	30	20	0	0
	Pigweed, Palmer	0	25	0	0	50	0	0	0	0
	Poinsettia, Wild	0	20	0	0	0	0	20	0	15
	Ragweed	0	65	0	0	0	0	0	0	0
	Ryegrass, Italian	0	0	0	0	0	0	0	0	0
25	Sandbur	0	0	0	0	0	0	0	0	0
	Smartweed	-	-	-	-	-	-	-	-	-
	Soybean	0	25	0	0	0	0	0	0	0
	Surinam Grass	0	0	0	0	0	0	0	0	0
	Velvetleaf	35	50	20	20	20	25	0	20	20
30	Waterhemp	0	75	0	20	35	70	30	0	0

Table E

Compounds

8 g ai/ha

7 25 170 179 292

Freemergence

	Arrowleaf Sida	0	0	0	0	0
35	Barnyardgrass	0	0	0	0	0
	Beggarticks	0	0	0	0	0
	Corn	0	0	0	0	0

	Crabgrass, Brazil	0	-	30	0	0
	Crabgrass, Large	0	0	0	0	0
	Dayflower, VA	0	30	0	0	20
	Field Bindweed	0	30	0	0	0
5	Foxtail, Giant	15	15	0	0	0
	Foxtail, Green	0	20	0	0	0
	Goosegrass	0	25	0	0	0
	Johnsongrass	0	0	15	0	0
	Kochia	0	0	0	0	0
10	Lambsquarters	0	0	0	0	0
	Morningglory	0	0	0	0	0
	Nightshade	0	0	0	0	0
	Nutsedge, Yellow	0	0	0	0	0
	Panicum, Fall	-	-	0	0	0
15	Pigweed, Palmer	0	35	0	0	0
	Poinsettia, Wild	0	0	0	0	0
	Ragweed	0	0	0	0	0
	Ryegrass, Italian	0	0	0	0	0
	Sandbur	0	0	0	0	0
20	Soybean	0	0	0	0	0
	Surinam Grass	0	35	0	0	0
	Velvetleaf	20	-	0	20	0
	Waterhemp	95	95	0	0	0

TEST F

- 25 Seeds of plant species selected from bermudagrass (*Cynodon dactylon*), surinam grass (*Brachiaria decumbens*), large (Lg) crabgrass (*Digitaria sanguinalis*), crabgrass, naked (naked crabgrass, *Digitaria nuda*), foxtail, green (green foxtail, *Setaria viridis*), johnsongrass (*Sorghum halepense*), kochia (*Kochia scoparia*), morningglory (pitted morningglory, *Ipomoea lacunosa*), nutsedge, purple (purple nutsedge, *Cyperus rotundus*), ragweed
- 30 (common ragweed, *Ambrosia elatior*), mustard, black (black mustard, *Brassica nigra*), guineagrass (*Panicum maximum*), dallisgrass (*Paspalum dilatatum*), barnyardgrass (*Echinochloa crus-galli*), sandbur (southern sandbur, *Cenchrus echinatus*), sowthistle (common sowthistle, *Sonchus oleraceus*), Italian ryegrass (*Lolium multiflorum*), signalgrass (broadleaf signalgrass, *Brachiaria platyphylla*), dayflower (Virginia (VA) dayflower, *Commelina virginica*), bluegrass (annual bluegrass, *Poa annua*), quackgrass (*Elytrigia repens*), mallow (common mallow, *Malva sylvestris*), buckwheat, wild (wild buckwheat, *Polygonum convolvulus*), leafy spurge (*Euphorbia esula*), chickweed (common chickweed, *Stellaria media*), wild poinsettia (*Euphorbia heterophylla*), and pigweed (*Amaranthus*

retroflexus) were planted into a blend of loam soil and sand and treated preemergence with test chemicals formulated in a non-phytotoxic solvent mixture which included a surfactant.

Treated plants and controls were maintained in a greenhouse for 21 days, after which time all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table F, 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 F	Compounds				Table F	Compounds			
250 g ai/ha	58	79	97	274	125 g ai/ha	58	79	97	274
Preemergence					Preemergence				
Barnyardgrass	100	100	100	100	Barnyardgrass	100	100	100	100
Bermudagrass	100	100	100	100	Bermudagrass	100	100	100	100
Bluegrass	100	100	100	100	Bluegrass	98	100	98	85
Buckwheat, Wild	100	100	100	100	Buckwheat, Wild	100	100	100	100
Chickweed	100	100	100	100	Chickweed	100	100	100	100
Crabgrass, Large	100	100	100	100	Crabgrass, Large	100	100	100	100
Crabgrass, Naked	100	100	100	100	Crabgrass, Naked	100	100	100	100
Dallisgrass	100	100	100	100	Dallisgrass	100	100	100	100
Dayflower, VA	100	100	100	100	Dayflower, VA	100	100	98	100
Foxtail, Green	100	100	100	100	Foxtail, Green	100	100	100	100
Guineagrass	100	100	100	100	Guineagrass	100	100	100	100
Johnsongrass	100	100	100	100	Johnsongrass	100	100	100	100
Kochia	100	100	100	100	Kochia	100	100	100	100
Leafy Spurge	100	100	100	100	Leafy Spurge	100	100	100	100
Mallow	100	100	100	100	Mallow	100	100	100	100
Morningglory	100	100	100	100	Morningglory	100	100	98	98
Mustard, Black	100	100	100	100	Mustard, Black	100	100	100	100
Nutsedge, Purple	80	85	90	98	Nutsedge, Purple	70	70	75	85
Pigweed	100	100	100	100	Pigweed	100	100	100	100
Poinsettia, Wild	100	100	98	100	Poinsettia, Wild	100	100	98	95
Quackgrass	100	100	100	98	Quackgrass	100	98	95	85
Ragweed	95	100	100	100	Ragweed	75	100	95	70
Ryegrass, Italian	100	100	100	100	Ryegrass, Italian	100	100	85	75
Sandbur	100	100	100	100	Sandbur	100	98	100	95
Signalgrass	100	100	100	100	Signalgrass	100	100	100	100
Sowthistle	100	100	100	100	Sowthistle	100	100	100	100
Surinam Grass	100	100	100	100	Surinam Grass	100	100	90	100

Table F	Compounds	Table F	Compounds
62 g ai/ha	58 79 97 274	31 g ai/ha	58 79 97 274
Preemergence		Preemergence	
Barnyardgrass	100 100 95 100	Barnyardgrass	100 100 90 100
Bermudagrass	100 100 100 100	Bermudagrass	100 100 95 100
Bluegrass	98 98 75 50	Bluegrass	80 75 35 20
Buckwheat, Wild	100 100 100 100	Buckwheat, Wild	100 100 100 100
Chickweed	100 100 100 100	Chickweed	100 100 100 98
Crabgrass, Large	100 100 100 100	Crabgrass, Large	100 100 100 100
Crabgrass, Naked	100 100 100 100	Crabgrass, Naked	100 100 100 100
Dallisgrass	100 100 100 100	Dallisgrass	100 98 98 100
Dayflower, VA	100 100 98 98	Dayflower, VA	95 98 80 95
Foxtail, Green	100 100 100 100	Foxtail, Green	100 100 100 100
Guineagrass	100 100 100 100	Guineagrass	100 100 100 100
Johnsongrass	100 100 95 100	Johnsongrass	98 100 65 70
Kochia	100 100 100 100	Kochia	100 100 100 100
Leafy Spurge	100 100 100 100	Leafy Spurge	95 98 98 98
Mallow	98 100 98 98	Mallow	100 100 75 98
Morningglory	100 100 90 65	Morningglory	98 100 60 50
Mustard, Black	100 100 100 100	Mustard, Black	100 100 100 100
Nutsedge, Purple	40 70 30 65	Nutsedge, Purple	60 10 35 50
Pigweed	100 100 100 100	Pigweed	100 100 100 100
Poinsettia, Wild	100 98 75 70	Poinsettia, Wild	65 85 20 10
Quackgrass	98 95 50 70	Quackgrass	70 70 35 40
Ragweed	70 98 85 30	Ragweed	65 70 75 30
Ryegrass, Italian	98 98 70 70	Ryegrass, Italian	95 75 35 40
Sandbur	95 95 25 70	Sandbur	35 15 10 20
Signalgrass	100 100 85 100	Signalgrass	100 100 90 70
Sowthistle	100 100 100 100	Sowthistle	100 100 100 100
Surinam Grass	98 95 50 70	Surinam Grass	60 90 10 35
Table F	Compounds	Table F	Compounds
16 g ai/ha	58 79 97 274	16 g ai/ha	58 79 97 274
Preemergence		Preemergence	
Barnyardgrass	70 75 0 75	Mallow	60 98 30 98
Bermudagrass	95 98 80 85	Morningglory	100 98 10 35
Bluegrass	50 50 5 0	Mustard, Black	100 100 90 98

Buckwheat, Wild	90	98	85	100	Nutsedge, Purple	0	0	15	35
Chickweed	100	98	100	98	Pigweed	100	100	100	100
Crabgrass, Large	100	98	98	100	Poinsettia, Wild	25	50	10	5
Crabgrass, Naked	100	100	100	100	Quackgrass	50	40	0	40
Dallisgrass	90	65	75	95	Ragweed	60	25	10	30
Dayflower, VA	90	95	35	90	Ryegrass, Italian	35	30	0	35
Foxtail, Green	75	95	75	100	Sandbur	10	10	0	5
Guineagrass	100	100	100	100	Signalgrass	95	98	25	75
Johnsongrass	65	65	0	65	Sowthistle	100	100	100	100
Kochia	98	100	100	100	Surinam Grass	25	75	0	10
Leafy Spurge	100	95	98	100					

TEST G

Three plastic pots (ca. 16-cm diameter) per rate were partially filled with sterilized Tama silt loam soil comprising a 35:50:15 ratio of sand, silt and clay and 2.6% organic matter. Separate plantings for each of the three pots were as follows. Seeds from the U.S. of monochoria (*Monochoria vaginalis*), sedge, umbrella (small-flower umbrella sedge, *Cyperus difformis*), hardstem bulrush (*Scirpus juncoides*), and redstem (purple redstem, *Ammannia coccinea*), were planted into one 16-cm pot for each rate. Seeds from the U.S. of rice flatsedge (*Cyperus iria*), bearded sprangletop (*Leptochloa fascicularis*), one stand of 9 or 10 water seeded rice seedlings (*Oryza sativa* cv. 'Japonica – M202'), and two stands of 3 or 4 transplanted rice seedlings (*Oryza sativa* cv. 'Japonica – M202') were planted into one 16-cm pot for each rate. Seeds from the U.S. of barnyardgrass (*Echinochloa crus-galli*), and late watergrass (*Echinochloa oryzicola*) were planted into one 16-cm pot for each rate. Plantings were sequential so that crop and weed species were at the 2.0 to 2.5-leaf stage at time of treatment.

Potted plants were grown in a greenhouse with day/night temperature settings of 30/27 °C, and supplemental balanced lighting was provided to maintain a 16-hour photoperiod. Test pots were maintained in the greenhouse until test completion.

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. Effects of treatments on rice and weeds were visually evaluated by comparison to untreated controls after 21 days. Plant response ratings, summarized in Table G, 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 G	Compounds	Table G	Compounds
250 g ai/ha	16 18	64 g ai/ha	16 18
Flood		Flood	

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Barnyardgrass	100	100
Bulrush, Hardstem	80	85
Flatsedge, Rice	100	100
Monochoria	100	100
Redstem	95	90
Rice, Transplanted	-	20
Rice, Water Seeded	100	100
Sedge, Umbrella	100	100
Sprangletop, Brdd.	100	100
Watergrass, Late	80	70

Table G	Compounds	
125 g ai/ha	16	18
Flood		
Barnyardgrass	100	35
Bulrush, Hardstem	65	0
Flatsedge, Rice	100	100
Monochoria	100	100
Redstem	85	75
Rice, Transplanted	-	15
Rice, Water Seeded	100	90
Sedge, Umbrella	100	35
Sprangletop, Brdd.	100	90
Watergrass, Late	0	0

Barnyardgrass	40	20
Bulrush, Hardstem	50	0
Flatsedge, Rice	85	75
Monochoria	95	95
Redstem	60	0
Rice, Water Seeded	90	60
Sedge, Umbrella	60	20
Sprangletop, Brdd.	100	80
Watergrass, Late	0	0

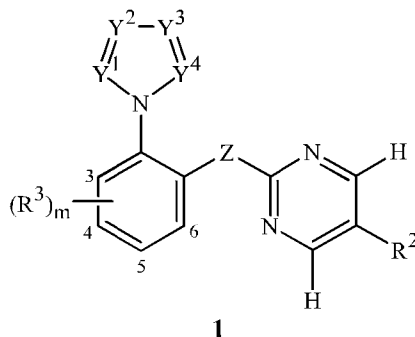
Table G	Compounds	
32 g ai/ha	16	18

Flood		
Barnyardgrass	0	0
Bulrush, Hardstem	40	0
Flatsedge, Rice	40	30
Monochoria	95	95
Redstem	0	0
Rice, Transplanted	0	-
Rice, Water Seeded	50	-
Sedge, Umbrella	0	0
Sprangletop, Brdd.	65	70
Watergrass, Late	0	0

CLAIMS

What is claimed is:

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



5 wherein

each Y¹, Y², Y³ and Y⁴ is independently N or CR¹, provided no more than 3 of Y¹,
Y², Y³ and Y⁴ are N;

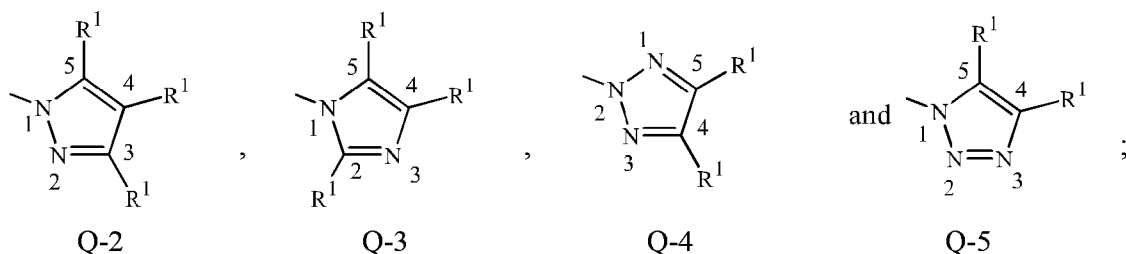
Z is O or S;

- each R¹ is independently hydrogen, halogen, cyano, nitro, SF₅, CHO, C(=O)NH₂,
10 C(=S)NH₂, SO₂NH₂, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄
haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆
halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₄-C₈ cycloalkylalkyl, C₂-C₆
alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₃-C₇
cycloalkylcarbonyl, C₂-C₈ alkylaminocarbonyl, C₃-C₁₀ dialkylaminocarbonyl,
15 C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄
haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆
halocycloalkoxy, C₄-C₈ cycloalkylalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆
haloalkoxyalkyl, C₂-C₆ alkoxyhaloalkyl, C₂-C₆ alkoxyalkoxy, C₂-C₄
alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C₂-C₆ cyanoalkoxy, C₂-C₄ alkylthioalkyl,
20 SO_nR^{1A}, Si(CH₃)₃ or B(-OC(R^{1B})₂C(R^{1B})₂O-); or a phenyl ring optionally
substituted with up to 5 substituents independently selected from R^{1C}; or a 5- or
6-membered heteroaromatic ring containing ring members selected from carbon
atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S
and up to 4 N atoms, each ring optionally substituted with up to 3 substituents
25 independently selected from R^{1C} on carbon atom ring members and R^{1D} on
nitrogen atom ring members;
- R² is halogen, cyano, nitro, C₁-C₄ alkoxy, C₁-C₄ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl,
SO_nR^{2A}, C₁-C₄ haloalkyl or C₃-C₆ cycloalkyl;
- m is 0, 1, 2 or 3;

- each R^3 is independently halogen, cyano, hydroxy, nitro, amino, CHO, C(=O)NH₂, C(=S)NH₂, SO₂NH₂, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₄-C₈ cycloalkylalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₃-C₇ cycloalkylcarbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₄-C₈ cycloalkylalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ alkoxyhaloalkyl, C₂-C₆ alkoxyalkoxy, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C₂-C₆ cyanoalkoxy, C₂-C₄ alkylthioalkyl, Si(CH₃)₃, C≡Si(CH₃)₃, C(=O)N(R^{3A})(R^{3B}), C(=NOR^{3C})H, C(=NR^{3D})H, SO_nR^{3E}; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; or pyrimidinyl;
- each n is independently 0, 1 or 2;
- each R^{1A}, R^{2A} and R^{3E} is independently C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkylamino or C₂-C₆ dialkylamino;
- each R^{1B} is independently H or C₁-C₄ alkyl;
- each R^{1C} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy;
- each R^{1D} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;
- each R^{3A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl;
- each R^{3B} is independently H, C₁-C₄ alkyl or C₁-C₄ haloalkyl;
- each R^{3C} is independently H or C₁-C₄ alkyl;
- each R^{3D} is independently H, amino, C₁-C₄ alkyl or C₁-C₄ alkylamino;
- each R^{3F} is independently hydroxy, halogen, cyano, nitro, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₁-C₆ haloalkoxy; and
- each R^{3G} is independently cyano, C₁-C₆ alkyl, C₁-C₆ haloalkyl, C₁-C₆ alkoxy or C₂-C₆ alkylcarbonyl;
- provided when i) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Cl, then R³ is other than 5-CF₃, 5-CN or 5-NO₂; ii) Y¹ is N; Y² is CH; Y³ is CBr; Y⁴ is CH; and R² is Br, then R³ is other than 5-CF₃; and iii) Y¹ is N; Y² is CCH₃; Y³ is CCl; Y⁴ is CCl; and R² is Cl, then m is other than 0.

2. A compound of Claim 1 wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is selected from



Z is O;

5 each R¹ is independently hydrogen, halogen, cyano, SF₅, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ cyanoalkyl, C₂-C₄ alkylthioalkyl, SO_nR^{1A}, Si(CH₃)₃ or B(-OC(R^{1B})₂C(R^{1B})₂O-);

R² is halogen, C₁-C₄ alkyl or C₁-C₄ haloalkyl;

15 each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₄-C₈ alkylcycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₃-C₆ cycloalkoxy, C₃-C₆ halocycloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylcarbonyloxy, C₂-C₆ cyanoalkyl, C(=O)N(R^{3A})(R^{3B}), C(=NOR^{3C})H, SO_nR^{3E}; or a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{3F}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; and

m is 0, 1 or 2.

3. A compound of Claim 2 wherein

30 -Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is selected from Q-2 and Q-5;

each R¹ is independently hydrogen, halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₁-C₄ alkoxy, C₃-C₄ alkenyloxy, C₃-C₄ alkynyloxy, C₁-C₄ haloalkoxy, C₃-C₄ haloalkenyloxy, C₃-C₄ haloalkynyloxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₄ alkylthioalkyl or SO_nR^{1A};

R² is halogen or C₁-C₄ alkyl;

each R³ is independently halogen, cyano, CHO, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₄ haloalkenyl, C₂-C₄ haloalkynyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl, C₂-C₆ haloalkoxyalkyl, C₂-C₆ cyanoalkyl, SO_nR^{3E}; or a 5- or 6-membered heteroaromatic ring containing ring members selected from carbon atoms and up to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring optionally substituted with up to 3 substituents independently selected from R^{3F} on carbon atom ring members and R^{3G} on nitrogen atom ring members; and

m is 0 or 1.

4. A compound of Claim 3 wherein

each R¹ is independently hydrogen, halogen, cyano, C₁-C₄ alkyl, C₁-C₄ haloalkyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy or SO_nR^{1A};

R² is halogen or CH₃;

each R³ is independently halogen, cyano, C₁-C₄ alkyl, C₂-C₄ alkenyl, C₂-C₄ alkynyl, C₁-C₄ haloalkyl, C₂-C₆ alkylcarbonyl, C₂-C₆ haloalkylcarbonyl, C₂-C₆ alkoxy carbonyl, C₁-C₄ alkoxy, C₁-C₄ haloalkoxy, C₂-C₆ alkoxyalkyl or C₂-C₆ haloalkoxyalkyl; and

each R^{1A} is independently C₁-C₄ alkyl or C₁-C₄ haloalkyl.

5. A compound of Claim 4 wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is Q-2;

each R¹ is independently hydrogen, halogen, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy;

and

each R³ is independently halogen, cyano, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

6. A compound of Claim 4 wherein

-Y¹=Y²-Y³=Y⁴- including the nitrogen to which Y¹ and Y⁴ are both attached is Q-5;

each R¹ is independently hydrogen, halogen, C₁-C₄ haloalkyl or C₁-C₄ haloalkoxy;

and

each R³ is independently halogen, cyano, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

7. A compound of Claim 1 selected from the group consisting of
 5-chloro-2-[2-[3-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine,
 5-bromo-2-[2-(4-chloro-1*H*-pyrazol-1-yl)phenoxy]pyrimidine,
 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-chloropyrimidine,
 2-[2-(4-bromo-1*H*-pyrazol-1-yl)phenoxy]-5-fluoropyrimidine,
 5-bromo-2-[2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine,
 2-(4-bromo-1*H*-pyrazol-1-yl)-3-[(5-chloro-2-pyrimidinyl)oxy]benzonitrile,
 2-[2-(4-bromo-2*H*-1,2,3-triazol-2-yl)phenoxy]-5-chloropyrimidine,
 3[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile,
 3-[(5-bromo-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile,
 5-chloro-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]-3-fluorophenoxy]pyrimidine,
 5-chloro-2-[2-[4-(trifluoromethyl)-1*H*-1,2,3-triazol-1-yl]phenoxy]pyrimidine,
 5-chloro-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]phenoxy]pyrimidine,
 3-[(5-fluoro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile,
 2-[2-(4-bromo-1*H*-pyrazol-1-yl)-3-fluorophenoxy]-5-chloropyrimidine,
 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(2,2,2-trifluoroethoxy)-1*H*-pyrazol-1-yl]benzonitrile,
 5-chloro-2-[2-[4-(2,2,2-trifluoroethoxy)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine,
 2-[2-(4-bromo-1*H*-pyrazol-1-yl)-3-(difluoromethyl)phenoxy]-5-chloropyrimidine,
 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(difluoromethyl)-1*H*-pyrazol-1-yl]benzonitrile,
 3-[(5-chloro-2-pyrimidinyl)oxy]-2-[4-(trifluoromethyl)-1*H*-imidazol-1-yl]benzonitrile,
 5-bromo-2-[2-[4-(difluoromethyl)-1*H*-1,2,3-triazol-1-yl]-3-fluorophenoxy]pyrimidine and
 5-chloro-2-[3-fluoro-2-[4-(trifluoromethyl)-1*H*-pyrazol-1-yl]phenoxy]pyrimidine.

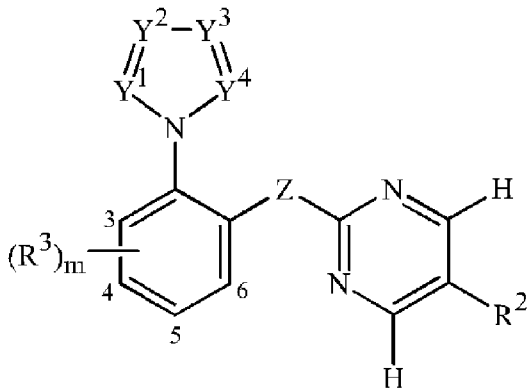
8. A herbicidal composition comprising a compound of any one of Claims 1-7 and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

5 9. A herbicidal composition comprising a compound of any one of Claims 1-7, 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.

10. A herbicidal mixture comprising (a) a compound of any one of Claims 1-7, 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 including mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine ammonium, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, (b16) herbicide safeners, and salts of compounds of (b1) through (b16).
11. 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 1-7.
12. A method for controlling the growth of undesired vegetation in a 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 any one of Claims 1-7.
13. A herbicidal mixture comprising (a) a compound of any one of Claims 1-7, 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.
14. A herbicidal mixture comprising (a) a compound of any one of Claims 1-7, 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, nicosulfuon, pyrasulfotole, pyroxasulfone, pyroxsulam, rimsulfuron, saflufenacil, tembotrione, thifensulfuron-methyl, topamazone and tribenuron.

15. A method for controlling the growth of undesired vegetation comprising contacting the vegetation or its environment with a herbicidally effective amount of the herbicidal mixture of Claim 13 or 14.

5 16. 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 the herbicidal mixture of Claim 13 or 14.



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