(12) STANDARD PATENT (11) Application No. **AU 2016259529 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Aryl substituted bicyclic compounds as herbicides

(51) International Patent Classification(s)
C07D 487/04 (2006.01) ***A01N 43/56*** (2006.01)
A01N 43/52 (2006.01) ***A01N 43/653*** (2006.01)

(21) Application No: **2016259529** (22) Date of Filing: **2016.05.02**

(87) WIPO No: **WO16/182780**

(30) Priority Data

(31) Number	(32) Date	(33) Country
62/160,592	**2015.05.12**	**US**

(43) Publication Date: **2016.11.17**
(44) Accepted Journal Date: **2020.10.01**

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(56) Related Art
WO 2004/037787 A1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 November 2016 (17.11.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/182780 A1

(51) International Patent Classification:
C07D 487/04 (2006.01) *A01N 43/653* (2006.01)
A01N 43/56 (2006.01) *A01N 43/52* (2006.01)

(21) International Application Number:
PCT/US2016/030450

(22) International Filing Date:
2 May 2016 (02.05.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/160,592 12 May 2015 (12.05.2015) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

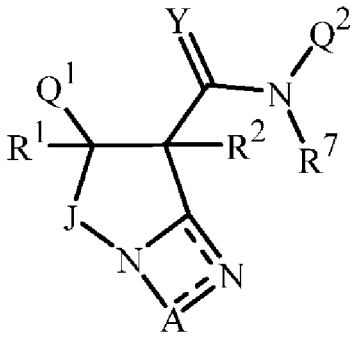
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) **Title**: ARYL SUBSTITUTED BICYCLIC COMPOUNDS AS HERBICIDES



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(57) **Abstract**: Disclosed are compounds of Formula 1, including all N oxides, stereoisomers, and salts thereof, wherein Q^1, Q^2, R^1, R^2, Y, J and R^7 are as defined in the disclosure. Also disclosed are compositions containing the compounds of Formula 1 and methods for controlling undesired vegetation comprising contacting the undesired vegetation or its environment with an effective amount of a compound or a composition of the invention.

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TITLE

ARYL SUBSTITUTED BICYCLIC COMPOUNDS AS HERBICIDES

FIELD OF THE INVENTION

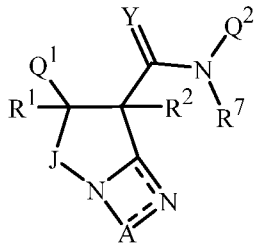
This invention relates to certain bicyclic carboxamides, their *N*-oxides, salts and compositions, and methods of their use for controlling undesirable vegetation.

BACKGROUND OF THE INVENTION

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

SUMMARY OF THE INVENTION

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



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wherein

Q^1 is a phenyl or benzyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring or an 8- to 10-membered heteroaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5

substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring or an 8- to 10-membered heteroaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members;

R^1 and R^2 are each independently H, halogen, hydroxy or C_1–C_4 alkyl;

Y is O, S or NR^{15};

A is a saturated, partially unsaturated or fully unsaturated chain containing 2 to 4 atoms selected from up to 4 carbon, up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon members are independently selected from C(=O) and C(=S) and the sulfur atom member is selected from $S(=O)_u(=NR^8)_v$; the said chain optionally substituted with up to 5 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently halogen, cyano, hydroxy, $-CO_2H$, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 alkylthio, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_3–C_6 cycloalkyl or C_4–C_6 cycloalkylalkyl; or

two R^3 are taken together with the carbon atom(s) to which they are bonded to form a C_3–C_7 cycloalkyl ring;

each R^4 is independently cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

J is $–CR^5R^6–$ or $–CR^5R^6\text{-}CR^{5a}R^{6a}–$ wherein the $–CR^5R^6–$ moiety is directly connected to N;

R^5 and R^6 are each independently H, halogen, hydroxy, C_1–C_4 alkyl or C_1–C_4 alkoxy; or

R^5 and R^6 are taken together with the carbon atom to which they are bonded to form a C_3–C_7 cycloalkyl ring;

R^{5a} and R^{6a} are each independently H, halogen or C_1–C_4 alkyl; or

R^{5a} and R^{6a} are taken together with the carbon atom to which they are bonded to form a C_3–C_7 cycloalkyl ring;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^8 is independently H, cyano, C_2–C_3 alkylcarbonyl or C_2–C_3 haloalkylcarbonyl;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino, C_2–C_8 alkoxycarbonylamino, C_1–C_6 alkylsulfonylamino, C_1–C_6

haloalkylsulfonylamino, -SF_5, -SCN, SO_2NH_2, C_3–C_{12} trialkylsilyl, C_4–C_{12} trialkylsilylalkyl, C_4–C_{12} trialkylsilylalkoxy or G^2;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -$C(=O)NH_2$, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino, C_2–C_8 alkoxycarbonylamino, C_1–C_6 alkylsulfonylamino, C_1–C_6 haloalkylsulfonylamino, -SF_5, -SCN, SO_2NH_2, C_3–C_{12} trialkylsilyl, C_4–C_{12} trialkylsilylalkyl, C_4–C_{12} trialkylsilylalkoxy or G^3;

each R^{10} and R^{12} is independently cyano, C_1–C_3 alkyl, C_2–C_3 alkenyl, C_2–C_3 alkynyl, C_3–C_6 cycloalkyl, C_2–C_3 alkoxyalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl, C_2–C_3 alkylaminoalkyl or C_3–C_4 dialkylaminoalkyl;

R^{15} is H, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, -$(C=O)CH_3$ or -$(C=O)CF_3$;

each G^1 is independently phenyl, phenylmethyl (i.e. benzyl), pyridinylmethyl, pyridinyloxy, phenylcarbonyl (i.e. benzoyl), phenoxy, phenylethynyl, phenylsulfonyl, phenylcarbonyl(C_1–C_4 alkyl); or a 5- or 6-membered

heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{13};

each G^2 is independently phenyl, phenylmethyl (i.e. benzyl), pyridinylmethyl, phenylcarbonyl (i.e. benzoyl), phenylcarbonylalkyl, phenoxy, phenylethynyl, phenylsulfonyl or pyridyloxy; or a 5- or 6-membered heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{14}; or $R^{16}ON=CR^{17}–$, $(R^{18})_2C=NO–$, $(R^{19})_2NN=CR^{17}–$, $(R^{18})_2C=NNR^{20}–$, $R^{21}N=CR^{17}–$, $(R^{18})_2C=N–$, $R^{22}ON=CR^{17}C(R^{23})_2–$ or $(R^{18})_2C=NOC(R^{23})_2–$, wherein the free bond projecting to the right indicates the connecting point to Q^1;

each G^3 is independently phenyl, phenylmethyl (i.e. benzyl), pyridinylmethyl, phenylcarbonyl (i.e. benzoyl), phenylcarbonylalkyl, phenoxy, phenylethynyl, phenylsulfonyl or pyridyloxy; or a 5- or 6-membered heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{15};

each R^{13}, R^{14} and R^{15} is independently halogen, cyano, hydroxy, amino, nitro, -CHO, -C(=O)OH, $-C(=O)NH_2$, $-SO_2NH_2$, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_8 alkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_2–C_8 alkylcarbonylamino or C_1–C_6 alkylsulfonylamino;

each R^{16} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{17} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8

haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl or G^1;

each R^{18} is independently H, hydroxy, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{19} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{20} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_6 alkoxyC_3–C_{10} trialkylsilyl or G^1;

each R^{21} is independently H, hydroxy, amino, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{22} is independently H, C_1–C_4 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{23} is independently H, halogen, cyano, hydroxy, C_1–C_4 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl; and

each u and v are independently 0, 1 or 2 in each instance of $S(=O)_u(=NR^8)_v$, provided that the sum of u and v is 0, 1 or 2; and provided the compound is other than a compound of Formula **1** wherein Q^1 is Ph(3-CF_3); Q^2 is Ph(2-F); R^1 is H; R^2 is H; Y is O; A is –CH_2CH_2–; J is –CR^5R^6–; R^5 is H; R^6 is H; and R^7 is H.

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

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

DETAILS OF THE INVENTION

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

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

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

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

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

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

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

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

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 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 (R^9 and R^{11}). The term "directly connected" means "connected" or "bonded".

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

isomers. "Alkynyl" can also include moieties comprised of multiple triple bonds such as 2,5-hexadiynyl.

"Alkoxy" includes, for example, methoxy, ethoxy, *n*-propyloxy, isopropyloxy and the different butoxy, pentoxy and hexyloxy isomers. "Alkoxyalkyl" denotes alkoxy substitution on alkyl. Examples of "alkoxyalkyl" include CH_3OCH_2, $CH_3OCH_2CH_2$, $CH_3CH_2OCH_2$, $CH_3CH_2CH_2CH_2OCH_2$ and $CH_3CH_2OCH_2CH_2$. "Alkoxyalkoxy" denotes alkoxy substitution on alkoxy. "Alkoxyalkoxyalkyl" denotes alkoxy substitution on an alkoxyalkyl moiety. "Alkenyloxy" includes straight-chain or branched alkenyloxy moieties. Examples of "alkenyloxy" include $H_2C=CHCH_2O$, $(CH_3)_2C=CHCH_2O$, $(CH_3)CH=CHCH_2O$, $(CH_3)CH=C(CH_3)CH_2O$ and $CH_2=CHCH_2CH_2O$. "Alkynyloxy" includes straight-chain or branched alkynyloxy moieties. Examples of "alkynyloxy" include $HC\equiv CCH_2O$, $CH_3C\equiv CCH_2O$ and $CH_3C\equiv CCH_2CH_2O$. "Alkylthio" includes branched or straight-chain alkylthio moieties such as methylthio, ethylthio, and the different propylthio, butylthio, pentylthio and hexylthio isomers. "Alkylsulfinyl" includes both enantiomers of an alkylsulfinyl group. Examples of "alkylsulfinyl" include $CH_3S(O)$-, $CH_3CH_2S(O)$-, $CH_3CH_2CH_2S(O)$-, $(CH_3)_2CHS(O)$- and the different butylsulfinyl, pentylsulfinyl and hexylsulfinyl isomers. Examples of "alkylsulfonyl" include $CH_3S(O)_2$-, $CH_3CH_2S(O)_2$-, $CH_3CH_2CH_2S(O)_2$-, $(CH_3)_2CHS(O)_2$-, and the different butylsulfonyl, pentylsulfonyl and hexylsulfonyl isomers. "Alkylthioalkyl" denotes alkylthio substitution on alkyl. Examples of "alkylthioalkyl" include CH_3SCH_2, $CH_3SCH_2CH_2$, $CH_3CH_2SCH_2$, $CH_3CH_2CH_2CH_2SCH_2$ and $CH_3CH_2SCH_2CH_2$. "Cyanoalkyl" denotes an alkyl group substituted with one cyano group. Examples of "cyanoalkyl" include $NCCH_2$, $NCCH_2CH_2$ and $CH_3CH(CN)CH_2$. "Alkylamino", "dialkylamino", and the like, are defined analogously to the above examples. The terms "alkylthioalkyl", "alkylsulfonylamino", "alkylsulfonyloxy", "alkylaminosulfonyl", "alkylsulfonylamino", "alkylaminoalkyl", "alkylsulfinylalkyl", "alkylsulfonylalkyl", "dialkylaminoalkyl" are defined likewise.

"Cycloalkyl" includes, for example, cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. The term "alkylcycloalkyl" denotes alkyl substitution on a cycloalkyl moiety and includes, for example, ethylcyclopropyl, *i*-propylcyclobutyl, 3-methylcyclopentyl and 4-methylcyclohexyl. The term "cycloalkylalkyl" denotes cycloalkyl substitution on an alkyl moiety. The term "cycloalkylalkenyl" denotes cycloalkyl substitution on an alkenyl moiety. The term "cycloalkylalkynyl" denotes cycloalkyl substitution on an alkynyl moiety. Examples of "cycloalkylalkyl" include cyclopropylmethyl, cyclopentylethyl, and other cycloalkyl moieties bonded to straight-chain or branched alkyl groups. The term "cycloalkoxy" denotes cycloalkyl linked through an oxygen atom such as cyclopentyloxy and cyclohexyloxy. "Cycloalkylalkoxy" denotes cycloalkylalkyl linked through an oxygen atom attached to the alkyl chain. Examples of "cycloalkylalkoxy" include cyclopropylmethoxy, cyclopentylethoxy, and other cycloalkyl moieties bonded to

straight-chain or branched alkoxy groups. "Cycloalkenyl" includes groups such as cyclopentenyl and cyclohexenyl as well as groups with more than one double bond such as 1,3- and 1,4-cyclohexadienyl. The term "cycloalkylcycloalkyl" means a cycloalkyl substitution on a cycloalkyl moiety". The terms "cycloalkoxyalkyl", "alkylcycloalkylalkyl", "cycloalkylaminoalkyl", "cycloalkylthio", "cycloalkylsulfinyl", "cycloalkylsulfonyl" and the like are defined likewise.

The term "halogen", either alone or in compound words such as "haloalkyl", or when used in descriptions such as "alkyl substituted with halogen" includes fluorine, chlorine, bromine or iodine. Further, when used in compound words such as "haloalkyl", or when used in descriptions such as "alkyl substituted with halogen" said alkyl may be partially or fully substituted with halogen atoms which may be the same or different. Examples of "haloalkyl" or "alkyl substituted with halogen" include F_3C, $ClCH_2$, CF_3CH_2 and CF_3CCl_2. The terms "halocycloalkyl", "halocycloalkoxy", "halocycloalkenyl", "halocycloalkylalkyl", "haloalkoxy", "haloalkoxyhaloalkoxy", "haloalkylaminoalkyl", "haloalkylcarbonylamino" "haloalkylthio", "haloalkylsulfonylamino", "haloalkenyl", "haloalkynyl", "haloalkylcarbonyloxy", "haloalkylsulfonyloxy", "haloalkynyloxy", and the like, areis defined analogously to the term "haloalkyl". Examples of "haloalkoxy" include CF_3O-, CCl_3CH_2O-, $HCF_2CH_2CH_2O$- and CF_3CH_2O-. Examples of "haloalkylthio" include CCl_3S-, CF_3S-, CCl_3CH_2S- and $ClCH_2CH_2CH_2S$-. Examples of "haloalkylsulfinyl" include $CF_3S(O)$-, $CCl_3S(O)$-, $CF_3CH_2S(O)$- and $CF_3CF_2S(O)$-. Examples of "haloalkylsulfonyl" include $CF_3S(O)_2$-, $CCl_3S(O)_2$-, $CF_3CH_2S(O)_2$- and $CF_3CF_2S(O)_2$-. Examples of "haloalkenyl" include $(Cl)_2C{=}CHCH_2$- and $CF_3CH_2CH{=}CHCH_2$-. Examples of "haloalkynyl" include $HC{\equiv}CCHCl$-, $CF_3C{\equiv}C$-, $CCl_3C{\equiv}C$- and $FCH_2C{\equiv}CCH_2$-. Examples of "haloalkoxyalkoxy" include CF_3OCH_2O-, $ClCH_2CH_2OCH_2CH_2O$-, $Cl_3CCH_2OCH_2O$- as well as branched alkyl derivatives. Examples of the "haloalkenyloxy" include $(Cl)_2C{=}CHCH_2O$- and $CF_3CH_2CH{=}CHCH_2O$-. Examples of "haloalkoxyalkyl" include CF_3OCH_2-, $CCl_3CH_2OCH_2$-, $HCF_2CH_2CH_2OCH_2$- and $CF_3CH_2OCH_2$-.

"Alkylcarbonyl" denotes a straight-chain or branched alkyl moieties bonded to a C(=O) moiety. Examples of "alkylcarbonyl" include $CH_3C(=O)$-, $CH_3CH_2CH_2C(=O)$- and $(CH_3)_2CHC(=O)$-. Examples of "alkoxycarbonyl" include $CH_3OC(=O)$-, $CH_3CH_2OC(=O)$-, $CH_3CH_2CH_2OC(=O)$-, $(CH_3)_2CHOC(=O)$- and the different butoxy- or pentoxycarbonyl isomers. The terms "alkylcarbonylalkyl", "alkylcarbonyloxy", "alkylcarbonylalkoxy", "alkylcarbonylamino", "alkoxycarbonylamino", "alkylaminocarbonyl", "dialkylaminosulfonyl" "cycloalkylcarbonyl", "cycloalkylalkoxycarbonyl", "cycloalkoxycarbonyl", "cycloalkylcarbonyloxy", "dialkylaminocarbonyl" "cycloalkylaminocarbonyl", "haloalkylcarbonyl" and "haloalkoxycarbonyl" are defined likewise. The term "hydroxyalkyl" refers to a hydroxy group attached to an alkyl group. The term "cyanoalkyl" refers to a cyano group attached to an alkyl group. The term

"cyanoalkoxy" refers to a cyano group attached to an alkoxy group. The term "nitroalkyl" refers to a nitro group attached to an alkyl group. The term "nitroalkenyl" refers to a nitro group attached to an alkenyl group.

The term "trialkylsilyl" means silyl substituted with three alkyl groups. The term "trialkylsilylalkyl" means refers to a trialkylsilyl group bonded through an alkyl group (e.g. $-CH_2TMS$).The term "trialkylsilyloxy" means refers to a trialkylsilyl group bonded through oxygen (e.g. –OTMS).

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 12. For example, C_1–C_4 alkylsulfonyl designates methylsulfonyl through butylsulfonyl; C_2 alkoxyalkyl designates CH_3OCH_2-; C_3 alkoxyalkyl designates, for example, $CH_3CH(OCH_3)$-, $CH_3OCH_2CH_2$- or $CH_3CH_2OCH_2$-; and C_4 alkoxyalkyl designates the various isomers of an alkyl group substituted with an alkoxy group containing a total of four carbon atoms, examples including $CH_3CH_2CH_2OCH_2$- and $CH_3CH_2OCH_2CH_2$-.

When a compound is substituted with a substituent bearing a subscript that indicates the number of said substituents can exceed 1, said substituents (when they exceed 1) are independently selected from the group of defined substituents, e.g., $S(=O)_u(=NR^8)_v$, u and v are independently 0, 1 or 2). When a group contains a substituent which can be hydrogen, for example (R^5 or R^6), then when this substituent is taken as hydrogen, it is recognized that this is equivalent to said group being unsubstituted. When a variable group is shown to be optionally attached to a position, for example R^9 and R^{11} wherein n 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., substituent Q^1 and Q^2 is heterocyclic). The term "ring system" denotes two or more fused rings. The terms "bicyclic ring system" and "fused bicyclic ring system" denote a ring system consisting of two fused rings, in which either ring can be saturated, partially unsaturated, or fully unsaturated unless otherwise indicated. The term "fused heterobicyclic ring system" denotes a fused bicyclic ring system in which at least one ring atom is not carbon. The term "ring member" refers to an atom or other moiety (e.g., C(=O), C(=S), S(O) or $S(O)_2$) forming the backbone of a ring or ring system.

The terms "heterocyclic ring", "heterocycle" or "heterocyclic ring system" denote a ring or ring system in which at least one atom forming the ring backbone is not carbon, e.g., nitrogen, oxygen or sulfur. Typically a heterocyclic ring contains no more than 4 nitrogens, no more than 2 oxygens and no more than 2 sulfurs. Unless otherwise indicated, a heterocyclic ring can be a saturated, partially unsaturated, or fully unsaturated ring. When a fully unsaturated heterocyclic ring satisfies Hückel's rule, then said ring is also called a

"heteroaromatic ring" or "aromatic heterocyclic ring". Unless otherwise indicated, heterocyclic rings and ring systems can be attached through any available carbon or nitrogen by replacement of a hydrogen on said carbon or nitrogen.

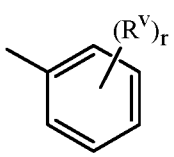
"Aromatic" indicates that each of the ring atoms is essentially in the same plane and has a *p*-orbital perpendicular to the ring plane, and that (4n + 2) π electrons, where n is a positive integer, are associated with the ring to comply with Hückel's rule. The term "aromatic ring system" denotes a carbocyclic or heterocyclic ring system in which at least one ring of the ring system is aromatic. The term "aromatic heterocyclic ring system" denotes a heterocyclic ring system in which at least one ring of the ring system is aromatic. The term "nonaromatic ring system" denotes a carbocyclic or heterocyclic ring system that may be fully saturated, as well as partially or fully unsaturated, provided that none of the rings in the ring system are aromatic.

The term "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.

As noted above, Q^1 can be (among others) phenyl optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary of the Invention. An example of phenyl optionally substituted with one to five substituents is the ring illustrated as U-1 in Exhibit 1, wherein R^v is R^9 as defined in the Summary of the Invention for Q^1 and R^v is R^{11} as defined in the Summary of the Invention for Q^2 and r is an integer from 0 to 5.

As noted above, Q^1 can be (among others) 5- or 6-membered fully unsaturated heterocyclic ring, which may be saturated or unsaturated, optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary of the Invention. Examples of a 5- or 6-membered unsaturated aromatic heterocyclic ring optionally substituted with from one or more substituents include the rings U-2 through U-61 illustrated in Exhibit 1 wherein R^v is any substituent as defined in the Summary of the Invention for Q^1 (i.e. R^9) and r is an integer from 0 to 5, limited by the number of available positions on each U group. As U-29, U-30, U-36, U-37, U-38, U-39, U-40, U-41, U-42 and U-43 have only one available position, for these U groups r is limited to the integers 0 or 1, and r being 0 means that the U group is unsubstituted and a hydrogen is present at the position indicated by $(R^v)_r$.

Exhibit 1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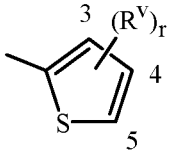
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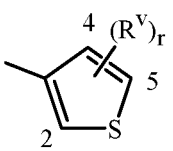
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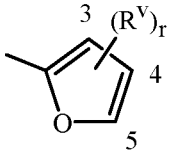
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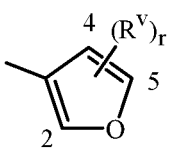
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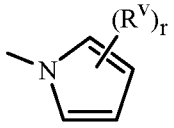
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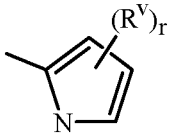
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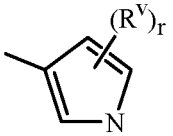
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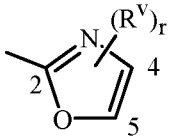
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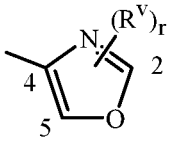
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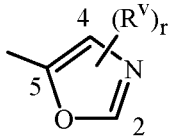
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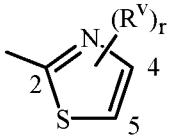
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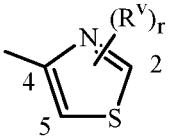
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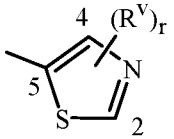
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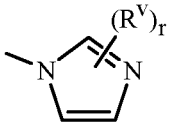
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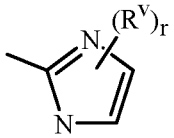
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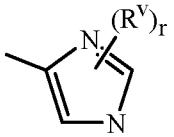
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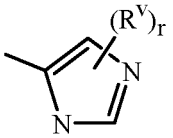
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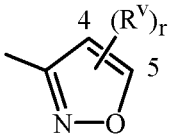
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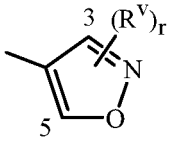
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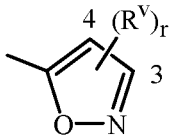
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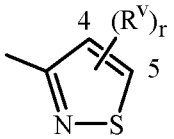
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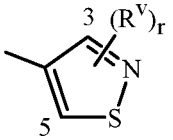
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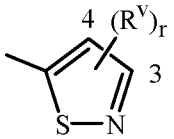
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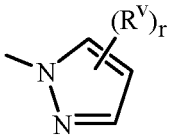
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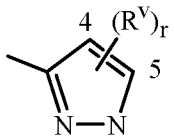
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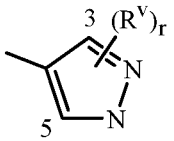
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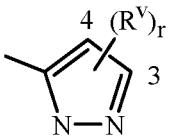
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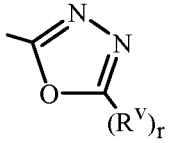
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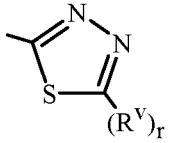
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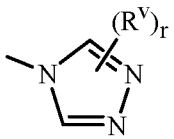
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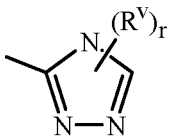
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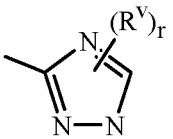
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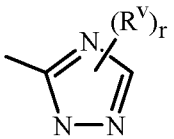
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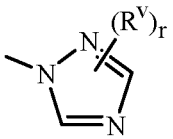
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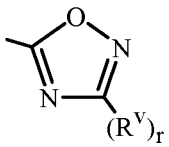
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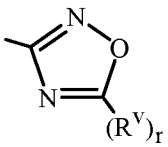
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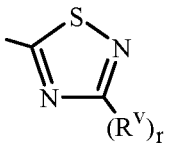
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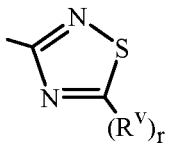
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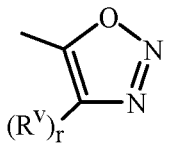
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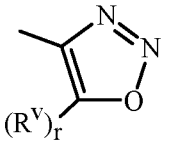
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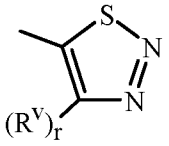
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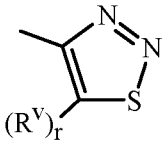
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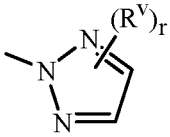
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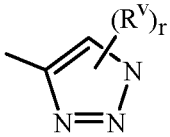
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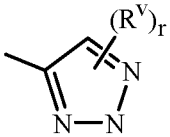
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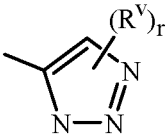
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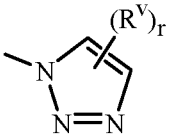
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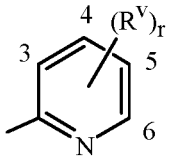
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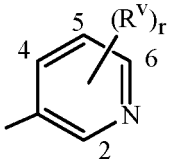
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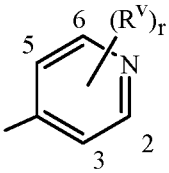
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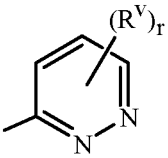
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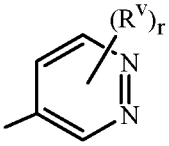
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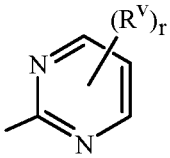
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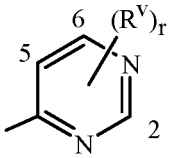
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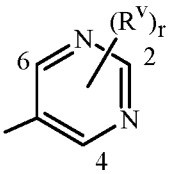
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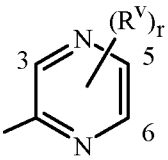
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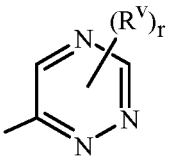
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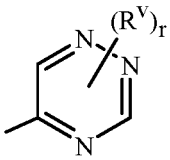
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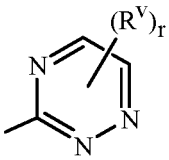
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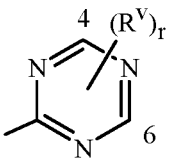
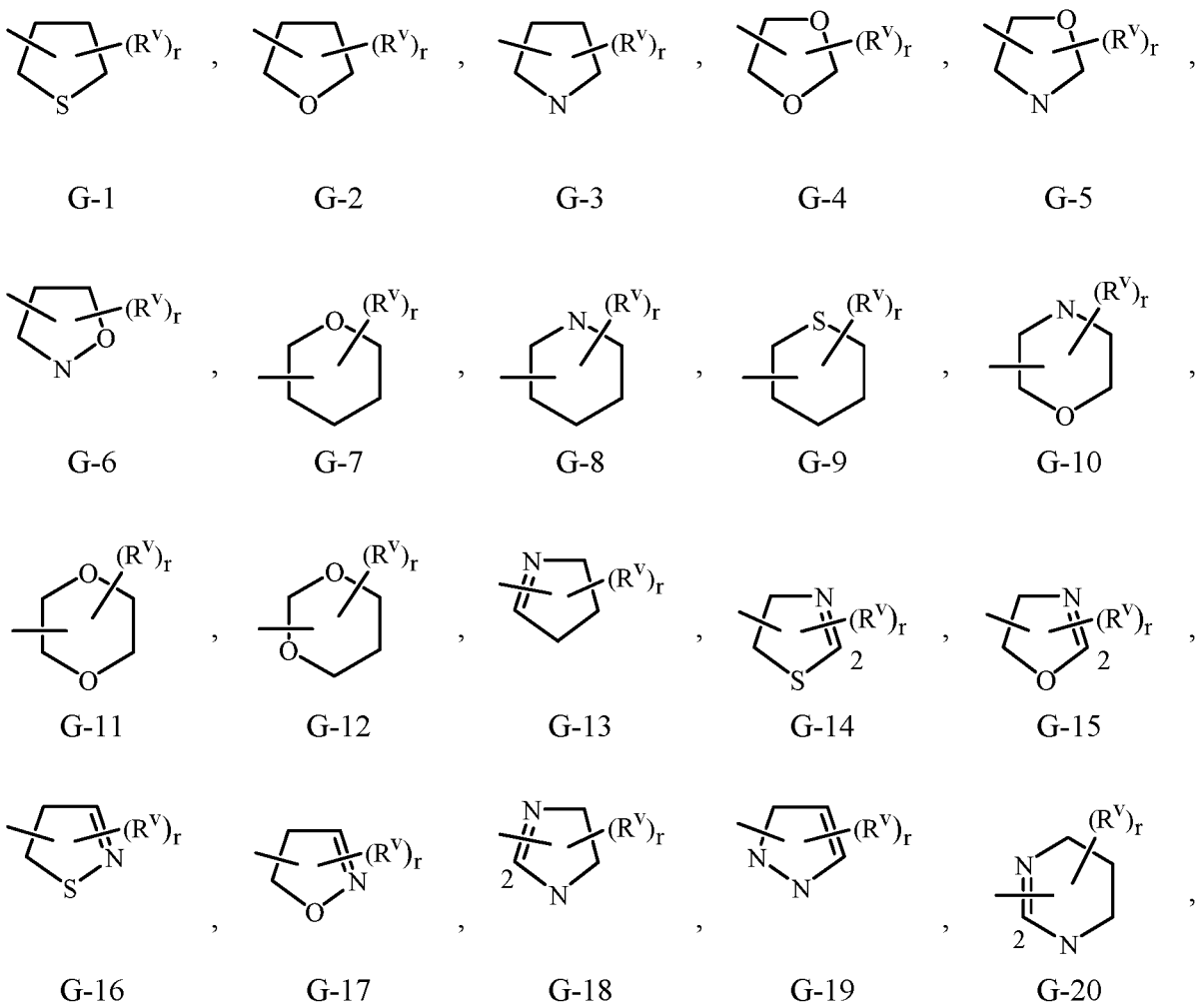

U-61 .

Examples of a 5- or 6-membered saturated or non-aromatic unsaturated heterocyclic ring containing ring members selected from up to two O atoms and up to two S atoms and up to 4 N atoms, and optionally substituted on carbon atom ring members with up to five halogen atoms includes the rings G-1 through G-35 as illustrated in Exhibit 2. Note that

when the attachment point on the G group is illustrated as floating, the G group can be attached to the remainder of Formula **1** through any available carbon or nitrogen of the G group by replacement of a hydrogen atom. The optional substituents corresponding to R^v can be attached to any available carbon or nitrogen by replacing a hydrogen atom. For these G rings, r is typically an integer from 0 to 5, limited by the number of available positions on each G group.

Note that when Q^1 or Q^2 comprises a ring selected from G-28 through G-35, G^2 is selected from O, S or N. Note that when G^2 is N, the nitrogen atom can complete its valence by substitution with either H or the substituents corresponding to R^v as defined in the Summary of the Invention for Q^1 or Q^2.

Exhibit 2

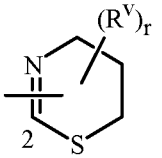


G-1, G-2, G-3, G-4, G-5

G-6, G-7, G-8, G-9, G-10

G-11, G-12, G-13, G-14, G-15

G-16, G-17, G-18, G-19, G-20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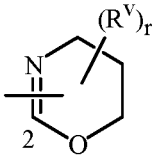
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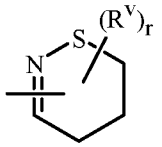
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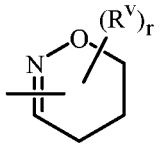
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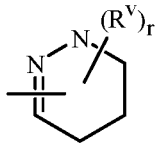
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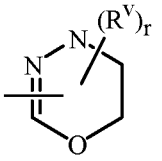
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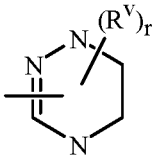
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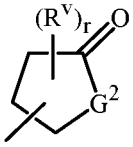
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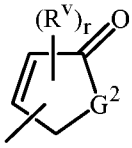
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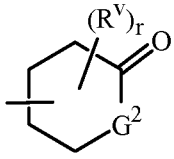
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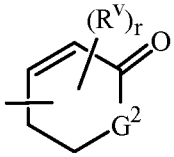
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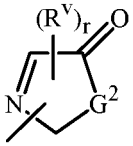
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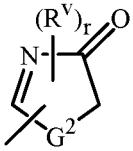
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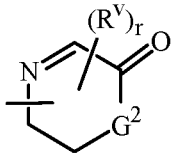
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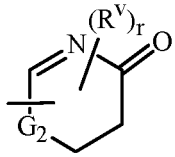
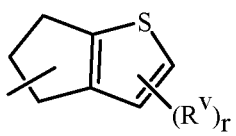

G-35 .

As noted above, Q^1 can be (among others) an 8-, 9- or 10-membered heteroaromatic bicyclic ring system optionally substituted with one or more substituents selected from a group of substituents as defined in the Summary of the Invention (i.e. R^9 and R^{11}). Examples of 8-, 9- or 10-membered heteraromatic bicyclic ring system optionally substituted with from one or more substituents include the rings U-81 through U-123 illustrated in Exhibit 3 wherein R^v is any substituent as defined in the Summary of the Invention for Q^1 (i.e. R^8), and r is typically an integer from 0 to 5.

Exhibit 3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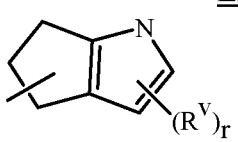
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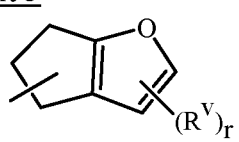
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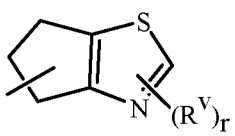
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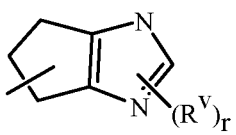
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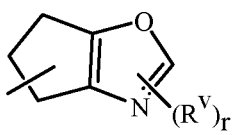
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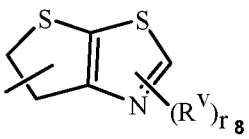
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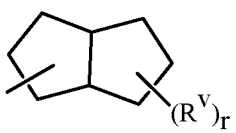
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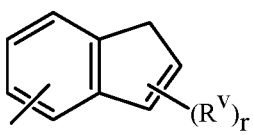
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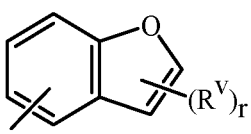
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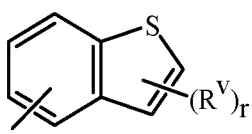
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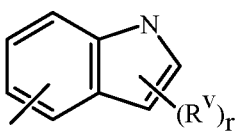
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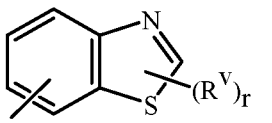
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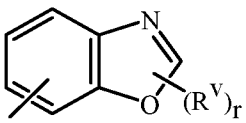
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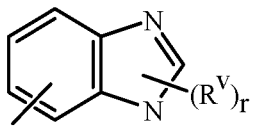
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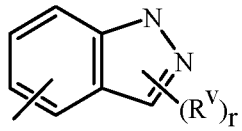
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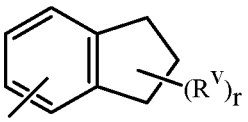
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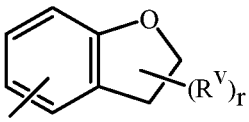
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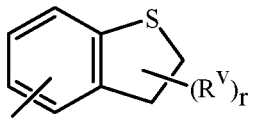
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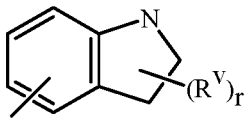
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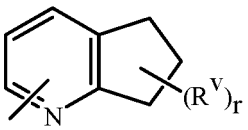
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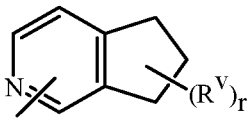
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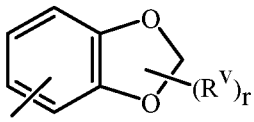
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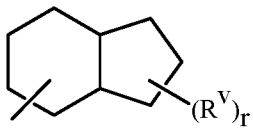
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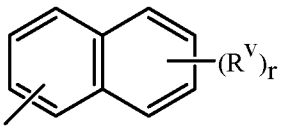
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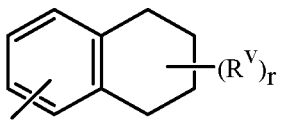
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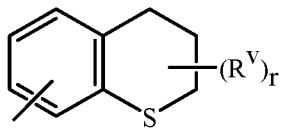
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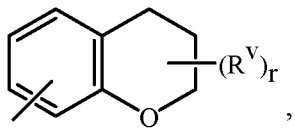
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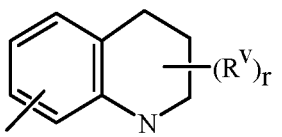
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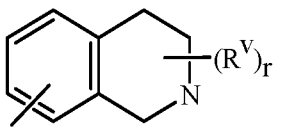
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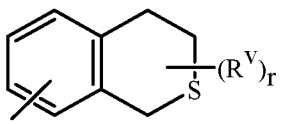
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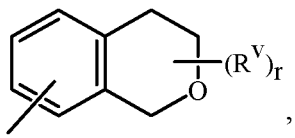
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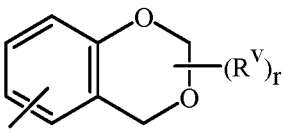
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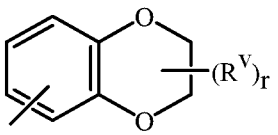
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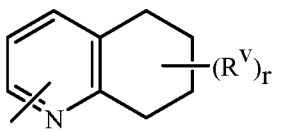
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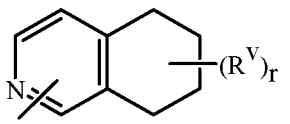
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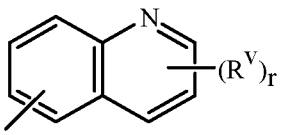
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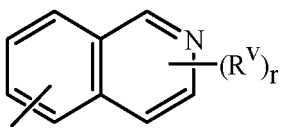
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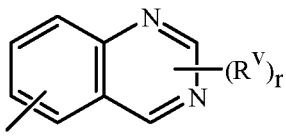
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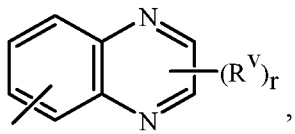
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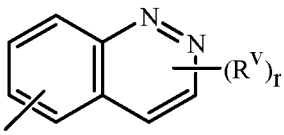
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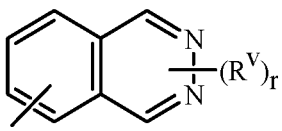
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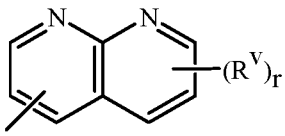

U-123 .

Although R^v groups are shown in the structures U-1 through U-123, it is noted that they do not need to be present since they are optional substituents. Note that when R^v is H when attached to an atom, this is the same as if said atom is unsubstituted. The nitrogen atoms that require substitution to fill their valence are substituted with H or R^v. Note that when the attachment point between $(R^v)_r$ and the U group is illustrated as floating, $(R^v)_r$ can be attached to any available carbon atom or nitrogen atom of the U group. Note that when the attachment point on the U group is illustrated as floating, the U group can be attached to the remainder of Formula **1** through any available carbon or nitrogen of the U group by replacement of a hydrogen atom. Note that some U groups can only be substituted with less than 4 R^v groups (e.g., U-2 through U-5, U-7 through U-48, and U-52 through U-61).

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.

When enantiomerically enriched, one enantiomer is present in greater amounts than the other, and the extent of enrichment can be defined by an expression of enantiomeric excess ("ee"), which is defined as $(2x–1)\cdot 100$ %, where x is the mole fraction of the dominant enantiomer in the mixture (e.g., an ee of 20 % corresponds to a 60:40 ratio of enantiomers).

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 this invention can exist as one or more conformational isomers due to restricted rotation about the amide bond (e.g., $C(Y)N(Q^2)(R^7)$) in Formula **1**. This invention comprises mixtures of conformational isomers. In addition, this invention includes compounds that are enriched in one conformer relative to others.

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

One skilled in the art will appreciate that not all nitrogen-containing heterocycles can form *N*-oxides since the nitrogen requires an available lone pair for oxidation to the oxide; one skilled in the art will recognize those nitrogen-containing heterocycles which can form *N*-oxides. One skilled in the art will also recognize that tertiary amines can form *N*-oxides. Synthetic methods for the preparation of *N*-oxides of heterocycles and tertiary amines are very well known by one skilled in the art including the oxidation of heterocycles and tertiary amines with peroxy acids such as peracetic and *m*-chloroperbenzoic acid (MCPBA), hydrogen peroxide, alkyl hydroperoxides such as *t*-butyl hydroperoxide, sodium perborate, and dioxiranes such as dimethyldioxirane. These methods for the preparation of *N*-oxides

have been extensively described and reviewed in the literature, see for example: T. L. Gilchrist in *Comprehensive Organic Synthesis*, vol. 7, pp 748–750, S. V. Ley, Ed., Pergamon Press; M. Tisler and B. Stanovnik in *Comprehensive Heterocyclic Chemistry*, vol. 3, pp 18–20, A. J. Boulton and A. McKillop, Eds., Pergamon Press; M. R. Grimmett and B. R. T. Keene in *Advances in Heterocyclic Chemistry*, vol. 43, pp 149–161, A. R. Katritzky, Ed., Academic Press; M. Tisler and B. Stanovnik in *Advances in Heterocyclic Chemistry*, vol. 9, pp 285–291, A. R. Katritzky and A. J. Boulton, Eds., Academic Press; and G. W. H. Cheeseman and E. S. G. Werstiuk in *Advances in Heterocyclic Chemistry*, vol. 22, pp 390–392, A. R. Katritzky and A. J. Boulton, Eds., Academic Press.

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

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

Embodiment 1. 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 2. A compound of Embodiment 1 wherein Q^1 is a phenyl or benzyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently

selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members.

Embodiment 3. A compound of Embodiment 2 wherein Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members.

Embodiment 4. A compound of Embodiment 3 wherein Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9.

Embodiment 5. A compound of Embodiment 4 wherein Q^1 is a phenyl ring substituted with 1 to 3 substituents independently selected from R^9.

Embodiment 6. A compound of Embodiment 5 wherein Q^1 is a phenyl ring substituted with 1 to 2 substituents independently selected from R^9.

Embodiment 7. A compound of Embodiment 6 wherein Q^1 is a phenyl ring having a substituent selected from R^9 at the para (4-) position (and optionally other substituents).

Embodiment 8. A compound of Embodiment 7 wherein when Q^1 is a phenyl ring substituted with at least two substituents selected from R^9, then one substituent is at the para (4-) position and at least one other substituent is at a meta position (of the phenyl ring).

Embodiment 9. A compound of any one of Embodiments 1 through 3 wherein Q^1 is a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 3 heteroatoms independently selected from up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members.

Embodiment 10. A compound of Embodiment 9 wherein Q^2 is a phenyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from

carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members.

Embodiment 11. A compound of Embodiment 10 wherein Q^2 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{11}.

Embodiment 12. A compound of Embodiment 11 wherein Q^2 is a phenyl ring optionally substituted with up to 3 substituents independently selected from R^{11}.

Embodiment 13. A compound of Embodiment 12 wherein Q^2 is a phenyl ring substituted with 1 substituent independently selected from R^{11} at the 3-position.

Embodiment 14. A compound of Embodiment 10 wherein Q^2 is 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members.

Embodiment 15. A compound of any one of Embodiments 1 through 14 wherein R^1 and R^2 are each independently H, halogen or C_1–C_4 alkyl.

Embodiment 16. A compound of Embodiment 15 wherein R^1 and R^2 are each independently H, Cl, or CH_3.

Embodiment 17. A compound of Embodiment 16 wherein R^1 and R^2 are each independently H or Cl.

Embodiment 18. A compound of Embodiment 17 wherein R^1 and R^2 are each H.

Embodiment 19. A compound any one of Embodiments 1 through 16 wherein Y is O or S.

Embodiment 20. A compound of Embodiment 19 wherein Y is O.

Embodiment 21. A compound of Embodiment 19 wherein Y is S.

Embodiment 22. A compound of any one of Embodiments 1 through 21 wherein A is a saturated, partially unsaturated or fully unsaturated chain containing 2 to 4 atoms selected from up to 3 carbon, up to 1 O, up to 1 S and up to 1 N atoms, wherein up to 2 carbon members are independently selected from C(=O) and C(=S) and the sulfur atom member is selected from $S(=O)_u(=NR^8)_v$; the said chain

optionally substituted with up to 3 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms.

Embodiment 23. A compound of Embodiment 22 wherein A is a saturated or partially unsaturated chain containing 2 to 4 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O) and C(=S); the said chain optionally substituted with up to 2 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms.

Embodiment 24. A compound of Embodiment 23 wherein A is a saturated or partially unsaturated chain containing 2 to 3 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O); the said chain optionally substituted with up to 1 substituent independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms.

Embodiment 25. A compound of Embodiment 24 wherein A is $–CH_2CH_2CH_2–$, $–NCH_2–$, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**.

Embodiment 26. A compound of Embodiment 25 wherein A is $–CH_2CH_2CH_2–$.

Embodiment 27. A compound of Embodiment 25 wherein A is $–NCH_2–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**.

Embodiment 28. A compound of Embodiment 25 wherein A is $–C(=O)CH_2–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**.

Embodiment 29. A compound of Embodiment 25 wherein A is –CH=CH–.

Embodiment 30. A compound of any one of Embodiments 1 through 29 wherein each R^3 is independently halogen, cyano, hydroxy, $-CO_2H$, $C_1–C_4$ alkyl, $C_1–C_4$ haloalkyl, $C_1–C_4$ alkoxy, $C_1–C_4$ alkylthio, $C_3–C_6$ cycloalkyl or $C_4–C_6$ cycloalkylalkyl.

Embodiment 31. A compound of Embodiment 30 wherein each R^3 is independently cyano, $-CO_2H$, $C_1–C_4$ alkyl, $C_1–C_4$ haloalkyl, $C_1–C_4$ alkylthio or $C_4–C_6$ cycloalkylalkyl.

Embodiment 32. A compound of Embodiment 31 wherein each R^3 is independently cyano, $-CO_2H$, $C_1–C_4$ alkyl or $C_1–C_4$ haloalkyl.

Embodiment 33. A compound of Embodiment 32 wherein each R^3 is independently cyano, $-CO_2H$ or $C_1–C_4$ alkyl.

Embodiment 34. A compound of Embodiment 1 wherein two R^3 are taken together with the carbon atom(s) to which they are bonded to form a C_4 cycloalkyl ring.

Embodiment 35. A compound of any one of Embodiments 1 through 34 wherein each R^4 is independently C_1–C_4 alkyl, C_1–C_4 haloalkyl or C_3–C_6 cycloalkyl.

Embodiment 36. A compound of Embodiment 35 wherein each R^4 is independently C_1–C_4 alkyl.

Embodiment 37. A compound of Embodiment 36 wherein each R^4 is CH_3.

Embodiment 38. A compound of any one of Embodiments 1 through 37 wherein J is $–CR^5R^6–$.

Embodiment 39. A compound of any one of Embodiments 1 through 37 wherein J is $–CR^5R^6\text{-}CR^{5a}R^{6a}–$ wherein the $–CR^5R^6–$ moiety is directly connected to N.

Embodiment 40. A compound of Embodiment 38 wherein J is $–CH_2–$.

Embodiment 41. A compound of Embodiment 39 wherein J is $–CH_2CH_2–$.

Embodiment 42. A compound of any one of Embodiments 1 through 39 wherein R^5 and R^6 are each independently H, halogen, hydroxy or CH_3.

Embodiment 43. A compound of Embodiment 42 wherein R^5 and R^6 are each independently H or halogen.

Embodiment 44. A compound of Embodiment 43 wherein R^5 and R^6 are each H.

Embodiment 45. A compound of any one of Embodiments 1 through 39 wherein R^5 and R^6 are taken together with the carbon atom to which they are bonded to form a C_4 cycloalkyl ring.

Embodiment 46. A compound of any one of Embodiment 1 through 39 wherein R^{5a} and R^{6a} are each independently H or C_1–C_4 alkyl.

Embodiment 47. A compound of any one of Embodiments 1 through 46 wherein R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl or C_4–C_{10} cycloalkylaminocarbonyl.

Embodiment 48. A compound of Embodiment 47 wherein R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl or C_2–C_8 alkylthioalkyl.

Embodiment 49. A compound of Embodiment 48 wherein R^7 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl or C_2–C_8 alkoxyalkyl.

Embodiment 50. A compound of Embodiment 49 wherein R^7 is H or C_1–C_6 alkyl.

Embodiment 51. A compound of any one of Embodiments 1 through 50 wherein each R^8 is independently H, cyano or C_2–C_3 alkylcarbonyl.

Embodiment 52. A compound of Embodiment 51 wherein each R^8 is independently H.

Embodiment 53. A compound of any one of Embodiments 1 through 52 wherein each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy or C_4–C_{10} cycloalkylcarbonyloxy.

Embodiment 54. A compound of Embodiment 53 wherein each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl or C_3–C_{10} dialkylaminoalkyl.

Embodiment 55. A compound of Embodiment 54 wherein each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl or C_6–C_{12} cycloalkylcycloalkyl.

Embodiment 56. A compound of Embodiment 55 wherein each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy or C_1–C_8 haloalkyl.

Embodiment 57. A compound of Embodiment 56 wherein each R^9 is independently halogen or C_1–C_8 haloalkyl.

Embodiment 58. A compound of Embodiment 57 wherein each R^9 is independently F, Cl or CF_3.

Embodiment 59. A compound of Embodiment 58 wherein each R^9 is independently F or CF_3.

Embodiment 60. A compound of any one of Embodiments 1 through 59 wherein each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8

haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino or C_2–C_8 alkoxycarbonylamino.

Embodiment 61. A compound of Embodiment 60 wherein each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl.

Embodiment 62. A compound of Embodiment 61 wherein each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl.

Embodiment 63. A compound of Embodiment 62 wherein each R^{11} is independently halogen, C_1–C_8 alkyl, C_1–C_8 haloalkyl or C_1–C_8 alkylsulfonyl.

Embodiment 64. A compound of Embodiment 63 wherein each R^{11} is independently F, Cl, CH_3, CF_3 or $-SO_2CF_3$.

Embodiment 65. A compound of Embodiment 64 wherein each R^{11} is independently F, Cl, CH_3, CF_3 or $-SO_2CF_3$.

Embodiment 66. A compound of any one of Embodiments 1 through 65 wherein each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl, C_2–C_3 alkoxyalkyl, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_2–C_3 alkylaminoalkyl.

Embodiment 67. A compound of Embodiment 66 wherein each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl or C_2–C_3 alkoxyalkyl.

Embodiment 68. A compound of Embodiment 67 wherein each R^{10} and R^{12} is independently C_1–C_3 alkyl.

Embodiment 69. A compound of Embodiment 68 wherein each R^{10} and R^{12} is independently CH_3.

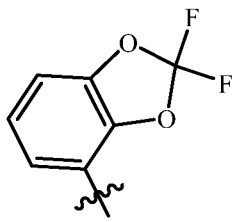
Embodiment 70. A compound of Embodiment 1 wherein Q^1 is an 8- to 10-membered heteroaromatic bicyclic ring system, each ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O and up to 2 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), each ring system optionally substituted with up to 4 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members.

Embodiment 71. A compound of Embodiment 70 wherein Q^1 is an 8- to 9-membered heteroaromatic bicyclic ring system, each ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O atoms, each ring system optionally substituted with up to 4 substituents independently selected from R^9 on carbon atom ring members.

Embodiment 72. A compound of Embodiment 71 wherein Q^1 is an 9-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O atoms, each ring system optionally substituted with up to 4 substituents independently selected from R^9 on carbon atom ring members.

Embodiment 73. A compound of Embodiment 72 wherein Q^1 is an 9-membered heteroaromatic bicyclic ring system containing ring members selected from carbon atoms and 2 O atoms, system optionally substituted with up to 3 substituents independently selected from R^9 on carbon atom ring members (i.e. U-103 in Exhibit 3).

Embodiment 74. A compound of Embodiment 73 wherein Q^1 is U-103A;



U-103A .

Embdoiment 75. A compund of any one of Embodiments 1, 2 and 10 through 69 wherein Q^1 is a phenyl ring optionally substituted with 1 to 4 substituents independently selected from R^9; or a 5- to 6-membered heteroaromatic ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, optionally

substituted with up to 4 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members.

Embodiment 76. A compound of Embodiment 1 wherein Q^2 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members.

Embodiment 77. A compound of Embodiment 1 or 76 wherein Q^2 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{11}; or a 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 4 N atoms, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members.

Embodiment 78. A compound of Embodiment 77 wherein Q^2 is a phenyl ring optionally substituted with up to 4 substituents independently selected from R^{11}; or a pyridyl ring, optionally substituted with up to 4 substituents independently selected from R^{11} on carbon atom ring members.

Embodiment 79. A compound of Embodiment 78 wherein Q^2 is a 3-pyridyl ring optionally substituted with up to 3 substituents independently selected from R^{11} on carbon atom ring members.

Embodiment 80. A compound of Embodiment 79 wherein Q^2 is a 3-pyridyl ring optionally substituted with up to 3 substituents independently selected from C_1–C_8 alkyl or C_1–C_8 haloalkyl.

Embodiment 81. A compound of any one of Embodiments 1 through 56 or 60 through 80 wherein each R^9 is independently halogen, C_1–C_8 alkyl or C_1–C_8 haloalkyl.

Embodiment 82. A compound of Embodiment 81 wherein each R^9 is independently Cl, F, CH_3 or CF_3.

Embodiment 83. A compound of Embodiment 82 wherein each R^9 is independently CH_3.

Embodiment 84. A compound of any one of Embodiments 1 through 64 or 66 through 83 wherein each R^{11} is independently F, Cl, CH_3 or CF_3.

Embodiment 85. A compound of Embodiment 24 wherein A is $–CH_2CH_2CH_2–$, –CH=N–, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is

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connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**.

Embodiment 86. A compound of any one of Embodiments 1 through 24 or 30 through 84 wherein A is $–CH_2CH_2CH_2–$, –CH=N–, $–C(CH_3)=N–$, $–C(CH_2CH_3)=N–$, $–C(CH_2CH_2CH_3)=N–$, $–C(CF_3)=N–$, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**.

Embodiment 87. A compound of Embodiment 86 wherein A is –CH=N–, $–C(CH_3)=N–$, $–C(CH_2CH_3)=N–$, $–C(CH_2CH_2CH_3)=N–$ or $–C(CF_3)=N–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**.

Embodiment 88. A compound of any one of Embodiments 1 through 24 or 30 through 84 wherein A is $–C(R^3)=N–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**.

Embodiment 89. A compound of Embodiment 88 wherein A is –CH=N–.

Embodiment 90. A compound of Embodiment 88 wherein A is $–C(CH_3)=N–$.

Embodiment 91. A compound of Embodiment 88 wherein A is $–C(CH_2CH_3)=N–$.

Embodiments of this invention, including Embodiments 1–91 above as well as any other embodiments described herein, can be combined in any manner, and the descriptions of variables in the embodiments pertain not only to the compounds of Formula **1** but also to the starting compounds and intermediate compounds useful for preparing the compounds of Formula **1**. In addition, embodiments of this invention, including Embodiments 1–91 above as well as any other embodiments described herein, and any combination thereof, pertain to the compositions and methods of the present invention.

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

Q^1 is a phenyl or benzyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members;

R^1 and R^2 are each independently H, halogen or C_1–C_4 alkyl;

Y is O or S;

A is a saturated, partially unsaturated or fully unsaturated chain containing 2 to 4 atoms selected from up to 3 carbon, up to 1 O, up to 1 S and up to 1 N atoms, wherein up to 2 carbon members are independently selected from C(=O) and C(=S) and the sulfur atom member is selected from $S(=O)_u(=NR^8)_v$; the said chain optionally substituted with up to 3 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently halogen, cyano, hydroxy, $-CO_2H$, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 alkylthio, C_3–C_6 cycloalkyl or C_4–C_6 cycloalkylalkyl;

each R^4 is independently C_1–C_4 alkyl, C_1–C_4 haloalkyl or C_3–C_6 cycloalkyl;

R^5 and R^6 are each independently H, halogen, hydroxy or CH_3;

R^{5a} and R^{6a} are each independently H or C_1–C_4 alkyl;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl or C_4–C_{10} cycloalkylaminocarbonyl;

each R^8 is independently H, cyano or C_2–C_3 alkylcarbonyl;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8

cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy or C_4–C_{10} cycloalkylcarbonyloxy;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8

alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino or C_2–C_8 alkoxycarbonylamino; and

each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl, C_2–C_3 alkoxyalkyl, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_2–C_3 alkylaminoalkyl.

Embodiment B. A compound of Embodiment A wherein

Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{11};

R^1 and R^2 are each independently H, Cl, or CH_3;

Y is O;

A is a saturated or partially unsaturated chain containing 2 to 4 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O) and C(=S); the said chain optionally substituted with up to 2 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently cyano, $-CO_2H$, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkylthio or C_4–C_6 cycloalkylalkyl;

each R^4 is independently C_1–C_4 alkyl;

J is $–CR^5R^6–$;

R^5 and R^6 are each independently H or halogen;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl or C_2–C_8 alkylthioalkyl;

each R^8 is independently H;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8

halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl or C_3–C_{10} dialkylaminoalkyl;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl; and

each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl or C_2–C_3 alkoxyalkyl.

Embodiment C. A compound of Embodiment B whererin

Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9;

Q^2 is a phenyl ring optionally substituted with up to 3 substituents independently selected from R^{11};

R^1 and R^2 are each independently H or Cl;

A is a saturated or partially unsaturated chain containing 2 to 3 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O); the said chain optionally substituted with up to 1 substituent independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently cyano, $-CO_2H$ or C_1–C_4 alkyl;

each R^4 is CH_3;

R^5 and R^6 are each independently H or halogen;

R^7 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl or C_2–C_8 alkoxyalkyl;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl or C_6–C_{12} cycloalkylcycloalkyl; and

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl.

Embodiment D. A compound of Embodiment C wherein

Q^1 is a phenyl ring substituted with 1 to 3 substituents independently selected from R^9;

Q^2 is a phenyl ring substituted with 1 substituent independently selected from R^{11} at the 3-position;

R^1 and R^2 are each H;

A is $–CH_2CH_2CH_2–$, $–NCH_2–$, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy or C_1–C_8 haloalkyl; and

each R^{11} is independently halogen, C_1–C_8 alkyl, C_1–C_8 haloalkyl or C_1–C_8 alkylsulfonyl.

Embodiment E. A compound of Embodiment D wherein

Q^1 is a phenyl ring substituted with 1 to 2 substituents independently selected from R^9;

A is $–CH_2CH_2CH_2–$;

each R^9 is independently halogen or C_1–C_8 haloalkyl; and

each R^{11} is independently F, Cl, CH_3, CF_3 or $–SO_2CF_3$.

Embodiment F. A compound of Embodiment D wherein

Q^1 is a phenyl ring substituted with 1 to 2 substituents independently selected from R^9;

A is $–NCH_2–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**;

each R^9 is independently F, Cl, CF_3; and

each R^{11} is independently F, Cl, CH_3, CF_3 or $–SO_2CF_3$.

Embodiment G. A compound of Embodiment C wherein

A is $-CH_2CH_2CH_2-$, $-CH=N-$, $-C(CH_3)=N-$, $-(CH_2CH_3)=N-$, $-C(CH_2CH_2CH_3)=N-$, $-C(CF_3)=N-$, $-C(=O)CH_2-$ or $-CH=CH-$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy or C_1–C_8 haloalkyl; and

each R^{11} is independently halogen, C_1–C_8 alkyl, C_1–C_8 haloalkyl or C_1–C_8 alkylsulfonyl.

Embodiment H. A compound of Embodiment G wherein

A is $-CH=N-$, $-C(CH_3)=N-$, $-C(CH_2CH_3)=N-$, $-C(CH_2CH_2CH_3)=N-$ or $-C(CF_3)=N-$wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**;

each R^9 is independently halogen, C_1–C_8 alkyl or C_1–C_8 haloalkyl; and

each R^{11} is independently F, Cl, CH_3 or CF_3.

Specific Embodiments of the Invention include a compound of the Summary of the Invention selected from:

N-(2-fluorophenyl)-6,7-dihydro-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide; and

N-(2-fluorophenyl)-2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)pheny]-5*H*-pyrrolo[1,2-a]imidazole-7-carboxamide.

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 broadleaf weeds in crops such as wheat, barley, maize, soybean, sunflower, cotton, oilseed rape and rice, and specialty crops such as sugarcane, citrus, fruit and nut crops.

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

This invention also includes a herbicidal mixture comprising (a) a compound selected from Formula **1**, *N*-oxides, and salts thereof, and (b) at least one additional active ingredient selected from (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b6) photosystem I electron diverters, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b8) glutamine synthetase (GS) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors,

(b10) auxin transport inhibitors, (b11) phytoene desaturase (PDS) inhibitors, (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors, (b13) homogentisate solanesyltransferase (HST) inhibitors, (b14) cellulose biosynthesis inhibitors, (b15) other herbicides including mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, hydantocidin, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, and (b16) herbicide safeners; and salts of compounds of (b1) through (b16).

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

"AHAS inhibitors" (b2) are chemical compounds that inhibit acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS), and thus kill plants by inhibiting the production of the branched-chain aliphatic amino acids such as valine, leucine and isoleucine, which are required for protein synthesis and cell growth. Examples of AHAS inhibitors include amidosulfuron, azimsulfuron, bensulfuron-methyl, bispyribac-sodium, cloransulam-methyl, chlorimuron-ethyl, chlorsulfuron, cinosulfuron, cyclosulfamuron, diclosulam, ethametsulfuron-methyl, ethoxysulfuron, flazasulfuron, florasulam, flucarbazone-sodium, flumetsulam, flupyrsulfuron-methyl, flupyrsulfuron-sodium, foramsulfuron, halosulfuron-methyl, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, imazosulfuron, iodosulfuron-methyl (including sodium salt), iofensulfuron (2-iodo-*N*-[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide), mesosulfuron-methyl, metazosulfuron (3-chloro-4-

(5,6-dihydro-5-methyl-1,4,2-dioxazin-3-yl)-*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-1-methyl-1*H*-pyrazole-5-sulfonamide), metosulam, metsulfuron-methyl, nicosulfuron, oxasulfuron, penoxsulam, primisulfuron-methyl, propoxycarbazone-sodium, propyrisulfuron (2-chloro-*N*-[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-6-propylimidazo[1,2-*b*]pyridazine-3-sulfonamide), prosulfuron, pyrazosulfuron-ethyl, pyribenzoxim, pyriftalid, pyriminobac-methyl, pyrithiobac-sodium, rimsulfuron, sulfometuron-methyl, sulfosulfuron, thiencarbazone, thifensulfuron-methyl, triafamone (*N*-[2-[(4,6-dimethoxy-1,3,5-triazin-2-yl)carbonyl]-6-fluorophenyl]-1,1-difluoro-*N*-methylmethanesulfonamide), triasulfuron, tribenuron-methyl, trifloxysulfuron (including sodium salt), triflusulfuron-methyl and tritosulfuron. Of note is a compound of the invention mixed with nicosulfuron, flupyrsulfuron or chlorimuron.

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

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. Of note is a compound of the invention mixed with dicamba.

"EPSP synthase inhibitors" (b5) are chemical compounds that inhibit the enzyme, 5-enol-pyruvylshikimate-3-phosphate synthase, which is involved in the synthesis of

aromatic amino acids such as tyrosine, tryptophan and phenylalanine. EPSP inhibitor herbicides are readily absorbed through plant foliage and translocated in the phloem to the growing points. Glyphosate is a relatively nonselective postemergence herbicide that belongs to this group. Glyphosate includes esters and salts such as ammonium, isopropylammonium, potassium, sodium (including sesquisodium) and trimesium (alternatively named sulfosate).

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

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

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

"VLCFA elongase inhibitors" (b9) are herbicides having a wide variety of chemical structures, which inhibit the elongase. Elongase is one of the enzymes located in or near chloroplasts which are involved in biosynthesis of VLCFAs. In plants, very-long-chain fatty acids are the main constituents of hydrophobic polymers that prevent desiccation at the leaf surface and provide stability to pollen grains. Such herbicides include acetochlor, alachlor, anilofos, butachlor, cafenstrole, dimethachlor, dimethenamid, diphenamid, fenoxasulfone (3-[[(2,5-dichloro-4-ethoxyphenyl)methyl]sulfonyl]-4,5-dihydro-5,5-dimethylisoxazole),

fentrazamide, flufenacet, indanofan, mefenacet, metazachlor, metolachlor, naproanilide, napropamide, napropamide-M ((2R)-*N*,*N*-diethyl-2-(1-naphthalenyloxy)propanamide), pethoxamid, piperophos, pretilachlor, propachlor, propisochlor, pyroxasulfone, and thenylchlor, including resolved forms such as S-metolachlor and chloroacetamides and oxyacetamides. Of note is a compound of the invention mixed with flufenacet.

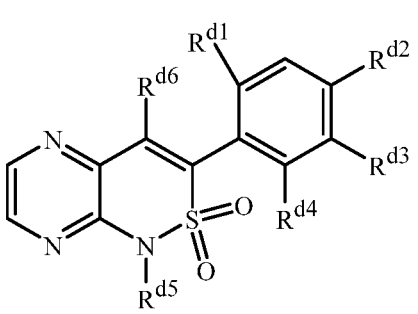
"Auxin transport inhibitors" (b10) are chemical substances that inhibit auxin transport in plants, such as by binding with an auxin-carrier protein. Examples of auxin transport inhibitors include diflufenzopyr, naptalam (also known as *N*-(1-naphthyl)phthalamic acid and 2-[(1-naphthalenylamino)carbonyl]benzoic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

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

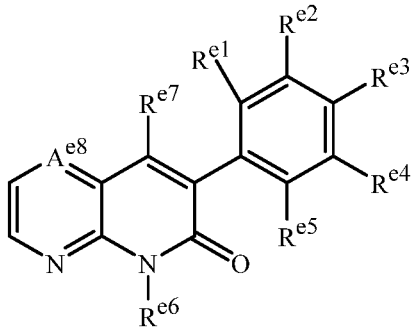
"HPPD inhibitors" (b12) are chemical substances that inhibit the biosynthesis of synthesis of 4-hydroxyphenyl-pyruvate dioxygenase. Examples of HPPD inhibitors include benzobicyclon, benzofenap, bicyclopyrone (4-hydroxy-3-[[2-[(2-methoxyethoxy)methyl]-6-(trifluoromethyl)-3-pyridinyl]carbonyl]bicyclo[3.2.1]oct-3-en-2-one),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

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

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



A



B

wherein R^{d1} is H, Cl or CF_3; R^{d2} is H, Cl or Br; R^{d3} is H or Cl; R^{d4} is H, Cl or CF_3; R^{d5} is CH_3, CH_2CH_3 or CH_2CHF_2; and R^{d6} is OH, or -OC(=O)-*i*-Pr; and R^{e1} is H, F, Cl, CH_3 or CH_2CH_3; R^{e2} is H or CF_3; R^{e3} is H, CH_3 or CH_2CH_3; R^{e4} is H, F or Br; R^{e5} is Cl, CH_3, CF_3, OCF_3 or CH_2CH_3; R^{e6} is H, CH_3, CH_2CHF_2 or C≡CH; R^{e7} is OH, -OC(=O)Et, -OC(=O)-*i*-Pr or -OC(=O)-*t*-Bu; and A^{e8} is N or CH.

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

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

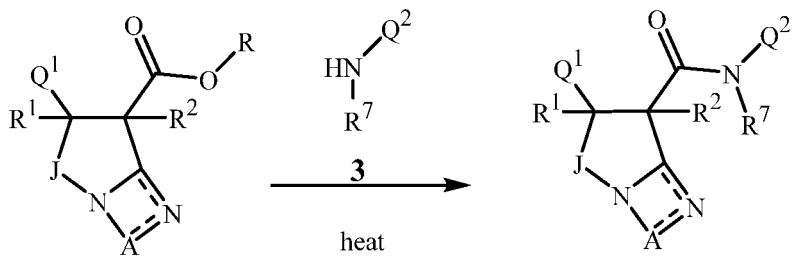
"Herbicide safeners" (b16) are substances added to a herbicide formulation to eliminate or reduce phytotoxic effects of the herbicide to certain crops. These compounds protect crops from injury by herbicides but typically do not prevent the herbicide from controlling undesired vegetation. Examples of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

fluxofenim, furilazole, isoxadifen-ethyl, mefenpyr-diethyl, mephenate, methoxyphenone, naphthalic anhydride, oxabetrinil, *N*-(aminocarbonyl)-2-methylbenzenesulfonamide and *N*-(aminocarbonyl)-2-fluorobenzenesulfonamide, 1-bromo-4-[(chloromethyl)sulfonyl]benzene, 2-(dichloromethyl)-2-methyl-1,3-dioxolane (MG 191), 4-(dichloroacetyl)-1-oxa-4-azospiro[4.5]decane (MON 4660), 2,2-dichloro-1-(2,2,5-trimethyl-3-oxazolidinyl)-ethanone and 2-methoxy-*N*-[[4-[[(methylamino)carbonyl]amino]phenyl]sulfonyl]-benzamide.

The compounds of Formula **1** can be prepared by general methods known in the art of synthetic organic chemistry, in combination with the methods shown below in Schemes 1 through 21 and variations thereof. The definitions of R^1, R^2, R^3, R^4, R^5, R^6, R^{5a}, R^{6a}, Q^1, Q^2 and Y in the compounds of Formulae **1** through **17** below are as defined above in the Summary of the Invention unless otherwise noted. The compounds of Formulae **1a**, **2a**, **4a**, **6a**, **8a**, **10a** and **13a** are various subsets of a compound of Formulae **1**, **2**, **4**, **8**, **10** and **13** respectively. The compounds of Formulae **1b**, **2b**, **8b**, **10b** and **13b** are various subsets of a compound of Formulae **1**, **2**, **8**, **10** and **13** respectively. The compounds of Formulae **1c**, **8c**, **10c**, and **13c** are various subsets of a compound of Formulae **1**, **8**, **10** and **13** respectively. The compounds of Formulae **10d** and **10e** are various subsets of a compound of Formula **10**. Substituents for each subset formula are as defined for its parent formula unless otherwise noted. Substituents of a compound of Formula **1** represented by Q^1 and $C(Y)N(Q^2)(R^7)$, respectively, are predominantly found to be in the *trans* configuration. In some instances, the presence of minor amounts of the *cis* isomer can be detected by NMR.

As shown in Scheme 1 compounds of Formula **1a** (i.e. a compound of Formula **1** wherein R^1 is H; R^2 is H; and Y is O) can be prepared by reaction of esters of Formula **2** with an exess of an amine of Formula **3** by heating at temperatures above 100 °C, optionally in the presence of a solvent. The method of Scheme 1 is illustrated by Step E in Synthesis Example 1, Step D in Synthesis Examples 2 and 3, and Step A in Synthesis Example 4.

Scheme 1



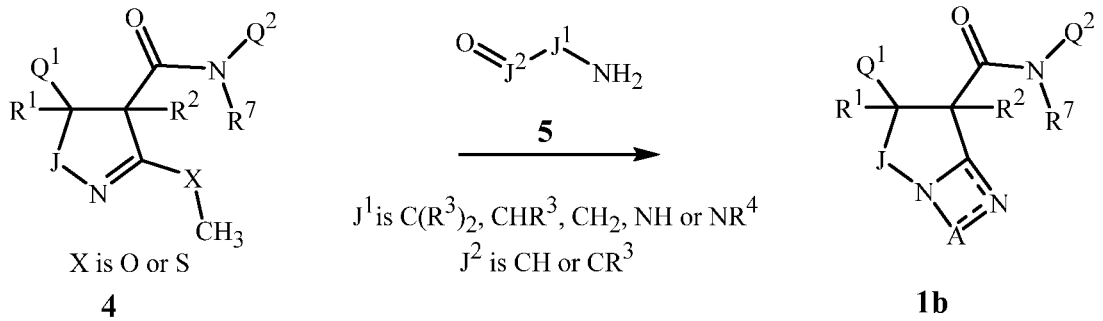
2
R is H or lower alkyl

1a

As shown in Scheme 2 a compound of Formula **1b** (i.e. a compound of Formula **1** wherein A is chain containing a carbon or oxygen atom; R^7 is H; and Y is O) can be

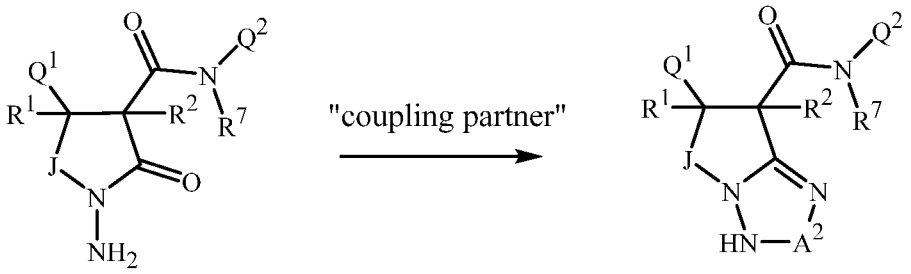
prepared by cyclization of a compound of Formula **4**. Cyclization is carried out using an appropriate nitrogen-containing compound of Formula **5** such as, but not limited to, aminoacetals, aminoaldehyes, aminoketones and hydrazides, under neutral conditions or acidic conditions. Suitable acids for the reaction include inorganic acids such as hydrochloric acid, hydrobromic acid and sulfuric acid, and organic acids such as acetic acid and trifluoroacetic acid. A wide variety of co-solvents are suitable for the reaction including, but not limited to, water, methanol, ethanol and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 10 °C. The method of Scheme 2 is illustrated by Step D of Synthesis Example 1, Step F of Synthesis Example 3, Step C of Synthesis Example 4, and Step A of Synthesis Example 5.

Scheme 2



As shown in Scheme 3 a compound of Formula **1c** (i.e. a compound of Formula **1** wherein R^1 is H; R^2 is H; Y is O; and A is –NHA^2–) can be prepared by cyclization of *N*-amino lactams of Formula **6** in the presence of a "coupling partner". The "coupling partner" for the reaction can be chosen singly or in combination from primary amides, acid chlorides, carbon disulfide, cyanides such as sodium or potassium cyanide or ammonia. The cyclization can be carried out optionally in the presence of an activating agent and typically in the presence of a co-solvent. Suitable activating agents for the reaction include, but are not limited to, metal chlorides such as zinc chloride and carboxylic acids such as acetic and propionic acid. A wide variety of co-solvents are suitable for the reaction including, but not limited to, acetic acid, toluene, benzene, xylenes, carbon disulfide, *N*,*N*-dimethylformamide and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 150 °C. The method of Scheme 3 is illustrated by Step G of Synthesis Example 1.

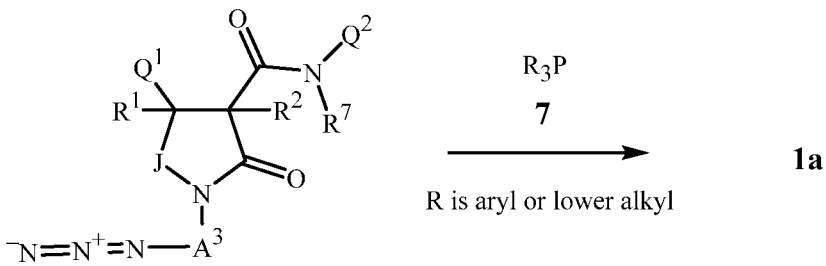
Scheme 3



6 **1c**

As shown in Scheme 4 a compound of Formula **1a** can also be prepared by cyclization of azido lactams of Formula **8**. Cyclization can be carried out by an organophosphine of Formula **7**, typically in the presence of a co-solvent. Suitable organophosphines for the reaction include, but are not limited to, triphenylphosphine or tri-*n*-butylphosphine. A wide variety of co-solvents are suitable for the reaction including, but not limited to, benzene, chlorobenzene, carbon tetrachloride, and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C. The method of Scheme 4 is illustrated by Step C of Synthesis Example 2.

Scheme 4

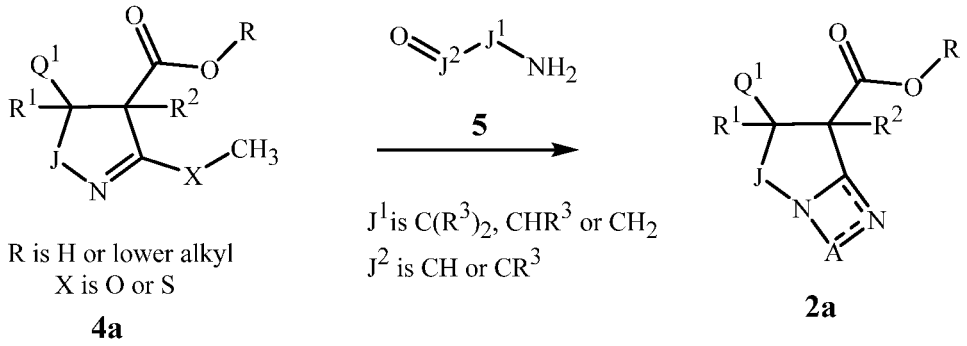


A^3 is alkyl or alkylcarbonyl

8

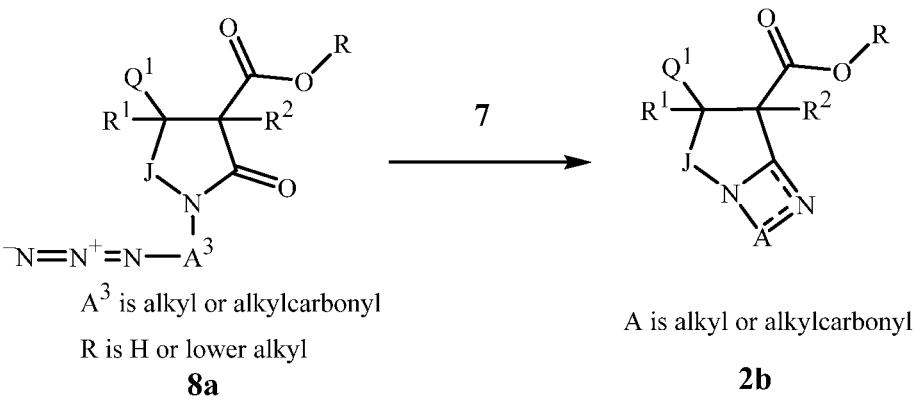
As shown in Scheme 5 a compound of Formula **2a** can be prepared by cyclization of a compound of Formula **4a**. Cyclization can be carried out using an appropriate nitrogen-containing compound such as, but not limited to, aminoacetals, aminoaldehyes, aminoketones and hydrazides, under neutral conditions or acidic conditions. Suitable acids for the reaction include, but are not limited to, inorganic acids such as hydrochloric acid, hydrobromic acid and sulfuric acid, and organic acids such as acetic acid and trifluoroacetic acid. A wide variety of co-solvents are suitable for the reaction including, but not limited to, water, methanol, ethanol and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C.

Scheme 5



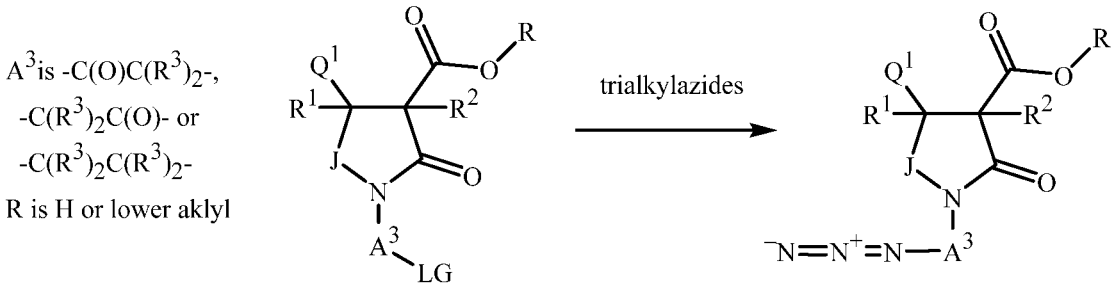
As shown in Scheme 6 a compound of Formula **2b** can be prepared by cyclization of azido lactams of Formula **8a**. Cyclization can be carried out by an organophosphine, typically in the presence of a co-solvent. Exemplary organophosphines for the reaction include triphenylphosphine or tri-*n*-butylphosphine. A wide variety of co-solvents are suitable for the reaction including, but not limited to, benzene, chlorobenzene, carbon tetrachloride, and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 to 100 °C.

Scheme 6



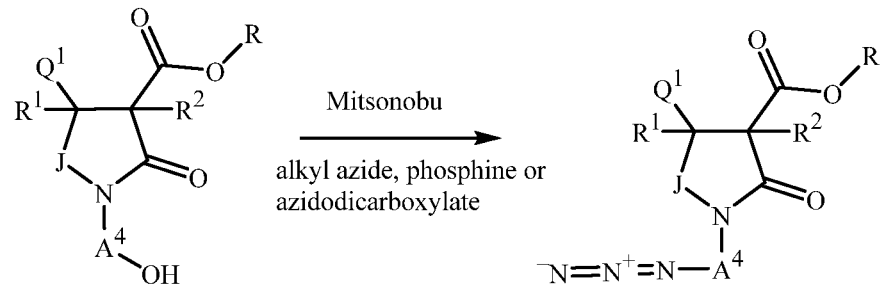
As shown in Scheme 7 a compound of Formula **8b** can be prepared by substitution of lactams of Formula **9**. Substitution is carried out with an inorganic azide or a trialkylsilyl azide, typically in the presence of a co-solvent. Suitable azides for the reaction include, but are not limited to, inorganic azides such as sodium azide and trialkylsilyl azides such as azidotrimethylsilane. A wide variety of co-solvents are suitable for the reaction including, but not limited to, *N*,*N*-dimethylformamide, *N*-methyl-2-pyrrolidone, dimethylsulfoxide, and ethanol. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C. The method of Scheme 7 is illustrated by Step B of Synthesis Example 2.

Scheme 7



As shown in Scheme 8 a compound of Formula **8c** can be prepared by substitution of alcohols of Formula **9** by the Mitsunobu substitution method. It is typically carried out with an azide, a phosphine and an azodicarboxylate, in the presence of a co-solvent. Suitable azides for the reaction include, but are not limited to, diphenylphosphoryl azide and azidotrimethylsilane. Suitable phosphines for the reaction include, but are not limited to, triphenylphosphine or tri-*n*-butylphosphine. Suitable phosphines for the reaction include, but are not limited to, diethyl azodicarboxylate and di-*tert*-butyl azodicarboxylate. A wide variety of co-solvents are suitable for the reaction including, but not limited to, *N*,*N*-dimethylformamide and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C. See *Org. Lett.* **2008**, *10*(14), 2997–3000 and *J. O. C.* **1999**, *64*(16), 6049–6055 for examples of this type of transformation.

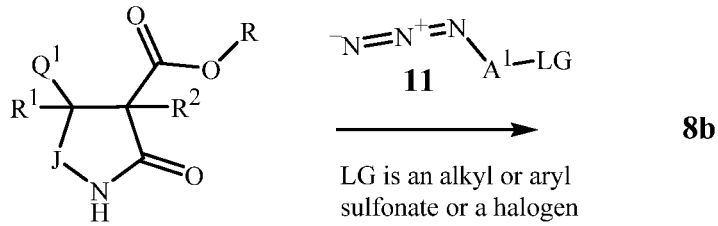
Scheme 8



As shown in Scheme 9 a compound of Formula **8b** can be prepared by reacting a compound of Formula **10** with a compound of Formula **11**. Substitution is carried out optionally in the presence of a base, typically in the presence of a co-solvent. Suitable bases for the reaction include, but are not limited to, hydroxides such as sodium and potassium hydroxide, carbonates such as sodium and potassium carbonate and nitrogen-containing bases such as triethylamine, *N*,*N*-diisopropylamine and 1,8-diazabicyclo[5.4.0]undec-7-ene. A wide variety of co-solvents are suitable for the reaction including, but not limited to,

benzene, toluene, *N*,*N*-dimethylformamide, *N*-methyl-2-pyrrolidone, dimethylsulfoxide, ethanol, methanol, acetonitrile and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C. A compound of Formula **10** (wherein J is –CR^5R^6–) can be prepared in multiple ways as described in PCT/US2014/068073 (WO 2015/084796). A compound of Formula **10** (wherein J is –CR^5R^6-$CR^{5a}R^{6a}$–) can be prepared in multiple ways as described in PCT/US2014/38473 (WO 2016/003997).

Scheme 9

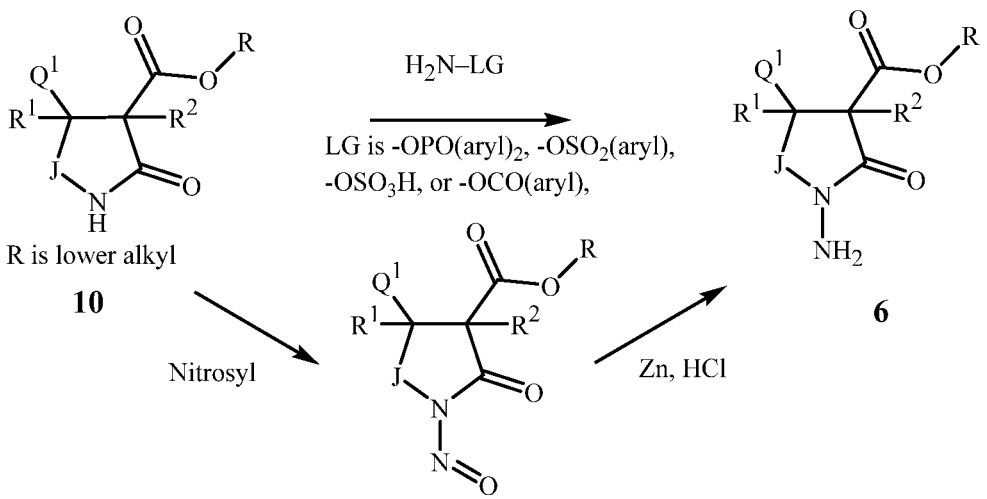


As shown in Scheme 10 a compound of Formula **6** can be prepared by *N*-amination of lactams of Formula **10**. Amination is carried out with an electrophilic aminating reagent, optionally in the presence of a base and typically in the presence of a co-solvent. Suitable electrophilic aminating reagents include, but are not limited to, *N*-chloroamine, *O*-diphenylphosphoryl hydroxylamine, *O*-mesitylsulfonyl hydroxylamine, *O*-sulfonic acid hydroxylamine, *O*-mesitoyl hydroxylamine and *O*-2,4-dinitrophenyl hydroxylamine. Suitable bases for the reaction include, but are not limited to, hydroxides such as sodium and potassium hydroxide, alkoxides such as sodium and potassium ethoxide, carbonates such as sodium and potassium carbonate, sodium hydride, metal amides such as lithium diisopropylamide and sodium hexamethyldisilazide and neutral nitrogen-containing bases such as triethylamine, *N*,*N*-diisopropylamine and 1,8-diazabicyclo[5.4.0]undec-7-ene. A wide variety of co-solvents are suitable for the reaction including, but not limited to, xylenes, toluene, benzene, diethyl ether, *N*,*N*-dimethylformamide and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 150 °C.

Alternatively, *N*-amination can be achieved by a two-step procedure proceeding through the formation and subsequent reduction of an intermediate *N*-nitrosolactam of Formula **12**. An *N*-nitrosolactam compound of Formula **12** can be obtained by carrying out the reaction of a lactam of Formula **10** with an appropriate nitrosylating agent in the presence of an activator and typically in the presence of a co-solvent. Suitable nitrosylating agents include, but are not limited to, nitrites such as sodium and potassium nitrite and nitrogen oxide. Suitable activators for the reaction include, but are not limited to, acetates

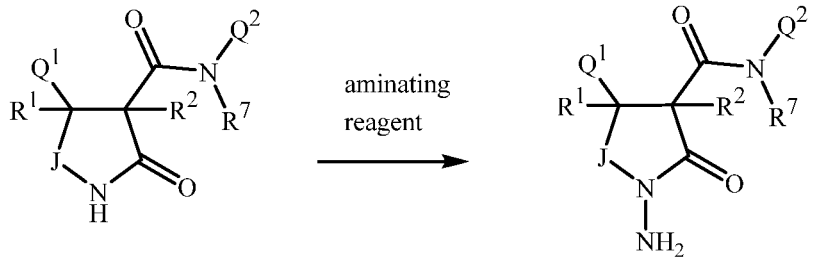
such as sodium and potassium acetate, carboxylic acids such as acetic and propionic acid and Lewis acids such as bismuth(III) trichloride and tin(IV) tetrachloride. A wide variety of co-solvents are suitable for the reaction including, but not limited to, acetic anhydride, carbon tetrachloride and methylene chloride. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C. An *N*-amino compound of Formula **6** can be obtained by carrying out the reaction of a *N*-nitrosolacatm of Formula **12** with an appropriate reducing agent, typically in the presence of a co-solvent. Suitable reducing agents include, but are not limited to, zinc metal. A variety of co-solvents are suitable for the reaction including, but not limited to, acetic acid and aqueous hydrochloric acid. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from –20 °C – 100 °C. See *Synthesis* **2006**, *14*, 2371–2375 and *Synthetic Communications* **2009**, *39*, 604–612 for representative procedures. A compound of Formula **10** (i.e. wherein J is –CR^5R^6–) can be prepared in multiple ways as taught in PCT/US2014/068073 (WO 2015/084796). A compound of Formula **10** (wherein J is –CR^5R^6-$CR^{5a}R^{6a}$–) can be prepared in multiple ways as described in PCT/US2014/38473 (WO 2016/003997).

Scheme 10



Alternatively, as shown in Scheme 11, a compound of Formula **6a** can be prepared by reacting a compound of Formula **10a** with an aminating reagent such as *O*-(diphenylphosphinyl)hydroxylamine and hydroxylamino-*O*-sulphonic acid. For procedures, conditions and reagents see *Bioorg. & Med. Chem. Lett.* **2009**, *19*, 5924–5926 and *J. O. C.* **2002**, *67*, 6236–6239.

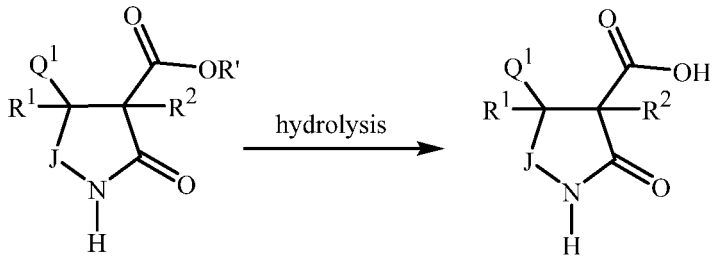
Scheme 11



10a **6a**

As shown in Scheme 12 a compound of Formula **10b** can be prepared by hydrolysis of esters of Formula **10a**. Hydrolysis is carried out with aqueous base or aqueous acid, typically in the presence of a co-solvent. Suitable bases for the reaction include, but are not limited to, hydroxides such as sodium and potassium hydroxide and carbonates such as sodium and potassium carbonate. Suitable acids for the reaction include, but are not limited to, inorganic acids such as hydrochloric acid, hydrobromic acid and sulfuric acid, and organic acids such as acetic acid and trifluoroacetic acid. A wide variety of co-solvents are suitable for the reaction including, but not limited to, methanol, ethanol and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 100 °C.

Scheme 12



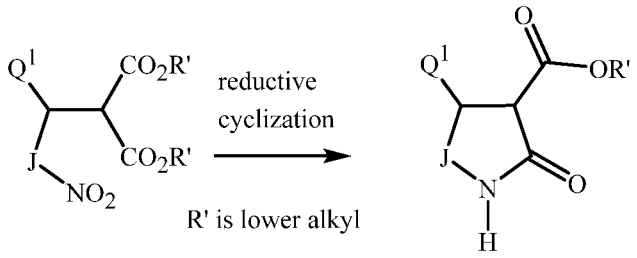
10a
R' is lower alkyl

10b

As shown in Scheme 13, a compound of Formula **4** can be obtained by reduction of a compound of Formula **13** and subsequent *in situ* cyclization of the resulting intermediate amine. A wide variety of methods for reduction of the aliphatic nitro group in compounds of Formula **13** are known in the literature. Typical reduction methods include catalytic hydrogenation in the presence of palladium on carbon or Raney nickel, iron or zinc metal in acidic medium (see, for example, *Berichte der Deutschen Chemischen Gesellschaft* **1904**, *37*, 3520–3525), and lithium aluminum hydride. Reduction can also be achieved with samarium(II) iodide in the presence of a proton source such as methanol (see for example, *Tet. Lett.* **1991**, *32* (14), 1699–1702). Alternatively sodium borohydride in the presence of a nickel catalyst such as nickel(II) acetate or nickel(II) chloride can be used (see for example,

Tet. Lett. **1985**, *26* (52), 6413–6416). The method of Scheme 12 utilizing sodium borohydride in the presence of nickel(II) chloride hexahydrate is illustrated by Step C of Synthesis Example 1.

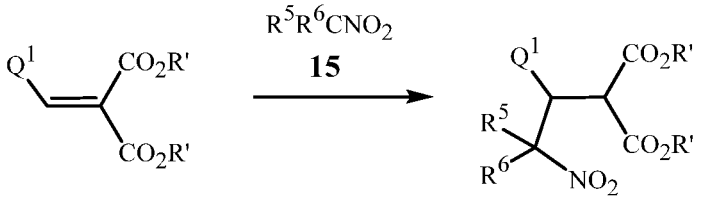
Scheme 13



13 **10a**

As shown in Scheme 14, a compound of Formula **13a** (a compound of Formula **13** wherein J is $-CR^5R^6-$) can be prepared by reacting diesters of Formula **14** with nitroalkanes of Formula **15**, typically in the presence of a base. Suitable bases for the reaction include alkali metal lower alkoxides such as sodium methoxide in methanol or sodium ethoxide in ethanol. The method of Scheme 14 is illustrated by Step B of Synthesis Example 1. A compound of Formula **14** can readily be prepared by methods known to those skilled in the art, e.g., by Knoevenagel condensation of aldehydes and malonates (see for example G. Jones, *Organic Reactions* Volume 15, John Wiley and Sons, 1967).

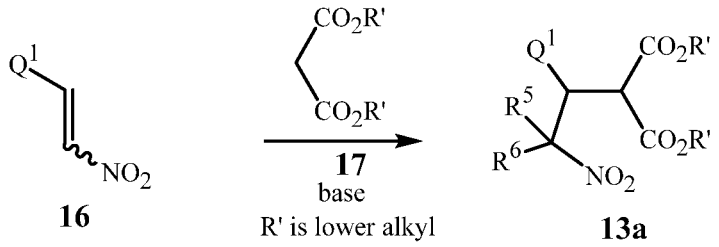
Scheme 14



14 **13a**

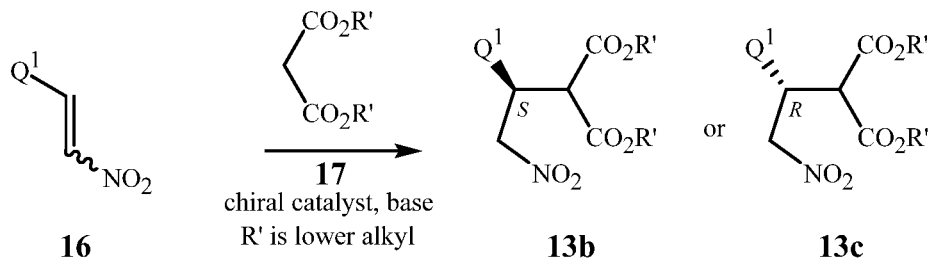
A compound of Formula **13a** (i.e. Formula **13** wherein J is $-CR^5R^6-$) can be prepared by reacting nitroalkenes of Formula **16** with a malonate of Formula **17** in the presence of a base as shown in Scheme 15. Suitable bases for this reaction include, but are not limited to, alkali metal lower alkoxides such as sodium methoxide in methanol or sodium ethoxide in ethanol, or bases such as lithium bis(trimethylsilyl)amide, sodium bis(trimethylsilyl)amide and lithium diisopropylamide in solvents such as tetrahydrofuran. Typically, the reaction is carried out in the range of from –78 °C to 23 °C. See *Synthesis* **2005**, 2239–2245 for conditions for effecting this transformation. Conditions for effecting this transformation in refluxing water in the absence of a catalyst have been reported in *Synthetic Communications* **2013**, *43*, 744–748. Nitroalkenes of Formula **16** can readily be prepared from aldehydes and nitromethane by known methods.

Scheme 15



Compounds of Formula **13b** and **13c** can be prepared stereoselectively by reacting nitroalkenes of Formula **16** with malonates of Formula **17** in the presence of a chiral catalyst and optionally in the presence of a suitable base as shown in Scheme 16. Suitable catalysts include, but are not limited to Ni(II) with vicinal diamine ligands such as Ni(II) Bis[(*R*,*R*)-*N*,*N*'-dibenzylcyclohexane-1,2-diamine]dibromide, Ni(II) Bis[(*S*,*S*)-*N*,*N*'-dibenzylcyclohexane-1,2-diamine]dibromide or nickel(II) bromide with chiral 1,1'-bi(tetrahydroisoquinoline) type diamines. Suitable organic bases for this reaction include, but are not limited to, piperidine, morpholine, triethylamine, 4-methylmorpholine or *N*,*N*-diisopropylethylamine. This transformation can be accomplished neat or in solvents such as tetrahydrofuran, toluene or dichloromethane. Typically, the reaction is carried out in the range of from –78 °C to 80 °C using 0 to 1 equivalent of catalyst and 0 to 1 equivalent of a base. Conditions for effecting this transformation have been reported in *J. Am. Chem. Soc.* **2005**, 9958–9959 or *Eur. J. Org. Chem.* **2011**, 5441–5446 for conditions. Nitroalkenes of Formula **16** can readily be prepared from aldehydes and nitromethane by methods known to those skilled in the art.

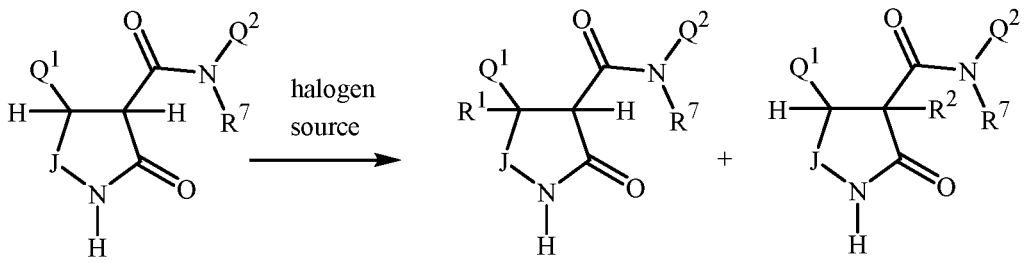
Scheme 16



As shown in Scheme 17, mixtures of compounds of Formulae **10b** (i.e. Formula **10** wherein Y is O; R^1 is halogen; and R^2 is H) and **10c** (i.e. Formula **10** wherein Y is O; R^1 is H; and R^2 is halogen) can be prepared by reacting a compound of Formula **10a** with a halogen source in a solvent, in the presence or absence of an initiator. Separation of the regioisomers produced in this reaction can be achieved by standard methods such as chromatography or fractional crystallization. Suitable halogen sources for this reaction include bromine, chlorine, *N*-chlorosuccinimide, *N*-bromosuccinimide and *N*-iodosuccinimide. Suitable initiators for this reaction include 2,2'-azobisisobutyronitrile

(AIBN) and benzoyl peroxide. Typically, the reaction is carried out in solvents such as dichloromethane in the range of from 0 °C to the boiling point of the solvent.

Scheme 17

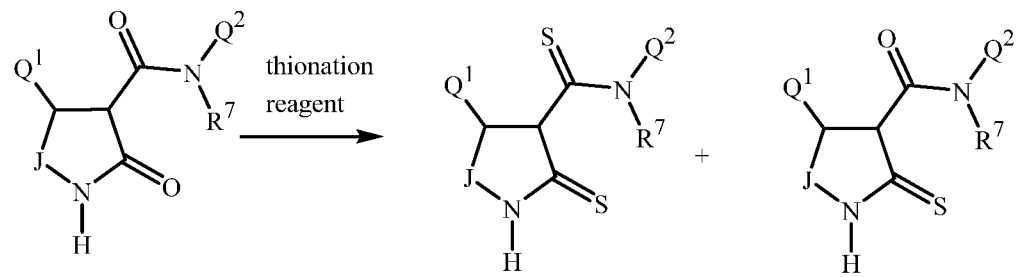


10a **10b** **10c**

R^1 is Cl, Br, I R^2 is Cl, Br, I

As shown in Scheme 18, compounds of Formula **10d** and **10e** (i.e. a compound of Formula **10** wherein R^1 and R^2 are H; and Y is O (**10d**) or S (**10e**), respectively) can be prepared by reacting compounds of Formula **10a** with at least two equivalents of a thionation reagent such as Lawesson's reagent, tetraphosphorus decasulfide or diphosphorus pentasulfide in a solvent such as tetrahydrofuran or toluene. Typically, the reaction is carried out at temperatures ranging from 0 to 115 °C. One skilled in the art recognizes that using less than two equivalents of the thionating reagent can provide mixtures comprising a products of a compound of Formulae **10d** and **10e** (i.e. wherein Y is S or O, respectively) which can be separated by conventional methods such as chromatography and crystallization. The method of Scheme 18 is illustrated by Step D of Synthesis Example 1.

Scheme 18

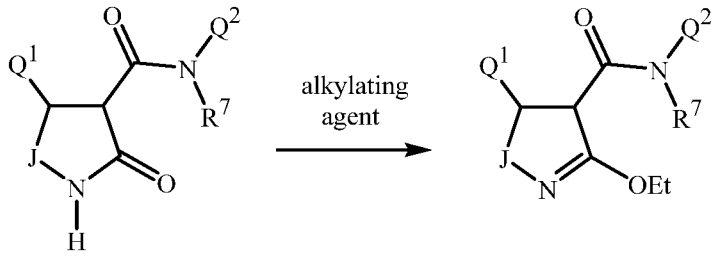


10a **10d** **10e**

As shown in Scheme 19, compounds of Formula **4** (i.e. Formula **1** wherein R^1 and R^2 are H; and Y is O) can be prepared by alkylation of compounds of Formula **10a** with an appropriate alkylating agent optionally in the presence of a base. Suitable alkylating agents include, but are not limited to, trimethyloxonium tetrafluoroborate, triethyloxonium tetrafluoroborate, iodomethane, iodoethane, bromomethane, and methyl *p*-toluenesulfonate. Suitable bases for the reaction include, but are not limited to, carbonates such as sodium and potassium carbonate and neutral nitrogen-containing bases such as triethylamine and

1,8-diazabicyclo[5.4.0]undec-7-ene. A wide variety of co-solvents are suitable for the reaction including, but not limited to, acetonitrile, *N*,*N*-dimethylformamide and tetrahydrofuran. The reaction is conducted at temperatures ranging from –20 °C to the boiling point of the solvent, and typically from 0 – 150 °C. The method of Scheme 19 is illustrated by Step F of Synthesis Example 1.

Scheme 19



10a **4**

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

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

One skilled in the art will also recognize that compounds of Formula **1** and the intermediates described herein can be subjected to various electrophilic, nucleophilic,

radical, organometallic, oxidation, and reduction reactions to add substituents or modify existing substituents.

Without further elaboration, it is believed that one skilled in the art using the preceding description can utilize the present invention to its fullest extent. The following non-limiting Examples are illustrative of the invention. Steps in the following Examples illustrate a procedure for each step in an overall synthetic transformation, and the starting material for each step may not have necessarily been prepared by a particular preparative run whose procedure is described in other Examples or Steps. Percentages are by weight except for chromatographic solvent mixtures or where otherwise indicated. Parts and percentages for chromatographic solvent mixtures are by volume unless otherwise indicated. ^{1}H NMR spectra are reported in ppm downfield from tetramethylsilane; "s" means singlet, "d" means doublet, "m" means multiplet, and "br s" means broad singlet.

SYNTHESIS EXAMPLE 1

Preparation of *N*-(2-fluorophenyl)-6,7-dihydro-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-*c*]-1,2,4-triazole-7-carboxamide (Compound 2)

Step A: Preparation of 1,3-diethyl 2-[[3-(trifluoromethyl)phenyl]methylene]propanedioate

A mixture of 3-(trifluoromethyl)benzaldehyde (7.55 g, 43.3 mmol), diethyl malonate (6.6 g, 41.3 mmol), piperidine (0.91 g, 10.7 mmol) and benzene (50 mL) was refluxed for 17 h with continuous removal of water using a Dean-Stark trap. The cooled reaction mixture was concentrated under reduced pressure, and the residue was chromatographed on silica gel, eluting with 0% to 30% ethyl acetate in hexanes, to afford the title compound as a clear, colorless oil (10.9 g).

^{1}H NMR δ 7.74 (m, 1H), 7.71 (m, 1H), 7.64 (m, 2H), 7.52 (m, 1H), 4.33 (m, 4H), 1.35 (m, 3H), 1.29 (m, 3H).

Step B: Preparation of 1,3-diethyl 2-[2-nitro-1-[3-(trifluoromethyl)phenyl]ethyl]propanedioate

A mixture of 1,3-diethyl 2-[[3-(trifluoromethyl)phenyl]methylene]propanedioate (i.e. the product of Step A, 10.9 g, 34.5 mmol), nitromethane (18.5 mL, 345 mmol) and a methanol solution of sodium methoxide (25 wt%, 0.76 g, 3.45 mmol) in ethanol (150 mL) was stirred at 23 °C for 21 h. The reaction mixture was then concentrated under reduced pressure to afford a thick oil, which was diluted with 25% ethyl acetate in hexanes and filtered through a pad of Celite® diatomaceous earth filter aid to remove insoluble particulates. The filtrate was concentrated under reduced pressure to afford the title compound as a yellow oil (11.0 g).

^{1}H NMR δ 7.57 (m, 1H), 7.51 (m, 1H), 7.47 (m, 2H), 4.97 (m, 1H), 4.89 (m, 1H), 4.32 (m, 1H), 4.23 (m, 4H), 3.82 (d, J = 9.0 Hz, 1H), 1.27 (m, 3H), 1.07 (m, 3H).

Step C: Preparation of ethyl 2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate

A stirred mixture of 1,3-diethyl 2-[2-nitro-1-[3-(trifluoromethyl)phenyl]ethyl]propanedioate (i.e. the product of Step B, 11.0 g, 29.0 mmol), nickel(II) chloride hexahydrate (13.8 g, 58.0 mmol) and ethanol (250 mL) was cooled in an ice bath and treated with sodium borohydride (6.6 g, 174 mmol) in 0.5 g portions added over 45 min. The resulting mixture was stirred at 23 °C for 4 h. Saturated ammonium chloride solution (500 mL) was then added, the mixture was stirred for 2 h. The aqueous layer was extracted with ethyl acetate (3 × 200 mL). The combined organic extracts were washed with brine, dried ($MgSO_4$) and concentrated under reduced pressure. The residue was dissolved in ethyl acetate (100 mL) and stirred vigorously with saturated ammonium chloride solution (100 mL) for 1 h when all of the black particles disappeared. The layers were separated, and the organic layer was washed with water, dried ($MgSO_4$) and concentrated under reduced pressure. The residue was chromatographed on silica gel, eluting with 0% to 100% ethyl acetate in hexanes, to afford the title compound as a clear colorless oil.

^{1}H NMR δ 7.57 (m, 1H), 7.51 (m, 1H), 7.48 (m, 2H), 6.47 (br s, 1H), 4.26 (m, 2H), 4.19 (m, 1H), 3.86 (m, 1H), 3.54 (d, J = 9.5 Hz, 1H), 3.46 (m, 1H), 1.29 (m, 3H).

Step D: Preparation of ethyl 2-thioxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate

A mixture of ethyl 2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step C, 1.0 g, 3.3 mmol) and Lawesson's reagent (0.67 g, 1.7 mmol) in toluene (15 mL) was stirred at reflux for 4 h. The cooled reaction mixture was concentrated under reduced pressure, and the residue was chromatographed on silica gel, eluting with 0% to 100% ethyl acetate in hexanes, to afford the title compound as a yellow oil (0.60 g).

^{1}H NMR δ 8.07 (br s, 1H), 7.57 (m, 1H), 7.49 (m, 2H), 7.44 (m, 1H), 4.28 (m, 3H), 4.16 (m, 1H), 3.90 (m, 1H), 3.72 (m, 1H), 1.31 (m, 3H).

Step E: Preparation of *N*-(2-fluorophenyl)-2-thioxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide

A mixture of ethyl 2-thioxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step D, 0.55 g, 1.7 mmol) and 2-fluoroaniline (2.0 mL, 20.7 mmol) was heated to 120 °C under a nitrogen atmosphere for 71 h. The mixture was chromatographed on silica gel, eluting with 0–40% ethyl acetate in hexanes, to afford the title product as an off-white solid (0.49 g).

^{1}H NMR δ 9.68 (br s, 1H), 8.21 (m, 1H), 7.75 (br s, 1H), 7.57 (m, 2H), 7.52 (m, 2H), 7.10 (m, 3H), 4.62 (m, 1H), 4.16 (m, 1H), 3.94 (d, J = 6.0 Hz ,1H), 3.72 (m, 1H).

Step F: Preparation of *N*-(2-fluorophenyl)-3,4-dihydro 5-methylthio-3-[3-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide

A mixture of *N*-(2-fluorophenyl)-2-thioxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide (i.e. the product of Step E, 0.49 g, 1.3 mmol), iodomethane (0.090 mL, 1.4 mmol) and potassium carbonate (0.36 g, 2.6 mmol) in acetonitrile (10 mL) was stirred at 23 °C for 4 h. The mixture was concentrated under reduced pressure. The residue was taken up in ethyl acetate (20 mL) and washed with water (2 × 10 mL). The organic extract was dried ($MgSO_4$) and concentrated under reduced pressure to afford the title product as a brown oil (0.39 g).

^{1}H NMR δ 8.29 (m, 1H), 7.60 (br s, 1H), 7.52 (m, 1H), 7.44 (m, 3H), 7.11 (m, 3H), 4.52 (m, 1H), 4.22 (m, 1H), 4.00 (m, 1H), 3.77 (s, 1H), 2.57 (m, 3H).

Step G: Preparation of *N*-(2-fluorophenyl)-6,7-dihydro-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-*c*]-1,2,4-triazole-7-carboxamide

A mixture of *N*-(2-fluorophenyl)-3,4-dihydro 5-methylthio-3-[3-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide (i.e. the product of Step F, 0.13 g, 0.33 mmol) and formic hydrazide (0.030 g, 0.50 mmol) in *N*,*N*-dimethylacetamide (0.4 mL) was stirred at 120 °C for 15 h. The mixture was concentrated under reduced pressure. The residue was chromatographed on silica gel, eluting with 0% to 100% ethyl acetate in hexanes then 0% to 5% methanol in ethyl acetate, to afford the title compound, a compound of the present invention, as a brown oil (0.065 g).

^{1}H NMR δ 9.17 (br s, 1H), 8.26 (s, 1H), 8.15 (m, 1H), 7.62 (m, 2H), 7.56 (m, 3H), 7.09 (m, 3H), 4.93 (m, 1H), 4.61 (m, 1H), 4.36 (d, J = 7.4 Hz, 1H), 4.14 (m, 1H).

SYNTHESIS EXAMPLE 2

Preparation of *N*-(2-fluorophenyl)-2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)phenyl]-5H-pyrrolo[1,2-a]imidazole-7-carboxamide (Compound 3)

Step A: Preparation of ethyl 1-(2-chloroacetyl)-2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate

A mixture ethyl 2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Example 1 Step C, 0.30 g, 1.0 mmol) and chloroacetyl chloride (0.16 mL, 2.0 mmol) in benzene (3 mL) was stirred at 75 °C for 16 h. The cooled reaction mixture was concentrated under reduced pressure to afford the title compound as a dark brown oil (0.37 g).

^{1}H NMR δ 7.61 (m, 1H), 7.53 (m, 2H), 7.46 (m, 1H), 4.73 (m, 2H), 4.42 (m, 1H), 4.27 (m, 2H), 4.10 (m, 1H), 3.82 (d, J = 10.7 Hz, 1H), 3.78 (m, 1 H), 1.30 (m, 3 H).

Step B: Preparation of ethyl 1-(2-azidoacetyl)-2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate

A mixture of ethyl 1-(2-chloroacetyl)-2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step A, 0.37 g, 1.0 mmol) and sodium azide (0.20 g, 3.0 mmol) in *N*,*N*-dimethylformamide (3 mL) was stirred at 23 °C for 6 h. The reaction mixture was diluted with ethyl acetate (40 mL). The mixture was washed successively with water (2 × 15 mL) and saturated sodium chloride (15 mL). The organic layer was dried ($MgSO_4$) and concentrated under reduced pressure to afford the title compound as a red oil (0.37 g).

^{1}H NMR δ 7.61 (m, 1H), 7.52 (m, 2H), 7.45 (m, 1H), 4.51 (s, 2H), 4.42 (m, 1H), 4.27 (m, 2H), 4.10 (m, 1H), 3.80 (d, J = 10.9 Hz, 1H), 3.77 (m, 1 H), 1.29 (m, 3H).

Step C: Preparation of ethyl 2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[1,2-a]imidazole-7-carboxylate

A mixture of ethyl 1-(2-azidoacetyl)-2-oxo-4-[3-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step B, 0.37 g, 1.0 mmol) and triphenylphosphine (0.29 g, 1.1 mmol) in benzene (10 mL) was stirred at reflux for 1 h. The solution was left to stand at 23 °C for 20 h during which time a solid formed. The mixture was filtered and washed with toluene to afford the title compound as a colorless solid (0.20 g). The filtrate was concentrated. The residue was dissolved in toluene (4 mL). Magnesium chloride (0.30 g) was added, and the mixture was stirred at 65 °C for 1 h. The cooled reaction mixture was filtered. The filtrate was concentrated under reduced pressure to afford an additional quantity of the title compound as a colorless solid (0.12 g).

^{1}H NMR δ 7.49 (m, 2H), 7.43 (m, 2H), 5.72 (br s, 1H), 4.67 (m, 1H), 4.38 (m, 2H), 4.15 (m, 1H), 4.02 (m, 2H), 3.59 (m, 1H), 1.08 (br s, 3H).

Step D: Preparation of *N*-(2-fluorophenyl)-2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)phenyl]-5H-pyrrolo[1,2-a]imidazole-7-carboxamide

A mixture of ethyl 2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[1,2-a]imidazole-7-carboxylate (i.e. the product of Step C, 0.10 g, 0.29 mmol) and 2-fluoroaniline (0.50 mL, 5.2 mmol) in toluene (3 mL) was heated to 200 °C in a microwave reactor for 2 h. The cooled reaction mixture was chromatographed on silica gel, eluting with 0–100% ethyl acetate in hexanes, to afford the title product, a compound of the present invention, as a yellow oil (0.027 g). The ^{1}H NMR shows approximately a 2:1 mixture of enamine:amidine tautomers.

^{1}H NMR δ Enamine tautomer 8.20 (m, 1H), 7.58 (m, 4H), 7.07 (m, 3H), 6.37 (br s, 1H), 6.27 (br s, 1H), 4.56 (m, 2H), 4.51 (m, 1H), 4.02 (m, 1H), 3.59 (m, 1H); Amidine tautomer 9.49 (br s, 1H), 8.20 (m, 1H), 7.58 (m, 4H), 7.07 (m, 3H), 4.77 (m, 1H), 4.41 (s, 2H), 4.28 (m, 1H), 4.14 (m, 1H), 3.59 (m, 1H).

SYNTHESIS EXAMPLE 3

Preparation of *N*-(2-fluorophenyl)-6,7-dihydro-methyl-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide (Compound 24)

Step A: Preparation 1,3-dimethyl 2-[2-nitro-1-[4-(trifluoromethyl)phenyl]ethyl]-propanedioate

A mixture of 4-(trifluoromethyl)benzaldehyde (25.0 g, 112 mmol), dimethyl malonate (15.6 g, 118 mmol), piperidine (2.39 g, 28.0 mmol) and benzene (75 mL) was refluxed for 2 h with continuous removal of water (Dean-Stark trap). Acetic acid (3.47 g, 57.7 mmol) was added, and the reaction was heated for another 1.5 h. The cooled reaction mixture was washed successively with aqueous hydrochloric acid (1 M, 2 × 40 mL) and saturated sodium bicarbonate (2 × 40 mL). The organic layer was dried (Na_2SO_4) and concentrated under reduced pressure to afford a yellow oil (0.37 g). A mixture of the yellow oil, nitromethane (60.0 mL, 1.12 mol) and a methanol solution of sodium methoxide (25 wt%, 2.42 g, 11.2 mmol) in methanol (110 mL) was stirred at 23 °C for 17 h. The reaction mixture was then concentrated under reduced pressure to afford a thick oil. The crude material was filtered through a pad of silica, eluting with 50% ethyl acetate in hexanes, to afford the title compound as an orange oil (29.0 g).

^{1}H NMR δ 7.60 (m, 2H), 7.38 (m, 2H), 4.93 (m, 2H), 4.32 (m, 1H), 3.87 (d, J = 8.8 Hz, 1H), 3.78 (s, 3H), 3.60 (s, 3H).

Step B: Preparation of methyl 2-oxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidine-carboxylate

A stirred mixture of 1,3-dimethyl 2-[2-nitro-1-[4-(trifluoromethyl)phenyl]ethyl]-propanedioate (i.e. the product of Step A, 29.0 g, 83.0 mmol), nickel(II) chloride hexahydrate (19.8 g, 83.0 mmol) and methanol (275 mL) was cooled in an ice bath and treated with sodium borohydride (9.5 g, 250 mmol) in 0.5 g portions added over 1 h. The resulting mixture was stirred at 0 °C for 1.5 h and then at 23 °C for 17 h. Saturated ammonium chloride solution (300 mL) and ethyl acetate (300 mL) was then added, the mixture was stirred vigorously for 2 h. The pale blue mixture was separated. The aqueous layer was extracted with ethyl acetate (2 × 100 mL). The combined organic extracts were washed with saturated ammonium chloride solution (100 mL), dried ($MgSO_4$) and concentrated under reduced pressure. The crude mixture was triturated with 1-chlorobutane (100 mL) to afford the title compound as a colorless solid (12.3 g).

^{1}H NMR δ 7.63 (m, 2H), 7.40 (m, 2H), 6.23 (br s, 1H), 4.21 (m, 1H), 3.86 (m, 1H), 3.80 (s, 3H), 3.57 (d, *J* = 9.6 Hz, 1H), 3.45 (m, 1H).

Step C: Preparation of methyl 2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate

A mixture of methyl 2-oxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step B, 8.0 g, 27.9 mmol) and Lawesson's reagent (5.63 g, 13.9 mmol) in toluene (70 mL) was stirred at reflux for 4.5 h. The cooled reaction mixture was concentrated under reduced pressure, and the residue was chromatographed on silica gel, eluting with 0% to 100% ethyl acetate in hexanes, to afford a yellow solid consisting of the title compound and 20% of an unknown impurity. The mixture was recrystallized from ethyl acetate (100 mL, hot) and hexanes (200 mL, cold) to afford the title compound as a pale yellow solid (5.0 g).

^{1}H NMR δ 8.20 (br s, 1H), 7.62 (m, 2H), 7.37 (m, 2H), 4.24 (m, 1H), 4.15 (m, 1H), 3.94 (d, J = 8.2 Hz, 1H), 3.82 (s, 3H), 3.71 (m, 1H).

Step D: Preparation of *N*-(2-fluorophenyl)-2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide

A mixture of methyl 2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Step C, 1.00 g, 3.3 mmol) and 2-fluoroaniline (2.55 mL, 26 mmol) was heated to 130 °C under a nitrogen atmosphere for 22 h. The reaction was concentrated under reduced pressure to remove the majority of the excess aniline. The remaining residue was triturated with 1-chlorobutane to afford the title compound as a colorless solid (1.18 g).

^{1}H NMR δ 9.67 (br s, 1H), 8.21 (m, 1H), 7.73 (br s, 1H), 7.64 (m, 2H), 7.45 (m, 2H), 7.10 (m, 3H), 4.62 (m, 1H), 4.16 (m, 1H), 3.93 (d, J = 5.8 Hz ,1H), 3.71 (m, 1H).

Step E: Preparation of *N*-(2-fluorophenyl)-3,4-dihydro-5-(methylthio)-3-[4-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide

A mixture of *N*-(2-fluorophenyl)-2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide (i.e. the product of Step D, 1.11 g, 2.9 mmol), iodomethane (0.22 mL, 3.5 mmol) and potassium carbonate (0.81 g, 5.8 mmol) in acetonitrile (15 mL) was stirred at 23 °C for 18 h. The mixture was diluted with water (100 mL) and extracted with ethyl acetate (2 × 100 mL). The organic extract was dried ($MgSO_4$) and concentrated under reduced pressure to afford the title product as a brown solid (0.97 g).

^{1}H NMR δ 8.29 (m, 1H), 7.60 (br s, 1H), 7.52 (m, 1H), 7.44 (m, 3H), 7.11 (m, 3H), 4.52 (m, 1H), 4.22 (m, 1H), 4.00 (m, 1H), 3.77 (s, 1H), 2.57 (s, 3H).

Step F: Preparation of *N*-(2-fluorophenyl)-6,7-dihydro-3-methyl-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide

A mixture of *N*-(2-fluorophenyl)-3,4-dihydro-5-(methylthio)-3-[4-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide (i.e. the product of Step E, 0.100 g, 0.25 mmol) and acetic hydrazide (0.028 g, 0.38 mmol) in acetic acid (1.2 mL) was stirred at 110 °C for 75 min. The mixture was concentrated onto silica gel and chromatographed on silica gel, eluting with 10% to 100% ethyl acetate in hexanes then 0% to 5% methanol in ethyl acetate to afford the title compound contaminated with several other impurities. The mixture was chromatographed on C18-silica gel, eluting with 10% to 100% 1:1 acetonitrile/methanol in water to afford the title compound, a compound of the present invention, as a yellow oil (0.021 g).

^{1}H NMR (d_6-acetone) δ 9.65 (br s, 1H), 8.25 (m, 1H), 7.76 (m, 4H), 7.15 (m, 3H), 7.09 (m, 3H), 4.92 (m, 1H), 4.63 (m, 2H), 4.17 (m, 1H), 2.39 (s, 3H).

SYNTHESIS EXAMPLE 4

Preparation of *N*-(2,3-difluorophenyl)-3-ethyl-6,7-dihydro-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide (Compound 8)

Step A: Preparation of *N*-(2,3-difluorophenyl)-2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide

A mixture of methyl 2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate (i.e. the product of Example 3 Step C, 1.00 g, 3.3 mmol) and 2,3-difluoroaniline (3.4 g, 26 mmol) was heated to 130 °C under a nitrogen atmosphere for 22 h. The reaction was concentrated under reduced pressure to remove the majority of the excess aniline. The remaining residue was triturated with 1-chlorobutane to afford the title compound as a colorless solid (1.13 g).

^{1}H NMR δ 9.84 (br s, 1H), 7.97 (m, 1H), 7.75 (br s, 1H), 7.64 (m, 2H), 7.45 (m, 2H), 7.04 (m, 1H), 6.92 (m, 1H), 4.60 (m, 1H), 4.15 (m, 1H), 3.94 (d, J = 6.3 Hz ,1H), 3.72 (m, 1H).

Step B: Preparation of *N*-(2,3-difluorophenyl)-3,4-dihydro-5-(methylthio)-3-[4-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide

A mixture of *N*-(2,3-difluorophenyl)-2-thioxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxamide (i.e. the product of Step A, 1.16 g, 2.9 mmol), iodomethane (0.22 mL, 3.5 mmol) and potassium carbonate (0.81 g, 5.8 mmol) in acetonitrile (15 mL) was stirred at 23 °C for 18 h. The mixture was diluted with water (100 mL) and extracted with ethyl acetate (2 × 100 mL). The organic extract was dried ($MgSO_4$) and concentrated under reduced pressure to afford the title product as a brown solid (1.10 g).

^{1}H NMR δ 8.06 (m, 1H), 7.60 (m, 3H), 7.33 (m, 2H), 7.07 (m, 1H), 6.94 (m, 1H), 4.51 (m, 1H), 4.22 (m, 1H), 4.01 (m, 1H), 3.77 (s, 1H), 2.58 (s, 3H).

Step C: Preparation of *N*-(2,3-difluorophenyl)-3-ethyl-6,7-dihydro-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide

A mixture of *N*-(2,3-difluorophenyl)-3,4-dihydro-5-(methylthio)-3-[4-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide (i.e. the product of Step B, 0.200 g, 0.48 mmol) and hydrazine hydrate (0.036 mL, 0.72 mmol) in propionic acid (2.4 mL) was stirred at 110 °C for 16.5 h. The mixture was concentrated onto Celite® diatomaceous earth filter aid and chromatographed on C18-silica gel, eluting with 10% to 100% 1:1 acetonitrile/methanol in water to afford the title compound, a compound of the present invention, as a brown solid (0.037 g).

^{1}H NMR δ 10.19 (br s, 1H), 7.82 (m, 1H), 7.64 (m, 2H), 7.47 (m, 2H), 6.92 (m, 1H), 6.83 (m, 1H), 4.99 (m, 1H), 4.50 (m, 2H), 3.98 (m, 1H), 2.81 (m, 2H), 1.37 (m, 3H).

SYNTHESIS EXAMPLE 5

Preparation of *N*-(2,3-difluorophenyl)-6,7-dihydro-3-(trifluoromethyl)-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide (Compound 22)

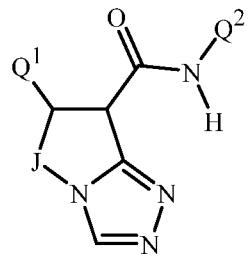
Step A: Preparation of *N*-(2,3-difluorophenyl)-6,7-dihydro-3-(trifluoromethyl)-6-[4-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide

A mixture of *N*-(2,3-difluorophenyl)-3,4-dihydro-5-(methylthio)-3-[4-(trifluoromethyl)phenyl]-2*H*-pyrrole-4-carboxamide (i.e. the product of Example 4 Step B, 0.220 g, 0.53 mmol), trifluoroacetic hydrazide (0.076 g, 0.58 mmol) and pivalic acid (2.7 g) was stirred at 130 °C for 90 min. The cooled mixture was diluted with ethyl acetate (100 mL) and washed successively with saturated sodium bicarbonate (50 mL), water (50 mL) and saturated sodium chloride (50 mL). The organic layer was dried ($MgSO_4$), concentrated onto Celite® diatomaceous earth filter aid and chromatographed on C18-silica gel, eluting with 10% to 100% 1:1 acetonitrile/methanol in water to afford the title compound contaminated with some impurities. The mixture was triturated with 1-chlorobutane to afford the title compound, a compound of the present invention, as a colorless solid (0.029 g).

^{1}H NMR δ 9.25 (br s, 1H), 7.89 (m, 1H), 7.70 (m, 2H), 7.51 (m, 2H), 7.03 (m, 1H), 6.92 (m, 1H), 5.04 (m, 1H), 4.71 (m, 1H), 4.46 (d, J = 7.6 Hz, 1H), 4.24 (m, 1H).

By the procedures described herein together with methods known in the art, the following compounds of Tables 1 to 140 can be prepared. The following abbreviations are used in the Tables which follow: *i*-Pr means isopropyl, Bu means butyl, Ph means phenyl, OMe means methoxy, OEt means ethoxy, SMe means methylthio, \S(O)Me means methylsulfinyl, and $S(O)_2$Me means methylsulfonyl.

Table 1



J is $-CH_2-$; Q^2 is Ph(2-F); and Q^1 is

Q^1	Q^1	Q^1
Ph(3-Cl)	Ph(4-OCF_3)	2-Pyridinyl(3-CF_3)
Ph(3-F)	Ph(4-OCF_2H)	2-Pyridinyl(3-Me)
Ph(3-Br)	Ph(4-OMe)	3-Pyridinyl
Ph(3-Me)	Ph(4-CH_2CF_3)	3-Pyridinyl(6-F)
Ph(3-Et)	Ph(4-O-*i*-Pr)	3-Pyridinyl(6-CF_3)
Ph(3-CF_3)	Ph(4-OCF_2CF_2H)	3-Pyridinyl(6-Me)
Ph(3-CH_2CF_3)	Ph(2,3-di-F)	3-Pyridinyl(5-F)
Ph(3-OCF_3)	Ph(2,4-di-F)	3-Pyridinyl(5-CF_3)
Ph(3-OCF_2H)	Ph(2,5-di-F)	3-Pyridinyl(5-Me)
Ph(3-O-*i*-Pr)	Ph(2,6-di-F)	3-Pyridinyl(4-F)
Ph(3-OMe)	Ph(3,4-di-F)	3-Pyridinyl(4-CF_3)
Ph(3-OCF_2CF_2H)	Ph(3,5-di-F)	3-Pyridinyl(4-Me)
Ph(2-Cl)	Ph(3-Me,4-F)	3-Pyridinyl(2-F)
Ph(2-F)	Ph(3-F,4-Me)	3-Pyridinyl(2-CF_3)
Ph(2-Br)	Ph(3-CF_3,4-F)	3-Pyridinyl(2-Me)
Ph(2-Me)	Ph(3-F,4-CF_3)	4-Pyridinyl
Ph(2-CF_3)	Ph(2,3,4-tri-F)	4-Pyridinyl(6-F)
Ph(2-OCF_3)	Ph(3,4,5-tri-F)	4-Pyridinyl(6-CF_3)
Ph(2-OCF_2H)	2-Pyridinyl	4-Pyridinyl(6-Me)
Ph(2-OMe)	2-Pyridinyl(6-F)	4-Pyridinyl(5-F)
Ph(2-OCF_2CF_2H)	2-Pyridinyl(6-CF_3)	4-Pyridinyl(5-CF_3)
Ph(2-CH_2CF_3)	2-Pyridinyl(6-Me)	4-Pyridinyl(5-Me)
Ph(2-O-*i*-Pr)	2-Pyridinyl(5-F)	4-Pyridinyl(3-F)
Ph(4-Cl)	2-Pyridinyl(5-CF_3)	4-Pyridinyl(3-CF_3)
Ph(4-F)	2-Pyridinyl(5-Me)	4-Pyridinyl(3-Me)
Ph(4-Br)	2-Pyridinyl(4-F)	4-Pyridinyl(2-F)
Ph(4-Me)	2-Pyridinyl(4-CF_3)	4-Pyridinyl(2-CF_3)
Ph(4-Et)	2-Pyridinyl(4-Me)	4-Pyridinyl(2-Me)
Ph(4-CF_3)	2-Pyridinyl(3-F)	2-Thienyl

Q^1	Q^1	Q^1
2-Thienyl(4-CF_3)	Oxazol-2-yl	7-Quinolinyl
2-Thienyl(5-CF_3)	Oxazol-2-yl(5-CF_3)	Indazol-1-yl
3-Thienyl	Oxazol-5-yl	Benzimidazol-1-yl
3-Thienyl(4-CF_3)	Oxazol-5-yl(2-CF_3)	Indol-1-yl
3-Thienyl(5-CF_3)	Isothiazol-5-yl	Pyrrolo[2,3-c]pyridin-1-yl
2-Furyl	Isothiazol-5-yl(3-CF_3)	Ph(3-OCH_2-*c*-Pr)
2-Furyl(4-CF_3)	Isothiazol-3-yl	Ph(2-OCH_2-*c*-Pr)
2-Furyl(5-CF_3)	Isothiazol-3-yl(5-CF_3)	Ph(4-$OCH_2CH_2CH_2CH_2$-c-hex)
3-Furyl	Isoxazol-5-yl	Ph(CH_2-c-Pr)
3-Furyl(4-CF_3)	Isoxazol-5-yl(3-CF_3)	Ph(4-$CH_2CH_2CH_2CH_2$-c-hex)
3-Furyl(5-CF_3)	Isoxazol-3-yl	Ph(3-OCH_2CF_2)
1*H*-Pyrazol-1-yl	Isoxazol-3-yl(5-CF_3)	Ph(2-(3,3-dichloroallyloxy))
4-CF_3-1*H*-Pyrazol-1-yl	1*H*-1,2,3,4-Tetrazol-1-yl	Ph(2-methoxyethoxy)
1*H*-Imidazol-1-yl	5-Me-1*H*-1,2,3,4-Tetrazol-1-yl	Ph(3-propoxypropoxy)
4-CF_3-1*H*-Imidazol-1-yl	1-Me-1*H*-1,2,3,4-Tetrazol-5-yl	Ph(2-$CH_2CH_2SCH_3$)
2-CF_3-1*H*-Imidazol-1-yl	1*H*-1,2,4-Triazol-1-yl	Ph(2-$CH_2CH_2SOCH_3$)
1-Me-1*H*-Imidazol-2-yl	1,3,4-Oxadiazol-2-yl	Ph(2-$CH_2CH_2SO_2CH_3$)
1-Me-1*H*-Imidazol-4-yl	1,3,4-Thiadiazol-2-yl	Ph(3-SMe)
3-Me-1*H*-Imidazol-4-yl	1,2,4-Oxadiazol-3-yl	Ph(3-SCF_3)
1-Me-1*H*-Pyrazol-4-yl	1,2,4-Thiadiazol-3-yl	Ph(3-S-*c*-Pr)
1-Me-1*H*-1,2,3-Triazol-4-yl	Tetrahydropyran-2-yl	Ph(3-SOMe)
2-Me-1*H*-1,2,3-Triazol-4-yl	Tetrahydropyran-3-yl	Ph(3-$SOCF_3$)
4-Me-1*H*-1,2,3-Triazol-2-yl	Tetrahydrofuran-2-yl	Ph(3-SO-*c*-Pr)
4-Me-1*H*-1,2,3-Triazol-1-yl	Tetrahydrofuran-3-yl	Ph(3-SO_2Me)
Pyrazin-2-yl	1,3-Dioxolan-4-yl	Ph(3-SO_2CF_3)
Pyrazin-2-yl(5-CF_3)	2,2-di-Fluoro-1,3-Dioxolan-4-yl	Ph(3-SO_2-*c*-Pr)
Pyrimidin-2-yl	1,3-Dithiolan-4-yl	Ph(3-propargyl)
Pyrimidin-2-yl(5-CF_3)	1,4-Dioxolan-2-yl	Ph(3-(2-Butynyl))
Pyrimidin-5-yl	1,4-Dithiolan-2-yl	Ph(2-$CH_2CH_2OCH_2CH_3$)
Pyrimidin-5-yl(2-CF_3)	1-naphthyl	Ph(2-C(=O)CH_3)
1,3,5-Triazin-2-yl	2-naphthyl	Ph(2-OC(=O)CH_3)
Thiazol-2-yl	Benzofuran-2-yl	Ph(3-OC(=O)CH_3)
Thiazol-2-yl(5-CF_3)	Benzothiophen-2-yl	Ph(2-OC(=O)CF_3)
Thiazol-5-yl	1,3-Benzoxazol-2-yl	Ph(3-OC(=O)CF_3)
Thiazol-5-yl(2-CF_3)	1,3-Benzothiazol-2-yl	

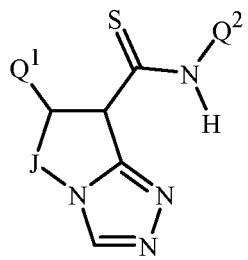
Table 2 is constructed in the same manner except that the Row Heading "J is $-CH_2-$; Q^2 is Ph(2-F); and Q^1 is" is replaced with the Row Heading listed for Table 2 below (i.e. "J is

–CH_2–; Q^2 is Ph(2,3-di-F); and Q^1 is"). Therefore the first entry in Table 2 is a compound of Formula **1** wherein J is –CH_2–; Q^2 is Ph(2,3-di-F); and Q^1 is Ph(3-Cl) (i.e. 3-chlorophenyl). Tables 3 through 20 are constructed similarly.

Table	Row Heading
2	J is –CH_2–; Q^2 is Ph(2,3-di-F); and Q^1 is
3	J is –CH_2–; Q^2 is Ph(2,4-di-F); and Q^1 is
4	J is –CH_2–; Q^2 is Ph(2,3,4-tri-F); and Q^1 is
5	J is –CH_2–; Q^2 is Ph(2-CF_3); and Q^1 is
6	J is –CH_2–; Q^2 is Ph(2-Me); and Q^1 is
7	J is –CH_2–; Q^2 is Ph(2-NO_2); and Q^1 is
8	J is –CH_2–; Q^2 is Ph(2-Cl); and Q^1 is
9	J is –CH_2–; Q^2 is Ph(2- SO_2Me); and Q^1 is
10	J is –CH_2–; Q^2 is Ph(2-F,3-Cl); and Q^1 is
11	J is –CH_2CH_2–; Q^2 is Ph(2-F); and Q^1 is
12	J is –CH_2CH_2–; Q^2 is Ph(2,3-di-F); and Q^1 is
13	J is –CH_2CH_2–; Q^2 is Ph(2,4-di-F); and Q^1 is
14	J is –CH_2CH_2–; Q^2 is Ph(2,3,4-tri-F); and Q^1 is
15	J is –CH_2CH_2–; Q^2 is Ph(2-CF_3); and Q^1 is
16	J is –CH_2CH_2–; Q^2 is Ph(2-Me); and Q^1 is
17	J is –CH_2CH_2–; Q^2 is Ph(2-NO_2); and Q^1 is
18	J is –CH_2CH_2–; Q^2 is Ph(2-Cl); and Q^1 is
19	J is –CH_2CH_2–; Q^2 is Ph(2-SO_2Me); and Q^1 is
20	J is –CH_2CH_2–; Q^2 is Ph(2-F,3-Cl); and Q^1 is

Table 21

Table 21 is constructed the same way as Table 1 above, except the structure is replaced with the following:

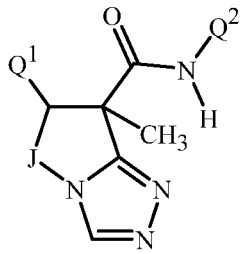


Tables 22 through 40

This disclosure also includes Tables 22 through 40, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 21 above.

Table 41

Table 41 is constructed the same way as Table 1 above, except the structure is replaced with the following:

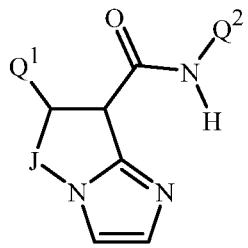


Tables 42 through 60

This disclosure also includes Tables 42 through 60, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 41 above.

Table 61

Table 61 is constructed the same way as Table 1 above, except the structure is replaced with the following:

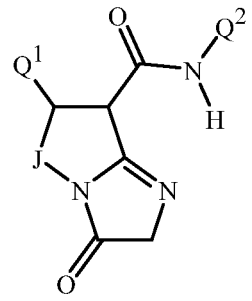


Tables 62 through 80

This disclosure also includes Tables 62 through 80, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 61 above.

Table 81

Table 81 is constructed the same way as Table 1 above, except the structure is replaced with the following:

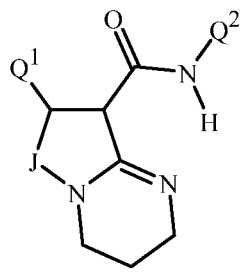


Tables 82 through 100

This disclosure also includes Tables 82 through 100, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 81 above.

Table 101

Table 101 is constructed the same way as Table 1 above, except the structure is replaced with the following:

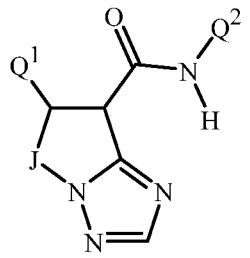


Tables 102 through 120

This disclosure also includes Tables 102 through 120, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 101 above.

Table 121

Table 121 is constructed the same way as Table 1 above, except the structure is replaced with the following:



Tables 122 through 140

This disclosure also includes Tables 122 through 140, each Table is constructed in the same fashion as Tables 2 through 20 above, except that the structure is replaced with the structure in Table 121 above.

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

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

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

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

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

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

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

Liquid diluents include, for example, water, *N*,*N*-dimethylalkanamides (e.g., *N*,*N*-dimethylformamide), limonene, dimethyl sulfoxide, *N*-alkylpyrrolidones (e.g., *N*-methylpyrrolidinone), alkyl phosphates (e.g., triethyl phosphate), ethylene glycol, triethylene glycol, propylene glycol, dipropylene glycol, polypropylene glycol, propylene carbonate, butylene carbonate, paraffins (e.g., white mineral oils, normal paraffins, isoparaffins), alkylbenzenes, alkylnaphthalenes, glycerine, glycerol triacetate, sorbitol, aromatic hydrocarbons, dearomatized aliphatics, alkylbenzenes, alkylnaphthalenes, ketones such as cyclohexanone, 2-heptanone, isophorone and 4-hydroxy-4-methyl-2-pentanone,

acetates such as isoamyl acetate, hexyl acetate, heptyl acetate, octyl acetate, nonyl acetate, tridecyl acetate and isobornyl acetate, other esters such as alkylated lactate esters, dibasic esters, alkyl and aryl benzoates and γ-butyrolactone, and alcohols, which can be linear, branched, saturated or unsaturated, such as methanol, ethanol, *n*-propanol, isopropyl alcohol, *n*-butanol, isobutyl alcohol, *n*-hexanol, 2-ethylhexanol, *n*-octanol, decanol, isodecyl alcohol, isooctadecanol, cetyl alcohol, lauryl alcohol, tridecyl alcohol, oleyl alcohol, cyclohexanol, tetrahydrofurfuryl alcohol, diacetone alcohol, cresol and benzyl alcohol. Liquid diluents also include glycerol esters of saturated and unsaturated fatty acids (typically C_6–C_{22}), such as plant seed and fruit oils (e.g., oils of olive, castor, linseed, sesame, corn (maize), peanut, sunflower, grapeseed, safflower, cottonseed, soybean, rapeseed, coconut and palm kernel), animal-sourced fats (e.g., beef tallow, pork tallow, lard, cod liver oil, fish oil), and mixtures thereof. Liquid diluents also include alkylated fatty acids (e.g., methylated, ethylated, butylated) wherein the fatty acids may be obtained by hydrolysis of glycerol esters from plant and animal sources, and can be purified by distillation. Typical liquid diluents are described in Marsden, *Solvents Guide*, 2nd Ed., Interscience, New York, 1950.

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

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

resins, graft or comb polymers and star polymers; polyethylene glycols (pegs); polyethylene glycol fatty acid esters; silicone-based surfactants; and sugar-derivatives such as sucrose esters, alkyl polyglycosides and alkyl polysaccharides.

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

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

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

Compositions of this invention may also contain formulation auxiliaries and additives, known to those skilled in the art as formulation aids (some of which may be considered to also function as solid diluents, liquid diluents or surfactants). Such formulation auxiliaries and additives may control: pH (buffers), foaming during processing (antifoams such polyorganosiloxanes), sedimentation of active ingredients (suspending agents), viscosity (thixotropic thickeners), in-container microbial growth (antimicrobials), product freezing (antifreezes), color (dyes/pigment dispersions), wash-off (film formers or stickers),

evaporation (evaporation retardants), and other formulation attributes. Film formers include, for example, polyvinyl acetates, polyvinyl acetate copolymers, polyvinylpyrrolidone-vinyl acetate copolymer, polyvinyl alcohols, polyvinyl alcohol copolymers and waxes. Examples of formulation auxiliaries and additives include those listed in *McCutcheon's Volume 2: Functional Materials*, annual International and North American editions published by McCutcheon's Division, The Manufacturing Confectioner Publishing Co.; and PCT Publication WO 03/024222.

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

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

Weed Control Handbook, 8th Ed., Blackwell Scientific Publications, Oxford, 1989; and *Developments in formulation technology*, PJB Publications, Richmond, UK, 2000.

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

Example A

High Strength Concentrate

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

Example B

Wettable Powder

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

Example C

Granule

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

Example D

Extruded Pellet

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

Example E

Emulsifiable Concentrate

Compound 1	10.0%
polyoxyethylene sorbitol hexoleate	20.0%
C_6–C_{10} fatty acid methyl ester	70.0%

Example F

Microemulsion

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

Example G

Suspension Concentrate

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

Example H

Emulsion in Water

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

Example I

Oil Dispersion

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

The present disclosure also includes Formulation Examples A through I above except "Compound is 1" in each of the above Examples A through I is replaced with

"Compound 2", "Compound 3" "Compound 4" "Compound 5", "Compound 6", "Compound 7", "Compound 8", "Compound 9", "Compound 10", "Compound 11", "Compound 12", "Compound 13", "Compound 14", "Compound 15", "Compound 16", "Compound 17", "Compound 18", "Compound 19", "Compound 20", "Compound 21", "Compound 22", "Compound 23", "Compound 24", "Compound 25", "Compound 26", "Compound 27" or "Compound 28".

Test results indicate that the compounds of the present invention are observed to be highly active preemergent and/or postemergent herbicides and/or plant growth regulants. The compounds of the invention are observed to 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 are observed to 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 observed to be 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 are obsereved to show tolerance to important agronomic crops including, but is not limited to, alfalfa, barley, cotton, wheat, rape, sugar beets, corn (maize), sorghum, soybeans, rice, oats, peanuts, vegetables, tomato, potato, perennial plantation crops including coffee, cocoa, oil palm, rubber, sugarcane, citrus, grapes, fruit trees, nut trees, banana, plantain, pineapple, hops, tea and forests such as eucalyptus and conifers (e.g., loblolly pine), and turf species (e.g., Kentucky bluegrass, St. Augustine grass, Kentucky fescue and Bermuda grass). Compounds of this invention can be used in crops genetically transformed or bred to incorporate resistance to herbicides, express proteins toxic to invertebrate pests (such as *Bacillus thuringiensis* toxin), and/or express other useful traits. Those skilled in the art will appreciate that not all compounds are equally effective against all weeds. Alternatively, the subject compounds are useful to modify plant growth.

As the compounds of the invention have both preemergent and postemergent herbicidal activity, to control undesired vegetation by killing or injuring the vegetation or reducing its growth, the compounds can be usefully applied by a variety of methods involving contacting a herbicidally effective amount of a compound of the invention, or a composition comprising said compound and at least one of a surfactant, a solid diluent or a

liquid diluent, to the foliage or other part of the undesired vegetation or to the environment of the undesired vegetation such as the soil or water in which the undesired vegetation is growing or which surrounds the seed or other propagule of the undesired vegetation.

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

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

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

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

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

Trait	Description	Trait	Description	Trait	Description
T1	Glyphosate tol.	T15	Cold tol.	T27	High tryptophan
T2	High lauric acid oil	T16	Imidazolinone herb. tol.	T28	Erect leaves semidwarf
T3	Glufosinate tol.	T17	Modified alpha-amylase	T29	Semidwarf
T4	Phytate breakdown	T18	Pollination control	T30	Low iron tol.

T5	Oxynil tol.	T19	2,4-D tol.	T31	Modified oil/fatty acid
T6	Disease res.	T20	Increased lysine	T32	HPPD tol.
T7	Insect res.	T21	Drought tol.	T33	High oil
T9	Modified flower color	T22	Delayed ripening/senescence	T34	Aryloxyalkanoate tol.
T11	ALS Herbicide tol.	T23	Modified product quality	T35	Mesotrione tol.
T12	Dicamba tol.	T24	High cellulose	T36	Reduced nicotine
T13	Anti-allergy	T25	Modified starch/carbohydrate	T37	Modified product
T14	Salt tol.	T26	Insect & disease resist.		

Exhibit C

Crop	Event Name	Event Code	Trait(s)	Gene(s)
Alfalfa	J101	MON-00101-8	T1	cp4 epsps (aroA:CP4)
Alfalfa	J163	MON-ØØ163-7	T1	cp4 epsps (aroA:CP4)
Canola*	23-18-17 (Event 18)	CGN-89465-2	T2	te
Canola*	23-198 (Event 23)	CGN-89465-2	T2	te
Canola*	61061	DP-Ø61Ø61-7	T1	gat4621
Canola*	73496	DP-Ø73496-4	T1	gat4621
Canola*	GT200 (RT200)	MON-89249-2	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	GT73 (RT73)	MON-ØØØ73-7	T1	cp4 epsps (aroA:CP4); goxv247
Canola*	HCN10 (Topas 19/2)	-	T3	bar
Canola*	HCN28 (T45)	ACS-BNØØ8-2	T3	pat (syn)
Canola*	HCN92 (Topas 19/2)	ACS-BNØØ7-1	T3	bar
Canola*	MON88302	MON-883Ø2-9	T1	cp4 epsps (aroA:CP4)
Canola*	MPS961	-	T4	phyA
Canola*	MPS962	-	T4	phyA
Canola*	MPS963	-	T4	phyA
Canola*	MPS964	-	T4	phyA
Canola*	MPS965	-	T4	phyA
Canola*	MS1 (B91-4)	ACS-BNØØ4-7	T3	bar
Canola*	MS8	ACS-BNØØ5-8	T3	bar
Canola*	OXY-235	ACS-BNØ11-5	T5	bxn
Canola*	PHY14	-	T3	bar
Canola*	PHY23	-	T3	bar
Canola*	PHY35	-	T3	bar
Canola*	PHY36	-	T3	bar
Canola*	RF1 (B93-101)	ACS-BNØØ1-4	T3	bar
Canola*	RF2 (B94-2)	ACS-BNØØ2-5	T3	bar
Canola*	RF3	ACS-BNØØ3-6	T3	bar

Bean	EMBRAPA 5.1	EMB-PV051-1	T6	ac1 (sense and antisense)
Brinjal #	EE-1	-	T7	cry1Ac
Cotton	19-51a	DD-Ø1951A-7	T11	S4-HrA
Cotton	281-24-236	DAS-24236-5	T3,T7	pat (syn); cry1F
Cotton	3006-210-23	DAS-21Ø23-5	T3,T7	pat (syn); cry1Ac
Cotton	31707	-	T5,T7	bxn; cry1Ac
Cotton	31803	-	T5,T7	bxn; cry1Ac
Cotton	31807	-	T5,T7	bxn; cry1Ac
Cotton	31808	-	T5,T7	bxn; cry1Ac
Cotton	42317	-	T5,T7	bxn; cry1Ac
Cotton	BNLA-601	-	T7	cry1Ac
Cotton	BXN10211	BXN10211-9	T5	bxn; cry1Ac
Cotton	BXN10215	BXN10215-4	T5	bxn; cry1Ac
Cotton	BXN10222	BXN10222-2	T5	bxn; cry1Ac
Cotton	BXN10224	BXN10224-4	T5	bxn; cry1Ac
Cotton	COT102	SYN-IR102-7	T7	vip3A(a)
Cotton	COT67B	SYN-IR67B-1	T7	cry1Ab
Cotton	COT202	-	T7	vip3A
Cotton	Event 1	-	T7	cry1Ac
Cotton	GMF Cry1A	GTL-GMF311-7	T7	cry1Ab-Ac
Cotton	GHB119	BCS-GH005-8	T7	cry2Ae
Cotton	GHB614	BCS-GH002-5	T1	2mepsps
Cotton	GK12	-	T7	cry1Ab-Ac
Cotton	LLCotton25	ACS-GH001-3	T3	bar
Cotton	MLS 9124	-	T7	cry1C
Cotton	MON1076	MON-89924-2	T7	cry1Ac
Cotton	MON1445	MON-01445-2	T1	cp4 epsps (aroA:CP4)
Cotton	MON15985	MON-15985-7	T7	cry1Ac; cry2Ab2
Cotton	MON1698	MON-89383-1	T7	cp4 epsps (aroA:CP4)
Cotton	MON531	MON-00531-6	T7	cry1Ac
Cotton	MON757	MON-00757-7	T7	cry1Ac
Cotton	MON88913	MON-88913-8	T1	cp4 epsps (aroA:CP4)
Cotton	Nqwe Chi 6 Bt	-	T7	-
Cotton	SKG321	-	T7	cry1A; CpTI
Cotton	T303-3	BCS-GH003-6	T3,T7	cry1Ab; bar
Cotton	T304-40	BCS-GH004-7	T3,T7	cry1Ab; bar
Cotton	CE43-67B	-	T7	cry1Ab
Cotton	CE46-02A	-	T7	cry1Ab
Cotton	CE44-69D	-	T7	cry1Ab
Cotton	1143-14A	-	T7	cry1Ab
Cotton	1143-51B	-	T7	cry1Ab

Cotton	T342-142	-	T7	cry1Ab
Cotton	PV-GHGT07 (1445)	-	T1	cp4 epsps (aroA:CP4)
Cotton	EE-GH3	-	T1	mepsps
Cotton	EE-GH5	-	T7	cry1Ab
Cotton	MON88701	MON-88701-3	T3,T12	Modified dmo; bar
Cotton	OsCr11	-	T13	Modified Cry j
Flax	FP967	CDC-FL001-2	T11	als
Lentil	RH44	-	T16	als
Maize	3272	SYN-E3272-5	T17	amy797E
Maize	5307	SYN-05307-1	T7	ecry3.1Ab
Maize	59122	DAS-59122-7	T3,T7	cry34Ab1; cry35Ab1; pat
Maize	676	PH-000676-7	T3,T18	pat; dam
Maize	678	PH-000678-9	T3,T18	pat; dam
Maize	680	PH-000680-2	T3,T18	pat; dam
Maize	98140	DP-098140-6	T1,T11	gat4621; zm-hra
Maize	Bt10	-	T3,T7	cry1Ab; pat
Maize	Bt176 (176)	SYN-EV176-9	T3,T7	cry1Ab; bar
Maize	BVLA430101	-	T4	phyA2
Maize	CBH-351	ACS-ZM004-3	T3,T7	cry9C; bar
Maize	DAS40278-9	DAS40278-9	T19	aad-1
Maize	DBT418	DKB-89614-9	T3,T7	cry1Ac; pinII; bar
Maize	DLL25 (B16)	DKB-89790-5	T3	bar
Maize	GA21	MON-00021-9	T1	mepsps
Maize	GG25	-	T1	mepsps
Maize	GJ11	-	T1	mepsps
Maize	Fl117	-	T1	mepsps
Maize	GAT-ZM1	-	T3	pat
Maize	LY038	REN-00038-3	T20	cordapA
Maize	MIR162	SYN-IR162-4	T7	vip3Aa20
Maize	MIR604	SYN-IR604-5	T7	mcry3A
Maize	MON801 (MON80100)	MON801	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON802	MON-80200-7	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON809	PH-MON-809-2	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON810	MON-00810-6	T1,T7	cry1Ab; cp4 epsps (aroA:CP4); goxv247
Maize	MON832	-	T1	cp4 epsps (aroA:CP4); goxv247
Maize	MON863	MON-00863-5	T7	cry3Bb1
Maize	MON87427	MON-87427-7	T1	cp4 epsps (aroA:CP4)
Maize	MON87460	MON-87460-4	T21	cspB
Maize	MON88017	MON-88017-3	T1,T7	cry3Bb1; cp4 epsps (aroA:CP4)
Maize	MON89034	MON-89034-3	T7	cry2Ab2; cry1A.105

Maize	MS3	ACS-ZM001-9	T3,T18	bar; barnase
Maize	MS6	ACS-ZM005-4	T3,T18	bar; barnase
Maize	NK603	MON-00603-6	T1	cp4 epsps (aroA:CP4)
Maize	T14	ACS-ZM002-1	T3	pat (syn)
Maize	T25	ACS-ZM003-2	T3	pat (syn)
Maize	TC1507	DAS-01507-1	T3,T7	cry1Fa2; pat
Maize	TC6275	DAS-06275-8	T3,T7	mocry1F; bar
Maize	VIP1034	-	T3,T7	vip3A; pat
Maize	43A47	DP-043A47-3	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Maize	40416	DP-040416-8	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Maize	32316	DP-032316-8	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Maize	4114	DP-004114-3	T3,T7	cry1F; cry34Ab1; cry35Ab1; pat
Melon	Melon A	-	T22	sam-k
Melon	Melon B	-	T22	sam-k
Papaya	55-1	CUH-CP551-8	T6	prsv cp
Papaya	63-1	CUH-CP631-7	T6	prsv cp
Papaya	Huanong No. 1	-	T6	prsv rep
Papaya	X17-2	UFL-X17CP-6	T6	prsv cp
Plum	C-5	ARS-PLMC5-6	T6	ppv cp
Canola**	ZSR500	-	T1	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR502	-	T1	cp4 epsps (aroA:CP4); goxv247
Canola**	ZSR503	-	T1	cp4 epsps (aroA:CP4); goxv247
Rice	7Crp#242-95-7	-	T13	7crp
Rice	7Crp#10	-	T13	7crp
Rice	GM Shanyou 63	-	T7	cry1Ab; cry1Ac
Rice	Huahui-1/TT51-1	-	T7	cry1Ab; cry1Ac
Rice	LLRICE06	ACS-OS001-4	T3	bar
Rice	LLRICE601	BCS-OS003-7	T3	bar
Rice	LLRICE62	ACS-OS002-5	T3	bar
Rice	Tarom molaii + cry1Ab	-	T7	cry1Ab (truncated)
Rice	GAT-OS2	-	T3	bar
Rice	GAT-OS3	-	T3	bar
Rice	PE-7	-	T7	Cry1Ac
Rice	7Crp#10	-	T13	7crp
Rice	KPD627-8	-	T27	OASA1D
Rice	KPD722-4	-	T27	OASA1D
Rice	KA317	-	T27	OASA1D
Rice	HW5	-	T27	OASA1D
Rice	HW1	-	T27	OASA1D
Rice	B-4-1-18	-	T28	Δ OsBRI1
Rice	G-3-3-22	-	T29	OSGA2ox1

Rice	AD77	-	T6	DEF
Rice	AD51	-	T6	DEF
Rice	AD48	-	T6	DEF
Rice	AD41	-	T6	DEF
Rice	13pNasNa800725atAprt1	-	T30	HvNAS1; HvNAAT-A; APRT
Rice	13pAprt1	-	T30	APRT
Rice	gHvNAS1-gHvNAAT-1	-	T30	HvNAS1; HvNAAT-A; HvNAAT-B
Rice	gHvIDS3-1	-	T30	HvIDS3
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-0ZW20-7	T6	zymv cp, wmv cp
Sugar Beet	GTSB77 (T9100152)	SY-GTSB77-8	T1	cp4 epsps (aroA:CP4); goxv247
Sugar Beet	H7-1	KM-000H71-4	T1	cp4 epsps (aroA:CP4)
Sugar Beet	T120-7	ACS-BV001-3	T3	pat
Sugar Beet	T227-1	-	T1	cp4 epsps (aroA:CP4)
Sugarcane	NXI-1T	-	T21	EcbetA
Sunflower	X81359	-	T16	als
Pepper	PK-SP01	-	T6	cmv cp
Tobacco	C/F/93/08-02	-	T5	bxn
Tobacco	Vector 21-41	-	T36	NtQPT1 (antisense)
Sunflower	X81359	-	T16	als
Wheat	MON71800	MON-718ØØ-3	T1	cp4 epsps (aroA:CP4)

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

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

Compounds of this invention can also be mixed with one or more other biologically active compounds or agents including herbicides, herbicide safeners, fungicides, insecticides, nematocides, bactericides, acaricides, growth regulators such as insect molting inhibitors and rooting stimulants, chemosterilants, semiochemicals, repellents, attractants, pheromones, feeding stimulants, plant nutrients, other biologically active compounds or entomopathogenic bacteria, virus or fungi to form a multi-component pesticide giving an even broader spectrum of agricultural protection. Mixtures of the compounds of the invention with other herbicides can broaden the spectrum of activity against additional weed

species, and suppress the proliferation of any resistant biotypes. Thus the present invention also pertains to a composition comprising a compound of Formula **1** (in a herbicidally effective amount) and at least one additional biologically active compound or agent (in a biologically effective amount) and can further comprise at least one of a surfactant, a solid diluent or a liquid diluent. The other biologically active compounds or agents can be formulated in compositions comprising at least one of a surfactant, solid or liquid diluent. For mixtures of the present invention, one or more other biologically active compounds or agents can be formulated together with a compound of Formula **1**, to form a premix, or one or more other biologically active compounds or agents can be formulated separately from the compound of Formula **1**, and the formulations combined together before application (e.g., in a spray tank) or, alternatively, applied in succession.

A mixture of one or more of the following herbicides with a compound of this invention may be particularly useful for weed control: acetochlor, acifluorfen and its sodium salt, aclonifen, acrolein (2-propenal), alachlor, alloxydim, ametryn, amicarbazone, amidosulfuron, aminocyclopyrachlor and its esters (e.g., methyl, ethyl) and salts (e.g., sodium, potassium), aminopyralid, amitrole, ammonium sulfamate, anilofos, asulam, atrazine, azimsulfuron, beflubutamid, benazolin, benazolin-ethyl, bencarbazone, benfluralin, benfuresate, bensulfuron-methyl, bensulide, bentazone, benzobicyclon, benzofenap, bicyclopyrone, bifenox, bilanafos, bispyribac and its sodium salt, bromacil, bromobutide, bromofenoxim, bromoxynil, bromoxynil octanoate, butachlor, butafenacil, butamifos, butralin, butroxydim, butylate, cafenstrole, carbetamide, carfentrazone-ethyl, catechin, chlomethoxyfen, chloramben, chlorbromuron, chlorflurenol-methyl, chloridazon, chlorimuron-ethyl, chlorotoluron, chlorpropham, chlorsulfuron, chlorthal-dimethyl, chlorthiamid, cinidon-ethyl, cinmethylin, cinosulfuron, clacyfos, clefoxydim, clethodim, clodinafop-propargyl, clomazone, clomeprop, clopyralid, clopyralid-olamine, cloransulam-methyl, cumyluron, cyanazine, cycloate, cyclopyrimorate, cyclosulfamuron, cycloxydim, cyhalofop-butyl, 2,4-D and its butotyl, butyl, isoctyl and isopropyl esters and its dimethylammonium, diolamine and trolamine salts, daimuron, dalapon, dalapon-sodium, dazomet, 2,4-DB and its dimethylammonium, potassium and sodium salts, desmedipham, desmetryn, dicamba and its diglycolammonium, dimethylammonium, potassium and sodium salts, dichlobenil, dichlorprop, diclofop-methyl, diclosulam, difenzoquat metilsulfate, diflufenican, diflufenzopyr, dimefuron, dimepiperate, dimethachlor, dimethametryn, dimethenamid, dimethenamid-P, dimethipin, dimethylarsinic acid and its sodium salt, dinitramine, dinoterb, diphenamid, diquat dibromide, dithiopyr, diuron, DNOC, endothal, EPTC, esprocarb, ethalfluralin, ethametsulfuron-methyl, ethiozin, ethofumesate, ethoxyfen, ethoxysulfuron, etobenzanid, fenoxaprop-ethyl, fenoxaprop-P-ethyl, fenoxasulfone, fenquinotrione, fentrazamide, fenuron, fenuron-TCA, flamprop-methyl, flamprop-M-isopropyl, flamprop-M-methyl, flazasulfuron, florasulam, fluazifop-butyl,

fluazifop-P-butyl, fluazolate, flucarbazone, flucetosulfuron, fluchloralin, flufenacet, flufenpyr, flufenpyr-ethyl, flumetsulam, flumiclorac-pentyl, flumioxazin, fluometuron, fluoroglycofen-ethyl, flupoxam, flupyrsulfuron-methyl and its sodium salt, flurenol, flurenol-butyl, fluridone, flurochloridone, fluroxypyr, flurtamone, fluthiacet-methyl, fomesafen, foramsulfuron, fosamine-ammonium, glufosinate, glufosinate-ammonium, glufosinate-P, glyphosate and its salts such as ammonium, isopropylammonium, potassium, sodium (including sesquisodium) and trimesium (alternatively named sulfosate), halauxifen, halauxifen-methyl, halosulfuron-methyl, haloxyfop-etotyl, haloxyfop-methyl, hexazinone, hydantocidin, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazaquin-ammonium, imazethapyr, imazethapyr-ammonium, imazosulfuron, indanofan, indaziflam, iofensulfuron, iodosulfuron-methyl, ioxynil, ioxynil octanoate, ioxynil-sodium, ipfencarbazone, isoproturon, isouron, isoxaben, isoxaflutole, isoxachlortole, lactofen, lenacil, linuron, maleic hydrazide, MCPA and its salts (e.g., MCPA-dimethylammonium, MCPA-potassium and MCPA-sodium, esters (e.g., MCPA-2-ethylhexyl, MCPA-butotyl) and thioesters (e.g., MCPA-thioethyl), MCPB and its salts (e.g., MCPB-sodium) and esters (e.g., MCPB-ethyl), mecoprop, mecoprop-P, mefenacet, mefluidide, mesosulfuron-methyl, mesotrione, metam-sodium, metamifop, metamitron, metazachlor, metazosulfuron, methabenzthiazuron, methylarsonic acid and its calcium, monoammonium, monosodium and disodium salts, methyldymron, metobenzuron, metobromuron, metolachlor, S-metolachlor, metosulam, metoxuron, metribuzin, metsulfuron-methyl, molinate, monolinuron, naproanilide, napropamide, napropamide-M, naptalam, neburon, nicosulfuron, norflurazon, orbencarb, orthosulfamuron, oryzalin, oxadiargyl, oxadiazon, oxasulfuron, oxaziclomefone, oxyfluorfen, paraquat dichloride, pebulate, pelargonic acid, pendimethalin, penoxsulam, pentanochlor, pentoxazone, perfluidone, pethoxamid, pethoxyamid, phenmedipham, picloram, picloram-potassium, picolinafen, pinoxaden, piperophos, pretilachlor, primisulfuron-methyl, prodiamine, profoxydim, prometon, prometryn, propachlor, propanil, propaquizafop, propazine, propham, propisochlor, propoxycarbazone, propyrisulfuron, propyzamide, prosulfocarb, prosulfuron, pyraclonil, pyraflufen-ethyl, pyrasulfotole, pyrazogyl, pyrazolynate, pyrazoxyfen, pyrazosulfuron-ethyl, pyribenzoxim, pyributicarb, pyridate, pyriftalid, pyriminobac-methyl, pyrimisulfan, pyrithiobac, pyrithiobac-sodium, pyroxasulfone, pyroxsulam, quinclorac, quinmerac, quinoclamine, quizalofop-ethyl, quizalofop-P-ethyl, quizalofop-P-tefuryl, rimsulfuron, saflufenacil, sethoxydim, siduron, simazine, simetryn, sulcotrione, sulfentrazone, sulfometuron-methyl, sulfosulfuron, 2,3,6-TBA, TCA, TCA-sodium, tebutam, tebuthiuron, tefuryltrione, tembotrione, tepraloxydim, terbacil, terbumeton, terbuthylazine, terbutryn, thenylchlor, thiazopyr, thiencarbazone, thifensulfuron-methyl, thiobencarb, tiafenacil, tiocarbazil, tolpyralate, topramezone, tralkoxydim, tri-allate, triafamone, triasulfuron, triaziflam, tribenuron-methyl, triclopyr, triclopyr-butotyl, triclopyr-triethylammonium, tridiphane, trietazine, trifloxysulfuron,

trifludimoxazin, trifluralin, triflusulfuron-methyl, tritosulfuron, vernolate, 3-(2-chloro-3,6-difluorophenyl)-4-hydroxy-1-methyl-1,5-naphthyridin-2(1*H*)-one, 5-chloro-3-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-1-(4-methoxyphenyl)-2(1*H*)-quinoxalinone, 2-chloro-*N*-(1-methyl-1*H*-tetrazol-5-yl)-6-(trifluoromethyl)-3-pyridinecarboxamide, 7-(3,5-dichloro-4-pyridinyl)-5-(2,2-difluoroethyl)-8-hydroxypyrido[2,3-*b*]pyrazin-6(5*H*)-one), 4-(2,6-diethyl-4-methylphenyl)-5-hydroxy-2,6-dimethyl-3(2*H*)-pyridazinone), 5-[[(2,6-difluorophenyl)methoxy]methyl]-4,5-dihydro-5-methyl-3-(3-methyl-2-thienyl)isoxazole (previously methioxolin), 4-(4-fluorophenyl)-6-[(2-hydroxy-6-oxo-1-cyclohexen-1-yl)carbonyl]-2-methyl-1,2,4-triazine-3,5(2*H*,4*H*)-dione, methyl 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoro-2-pyridinecarboxylate, 2-methyl-3-(methylsulfonyl)-*N*-(1-methyl-1*H*-tetrazol-5-yl)-4-(trifluoromethyl)benzamide and 2-methyl-*N*-(4-methyl-1,2,5-oxadiazol-3-yl)-3-(methylsulfinyl)-4-(trifluoromethyl)benzamide. Other herbicides also include bioherbicides such as *Alternaria destruens* Simmons, *Colletotrichum gloeosporiodes* (Penz.) Penz. & Sacc., *Drechsiera monoceras* (MTB-951), *Myrothecium verrucaria* (Albertini & Schweinitz) Ditmar: Fries, *Phytophthora palmivora* (Butl.) Butl. and *Puccinia thlaspeos* Schub.

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

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

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

including these additional components may expand the spectrum of weeds controlled beyond the spectrum controlled by the compound of Formula **1** alone.

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

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

Compounds of this invention can also be used in combination with herbicide safeners such as allidochlor, benoxacor, cloquintocet-mexyl, cumyluron, cyometrinil, cyprosulfonamide, daimuron, dichlormid, dicyclonon, dietholate, dimepiperate, fenchlorazole-ethyl, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen-ethyl, mefenpyr-diethyl, mephenate, methoxyphenone naphthalic anhydride (1,8-naphthalic anhydride), oxabetrinil, *N*-(aminocarbonyl)-2-methylbenzenesulfonamide, *N*-(aminocarbonyl)-2-fluorobenzenesulfonamide, 1-bromo-4-[(chloromethyl)sulfonyl]benzene (BCS), 4-(dichloroacetyl)-1-oxa-4-azospiro[4.5]decane (MON 4660), 2-(dichloromethyl)-2-methyl-1,3-dioxolane (MG 191), ethyl 1,6-dihydro-1-(2-methoxyphenyl)-6-oxo-2-phenyl-5-pyrimidinecarboxylate, 2-hydroxy-*N*,*N*-dimethyl-6-(trifluoromethyl)pyridine-3-carboxamide, and 3-oxo-1-cyclohexen-l-yl 1-(3,4-dimethylphenyl)-l,6-dihydro-6-oxo-2-phenyl-5-pyrimidinecarboxylate, 2,2-dichloro-1-(2,2,5-trimethyl-3-oxazolidinyl)-ethanone and 2-methoxy-*N*-[[4-[[(methylamino)carbonyl]amino]phenyl]sulfonyl]-benzamide to increase safety to certain crops. Antidotally effective amounts of the herbicide safeners can be applied at the same time as the compounds of this invention, or applied as seed treatments. Therefore an aspect of the present invention relates to a herbicidal mixture

comprising a compound of this invention and an antidotally effective amount of a herbicide safener. Seed treatment is particularly useful for selective weed control, because it physically restricts antidoting to the crop plants. Therefore a particularly useful embodiment of the present invention is a method for selectively controlling the growth of undesired vegetation in a crop comprising contacting the locus of the crop with a herbicidally effective amount of a compound of this invention wherein seed from which the crop is grown is treated with an antidotally effective amount of safener. Antidotally effective amounts of safeners can be easily determined by one skilled in the art through simple experimentation.

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

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

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

TABLE A1

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	2,4-D	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Acetochlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Acifluorfen	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Aclonifen	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
1	Alachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Ametryn	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Amicarbazone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Amidosulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
1	Aminocyclopyrachlor	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
1	Aminopyralid	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Amitrole	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Anilofos	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Asulam	1:960 – 2:1	1:320 – 1:3	1:120 – 1:14
1	Atrazine	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Azimsulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
1	Beflubutamid	1:342 – 4:1	1:114 – 2:1	1:42 – 1:5
1	Benfuresate	1:617 – 2:1	1:205 – 1:2	1:77 – 1:9
1	Bensulfuron-methyl	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Bentazone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Benzobicyclon	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
1	Benzofenap	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
1	Bicyclopyrone	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Bifenox	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
1	Bispyribac-sodium	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Bromacil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Bromobutide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Bromoxynil	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Butachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Butafenacil	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Butylate	1:1542 – 1:2	1:514 – 1:5	1:192 – 1:22
1	Carfenstrole	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Carfentrazone-ethyl	1:128 – 9:1	1:42 – 3:1	1:16 – 1:2
1	Chlorimuron-ethyl	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Chlorotoluron	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Chlorsulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
1	Cincosulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Cinidon-ethyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Cinmethylin	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Clacyfos	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Clethodim	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Clodinafop-propargyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Clomazone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Clomeprop	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
1	Clopyralid	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Cloransulam-methyl	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
1	Cumyluron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Cyanazine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Cyclopyrimorate	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Cyclosulfamuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Cycloxydim	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Cyhalofop	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Daimuron	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Desmedipham	1:322 – 4:1	1:107 – 2:1	1:40 – 1:5
1	Dicamba	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Dichlobenil	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
1	Dichlorprop	1:925 – 2:1	1:308 – 1:3	1:115 – 1:13
1	Diclofop-methyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Diclosulam	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Difenzoquat	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Diflufenican	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
1	Diflufenzopyr	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
1	Dimethachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Dimethametryn	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Dimethenamid-P	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Dithiopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Diuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	EPTC	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Esprocarb	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
1	Ethalfluralin	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Ethametsulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Ethoxyfen	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Ethoxysulfuron	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Etobenzanid	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
1	Fenoxaprop-ethyl	1:120 – 10:1	1:40 – 4:1	1:15 – 1:2
1	Fenoxasulfone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Fenquinotrione	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Fentrazamide	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Flazasulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Florasulam	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
1	Fluazifop-butyl	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Flucarbazone	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Flucetosulfuron	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Flufenacet	1:257 – 5:1	1:85 – 2:1	1:32 – 1:4
1	Flumetsulam	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
1	Flumiclorac-pentyl	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Flumioxazin	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Fluometuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Flupyrsulfuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
1	Fluridone	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Fluroxypyr	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Flurtamone	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
1	Fluthiacet-methyl	1:48 – 42:1	1:16 – 14:1	1:3 – 3:1
1	Fomesafen	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Foramsulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
1	Glufosinate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Glyphosate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Halosulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Halauxifen	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Halauxifen methyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Haloxyfop-methyl	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Hexazinone	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Hydantocidin	1:1100 – 16:1	1:385 – 8:1	1:144 – 4:1
1	Imazamox	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
1	Imazapic	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Imazapyr	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
1	Imazaquin	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Imazethabenz-methyl	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
1	Imazethapyr	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
1	Imazosulfuron	1:27 – 42:1	1:9 – 14:1	1:3 – 3:1
1	Indanofan	1:342 – 4:1	1:114 – 2:1	1:42 – 1:5

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Indaziflam	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Iodosulfuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
1	Ioxynil	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Ipfencarbazone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
1	Isoproturon	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Isoxaben	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Isoxaflutole	1:60 – 20:1	1:20 – 7:1	1:7 – 2:1
1	Lactofen	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Lenacil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Linuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	MCPA	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	MCPB	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Mecoprop	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Mefenacet	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Mefluidide	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Mesosulfuron-methyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
1	Mesotrione	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Metamifop	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Metazachlor	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Metazosulfuron	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Methabenzthiazuron	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Metolachlor	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Metosulam	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Metribuzin	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Metsulfuron-methyl	1:2 – 560:1	1:1 – 187:1	3:1 – 35:1
1	Molinate	1:1028 – 2:1	1:342 – 1:3	1:128 – 1:15
1	Napropamide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Napropamide-M	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Naptalam	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Nicosulfuron	1:12 – 96:1	1:4 – 32:1	1:1 – 6:1
1	Norflurazon	1:1152 – 1:1	1:384 – 1:3	1:144 – 1:16
1	Orbencarb	1:1371 – 1:2	1:457 – 1:4	1:171 – 1:20
1	Orthosulfamuron	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Oryzalin	1:514 – 3:1	1:171 – 1:2	1:64 – 1:8
1	Oxadiargyl	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Oxadiazon	1:548 – 3:1	1:182 – 1:2	1:68 – 1:8
1	Oxasulfuron	1:27 – 42:1	1:9 – 14:1	1:3 – 3:1
1	Oxaziclomefone	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Oxyfluorfen	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Paraquat	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Pendimethalin	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Penoxsulam	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Penthoxamid	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Pentoxazone	1:102 – 12:1	1:34 – 4:1	1:12 – 1:2
1	Phenmedipham	1:102 – 12:1	1:34 – 4:1	1:12 – 1:2
1	Picloram	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Picolinafen	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Pinoxaden	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Pretilachlor	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Primisulfuron-methyl	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Prodiamine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Profoxydim	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Prometryn	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Propachlor	1:1152 – 1:1	1:384 – 1:3	1:144 – 1:16
1	Propanil	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Propaquizafop	1:48 – 24:1	1:16 – 8:1	1:6 – 2:1
1	Propoxycarbazone	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Propyrisulfuron	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Propyzamide	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Prosulfocarb	1:1200 – 1:2	1:400 – 1:4	1:150 – 1:17
1	Prosulfuron	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
1	Pyraclonil	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Pyraflufen-ethyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
1	Pyrasulfotole	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
1	Pyrazolynate	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
1	Pyrazosulfuron-ethyl	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Pyrazoxyfen	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
1	Pyribenzoxim	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Pyributicarb	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Pyridate	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Pyriftalid	1:10 – 112:1	1:3 – 38:1	1:1 – 7:1
1	Pyriminobac-methyl	1:20 – 56:1	1:6 – 19:1	1:2 – 4:1
1	Pyrimisulfan	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Pyrithiobac	1:24 – 48:1	1:8 – 16:1	1:3 – 3:1
1	Pyroxasulfone	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
1	Pyroxsulam	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
1	Quinclorac	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Quizalofop-ethyl	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Rimsulfuron	1:13 – 84:1	1:4 – 28:1	1:1 – 6:1
1	Saflufenacil	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Sethoxydim	1:96 – 12:1	1:32 – 4:1	1:12 – 1:2
1	Simazine	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Sulcotrione	1:120 – 10:1	1:40 – 4:1	1:15 – 1:2
1	Sulfentrazone	1:147 – 8:1	1:49 – 3:1	1:18 – 1:3
1	Sulfometuron-methyl	1:34 – 34:1	1:11 – 12:1	1:4 – 3:1
1	Sulfosulfuron	1:8 – 135:1	1:2 – 45:1	1:1 – 9:1
1	Tebuthiuron	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Tefuryltrione	1:42 – 27:1	1:14 – 9:1	1:5 – 2:1
1	Tembotrione	1:31 – 37:1	1:10 – 13:1	1:3 – 3:1
1	Tepraloxydim	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Terbacil	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Terbuthylazine	1:857 – 2:1	1:285 – 1:3	1:107 – 1:12
1	Terbutryn	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Thenylchlor	1:85 – 14:1	1:28 – 5:1	1:10 – 1:2
1	Thiazopyr	1:384 – 3:1	1:128 – 1:1	1:48 – 1:6
1	Thiencarbazone	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
1	Thifensulfuron-methyl	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1
1	Tiafenacil	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	Thiobencarb	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Tolpyralate	1:31 – 37:1	1:10 – 13:1	1:3 – 3:1
1	Topramzone	1:6 – 168:1	1:2 – 56:1	1:1 – 11:1
1	Tralkoxydim	1:68 – 17:1	1:22 – 6:1	1:8 – 2:1
1	Triafamone	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
1	Triallate	1:768 – 2:1	1:256 – 1:2	1:96 – 1:11
1	Triasulfuron	1:5 – 224:1	1:1 – 75:1	1:1 – 14:1

Component (a) (Compound #)	Component (b)	Typical Weight Ratio	More Typical Weight Ratio	Most Typical Weight Ratio
1	Triaziflam	1:171 – 7:1	1:57 – 3:1	1:21 – 1:3
1	Tribenuron-methyl	1:3 – 336:1	1:1 – 112:1	2:1 – 21:1
1	Triclopyr	1:192 – 6:1	1:64 – 2:1	1:24 – 1:3
1	Trifloxysulfuron	1:2 – 420:1	1:1 – 140:1	2:1 – 27:1
1	Trifludimoxazin	1:25 – 45:1	1:8 – 15:1	1:3 – 3:1
1	Trifluralin	1:288 – 4:1	1:96 – 2:1	1:36 – 1:4
1	Triflusulfuron-methyl	1:17 – 68:1	1:5 – 23:1	1:2 – 5:1
1	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 1 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 2" (i.e. Compound 2 identified in Index Table A), and the first line below the column headings in Table A2 specifically discloses a mixture of Compound 2 with 2,4-D. Tables A3 through A7 are constructed similarly.

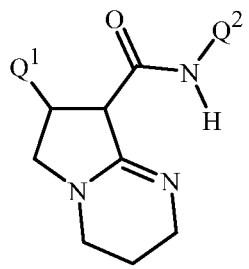
Table Number	Component (a) Column Entries	Table Number	Component (a) Column Entries
A2	Compound 2	A16	Compound 16
A3	Compound 3	A17	Compound 17
A4	Compound 4	A18	Compound 18
A5	Compound 5	A19	Compound 19
A6	Compound 6	A20	Compound 20
A7	Compound 7	A21	Compound 21
A8	Compound 8	A22	Compound 22
A9	Compound 9	A23	Compound 23
A10	Compound 10	A24	Compound 24
A11	Compound 11	A25	Compound 25
A12	Compound 12	A26	Compound 26
A13	Compound 13	A27	Compound 27
A14	Compound 14	A28	Compound 28
A15	Compound 15		

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 chlorimuron-ethyl, nicosulfuron, mesotrione,

thifensulfuron-methyl, flupyrsulfuron-methyl, tribenuron, pyroxasulfone, pinoxaden, tembotrione, pyroxsulam, metolachlor and *S*-metolachlor.

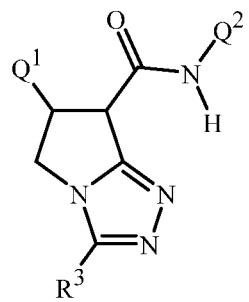
The following Tests demonstrate the control efficacy of the compounds of this invention against specific weeds. The weed control afforded by the compounds is not limited, however, to these species. See Index Tables A through D for compound descriptions. The abbreviation "Cmpd. No." stands for "Compound Number". The abbreviation "Ex." stands for "Example" and is followed by a number indicating in which Synthesis Example the compound is prepared. Mass spectra (MS) are reported with an estimated precision within ±0.5 Da as the molecular weight of the highest isotopic abundance parent ion (M+1) formed by addition of H+ (molecular weight of 1) to the molecule, or (M–1) formed by the loss of H+ (molecular weight of 1) from the molecule, observed by using liquid chromatography coupled to a mass spectrometer (LCMS) using either atmospheric pressure chemical ionization (AP+) where "amu" stands for unified atomic mass units.

INDEX TABLE A



Cmpd. No.	Q^1	Q^2	M.S. (AP+)
1	Ph(3-CF_3)	Ph(2-F)	406.4

INDEX TABLE B

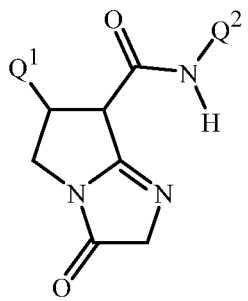


Cmpd. No.	Q^1	Q^2	R^3	m.p. (°C)
2 (Ex. 1)	Ph(3-CF_3)	Ph(2-F)	H	**
5	Ph(4-Cl)	Ph(2,3-di-F)	CH_3	389.5 (M+1)
6	Ph(4-CF_3)	Ph(2-CF_3)	CH_3	455.5(M+1)
7	Ph(4-Cl)	Ph(2,3-di-F)	H	375.4 (M+1)

Cmpd. No.	Q^1	Q^2	R^3	m.p. (°C)
8 (Ex. 4)	Ph(4-CF_3)	Ph(2,3-di-F)	CH_2CH_3	437.5 (M+1)
9	Ph(4-CH_2CH_3)	Ph(3-F,2-CH_3)	CH_3	379.6(M+1)
10	Ph(3,4-di-CH_3)	Ph(3-F,2-CH_3)	CH_3	379.6(M+1)
11	Ph(4-CH_2CH_3)	Ph(2,3-di-F)	H	369.5(M+1)
12	Ph(4-CF_3)	Ph(2,3-di-F)	H	409.5(M+1)
13	Ph(4-CH_3)	Ph(2-F)	H	337.2(M+1)
14	Ph(3,4-di-CH_3)	Ph(2-SCH_3)	CH_3	393.6(M+1)
15	Ph(4-CH_2CH_3)	Ph(2-SCH_3)	CH_3	393.6(M+1)
16	Ph(3,4-di-CH_3)	Ph(2,3-di-F)	H	369.5(M+1)
17	Ph(4-CF_3)	Ph(2,3-di-F)	*n*-Pr	451.6(M+1)
18	Ph(3,4-di-CH_3)	Ph(2-SCH_3)	H	379.6(M+1)
19	Ph(3,4-di-CH_3)	Ph(2,3-di-F)	CH_3	383.5(M+1)
20	Ph(4-Cl)	Ph(6-F)	H	357.4 (M+1)
21	Ph(4-Cl)	Ph(2-F)	CH_3	371.5(M+1)
22 (Ex. 5)	Ph(4-CF_3)	Ph(2,3-di-F)	CF_3	477.5(M+1)
23	Ph(4-CH_2CH_3)	Ph(2,3-di-F)	CH_3	383.5(M+1)
24 (Ex. 3)	Ph(4-CF_3)	Ph(2-F)	CH_3	405.5(M+1)
25	Ph(4-CH_2CH_3)	Ph(2-SCH_3)	H	379.5(M+1)
26	Ph(3,4-di-CH_3)	Ph(3-F,2-CH_3)	H	365.6(M+1)
27	Ph(4-CH_3)	Ph(2-F)	CH_3	351.5(M+1)
28	Ph(4-CH_2CH_3)	Ph(3-F,2-CH_3)	H	365.6(M+1)

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

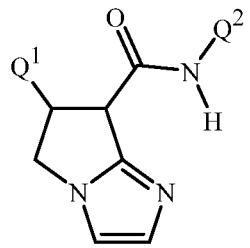
INDEX TABLE C



Cmpd. No.	Q^1	Q^2	m.p. (°C)
3 (Ex. 2)	Ph(3-CF_3)	Ph(2-F)	**

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

INDEX TABLE D



Cmpd. No.	Q^1	Q^2	M.S. (AP+)
4	Ph(3-CF_3)	Ph(2-F)	390

BIOLOGICAL EXAMPLES OF THE INVENTION

TEST A

Seeds of plant species selected from barnyardgrass (*Echinochloa crus-galli*), kochia (*Kochia scoparia*), ragweed (common ragweed, *Ambrosia elatior*), ryegrass, Italian (Italian ryegrass, *Lolium multiflorum*), foxtail, giant (giant foxtail, *Setaria faberii*), and pigweed (*Amaranthus retroflexus*), were planted into a blend of loam soil and sand and treated preemergence with a directed soil spray using test chemicals formulated in a non-phytotoxic solvent mixture which included a surfactant.

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

Table A	Compounds			
500 g ai/ha	1	2	3	4
Postemergence				
Barnyardgrass	60	80	30	60
Blackgrass	0	70	0	40
Corn	20	40	0	0
Foxtail, Giant	40	90	50	70
Galium	0	50	0	0
Kochia	0	30	0	0
Pigweed	0	10	0	0

Table A	Compounds			
125 g ai/ha	1	2	3	4
Postemergence				
Barnyardgrass	0	60	0	20
Blackgrass	0	40	0	20
Corn	0	20	0	0
Foxtail, Giant	0	50	20	20
Galium	0	50	0	0
Kochia	0	0	0	0
Pigweed	0	0	0	0

Ragweed	0	10	0	0	Ragweed	0	0	0	0		
Ryegrass, Italian	0	50	10	0	Ryegrass, Italian	0	0	0	0		
Wheat	0	50	0	20	Wheat	0	0	0	0		

Table A Compounds

500 g ai/ha	5	6	7	8	9	10	11	12	13	14	15
Postemergence											
Barnyardgrass	80	40	70	50	70	90	80	90	90	20	0
Blackgrass	20	20	0	0	70	70	20	60	40	20	0
Corn	30	0	30	0	0	40	30	60	20	0	0
Foxtail, Giant	80	30	70	60	50	80	70	90	80	20	0
Galium	70	30	50	50	20	50	50	70	40	0	0
Kochia	30	0	40	40	0	30	50	60	30	0	0
Pigweed	20	0	50	60	0	0	0	70	0	0	0
Ragweed	20	0	60	20	0	20	30	50	30	0	0
Ryegrass, Italian	20	20	20	0	20	30	50	60	0	0	0
Wheat	20	0	20	0	0	30	20	40	0	0	0

Table A Compounds

500 g ai/ha	16	17	18	19	20	21	22	23	24	25	26	27	28
Postemergence													
Barnyardgrass	80	30	30	90	60	40	0	90	80	30	80	90	80
Blackgrass	60	20	0	70	0	20	0	20	50	0	50	20	40
Corn	70	0	0	30	80	0	0	20	40	0	0	0	0
Foxtail, Giant	80	30	20	80	70	70	0	70	80	30	80	90	60
Galium	50	50	20	50	50	50	0	30	60	0	0	40	30
Kochia	30	50	20	20	40	0	0	30	0	30	0	0	50
Pigweed	0	40	0	0	0	0	0	0	20	0	0	0	0
Ragweed	50	0	0	20	20	0	0	0	0	0	0	0	0
Ryegrass, Italian	50	0	0	20	0	20	0	0	20	0	20	30	50
Wheat	50	0	0	30	20	0	0	0	30	0	0	0	0

Table A Compounds

125 g ai/ha	5	6	7	8	9	10	11	12	13	14	15
Postemergence											
Barnyardgrass	20	0	20	20	30	50	70	30	50	0	0
Blackgrass	0	0	0	0	20	0	0	0	20	0	0
Corn	20	0	20	0	0	20	0	0	0	0	0
Foxtail, Giant	30	0	20	20	0	30	40	30	60	0	0
Galium	40	0	40	30	0	0	20	30	40	0	0

Kochia	0	0	0	0	0	0	40	20	0	0	0
Pigweed	0	0	0	20	0	0	0	0	0	0	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	30	0	0	0	0	0

Table A Compounds

125 g ai/ha	16	17	18	19	20	21	22	23	24	25	26	27	28
Postemergence													
Barnyardgrass	60	0	0	60	20	0	0	50	30	20	50	40	50
Blackgrass	0	0	0	0	0	0	0	0	0	0	0	0	20
Corn	0	0	0	0	20	0	0	0	0	0	20	0	0
Foxtail, Giant	60	0	0	30	20	0	0	30	40	0	50	30	40
Galium	40	40	20	0	30	0	0	0	0	0	30	0	20
Kochia	30	20	20	0	0	0	0	30	0	30	0	0	20
Pigweed	0	0	0	0	0	0	0	0	0	0	0	0	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0	0	30	0	0

Table A	Compounds				Table A	Compounds			
500 g ai/ha	1	2	3	4	125 g ai/ha	1	2	3	4
Preemergence					Preemergence				
Barnyardgrass	70	90	60	90	Barnyardgrass	0	60	0	20
Foxtail, Giant	60	90	80	90	Foxtail, Giant	0	90	0	60
Kochia	0	0	0	0	Kochia	0	0	0	0
Pigweed	0	0	0	0	Pigweed	0	0	0	0
Ragweed	0	0	0	0	Ragweed	0	0	0	0
Ryegrass, Italian	0	0	0	0	Ryegrass, Italian	0	0	0	0

Table A Compounds

500 g ai/ha	5	6	7	8	9	10	11	12	13	14	15
Preemergence											
Barnyardgrass	80	40	70	70	70	90	90	80	70	30	0
Foxtail, Giant	90	90	80	90	90	90	90	90	90	60	0
Kochia	50	0	40	-	0	50	70	80	70	0	0
Pigweed	0	40	20	50	0	20	30	80	0	0	0
Ragweed	40	0	50	0	0	0	40	50	80	0	0
Ryegrass, Italian	30	60	0	0	0	70	30	60	0	0	0

Table A	Compounds												
500 g ai/ha	16	17	18	19	20	21	22	23	24	25	26	27	28
Preemergence													
Barnyardgrass	90	50	60	90	70	40	20	90	40	40	90	90	90
Foxtail, Giant	90	90	80	90	90	70	30	90	90	40	90	90	90
Kochia	80	30	0	30	90	40	0	40	60	20	30	0	60
Pigweed	0	20	0	0	0	0	0	20	20	0	0	0	0
Ragweed	50	0	30	0	50	0	0	0	30	0	0	0	30
Ryegrass, Italian	60	0	20	20	0	40	0	0	30	0	50	20	30

Table A	Compounds										
125 g ai/ha	5	6	7	8	9	10	11	12	13	14	15
Preemergence											
Barnyardgrass	30	0	30	30	40	50	70	20	60	0	0
Foxtail, Giant	50	0	40	30	60	80	80	90	70	0	0
Kochia	0	0	0	0	0	0	60	30	70	0	0
Pigweed	0	0	0	20	0	0	30	30	0	0	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	20	40	0	0	0	0	0	40	0	0	0

Table A	Compounds												
125 g ai/ha	16	17	18	19	20	21	22	23	24	25	26	27	28
Preemergence													
Barnyardgrass	70	0	20	50	20	0	0	60	0	0	60	0	60
Foxtail, Giant	90	30	0	70	30	0	0	70	30	0	80	80	70
Kochia	70	0	0	0	30	0	0	20	0	0	20	0	60
Pigweed	0	0	0	0	0	0	0	0	0	0	0	0	0
Ragweed	0	0	0	0	0	0	0	0	0	0	0	0	0
Ryegrass, Italian	0	0	0	0	0	40	0	0	0	0	0	20	0

TEST B

Plant species in the flooded paddy test selected from rice (*Oryza sativa*), sedge, umbrella (small-flower umbrella sedge, *Cyperus difformis*), ducksalad (*Heteranthera limosa*), and barnyardgrass (*Echinochloa crus-galli*) were grown to the 2-leaf stage for testing. At time of treatment, test pots were flooded to 3 cm above the soil surface, treated by application of test compounds directly to the paddy water, and then maintained at that water depth for the duration of the test. Treated plants and controls were maintained in a greenhouse for 13 to 15 days, after which time all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table B, are based on a scale of 0

to 100 where 0 is no effect and 100 is complete control. A dash (–) response means no test result.

Table B	Compounds	
500 g ai/ha	2	4
Flood		
Barnyardgrass	0	0
Ducksalad	0	0
Rice	0	0
Sedge, Umbrella	0	0

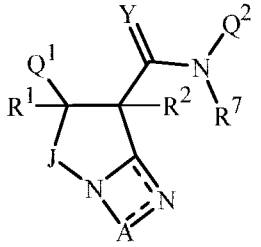
Table B	Compound
250 g ai/ha	1
Flood	
Barnyardgrass	0
Ducksalad	70
Rice	0
Sedge, Umbrella	50

Table B	Compounds												
250 g ai/ha	5	6	7	8	9	10	11	12	13	14	15	16	17
Flood													
Barnyardgrass	40	0	0	0	20	20	0	0	40	20	0	50	0
Ducksalad	20	0	50	40	75	45	95	75	45	60	50	75	30
Rice	0	0	15	0	15	0	0	0	20	0	20	15	0
Sedge, Umbrella	0	0	0	0	0	0	70	0	0	0	0	0	0

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

The Claims defining the invention are as follows:

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



1

wherein

Q^1 is a phenyl or benzyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring or an 8- to 10-membered heteroaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring or an 8- to 10-membered heteroaromatic bicyclic ring system, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members;

R^1 and R^2 are each independently H, halogen, hydroxy or C_1–C_4 alkyl;

Y is O, S or NR^{15};

A is a saturated, partially unsaturated or fully unsaturated chain containing 2 to 4 atoms selected from up to 4 carbon, up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon members are independently selected from C(=O) and C(=S) and the sulfur atom member is selected from $S(=O)_u(=NR^8)_v$; the said

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chain optionally substituted with up to 5 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently halogen, cyano, hydroxy, -CO_2H, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 alkylthio, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl, C_3–C_6 cycloalkyl or C_4–C_6 cycloalkylalkyl; or

two R^3 are taken together with the carbon atom(s) to which they are bonded to form a C_3–C_7 cycloalkyl ring;

each R^4 is independently cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

J is –CR^5R^6– or –CR^5R^6-$CR^{5a}R^{6a}$– wherein the –CR^5R^6– moiety is directly connected to N;

R^5 and R^6 are each independently H, halogen, hydroxy, C_1–C_4 alkyl or C_1–C_4 alkoxy; or

R^5 and R^6 are taken together with the carbon atom to which they are bonded to form a C_3–C_7 cycloalkyl ring;

R^{5a} and R^{6a} are each independently H, halogen or C_1–C_4 alkyl; or

R^{5a} and R^{6a} are taken together with the carbon atom to which they are bonded to form a C_3–C_7 cycloalkyl ring;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^8 is independently H, cyano, C_2–C_3 alkylcarbonyl or C_2–C_3 haloalkylcarbonyl;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8

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haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino, C_2–C_8 alkoxycarbonylamino, C_1–C_6 alkylsulfonylamino, C_1–C_6 haloalkylsulfonylamino, -SF_5, -SCN, SO_2NH_2, C_3–C_{12} trialkylsilyl, C_4–C_{12} trialkylsilylalkyl, C_4–C_{12} trialkylsilylalkoxy or G^2;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy,

C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino, C_2–C_8 alkoxycarbonylamino, C_1–C_6 alkylsulfonylamino, C_1–C_6 haloalkylsulfonylamino, -SF_5, -SCN, SO_2NH_2, C_3–C_{12} trialkylsilyl, C_4–C_{12} trialkylsilylalkyl, C_4–C_{12} trialkylsilylalkoxy or G^3;

each R^{10} and R^{12} is independently cyano, C_1–C_3 alkyl, C_2–C_3 alkenyl, C_2–C_3 alkynyl, C_3–C_6 cycloalkyl, C_2–C_3 alkoxyalkyl, C_1–C_3 alkoxy, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl, C_2–C_3 alkylaminoalkyl or C_3–C_4 dialkylaminoalkyl;

R^{15} is H, cyano, C_1–C_4 alkyl, C_1–C_4 haloalkyl, -(C=O)CH_3 or -(C=O)CF_3;

each G^1 is independently phenyl, phenylmethyl, pyridinylmethyl, pyridinyloxy, phenylcarbonyl, phenoxy, phenylethynyl, phenylsulfonyl, phenylcarbonyl(C_1–C_4 alkyl); or a 5- or 6-membered heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{13};

each G^2 is independently phenyl, phenylmethyl, pyridinylmethyl, phenylcarbonyl, phenylcarbonylalkyl, phenoxy, phenylethynyl, phenylsulfonyl or pyridyloxy; or a 5- or 6-membered heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{14}; or $R^{16}ON=CR^{17}$–, $(R^{18})_2C=NO$–, $(R^{19})_2NN=CR^{17}$–, $(R^{18})_2C=NNR^{20}$–, $R^{21}N=CR^{17}$–, $(R^{18})_2C=N$–, $R^{22}ON=CR^{17}C(R^{23})_2$– or $(R^{18})_2C=NOC(R^{23})_2$–, wherein the free bond projecting to the right indicates the connecting point to Q^1;

each G^3 is independently phenyl, phenylmethyl, pyridinylmethyl, phenylcarbonyl, phenylcarbonylalkyl, phenoxy, phenylethynyl, phenylsulfonyl or pyridyloxy; or a 5- or 6-membered heteroaromatic ring, each optionally substituted on ring members with up to 5 substituents independently selected from R^{15};

each R^{13}, R^{14} and R^{15} is independently halogen, cyano, hydroxy, amino, nitro, -CHO, -C(=O)OH, -C(=O)NH_2, -SO_2NH_2, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_2–C_6 alkynyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 haloalkoxy, C_2–C_8 alkylcarbonyloxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_1–C_6

alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl, C_1–C_6 alkylamino, C_2–C_8 dialkylamino, C_2–C_8 alkylcarbonylamino or C_1–C_6 alkylsulfonylamino;

each R^{16} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{17} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_3–C_{10} trialkylsilyl or G^1;

each R^{18} is independently H, hydroxy, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylthio, C_1–C_6 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{19} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6

alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{20} is independently H, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_6 alkoxyC_3–C_{10} trialkylsilyl or G^1;

each R^{21} is independently H, hydroxy, amino, C_1–C_6 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_1–C_6 alkoxy, C_1–C_6 alkylsulfinyl, C_1–C_6 haloalkylsulfinyl, C_3–C_8 cycloalkylsulfinyl, C_1–C_6 alkylsulfonyl, C_1–C_6 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, C_1–C_6 alkylaminosulfonyl, C_2–C_8 dialkylaminosulfonyl, C_3–C_{10} trialkylsilyl or G^1;

each R^{22} is independently H, C_1–C_4 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl;

each R^{23} is independently H, halogen, cyano, hydroxy, C_1–C_4 alkyl, C_3–C_8 cycloalkyl, C_4–C_8 cycloalkylalkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 haloalkoxy, C_2–C_4 alkoxyalkyl, C_2–C_4 alkylcarbonyl, C_2–C_4 alkoxycarbonyl or C_3–C_6 cycloalkyl; and

each u and v are independently 0, 1 or 2 in each instance of S(=O)u(=NR8)v, provided that the sum of u and v is 0, 1 or 2; and provided the compound is other than a compound of Formula **1** wherein Q^1 is Ph(3-CF_3); Q^2 is Ph(2-F); R^1 is H; R^2 is H; Y is O; A is –CH_2CH_2–; J is –CR^5R^6–; R^5 is H; R^6 is H; and R^7 is H.

2. The compound of Claim 1 wherein

Q^1 is a phenyl or benzyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring or ring system containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring or a naphthalenyl ring system, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11}; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 1 O, up to 1 S and up to 2 N atoms, wherein up to 2 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^{11} on carbon atom ring members and selected from R^{12} on nitrogen atom ring members;

R^1 and R^2 are each independently H, halogen or C_1–C_4 alkyl;

Y is O or S;

A is a saturated, partially unsaturated or fully unsaturated chain containing 2 to 4 atoms selected from up to 3 carbon, up to 1 O, up to 1 S and up to 1 N atoms, wherein up to 2 carbon members are independently selected from C(=O) and C(=S) and the sulfur atom member is selected from $S(=O)_u(=NR^8)_v$; the said chain optionally substituted with up to 3 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently halogen, cyano, hydroxy, $-CO_2H$, C_1-C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkoxy, C_1–C_4 alkylthio, C_3–C_6 cycloalkyl or C_4–C_6 cycloalkylalkyl;

each R^4 is independently C_1–C_4 alkyl, C_1–C_4 haloalkyl or C_3–C_6 cycloalkyl;

R^5 and R^6 are each independently H, halogen, hydroxy or CH_3;

R^{5a} and R^{6a} are each independently H or C_1–C_4 alkyl;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_2–C_8 alkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl or C_4–C_{10} cycloalkylaminocarbonyl;

each R^8 is independently H, cyano or C_2–C_3 alkylcarbonyl;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8

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cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy or C_4–C_{10} cycloalkylcarbonyloxy;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl, C_3–C_{10} dialkylaminoalkyl, -CHO, C_2–C_8 alkylcarbonyl, C_2–C_8 haloalkylcarbonyl, C_4–C_{10} cycloalkylcarbonyl, -C(=O)OH, C_2–C_8 alkoxycarbonyl, C_2–C_8 haloalkoxycarbonyl, C_4–C_{10} cycloalkoxycarbonyl, C_5–C_{12} cycloalkylalkoxycarbonyl, -C(=O)NH_2, C_2–C_8 alkylaminocarbonyl, C_4–C_{10} cycloalkylaminocarbonyl, C_3–C_{10} dialkylaminocarbonyl, C_1–C_8 alkoxy, C_1–C_8 haloalkoxy, C_2–C_8 alkoxyalkoxy, C_2–C_8 alkenyloxy, C_2–C_8 haloalkenyloxy, C_2–C_8 haloalkoxyhaloalkoxy, C_3–C_8 alkynyloxy, C_3–C_8 haloalkynyloxy, C_3–C_8 cycloalkoxy, C_3–C_8 halocycloalkoxy, C_4–C_{10} cycloalkylalkoxy, C_3–C_{10} alkylcarbonylalkoxy, C_2–C_8 alkylcarbonyloxy, C_2–C_8 haloalkylcarbonyloxy, C_4–C_{10} cycloalkylcarbonyloxy, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8

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alkylsulfonyl, C_1–C_8 haloalkylsulfonyl, C_3–C_8 cycloalkylsulfonyl, formylamino, C_2–C_8 alkylcarbonylamino, C_2–C_8 haloalkylcarbonylamino or C_2–C_8 alkoxycarbonylamino; and

each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl, C_2–C_3 alkoxyalkyl, C_2–C_3 alkylcarbonyl, C_2–C_3 alkoxycarbonyl or C_2–C_3 alkylaminoalkyl.

3. The compound of Claim 2 wherein

Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9; or a 5- to 6-membered fully unsaturated heterocyclic ring, each ring containing ring members selected from carbon atoms and 1 to 4 heteroatoms independently selected from up to 2 O, up to 2 S and up to 4 N atoms, wherein up to 3 carbon ring members are independently selected from C(=O) and C(=S), and the sulfur atom ring members are independently selected from $S(=O)_u(=NR^8)_v$, each ring or ring system optionally substituted with up to 5 substituents independently selected from R^9 on carbon atom ring members and selected from R^{10} on nitrogen atom ring members;

Q^2 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^{11};

R^1 and R^2 are each independently H, Cl, or CH_3;

Y is O;

A is a saturated or partially unsaturated chain containing 2 to 4 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O) and C(=S); the said chain optionally substituted with up to 2 substituents independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently cyano, $-CO_2H$, C_1–C_4 alkyl, C_1–C_4 haloalkyl, C_1–C_4 alkylthio or C_4–C_6 cycloalkylalkyl;

each R^4 is independently C_1–C_4 alkyl;

J is $–CR^5R^6–$;

R^5 and R^6 are each independently H or halogen;

R^7 is H, hydroxy, amino, C_1–C_6 alkyl, C_1–C_6 haloalkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl or C_2–C_8 alkylthioalkyl;

each R^8 is independently H;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8

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halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_2–C_8 alkylaminoalkyl, C_2–C_8 haloalkylaminoalkyl, C_4–C_{10} cycloalkylaminoalkyl or C_3–C_{10} dialkylaminoalkyl;

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl, C_6–C_{12} cycloalkylcycloalkyl, C_3–C_8 cycloalkenyl, C_3–C_8 halocycloalkenyl, C_2–C_8 alkoxyalkyl, C_2–C_8 haloalkoxyalkyl, C_3–C_8 haloalkoxyalkoxy, C_1–C_4 hydroxyalkyl, C_4–C_{10} cycloalkoxyalkyl, C_3–C_{10} alkoxyalkoxyalkyl, C_2–C_8 alkylthioalkyl, C_2–C_8 alkylsulfinylalkyl, C_2–C_8 alkylsulfonylalkyl, C_1–C_8 alkylsulfonyloxy, C_1–C_8 haloalkylsulfonyloxy, C_1–C_8 alkylthio, C_1–C_8 haloalkylthio, C_3–C_8 cycloalkylthio, C_1–C_8 alkylsulfinyl, C_1–C_8 haloalkylsulfinyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl; and

each R^{10} and R^{12} is independently C_1–C_3 alkyl, C_3–C_6 cycloalkyl or C_2–C_3 alkoxyalkyl.

4. The compound of Claim 3 wherein

Q^1 is a phenyl ring optionally substituted with up to 5 substituents independently selected from R^9;

Q^2 is a phenyl ring optionally substituted with up to 3 substituents independently selected from R^{11};

R^1 and R^2 are each independently H or Cl;

A is a saturated or partially unsaturated chain containing 2 to 3 atoms selected from up to 2 carbon and up to 1 N atoms, wherein up to 1 carbon member is independently selected from C(=O); the said chain optionally substituted with up to 1 substituent independently selected from R^3 on carbon atoms and R^4 on nitrogen atoms;

each R^3 is independently cyano, -CO_2H or C_1–C_4 alkyl;

each R^4 is CH_3;

R^5 and R^6 are each independently H or halogen;

R^7 is H, C_1–C_6 alkyl, C_2–C_6 alkenyl, C_3–C_6 alkynyl or C_2–C_8 alkoxyalkyl

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each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_3–C_8 halocycloalkyl, C_4–C_{10} alkylcycloalkyl or C_6–C_{12} cycloalkylcycloalkyl; and

each R^{11} is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy, C_1–C_8 haloalkyl, C_1–C_8 nitroalkyl, C_2–C_8 alkenyl, C_2–C_8 haloalkenyl, C_2–C_8 nitroalkenyl, C_2–C_8 alkynyl, C_2–C_8 haloalkynyl, C_4–C_{10} cycloalkylalkyl, C_4–C_{10} halocycloalkylalkyl, C_5–C_{12} alkylcycloalkylalkyl, C_5–C_{12} cycloalkylalkenyl, C_5–C_{12} cycloalkylalkynyl, C_3–C_8 cycloalkyl, C_1–C_8 alkylsulfonyl, C_1–C_8 haloalkylsulfonyl or C_3–C_8 cycloalkylsulfonyl.

5. The compound of Claim 4 wherein

Q^1 is a phenyl ring substituted with 1 to 3 substituents independently selected from R^9;

Q^2 is a phenyl ring substituted with 1 substituent independently selected from R^{11} at the 3-position;

R^1 and R^2 are each H;

A is $–CH_2CH_2CH_2–$, $–CH_2N–$, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**;

each R^9 is independently halogen, cyano, nitro, C_1–C_8 alkyl, C_1–C_4 cyanoalkyl, C_1–C_4 cyanoalkoxy or C_1–C_8 haloalkyl; and

each R^{11} is independently halogen, C_1–C_8 alkyl, C_1–C_8 haloalkyl or C_1–C_8 alkylsulfonyl.

6. The compound of Claim 5 wherein

Q^1 is a phenyl ring substituted with 1 to 2 substituents independently selected from R^9;

A is $–CH_2CH_2CH_2–$;

each R^9 is independently halogen or C_1–C_8 haloalkyl; and

each R^{11} is independently F, Cl, CH_3, CF_3 or $–SO_2CF_3$.

7. The compound of Claim 5 wherein

Q^1 is a phenyl ring substituted with 1 to 2 substituents independently selected from R^9;

A is $–NCH_2–$ wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- moiety of Formula **1**;

each R^9 is independently F, Cl, CF_3; and

each R^{11} is independently F, Cl, CH_3, CF_3 or $–SO_2CF_3$.

8. A compound of Claim 1 selected from the group consisting of
N-(2-fluorophenyl)-6,7-dihydro-6-[3-(trifluoromethyl)phenyl]-5*H*-pyrrolo[2,1-c]-1,2,4-triazole-7-carboxamide; and
N-(2-fluorophenyl)-2,3,6,7-tetrahydro-3-oxo-6-[3-(trifluoromethyl)pheny]-5*H*-pyrrolo[1,2-a]imidazole-7-carboxamide.

9. A compound of Claim 4 whererin
A is $–CH_2CH_2CH_2–$, –CH=N–, $–C(CH_3)=N–$, $–C(CH_2CH_3)=N–$, $–C(CH_2CH_2CH_3)=N–$, $–C(CF_3)=N–$, $–C(=O)CH_2–$ or –CH=CH– wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**;
each R^9 is independently halogen, cyano, nitro, $C_1–C_8$ alkyl, $C_1–C_4$ cyanoalkyl, $C_1–C_4$ cyanoalkoxy or $C_1–C_8$ haloalkyl; and
each R^{11} is independently halogen, $C_1–C_8$ alkyl, $C_1–C_8$ haloalkyl or $C_1–C_8$ alkylsulfonyl.

10. A compound of Claim 9 wherein
A is –CH=N–, $–C(CH_3)=N–$, $–C(CH_2CH_3)=N–$, $–C(CH_2CH_2CH_3)=N–$ or $–C(CF_3)=N–$wherein the bond projecting to the left is connected to nitrogen of the –N–J- moiety, and the bond projecting to the right is connected to the nitrogen of the –N=C- (or –N-CH–) moiety of Formula **1**;
each R^9 is independently halogen, $C_1–C_8$ alkyl or $C_1–C_8$ haloalkyl; and
each R^{11} is independently F, Cl, CH_3 or CF_3.

11. A herbicidal composition comprising a compound of any one of Claims 1 through 10, and at least one component selected from the group consisting of surfactants, solid diluents and liquid diluents.

12. A herbicidal composition comprising a compound of any one of Claims 1 through 10, 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.

13. A herbicidal mixture comprising (a) a compound of any one of Claims 1 through 10, and (b) at least one additional active ingredient selected from (b1) photosystem II inhibitors, (b2) acetohydroxy acid synthase (AHAS) inhibitors, (b3) acetyl-CoA carboxylase (ACCase) inhibitors, (b4) auxin mimics, (b5) 5-enol-pyruvylshikimate-3-phosphate (EPSP) synthase inhibitors, (b6) photosystem I electron diverters, (b7) protoporphyrinogen oxidase (PPO) inhibitors, (b8) glutamine synthetase (GS) inhibitors, (b9) very long chain fatty acid (VLCFA) elongase inhibitors, (b10) auxin transport inhibitors, (b11) phytoene desaturase (PDS) inhibitors, (b12) 4-hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitors, (b13)

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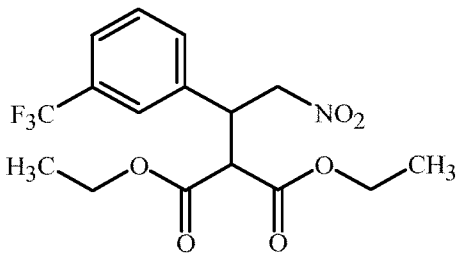
homogentisate solanesyltransferase (HST) inhibitors, (b14) cellulose biosynthesis inhibitors, (b15) other herbicides including mitotic disruptors, organic arsenicals, asulam, bromobutide, cinmethylin, cumyluron, dazomet, difenzoquat, dymron, etobenzanid, flurenol, fosamine, fosamine-ammonium, hydantocidin, metam, methyldymron, oleic acid, oxaziclomefone, pelargonic acid and pyributicarb, (b16) herbicide safeners, and salts of compounds of (b1) through (b16).

14. A method for controlling the growth of undesired vegetation comprising contacting the vegetation in agronomic crops selected from alfalfa, barley, cotton, wheat, rape, sugar beets, corn, 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 selected from eucalyptus and conifers, and turf species with a herbicidally effective amount of a compound of any one of Claims 1 through 10.

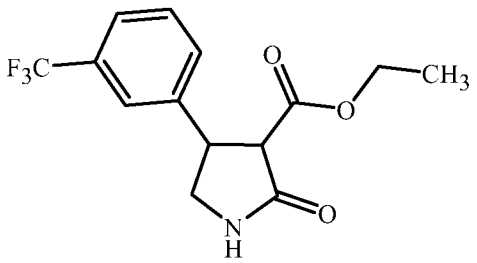
15. A compound of Formula **1B**



1B .

16. The compound of Formula **1B** in Claim 15 that is racemic.

17. A process for preparing a compound of Formula **1C**



1C

comprising reducing a compound of Formula **1B**

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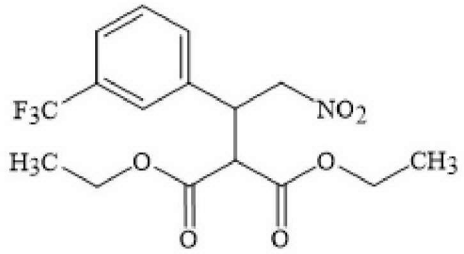
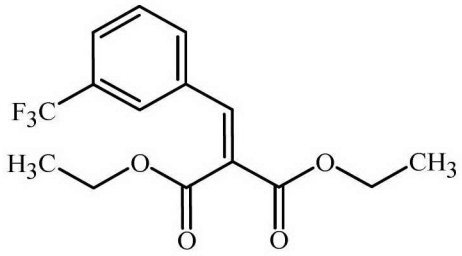


1B

followed by *in-situ* cyclization of the resulting amine,

wherein the compound of Formula **1B** is prepared by reacting a compound of Formula **1A**



1A

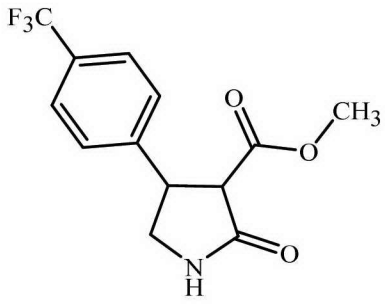
with nitromethane.

18. A process according to Claim 17, wherein the reduction of the compound of Formula **1B** is carried out in the presence of a nickel catalyst.

19. A process according to Claim 17, wherein the reduction of the compound of Formula **1B** is carried out using sodium borohydride in the presence of nickel(II) chloride hexahydrate.

20. A compound that is methyl 2-oxo-4-[4-(trifluoromethyl)phenyl]-3-pyrrolidinecarboxylate.

21. A process for preparing a compound of Formula **3C**



3C

comprising reducing a compound of Formula **3B**

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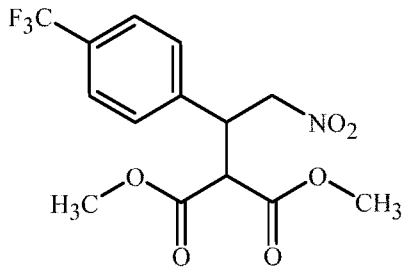

3B

followed by *in-situ* cyclization of the resulting amine.

22. The process of Claim 21 wherein the reduction of the compound of Formula **3B** takes place in the presence of a nickel catalyst.

23. The process of Claim 21 wherein the reduction of the compound of Formula **3B** is carried out using sodium borohydride in the presence of nickel(II) chloride hexahydrate.

24. The process of Claim 21 wherein the compound of Formula **3B** is prepared by reacting 4-trifluoromethylbenzaldehyde with dimethyl malonate.

25. The process of Claim 24 wherein the reaction takes place in the presence of piperidine.