

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

TITLE

CROP-SELECTIVE HERBICIDAL SULFONAMIDES

5 CROSS-REFERENCE TO RELATED APPLICATION

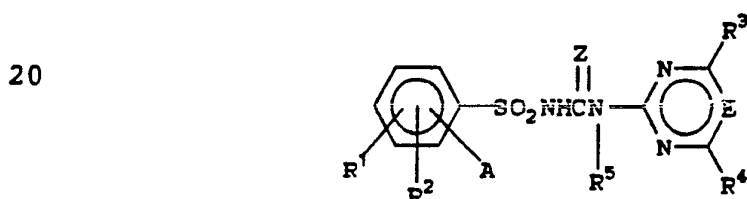
This is a continuation-in-part of application
Serial No. 07/503,182, filed April 4, 1990.

BACKGROUND OF THE INVENTION

10 This invention relates to novel sulfonamides
and their use as crop selective herbicides.
Compounds of the instant invention have demonstrated
excellent control of weeds coupled with corn safety.

EP-A-120,814 discloses herbicidal
sulfonylureas of the formula

15



25 wherein:

A is C₁-C₆ haloalkyl;

R¹ is H, halogen, NO₂, CN, C₁-C₄ alkyl,

C₁-C₄ haloalkyl, C₁-C₄ alkoxy, C₁-C₄
alkylthio, C₁-C₄ alkylsulfinyl, C₁-C₄

30 alkylsulfonyl, COR⁶, NR⁷R⁸, CONR⁹R¹⁰ or
SO₂NR¹¹R¹²; and

R⁶ is C₁-C₄ alkoxy, C₁-C₄ haloalkoxy,

C₁-C₄ alkylthio, C₂-C₆ alkoxyalkoxy,

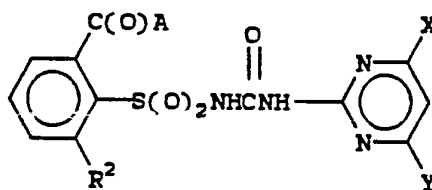
hydrogen, C₁-C₄ alkyl or C₁-C₄ haloalkyl.

35 Although this reference broadly embraces
compounds of the instant invention, it does not teach
or suggest these particular compounds or their
herbicidal utility.

Additionally, a need still exists for herbicides because of world-wide food shortages. In addition, herbicides which are selective to important crops such as corn are particularly necessary. According to the instant invention, such compounds have been found.

SUMMARY OF THE INVENTION

More specifically, this invention comprises novel compounds of Formula I, agriculturally suitable compositions containing them, and their method-of-use as preemergence and/or postemergence herbicides or plant growth regulants:



I

wherein:

- A is OR¹ or N(CH₃)₂;
 - R¹ is C₁-C₃ alkyl, CH₂CH=CH₂, CH₂C≡CH, CH₂CH₂Cl or CH₂CH₂OCH₃;
 - R² is CH₂F, CHF₂, CHFCH₃ or CH₂CN;
 - X is CH₃ or OCH₃; and
 - Y is H, Cl, CH₃, C₂H₅, OCH₃ or OCF₂H;
- and their agriculturally suitable salts; provided that when Y is Cl, then X is OCH₃.

In the above definitions, the term "alkyl" denotes straight chain or branched alkyl, e.g.

5 methyl, ethyl, *n*-propyl or isopropyl. 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 1 to 3. For example, C₁-C₃ alkyl would designate methyl through propyl (both *n*-propyl and isopropyl).

10 Preferred for reasons of increased ease of synthesis and/or greater herbicidal efficacy and/or crop safety are:

1. Compounds of Formula I wherein
A is OR¹; and
R¹ is CH₃, CH₂CH₃ or CH(CH₃)₂.
- 15 2. Compounds of Preferred 1 where
when one of X and Y is CH₃, then the other of X and Y is other than OCH₃.

Specifically preferred for reason of greatest safety to corn (maize) is:

- 20 • Methyl 3-(cyanomethyl)-2-[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoate (Formula I: A is OR¹, R¹ is CH₃, R² is CH₂CN, X and Y are CH₃).

25 Specifically Preferred for reason of greatest safety to corn, wheat and barley are:

- 30 • Methyl 2-[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-(cyanomethyl)benzoate (Formula I: A is OR¹, R¹ is CH₃, R² is CH₂CN, X is OCH₃, Y is Cl);
- Methyl 3-(cyanomethyl)-2-[[[(4-(difluoromethoxy)-6-methoxy-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]benzoate (Formula I: A is OR¹, R¹ is CH₃, R² is CH₂CN, X is OCH₃, Y is OCF₂H);
- 35 • Methyl 3-(difluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-

benzoate (Formula I: A is OR^1 , R^1 is CH_3 ,
 R^2 is CHF_2 , X is OCH_3 , Y is H);

- 5 • Methyl 3-(fluoromethyl)-2-[[[(4-methoxy-2-
 pyrimidinyl)amino]carbonyl]amino]sulfonyl]-
 benzoate (Formula I: A is OR^1 , R^1 is CH_3 ,
 R^2 is CH_2F , X is OCH_3 , Y is H).

Specifically preferred for reason of greatest
 10 safety to wheat and barley is:

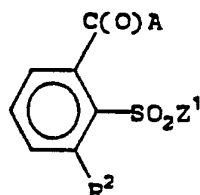
- Methyl 2-[[[(4,6-dimethoxy-2-pyrimidinyl)-
 amino]carbonyl]amino]sulfonyl]-3-
 (fluoromethyl)benzoate (Formula I: A is
 OR^1 , R^1 is CH_3 , R^2 is CH_2F , X and Y are
 15 OCH_3).

Specifically preferred for reason of greatest
 safety to corn, wheat, barley and rice is:

- Ethyl 2-[[[(4-chloro-6-methoxy-2-
 pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-
 20 (fluoromethyl)benzoate (Formula I:
 A is OR^1 , R^1 is CH_2CH_3 , R^2 is CH_2F , X is
 OCH_3 , Y is Cl).

This invention also comprises novel compounds,
 such as the sulfonyl benzoates of Formula II, useful
 25 as intermediates for preparation of the compounds of
 Formula I:

30



35

II

wherein:

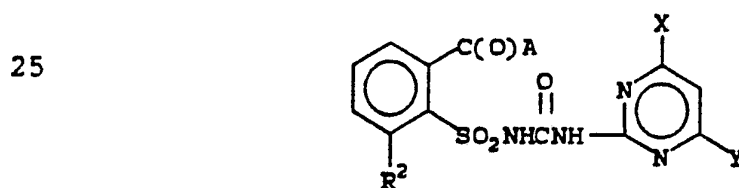
- 5 A is OR^1 or $N(CH_3)_2$;
 R^1 is C_1-C_3 alkyl, $CH_2CH=CH_2$, $CH_2C\equiv CH$,
 CH_2CH_2Cl or $CH_2CH_2OCH_3$;
 R^2 is CH_2F , CHF_2 , $CHFCH_3$ or CH_2CN ; and
 Z^1 is Cl or $NHSiR^3R^4R^5$;
 R^3 is C_1-C_4 alkyl;
 10 R^4 is C_1-C_4 alkyl; and
 R^5 is C_1-C_4 alkyl.

Preferred for reason of increased herbicidal activity of final products of Formula I, are intermediates of Formula II wherein A is OR^1 and R^1 is C_1-C_2 alkyl.

Preferred for reason of increased ease of synthesis are intermediates of the above preferred wherein R^3 and R^4 are CH_3 and R^5 is $C(CH_3)_3$.

DETAILED DESCRIPTION OF THE INVENTION

20



(1)

30

SYNTHESIS

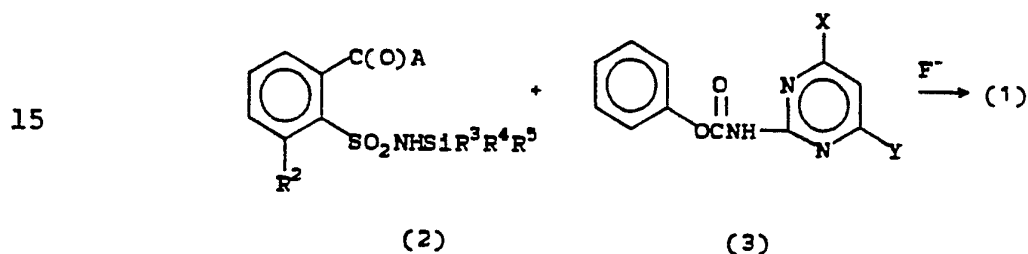
The compounds of Formula (1), which corresponds to Formula I, can be prepared by one or more of the methods described below. The proper choice of reaction sequences for a given compound will be known to one skilled in the art.

35

As shown in Equation 1, many of the compounds of Formula (1) are prepared by reacting a silyl sulfonamide of Formula (2) with a pyrimidine carbamate of Formula (3). R^3 , R^4 , and R^5 are independently C_1 to C_4 alkyl.

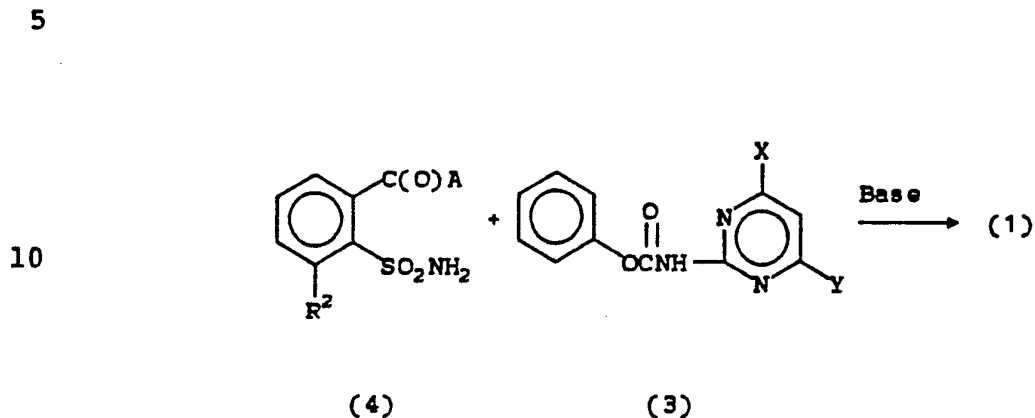
Equation 1

10



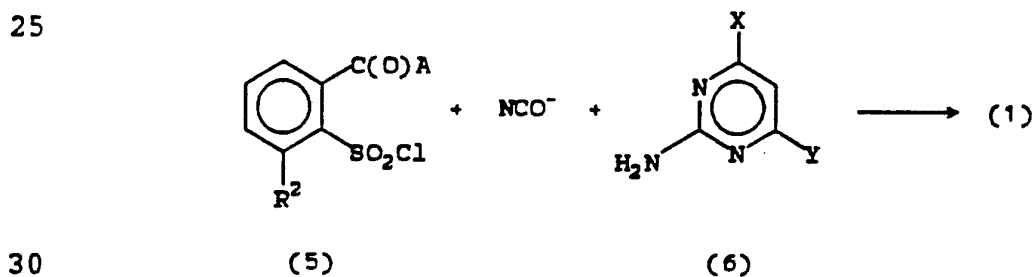
20 The reaction is carried out at $0^\circ C$ to $50^\circ C$ in a solvent such as acetonitrile, dioxane, or tetrahydrofuran; in the presence of a fluoride ion source such as cesium fluoride, or tetrabutylammonium fluoride for 0.1 to 2 hours. A catalytic amount of
 25 base, such as 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU), increases the reaction rate.

Alternatively, some of the sulfonamides of Formula (4) can be prepared and reacted with pyrimidine carbamates of Formula (3) to give
 30 compounds of Formula (1) as shown in Equation 2. The reaction is carried out at $0^\circ C$ to $50^\circ C$ in a solvent, such as acetonitrile, dioxane, or tetrahydrofuran, in the presence of a non-nucleophilic base, such as DBU for 0.2 to 2 hours. U.S. Patent 4,604,131 discloses
 35 details for similar reactions and is herein incorporated by reference.

Equation 2

15

Sulfonyl chlorides of Formula (5) may be reacted with cyanate anion in the presence of pyrimidine amines of Formula (6) to give compounds of Formula (1) as shown in Equation 3.

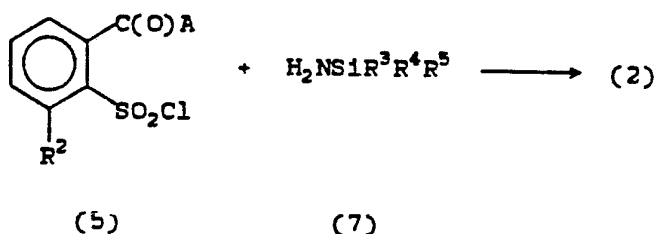
20 Equation 3

The reaction is carried out by mixing one equivalent of sulfonyl chloride (5), pyrimidine amine
35 (6), a metal cyanate, such as potassium cyanate, and a catalytic amount of an amine base, such as Aliquat® 336 (Tricaprylylmethylammonium chloride), in a solvent such as acetonitrile for 0.2 to 10 days.

Alternatively, one can use a tetraalkylammonium cyanate, such as tetraethylammonium cyanate, to effect this reaction by the method described in U.S. Patent 4,604,131 herein incorporated by reference.

Silyl sulfonamides of Formula (2) are prepared by reacting sulfonyl chlorides of Formula (5) with a trialkylsilyl amine of Formula (7), such as t-butyldimethylsilyl amine, as shown in Equation 4. Equation 4

15



20

The reaction is carried out at 0°C to 30°C in a solvent, such as dichloromethane, in the presence of 1 to 2 equivalents of the amine and 1 equivalent of a bicarbonate. J. R. Bowser et. al. describe methods to prepare silyl amines of Formula (7) in *Inorganic Chemistry* 17, 1882 (1978).

The sulfonyl chlorides of Formula (5) and the silyl sulfonamides of Formula (2) correspond to the intermediates of Formula II.

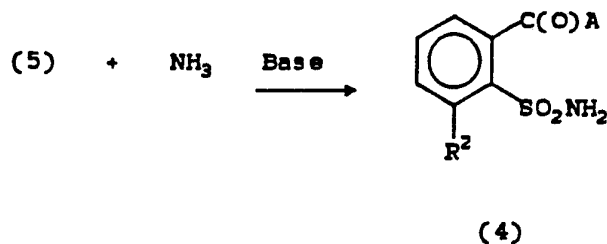
Sulfonyl chlorides of Formula (5) can be reacted with no more than 2 equivalents of ammonia or, alternatively, 1 equivalent of ammonia and 1 equivalent of a base to give sulfonamides of Formula (4) as outlined in Equation 5.

35

Equation 5

5

10



15 Sulfonamides of Formula (4) tend to be unstable and can be difficult to isolate.

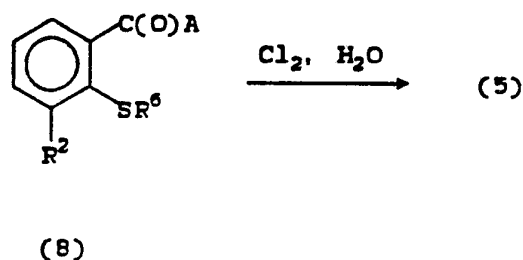
Sulfonyl chlorides of Formula (5) are prepared by the methods shown in Equations 6 and 7.

20 Sulfur-containing compounds of Formula (8) are oxidized with chlorine as shown in Equation 6. R^6 is H, alkyl, benzyl or carbamoyl.

Equation 6

25

30



35

The reaction of Equation 6 is carried out by contacting compounds of Formula (8) in a solvent, such as acetic acid or propionic acid, with at least

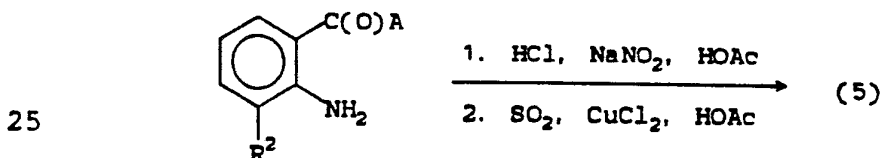
3.0 equivalents of chlorine in the presence of at least 2.5 equivalents of water for 0.2 to 5 hours at -20°C to 30°C. A. Wagenaar teaches specific reaction conditions for related compounds in Recl. Trav. Chim. Pays-Bas 101, 91 (1982).

Alternatively, reaction of compounds of Formula (8), where R⁶ is H or benzyl, with a hypochlorite solution, such as 5% NaOCl, can provide sulfonyl chlorides of Formula (5). Reaction conditions for similar reactions are obvious to one skilled in the art and are described in EP-A-142,152.

As shown in Equation 7, below, sulfonyl chlorides of Formula (5) may be prepared from the corresponding anilines of Formula (9) by a Meerwein reaction.

Equation 7

20



(9)

30 The aniline is diazotized and then reacted with sulfur dioxide and cupric chloride analogous to the teachings of Yale and Sowinski, J. Org. Chem. 25, 1824 (1960). Alternatively, the hydrochloride salts of anilines of Formula (9) can be diazotized in an organic solvent with an alkyl nitrite and reacted with sulfur dioxide to give sulfonyl chlorides (5) analogous to the teachings of M. Doyle, J. Org. Chem. 42, 2426,2431 (1977).

35

The pyrimidine carbamates of Formula (3) and the pyrimidine amines of Formula (6) are prepared by the methods described and referenced in EP-A-72,347, EP-A-164,269, EP-A-173,498, U.S. Patent 4,540,782, and U.S. Patent 4,666,506, herein incorporated by reference.

Agriculturally suitable salts of compounds of Formula I are also useful herbicides and can be prepared in a number of ways known to the art. For example, metal salts can be made by contacting compounds of Formula I with a solution of an alkali or alkaline earth metal salt having a sufficiently basic anion (e.g., hydroxide, alkoxide, carbonate or hydroxide). Quaternary amine salts can be made by similar techniques.

Salts of compounds of Formula I can also be prepared by exchange of one cation for another. Cationic exchange can be effected by direct contact of an aqueous solution of a salt of a compound of Formula I (e.g., alkali or quaternary amine salt) with a solution containing the cation to be exchanged. This method is most effective when the desired salt containing the exchanged cation is insoluble in water and can be separated by filtration.

Exchange may also be effected by passing an aqueous solution of a salt of a compound of Formula I (e.g., an alkali metal or quaternary amine salt) through a column packed with a cation exchange resin containing the cation to be exchanged for that of the original salt and the desired product is eluted from the column. This method is particularly useful when the desired salt is water-soluble, e.g., a potassium, sodium or calcium salt.

Acid addition salts, useful in this invention, can be obtained by reacting a compound of Formula I

with a suitable acid, e.g., p-toluenesulfonic acid, trichloroacetic acid or the like.

5 The preparation of the compounds of this invention is further illustrated by the following specific examples. Temperatures are reported in degrees Celsius; abbreviations for nuclear magnetic resonance (NMR) are: s = singlet, d = doublet, t =
10 triplet, m = multiplet, and peak positions are reported as parts per million downfield from internal tetramethylsilane. Infrared (IR) peak positions are given in reciprocal centimeters (cm^{-1}) and sh denotes a shoulder.

15

EXAMPLE 1

Methyl 3-(Cyanomethyl)-2-nitrobenzoate

To a stirred solution of potassium cyanide (6.2 g) in methanol (100 mL) and water (150 mL) at 0°C was added an acetonitrile solution of methyl
20 3-(bromomethyl)-2-nitrobenzoate (24.9 g). A catalytic amount of 18-crown-6 ether was then added. After stirring overnight at room temperature, the reaction was extracted with ethyl acetate. The combined extracts were washed with a brine solution,
25 dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 20% ethyl acetate in hexanes to give 8.5 g of the title compound as a white solid.

90 MHz NMR (CDCl_3) δ : 3.83 (s, 2H, CH_2);
30 3.93 (s, 3H, CH_3); and
 7.9 (m, 3H, arom.)

EXAMPLE 2

2-(Methoxycarbonyl)-6-(cyanomethyl)-benzenesulfonyl Chloride

35 To a stirred suspension of dry tetrahydrofuran (150 mL) and 26% potassium hydride in oil (6.66 g) was slowly added benzyl mercaptan (4.82 mL) at 0°C under a nitrogen atmosphere. After 15 minutes, methyl

3-(cyanomethyl)-2-nitrobenzoate (8.5 g) was added and the resulting mixture was stirred at room temperature overnight. The reaction was contacted with 6N sodium hydroxide (25 mL) and extracted with ethyl acetate. The extracts were washed with a brine solution, dried over magnesium sulfate, filtered, and concentrated to give 9.0 g of crude methyl 3-(cyanomethyl)-2-(phenylmethylthio)benzoate as a purple oil.

The crude thioether was stirred in a mixture of dichloromethane (200 mL) and 6N hydrochloric acid (25 mL) at 0°C, as 5% sodium hypochlorite (180 mL) was slowly added. The reaction mixture was then stirred at 0°C for 2 hours. The dichloromethane layer was washed with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 25% ethyl acetate in hexanes to give 1.7 g of the title compound as a yellow solid.

90 MHz NMR (CDCl₃) δ: 3.98 (s, 3H, CH₃);
4.41 (s, 2H, CH₂); and
7.83 (m, 3H, arom.).

EXAMPLE 3

Methyl 3-(Cyanomethyl)-2-[[[(1,1-dimethylethyl)-dimethylsilyl]aminol]sulfonyl]benzoate

A suspension of 2-(methoxycarbonyl)-6-(cyanomethyl)benzenesulfonyl chloride (10.7 g), amino-t-butyl dimethylsilane (10.3 g), and sodium bicarbonate (3.36 g) in dichloromethane (200 mL) was stirred at room temperature in a stoppered flask for 4 days. The organic phase was washed with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 30% ethyl acetate in hexanes to give 5.0 g of the title compound as a yellow solid, m.p. 113-115°C.

90 MHz NMR (CDCl₃) δ: 0.32 (s, 6H, SiCH₃);
0.95 (s, 9H, C(CH₃)₃);

14

5
 3.99 (s, 3H, OCH₃);
 4.42 (s, 2H, CH₂CN);
 5.91 (s, 1H, NH);
 7.6 (m, 2H, arom.); and
 7.8 (m, 1H, arom.).
 IR (mineral oil) 3290, 2250, and 1710 cm⁻¹.

EXAMPLE 4

10 Methyl 3-(Cyanomethyl)-2-[[[(4,6-dimethyl-
2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]benzoate

 A mixture of methyl 3-(cyanomethyl)-
 2-[[[(1,1-dimethylethyl)dimethylsilyl]amino]-
 15 sulfonyl]benzoate (0.34 g), O-phenyl-N-(4,6-dimethyl-
 2-pyrimidinyl)carbamate (0.24 g), and acetonitrile
 (2.5 mL) were stirred and cooled in an ice-acetone
 bath. A stock solution of 1 M tetrabutylammonium
 fluoride containing 8 mole % 1,8-diazabicyclo-
 [5.4.0]undec-7-ene (1.0 mL) was added and the
 20 reaction was stirred under a nitrogen atmosphere for
 45 minutes. The reaction was added to water (30 mL)
 and acidified to pH 5 with 1N hydrochloric acid. The
 resulting precipitate was filtered, washed with water
 and hexanes, and air dried to give 0.23 g of the
 25 title compound as a yellow solid, m.p. 182-185°C.

200 MHz NMR (DMSO) δ: 2.40 (s, 6H, CH₃);
 3.79 (s, 3H, OCH₃);
 4.67 (s, 2H, CH₂CN);
 7.04 (s, 1H, pyrim. H);
 30 7.64 (m, 1H, arom.);
 7.82 (m, 2H, arom.);
 10.8 (s, 1H, NH); and
 13.7 (s, 1H, NH).

IR (mineral oil) 2240, 1740 cm⁻¹.

35

EXAMPLE 5

Methyl 3-Formyl-2-nitrobenzoate

Methyl 3-(dibromomethyl)-2-nitrobenzoate (62.6
 g), silver nitrate (109 g), 1,2-dimethoxyethane (500

mL), and water (400 mL) were heated at reflux overnight. The undissolved salts were filtered off
5 and the filtrate was extracted with ethyl acetate. The extracts were washed with a brine solution, dried over magnesium sulfate, filtered, and concentrated to give a crude solid. Recrystallization from
10 chlorobutane gave 20.9 g of the title compound as an orange solid.

90 MHz NMR (CDCl₃) δ: 3.98 (s, 3H, OCH₃);
7.8 (m, 1H, arom.);
8.3 (m, 2H, arom.); and
10.0 (s, 1H, HCO).

15

EXAMPLE 6Methyl 3-(Difluoromethyl)-2-nitrobenzoate

To a solution of diethylaminosulfur trifluoride (11 mL) in dichloromethane (75 mL) stirred at -70°C under a nitrogen atmosphere, was added a
20 dichloromethane solution of methyl 3-formyl-2-nitrobenzoate (5.9 g). The reaction was allowed to warm to room temperature. After 3 hours it was poured onto ice (300 mL) and extracted with
25 dichloromethane. The extracts were washed with water, dried over magnesium sulfate, filtered, and concentrated to give a crude solid. Recrystallization from hexanes-chlorobutane gave 3.94 g of the
title compound as a peach-colored solid, m.p. 66-69°C.

90 MHz NMR (CDCl₃) δ: 3.94 (s, 3H, OCH₃);
30 6.87 (t, 1H, CHF₂); and
7.9 (m, 3H, arom.).

EXAMPLE 72-(Methoxycarbonyl)-6-(difluoromethyl)-benzenesulfonyl Chloride

35 To a stirred suspension of dry tetrahydrofuran (250 mL) and 26% potassium hydride in oil (6.17 g) was slowly added benzyl mercaptan (4.63 mL) at 0°C under a nitrogen atmosphere. After 15 minutes,

methyl 3-(difluoromethyl)-2-nitrobenzoate (7.5 g) was added, and the resulting mixture was stirred at room temperature overnight. The reaction was contacted with aqueous sodium bicarbonate (50 mL) and extracted with ethyl acetate. The extracts were dried over magnesium sulfate, filtered, and concentrated to give 10.8 g of crude methyl 3-(difluoromethyl)-2-(phenylmethylthio)benzoate as a brown oil.

The crude thioether was stirred in a mixture of dichloromethane (400 mL) and 6N hydrochloric acid (28 mL) at 0°C, as 5% sodium hypochlorite (204 mL) was slowly added. The reaction mixture was stirred at 0°C for 2.5 hours. The dichloromethane layer was washed with water, dried over magnesium sulfate, filtered, concentrated, and triturated with hexanes to give 5.17 g of the title compound as a yellow solid.

90 MHz NMR (CDCl₃) δ: 4.13 (s, 3H, OCH₃); and 7.1 - 8.3 (m, 4H, CHF₂ and arom.).

EXAMPLE 8

Methyl 3-(Difluoromethyl)-2-[[[(1,1-dimethyl-ethyl)dimethylsilyl]amino]sulfonyl]benzoate

A suspension of 2-(methoxycarbonyl)-6-(difluoromethyl)benzenesulfonyl chloride (5.17 g), amino-t-butyl dimethylsilane (4.9 g), and sodium bicarbonate (1.5 g) in dichloromethane (150 mL) was stirred at room temperature in a stoppered flask for 4 days. The organic phase was washed with water, dried over magnesium sulfate, filtered, concentrated, and chromatographed on silica gel eluting with 10 % ethyl acetate in hexanes to give 2.23 g of the title compound as a white solid.

90 MHz NMR (CDCl₃) δ: 0.2 (s, 6H, SiCH₃); 0.87 (s, 9H, C(CH₃)₃); 3.90 (s, 3H, OCH₃);

17

5.88 (s, 1H, NH); and
7.20 - 8.36 (m, 4H, CHF₂ and
arom.).

5

EXAMPLE 9Methyl 3-(Difluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)aminolcarbonyl]aminol]sulfonyl]benzoate

A mixture of methyl 3-(difluoromethyl)-2-
10 [[[(1,1-dimethylethyl)dimethylsilyl]amino]sulfonyl]-
benzoate (0.22 g), O-phenyl-N-(4-methoxy-
2-pyrimidinyl)carbamate (0.15 g), and acetonitrile
(2.0 mL) were stirred and cooled in an ice-acetone
bath. A stock solution of 1 M tetrabutylammonium
15 fluoride containing 8 mol % 1,8-diazabicyclo-
[5.4.0]undec-7-ene (0.61 mL) was added, and the
reaction was stirred under a nitrogen atmosphere for
1 hour. The reaction was added to water (30 mL) and
acidified to pH 5 with 1N hydrochloric acid. The
20 resulting precipitate was filtered, washed with water
and hexanes, and air dried to give 0.06 g of the
title compound as a white solid, m.p. 178-180°C
(decomposition).

200 MHz NMR (DMSO) δ: 3.94 (s, 3H, OCH₃);
25 4.14 (s, 3H, OCH₃);
6.87 (d, 1H, pyrim. H);
7.8 - 8.2 (m, 3H, arom.);
8.43 (d, 1H, pyrim. H);
11.46 (s, 1H, NH); and
30 13.90 (s, 1H, NH).

IR (mineral oil) 1730, 1720 cm⁻¹.

EXAMPLE 10Methyl 3-(1-Hydroxyethyl)-2-nitrobenzoate

Titanium tetrachloride (6.25 mL) was added to
35 dry diethylether (250 mL) at -78°C and was stirred
under a nitrogen atmosphere. The resulting yellow
suspension was allowed to warm to -50°C and was
recooled to -78°C prior to adding 1.4 molar

methyllithium in diethylether (41.6 mL). The mixture was warmed to -30°C and the resulting purple mixture was cooled to -60°C and transferred by cannula into an adjacent flask containing methyl 3-formyl-2-nitrobenzoate (11.6 g) and dry tetrahydrofuran (250 mL). The resulting mixture was allowed to warm to room temperature and was stirred under a nitrogen atmosphere for about 18 hours. The reaction was poured onto a mixture of ice (100 mL) and 3N hydrochloric acid (100 mL) and extracted with ethyl acetate. The extracts were washed with saturated sodium bicarbonate and brine, dried over magnesium sulfate, filtered, and concentrated to a crude oil. Flash column chromatography on silica gel, eluting with dichloromethane gave 9.8 g of the title compound as a yellow oil, n_D 1.5309.

90 MHz NMR (CDCl_3) δ : 1.47 (d, 3H, CH_3);
2.58 (s, 1H, OH);
3.92 (s, 3H, OCH_3);
4.93 (m, 1H, CH); and
7.8 (m, 3H, arom.).

IR (neat) 3431, 1735 cm^{-1} .

25

EXAMPLE 11

Methyl 3-(1-Fluoroethyl)-2-nitrobenzoate

To a solution of diethylamino sulfur trifluoride (18 mL), in dichloromethane (100 mL), stirred at -74°C under a nitrogen atmosphere was added a dichloromethane solution of methyl 3-(1-hydroxyethyl)-2-nitrobenzoate (14.6 g). The reaction was allowed to warm to room temperature and was briefly warmed to 35°C . After a 4 hour reaction period, the reaction was poured onto ice and water (200 mL) and extracted with dichloromethane. The combined extracts were washed with a 1:1 mixture of 1N NaOH and saturated sodium bicarbonate, dried over magnesium sulfate, filtered, and concentrated to give

11.3 g of the title compound as a dark amber oil, n_D 1.5151.

5 90 MHz NMR ($CDCl_3$) δ : 1.67 (d of d, 3H, CH_3);
3.93 (s, 3H, OCH_3);
5.7 (d of q, 1H, CHF); and
7.9 (m, 3H, arom.).

IR (neat) 1736 cm^{-1} .

10

EXAMPLE 12

Methyl 3-(1-Fluoroethyl)-2-
(phenylmethylthio)benzoate

Following the procedure described in Example 2, methyl 3-(1-fluoroethyl)-2-nitrobenzoate (15 g) was
15 reacted to give 17.55 g of the unpurified title compound as a brown oil.

EXAMPLE 13

2-(Methoxycarbonyl)-6-(1-fluoroethyl)-
benzene sulfonyl Chloride

20 Following the procedure described in Example 2, methyl 3-(1-fluoroethyl)-2-(phenylmethylthio)benzoate (8.8 g) was reacted and chromatographed on silica eluting with 10% ethyl acetate in hexanes to give 1.7 g of the title compound as an orange oil.

25 90 MHz NMR ($CDCl_3$) δ : 1.8 (d of d, 3H, CH_3);
4.0 (s, 3H, OCH_3);
6.6 (d of q, 1H, CHF); and
7.8 (m, 3H, arom.).

EXAMPLE 14

30 Methyl 3-(1-Fluoroethyl)-2-[[[(1,1-dimethyl-ethyl)dimethylsilyl]amino]sulfonyl]benzoate

Following the procedure described in Example 3, 2-(methoxycarbonyl)-6-(1-fluoroethyl)benzene sulfonyl chloride (2.4 g) was reacted and chromatographed on
35 silica eluting with 15% ethyl acetate in hexanes to give 1.3 g of the title compound as an orange oil.

90 MHz NMR (CDCl₃) δ: 0.17 (s, 3H, SiCH₃);
0.24 (s, 3H, SiCH₃);
5 0.84 (s, 9H, C(CH₃)₃);
1.57 (d of d, 3H, CH₃);
3.88 (s, 3H, OCH₃);
5.83 (s, 1H, NH);
6.6 (d of q, 1H, CHF); and
10 7.6 (m, 3H, arom.).

EXAMPLE 15

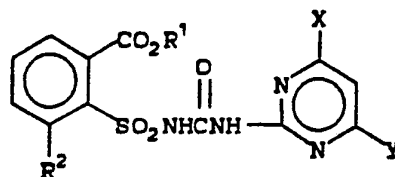
Methyl 3-(1-Fluoroethyl)-2-[[[(4,6-dimethoxy-2-pyrimidinyl)aminolcarbonyllaminolsulfonyl]benzoate

Following the procedure described in Example 4,
15 methyl 3-(1-fluoroethyl)-2-[[[(1,1-dimethylethyl)-
dimethylsilyl]amino]sulfonyl]benzoate (0.26 g) and
O-phenyl-N-(4,6-dimethoxy-2-pyrimidinyl)carbamate
(0.2 g) were reacted to give 0.16 g of the title
20 compound as a pink solid, m.p. 155-158°C
(decomposition).

200 MHz NMR (DMSO) δ: 1.64 (d of d, 3H, CH₃);
3.85 (s, 3H, CO₂CH₃);
3.98 (s, 6H, OCH₃);
6.08 (s, 1H, pyrim. H);
25 7.04 (d of q, 1H, CHF);
7.72 (m, 1H, arom.);
7.96 (m, 2H, arom.);
10.85 (s, 1H, NH); and
12.75 (s, 1H, NH).

30 IR (mineral oil) 3281, 1738, 1722 cm⁻¹.

By applying the procedures of Equations 1
through 7 and Examples 1 through 15, the compounds in
Tables 1 through 4 can be readily prepared by one
skilled in the art.

TABLE 1R¹ is CH₃

R ²	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H
CH ₂ F	OCH ₃	Cl
CH ₂ F	OCH ₃	C ₂ H ₅
CH ₂ F	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H
CHF ₂	CH ₃	CH ₃
CHF ₂	CH ₃	C ₂ H ₅
CHF ₂	CH ₃	OCH ₃
CHF ₂	CH ₃	OCH ₂ F
CHF ₂	OCH ₃	H
CHF ₂	OCH ₃	Cl
CHF ₂	OCH ₃	C ₂ H ₅

R¹ is CH₂CH₃

R ²	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H
CH ₂ F	OCH ₃	Cl
CH ₂ F	OCH ₃	C ₂ H ₅
CH ₂ F	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H
CHF ₂	CH ₃	CH ₃
CHF ₂	CH ₃	C ₂ H ₅
CHF ₂	CH ₃	OCH ₃
CHF ₂	CH ₃	OCH ₂ F
CHF ₂	OCH ₃	H
CHF ₂	OCH ₃	Cl
CHF ₂	OCH ₃	C ₂ H ₅

R¹ is CH₃

R ²	X	Y
CHF ₂	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCHF ₂
CH ₂ CN	CH ₃	H
CH ₂ CN	CH ₃	CH ₃
CH ₂ CH	CH ₃	C ₂ H ₅
CH ₂ CN	CH ₃	OCH ₃
CH ₂ CN	CH ₃	OCHF ₂
CH ₂ CN	OCH ₃	H
CH ₂ CN	OCH ₃	Cl
CH ₂ CH	OCH ₃	C ₂ H ₅
CH ₂ CN	OCH ₃	OCH ₃
CH ₂ CN	OCH ₃	OCHF ₂
CHFCH ₃	CH ₃	H
CHFCH ₃	CH ₃	CH ₃
CHFCH ₃	CH ₃	C ₂ H ₅
CHFCH ₃	CH ₃	OCH ₃
CHFCH ₃	CH ₃	OCHF ₂
CHFCH ₃	OCH ₃	H
CHFCH ₃	OCH ₃	Cl
CHFCH ₃	OCH ₃	OCH ₃
CHFCH ₃	OCH ₃	OCHF ₂

R¹ is CH₂CH₂CH₃

R ²	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H

R¹ is CH₂CH₃

R ²	X	Y
CHF ₂	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCHF ₂
CH ₂ CN	CH ₃	H
CH ₂ CN	CH ₃	CH ₃
CH ₂ CN	CH ₃	C ₂ H ₅
CH ₂ CN	CH ₃	OCH ₃
CH ₂ CN	CH ₃	OCHF ₂
CH ₂ CN	OCH ₃	H
CH ₂ CN	OCH ₃	Cl
CH ₂ CN	OCH ₃	C ₂ H ₅
CH ₂ CN	OCH ₃	OCH ₃
CH ₂ CN	OCH ₃	OCHF ₂
CHFCH ₃	CH ₃	H
CHFCH ₃	CH ₃	CH ₃
CHFCH ₃	CH ₃	C ₂ H ₅
CHFCH ₃	CH ₃	OCH ₃
CHFCH ₃	CH ₃	OCHF ₂
CHFCH ₃	OCH ₃	H
CHFCH ₃	OCH ₃	Cl
CHFCH ₃	OCH ₃	OCH ₃
CHFCH ₃	OCH ₃	OCHF ₂

R¹ is CH(CH₃)₂

R ²	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H

R ¹ is CH ₂ CH ₂ CH ₃			R ¹ is CH(CH ₃) ₂		
R ²	X	Y	R ²	X	Y
CH ₂ F	OCH ₃	Cl	CH ₂ F	OCH ₃	Cl
CH ₂ F	OCH ₃	C ₂ H ₅	CH ₂ F	OCH ₃	C ₂ H ₅
CH ₂ F	OCH ₃	OCH ₃	CH ₂ F	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂	CH ₂ F	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H	CHF ₂	CH ₃	H
CHF ₂	CH ₃	CH ₃	CHF ₂	CH ₃	CH ₃
CHF ₂	CH ₃	C ₂ H ₅	CHF ₂	CH ₃	C ₂ H ₅
CHF ₂	CH ₃	OCH ₃	CHF ₂	CH ₃	OCH ₃
CHF ₂	CH ₃	OCHF ₂	CHF ₂	CH ₃	OCH ₃
CHF ₂	OCH ₃	H	CHF ₂	OCH ₃	H
CHF ₂	OCH ₃	Cl	CHF ₂	OCH ₃	Cl
CHF ₂	OCH ₃	C ₂ H ₅	CHF ₂	OCH ₃	C ₂ H ₅
CHF ₂	OCH ₃	OCH ₃	CHF ₂	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCHF ₂	CHF ₂	OCH ₃	OCHF ₂
CH ₂ CN	CH ₃	H	CH ₂ CN	CH ₃	H
CH ₂ CN	CH ₃	CH ₃	CH ₂ CN	CH ₃	CH ₃
CH ₂ CN	CH ₃	C ₂ H ₅	CH ₂ CN	CH ₃	C ₂ H ₅
CH ₂ CN	CH ₃	OCH ₃	CH ₂ CN	CH ₃	OCH ₃
CH ₂ CN	CH ₃	OCHF ₂	CH ₂ CN	CH ₃	OCHF ₂
CH ₂ CN	OCH ₃	H	CH ₂ CN	OCH ₃	H
CH ₂ CN	OCH ₃	Cl	CH ₂ CN	OCH ₃	Cl
CH ₂ CN	OCH ₃	C ₂ H ₅	CH ₂ CN	OCH ₃	C ₂ H ₅
CH ₂ CN	OCH ₃	OCH ₃	CH ₂ CN	OCH ₃	OCH ₃
CH ₂ CN	OCH ₃	OCHF ₂	CH ₂ CN	OCH ₃	OCHF ₂
CHFCH ₃	CH ₃	H	CHFCH ₃	CH ₃	H
CHFCH ₃	CH ₃	CH ₃	CHFCH ₃	CH ₃	CH ₃
CHFCH ₃	CH ₃	C ₂ H ₅	CHFCH ₃	CH ₃	C ₂ H ₅
CHFCH ₃	CH ₃	OCH ₃	CHFCH ₃	CH ₃	OCH ₃
CHFCH ₃	CH ₃	OCHF ₂	CHFCH ₃	CH ₃	OCHF ₂
CHFCH ₃	OCH ₃	H	CHFCH ₃	OCH ₃	H
CHFCH ₃	OCH ₃	Cl	CHFCH ₃	OCH ₃	Cl

R^1 is $CH_2CH_2CH_3$

R^2	X	Y
CHFCH ₃	OCH ₃	OCH ₃
CHFCH ₃	OCH ₃	OCHF ₂

R^1 is $CH_2CH=CH_2$

R^2	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H
CH ₂ F	OCH ₃	Cl
CH ₂ F	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H
CHF ₂	CH ₃	CH ₃
CHF ₂	CH ₃	C ₂ H ₅
CHF ₂	CH ₃	OCH ₃
CHF ₂	CH ₃	OCHF ₂
CHF ₂	OCH ₃	H
CHF ₂	OCH ₃	Cl
CHF ₂	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCHF ₂
CH ₂ CN	CH ₃	H
CH ₂ CN	CH ₃	CH ₃
CH ₂ CN	CH ₃	C ₂ H ₅
CH ₂ CN	CH ₃	OCH ₃
CH ₂ CN	CH ₃	OCHF ₂
CH ₂ CN	OCH ₃	H
CH ₂ CN	OCH ₃	Cl

R^1 is $CH(CH_3)_2$

R^2	X	Y
CHFCH ₃	OCH ₃	OCH ₃
CHFCH ₃	OCH ₃	OCHF ₂

R^1 is CH_2CH_2Cl

R^2	X	Y
CH ₂ F	CH ₃	H
CH ₂ F	CH ₃	CH ₃
CH ₂ F	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H
CH ₂ F	OCH ₃	Cl
CH ₂ F	OCH ₃	C ₂ H ₅
CH ₂ F	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H
CHF ₂	CH ₃	CH ₃
CHF ₂	CH ₃	OCH ₃
CHF ₂	CH ₃	OCHF ₂
CHF ₂	OCH ₃	H
CHF ₂	OCH ₃	Cl
CHF ₂	OCH ₃	C ₂ H ₅
CHF ₂	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCHF ₂
CH ₂ CN	CH ₃	H
CH ₂ CN	CH ₃	CH ₃
CH ₂ CN	CH ₃	OCH ₃
CH ₂ CN	CH ₃	OCHF ₂
CH ₂ CN	OCH ₃	H
CH ₂ CN	OCH ₃	Cl
CH ₂ CN	OCH ₃	C ₂ H ₅

R^1 is $\text{CH}_2\text{CH}=\text{CH}_2$

R^2	X	Y
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	OCHF_2
CHFCH_3	CH_3	H
CHFCH_3	CH_3	CH_3
CHFCH_3	CH_3	C_2H_5
CHFCH_3	CH_3	OCH_3
CHFCH_3	CH_3	OCHF_2
CHFCH_3	OCH_3	H
CHFCH_3	OCH_3	Cl
CHFCH_3	OCH_3	OCH_3
CHFCH_3	OCH_3	OCHF_2

 R^1 is $\text{CH}_2\text{C}\equiv\text{CH}$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	C_2H_5
CH_2F	CH_3	OCH_3
CH_2F	CH_3	OCHF_2
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	OCHF_2
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	C_2H_5
CHF_2	CH_3	OCH_3
CHF_2	CH_3	OCHF_2
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl

 R^1 is $\text{CH}_2\text{CH}_2\text{Cl}$

R^2	X	Y
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	OCHF_2
CHFCH_3	CH_3	CH_3
CHFCH_3	CH_3	CH_3
CHFCH_3	CH_3	C_2H_5
CHFCH_3	CH_3	OCH_3
CHFCH_3	CH_3	OCHF_2
CHFCH_3	OCH_3	H
CHFCH_3	OCH_3	Cl
CHFCH_3	OCH_3	OCH_3
CHFCH_3	OCH_3	OCHF_2

 R^1 is $\text{CH}_2\text{CH}_2\text{OCH}_3$

R^2	X	Y
CH_2F	CH_3	H
CH_2F	CH_3	CH_3
CH_2F	CH_3	OCH_3
CH_2F	CH_3	OCHF_2
CH_2F	OCH_3	H
CH_2F	OCH_3	Cl
CH_2F	OCH_3	C_2H_5
CH_2F	OCH_3	OCH_3
CH_2F	OCH_3	OCHF_2
CHF_2	CH_3	H
CHF_2	CH_3	CH_3
CHF_2	CH_3	OCH_3
CHF_2	CH_3	OCHF_2
CHF_2	OCH_3	H
CHF_2	OCH_3	Cl
CHF_2	OCH_3	C_2H_5

R^1 is $\text{CH}_2\text{C}\equiv\text{CH}$

R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	OCHF_2
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	C_2H_5
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	OCHF_2
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	OCHF_2
CHFCH_3	CH_3	H
CHFCH_3	CH_3	CH_3
CHFCH_3	CH_3	C_2H_5
CHFCH_3	CH_3	OCH_3
CHFCH_3	CH_3	OCHF_2
CHFCH_3	OCH_3	H
CHFCH_3	OCH_3	Cl
CHFCH_3	OCH_3	OCH_3
CHFCH_3	OCH_3	OCHF_2

 R^1 is $\text{CH}_2\text{CH}_2\text{OCH}_3$

R^2	X	Y
CHF_2	OCH_3	OCH_3
CHF_2	OCH_3	OCHF_2
CH_2CN	CH_3	H
CH_2CN	CH_3	CH_3
CH_2CN	CH_3	OCH_3
CH_2CN	CH_3	OCHF_2
CH_2CN	OCH_3	H
CH_2CN	OCH_3	Cl
CH_2CN	OCH_3	C_2H_5
CH_2CN	OCH_3	OCH_3
CH_2CN	OCH_3	OCHF_2
CHFCH_3	CH_3	H
CHFCH_3	CH_3	CH_3
CHFCH_3	CH_3	C_2H_5
CHFCH_3	CH_3	OCH_3
CHFCH_3	CH_3	OCHF_2
CHFCH_3	OCH_3	H
CHFCH_3	OCH_3	Cl
CHFCH_3	OCH_3	OCH_3
CHFCH_3	OCH_3	OCHF_2

TABLE 3

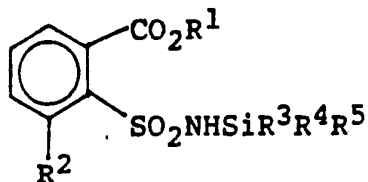
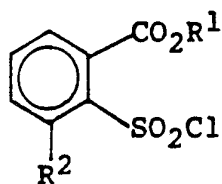


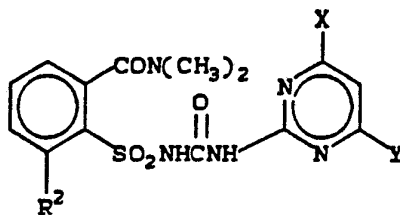
TABLE 2



R ¹	R ²	R ¹	R ²	R ³	R ⁴	R ⁵
CH ₃	CH ₂ F	CH ₃	CH ₂ F	CH ₃	CH ₃	CH ₃
CH ₃	CHF ₂	CH ₃	CHF ₂	CH ₃	CH ₃	CH ₃
CH ₃	CH ₂ CN	CH ₃	CH ₂ CN	CH ₃	CH ₃	CH ₃
CH ₃	CHFCH ₃	CH ₃	CHFCH ₃	CH ₃	CH ₃	CH ₃
CH ₂ CH ₃	CH ₂ F	CH ₂ CH ₃	CH ₂ F	CH ₃	CH ₃	CH ₃
CH ₂ CH ₃	CHF ₂	CH ₂ CH ₃	CHF ₂	CH ₃	CH ₃	CH ₃
CH ₂ CH ₃	CH ₂ CN	CH ₂ CH ₃	CH ₂ CN	CH ₃	CH ₃	CH ₃
CH ₂ CH ₃	CHFCH ₃	CH ₂ CH ₃	CHFCH ₃	CH ₃	CH ₃	CH ₃
CH ₃	CH ₂ F	CH ₃	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₃	CHF ₂	CH ₃	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₃	CH ₂ CN	CH ₃	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₃	CHFCH ₃	CH ₃	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₃	CH ₂ F	CH ₂ CH ₃	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₃	CHF ₂	CH ₂ CH ₃	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₃	CH ₂ CN	CH ₂ CH ₃	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₃	CHFCH ₃	CH ₂ CH ₃	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ CH ₃	CH ₂ F	CH ₂ CH ₂ CH ₃	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ CH ₃	CHF ₂	CH ₂ CH ₂ CH ₃	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ CH ₃	CH ₂ CN	CH ₂ CH ₂ CH ₃	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ CH ₃	CHFCH ₃	CH ₂ CH ₂ CH ₃	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH(CH ₃) ₂	CH ₂ F	CH(CH ₃) ₂	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH(CH ₃) ₂	CHF ₂	CH(CH ₃) ₂	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃

R ¹	R ²	R ¹	R ²	R ³	R ⁴	R ⁵
CH(CH ₃) ₂	CH ₂ CN	CH(CH ₃) ₂	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH(CH ₃) ₂	CHFCH ₃	CH(CH ₃) ₂	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH=CH ₂	CH ₂ F	CH ₂ CH=CH ₂	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH=CH ₂	CHF ₂	CH ₂ CH=CH ₂	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH=CH ₂	CH ₂ CN	CH ₂ CH=CH ₂	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH=CH ₂	CHFCH ₃	CH ₂ CH=CH ₂	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ C≡CH	CH ₂ F	CH ₂ C≡CH	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ C≡CH	CHF ₂	CH ₂ C≡CH	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ C≡CH	CH ₂ CN	CH ₂ C≡CH	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ C≡CH	CHFCH ₃	CH ₂ C≡CH	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ Cl	CH ₂ F	CH ₂ CH ₂ Cl	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ Cl	CHF ₂	CH ₂ CH ₂ Cl	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ Cl	CH ₂ CN	CH ₂ CH ₂ Cl	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ Cl	CHFCH ₃	CH ₂ CH ₂ Cl	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ OCH ₃	CH ₂ F	CH ₂ CH ₂ OCH ₃	CH ₂ F	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ OCH ₃	CHF ₂	CH ₂ CH ₂ OCH ₃	CHF ₂	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ OCH ₃	CH ₂ CN	CH ₂ CH ₂ OCH ₃	CH ₂ CN	CH ₃	CH ₃	C(CH ₃) ₃
CH ₂ CH ₂ OCH ₃	CHFCH ₃	CH ₂ CH ₂ OCH ₃	CHFCH ₃	CH ₃	CH ₃	C(CH ₃) ₃

TABLE 4



R ²	X	Y	R ²	X	Y
CH ₂ F	CH ₃	H	CH ₂ CN	CH ₃	H
CH ₂ F	CH ₃	CH ₃	CH ₂ CN	CH ₃	CH ₃
CH ₂ F	CH ₃	C ₂ H ₅	CH ₂ CN	CH ₃	C ₂ H ₅
CH ₂ F	CH ₃	OCH ₃	CH ₂ CN	CH ₃	OCH ₃
CH ₂ F	CH ₃	OCHF ₂	CH ₂ CN	CH ₃	OCHF ₂
CH ₂ F	OCH ₃	H	CH ₂ CN	OCH ₃	H
CH ₂ F	OCH ₃	Cl	CH ₂ CN	OCH ₃	Cl
CH ₂ F	OCH ₃	C ₂ H ₅	CH ₂ CN	OCH ₃	C ₂ H ₅
CH ₂ F	OCH ₃	OCH ₃	CH ₂ CN	OCH ₃	OCH ₃
CH ₂ F	OCH ₃	OCHF ₂	CH ₂ CN	OCH ₃	OCHF ₂
CHF ₂	CH ₃	H	CHFCH ₃	CH ₃	H
CHF ₂	CH ₃	CH ₃	CHFCH ₃	CH ₃	CH ₃
CHF ₂	CH ₃	C ₂ H ₅	CHFCH ₃	CH ₃	C ₂ H ₅
CHF ₂	CH ₃	OCH ₃	CHFCH ₃	CH ₃	OCH ₃
CHF ₂	CH ₃	OCHF ₂	CHFCH ₃	CH ₃	OCHF ₂
CHF ₂	OCH ₃	H	CHFCH ₃	OCH ₃	H
CHF ₂	OCH ₃	Cl	CHFCH ₃	OCH ₃	Cl
CHF ₂	OCH ₃	C ₂ H ₅	CHFCH ₃	OCH ₃	OCH ₃
CHF ₂	OCH ₃	OCH ₃	CHFCH ₃	OCH ₃	OCHF ₂
CHF ₂	OCH ₃	OCHF ₂			

Formulations

Useful formulations of the compounds of Formula I can be prepared in conventional ways. They include dusts, granules, pellets, solutions, suspensions, emulsions, wettable powders, emulsifiable concentrates and the like. Many of these may be applied directly. Sprayable formulations can be extended in suitable media and used at spray volumes of from a few liters to several hundred liters per hectare. High strength compositions are primarily used as intermediates for further formulation. The formulations, broadly, contain about 0.1% to 99% by weight of active ingredient(s) and at least one of (a) about 0.1% to 20% surfactant(s) and (b) about 1% to 99.9% solid or liquid inert diluent(s). More specifically, they will contain these ingredients in the following approximate proportions:

	<u>Weight Percent*</u>		
	<u>Active</u>	<u>Diluent(s)</u>	<u>Surfactant(s)</u>
Wettable Powders	20-90	0-74	1-10
Oil Suspensions, Emulsions, Solutions, (including Emulsifiable Concentrates)	3-50	40-95	0-15
Aqueous Suspension	10-50	40-84	1-20
Dusts	1-25	70-99	0-5
Granules and Pellets	0.1-95	5-99.9	0-15
High Strength Compositions	90-99	0-10	0-2

* Active ingredient plus at least one of a Surfactant or a Diluent equals 100 weight percent.

Lower or higher levels of active ingredient can, of course, be present depending on the intended use and the physical properties of the compound. Higher ratios of surfactant to active ingredient are sometimes desirable, and are achieved by incorporation into the formulation or by tank mixing.

Typical solid diluents are described in Watkins, et al., "Handbook of Insecticide Dust Diluents and Carriers", 2nd Ed., Dorland Books, Caldwell, New Jersey, but other solids, either mined or manufactured, may be used. The more absorptive diluents are preferred for wettable powders and the denser ones for dusts. Typical liquid diluents and solvents are described in Marsden, "Solvents Guide," 2nd Ed., Interscience, New York, 1950. Solubility under 0.1% is preferred for suspension concentrates; solution concentrates are preferably stable against phase separation at 0°C. "McCutcheon's Detergents and Emulsifiers Annual", MC Publishing Corp., Ridgewood, New Jersey, as well as Sisely and Wood, "Encyclopedia of Surface Active Agents", Chemical Publishing Co., Inc., New York, 1964, list surfactants and recommended uses. All formulations can contain minor amounts of additives to reduce foaming, caking, corrosion, microbiological growth, etc.

The methods of making such compositions are well known. Solutions are prepared by simply mixing the ingredients. Fine solid compositions are made by blending and, usually, grinding as in a hammer or fluid energy mill. Suspensions are prepared by wet milling (see, for example, Littler, U.S. Patent 3,060,084). Granules and pellets may be made by spraying the active material upon preformed granular carriers or by agglomeration techniques. See J. E. Browning, "Agglomeration", Chemical Engineering, December 4, 1967, pp. 147ff. and "Perry's Chemical

Engineer's Handbook", 5th Ed., McGraw-Hill, New York, 1963, pp. 8-57ff.

5 For further information regarding the art of formulation, see for example:

H. M. Loux, U.S. Patent 3,235,361, February 15, 1966, Col. 6, line 16 through Col. 7, line 19 and Examples 10 through 41;

10 R. W. Luckenbaugh, U.S. Patent 3,309,192, March 14, 1967, 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;

15 H. Gysin and E. Knusli, U.S. Patent 2,891,855, June 23, 1959, Col. 3, line 66 through Col. 5, line 17 and Examples 1-4; G. C. Klingman, "Weed Control as a Science", John Wiley and Sons, Inc., New York, 1961, pp. 81-96; and

20 J. D. Fryer and S. A. Evans, "Weed Control Handbook", 5th Ed., Blackwell Scientific Publications, Oxford, 1968, pp. 101-103.

In the following examples, all parts are by weight unless otherwise indicated.

Example A

High Strength Concentrate

Methyl 3-(cyanomethyl)-2-[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonyl]amino]-

30 sulfonyl]benzoate 99%
trimethylnonyl polyethylene glycol ether 1%

The surfactant is sprayed upon the active ingredient in a blender and the mixture sifted through a U. S. S. No. 40 sieve (0.42 mm openings) prior to packaging. The concentrate may be formulated further for practical use.

Example BWettable Powder

5	Methyl 2-[[[(4-chloro-6-methoxy-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-3-(cyanomethyl)-benzoate	65%
	dodecylphenol polyethylene glycol ether	2%
	sodium ligninsulfonate	4%
10	sodium silicoaluminate	6%
	montmorillonite (calcined)	23%

The ingredients are thoroughly blended. The liquid surfactant is added by spraying upon the solid ingredients in the blender. After grinding in a hammer mill to produce particles essentially all below 100 microns, the material is reblended and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) and packaged.

Example C20 Aqueous Suspension

	Methyl 3-(cyanomethyl)-2-[[[(4-(difluoromethoxy)-6-methoxy-2-pyrimidinyl]amino)-carbonyl]amino]sulfonyl]benzoate	50.0%
	polyacrylic acid thickener	0.3%
25	dodecylphenol polyethylene glycol ether	0.5%
	disodium phosphate	1%
	monosodium phosphate	0.5%
	polyvinyl alcohol	1.0%
	water	56.7%

30 The ingredients are blended and ground together in a sand mill to produce particles essentially all under 5 microns in size.

Example DOil Suspension

35	Methyl 3-(difluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	35%
----	---	-----

	blend of polyalcohol carboxylic esters	
	and oil soluble petroleum sulfonates	6%
5	xylene	59%

The ingredients are combined and ground together in a sand mill to produce particles essentially all below 3 microns. The product can be used directly, extended with oils, or emulsified in water.

10 Example E

Oil Suspension

	Methyl 3-(fluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	25%
15	polyoxyethylene sorbitol hexaoleate	5%
	highly aliphatic hydrocarbon oil	70%

The ingredients are ground together in a sand mill until the solid particles have been reduced to under about 5 microns. The resulting thick suspension may be applied directly, but preferably after being extended with oils or emulsified in water.

20

Example F

Aqueous Suspension

25	Methyl 2-[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)-benzoate	25%
	hydrated attapulgate	3%
	crude calcium ligninsulfonate	10%
	sodium dihydrogen phosphate	0.5%
30	water	61.5%

The ingredients are ground together in a ball or roller mill until the solid particles have been reduced to diameters under 10 microns.

Example G

35 Wettable Powder

	Ethyl 2-[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-3-(fluoromethyl)-benzoate	40.0%
--	---	-------

	dioctyl sodium sulfosuccinate	1.5%
	sodium ligninsulfonate	3%
5	low viscosity methyl cellulose	1.5%
	attapulgate	54%

The ingredients are thoroughly blended, passed through an air mill, to produce an average particle size under 15 microns, reblended, and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) before packaging.

All compounds of the invention may be formulated in the same manner.

Example H

Granule

15	wettable powder of Example G	15%
	gypsum	69%
	potassium sulfate	16%

The ingredients are blended in a rotating mixer and water sprayed on to accomplish granulation. When most of the material has reached the desired range of 1.0 to 0.42 cm (U.S.S.#18 to 40 sieves), the granules are removed, dried, and screened. Oversized material is crushed to produce additional material in the desired range. These granules contain % active ingredient.

Example I

Wettable Powder

	Methyl 2-[[[(4,6-dimethoxy-2-pyrimidinyl)amino]-carbonyl]amino]sulfonyl]-3-(fluoromethyl)-	
30	benzoate	50%
	sodium alkyl naphthalenesulfonate	2%
	low viscosity methyl cellulose	2%
	diatomaceous earth	46%

The ingredients are blended, coarsely hammer-milled and the air milled to produce particles of active essentially all below 10 microns in diameter. The product is reblended before packaging.

Example J

Extruded Pellet

5	Methyl 3-(fluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	25%
	anhydrous sodium sulfate	10%
	crude calcium ligninsulfonate	5%
10	sodium alkylnaphthalenesulfonate	1%
	calcium/magnesium bentonite	59%

The ingredients are blended, hammer-milled and then moistened with about 12% water. The mixture is extruded as cylinders about 3 mm diameter which are cut to produce pellets about 3 mm long. These may be used directly after drying, or the dried pellets may be crushed to pass a U.S.S. No. 20 sieve (0.84 mm openings). The granules held on a U.S.S. No. 40 sieve (0.42 mm openings) may be packaged for use and the fines recycled.

Example K

Wettable Powder

25	Methyl 3-(difluoromethyl)-2-[[[(4-methoxy-2-pyrimidinyl)amino]carbonyl]amino]sulfonyl]-benzoate	80%
	sodium alkylnaphthalenesulfonate	2%
	sodium ligninsulfonate	2%
	synthetic amorphous silica	3%
	kaolinite	13%

The ingredients are blended and then ground in a hammermill to produce particles with an average particle size less than 25 microns in diameter. The material is reblended and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) before being packaged.

limited to, cocklebur (Xanthium pensylvanicum),
jimsonweed (Datura stramonium), lambsquarters
5 (Chenopodium album), morningglory (Ipomoea spp.),
pigweed (Amaranthus spp.), Polygonum spp., sicklepod
(Cassia obtusifolia), and velvetleaf (Abutilon
theophrasti). Many compounds in this invention also
control nutsedge (Cyperus spp.). Several compounds
10 from this invention are particularly useful for weed
control in cereal crops such as barley and wheat. A
select few of these compounds are particularly useful
for weed control in corn.

Several compounds in this invention have utility
15 in non-crop areas where selected or complete control
of plants or weeds is desired, such as around storage
tanks, parking lots, billboards, highways, and
railroad structures. These compounds are also useful
in fallow areas of crop production such as in wheat
20 and barley and in plantation crops such as palm,
banana, citrus, rubber, etc. Alternatively, these
compounds may be useful to modify plant growth or as
citrus harvest aid abscission agents.

Rates of application for compounds of this
25 invention are determined by a number of factors.
These factors include: formulation selected, method
of application, amount of vegetation present, growing
conditions, etc. In general terms, the subject
compounds should be applied at rates from 0.001 to 20
30 kg/ha with a preferred rate range of from 0.004 to
0.25 kg/ha. One skilled in the art can easily
determine rates needed for the desired level of weed
control.

Compounds of this invention may be used alone or
35 in combination with other commercial herbicides,
insecticides, or fungicides. The following list

exemplifies some of the herbicides suitable for use in mixtures. A combination of compounds from this invention with one or more of the following herbicides may be particularly useful for weed control.

	<u>Common Name</u>	<u>Chemical Name</u>
10	acetochlor	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide
	acifluorfen	5-[2-chloro-4-(trifluoromethyl)-phenoxy]-2-nitrobenzoic acid
	alachlor	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide
15	anilofos	S-4-chloro-N-isopropylcarbaniloyl-methyl-O,O-dimethyl phosphorodithioate
	ametryn	N-ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
20	amitrole	1H-1,2,4-triazol-3-amine
	AMS	ammonium sulfamate
	asulam	methyl [(4-aminophenyl)sulfonyl]-carbamate
25	atrazine	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine
	barban	4-chloro-2-butynyl 3-chlorocarbamate
	benefin	N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl)benzenamine
30	bensulfuron methyl	2-[[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]methyl]benzoic acid, methyl ester
	bensulide	O,O-bis(1-methylethyl) S-[2-[(phenylsulfonyl)amino]-ethyl]phosphorodithioate
35	bentazon	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one, 2,2-dioxide

	<u>Common Name</u>	<u>Chemical Name</u>
5	benzofluor	N-[4-(ethylthio)-2-(trifluoromethyl)phenyl]methanesulfonamide
	benzoylprop	N-benzoyl-N-(3,4-dichlorophenyl)-DL-alanine
10	bifenox	methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate
	bromacil	5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H,3H)pyrimidinedione
	bromoxynil	3,5-dibromo-4-hydroxybenzotrile
15	butachlor	N-(butoxymethyl)-2-chloro-N-(2,6-diethylphenyl)acetamide
	buthidazole	3-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-4-hydroxy-1-methyl-2-imidazolidinone
20	butralin	4-(1,1-dimethylethyl)-N-(1-methylpropyl)-2,6-dinitrobenzenamine
	butylate	S-ethyl bis(2-methylpropyl)-carbamoithioate
	cacodylic acid	dimethyl arsenic oxide
25	CDAА	2-chloro-N,N-di-2-propenylacetamide
	CDEC	2-chloroallyl diethyldithiocarbamate
	CGA 142,464	3-(4,6-dimethoxy-1,3,5-triazin-2-yl)-1-[2-(2-methoxyethoxy)-phenylsulfonyl]-urea
30	chloramben	3-amino-2,5-dichlorobenzoic acid
	chlorbromuron	3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea
35	chlorimuron ethyl	2-[[[(4-chloro-6-methoxy-2-pyrimidinyl)amino]carbonyl]-amino]sulfonyl]benzoic acid, ethyl ester
	chlormethoxy-nil	2,4-dichlorophenyl 4-nitro-3-methoxyphenyl ether

	<u>Common Name</u>	<u>Chemical Name</u>
5	chlornitrofen	2,4,6-trichlorophenyl-4-nitrophenyl ether
	chloroxuron	N'-[4-(4-chlorophenoxy)phenyl]-N,N-dimethylurea
	chlorpropham	1-methylethyl 3-chlorophenylcarbamate
10	chlorsulfuron	2-chloro-N-[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide
	chlortoluron	N'-(3-chloro-4-methylphenyl)-N,N-dimethylurea
15	cinmethylin	exo-1-methyl-4-(1-methylethyl)-2-[(2-methylphenyl)methoxy]-7-oxabicyclo[2.2.1]heptane
	clethodim	(E,E)-(±)-2-[1-[[[3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
20	clomazone	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone
	cloproxydim	(E,E)-2-[1-[[[3-chloro-2-propenyl)oxy]imino]butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
25	clopyralid	3,6-dichloro-2-pyridinecarboxylic acid
	CMA	calcium salt of MAA
	cyanazine	2-[[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitrile
30	cycloate	S-ethyl cyclohexylethylcarbamothioate
	cycluron	3-cyclooctyl-1,1-dimethylurea
	cyperquat	1-methyl-4-phenylpyridinium
	cyprazine	2-chloro-4-(cyclopropylamino)-6-(isopropylamino)-s-triazine
35		

	<u>Common Name</u>	<u>Chemical Name</u>
5	cyprazole	N-[5-(2-chloro-1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]cyclopropanecarboxamide
	cypromid	3',4'-dichlorocyclopropanecarboxanilide
	dalapon	2,2-dichloropropanoic acid
10	dazomet	tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione
	DCPA	dimethyl 2,3,5,6-tetrachloro-1,4-benzenedicarboxylate
15	desmediphan	ethyl [3-[[[(phenylamino)carbonyl]oxy]phenyl]carbamate
	desmetryn	2-(isopropylamino)-4-(methylamino)-6-(methylthio)-s-triazine
	diallate	S-(2,3-dichloro-2-propenyl)bis(1-methylethyl)carbamothioate
20	dicamba	3,6-dichloro-2-methoxybenzoic acid
	dichlobenil	2,6-dichlorobenzonitrile
	dichlorprop	(±)-2-(2,4-dichlorophenoxy)propanoic acid
25	dichlofop	(±)-2-[4-(2,4-dichlorophenoxy)phenoxy]propanoic acid, methyl ester
	diethatyl	N-(chloroacetyl)-N-(2,6-diethylphenyl)glycine
	difenzoquat	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium
30	dimepiperate	S-1-methyl-1-phenylethylpiperidine-1-carbothioate
	dinitramine	N ³ ,N ³ -diethyl-2,4-dinitro-6-(trifluoromethyl)-1,3-benzenediamine
	dinoseb	2-(1-methylpropyl)-4,6-dinitrophenol
35	diphenamid	N,N-dimethyl-α-phenylbenzeneacetamide

	<u>Common Name</u>	<u>Chemical Name</u>
5	dipropetryn	6-(ethylthio)-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
	diquat	6,7-dihydrodipyrido[1,2-a:2',1'-c]-pyrazinedium ion
	diuron	N'-(3,4-dichlorophenyl)-N,N-dimethylurea
10	DNOC	2-methyl-4,6-dinitrophenol
	DPX-M6316	3-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid, methyl ester
15	DSMA	disodium salt of MAA
	dymron	N-(4-methylphenyl)-N'-(1-methyl-1-phenylethyl)urea
	endothall	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
20	EPTC	S-ethyl dipropylcarbamoate
	esprocarb (SC2957)	S-benzyl-N-ethyl-N-(1,2-dimethyl)-propylthiolcarbamate
	ethalfluralin	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)-benzenamine
25	ethofumesate	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
	fenac	2,3,6-trichlorobenzeneacetic acid
30	fenoxaprop	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]-phenoxy]propanoic acid
	fenuron	N,N-dimethyl-N'-phenylurea
	fenuron TCA	Salt of fenuron and TCA
35	flamprop	N-benzoyl-N-(3-chloro-4-fluorophenyl)-DL-alanine

	<u>Common Name</u>	<u>Chemical Name</u>
5	fluazifop	(±)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
	fluazifop-P	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
10	fluchloralin	N-(2-chloroethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine
	fluometuron	N,N-dimethyl-N'-[3-(trifluoromethyl)-phenyl]urea
	fluorochloridone	3-chloro-4-(chloromethyl)-1-[3-(trifluoromethyl)phenyl]-2-pyrrolidinone
15	fluorodifen	p-nitrophenyl α,α,α-trifluoro-2-nitro-p-tolyl ether
	fluoroglycofen	carboxymethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
20	fluridone	1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone
	fomesafen	5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide
	fosamine	ethyl hydrogen (aminocarbonyl)-phosphate
25	glyphosate	N-(phosphonomethyl)glycine
	haloxyfop	2-[4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
	hexaflurate	potassium hexafluoroarsenate
30	hexazinone	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
	imazamethabenz	6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-m-toluic acid, methyl ester and 6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-p-toluic acid, methyl ester
35		

	<u>Common Name</u>	<u>Chemical Name</u>
5	imazapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methyl-ethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid
	imazaquin	2-[4,5-dihydro-4-methyl-4-(1-methyl-ethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid
10	imazethapyr	(±)-2-[4,5-dihydro-4-methyl-4-(1-methyl-ethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid
	ioxynil	4-hydroxy-3,5-diiodobenzonitrile
15	isopropalin'	4-(1-methylethyl)-2,6-dinitro-N,N-dipropylbenzenamine
	isoproturon	N-(4-isopropylphenyl)-N',N'-dimethylurea
	isouron	N'-[5-(1,1-dimethylethyl)-3-isoxazolyl]-N,N-dimethylurea
20	isoxaben	N-[3-(1-ethyl-1-methylpropyl)-5-isoxazolyl]-2,6-dimethoxybenzamide
	karbutilate	3-[[[(dimethylamino)carbonyl]amino]-phenyl-(1,1-dimethylethyl) carbamate
25	lactofen	(±)-2-ethoxy-1-methyl-2-oxoethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
	lenacil	3-cyclohexyl-6,7-dihydro-1H-cyclopentapyrimidine-2,4(3H,5H)-dione
	linuron	N'-(3,4-dichlorophenyl)-N-methoxy-N-methylurea
30	MAA	methylarsonic acid
	MAMA	monoammonium salt of MAA
	MCPA	(4-chloro-2-methylphenoxy)acetic acid
35	MCPB	4-(4-chloro-2-methylphenoxy)butanoic acid

	<u>Common Name</u>	<u>Chemical Name</u>
5	MON 7200	S,S-dimethyl-2-(difluoromethyl)-4-(2-methylpropyl)-6-(trifluoromethyl)-3,5-pyridinedicarbothionate
	mecoprop	(±)-2-(4-chloro-2-methylphenoxy)-propanoic acid
10	mefenacet	2-(2-benzothiazolyloxy-N-methyl-N-phenylacetamide)
	mefluidide	N-[2,4-dimethyl-5-[[trifluoromethyl)sulfonyl]amino]phenyl]acetamide
15	methal-propalin	N-(2-methyl-2-propenyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamide
	methabenz-thiazuron	1,3-dimethyl-3-(2-benzothiazolyl)urea
	metham	methylcarbamidithioic acid
20	methazole	2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione
	methoxuron	N'-(3-chloro-4-methoxyphenyl)-N,N-dimethylurea
	metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide
25	metribuzin	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
	metsulfuron methyl	2-[[[[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]benzoic acid, methyl ester
30	MH	1,2-dihydro-3,6-pyridazinedione
	molinate	S-ethyl hexahydro-1H-azepine-1-carbothioate
35		

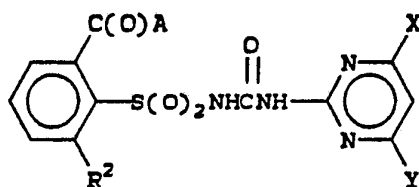
	<u>Common Name</u>	<u>Chemical Name</u>
5	monolinuron	3-(p-chlorophenyl)-1-methoxy-1-methyl-urea
	monuron	N'-(4-chlorophenyl)-N,N-dimethylurea
	monuron TCA	Salt of monuron and TCA
10	MSMA	monosodium salt of MAA
	napropamide	N,N-diethyl-2-(1-naphthalenyloxy)-propanamide
	naptalam	2-[(1-naphthalenylamino)carbonyl]-benzoic acid
15	neburon	1-butyl-3-(3,4-dichlorophenyl)-1-methyl-urea
	nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline
	nitrofen	2,4-dichloro-1-(4-nitrophenoxy)benzene
20	nitrofluorfen	2-chloro-1-(4-nitrophenoxy)-4-(trifluoromethyl)benzene
	norea	N,N-dimethyl-N'-(octahydro-4,7-methano-1H-inden-5-yl)urea 3 α , -4 α , 5 α , 7 α , 7 α -isomer
25	norflurazon	4-chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone
	oryzalin	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide
30	oxadiazon	3-[2,4-dichloro-5-(1-methylethoxy)-phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one
	oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
35	paraquat	1,1'-dimethyl-4,4'-dipyridinium ion

	<u>Common Name</u>	<u>Chemical Name</u>
5	pebulate	S-propyl butylethylcarbamoithioate
	pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
	perfluidone	1,1,1-trifluoro-N-[2-methyl-4-(phenylsulfonyl)phenyl]methanesulfonamide
10	phenmedipham	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate
	picloram	4-amino-3,5,6-trichloro-2-pyridine-carboxylic acid
15	PPG-1013	5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitroacetophenone oxime-O-acetic acid, methyl ester
	pretilachlor	α -chloro-2,6-diethyl-N-(2-propoxyethyl)acetanilide
20	procyazine	2-[[4-chloro-6-(cyclopropylamino)-1,3,5-triazine-2-yl]amino]-2-methylpropane-nitrile
	profluralin	N-(cyclopropylmethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine
	prometon	6-methoxy-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
25	prometryn	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
	pronamide	3,5-dichloro-N-(1,1-dimethyl-2-propynyl)benzamide
30	propachlor	2-chloro-N-(1-methylethyl)-N-phenylacetamide
	propanil	N-(3,4-dichlorophenyl)propanamide
	propazine	6-chloro-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
35	propham	1-methylethyl phenylcarbamate

	<u>Common Name</u>	<u>Chemical Name</u>
5	prosulfalin	N-[[4-(dipropylamino)-3,5-dinitrophenyl]sulfonyl]-S,S-dimethylsulfilimine
	prynachlor	2-chloro-N-(1-methyl-2-propynyl)acetanilide
10	pyrazolate	4-(2,4-dichlorobenzoyl)-1,3-dimethylpyrazol-5-yl-p-toluenesulphonate
	pyrazon	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
15	pyrazosulfuron ethyl	ethyl 5-[3-(4,6-dimethoxypyrimidin-2-yl)ureadosulfonyl]-1-methylpyrazole-4-carboxylate
	quinclorac	3,7-dichloro-8-quinoline carboxylic acid
	quizalofop ethyl	(±)-2-[4-[(6-chloro-2-quinoxalinyloxy]phenoxy]propanoic acid, ethyl ester
20	secbumeton	N-ethyl-6-methoxy-N'-(1-methylpropyl)-1,3,5-triazine-2,4-diamine
	sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
25	siduron	N-(2-methylcyclohexyl)-N'-phenylurea
	simazine	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine
	SK-233	1-(α,α-dimethylbenzyl)-3-(4-methylphenyl)urea
30	sulfometuron methyl	2-[[[(4,6-dimethyl-2-pyrimidinyl)amino]carbonylamino]sulfonyl]-benzoic acid, methyl ester
	TCA	trichloroacetic acid
35	tebuthiuron	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea
	terbacil	5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione

	<u>Common Name</u>	<u>Chemical Name</u>
5	terbuchlor	N-(butoxymethyl)-2-chloro-N-[2-(1,1-dimethylethyl)-6-methylphenyl]-acetamide
	terbutyl- azine	2-(<u>tert</u> -butylamino)-4-chloro-6-(ethylamino)- <u>s</u> -triazine
10	terbutol	2,6-di- <u>tert</u> -butyl-p-tolyl methylcarbamate
	terbutryn	N-(1,1-dimethylethyl)-N'-ethyl-6-(methylthio)-1,3,5-triazine-2,4-diamine
15	thiobencarb	S-[(4-chlorophenyl)methyl] diethylcarbamothioate
	triallate	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl)carbamothioate
20	tribenuron methyl	2-[[[N-(4-methoxy-6-methyl-1,3,5-triazine-2-yl)-N-methylamino]carbonyl]amino]sulfonyl]benzoic acid, methyl ester
	triclopyr	[(3,5,6-trichloro-2-pyridinyl)-oxy]acetic acid
25	tridiphane	2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane
	trifluralin	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine
	trimeturon	1-(p-chlorophenyl)-2,3,3-trimethylpseudourea
30	2,4-D	(2,4-dichlorophenoxy)acetic acid
	2,4-DB	4-(2,4-dichlorophenoxy)butanoic acid
	vernolate	S-propyl dipropylcarbamothioate
35	xylachlor	2-chloro-N-(2,3-dimethylphenyl)-N-(1-methylethyl)acetamide

Herbicidal properties of the subject compounds were discovered in a series of greenhouse tests. Test procedures and results follow.

COMPOUND TABLEA = OR¹

<u>CMPD</u>	<u>R¹</u>	<u>R²</u>	<u>X</u>	<u>Y</u>	<u>m.p. (°C)</u>
1	CH ₂ CH ₃	CH ₂ CN	CH ₃	CH ₃	169-175
2	CH ₂ CH ₃	CH ₂ CN	CH ₃	OCH ₃	153-156
3	CH ₂ CH ₃	CH ₂ CN	OCH ₃	OCH ₃	187-191
4	CH ₂ CH ₃	CH ₂ CN	OCH ₃	Cl	177-184
5	CH ₃	CH ₂ CN	CH ₃	CH ₃	183-185
6	CH ₃	CH ₂ CN	CH ₃	OCH ₃	168-170
7	CH ₃	CH ₂ CN	OCH ₃	OCH ₃	186-194
8	CH ₃	CH ₂ CN	OCH ₃	Cl	186-194
9	CH ₃	CH ₂ CN	OCH ₃	OCF ₂ H	165-171
10	CH ₃	CH ₂ CN	OCH ₃	H	179-180(d)
11	CH ₂ CH ₃	CH ₂ F	OCH ₃	OCH ₃	190-195
12	CH ₃	CH ₂ F	OCH ₃	OCH ₃	168-170
13	CH ₂ CH ₃	CH ₂ F	CH ₃	OCH ₃	177-179
14	CH ₂ CH ₃	CH ₂ F	OCH ₃	Cl	168-172
15	CH ₃	CH ₂ F	OCH ₃	Cl	165-172
16	CH ₃	CH ₂ F	CH ₃	OCH ₃	162-163
17	CH ₃	CH ₂ F	OCH ₃	H	166-167(d)

<u>CMPD</u>	<u>R¹</u>	<u>R²</u>	<u>X</u>	<u>Y</u>	<u>m.p. (°C)</u>
18	CH(CH ₃) ₂	CH ₂ CN	CH ₃	OCH ₃	176-177
19	CH(CH ₃) ₂	CH ₂ CN	OCH ₃	OCH ₃	196-199
20	CH(CH ₃) ₂	CH ₂ CN	OCH ₃	Cl	196-200
21	CH(CH ₃) ₂	CH ₂ CN	OCH ₃	H	174-175
22	CH ₃	CHF ₂	CH ₃	OCH ₃	165-167
23	CH ₃	CHF ₂	OCH ₃	OCH ₃	181-185
24	CH ₃	CHF ₂	OCH ₃	H	178-180(d)
25	CH ₃	CHF ₂	CH ₃	CH ₃	167-171
26	CH ₂ CH ₃	CHF ₂	OCH ₃	H	148-155
27	CH ₂ CH ₃	CHF ₂	OCH ₃	OCH ₃	192-194
28	CH ₂ CH ₃	CHF ₂	CH ₃	OCH ₃	162-164
29	CH(CH ₃) ₂	CHF ₂	CH ₃	OCH ₃	174-176
30	CH(CH ₃) ₂	CHF ₂	OCH ₃	OCH ₃	177-180
31	CH(CH ₃) ₂	CHF ₂	OCH ₃	Cl	186-196
32	CH ₂ CH ₃	CHF ₂	CH ₃	CH ₃	180-192(d)
33	CH ₂ CH ₃	CH ₂ F	CH ₃	CH ₃	194-196
34	CH ₃	CH ₂ F	CH ₃	CH ₃	180-182(d)
35	CH ₃	CHF ₂	CH ₃	CH ₃	167-169(d)
36	CH ₂ CH ₃	CHF ₂	OCH ₃	Cl	173-177
37	CH ₃	CHFCH ₃	OCH ₃	OCH ₃	155-158
38	CH ₃	CHFCH ₃	CH ₃	CH ₃	149-153(d)
39	CH ₃	CHFCH ₃	OCH ₃	Cl	134-137(d)
40	CH ₃	CHFCH ₃	CH ₃	OCH ₃	58-64(d)
41	CH ₂ CH ₃	CHFCH ₃	OCH ₃	Cl	153-156(d)
43	CH ₃	CH ₂ CN	CH ₃	CH ₂ CH ₃	173-175
<u>CMPD</u>	<u>A</u>	<u>R²</u>	<u>X</u>	<u>Y</u>	<u>m.p. (°C)</u>
42	N(CH ₃) ₂	CHFCH ₃	OCH ₃	OCH ₃	156-158

TEST A

Seeds of barley (Hordeum vulgare),
5 barnyardgrass (Echinochloa crus-galli), cheatgrass
(Bromus secalinus), cocklebur (Xanthium
pensylvanicum), corn (Zea mays), cotton (Gossypium
hirsutum), crabgrass (Digitaria spp.), giant foxtail
(Setaria faberi), morningglory (Ipomoea spp.), rice
10 (Oryza sativa), sorghum (Sorghum bicolor), soybean
(Glycine max), sugar beet (Beta vulgaris), velvetleaf
(Abutilon theophrasti), wheat (Triticum aestivum),
and wild oat (Avena fatua) and purple nutsedge
(Cyperus rotundus) tubers were planted and treated
15 preemergence with test chemicals dissolved in a
non-phytotoxic solvent. At the same time, these crop
and weed species were also treated with postemergence
applications of test chemicals. Plants ranged in
height from two to eighteen cm (two to three leaf
20 stage) for postemergence treatments. Treated plants
and controls were maintained in a greenhouse for
approximately sixteen days, after which all species
were compared to controls and visually evaluated.
Plant response ratings, summarized in Table A, are
25 based on a scale of 0 to 10 where 0 is no effect and
10 is complete control. A dash (-) response means no
test result.

30

35

Table A

Rate (50 g/ha)	COMPOUND																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36		
POSTEMERGENCE																																		
Barley	9	9	8	3	9	9	9	8	7	0	2	5	9	0	6	9	2	7	9	8	0	9	3	0	9	0	0	8	9	8	6	0		
Barnyardgrass	9	9	9	10	9	9	9	9	8	9	9	10	9	9	10	7	9	9	8	1	9	9	7	9	7	8	9	9	9	7	7			
Cheatgrass	9	10	10	9	9	9	9	9	9	3	9	9	9	10	9	9	8	9	9	8	0	9	9	9	9	8	7	9	9	6	6	9		
Cocklebur	10	10	10	10	9	10	10	9	9	9	10	10	9	10	10	9	10	10	10	9	10	10	9	10	9	10	9	10	10	10	9	9		
Corn	9	9	9	6	5	9	9	3	6	0	9	9	9	7	7	10	4	9	9	8	2	10	9	0	9	0	5	10	9	8	3	2		
Cotton	10	9	9	9	10	9	9	9	9	10	9	10	9	9	10	10	9	9	9	9	9	10	9	9	9	9	9	10	9	9	9	10		
Crabgrass	-	9	8	5	9	10	6	8	7	2	9	8	6	8	6	9	0	6	3	1	0	3	1	4	9	0	0	9	4	5	4	0		
Giant foxtail	9	9	9	8	9	10	9	9	6	5	5	9	8	3	8	9	3	9	9	3	0	10	6	4	9	0	2	8	7	8	6	1		
Morningglory	9	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	9	10	10	10	10	10	10	9		
Nutsedge	9	10	10	10	-	10	10	10	10	6	10	-	10	10	10	10	9	9	10	-	-	10	10	9	10	9	8	9	9	10	10	0		
Rice	9	9	9	9	9	9	9	9	4	9	9	8	7	9	9	4	9	9	9	5	9	9	8	9	4	3	8	9	8	7	5			
Sorghum	9	9	9	9	9	9	10	9	9	9	9	9	8	9	9	9	9	9	9	8	9	-	9	-	6	4	9	9	6	7	6			
Soybean	9	9	9	7	9	9	9	9	9	9	9	9	6	9	9	9	9	9	7	9	9	9	9	9	9	9	9	9	9	7	9			
Sugar beet	9	9	10	10	9	10	9	9	10	10	9	9	9	9	9	9	9	10	10	9	9	10	10	9	10	10	10	10	10	9	9	10		
Velvetleaf	10	10	10	9	10	10	9	10	10	9	9	10	10	9	9	10	9	9	9	-	-	9	9	10	9	9	-	9	9	10	9			
Wheat	9	9	9	7	9	9	9	7	2	7	5	9	2	8	9	0	9	9	3	0	9	3	0	9	0	8	6	2	0	0				
Wild oat	9	9	7	5	9	9	7	8	6	4	3	3	8	4	6	9	2	8	5	3	0	7	4	2	9	0	6	5	0	3	3			

Table A

		COMPOUND																																			
Rate (50 g/ha)	PREEMERGENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36				
	Barley	9	8	9	6	9	9	9	9	3	0	3	0	8	2	4	9	0	8	6	2	0	7	3	2	9	1	3	7	7	0	1	2				
	Barnyardgrass	9	9	9	8	9	9	9	9	6	0	5	9	9	0	9	9	4	9	9	9	1	9	7	2	9	0	2	8	8	7	4	5				
	Cheatgrass	9	9	9	7	9	9	9	7	4	2	8	8	8	6	8	9	4	8	8	8	6	8	7	5	8	5	6	7	9	7	7	5				
	Cocklebur	9	9	9	8	9	8	9	5	7	1	9	-	9	7	7	9	4	9	9	6	2	9	8	6	9	6	9	8	8	8	6	8				
	Corn	9	9	9	7	8	9	8	1	0	0	0	3	9	0	2	9	0	9	8	8	0	8	2	0	9	3	5	9	7	1	0	3				
	Cotton	9	9	9	3	9	9	9	7	0	2	3	2	8	1	7	9	6	7	8	7	0	4	8	4	9	8	1	7	6	4	-	5				
	Crabgrass	8	9	8	6	10	9	9	9	7	0	4	4	9	2	9	9	2	6	4	2	0	7	4	6	10	0	5	7	6	3	0	2				
	Giant foxtail	9	9	8	6	9	9	9	8	3	2	5	5	7	0	6	9	3	8	6	7	0	9	5	2	9	0	2	6	7	4	2	2				
	Morningglory	9	8	9	9	9	9	9	9	9	2	0	8	2	8	9	9	7	9	9	6	2	9	9	4	9	3	9	7	9	6	9	9				
	Nutsedge	10	8	8	8	10	10	9	9	9	0	0	10	9	0	8	9	0	8	10	10	0	8	0	4	9	10	0	-	6	10	10	0				
	Rice	9	9	9	9	10	9	9	9	8	0	5	8	9	7	8	9	7	10	9	9	5	9	8	8	10	6	5	9	8	5	4	4				
	Sorghum	10	9	9	9	10	9	9	9	9	6	3	4	9	7	9	9	8	9	9	9	7	9	7	8	10	4	2	9	9	2	4	6				
	Soybean	9	9	9	5	9	9	9	8	4	3	1	4	9	0	1	8	4	9	9	3	1	7	7	7	8	6	7	8	8	3	5	5				
	Sugar beet	9	9	9	9	9	9	9	9	9	8	6	8	9	8	9	9	7	9	9	9	9	9	9	8	9	9	9	9	9	8	9	8				
	Velvetleaf	9	9	8	8	9	9	9	8	9	3	7	7	9	6	9	9	9	5	6	5	8	7	8	9	7	8	9	7	9	9	8	5	9			
	Wheat	9	8	9	7	9	9	9	9	8	0	0	0	9	0	2	9	0	9	8	8	0	8	0	0	9	0	9	0	9	6	0	0	0			
	Wild oat	8	8	5	5	8	8	7	6	0	2	0	0	8	0	3	8	0	8	3	3	2	6	2	0	8	0	0	4	5	0	0	0	0			

Table A

Rate (10 g/ha)	COMPOUND																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36				
PREEMERGENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	36				
Barley	8	8	7	2	9	9	8	7	0	0	0	0	6	0	0	8	0	6	0	0	0	5	3	0	8	0	0	3	2	0	0	0				
Barnyardgrass	7	9	7	7	9	9	9	8	0	0	0	4	9	0	7	9	3	9	5	3	0	7	5	0	8	0	0	0	3	2	0	0				
Cheatgrass	8	8	8	7	9	9	8	7	2	0	2	5	7	0	6	8	2	7	7	5	0	5	2	2	8	2	0	3	7	2	2	0				
Cocklebur	7	7	7	5	9	8	8	5	0	0	-	3	5	0	7	4	3	8	5	7	2	7	5	-	8	2	3	2	6	3	-	1				
Corn	9	9	8	3	6	6	8	0	0	0	0	2	7	0	0	7	2	8	5	6	0	3	0	0	9	0	0	2	0	0	0	0				
Cotton	7	4	2	3	8	8	9	2	0	0	0	0	3	0	2	8	4	7	2	3	0	2	0	0	8	1	0	1	5	2	0	0				
Crabgrass	7	7	4	2	9	9	7	9	0	0	0	4	2	0	7	9	0	2	2	0	0	5	4	2	8	0	0	2	0	0	0	0				
Giant foxtail	9	8	7	1	9	9	9	2	3	0	0	2	3	0	2	9	3	7	2	3	0	6	0	0	7	0	0	2	2	0	0	0				
Morningglory	3	4	9	8	7	9	9	8	2	0	0	4	3	0	4	7	6	7	0	0	0	9	7	2	8	0	3	2	2	1	1	9				
Nutsedge	9	8	5	3	10	9	10	0	7	0	0	0	2	0	10	7	-	7	5	0	0	0	0	0	0	0	0	0	10	6	4	0				
Rice	-	9	9	9	9	9	8	9	5	0	0	7	8	0	7	9	3	9	8	7	0	6	0	3	9	2	0	4	4	0	0	0				
Sorghum	9	10	9	9	10	9	9	9	3	2	0	0	8	0	7	9	3	9	9	8	2	7	6	3	9	3	0	3	5	2	2	0				
Soybean	8	9	6	5	9	8	6	3	1	0	1	3	7	0	0	7	2	7	1	1	0	4	3	5	9	2	2	3	4	2	0	0				
Sugar beet	9	9	9	9	9	9	9	7	8	4	2	6	7	0	8	9	4	8	5	5	2	9	6	3	8	9	4	9	8	4	7	8				
Velvetleaf	9	7	4	5	9	8	8	7	2	2	0	5	9	0	7	9	6	8	2	7	2	3	3	4	3	1	5	2	8	3	2	0				
Wheat	9	9	8	5	8	9	8	7	0	0	0	0	5	0	0	9	0	8	4	2	0	3	0	0	6	0	0	0	0	0	0	0				
Wild oat	8	6	4	0	8	8	3	0	0	0	0	0	5	0	0	6	0	7	0	0	0	2	0	0	3	0	0	0	2	0	0	0				

TEST B

Seeds of barley (Hordeum vulgare),
5 barnyardgrass (Echinochloa crus-galli), blackgrass
(Alopecurus myosuroides), cheatgrass (Bromus
secalinus), chickweed (Stellaria media), cocklebur
(Xanthium pensylvanicum), corn (Zea mays), cotton
(Gossypium hirsutum), crabgrass (Digitaria spp.),
10 bedstraw (Galium aparine), giant foxtail (Setaria
faberii), lambsquarters (Chenopodium album),
morningglory (Ipomoea hederacea), rape (Brassica
napus), rice (Oryza sativa), sorghum (Sorghum
bicolor), soybean (Glycine max), sugar beet (Beta
15 vulgaris), velvetleaf (Abutilon theophrasti), wheat
(Triticum aestivum), wild buckwheat (Polygonum
convolvulus), and wild oat (Avena fatua) and purple
nutsedge (Cyperus rotundus) tubers were planted and
treated preemergence with test chemicals dissolved in
20 a non-phytotoxic solvent. At the same time, these
crop and weed species were also treated with
postemergence applications of test chemicals. Plants
ranged in height from two to eighteen cm (one to four
leaf stage) for postemergence treatments. Treated
25 plants and controls were maintained in a greenhouse
for twelve to sixteen days, after which all species
were compared to controls and visually evaluated.
Plant response ratings, summarized in Table B, are
based on a scale of 0 to 10 where 0 is no effect and
30 10 is complete control. A dash (-) response means no
test result.

Table B

	COMPOUND
Rate (200 g/ha)	43
POSTEMERGENCE	
Barley	8
Barnyardgrass	10
Bedstraw	9
Blackgrass	10
Cheatgrass	9
Chickweed	10
Corn	9
Cotton	9
Crabgrass	6
Giant foxtail	9
Lambsquarters	9
Morningglory	10
Nutsedge	10
Rape	10
Rice	9
Sorghum	9
Soybean	9
Sugar beet	9
Velvetleaf	9
Wheat	9
Wild buckwheat	9
Wild oat	8

Table B

	COMPOUND
Rate (200 g/ha)	43
PREEMERGENCE	
Barley	8
Barnyardgrass	9
Bedstraw	9
Blackgrass	9
Cheatgrass	8
Chickweed	9
Corn	9
Cotton	8
Crabgrass	9
Giant foxtail	9
Lambsquarters	9
Morningglory	9
Nutsedge	10
Rape	9
Rice	10
Sorghum	9
Soybean	9
Sugar beet	9
Velvetleaf	9
Wheat	9
Wild buckwheat	9
Wild oat	8

Table B

Rate (50 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley	9	9	10	10	7	9	5	9	5	9	7
Barnyardgrass	9	10	10	9	9	9	10	9	9	10	9
Bedstraw	10	9	9	10	9	10	10	10	10	10	7
Blackgrass	9	10	10	9	9	9	9	9	8	9	9
Cheatgrass	9	9	10	9	9	9	9	9	9	9	8
Chickweed	10	-	-	10	10	10	9	10	9	10	9
Cocklebur	10	10	10	10	10	10	10	10	-	10	-
Corn	10	10	9	10	10	10	9	9	9	10	7
Cotton	9	9	10	10	9	10	10	9	10	9	9
Crabgrass	9	-	-	9	4	10	5	4	0	5	4
Giant foxtail	9	9	10	9	9	10	9	9	6	9	9
Lambsquarters	10	10	10	10	10	10	9	9	10	10	9
Morningglory	9	9	9	9	10	10	9	10	10	10	10
Nutsedge	10	10	10	9	10	10	10	10	9	-	10
Rape	10	9	9	9	9	9	9	10	10	9	9
Rice	9	9	10	9	9	10	9	9	8	9	9
Sorghum	9	9	10	9	9	10	9	9	8	10	9
Soybean	9	9	9	9	9	9	9	9	9	9	9
Sugar beet	10	9	9	10	9	9	9	10	10	10	9
Velvetleaf	9	10	10	10	10	10	10	9	9	10	9
Wheat	9	9	9	9	8	9	4	9	5	9	8
Wild buckwheat	10	10	10	10	10	10	10	10	10	9	7
Wild oat	9	9	10	9	7	9	8	9	7	6	5

Table B

Rate (50 g/ha)	COMPOUND											
	32	33	34	35	37	38	39	40	41	42	43	
PREEMERGENCE												
Barley	9	9	9	9	2	9	1	2	2	9	5	
Barnyardgrass	9	9	9	9	7	9	5	7	5	9	9	
Bedstraw	7	8	8	7	7	9	9	8	8	9	8	
Blackgrass	9	9	9	8	5	9	4	9	8	9	8	
Cheatgrass	9	9	10	9	8	9	8	9	8	9	8	
Chickweed	10	-	-	10	9	10	10	-	9	10	8	
Cocklebur	9	9	9	-	6	8	9	-	-	9	-	
Corn	9	9	9	9	7	9	3	8	6	9	7	
Cotton	9	9	9	9	3	9	8	8	0	8	5	
Crabgrass	7	9	9	8	5	9	2	6	2	7	7	
Giant foxtail	7	6	8	9	5	8	6	7	2	9	8	
Lambsquarters	10	10	-	10	9	9	10	10	9	10	9	
Morningglory	8	6	9	10	9	9	9	9	9	9	9	
Nutsedge	9	10	9	10	7	10	9	0	9	10	10	
Rape	10	9	9	9	9	10	9	9	9	9	8	
Rice	10	9	10	9	8	10	8	7	8	9	9	
Sorghum	9	9	9	9	9	10	8	7	0	9	9	
Soybean	9	9	9	9	9	9	6	8	2	9	7	
Sugar beet	9	8	8	9	9	9	9	9	9	9	9	
Velvetleaf	9	9	9	9	8	9	7	9	7	9	8	
Wheat	9	9	9	9	0	9	2	7	2	9	9	
Wild buckwheat	8	8	8	8	5	6	1	5	5	9	8	
Wild oat	9	9	9	9	1	9	1	2	7	2	7	

Table B

Rate (10 g/ha)	COMPOUND									
	32	33	34	35	37	38	39	40	41	42
POSTEMERGENCE										
Barley	9	9	9	9	4	9	4	9	0	9
Barnyardgrass	8	10	10	9	9	9	9	9	8	10
Bedstraw	6	7	7	8	10	9	10	10	9	9
Blackgrass	9	9	9	8	8	9	7	9	9	10
Cheatgrass	9	9	9	9	9	9	7	9	5	9
Chickweed	10	9	-	10	10	9	10	10	8	9
Cocklebur	10	9	10	10	10	10	10	9	-	-
Corn	9	9	9	9	9	10	1	9	4	9
Cotton	9	9	9	9	9	9	9	9	9	9
Crabgrass	-	-	-	7	-	9	2	3	0	0
Giant foxtail	8	7	10	9	5	9	5	8	3	8
Lambsquarters	9	9	10	10	10	9	10	9	9	9
Morningglory	6	3	8	9	10	10	9	9	10	10
Nutsedge	9	10	10	9	10	10	10	9	9	8
Rape	10	9	9	9	9	9	9	10	10	9
Rice	9	9	10	9	7	9	3	8	2	9
Sorghum	9	9	10	9	9	10	8	9	2	9
Soybean	9	9	9	9	9	9	9	9	8	9
Sugar beet	10	5	9	9	10	9	9	9	10	9
Velvetleaf	9	9	10	9	10	9	9	9	9	9
Wheat	9	9	9	9	3	9	2	7	1	9
Wild buckwheat	-	7	10	9	9	9	10	9	9	7
Wild oat	9	9	10	9	3	9	2	5	2	2

Table B

Rate (10 g/ha)	COMPOUND									
	32	33	34	35	37	38	39	40	41	42
PREEMERGENCE										
Barley	7	8	8	2	0	3	0	1	0	3
Barnyardgrass	3	4	9	7	3	7	0	3	2	7
Bedstraw	7	5	8	0	3	5	0	3	1	3
Blackgrass	8	8	9	7	2	7	3	6	0	7
Cheatgrass	9	9	9	9	7	9	7	8	7	8
Chickweed	10	-	-	-	10	9	10	-	8	10
Cocklebur	7	4	7	-	0	8	7	0	-	6
Corn	9	9	9	8	1	7	0	2	0	0
Cotton	5	9	8	9	0	6	8	6	0	3
Crabgrass	2	6	6	3	1	9	0	2	0	0
Giant foxtail	3	6	2	5	0	7	0	5	0	4
Lambsquarters	9	-	9	9	10	9	10	10	6	9
Morningglory	4	4	5	9	3	9	6	3	0	6
Nutsedge	5	9	9	9	0	10	7	3	0	0
Rape	9	9	9	9	8	9	2	2	3	9
Rice	9	9	9	9	4	9	6	2	3	6
Sorghum	1	9	8	9	0	8	0	1	0	3
Soybean	7	6	6	7	3	6	2	2	0	6
Sugar beet	8	7	7	8	8	8	9	7	8	8
Velvetleaf	7	2	9	7	7	8	5	5	2	3
Wheat	7	8	9	7	0	6	0	2	0	6
Wild buckwheat	5	6	8	3	2	3	0	0	2	2
Wild oat	5	8	9	6	0	4	0	3	4	0

TEST C

Seeds of barley (Hordeum vulgare),
5 barnyardgrass (Echinochloa crus-galli), blackgrass
(Alopecurus myosuroides), chickweed (Stellaria
media), cocklebur (Xanthium pensylvanicum), corn (Zea
mays), cotton (Gossypium hirsutum), crabgrass
(Digitaria spp.), downy brome (Bromus tectorum),
10 giant foxtail (Setaria faberi), green foxtail
(Setaria viridis), jimsonweed (Datura stramonium),
johnsongrass (Sorghum halepense), lambsquarters
(Chenopodium album), morningglory (Ipomoea spp.),
rape (Brassica napus), rice (Oryza sativa), sicklepod
15 (Cassia obtusifolia), soybean (Glycine max), sugar
beet (Beta vulgaris), teaweed (Sida spinosa),
velvetleaf (Abutilon theophrasti), wheat (Triticum
aestivum), wild buckwheat (Polygonum convolvulus),
and wild oat (Avena fatua) and purple nutsedge
20 (Cyperus rotundus) tubers were planted and treated
preemergence with test chemicals dissolved in a
non-phytotoxic solvent. At the same time, these crop
and weed species were also treated with postemergence
applications of test chemicals. Plants ranged in
25 height from two to eighteen cm (two to three leaf
stage) for postemergence treatments. Treated plants
and controls were maintained in a greenhouse for
approximately 24 days, after which all species were
30 compared to controls and visually evaluated. Plant
response ratings, summarized in Table C, are reported
on a 0 to 10 scale where 0 is no effect and 10 is
complete control. A dash (-) response means no test
result.

Table C

Rate (250 g/ha)	COMPOUND	
	4	10
POSTEMERGENCE		
Barley	7	-
Blackgrass	9	5
Chickweed	10	10
Cocklebur	10	10
Corn	8	2
Cotton	10	9
Crabgrass	7	3
Downy brome	7	5
Giant foxtail	7	7
Green foxtail	8	7
Jimsonweed	10	10
Johnsongrass	9	10
Lambsquarters	10	10
Morningglory	10	10
Nutsedge	10	4
Rape	10	10
Rice Dry Seed	10	9
Sicklepod	10	8
Soybean	9	10
Sugar beet	10	10
Teaweed	9	7
Velvetleaf	10	10
Wheat	8	3
Wild buckwheat	9	10
Wild oat	9	2
Barnyardgrass	10	9

Table C

Rate (250 g/ha)	COMPOUND	
	4	10
PREEMERGENCE		
Barley	7	0
Blackgrass	9	-
Chickweed	7	7
Cocklebur	10	6
Corn	9	0
Cotton	7	4
Crabgrass	9	10
Downy brome	9	6
Giant foxtail	8	7
Green foxtail	9	7
Jimsonweed	9	8
Johnsongrass	9	8
Lambsquarters	10	-
Morningglory	9	8
Nutsedge	9	0
Rape	10	9
Rice Dry Seed	10	9
Sicklepod	9	5
Soybean	8	3
Sugar beet	9	9
Teaweed	8	6
Velvetleaf	9	10
Wheat	9	0
Wild buckwheat	9	7
Wild oat	8	-
Barnyardgrass	10	6

Table C

Rate (62 g/ha) POSTEMERGENCE	COMPOUND																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36						
Barley	9	9	8	6	10	10	9	8	-	-	3	4	7	4	9	2	6	4	0	10	4	5	10	5	4	9	8	2	3	5						
Blackgrass	9	10	9	9	10	10	10	9	10	5	10	7	9	6	8	4	9	8	7	10	6	5	10	6	7	10	10	9	5	3						
Chickweed	10	10	10	9	10	10	10	10	10	9	10	9	10	8	10	10	8	10	0	10	10	10	10	6	10	10	10	10	6	9						
Cocklebur	10	10	10	9	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10						
Corn	9	10	10	7	9	10	10	2	6	0	10	10	6	10	0	10	10	7	10	10	4	10	0	7	10	10	10	6	7							
Cotton	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10						
Crabgrass	8	5	8	5	9	7	7	8	5	2	7	9	6	3	9	4	6	4	3	10	-	6	10	0	4	7	5	0	0	6						
Downy brome	9	9	8	7	10	10	9	7	5	4	3	2	7	6	9	3	6	5	0	10	4	0	10	0	0	8	9	0	3	0						
Giant foxtail	10	9	10	7	10	10	10	8	5	5	4	7	7	7	10	2	8	6	3	10	6	5	10	0	0	5	0	0	4	2						
Green foxtail	9	8	8	7	10	10	10	8	2	6	5	7	7	6	10	4	7	6	3	10	7	7	10	0	2	8	4	0	4	2						
Jimsonweed	9	10	9	9	10	10	10	9	9	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10						
Johnsongrass	10	10	10	7	10	10	10	10	8	10	7	9	10	9	10	6	7	9	7	10	6	8	10	7	2	10	5	4	7	5						
Lambsquarters	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10	-	8	-	-	10	10	10	-	-	-	-	-	-	-	10						
Morningglory	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10					
Nutsedge	10	10	10	10	10	10	10	10	10	4	10	10	10	10	10	10	10	10	10	10	10	10	10	5	10	10	10	6	10	10						
Rape	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10						
Rice Dry Seed	10	10	10	9	10	10	10	10	9	6	5	7	6	7	9	6	8	7	7	10	10	9	10	6	4	8	9	5	5	5						
Sicklepod	10	10	10	8	10	10	10	9	10	6	10	10	9	10	10	9	10	10	8	10	10	10	10	6	10	10	10	10	7	10						
Soybean	10	10	10	9	9	10	10	10	10	10	10	10	10	9	9	10	10	9	10	10	9	10	10	10	10	10	10	10	10	10	10					
Sugar beet	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10					
Teaweed	9	9	8	8	10	9	8	9	6	5	7	9	9	9	10	8	9	7	8	10	10	10	10	9	6	10	7	8	8	10						
Velvetleaf	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	9					
Wheat	9	8	9	5	10	10	9	9	6	0	1	2	8	4	9	2	8	6	3	10	5	0	10	0	3	7	6	0	0	0						
Wild buckwheat	10	10	10	9	10	10	10	10	10	9	10	10	10	10	9	9	10	10	8	10	10	10	10	10	9	10	10	10	9	9						
Wild oat	10	9	9	5	10	10	9	9	0	0	1	0	6	8	8	0	6	5	3	8	0	0	10	3	4	5	6	0	0	4						
Barnyardgrass	10	10	10	9	10	10	10	10	10	8	8	10	10	10	10	7	8	8	7	10	10	10	10	0	6	10	9	8	4	8						

Table C

		COMPOUND																																			
Rate (16 g/ha)	POSTEMERGENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36						
	Barley	8	8	7	4	9	9	7	4	-	-	0	3	6	2	8	0	4	0	0	0	9	3	3	10	3	0	6	5	0	0	0					
	Blackgrass	9	9	9	8	9	10	10	8	9	0	5	5	8	4	7	2	8	6	5	9	5	4	8	4	3	10	9	5	2	3						
	Chickweed	10	10	10	7	9	10	10	8	9	8	9	9	8	10	7	7	7	7	0	10	10	7	10	5	9	9	10	10	0	9						
	Cocklebur	9	9	10	8	10	9	10	9	10	9	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10	-	10	-	9	10				
	Corn	8	9	9	4	3	9	9	0	4	0	10	10	9	2	10	0	8	10	5	10	9	2	10	0	4	10	9	7	1	4						
	Cotton	9	9	10	9	10	9	10	9	10	10	8	10	10	9	9	7	9	10	8	10	10	9	10	9	10	6	10	10	9	7	6	10				
	Crabgrass	7	5	5	3	7	7	3	5	4	0	6	6	5	3	7	2	4	2	3	10	10	6	10	-	3	6	3	0	0	6						
	Downy brome	7	8	7	5	10	9	9	4	4	3	0	0	6	4	8	2	4	3	0	9	4	0	10	0	0	7	3	0	0	0						
	Giant foxtail	9	9	7	4	10	10	9	6	4	4	3	6	5	4	9	0	6	3	0	8	5	4	10	0	0	4	-	0	1	0						
	Green foxtail	8	7	5	3	10	9	9	7	0	4	4	6	5	4	9	2	6	3	0	10	6	4	10	0	0	5	0	0	0	0						
	Jimsonweed	8	10	9	7	7	10	9	9	8	6	7	8	10	10	10	6	7	8	6	10	10	7	10	6	10	10	8	10	9	10						
	Johnsongrass	10	9	9	7	10	10	10	8	8	6	6	8	8	7	9	5	6	6	3	10	6	5	10	2	2	8	4	3	6	2						
	Lambsquarters	9	10	8	8	10	10	10	10	10	10	10	10	10	5	-	5	-	-	-	10	-	10	10	-	-	-	-	-	-	8						
	Morningglory	9	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	8	9	10	10	9	10	10	10	10	10	10	10	10					
	Nutsedge	10	10	10	10	10	10	10	10	10	3	10	10	10	9	10	10	7	10	10	-	10	10	4	10	10	8	-	10	9							
	Rape	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10					
	Rice Dry Seed	10	10	9	8	10	10	10	9	8	5	3	6	5	6	7	4	7	6	6	9	9	8	10	4	2	7	6	3	0	3						
	Sicklepod	10	10	10	8	9	10	10	9	9	4	10	10	9	10	10	4	9	9	7	10	10	9	10	0	10	10	8	10	2	-						
	Soybean	9	10	10	8	9	9	10	8	10	10	10	10	7	9	9	10	10	10	8	10	10	10	10	10	10	10	10	10	9	3						
	Sugar beet	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	10	10	10	10	10	10	10	10	10	9						
	Teaweed	8	7	5	7	8	9	5	8	6	3	5	7	8	9	10	6	7	5	7	10	9	6	10	8	6	8	6	4	7							
	Velvetleaf	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	7	10	9	8	10	10	7	10	9	7	10	10	7	9	9					
	Wheat	8	6	8	3	9	10	9	8	0	0	0	0	7	1	8	0	4	3	0	10	4	0	10	0	0	5	4	0	0	0						
	Wild buckwheat	10	10	10	9	10	9	10	10	8	7	9	10	9	8	9	5	9	7	6	10	9	9	10	10	8	10	9	6	7	7						
	Wild oat	10	9	8	4	10	10	6	9	0	0	0	0	5	4	5	0	4	2	0	7	0	0	9	0	0	4	3	0	0	2						
	Barnyardgrass	10	10	9	9	10	10	10	9	8	6	7	10	9	10	10	4	8	6	3	10	10	9	10	0	6	8	8	8	4	3						

Table C

Rate (4 g/ha) PREEMERGENCE	COMPOUND																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	28	29	30	31	36						
Barley	5	6	0	0	3	4	0	0	0	0	0	0	4	0	5	0	4	3	0	3	0	0	3	0	0	0	0	4	0	0	0	2				
Blackgrass	7	5	5	5	10	9	3	3	-	-	0	3	6	0	6	0	7	7	6	3	3	0	0	0	2	2	5	3	0	0	0					
Chickweed	5	7	6	5	3	8	8	2	7	7	6	7	7	5	8	0	7	7	0	7	7	3	5	0	4	0	6	4	0	3						
Cocklebur	6	8	7	3	9	8	4	2	0	0	7	7	7	3	6	0	10	9	7	7	7	5	0	7	6	6	6	5	7	3						
Corn	3	5	0	0	0	4	2	0	0	0	0	0	6	0	3	0	4	0	3	5	0	0	6	0	5	0	0	0	0	2						
Cotton	6	3	3	0	2	2	0	3	0	0	3	8	7	4	4	0	3	3	0	6	3	4	7	3	3	5	0	2	0	2						
Crabgrass	8	8	7	3	8	9	7	4	8	10	5	7	3	6	8	0	3	3	0	3	4	0	6	0	2	8	3	4	6	3						
Downy brome	5	6	3	0	5	4	3	2	0	0	0	0	3	2	6	0	4	3	0	3	0	0	3	2	0	0	4	0	0	4						
Giant foxtail	7	5	4	3	9	8	5	6	0	0	0	0	3	0	3	0	7	3	0	4	0	0	3	0	2	2	0	0	0	0						
Green foxtail	7	8	3	3	8	8	2	4	0	0	0	3	3	0	6	0	7	3	0	6	3	0	6	0	0	2	3	0	0	1						
Jimsonweed	3	3	4	0	8	8	8	2	5	0	6	6	7	7	7	0	4	3	3	8	6	5	8	0	2	0	6	3	4	4						
Johnsongrass	6	3	3	0	3	8	8	3	3	0	3	3	7	6	7	0	8	4	3	7	0	3	7	0	0	5	4	0	3	2						
Lambsquarters	9	8	9	8	10	9	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	7							
Morningglory	3	8	7	3	3	3	3	7	6	0	4	7	6	6	5	0	7	3	3	5	5	4	7	5	3	5	6	4	4	4						
Nutsedge	8	7	0	7	9	9	6	0	0	0	3	8	5	0	3	3	9	4	3	8	3	0	7	4	7	2	3	4	4	-						
Rape	9	9	7	7	9	9	10	5	7	0	7	6	10	7	5	0	9	9	7	8	9	6	9	7	3	6	8	3	6	9						
Rice Dry Seed	8	8	8	8	9	9	4	5	4	0	0	0	6	0	7	0	7	5	6	7	3	3	9	2	0	3	3	0	2	2						
Sicklepod	5	3	7	0	3	3	0	0	3	0	7	8	7	5	6	3	0	0	3	8	7	5	10	0	0	5	3	3	0	-						
Soybean	5	2	2	0	8	3	2	0	0	0	0	0	7	0	4	0	4	3	0	4	3	0	6	3	0	2	0	0	0	0						
Sugar beet	8	7	8	7	9	9	9	3	7	6	6	7	9	7	8	3	7	3	6	6	10	7	7	8	8	8	8	5	6	6						
Teaweed	3	3	2	0	5	7	0	0	3	7	6	3	7	8	8	3	7	3	6	7	0	5	5	0	2	3	5	4	0	-						
Velvetleaf	9	8	0	3	3	9	7	5	10	-	6	6	7	4	7	4	7	7	8	8	7	7	9	-	4	0	-	9	4	5						
Wheat	5	7	3	0	3	3	5	2	2	0	0	0	3	0	5	0	0	3	0	0	0	0	5	0	0	0	3	0	0	0						
Wild buckwheat	8	7	8	7	8	8	8	4	0	5	7	7	5	6	0	7	5	4	7	6	7	8	9	4	5	6	3	3	7	7						
Wild oat	6	5	3	2	3	3	2	0	0	-	0	0	3	0	3	0	5	0	0	0	0	0	3	0	0	3	3	0	0	0						
Barnyardgrass	6	3	3	0	2	5	5	9	0	0	0	6	8	3	9	0	8	3	3	8	0	0	9	3	3	0	3	0	0	3						

TEST D

5 The compounds evaluated in this test were
formulated in a non-phytoxic solvent and applied to
the soil surface before plant seedlings emerged
(preemergence application), to water that covered the
soil surface (paddy application), and to plants that
were in the one-to-four leaf stage (postemergence
10 application). A sandy loam soil was used for the
preemergence and postemergence tests, while a silt
loam soil was used in the paddy test. Water depth
was approximately 2.5 cm for the paddy test and was
maintained at this level for the duration of the test.

15 Plant species in the preemergence and
postemergence tests consisted of barley (Hordeum
vulgare), bedstraw (Galium aparine), blackgrass
(Alopecurus myosuroides), chickweed (Stellaria
media), corn (Zea mays), cotton (Gossypium hirsutum),
20 crabgrass (Digitaria sanguinalis), downy brome
(Bromus tectorum), giant foxtail (Setaria faberii),
lambsquarters (Chenopodium album), morningglory
(Ipomoea hederacea), pigweed (Amaranthus retroflexus),
rape (Brassica napus), ryegrass (Lolium multiflorum),
25 sorghum (Sorghum bicolor), soybean (Glycine max),
speedwell (Veronica persica), sugar beet (Beta
vulgaris), velvetleaf (Abutilon theophrasti), wheat
(Triticum aestivum), wild buckwheat (Polygonum
convolvulus), and wild oat (Avena fatua). All plant
30 species were planted one day before application of
the compound for the preemergence portion of this
test. Plantings of these species were adjusted to
produce plants of appropriate size for the
postemergence portion of the test. Plant species in
35 the paddy test consisted of barnyardgrass

(Echinochloa crus-galli), rice (Oryza sativa), and umbrella sedge (Cyperus difformis).

5 All plant species were grown using normal greenhouse practices. Visual evaluations of injury expressed on treated plants, when compared to untreated controls, were recorded approximately fourteen to twenty-one days after application of the
10 test compound. Plant response ratings, summarized in Table D, were recorded on a 0 to 10 scale where 0 is no injury and 10 is complete control. A dash (-) response means no test result.

15

20

25

30

35

Table D

Rate (62 g/ha)	COMPOUND					
	32	35	40	41	42	43
POSTEMERGENCE						
Barley Igri	9	10	10	5	10	6
Bedstraw	10	10	10	10	10	10
Blackgrass	9	10	10	10	10	10
Chickweed	10	10	10	10	10	10
Corn	10	10	10	9	10	8
Cotton	10	10	10	10	10	10
Crabgrass	7	10	6	0	3	4
Downy brome	9	10	9	6	10	8
Duck salad	-	-	-	9	9	-
Giant foxtail	10	10	10	7	10	9
Lambsquarters	10	10	10	10	10	10
Morningglory	10	10	10	10	10	10
Pigweed	10	10	10	10	10	10
Rape	10	10	10	10	10	10
Ryegrass	10	10	10	3	5	7
Sorghum	10	10	10	7	10	10
Soybean	10	10	10	7	10	9
Speedwell	9	10	10	10	8	9
Sugar beet	10	10	10	10	10	10
Velvetleaf	10	10	10	10	9	10
Wheat	9	9	9	3	9	7
Wild buckwheat	10	10	10	10	9	8
Wild oat	9	9	6	5	4	7
Barnyardgrass	9	10	9	9	10	9
Rice Japonica	8	8	8	8	8	9
Umbrella sedge	10	10	9	9	9	9

Table D

Rate (62 g/ha)	COMPOUND					
	32	35	40	41	42	43
PREEMERGENCE						
Barley Igri	9	5	4	2	9	2
Bedstraw	9	9	10	10	10	10
Blackgrass	9	7	9	7	9	10
Chickweed	10	-	10	9	9	9
Corn	8	10	2	3	7	3
Cotton	6	9	9	10	10	7
Crabgrass	8	10	7	8	5	7
Downy brome	10	7	7	7	10	7
Giant foxtail	7	9	4	6	7	7
Lambsquarters	10	-	10	9	10	10
Morningglory	8	8	10	10	9	8
Pigweed	10	10	10	9	10	9
Rape	10	9	10	10	9	10
Ryegrass	10	10	6	6	7	8
Sorghum	9	10	9	7	10	9
Soybean	7	9	7	0	9	4
Speedwell	10	9	10	9	10	9
Sugar beet	10	9	9	10	10	10
Velvetleaf	8	9	9	8	9	9
Wheat	9	7	4	2	9	4
Wild buckwheat	9	8	9	8	9	9
Wild oat	6	5	5	3	3	3

Table D

Rate (31 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	9	9	9	10	6	10	4	9	4	9	5
Bedstraw	10	10	10	10	10	10	10	10	10	10	10
Blackgrass	9	9	9	10	10	10	9	10	9	10	10
Chickweed	10	10	10	10	10	10	10	10	10	10	10
Corn	10	10	10	10	8	10	7	10	8	10	7
Cotton	10	10	10	10	10	10	10	10	10	10	9
Crabgrass	6	7	10	10	0	8	0	5	0	0	3
Downy brome	8	10	10	10	5	10	4	9	5	10	7
Duck salad	-	-	-	-	-	-	-	-	7	8	-
Giant foxtail	8	10	10	10	6	10	6	10	5	7	8
Lambsquarters	10	10	10	10	10	10	-	10	10	10	10
Morningglory	10	8	8	10	10	10	10	10	10	10	10
Pigweed	10	10	10	10	10	10	0	10	8	10	9
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	9	10	10	10	0	10	4	10	2	4	7
Sorghum	10	10	10	10	10	10	7	10	6	10	10
Soybean	10	10	10	10	10	10	10	10	7	10	9
Speedwell	9	8	8	10	5	8	9	9	10	8	8
Sugar beet	10	10	10	10	10	10	10	10	10	10	10
Velvetleaf	10	10	10	10	8	10	10	10	10	9	10
Wheat	9	9	9	9	4	9	2	9	0	8	7
Wild buckwheat	10	10	10	10	10	10	9	10	10	9	7
Wild oat	8	9	10	7	3	9	4	5	4	4	6
Barnyardgrass	9	8	9	9	8	9	7	9	8	9	9
Rice Japonica	8	8	9	8	7	9	8	8	8	8	9
Umbrella sedge	10	9	10	10	9	9	9	9	9	9	9

Table D

Rate (31 g/ha)	COMPOUND											
	32	33	34	35	37	38	39	40	41	42	43	
PREEMERGENCE												
Barley Igri	8	3	7	4	3	4	0	2	0	7	2	
Bedstraw	8	9	10	9	10	8	9	10	9	10	10	
Blackgrass	9	10	8	6	9	8	7	9	6	9	9	
Chickweed	10	10	10	-	10	9	8	10	9	9	7	
Corn	5	8	9	10	0	6	3	0	0	7	2	
Cotton	6	7	8	9	7	8	3	7	6	9	5	
Crabgrass	8	7	8	10	3	7	0	7	6	4	5	
Downy brome	8	8	10	6	4	8	4	5	6	9	5	
Giant foxtail	6	8	8	9	2	7	10	3	6	6	4	
Lambsquarters	10	10	10	-	10	10	9	10	9	10	9	
Morningglory	8	6	7	7	6	3	6	10	9	9	3	
Pigweed	10	9	9	10	8	8	7	10	9	9	9	
Rape	10	9	9	8	10	10	10	10	10	9	10	
Ryegrass	9	10	10	9	4	5	5	4	6	6	5	
Sorghum	8	9	10	10	5	10	7	9	4	7	9	
Soybean	6	7	2	7	0	6	0	6	0	9	4	
Speedwell	10	10	10	8	9	10	10	10	9	9	9	
Sugar beet	9	9	10	9	10	9	9	9	10	10	9	
Velvetleaf	8	9	7	9	8	8	7	8	8	8	8	
Wheat	6	6	6	6	0	3	0	3	1	5	2	
Wild buckwheat	9	9	8	8	8	9	8	8	7	9	9	
Wild oat	4	4	5	4	0	0	0	3	2	0	0	

Table D

Rate (16 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	8	9	9	10	5	9	4	8	3	9	4
Bedstraw	10	10	10	10	10	10	10	10	10	10	9
Blackgrass	9	9	9	10	10	10	8	9	9	10	10
Chickweed	10	9	10	10	10	10	10	10	10	10	7
Corn	10	10	10	10	8	10	6	10	6	10	6
Cotton	9	10	10	10	10	10	10	10	10	10	9
Crabgrass	5	6	9	9	0	7	0	4	0	0	0
Downy brome	7	9	9	8	4	10	4	5	4	10	6
Duck salad	-	-	-	-	-	-	-	-	1	7	-
Giant foxtail	7	9	10	10	6	10	5	10	3	6	8
Lambsquarters	10	10	10	10	10	10	10	10	10	10	9
Morningglory	10	7	7	10	10	10	10	10	10	10	9
Pigweed	10	9	10	10	7	9	0	10	7	5	8
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	9	10	10	10	0	10	4	9	0	4	6
Sorghum	10	10	10	10	10	10	6	10	6	10	10
Soybean	10	10	10	10	10	10	10	10	7	10	9
Speedwell	8	8	8	9	5	8	9	8	10	7	7
Sugar beet	10	10	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	10	10	7	10	7	10	10	5	9
Wheat	6	9	9	4	4	9	0	7	0	8	7
Wild buckwheat	10	10	9	10	10	10	8	10	10	9	6
Wild oat	4	8	9	5	2	9	4	4	4	4	5
Barnyardgrass	8	8	9	9	5	9	5	7	6	9	8
Rice Japonica	8	8	8	8	7	8	7	8	6	8	8
Umbrella sedge	9	9	10	9	9	9	5	9	9	9	9

Table D

Rate (16 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
PREEMERGENCE											
Barley Igri	7	3	6	3	0	2	0	1	0	6	1
Bedstraw	8	9	10	9	10	8	9	9	9	10	10
Blackgrass	9	8	7	6	6	7	5	8	5	9	9
Chickweed	9	10	10	-	10	9	8	9	8	9	4
Corn	4	8	2	4	0	0	2	0	0	2	0
Cotton	6	7	8	7	7	7	2	5	-	9	5
Crabgrass	6	7	7	10	2	5	0	6	6	3	3
Downy brome	8	7	8	4	0	3	3	4	5	9	2
Giant foxtail	5	8	7	8	0	6	2	3	6	4	4
Lambsquarters	10	10	10	-	9	9	8	8	9	9	9
Morningglory	6	5	3	7	6	3	2	10	7	9	2
Pigweed	9	9	9	10	8	8	7	10	9	9	8
Rape	10	9	9	8	9	9	8	9	10	9	10
Ryegrass	9	10	10	9	0	4	4	4	3	6	5
Sorghum	3	9	6	10	2	10	4	3	4	4	9
Soybean	6	6	2	6	0	3	0	5	0	7	2
Speedwell	10	9	10	8	8	8	9	9	8	9	9
Sugar beet	9	9	9	9	9	9	9	8	10	10	9
Velvetleaf	7	8	7	8	8	7	7	7	7	7	7
Wheat	6	4	4	3	0	0	0	1	0	5	0
Wild buckwheat	8	8	7	7	8	9	7	7	7	9	8
Wild oat	0	3	3	3	0	0	0	0	0	0	0

Table D

Rate (8 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	8	8	9	9	4	9	3	7	0	9	3
Bedstraw	10	10	10	10	10	10	10	10	10	10	8
Blackgrass	9	9	8	10	7	10	6	9	9	10	9
Chickweed	9	9	10	10	10	10	10	10	10	10	7
Corn	10	8	10	10	7	9	2	10	2	10	5
Cotton	9	9	10	10	10	10	10	10	10	10	9
Crabgrass	0	5	8	7	0	6	0	3	0	0	0
Downy brome	5	6	9	8	4	9	3	4	3	10	4
Duck salad	-	-	-	-	-	-	-	-	0	0	-
Giant foxtail	6	7	10	9	5	10	3	10	0	4	7
Lambsquarters	10	8	10	9	10	10	10	10	10	10	8
Morningglory	8	6	7	8	10	10	10	10	10	10	7
Pigweed	10	8	10	9	7	7	0	10	6	4	8
Rape	10	10	10	10	10	10	10	10	10	10	10
Ryegrass	6	9	10	10	0	9	3	7	0	2	5
Sorghum	7	10	10	10	10	10	6	10	5	9	10
Soybean	10	10	10	9	10	10	10	10	7	10	9
Speedwell	8	7	8	9	4	8	9	-	10	6	7
Sugar beet	10	9	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	10	10	7	10	7	10	10	5	9
Wheat	5	6	9	4	0	8	0	5	0	7	6
Wild buckwheat	10	8	9	9	9	10	8	10	9	9	6
Wild oat	4	6	9	3	2	8	3	0	2	2	3
Barnyardgrass	7	7	9	9	4	7	1	6	4	6	8
Rice Japonica	8	8	8	8	6	8	1	8	1	6	8
Umbrella sedge	9	9	9	9	6	9	4	9	7	6	9

Table D

Rate (4 g/ha)	COMPOUND										
	32	33	34	35	37	38	39	40	41	42	43
POSTEMERGENCE											
Barley Igri	6	7	7	6	4	8	2	5	0	7	0
Bedstraw	9	8	10	10	10	10	10	10	10	10	7
Blackgrass	9	8	8	9	6	9	5	9	0	10	8
Chickweed	9	8	10	10	10	10	10	10	10	10	7
Corn	10	7	7	9	3	8	2	10	0	10	4
Cotton	9	8	10	10	10	10	9	9	10	9	8
Crabgrass	0	4	6	5	0	4	0	2	0	0	0
Downy brome	3	4	8	0	2	4	0	4	0	9	3
Duck salad	-	-	-	-	-	-	-	-	0	0	-
Giant foxtail	5	6	10	8	3	7	3	6	0	2	4
Lambsquarters	10	8	10	8	9	10	10	10	9	10	7
Morningglory	6	4	6	7	10	10	10	10	10	10	3
Pigweed	7	8	10	9	7	7	0	10	5	4	4
Rape	10	10	10	10	9	10	10	10	10	10	10
Ryegrass	5	9	9	10	0	7	0	5	0	0	3
Sorghum	7	9	10	10	7	10	6	10	3	8	10
Soybean	10	10	10	9	10	10	10	10	7	10	9
Speedwell	8	7	7	8	3	8	7	6	9	5	5
Sugar beet	9	8	10	10	10	10	10	10	10	10	8
Velvetleaf	10	10	9	10	7	10	6	10	10	2	9
Wheat	4	4	7	0	0	5	0	3	0	7	4
Wild buckwheat	9	8	9	7	9	10	-	8	9	7	6
Wild oat	2	4	6	0	0	5	2	0	0	0	0
Barnyardgrass	4	5	8	8	0	6	0	2	2	5	5
Rice Japonica	8	8	8	8	2	8	0	7	0	0	7
Umbrella sedge	9	8	9	9	3	9	1	9	3	5	9

Table D

Rate (2 g/ha)	COMPOUND				
	33	34	37	38	39
POSTEMERGENCE					
Barley Igri	5	7	3	5	2
Bedstraw	8	10	10	8	8
Blackgrass	7	7	6	8	4
Chickweed	6	9	10	10	8
Corn	7	7	0	7	0
Cotton	5	8	10	8	6
Crabgrass	3	4	0	0	0
Downy brome	2	6	0	3	0
Giant foxtail	5	10	3	5	2
Lambsquarters	7	8	8	10	7
Morningglory	2	4	10	10	10
Pigweed	6	10	0	3	0
Rape	10	10	8	10	10
Ryegrass	6	8	0	4	0
Sorghum	7	9	7	10	6
Soybean	10	9	10	10	10
Speedwell	5	7	3	6	6
Sugar beet	8	10	10	9	10
Velvetleaf	7	7	7	7	6
Wheat	4	6	0	4	0
Wild buckwheat	3	9	7	9	7
Wild oat	3	4	0	4	0
Barnyardgrass	0	-	0	3	0
Rice Japonica	7	7	1	7	0
Umbrella sedge	7	9	3	9	0

Table D

Rate (2 g/ha)	COMPOUND				
	33	34	37	38	39
PREEMERGENCE					
Barley Igri	0	0	0	0	0
Bedstraw	8	8	5	5	4
Blackgrass	6	5	2	3	3
Chickweed	10	10	9	5	6
Corn	4	0	0	0	0
Cotton	6	5	0	2	0
Crabgrass	2	0	0	0	0
Downy brome	3	6	0	0	0
Giant foxtail	2	0	0	0	0
Lambsquarters	9	9	5	6	5
Morningglory	0	0	0	0	0
Pigweed	7	7	6	5	4
Rape	8	8	6	5	0
Ryegrass	4	7	0	0	0
Sorghum	5	2	0	0	0
Soybean	0	0	0	0	0
Speedwell	9	8	-	4	7
Sugar beet	8	8	6	7	6
Velvetleaf	6	6	0	3	0
Wheat	0	0	0	0	0
Wild buckwheat	7	7	7	6	4
Wild oat	0	0	0	0	0

TEST E

Seeds of barnyardgrass (Echinochloa
5 crus-galli), cocklebur (Xanthium pensylvanicum), corn
(Zea mays) (soil surface exposed and soil surface
covered with perlite), crabgrass (Digitaria spp.),
fall panicum (Panicum dichotomiflorum), giant foxtail
(Setaria faberii), green foxtail (Setaria viridis),
10 ivyleaf morningglory (Ipomoea hederacea), jimsonweed
(Datura stramonium), johnsongrass (Sorghum
halepense), ladythumb smartweed (Polygonum
persicaria), lambsquarters (Chenopodium album),
redroot pigweed (Amaranthus retroflexus), sorghum
15 (Sorghum bicolor), soybean (Glycine max), and
velvetleaf (Abutilon theophrasti) and purple nutsedge
(Cyperus rotundus) tubers were planted and treated
preemergence with test chemicals dissolved in a
non-phytotoxic solvent. These crop and weed species
20 were also treated with postemergence applications of
test compounds. Plants ranged in height from two to
twenty-five cm for postemergence treatments.

Treated plants and controls were maintained in
a greenhouse for approximately 24 days, after which
25 all species were compared to controls and visually
evaluated. The ratings, summarized in Table E, are
based on a scale of 0 to 10 where 0 is no effect and
10 is complete control. A dash (-) response means no
test result.

30

35

Table E

	COMPOUND
Rate (500 g/ha)	5
PREEMERGENCE	
Barnyardgrass	10
Cocklebur	10
Corn	6
Crabgrass	10
Fall panicum	10
Giant foxtail	10
Green foxtail	10
Ivlf mrninglory	10
Jimsonweed	10
Johnsongrass	10
Ladysthmb smtwd	10
Lambsquarters	10
Purple nutsedge	10
Redroot pigweed	10
Sorghum	10
Soybean	10
Velvetleaf	10

Table E

Rate (250 g/ha)	COMPOUND				
	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	10	10	7
Cocklebur	10	9	6	8	2
Corn	3	9	4	6	0
Crabgrass	9	9	6	8	2
Fall panicum	10	10	7	9	4
Giant foxtail	10	10	10	9	4
Green foxtail	10	10	9	9	3
Ivlf mrninglory	10	9	9	9	3
Jimsonweed	10	4	6	9	2
Johnsongrass	10	10	10	10	6
Ladysthmb smtwd	10	-	-	10	9
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	10	10	10	4
Redroot pigweed	10	10	10	10	10
Sorghum	10	10	10	10	9
Soybean	10	-	-	8	7
Velvetleaf	10	8	8	6	4

Table E

Rate (125 g/ha)	COMPOUND				
	5	7	8	9	10
POSTEMERGENCE					
Barnyardgrass	10	10	10	10	9
Cocklebur	10	10	10	10	10
Corn	7	10	2	6	0
Crabgrass	10	10	7	2	0
Fall panicum	10	10	9	2	0
Giant foxtail	10	10	8	4	2
Green foxtail	10	10	9	4	4
Ivlf mrninglory	10	10	10	10	10
Jimsonweed	10	10	10	10	10
Johnsongrass	10	10	10	10	10
Ladysthmb smtwd	10	-	-	10	6
Lambsquarters	9	10	9	7	6
Perlite corn	5	6	2	4	0
Purple nutsedge	10	10	10	10	4
Redroot pigweed	10	10	10	10	10
Sorghum	10	10	10	10	10
Soybean	10	10	10	10	10
Velvetleaf	10	10	10	10	10

Table E

Rate (125 g/ha)	COMPOUND				
	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	10	9	4
Cocklebur	8	7	3	6	0
Corn	2	6	2	4	0
Crabgrass	7	7	5	5	0
Fall panicum	10	7	6	6	2
Giant foxtail	10	9	9	7	0
Green foxtail	10	8	8	6	0
Ivlf mrninglory	8	7	7	8	2
Jimsonweed	9	2	3	7	0
Johnsongrass	10	10	10	9	5
Ladysthmb smtwd	10	-	-	10	6
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	10	9	9	0
Redroot pigweed	10	10	10	10	9
Sorghum	10	10	10	9	7
Soybean	9	-	-	6	4
Velvetleaf	9	6	6	3	2

Table E

Rate (64 g/ha)	COMPOUND					
	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	10	10	8	9
Cocklebur	10	10	10	10	10	10
Corn	3	9	0	3	0	0
Crabgrass	10	9	5	0	0	0
Fall panicum	10	10	7	0	0	0
Giant foxtail	10	9	7	2	0	0
Green foxtail	10	10	8	2	2	0
Ivlf mrninglory	10	10	9	10	10	10
Jimsonweed	10	7	10	9	10	9
Johnsongrass	10	10	10	10	7	7
Ladysthmb smtwd	10	-	-	10	5	9
Lambsquarters	8	9	8	6	4	7
Perlite corn	2	4	0	2	0	0
Purple nutsedge	10	10	10	10	2	10
Redroot pigweed	8	10	10	10	10	10
Sorghum	10	10	10	10	9	8
Soybean	10	10	10	10	10	10
Velvetleaf	10	10	10	10	10	10

Table E

Rate (64 g/ha)	COMPOUND				
	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	10	10	8	7	2
Cocklebur	5	7	0	2	0
Corn	0	4	0	3	0
Crabgrass	5	5	3	3	0
Fall panicum	10	6	4	3	0
Giant foxtail	9	6	6	4	0
Green foxtail	10	5	4	3	0
Ivlf morninglory	6	6	5	5	0
Jimsonweed	6	0	0	4	0
Johnsongrass	10	10	10	7	3
Ladysthmb smtwd	9	-	-	8	4
Lambsquarters	10	-	-	-	-
Purple nutsedge	10	8	8	7	0
Redroot pigweed	10	10	10	10	8
Sorghum	10	10	10	6	5
Soybean	7	-	-	4	2
Velvetleaf	6	5	2	2	0

Table E

Rate (32 g/ha)	COMPOUND					
	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	10	10	6	6
Cocklebur	10	10	10	10	10	10
Corn	0	6	0	0	0	0
Crabgrass	6	8	3	0	0	0
Fall panicum	10	8	4	0	0	0
Giant foxtail	10	9	5	0	0	0
Green foxtail	10	10	8	0	0	0
Ivlf mrninglory	10	10	8	9	10	10
Jimsonweed	8	6	8	9	10	8
Johnsongrass	10	10	10	10	6	5
Ladysthmb smtwd	9	-	-	9	5	9
Lambsquarters	7	7	7	4	2	6
Perlite corn	0	3	0	0	0	0
Purple nutsedge	10	10	9	9	2	10
Redroot pigweed	7	10	10	10	10	9
Sorghum	10	10	10	10	8	5
Soybean	10	10	10	10	10	10
Velvetleaf	10	10	9	9	9	10

Table E

Rate (32 g/ha)	COMPOUND				
	5	7	8	9	10
PREEMERGENCE					
Barnyardgrass	8	6	4	3	0
Cocklebur	2	4	0	0	0
Corn	0	2	0	0	0
Crabgrass	3	2	0	0	0
Fall panicum	7	3	2	0	0
Giant foxtail	8	5	2	0	0
Green foxtail	8	4	0	0	0
Ivlf mrninglory	3	3	2	2	0
Jimsonweed	2	0	0	2	0
Johnsongrass	9	7	6	3	0
Ladysthmb smtwd	8	-	-	3	2
Lambsquarters	9	-	-	-	-
Purple nutsedge	9	7	3	3	0
Redroot pigweed	10	9	8	6	6
Sorghum	10	8	5	3	2
Soybean	5	-	-	0	0
Velvetleaf	2	3	0	0	0

Table E

Rate (16 g/ha)	COMPOUND					
	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	8	9	4	2
Cocklebur	10	10	9	10	8	10
Corn	0	4	0	0	0	0
Crabgrass	4	6	0	0	0	0
Fall panicum	8	6	3	0	0	0
Giant foxtail	9	8	3	0	0	0
Green foxtail	9	9	7	0	0	0
Ivlf mrninglory	10	9	7	9	9	10
Jimsonweed	7	4	6	7	9	8
Johnsongrass	10	10	9	9	3	2
Ladysthmb smtwd	8	-	-	8	3	7
Lambsquarters	6	6	5	2	0	5
Perlite corn	0	2	0	0	0	0
Purple nutsedge	10	10	6	8	0	7
Redroot pigweed	6	10	9	9	10	7
Sorghum	10	10	10	10	5	3
Soybean	10	10	9	10	10	10
Velvetleaf	10	10	6	7	6	10

100

Table E

Rate (16 g/ha)	COMPOUND	
	5	9
PREEMERGENCE		
Barnyardgrass	6	0
Cocklebur	0	0
Corn	0	0
Crabgrass	0	0
Fall panicum	4	0
Giant foxtail	4	0
Green foxtail	4	0
Ivlf mrninglory	2	0
Jimsonweed	0	0
Johnsongrass	6	0
Ladysthmb smtwd	6	0
Lambsquarters	5	-
Purple nutsedge	7	0
Redroot pigweed	6	3
Sorghum	7	0
Soybean	2	0
Velvetleaf	0	0

Table E

Rate (8 g/ha)	COMPOUND					
	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	10	10	6	7	2	0
Cocklebur	8	8	5	8	7	9
Corn	0	2	0	0	0	0
Crabgrass	2	3	0	0	0	0
Fall panicum	6	3	0	0	0	0
Giant foxtail	8	5	2	0	0	0
Green foxtail	9	8	5	0	0	0
Ivlf mrninglory	9	8	3	8	7	9
Jimsonweed	7	2	3	4	7	7
Johnsongrass	9	10	8	6	2	0
Ladysthmb smtwd	7	-	-	5	2	5
Lambsquarters	3	4	2	0	0	4
Perlite corn	0	0	0	0	0	0
Purple nutsedge	10	9	4	5	0	4
Redroot pigweed	3	9	9	8	9	7
Sorghum	10	10	9	6	3	0
Soybean	10	10	7	10	6	10
Velvetleaf	9	8	3	4	4	8

Table E

Rate (4 g/ha)	COMPOUND					
	5	7	8	9	10	24
POSTEMERGENCE						
Barnyardgrass	9	7	2	3	0	0
Cocklebur	6	5	2	3	3	6
Corn	0	0	0	0	0	0
Crabgrass	0	0	0	0	0	0
Fall panicum	3	0	0	0	0	0
Giant foxtail	5	3	0	0	0	0
Green foxtail	7	6	3	0	0	0
Ivlf mrninglory	7	5	0	3	3	6
Jimsonweed	6	0	0	2	3	4
Johnsongrass	8	9	6	2	0	0
Ladysthmb smtwd	3	-	-	2	0	2
Lambsquarters	0	2	0	0	0	2
Perlite corn	0	0	0	0	0	0
Purple nutsedge	8	6	2	2	0	2
Redroot pigweed	0	8	5	6	6	4
Sorghum	9	9	5	2	0	0
Soybean	10	10	3	8	3	10
Velvetleaf	7	6	0	2	2	5

TEST F

5 Plastic pots were partially filled with silt
loam soil. The soil was then saturated with water.
Indica and Japonica rice (Oryza sativa) seedlings at
the 2.0 to 2.5 leaf stage, seeds selected from
barnyardgrass (Echinochloa crus-galli), bulrush
10 (Scirpus mucronatus), duck salad (Heteranthera
Bimosa), umbrella sedge (Cyperus difformis) and
tubers selected from waterchestnut (Eleocharis spp.),
were planted into this soil. After planting, water
levels were raised to 3 cm above the soil surface and
maintained at this level throughout the test.
15 Chemical treatments were formulated in a
non-phytotoxic solvent and applied directly to the
paddy water. Treated plants and controls were
maintained in a greenhouse for approximately 21 days,
after which all species were compared to controls and
20 visually evaluated. Plant response ratings,
summarized in Table F, are reported on a 0 to 10
scale where 0 is no effect and 10 is complete
control. A dash (-) response means no test result.

25

30

35

Table F

	COMPOUND				
Rate (64 g/ha)	27				
PADDY					
Barnyardgrass	6				
Bulrush	9				
Duck salad	10				
Indica rice	2				
Japonica rice	4				
Umbrella sedge	10				
Waterchestnut	10				
	COMPOUND				
Rate (32 g/ha)	11 17 27				
PADDY					
Barnyardgrass	8 5 6				
Bulrush	9 9 9				
Duck salad	10 10 10				
Indica rice	3 0 2				
Japonica rice	4 4 4				
Umbrella sedge	10 9 10				
Waterchestnut	- - 9				
	COMPOUND				
Rate (16 g/ha)	11 17 22 23 27				
PADDY					
Barnyardgrass	7 4 10 7 4				
Bulrush	8 9 8 9 7				
Duck salad	10 10 10 10 8				
Indica rice	3 0 9 4 2				
Japonica rice	3 0 9 6 0				
Umbrella sedge	10 9 10 10 9				
Waterchestnut	- - 10 8 9				

Table F

Rate (8 g/ha)	COMPOUND				
	11	17	22	23	27
PADDY					
Barnyardgrass	6	0	9	5	4
Bulrush	7	8	8	6	6
Duck salad	10	4	10	8	7
Indica rice	2	0	8	4	0
Japonica rice	3	0	8	6	0
Umbrella sedge	9	9	10	8	7
Waterchestnut	-	-	6	2	3

Rate (4 g/ha)	COMPOUND				
	11	17	22	23	27
PADDY					
Barnyardgrass	3	0	9	4	3
Bulrush	0	2	8	0	0
Duck salad	9	0	10	3	0
Indica rice	0	0	6	2	0
Japonica rice	0	0	7	4	0
Umbrella sedge	9	7	10	6	5
Waterchestnut	-	-	4	2	3

Rate (2 g/ha)	COMPOUND			
	11	17	22	23
PADDY				
Barnyardgrass	3	0	7	2
Bulrush	0	0	2	0
Duck salad	7	0	9	2
Indica rice	0	0	4	0
Japonica rice	0	0	7	4
Umbrella sedge	7	0	8	3
Waterchestnut	-	-	3	2

Table F

Rate (l g/ha)	COMPOUND	
	22	23
PADDY		
Barnyardgrass	6	0
Bulrush	2	0
Duck salad	3	0
Indica rice	4	0
Japonica rice	6	4
Umbrella sedge	4	2
Waterchestnut	2	2

TEST G

Compounds evaluated in this test were

5 formulated in a non-phytoxic solvent and applied to the soil surface before plant seedlings emerged (preemergence application) and to plants that were in the one-to-four leaf stage (postemergence application). A sandy loam soil was used for the

10 preemergence test while a mixture of sandy loam soil and greenhouse potting mix in a 60:40 ratio was used for the postemergence test. Test compounds were applied within approximately one day after planting seeds for the preemergence test. Plantings of these

15 crops and weed species were adjusted to produce plants of appropriate size for the postemergence test. All plant species were grown using normal greenhouse practices. Crop and weed species include winter barley (Hordeum vulgare cv. 'Igri'), bedstraw

20 (Galium aparine), blackgrass (Alopecurus myosuroides), chickweed (Stellaria media), downy brome (Bromus tectorum), field violet (Viola arvensis), green foxtail (Setaria viridis), kochia (Kochia scoparia), lambsquarters (Chenopodium album),

25 Persian speedwell (Veronica persica), rape (Brassica napus cv. 'Jet Neuf'), ryegrass (Lolium multiflorum), sugar beet (Beta vulgaris cv. 'US1'), sunflower (Helianthus annuus cv. 'Russian Giant'), spring wheat (Triticum aestivum cv. 'ERA'), winter wheat (Triticum

30 aestivum cv. 'Talent'), wild buckwheat (Polygonum convolvulus), wild mustard (Sinapis arvensis), wild oat (Avena fatua), and wild radish (Raphanus raphanistrum). Blackgrass and wild oat were treated postemergence at two growth stages. The first stage

35 (1) was when the plants had two to three leaves. The second stage (2) was when the plants had

approximately four leaves or in the initial stages of
tillering. Treated plants and untreated controls
5 were maintained in a greenhouse for approximately 21
to 28 days, after which all treated plants were
compared to untreated controls and visually
evaluated. Plant response ratings, summarized in
Table G, are based upon a 0 to 10 scale where 0 is no
10 effect and 10 is complete control. A dash response
(-) means no test result.

15

20

25

30

35

Table G

	COMPOUND	
Rate (125 g/ha)	37	39
POSTEMERGENCE		
Bedstraw	10	10
Blackgrass (1)	8	6
Blackgrass (2)	8	5
Chickweed	10	10
Downy brome	8	7
Field violet	10	7
Green foxtail	6	4
Persn Speedwell	4	8
Rape	10	10
Ryegrass	2	2
Sugar beet	10	10
Sunflower	10	10
Wheat (Spring)	3	3
Wheat (Winter)	2	3
Wild buckwheat	10	9
Wild mustard	10	10
Wild oat (1)	2	5
Wild oat (2)	0	4
Wild radish	10	10
Winter Barley	3	3

Table G

	COMPOUND	
Rate (125 g/ha)	37	39
PREEMERGENCE		
Bedstraw	10	10
Blackgrass (1)	2	0
Blackgrass (2)	2	0
Chickweed	10	9
Downy brome	4	2
Field violet	10	7
Green foxtail	2	2
Persn Speedwell	10	8
Rape	10	10
Ryegrass	4	3
Sugar beet	10	10
Sunflower	7	5
Wheat (Spring)	3	2
Wheat (Winter)	3	2
Wild buckwheat	7	5
Wild mustard	10	10
Wild oat (1)	3	0
Wild oat (2)	2	0
Wild radish	10	9
Winter Barley	4	2

Table G

Rate (64 g/ha)	COMPOUND			
	34	35	37	39
POSTEMERGENCE				
Bedstraw	10	8	10	10
Blackgrass (1)	4	8	6	4
Blackgrass (2)	5	8	5	4
Chickweed	10	10	10	10
Downy brome	9	10	6	5
Field violet	6	5	8	5
Green foxtail	10	9	5	2
Kochia	-	9	-	-
Lambsquarters	10	8	-	-
Persn Speedwell	7	3	3	6
Rape	10	10	10	10
Ryegrass	10	10	0	0
Sugar beet	10	10	10	10
Sunflower	10	10	10	10
Wheat (Spring)	9	10	2	2
Wheat (Winter)	9	10	1	2
Wild buckwheat	10	9	9	8
Wild mustard	10	10	10	10
Wild oat (1)	10	10	0	2
Wild oat (2)	10	10	0	2
Wild radish	10	10	10	10
Winter Barley	10	10	2	2

Table G

Rate (64 g/ha)	COMPOUND			
	34	35	37	39
PREEMERGENCE				
Bedstraw	10	10	10	8
Blackgrass (1)	3	8	0	0
Blackgrass (2)	3	8	0	0
Chickweed	10	10	10	8
Downy brome	6	10	2	0
Field violet	10	10	10	5
Green foxtail	10	10	0	0
Kochia	-	9	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	10	9	10	7
Rape	10	10	10	10
Ryegrass	7	10	2	0
Sugar beet	10	10	10	10
Sunflower	8	10	6	3
Wheat (Spring)	3	9	2	0
Wheat (Winter)	3	8	2	0
Wild buckwheat	4	8	5	3
Wild mustard	10	10	10	10
Wild oat (1)	4	6	0	0
Wild oat (2)	4	6	0	0
Wild radish	9	10	8	7
Winter Barley	5	10	2	0

Table G

Rate (32 g/ha)	COMPOUND			
	34	35	37	39
POSTEMERGENCE				
Bedstraw	10	6	8	8
Blackgrass (1)	3	6	4	2
Blackgrass (2)	4	6	4	2
Chickweed	10	10	10	10
Downy brome	8	10	3	3
Field violet	5	3	6	3
Green foxtail	10	9	4	0
Kochia	-	6	-	-
Lambsquarters	10	6	-	-
Persn Speedwell	5	2	2	4
Rape	10	10	10	10
Ryegrass	10	10	0	0
Sugar beet	10	10	10	10
Sunflower	10	10	10	10
Wheat (Spring)	8	8	0	0
Wheat (Winter)	7	7	0	0
Wild buckwheat	8	7	6	6
Wild mustard	10	10	10	10
Wild oat (1)	8	8	0	0
Wild oat (2)	8	8	0	0
Wild radish	10	10	10	10
Winter Barley	10	10	0	0

Table G

Rate (32 g/ha)	COMPOUND			
	34	35	37	39
PREEMERGENCE				
Bedstraw	10	8	7	6
Blackgrass (1)	2	7	0	0
Blackgrass (2)	2	7	0	0
Chickweed	10	10	9	5
Downy brome	5	10	0	0
Field violet	8	10	9	4
Green foxtail	10	10	0	0
Kochia	-	8	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	10	8	8	5
Rape	10	10	10	9
Ryegrass	4	10	0	0
Sugar beet	10	10	10	10
Sunflower	6	9	4	2
Wheat (Spring)	2	7	0	0
Wheat (Winter)	1	6	0	0
Wild buckwheat	3	6	4	2
Wild mustard	10	10	10	9
Wild oat (1)	2	4	0	0
Wild oat (2)	2	5	0	0
Wild radish	7	10	7	4
Winter Barley	4	10	0	0

Table G

Rate (16 g/ha)	COMPOUND			
	34	35	37	39
POSTEMERGENCE				
Bedstraw	8	4	6	5
Blackgrass (1)	2	3	2	0
Blackgrass (2)	2	4	2	0
Chickweed	9	9	10	7
Downy brome	6	8	0	0
Field violet	4	2	3	2
Green foxtail	10	8	2	0
Kochia	-	4	-	-
Lambsquarters	9	3	-	-
Persn Speedwell	3	0	0	2
Rape	10	10	10	10
Ryegrass	10	8	0	0
Sugar beet	9	9	10	10
Sunflower	10	10	10	10
Wheat (Spring)	5	5	0	0
Wheat (Winter)	5	4	0	0
Wild buckwheat	7	3	4	5
Wild mustard	10	10	10	10
Wild oat (1)	7	7	0	0
Wild oat (2)	6	7	0	0
Wild radish	10	10	10	10
Winter Barley	10	9	0	0

Table G

Rate (16 g/ha)	COMPOUND			
	34	35	37	39
PREEMERGENCE				
Bedstraw	8	6	5	4
Blackgrass (1)	0	4	0	0
Blackgrass (2)	0	5	0	0
Chickweed	8	8	8	3
Downy brome	4	8	0	0
Field violet	5	10	7	2
Green foxtail	7	8	0	0
Kochia	-	6	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	7	7	6	3
Rape	10	10	8	7
Ryegrass	2	9	0	0
Sugar beet	10	10	9	8
Sunflower	4	7	3	0
Wheat (Spring)	0	4	0	0
Wheat (Winter)	0	4	0	0
Wild buckwheat	2	5	2	0
Wild mustard	10	10	9	8
Wild oat (1)	0	2	0	0
Wild oat (2)	0	2	0	0
Wild radish	6	8	6	3
Winter Barley	2	8	0	0

Table G

Rate (8 g/ha)	COMPOUND			
	34	35	37	39
POSTEMERGENCE				
Bedstraw	5	2	4	2
Blackgrass (1)	0	2	0	0
Blackgrass (2)	0	2	0	0
Chickweed	7	8	10	4
Downy brome	4	4	0	0
Field violet	2	0	0	0
Green foxtail	7	5	0	0
Kochia	-	2	-	-
Lambsquarters	7	0	-	-
Persn Speedwell	2	0	0	0
Rape	10	10	10	10
Ryegrass	10	6	0	0
Sugar beet	6	8	10	10
Sunflower	10	10	10	10
Wheat (Spring)	3	3	0	0
Wheat (Winter)	2	2	0	0
Wild buckwheat	4	0	2	2
Wild mustard	10	10	10	8
Wild oat (1)	5	4	0	0
Wild oat (2)	4	5	0	0
Wild radish	10	10	10	10
Winter Barley	8	6	0	0

Table G

Rate (8 g/ha)	COMPOUND			
	34	35	37	39
PREEMERGENCE				
Bedstraw	6	5	3	2
Blackgrass (1)	0	2	0	0
Blackgrass (2)	0	2	0	0
Chickweed	6	7	4	0
Downy brome	2	6	0	0
Field violet	3	9	4	0
Green foxtail	4	6	0	0
Kochia	-	5	-	-
Lambsquarters	-	10	-	-
Persn Speedwell	5	6	3	0
Rape	7	10	6	6
Ryegrass	0	7	0	0
Sugar beet	8	9	7	6
Sunflower	3	6	0	0
Wheat (Spring)	0	3	0	0
Wheat (Winter)	0	2	0	0
Wild buckwheat	0	4	0	0
Wild mustard	8	9	7	6
Wild oat (1)	0	0	0	0
Wild oat (2)	0	0	0	0
Wild radish	4	7	4	0
Winter Barley	0	5	0	0

Table G

Rate (4 g/ha)	COMPOUND			
	34	35	37	39
POSTEMERGENCE				
Bedstraw	3	0	2	0
Blackgrass (1)	0	0	0	0
Blackgrass (2)	0	0	0	0
Chickweed	5	5	10	2
Downy brome	3	2	0	0
Field violet	0	0	0	0
Green foxtail	6	4	0	0
Kochia	-	0	-	-
Lambsquarters	6	0	-	-
Persn Speedwell	0	0	0	0
Rape	10	10	10	10
Ryegrass	7	3	0	0
Sugar beet	4	5	10	8
Sunflower	10	10	10	10
Wheat (Spring)	0	2	0	0
Wheat (Winter)	0	0	0	0
Wild buckwheat	2	0	0	0
Wild mustard	10	10	8	6
Wild oat (1)	3	2	0	0
Wild oat (2)	2	3	0	0
Wild radish	9	10	10	10
Winter Barley	6	3	0	0

Table G

Rate (4 g/ha)	COMPOUND			
	34	35	37	39
PREEMERGENCE				
Bedstraw	3	4	2	0
Blackgrass (1)	0	0	0	0
Blackgrass (2)	0	0	0	0
Chickweed	4	4	2	0
Downy brome	0	3	0	0
Field violet	2	6	2	0
Green foxtail	2	4	0	0
Kochia	-	3	-	-
Lambsquarters	-	7	-	-
Persn Speedwell	3	4	0	0
Rape	6	9	4	4
Ryegrass	0	3	0	0
Sugar beet	7	8	6	4
Sunflower	0	5	0	0
Wheat (Spring)	0	0	0	0
Wheat (Winter)	0	0	0	0
Wild buckwheat	0	3	0	0
Wild mustard	4	8	5	3
Wild oat (1)	0	0	0	0
Wild oat (2)	0	0	0	0
Wild radish	2	5	2	0
Winter Barley	0	4	0	0

Table G

Rate (2 g/ha)	COMPOUND	
	34	35
POSTEMERGENCE		
Bedstraw	2	0
Blackgrass (1)	0	0
Blackgrass (2)	0	0
Chickweed	4	2
Downy brome	2	0
Field violet	0	0
Green foxtail	3	2
Kochia	-	0
Lambsquarters	5	0
Persn Speedwell	0	0
Rape	10	8
Ryegrass	5	2
Sugar beet	2	3
Sunflower	10	10
Wheat (Spring)	0	0
Wheat (Winter)	0	0
Wild buckwheat	0	0
Wild mustard	10	10
Wild oat (1)	2	0
Wild oat (2)	0	0
Wild radish	8	9
Winter Barley	4	2

Table G

Rate (2 g/ha)	COMPOUND	
	34	35
PREEMERGENCE		
Bedstraw	2	3
Blackgrass (1)	0	0
Blackgrass (2)	0	0
Chickweed	2	2
Downy brome	0	0
Field violet	0	4
Green foxtail	0	3
Kochia	-	0
Lambsquarters	-	4
Persn Speedwell	2	2
Rape	4	6
Ryegrass	0	0
Sugar beet	6	6
Sunflower	0	3
Wheat (Spring)	0	0
Wheat (Winter)	0	0
Wild buckwheat	0	2
Wild mustard	2	6
Wild oat (1)	0	0
Wild oat (2)	0	0
Wild radish	0	3
Winter Barley	0	2

123

Table G

	COMPOUND
Rate (1 g/ha)	34
POSTEMERGENCE	
Bedstraw	0
Blackgrass (1)	0
Blackgrass (2)	0
Chickweed	2
Downy brome	0
Field violet	0
Green foxtail	0
Lambsquarters	3
Persn Speedwell	0
Rape	8
Ryegrass	2
Sugar beet	0
Sunflower	10
Wheat (Spring)	0
Wheat (Winter)	0
Wild buckwheat	0
Wild mustard	10
Wild oat (1)	0
Wild oat (2)	0
Wild radish	6
Winter Barley	2

Table G

	COMPOUND
Rate (1 g/ha)	34
PREEMERGENCE	
Bedstraw	0
Blackgrass (1)	0
Blackgrass (2)	0
Chickweed	0
Downy brome	0
Field violet	0
Green foxtail	0
Lambsquarters	-
Persn Speedwell	0
Rape	3
Ryegrass	0
Sugar beet	4
Sunflower	0
Wheat (Spring)	0
Wheat (Winter)	0
Wild buckwheat	0
Wild mustard	0
Wild oat (1)	0
Wild oat (2)	0
Wild radish	0
Winter Barley	0

TEST H

5 Seeds of alfalfa (Medicago sativa), bean
(Phaseolus vulgaris), bluegrass (Poa pratensis),
cabbage (Brassica rapa), carrot (Daucus sativa), corn
(Zea mays), flax (Linum usitatissimum), lettuce
(Lactuca sativa), lupine (Lupinus albus), oats (Avena
10 sativa), onion (Allium cepa), pea (sativum), peanut
(Arachis hypogaea), potato (Solanum tuberosum), rye
(Secale cereal), sorghum (Sorghum bicolor), sunflower
(Helianthus annuus), and tomato (Lycopersicon
esculentum) were planted and treated preemergence
15 with a test chemical dissolved in a non-phytotoxic
solvent. These crop species were also treated with
postemergence applications of the test chemical.
Plants ranged in height from four to twenty cm (two
to three leaf stage) when post-emergence applications
were applied. Treated plants and controls were grown
20 under greenhouse conditions for approximately
twenty-four days, after which all plants treated with
the test chemical were compared to untreated controls
and visually evaluated for injury response.
Application rates for the test chemical are shown in
25 Table H. Plant response ratings, summarized in Table
H, are from 0 to 10 where 0 is no injury and 10 is
complete control. A dash (-) response means no test
result.

30

35

Table H

	COMPOUND
Rate (250 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	10
Cabbage	10
Carrott	9
Corn	8
Flax	10
Lettuce	9
Lupine	10
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	10
Rye	10
Sorghum	10
Sunflower	10
Tomato	9

127

Table H

	COMPOUND
Rate (125 g/ha)	5
POSTEMERGENCE	
Alfalfa	9
Bean	10
Bluegrass	6
Cabbage	9
Carrott	10
Corn	8
Flax	9
Lettuce	9
Lupine	10
Oats	9
Onion	8
Pea	7
Peanut	9
Potato	7
Rye	9
Sorghum	10
Sunflower	10
Tomato	9

128

Table H

	COMPOUND
Rate (125 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	9
Cabbage	10
Carrott	9
Corn	8
Flax	10
Lettuce	9
Lupine	10
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	9
Rye	10
Sorghum	10
Sunflower	10
Tomato	9

Table H

	COMPOUND
Rate (64 g/ha)	5
POSTEMERGENCE	
Alfalfa	8
Bean	10
Bluegrass	6
Cabbage	9
Carrott	9
Corn	7
Flax	6
Lettuce	9
Lupine	10
Oats	7
Onion	7
Pea	6
Peanut	8
Potato	7
Rye	9
Sorghum	9
Sunflower	10
Tomato	8

130

Table H

	COMPOUND
Rate (64 g/ha)	5
PREEMERGENCE	
Alfalfa	9
Bean	9
Bluegrass	9
Cabbage	10
Carrott	8
Corn	5
Flax	9
Lettuce	10
Lupine	8
Oats	9
Onion	10
Pea	10
Peanut	9
Potato	9
Rye	10
Sorghum	10
Sunflower	9
Tomato	9

Table H

	COMPOUND
Rate (32 g/ha)	5
POSTEMERGENCE	
Alfalfa	8
Bean	9
Bluegrass	7
Cabbage	6
Carrott	9
Corn	3
Flax	6
Lettuce	10
Lupine	10
Oats	7
Onion	7
Pea	5
Peanut	9
Potato	7
Rye	9
Sorghum	9
Sunflower	10
Tomato	7

Table H

	COMPOUND
Rate (32 g/ha)	5
PREEMERGENCE	
Alfalfa	7
Bean	9
Bluegrass	8
Cabbage	9
Carrott	7
Corn	3
Flax	7
Lettuce	7
Lupine	6
Oats	9
Onion	9
Pea	10
Peanut	7
Potato	8
Rye	9
Sorghum	10
Sunflower	9
Tomato	9

Table H

	COMPOUND
Rate (16 g/ha)	5
POSTEMERGENCE	
Alfalfa	6
Bean	9
Bluegrass	6
Cabbage	7
Carrott	9
Corn	1
Flax	6
Lettuce	9
Lupine	10
Oats	8
Onion	6
Pea	6
Peanut	7
Potato	4
Rye	7
Sorghum	9
Sunflower	10
Tomato	4

Table H

	COMPOUND
Rate (16 g/ha)	5
PREEMERGENCE	
Alfalfa	6
Bean	2
Bluegrass	6
Cabbage	9
Carrott	2
Corn	1
Flax	6
Lettuce	3
Lupine	8
Oats	9
Onion	7
Pea	10
Peanut	6
Potato	6
Rye	9
Sorghum	9
Sunflower	9
Tomato	8

135

Table H

	COMPOUND
Rate (8 g/ha)	5
POSTEMERGENCE	
Alfalfa	3
Bean	8
Bluegrass	6
Cabbage	2
Carrott	8
Corn	0
Flax	3
Lettuce	9
Lupine	10
Oats	7
Onion	6
Pea	6
Peanut	6
Potato	2
Rye	7
Sorghum	9
Sunflower	10
Tomato	3

CLAIMS

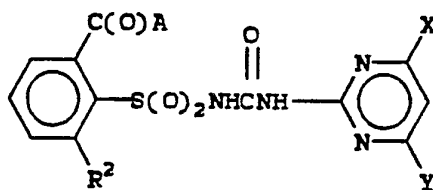
5

What is claimed is:

1. A compound selected from

10

15



I

20

wherein:

A is OR¹ or N(CH₃)₂;R¹ is C₁-C₃ alkyl, CH₂CH=CH₂, CH₂C≡CH, CH₂CH₂Cl
or CH₂CH₂OCH₃;25 R² is CH₂F, CHF₂, CHFCH₃ or CH₂CN;X is CH₃ or OCH₃; andY is H, Cl, CH₃, C₂H₅, OCH₃ or OCF₂H;and their agriculturally suitable salts; provided
that when Y is Cl, then X is OCH₃.

30

2. A compound of Claim 1 wherein
A is OR¹; and
R¹ is CH₃, CH₂CH₃ or CH(CH₃)₂.

35

3. A compound of Claim 2 where
when one of X and Y is CH₃, then the
other of X and Y is other than OCH₃.

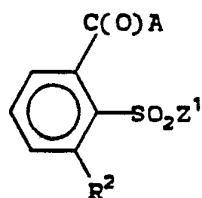
4. The compound of Claim 1,
methyl 3-(cyanomethyl)-2-[[[(4,6-
5 dimethyl-2-pyrimidinyl)amino]carbonyl]-
amino]sulfonyl]benzoate.
5. The compound of Claim 1,
methyl 2-[[[(4-chloro-6-methoxy-2-
10 pyrimidinyl)amino]carbonyl]amino]-
sulfonyl]-3-(cyanomethyl)benzoate.
6. The compound of Claim 1,
methyl 3-(cyanomethyl)-2-[[[(4-
15 (difluoromethoxy)-6-methoxy-2-pyrimi-
dinyl)amino]carbonyl]amino]sulfonyl]-
benzoate.
7. The compound of Claim 1,
20 methyl 3-(difluoromethyl)-2-[[[(4-
methoxy-2-pyrimidinyl)amino]carbonyl]-
amino]sulfonyl]benzoate.
8. The compound of Claim 1,
25 methyl 3-(fluoromethyl)-2-[[[(4-
methoxy-2-pyrimidinyl)amino]carbonyl]-
amino]sulfonyl]benzoate.
9. The compound of Claim 1,
30 methyl 2-[[[(4,6-dimethoxy-2-pyrimi-
dinyl)amino]carbonyl]amino]sulfonyl]-3-
(fluoromethyl)benzoate.

10. The compound of Claim 1,
ethyl 2-[[[(4-chloro-6-methoxy-2-
5 pyrimidinyl)amino]carbonyl]amino]-
sulfonyl]-3-(fluoromethyl)benzoate.

11. A compound selected from

10

15



II

20

wherein:

A is OR^1 or $N(CH_3)_2$;

R^1 is C_1-C_3 alkyl, $CH_2CH=CH_2$, $CH_2C\equiv CH$,
 CH_2CH_2Cl or $CH_2CH_2OCH_3$;

25 R^2 is CH_2F , CHF_2 , $CHFCH_3$ or CH_2CN ; and

Z^1 is Cl or $NHSiR^3R^4R^5$;

R^3 is C_1-C_4 alkyl;

R^4 is C_1-C_4 alkyl; and

R^5 is C_1-C_4 alkyl.

30

12. A compound of Claim 11 wherein A is OR^1
and R^1 is C_1-C_2 alkyl.

13. A compound of Claim 12 wherein R^3 and R^4
35 are CH_3 and R^5 is $C(CH_3)_3$.

14. A composition suitable for controlling
the growth of undesired vegetation which comprises an
5 effective amount of a compound of Claim 1 and at
least one of the following: surfactant, solid
diluent or liquid diluent.

15. A composition suitable for controlling
10 the growth of undesired vegetation which comprises an
effective amount of a compound of Claim 2 and at
least one of the following: surfactant, solid
diluent or liquid diluent.

15 16. A composition suitable for controlling
the growth of undesired vegetation which comprises an
effective amount of a compound of Claim 3 and at
least one of the following: surfactant, solid
diluent or liquid diluent.

20 17. A composition suitable for controlling
the growth of undesired vegetation which comprises an
effective amount of a compound of Claim 4 and at
least one of the following: surfactant, solid
25 diluent or liquid diluent.

18. A composition suitable for controlling
the growth of undesired vegetation which comprises an
effective amount of a compound of Claim 5 and at
30 least one of the following: surfactant, solid
diluent or liquid diluent.

19. A method for controlling the growth of
undesired vegetation which comprises applying to the
35 locus to be protected an effective amount of the com-
pound of Claim 1.

20. A method for controlling the growth of
5 undesired vegetation which comprises applying to the
locus to be protected an effective amount of the com-
pound of Claim 2.

21. A method for controlling the growth of
10 undesired vegetation which comprises applying to the
locus to be protected an effective amount of the com-
pound of Claim 3.

22. A method for controlling the growth of
15 undesired vegetation which comprises applying to the
locus to be protected an effective amount of the com-
pound of Claim 4.

23. A method for controlling the growth of
20 undesired vegetation which comprises applying to the
locus to be protected an effective amount of the com-
pound of Claim 5.

24. The method of Claim 22 wherein the locus
25 to be protected is corn.

25. A method for controlling the growth of
undesired vegetation in wheat or barley which
comprises applying to the wheat or barley an
30 effective amount of the compound of Claim 9.

INTERNATIONAL SEARCH REPORT

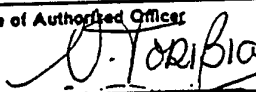
International Application No

PCT/US 91/01075

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁴	
According to International Patent Classification (IPC) or to both National Classification and IPC	
IPC ⁵ : C 07 D 239/42, C 07 D 239/47, C 07 D 239/52, C 07 C 309/89, A 01 N 43/54	
II. FIELDS SEARCHED	
Minimum Documentation Searched ⁷	
Classification System	Classification Symbols
IPC ⁵	C 07 D 239/00, C 07 D 251/00, C 07 C 309/00, A 01 N 43/00
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁶	

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁸	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	EP, A2, 0 096 002 (CIBA-GEIGY) 07 December 1983 (07.12.83), see claims 1,10, 11,12,17.	1, 14, 19, 24, 25
A	--	
A	EP, A2, 0 073 627 (DU PONT) 09 March 1983 (09.03.83) see claims 1,25,26.	1, 14, 19
X	--	
X	WO, A1, 89/09 214 (DU PONT) 05 October 1989 (05.10.89), see examples. see claims 1,8,15.	11
A	--	
A	EP, A1, 0 181 526 (CHUGAI) 21 May 1986 (21.05.86), see claim 1.	1, 14, 19
A	---	
A	----	

- | | |
|---|--|
| <p>¹⁰ Special categories of cited documents:</p> <ul style="list-style-type: none"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed | <ul style="list-style-type: none"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family |
|---|--|

IV. CERTIFICATION	
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15 April 1991	10.06.91
International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	 Nurta TORIBIO

ANHANG
zum internationalen Recherchen-
bericht über die internationale
Patentanmeldung Nr.

ANNEX
to the International Search
Report to the International Patent
Application No.

ANNEXE
au rapport de recherche inter-
national relatif à la demande de brevet
international n°

PCT/US91/01075 SAE 45036

In diesem Anhang sind die Mitglieder
der Patentfamilien der im obenge-
nannten internationalen Recherchenbericht
angeführten Patentedokumente angegeben.
Diese Angaben dienen nur zur Unter-
richtung und erfolgen ohne Gewähr.

This Annex lists the patent family
members relating to the patent documents
cited in the above-mentioned inter-
national search report. The Office is
in no way liable for these particulars
which are given merely for the purpose
of information.

La présente annexe indique les
membres de la famille de brevets
relatifs aux documents de brevets cités
dans le rapport de recherche inter-
national visée ci-dessus. Les renseigne-
ments fournis sont donnés à titre indica-
tif et n'engagent pas la responsabilité
de l'Office.

Im Recherchenbericht angeführtes Patentedokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
EP-A1- 181526	21-05-86	AT-E - 40112	15-02-89
		CA-A1- 1255329	06-06-89
		DE-CO- 3567643	23-02-89
		EP-B1- 181526	18-01-89
		JP-A2-61097257	15-05-86
		US-A - 4698364	06-10-87
		JP-A2-61097219	15-05-86
		EP-A2- 73627	09-03-83
		AT-E - 23999	15-12-86
		AU-A1-87517/82	03-03-83
		AU-B2- 555081	11-09-86
		BR-A - 8204883	02-08-83
		CA-A1- 1220203	07-04-87
		DE-CO- 3274547	15-01-87
		DK-A - 3754/82	25-02-83
		EP-A3- 73627	28-03-84
		EP-B1- 73627	03-12-86
		ES-A1- 515183	16-10-83
		ES-A1- 8406072	16-10-84
		IL-A0- 66617	31-12-82
		IL-A1- 66617	31-03-86
		JP-A2-58043959	14-03-83
		NZ-A - 201676	31-05-85
		PL-A1- 238013	09-05-83
		US-A - 4555261	26-11-85
		ZA-A - 8206115	28-03-84
EP-A2- 96002	07-12-83	AT-E - 28637	15-08-87
		CA-A1- 1228355	20-10-87
		DE-CO- 3372760	03-09-87
		EP-A3- 96002	25-07-84
		EP-B1- 96002	29-07-87
		IL-A0- 69770	30-09-83
		IL-A1- 68770	29-04-86
		JP-A2-58216167	15-12-83
		US-A - 4537618	27-08-85
		US-A - 4594097	10-06-86
		US-A - 4727186	23-02-88
		ZA-A - 8303779	29-02-84
		IL-A0- 69770	30-12-83
		AU-A1-19566/83	05-04-84
		DD-A5- 207714	14-03-84
		DK-A0- 4389/83	26-09-83
		EP-A2- 111993	27-06-84
		EP-A3- 111993	25-07-84
		FI-A0- 833424	23-09-83
		FI-A - 833424	28-03-84
		GB-A0- 8325360	26-10-83
		GB-A1- 2127408	11-04-84
		GB-B2- 2127408	14-05-86
		IL-A0- 69770	30-12-83
		JP-A2-59080666	10-05-84
		PL-A1- 243905	30-01-85
		PT-A - 77398	01-10-83
		PT-B - 77398	20-03-86
		US-A - 4492708	08-01-85
		ZA-A - 8306958	24-04-85

WO-A1- 8909214

05-10-89

AU-A1-34300/89

16-10-89

DK-A0- 2288/90

21-09-90

DK-A - 2288/90

23-11-90

EP-A1- 336587

11-10-89

EP-A1- 406322

09-01-91
