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(54) Title: SYNERGISTIC HERBICIDAL COMPOSITIONS

(57) Abstract

There is described new herbicidal compositions with synergistic activity which comprises a mixture of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]perhydroimidazo[1,5-a]pyridin-1,3-one and a herbicide selected from the group consisting of glyphosate (II), sulfometuron-methyl (III), imazapyr (IV), 2,4-D (V), dicamba (VI), diuron (VII), oxyfluorfen (VIII), glufosinate-ammonium (IX), amitrole (X), sethoxydim (XI), metribuzin (XII), linuron (XIII), acifluorfen (XIV), lactofen (XV), fomesafen (XVI), pendimethalin (XVII), alachlor (XVIII), metolachlor (XIX), trifluralin (XX), chlorimuron-ethyl (XXI), imazaquin (XXII) and imazethapyr (XXIII).

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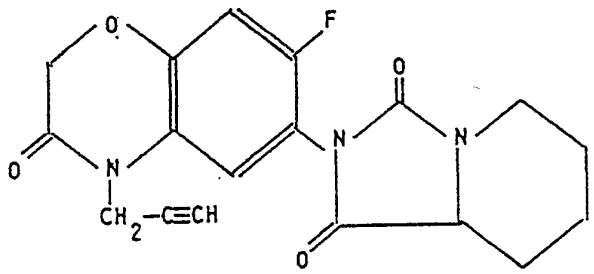
SYNERGISTIC HERBICIDAL COMPOSITIONS

This invention relates to a new herbicidal composition having synergistic activity comprising a mixture of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]perhydroimidazo[1,5-a]pyridin-1,3-one and another selective herbicide and its use for combating weeds in crops.

The herbicidal activity of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]perhydro-imidazo[1,5-a]pyridin-1,3-one is already known (EP 311 135). This compound has the following chemical structure (I)



(I)

It has now been found that herbicidal compositions which comprise, as active components, a mixture of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]perhydroimidazo[1,5-a]pyridin-1,3-one and a herbicide selected from the group consisting of glyphosate (II), sulfometuron-methyl (III), imazapyr (IV), 2,4-D (V), dicamba (VI), diuron (VII), oxyfluorfen (VIII), glufosinate-ammonium (IX), amitrole (X) and sethoxydim (XI) as well as metribuzin (XII), linuron (XIII), acifluorfen (XIV), lactofen (XV), fomesafen (XVI), pendimethalin (XVII), alachlor (XVIII), metolachlor (XIX), trifluralin (XX), chlorimuron-ethyl (XXI), imazaquin

(XXII) and imazethapyr (XXIII), broaden the spectrum of weeds that can be controlled and show an increase in herbicidal activity in comparison with the individual components without losing the selectivity properties in agricultural crops.

Glyphosate is the common name for N-(phosphonomethyl)-glycine;
sulfometuron-methyl is the common name for methyl 2-(4,6-dimethylpyridin-2-ylcarbamoylsulfamoyl)benzoate;
imazapyr is the common name for 2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-nicotinic acid;
2,4-D is the common name for 2-(4-chloro-2-methyl-phenoxy)acetic acid;
dicamba is the common name for 3,6 dichloro-2-methoxy-benzoic acid;
diuron is the common name for 3-(3,4-dichlorophenyl)-1,1-dimethylurea;
oxyfluorfen is the common name for 2-chloro-α,α,α-trifluoro-p-tolyl 3-ethoxy-4-nitrophenyl ether;
glufosinate ammonium is the common name for ammonium 4-[hydroxy(methyl)phosphinoyl]-DL-homoalaninate;
amitrole is the common name for 1H-1,2,4-triazol-3-ylamine;
sethoxydim is the common name for (±)-(EZ)-2-(1-ethoxyiminobutyl)-5-[2-(ethylthio)propyl]-3-hydroxy-cyclohex-2-enone;
metribuzin is the common name for 4-amino-6-*tert.*-butyl-4,5-dihydro-3-methylthio-1,2,4-triazin-5-one;
linuron is the common name for 3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea;
acifluorfen is the common name for 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoic acid;
lactofen is the common name for (±)-2-ethoxy-1-ethyl-2-oxoethyl 5-[chloro-4-(trifluoromethyl)phenoxy]-

2-nitrobenzoate;
fomesafen is the common name for 5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide;
pendimethalin is the common name for N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitroaniline;
alachlor is the common name for 2-chloro-2',6'-diethyl-N-methoxymethylacetanilide;
metolachlor is the common name for 2-chloro-6'-ethyl-2'-methyl-N-(2-methoxy-1-methylethyl)acetanilide;
trifluralin is the common name for 2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)aniline;
chlorimuron-ethyl is the common name for ethyl 2-(4-chloro-6-methoxypyrimidin-2-ylcarbamoylsulfamoyl)-benzoate;
imazaquin is the common name for (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazole-2-yl]-5-ethyl-3-pyridinecarboxylic acid; and
imazethapyr is the common name for (±)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-2-yl]-3-quinoline carboxylic acid.

All these herbicides are described in the "Pesticide Manual", ninth edition, 1991, published by the British Crop Protection Council, London.

The combinations of the invention are suitable for the control of important annual and perennial weeds, especially in plantation and permanent crops, such as for example in fruit, wine, citrus, forests and ornamental cultivations, in arable land outside the vegetation time (for example stubble treatment), as well as in the industrial area including highways and railways. Further uses are for the control of important weeds in a range of crops, such as for example soya beans.

The combination of active ingredients of the invention can used for example against the following plant species:

Dicotyledonous weeds of the species Sinapis, Lepidium, Galium, Stellaria, Matricaria, Anthemis, Galinsoga, Chenopodium, Brassica, Urtica, Senecio, Amaranthus, Portulaca, Xanthium, Convolvulus, Ipomoea, Polygonum, Sesbania, Ambrosia, Cirsium, Carduus, Sonchus, Solanum, Rorippa, Lamium, Veronica, Abutilon, Datura, Viola, Galeopsis, Papaver, Centaurea and Chrysanthemum.

Monocotyledonous weeds of the species Avena, Alopecurus, Echinochloa, Setaria, Panicum, Digitaria, Poa, Eleusine, Brachiaria, Lolium, Bromus, Cyperus, Agropyron (= Elymus), Sagittaria, Monocharia, Fimbristylis, Eleocharis, Ischaemum and Apera.

The combinations of I with II-XI can be applied pre-emergently, and the combinations of I with XII-XXIII can be applied post-emergently. The rate of use lies between 0.001 and 5 kg/ha of the mixture, depending on the use. By using the mixtures for control of weeds the amount of herbicide needed can be generally reduced.

The weight ratio of component I) to the other component is generally between 50:1 and 1:100.

The compositions of the invention can also be used in admixture with other active agents for example other plant-protection agents or pesticides, depending on the particular need.

An improvement in the intensity and speed of action can be obtained, for example, by addition of suitable adjuvants, such as organic solvents, wetting agents and oils. Such

additives may allow a decrease in the dose.

The designated active ingredients or their mixtures can suitably be used, for example, as powders, dusts, granules, solutions, emulsions or suspensions, with the addition of liquid and/or solid carriers and/or diluents and, optionally, binding, wetting, emulsifying and/or dispersing adjuvants.

Suitable liquid carriers are, for example aliphatic and aromatic hydrocarbons, such as benzene, toluene, xylene, cyclohexanone, isophorone, dimethyl sulfoxide, dimethylformamide and other mineral-oil fractions and plant oils.

Suitable solid carriers include mineral earths, e.g. bentonite, silica gel, talc, kaolin, attapulgite, limestone, silicic acid and plant products, e.g. flours.

As surface-active agents there can be used for example calcium lignosulfonate, polyoxyethylenealkylphenyl ethers, naphthalenesulfonic acids and their salts, phenolsulfonic acids and their salts, formaldehyde condensates, fatty alcohol sulfates, as well as substituted benzenesulfonic acids and their salts.

The percentage of the active ingredient(s) in the various preparations can vary within wide limits. For example, the compositions can contain about 10 to 90 percent by weight active ingredients, and about 90 to 10 percent by weight liquid or solid carriers, as well as, optionally up to 20 percent by weight of surfactant.

The agents can be applied in customary fashion, for example with water as the carrier in spray mixture volumes

of approximately 100 to 1,000 l/ha. The agents can be applied using low-volume or ultra-low-volume techniques or in the form of so-called microgranules.

The preparation of these formulations can be carried out in known manner, for example by milling or mixing processes. Optionally, individual components can be mixed just before use for example by the so-called commonly used tank-mixing method.

The following Examples illustrate the use of compositions of the invention.

The calculation of synergistic effect is carried out according to S R Colby "Calculating Synergistic and Antagonistic Response to Herbicide Combinations" , Weeds, 15/1, 1967 pages 20 to 22. In this the following formula was used:

$$E = X + Y - \frac{XY}{100}$$

in which X = the herbicidal activity (%) of substance A at a rate of p g/ha.

Y = the herbicidal activity (%) of substance B at a rate of q g/ha., and

E = the expected additive activity of the herbicide (%) of the substances A + B at a rate of p + q g/ha.

If the observed value is greater than the value of E calculated according to Colby, the combination shows synergistic activity.

Experiments

In a greenhouse the plant species shown in tables A-K were treated post-emergently with the components at the stated rates. The compositions were diluted with 500 litres of water and sprayed evenly over the plants. Two weeks after treatment the herbicidal effect was evaluated.

Table A

Mixtures of I with glyphosate (II)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Amaranthus retroflexus			
I	1	80	
II	50	5	
I + II	1 + 50	85	(81)
Cyperus esculentus			
I	4	40	
II	400	5	
I + II	4 + 400	90	(43)
Elymus repens			
I	4	50	
II	400	40	
III	4 + 400	85	(70)

Table B

Mixtures of I with sulfometuron-methyl (III)

Component	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Brachiaria mutica			
I	8	10	
III	2	50	
I + III	8 + 2	75	(59)
Sesbania exaltata			
I	4	20	
III	2	60	
I + III	4 + 2	75	(68)
Bromus sp.			
I	8	20	
III	4	60	
I + III	8 + 4	75	(68)

Table C

Mixtures of I with imazapyr (IV)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Setaria viridis			
I	1	30	
IV	2	80	
I + IV	1 + 2	90	(86)
Sorghum halepense			
I	8	70	
IV	1	20	
I + IV	8 + 1	90	(76)
Cyperus esculentus			
I	4	80	
IV	4	10	
I + IV	4 + 4	98	(82)

Table D

Mixtures of I with 2,4-D (V)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Bidens pilosa			
I	4	60	
V	100	0	
	200	10	
I + V	4 + 100	80	(60)
	4 + 200	85	(64)
Sesbania exaltata			
I	4	40	
	8	80	
V	100	0	
I + V	4 + 100	90	(40)
	8 + 100	98	(80)
Amaranthus retroflexus			
I	2	70	
V	50	10	
	200	20	
I + V	2 + 50	90	(73)
	2 + 200	90	(76)

Table E

Mixtures of I with dicamba (VI)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sesbania exaltata			
I	1	20	
VI	25	70	
I + VI	1 + 25	90	(76)
Bidens pilosa			
I	1	40	
VI	25	60	
I + VI	1 + 25	85	(76)

Table F

Mixtures of I with diuron (VII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sesbania exaltata			
I	0,5	0	
	1	0	
	2	30	
	4	90	
VII	50	5	
	100	80	
I + VII	0,5 + 100	95	(80)
	1 + 100	95	(80)
	2 + 50	75	(34)
	4 + 50	95	(91)
Bidens pilosa			
I	2	50	
	4	65	
	8	80	
VII	25	0	
I + VII	2 + 25	85	(50)
	4 + 25	99	(65)
	8 + 25	100	(80)
Cyperus esculentus			
I	8	40	
VII	100	0	
	200	5	
I + VII	8 + 100	70	(40)
	8 + 200	80	(43)
Setaria viridis			
I	1	5	
VII	100	70	
I + VII	1 + 100	97	(72)

Table G

Mixtures of I with oxyfluorfen (VIII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sesbania exaltata			
I	1	20	
	2	50	
VIII	2	30	
I + VIII	1 + 2	70	(49)
	2 + 2	90	(65)
Amaranthus retroflexus			
I	1	60	
VIII	2	70	
I + VIII	1 + 2	98	(88)

Table H

Mixtures of I with glufosinate-ammonium (IX)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Setaria viridis			
I	4	20	
IX	80	60	
I + IX	4 + 80	80	(68)
Brachiaria mutica			
I	8	20	
IX	80	20	
I + IX	8 + 80	95	(36)
Sorghum halepense			
I	8	50	
IX	40	0	
I + IX	8 + 50	90	(50)
Sesbania exaltata			
I	2	60	
IV	80	0	
I + IX	2 + 80	98	(60)

Table I

Mixtures of I with amitrole (X)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Setaria viridis			
I	4	20	
X	200	60	
I + X	4 + 200	80	(68)
Bracharia mutica			
I	4	0	
	8	5	
X	200	30	
I + X	4 + 200	70	(30)
	8 + 200	95	(33)
Bidens pilosa			
I	4	70	
X	50	20	
I + X	4 + 50	85	(76)
Sesbania exaltata			
I	1	30	
	2	50	
X	25	5	
	50	30	
I + X	1 + 25	70	(33)
	1 + 50	85	(51)
	2 + 25	90	(53)
	2 + 50	95	(65)

Table K

Mixtures of I with sethoxydim (XI)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Setaria viridis			
I	4	10	
XI	100	70	
I + XI	4 + 100	98	(73)
Brachiaria mutica			
I	8	15	
XI	50	80	
I + XI	8 + 50	95	(83)
Bromus sp.			
I	2	10	
XI	200	60	
I + XI	2 + 200	85	(64)

Experiments

In a greenhouse the plant species shown in tables L-W were treated pre-emergently with the components at the stated rates. The compositions were diluted with 500 litres of water and sprayed evenly over the soil. Two weeks after treatment the herbicidal effect was evaluated.

Table L

Mixtures of I with metribuzin (XII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	4	0	
	8	0	
XII	12,5	0	
	50	0	
	100	5	
I + XII	4 + 12,5	5	(0)
	8 + 12,5	5	(0)
	4 + 50	0	(0)
	8 + 50	5	(0)
	4 + 100	5	(5)
	8 + 100	10	(5)
Ipomoea purpurea			
I	8	60	
XII	50	5	
I + XII	8 + 50	70	(62)
Amaranthus retroflexus			
I	4	10	
	8	10	
XII	50	50	
I + XII	4 + 50	98	(55)
	8 + 50	98	(55)

Table M

Mixtures of I with linuron (XIII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	8	0	
XIII	100	0	
	200	0	
I + XIII	2 + 100	0	(0)
	2 + 200	0	(0)
	8 + 100	0	(6)
	8 + 200	5	(5)
Amaranthus retroflexus			
I	8	20	
XIII	100	0	
I + XIII	8 + 100	80	(20)
Polygonum lapathiflolium			
I	2	20	
XIII	200	50	
I + XIII	2 + 200	80	(60)
Setaria viridis			
I	8	40	
XIII	100	0	
I + XIII	8 + 100	75	(40)

Table N

Mixtures of I with acifluorfen (XIV)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	4	20	
	8	40	
XIV	10	0	
	20	5	
	40	10	
I + XIV	2 + 10	0	(0)
	2 + 20	10	(5)
	2 + 40	0	(10)
	4 + 10	0	(20)
	4 + 20	20	(24)
	4 + 40	10	(27)
	8 + 10	20	(40)
	8 + 20	50	(43)
	8 + 40	10	(46)
Ipomoea purpurea			
I	8	70	
XIV	10	0	
	20	10	
I + XIV	8 + 10	85	(70)
	8 + 20	95	(73)
Amaranthus retroflexus			
I	4	40	
XIV	40	30	
I + XIV	4 + 40	90	(58)
Polygonum lapathifolium			
I	8	80	
XIV	10	0	
I + XIV	8 + 10	95	(80)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sorghum halepense			
I	2	20	
XIV	20	70	
I + XIV	2 + 20	90	(76)
Digitaria ischaemum			
I	2	10	
XIV	20	50	
I + XIV	2 + 20	75	(55)

Table O

Mixtures of I with lactofen (XV)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	1	0	
	2	5	
	4	10	
XV	20	0	
I + XV	1 + 20	0	(0)
	2 + 20	0	(5)
	4 + 20	0	(10)
Amaranthus retroflexus			
I	2	20	
	4	50	
XV	20	40	
I + XV	2 + 20	85	(52)
	4 + 20	90	(70)
Polygonum lapathiflolium			
I	2	40	
	4	70	
XV	20	0	
I + XV	2 + 20	90	(40)
	4 + 20	95	(70)
Digitaria ischaemum			
I	1	0	
XV	20	50	
I + XV	1 + 20	90	(50)

Table P

Mixtures of I with fomesafen (XVI)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	4	20	
	8	20	
XVI	10	10	
	40	20	
	80	20	
I + XVI	2 + 10	0	(10)
	2 + 40	30	(20)
	2 + 80	20	(20)
	4 + 10	10	(28)
	4 + 40	10	(36)
	4 + 80	20	(36)
	8 + 10	20	(28)
	8 + 40	20	(36)
	8 + 80	20	(36)
Impomoea purpurea			
I	8	60	
XVI	40	20	
	80	40	
I + XVI	8 + 40	90	(68)
	8 + 80	95	(76)
Polygonum lapathiflolium			
I	2	5	
	4	75	
XVI	10	5	
I + XVI	2 + 10	80	(8)
	4 + 10	98	(77)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sorghum halepense			
I	4	50	
XVI	10	10	
I + XVI	4 + 10	85	(55)
Digitaria ischaemum			
I	4	50	
XVI	10	30	
I + XVI	4 + 10	90	(65)

Table Q

Mixtures of I with pendimethalin (XVII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	4	0	
	8	0	
XVII	25	0	
	200	0	
I + XVII	2 + 25	0	(0)
	4 + 25	0	(0)
	8 + 25	0	(0)
	2 + 200	0	(0)
	4 + 200	0	(0)
	8 + 200	0	(0)
Setaria viridis			
I	8	0	
XVII	200	75	
I + XVII	8 + 200	98	(75)
Polygonum lapathiflolium			
I	4	50	
XVII	25	0	
I + XVII	4 + 25	85	(50)
Amaranthus retroflexus			
I	2	0	
XVII	200	20	
I + XVII	2 + 200	85	(20)

Table R

Mixtures of I with alachlor (XVIII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	4	0	
	8	0	
XVIII	50	0	
I + XVIII	4 + 50	0	(0)
	8 + 50	0	(0)
Polygonum lapathifolium			
I	4	20	
	8	80	
XVIII	50	0	
I + XVIII	4 + 50	95	(20)
	8 + 50	100	(80)
Digitaria ischaemum			
I	4	0	
	8	40	
XVIII	50	30	
I + XVIII	4 + 50	90	(30)
	8 + 50	97	(58)

Table S

Mixtures of I with metolachlor (XIX)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	4	0	
	8	0	
XIX	50	0	
	100	0	
I + XIX	4 + 50	0	(0)
	8 + 50	0	(0)
	4 + 100	0	(0)
	8 + 100	0	(0)
Amaranthus retroflexus			
I	8	40	
XIX	100	0	
I + XIX	8 + 100	70	(40)
Setaria viridis			
I	8	40	
XIX	50	40	
I + XIX	8 + 50	85	(64)
Digitaria ischaemum			
I	4	20	
	8	30	
XIX	50	60	
I + XIX	4 + 50	90	(68)
	8 + 50	95	(72)

Table T

Mixtures of I with trifluralin (XX)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	4	10	
	8	10	
XX	100	0	
	200	10	
	400	10	
I + XX	2 + 100	0	(0)
	4 + 100	0	(10)
	8 + 100	10	(10)
	2 + 200	0	(10)
	4 + 200	10	(19)
	8 + 200	10	(19)
	2 + 400	0	(10)
	4 + 400	0	(19)
	8 + 400	10	(19)
Amaranthus retroflexus			
I	4	50	
XX	200	15	
	400	50	
I + XX	4 + 200	90	(58)
	4 + 400	95	(75)
Abutilon theoohrasti			
I	4	80	
XX	400	15	
I + XX	4 + 400	90	(83)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Polygonum lapathifolium			
I	8	50	
XX	200	0	
	400	10	
I + XX	8 + 200	95	(50)
	8 + 400	95	(55)
Panicum maximum			
I	2	0	
	4	10	
XX	100	90	
I + XX	2 + 100	99	(90)
	4 + 100	99	(91)

Table U

Mixtures of I with Chlorimuron-ethyl (XXI)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	8	0	
XXI	4	0	
	8	0	
I + XXI	8 + 4	5	(0)
	8 + 8	5	(0)
Ipomoea purpurea			
I	8	5	
XXI	4	40	
I + XXI	8 + 4	70	(43)
Bidens pilosa			
I	8	0	
XXI	8	70	
I + XXI	8 + 8	80	(70)

Table V

Mixtures of I with imazaquin (XXII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	2	0	
	8	0	
XXII	4	0	
	16	0	
I + XXII	2 + 4	0	(0)
	2 + 16	0	(0)
	8 + 4	0	(0)
	8 + 16	5	(0)
Ipomoea purpurea			
I	8	10	
XXII	16	60	
I + XXII	8 + 16	75	(64)
Amaranthus retroflexus			
I	8	50	
XXII	16	20	
I + XXII	8 + 16	90	(60)
Polygonum lapathifolium			
I	2	20	
XXII	4	20	
I + XXII	2 + 4	80	(36)

Table W

Mixtures of I with imazethapyr (XXIII)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Sojabohne			
I	1	0	
	2	0	
	4	0	
	8	0	
XXIII	2	0	
	4	0	
	8	10	
	16	0	
I + XXIII	1 + 2	0	(0)
	1 + 4	0	(0)
	1 + 8	0	(10)
	1 + 16	0	(0)
	2 + 2	0	(0)
	2 + 4	0	(0)
	2 + 8	0	(10)
	2 + 16	0	(0)
	4 + 2	0	(0)
	4 + 4	0	(0)
	4 + 8	0	(10)
	4 + 16	0	(0)
	8 + 2	0	(0)
	8 + 4	0	(0)
	8 + 8	0	(10)
	8 + 16	10	(0)
Ipomoea purpurea			
I	8	15	
XXIII	8	40	
I + XXIII	8 + 8	70	(49)

	Rate (g/ha)	Herbicidal activity (%)	E (according to Colby)
Amaranthus retroflexus			
I	4	75	
XXIII	2	0	
	4	0	
I + XXIII	4 + 2	85	(75)
	4 + 4	85	(75)
Polygonum lapathifolium			
I	4	70	
XXIII	2	10	
I + XXIII	4 + 2	95	(73)
Setaria viridis			
I	1	0	
	2	0	
XXIII	16	50	
I + XXIII	1 + 16	75	(50)
	2 + 16	80	(50)

Claims

1. A herbicidal composition which comprises, a mixture of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl]perhydroimidazo[1,5-a]pyridin-1,3-one and a herbicide selected from the group consisting of glyphosate (II), sulfometuron-methyl (III), imazapyr (IV), 2,4-D (V), dicamba (VI), diuron (VII), oxyfluorfen (VIII), glufosinate-ammonium (IX), amitrole (X), sethoxydim (XI), metribuzin (XII), linuron (XIII), acifluorfen (XIV), lactofen (XV), fomesafen (XVI), pendimethalin (XVII), alachlor (XVIII), metolachlor (XIX), trifluralin (XX), chlorimuron-ethyl (XXI), imazaquin (XXII) and imazethapyr (XXIII).

2. A composition according to claim 1, in which the weight ratio of the mixture components is between 50:1 and 1:100.

3. A method of combating weeds which comprises applying post-emergently, a composition according to claim 1 or 2, which comprises component I and at least ome of the components II to XI.

4. A method of combating weeds which comprises applying pre-emergently, a composition according to claim 1 or 2, which comprises component I and at least ome of the components XII to XXIII.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 92/02535

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A01N 43/90, A01N 57/20, A01N 47/36, A01N 39/04, A01N 37/10, A01N 47/30, A01N 33/18, A01N 41/06, A01N 43/653, A01N 35/04, A01N 43/707, A01N 37/22

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A01N

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

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

CA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A2, 0311135 (SCHERING AKTIENGESELLSCHAFT), 12 April 1989 (12.04.89), page 15, line 7 - line 19, the claims	1-4

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" erlier 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

"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 when the document is taken alone

"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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 February 1993	26. 02. 93
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer GERD WRANNE

Form PCT/ISA/210 (second sheet) (July 1992)

SA 6979

INTERNATIONAL SEARCH REPORT

Information on patent family members

08/01/93

International application No.
PCT/EP 92/02535

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A2- 0311135	12/04/89	AU-A-	2356888	13/04/89
		CN-A-	1032479	26/04/89
		DE-A-	3734745	20/04/89
		JP-A-	1157977	21/06/89
		SU-A-	1722204	23/03/92

FURTHER INFORMATION CONTINUED FROM PCT/ISA/210

and
claims 1-3 in part glyphosate (II) or glufosinate-ammonium (IX),
claims 1-4 in part sulfometuron-methyl (III) or chlorimuron-ethyl (XXI),
claims 1-4 in part imazapyr (IV), imazaquin (XXII) or imazethapyr (XXIII),
claims 1-3 in part 2,4-D(V) or dicamba (VI),
claims 1-4 in part diuron (VII) or linuron (XIII),
claims 1-4 in part oxyfluorfen (VIII) acifluorfen (XIV), lactofen (XV) or fomesafen (XVI),
claims 1-3 in part amitrole (X),
claims 1-3 in part sethoxydin (XI),
claims 1,2,4 in part metribuzin (XII),
claims 1,2,4 in part pendimethalin (XVII) or trifluarin (XX),
claims 1,2,4 in part alachlor (XVIII) or metholachlor (XIX).

national application No.

PCT/EP 92/ 02535

INTERNATIONAL SEARCH REPORT

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The subjects, defined by the names and structures as listed below are so different from each other that no technical relationship or interaction can be appreciated to be present so as to form a single general inventive concept. Herbicidal compositions comprising a mixture of 2-[7-fluoro-3,4-dihydro-3-oxo-4-(2-propynyl)-2H-1,4-benzoxazin-6-yl] perhydroimidazo[1,5-a]pyridin-1,3-one

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searches without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.