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**SYNERGISTIC HERBICIDAL COMPOSITIONS**

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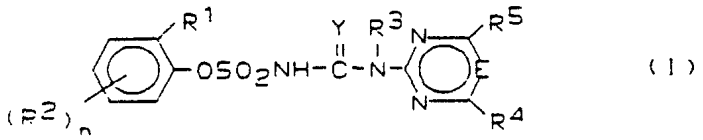
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(57) Compositions of a combination of

A) compounds of the formula (I) or salts thereof



(I)

in which $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, E, Y and n are as defined in claim 1, and

B) one or more compounds from amongst the group comprising pyrazosulfuron-ethyl, bensulfuron-methyl, amidosulfuron, imazosulfuron, dimetrasulfuron and metsulfuron-methyl

have very good herbicidal properties and show synergistic increases in action or safener effects.

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# ORIGINAL
# COMPLETE SPECIFICATION
# STANDARD PATENT

Application Number:

Lodged:

Invention Title: SYNERGISTIC HERBICIDAL COMPOSITIONS

**The following statement is a full description of this invention, including the best method of performing it known to** :- us

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Description

# Synergistic herbicidal compositions

The invention is in the field of the crop protection agents which can be used against monocotyledon and dicotyledon weeds.

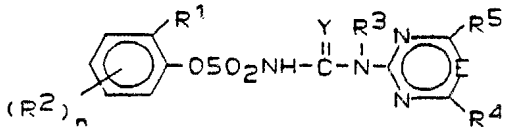
EP-A-0,342,569, EP-A-0,342,568 and EP-A-0,388,771 describe heterocyclically substituted phenoxysulfonylureas by means of which a broad range of mono- and dicotyledon weeds can be controlled. They can be employed both as a soil-acting herbicide and via the leaves and also show a particularly high selectivity in monocotyledon crop plants such as cereals, corn and sorghum, but also in rice, in particular in paddy rice.

However, a series of economically highly important monocotyledon weeds, for example Cyperus rotundus, Cyperus esculentus, Cyperus serotinus, Eleocharis kuroguwai and many others, exist in rice and in other crops, and these weeds cannot be controlled in an optimal fashion using the abovementioned compounds on their own.

Surprisingly, some herbicidal active substances have now been found which, when used in conjunction with the abovementioned compounds, have pronounced synergistic properties as regards the effectivity against weeds.

The present invention relates to herbicidal compositions with an effective content of

A) compounds of the formula (I) or salts thereof



(I)

in which

$a_1$) $R^1$ is ethoxy, propoxy or isopropoxy and
$R^2$ is halogen, $NO_2$, $CF_3$, CN, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio or ($C_1$-$C_4$-alkoxy)-carbonyl and
n is 0, 1, 2 or 3, or

$a_2$) $R^1$ is optionally unsaturated $C_1$-$C_8$-alkoxy which is substituted by halogen, optionally unsaturated $C_1$-$C_8$-alkoxy, a radical of the formula ($C_1$-$C_8$-alkyl)-S-, ($C_1$-$C_8$-alkyl)-SO-, ($C_1$-$C_8$-alkyl)-$SO_2$-, ($C_1$-$C_8$-alkyl)-O-CO-, $NO_2$, CN or phenyl; furthermore $C_2$-$C_8$-alkenyloxy or -alkynyloxy and
$R^2$ is saturated or unsaturated $C_1$-$C_8$-alkyl, phenyl, phenoxy, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio, ($C_1$-$C_4$-alkoxy)-carbonyl, it being possible for all the above $R^2$ radicals to be substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, or is halogen, $NO_2$, $C_1$-$C_4$-alkylsulfonyl or -sulfinyl, and
n is 0, 1, 2 or 3, or

$a_3$) $R^1$ is $C_1$-$C_8$-alkoxy and
$R^2$ is $C_2$-$C_8$-alkenyl or -alkynyl, phenyl or phenoxy, the abovementioned $R^2$ radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or -alkylthio, or is $C_1$-$C_4$-alkylsulfonyl or -alkylsulfinyl and
n is 1, 2 or 3, or

$a_4$) $R^1$ - in each case in the 2-position on the phenyl radical - is halogen, methoxy, ethyl or propyl,
$R^2$ is ($C_1$-$C_4$-alkoxy)-carbonyl in the 6-position on the phenyl radical and
n is 1,

and, in all cases $a_1$)-$a_4$),

$R^3$ is hydrogen, saturated or unsaturated $C_1$-$C_8$-alkyl or $C_1$-$C_4$-alkoxy,

$R^4$ and $R^5$ independently of one another are hydrogen, halogen, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio, the three last-mentioned radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio,

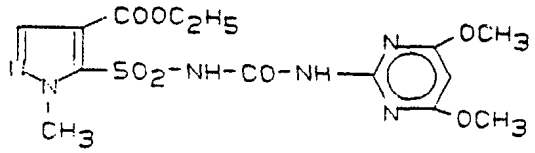
Y is O or S and

E is CH or N,

in combination with

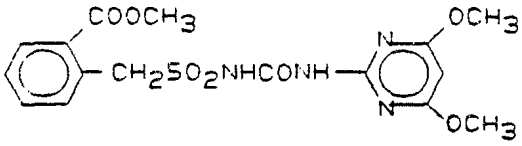
B) one or more compound(s) from the group comprising the compounds

B1) pyrazosulfuron-ethyl (NC 311) of the formula



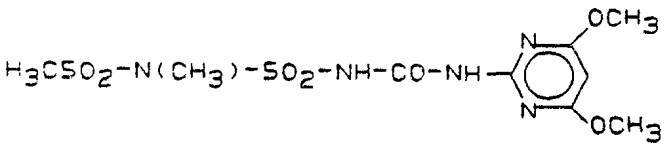
(B1)

B2) bensulfuron-methyl of the formula



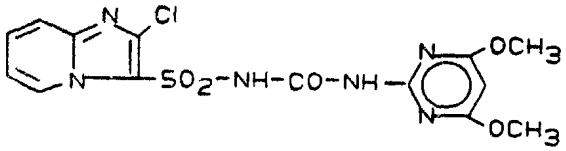
(B2)

B3) amidosulfuron of the formula



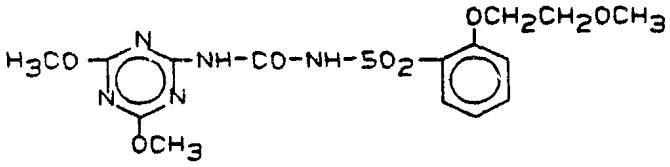
(B3)

B4) imazosulfuron (TH 913) of the formula



(B4)

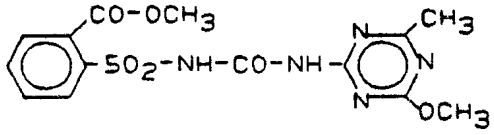
B5) dimetrasulfuron (cinosulfuron) of the formula



(B5)

and

B6) metsulfuron-methyl (DPX-T 6376) of the formula



(B6)

The compounds A (compounds of the formula I) are disclosed in the German patent applications mentioned at the outset.

The compound pyrazosulfuron-ethyl is known from Japan Pesticide Information No. 55 (1989), pages 17 to 20, and from "Farm Chemicals Handbook '90", Meister Publishing Company, Willoughby, Ohio, USA.

Bensulfuron-methyl is known from publications by G.S. Peudpaichit et al. as DPX-F 5384 in Asian-Pacific Weed Science Society, pages 114 to 122, and by S. Tokeda et al. (ibid. pages 156 to 161) and in the abovementioned "Farm Chemicals Handbook '90".

Amidosulfuron is known from E. Hacker et al. in Z. Pfl. Krankh. Pfl.Schutz, Sonderh. XII [Special Issue], pages 489 to 497 (1990), as HOE 75032.

Imazosulfuron (TH 913) is disclosed in EP-A-0,238,070.

Dimetrasulfuron (cinosulfuron) is known from British Crop Prot. Conf. (Weeds) 1987.

Metsulfuron-methyl is described in "The Pesticide Manual", British Crop Protection Council, 8th ed., page 575.

Herbicidal compositions according to the invention with compounds of the abovementioned formula (I) or salts thereof which are of particular interest are those in which

$a_1$) $R^1$ is ethoxy, propoxy or isopropoxy and
$R^2$ is in the 6-position and has the abovementioned meaning, and
n is 0 or 1, or

$a_2$) $R^1$ is optionally unsaturated $C_1$-$C_4$-alkoxy which is substituted by halogen, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio or -sulfinyl or -sulfonyl, ($C_1$-$C_4$-alkoxy)-carbonyl, $NO_2$, CN or phenyl; furthermore $C_2$-$C_5$-alkenyloxy or $C_2$-$C_4$-alkynyloxy, and
$R^2$ is $C_1$-$C_4$-alkyl, $C_2$-$C_5$-alkenyl, ($C_1$-$C_4$-alkoxy)-carbonyl, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, each of which can be substituted as indicated above, or is halogen, and
n is 0 or 1, or

$a_3$) $R^1$ is methoxy, ethyl or propyl and
$R^2$ is 6-methoxycarbonyl or 6-ethoxycarbonyl and
n is 1, and

in all cases $a_1$) - $a_3$),

$R^3$ is hydrogen, $C_1$-$C_4$-alkyl, in particular hydrogen or methyl,

$R^4$ and $R^5$ are halogen, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, the 3 last-mentioned radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio,

Y is O or S, in particular O, and

E is CH or N, in particular CH.

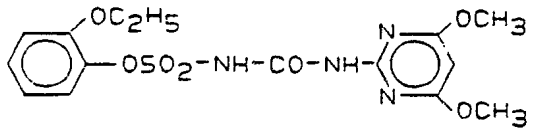
Analogously, saturated or unsaturated alkyl and alkoxy are straight-chain or branched alkyl or alkoxy; halogen is F, Cl, Br and I, preferably F and Cl.

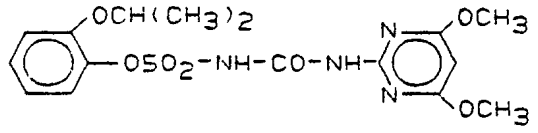
The compounds of the formula (I) can form salts in which

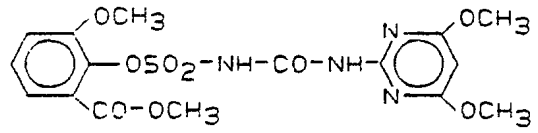
the hydrogen of the $-SO_2-NH-$ group is replaced by a cation suitable for agriculture. These salts are generally metal salts, in particular alkali metal salts, alkaline earth metal salts, optionally alkylated ammonium salts or salts of other organic amines.

The stereochemistry of the abovementioned formulae of the compounds A and B was not indicated in detail. If it is possible for stereoisomers to occur, the formulae also embrace all geometric isomers, enantiomers and diastereomers, and their mixtures.

Preferred herbicidal compositions contain, as compounds A, one or more compounds of the formulae A1, A2 and A3, the formulae having the following meanings:


(A1)


(A2)


(A3)

The herbicidal compositions according to the invention have an excellent herbicidal activity against a broad range of economically important monocotyledon and dicotyledon harmful plants. The active substance combinations also act efficiently on perennial weeds which produce shoots from rhizomes, rootstocks or other perennial organs and which are difficult to control. In this context, it does not matter whether the substances are applied pre-seeding, pre-emergence or post-emergence. Specifically, examples may be mentioned of some

representatives of the monocotyledon and dicotyledon weed flora which can be controlled by the compositions according to the invention, without the enumeration being a restriction to certain species.

Examples of monocotyledon weed species on which the compositions act efficiently are Echinochloa, Digitaria, Setaria and also Cyperus species, and also perennial Cyperus species.

In the case of the dicotyledon weed species, the range of action extends to Galium, Viola, Veronica, Lamium, Chenopodium, Stellaria, Amaranthus, Sinapis, Ipomoea, Matricaria, Polygonum, Abutilon and Sida from amongst the annuals, and inter alia, Convolvulus, Cirsium, Rumex and Artemisia in the case of the perennial weeds.

The active substance combinations according to the invention likewise effect outstanding control of monocotyledon and dicotyledon weeds which occur under the specific conditions of rice growing, such as, for example, Sagittaria, Alisma, Eleocharis, Scirpus, Cyperus and others.

If the herbicidal compositions according to the invention are applied to the soil surface before germination or are broadcast, or poured, into the flooded paddy field, then the weed seedlings are either prevented completely from emerging, or the weeds grow until they have reached the cotyledon stage but then their growth stops, and, eventually, after three to four weeks have elapsed, they die completely.

If the active substance combinations are applied post-emergence on the green parts of the plants or to the flooded paddy field, growth also stops drastically a very short time after the treatment and the weed plants remain at the growth stage at the time of application, or after a certain time they completely die more or less rapidly,

so that in this manner competition by the weeds, which is harmful to the crop plants, can be eliminated at a very early point in time and in a sustained manner by using the novel compositions according to the invention.

Even though the compositions according to the invention have an excellent herbicidal activity against monocotyledon and dicotyledon weeds, crop plants of economically important crops, such as, for example, wheat, barley, corn and/or rice, are damaged not at all, or only to a negligible extent. For these reasons, the compositions are highly suitable for selectively controlling undesired plant growth in plantings for agricultural use.

For example, the active substance combinations according to the invention allow a herbicidal action to be achieved which exceeds what would have been expected as the additive action of the individual components. Such increases in action permit the dosage rates of the individual active substances to be reduced substantially. There have also been found advantageous effects of such a nature that either the long-time action of the combinations is improved or that the speed of action is found to have increased. Such properties are therefore novel inventions economically progressive which have considerable advantages for the user in practical weed control since he can control weeds more cost-effectively or more rapidly or in a more sustained manner, which allows higher yields to be harvested in the crop plant stand.

Furthermore, it has been found that a number of the active substance combinations exhibit a pronounced safener or antidote action, i.e. phytotoxic side-effects in crop plants, for example rice, which are caused by the active substances used are reduced or avoided completely.

The mixing ratios A : B can vary within wide limits and

are generally between 1 : 0.1 to 1 : 10. The mixing ratio is selected as a function of, for example, the mixture components, the development stage of the weeds, the weed spectrum and the prevailing climatic conditions.

It is preferred to use mixing ratios from 1 : 0.25 to 1 : 4. The application rates of herbicide A in the active substance mixtures are preferably between 5 and 50 g/ha, the application rates of B between 5 g and 200 g/ha.

The active substance combinations according to the invention can exist in the form of mixed formulations of the two components which are then diluted with water and applied in the customary fashion, or they can be prepared in the form of so-called tank mixes by conjoint dilution of the separately formulated components with water.

The compounds A and B or the combinations thereof can be formulated in a variety of ways, as predetermined by the biological and/or physicochemical parameters. The following possibilities, for example, are suitable for formulation: wettable powders (WP), emulsifiable concentrates (EC), aqueous solutions (SL), emulsions (EW) such as oil-in-water and water-in-oil emulsions, sprayable solutions or emulsions, dispersions on an oil or water base, suspo-emulsions, dusts (DP), seed-dressing agents, granules for soil application or for broadcasting or water-dispersible granules (WG), ULV formulations, microcapsules or waxes.

These individual formulation types are known in principle and are described, for example, in: Winnacker-Küchler, "Chemische Technologie" [Chemical Technology], Volume 7, C. Hauser Verlag Munich, 4th Ed. 1986; van Valkenburg, "Pesticides Formulations", Marcel Dekker N.Y., 2nd Ed. 1972-73; K. Martens, "Spray Drying Handbook", 3rd Ed. 1979, G. Goodwin Ltd. London.

The formulation auxiliaries required, such as inert materials, surfactants, solvents and other additives, are

also known and are described, for example in: Watkins, "Handbook of Insecticide Dust Diluents and Carriers", 2nd Ed., Darland Books, Caldwell N.J.; H.v.Olphen, "Introduction to Clay Colloid Chemistry", 2nd Ed., J. Wiley & Sons, N.Y.; Marsden, "Solvents Guide", 2nd Ed., Interscience, N.Y. 1950; McCutcheon's, "Detergents and Emulsifiers Annual", MC Publ. Corp., Ridgewood N.J.; Sisley and Wood, "Encyclopedia of Surface Active Agents", Chem. Publ. Co. Inc., N.Y. 1964; Schönfeldt, "Grenzflächenaktive Äthylenoxidaddukte" [Surface-active Ethylene Oxide Adducts]", Wiss. Verlagsgesell., Stuttgart 1976; Winnacker-Küchler, "Chemische Technologie" [Chemical Technology], Volume 7, C. Hauser Verlag Munich, 4th Ed. 1986.

Combinations with other pesticidally active substances, such as other herbicides, fungicides or insecticides, and with fertilizers and/or growth regulators may also be prepared on the basis of these formulations, for example in the form of a readymix formulation or as a tank mix.

Wettable powders are preparations which are uniformly dispersible in water and which, besides the active substance, also contain wetting agents, for example polyoxethylated alkylphenols, polyoxethylated fatty alcohols or fatty amines, alkane- or alkylbenzenesulfonates, and dispersing agents, for example sodium lignin-sulfonate, sodium 2,2'-dinaphthylmethane-6,6'-disulfonate, sodium dibutylnaphthalenesulfonate, or alternatively sodium oleylmethyltaurinate, in addition to a diluent or inert substance.

Emulsifiable concentrates are prepared by dissolving the active substance in an organic solvent, for example butanol, cyclohexanone, dimethylformamide, xylene and also higher-boiling aromatic compounds or hydrocarbons, with the addition of one or more emulsifiers. Examples of emulsifiers which can be used are: calcium salts of an alkylarylsulfonic acid, such as Ca

dodecylbenzenesulfonate, or non-ionic emulsifiers, such as fatty acid polyglycol esters, alkylaryl polyglycol ethers, fatty alcohol polyglycol ethers, propylene oxide/ethylene oxide condensation products, alkyl polyethers, sorbitan fatty acid esters, polyoxyethylene sorbitan fatty acid esters or polyoxyethylene sorbitol esters.

Dusts can be obtained by grinding the active substance with finely divided solid substances, for example talc or natural clays, such as kaolin, bentonite, pyrophyllite or diatomaceous earth.

Granules can be produced either by spraying the active substance onto adsorptive, granulated inert material or by applying active substance concentrates onto the surface of carriers, such as sand, kaolinites or granulated inert material, by means of binders, for example polyvinyl alcohol, sodium polyacrylate or, alternatively, mineral oils. Suitable active substances can also be granulated in the manner which is conventional for the production of fertilizer granules, if desired in a mixture with fertilizers.

The agrochemical preparations generally contain 0.1 to 99 percent by weight, in particular 2 to 95% by weight, of active substances A + B. The concentrations of the active substances A + B can vary in the formulations.

The concentration of active substance in wettable powders is, for example, about 10 to 95% by weight; the remainder to 100% by weight is composed of conventional formulation components. In the case of emulsifiable concentrates, the concentration of active substance can be about 1 to 85% by weight, preferably 5 to 80% by weight. Formulations in the form of dusts contain about 1 to 25% by weight, usually 5 to 20% by weight of active substance, sprayable solutions about 0.2 to 25% by weight, preferably 2 to 20% by weight of active substance. In the case of granules

such as water-dispersible granules, the active substance content depends partly on whether the active compound is liquid or solid and on which granulation auxiliaries and fillers are used. As a rule, the content in the case of the water-dispersible granules is between 10 and 90% by weight.

In addition, the active substance formulations mentioned contain, if appropriate, the adhesives, wetting agents, dispersing agents, emulsifiers, penetrants, solvents, fillers or carriers which are conventional in each case.

For use, the formulations, present in commercially available form, are diluted, if appropriate, in a customary manner, for example using water in the case of wettable powders, emulsifiable concentrates, dispersions and water-dispersible granules. Preparations in the form of dusts or granules for soil application or for broadcasting and also sprayable solutions are usually not further diluted with other inert substances before use.

The application rate required for the compounds of the formula (I) varies with the external conditions, such as, inter alia, temperature, humidity and the nature of the herbicide used.

The examples which follow serve to illustrate the invention:

A. Formulation Examples

a) A dust is obtained by mixing 10 parts by weight of an active substance combination according to the invention and 90 parts by weight of talc as inert substance and comminuting the mixture in a hammer mill.

b) A wettable powder which is readily dispersible in water is obtained by mixing 25 parts by weight of

active substance A + B, 64 parts by weight of kaolin-containing quartz as the inert substance, 10 parts by weight of potassium ligninsulfonate and 1 part by weight of sodium oleoylmethyltaurinate as the wetting and dispersing agent, and grinding the mixture in a pinned disk mill.

c) A dispersion concentrate which is readily dispersible in water is obtained by mixing 20 parts by weight of active substance A + B with 6 parts by weight of alkylphenol polyglycol ether (®Triton X 207), 3 parts by weight of isotridecanol polyglycol ether (8 EO) and 71 parts by weight of paraffinic mineral oil (boiling range, for example, about 255 to above 277°C) and grinding the mixture in a ball mill to a fineness of below 5 microns.

d) An emulsifiable concentrate is obtained from 15 parts by weight of active substance A + B, 75 parts by weight of cyclohexanone as the solvent and 10 parts by weight of oxethylated nonylphenol as the emulsifier.

e) Water-dispersible granules are obtained by mixing

| | | |
|---|---|---|
| 75 | parts by weight of | active substances A + B, |
| 10 | " | calcium ligninsulfonate, |
| 5 | " | sodium lauryl sulfate, |
| 3 | " | polyvinyl alcohol and |
| 7 | " | kaolin, |

grinding the mixture on a pinned disk mill, and granulating the powder in a fluidized bed by spraying on water as the granulation liquid.

f) Water-dispersible granules are also obtained by homogenizing and precomminuting, on a colloid mill,

25 parts by weight of active substances A + B,
5 " sodium 2,2'-dinaphthyl-methane-6,6'-disulfonate,
2 " sodium oleoylmethyltaurinate,
1 part by weight of polyvinyl alchol,
17 parts by weight of calcium carbonate and
50 " water,

subsequently grinding the mixture on a bead mill, and atomizing and drying the resulting suspension in a spray tower by means of a single-compound nozzle.

For example, the active substance combinations in Table 1 below are formulated in the formulations described under a) to f):

Table 1

| Active substance A | Active substance B | Ratio |
|---|---|---|
| A1 | B1 | 1 : 1 |
| | | 1 : 2 |
| A1 | B2 | 1 : 1 |
| | | 1 : 2 |
| | | 1 : 3 |
| A1 | B3 | 1 : 1 |
| | | 1 : 2 |
| | | 1 : 4 |
| A1 | B4 | 1 : 1 |
| | | 1 : 2 |
| | | 1 : 4 |
| A1 | B5 | 1 : 1 |
| | | 1 : 2 |
| | | 1 : 4 |
| A1 | B6 | 1 : 1 |
| | | 1 : 2 |
| | | 1 : 4 |

Biological Examples

1. Pre-emergence action on weeds

Seeds or rhizome pieces of mono- and dicotyledon weed plants are placed in plastic pots of diameter 9 cm which contain sandy loam soil, and covered with soil. Weeds which occur in rice cultivation are grown in water-saturated soil, the pots being filled with such an amount of water that the water reaches the soil surface or floods it to a depth of some millimeters. The active substance combinations according to the invention which

are formulated as wettable powders or emulsion concentrates and, in parallel experiments, the suitably formulated individual active substances, are then applied to the surface of the soil cover in the form of aqueous suspensions or emulsions at an application rate of 600 to 800 l of water/ha (converted), in various dosages or in the case of rice poured into the irrigation water.

After the treatment, the pots are placed in the greenhouse and kept under good growth conditions for the weeds. After the test plants have emerged, the damage to the plants or the negative effect on the emergence is scored visually after a test period of 3 to 4 weeks by comparison with untreated controls. The herbicidal compositions according to the invention have a good herbicidal pre-emergence activity against a broad range of grass weeds and broad-leaved weeds.

The active substance combinations according to the invention have a herbicidal action which is higher than would have been expected based on the effects which were observed when the individual components were applied on their own. The active substance combinations are therefore synergistic.

2. Post-emergence action on weeds

Seeds or rhizome pieces of mono- and dicotyledon weeds are placed in sandy loam soil in plastic pots, covered with soil and grown in a greenhouse under good growth conditions. Weeds which occur in rice cultivation are grown in pots which are flooded with water up to a depth of 2 cm above the soil surface, and cultured during the test period. Three weeks after sowing, the test plants are treated in the three-leaf stage.

The active substance combinations according to the invention which are formulated as wettable powders or emulsion concentrates, and, in parallel tests, the

suitably formulated individual active substances, are sprayed onto the green parts of the plants at an application rate of 300 to 600 l of water/ha (converted), in various dosages, and, after the test plants had remained in the greenhouse for about 3 to 4 weeks under ideal growth conditions, the effect of the preparations was scored visually by comparison with untreated controls. In the case of those weeds which occur in rice cultivation, the active substances are also placed directly into the irrigation water (application analogously to the so-called granule application) or sprayed onto plants and into the irrigation water. In post-emergence, too, the compositions according to the invention have a good herbicidal activity against a broad range of economically important grass weeds and broad-leaved weeds. The actions of the compositions according to the invention are synergistic.

3. Crop plant compatibility

In further greenhouse experiments, seeds of a substantial number of crop plants and weeds are placed in sandy loam soil and covered with soil. Rice is grown and cultured in water-saturated soil as paddy rice.

Some of the pots are treated immediately as described under 1., and the remaining pots are placed in the greenhouse until the plants have developed two to three true leaves and then sprayed with the active substance combinations according to the invention and, for comparison, only with an individual active substance in various dosages, as described under 2. In the case of paddy rice the application can also take place partially by pouring the active substances or a formulation thereof into the irrigation water.

Visual scoring four to five weeks after the application and after the plants had been in the greenhouse reveals that pre- and post-emergence treatments with the active

substance combinations according to the invention do not inflict any damage to various crops, even when high dosages of active substance are used. They leave Gramineae crops, for example wheat and rice, unharmed. The active substance combinations according to the invention therefore have a high selectivity when used for controlling undesirable plant growth in agricultural crops.

Compared with the use of the individual active substances on their own, it becomes obvious that the selectivity of the active substance combinations compared with equal application rates of the individual active substances is better than the most effective of each of the herbicides, in particular in the case of higher dosage rates. The active substance combinations are therefore suitable for effectively reducing herbicide damage to crop plants.

4. Biological field trial

In a field trial with plots of size 0.8 $m^2$, rice in the 2-leaf stage was planted at a depth of 2 cm. Weeds were additionally seeded in or planted. When Echinochloa was in the 1/2 leaf stage, the area under cultivation was treated with compositions according to the invention. Scoring of the damage to rice was carried out 28 days after the treatment, and damage to the remaining plants was carried out 56 days after the treatment. The results are compiled in Table 2.

Table 2: Herbicidal action (field trial)

| Herbicide(s) | Dosage rate [g of a.i./ha | % damage in SAPY | CYSE | SCIU | MOVP | Trans-planted rice |
|---|---|---|---|---|---|---|
| A1 | 10.5 | 40 | 30 | 10 | 98 | 0 |
| | 21.0 | 88 | 60 | 75 | 100 | 0 |
| B1 | 10.5 | 45 | 65 | 75 | 50 | 3 |
| | 15.8 | 70 | 70 | 65 | 65 | 5 |
| | 21.0 | 70 | 75 | 70 | 70 | 5 |
| A1+B1 | 10.5+15.8 | 85 | 83 | 78 | 100 | 3 |
| | 10.5+21.0 | 93 | 85 | 90 | 99 | 10 |
| | 21.0+10.5 | 88 | 83 | 90 | 100 | 3 |
| | 21.0+15.8 | 90 | 85 | 93 | 100 | 0 |
| | 21.0+21.0 | 95 | 90 | 95 | 100 | 3 |

Abbreviations:
a.i. = active ingredient (based on pure active substance)
SAPY = Sagittaria pygmaea; transplanted tubers
SCIU = Scirpus juncoides, seeded
MOVP = Monochoria vaginalis, seeded
CYSE = Cyperus serotinus; transplanted tubers
A1 = 1-[(2-ethoxyphenoxy)sulfonyl]-3-(4,6-dimethoxy-2-pyrimidinyl)-urea as 0.07% granules
B1 = pyrazosulfuron-ethyl as 0.07% granules

5. Biological field trial

Analogously to Example 4, wheat or barley plots which were infested with weeds were treated in the 2- to 4-leaf stage and scored 4 to 6 weeks after the compositions given in Table 3 had been applied; the results are compiled in Table 3.

Table 3

| Herbicide(s) | Dosage rate [g of a.i./ha] | % damage in AMARE | CHEAL | POLSC | TA | HV |
|---|---|---|---|---|---|---|
| A1 | 11.25 | 83 | 39 | 45 | 0 | 0 |
| | 22.5 | 84 | 41 | 76 | 0 | 0 |
| | 45 | 89 | 43 | 78 | 0 | 0 |
| B3 | 30 | 64 | 70 | 54 | 0 | 0 |
| | 60 | 89 | 92 | 86 | 0 | 0 |
| A1+B3 | 30+11.25 | 97 | 90 | 86 | 0 | 0 |
| | 30+22.5 | 97 | 92 | 92 | 0 | 0 |

Abbreviations to Table 3:

a.i. = active ingredient (based on pure active substance)

A1 = 1-[(2-ethoxyphenoxy)sulfonyl]-3-(4,6-dimethoxy-2-pyrimidinyl)-urea and 0.3% wetting agent based on sodium salt of $C_{12}/C_{14}$-fatty alcohol diglycol ether sulfate

B3 = amidosulfuron with 0.3% wetting agent as in A1

AMARE = Amaranthus retroflexus

CHEAL= Chenopodium album

POLSC = Polygonum scandens

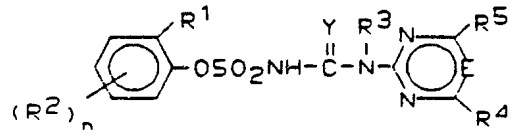
TA = Triticum aestivum (wheat)

HV = Hordeum vulgare (barley)

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:
Patentxxclaimsxxxxxxxxxx

1. A herbicidal composition with an effective content of

A) compounds of the formula (I) or salts thereof



(I)

in which

$a_1$) $R^1$ is ethoxy, propoxy or isopropoxy and
$R^2$ is halogen, $NO_2$, $CF_3$, CN, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio or ($C_1$-$C_4$-alkoxy)-carbonyl and
n is 0, 1, 2 or 3, or

$a_2$) $R^1$ is optionally unsaturated $C_1$-$C_8$-alkoxy which is substituted by halogen, optionally unsaturated $C_1$-$C_6$-alkoxy, a radical of the formula ($C_1$-$C_6$-alkyl)-S-, ($C_1$-$C_6$-alkyl)-SO-, ($C_1$-$C_6$-alkyl)-$SO_2$-, ($C_1$-$C_6$-alkyl)-O-CO-, $NO_2$, CN or phenyl; furthermore $C_2$-$C_8$-alkenyloxy or -alkynyloxy and
$R^2$ is saturated or unsaturated $C_1$-$C_8$-alkyl, phenyl, phenoxy, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio, ($C_1$-$C_4$-alkoxy)-carbonyl, it being possible for all the above $R^2$ radicals to be substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, or is halogen, $NO_2$, $C_1$-$C_4$-alkylsulfonyl or -sulfinyl, and
n is 0, 1, 2 or 3, or

$a_3$) $R^1$ is $C_1$-$C_8$-alkoxy and
$R^2$ is $C_2$-$C_8$-alkenyl or -alkynyl, phenyl or phenoxy, the abovementioned $R^2$ radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or -alkylthio, or is $C_1$-$C_4$-alkylsulfonyl or -alkylsulfinyl and
n is 1, 2 or 3, or

$a_4$) $R^1$ - in each case in the 2-position on the phenyl radical - is halogen, methoxy, ethyl or propyl,

$R^2$ is ($C_1$-$C_4$-alkoxy)-carbonyl in the 6-position on the phenyl radical and

n is 1,

and, in all cases $a_1$)-$a_4$),

$R^3$ is hydrogen, saturated or unsaturated $C_1$-$C_8$-alkyl or $C_1$-$C_4$-alkoxy,

$R^4$ and $R^5$ independently of one another are hydrogen, halogen, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio, the three last-mentioned radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio,

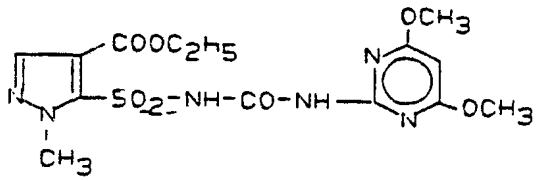
Y is O or S and

E is CH or N,

in combination with

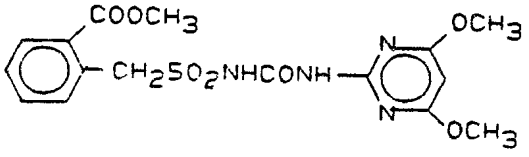
B) one or more compound(s) from the group comprising the compounds

B1) pyrazosulfuron-ethyl (NC 311) of the formula



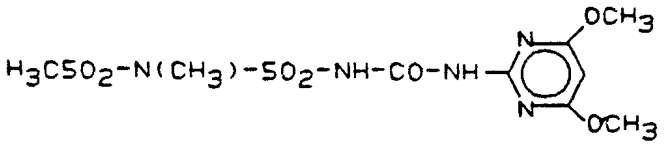
(B1)

B2) bensulfuron-methyl of the formula



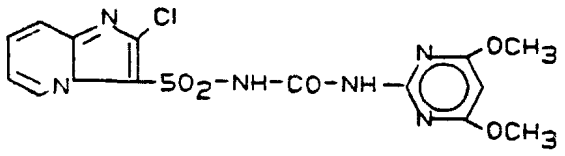
(B2)

B3) amidosulfuron of the formula



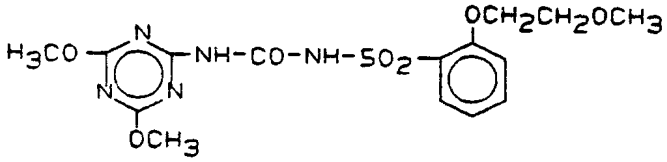
(B3)

B4) imazosulfuron (TH 913) of the formula



(B4)

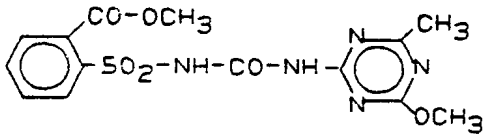
B5) dimetrasulfuron (cinosulfuron) of the formula



(B5)

and

B6) metsulfuron-methyl (DPX-T 6376) of the formula



(B6)

2. The composition as claimed in claim 1, which contains compounds of the formula (I) or salts thereof, in which

$a_1$) $R^1$ is ethoxy, propoxy or isopropoxy and
$R^2$ is in the 6-position and has the abovementioned meaning, and
n is 0 or 1, or

$a_2$) $R^1$ is optionally unsaturated $C_1$-$C_4$-alkoxy which is substituted by halogen, $C_1$-$C_4$-alkoxy, $C_1$-$C_4$-alkylthio or -sulfinyl or -sulfonyl, ($C_1$-$C_4$-alkoxy)-carbonyl, $NO_2$, CN or phenyl; furthermore $C_2$-$C_5$-alkenyloxy or $C_2$-$C_4$-alkynyloxy, and
$R^2$ is $C_1$-$C_4$-alkyl, $C_2$-$C_5$-alkenyl, ($C_1$-$C_4$-alkoxy)-carbonyl, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, each of which can be substituted as indicated above, or is halogen, and
n is 0 or 1, or

$a_3$) $R^1$ is methoxy, ethyl or propyl and

$R^2$ is 6-methoxycarbonyl or 6-ethoxycarbonyl and

n is 1, and

in all cases $a_1$) - $a_3$),

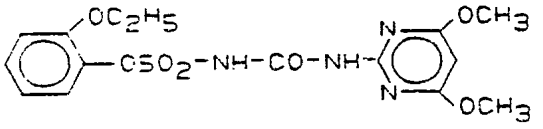
$R^3$ is hydrogen, $C_1$-$C_4$-alkyl,

$R^4$ and $R^5$ are halogen, $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio, the 3 last-mentioned radicals being unsubstituted or substituted by halogen, $C_1$-$C_4$-alkoxy or $C_1$-$C_4$-alkylthio,

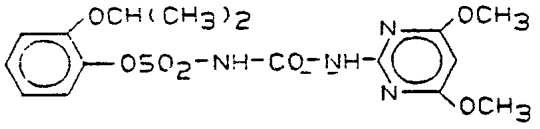
Y is O or S and

E is CH or N.

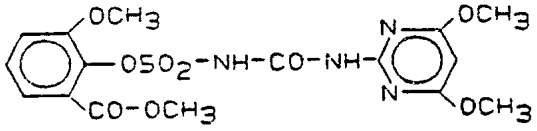
3. The composition as claimed in claim 1 or 2, which contains one or more compounds of the formulae A1, A2 and A3 or salts thereof



(A1)



(A2)



(A3)

4. The composition as claimed in one or more of claims 1 to 3, which contains 0.1 to 99% by weight of the active substances A and B, besides customary formulation auxiliaries.

5. The composition as claimed in one or more of claims 1 to 4, which contains the active substances A and

B in a ratio by weight of 1 : 0.1 to 1 : 10.

6. A process for the preparation of a composition as claimed in one or more of claims 1 to 5, which comprises formulating one or more compounds A with one or more compounds B analogously to a conventional formulation for crop protection agents from the group comprising wettable powders, emulsifiable concentrates, aqueous solutions, emulsions, sprayable solutions (tank mix), dispersions on an oil or water base, suspoemulsions, dusts, seed-dressing agents, granules for soil application or for broadcasting, water-dispersible granules, ULV formulations, microcapsules and waxes.

7. A method of controlling undesirable plants, which comprises applying to these plants or their areas of cultivation a herbicidally effective amount of a combination of active substances A + B as defined in one or more of claims 1 to 5.

8. The method as claimed in claim 7, wherein weeds in crops of useful plants are controlled selectively.

9. The method as claimed in claim 8, wherein the crop of useful plants is one from amongst the group comprising wheat, barley, corn and rice.

10. The use of the herbicidal composition as claimed in one or more of claims 1 to 5 for selective weed control in crops of useful plants.

DATED this 4th day of October 1991.

HOECHST AKTIENGESELLSCHAFT

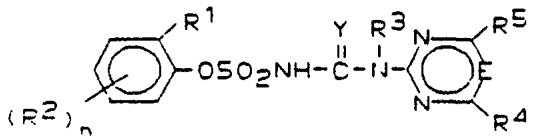
WATERMARK PATENT & TRADEMARK ATTORNEYS
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ABSTRACT OF THE DISCLOSURE

Synergistic herbicidal compositions

Compositions of a combination of

A) compounds of the formula (I) or salts thereof



(I)

in which $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, E, Y and n are as defined in claim 1, and

B) one or more compounds from amongst the group comprising pyrazosulfuron-ethyl, bensulfuron-methyl, amidosulfuron, imazosulfuron, dimetrasulfuron and metsulfuron-methyl

have very good herbicidal properties and show synergistic increases in action or safener effects.