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- (54) Benævnelse: **HERBICIDE MIDLER INDEHOLDENDE DIFLUFENICAN, FLUFENACET OG FLURTAMONE**
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EP-A1- 0 531 116
EP-A2- 1 642 498
WO-A-02/19821
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DATABASE CROPU [Online] 1999, ORTMAYR J: "Herold - for fall bentgrass and weed control in winter cereals. (Herold - zur Windhalm- und Unkrautbekaempfung im Herbst in Wintergetreide)", XP002454010, gefunden im STN Database accession no. 1999-88286 & PFLANZENARZT (52, NO. 9-10, 20-21, 1999) 1 FIG. 1 TAB. CODEN: PFLZQA AV - NO REPRINT ADDRESS., 1999,

Description

The present invention relates to the field of formulations comprising plant protection agents. The invention relates in particular to herbicidal compositions which, in addition to the herbicidal active substances diflufenican and flurtamone, additionally comprise the active substance flufenacet.

Herbicidal active substances are generally not used in their pure form. Depending on the field of application and the type of application, and on physical, chemical and biological parameters, the active substances are used as a mixture with conventional auxiliaries and additives as active substance formulation. The combinations with additional active substances, in order to broaden the spectrum of activities and/or to protect crop plants (e.g., through safeners, antidotes), are also known.

Formulations of herbicidal active substances should generally exhibit high chemical and physical stability, good applicability and user friendliness, and a broad biological action with high selectivity.

Aqueous dispersions for herbicidal active substances are known, inter alia, from EP-A-0 514 768 (US 5 707 926) or EP-A-0 592 880 (US 5 376 621). In addition, EP 1 642 498 A2 describes aqueous dispersions which comprise diflufenican and which are free from alkylphenol polyethoxylate. The active substance combination of diflufenican and flurtamone is described in EP 0 531 116 A1 and the active substance combination of diflufenican and flufenacet has been both publicized (Ortmayr, Johannes: Herold - zur Windhalm- und Unkrautbekämpfung im Herbst in Wintergetreide [Herold - for fall bentgrass and weed control in winter cereals]; in: Der Pflanzenarzt, Volume 52, No. 9-10, pp 20-21, 1999) and described also in WO 2003/028467 A1.

The herbicidal active substances diflufenican and flurtamone

are used alone and as a mixture (tank mix, coformulation),
inter alia, as aqueous suspension concentrates (SC), for
example with the trade name Carat® 350 SC. A disadvantage of
the formulations underlying this or similar products is the
5 fact that they comprise surfactants from the group consisting
of the alkylphenol polyethoxylates (APE) which, because of
their delayed biodegradability, are classified as doubtful. On
attempting to manufacture APE-free formulations for this
active substance mixture, undesirable effects were produced,
10 such as flocculation, agglomeration and/or crystal growth,
resulting in satisfactory storage stability no longer being
guaranteed.

Although the abovementioned mixtures of the herbicidal active
15 substances diflufenican and flurtamone show a good herbicidal
action, there always exists a broad scope for improvements.
Thus, the users desire, with regard to the amounts which have
to be expended, more flexible solutions with the same to
increased activity, for example in the combating of harmful
20 grasses, such as bent grass and Poa species. The object of the
present invention was,

- to discover a herbicidal composition which exhibits the
abovementioned improvements to the herbicidal active substance
25 mixture of diflufenican and flurtamone.

This object is achieved by

- herbicidal compositions which, in addition to the
30 herbicidal active substances diflufenican and flurtamone,
additionally comprise the active substance flufenacet.

The present invention accordingly relates to aqueous
dispersions which comprise

35 a) the herbicidal active substances from the group consisting
of the naphthalenesulfonates or diflufenican and flurtamone,

b) one or more anionic surfactants from the group consisting of the naphthalenesulfonates or from the group consisting of the condensation products of naphthalenesulfonates with formaldehyde,

5

c) one or more nonionic surfactants from the group consisting of the di- and triblock copolymers of alkylene oxides,

d) one or more polybasic organic acids,

10

e) optionally one or more thickeners,

f) the herbicidal active substance flufenacet and optionally one or more agrochemical active substances other than component a),

15

g) optionally one or more additional standard auxiliaries and additives,

20 and

water.

The dispersions according to the invention show an outstanding stability on storage. They are stable on storage at ambient temperature for at least 2 years and show, in this connection, no undesirable effects, such as, e.g., crystal growth.

25

In a preferred embodiment, these dispersions comprise

30

a) 0.1 to 50% of diflufenican and 0.1 to 50% of flurtamone,

b) 0.1 to 10% of one or more anionic surfactants from the group consisting of the naphthalenesulfonates or from the group consisting of the condensation products of naphthalenesulfonates with formaldehyde,

35

c) 0.1 to 20% of one or more nonionic surfactants from the

group consisting of the di- and triblock copolymers of alkylene oxides,

d) 0.05 to 10% of one or more polybasic organic acids,

e) 0 to 5% of one or more thickeners,

f) 0.1 to 50% of flufenacet and 0 to 50% of one or more agrochemical active substances other than component a),

g) 0 to 20% of one or more additional standard auxiliaries and additives,

and

20 to 70% of water.

A particularly preferred embodiment is composed of dispersions according to the invention in which are present

a) 0.5 to 20% of diflufenican and 0.5 to 30% of flurtamone,

b) 0.2 to 5% of one or more anionic surfactants from the group consisting of the naphthalenesulfonates or from the group consisting of the condensation products of naphthalenesulfonates with formaldehyde,

c) 0.5 to 14% of one or more nonionic surfactants from the group consisting of the di- and triblock copolymers of alkylene oxides,

d) 0.1 to 5% of one or more polybasic organic acids,

e) 0.05 to 2.5% of one or more thickeners,

f) 0.5 to 22% of flufenacet and 0 to 40% of one or more agrochemical active substances other than component a),

g) 0 to 15% of one or more additional standard auxiliaries and additives,

and

20 to 60% of water.

A very particularly preferred embodiment is composed of dispersions according to the invention in which are present

a) 2 to 16% of diflufenican and 4 to 22% of flurtamone,

b) 0.3 to 1.5% of one or more anionic surfactants from the group consisting of the naphthalenesulfonates or from the group consisting of the condensation products of naphthalenesulfonates with formaldehyde,

c) 1 to 10% of one or more nonionic surfactants from the group consisting of the di- and triblock copolymers of alkylene oxides,

d) 0.2 to 2% of one or more polybasic organic acids,

e) 0.075 to 1.5% of one or more thickeners,

f) 4 to 22% of flufenacet,

g) 0 to 15% of one or more additional standard auxiliaries and additives,

and

30 to 55% of water.

All percentage values are, here and throughout the description, percentages by weight (% by weight) and refer, unless otherwise defined, to the relative weight of the respective component, based on the total weight of the

formulation.

The herbicidal active substances a) diflufenican (251) and flurtamone (392) are, as individual substances or as a mixture, e.g., known from "The Pesticide Manual", 13th edition (2003), The British Crop Protection Council (note: index number in brackets).

The proportion of these active substances in the dispersions according to the invention (component a)) can, for diflufenican, be 0.1 - 50% by weight, preferably 0.5 - 20% by weight, particularly preferably 2 - 16% by weight, and, for flurtamone, be 0.1 - 50% by weight, preferably 0.5 - 30% by weight, particularly preferably 4 - 22% by weight.

Examples of anionic surfactants b) from the group consisting of the naphthalenesulfonates are Galory® MT 800 (sodium dibutyl naphthalenesulfonic acid) and Nekal® BX (alkyl naphthalenesulfonate). Examples of anionic surfactants b) from the group consisting of the condensation products of naphthalenesulfonates with formaldehyde are Galoryl® DT 201 (naphthalenesulfonic acid hydroxy polymer with formaldehyde and methylphenol sodium salt), Galoryl® DT 250 (condensation product of phenol- and naphthalenesulfonates) and Reserve® C (condensation product of phenol- and naphthalenesulfonates). Preference is given to naphthalenesulfonates 1,2-substituted by dibutyl or diisobutyl, such as, e.g., products such as Galoryl® MT 800 (CFPI-Nufarm) and Nekal® BX (BASF).

The proportion of the anionic surfactants in the dispersions according to the invention (component b)) can be 0.1 - 10% by weight, preferably 0.2 - 5% by weight, particularly preferably 0.3 - 1.5% by weight.

Possible nonionic surfactants c) from the group consisting of the di- and triblock copolymers of alkylene oxides are, e.g., compounds synthesized on the basis of ethylene and propylene oxide with average molar masses between 200 and 10 000 g/mol,

preferably 1000 to 4000 g/mol, the proportion by weight of the polyethoxylated block varying between 10 and 80%, such as, e.g., Synperonic® PE series (Uniqema), Pluronic® PE series (BASF), VOP® 32 or Genapol® PF series (Clariant). Products
5 such as Pluronic® PE 10500 are preferred, for example.

The proportion of the nonionic surfactants in the dispersions according to the invention (component c)) can be 0.1 - 20% by weight, preferably 0.5 - 14% by weight, particularly
10 preferably 1 - 10% by weight.

Examples of polybasic organic acids d) are, e.g., citric acid, tartaric acid, succinic acid, maleic acid, fumaric acid, and the like. Citric acid is preferred.
15

The proportion of the polybasic organic acids in the dispersions according to the invention (component d)) can be 0.05 - 10% by weight, preferably 0.1 - 5% by weight, particularly preferably 0.2 - 2% by weight.
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Suitable thickeners e) optionally added are, for example:

1) modified natural silicates, such as chemically modified bentonites, hectorites, attapulgites, montmorillonites, smectites or other silicate minerals, such as Bentone® (Elementis), Attagel® (Engelhard), Agsorb® (Oil-Dri Corporation) or Hectorite® (Akzo Nobel),
25

2) thickeners based on synthetic polymers, such as thickeners of the Thixin® or Thixatrol® series (Elementis) and also Rhodopol® (Rhodia) and Kelzan® S (Kelco Corp.),
30

3) synthetic silicates, such as silicates of the Sipernat®, Aerosil® or Durosil® series (Degussa), of the CAB-O-SIL® series (Cabot) or of the Van Gel series (R.T. Vanderbilt).
35

Organic- and/or inorganic-based thickeners are preferred, such as, e.g., products such as Bentone® EW (Elementis) and

Rhodopol® 23 (Rhodia).

The proportion in the dispersions according to the invention of thickeners optionally added (component e)) can be up to 5% by weight, preferably 0.05 - 2.5% by weight, particularly preferably 0.075 - 1.5% by weight.

Herbicides, fungicides, insecticides, plant growth regulators, safeners and the like are suitable as agrochemical active substances f) other than component a) optionally added. These active substances are, for example, known from "The Pesticide Manual", 13th edition (2003), The British Crop Protection Council (note: index number in brackets).

Preference is given to herbicides, such as ioxynil (467), bromoxynil (95), bifenox (75), aclonifen (8), trifluralin (836), clodinafop-propargyl (156), oxadiazon (600), oxadiargyl (599), pyraflufen-ethyl (691), carbetamide (117), terbuthylazine (775), active substances based on phenylurea, such as isoproturon (475), diuron (281), linuron (489), active substances based on phenoxyacetic or phenoxypropionic and phenoxybutyric acids, such as MCPA (499), mecoprop (503), mecoprop-P (504), 2,4-D (211), fluazifop-butyl (361), diclofop-methyl (238), fenoxaprop-P-ethyl (339), and also in each case the derivatives thereof in the form of acids or esters. The herbicidal active substances flufenacet and isoproturon are particularly preferred and flufenacet is very particularly preferred.

The proportion in the dispersions according to the invention of agrochemical active substances other than component a) (component f)) optionally added can be up to 50% by weight, preferably up to 40% by weight, particularly preferably up to 30% by weight. In the case of the herbicidal active substance flufenacet, the proportion can be 0.1 - 50% by weight, preferably 0.5 - 22% by weight, particularly preferably 4 - 22% by weight.

The additional standard auxiliaries and additives g) optionally added are, for example, antifoaming agents, antifreeze agents, structuring agents, preservatives, antioxidants, colorants, aromatic principles, wetting agents, anti-drift agents, deposit builders, penetrating agents (adjuvants), fertilizers and additional surfactants other than the components b) and c).

Suitable antifoaming agents are surface-active compounds based on silicone or silane, such as the Tegopren® products (Goldschmidt), the SE® products (Wacker), and also the Bevaloid®, Rhodorsil® and Silcolapse® products (Rhodia, Dow Corning, Reliance, GE, Bayer). SE® (Wacker), Rhodorsil® and Silcolapse® products (Rhodia) are preferred and, e.g., products such as Silcolapse® 5020 are particularly preferred. Suitable antifreeze agents are those from the group consisting of ureas, diols and polyols, such as ethylene glycol and propylene glycol, preferably propylene glycol.

Suitable preservatives are, e.g., products such as Acticide® MBS (biocide, Thor Chemie).

Suitable antioxidants, colorants, aromatic principles, wetting agents, anti-drift agents, deposit builders, penetrating agents (adjuvants) and fertilizers are known to a person skilled in the art. Additional surfactants other than the components b) and c) which are suitable are, for example, emulsifiers and dispersants.

Possible emulsifiers and dispersants are, e.g., nonionic emulsifiers and dispersants, e.g.:

1) polyalkoxylated, preferably polyethoxylated, saturated and unsaturated aliphatic alcohols,

- with 8 to 24 carbon atoms in the alkyl radical, which is derived from the corresponding fatty acids or from petrochemical products, and

- with 1 to 100, preferably 2 to 50, ethylene oxide units (EO), the free hydroxyl group optionally being alkoxyated, and

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- which, e.g., are available commercially as Genapol® X and Genapol® O series (Clariant), Crovol® M series (Croda) or Lutensol® series (BASF);

10 2) polyalkoxylated, preferably polyethoxylated, hydroxyfatty acids or glycerides comprising hydroxyfatty acids, such as, e.g., ricinine or castor oil, with a degree of ethoxylation of between 10 and 80, preferably 25 to 40, such as, e.g., Emulsogen® EL series (Clariant) or Agnique® CSO series
15 (Cognis);

3) polyalkoxylated, preferably polyethoxylated, sorbitan esters, such as, e.g., Atplus® 309 F (Uniqema) or Alkamuls® series (Rhodia).

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Preferred nonionic emulsifiers and dispersants are, e.g., polyethoxylated alcohols and polyethoxylated triglycerides comprising hydroxyfatty acids.

25 Ionic emulsifiers and dispersants are also possible, e.g.:

1) polyalkoxylated, preferably polyethoxylated, emulsifiers/dispersants which are ionically modified, e.g. by conversion of the terminal free hydroxyl functional group of
30 the polyethylene oxide block to give a sulfate or phosphate ester (e.g., as alkali metal and alkaline earth metal salts), such as, e.g., Genapol® LRO or Dispersogen 3618 (Clariant), Emulphor® (BASF) or Crafol® AP (Cognis);

35 2) alkali metal and alkaline earth metal salts of alkylarylsulfonic acids with a linear or branched alkyl chain, such as phenylsulfonate CA or phenylsulfonate CAL (Clariant), Atlox® 3377BM (ICI), Empiphos® TM series (Huntsman);

3) polyelectrolytes, such as lignosulfonates, polystyrenesulfonate or sulfonated unsaturated or aromatic polymers (polystyrenes, polybutadienes or polyterpenes), such as Tamol® series (BASF), Morwet® D425 (Witco), Kraftsperser® series (Westvaco), Borresperser® series (Borregard).

Preferred ionic emulsifiers/dispersants are, e.g., salts of alkylarylsulfonic acids and lignosulfonates.

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The proportion in the dispersions according to the invention of the additional standard auxiliaries and additives (component g)) optionally added can be up to 20% by weight, preferably up to 15% by weight.

15

The proportion of the component water in the dispersions according to the invention can be 20 - 70% by weight, preferably 20 - 60% by weight, particularly preferably 30 - 55% by weight.

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The abovementioned formulation auxiliaries of the components b), c), d), e) and g) are known to a person skilled in the art and/or 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.; C. Marsden, "Solvents Guide", 2nd Ed., Interscience, N.Y. 1963; 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, 4th edition, C. Hanser Verlag, Munich, 1986.

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The combination of the active substances diflufenican, flurtamone and flufenacet is novel per se and accordingly

another subject matter of the invention is a herbicidal composition comprising, as components, the active substances diflufenican, flurtamone and flufenacet. These active substances form the herbicidal composition and are used for this either alone and/or as partial or total mixture (tank mix, coformulation), simultaneously or sequentially.

This active substance mixture (3-component combination) is very highly suitable as herbicidal composition and solves the problems posed. In addition, it can be advantageous to add additional plant protection agents, alone or mixtures thereof, to this 3-component combination. Mention may in particular be made here of additional herbicides, safeners, plant growth regulators, insecticides, acaricides, nematocides, fungicides and bactericides, and also substances which are effective as adjuvants.

Examples of herbicides are, e.g., from the groups consisting of ALS inhibitors (acetolactate synthetase inhibitors, such as sulfonylureas), carbamates, thiocarbamates, haloacetanilides, phenylpyrazolines (such as pinoxaden), substituted phenoxy-, naphthoxy- and phenoxyphenoxyalkanoic acid derivatives and also heteroaryloxyphenoxyalkanoic acid derivatives, such as quinolyloxy-, quinoxalyloxy-, pyridyloxy-, benzoxalyloxy- and benzothiazolyloxyphenoxyalkanoic acid esters, cyclohexanedione derivatives, imidazolinones, phosphorus-comprising herbicides (e.g., of glufosinate type or of glyphosate type), pyrimidinylpyridinecarboxylic acid derivatives, pyrimidyloxybenzoic acid derivatives, triazolopyrimidinesulfonamide derivatives and also S-(N-aryl-N-alkylcarbamoylmethyl)dithiophosphoric acid esters, ureas and also hydroxybenzonitriles.

Examples of safeners are, e.g., 4-dichloroacetyl-1-oxa-4-azaspiro[4.5]decane (AD-67), 1-dichloroacetyl-hexahydro-3,3,8a-trimethylpyrrolo[1,2-a]pyrimidin-6(2H)-one (dicyclonone, BAS-145138), 4-dichloroacetyl-3,4-dihydro-3-methyl-2H-1,4-benzoxazine (benoxacor), cloquintocet, (5-

chloroquinolin-8-yloxy)acetic acid 1-methylhexyl ester
 (cloquintocet-mexyl), α -(cyanomethoxyimino)phenylacetoneitrile
 (cyometrinil), 2,2-dichloro-N-(2-oxo-2-(2-
 propenylamino)ethyl)-N-(2-propenyl)-acetamide (DKA-24), 2,2-
 5 dichloro-N,N-di(2-propenyl)acetamide (dichlormid),
 N-(4-methylphenyl)-N'-(1-methyl-1-phenylethyl)urea (Dymron),
 4,6-dichloro-2-phenyl-pyrimidine (fencloirim), 1-(2,4-
 dichlorophenyl)-5-trichloromethyl-1H-1,2,4-triazole-3-
 carboxylic acid ethyl ester (fenchlorazole-ethyl), 2-chloro-4-
 10 (trifluoromethyl)thiazole-5-carboxylic acid phenylmethyl ester
 (flurazole), 4-chloro-N-((1,3-dioxolan-2-yl)methoxy)- α -
 trifluoroacetophenonoxime (fluxofenim), 3-dichloroacetyl-
 5-(2-furanyl)-2,2-dimethyloxazolidine (furilazole, MON-13900),
 ethyl 4,5-dihydro-5,5-diphenyl-3-isoxazolecarboxylate
 15 (isoxadifen-ethyl), diethyl 1-(2,4-dichlorophenyl)-4,5-
 dihydro-5-methyl-1H-pyrazole-3,5-dicarboxylate (mefenpyr-
 diethyl), 2-dichloromethyl-2-methyl-1,3-dioxolane (MG-191),
 1,8-naphthalic acid anhydride, α -((1,3-dioxolan-2-
 yl)methoxyimino)phenylacetoneitrile (oxabetrinil),
 20 2,2-dichloro-N-((1,3-dioxolan-2-yl)methyl)-N-(2-
 propenyl)acetamide (PPG-1292), 3-dichloroacetyl-2,2-
 dimethyloxazolidine (R-28725), 3-dichloroacetyl-2,2,5-
 trimethyloxazolidine (R-29148), 1-(2-chlorophenyl)-5-phenyl-
 1H-pyrazole-3-carboxylic acid methyl ester, 4-
 25 cyclopropylaminocarbonyl-N-(2-methoxybenzoyl)-
 benzenesulfonamide (cyprosulfamide), 4-isopropylaminocarbonyl-
 N-(2-methoxybenzoyl)benzenesulfonamide and N-(2-
 methoxybenzoyl)-
 4-[(methylaminocarbonyl)amino]benzenesulfonamide.

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Examples of insecticides are, e.g., from the groups consisting
 of carbamates, organophosphates, pyrethroids and
 chloronicotinyls (such as acetamiprid, clothianidin,
 dinotefuran, imidacloprid, nitenpyram, nithiazine,
 35 thiacloprid, thiamethoxam).

Examples of fungicides are, e.g., from the groups consisting
 of ergosterol biosynthesis inhibitors (such as fenhexamid,

azaconazole, bitertanol, bromuconazole, cyproconazole, diclobutrazol, difenoconazole, diniconazole, diniconazole-M, epoxiconazole, etaconazole, fenbuconazole, fluquinconazole, flusilazole, flutriafol, furconazole, furconazole-cis, 5 hexaconazole, imibenconazole, ipconazole, metconazole, myclobutanil, paclobutrazol, penconazole, propiconazole, prothioconazole, simeconazole, tebuconazole, tetraconazole, triadimefon, triadimenol, triticonazole, uniconazole, voriconazole, imazalil, imazalil sulfate, oxpoconazole, 10 fenarimol, flurprimidol, nuarimol, pyrifenox, triforine, pefurazoate, prochloraz, triflumizole, viniconazole, aldimorph, dodemorph, dodemorph acetate, fenpropimorph, tridemorph, fenpropidin, spiroxamine, naftifine, pyributicarb, terbinafine) and respiratory chain inhibitors (e.g., complex 15 III, such as azoxystrobin, cyazofamid, dimoxystrobin, enestrobin, famoxadone, fenamidone, fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, pyraclostrobin, picoxystrobin, trifloxystrobin).

20 For application, the herbicidal compositions according to the invention can be diluted in the normal way, e.g. using water. It can be advantageous to add, to spray mixtures obtained, additional agrochemical active substances (e.g., tank mix components in the form of appropriate formulations) and/or 25 auxiliaries and additives standard for application, e.g. self-emulsifying oils, such as vegetable oils or liquid paraffins, and/or fertilizers. The present invention also accordingly relates to those herbicidal compositions based on the dispersions according to the invention.

30 The dispersions or herbicidal compositions according to the invention exhibit an outstanding herbicidal activity against a broad spectrum of economically important harmful monocotyledonous and dicotyledonous plants. Even perennial 35 weeds which sprout from rhizomes, root stocks or other perennial organs and which are difficult to combat are successfully included. In this connection, the compositions can be applied, e.g., in the presowing, preemergence or

postemergence method. Specifically, mention may be made, by way of example, of some representatives of the mono- and dicotyledonous weed flora which can be controlled by the dispersions or herbicidal compositions according to the invention, without the designation resulting in a limitation to certain species.

In the case of the monocotyledonous weed species, *Apera spica-venti*, *Avena* spp., *Alopecurus* spp., *Brachiaria* spp., *Digitaria* spp., *Lolium* spp., *Echinochloa* spp., *Panicum* spp., *Phalaris* spp., *Poa* spp., *Setaria* spp. and also *Bromus* spp., such as *Bromus catharticus*, *Bromus secalinus*, *Bromus erectus*, *Bromus tectorum* and *Bromus japonicus*, and *Cyperus* species from the group of the annuals and, in the case of the perennial species, *Agropyron*, *Cynodon*, *Imperata* and also *Sorghum* and even perennial *Cyperus* species, e.g., are successfully included.

With dicotyledonous weed species, the spectrum of activity applies to species such as, e.g., *Abutilon* spp., *Amaranthus* spp., *Chenopodium* spp., *Chrysanthemum* spp., *Galium* spp., such as *Galium aparine*, *Ipomoea* spp., *Kochia* spp., *Lamium* spp., *Matricaria* spp., *Pharbitis* spp., *Polygonum* spp., *Sida* spp., *Sinapis* spp., *Solanum* spp., *Stellaria* spp., *Veronica* spp. and *Viola* spp., *Xanthium* spp., in the case of the annuals, and *Convolvulus*, *Cirsium*, *Rumex* and *Artemisia* with the perennial weeds.

Harmful plants occurring under the specific cultivation conditions in rice, such as, e.g., *Echinochloa*, *Sagittaria*, *Alisma*, *Eleocharis*, *Scirpus* and *Cyperus*, are likewise combated in an outstanding fashion by the dispersions or herbicidal compositions according to the invention.

If the dispersions or herbicidal compositions according to the invention are applied to the soil surface before germination, then either the emergence of the weed seedlings is completely prevented or the weeds grow until they have reached the

cotyledon stage but then their growth ceases and finally, after 3 to 4 weeks have elapsed, they completely die.

5 On application of the dispersions or herbicidal compositions according to the invention to the green parts of the plants in the postemergence method, a drastic halt in growth likewise occurs very quickly after the treatment and the weed plants stay in the growth stage present at the time of application or completely die after a certain time, so that in this way
10 competition by weeds, which is harmful for the crop plants, is eliminated very early and with lasting effect.

The dispersions or herbicidal compositions according to the invention are distinguished by a rapidly commencing and
15 longlasting herbicidal action. The resistance to rain of the active substances in the combinations according to the invention is generally good. A particular advantage is crucially that the dosages of herbicidal compounds which are used in the herbicidal compositions and which are effective
20 can be adjusted to such a low value that their soil action is optimally low. Accordingly, not only is their use finally possible in sensitive crops but groundwater contamination is virtually avoided. A substantial reduction in the amount of the active substances which has to be expended is made
25 possible by the active substance combination according to the invention.

The properties and advantages mentioned are of use in the practical combating of weeds in order to keep agricultural
30 crops free from undesirable competing plants and accordingly to safeguard and/or to increase the yields in terms of quality and quantity. The technical standard is, with regard to the properties described, clearly exceeded by these new compositions.

35 Although the dispersions or herbicidal compositions according to the invention exhibit an outstanding herbicidal activity with regard to mono- and dicotyledonous weeds, crop plants of

economically important crops, e.g. dicotyledonous crops, such as soya, cotton, rape, sugar beet, or gramineous crops, such as wheat, barley, rye, oats, millet, rice or corn, are only insignificantly damaged or completely undamaged. The components of the herbicidal composition according to the invention, for these reasons, are very well suited to the selective combating of undesirable plant growth in agriculturally useful plants or in ornamental plants.

10 In addition, the components of the herbicidal composition according to the invention exhibit outstanding growth-regulatory properties in crop plants. They intervene in a regulatory manner in the plants' metabolism and can accordingly be used for the selective influencing of plant contents and for making it easier to harvest, such as, e.g., by controlling desiccation and stunted growth. Furthermore, they are also suitable for the general control and inhibition of undesirable vegetative growth, without in this connection killing the plants. Inhibition of vegetative growth plays a major role in many mono- and dicotyledonous crops since lodging can be reduced or completely prevented through this.

Because of their herbicidal and plant-growth-regulatory properties, the components of the herbicidal composition according to the invention can also be used for combating harmful plants in crops of known genetically modified plants or genetically modified plants still to be developed. The transgenic plants are generally distinguished by particular advantageous properties, for example by resistance to certain pesticides, mainly certain herbicides, resistance to plant diseases or causative agents of plant diseases, such as certain insects or microorganisms, such as fungi, bacteria or viruses. Other particular properties relate, e.g., to the harvested crops with regard to amount, quality, storability, composition and special ingredients. Thus, transgenic plants with increased starch content or modified quality of the starch or those with a different fatty acid composition of the harvested crops are known.

Preference is given to the use of the dispersions or herbicidal compositions according to the invention in economically important transgenic crops of useful and ornamental plants, e.g. of gramineous crops, such as wheat, barley, rye, oats, millet, rice and corn, or also crops of sugar beet, cotton, soya, rape, potato, tomato, peas and other kinds of vegetable. Preferably, the dispersions or compositions according to the invention can be used as herbicides in crops of useful plants which are resistant to the phytotoxic effects of the herbicides or which have been made resistant by genetic engineering.

When the dispersions or herbicidal compositions according to the invention are used in transgenic crops, effects often occur, in addition to the effects with regard to harmful plants to be observed in other crops, which are specific for the application in the respective transgenic crop, for example a modified or specially broadened weed spectrum which can be combated, modified amounts to be expended which can be used for the application, preferably good ability to be combined with the herbicides to which the transgenic crop is resistant, and influencing of growth and yield of the transgenic crop plants.

Another subject matter of the present invention is furthermore a process for combating undesirable plant growth, preferably in crop plants, such as cereals (e.g., wheat, barley, rye, oats, rice, corn, millet), sugar beet, sugar cane, rape, cotton and soya, particularly preferably in monocotyledonous crops, such as cereals, e.g. wheat, barley, rye, oats, hybrids thereof, such as triticale, rice, corn and millet, one or more components of the herbicidal composition according to the invention being applied to the harmful plants, plant parts, plant seeds or the area on which the plants are growing, e.g. the area under cultivation.

The crop plants can also be modified by genetic engineering or

obtained by mutation selection and are preferably tolerant to acetolactate synthase (ALS) inhibitors.

5 The dispersions according to the invention can be prepared according to processes known to a person skilled in the art; for example according to Houben-Weil, by wet milling by means of bead mills (see: Winnacker-Küchler, "Chemische Technologie" [Chemical Technology], Volume 7, 4th edition, C. Hanser Verlag, Munich, 1986; Wade van Valkenburg, "Pesticide
10 Formulations", Marcel Dekker, N.Y., 1973; K. Martens, "Spray Drying Handbook", 3rd Ed., G. Goodwin Ltd., London, 1979). A uniform particle distribution of the relevant active substances is optionally advantageous in this connection, in order additionally to further prevent crystal growth and
15 flocculation.

Examples of aqueous dispersions according to the invention are found in the following table.

20 The terms used in the following examples have the following meaning:

diflufenican = common name (BSI, draft E-ISO, (*m*) draft F-ISO); IUPAC name: 2',4'-difluoro-2-(α,α,α -trifluoro-*m*-
25 tolyloxy)nicotinilide (Bayer CropScience)

flurtamone = common name (BSI, ANSI, draft E-ISO); IUPAC name: (*RS*)-5-methylamino-2-phenyl-4-(α,α,α -trifluoro-*m*-tolyl)furan-3(2*H*)-one (Bayer CropScience)

30 Nokal® BX = alkylnaphthalenesulfonic acid sodium salt (BASF)

Pluronic® PE 10500 = propylene oxide/ethylene oxide
35 (PO/EO) block polymer (BASF)

citric acid = polybasic organic acid

Bentone® EW = modified sheet silicate (Elementis)

Rhodopol® 23 = xanthan derivate (Rhodia)

5 flufenacet = common name (BSI, pa ISO); IUPAC
name: 4'-fluoro-*N*-isopropyl-2-(5-trifluoromethyl-1,3,4-
thiadiazol-2-yloxy)acetanilide (Bayer CropScience)

10 Silcolapse® 5020 = silicone antifoaming agent
(Rhodia)

propylene glycol = antifreeze agent

15 Acticide® MBS = preservative (biocide, Thor Chemie)

Preparation of an aqueous dispersion:

20 For the preparation of the examples mentioned in table 1,
water is first placed in a vessel. Diflufenican and flurtamone
and also the additional constituents of the formulation are
subsequently added with stirring. The sequence of the addition
of the additional components is generally unimportant. A wet
milling, for example by means of a bead mill, is optionally
carried out subsequently.

25

Table 1 (figures follow in percentage by weight)

Component		Example No.						
		1	2	3	4	5	6	7
a	Diflufenican	10.7	10.5	10.3	15.7	8	4	12
a	Flurtamone	10.7	10.5	14.8	11	20	8	12
b	Nekal® BX	0.5	0.7	0.8	0.6	0.4	0.6	1
c	Pluronic® PE 10500	5	6	6.3	7	7	7	6
d	Citric acid	0.5	0.6	0.7	0.7	0.4	0.6	1
e	Bentone® EW	0.1	0.1	0.1	0.2	0.1	0.1	0.1
e	Rhodopol® 23	0.1	0.2	0.1	0.1	0.2	0.2	0.1
f	Flufenacet	10.7	15.3	10.3	11	8	22	12

g	Silcolapse® 5020	1	0.8	1.2	1	1.5	1	1
g	Propylene glycol	8	7	7.5	6	10	9	8
g	Acticide® MBS	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Water		52.5	48.2	47.7	46.5	44.2	47.3	46.6
Total:		100	100	100	100	100	100	100

Stability of the aqueous dispersion:

5 The dispersions according to the invention of examples 1 to 7 exhibit an excellent stability on storage. They are stable at ambient temperature for at least 2 years and at 50°C for at least 3 months without visible change.

Herbicidal action:

10

1. The action of the herbicidal compositions according to the invention comprising the active substances diflufenican, flurtamone and flufenacet as components (3-component combination) corresponds to the requirements and accordingly
15 solves the problem posed (inter alia, provision of more flexible solutions, with regard to the amounts which have to be expended, with the same to increased activity).

In field trials, it was established, inter alia, that, by the
20 use of the 3-component combination, the amounts of application products necessary in the combating of harmful grasses, such as bent grass and Poa species, could be reduced by up to 40%, in comparison with the 2-component combination (diflufenican and flurtamone active substance mixture). In addition, with
25 the same amount expended, a greater activity of the 3-component combination compared with the 2-component combination was established.

Patentkrav

1. Herbicidt middel indeholdende som bestanddele aktivstofferne diflufenican, flurtamone og flufenacet.

5

2. Fremgangsmåde til bekæmpelse af uønsket plantevækst, hvori en aktiv mængde af bestanddelene i det herbicide middel ifølge krav 1 appliceres på planterne, dele af planterne, såsæden eller det areal, hvorpå der vokser planter.

10

3. Anvendelse af bestanddelene i det herbicide middel ifølge krav 1 til bekæmpelse af uønsket plantevækst.

4. Flydende herbicidt middel, som er opnåeligt ved hjælp af fortynding af et herbicidt middel ifølge krav 1.

15

5. Flydende herbicidt middel ifølge krav 4, hvori det herbicide middel er en emulsion, suspension, suspoemulsion eller opløsning.