



US 20110201501A1

(19) **United States**(12) **Patent Application Publication****Song et al.**(10) **Pub. No.: US 2011/0201501 A1**(43) **Pub. Date: Aug. 18, 2011**(54) **SUBSTITUTED PYRIDINES HAVING A
HERBICIDAL EFFECT**

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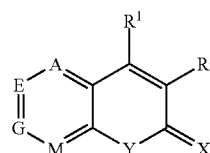
§ 371 (c)(1),
 (2), (4) Date: **Apr. 27, 2011**

(30) **Foreign Application Priority Data**

Oct. 29, 2008 (EP) 08167850.0

Publication Classification(51) **Int. Cl.****A01N 43/40** (2006.01)**C07D 471/04** (2006.01)**A01P 13/00** (2006.01)(52) **U.S. Cl. 504/130; 546/122; 504/246**(57) **ABSTRACT**

Substituted pyridines of the formula I

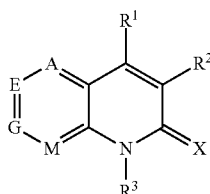


I

in which the variables are defined according to the description, their agriculturally suitable salts, processes and intermediates for preparing the pyridines of the formula I, compositions comprising them and their use as herbicides, i.e. for controlling harmful plants, and also a method for controlling unwanted vegetation which comprises allowing a herbicidally effective amount of at least one pyridine compound of the formula I to act on plants, their seed and/or their habitat.

SUBSTITUTED PYRIDINES HAVING A HERBICIDAL EFFECT

[0001] The present invention relates substituted pyridines of the formula I



in which the variables have the following meaning:

[0002] R^1 is $O-R^4$, $S(O)_n-R^4$ or $O-S(O)_n-R^4$;

[0003] R^4 is hydrogen, C_1-C_4 -alkyl, $Z-C_3-C_6$ -cycloalkyl, C_1-C_4 -haloalkyl, C_2-C_6 -alkenyl, $Z-C_3-C_6$ -cycloalkenyl, C_2-C_6 -alkynyl, $Z-(tri-C_1-C_4$ -alkyl)silyl, $Z-C(=O)-R^a$, $Z-NR^i-C(O)-NR^iR^{ii}$, $Z-P(=O)(R^a)_2$, NR^iR^{ii} , a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, which may be partially or fully substituted by groups R^a and/or R^b ;

[0004] R^a is hydrogen, OH, C_1-C_8 -alkyl, C_1-C_4 -haloalkyl, $Z-C_3-C_6$ -cycloalkyl, C_2-C_8 -alkenyl, $Z-C_5-C_6$ -cycloalkenyl, C_2-C_8 -alkynyl, $Z-C_1-C_6$ -alkoxy, $Z-C_1-C_4$ -haloalkoxy, $Z-C_3-C_8$ -alkenyl, $Z-C_3-C_8$ -alkynyl, NR^iR^{ii} , C_1-C_6 -alkylsulfonyl, $Z-(tri-C_1-C_4$ -alkyl)silyl, Z -phenyl, Z -phenoxy, Z -phenylamino or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b ;

[0005] R^i , R^{ii} independently of one another are hydrogen, C_1-C_8 -alkyl, C_1-C_4 -haloalkyl, C_3-C_8 -alkenyl, C_3-C_8 -alkynyl, $Z-C_3-C_6$ -cycloalkyl, $Z-C_1-C_8$ -alkoxy, $Z-C_1-C_8$ -haloalkoxy, $Z-C(=O)-R^a$, Z -phenyl, a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S and which is attached via Z;

[0006] R^i and R^{ii} together with the nitrogen atom to which they are attached may also form a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S;

[0007] Z is a covalent bond or C_1-C_4 -alkylene;

[0008] n is 0, 1 or 2;

[0009] R^2 is phenyl, naphthyl or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b ;

[0010] R^b independently of one another are $Z-CN$, $Z-OH$, $Z-NO_2$, Z -halogen, C_1-C_8 -alkyl, C_1-C_4 -haloalkyl, C_2-C_8 -alkenyl, C_2-C_8 -alkynyl, $Z-C_1-C_8$ -alkoxy, $Z-C_1-C_8$ -haloalkoxy, $Z-C_3-C_{10}$ -cycloalkyl, $O-Z-C_3-C_{10}$ -cycloalkyl, $Z-C(=O)-R^a$, NR^iR^{ii} , $Z-(tri-C_1-C_4$ -alkyl)silyl, Z -phenyl and $S(O)_nR^{bb}$,

[0011] where R^{bb} is C_1-C_8 -alkyl or C_1-C_6 -haloalkyl and

[0012] n is 0, 1 or 2;

[0013] R^b together with the group R^b attached to the adjacent carbon atom may also form a five- or six-membered saturated or partially or fully unsaturated ring which, in addition to carbon atoms, may contain 1, 2 or 3 heteroatoms selected from the group consisting of O, N and S;

[0014] R^3 is hydrogen, C_1-C_6 -alkyl, C_1-C_4 -haloalkyl, C_2-C_6 -alkenyl, C_3-C_6 -alkynyl, $Z-C_3-C_{10}$ -cycloalkyl, C_1-C_6 -alkoxy- C_1-C_6 -alkyl, C_1-C_6 -cyanoalkyl, Z -phenyl, $Z-C(=O)-R^{a2}$ or tri- C_1-C_4 -alkylsilyl;

[0015] R^{a2} is C_1-C_6 -alkyl, C_1-C_4 -haloalkyl, $Z-C_1-C_6$ -alkoxy, $Z-C_1-C_4$ -haloalkoxy or NR^iR^{ii} ;

[0016] A, E, G, M are N or $C-R^c$, one of these groups being N;

[0017] R^b is hydrogen or one of the groups mentioned for R^b ;

where in the groups R^4 and R^3 and their substituents, the carbon chains and/or the cyclic groups may be partially or fully substituted by groups R^b , or a N-oxide or an agriculturally suitable salt thereof.

[0018] Moreover, the invention relates to processes and intermediates for preparing the pyridines of the formula I and the N-oxides thereof, the agriculturally usable salts thereof, and also to active compound combinations comprising them, to compositions comprising them and to their use as herbicides, i.e. for controlling harmful plants, and also to a method for controlling unwanted vegetation which comprises allowing a herbicidally effective amount of at least one pyridine compound of the formula I or of an agriculturally suitable salt of I to act on plants, their seed and/or their habitat.

[0019] Further embodiments of the present invention can be found in the claims, the description and the examples. It is to be understood that the features mentioned above and those still to be illustrated below of the subject matter of the invention can be applied not only in the respective given combination but also in other combinations without leaving the scope of the invention.

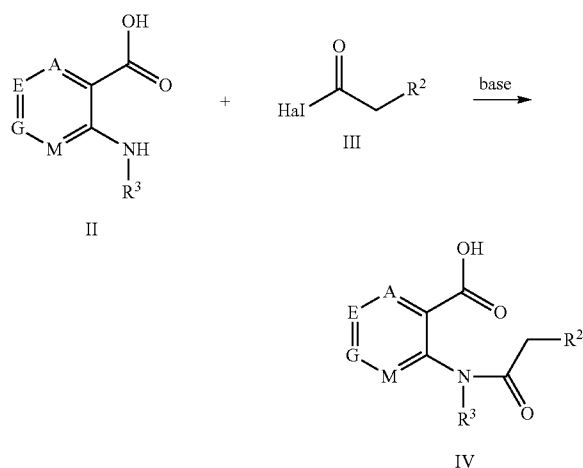
[0020] WO 2008/009908, WO 2008/071918 describe herbicidal pyridopyrazines; however, their herbicidal action at low application rates and/or their compatibility with crop plants leave scope for improvement.

[0021] It is an object of the present invention to provide compounds having herbicidal action. To be provided are in particular active compounds having strong herbicidal action, in particular even at low application rates, whose compatibility with crop plants is sufficient for commercial application.

[0022] These and further objects are achieved by the compounds of the formula I defined at the outset and by their N-oxides and also their agriculturally suitable salts.

[0023] The compounds according to the invention can be prepared analogously to the synthesis routes described in WO 2008/009908 and WO 2008/071918 according to standard processes of organic chemistry, for example according to the following synthesis route:

[0024] Pyridine carboxylic acids of the formula II can be reacted with carbonyl compounds of the formula III to give compounds of the formula IV. In the formulae. II and III, the variables have the meaning given for formula I. The group Hal is a halogen atom or another suitable nucleophilic leaving group, such as alkoxy or phenoxy.



[0025] This reaction is usually carried out at temperatures of from -78°C. to 120°C. , preferably from -20°C. to 50°C. , in an inert organic solvent in the presence of a base, such as, for example, triethylamine (cf. J. Agric. and Food Chem. 1994, 42(4), 1019-1025), a catalyst, such as, for example, dicyclohexylcarbodiimide (cf. Egyptian Journal of Chemistry 1994, 37(3), 273-282) or other known coupling agents.

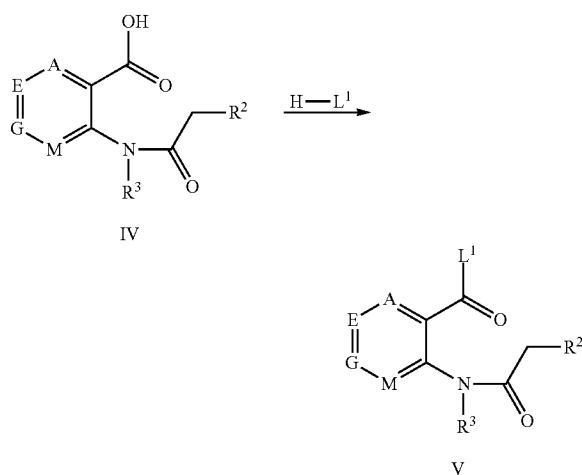
[0026] Suitable solvents are aliphatic hydrocarbons, such as pentane, hexane, cyclohexane and petroleum ether, aromatic hydrocarbons, such as toluene, o-, m- and p-xylene, halogenated hydrocarbons, such as methylene chloride, chloroform and chlorobenzene, ethers, such as diethyl ether, diisopropyl ether, tert-butyl methyl ether, dioxane, anisole and tetrahydrofuran, nitriles, such as acetonitrile and propionitrile, ketones, such as acetone, methyl ethyl ketone, diethyl ketone and tert-butyl methyl ketone, and also dimethyl sulfoxide, dimethylformamide and dimethylacetamide, particularly preferably halogenated hydrocarbons, such as methylene chloride, chloroform and chlorobenzene. It is also possible to use mixtures of the solvents mentioned.

[0027] Suitable bases are, in general, inorganic compounds, such as alkali metal and alkaline earth metal hydroxides, such as lithium hydroxide, sodium hydroxide, potassium hydroxide and calcium hydroxide, alkali metal and alkaline earth metal oxides, such as lithium oxide, sodium oxide, calcium oxide and magnesium oxide, alkali metal and alkaline earth metal hydrides, such as lithium hydride, sodium hydride, potassium hydride and calcium hydride, alkali metal amides, such as lithium amide, sodium amide and potassium amide, alkali metal and alkaline earth metal carbonates, such as lithium carbonate, potassium carbonate and calcium carbonate, and also alkali metal bicarbonates, such as sodium bicarbonate, organometallic compounds, in particular alkali metal alkyls, such as methyl lithium, butyllithium and phenyllithium, alkylmagnesium halides, such as methylmagnesium chloride, and also alkali metal and alkaline earth metal alkoxides, such as sodium methoxide, sodium ethoxide,

potassium ethoxide, potassium tert-butoxide and dimethoxymagnesium, moreover organic bases, for example tertiary amines, such as trimethylamine, triethylamine, tributylamine, diisopropylethylamine and N-methylpiperidine, pyridine, substituted pyridines, such as collidine, lutidine and 4-dimethylaminopyridine, and also bicyclic amines. Particular preference is given to tertiary amines such as trimethylamine, triethylamine, tributylamine, diisopropylethylamine. The bases are generally employed in catalytic amounts; however, they can also be used in equimolar amounts, in excess or, if appropriate, as solvents.

[0028] The starting materials are generally reacted with one another in equimolar amounts.

[0029] The compounds of the formula IV are activated by introducing a leaving group L^1 . Suitable leaving groups L^1 are, in general, groups which increase the electrophilicity of the carbonyl group, for example O-alkyl, O-aryl, halides, activated esters or aldehydes (such as, for example, Weinreb amide), in particular pentafluorophenoxy.



[0030] This reaction is usually carried out at temperatures of from -78°C. to 120°C. , preferably from -20°C. to 50°C. , in an inert organic solvent in the presence of a base, such as, for example, triethylamine (cf. J. Agric. and Food Chem. 1994, 42(4), 1019-1025), a catalyst, such as, for example, dicyclohexylcarbodiimide (cf. Egyptian Journal of Chemistry 1994, 37(3), 273-282) or other known coupling agents.

[0031] Suitable solvents are aliphatic hydrocarbons, such as pentane, hexane, cyclohexane and petroleum ether, aromatic hydrocarbons, such as toluene, o-, m- and p-xylene, halogenated hydrocarbons, such as methylene chloride, chloroform and chlorobenzene, ethers, such as diethyl ether, diisopropyl ether, tert-butyl methyl ether, dioxane, anisole and tetrahydrofuran, nitriles, such as acetonitrile and propionitrile, ketones, such as acetone, methyl ethyl ketone, diethyl ketone and tert-butyl methyl ketone, and also dimethyl sulfoxide, dimethylformamide and dimethylacetamide, particularly preferably methylene chloride and toluene. It is also possible to use mixtures of the solvents mentioned.

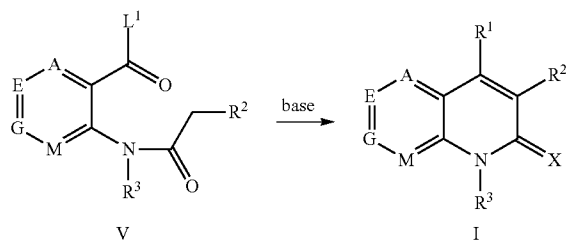
[0032] Suitable bases are, in general, inorganic compounds, such as alkali metal and alkaline earth metal hydroxides, such as lithium hydroxide, sodium hydroxide, potassium hydroxide and calcium hydroxide, alkali metal and alkaline earth metal oxides, such as lithium oxide, sodium

oxide, calcium oxide and magnesium oxide, alkali metal and alkaline earth metal hydrides, such as lithium hydride, sodium hydride, potassium hydride and calcium hydride, alkali metal amides, such as lithium amide, sodium amide and potassium amide, alkali metal and alkaline earth metal carbonates, such as lithium carbonate, potassium carbonate and calcium carbonate, and also alkali metal bicarbonates, such as sodium bicarbonate, organometallic compounds, in particular alkali metal alkyls, such as methyllithium, butyllithium and phenyllithium, alkylmagnesium halides, such as methylmagnesium chloride, and also alkali metal and alkaline earth metal alkoxides, such as sodium methoxide, sodium ethoxide, potassium ethoxide, potassium tert-butoxide and dimethoxymagnesium, moreover organic bases, for example tertiary amines, such as trimethylamine, triethylamine, tributylamine, diisopropylethylamine and N-methylpiperidine, pyridine, substituted pyridines, such as collidine, lutidine and 4-dimethylaminopyridine, and also bicyclic amines. Particular preference is given to alkali metal and alkaline earth metal carbonates, such as lithium carbonate, potassium carbonate, calcium carbonate, cesium carbonate and rubidium carbonate. The bases are generally employed in catalytic amounts; however, they can also be used in equimolar amounts, in excess or, if appropriate, as solvents.

[0033] The starting materials are generally reacted with one another in equimolar amounts.

[0034] Suitable agents $H-L^1$ are alcohols, optionally substituted phenols, N,O-dialkyl-hydroxylamine, in particular pentafluorophenol or N,O-dimethylhydroxylamine.

[0035] The compounds of the formula V are cyclized to give the compounds of the formula I.



[0036] This reaction is usually carried out at temperatures of from -78°C . to 120°C ., preferably from -20°C . to 50°C ., in an inert organic solvent in the presence of a base or a Lewis acid or a catalyst [cf. Silverman, Richard B. J. Am. Chem. Soc. 1981, 103(13), 3910].

[0037] Suitable solvents are aliphatic hydrocarbons, such as pentane, hexane, cyclohexane and petroleum ether, aromatic hydrocarbons, such as toluene, o-, m- and p-xylene, halogenated hydrocarbons, such as methylene chloride, chloroform and chloro-benzene, ethers, such as diethyl ether, diisopropyl ether, tert-butyl methyl ether, dioxane, anisole and tetrahydrofuran, nitriles, such as acetonitrile and propionitrile, ketones, such as acetone, methyl ethyl ketone, diethyl ketone and tert-butyl methyl ketone, and also dimethyl sulfoxide, dimethylformamide and dimethylacetamide, particularly preferably acetonitrile and dimethylformamide. It is also possible to use mixtures of the solvents mentioned.

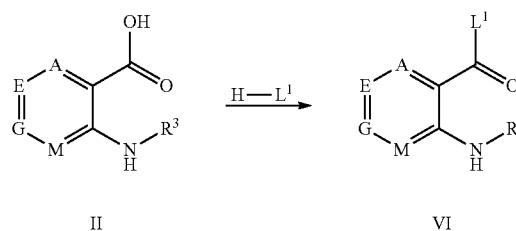
[0038] Suitable bases are, in general, inorganic compounds, such as alkali metal and alkaline earth metal hydroxides, such as lithium hydroxide, sodium hydroxide, potassium hydroxide and calcium hydroxide, alkali metal and

alkaline earth metal oxides, such as lithium oxide, sodium oxide, calcium oxide and magnesium oxide, alkali metal and alkaline earth metal hydrides, such as lithium hydride, sodium hydride, potassium hydride and calcium hydride, alkali metal amides, such as lithium amide, sodium amide and potassium amide, alkali metal and alkaline earth metal carbonates, such as lithium carbonate, potassium carbonate, calcium carbonate, cesium carbonate and rubidium carbonate, and also alkali metal bicarbonates, such as sodium bicarbonate, organometallic compounds, in particular alkali metal alkyls, such as methyllithium, butyllithium and phenyllithium, alkylmagnesium halides, such as methylmagnesium chloride, and also alkali metal and alkaline earth metal alkoxides, such as sodium methoxide, sodium ethoxide, potassium ethoxide, potassium tert-butoxide and dimethoxymagnesium, moreover organic bases, for example tertiary amines, such as trimethylamine, triethylamine, tributylamine, diisopropylethylamine and N-methylpiperidine, pyridine, substituted pyridines, such as collidine, lutidine and 4-dimethylaminopyridine, and also bicyclic amines. Particular preference is given to alkali metal and alkaline earth metal carbonates, such as lithium carbonate, potassium carbonate, calcium carbonate, cesium carbonate and rubidium carbonate.

[0039] The bases are generally employed in catalytic amounts; however, they can also be used in equimolar amounts, in excess or, if appropriate, as solvents.

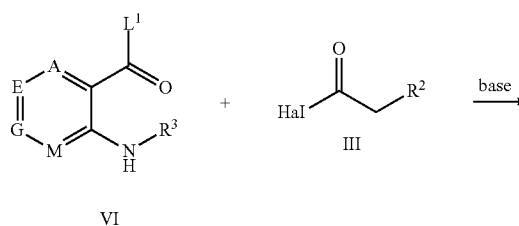
[0040] The starting materials are generally reacted with one another in equimolar amounts.

[0041] Alternatively, the compounds of the formula I can also be obtained via a reverse reaction sequence, i.e. the reaction of the compounds of the formula II with compounds $H-L^1$ gives the activated derivatives of the formula VI.

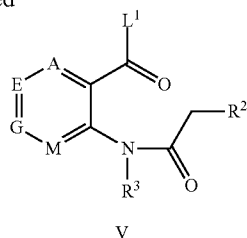


[0042] Per se, this reaction is carried out under the conditions mentioned for the reaction of the formula IV with $H-L^1$.

[0043] The compounds of the formula VI can then be reacted with compounds III to give the derivatives of the formula V.



-continued



[0044] Per se, this reaction is carried out under the conditions mentioned for the reaction of the formula II with III.

[0045] The reaction mixtures are worked up in a customary manner, for example by mixing with water, separating the phases and, if appropriate, chromatographic purification of the crude products. Some of the intermediates and end products are obtained in the form of colorless or slightly brownish viscous oils which are purified or freed from volatile components under reduced pressure and at moderately elevated temperature. If the intermediates and end products are obtained as solids, the purification can also be carried out by recrystallization or digestion.

[0046] If individual compounds I cannot be obtained by the routes described above, they can be prepared by derivatization of other compounds I.

[0047] If the synthesis yields mixtures of isomers, a separation is generally however not necessarily required since in some cases the individual isomers can be interconverted during work-up for use or during application (for example under the action of light, acids or bases). Such conversions may also take place after application, for example in the case of the treatment of plants in the treated plant or in the harmful plant to be controlled.

[0048] The organic moieties mentioned for the substituents of the compounds according to the invention are collective terms for individual enumerations of the individual group members. All hydrocarbon chains, such as alkyl, haloalkyl, alkenyl, alkynyl, and the alkyl moieties and alkenyl moieties in alkoxy, haloalkoxy, alkylamino, dialkylamino, N-alkylsulfonylamino, alkenyloxy, alkynyloxy, alkoxyamino, alkylaminosulfonylamino, dialkylaminosulfonylamino, alkenylamino, alkynylamino, N-(alkenyl)-N-(alkyl)amino, N-(alkynyl)-N-(alkyl)amino, N-(alkoxy)-N-(alkyl)amino, N-(alkenyl)-N-(alkoxy)amino or N-(alkynyl)-N-(alkoxy)amino can be straight-chain or branched.

[0049] The prefix C_n-C_m — indicates the respective number of carbons of the hydrocarbon unit. Unless indicated otherwise, halogenated substituents preferably carry one to five identical or different halogen atoms, in particular fluorine atoms or chlorine atoms.

[0050] The meaning halogen denotes in each case fluorine, chlorine, bromine or iodine.

[0051] Examples of other meanings are:

[0052] alkyl and the alkyl moieties for example in alkoxy, alkylamino, dialkylamino, N-alkyl-sulfonylamino, alkylaminosulfonylamino, dialkylaminosulfonylamino, N-(alkenyl)-N-(alkyl)amino, N-(alkynyl)-N-(alkyl)amino, N-(alkoxy)-N-(alkyl)amino: saturated straight-chain or branched hydrocarbon radicals having one or more carbon atoms, for example 1 or 2, 1 to 4 or 1 to 6 carbon atoms, for example C_1 - C_6 -alkyl, such as methyl, ethyl, propyl, 1-methylethyl, butyl, 1-methylpropyl, 2-methylpropyl, 1,1-dimethylethyl,

pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, 2,2-dimethylpropyl, 1-ethylpropyl, hexyl, 1,1-dimethylpropyl, 1,2-dimethylpropyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, 4-methylpentyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,2-dimethylbutyl, 2,3-dimethylbutyl, 3,3-dimethylbutyl, 1-ethylbutyl, 2-ethylbutyl, 1,1,2-trimethylpropyl, 1,2,2-trimethylpropyl, 1-ethyl-1-methylpropyl, 1-ethyl-2-methylpropyl. In one embodiment according to the invention, alkyl denotes small alkyl groups, such as C_1 - C_4 -alkyl. In another embodiment according to the invention, alkyl denotes relatively large alkyl groups, such as C_5 - C_6 -alkyl.

[0053] Haloalkyl: an alkyl radical as mentioned above, some or all of whose hydrogen atoms are substituted by halogen atoms, such as fluorine, chlorine, bromine and/or iodine, for example chloromethyl, dichloromethyl, trichloromethyl, fluoromethyl, difluoro-methyl, trifluoromethyl, chlorofluoromethyl, dichlorofluoromethyl, chlorodifluoromethyl, 2-fluoroethyl, 2-chloroethyl, 2-bromoethyl, 2-iodoethyl, 2,2-difluoroethyl, 2,2,2-trifluoroethyl, 2-chloro-2-fluoroethyl, 2-chloro-2,2-difluoroethyl, 2,2-dichloro-2-fluoroethyl, 2,2,2-trichloroethyl, pentafluoroethyl, 2-fluoropropyl, 3-fluoropropyl, 2,2-difluoropropyl, 2,3-difluoropropyl, 2-chloropropyl, 3-chloropropyl, 2,3-dichloropropyl, 2-bromopropyl, 3-bromopropyl, 3,3,3-trifluoropropyl, 3,3,3-trichloropropyl, 2,2,3,3,3-pentafluoropropyl, heptafluoropropyl, 1-(fluoromethyl)-2-fluoroethyl, 1-(chloromethyl)-2-chloroethyl, 1-(bromomethyl)-2-bromoethyl, 4-fluorobutyl, 4-chlorobutyl, 4-bromobutyl and nonafluorobutyl.

[0054] Cycloalkyl and the cycloalkyl moieties for example in cycloalkoxy or cycloalkylcarbonyl: monocyclic saturated hydrocarbon groups having three or more carbon atoms, for example 3 to 6 carbon ring members, such as cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl.

[0055] Alkenyl and the alkenyl moieties for example in alkenylamino, alkenyloxy, N-(alkenyl)-N-(alkyl)amino, N-(alkenyl)-N-(alkoxy)amino: monounsaturated straight-chain or branched hydrocarbon radicals having two or more carbon atoms, for example 2 to 4, 2 to 6 or 3 to 6 carbon atoms, and a double bond in any position, for example C_2 - C_6 -alkenyl, such as ethenyl, 1-propenyl, 2-propenyl, 1-methylethenyl, 1-butenyl, 2-butenyl, 3-butenyl, 1-methyl-1-propenyl, 2-methyl-1-propenyl, 1-methyl-2-propenyl, 2-methyl-2-propenyl, 1-pentenyl, 2-pentenyl, 3-pentenyl, 4-pentenyl, 1-methyl-1-butenyl, 2-methyl-1-butenyl, 3-methyl-1-butenyl, 1-methyl-2-butenyl, 2-methyl-2-butenyl, 3-methyl-2-butenyl, 1-methyl-3-butenyl, 2-methyl-3-butenyl, 3-methyl-3-butenyl, 1,1-dimethyl-2-propenyl, 1,2-dimethyl-1-propenyl, 1,2-dimethyl-2-propenyl, 1-ethyl-1-propenyl, 1-ethyl-2-propenyl, 1-hexenyl, 2-hexenyl, 3-hexenyl, 4-hexenyl, 5-hexenyl, 1-methyl-1-pentenyl, 2-methyl-1-pentenyl, 3-methyl-1-pentenyl, 4-methyl-1-pentenyl, 1-methyl-2-pentenyl, 2-methyl-2-pentenyl, 3-methyl-2-pentenyl, 4-methyl-2-pentenyl, 1-methyl-3-pentenyl, 2-methyl-3-pentenyl, 3-methyl-3-pentenyl, 4-methyl-3-pentenyl, 1-methyl-4-pentenyl, 2-methyl-4-pentenyl, 3-methyl-4-pentenyl, 4-methyl-4-pentenyl, 1,1-dimethyl-2-butenyl, 1,1-dimethyl-3-butenyl, 1,2-dimethyl-1-butenyl, 1,2-dimethyl-2-butenyl, 1,2-dimethyl-3-butenyl, 1,3-dimethyl-1-butenyl, 1,3-dimethyl-2-butenyl, 1,3-dimethyl-3-butenyl, 2,2-dimethyl-3-butenyl, 2,3-dimethyl-1-butenyl, 2,3-dimethyl-2-butenyl, 2,3-dimethyl-3-butenyl, 3,3-dimethyl-1-butenyl, 3,3-dimethyl-2-butenyl, 1-ethyl-1-butenyl, 1-ethyl-2-butenyl, 1-ethyl-3-butenyl,

2-ethyl-1-butenyl, 2-ethyl-2-butenyl, 2-ethyl-3-butenyl, 1,1,2-trimethyl-2-propenyl, 1-ethyl-1-methyl-2-propenyl, 1-ethyl-2-methyl-1-propenyl, 1-ethyl-2-methyl-2-propenyl.

[0056] Cycloalkenyl: monocyclic monounsaturated hydrocarbon groups having 3 to 6, preferably 5 or 6, carbon ring members, such as cyclopenten-1-yl, cyclopenten-3-yl, cyclohexen-1-yl, cyclohexen-3-yl, cyclohexen-4-yl.

[0057] Alkynyl and the alkynyl moieties for example in alkynyloxy, alkynylamino, N-(alkynyl)-N-(alkyl)amino or N-(alkynyl)-N-(alkoxy)amino: straight-chain or branched hydrocarbon groups having two or more carbon atoms, for example 2 to 4, 2 to 6 or 3 to 6 carbon atoms, and a triple bond in any position, for example C₂-C₆-alkynyl, such as ethynyl, 1-propynyl, 2-propynyl, 1-butenyl, 2-butenyl, 3-butenyl, 1-methyl-2-propynyl, 1-pentynyl, 2-pentynyl, 3-pentynyl, 4-pentynyl, 1-methyl-2-butenyl, 1-methyl-3-butenyl, 2-methyl-3-butenyl, 3-methyl-1-butenyl, 1,1-dimethyl-2-propynyl, 1-ethyl-2-propynyl, 1-hexynyl, 2-hexynyl, 3-hexynyl, 4-hexynyl, 5-hexynyl, 1-methyl-2-pentynyl, 1-methyl-3-pentynyl, 1-methyl-4-pentynyl, 2-methyl-3-pentynyl, 2-methyl-4-pentynyl, 3-methyl-1-pentynyl, 3-methyl-4-pentynyl, 4-methyl-1-pentynyl, 4-methyl-2-pentynyl, 1,1-dimethyl-2-butenyl, 1,1-dimethyl-3-butenyl, 1,2-dimethyl-3-butenyl, 2,2-dimethyl-3-butenyl, 3,3-dimethyl-1-butenyl, 1-ethyl-2-butenyl, 1-ethyl-3-butenyl, 2-ethyl-3-butenyl, 1-ethyl-1-methyl-2-propynyl.

[0058] Alkoxy: alkyl as defined above which is attached via an oxygen atom, for example methoxy, ethoxy, n-propoxy, 1-methylethoxy, butoxy, 1-methylpropoxy, 2-methylpropoxy or 1,1-dimethylethoxy, pentoxy, 1-methylbutoxy, 2-methylbutoxy, 3-methylbutoxy, 1,1-dimethylpropoxy, 1,2-dimethylpropoxy, 2,2-dimethylpropoxy, 1-ethylpropoxy, hexoxy, 1-methylpentoxy, 2-methylpentoxy, 3-methylpentoxy, 4-methylpentoxy, 1,1-dimethylbutoxy, 1,2-dimethylbutoxy, 1,3-dimethylbutoxy, 2,2-dimethylbutoxy, 2,3-dimethylbutoxy, 3,3-dimethylbutoxy, 1-ethylbutoxy, 2-ethylbutoxy, 1,1,2-trimethylpropoxy, 1,2,2-trimethylpropoxy, 1-ethyl-1-methylpropoxy or 1-ethyl-2-methylpropoxy.

[0059] 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S and which can be attached via C or N. Preferred from among these are 5- or 6-membered heterocycles.

[0060] Saturated or unsaturated heterocyclic groups which are attached via N, such as: pyridazin-3-yl, pyridazin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, pyrimidin-5-yl, pyrazin-2-yl, 2-furyl, 3-furyl, 2-thienyl, 3-thienyl, pyrazol-1-yl, pyrazol-3-yl, pyrazol-4-yl, isoxazol-3-yl, isoxazol-4-yl, isoxazol-5-yl, isothiazol-3-yl, isothiazol-4-yl, isothiazol-5-yl, imidazol-1-yl, imidazol-2-yl, imidazol-4-yl, oxazol-2-yl, oxazol-4-yl, oxazol-5-yl, thiazol-2-yl, thiazol-4-yl and thiazol-5-yl.

[0061] Heteroaromatic groups which are attached via C, such as: pyrazol-3-yl, imidazol-5-yl, oxazol-2-yl, thiazol-2-yl, thiazol-4-yl, thiazol-5-yl, pyridin-2-yl, pyridin-3-yl, pyridin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, pyrimidin-5-yl, pyridazin-4-yl, pyrazin-2-yl, [1H]-tetrazol-5-yl and [2H]-tetrazol-5-yl.

[0062] The compounds of the formula I may, depending on the substitution pattern, contain one or more further centers of chirality. Accordingly, the compounds according to the invention can be present as pure enantiomers or diastereomers or as

enantiomer or diastereomer mixtures. The invention provides both the pure enantiomers or diastereomers and their mixtures.

[0063] The compounds of the formula I may also be present in the form of the N-oxides and/or of their agriculturally useful salts, the type of salt generally not being important. Suitable salts are generally the salts of those cations or the acid addition salts of those acids whose cations and anions, respectively, have no adverse effect on the herbicidal activity of the compounds I.

[0064] Suitable cations are in particular ions of the alkali metals, preferably lithium, sodium or potassium, of the alkaline earth metals, preferably calcium or magnesium, and of the transition metals, preferably manganese, copper, zinc or iron. Another cation that may be used is ammonium, where, if desired, one to four hydrogen atoms may be replaced by C₁-C₄-alkyl, hydroxy-C₁-C₄-alkyl, C₁-C₄-alkoxy-C₁-C₄-alkyl, hydroxy-C₁-C₄-alkoxy-C₁-C₄-alkyl, phenyl or benzyl, preferably ammonium, dimethylammonium, diisopropylammonium, tetramethylammonium, tetrabutylammonium, 2-(2-hydroxyethyl-1-oxy)ethyl-1-ylammonium, di(2-hydroxyethyl-1-yl)ammonium, trimethylbenzylammonium. Another suitable ammonium cation is the pyridine nitrogen atom of the formula I quaternized by alkylation or arylation. Also suitable are phosphonium ions, sulfonium ions, preferably tri(C₁-C₄-alkyl)sulfonium, or sulfoxonium ions, preferably tri(C₁-C₄-alkyl)sulfoxonium.

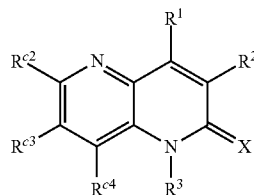
[0065] Anions of suitable acid addition salts are primarily chloride, bromide, fluoride, hydrogensulfate, sulfate, dihydrogenphosphate, hydrogenphosphate, nitrate, bicarbonate, carbonate, hexafluorosilicate, hexafluorophosphate, benzoate and also the anions of C₁-C₄-alkanoic acids, preferably formate, acetate, propionate, butyrate or trifluoroacetate.

[0066] With respect to the variables, the particularly preferred embodiments of the intermediates correspond to those of the groups of the formula I.

[0067] In a particular embodiment, the variables of the compounds of the formula I have the following meanings, these meanings, both on their own and in combination with one another, being particular embodiments of the compounds of the formula I:

[0068] In one preferred embodiment of the compounds of the formula I, A is N and E, G and M are C—R^c. These compounds correspond to the formula I.1

I.1



[0069] in which the groups R^{c2}, R^{c3} and R^{c4} each correspond to a group R^c and preferably have the following meanings:

[0070] R^{c2} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H, Br, OH and OCH₃;

[0071] R^{c3} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H; and

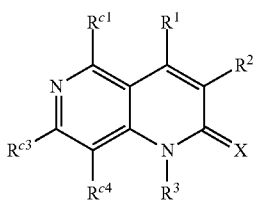
[0072] R^{c4} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H.

[0073] In particularly preferred embodiments of the compounds of the formula I and in particular those of the formula I.1, R^1 is selected from the group consisting of OH, OCH_3 , $OC(O)CH_3$, $OC(O)CH_2CH_3$, $OC(O)CH(CH_3)_2$, $OC(O)C(CH_3)_3$, $OC(O)-c-C_3H_5$, $OC(O)-C_6H_5$, $OC(O)-CH_2C_6H_5$, $OC(O)CH_2Cl$, $OC(O)-CF_3$, $OC(O)-CH_2OCH_3$, $OC(O)-N(CH_3)_2$ and $OC(O)-OCH_2CH_3$.

[0074] In particularly preferred embodiments of the compounds of the formula I and in particular those of the formula I.1, R^2 is phenyl which is substituted by a group selected from the group consisting of 2-Br, 2-Cl, 2,4-Cl₂, 2-Cl-4-F, 2-Cl-5-F, 2-Cl-6-F, 2-Cl-4-CF₃, 2-Cl-5-CF₃, 2-Cl-6-CF₃, 2-Cl-3,6-F₂, 2-F, 2,4-F₂, 2,5-F₂, 2,6-F₂, 2-F-4-CF₃, 2-F-5-CF₃, 2-F-6-CF₃, 2,3,6-F₃, 2-NO₂, 2-NO₂-4-F, 2-NO₂-5-F, 2-NO₂-6-F, 2-NO₂-4-CF₃, 2-NO₂-5-CF₃, 2-NO₂-6-CF₃, 2-NO₂-3,6-F₂, 2-CN, 2-CH₃, 2-CH₃-4-F, 2-CH₃-5-F, 2-CH₃-6-F, 2-CH₃-4-CF₃, 2-CH₃-5-CF₃, 2-CH₃-6-CF₃, 2-CH₃-3,6-F₂, 2-OCH₃, 2-OCH₃-4-F, 2-OCH₃-5-F, 2-OCH₃-6-F, 2-OCH₃-4-CF₃, 2-OCH₃-5-CF₃, 2-OCH₃-6-CF₃, 2-OCH₃-3,6-F₂, 2-CHF₂, 2-CHF₂-4-F, 2-CHF₂-5-F, 2-CHF₂-6-F, 2-CHF₂-4-CF₃, 2-CHF₂-5-CF₃, 2-CHF₂-6-CF₃, 2-CHF₂-3,6-F₂, 2-CF₃, 2-CF₃-4-F, 2-CF₃-5-F, 2-CF₃-6-F, 2-CF₃-4-CF₃, 2-CF₃-5-CF₃, 2-CF₃-6-CF₃, 2-CF₃-3,6-F₂, 2-OCHF₂, 2-OCHF₂-4-F, 2-OCHF₂-5-F, 2-OCHF₂-6-F, 2-OCHF₂-4-CF₃, 2-OCHF₂-5-CF₃, 2-OCHF₂-6-CF₃, 2-OCHF₂-3,6-F₂, 2-OCF₃, 2-OCF₃-4-F, 2-OCF₃-5-F, 2-OCF₃-6-F, 2-OCF₃-4-CF₃, 2-OCF₃-5-CF₃, 2-OCF₃-6-CF₃ and 2-OCF₃-3,6-F₂.

[0075] In particularly preferred embodiments of the compounds of the formula I and in particular those of the formula I.1, X is selected from the group consisting of oxygen and sulfur.

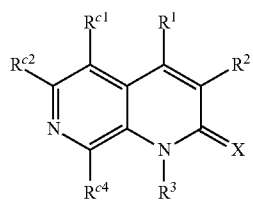
[0076] In a further embodiment of the compounds of the formula I, A, G and M are $C-R^c$ and E is N. These compounds correspond to the formula I.2



I.2

[0077] in which the groups R^{c1} , R^{c3} and R^{c4} each correspond to a group R^c .

[0078] In a further embodiment of the compounds of the formula I, A, E and M are $C-R^c$ and G is N. These compounds correspond to the formula I.3



I.3

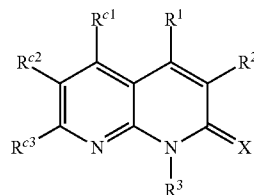
[0079] in which the groups R^{c1} , R^{c2} and R^{c4} each correspond to a group R^c and preferably have the following meanings:

[0080] R^{c1} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl;

[0081] R^{c2} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H, Br, OH and OCH_3 ; and

[0082] R^{c4} is H, OH, CN, halogen; alkyl, alkoxy, haloalkyl, in particular H, Br, OH and OCH_3 .

[0083] In a further embodiment of the compounds of the formula I, A, E and G are $C-R^c$ and M is N. These compounds correspond to the formula I.4



I.4

[0084] in which the groups R^{c1} , R^{c2} and R^{c3} each correspond to a group R^c and preferably have the following meanings:

[0085] R^{c1} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H;

[0086] R^{c2} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H; and

[0087] R^{c3} is H, OH, CN, halogen, alkyl, alkoxy, haloalkyl, in particular H, Br, OH and OCH_3 .

[0088] In one embodiment of the compounds of the formulae I.1, I.2, I.3 and I.4, at least one group R^{c1} , R^{c2} and R^{c3} is not hydrogen.

[0089] Particularly preferred aspects of the compounds of the formula I relate to those of each of the formulae I.1 to I.14 in which the variables have the meanings preferred for formula I.

[0090] In a first preferred embodiment of the invention, R^1 is $O-R^4$.

[0091] In a further preferred embodiment of the invention, R^1 is $S(O)_n-R^4$ where n is preferably 0 or 2, in particular 2.

[0092] In a further preferred embodiment, R^1 is $O-S(O)_n-R^4$ where n is preferably 0 or 2, in particular 2, such as, for example, $OS(O)_2-CH_3$, $OS(O)_2-C_2H_5$, $OS(O)_2-C_3H_7$, $OS(O)_2-C_6H_5$ or $OS(O)_2-(4-CH_3-C_6H_4)$.

[0093] In a further preferred embodiment, R^1 is $O-S(O)_n-NR'R''$ which has in particular the groups $NR'R''$ mentioned below as being preferred.

[0094] R^4 is in particular H, C_1-C_6 -alkylcarbonyl, such as $C(O)CH_3$, $C(O)CH_2CH_3$, $C(O)CH(CH_3)_2$ or $C(O)C(CH_3)_3$; C_1-C_6 -cycloalkylcarbonyl, such as cyclopropylcarbonyl, cyclopentylcarbonyl or cyclohexylcarbonyl; C_2-C_6 -alkenylcarbonyl, such as $C(O)CH=CH_2$ or $C(O)CH_2CH=CH_2$, optionally subst. benzoyl, such as $C(O)C_6H_5$, $C(O)[2-CH_3-C_6H_4]$, $C(O)[4-CH_3-C_6H_4]$, $C(O)[2-F-C_6H_4]$, $C(O)[4-F-C_6H_4]$, or optionally subst. heteroaryl, such as pyridine, which is attached via a carbonyl group. Particularly preferably, R^4 is H or C_1-C_6 -alkylcarbonyl.

[0095] More particularly preferably, R^4 is selected from the group consisting of H, OCH_3 , $C(O)CH_3$, $C(O)CH_2CH_3$, $C(O)CH(CH_3)_2$, $C(O)C(CH_3)_3$, $C(O)-c-C_3H_5$, $C(O)-C_6H_5$, $C(O)-CH_2C_6H_5$, $C(O)CH_2Cl$, $C(O)CF_3$, $C(O)CH_2OCH_3$, $C(O)N(CH_3)_2$ and $C(O)OCH_2CH_3$.

[0096] In a further preferred embodiment of the invention, R^4 is $NR'R''$.

[0097] In a further preferred embodiment of the invention, R^4 is $Z-NR^i-C(O)-NR'R''$, where R_i and R'' are as defined at the outset and preferably as defined below. In further embodiments, C_1 - C_4 -alkoxy, C_1 - C_4 -haloalkoxy and C_1 - C_4 -alkoxy- C_1 - C_4 -alkyl, in particular OCH_3 , OC_2H_5 , $CH_2CH_2OCH_3$ and CH_2CH_2Cl , may also be possible for R' and R'' , independently of one another.

[0098] R' and R'' are preferably C_1 - C_8 -alkyl, C_1 - C_4 -haloalkyl, $Z-C_3$ - C_6 -cycloalkyl, $Z-C_1$ - C_8 -alkoxy, $Z-C_1$ - C_8 -haloalkoxy, Z -phenyl, $Z-C(=O)-R^a$ or Z -hetaryl. Here, preference is given to CH_3 , C_2H_5 , n -propyl, $CH(CH_3)_2$, butyl, 2-chloroethyl, cyclopentyl, cyclohexyl, 2-ethoxymethyl, 2-chloroethoxy, phenyl, pyrimidines or triazines whose rings are unsubstituted or substituted. Here, preferred substituents are C_1 - C_4 -alkyl-carbonyl or C_1 - C_4 -haloalkyl-carbonyl, in particular $C(=O)-CH_3$, $C(=O)-C_2H_5$, $C(=O)-C_3H_7$, $C(=O)-CH(CH_3)_2$, butylcarbonyl and $C(=O)-CH_2Cl$. Particularly preferred aspects of the group $NR'R''$ are N (di- C_1 - C_4 -alkyl), in particular $N(CH_3)-C_1$ - C_4 -alkyl, such as $N(CH_3)_2$, $N(CH_3)CH_2CH_3$, $N(CH_3)C_3H_7$ and $N(CH_3)CH(CH_3)_2$.

[0099] Further particularly preferred aspects of $NR'R''$ are NH -aryl, where aryl is preferably phenyl which is substituted—in particular in the 2- and 6-position—by one to three identical or different halogen, CH_3 , halo- C_1 - C_2 -alkyl, halo- C_1 - C_2 -alkoxy and carboxyl groups, such as 2-Cl, 6-COOH- C_6H_3 , 2,6-Cl $_2$ - C_6H_3 , 2,6-F $_2$ - C_6H_3 , 2,6-Cl $_2$ 3- C_6H_2 , 2-CF $_3$, 6- CH_2CHF_2 - C_6H_3 , 2-CF $_3$, 6-OCF $_3$ - C_6H_3 and 2-CF $_3$, 6- CH_2CHF_2 - C_6H_3 .

[0100] Further preferred aspects of $NR'R''$ are NH -heteroaryl, where heteroaryl is preferably one of the preferred heteroaromatic groups below, in particular triazinyl, pyrimidinyl or triazolopyrimidinyl, such as [1,2,4]triazolo[1,5-a]pyrimidin-2-yl, which groups may be substituted, in particular by C_1 - C_4 -alkoxy and/or halogen. Particular preference is given to 5,7-dimethoxy-[1,2,4]triazolo[1,5-a]pyrimidin-2-yl, 5,7-diethoxy-[1,2,4]triazolo[1,5-a]pyrimidin-2-yl, 5-fluoro-7-methoxy-[1,2,4]triazolo[1,5-a]pyrimidin-2-yl and 5-fluoro-7-ethoxy-[1,2,4]triazolo[1,5-a]pyrimidin-2-yl.

[0101] In a further preferred embodiment of the invention, R^4 is a 5- or 6-membered heterocycle optionally substituted by R^b as defined above, which preferably has either 1, 2, 3 or 4 nitrogen atoms or 1 oxygen or 1 sulfur atom and if appropriate 1 or 2 nitrogen atoms as ring members and which is unsubstituted or may have 1 or 2 substituents selected from R^b . Preference is given to saturated or unsaturated groups attached via nitrogen, such as, for example:

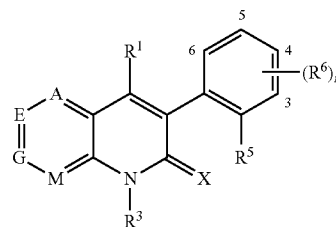
[0102] Heteroaromatic groups: pyridazin-3-yl, pyridazin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, pyrimidin-5-yl, pyrazin-2-yl, 2-furyl, 3-furyl, 2-thienyl, 3-thienyl, pyrazol-1-yl, pyrazol-3-yl, pyrazol-4-yl, isoxazol-3-yl, isoxazol-4-yl, isoxazol-5-yl, isothiazol-3-yl, isothiazol-4-yl, isothiazol-5-yl, imidazol-1-yl, imidazol-2-yl, imidazol-4-yl, oxazol-2-yl, oxazol-4-yl, oxazol-5-yl, thiazol-2-yl, thiazol-4-yl and thiazol-5-yl;

In another aspect, R^4 is a heteroaromatic group attached via carbon, such as pyrazol-3-yl, imidazol-5-yl, oxazol-2-yl, thiazol-2-yl, thiazol-4-yl, thiazol-5-yl, pyridin-2-yl, pyridin-3-yl, pyridin-4-yl, pyrimidin-2-yl, pyrimidin-4-yl, pyrimidin-5-yl, pyridazin-4-yl, pyrazin-2-yl, [1H]-tetrazol-5-yl and [2H]-tetrazol-5-yl, where each of the heterocycles mentioned here in an exemplary manner may have 1 or 2 substituents

selected from R^b . Preferred groups R^b are in particular F, Cl, CN, NO_2 , CH_3 , C_2H_5 , OCH_3 , OC_2H_5 , $OCHF_2$, OCF_3 and CF_3 .

[0103] In a further preferred aspect, R^2 is phenyl which is unsubstituted or partially or fully substituted by groups R^b . Particular preference is given to compounds in which a group R^b is located in the ortho-position. Such compounds of the formula I are described by the formula I.A:

I.A



[0104] In formula I.A, the index m is zero or an integer from one to four, preferably 0, 1 or 2, in particular 0 or 1. R^5 and R^6 are groups R^b as defined at the outset, preferably halogen, NO_2 , C_1 - C_4 -alkyl, C_1 - C_2 -haloalkyl and C_1 - C_4 -alkoxy. One group R^6 is preferably located in position 5. A group R^6 in position 3 is a further preferred embodiment.

[0105] Particularly preferably, R^5 is Br, F, NO_2 , CN, CH_3 , OCH_3 , CHF_2 or $OCHF_2$. R^6 is particularly preferably halogen or halomethyl, such as Cl, F or CF_3 . Especially preferably, $(R^6)_m$ is selected from the group consisting of 4-F, 5-F, 6-F, 4-CF $_3$, 5-CF $_3$ and 3,6-F $_2$.

[0106] In a preferred embodiment, X is O.

[0107] In a further embodiment, X is S.

[0108] In a further embodiment, X is NR^3 .

[0109] R^3 is preferably H, C_1 - C_6 -alkyl, such as CH_3 , C_2H_5 , n - C_3H_7 , $CH(CH_3)_2$, n - C_4H_9 , or $C(CH_3)_3$; C_3 - C_6 -cycloalkyl- C_1 - C_4 -alkyl, such as cyclopropylmethyl, C_3 - C_6 -alkenyl, such as $CH_2CH=CH_2$, $CH_2C(CH_3)=CH_2$, $CH_2CH_2CH=CH_2$, $CH_2CH_2C(CH_3)=CH_2$, $CH_2CH_2CH_2CH=CH_2$, $CH_2CH_2CH_2C(CH_3)=CH_2$, or optionally subst. phenyl, such as C_6H_5 , 4- CH_3 - C_6H_4 , 4-F- C_6H_4 or $S(O)_n-R^N$, where R^N is C_1 - C_6 -haloalkyl, such as CH_2CF_3 , CH_2CHF_2 . Particularly preferably, R^3 is H. If the compounds of the formula I have two groups R^3 , these groups can be identical or different. A preferred aspect of R^3 is CH_2CN , a further is $CH_2C_6H_5$. A further preferred aspect of R^3 is optionally substituted phenyl, such as C_6H_5 , 4- CH_3 - C_6H_4 , 4-F- C_6H_4 or $S(O)_n-R^N$, where R^N is C_1 - C_6 -haloalkyl, such as CH_2CF_3 , CH_2CHF_2 .

[0110] A further embodiment relates to the N-oxides of the compounds of the formula I.

[0111] A further embodiment relates to salts of the compounds of the formula I, in particular those which are obtainable by quaternization of the pyridine nitrogen atom, which may preferably take place by alkylation or arylation of the compounds of the formula I. Preferred salts of the compounds are thus the N-alkyl salts, in particular the N-methyl salts, and the N-phenyl salts.

[0112] In particular with a view to their use, preference is given to the compounds of the formula I compiled in the tables below, which compounds correspond to the formula I.1A. The groups mentioned for a substituent in the tables are

furthermore per se, independently of the combination in which they are mentioned, a particularly preferred aspect of the substituent in question.

[0113] One aspect relates to the compounds of tables 11 to 20 and 31 to 60, the compounds A-1 to A-14 and A-29 to A-341 of tables 21 to 30 and the compounds in which R¹ is a group attached via OS(O)₂—.

[0114] A further aspect relates to the compounds of tables 131 to 140 and 151 to 180, the compounds A-1 to A-14 and A-29 to A-341 of tables 141 to 150 and the compounds in which R¹ is a group attached via OS(O)₂—.

[0115] Table 1

Compounds of the formula I.1A in which X is O and R³ is H, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0116] Table 2

Compounds of the formula I.1A in which X is O and R³ is CH₃, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0117] Table 3

Compounds of the formula I.1A in which X is O and R³ is C₂H₅, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0118] Table 4

Compounds of the formula I.1A in which X is O and R³ is n-C₃H₇, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0119] Table 5

Compounds of the formula I.1A in which X is O and R³ is CH(CH₃)₂, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0120] Table 6

Compounds of the formula I.1A in which X is O and R³ is n-C₄H₉, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0121] Table 7

Compounds of the formula I.1A in which X is O and R³ is CH₂CH=CH₂, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0122] Table 8

Compounds of the formula I.1A in which X is O and R³ is CH₂C=CH, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0123] Table 9

Compounds of the formula I.1A in which X is O and R³ is CH₂CN, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0124] Table 10

Compounds of the formula I.1A in which X is O and R³ is CH₂C₆H₅, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0125] Table 11

Compounds of the formula I.1A in which X is O and R³ is H, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0126] Table 12

Compounds of the formula I.1A in which X is O and R³ is CH₃, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0127] Table 13

Compounds of the formula I.1A in which X is O and R³ is C₂H₅, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0128] Table 14

Compounds of the formula I.1A in which X is O and R³ is n-C₃H₇, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0129] Table 15

Compounds of the formula I.1A in which X is O and R³ is CH(CH₃)₂, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0130] Table 16

Compounds of the formula I.1A in which X is O and R³ is n-C₄H₉, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0131] Table 17

Compounds of the formula I.1A in which X is O and R³ is CH₂CH=CH₂, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0132] Table 18

Compounds of the formula I.1A in which X is O and R³ is CH₂C=CH, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0133] Table 19

Compounds of the formula I.1A in which X is O and R³ is CH₂CN, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0134] Table 20

Compounds of the formula I.1A in which X is O and R³ is CH₂C₆H₅, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0135] Table 21

Compounds of the formula I.1A in which X is O and R³ is H, (R⁶)_m is 4-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

Here, the compounds A-15 to A-28 are preferred embodiments.

[0136] Table 22

Compounds of the formula I.1A in which X is O and R³ is CH₃, (R⁶)_m is 4-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

Here, the compounds A-15 to A-28 are preferred embodiments.

[0137] Table 23

Compounds of the formula I.1A in which X is O and R³ is C₂H₅, (R⁶)_m is 4-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

Here, the compounds A-15 to A-28 are preferred embodiments.

[0138] Table 24

Compounds of the formula I.1A in which X is O and R³ is n-C₃H₇, (R⁶)_m is 4-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0167] Table 53

[0168] Table 54

[0169] Table 55

[0170] Table 56

[0171] Table 57

[0172] Table 58

[0173] Table 59

[0174] Table 60

[0175] Table 61

[0176] Table 62

[0177] Table 63

[0178] Table 64

[0179] Table 65

[0180] Table 66

[0181] Table 67

[0182] Table 68

[0183] Table 69

[0184] Table 70

[0185] Table 71

[0186] Table 72

[0187] Table 73

[0188] Table 74

[0189] Table 75

[0190] Table 76

[0191] Table 77

[0192] Table 78

[0193] Table 79

[0194] Table 80

[0195] Table 81

Compounds of the formula I.1A in which X is O and R³ is H, (R⁶)_m is 6-F and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0226] Table 112

[0227] Table 113

[0228] Table 114

[0229] Table 115

[0230] Table 116

[0231] Table 117

[0232] Table 118

[0233] Table 119

[0234] Table 120

A

Compounds of the formula I.1A in which X is S and R³ is H, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0236] Table 122

Compounds of the formula I.1A in which X is S and R³ is CH₃, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0237] Table 123

Compounds of the formula I.1A in which X is S and R³ is C₂H₅, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0238] Table 124

Compounds of the formula I.1A in which X is S and R³ is n-C₃H₇, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0239] Table 125

Compounds of the formula I.1A in which X is S and R³ is CH(CH₃)₂, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0240] Table 126

Compounds of the formula I.1A in which X is S and R³ is n-C₄H₉, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0241] Table 127

Compounds of the formula I.1A in which X is S and R³ is CH₂CH=CH₂, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0242] Table 128

Compounds of the formula I.1A in which X is S and R³ is CH₂C=CH, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0243] Table 129

Compounds of the formula I.1A in which X is S and R³ is CH₂CN, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0244] Table 130

Compounds of the formula I.1A in which X is S and R³ is CH₂C₆H₅, the index m in (R⁶)_m is zero and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0245] Table 131

Compounds of the formula I.1A in which X is S and R³ is H, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0246] Table 132

Compounds of the formula I.1A in which X is S and R³ is CH₃, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0247] Table 133

Compounds of the formula I.1A in which X is S and R³ is C₂H₅, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0248] Table 134

Compounds of the formula I.1A in which X is S and R³ is n-C₃H₇, (R⁶), is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0249] Table 135

Compounds of the formula I.1A in which X is S and R³ is CH(CH₃)₂, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0250] Table 136

Compounds of the formula I.1A in which X is S and R³ is n-C₄H₉, (R⁶)_m is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0251] Table 137

Compounds of the formula I.1A in which X is S and R³ is CH₂CH=CH₂, (R⁶), is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0252] Table 138

Compounds of the formula I.1A in which X is S and R³ is CH₂C=CH, (R⁶), is 3-Cl and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0309] Table 195

[0310] Table 196

[0311] Table 197

[0312] Table 198

[0313] Table 199

[0314] Table 200

[0315] Table 201

[0316] Table 202

[0317] Table 203

[0318] Table 204

[0319] Table 205

[0320] Table 206

[0321] Table 207

[0322] Table 208

Compounds of the formula I.1A in which X is S and R³ is CH₂C≡CH, (R⁶)_m is 6-F and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0323] Table 209

[0324] Table 210

[0325] Table 211

[0326] Table 212

[0327] Table 213

[0328] Table 214

[0329] Table 215

A

a compound corres

R⁵ for a compound
$$\text{CH}_2\text{C}\equiv\text{CH}, (\text{R}^6)_m$$

Compounds of the

Compounds of the

[0335] Table 221

[0336] Table 222

[0337] Table 223

Compounds of the formula I.1A in which X is S and R³ is C₂H₅, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0338] Table 224

Compounds of the formula I.1A in which X is S and R³ is n-C₃H₇, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0339] Table 225

Compounds of the formula I.1A in which X is S and R³ is CH(CH₃)₂, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0340] Table 226

Compounds of the formula I.1A in which X is S and R³ is n-C₄H₉, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0341] Table 227

Compounds of the formula I.1A in which X is S and R³ is CH₂CH=CH₂, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0342] Table 228

Compounds of the formula I.1A in which X is S and R³ is CH₂C≡CH, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0343] Table 229

Compounds of the formula I.1A in which X is S and R³ is CH₂CN, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0344] Table 230

Compounds of the formula I.1A in which X is S and R³ is CH₂C₆H₅, (R⁶)_m is 5-CF₃ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0345] Table 231

Compounds of the formula I.1A in which X is S and R³ is H, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0346] Table 232

Compounds of the formula I.1A in which X is S and R³ is CH₃, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0347] Table 233

Compounds of the formula I.1A in which X is S and R³ is C₂H₅, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0348] Table 234

Compounds of the formula I.1A in which X is S and R³ is n-C₃H₇, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0349] Table 235

Compounds of the formula I.1A in which X is S and R³ is CH(CH₃)₂, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0350] Table 236

Compounds of the formula I.1A in which X is S and R³ is n-C₄H₉, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0351] Table 237

Compounds of the formula I.1A in which X is S and R³ is CH₂CH=CH₂, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0352] Table 238

Compounds of the formula I.1A in which X is S and R³ is CH₂C≡CH, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

[0353] Table 239

Compounds of the formula I.1A in which X is S and R³ is CH₂CN, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

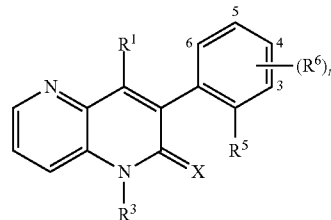
[0354] Table 240

Compounds of the formula I.1A in which X is S and R³ is CH₂C₆H₅, (R⁶)_m is 3,6-F₂ and the combination of R¹ and R⁵ for a compound corresponds in each case to one row of table A

TABLE A

Compounds of the formula I which correspond to the formula I.1A

I.1A



No.	R ¹	R ⁵
A-1	OH	Br
A-2	OCH ₃	Br
A-3	OC(O)CH ₃	Br
A-4	OC(O)CH ₂ CH ₃	Br
A-5	OC(O)CH(CH ₃) ₂	Br
A-6	OC(O)C(CH ₃) ₃	Br
A-7	OC(O)—c-C ₃ H ₅	Br
A-8	OC(O)—C ₆ H ₅	Br
A-9	OC(O)—CH ₂ C ₆ H ₅	Br
A-10	OC(O)CH ₂ Cl	Br
A-11	OC(O)—CF ₃	Br
A-12	OC(O)—CH ₂ OCH ₃	Br
A-13	OC(O)—N(CH ₃) ₂	Br
A-14	OC(O)—OCH ₂ CH ₃	Br
A-15	OS(O) ₂ —CH ₃	Br
A-16	OS(O) ₂ —C ₂ H ₅	Br
A-17	OS(O) ₂ —C ₃ H ₇	Br
A-18	OS(O) ₂ —CH(CH ₃) ₂	Br
A-19	OS(O) ₂ —C ₆ H ₅	Br
A-20	OS(O) ₂ —T1	Br
A-21	OS(O) ₂ —T2	Br
A-22	OS(O) ₂ —T3	Br
A-23	OS(O) ₂ —T4	Br
A-24	OS(O) ₂ —T5	Br
A-25	OS(O) ₂ —T6	Br
A-26	OS(O) ₂ —T7	Br
A-27	OS(O) ₂ —T8	Br
A-28	OS(O) ₂ —T9	Br
A-29	OS(O) ₂ —T10	Br
A-30	OS(O) ₂ —T11	Br
A-31	OS(O) ₂ —T12	Br
A-32	OH	Cl
A-33	OCH ₃	Cl
A-34	OC(O)CH ₃	Cl
A-35	OC(O)CH ₂ CH ₃	Cl
A-36	OC(O)CH(CH ₃) ₂	Cl
A-37	OC(O)C(CH ₃) ₃	Cl
A-38	OC(O)—c-C ₃ H ₅	Cl
A-39	OC(O)—C ₆ H ₅	Cl
A-40	OC(O)—CH ₂ C ₆ H ₅	Cl
A-41	OC(O)CH ₂ Cl	Cl
A-42	OC(O)—CF ₃	Cl

TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A		
No.	R ¹	R ⁵
A-43	OC(O)—CH ₂ OCH ₃	Cl
A-44	OC(O)—N(CH ₃) ₂	Cl
A-45	OC(O)—OCH ₂ CH ₃	Cl
A-46	OS(O) ₂ —CH ₃	Cl
A-47	OS(O) ₂ —C ₂ H ₅	Cl
A-48	OS(O) ₂ —C ₃ H ₇	Cl
A-49	OS(O) ₂ —CH(CH ₃) ₂	Cl
A-50	OS(O) ₂ —C ₆ H ₅	Cl
A-51	OS(O) ₂ —T1	Cl
A-52	OS(O) ₂ —T2	Cl
A-53	OS(O) ₂ —T3	Cl
A-54	OS(O) ₂ —T4	Cl
A-55	OS(O) ₂ —T5	Cl
A-56	OS(O) ₂ —T6	Cl
A-57	OS(O) ₂ —T7	Cl
A-58	OS(O) ₂ —T8	Cl
A-59	OS(O) ₂ —T9	Cl
A-60	OS(O) ₂ —T10	Cl
A-61	OS(O) ₂ —T11	Cl
A-62	OS(O) ₂ —T12	Cl
A-63	OH	F
A-64	OCH ₃	F
A-65	OC(O)CH ₃	F
A-66	OC(O)CH ₂ CH ₃	F
A-67	OC(O)CH(CH ₃) ₂	F
A-68	OC(O)C(CH ₃) ₃	F
A-69	OC(O)—c-C ₃ H ₅	F
A-70	OC(O)—C ₆ H ₅	F
A-71	OC(O)—CH ₂ C ₆ H ₅	F
A-72	OC(O)CH ₂ Cl	F
A-73	OC(O)—CF ₃	F
A-74	OC(O)—CH ₂ OCH ₃	F
A-75	OC(O)—N(CH ₃) ₂	F
A-76	OC(O)—OCH ₂ CH ₃	F
A-77	OS(O) ₂ —CH ₃	F
A-78	OS(O) ₂ —C ₂ H ₅	F
A-79	OS(O) ₂ —C ₃ H ₇	F
A-80	OS(O) ₂ —CH(CH ₃) ₂	F
A-81	OS(O) ₂ —C ₆ H ₅	F
A-82	OS(O) ₂ —T1	F
A-83	OS(O) ₂ —T2	F
A-84	OS(O) ₂ —T3	F
A-85	OS(O) ₂ —T4	F
A-86	OS(O) ₂ —T5	F
A-87	OS(O) ₂ —T6	F
A-88	OS(O) ₂ —T7	F
A-89	OS(O) ₂ —T8	F
A-90	OS(O) ₂ —T9	F
A-91	OS(O) ₂ —T10	F
A-92	OS(O) ₂ —T11	F
A-93	OS(O) ₂ —T12	F
A-94	OH	NO ₂
A-95	OCH ₃	NO ₂
A-96	OC(O)CH ₃	NO ₂
A-97	OC(O)CH ₂ CH ₃	NO ₂
A-98	OC(O)CH(CH ₃) ₂	NO ₂
A-99	OC(O)C(CH ₃) ₃	NO ₂
A-100	OC(O)—c-C ₃ H ₅	NO ₂
A-101	OC(O)—C ₆ H ₅	NO ₂

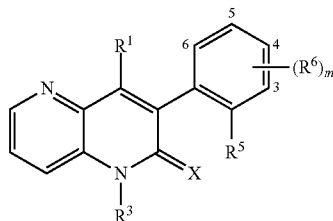
TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A		
No.	R ¹	R ⁵
A-102	OC(O)—CH ₂ C ₆ H ₅	NO ₂
A-103	OC(O)CH ₂ Cl	NO ₂
A-104	OC(O)—CF ₃	NO ₂
A-105	OC(O)—CH ₂ OCH ₃	NO ₂
A-106	OC(O)—N(CH ₃) ₂	NO ₂
A-107	OC(O)—OCH ₂ CH ₃	NO ₂
A-108	OS(O) ₂ —CH ₃	NO ₂
A-109	OS(O) ₂ —C ₂ H ₅	NO ₂
A-110	OS(O) ₂ —C ₃ H ₇	NO ₂
A-111	OS(O) ₂ —CH(CH ₃) ₂	NO ₂
A-112	OS(O) ₂ —C ₆ H ₅	NO ₂
A-113	OS(O) ₂ —T1	NO ₂
A-114	OS(O) ₂ —T2	NO ₂
A-115	OS(O) ₂ —T3	NO ₂
A-116	OS(O) ₂ —T4	NO ₂
A-117	OS(O) ₂ —T5	NO ₂
A-118	OS(O) ₂ —T6	NO ₂
A-119	OS(O) ₂ —T7	NO ₂
A-120	OS(O) ₂ —T8	NO ₂
A-121	OS(O) ₂ —T9	NO ₂
A-122	OS(O) ₂ —T10	NO ₂
A-123	OS(O) ₂ —T11	NO ₂
A-124	OS(O) ₂ —T12	NO ₂
A-125	OH	CN
A-126	OCH ₃	CN
A-127	OC(O)CH ₃	CN
A-128	OC(O)CH ₂ CH ₃	CN
A-129	OC(O)CH(CH ₃) ₂	CN
A-130	OC(O)C(CH ₃) ₃	CN
A-131	OC(O)—c-C ₃ H ₅	CN
A-132	OC(O)—C ₆ H ₅	CN
A-133	OC(O)—CH ₂ C ₆ H ₅	CN
A-134	OC(O)CH ₂ Cl	CN
A-135	OC(O)—CF ₃	CN
A-136	OC(O)—CH ₂ OCH ₃	CN
A-137	OC(O)—N(CH ₃) ₂	CN
A-138	OC(O)—OCH ₂ CH ₃	CN
A-139	OS(O) ₂ —CH ₃	CN
A-140	OS(O) ₂ —C ₂ H ₅	CN
A-141	OS(O) ₂ —C ₃ H ₇	CN
A-142	OS(O) ₂ —CH(CH ₃) ₂	CN
A-143	OS(O) ₂ —C ₆ H ₅	CN
A-144	OS(O) ₂ —T1	CN
A-145	OS(O) ₂ —T2	CN
A-146	OS(O) ₂ —T3	CN
A-147	OS(O) ₂ —T4	CN
A-148	OS(O) ₂ —T5	CN
A-149	OS(O) ₂ —T6	CN
A-150	OS(O) ₂ —T7	CN
A-151	OS(O) ₂ —T8	CN
A-152	OS(O) ₂ —T9	CN
A-153	OS(O) ₂ —T10	CN
A-154	OS(O) ₂ —T11	CN
A-155	OS(O) ₂ —T12	CN
A-156	OH	CH ₃
A-157	OCH ₃	CH ₃
A-158	OC(O)CH ₃	CH ₃
A-159	OC(O)CH ₂ CH ₃	CH ₃
A-160	OC(O)CH(CH ₃) ₂	CH ₃

TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A

I.1A

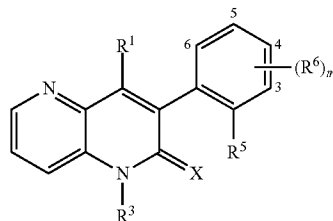


No.	R ¹	R ⁵
A-161	OC(O)C(CH ₃) ₃	CH ₃
A-162	OC(O)—c-C ₃ H ₅	CH ₃
A-163	OC(O)—C ₆ H ₅	CH ₃
A-164	OC(O)—CH ₂ C ₆ H ₅	CH ₃
A-165	OC(O)CH ₂ Cl	CH ₃
A-166	OC(O)—CF ₃	CH ₃
A-167	OC(O)—CH ₂ OCH ₃	CH ₃
A-168	OC(O)—N(CH ₃) ₂	CH ₃
A-169	OC(O)—OCH ₂ CH ₃	CH ₃
A-170	OS(O) ₂ —CH ₃	CH ₃
A-171	OS(O) ₂ —C ₂ H ₅	CH ₃
A-172	OS(O) ₂ —C ₃ H ₇	CH ₃
A-173	OS(O) ₂ —CH(CH ₃) ₂	CH ₃
A-174	OS(O) ₂ —C ₆ H ₅	CH ₃
A-175	OS(O) ₂ —T1	CH ₃
A-176	OS(O) ₂ —T2	CH ₃
A-177	OS(O) ₂ —T3	CH ₃
A-178	OS(O) ₂ —T4	CH ₃
A-179	OS(O) ₂ —T5	CH ₃
A-180	OS(O) ₂ —T6	CH ₃
A-181	OS(O) ₂ —T7	CH ₃
A-182	OS(O) ₂ —T8	CH ₃
A-183	OS(O) ₂ —T9	CH ₃
A-184	OS(O) ₂ —T10	CH ₃
A-185	OS(O) ₂ —T11	CH ₃
A-186	OS(O) ₂ —T12	CH ₃
A-187	OH	OCH ₃
A-188	OCH ₃	OCH ₃
A-189	OC(O)CH ₃	OCH ₃
A-190	OC(O)CH ₂ CH ₃	OCH ₃
A-191	OC(O)CH(CH ₃) ₂	OCH ₃
A-192	OC(O)C(CH ₃) ₃	OCH ₃
A-193	OC(O)—c-C ₃ H ₅	OCH ₃
A-194	OC(O)—C ₆ H ₅	OCH ₃
A-195	OC(O)—CH ₂ C ₆ H ₅	OCH ₃
A-196	OC(O)CH ₂ Cl	OCH ₃
A-197	OC(O)—CF ₃	OCH ₃
A-198	OC(O)—CH ₂ OCH ₃	OCH ₃
A-199	OC(O)—N(CH ₃) ₂	OCH ₃
A-200	OC(O)—OCH ₂ CH ₃	OCH ₃
A-201	OS(O) ₂ —CH ₃	OCH ₃
A-202	OS(O) ₂ —C ₂ H ₅	OCH ₃
A-203	OS(O) ₂ —C ₃ H ₇	OCH ₃
A-204	OS(O) ₂ —CH(CH ₃) ₂	OCH ₃
A-205	OS(O) ₂ —C ₆ H ₅	OCH ₃
A-206	OS(O) ₂ —T1	OCH ₃
A-207	OS(O) ₂ —T2	OCH ₃
A-208	OS(O) ₂ —T3	OCH ₃
A-209	OS(O) ₂ —T4	OCH ₃
A-210	OS(O) ₂ —T5	OCH ₃
A-211	OS(O) ₂ —T6	OCH ₃
A-212	OS(O) ₂ —T7	OCH ₃
A-213	OS(O) ₂ —T8	OCH ₃
A-214	OS(O) ₂ —T9	OCH ₃
A-215	OS(O) ₂ —T10	OCH ₃
A-216	OS(O) ₂ —T11	OCH ₃
A-217	OS(O) ₂ —T12	OCH ₃
A-218	OH	CHF ₂
A-219	OCH ₃	CHF ₂

TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A

I.1A



No.	R ¹	R ⁵
A-220	OC(O)CH ₃	CHF ₂
A-221	OC(O)CH ₂ CH ₃	CHF ₂
A-222	OC(O)CH(CH ₃) ₂	CHF ₂
A-223	OC(O)C(CH ₃) ₃	CHF ₂
A-224	OC(O)—c-C ₃ H ₅	CHF ₂
A-225	OC(O)—C ₆ H ₅	CHF ₂
A-226	OC(O)—CH ₂ C ₆ H ₅	CHF ₂
A-227	OC(O)CH ₂ Cl	CHF ₂
A-228	OC(O)—CF ₃	CHF ₂
A-229	OC(O)—CH ₂ OCH ₃	CHF ₂
A-230	OC(O)—N(CH ₃) ₂	CHF ₂
A-231	OC(O)—OCH ₂ CH ₃	CHF ₂
A-232	OS(O) ₂ —CH ₃	CHF ₂
A-233	OS(O) ₂ —C ₂ H ₅	CHF ₂
A-234	OS(O) ₂ —C ₃ H ₇	CHF ₂
A-235	OS(O) ₂ —CH(CH ₃) ₂	CHF ₂
A-236	OS(O) ₂ —C ₆ H ₅	CHF ₂
A-237	OS(O) ₂ —T1	CHF ₂
A-238	OS(O) ₂ —T2	CHF ₂
A-239	OS(O) ₂ —T3	CHF ₂
A-240	OS(O) ₂ —T4	CHF ₂
A-241	OS(O) ₂ —T5	CHF ₂
A-242	OS(O) ₂ —T6	CHF ₂
A-243	OS(O) ₂ —T7	CHF ₂
A-244	OS(O) ₂ —T8	CHF ₂
A-245	OS(O) ₂ —T9	CHF ₂
A-246	OS(O) ₂ —T10	CHF ₂
A-247	OS(O) ₂ —T11	CHF ₂
A-248	OS(O) ₂ —T12	CHF ₂
A-249	OH	CF ₃
A-250	OCH ₃	CF ₃
A-251	OC(O)CH ₃	CF ₃
A-252	OC(O)CH ₂ CH ₃	CF ₃
A-253	OC(O)CH(CH ₃) ₂	CF ₃
A-254	OC(O)C(CH ₃) ₃	CF ₃
A-255	OC(O)—c-C ₃ H ₅	CF ₃
A-256	OC(O)—C ₆ H ₅	CF ₃
A-257	OC(O)—CH ₂ C ₆ H ₅	CF ₃
A-258	OC(O)CH ₂ Cl	CF ₃
A-259	OC(O)—CF ₃	CF ₃
A-260	OC(O)—CH ₂ OCH ₃	CF ₃
A-261	OC(O)—N(CH ₃) ₂	CF ₃
A-262	OC(O)—OCH ₂ CH ₃	CF ₃
A-263	OS(O) ₂ —CH ₃	CF ₃
A-264	OS(O) ₂ —C ₂ H ₅	CF ₃
A-265	OS(O) ₂ —C ₃ H ₇	CF ₃
A-266	OS(O) ₂ —CH(CH ₃) ₂	CF ₃
A-267	OS(O) ₂ —C ₆ H ₅	CF ₃
A-268	OS(O) ₂ —T1	CF ₃
A-269	OS(O) ₂ —T2	CF ₃
A-270	OS(O) ₂ —T3	CF ₃
A-271	OS(O) ₂ —T4	CF ₃
A-272	OS(O) ₂ —T5	CF ₃
A-273	OS(O) ₂ —T6	CF ₃
A-274	OS(O) ₂ —T7	CF ₃
A-275	OS(O) ₂ —T8	CF ₃
A-276	OS(O) ₂ —T9	CF ₃
A-277	OS(O) ₂ —T10	CF ₃
A-278	OS(O) ₂ —T11	CF ₃

TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A

No.	R ¹	R ⁵
A-279	OS(O) ₂ —T12	CF ₃
A-280	OH	OCHF ₂
A-281	OCH ₃	OCHF ₂
A-282	OC(O)CH ₃	OCHF ₂
A-283	OC(O)CH ₂ CH ₃	OCHF ₂
A-284	OC(O)CH(CH ₃) ₂	OCHF ₂
A-285	OC(O)C(CH ₃) ₃	OCHF ₂
A-286	OC(O)—c-C ₃ H ₅	OCHF ₂
A-287	OC(O)—C ₆ H ₅	OCHF ₂
A-288	OC(O)—CH ₂ C ₆ H ₅	OCHF ₂
A-289	OC(O)CH ₂ Cl	OCHF ₂
A-290	OC(O)—CF ₃	OCHF ₂
A-291	OC(O)—CH ₂ OCH ₃	OCHF ₂
A-292	OC(O)—N(CH ₃) ₂	OCHF ₂
A-293	OC(O)—OCH ₂ CH ₃	OCHF ₂
A-294	OS(O) ₂ —CH ₃	OCHF ₂
A-295	OS(O) ₂ —C ₂ H ₅	OCHF ₂
A-296	OS(O) ₂ —C ₃ H ₇	OCHF ₂
A-297	OS(O) ₂ —CH(CH ₃) ₂	OCHF ₂
A-298	OS(O) ₂ —C ₆ H ₅	OCHF ₂
A-299	OS(O) ₂ —T1	OCHF ₂
A-300	OS(O) ₂ —T2	OCHF ₂
A-301	OS(O) ₂ —T3	OCHF ₂
A-302	OS(O) ₂ —T4	OCHF ₂
A-303	OS(O) ₂ —T5	OCHF ₂
A-304	OS(O) ₂ —T6	OCHF ₂
A-305	OS(O) ₂ —T7	OCHF ₂
A-306	OS(O) ₂ —T8	OCHF ₂
A-307	OS(O) ₂ —T9	OCHF ₂
A-308	OS(O) ₂ —T10	OCHF ₂
A-309	OS(O) ₂ —T11	OCHF ₂
A-310	OS(O) ₂ —T12	OCHF ₂
A-311	OH	OCF ₃
A-312	OCH ₃	OCF ₃
A-313	OC(O)CH ₃	OCF ₃
A-314	OC(O)CH ₂ CH ₃	OCF ₃
A-315	OC(O)CH(CH ₃) ₂	OCF ₃
A-316	OC(O)C(CH ₃) ₃	OCF ₃
A-317	OC(O)—c-C ₃ H ₅	OCF ₃
A-318	OC(O)—C ₆ H ₅	OCF ₃
A-319	OC(O)—CH ₂ C ₆ H ₅	OCF ₃
A-320	OC(O)CH ₂ Cl	OCF ₃
A-321	OC(O)—CF ₃	OCF ₃
A-322	OC(O)—CH ₂ OCH ₃	OCF ₃
A-323	OC(O)—N(CH ₃) ₂	OCF ₃
A-324	OC(O)—OCH ₂ CH ₃	OCF ₃
A-325	OS(O) ₂ —CH ₃	OCF ₃
A-326	OS(O) ₂ —C ₂ H ₅	OCF ₃
A-327	OS(O) ₂ —C ₃ H ₇	OCF ₃
A-328	OS(O) ₂ —CH(CH ₃) ₂	OCF ₃
A-329	OS(O) ₂ —C ₆ H ₅	OCF ₃
A-330	OS(O) ₂ —T1	OCF ₃
A-331	OS(O) ₂ —T2	OCF ₃
A-332	OS(O) ₂ —T3	OCF ₃
A-333	OS(O) ₂ —T4	OCF ₃
A-334	OS(O) ₂ —T5	OCF ₃
A-335	OS(O) ₂ —T6	OCF ₃
A-336	OS(O) ₂ —T7	OCF ₃
A-337	OS(O) ₂ —T8	OCF ₃

I.1A

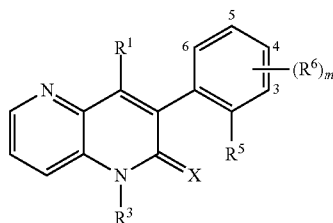
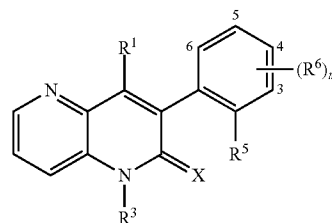


TABLE A-continued

Compounds of the formula I which correspond to the formula I.1A

No.	R ¹	R ⁵
A-338	OS(O) ₂ —T9	OCF ₃
A-339	OS(O) ₂ —T10	OCF ₃
A-340	OS(O) ₂ —T11	OCF ₃
A-341	OS(O) ₂ —T12	OCF ₃

I.1A



T1 = 4-CH₃—C₆H₄
 T2 = N(CH₃)₂
 T3 = N(CH₃)CH₂CH₃
 T4 = N(CH₃)C₃H₇
 T5 = N(CH₃)CH(CH₃)₂
 T6 = 2-Cl, 6-COOH—C₆H₃
 T7 = 2,6-Cl₂—C₆H₃
 T8 = 2,6-F₂—C₆H₃
 T9 = 2,6-Cl₂, 3-CH₃—C₆H₂
 T10 = 2-CF₃, 6-CH₂CHF₂—C₆H₃
 T11 = 2-CF₃, 6-OCF₃—C₆H₃
 T12 = 2-CF₃, 6-OCH₂CHF₂—C₆H₃

[0355] The compounds I and their agriculturally useful salts are suitable, both as isomer mixtures and in the form of the pure isomers, as herbicides. They are suitable as such or as an appropriately formulated composition. The herbicidal compositions comprising the compound I, in particular the preferred aspects thereof, control vegetation on non-crop areas very efficiently, especially at high rates of application. They act against broad-leaved weeds and weed grasses in crops such as wheat, rice, corn, soybeans and cotton without causing any significant damage to the crop plants. This effect is mainly observed at low rates of application.

[0356] Depending on the application method in question, the compounds I, in particular the preferred aspects thereof, or compositions comprising them can additionally be employed in a further number of crop plants for eliminating unwanted plants. Examples of suitable crops are the following:

[0357] *Allium cepa*, *Ananas comosus*, *Arachis hypogaea*, *Asparagus officinalis*, *Avena sativa*, *Beta vulgaris* spec. altissima, *Beta vulgaris* spec. rapa, *Brassica napus* var. napus, *Brassica napus* var. napobrassica, *Brassica rapa* var. silvestris, *Brassica oleracea*, *Brassica nigra*, *Camellia sinensis*, *Carthamus tinctorius*, *Carya illinoensis*, *Citrus limon*, *Citrus sinensis*, *Coffea arabica* (*Coffea canephora*, *Coffea liberica*), *Cucumis sativus*, *Cynodon dactylon*, *Daucus carota*, *Elaeis guineensis*, *Fragaria vesca*, *Glycine max*, *Gossypium hirsutum*, (*Gossypium arboreum*, *Gossypium herbaceum*, *Gossypium vitifolium*), *Helianthus annuus*, *Hevea brasiliensis*, *Hordeum vulgare*, *Humulus lupulus*, *Ipomoea batatas*, *Juglans regia*, *Lens culinaris*, *Linum usitatissimum*, *Lycopersicon lycopersicum*, *Malus* spec., *Manihot esculenta*, *Medicago sativa*, *Musa* spec., *Nicotiana tabacum* (*N. rustica*), *Olea europaea*, *Oryza sativa*, *Phaseolus lunatus*, *Phaseolus vulgaris*, *Picea abies*, *Pinus* spec., *Pistacia vera*,

Pisum sativum, *Prunus avium*, *Prunus persica*, *Pyrus communis*, *Prunus armeniaca*, *Prunus cerasus*, *Prunus dulcis* and *Prunus domestica*, *Ribes sylvestre*, *Ricinus communis*, *Saccharum officinarum*, *Secale cereale*, *Sinapis alba*, *Solanum tuberosum*, *Sorghum bicolor* (*S. vulgare*), *Theobroma cacao*, *Trifolium pratense*, *Triticum aestivum*, *Triticale*, *Triticum durum*, *Vicia faba*, *Vitis vinifera*, *Zea mays*.

[0358] The term “crop plants” also includes plants which have been modified by breeding, mutagenesis or genetic engineering. Genetically modified plants are plants whose genetic material has been modified in a manner which does not occur under natural conditions by crossing, mutations or natural recombination (i.e. reassembly of the genetic information). Here, in general, one or more genes are integrated into the genetic material of the plant to improve the properties of the plant.

[0359] Accordingly, the term “crop plants” also includes plants which, by breeding and genetic engineering, have acquired tolerance to certain classes of herbicides, such as hydroxyphenylpyruvate dioxygenase (HPPD) inhibitors, acetolactate synthase (ALS) inhibitors, such as, for example, sulfonylureas (EP-A-0257993, U.S. Pat. No. 5,013,659) or imidazolinones (see, for example, U.S. Pat. No. 6,222,100, WO 01/82685, WO 00/26390, WO 97/41218, WO 98/02526, WO 98/02527, WO 04/106529, WO 05/20673, WO 03/14357, WO 03/13225, WO 03/14356, WO 04/16073), enolpyruvylshikimate 3-phosphate synthase (EPSPS) inhibitors, such as, for example, glyphosate (see, for example, WO 92/00377), glutamine synthetase (GS) inhibitors, such as, for example, glufosinate (see, for example, EP-A-0242236, EP-A-242246), or oxynil herbicides (see, for example, U.S. Pat. No. 5,559,024).

[0360] Numerous crop plants, for example Clearfield® oilseed rape, tolerant to imidazolinones, for example imazamox, have been generated with the aid of classic breeding methods (mutagenesis). Crop plants such as soybeans, cotton, corn, beet and oilseed rape, resistant to glyphosate or glufosinate, which are available under the tradenames RoundupReady® (glyphosate) and Liberty Link® (glufosinate) have been generated with the aid of genetic engineering methods.

[0361] Accordingly, the term “crop plants” also includes plants which, with the aid of genetic engineering, produce one or more toxins, for example those of the bacterial strain *Bacillus* spp. Toxins which are produced by such genetically modified plants include, for example, insecticidal proteins of *Bacillus* spp., in particular *B. thuringiensis*, such as the endotoxins Cry1Ab, Cry1Ac, Cry1F, Cry1Fa2, Cry2Ab, Cry3A, Cry3Bb1, Cry9c, Cry34Ab1 or Cry35Ab1; or vegetative insecticidal proteins (VIPs), for example VIP1, VIP2, VIP3, or VIP3A; insecticidal proteins of nematode-colonizing bacteria, for example *Photorhabdus* spp. or *Xenorhabdus* spp.; toxins of animal organisms, for example wasp, spider or scorpion toxins; fungal toxins, for example from Streptomycetes; plant lectins, for example from peas or barley; agglutinins; proteinase inhibitors, for example trypsin inhibitors, serine protease inhibitors, patatin, cystatin or papain inhibitors, ribosome-inactivating proteins (RIPs), for example ricin, corn-RIP, abrin, luffin, saporin or bryodin; steroid-metabolizing enzymes, for example 3-hydroxysteroid oxidase, ecdysteroid-IDP glycosyl transferase, cholesterol oxidase, ecdysone inhibitors, or HMG-CoA reductase; ion channel blockers, for example inhibitors of sodium channels or calcium channels; juvenile hormone esterase; receptors of the diuretic hormone (helicokinin receptors); stilbene

synthase, bibenzyl synthase, chitinases and glucanases. In the plants, these toxins may also be produced as pretoxins, hybrid proteins or truncated or otherwise modified proteins. Hybrid proteins are characterized by a novel combination of different protein domains (see, for example, WO 2002/015701). Further examples of such toxins or genetically modified plants which produce these toxins are disclosed in EP-A 374 753, WO 93/007278; WO 95/34656, EP-A 427 529, EP-A 451 878, WO 03/018810 and WO 03/052073. The methods for producing these genetically modified plants are known to the person skilled in the art and disclosed, for example, in the publications mentioned above. Numerous of the toxins mentioned above bestow, upon the plants by which they are produced, tolerance to pests from all taxonomic classes of arthropods, in particular to beetles (Coeleroptera), dipterans (Diptera) and butterflies (Lepidoptera) and to nematodes (Nematoda).

[0362] Genetically modified plants which produce one or more genes coding for insecticidal toxins are described, for example, in the publications mentioned above, and some of them are commercially available, such as, for example, Yield-Gard® (corn varieties producing the toxin Cry1Ab), Yield-Gard® Plus (corn varieties which produce the toxins Cry1Ab and Cry3Bb1), Starlink® (corn varieties which produce the toxin Cry9c), Herculex® RW (corn varieties which produce the toxins Cry34Ab1, Cry35Ab1 and the enzyme phosphinothricin-N-acetyltransferase [PAT]); NuCOTN® 33B (cotton varieties which produce the toxin Cry1Ac), Bollgard® I (cotton varieties which produce the toxin Cry1Ac), Bollgard® II (cotton varieties which produce the toxins Cry1Ac and Cry2Ab2); VIPCOT® (cotton varieties which produce a VIP toxin); NewLeaf® (potato varieties which produce the toxin Cry3A); Bt-Xtra®, NatureGard®, KnockOut®, BiteGard®, Protecta®, Bt11 (for example Agrisure® CB) and Bt176 from Syngenta Seeds SAS, France (corn varieties which produce the toxin Cry1Ab and the PAT enzyme), MIR604 from Syngenta Seeds SAS, France (corn varieties which produce a modified version of the toxin Cry3A, see WO 03/018810), MON 863 from Monsanto Europe S.A., Belgium (corn varieties which produce the toxin Cry3Bb1), IPC 531 from Monsanto Europe S.A., Belgium (cotton varieties which produce a modified version of the toxin Cry1Ac) and 1507 from Pioneer Overseas Corporation, Belgium (corn varieties which produce the toxin Cry1F and the PAT enzyme).

[0363] Accordingly, the term “crop plants” also includes plants which, with the aid of genetic engineering, produce one or more proteins which are more robust or have increased resistance to bacterial, viral or fungal pathogens, such as, for example, pathogenesis-related proteins (PR proteins, see EP-A 0 392 225), resistance proteins (for example potato varieties producing two resistance genes against *Phytophthora infestans* from the wild Mexican potato *Solanum bulbocastanum*) or T4 lysozyme (for example potato cultivars which, by producing this protein, are resistant to bacteria such as *Erwinia amylovora*).

[0364] Accordingly, the term “crop plants” also includes plants whose productivity has been improved with the aid of genetic engineering methods, for example by enhancing the potential yield (for example biomass, grain yield, starch, oil or protein content), tolerance to drought, salt or other limiting environmental factors or resistance to pests and fungal, bacterial and viral pathogens.

[0365] The term “crop plants” also includes plants whose ingredients have been modified with the aid of genetic engineering methods in particular for improving human or animal

diet, for example by oil plants producing health-promoting long-chain omega 3 fatty acids or monounsaturated omega 9 fatty acids (for example Nexera® oilseed rape).

[0366] The term "crop plants" also includes plants which have been modified with the aid of genetic engineering methods for improving the production of raw materials, for example by increasing the amylopectin content of potatoes (Amflora® potato).

[0367] Furthermore, it has been found that the compounds of the formula I are also suitable for the defoliation and/or desiccation of plant parts, for which crop plants such as cotton, potato, oilseed rape, sunflower, soybean or field beans, in particular cotton, are suitable. In this regard, there have been found compositions for the desiccation and/or defoliation of plants, processes for preparing these compositions and methods for desiccating and/or defoliating plants using the compounds of the formula I.

[0368] As desiccants, the compounds of the formula I are particularly suitable for desiccating the above-ground parts of crop plants such as potato, oilseed rape, sunflower and soybean, but also cereals. This makes possible the fully mechanical harvesting of these important crop plants.

[0369] Also of economic interest is to facilitate harvesting, which is made possible by concentrating within a certain period of time the dehiscence, or reduction of adhesion to the tree, in citrus fruit, olives and other species and varieties of pomaceous fruit, stone fruit and nuts. The same mechanism, i.e. the promotion of the development of abscission tissue between fruit part or leaf part and shoot part of the plants is also essential for the readily controllable defoliation of useful plants, in particular cotton.

[0370] Moreover, a shortening of the time interval in which the individual cotton plants mature leads to an increased fiber quality after harvesting.

[0371] The compounds I, or the herbicidal compositions comprising the compounds I, can be used, for example, in the form of ready-to-spray aqueous solutions, powders, suspensions, also highly concentrated aqueous, oily or other suspensions or dispersions, emulsions, oil dispersions, pastes, dusts, materials for broadcasting, or granules, by means of spraying, atomizing, dusting, spreading, watering or treatment of the seed or mixing with the seed. The use forms depend on the intended purpose; in each case, they should ensure the finest possible distribution of the active ingredients according to the invention.

[0372] The herbicidal compositions comprise a herbicidally effective amount of at least one compound of the formula I or an agriculturally useful salt of I, and auxiliaries which are customary for the formulation of crop protection agents.

[0373] Examples of auxiliaries customary for the formulation of crop protection agents are inert auxiliaries, solid carriers, surfactants (such as dispersants, protective colloids, emulsifiers, wetting agents and tackifiers), organic and inorganic thickeners, bactericides, antifreeze agents, antifoams, if appropriate colorants and, for seed formulations, adhesives.

[0374] Examples of thickeners (i.e. compounds which impart to the formulation modified flow properties, i.e. high viscosity in the state of rest and low viscosity in motion) are polysaccharides, such as xanthan gum (Kelzan® from Kelco), Rhodopol® 23 (Rhône Poulenc) or Veegum® (from R.T. Vanderbilt), and also organic and inorganic sheet minerals, such as Attaclay® (from Engelhardt).

[0375] Examples of antifoams are silicone emulsions (such as, for example, Silikon® SRE, Wacker or Rhodorsil® from

Rhodia), long-chain alcohols, fatty acids, salts of fatty acids, organofluorine compounds and mixtures thereof.

[0376] Bactericides can be added for stabilizing the aqueous herbicidal formulation. Examples of bactericides are bactericides based on dichlorophen and benzyl alcohol hemiformal (Proxel® from ICI or Acticide® RS from Thor Chemie and Kathon® MK from Rohm & Haas), and also isothiazolinone derivatives, such as alkylisothiazolinones and benzisothiazolinones (Acticide MBS from Thor Chemie).

[0377] Examples of antifreeze agents are ethylene glycol, propylene glycol, urea or glycerol.

[0378] Examples of colorants are both sparingly water-soluble pigments and water-soluble dyes. Examples which may be mentioned are the dyes known under the names Rhodamin B, C.I. Pigment Red 112 and C.I. Solvent Red 1, and also pigment blue 15:4, pigment blue 15:3, pigment blue 15:2, pigment blue 15:1, pigment blue 80, pigment yellow 1, pigment yellow 13, pigment red 112, pigment red 48:2, pigment red 48:1, pigment red 57:1, pigment red 53:1, pigment orange 43, pigment orange 34, pigment orange 5, pigment green 36, pigment green 7, pigment white 6, pigment brown 25, basic violet 10, basic violet 49, acid red 51, acid red 52, acid red 14, acid blue 9, acid yellow 23, basic red 10, basic red 108.

[0379] Examples of adhesives are polyvinylpyrrolidone, polyvinyl acetate, polyvinyl alcohol and tylose.

[0380] Suitable inert auxiliaries are, for example, the following:

[0381] mineral oil fractions of medium to high boiling point, such as kerosene and diesel oil, furthermore coal tar oils and oils of vegetable or animal origin, aliphatic, cyclic and aromatic hydrocarbons, for example paraffin, tetrahydronaphthalene, alkylated naphthalenes and their derivatives, alkylated benzenes and their derivatives, alcohols such as methanol, ethanol, propanol, butanol and cyclohexanol, ketones such as cyclohexanone or strongly polar solvents, for example amines such as N-methylpyrrolidone, and water.

[0382] Solid carriers are mineral earths such as silicas, silica gels, silicates, talc, kaolin, limestone, lime, chalk, bole, loess, clay, dolomite, diatomaceous earth, calcium sulfate, magnesium sulfate and magnesium oxide, ground synthetic materials, fertilizers such as ammonium sulfate, ammonium phosphate, ammonium nitrate and ureas, and products of vegetable origin, such as cereal meal, tree bark meal, wood meal and nutshell meal, cellulose powders, or other solid carriers.

[0383] Suitable surfactants (adjuvants, wetting agents, tackifiers, dispersants and also emulsifiers) are the alkali metal salts, alkaline earth metal salts and ammonium salts of aromatic sulfonic acids, for example lignosulfonic acids (e.g. Borrespers-types, Borregaard), phenolsulfonic acids, naphthalenesulfonic acids (Morwet types, Akzo Nobel) and dibutyl-naphthalenesulfonic acid (Nekal types, BASF SE), and of fatty acids, alkyl- and alkylarylsulfonates, alkyl sulfates, lauryl ether sulfates and fatty alcohol sulfates, and salts of sulfated hexa-, hepta- and octadecanols, and also of fatty alcohol glycol ethers, condensates of sulfonated naphthalene and its derivatives with formaldehyde, condensates of naphthalene or of the naphthalenesulfonic acids with phenol and formaldehyde, polyoxyethylene octylphenol ether, ethoxylated isooctyl-, octyl- or nonylphenol, alkylphenyl or tributylphenyl polyglycol ether, alkylaryl polyether alcohols, isotridecyl alcohol, fatty alcohol/ethylene oxide condensates, ethoxylated castor oil, polyoxyethylene alkyl ethers or polyoxypro-

pylene alkyl ethers, lauryl alcohol polyglycol ether acetate, sorbitol esters, lagnosulfite waste liquors and proteins, denatured proteins, polysaccharides (e.g. methylcellulose), hydrophobically modified starches, polyvinyl alcohol (Mowiol types Clariant), polycarboxylates (BASF SE, Sokalan types), polyalkoxylates, polyvinylamine (BASF SE, Lupamine types), polyethyleneimine (BASF SE, Lupasol types), polyvinylpyrrolidone and copolymers thereof.

[0384] Powders, materials for broadcasting and dusts can be prepared by mixing or grinding the active ingredients together with a solid carrier.

[0385] Granules, for example coated granules, impregnated granules and homogeneous granules, can be prepared by binding the active ingredients to solid carriers.

[0386] Aqueous use forms can be prepared from emulsion concentrates, suspensions, pastes, wettable powders or water-dispersible granules by adding water. To prepare emulsions, pastes or oil dispersions, the compounds of the formula I or Ia, either as such or dissolved in an oil or solvent, can be homogenized in water by means of a wetting agent, tackifier, dispersant or emulsifier. Alternatively, it is also possible to prepare concentrates comprising active substance, wetting agent, tackifier, dispersant or emulsifier and, if desired, solvent or oil, which are suitable for dilution with water.

[0387] The concentrations of the compounds of the formula I in the ready-to-use preparations can be varied within wide ranges. In general, the formulations comprise from 0.001 to 98% by weight, preferably 0.01 to 95% by weight of at least one active compound. The active compounds are employed in a purity of from 90% to 100%, preferably 95% to 100% (according to NMR spectrum).

[0388] The compounds I of the invention can for example be formulated as follows:

[0389] 1. Products for Dilution with Water

[0390] A Water-Soluble Concentrates

[0391] 10 parts by weight of active compound are dissolved in 90 parts by weight of water or a water-soluble solvent. As an alternative, wetters or other adjuvants are added. The active compound dissolves upon dilution with water. This gives a formulation with an active compound content of 10% by weight.

[0392] B Dispersible Concentrates

[0393] 20 parts by weight of active compound are dissolved in 70 parts by weight of cyclohexanone with addition of 10 parts by weight of a dispersant, for example polyvinylpyrrolidone. Dilution with water gives a dispersion. The active compound content is 20% by weight.

[0394] C Emulsifiable Concentrates

[0395] 15 parts by weight of active compound are dissolved in 75 parts by weight of an organic solvent (e.g. alkylaromatics) with addition of calcium dodecylbenzenesulfonate and castor oil ethoxylate (in each case 5 parts by weight). Dilution with water gives an emulsion. The formulation has an active compound content of 15% by weight.

[0396] D Emulsions

[0397] 25 parts by weight of active compound are dissolved in 35 parts by weight of an organic solvent (e.g. alkylaromatics) with addition of calcium dodecylbenzenesulfonate and castor oil ethoxylate (in each case 5 parts by weight). This mixture is introduced into 30 parts by weight of water by means of an emulsifier (e.g. Ultraturax) and made into a homogeneous emulsion. Dilution with water gives an emulsion. The formulation has an active compound content of 25% by weight.

[0398] E Suspensions

[0399] In an agitated ball mill, 20 parts by weight of active compound are comminuted with addition of 10 parts by weight of dispersants and wetters and 70 parts by weight of water or an organic solvent to give a fine active compound suspension. Dilution with water gives a stable suspension of the active compound. The active compound content in the formulation is 20% by weight.

[0400] F Water-Dispersible Granules and Water-Soluble Granules

[0401] 50 parts by weight of active compound are ground finely with addition of 50 parts by weight of dispersants and wetters and made into water-dispersible or water-soluble granules by means of technical appliances (for example extrusion, spray tower, fluidized bed). Dilution with water gives a stable dispersion or solution of the active compound. The formulation has an active compound content of 50% by weight.

[0402] G Water-Dispersible Powders and Water-Soluble Powders

[0403] 75 parts by weight of active compound are ground in a rotor-stator mill with addition of 25 parts by weight of dispersants, wetters and silica gel. Dilution with water gives a stable dispersion or solution of the active compound. The active compound content of the formulation is 75% by weight.

[0404] H Gel Formulations

[0405] In a ball mill, 20 parts by weight of active compound, 10 parts by weight of dispersant, 1 part by weight of gelling agent and 70 parts by weight of water or of an organic solvent are ground to give a fine suspension. Dilution with water gives a stable suspension with active compound content of 20% by weight.

[0406] 2. Products to be Applied Undiluted

[0407] I Dusts

[0408] 5 parts by weight of active compound are ground finely and mixed intimately with 95 parts by weight of finely divided kaolin. This gives a dusting powder with an active compound content of 5% by weight.

[0409] J Granules (GR, FG, GG, MG)

[0410] 0.5 parts by weight of active compound are ground finely and associated with 99.5 parts by weight of carriers. Current methods here are extrusion, spray-drying or the fluidized bed. This gives granules to be applied undiluted with an active compound content of 0.5% by weight.

[0411] K ULV Solutions (UL)

[0412] 10 parts by weight of active compound are dissolved in 90 parts by weight of an organic solvent, for example xylene. This gives a product to be applied undiluted with an active compound content of 10% by weight.

[0413] The compounds I or the herbicidal compositions comprising them can be applied pre- or post-emergence, or together with the seed of a crop plant. It is also possible to apply the herbicidal compositions or active compounds by applying seed, pretreated with the herbicidal compositions or active compounds, of a crop plant. If the active compounds are less well tolerated by certain crop plants, application techniques may be used in which the herbicidal compositions are sprayed, with the aid of the spraying equipment, in such a way that as far as possible they do not come into contact with the leaves of the sensitive crop plants, while the active compounds reach the leaves of undesirable plants growing underneath, or the bare soil surface (post-directed, lay-by).

[0414] In a further embodiment, the compounds of the formula I or the herbicidal compositions can be applied by treating seed.

[0415] The treatment of seed comprises essentially all procedures familiar to the person skilled in the art (seed dressing, seed coating, seed dusting, seed soaking, seed film coating, seed multilayer coating, seed encrusting, seed dripping and seed pelleting) based on the compounds of the formula I according to the invention or the compositions prepared therefrom. Here, the herbicidal compositions can be applied diluted or undiluted.

[0416] The term seed comprises seed of all types, such as, for example, corns, seeds, fruits, tubers, cuttings and similar forms. Here, preferably, the term seed describes corns and seeds.

[0417] The seed used can be seed of the useful plants mentioned above, but also the seed of transgenic plants or plants obtained by customary breeding methods.

[0418] The rates of application of active compound are from 0.001 to 3.0, preferably 0.01 to 1.0, kg/ha of active substance (a.s.), depending on the control target, the season, the target plants and the growth stage. To treat the seed, the compounds I are generally employed in amounts of from 0.001 to 10 kg per 100 kg of seed.

[0419] It may also be advantageous to use the compounds of the formula I in combination with safeners. Safeners are chemical compounds which prevent or reduce damage to useful plants without substantially affecting the herbicidal action of the compounds of the formula I on unwanted plants. They can be used both before sowing (for example in the treatment of seed, or on cuttings or seedlings) and before or after the emergence of the useful plant. The safeners and the compounds of the formula I can be used simultaneously or in succession. Suitable safeners are, for example, (quinolin-8-oxo)acetic acids, 1-phenyl-5-haloalkyl-1H-1,2,4-triazole-3-carboxylic acids, 1-phenyl-4,5-dihydro-5-alkyl-1H-pyrazole-3,5-dicarboxylic acids, 4,5-dihydro-5,5-diaryl-3-isoxazolecarboxylic acids, dichloroacetamides, alpha-oximinophenylacetoneitriles, acetophenone oximes, 4,6-dihalo-2-phenylpyrimidines, N-[[4-(aminocarbonyl)phenyl]-sulfonyl]-2-benzamides, 1,8-naphthalic anhydride, 2-halo-4-(haloalkyl)-5-thiazole-carboxylic acids, phosphorothiolates and O-phenyl N-alkylcarbamates and their agriculturally useful salts and, provided that they have an acid function, their agriculturally useful derivatives, such as amides, esters and thioesters.

[0420] To broaden the activity spectrum and to obtain synergistic effects, the compounds of the formula I can be mixed and jointly applied with numerous representatives of other herbicidal or growth-regulating groups of active compounds or with safeners. Suitable mixing partners are, for example, 1,2,4-thiadiazoles, 1,3,4-thiadiazoles, amides, aminophosphoric acid and its derivatives, aminotriazoles, anilides, aryloxy/heteroaryl-oxyalkanoic acids and their derivatives, benzoic acid and its derivatives, benzothiadiazinones, 2-(hetaroyl/aryl)-1,3-cyclohexanediones, heteroaryl aryl ketones, benzyloxazolidinones, meta-CF₃-phenyl derivatives, carbamates, quinoline carboxylic acid and its derivatives, chloroacetanilides, cyclohexenone oxime ether derivatives, diazines, dichloropropionic acid and its derivatives, dihydrobenzofurans, dihydrofuran-3-ones, dinitroanilines, dinitrophenols, diphenyl ethers, dipyridyls, halocarboxylic acids and their derivatives, ureas, 3-phenyluracils, imidazoles, imidazolinones, N-phenyl-3,4,5,6-tetrahydrophthal-

imides, oxadiazoles, oxiranes, phenols, aryloxy- and heteroaryloxyphenoxypionic esters, phenylacetic acid and its derivatives, 2-phenylpropionic acid and its derivatives, pyrazoles, phenylpyrazoles, pyridazines, pyridinecarboxylic acid and its derivatives, pyrimidyl ethers, sulfonamides, sulfonylureas, triazines, triazinones, triazolinones, triazolecarboxamides, uracils and also phenylpyrazolines and isoxazoles and their derivatives.

[0421] Moreover, it may be useful to apply the compounds I alone or in combination with other herbicides or else also mixed with further crop protection agents, jointly, for example with compositions for controlling pests or phytopathogenic fungi or bacteria. Also of interest is the miscibility with mineral salt solutions which are employed for alleviating nutritional and trace element deficiencies. Other additives such as nonphytotoxic oils and oil concentrates may also be added.

[0422] Examples of herbicides which can be used in combination with the pyridine compounds of the formula I according to the present invention are:

[0423] b1) from the group of the lipid biosynthesis inhibitors:

[0424] alloxymid, alloxymid-sodium, butoxydim, clethodim, clodinafop, clodinafop-propargyl, cycloxydim, cyhalofop, cyhalofop-butyl, diclofop, diclofop-methyl, fenoxaprop, fenoxaprop-ethyl, fenoxaprop-P, fenoxaprop-P-ethyl, fluazifop, fluazifop-butyl, fluazifop-P, fluazifop-P-butyl, haloxyfop, haloxyfop-methyl, haloxyfop-P, haloxyfop-P-methyl, metamifop, pinoxaden, profoxydim, propaquizafop, quizalofop, quizalofop-ethyl, quizalofop-tefuryl, quizalofop-P, quizalofop-P-ethyl, quizalofop-P-tefuryl, sethoxydim, tepraloxymid, tralkoxydim, benfuresate, butylate, cycloate, dalapon, dimepiperate, EPTC, esprocarb, ethofumesate, flupropanate, molinate, orbencarb, pebulate, prosulfocarb, TCA, thiobencarb, tiocarbazil, triallate and vernolate;

[0425] b2) from the group of the ALS inhibitors:

[0426] amidosulfuron, azimsulfuron, bensulfuron, bensulfuron-methyl, bispyribac, bispyribac-sodium, chlorimuron, chlorimuron-ethyl, chiorsulfuron, cinosulfuron, cloransulam, cloransulam-methyl, cyclosulfamuron, diclosulam, ethametsulfuron, ethametsulfuron-methyl, ethoxysulfuron, flazasulfuron, florasulam, flucarbazone, flucarbazone-sodium, flucetosulfuron, flumetsulam, flupyrsulfuron, flupyrsulfuron-methyl-sodium, foramsulfuron, halosulfuron, halo-sulfuron-methyl, imazamethabenz, imazamethabenz-methyl, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, imazosulfuron, iodosulfuron, iodosulfuron-methyl-sodium, mesosulfuron, metosulam, metsulfuron, metsulfuron-methyl, nicosulfuron, orthosulfamuron, oxasulfuron, penoxsulam, primisulfuron, primisulfuron-methyl, propoxycarbazone, propoxycarbazone-sodium, prosulfuron, pyrazosulfuron, pyrazosulfuron-ethyl, pyribenzoxim, pyrimisulfan, pyriftalid, pyriminobac, pyriminobac-methyl, pyriothibac, pyriothibac-sodium, pyroxsulam, rimsulfuron, sulfometuron, sulfometuron-methyl, sulfosulfuron, thien-carbazone, thien-carbazone-methyl, thifensulfuron, thifensulfuron-methyl, triasulfuron, tribenuron, tribenuron-methyl, trifloxysulfuron, triflusulfuron, triflusulfuron-methyl and tritosulfuron;

[0427] b3) from the group of the photosynthesis inhibitors:

[0428] ametryn, amicarbazone, atrazine, bentazone, bentazone-sodium, bromacil, bromofenoxim, bromoxynil and its salts and esters, chlorobromuron, chloridazone, chlorotoluron, chloroxuron, cyanazine, desmedipham, desmetryn,

dimefuron, dimethametryn, diquat, diquat-dibromide, diuron, fluometuron, hexazinone, ioxynil and its salts and esters, isoproturon, isouron, karbutilate, lenacil, linuron, metamitron, methabenzthiazuron, metobenzuron, metoxuron, metribuzin, monolinuron, neburon, paraquat, paraquat-dichloride, paraquat-dimethylsulfate, pentanochlor, phenmedipham, phenmedipham-ethyl, prometon, prometryn, propanil, propazine, pyridafol, pyridate, siduron, simazine, simetryn, tebuthiuron, terbacil, terbumeton, terbuthylazine, terbutryn, thidiazuron and trietazine;

[0429] b4) from the group of the protoporphyrinogen-IX oxidase inhibitors:

[0430] acifluorfen, acifluorfen-sodium, azafenidin, bencarbazone, benzfendizone, bifenox, butafenacil, carfentrazone, carfentrazone-ethyl, chlomethoxyfen, cinidon-ethyl, flua-zolate, flufenpyr, flufenpyr-ethyl, flumiclorac, flumiclorac-pentyl, flumioxazin, fluoroglycofen, fluoroglycofen-ethyl, fluthiacet, fluthiacet-methyl, fomesafen, halosafen, lactofen, oxadiargyl, oxadiazon, oxyfluorfen, pentoxazone, proflua-zol, pyraclostrobin, pyraflufen, pyraflufen-ethyl, saflufenacil, sulfentrazone, thidiazimin, 2-chloro-5-[3,6-dihydro-3-methyl-2,6-dioxo-4-(trifluoromethyl)-[(2H)-pyrimidinyl]-4-fluoro-N-Risopropyl]-methylsulfamoyl]benzamide (H-1; CAS 372137-35-4), ethyl [3-[2-chloro-4-fluoro-5-(1-methyl-6-trifluoromethyl-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-3-yl)phenoxy]-2-pyridyloxy]acetate (H-2; CAS 353292-31-6), N-ethyl-3-(2,6-dichloro-4-trifluoro-methylphenoxy)-5-methyl-1H-pyrazole-1-carboxamide (H-3; CAS 452098-92-9), N-tetrahydrofurfuryl-3-(2,6-dichloro-4-trifluoromethylphenoxy)-5-methyl-1H-pyrazole-1-carboxamide (H-4; CAS 915396-43-9), N-ethyl-3-(2-chloro-6-fluoro-4-trifluoromethyl-phenoxy)-5-methyl-1H-pyrazole-1-carboxamide (H-5; CAS 452099-05-7) and N-tetrahydrofurfuryl-3-(2-chloro-6-fluoro-4-trifluoromethylphenoxy)-5-methyl-1H-pyrazole-1-carboxamide (H-6; CAS 45100-03-7);

[0431] b5) from the group of the bleacher herbicides:

[0432] aclonifen, amitrol, befiubutamid, benzobicyclon, benzofenap, clomazone, diflufenican, fluridone, fluorchloridone, flurtamone, isoxaflutole, mesotrione, norflurazon, picolinafen, pyrasulfutole, pyrazolynate, pyrazoxyfen, sulcotrione, tefuryltrione, tembotrione, topramezone, 4-hydroxy-3-[[2-[(2-methoxyethoxy)methyl]-6-(trifluoromethyl)-3-pyridyl]carbonyl]bicyclo[3.2.1]oct-3-en-2-one (H-7; CAS 352010-68-5) and 4-(3-trifluoromethylphenoxy)-2-(4-trifluoromethylphenyl)pyrimidine (H-8; CAS 180608-33-7);

[0433] b6) from the group of the EPSP synthase inhibitors:

[0434] glyphosate, glyphosate-isopropylammonium and glyphosate-trimesium (sulfosate);

[0435] b7) from the group of the glutamine synthase inhibitors:

[0436] bilanaphos (bialaphos), bilanaphos-sodium, glufosinate and glufosinate-ammonium;

[0437] b8) from the group of the DHP synthase inhibitors:

[0438] asulam;

[0439] b9) from the group of the mitose inhibitors:

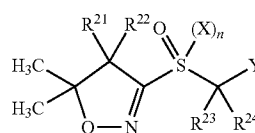
[0440] amiprofos, amiprofos-methyl, benfluralin, butamipfos, butralin, carbetamide, chlorpropham, chlorthal, chlorthal-dimethyl, dinitramine, dithiopyr, ethalfluralin, fluchloralin, oryzalin, pendimethalin, prodiamine, propham, propyzamide, tebutam, thiazopyr and trifluralin;

[0441] b10) from the group of the VLCFA inhibitors:

[0442] acetochlor, alachlor, anilofos, butachlor, cafens-trole, dimethachlor, dimethanamid, dimethanamid-P, diphe-

namid, fentrazamide, flufenacet, mefenacet, metazachlor, metolachlor, metolachlor-S, naproanilide, napropamide, pethoxamid, piperophos, pretilachlor, propachlor, propisochlor, pyroxasulfone (KIH-485) and thienylchlor;

[0443] Compounds of the formula 2:



2

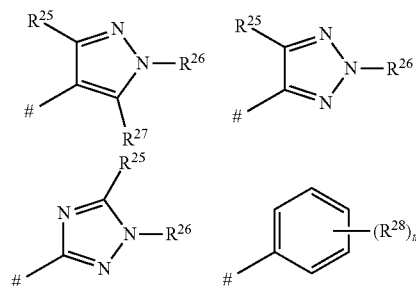
in which the variables have the following meanings:

Y is phenyl or 5- or 6-membered heteroaryl as defined at the outset, which radicals may be substituted by one to three groups R^{aa} ; R^{21} , R^{22} , R^{23} , R^{24} are H, halogen or C_1 - C_4 -alkyl; X is O or NH; N is 0 or 1.

[0444] Compounds of the formula 2 have in particular the following meanings:

Y is

[0445]

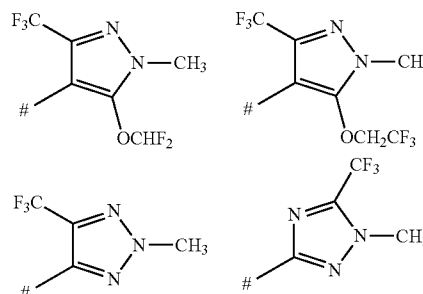


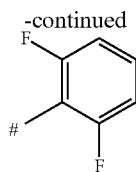
where # denotes the bond to the skeleton of the molecule; and R^{21} , R^{22} , R^{23} , R^{24} are H, Cl, F or CH_3 ; R^{25} is halogen, C_1 - C_4 -alkyl or C_1 - C_4 -haloalkyl; R^{26} is C_1 - C_4 -alkyl; R^{27} is halogen, C_1 - C_4 -alkoxy or C_1 - C_4 -haloalkoxy; R^{28} is H, halogen, C_1 - C_4 -haloalkyl or C_1 - C_4 -haloalkoxy; M is 0, 1, 2 or 3; X is oxygen; N is 0 or 1.

[0446] Preferred compounds of the formula 2 have the following meanings:

Y is

[0447]





R²¹ is H; R²², R²³ are F; R²⁴ is H or F; X is oxygen; N is 0 or 1.

[0448] Particularly preferred compounds of the formula 2 are:

3-[5-(2,2-difluoroethoxy)-1-methyl-3-trifluoromethyl-1H-pyrazol-4-ylmethanesulfonyl]-4-fluoro-5,5-dimethyl-4,5-dihydroisoxazole (2-1); 3-[[5-(2,2-difluoroethoxy)-1-methyl-3-trifluoromethyl-1H-pyrazol-4-yl]fluoromethanesulfonyl]-5,5-dimethyl-4,5-dihydroisoxazole (2-2); 4-(4-fluoro-5,5-dimethyl-4,5-dihydroisoxazole-3-sulfonylmethyl)-2-methyl-5-trifluoromethyl-2H-[1,2,3]triazole (2-3); 4-[(5,5-dimethyl-4,5-dihydroisoxazole-3-sulfonylmethyl)-2-methyl-5-trifluoromethyl-2H-[1,2,3]triazole (2-4); 4-(5,5-dimethyl-4,5-dihydroisoxazole-3-sulfonylmethyl)-2-methyl-5-trifluoro-methyl-2H-[1,2,3]triazole (2-5); 3-[[5-(2,2-difluoroethoxy)-1-methyl-3-trifluoromethyl-1H-pyrazol-4-yl]difluoromethanesulfonyl]-5,5-dimethyl-4,5-dihydroisoxazole (2-6); 4-[(5,5-dimethyl-4,5-dihydroisoxazole-3-sulfonyl)difluoromethyl]-2-methyl-5-trifluoro-methyl-2H-[1,2,3]triazole (2-7); 3-[[5-(2,2-difluoroethoxy)-1-methyl-3-trifluoromethyl-1H-pyrazol-4-yl]difluoromethanesulfonyl]-4-fluoro-5,5-dimethyl-4,5-dihydroisoxazole (2-8); 4-[difluoro-(4-fluoro-5,5-dimethyl-4,5-dihydroisoxazole-3-sulfonyl)methyl]-2-methyl-5-trifluoromethyl-2H-[1,2,3]triazole (2-9);

[0449] b11) from the group of the cellulose biosynthesis inhibitors:

[0450] chlorthiamid, dichlobenil, flupoxam and isoxaben;

[0451] b12) from the group of the decoupler herbicides:

[0452] dinoseb, dinoterb and DNOC and its salts;

[0453] b13) from the group of the auxin herbicides:

[0454] 2,4-D and its salts and esters, 2,4-DB and its salts and esters, aminopyralid and its salts such as aminopyralid-tris(2-hydroxypropyl)ammonium and its esters, benazolin, benazolin-ethyl, chloramben and its salts and esters, clomeprop, clopyralid and its salts and esters, dicamba and its salts and esters, dichlorpropand its salts and esters, dichlorprop-P and its salts and esters, fluoroxyppy, fluoroxyppy-butomethyl, fluoroxyppy-meptyl, MCPA and its salts and esters, MCPA-thioethyl, MCPB and its salts and esters, mecopropand its salts and esters, mecoprop-P and its salts and esters, picloram and its salts and esters, quinclorac, quinmerac, TBA (2,3,6) and its salts and esters, triclopyr and its salts and esters, and 5,6-dichloro-2-cyclopropyl-4-pyrimidinecarboxylic acid (H-9; CAS 858956-08-8) and its salts and esters;

[0455] b14) from the group of the auxin transport inhibitors: diflufenzopyr, diflufenzopyr-sodium, naptalam and naptalam-sodium;

[0456] b15) from the group of the other herbicides: bromobutide, chlorflurenol, chlorflurenol-methyl, cinmethylin, cumyluron, dalapon, dalapon, difenzoquat, difenzoquat-metilsulfate, dimethipin, DSMA, dymron, endothal and its salts, etobenzanid, flamprop, flamprop-isopropyl, flamprop-methyl, flamprop-M-isopropyl, flamprop-M-methyl, flurenol, flurenol-butyl, flurprimidol, fosamine, fosamine-ammonium,

indanofan, maleic hydrazide, mefluidide, metam, methyl azide, methyl bromide, methyl-dymron, methyl iodide, MSMA, oleic acid, oxaziclomefone, pelargonic acid, pyributicarb, quinclamine, triaziflam, tridiphane and 6-chloro-3-(2-cyclopropyl-6-methylphenoxy)-4-pyridazinol (H-10; CAS 499223-49-3) and its salts and esters.

[0457] Examples of preferred safeners C are benoxacor, cloquintocet, cyometrinil, cyprosulfamide, dichlormid, dicyclonone, dietholate, fenchlorazole, fenclorim, flurazole, fluxofenim, furilazole, isoxadifen, mefenpyr, mephenate, naphthalic anhydride, oxabetrinil, 4-(dichloroacetyl)-1-oxa-4-azaspiro[4.5]decane (H-11; MON4660, CAS 71526-07-3) and 2,2,5-trimethyl-3-(dichloroacetyl)-1,3-oxazolidine (H-12; R-29148, CAS 52836-31-4).

[0458] The active compounds of groups b1) to b15) and the safeners C are known herbicides and safeners, see, for example, The Compendium of Pesticide Common Names (<http://www.alanwood.net/pesticides/>); B. Hock, C. Fedtke, R. R. Schmidt, Herbicide [Herbicides], Georg Thieme Verlag, Stuttgart, 1995. Further herbicidally active compounds are known from WO 96/26202, WO 97/41116, WO 97/41117, WO 97/41118, WO 01/83459 and WO 2008/074991 and from W. Kramer et al. (ed.) "Modern Crop Protection Compounds", Vol. 1, Wiley VCH, 2007 and the literature quoted therein.

[0459] The invention also relates to compositions in the form of a crop protection composition formulated as a 1-component composition comprising an active compound combination comprising at least one pyridine compound of the formula I and at least one further active compound, preferably selected from the active compounds of groups b1 to b15, and at least one solid or liquid carrier and/or one or more surfactants and, if desired, one or more further auxiliaries customary for crop protection compositions.

[0460] The invention also relates to compositions in the form of a crop protection composition formulated as a 2-component composition comprising a first component comprising at least one pyridine compound of the formula I, a solid or liquid carrier and/or one or more surfactants and a second component comprising at least one further active compound selected from the active compounds of groups b1 to b15, a solid or liquid carrier and/or one or more surfactants, where additionally both components may also comprise further auxiliaries customary for crop protection compositions.

[0461] In binary compositions comprising at least one compound of the formula I as component A and at least one herbicide B, the weight ratio of the active compounds A:B is generally in the range of from 1:1000 to 1000:1, preferably in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and particularly preferably in the range of from 1:75 to 75:1.

[0462] In binary compositions comprising at least one compound of the formula I as component A and at least one safener C, the weight ratio of the active compounds A:C is generally in the range of from 1:1000 to 1000:1, preferably in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and particularly preferably in the range of from 1:75 to 75:1.

[0463] In ternary compositions comprising both at least one compound of the formula I as component A, at least one herbicide B and at least one safener C, the relative parts by weight of the components A:B are generally in the range of from 1:1000 to 1000:1, preferably in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and

particularly preferably in the range of from 1:75 to 75:1; the weight ratio of the components A:C is generally in the range of from 1:1000 to 1000:1, preferably in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and particularly preferably in the range of from 1:75 to 75:1; and the weight ratio of the components B:C is generally in the range of from 1:1000 to 1000:1, preferably in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and particularly preferably in the range of from 1:75 to 75:1. Preferably, the weight ratio of the components A+B to the component C is in the range of from 1:500 to 500:1, in particular in the range of from 1:250 to 250:1 and particularly preferably in the range of from 1:75 to 75:1.

[0464] Examples of particularly preferred compositions according to the invention comprising in each case one individualized compound of the formula I and one mixing partner or a mixing partner combination are given in Table B below.

[0465] A further aspect of the invention relates to the compositions B-1 to B-1227 listed in Table B below, where in each case one row of Table B corresponds to a herbicidal composition comprising one of the compounds of the formula I individualized in the above description (component 1) and the further active compound from groups b1) to b15) and/or safener C stated in each case in the row in question (component 2). The active compounds in the compositions described are in each case preferably present in synergistically effective amounts.

TABLE B

	Herbicide(s) B	Safener C
B-1	clodinafop-propargyl	—
B-2	cycloxydim	—
B-3	cyhalofop-butyl	—
B-4	fenoxaprop-P-ethyl	—
B-5	pinoxaden	—
B-6	profoxydim	—
B-7	tepraloxydim	—
B-8	tralkoxydim	—
B-9	esprocarb	—
B-10	prosulfocarb	—
B-11	thiobencarb	—
B-12	triallate	—
B-13	bensulfuron-methyl	—
B-14	bispyribac-sodium	—
B-15	cyclosulfamuron	—
B-16	flumetsulam	—
B-17	flupyr-sulfuron-methyl-sodium	—
B-18	foramsulfuron	—
B-19	imazamox	—
B-20	imazapic	—
B-21	imazapyr	—
B-22	imazaquin	—
B-23	imazethapyr	—
B-24	imazosulfuron	—
B-25	iodosulfuron-methyl-sodium	—
B-26	mesosulfuron	—
B-27	nicosulfuron	—
B-28	penoxsulam	—
B-29	propoxycarbazone-sodium	—
B-30	pyrazosulfuron-ethyl	—
B-31	pyroxsulam	—
B-32	rimsulfuron	—
B-33	sulfosulfuron	—
B-34	thiencarbazone-methyl	—
B-35	tritosulfuron	—
B-36	2,4-D and its salts and esters	—
B-37	aminopyralid and its salts and esters	—
B-38	clopyralid and its salts and esters	—
B-39	dicamba and its salts and esters	—
B-40	fluroxypyr-neptyl	—

TABLE B-continued

	Herbicide(s) B	Safener C
B-41	quinclorac	—
B-42	quinmerac	—
B-43	H-9	—
B-44	diflufenzopyr	—
B-45	diflufenzopyr-sodium	—
B-46	clomazone	—
B-47	diflufenican	—
B-48	fluorochloridone	—
B-49	isoxaflutol	—
B-50	mesotrione	—
B-51	picolinafen	—
B-52	sulcotrione	—
B-53	tefuryltrione	—
B-54	tembotrione	—
B-55	topramezone	—
B-56	H-7	—
B-57	atrazine	—
B-58	diuron	—
B-59	fluometuron	—
B-60	hexazinone	—
B-61	isoproturon	—
B-62	metribuzin	—
B-63	propanil	—
B-64	terbutylazine	—
B-65	paraquat dichloride	—
B-66	flumioxazin	—
B-67	oxyfluorfen	—
B-68	sulfentrazone	—
B-69	H-1	—
B-70	H-2	—
B-71	glyphosate	—
B-72	glyphosate-isopropylammonium	—
B-73	glyphosate-trimesium (sulfosate)	—
B-74	glufosinate	—
B-75	glufosinate-ammonium	—
B-76	pendimethalin	—
B-77	trifluralin	—
B-78	acetochlor	—
B-79	cafenstrole	—
B-80	dimethenamid-P	—
B-81	fentrazamide	—
B-82	flufenacet	—
B-83	mefenacet	—
B-84	metazachlor	—
B-85	metolachlor-S	—
B-86	pyroxasulfone	—
B-87	isoxaben	—
B-88	dymron	—
B-89	indanofan	—
B-90	oxaziclomefone	—
B-91	triaziflam	—
B-92	atrazine + H-1	—
B-93	atrazine + glyphosate	—
B-94	atrazine + mesotrione	—
B-95	atrazine + nicosulfuron	—
B-96	atrazine + tembotrione	—
B-97	atrazine + topramezone	—
B-98	clomazone + glyphosate	—
B-99	diflufenican + clodinafop-propargyl	—
B-100	diflufenican + fenoxaprop-P-ethyl	—
B-101	diflufenican + flupyr-sulfuron-methyl-sodium	—
B-102	diflufenican + glyphosate	—
B-103	diflufenican + mesosulfuron-methyl	—
B-104	diflufenican + pinoxaden	—
B-105	diflufenican + pyroxsulam	—
B-106	flumetsulam + glyphosate	—
B-107	flumioxazin + glyphosate	—
B-108	imazapic + glyphosate	—
B-109	imazethapyr + glyphosate	—
B-110	isoxaflutol + H-1	—
B-111	isoxaflutol + glyphosate	—
B-112	metazachlor + H-1	—
B-113	metazachlor + glyphosate	—
B-114	metazachlor + mesotrione	—

TABLE B-continued

Herbicide(s) B	Safener C
B-115	metazachlor + nicosulfuron
B-116	metazachlor + terbuthylazin
B-117	metazachlor + topramezone
B-118	metribuzin + glyphosate
B-119	pendimethalin + H-1
B-120	pendimethalin + clodinafop-propargyl
B-121	pendimethalin + fenoxaprop-P-ethyl
B-122	pendimethalin + flupyr-sulfuron-methyl-sodium
B-123	pendimethalin + glyphosate
B-124	pendimethalin + mesosulfuron-methyl
B-125	pendimethalin + mesotrione
B-126	pendimethalin + nicosulfuron
B-127	pendimethalin + pinoxaden
B-128	pendimethalin + pyroxulam
B-129	pendimethalin + tembotrione
B-130	pendimethalin + topamezone
B-131	pyroxasulfone + tembotrione
B-132	pyroxasulfone + topamezone
B-133	sulfentrazone + glyphosate
B-134	terbuthylazin + H-1
B-135	terbuthylazin + foramsulfuron
B-136	terbuthylazin + glyphosate
B-137	terbuthylazin + mesotrione
B-138	terbuthylazin + nicosulfuron
B-139	terbuthylazin + tembotrione
B-140	terbuthylazin + topamezone
B-141	trifluralin + glyphosate
B-142	—
B-143	—
B-144	—
B-145	—
B-146	—
B-147	—
B-148	—
B-149	—
B-150	—
B-151	clodinafop-propargyl
B-152	cycloxydim
B-153	cyhalofop-butyl
B-154	fenoxaprop-P-ethyl
B-155	pinoxaden
B-156	profoxydim
B-157	tepraloxydim
B-158	tralkoxydim
B-159	esprocarb
B-160	prosulcarb
B-161	thiobencarb
B-162	triallate
B-163	bensulfuron-methyl
B-164	bispyribac-sodium
B-165	cyclosulfamuron
B-166	flumetsulam
B-167	flupyr-sulfuron-methyl-sodium
B-168	foramsulfuron
B-169	imazamox
B-170	imazapic
B-171	imazapyr
B-172	imazaquin
B-173	imazethapyr
B-174	imazosulfuron
B-175	iodosulfuron-methyl-sodium
B-176	mesosulfuron
B-177	nicosulfuron
B-178	penoxulam
B-179	propoxycarbazone-sodium
B-180	pyrazosulfuron-ethyl
B-181	pyroxulam
B-182	rimsulfuron
B-183	sulfosulfuron
B-184	thiencarbazone-methyl
B-185	tritosulfuron
B-186	2,4-D and its salts and esters
B-187	aminopyralid and its salts and esters
B-188	clopyralid and its salts and esters

TABLE B-continued

Herbicide(s) B	Safener C
B-189	dicamba and its salts and esters
B-190	fluroxypyr-meptyl
B-191	quinclorac
B-192	quinmerac
B-193	H-9
B-194	diflufenzopyr
B-195	diflufenzopyr-sodium
B-196	clomazone
B-197	diflufenican
B-198	fluorochloridone
B-199	isoxaflutol
B-200	mesotrione
B-201	picolinafen
B-202	sulcotrione
B-203	tefuryltrione
B-204	tembotrione
B-205	topramezone
B-206	H-7
B-207	atrazine
B-208	diuron
B-209	fluometuron
B-210	hexazinone
B-211	isoproturon
B-212	metribuzin
B-213	propanil
B-214	terbuthylazin
B-215	paraquat dichloride
B-216	flumioxazin
B-217	oxyfluorfen
B-218	sulfentrazone
B-219	H-1
B-220	H-2
B-221	glyphosate
B-222	glyphosate-isopropylammonium
B-223	glyphosate-trimesium (sulfosate)
B-224	glufosinate
B-225	glufosinate-ammonium
B-226	pendimethalin
B-227	trifluralin
B-228	acetochlor
B-229	cafenstrole
B-230	dimethenamid-P
B-231	fentrazamide
B-232	flufenacet
B-233	mefenacet
B-234	metazachlor
B-235	metolachlor-S
B-236	pyroxasulfone
B-237	isoxaben
B-238	dymron
B-239	indanofan
B-240	oxaziclomefone
B-241	triaziflam
B-242	atrazine + H-1
B-243	atrazine + glyphosate
B-244	atrazine + mesotrione
B-245	atrazine + nicosulfuron
B-246	atrazine + tembotrione
B-247	atrazine + topamezone
B-248	clomazone + glyphosate
B-249	diflufenican + clodinafop-propargyl
B-250	diflufenican + fenoxaprop-P-ethyl
B-251	diflufenican + flupyr-sulfuron-methyl-sodium
B-252	diflufenican + glyphosate
B-253	diflufenican + mesosulfuron-methyl
B-254	diflufenican + pinoxaden
B-255	diflufenican + pyroxulam
B-256	flumetsulam + glyphosate
B-257	flumioxazin + glyphosate
B-258	imazapic + glyphosate
B-259	imazethapyr + glyphosate
B-260	isoxaflutol + H-1
B-261	isoxaflutol + glyphosate
B-262	metazachlor + H-1

TABLE B-continued

Herbicide(s) B	Safener C
B-263	metazachlor + glyphosate
B-264	metazachlor + mesotrione
B-265	metazachlor + nicosulfuron
B-266	metazachlor + terbuthylazin
B-267	metazachlor + topramezone
B-268	metribuzin + glyphosate
B-269	pendimethalin + H-1
B-270	pendimethalin + clodinafop-propargyl
B-271	pendimethalin + fenoxaprop-P-ethyl
B-272	pendimethalin + flupyr-sulfuron-methyl-sodium
B-273	pendimethalin + glyphosate
B-274	pendimethalin + mesosulfuron-methyl
B-275	pendimethalin + mesotrione
B-276	pendimethalin + nicosulfuron
B-277	pendimethalin + pinoxaden
B-278	pendimethalin + pyroxasulam
B-279	pendimethalin + tembotrione
B-280	pendimethalin + topamezone
B-281	pyroxasulfone + tembotrione
B-282	pyroxasulfone + topamezone
B-283	sulfentrazone + glyphosate
B-284	terbuthylazin + H-1
B-285	terbuthylazin + foramsulfuron
B-286	terbuthylazin + glyphosate
B-287	terbuthylazin + mesotrione
B-288	terbuthylazin + nicosulfuron
B-289	terbuthylazin + tembotrione
B-290	terbuthylazin + topamezone
B-291	trifluralin + glyphosate
B-292	clodinafop-propargyl
B-293	cycloxydim
B-294	cyhalofop-butyl
B-295	fenoxaprop-P-ethyl
B-296	pinoxaden
B-297	profoxydim
B-298	tepraloxym
B-299	tralkoxydim
B-300	esprocarb
B-301	prosulfocarb
B-302	thiobencarb
B-303	triallate
B-304	bensulfuron-methyl
B-305	bispyribac-sodium
B-306	cyclosulfamuron
B-307	flumetsulam
B-308	flupyr-sulfuron-methyl-sodium
B-309	foramsulfuron
B-310	imazamox
B-311	imazapic
B-312	imazapyr
B-313	imazaquin
B-314	imazethapyr
B-315	imazosulfuron
B-316	iodosulfuron-methyl-sodium
B-317	mesosulfuron
B-318	nicosulfuron
B-319	penoxsulam
B-320	propoxycarbazone-sodium
B-321	pyrazosulfuron-ethyl
B-322	pyroxasulam
B-323	rimisulfuron
B-324	sulfosulfuron
B-325	thiencarbazone-methyl
B-326	tritosulfuron
B-327	2,4-D and its salts and esters
B-328	aminopyralid and its salts and esters
B-329	clopyralid and its salts and esters
B-330	dicamba and its salts and esters
B-331	fluroxypyr-meptyl
B-332	quinclorac
B-333	quinmerac
B-334	H-9
B-335	diflufenzopyr
B-336	diflufenzopyr-sodium

TABLE B-continued

Herbicide(s) B	Safener C
B-337	clomazone
B-338	diflufenican
B-339	fluorochloridone
B-340	isoxaflutol
B-341	mesotrione
B-342	picolinafen
B-343	sulcotrione
B-344	tefuryltrione
B-345	tembotrione
B-346	topramezone
B-347	H-7
B-348	atrazine
B-349	diuron
B-350	fluometuron
B-351	hexazinone
B-352	isoproturon
B-353	metribuzin
B-354	propanil
B-355	terbuthylazin
B-356	paraquat dichloride
B-357	flumioxazin
B-358	oxyfluorfen
B-359	sulfentrazone
B-360	H-1
B-361	H-2
B-362	glyphosate
B-363	glyphosate-isopropylammonium
B-364	glyphosate-trimesium (sulfosate)
B-365	glufosinate
B-366	glufosinate-ammonium
B-367	pendimethalin
B-368	trifluralin
B-369	acetochlor
B-370	cafenstrole
B-371	dimethenamid-P
B-372	fentazamide
B-373	flufenacet
B-374	mefenacet
B-375	metazachlor
B-376	metolachlor-S
B-377	pyroxasulfone
B-378	isoxaben
B-379	dymron
B-380	indanofan
B-381	oxaziclomefone
B-382	triaziflam
B-383	atrazine + H-1
B-384	atrazine + glyphosate
B-385	atrazine + mesotrione
B-386	atrazine + nicosulfuron
B-387	atrazine + tembotrione
B-388	atrazine + topamezone
B-389	clomazone + glyphosate
B-390	diflufenican + clodinafop-propargyl
B-391	diflufenican + fenoxaprop-p-ethyl
B-392	diflufenican + flupyr-sulfuron-methyl-sodium
B-393	diflufenican + glyphosate
B-394	diflufenican + mesosulfuron-methyl
B-395	diflufenican + pinoxaden
B-396	diflufenican + pyroxasulam
B-397	flumetsulam + glyphosate
B-398	flumioxazin + glyphosate
B-399	imazapic + glyphosate
B-400	imazethapyr + glyphosate
B-401	isoxaflutol + H-1
B-402	isoxaflutol + glyphosate
B-403	metazachlor + H-1
B-404	metazachlor + glyphosate
B-405	metazachlor + mesotrione
B-406	metazachlor + nicosulfuron
B-407	metazachlor + terbuthylazin
B-408	metazachlor + topamezone
B-409	metribuzin + glyphosate
B-410	pendimethalin + H-1

TABLE B-continued

Herbicide(s) B	Safener C
B-411	pendimethalin + clodinafop-propargyl
B-412	pendimethalin + fenoxaprop-P-ethyl
B-413	pendimethalin + flupyr-sulfuron-methyl-sodium
B-414	pendimethalin + glyphosate
B-415	pendimethalin + mesosulfuron-methyl
B-416	pendimethalin + mesotrione
B-417	pendimethalin + nicosulfuron
B-418	pendimethalin + pinoxaden
B-419	pendimethalin + pyroxsulam
B-420	pendimethalin + tembotrione
B-421	pendimethalin + topramezone
B-422	pyroxasulfone + tembotrione
B-423	pyroxasulfone + topramezone
B-424	sulfentrazone + glyphosate
B-425	terbuthylazin + H-1
B-426	terbuthylazin + foramsulfuron
B-427	terbuthylazin + glyphosate
B-428	terbuthylazin + mesotrione
B-429	terbuthylazin + nicosulfuron
B-430	terbuthylazin + tembotrione
B-431	terbuthylazin + topramezone
B-432	trifluralin + glyphosate
B-433	clodinafop-propargyl
B-434	cycloxydim
B-435	cyhalofop-butyl
B-436	fenoxaprop-P-ethyl
B-437	pinoxaden
B-438	profoxydim
B-439	tepraloxym
B-440	tralkoxydim
B-441	esprocarb
B-442	prosulfocarb
B-443	thiobencarb
B-444	triallate
B-445	bensulfuron-methyl
B-446	bispyribac-sodium
B-447	cyclosulfamuron
B-448	flumetsulam
B-449	flupyr-sulfuron-methyl-sodium
B-450	foramsulfuron
B-451	imazamox
B-452	imazapic
B-453	imazapyr
B-454	imazaquin
B-455	imazethapyr
B-456	imazosulfuron
B-457	iodosulfuron-methyl-sodium
B-458	mesosulfuron
B-459	nicosulfuron
B-460	penoxsulam
B-461	propoxycarbazone-sodium
B-462	pyrazosulfuron-ethyl
B-463	pyroxsulam
B-464	rimisulfuron
B-465	sulfosulfuron
B-466	thiencarbazone-methyl
B-467	tritosulfuron
B-468	2,4-D and its salts and esters
B-469	aminopyralid and its salts and esters
B-470	clopyralid and its salts and esters
B-471	dicamba and its salts and esters
B-472	fluroxypyr-neptyl
B-473	quinclorac
B-474	quinmerac
B-475	H-9
B-476	diflufenzopyr
B-477	diflufenzopyr-sodium
B-478	clomazone
B-479	diflufenican
B-480	fluorochloridone
B-481	isoxaflutol
B-482	mesotrione
B-483	picolinafen
B-484	sulcotrione

TABLE B-continued

Herbicide(s) B	Safener C
B-485	tefuryltrione
B-486	tembotrione
B-487	topramezone
B-488	H-7
B-489	atrazine
B-490	diuron
B-491	fluometuron
B-492	hexazinone
B-493	isoproturon
B-494	metribuzin
B-495	propanil
B-496	terbuthylazin
B-497	paraquat dichloride
B-498	flumioxazin
B-499	oxyfluorfen
B-500	sulfentrazone
B-501	H-1
B-502	H-2
B-503	glyphosate
B-504	glyphosate-isopropylammonium
B-505	glyphosate-trimesium (sulfosate)
B-506	glufosinate
B-507	glufosinate-ammonium
B-508	pendimethalin
B-509	trifluralin
B-510	acetochlor
B-511	cafenstrole
B-512	dimethenamid-P
B-513	fentazamide
B-514	flufenacet
B-515	mefenacet
B-516	metazachlor
B-517	metolachlor-S
B-518	pyroxasulfone
B-519	isoxaben
B-520	dymron
B-521	indanofan
B-522	oxaziclonofone
B-523	triaziflam
B-524	atrazine + H-1
B-525	atrazine + glyphosate
B-526	atrazine + mesotrione
B-527	atrazine + nicosulfuron
B-528	atrazine + tembotrione
B-529	atrazine + topramezone
B-530	clomazone + glyphosate
B-531	diflufenican + clodinafop-propargyl
B-532	diflufenican + fenoxaprop-P-ethyl
B-533	diflufenican + flupyr-sulfuron-methyl-sodium
B-534	diflufenican + glyphosate
B-535	diflufenican + mesosulfuron-methyl
B-536	diflufenican + pinoxaden
B-537	diflufenican + pyroxsulam
B-538	flumetsulam + glyphosate
B-539	flumioxazin + glyphosate
B-540	imazapic + glyphosate
B-541	imazethapyr + glyphosate
B-542	isoxaflutol + H-1
B-543	isoxaflutol + glyphosate
B-544	metazachlor + H-1
B-545	metazachlor + glyphosate
B-546	metazachlor + mesotrione
B-547	metazachlor + nicosulfuron
B-548	metazachlor + terbuthylazin
B-549	metazachlor + topramezone
B-550	metribuzin + glyphosate
B-551	pendimethalin + H-1
B-552	pendimethalin + clodinafop-propargyl
B-553	pendimethalin + fenoxaprop-P-ethyl
B-554	pendimethalin + flupyr-sulfuron-methyl-sodium
B-555	pendimethalin + glyphosate
B-556	pendimethalin + mesosulfuron-methyl
B-557	pendimethalin + mesotrione
B-558	pendimethalin + nicosulfuron

TABLE B-continued

Herbicide(s) B	Safener C
B-559	pendimethalin + pinoxaden
B-560	pendimethalin + pyroxsulam
B-561	pendimethalin + tembotrione
B-562	pendimethalin + topramezone
B-563	pyroxasulfone + tembotrione
B-564	pyroxasulfone + topramezone
B-565	sulfentrazone + glyphosate
B-566	ferbuthylazin + H-1
B-567	terbuthylazin + foramsulfuron
B-568	terbuthylazin + glyphosate
B-569	terbuthylazin + mesotrione
B-570	terbuthylazin + nicosulfuron
B-571	terbuthylazin + tembotrione
B-572	terbuthylazin + topramezone
B-573	trifluralin + glyphosate
B-574	clodinafop-propargyl
B-575	cycloxydim
B-576	cyhalofop-butyl
B-577	fenoxaprop-P-ethyl
B-578	pinoxaden
B-579	profoxydim
B-580	tepraloxydim
B-581	tralkoxydim
B-582	esprocarb
B-583	prosulfofcarb
B-584	thiobencarb
B-585	triallate
B-586	bensulfuron-methyl
B-587	bispyribac-sodium
B-588	cyclosulfamuron
B-589	flumetsulam
B-590	flupyr-sulfuron-methyl-sodium
B-591	foramsulfuron
B-592	imazamox
B-593	imazapic
B-594	imazapyr
B-595	imazaquin
B-596	imazethapyr
B-597	imazosulfuron
B-598	iodosulfuron-methyl-sodium
B-599	mesosulfuron
B-600	nicosulfuron
B-601	penoxsulam
B-602	propoxycarbazone-sodium
B-603	pyrazosulfuron-ethyl
B-604	pyroxsulam
B-605	rimsulfuron
B-606	sulfosulfuron
B-607	thiencarbazone-methyl
B-608	tritosulfuron
B-609	2,4-D and its salts and esters
B-610	aminopyralid and its salts and esters
B-611	clopyralid and its salts and esters
B-612	dicamba and its salts and esters
B-613	fluroxypyr-meptyl
B-614	quinclorac
B-615	quinmerac
B-616	H-9
B-617	diflufenzopyr
B-618	diflufenzopyr-sodium
B-619	clomazone
B-620	diflufenican
B-621	fluorochloridone
B-622	isoxaflutol
B-623	mesotrione
B-624	picolinafen
B-625	sulcotrione
B-626	tefuryltrione
B-627	tembotrione
B-628	topramezone
B-629	H-7
B-630	atrazine
B-631	diuron
B-632	fluometuron

TABLE B-continued

Herbicide(s) B	Safener C
B-633	hexazinone
B-634	isoproturon
B-635	metribuzin
B-636	propanil
B-637	terbuthylazin
B-638	paraquat dichloride
B-639	flumioxazin
B-640	oxyfluorfen
B-641	sulfentrazone
B-642	H-1
B-643	H-2
B-644	glyphosate
B-645	glyphosate-isopropylammonium
B-646	glyphosate-trimesium (sulfosate)
B-647	glufosinate
B-648	glufosinate-ammonium
B-649	pendimethalin
B-650	trifluralin
B-651	acetochlor
B-652	cafenstrole
B-653	dimethenamid-P
B-654	fentrazamide
B-655	flufenacet
B-656	mefenacet
B-657	metazachlor
B-658	metolachlor-S
B-659	pyroxasulfone
B-660	isoxaben
B-661	dymron
B-662	indanofan
B-663	oxaziclomofone
B-664	fiaziflam
B-665	atrazine + H-1
B-666	atrazine + glyphosate
B-667	atrazine + mesotrione
B-668	atrazine + nicosulfuron
B-669	atrazine + tembotrione
B-670	atrazine + topramezone
B-671	clomazone + glyphosate
B-672	diflufenican + clodinafop-propargyl
B-673	diflufenican + fenoxaprop-P-ethyl
B-674	diflufenican + flupyr-sulfuron-methyl-sodium
B-675	diflufenican + glyphosate
B-676	diflufenican + mesosulfuron-methyl
B-677	diflufenican + pinoxaden
B-678	diflufenican + pyroxsulam
B-679	flumetsulam + glyphosate
B-680	flumioxazin + glyphosate
B-681	imazapic + glyphosate
B-682	imazethapyr + glyphosate
B-683	isoxaflutol + H-1
B-684	isoxaflutol + glyphosate
B-685	metazachlor + H-1
B-686	metazachlor + glyphosate
B-687	metazachlor + mesotrione
B-688	metazachlor + nicosulfuron
B-689	metazachlor + terbuthylazin
B-690	metazachlor + topramezone
B-691	metribuzin + glyphosate
B-692	pendimethalin + H-1
B-693	pendimethalin + clodinafop-propargyl
B-694	pendimethalin + fenoxaprop-P-ethyl
B-695	pendimethalin + flupyr-sulfuron-methyl-sodium
B-696	pendimethalin + glyphosate
B-697	pendimethalin + mesosulfuron-methyl
B-698	pendimethalin + mesotrione
B-699	pendimethalin + nicosulfuron
B-700	pendimethalin + pinoxaden
B-701	pendimethalin + pyroxsulam
B-702	pendimethalin + tembotrione
B-703	pendimethalin + topramezone
B-704	pyroxasulfone + tembotrione
B-705	pyroxasulfone + topramezone
B-706	sulfentrazone + glyphosate

TABLE B-continued

Herbicide(s) B	Safener C
B-707	terbuthylazin + H-1
B-708	terbuthylazin + foramsulfuron
B-709	terbuthylazin + glyphosate
B-710	terbuthylazin + mesotrione
B-711	terbuthylazin + nicosulfuron
B-712	terbuthylazin + tembotrione
B-713	terbuthylazin + topramezone
B-714	trifluralin + glyphosate
B-715	clodinafop-propargyl
B-716	cycloxydim
B-717	cyhalofop-butyl
B-718	fenoxaprop-P-ethyl
B-719	pinoxaden
B-720	profoxydim
B-721	tepraloxydim
B-722	tralkoxydim
B-723	esprocarb
B-724	prosulfocarb
B-725	thiobencarb
B-726	triallate
B-727	bensulfuron-methyl
B-728	bispyribac-sodium
B-729	cyclosulfamuron
B-730	flumetsulam
B-731	flupyrsulfuron-methyl-sodium
B-732	foramsulfuron
B-733	imazamox
B-734	imazapic
B-735	imazapyr
B-736	imazaquin
B-737	imazethapyr
B-738	imazosulfuron
B-739	iodosulfuron-methyl-sodium
B-740	mesosulfuron
B-741	nicosulfuron
B-742	penoxsulam
B-743	propoxy carbazone-sodium
B-744	pyrazosulfuron-ethyl
B-745	pyroxulam
B-746	rimisulfuron
B-747	sulfosulfuron
B-748	thiencarbazone-methyl
B-749	tritosulfuron
B-750	2,4-D and its salts and esters
B-751	aminopyralid and its salts and esters
B-752	clopyralid and its salts and esters
B-753	dicamba and its salts and esters
B-754	fluroxypyr-meptyl
B-755	quinclorac
B-756	quinmerac
B-757	H-9
B-758	diflufenzopyr
B-759	diflufenzopyr-sodium
B-760	clomazone
B-761	diflufenican
B-762	fluorochloridone
B-763	isoxaflutol
B-764	mesotrione
B-765	picolinafen
B-766	sulcotrione
B-767	tefuryltrione
B-768	tembotrione
B-769	topramezone
B-770	H-7
B-771	atrazine
B-772	diuron
B-773	fluometuron
B-774	hexazinone
B-775	isoproturon
B-776	metribuzin
B-777	propanil
B-778	terbuthylazin
B-779	paraquat dichloride
B-780	flumioxazin

TABLE B-continued

Herbicide(s) B	Safener C
B-781	oxyfluorfen
B-782	sulfentrazone
B-783	H-1
B-784	H-2
B-785	glyphosate
B-786	glyphosate-isopropylammonium
B-787	glyphosate-trimesium (sulfosate)
B-788	glufosinate
B-789	glufosinate-ammonium
B-790	pendimethalin
B-791	trifluralin
B-792	acetochlor
B-793	cafenstrole
B-794	dimethenamid-P
B-795	fentazamide
B-796	flufenacet
B-797	mefenacet
B-798	metazachlor
B-799	metolachlor-S
B-800	pyroxasulfone
B-801	isoxaben
B-802	dymron
B-803	indanofan
B-804	oxaziclomefone
B-805	triaziflam
B-806	atrazine + H-1
B-807	atrazine + glyphosate
B-808	atrazine + mesotrione
B-809	atrazine + nicosulfuron
B-810	atrazine + tembotrione
B-811	atrazine + topramezone
B-812	clomazone + glyphosate
B-813	diflufenican + clodinafop-propargyl
B-814	diflufenican + fenoxaprop-P-ethyl
B-815	diflufenican + flupyrsulfuron-methyl-sodium
B-816	diflufenican + glyphosate
B-817	diflufenican + mesosulfuron-methyl
B-818	diflufenican + pinoxaden
B-819	diflufenican + pyroxulam
B-820	flumetsulam + glyphosate
B-821	flumioxazin + glyphosate
B-822	imazapic + glyphosate
B-823	imazethapyr + glyphosate
B-824	isoxaflutol + H-1
B-825	isoxaflutol + glyphosate
B-826	metazachlor + H-1
B-827	metazachlor + glyphosate
B-828	metazachlor + mesotrione
B-829	metazachlor + nicosulfuron
B-830	metazachlor + terbuthylazin
B-831	metazachlor + topramezone
B-832	metribuzin + glyphosate
B-833	pendimethalin + H-1
B-834	pendimethalin + clodinafop-propargyl
B-835	pendimethalin + fenoxaprop-P-ethyl
B-836	pendimethalin + flupyrsulfuron-methyl-sodium
B-837	pendimethalin + glyphosate
B-838	pendimethalin + mesosulfuron-methyl
B-839	pendimethalin + mesotrione
B-840	pendimethalin + nicosulfuron
B-841	pendimethalin + pinoxaden
B-842	pendimethalin + pyroxulam
B-843	pendimethalin + tembotrione
B-844	pendimethalin + topramezone
B-845	pyroxasulfone + tembotrione
B-846	pyroxasulfone + topramezone
B-847	sulfentrazone + glyphosate
B-848	terbuthylazin + H-1
B-849	terbuthylazin + foramsulfuron
B-850	terbuthylazin + glyphosate
B-851	terbuthylazin + mesotrione
B-852	terbuthylazin + nicosulfuron
B-853	terbuthylazin + tembotrione
B-854	terbuthylazin + topramezone

TABLE B-continued

Herbicide(s) B	Safener C
B-855	trifluralin + glyphosate
B-856	clodinafop-propargyl
B-857	cycloxydim
B-858	cyhalofop-butyl
B-859	fenoxaprop-P-ethyl
B-860	pinoxaden
B-861	profoxydim
B-862	tepraloxydim
B-863	tralkoxydim
B-864	esprocarb
B-865	prosulfocarb
B-866	thiobencarb
B-867	triallate
B-868	bensulfuron-methyl
B-869	bispyribac-sodium
B-870	cyclosulfuron
B-871	flumetsulam
B-872	flupyrsulfuron-methyl-sodium
B-873	foramsulfuron
B-874	imazamox
B-875	imazapic
B-876	imazapyr
B-877	imazaquin
B-878	imazethapyr
B-879	imazosulfuron
B-880	iodosulfuron-methyl-sodium
B-881	mesosulfuron
B-882	nicosulfuron
B-883	penoxsulam
B-884	propoxy carbazone-sodium
B-885	pyrazosulfuron-ethyl
B-886	pyroxsulam
B-887	rimsulfuron
B-888	sulfosulfuron
B-889	thiencarbazone-methyl
B-890	tritosulfuron
B-891	2,4-D and its salts and esters
B-892	aminopyralid and its salts and esters
B-893	clopyralid and its salts and esters
B-894	dicamba and its salts and esters
B-895	fluroxypyr-meptyl
B-896	quinclorac
B-897	quinmerac
B-898	H-9
B-899	diflufenzopyr
B-900	diflufenzopyr-sodium
B-901	clomazone
B-902	diflufenican
B-903	fluorochloridone
B-904	isoxaflutol
B-905	mesotrione
B-906	picolinafen
B-907	sulcotrione
B-908	tefuryltrione
B-909	tembotrione
B-910	topramezone
B-911	H-7
B-912	atrazine
B-913	diuron
B-914	fluometuron
B-915	hexazinone
B-916	isoproturon
B-917	metribuzin
B-918	propanil
B-919	terbuthylazin
B-920	paraquat dichloride
B-921	flumioxazin
B-922	oxyfluorfen
B-923	sulfentrazone
B-924	H-1
B-925	H-2
B-926	glyphosate
B-927	glyphosate-isopropylammonium
B-928	glyphosate-trimesium (sulfosate)

TABLE B-continued

Herbicide(s) B	Safener C
B-929	glufosinate
B-930	glufosinate-ammonium
B-931	pendimethalin
B-932	trifluralin
B-933	acetochlor
B-934	cafenstrole
B-935	dimethenamid-p
B-936	fentrazamide
B-937	flufenacet
B-938	mefenacet
B-939	metazachlor
B-940	metolachlor-S
B-941	pyroxasulfone
B-942	isoxaben
B-943	dymron
B-944	indanofan
B-945	oxaziclomefone
B-946	triaziflam
B-947	atrazine + H-1
B-948	atrazine + glyphosate
B-949	atrazine + mesotrione
B-950	atrazine + nicosulfuron
B-951	atrazine + tembotrione
B-952	atrazine + topramezone
B-953	clomazone + glyphosate
B-954	diflufenican + clodinafop-propargyl
B-955	diflufenican + fenoxaprop-P-ethyl
B-956	diflufenican + flupyrsulfuron-methyl-sodium
B-957	diflufenican + glyphosate
B-958	diflufenican + mesosulfuron-methyl
B-959	diflufenican + pinoxaden
B-960	diflufenican + pyroxsulam
B-961	flumetsulam + glyphosate
B-962	flumioxazin + glyphosate
B-963	imazapic + glyphosate
B-964	imazethapyr + glyphosate
B-965	isoxaflutol + H-1
B-966	isoxaflutol + glyphosate
B-967	metazachlor + H-1
B-968	metazachlor + glyphosate
B-969	metazachlor + mesotrione
B-970	metazachlor + nicosulfuron
B-971	metazachlor + terbuthylazin
B-972	metazachlor + topramezone
B-973	metribuzin + glyphosate
B-974	pendimethalin + H-1
B-975	pendimethalin + clodinafop-propargyl
B-976	pendimethalin + fenoxaprop-P-ethyl
B-977	pendimethalin + flupyrsulfuron-methyl-sodium
B-978	pendimethalin + glyphosate
B-979	pendimethalin + mesosulfuron-methyl
B-980	pendimethalin + mesotrione
B-981	pendimethalin + nicosulfuron
B-982	pendimethalin + pinoxaden
B-983	pendimethalin + pyroxsulam
B-984	pendimethalin + tembotrione
B-985	pendimethalin + topramezone
B-986	pyroxasulfone + tembotrione
B-987	pyroxasulfone + topramezone
B-988	sulfentrazone + glyphosate
B-989	terbuthylazin + H-1
B-990	terbuthylazin + foramsulfuron
B-991	terbuthylazin + glyphosate
B-992	terbuthylazin + mesotrione
B-993	terbuthylazin + nicosulfuron
B-994	terbuthylazin + tembotrione
B-995	terbuthylazin + topramezone
B-996	trifluralin + glyphosate
B-997	clodinafop-propargyl
B-998	cycloxydim
B-999	cyhalofop-butyl
B-1000	fenoxaprop-P-ethyl
B-1001	pinoxaden
B-1002	profoxydim

TABLE B-continued

Herbicide(s) B	Safener C
B-1003	tepraloxydim
B-1004	tralkoxydim
B-1005	esprocarb
B-1006	prosulfocarb
B-1007	thiobencarb
B-1008	triallate
B-1009	bensulfuron-methyl
B-1010	bispyribac-sodium
B-1011	cyclosulfamuron
B-1012	flumetsulam
B-1013	flupyr-sulfuron-methyl-sodium
B-1014	foramsulfuron
B-1015	imazamox
B-1016	imazapic
B-1017	imazapyr
B-1018	imazaquin
B-1019	imazethapyr
B-1020	imazosulfuron
B-1021	iodosulfuron-methyl-sodium
B-1022	mesosulfuron
B-1023	nicosulfuron
B-1024	penoxsulam
B-1025	propoxycarbazone-sodium
B-1026	pyrazosulfuron-ethyl
B-1027	pyroxulam
B-1028	rimsulfuron
B-1029	sulfosulfuron
B-1030	thiencarbazone-methyl
B-1031	tritosulfuron
B-1032	2,4-D and its salts and esters
B-1033	aminopyralid and its salts and esters
B-1034	clopyralid and its salts and esters
B-1035	dicamba and its salts and esters
B-1036	fluroxypyr-meptyl
B-1037	quinclorac
B-1038	quinmerac
B-1039	H-9
B-1040	diflufenzopyr
B-1041	diflufenzopyr-sodium
B-1042	clomazone
B-1043	diflufenican
B-1044	fluorochloridone
B-1045	isoxaflutol
B-1046	mesotrione
B-1047	picolinafen
B-1048	sulcotrione
B-1049	tefuryltrione
B-1050	tembotrione
B-1051	topramezone
B-1052	H-7
B-1053	atrazine
B-1054	diuron
B-1055	fluometuron
B-1056	hexazinone
B-1057	isoproturon
B-1058	metribuzin
B-1059	propanil
B-1060	terbuthylazin
B-1061	paraquat dichloride
B-1062	flumioxazin
B-1063	oxyfluorfen
B-1064	sulfentrazone
B-1065	H-1
B-1066	H-2
B-1067	glyphosate
B-1068	glyphosate-isopropylammonium
B-1069	glyphosate-trimesium (sulfosate)
B-1070	glufosinate
B-1071	glufosinate-ammonium
B-1072	pendimethalin
B-1073	trifluralin
B-1074	acetochlor
B-1075	cafenstrole
B-1076	dimethenamid-P

TABLE B-continued

Herbicide(s) B	Safener C
B-1077	fentrazamide
B-1078	flufenacet
B-1079	mefenacet
B-1080	metazachlor
B-1081	metolachlor-S
B-1082	pyroxasulfone
B-1083	isoxaben
B-1084	dymron
B-1085	indanofan
B-1086	oxaziclomofone
B-1087	triaziflam
B-1088	atrazine + H-1
B-1089	atrazine + glyphosate
B-1090	atrazine + mesotrione
B-1091	atrazine + nicosulfuron
B-1092	atrazine + tembotrione
B-1093	atrazine + topramezone
B-1094	clomazone + glyphosate
B-1095	diflufenican + clodinafop-propargyl
B-1096	diflufenican + fenoxaprop-P-ethyl
B-1097	diflufenican + flupyr-sulfuron-methyl-sodium
B-1098	diflufenican + glyphosate
B-1099	diflufenican + mesosulfuron-methyl
B-1100	diflufenican + pinoxaden
B-1101	diflufenican + pyroxulam
B-1102	flumetsulam + glyphosate
B-1103	flumioxazin + glyphosate
B-1104	imazapic + glyphosate
B-1105	imazethapyr + glyphosate
B-1106	isoxaflutol + H-1
B-1107	isoxaflutol + glyphosate
B-1108	metazachlor + H-1
B-1109	metazachlor + glyphosate
B-1110	metazachlor + mesotrione
B-1111	metazachlor + nicosulfuron
B-1112	metazachlor + terbuthylazin
B-1113	metazachlor + topramezone
B-1114	metribuzin + glyphosate
B-1115	pendimethalin + H-1
B-1116	pendimethalin + clodinafop-propargyl
B-1117	pendimethalin + fenoxaprop-P-ethyl
B-1118	pendimethalin + flupyr-sulfuron-methyl-sodium
B-1119	pendimethalin + glyphosate
B-1120	pendimethalin + mesosulfuron-methyl
B-1121	pendimethalin + mesotrione
B-1122	pendimethalin + nicosulfuron
B-1123	pendimethalin + pinoxaden
B-1124	pendimethalin + pyroxulam
B-1125	pendimethalin + tembotrione
B-1126	pendimethalin + topramezone
B-1127	pyroxasulfone + tembotrione
B-1128	pyroxasulfone + topramezone
B-1129	sulfentrazone + glyphosate
B-1130	terbuthylazin + H-1
B-1131	terbuthylazin + foramsulfuron
B-1132	terbuthylazin + glyphosate
B-1133	terbuthylazin + mesotrione
B-1134	terbuthylazin + nicosulfuron
B-1135	terbuthylazin + tembotrione
B-1136	terbuthylazin + topramezone
B-1137	trifluralin + glyphosate
B-1138	2-1
B-1139	2-2
B-1140	2-3
B-1141	2-4
B-1142	2-5
B-1143	2-6
B-1144	2-7
B-1145	2-8
B-1146	2-9
B-1147	2-1
B-1148	2-2
B-1149	2-3
B-1150	2-4

benoxacor
benoxacor
benoxacor
benoxacor

TABLE B-continued

Herbicide(s) B	Safener C
B-1151 2-5	benoxacor
B-1152 2-6	benoxacor
B-1153 2-7	benoxacor
B-1154 2-8	benoxacor
B-1155 2-9	benoxacor
B-1156 2-1	cloquintocet
B-1157 2-2	cloquintocet
B-1158 2-3	cloquintocet
B-1159 2-4	cloquintocet
B-1160 2-5	cloquintocet
B-1161 2-6	cloquintocet
B-1162 2-7	cloquintocet
B-1163 2-8	cloquintocet
B-1164 2-9	cloquintocet
B-1165 2-1	cyprosulfamide
B-1166 2-2	cyprosulfamide
B-1167 2-3	cyprosulfamide
B-1168 2-4	cyprosulfamide
B-1169 2-5	cyprosulfamide
B-1170 2-6	cyprosulfamide
B-1171 2-7	cyprosulfamide
B-1172 2-8	cyprosulfamide
B-1173 2-9	cyprosulfamide
B-1174 2-1	dichlormid
B-1175 2-2	dichlormid
B-1176 2-3	dichlormid
B-1177 2-4	dichlormid
B-1178 2-5	dichlormid
B-1179 2-6	dichlormid
B-1180 2-7	dichlormid
B-1181 2-8	dichlormid
B-1182 2-9	dichlormid
B-1183 2-1	fenchlorazole
B-1184 2-2	fenchlorazole
B-1185 2-3	fenchlorazole
B-1186 2-4	fenchlorazole
B-1187 2-5	fenchlorazole
B-1188 2-6	fenchlorazole
B-1189 2-7	fenchlorazole
B-1190 2-8	fenchlorazole
B-1191 2-9	fenchlorazole
B-1192 2-1	isoxadifen
B-1193 2-2	isoxadifen
B-1194 2-3	isoxadifen
B-1195 2-4	isoxadifen
B-1196 2-5	isoxadifen
B-1197 2-6	isoxadifen
B-1198 2-7	isoxadifen
B-1199 2-8	isoxadifen
B-1200 2-9	isoxadifen
B-1201 2-1	mefenpyr
B-1202 2-2	mefenpyr
B-1203 2-3	mefenpyr
B-1204 2-4	mefenpyr
B-1205 2-5	mefenpyr
B-1206 2-6	mefenpyr
B-1207 2-7	mefenpyr
B-1208 2-8	mefenpyr
B-1209 2-9	mefenpyr
B-1210 2-1	H-11
B-1211 2-2	H-11
B-1212 2-3	H-11
B-1213 2-4	H-11
B-1214 2-5	H-11
B-1215 2-6	H-11
B-1216 2-7	H-11
B-1217 2-8	H-11
B-1218 2-9	H-11
B-1219 2-1	H-12
B-1220 2-2	H-12
B-1221 2-3	H-12
B-1222 2-4	H-12
B-1223 2-5	H-12
B-1224 2-6	H-12

TABLE B-continued

Herbicide(s) B	Safener C
B-1225 2-7	H-12
B-1226 2-8	H-12
B-1227 2-9	H-12

[0466] The compounds I and the compositions according to the invention may also have a plant-strengthening action. Accordingly, they are suitable for mobilizing the defense system of the plants against attack by unwanted microorganisms, such as harmful fungi, but also viruses and bacteria. Plant-strengthening (resistance-inducing) substances are to be understood as meaning, in the present context, those substances which are capable of stimulating the defense system of treated plants in such a way that, when subsequently inoculated by unwanted microorganisms, the treated plants display a substantial degree of resistance to these microorganisms.

[0467] The compounds I can be employed for protecting plants against attack by unwanted microorganisms within a certain period of time after the treatment. The period of time within which their protection is effected generally extends from 1 to 28 days, preferably from 1 to 14 days, after the treatment of the plants with the compounds I, or, after treatment of the seed, for up to 9 months after sowing.

[0468] The compounds I and the compositions according to the invention are also suitable for increasing the harvest yield.

[0469] Moreover, they have reduced toxicity and are tolerated well by the plants.

Hereinbelow, the preparation of pyridine compounds of the formula I is illustrated by way of examples, without limiting the subject matter of the present invention to the examples shown.

SYNTHESIS EXAMPLES

[0470] With appropriate modification of the starting materials, the procedures given in the synthesis examples below were used to obtain further compounds I. The compounds obtained in this manner are listed in the table that follows, together with physical data.

I. PREPARATION EXAMPLES

Example 1

Preparation of 4-hydroxy-3-(3-trifluoromethoxyphenyl)pyrano[3,2-b]pyridin-2-one (non-inventive)

Step 1: Pentafluorophenyl 3-hydroxypyridine-2-carboxylate

[0471] At 20-25° C. 13 g of N,N'-diisopropylcarbodiimide (DIC) were added dropwise to a solution of 14 g of 3-hydroxypyridine-2-carboxylic acid and 18.5 g of pentafluorophenol in 700 ml of CH₂Cl₂. After the reaction had ended (about 40 min), the solution was allowed to stand at 20-25° C. for about 12 hours. The solvent was removed, and the residue formed was then taken up in water and the solution was extracted with CH₂Cl₂. The organic phase gave, after drying and removal of the solvent, 29 g of the title compound.

Step 2: 4-Hydroxy-3-(3-trifluoromethoxyphenyl)pyrano[3,2-b]pyridin-2-one

[0472] 3.5 g of K₂CO₃ were added to a solution of 0.64 g of pentafluorophenyl 3-hydroxy-pyridine-2-carboxylate (from

step 1) and 0.5 g of (3-trifluoromethoxyphenyl)acetyl chloride in 150 ml of acetonitrile, and the mixture was stirred at 20-25° C. under an atmosphere of nitrogen for about 12 hours. After filtration, the solvent was removed from the filtrate and the residue obtained was taken up in water and, after acidification to pH<4, extracted with CH₂Cl₂. The organic phase was dried, then freed from the solvent. The residue gave, after preparative HPLC [column: Luna (2), from Phenomenex, 300*50 mm 10 µm; mobile phase: water (+0.0375% trifluoroacetic acid [TFA]) and acetonitrile in mixing ratios of 80:20 and 50:50; flow rate 80 ml/min; detection at 220 and 254 nm), 20-25° C.], 300 mg of the title compound.

[0473] ¹H-NMR (CDCl₃) δ 8.55 (m, 1H), 7.74 (m, 1H), 7.58-7.73 (m, 3H), 7.48-7.50 (m, 1H), 7.22-7.26 (m, 1H).

Example 2

Preparation of 4-hydroxy-3-(2-trifluoromethylphenyl)-1H-[1,5]naphthyridin-2-one [I-1]

Step 1

Methyl 3-[2-(2-trifluoromethylphenyl)acetylamino]pyridine-2-carboxylate

[0474] 0.6 g of triethylamine was added to a solution of 0.45 g of 3-aminopyridine-2-methyl ester and 0.66 g of (2-trifluoromethylphenyl)acetyl chloride in 50 ml of CH₂Cl₂. After about 6 hours of stirring at 20-25° C., the solution was washed with water. After phase separation, the combined organic phases were dried and then freed from the solvent under reduced pressure. The residue gave, after preparative HPLC (stationary phase Luna 100*21.2 mm C18; mobile phase: water [+0.1% trifluoroacetic acid {TFA}]) and methanol 70:30-40:60 gradient over 10 min), 0.8 g of the title compound.

Step 2

4-Hydroxy-3-(2-trifluoromethylphenyl)-1H-[1,5]naphthyridin-2-one

[0475] Under an atmosphere of N₂, 4.8 ml of a 1.0 M solution were added at -40° C. to a solution of 0.8 g of the ester from step 1 in 50 ml of THF. After about 15 hours of stirring at 20-25° C., the mixture was diluted with water, and

the solution was then extracted with CH₂Cl₂. After drying, the combined organic phases were freed from the solvent under reduced pressure. The residue gave, after preparative HPLC (see Ex. 1), 200 mg of the title compound.

Example 3

Preparation of 4-hydroxy-1-methyl-3-(2-trifluoromethylphenyl)-1H-[1,5]naphthyridin-2-one [I-2]

Step 1

Methyl 3-methylaminopyridine-2-carboxylate

[0476] A mixture of 1.6 g of (2-chloropyridin-3-yl)methylamine, 0.2 g of [1,1'-bis(diphenyl-phosphino)ferrocene]dichloropalladium(II) and 3.1 ml of triethylamine (TEA) in 30 ml of methanol was stirred under a 50 PSI CO atmosphere at 50° C. for 48 hours. Chromatography on silica gel (mobile phase petroleum ether:ethyl acetate 10:1-3:1) gave 360 mg of the title compound as a colorless oil.

Step 2

Methyl 3-{methyl-[2-(2-trifluoromethylphenyl)acetyl]amino}pyridine-2-carboxylate

[0477] 488 mg of (2-trifluoromethylphenyl)acetyl chloride were added to a mixture of 360 mg of the ester from step 1 in 30 ml of CH₂Cl₂. 367 µl of TEA were then added slowly and the mixture was subsequently heated under reflux for 24 hours. The mixture gave, after preparative HPLC, 240 mg of the title compound as a yellow oil.

Step 3

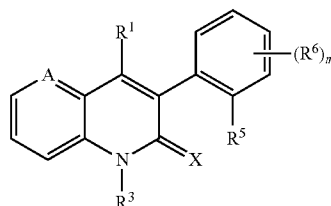
4-Hydroxy-1-methyl-3-(2-trifluoromethylphenyl)-1H-[1,5]naphthyridin-2-one

[0478] 27 mg of NaH were added to a solution of 240 mg of the ester from step 2 and 10 ml of THF. The mixture was stirred at 20-25° C. for about 30 min. Preparative HPLC gave 60 mg of the title compound as a yellow crystalline material.

TABLE I

Compounds of the formula I which correspond to the formula I.1A':

I.1A'



No.	A	R ³	X	R ¹	R ⁵	(R ⁶) _m	phys. data ¹ H-NMR (δ [ppm]) ^(a)
I-1	N	H	O	OH	CF ₃	H	(M): 10.14-10.08 (br,s), 8.60 (d), 7.83 (t), 7.69-7.57 (m), 7.39 (d)
I-2	N	CH ₃	O	OH	CF ₃	H	(M): 8.59 (d), 8.12 (d), 7.80-7.74 (m), 7.68 (t), 7.57 (t), 7.36 (d), 3.72 (s)
I-3	N—O ⁽¹⁾	H	O	OH	CF ₃	H	(D): 11.96 (s), 8.32-8.30 (m), 7.77-7.49 (m), 7.33-7.31 (m)
I-4	N—O ⁽¹⁾	H	O	OH	CHF ₂	H	(M): 8.22 (d), 7.70-7.68 (m), 7.59-7.49 (m), 7.32-7.30 (m), 6.69 (t)

TABLE I-continued

I-5	N—O ¹⁾	H	O	OH	OCF ₃	H	(C): 8.06 (d), 7.52-7.41 (m), 7.40-7.26 (m)
I-6	N	H	O	OH	CHF ₂	H	(C): 8.48 (d), 7.72-7.48 (m), 7.27 (d), 6.7 (t)
I-7	N	CH ₂ CF ₃	O	OH	CF ₃	H	(M): 8.63-8.61 (m), 8.14-8.12 (m), 7.80-7.78 (m), 7.74-7.70 (m), 7.68-7.66 (m), 7.59-7.55 (m), 7.38-7.36 (m), 5.26-5.07 (m)
I-8	N	CH ₂ CHF ₂	O	OH	CF ₃	H	(C): 8.54-8.53 (m), 7.91-7.89 (m), 7.82-7.80 (m), 7.67-7.63 (m), 7.57-7.53 (m), 7.40-7.38 (m), 6.28-5.98 (m), 4.65-4.57 (m)

¹⁾N—O = N-oxide^{#)}Specification of the solvent: (C) = CDCl₃; (M) = CH₃OD; (D) = DMSO-d₆

Use Examples

[0479] The herbicidal activity of the compounds of the formula I was demonstrated by the following greenhouse experiments:

[0480] The culture containers used were plastic flowerpots containing loamy sand with approximately 3.0% of humus as the substrate. The seeds of the test plants were sown separately for each species.

[0481] For the pre-emergence treatment, the active compounds, which had been suspended or emulsified in water, were applied directly after sowing by means of finely distributing nozzles. The containers were irrigated gently to promote germination and growth and subsequently covered with transparent plastic hoods until the plants had rooted. This cover caused uniform germination of the test plants, unless this has been impaired by the active compounds.

[0482] For the post-emergence treatment, the test plants were first grown to a height of 3 to 15 cm, depending on the plant habit, and then treated with the active compounds which had been suspended or emulsified in water. For this purpose, the test plants were either sown directly and grown in the same containers, or they were first grown separately as seedlings and transplanted into the test containers a few days prior to treatment.

[0483] Depending on the species, the plants were kept at 10-25° C. or 20-35° C. The test period extended over 2 to 4 weeks. During this time, the plants were tended, and their response to the individual treatments was evaluated.

[0484] Evaluation was carried out using a scale from 0 to 100. 100 means no emergence of the plants, or complete destruction of at least the aerial moieties, and 0 means no damage, or normal course of growth. A good herbicidal activity is given at values of at least 70 and a very good herbicidal activity is given at values of at least 85.

[0485] The plants used in the greenhouse experiments belonged to the following species:

Bayer code	Scientific name	Common name
AMARE	<i>Amaranthus retroflexus</i>	Carelessweed
AVEFA	<i>Avena fatua</i>	Spring wild-oat
APESV	<i>Apera spica-venti</i>	Corngrass
CHEAL	<i>Chenopodium album</i>	Pigweed
SETFA	<i>Setaria faberi</i>	Giant foxtail

[0486] 1) At application rates of 1.0 kg/ha and 0.5 kg/ha, the active compound I-6 and the active compounds I-7 and I-8, respectively, applied by the post-emergence method, showed very good herbicidal activity against AMARE.

[0487] 2) At an application rate of 3.0 kg/ha, the active compounds I-1 and I-2, applied by the post-emergence method, showed very good herbicidal activity against AVEFA.

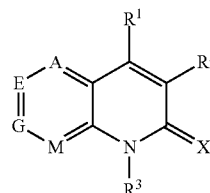
[0488] 3) At application rates of 1.0 kg/ha and 0.5 kg/ha, the active compounds I-6 and I-7, respectively, applied by the post-emergence method, showed good and very good herbicidal activity, respectively, against APESV.

[0489] 4) At an application rate of 0.5 kg/ha, the active compound I-7, applied by the post-emergence method, showed very good herbicidal activity against CHEAL.

[0490] 5) At an application rate of 3.0 kg/ha, the active compounds I-1, I-3 and I-4, respectively, applied by the post-emergence method, showed very good herbicidal activity against SETFA.

1-15. (canceled)

16. A compound of the formula I



wherein

R¹ is O—R^a, S(O)_n—R^a or O—S(O)_n—R^a;

R^a is hydrogen, C₁-C₄-alkyl, Z—C₃-C₆-cycloalkyl, C₁-C₄-haloalkyl, C₂-C₆-alkenyl, Z—C₃-C₆-cycloalkenyl, C₂-C₆-alkynyl, Z-(tri-C₁-C₄-alkyl)silyl, Z—C(=O)—R^a, Z—NRⁱ—C(O)—NRⁱRⁱⁱ, Z—P(=O)(R^a)₂, NRⁱRⁱⁱ, a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, which may be partially or fully substituted by groups R^a and/or R^b;

R^a is hydrogen, OH, C₁-C₈-alkyl, C₁-C₄-haloalkyl, Z—C₃-C₆-cycloalkyl, C₂-C₈-alkenyl, Z—C₅-C₆-cycloalkenyl, C₂-C₈-alkynyl, Z—C₁-C₆-alkoxy, Z—C₁-C₄-haloalkoxy, Z—C₃-C₈-alkenyloxy, Z—C₃-C₈-alkynyloxy, NRⁱRⁱⁱ, C₁-C₆-alkylsulfonyl, Z-(tri-C₁-C₄-alkyl)silyl, Z-phenyl, Z-phenoxy, Z-phenylamino or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b;

Rⁱ, Rⁱⁱ independently of one another are hydrogen, C₁-C₈-alkyl, C₁-C₄-haloalkyl, C₃-C₈-alkenyl, C₃-C₈-alkynyl, Z—C₃-C₆-cycloalkyl, Z—C₁-C₈-alkoxy, Z—C₁-C₈-haloalkoxy, Z—C(=O)—R^a, Z-phenyl, a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or

aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S and which is attached via Z; or

Rⁱ and Rⁱⁱ together with the nitrogen atom to which they are attached may form a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S;

Z is a covalent bond or C₁-C₄-alkylene;

n is 0, 1 or 2;

R² is phenyl, naphthyl or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b;

R^b independently of one another are Z—CN, Z—OH, Z—NO₂, Z-halogen, C₁-C₈-alkyl, C₁-C₄-haloalkyl, C₂-C₈-alkenyl, C₂-C₈-alkynyl, Z—C₁-C₈-alkoxy, Z—C₁-C₈-haloalkoxy, Z—C₃-C₁₀-cycloalkyl, O—Z—C₃-C₁₀-cycloalkyl, Z—C(=O)—R^a, NRⁱRⁱⁱ, Z-(tri-C₁-C₄-alkyl)silyl, Z-phenyl and S(O)_nR^{bb},

where R^{bb} is C₁-C₈-alkyl or C₁-C₆-haloalkyl and

n is 0, 1 or 2; or

R^b together with the group R^b attached to the adjacent carbon atom may form a five- or six-membered saturated or partially or fully unsaturated ring which, in addition to carbon atoms, may contain 1, 2 or 3 heteroatoms selected from the group consisting of O, N and S;

R³ is hydrogen, C₁-C₆-alkyl, C₁-C₄-haloalkyl, C₂-C₆-alkenyl, C₃-C₆-alkynyl, Z—C₃-C₁₀-cycloalkyl, C₁-C₆-alkoxy-C₁-C₆-alkyl, C₁-C₆-cyanoalkyl, Z-phenyl, Z—C(=O)—R^{a2} or tri-C₁-C₄-alkylsilyl;

R^{a2} is C₁-C₆-alkyl, C₁-C₄-haloalkyl, Z—C₁-C₆-alkoxy, Z—C₁-C₄-haloalkoxy or NRⁱRⁱⁱ;

A, E, G, M are N or C—R^c, one of these groups being N;

R^c is hydrogen or one of the groups mentioned for R^b;

where in the groups R^a, R², R³ and their substituents, the carbon chains and/or the cyclic groups may be partially or fully substituted by groups R¹,

or a N-oxide or an agriculturally suitable salt thereof.

17. The compound of the formula I according to claim 16, wherein

R¹ is O—R^a or S(O)_n—R^a;

R^a is hydrogen, C₁-C₄-alkyl, Z—C₃-C₆-cycloalkyl, C₁-C₄-haloalkyl, C₂-C₆-alkenyl, Z—C₃-C₆-cycloalkenyl, C₂-C₆-alkynyl, Z-(tri-C₁-C₄-alkyl)silyl, Z—C(=O)—Ie, Z—P(=O)(R^a)₂, a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated, unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S which may be partially or fully substituted by groups R^a and/or R^b, and which is attached via C or N;

R^a is hydrogen, OH, C₁-C₈-alkyl, C₁-C₄-haloalkyl, Z—C₃-C₆-cycloalkyl, C₂-C₈-alkenyl, Z—C₅-C₆-cycloalkenyl, C₂-C₈-alkynyl, Z—C₁-C₆-alkoxy, Z—C₁-C₄-haloalkoxy, Z—C₃-C₈-alkenyloxy, Z—C₃-C₈-alkynyloxy, NRⁱRⁱⁱ, C₁-C₆-alkylsulfonyle, Z-(tri-C₁-C₄-alkyl)silyl, Z-phenyl, Z-phenoxy, Z-phenylamino or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b;

Rⁱ, Rⁱⁱ independently of one another are hydrogen, C₁-C₈-alkyl, haloalkyl, C₃-C₈-alkenyl, C₃-C₈-

alkynyl, Z—C₃-C₆-cycloalkyl, Z—C₁-C₈-alkoxy, or Z—C₁-C₈-haloalkoxy; or

Rⁱ and Rⁱⁱ together with the nitrogen atom to which they are attached may form a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S.

18. The compound of the formula I according to claim 16, wherein X is S.

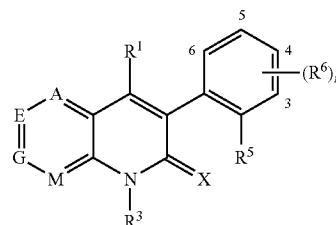
19. The compound of the formula I according to claim 16, wherein X is NR³.

20. The compound of the formula I according to claim 16, wherein R^a is hydrogen, C₁-C₆-alkylcarbonyl or OS(O)_n—R^a.

21. The compound of the formula I according to claim 16, wherein a group R³ is CH₂C₆H₅ or tri-C₁-C₄-alkylsilyl.

22. The compound of the formula I according to claim 16 which corresponds to the formula I.A

I.A



wherein

A is N and E, G, M are each CH;

R⁵ is Br, F, NO₂, CN, CH₃, OCH₃, CHF₂, CF₃ or OCHF₂;

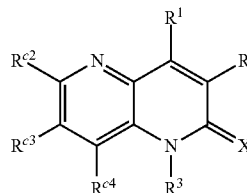
and

R⁶ is NO₂, C₁-C₄-alkyl, C₁-C₂-haloalkyl or C₁-C₄-alkoxy;

m is zero or an integer from one to four.

23. The compound of the formula I according to claim 16, which corresponds to the formula I.I

I.I



in which R^{c2}, R^{c3} and R^{c4} each correspond to a group R^c.

24. The compound of the formula I.I according to claim 23, in which

R^{c2}, R^{c3} and R^{c4} are H,

R¹ is OH, OCH₃, OC(O)CH₃, OC(O)CH₂CH₃, OC(O)CH(CH₃)₂, OC(O)C(CH₃)₃, OC(O)-c-C₃H₅, OC(O)—C₆H₅, OC(O)—CH₂C₆H₅, OC(O)CH₂Cl, OC(O)—CF₃, OC(O)—CH₂OCH₃, OC(O)—N(CH₃)₂ or OC(O)—OCH₂CH₃;

R² is phenyl which is substituted by a group selected from the group consisting of 2-Br, 2-Cl, 2,4-Cl₂, 2-Cl-4-F, 2-Cl-5-F, 2-Cl-6-F, 2-Cl-4-CF₃, 2-Cl-5-CF₃, 2-Cl-6-CF₃, 2-Cl-3,6-F₂, 2-F, 2,4-F₂, 2,5-F₂, 2,6-F₂, 2-F-4-CF₃, 2-F-5-CF₃, 2-F-6-CF₃, 2,3,6-F₃, 2-NO₂, 2-NO₂-4-F, 2-NO₂-5-F, 2-NO₂-6-F, 2-NO₂-4-CF₃, 2-NO₂-5-CF₃, 2-NO₂-6-CF₃, 2-NO₂-3,6-F₂, 2-CN, 2-CH₃, 2-CH₃-4-F,

2-CH₃-5-F, 2-CH₃-6-F, 2-CH₃-4-CF₃, 2-CH₃-5-CF₃, 2-CH₃-6-CF₃, 2-CH₃-3,6-F₂, 2-OCH₃, 2-OCH₃-4-F, 2-OCH₃-5-F, 2-OCH₃-6-F, 2-OCH₃-4-CF₃, 2-OCH₃-5-CF₃, 2-OCH₃-6-CF₃, 2-OCH₃-3,6-F₂, 2-CHF₂, 2-CHF₂-4-F, 2-CHF₂-5-F, 2-CHF₂-6-F, 2-CHF₂-4-CF₃, 2-CHF₂-5-CF₃, 2-CHF₂-6-CF₃, 2-CHF₂-3,6-F₂, 2-CF₃, 2-CF₃-4-F, 2-CF₃-5-F, 2-CF₃-6-F, 2-CF₃-4-CF₃, 2-CF₃-5-CF₃, 2-CF₃-6-CF₃, 2-CF₃-3,6-F₂, 2-OCHF₂, 2-OCHF₂-4-F, 2-OCHF₂-5-F, 2-OCHF₂-6-F, 2-OCHF₂-4-CF₃, 2-OCHF₂-5-CF₃, 2-OCHF₂-6-CF₃, 2-OCHF₂-3,6-F₂, 2-OCF₃, 2-OCF₃-4-F, 2-OCF₃-5-F, 2-OCF₃-6-F, 2-OCF₃-4-CF₃, 2-OCF₃-5-CF₃, 2-OCF₃-6-CF₃ and 2-OCF₃-3,6-F₂;

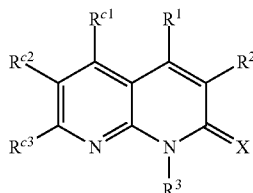
R³ is selected from the group consisting of H, CH₃, C₂H₅, n-C₃H₇, CH(CH₃)₂, n-C₄H₉, CH₂CH=CH₂, CH₂C≡CH, CH₂CN and CH₂C₆H₅; and

X is O or S;

with the provisos that

- a) R¹ is not OH, OC(O)CH(CH₃)₂ or OC(O)C(CH₃)₃ if R² is 2,4-Cl₂-phenyl, 2-Cl-3,6-F₂-phenyl or 2-OCF₃-phenyl, R³ is CH₃ and X is O, and
- b) R¹ is not OH if R² is 2,4-Cl₂-phenyl or 2-OCF₃-phenyl, R³ is H and X is O.

25. The compound of the formula I according to claim 16 which corresponds to the formula I.4



I.4

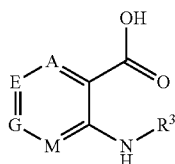
in which, independently of one another,

R^{c1} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl;

R^{c2} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl; and

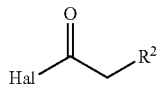
R^{c3} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl.

26. A process for preparing the compound of the formula I according to claim 16 by reacting a compound of formula II



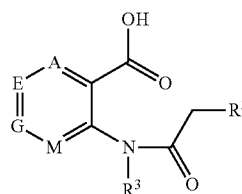
II

under basic conditions with a carbonyl compound of the formula III,



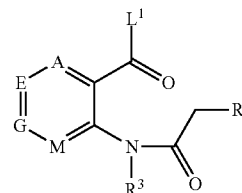
III

in which Hal is a halogen atom or another suitable nucleophilic leaving group to give a compound of the formula IV,



IV

which, with agents H-L¹ in which L¹ is a nucleophilic leaving group is converted into a compound of the formula V



V

which, under basic conditions, is cyclized to give a compound of the formula I.

27. A composition comprising a herbicidally effective amount of at least one compound of the formula I or an agriculturally suitable salt thereof according to claim 16 and auxiliaries customary for formulating crop protection agents.

28. The composition according to claim 27 which comprises at least one further active compound.

29. The composition according to claim 28 in the form of a crop protection composition formulated as a 2-component composition comprising a first component comprising at least one compound of the formula I according to claim 16 and a second component comprising at least one further active compound of groups b1 to b15:

- b1) lipid biosynthesis inhibitors,
- b2) ALS inhibitors,
- b3) photosynthesis inhibitors,
- b4) protoporphyrinogen-IX oxidase inhibitors,
- b5) bleacher herbicides,
- b6) EPSP synthase inhibitors,
- b7) glutamine synthase inhibitors,
- b8) DHP synthase inhibitors,
- b9) mitose inhibitors,
- b10) VLCFA inhibitors,
- b11) cellulose biosynthesis inhibitors,
- b12) decoupler herbicides,
- b13) auxin herbicides,
- b14) auxin transport inhibitors,
- b15) other herbicides.

30. A method for controlling unwanted vegetation which comprises allowing a herbicidally effective amount of a compound of claim 16 to act on plants, their seed and/or their habitat.

31. The method of claim 30, wherein

R₁ is O—R⁴ or S(O)_n—R⁴;

R⁴ is hydrogen, C₁-C₄-alkyl, Z—C₃-C₆-cycloalkyl, C₁-C₄-haloalkyl, C₂-C₆-alkenyl, Z—C₃-C₆-cycloalkenyl, C₂-C₆-alkynyl, Z-(tri-C₁-C₄-alkyl)silyl, Z—C(=O)—R^a, Z—P(=O)(R^a)₂, a 3- to 7-membered monocyclic or 9- or 10-membered bicyclic saturated,

unsaturated or aromatic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S which may be partially or fully substituted by groups Ra and/or Rb, and which is attached via C or N, R^a is hydrogen, OH, C_1 - C_8 -alkyl, C_1 - C_4 -haloalkyl, $Z-C_3$ - C_6 -cycloalkyl, C_2 - C_8 -alkenyl, $Z-C_5$ - C_6 -cycloalkenyl, C_2 - C_8 -alkynyl, $Z-C_1$ - C_6 -alkoxy, $Z-C_1$ - C_4 -haloalkoxy, $Z-C_3$ - C_8 -alkenyloxy, $Z-C_3$ - C_8 -alkynyloxy, NR^iR^{ii} , C_1 - C_6 -alkylsulfonyl, Z -(tri- C_1 - C_4 -alkyl)silyl, Z -phenyl, Z -phenoxy, Z -phenylamino or a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S, where the cyclic groups are unsubstituted or substituted by 1, 2, 3 or 4 groups R^b ; R^i , R^{ii} independently of one another are hydrogen, C_1 - C_8 -alkyl, C_1 - C_4 -haloalkyl, C_3 - C_8 -alkenyl, C_3 - C_8 -alkynyl, $Z-C_3$ - C_6 -cycloalkyl, $Z-C_1$ - C_8 -alkoxy, or $Z-C_1$ - C_8 -haloalkoxy; or R^i and R^{ii} together with the nitrogen atom to which they are attached may form a 5- or 6-membered monocyclic or 9- or 10-membered bicyclic heterocycle which contains 1, 2, 3 or 4 heteroatoms selected from the group consisting of O, N and S.

32. The method of claim 30, wherein X is S.

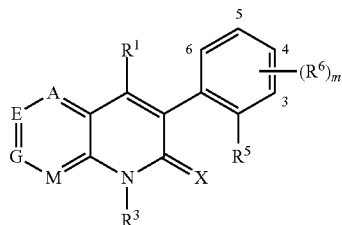
33. The method of claim 30, wherein X is NR^3 .

34. The method of claim 30, wherein R^4 is hydrogen, C_1 - C_6 -alkylcarbonyl or $OS(O)_n-R^4$.

35. The method of claim 30, wherein R^3 is $CH_2C_6H_5$ or tri- C_1 - C_4 -alkylsilyl.

36. The method of claim 30, wherein the compound corresponds to the formula I.A

I.A



wherein

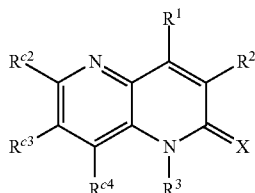
A is N and E, G, M are each CH;

R^5 is Br, F, NO_2 , CN, CH_3 , OCH_3 , CHF_2 , CF_3 or $OCHF_2$; and

R^6 is NO_2 , C_1 - C_4 -alkyl, C_1 - C_2 -haloalkyl or C_1 - C_4 -alkoxy; m is zero or an integer from one to four.

37. The method of claim 30, wherein the compound corresponds to the formula I.1

I.1



wherein R^{c2} , R^{c3} and R^{c4} each correspond to a group R^c .

38. The method of claim 37, wherein

R^{c2} , R^{c3} and R^{c4} are H,

R^1 is OH, OCH_3 , $OC(O)CH_3$, $OC(O)CH_2CH_3$, $OC(O)CH(CH_3)_2$, $OC(O)C(CH_3)_3$, $OC(O)-c-C_3H_5$, $OC(O)-C_6H_5$, $OC(O)-CH_2C_6H_5$, $OC(O)CH_2Cl$, $OC(O)-CF_3$, $OC(O)-CH_2OCH_3$, $OC(O)-N(CH_3)_2$ or $OC(O)-OCH_2CH_3$;

R^2 is phenyl which is substituted by a group selected from the group consisting of 2-Br, 2-Cl, 2,4- Cl_2 , 2-Cl-4-F, 2-Cl-5-F, 2-Cl-6-F, 2-Cl-4- CF_3 , 2-Cl-5- CF_3 , 2-Cl-6- CF_3 , 2-Cl-3,6- F_2 , 2-F, 2,4- F_2 , 2,5- F_2 , 2,6- F_2 , 2-F-4- CF_3 , 2-F-5- CF_3 , 2-F-6- CF_3 , 2,3,6- F_3 , 2- NO_2 , 2- NO_2 -4-F, 2- NO_2 -5-F, 2- NO_2 -6-F, 2- NO_2 -4- CF_3 , 2- NO_2 -5- CF_3 , 2- NO_2 -6- CF_3 , 2- NO_2 -3,6- F_2 , 2-CN, 2- CH_3 , 2- CH_3 -4-F, 2- CH_3 -5-F, 2- CH_3 -6-F, 2- CH_3 -4- CF_3 , 2- CH_3 -5- CF_3 , 2- CH_3 -6- CF_3 , 2- CH_3 -3,6- F_2 , 2- OCH_3 , 2- OCH_3 -4-F, 2- OCH_3 -5-F, 2- OCH_3 -6-F, 2- OCH_3 -4- CF_3 , 2- OCH_3 -5- CF_3 , 2- OCH_3 -6- CF_3 , 2- OCH_3 -3,6- F_2 , 2- CHF_2 , 2- CHF_2 -4-F, 2- CHF_2 -5-F, 2- CHF_2 -6-F, 2- CHF_2 -4- CF_3 , 2- CHF_2 -5- CF_3 , 2- CHF_2 -6- CF_3 , 2- CHF_2 -3,6- F_2 , 2- CF_3 , 2- CF_3 -4-F, 2- CF_3 -5-F, 2- CF_3 -6-F, 2- CF_3 -4- CF_3 , 2- CF_3 -5- CF_3 , 2- CF_3 -6- CF_3 , 2- CF_3 -3,6- F_2 , 2- $OCHF_2$, 2- $OCHF_2$ -4-F, 2- $OCHF_2$ -5-F, 2- $OCHF_2$ -6-F, 2- $OCHF_2$ -4- CF_3 , 2- $OCHF_2$ -5- CF_3 , 2- $OCHF_2$ -6- CF_3 , 2- $OCHF_2$ -3,6- F_2 , 2- OCF_3 , 2- OCF_3 -4-F, 2- OCF_3 -5-F, 2- OCF_3 -6-F, 2- OCF_3 -4- CF_3 , 2- OCF_3 -5- CF_3 , 2- OCF_3 -6- CF_3 and 2- OCF_3 -3,6- F_2 ;

R^3 is selected from the group consisting of H, CH_3 , C_2H_5 , $n-C_3H_7$, $CH(CH_3)_2$, $n-C_4H_9$, $CH_2CH=CH_2$, $CH_2C\equiv CH$, CH_2CN and $CH_2C_6H_5$; and

X is O or S;

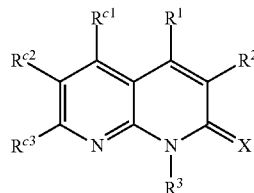
with the provisos that

a) R^1 is not OH, $OC(O)CH(CH_3)_2$ or $OC(O)C(CH_3)_3$ if R^2 is 2,4- Cl_2 -phenyl, 2-Cl-3,6- F_2 -phenyl or 2- OCF_3 -phenyl, R^3 is CH_3 and X is O, and

b) R^1 is not OH if R^2 is 2,4- Cl_2 -phenyl or 2- OCF_3 -phenyl, R^3 is H and X is O.

39. The method of claim 30, wherein the compound corresponds to the formula I.4

I.4



wherein, independently of one another,

R^{c1} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl;

R^{c2} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl; and

R^{c3} is H, OH, CN, halogen, alkyl, alkoxy or haloalkyl.

* * * * *