Title: HERBICIDAL HALOALKYLSULPHONAMIDE DERIVATIVES

Abstract: The present invention relates to haloalkylsulphonamide derivatives of the formula (1); wherein A represents -CH=CH- or a sulphur atom, W represents an oxygen atom or the like, R1 represents C-1-C6 haloalkyl, R2, R3 and R4 each independently represent hydrogen atoms or the like, R5 represents a hydrogen atom, C-1-C6 alkyl or the like, R6, R7, R8 and R9 each independently represent hydrogen atoms or the like, X represents a halogen atom or the like, m represents a whole number 0-4, n represents a whole number 1-4, and p represents a whole number 0-1 and herbicides containing these as well as methods of using these compounds to control plant growth.
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(a))
— of inventorship (Rule 4.17(iv))

Published:
— with international search report (Art. 21(3))
HERBICIDAL HALOALKYLSULPHONAMIDE DERIVATIVES

The present invention relates to novel haloalkylsulphonamide derivatives and salts thereof, and agrichemicals which contain the said haloalkylsulphonamide derivatives and salts thereof as active component, and in particular to herbicides. Further, agrichemical in the present invention means insecticide, acaricide, nematocide, herbicide, bactericide and the like.


The purpose of the present invention is to provide chemical substances which reliably display efficacy against various weeds at lower dosages and with which problems such as soil contamination, effects on future crops and the like are alleviated, which are very safe, and are useful as effective components of herbicides.

The present inventors, as a result of repeated and diligent studies with the aim of solving the aforesaid problem, discovered that the novel haloalkylsulphonamide derivatives represented by the following formula (1) of the present invention are very useful compounds which have excellent herbicidal activity as herbicides and are very safe towards the crops concerned, and have practically no harmful effects on non-target animals such as mammals, fish and beneficial insects, and thus accomplished the present invention.

Thus, in one aspect, the present invention relates to a haloalkylsulphonamide derivative represented by the formula (1):

\[
\text{R}_5
\]
wherein

A represents -CH=CH- or a sulphur atom,

W represents an oxygen atom or a sulphur atom,

X represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₂-C₆ alkenyl, C₂-C₆ haloalkynyl, cyano, -C(0)R, hydroxy, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, amino, nitro or -S(0)R, and when m represents a whole number 2 or more, the respective X may be the same or different, further, if 2 X are adjacent, the 2 adjacent X, by forming -CH₂CH₂CH₂-, -CH₂CH₂O-, -CH₂OCH₂-, -OCH₂O-, -CH₂CH₂S-, -CH₂CH₂CH₂-, -CH₂CH₂CH₂O-, -CH₂CH₂OCH₂-, -CH₂OCH₂O-, -OCH₂CH₂O-, -CH₂CH₂CH₂S-, -OCH₂CH₂S- or -CH=CH-CH=CH-, can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 X, and in this case the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with halogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl,

m represents a whole number 0, 1 or 2,

n represents a whole number 1, 2, 3 or 4,

p represents a whole number 0 or 1,

R¹ represents Ci-C₆ haloalkyl,

R² represents a hydrogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R¹⁰, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R¹⁰, C₂-C₆ alkenyl, (C₂-C₆) alkenyl optionally substituted with R¹⁰, -C(0)R, Ci-C₆ alkynyl, (Ci-C₆) alkynyl optionally substituted with R¹⁰, -C(0)R or -S(0)R,

R³ and R⁴ each independently represent a hydrogen atom, halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₂-C₆ halocycloalkyl, Ci-C₆ alkoxy or Ci-C₆ haloalkoxy or else R¹ by forming a C₂-C₆ alkylene chain together with R⁴ can form a 3 to 7-membered ring together with the carbon atom linking R³ and R⁴,

R⁵ represents a hydrogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R²⁷, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R²⁷, C₂-C₆ alkenyl, (C₂-C₆)
alkenyl optionally substituted with \(R^{27}, C_2-C_6\) alkenyl, \((C_2-C_6)\) alkenyl optionally substituted with \(R^{27}, -C(0)R^{28}, -S(0)R^{30}\) or D-1 to D-9.

\(R^6\) and \(R^7\) each independently represent a hydrogen atom, halogen atom, \(Ci-C_6\) alkyl, \((Ci-C_6)\) alkyl optionally substituted with \(R^{39}, C_3-C_6\) cycloalkyl, \((C_3-C_6)\) cycloalkyl optionally substituted with \(R^{39}, C_2-C_6\) alkenyl, \((C_2-C_6)\) alkenyl optionally substituted with \(R^{39}, phenyl, phenyl substituted with (R^{40})_{65}, -C(0)R^{41}, cyano, -OR^{42} or -S(0)R^{43}\) or else \(R^6\) and \(R^7\) on the same carbon, by together forming a \(C_2-C_6\) alkylene chain, can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, or else \(R^6\) and \(R^7\) on the same carbon atom can link together and form =CH\(_2\) or carbonyl, further, when \(n = 2\) to 4, \(R^6\) and \(R^7\) by forming a \(C_2-C_6\) alkylene chain together with an \(R^6\) or \(R^7\) on a different carbon can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and further, \(R^6\) and \(R^7\) can be the same as or different from \(R^6\) or \(R^7\) on different carbons, and \(R^6\) and \(R^7\) together with an \(R^6\) or \(R^7\) on an adjacent carbon can represent a bond.

\(R^8\) and \(R^9\) each independently represent a hydrogen atom, halogen atom, \(Ci-C_6\) alkyl, \((Ci-C_6)\) alkyl optionally substituted with \(R^{39}, C_3-C_6\) cycloalkyl, \((C_3-C_6)\) cycloalkyl optionally substituted with \(R^{39}, C_2-C_6\) alkenyl, \((C_2-C_6)\) alkenyl optionally substituted with \(R^{39}, C_2-C_6\) alkenyl optionally substituted with \(R^{39}, phenyl, phenyl substituted with (R^{40})_{65}, -C(0)R^{41}, cyano, -OR^{42} or -S(0)R^{43}\) or else \(R^8\) together with \(R^9\) on the same carbon, by forming a \(C_2-C_6\) alkylene chain, can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, or \(R^8\) and \(R^9\) on the same carbon can join together forming =CH\(_2\) or carbonyl,

D-1 to D-9 represent the rings shown in the respective following structural formulae,
R\(^{10}\) represents a halogen atom, phenyl, phenyl substituted with \((R^{13})_qi\), -C(0)R\(^{14}\), -OR\(^{15}\) or -S(0)\(^{2q}\)R\(^{19}\).

R\(^{11}\) represents C\(_1\)-C\(_{12}\) alkyl, (C\(_1\)-C\(_{12}\)) alkyl optionally substituted with R\(^{20}\), C\(_2\)-C\(_6\) cycloalkyl, (C\(_3\)-C\(_6\)) cycloalkyl optionally substituted with R\(^{20}\), C\(_2\)-C\(_6\) alkenyl, (C\(_2\)-C\(_6\)) alkenyl optionally substituted with R\(^{20}\), phenyl, phenyl substituted with \((R^{13})_qi\), -OR\(^{21}\), -N(R\(^{22}\))R\(^{23}\) or -SR\(^{24}\).

R\(^{12}\) represents Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, phenyl, phenyl substituted with \((R^{13})_qi\) or -N(R\(^{25}\))R\(^{26}\).

R\(^{13}\) represents a halogen atom, Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, Ci-C\(_6\) alkoxy, Ci-C\(_6\) haloalkoxy, amino or nitro and when q\(_i\) represents a whole number 2 or more, the respective R\(^{13}\) may be the same or different, further, if 2 R\(^{13}\) are adjacent, the 2 adjacent R\(^{13}\), by forming -CH\(_2\)CH\(_2\)CH\(_2\), -CH\(_2\)CH\(_2\)O-, -CH\(_2\)OCH\(_2\)-, -OCH\(_2\)O-, -CH\(_2\)CH\(_2\)S-, -CH\(_2\)SCH\(_2\)-, -CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)-, -CH\(_2\)CH\(_2\)CH\(_2\)O-, -CH\(_2\)CH\(_2\)OCH\(_2\)-, -CH\(_2\)OCH\(_2\)O-, -OCH\(_2\)CH\(_2\)O-, -CH\(_2\)CH\(_2\)S-, -OCH\(_2\)CH\(_2\)S- or -CH=CH-CH=CH- can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 R\(^{13}\), and in this case, the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with a halogen atom, Ci-C\(_6\) alkyl or Ci-C\(_6\) haloalkyl.

R\(^{14}\) represents Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, Ci-C\(_6\) alkoxy, Ci-C\(_6\) haloalkoxy, phenyl or phenyl substituted with \((R^{13})_qi\).
R$^{15}$ represents a hydrogen atom, Ci-C$_6$ alkyl, Ci-C$_6$ haloalkyl, phenyl, phenyl substituted with (R$^{13}$)$_k$ or -C(0)R$^{16}$.

R$^{16}$ represents Ci-C$_6$ alkyl, phenyl, phenyl substituted with (R$^{13}$)$_k$, Ci-C$_6$ alkoxy or -N(R$^i$)$_b$ together with the linking nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C$_6$ alkoxy group, Ci-C$_6$ haloalkyl group, Ci-C$_6$ alkoxy group, formyl group, Ci-C$_6$ alky carbonyl group, Ci-C$_6$ alkoxy carbonyl group or oxo group.

R$^{17}$ and R$^{18}$ each independently represent a hydrogen atom, Ci-C$_6$ alkyl or Ci-C$_6$ haloalkyl or else R$^{17}$, together with R$^{18}$, by forming a C$_2$-C$_6$ alkyne chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C$_6$ alkyl group, Ci-C$_6$ haloalkyl group, Ci-C$_6$ alkoxy group, formyl group, Ci-C$_6$ alky carbonyl group, Ci-C$_6$ alkoxy carbonyl group or oxo group.

R$^{19}$ represents Ci-C$_6$ alkyl, Ci-C$_6$ haloalkyl, phenyl or phenyl substituted with (R$^{13}$)$_k$.

R$^{20}$ represents a halogen atom, C$_3$-C$_6$ cycloalkyl, phenyl, phenyl substituted with (R$^{13}$)$_k$, Ci-C$_6$ alkoxy, Ci-C$_6$ haloalkoxy or phenoxy.

R$^{21}$ represents C$_1$-C$_{12}$ alkyl, (C$_1$-C$_{12}$) alkyl optionally substituted with R$^{20}$, C$_3$-C$_6$ cycloalkyl, (C$_3$-C$_6$) cycloalkyl optionally substituted with R$^{20}$, C$_2$-C$_6$ alkenyl, (C$_2$-Ce) alkenyl optionally substituted with R$^{20}$, C$_2$-C$_6$ alkynyl, (C$_2$-Ce) alkynyl optionally substituted with R$^{20}$, phenyl or phenyl substituted with (R$^{13}$)$_k$.

R$^{22}$ and R$^{23}$ each independently represent a hydrogen atom, Ci-C$_6$ alkyl or Ci-C$_6$ haloalkyl or else R$^{22}$, together with R$^{23}$, by forming a C$_2$-C$_6$ alkyne chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C$_6$ alkyl group, Ci-C$_6$ haloalkyl group, Ci-C$_6$ alkoxy group, formyl group, Ci-C$_6$ alky carbonyl group, Ci-C$_6$ alkoxy carbonyl group or oxo group.

R$^{24}$ represents Ci-C$_6$ alkyl or Ci-C$_6$ haloalkyl.

R$^{25}$ and R$^{26}$ each independently represent a hydrogen atom or Ci-C$_6$ alkyl or else R$^{25}$, together with R$^{26}$, by forming a C$_2$-C$_6$ alkyne chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a
halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, C₁-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R²⁷ represents a halogen atom, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, -C(0)R³¹ -OR³², -N(R³³)R³⁴, -S(0)₄R³⁵, tri(Ci-C₆ alkyl)silyl or D-I to D-9,

R²⁸ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, -N(R³⁶)R³⁷ or -SR³⁸,

R²⁹ represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, amino or nitro and when q³ represents a whole number 2 or more, the respective R²⁹ may be the same or different, further, if 2 R²⁹ are adjacent, the 2 adjacent R²⁹, by forming

-CH₂CH₂CH₂₂, -CH₂CH₂O₂, -CH₂OCH₂₂, -OCH₂O₂, -CH₂CH₂S₂, -CH₂SCH₂₂, -CH₂CH₂CH₂₂, -CH₂CH₂CH₂₂, -CH₂CH₂OH₂, -CH₂OCH₂₀, -OCH₂CH₂₀, -CH₂CH₂S₂, -OCH₂CH₂S₂ or -CH=CH=CH₂, can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 R²⁹, and in this case, the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with a halogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl,

R³⁰ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R²⁹)₄³.

R³¹ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, Ci-C₆ alkoxy or Ci-C₆ haloalkoxy,

R³² represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R²⁹)₄³,

R³³ and R³⁴ each independently represent a hydrogen atom or Ci-C₆ alkyl or else R³³, together with R³⁴, by forming a C₂-C₆ alkyne chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R³⁵ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R²⁹)₄³.

R³⁶ and R³⁷ each independently represent a hydrogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl or else R³⁶, together with R³⁷, by forming a C₂-C₆ alkyne chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyne chain may contain
1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R³⁸ represents Ci-C₆ alkyl or Ci-C₆ haloalkyl,

R³⁹ represents a halogen atom, C₃-C₆ cycloalkyl, phenyl, hydroxy, Ci-C₆ alkoxy or Ci-C₆ haloalkoxy,

R⁴⁰ represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, amino or nitro, and when q⁵ represents a whole number 2 or more, the respective R⁴⁰ may be the same or different, further, if 2 R⁴⁰ are adjacent, the 2 adjacent R⁴⁰, by forming -CH₂CH₂CH₂⁻, -CH₂CH₂O⁻, -CH₂OCH₂⁻, -OCH₂O⁻, -CH₂CH₂S⁻, -CH₂SCH₂⁻, -CH₂CH₂CH₂⁻, -CH₂CH₂CH₂O⁻, -CH₂CH₂OCH₂⁻, -CH₂CH₂OH⁻, -OCH₂CH₂O⁻, -CH₂CH₂S⁻, -OCH₂CH₂S⁻ or -CH=CH-CH=CH- can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 R⁴⁰, and in this case the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with a halogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl,

R⁴¹ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, hydroxy, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy or -N(R⁴⁴)R⁴⁵,

R⁴² represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R⁴⁰)q⁵,

R⁴³ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R⁴⁰)q⁵

R⁴⁴ and R⁴⁵ each independently represent a hydrogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl or else R⁴⁴, together with R⁴⁵, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R⁴⁶ represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ alkoxy or -N(R⁴⁷)R⁴⁸,

R⁴⁷ and R⁴⁸ each independently represent a hydrogen atom or Ci-C₆ alkyl or else R⁴⁷, together with R⁴⁸, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring
together with the linking nitrogen atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, \( \text{Ci-}C_6 \) alkyl group, \( \text{Ci-}C_6 \) haloalkyl group, \( \text{Ci-}C_6 \) alkoxy group, formyl group, \( \text{Ci-}C_6 \) alkylcarbonyl group, \( \text{Ci-}C_6 \) alkoxy carbonyl group or oxo group,

\[ R^{49} \text{ represents } \text{Ci-}C_6 \text{ alkyl or } \text{Ci-}C_6 \text{ haloalkyl,} \]

\[ q^1 \text{ represents a whole number } 1, 2, 3, 4 \text{ or } 5, \]

\[ q^2 \text{ represents a whole number } 0, 1 \text{ or } 2, \]

\[ q^3 \text{ represents a whole number } 1, 2, 3, 4 \text{ or } 5, \]

\[ q^4 \text{ represents a whole number } 0, 1 \text{ or } 2, \]

\[ q^5 \text{ represents a whole number } 1, 2, 3, 4 \text{ or } 5, \]

\[ q^6 \text{ and } q^7 \text{ each independently represent a whole number } 0, 1 \text{ or } 2, \]

\[ t^1 \text{ represents a whole number } 0, 1, 2, 3, 4 \text{ or } 5, \]

\[ t^2 \text{ represents a whole number } 0, 1, 2, 3 \text{ or } 4, \]

\[ t^3 \text{ represents a whole number } 0, 1, 2, 3, 4, 5, 6 \text{ or } 7, \]

\[ t^4 \text{ represents a whole number } 0, 1, 2, 3, 4, 5, 6, 7, 8 \text{ or } 9 \text{ or salt thereof.} \]

In particularly preferred embodiments of the invention, the preferred groups for \( A, W, X, m, n, p, q, t \) and all \( R \) numbers in any combination thereof, are as set out below.

Preferably, \( A \) represents \(-\text{CH=CH-}\).

Preferably, \( W \) represents an oxygen atom.

Preferably, \( R^2 \) represents a hydrogen atom, \( \text{Ci-}C_6 \) alkyl, \((\text{Ci-}C_6)\) alkyl optionally substituted with \( R^{10}, C_2-C_6 \) alkenyl, \( C_2-C_6 \) alkynyl, \(-\text{C(0)R}^{11} \) or \(-\text{S(0)}_2 \text{R}^{12} \). More preferably, \( R^2 \) represents a hydrogen atom or \(-\text{C(0)R}^{11} \).

Preferably, \( R^3 \) and \( R^4 \) represent hydrogen atoms.

Preferably, \( R^5 \) represents a hydrogen atom, \( \text{Ci-}C_6 \) alkyl, \((\text{Ci-}C_6)\) alkyl optionally substituted with \( R^{27}, C_3-C_6 \) cycloalkyl, \( C_2-C_6 \) alkenyl, \( C_2-C_6 \) alkynyl, \(-\text{C(0)R}^{28} \) or D-7. More
preferably, R^5 represents a hydrogen atom, CI-C_6 alkyl, (CI-C_6) alkyl optionally substituted with R^{27}, -C(0)R^{28} or D-7.

Preferably, R^6 and R^7 each independently represent a hydrogen atom, halogen atom, CI-C_6 alkyl, (CI-C_6) alkyl optionally substituted with R^{39}, phenyl, -C(0)R^{41}, cyano, -OR^{42} or -S(0)_{q6}R^{43} or else R^6 and R^7 on the same carbon, by together forming a C_2 alkylene chain, can form a 3-membered ring together with the linking carbon atom, or else R^6 and R^7 on the same carbon atom can link together and form =CH_2 or carbonyl, further, when n = 2 to 4, R^6 and R^7 by forming a C_2-C_6 alkylene chain together with an R^6 or R^7 on a different carbon can form a 4 to 6-membered ring together with the linking carbon atom, and further, R^6 and R^7 can be the same as or different from R^6 or R^7 on different carbons, and R^6 and R^7 together with an R^6 or R^7 on an adjacent carbon can represent a bond. More preferably, R^6 and R^7, represent hydrogen atoms.

Preferably, R^8 and R^9 each independently represent a hydrogen atom, halogen atom, CI-C_6 alkyl, (CI-C_6) alkyl optionally substituted with R^{39}, phenyl, -C(0)R^{41}, cyano, -OR^{42} or -S(0)_{q6}R^{43} or else R^8 and R^9 on the same carbon, by together forming a C_2 alkylene chain, can form a 3-membered ring together with the linking carbon atom, or else R^8 and R^9 on the same carbon atom can link together and form =CH_2 or carbonyl. More preferably, R^8 and R^9 each independently represent hydrogen atoms.

Preferably, R^{10} represents phenyl, -C(0)R^{14}, -OR^{15} or -S(0)_{q6}R^{19}.

Preferably, R^{11} represents CI-C_i alkyl, (CI-C_i) alkyl optionally substituted with R^{20}, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl, phenyl, -OR^{21} or -SR^{24}. More preferably, R^{11} represents -OR^{21}.

Preferably, R^{12} represents CI-C_6 alkyl, CI-C_6 haloalkyl, phenyl or phenyl substituted with (R^{12})_{q,i}.

Preferably, R^{13} represents a halogen atom, CI-C_6 alkyl, CI-C_6 haloalkyl or CI-C_6 alkoxy.

Preferably, R^{14} represents CI-C_6 alkoxy or phenyl.

Preferably, R^{15} represents a hydrogen atom, CI-C_6 alkyl or -C(0)R^{16}.

Preferably, R^{16} represents CI-C_6 alkyl or CI-C_6 alkoxy.
Preferably, \( R^{19} \) represents \( \text{Ci-C}_6 \) alkyl.

Preferably, \( R^{20} \) represents a halogen atom or phenoxy.

Preferably, \( R^{21} \) represents \( \text{C}_1-\text{C}_{12} \) alkyl, \( (\text{d-C}_{12}) \) alkyl optionally substituted with \( R^{20} \), \( \text{C}_2-\text{C}_6 \) alkenyl, \( \text{C}_2-\text{C}_6 \) alkynyl or phenyl. More preferably, \( R^{21} \) represents \( \text{d-C}_6 \) alkyl.

Preferably, \( R^{24} \) represents \( \text{Ci-C}_6 \) alkyl.

Preferably, \( R^{27} \) represents a halogen atom, \( -\text{C}(\text{O})R^{31} \), \( -\text{OR}^{32} \), \( \text{tri(Ci-C}_6 \) alkyl)silyl or \( \text{D-1} \).

Preferably, \( R^{28} \) and \( R^{31} \) each independently represent \( \text{Ci-C}_6 \) alkoxy.

Preferably, \( R^{32} \) represents \( \text{d-C}_6 \) alkyl.

Preferably, \( R^{39} \) represents a halogen atom, phenyl, hydroxy or \( \text{Ci-C}_6 \) alkoxy.

Preferably, \( R^{41} \) represents hydroxy or \( \text{Ci-C}_6 \) alkoxy.

Preferably, \( R^{42} \) represents a hydrogen atom, \( \text{Ci-C}_6 \) alkyl or phenyl.

Preferably, \( R^{43} \) represents \( \text{d-C}_6 \) alkyl or phenyl.

In a particular embodiment, the present invention provides a haloalkylsulphonamide derivative or salt thereof as described above wherein:

\( A \) represents \(-\text{CH}=\text{CH}-\),

\( W \) represents an oxygen atom,

\( R^{6} \) represents a hydrogen atom, \( \text{Ci-C}_6 \) alkyl, \( (\text{d-C}_6) \) alkyl optionally substituted with \( R^{30} \), \( \text{C}_2-\text{C}_6 \) alkenyl, \( \text{C}_2-\text{C}_6 \) alkynyl, \( -\text{C}(\text{O})R^{11} \) or \(-\text{S}(\text{O})_2R^{12} \),

\( R^{3} \) and \( R^{4} \) represent hydrogen atoms,

\( R^{5} \) represents a hydrogen atom, \( \text{Ci-C}_6 \) alkyl, \( (\text{Ci-C}_6) \) alkyl optionally substituted with \( R^{27} \), \( \text{C}_3-\text{C}_6 \) cycloalkyl, \( \text{C}_2-\text{C}_6 \) alkenyl, \( \text{C}_2-\text{C}_6 \) alkynyl, \( -\text{C}(\text{O})R^{28} \) or \( \text{D-7} \),

\( R^{6} \) and \( R^{7} \) each independently represent a hydrogen atom, halogen atom, \( \text{C}_1-\text{C}_6 \) alkyl, \( (\text{d-C}_6) \) alkyl optionally substituted with \( R^{39} \), phenyl, \( -\text{C}(\text{O})R^{41} \), cyano, \( -\text{OR}^{42} \) or \(-\text{S}(\text{O})_2R^{43} \) or else \( R^{6} \) and \( R^{7} \) on the same carbon, by together forming a \( \text{C}_2 \) alkylene chain, can form a 3-
membered ring together with the linking carbon atom, or else R\textsubscript{6} and R\textsubscript{7} on the same carbon
atom can link together and form =CH\textsubscript{2} or carbonyl, further, when n = 2 to 4, R\textsubscript{6} and R\textsubscript{7} by
forming a C\textsubscript{2}-C\textsubscript{6} alkylene chain together with an R\textsubscript{6} or R\textsubscript{7} on a different carbon can form a 4
to 6-membered ring together with the linking carbon atom, and further, R\textsubscript{6} and R\textsubscript{7} can be the
same as or different from R\textsubscript{6} or R\textsubscript{7} on different carbons, and R\textsubscript{6} and R\textsubscript{7} together with an R\textsubscript{6} or
R\textsubscript{7} on an adjacent carbon can represent a bond,

R\textsuperscript{8} and R\textsuperscript{9} each independently represent a hydrogen atom, halogen atom, Ci-C\textsubscript{6} alkyl, (Ci-C\textsubscript{6})
alkyl optionally substituted with R\textsuperscript{39}, phenyl, -C(0)R\textsuperscript{41}, cyano, -OR\textsuperscript{42} or -S(0)\textsubscript{96}R\textsuperscript{43} or else
R\textsuperscript{8} and R\textsuperscript{9} on the same carbon, by together forming a C\textsubscript{2} alkylene chain, can form a 3-
membered ring together with the linking carbon atom, or else R\textsuperscript{8} and R\textsuperscript{9} on the same carbon
atom can link together and form =CH\textsubscript{2} or carbonyl,

R\textsuperscript{10} represents phenyl, -C(0)R\textsuperscript{14}, -OR\textsuperscript{15} or -S(0)\textsubscript{92}R\textsuperscript{19},

R\textsuperscript{11} represents Ci-Ci\textsubscript{2} alkyl, (Ci-Ci\textsubscript{2}) alkyl optionally substituted with R\textsuperscript{20}, C\textsubscript{3}-C\textsubscript{6} cycloalkyl,
C\textsubscript{2}-C\textsubscript{6} alkenyl, phenyl, -OR\textsuperscript{21} or -SR\textsuperscript{24},

R\textsuperscript{12} represents Ci-C\textsubscript{6} alkyl, Ci-C\textsubscript{6} haloalkyl, phenyl or phenyl substituted with (R\textsuperscript{13})\textsubscript{q}i,

R\textsuperscript{13} represents a halogen atom, Ci-C\textsubscript{6} alkyl, Ci-C\textsubscript{6} haloalkyl or Ci-C\textsubscript{6} alkoxy,

R\textsuperscript{14} represents Ci-C\textsubscript{6} alkoxy or phenyl,

R\textsuperscript{15} represents a hydrogen atom, Ci-C\textsubscript{6} alkyl or -C(0)R\textsuperscript{16},

R\textsuperscript{16} represents Ci-C\textsubscript{6} alkyl or Ci-C\textsubscript{6} alkoxy,

R\textsuperscript{19} represents Ci-C\textsubscript{6} alkyl,

R\textsuperscript{20} represents a halogen atom or phenoxy,

R\textsuperscript{21} represents Ci-Ci\textsubscript{2} alkyl, (Ci-Ci\textsubscript{2}) alkyl optionally substituted with R\textsuperscript{20}, C\textsubscript{2}-C\textsubscript{6} alkenyl, C\textsubscript{2}-
C\textsubscript{6} alkynyl or phenyl,

R\textsuperscript{24} represents Ci-C\textsubscript{6} alkyl,

R\textsuperscript{27} represents a halogen atom, -C(0)R\textsuperscript{31}, -OR\textsuperscript{32}, tri(Ci-C\textsubscript{6} alkyl)silyl or D-l,

R\textsuperscript{28} and R\textsuperscript{31} each independently represent Ci-C\textsubscript{6} alkoxy,
R\textsuperscript{32} represents Ci-C\textsubscript{6} alkyl,

R\textsuperscript{39} represents a halogen atom, phenyl, hydroxy or Ci-C\textsubscript{6} alkoxy,

R\textsuperscript{41} represents hydroxy or Ci-C\textsubscript{6} alkoxy,

R\textsuperscript{42} represents a hydrogen atom, Ci-C\textsubscript{6} alkyl or phenyl,

R\textsuperscript{43} represents Ci-C\textsubscript{6} alkyl or phenyl.

In a more preferred embodiment, the present invention provides a haloalkylsulphonamide derivative or salt thereof as described above wherein

R\textsuperscript{5} represents a hydrogen atom, Ci-C\textsubscript{6} alkyl, (Ci-C\textsubscript{6}) alkyl optionally substituted with R\textsuperscript{27}, -C(0)R\textsuperscript{28} or D-7, and

R\textsuperscript{6}, R\textsuperscript{7}, R\textsuperscript{8} and R\textsuperscript{9} represent hydrogen atoms.

In an even more preferred embodiment, the present invention provides a haloalkylsulphonamide derivative or salt thereof as described above, wherein

R\textsuperscript{2} represents a hydrogen atom or -C(0)R\textsuperscript{11},

R\textsuperscript{11} represents -OR\textsuperscript{21}, and

R\textsuperscript{21} represents Ci-C\textsubscript{6} alkyl.

In another aspect, the present invention provides a pesticide containing as active component 1 or 2 or more selected from haloalkylsulphonamide derivatives or salts thereof as described above.

In another aspect, the present invention provides a herbicide containing as active component 1 or 2 or more selected from haloalkylsulphonamide derivatives or salts thereof as described above. In particular, the herbicide is in the form of a composition comprising the active component and, in addition, at least one agriculturally acceptable adjuvant or diluent.

In another aspect, the present invention also provides the use of a haloalkylsulphonamide derivative or salts thereof as described above as a herbicide.
In another aspect, the present invention also provides a method of controlling plants which comprises applying to the plants or to the locus thereof a herbicidally effective amount of a haloalkylsulphonamide derivative or salts thereof as described above.

In another aspect, the present invention also provides a method of inhibiting plant growth which comprises applying to the plants or to the locus thereof a herbicidally effective amount of a haloalkylsulphonamide derivative or salts thereof as described above.

In another aspect, the present invention also provides a method of controlling weeds in crops of useful plants, comprising applying to said weeds or to the locus of said weeds, or to said useful crop plants, a compound or a composition of the invention.

In another aspect, the present invention also provides a method of selectively controlling grasses and/or weeds in crops of useful plants which comprises applying to the useful plants or locus thereof or to the area of cultivation a herbicidally effective amount of a haloalkylsulphonamide derivative or salts thereof as described above.

The compounds of the present invention have excellent herbicidal activity against various weeds and are very safe towards the crops concerned, have practically no harmful effects on non-target animals such as mammals, fish and beneficial insects, and as they have low residue, they are also low-polluting towards the environment.

Consequently, the present invention can provide herbicides valuable in the field of farming and horticulture, for example in paddy fields, farms and orchards.

Depending on the nature of the substituents, E-form and Z-form geometrical isomers may be present in the compounds included in the present invention, and the present invention includes these E-forms, Z-forms or mixtures containing the E-form and Z-form in any proportion. Further, in the compounds included in the present invention, optically active forms due to the presence of 1 or 2 or more asymmetric carbon atoms are present, and the present invention includes all optically active forms or racemic forms.

Among the compounds included in the present invention, those which can be made into acid addition salts by usual methods, for example, can be made into salts of hydrogen halides such as hydrofluoric acid, hydrochloric acid, hydrobromic acid, and hydriodic acid, salts of inorganic acids such as nitric acid, sulphuric acid, phosphoric acid, chloric acid and perchloric acid, salts of sulphonic acids such as methanesulphonic acid, ethanesulphonic
acid, tri-fluoromethanesulphonic acid, benzenesulphonic acid and p-toluenesulphonic acid, salts of carboxylic acids such as formic acid, acetic acid, propionic acid, trifluoroacetic acid, fumaric acid, tartaric acid, oxalic acid, maleic acid, malic acid, succinic acid, benzoic acid, mandelic acid, ascorbic acid, lactic acid, gluconic acid, and citric acid or salts of amino acids such as glutamic acid and aspartic acid.

Alternatively, among the compounds included in the present invention, those which can be made into metal salts by usual methods can for example be made into salts of alkali metals such as lithium, sodium and potassium, salts of alkaline earth metals such as calcium, barium and magnesium or salts of aluminium. In addition, suitable salts also include those derived from ammonia and amines. Preferred cations include ammonium cations of the formula $\text{NH}_4^+$($\text{R}^{19}\text{R}^{20}\text{R}^{21}\text{R}^{22}$) wherein $\text{R}^{19}$, $\text{R}^{20}$, $\text{R}^{21}$ and $\text{R}^{22}$ are independently selected from hydrogen, Ci-C$_6$ alkyl and Ci-C$_6$ hydroxyalkyl. Salts of the compounds of formula (I) can be prepared by treatment of compounds of formula (I) with a metal hydroxide, such as sodium hydroxide, or an amine, such as ammonia, trimethylamine, diethanolamine, 2-methylthiopropylamine, bisallylamine, 2-butoxyethylamine, morpholine, cyclododecylamine, or benzylamine. Amine salts are often preferred forms of the compounds of formula (I) because they are water-soluble and lend themselves to the preparation of desirable aqueous based herbicidal compositions.

Next, specific examples of substituent groups indicated in the present specification are indicated below. Here, n- means normal, i- iso, s- secondary, and tert- tertiary respectively, and Ph means phenyl.

As halogen atoms in the present specification, the fluorine atom, chlorine atom, bromine atom and iodine atom are mentioned. It should be noted that "halo" in the present specification indicates these halogen atoms.

The expression C$_a$-C$_b$ alkyl in the present specification indicates a linear or branched hydrocarbon group with a number of carbon atoms a to b, for example methyl group, ethyl group, n-propyl group, i-propyl group, n-butyl group, i-butyl group, s-butyl group, tert-butyl group, n-pentyl group, 1,1-dimethylpropyl group, n-hexyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.
The expression $C_{a}^{\text{-}}C_{b}^{\text{-}}$ cycloalkyl in the present specification indicates a cyclic hydrocarbon group made up of a number of carbon atoms $a$ to $b$, and single ring or multiple ring structures of 3-membered rings to 6-membered rings can be formed. Further, each ring can be optionally substituted with alkyl groups with the specified numbers of carbon atoms. For example the cyclopropyl group, 1-methylcyclopropyl group, 2-methylcyclopropyl group, 2,2-dimethylcyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression $C_{a}^{\text{-}}C_{b}^{\text{-}}$ alkenyl in the present specification indicates a linear or branched unsaturated hydrocarbon group with a number of carbon atoms $a$ to $b$ which has 1 or 2 or more double bonds in the molecule, for example a vinyl group, 1-propenyl group, 2-propenyl group, 1-methylethenyl group, 2-butenyl group, 2-methyl-2-propenyl group, 3-methyl-2-butenyl group, 1,1-dimethyl-2-propenyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression $C_{a}^{\text{-}}C_{b}^{\text{-}}$ alkynyl in the present specification indicates an unsaturated hydrocarbon group with a number of carbon atoms $a$ to $b$ which has 1 or 2 or more triple bonds in the molecule, for example an ethinyl group, 1-propinyl group, 2-propinyl group, 1-butinyl group, 2-butinyl group, 3-butinyl group, 1,1-dimethyl-2-propinyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression $C_{a}^{\text{-}}C_{b}^{\text{-}}$ haloalkyl in the present specification indicates a linear or branched hydrocarbon group made up of a number of carbon atoms $a$ to $b$, wherein the hydrogen atoms linked to carbon atoms are optionally substituted with halogen atoms, and, in this case, if they are substituted with 2 or more halogen atoms, these halogen atoms can be the same or different. For example the fluoromethyl group, chloromethyl group, bromomethyl group, iodomethyl group, difluoromethyl group, dichloromethyl group, trifluoromethyl group, chlorodifluoromethyl group, trichloromethyl group, bromodifluoromethyl group, 2-fluoroethyl group, 2-chloroethyl group, 2-bromoethyl group, 2,2-difluoroethyl group, 2,2,2-trifluoroethyl group, 2-chloro-2,2-difluoroethyl group, 2,2,2-trichloroethyl group, 1,1,2,2-tetrafluoroethyl group, 2-chloro-1,1,2-trifluoroethyl group, pentafluoroethyl group, 3,3,3-trifluoropropyl group, 2,2,3,3,3-pentafluoropropyl group,
1,1,2,3,3,3-hexafluoropropyl group, heptafluoropropyl group, 2,2,2-trifluoro-l-(trifluoromethyl)ethyl group, 1,2,2,2-tetrafluoro-l-(trifluoromethyl)-ethyl group, 2,2,3,3,4,4,4-heptafluorobutyl group, nonafluorobutyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) haloalkenyl in the present specification indicates a linear or branched unsaturated hydrocarbon group made up of a number of carbon atoms \( a \) to \( b \), which has 1 or 2 or more double bonds in the molecule, wherein the hydrogen atoms linked to carbon atoms are optionally substituted with halogen atoms, and, in this case, if they are substituted with 2 or more halogen atoms, these halogen atoms can be the same or different. For example, the 1-chloroethenyl group, 2-chloroethenyl group, 2-fluoroethenyl group, 2,2-dichloroethenyl group, 3-chloro-2-propenyl group, 3-fluoro-2-propenyl group, 2-chloro-2-propenyl group, 4-chloro-3-butenyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) haloalkynyl in the present specification indicates a linear or branched unsaturated hydrocarbon group made up of a number of carbon atoms \( a \) to \( b \), which has 1 or 2 or more triple bonds in the molecule, wherein the hydrogen atoms linked to carbon atoms are optionally substituted with halogen atoms, and for example the chloroethinyl group, fluoroethinyl group, bromoethinyl group, 3-chloro-2-propinyl group, 4-chloro-2-butinyl group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) alkoxy in the present specification indicates an alkyl-O- group wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning, and for example the methoxy group, ethoxy group, propyloxy group, i-propyloxy group, butyloxy group, i-butyloxy group, s-butyloxy group, t-butyloxy group, pentyloxy group, 1-methylbutyloxy group, 2-methylbutyloxy group, 3-methylbutyloxy group, 1,1-dimethylpropyloxy group, 1,2-dimethylpropyloxy group, 2,2-dimethylpropyloxy group, 1-ethylpropyloxy group, hexyloxy group, 1-methylpentyloxy group, 2-methylpentyloxy group, 3-methylpentyloxy group, 4-methylpentyloxy group, 1,1-dimethylbutyloxy group, 1,2-dimethylbutyloxy group, 1,3-dimethylbutyloxy group, 2,2-dimethylbutyloxy group, 2,3-dimethylbutyloxy group, 3,3-dimethylbutyloxy group, 1-ethylbutyloxy group, 2-
ethylbutyloxy group, 1,1,2-trimethylpropyloxy group, 1,2,2-trimethylpropyloxy group, 1-ethyl-1-methylpropyloxy group, 1-ethyl-2-methylpropyloxy group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) haloalkoxy in the present specification indicates a haloalkyl-O-group, wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning, and for example fluoromethoxy group, difluoromethoxy group, trifluoromethoxy group, chlorodifluoromethoxy group, bromodifluoromethoxy group, dichlorofluoromethoxy group, chloromethoxy group, dichloromethoxy group, trichloromethoxy group, bromomethoxy group, 1-fluoroethoxy group, 2-fluoroethoxy group, 2-chloroethoxy group, 2-bromoethoxy group, 2,2-difluoroethoxy group, 2,2,2-trifluoroethoxy group, 1,1,2,2-tetrafluoroethoxy group, pentafluoroethoxy group, 2,2,2-trichloroethoxy group, 2,2,2-trifluoroethoxy group, 1-fluoropropoxy group, 2-fluoropropoxy group, 3-fluoropropoxy group, 3-chloropropoxy group, 3-bromopropoxy group, 1-fluorobutyloxy group, 2-fluorobutyloxy group, 3-fluorobutyloxy group and 4-fluorobutyloxy group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) alkylcarbonyl in the present specification indicates an alkyl-C(0)-group wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning, and for example the \( CH_3C(0) \)- group, \( CH_3CH_2C(0) \)- group, \( CH_3CH_2CH_2C(0) \)- group, \( CH_3OH \)- group, \( CH_3CH(OH) \)- group, \( CH_3CH(OC) \)- group, \( CH_3CH_2CH(OC) \)- group, \( CH_3CH_2CH_2CH(OC) \)- group, \( CH_3CH_2CH_2CH_2CH(OC) \)- group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.

The expression \( C_a-C_b \) alkoxy carbonyl in the present specification indicates an alkyl-O-C(0)-group wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning, and for example the \( CH_3OC(0) \)- group, \( CH_3CH_2OC(0) \)- group, \( CH_3CH_2CH_2OC(0) \)- group, \( CH_3OH \)- group, \( CH_3CH(OH) \)- group, \( CH_3CH(OC) \)- group, \( CH_3CH_2CH(OC) \)- group, \( CH_3CH_2CH_2CH(OC) \)- group, \( CH_3CH_2CH_2CH_2CH(OC) \)- group and the like are mentioned as specific examples, and they are selected in the respective specified carbon atom number range.
The trimethylsilyl group, triethylsilyl group and the like are mentioned as specific examples of the expression tri(C₆H₅alkyl)silyl in the present specification, and they are selected in the respective specified carbon atom number range.

As specific examples of the expression "R³ and R⁴ can form a 3 to 7-membered ring by bonding together" in the present specification, for example cyclopropane, cyclobutane, cyclopentane, cyclohexane and the like are mentioned, and they are selected in the respective specified atom number range.

As specific examples of the expression "R⁶, together with R⁷, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom" in the present specification, for example aziridine, azetidine, azetidin-2-one, pyrrolidine, pyrrolidin-2-one, oxazolidin-2-one, thiazolidine, thiazolidin-2-one, imidazolidine, imidazolidin-2-one, piperidine, piperidin-2-one, morpholine, tetrahydro-1,3-oxazin-2-one, thiomorpholine, tetrahydro-1,3-thiazin-2-one, piperazine, tetrahydropyrimidin-2-one, homopiperidine, homopiperidin-2-one and the like are mentioned, and they are selected in the respective specified atom number range.

Expressions such as \( (C_aC_b) \) alkyl optionally substituted with \( R^{10} \) in the present specification indicate an alkyl group wherein hydrogen atoms bonded to the carbon atoms can be optionally replaced by any \( R^{10} \) and wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning and they are selected in the respective specified carbon atom number range. In this case, when 2 or more substituents \( R^{10} \) are present on the respective \( (C_aC_b) \) alkyl groups, the respective \( R^{10} \) can be the same or different.

Expressions such as \( (C_aC_b) \) cycloalkyl optionally substituted with \( R^{10} \) in the present specification indicate a cycloalkyl group wherein hydrogen atoms bonded to the carbon atoms can be optionally replaced by any \( R^{10} \) and wherein made up of a number of carbon atoms \( a \) to \( b \) has the aforesaid meaning and they are selected in the respective specified carbon atom number range. In this case, when 2 or more substituents \( R^{10} \) are present on the respective \( (C_aC_b) \) cycloalkyl groups, the respective \( R^{10} \) can be the same or different.

Expressions such as \( (C_aC_b) \) alkenyl optionally substituted with \( R^{10} \) in the present specification indicate an alkenyl group wherein hydrogen atoms bonded to the carbon atoms can be optionally replaced by any \( R^{10} \) and wherein made up of a number of carbon atoms \( a \) to
b has the aforesaid meaning and they are selected in the respective specified carbon atom number range. In this case, when 2 or more substituents $R^{10}$ are present on the respective $(C_a-C_b)$ alkenyl groups, the respective $R^{10}$ can be the same or different.

Expressions such as $(C_a-C_b)$ alkynyl optionally substituted with $R^{10}$ in the present specification indicate an alkynyl group wherein hydrogen atoms bonded to the carbon atoms can be optionally replaced by any $R^{10}$ and wherein made up of a number of carbon atoms a to b has the aforesaid meaning and they are selected in the respective specified carbon atom number range. In this case, when 2 or more substituents $R^{10}$ are present on the respective $(C_a-C_b)$ alkynyl groups, the respective $R^{10}$ can be the same or different.

Next, methods for production of the compounds of the present invention are explained below.

Production method A

The haloalkylsulphonamide derivatives represented by the formula (1) can for example be produced by reacting a compound represented by the formula (2) and a compound represented by the formula (3).

The compounds of the present invention represented by the formula (1) can be produced by reacting a compound represented by the formula (2) [in the formula, $W$, $X$, $R^1$, $R^2$, $R^3$, $R^4$, $R^5$, $R^6$, $R^7$, $R^8$, $R^9$, $m$, $n$ and $p$ have the same meanings as aforesaid] or salts thereof and a compound represented by the formula (3) [in the formula, $R^5$ has the same meanings as aforesaid] or salts thereof in a solvent or with no solvent, using a base if necessary, and adding additives if necessary.
In this reaction, in the range from 0.1 to 100 equivalents of the compound represented by the formula (3) can be used per equivalent of the compound represented by the formula (2).

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulphoxide, 1,3-dimethyl-2-imidazolinone and water, ethers such as diethyl ether, tetrahydrofuran, 1,4-dioxan, 1,2-dimethoxyethane and diphenyl ether, alcohols such as ethanol and methanol, aromatic hydrocarbons such as benzene, toluene and xylene, halogenated hydrocarbons such as methylene chloride, chloroform, carbon tetrachloride and 1,2-dichloroethane, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used when mixed.

If a base is used, as the base used, an organic base such as triethylamine, pyridine and 4-(dimethylamino)pyridine or an inorganic base such as potassium carbonate, sodium carbonate, potassium acetate and sodium acetate can be used, and can be used in the range from 0.1 to 50 equivalents per equivalent of the compound represented by the formula (2).

If an additive is used, as the additive used, ethers such as 1,4,7,10,13,16-hexaoxa-cyclooctadecane, quaternary ammonium salts such as tetra-n-butylammonium bromide and the like can be used, and can be used in the range from 0.1 to 50 equivalents per equivalent of the compound represented by the formula (2).

As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

Some compounds represented by the formula (3) are known compounds and some are obtainable as commercial products.

Production method B

The haloalkylsulphonamide derivatives represented by the formula (1) can for example be produced by reacting a compound represented by the formula (4) and a compound represented by the formula (5).
The compounds of the present invention represented by the formula (1) can be produced by reacting a compound represented by the formula (4) [in the formula, W, X, R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, m, n and p have the same meanings as aforesaid] which can be produced according to the method described in production method A or salts thereof and a compound represented by the formula (5) [in the formula, R⁵ has the same meaning as aforesaid, and L represents a leaving group such as a halogen atom] or salts thereof in a solvent or with no solvent, using a base if necessary, and adding additives if necessary.

In this reaction, from 0.1 to 100 equivalents of the compound represented by the formula (5) can be used per equivalent of the compound represented by the formula (4).

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulphoxide, 1,3-dimethyl-2-imidazolinone and water, ethers such as diethyl ether, tetrahydrofuran, 1,4-dioxan, 1,2-dimethoxyethane and diphenyl ether, aromatic hydrocarbons such as benzene, toluene and xylene, halogenated hydrocarbons such as methylene chloride, chloroform, carbon tetrachloride and 1,2-dichloroethane, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used when mixed.

If a base is used, as the base used, an organic base such as triethylamine, pyridine or 4-(dimethylamino)pyridine or an inorganic base such as potassium carbonate, sodium carbonate or sodium hydrogen carbonate can be used, and from 0.1 to 50 equivalents can be used per equivalent of the compound represented by the formula (4).

If an additive is used, as the additive used, ethers such as 1,4,7,10,13,16-hexaoxa-cyclooctadecane, quaternary ammonium salts such as tetra-n-butylammonium bromide and
the like can be used, and from 0.1 to 50 equivalents can be used per equivalent of the compound represented by the formula (4).

As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

Some compounds represented by the formula (5) are known compounds and some are obtainable as commercial products.

In production method A and production method B, the compounds of the present invention can be obtained by performing normal postprocessing, in that the reaction mixture after the end of the reaction is concentrated directly or extracted with an organic solvent and concentrated after washing with water, or poured into ice-water and concentrated after organic solvent extraction. Further, when purification is necessary, they can be isolated and purified by any purification method such as recrystallization, column chromatography, thin layer chromatography or liquid chromatography fractionation.

Some compounds represented by the formula (2) can be synthesized by the reaction scheme 1 shown below.

Reaction scheme 1
Compounds represented by the formula (7) [in the formula, W, X, R₁, R₂, R₃, R₄, R₆, R₇, R₈, R₉, m, n and p have the same meanings as aforesaid] can be produced by reacting a compound of the formula (6) [in the formula, W, X, R₁, R₂, R₃, R₄, R₆, R₇, R₈, R₉, m, n and p have the same meanings as aforesaid] or salts thereof and a brominating agent in a solvent or with no solvent, using a base if necessary, and adding additives if necessary.

In this reaction, in the range from 0.1 to 100 equivalents of brominating agent can be used per equivalent of compound represented by the formula (6).

As the brominating agent used, for example, quaternary ammonium salts such as phenyl trimethylammonium bromide or phenyl trimethylammonium tribromide and the like are mentioned.

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulphoxide and 1,3-dimethyl-2-imidazolinone, ethers such as diethyl ether,
tetrahydrofuran, 1,4-dioxan, 1,2-dimethoxyethane and diphenyl ether, aromatic hydrocarbons such as benzene, toluene and xylene, halogenated hydrocarbons such as methylene chloride, chloroform, carbon tetrachloride and 1,2-dichloroethane, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used mixed.

If a base is used, as the base used, organic bases such as triethylamine, pyridine, 4-(dimethylamino)pyridine and diisopropylethylamine, or inorganic bases such as potassium carbonate and sodium carbonate can be used, and from 0.1 to 50 equivalents can be used per equivalent of compound represented by the formula (6).

If an additive is used, as the additive used, silylating agents such as trimethylsilyl trifluoromethanesulphonate can be used, and from 0.1 to 50 equivalents can be used per equivalent of compound represented by the formula (6).

As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

The compounds represented by the formula (7) can be obtained by performing normal postprocessing, in that the reaction mixture after the end of the reaction is concentrated directly or extracted with an organic solvent and concentrated after washing with water, or poured into ice-water and concentrated after organic solvent extraction. Further, when purification is necessary, they can be isolated and purified by any purification method such as recrystallization, column chromatography, thin layer chromatography or liquid chromatography fractionation.

Further, the compounds represented by the formula (7) produced by this method can be used as such in the reaction of the next stage without isolation or purification.

Some compounds represented by the formula (6) are known compounds, and can be produced by known methods. For example, they can be produced according to the methods described in International Laid-Open Specification No. 2010/026989 and International Laid-Open Specification No. 2013/061973.
The compounds represented by the formula (9) [in the formula, W, X, \( R_1, R_2, R_3, R_4, R_5, R_7, R_8, R_9, m, n \) and p have the same meanings as aforesaid] can be produced by reacting a compound represented by the formula (7) or salts thereof and a compound represented by the formula (8) [in the formula, M represents a metal atom such as sodium or potassium, and V represents \( \text{Ci-C}_6 \) alkyl] or salts thereof in a solvent or with no solvent, and by adding additives if necessary.

In this reaction, from 0.1 to 100 equivalents of compound represented by the formula (8) can be used per equivalent of compound represented by the formula (7).

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulphoxide, 1,3-dimethyl-2-imidazolinone and water, aromatic hydrocarbons such as benzene, toluene and xylene, halogenated hydrocarbons such as methylene chloride, chloroform, carbon tetrachloride and 1,2-dichloroethane, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used when mixed.

If an additive is used, as the additive used, ethers such as 1,4,7,10,13,16-hexaoxa-cyclooctadecane, quaternary ammonium salts such as tetra-n-butylammonium bromide and the like can be used, and from 0.1 to 50 equivalents can be used per equivalent of compound represented by the formula (7).

As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

The compounds represented by the formula (9) can be obtained by performing normal postprocessing, in that the reaction mixture after the end of the reaction is concentrated directly or extracted with an organic solvent and concentrated after washing with water, or poured into ice-water and concentrated after organic solvent extraction. Further, when purification is necessary, they can be isolated and purified by any purification method such as recrystallization, column chromatography, thin layer chromatography or liquid chromatography fractionation.
Further, the compounds represented by the formula (9) produced by this method can be used as such in the reaction of the next stage without isolation or purification.

Some compounds represented by the formula (8) are known compounds and some are obtainable as commercial products.

Production stage 3

The compounds represented by the formula (10) [in the formula, W, X, R₁, R₂, R₃, R₄, R₅, R₇, R₈, R₉, m, n and p have the same meanings as aforesaid] can be produced by reacting a compound represented by the formula (9) or salts thereof and a base in a solvent or with no solvent.

In this reaction, from 0.1 to 100 equivalents of base can be used per equivalent of compound represented by the formula (9).

As the base used, organic bases such as triethylamine, pyridine and 4-(dimethylamino)pyridine, inorganic bases such as potassium carbonate, sodium carbonate, potassium hydroxide and sodium hydroxide and the like are mentioned.

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulfoxide, 1,3-dimethyl-2-imidazolinone and water, ethers such as diethyl ether, tetrahydrofuran, 1,4-dioxan, 1,2-dimethoxyethane and diphenyl ether, alcohols such as ethanol and methanol, aromatic hydrocarbons such as benzene, toluene and xylene, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used when mixed.

As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

The compounds of the formula (10) can be obtained by performing normal postprocessing, in that the reaction mixture after the end of the reaction is concentrated directly or extracted with an organic solvent and concentrated after washing with water, or poured into ice-water and concentrated after organic solvent extraction. Further, when
purification is necessary, they can be isolated and purified by any purification method such as recrystallization, column chromatography, thin layer chromatography or liquid chromatography fractionation.

Further, the compounds represented by the formula (10) produced by this method can be used as such in the reaction of the next stage without isolation or purification.

Production stage 4

The compound represented by the formula (2) can be produced by reacting a compound represented by the formula (10) or salts thereof and an oxidizing agent in a solvent or with no solvent, and by adding additives if necessary.

In this reaction, from 0.1 to 100 equivalents of oxidizing agent can be used per equivalent of compound represented by the formula (10).

As the oxidizing agent used, for example, chromic acid salts such as pyridinium chlorochromate and pyridinium dichromate, manganese compounds such as potassium permanganate and manganese dioxide, hypervalent iodine compounds such as 1,1,1-triacetoxy-l,l-dihydro-l,2-benzoiodoxol-3-(lH)-one (Dess-Martin periodinane), radical compounds such as the 2,2,6,6-tetramethylpiperidin-l-oxo radical and the like are mentioned.

If a solvent is used, the solvent used is preferably inert in the reaction and for example polar solvents such as N,N-dimethylformamide, N,N-dimethylacetamide, acetonitrile, dimethyl sulphoxide, 1,3-dimethyl-2-imidazolinone and water, ethers such as diethyl ether, tetrahydrofuran, 1,4-dioxan, 1,2-dimethoxyethane and diphenyl ether, aromatic hydrocarbons such as benzene, toluene and xylene, halogenated hydrocarbons such as methylene chloride, chloroform, carbon tetrachloride and 1,2-dichloroethane, and aliphatic hydrocarbons such as n-pentane and n-hexane are mentioned. These solvents can be used alone, and 2 or more of these can also be used when mixed.

If an additive is used, as the additive used, ethers such as 1,4,7,10,13,16-hexaoxa-cyclooctadecane, quaternary ammonium salts such as tetra-n-butylammonium bromide and the like can be used, and from 0.1 to 50 equivalents can be used per equivalent of compound represented by the formula (10).
As the reaction temperature, any temperature in the range from -78°C to the reflux temperature of the reaction mixture can be set, and the reaction time varies depending on the concentration of the reactants and the reaction temperature, but can normally be set anywhere in the range from 5 mins to 100 hrs.

The production intermediates used as starting materials in production method A can be obtained by performing normal postprocessing, in that the reaction mixtures after the end of the reactions are concentrated directly or extracted with an organic solvent and concentrated after washing with water, or poured into ice-water and concentrated after organic solvent extraction. Further, when purification is necessary, they can be isolated and purified by any purification method such as recrystallization, column chromatography, thin layer chromatography or liquid chromatography fractionation.

Further, the production intermediates produced by this method can be used as such in the reaction of the next stage without isolation or purification.

Next, examples of compounds included in the present invention are shown in Table 1, but the compounds of the present invention are not limited to these. It should be noted that the entry Me in the table represents methyl group, and similarly below Et represents ethyl group, Pr propyl group, Bu butyl group, Ph phenyl group, n- normal and i- iso.

In the formulae, U represents the structures shown by U-1 [in the formula, R² have the same meanings as aforesaid] or U-2 [in the formula, R² have the same meanings as aforesaid].

Further, the substituents represented by D-7a in the table have the following structures.
Table 1

<table>
<thead>
<tr>
<th></th>
<th>R²</th>
<th>R⁵</th>
<th>U</th>
<th>R²</th>
<th>R⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-1</td>
<td>H</td>
<td>H</td>
<td>U-2</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>Me</td>
<td>U-2</td>
<td>H</td>
<td>Me</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>Et</td>
<td>U-2</td>
<td>H</td>
<td>Et</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>n-Pr</td>
<td>U-2</td>
<td>H</td>
<td>n-Pr</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>i-Pr</td>
<td>U-2</td>
<td>H</td>
<td>i-Pr</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>n-Bu</td>
<td>U-2</td>
<td>H</td>
<td>n-Bu</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>i-Bu</td>
<td>U-2</td>
<td>H</td>
<td>i-Bu</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CH₂Ph</td>
<td>U-2</td>
<td>H</td>
<td>CH₂Ph</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CH₂C(0)OEt</td>
<td>U-2</td>
<td>H</td>
<td>CH₂C(0)OEt</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CH₂CH₂OMe</td>
<td>U-2</td>
<td>H</td>
<td>CH₂CH₂OMe</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CH₂CH₂C₁</td>
<td>U-2</td>
<td>H</td>
<td>CH₂CH₂C₁</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>D-7a</td>
<td>U-2</td>
<td>H</td>
<td>D-7a</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CH₂CH₂Si(Me)₃</td>
<td>U-2</td>
<td>H</td>
<td>CH₂CH₂Si(Me)₃</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>CF₂H</td>
<td>U-2</td>
<td>H</td>
<td>CF₂H</td>
</tr>
<tr>
<td>U-1</td>
<td>H</td>
<td>C(0)OEt</td>
<td>U-2</td>
<td>H</td>
<td>C(0)OEt</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>H</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>H</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>Me</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>Me</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>Et</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>Et</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>n-Pr</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>n-Pr</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>i-Pr</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>i-Pr</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>n-Bu</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>n-Bu</td>
</tr>
<tr>
<td>U-1</td>
<td>C(0)OEt</td>
<td>i-Bu</td>
<td>U-2</td>
<td>C(0)OEt</td>
<td>i-Bu</td>
</tr>
</tbody>
</table>
As paddy field herbicides, the compounds of the present invention can be used both for flooded soil treatment methods and for foliage treatment methods. As paddy field weeds, for example, Potamogetonaceae weeds typified for example by Potamogeton distinctus, Alismataceae weeds typified for example by Alisma canaliculatum, Sagittaria pygmaea and Sagittaria trifolia, Gramineae weeds typified for example by Leptochloa chinensis, Echinochloa crus-galli, Echinochloa oryzicola, Homalocenchrus japonocus and Paspalum distichum, Cyperaceae weeds typified for example by Eleocharis kuroguwai, Scirpus juncoides, Scirpus nipponicus, Cyperus serotinus, Cyperus difformis and Cyperus hakonensis, Lemnaceae weeds typified for example by Spirodela polyrhiza and Lemna paucicostata, Commelinaceae weeds typified for example by Murdannia keisak, Pontederiaceae weeds typified for example by Monochoria korsakowii and Monochoria vaginalis, Elatinaceae weeds typified for example by Elatine triandra, Lythraceae weeds typified for example by Ammannia multiflora and Rotala indica, Oenotheraceae weeds typified for example by Lidwigia epilobioiides, Scrophulariaceae weeds typified for example by Dopatrium junceum, Gratiola japonica, Limonaphila sessilifolia, Lindernia pyxidaria and Lindernia dubia, Leguminosae weeds typified for example by Aeschynomene indica, Compositae weeds such as Bidens frondosa and Bidens tripartita weeds and the like are mentioned.

Further, the compounds of the present invention can also be used as field and orchard herbicides, and can be used in soil treatment, soil incorporation treatment and foliage treatment methods. As field weeds, for example, Solanaceae weeds typified for example by Solanum nigrum and Datura stramonium, Geraniaceae weeds typified for example by Graniun carolinianum, Malvaceae weeds typified for example by Abutilon theophrasti and
Sida spinosa, Convolvulaceae weeds typified for example by Ipomoea spps. such as Ipomoea purpurea, Ipomoea hederacea and Calystegia spps., Amaranthaceae weeds typified for example by Amaranthus lividus and Amarnathus retroflexus, Compositae weeds typified for example by Xanthium pensylvanicum, Xanthium strumarium, Ambrosia artemisiaefolia, Helianthus annuus, Galinsoga ciliate, Circium arvense, Senecio vulgaris and Erigeron annus, Cruciferae weeds typified for example by Rorippa indica, Sinapis arvensis and Capsella Bursapastoris, Polygonaceae weeds typified for example by Polygonum Blumei and Polygonum convolvulus, Portulacaceae weeds typified for example by Portulaca oleracea, Chenopodiaceae weeds typified for example by Chenopodium album, Chenopodium ficifolium and Kochia scoparia, Caryophyllaceae weeds typified for example by Stellaria media, Scrophulariaceae weeds typified for example by Veronica persica, Commelinaceae weeds typified for example by Commelina communis, Labiatae weeds typified for example by Lamium amplexicaule and Lamium purpureum, Euphorbiaceae weeds typified for example by Euphorbia supina, Euphorbia heterophylla and Euphorbia maculata, Rubiaceae weeds typified for example by Galium spurium, Gallium aparine and Rubia akane, Violaceae weeds typified for example by Viola mandshurica, and broad-leaved weeds such as Bidens pilosa, Leguminosae weeds typified for example by Sesbania exaltata and Cassia obtusifolia, and Oxsalidaceae weeds typified for example by Oxsalis courniculata, Graminaceous weeds typified for example by Brachiaria plantaginea, Bromus tectorum, Lolium perenne, Lolium multiflorum, Sorghum bicolor, Panicum dichotomiflorum, Panicum miliaceum, Sorghum halepense, Echinochloa crus-galli var. crus-galli, Echinochloa crus-galli var. praticola, Echinochloa utilis, Digitaria ciliaris, Digitaria sanguinalis, Avena fatua, Alopecurus myosuroides, Eluesine indica, Setaria viridis, Setaria faberi and Alopecurus aegualis and Cyperaceous weeds typified for example by Cyperus rotundus/Cyperus esculentus and the like are mentioned.

Further, apart from the farming and horticultural fields such as in paddy fields, open fields and orchards, the compounds of the present invention can also be used in soil treatment, soil incorporation treatment and foliage treatment methods on non-agricultural land, for example on lawns, sports grounds, waste land, road verges and railway verges. As these weeds, in addition to those mentioned under field and orchard weed killers, Poa annua, Taraxacum officinale, Conyza sumatrensis, Cardamine flexuosa, Trifolium repens,
Hydrocotyle sibthorpioides, Plantago asiatica, Cyperus brevifolius/Kyllinga brevifolia, Equisetum arvense and the like are mentioned.

The term "herbicide" as used herein means a compound that controls or modifies the growth of plants. The term "herbicidally effective amount" means the quantity of such a compound or combination of such compounds that is capable of producing a controlling or modifying effect on the growth of plants. Controlling or modifying effects include all deviation from natural development, for example: killing, retardation, leaf burn, albinism, dwarfing and the like. The term "plants" refers to all physical parts of a plant, including seeds, seedlings, saplings, roots, tubers, stems, stalks, foliage, and fruits. The term "locus" is intended to include soil, seeds, and seedlings, as well as established vegetation and includes not only areas where weeds may already be growing, but also areas where weeds have yet to emerge, and also to areas under cultivation with respect to crops of useful plants. "Areas under cultivation" include land on which the crop plants are already growing and land intended for cultivation with such crop plants. The term "weeds" as used herein means any undesired plant, and thus includes not only agronomically important weeds as described below, but also volunteer crop plants.

The compounds of the invention can be applied before or after planting of the crops, before weeds emerge (pre-emergence application) or after weeds emerge (post-emergence application), and are particularly effective when applied pre-emergence.

Crops of useful plants in which the composition according to the invention can be used include, but are not limited to, perennial crops, such as citrus fruit, grapevines, nuts, oil palms, olives, pome fruit, stone fruit and rubber, and annual arable crops, such as cereals, for example barley and wheat, cotton, oilseed rape, maize, rice, soy beans, sugar beet, sugar cane, sunflowers, ornamentals, switchgrass, turf and vegetables, especially cereals, maize, rice and soy beans.

Crops are to be understood as also including those crops which have been rendered tolerant to herbicides or classes of herbicides (e.g. auxins or ALS-, EPSPS-, PPO- and HPPD-inhibitors) by conventional methods of breeding or by genetic engineering. An example of a crop that has been rendered tolerant to imidazolinones, e.g. imazamox, by conventional methods of breeding is Clearfield® summer rape (canola). Examples of crops that have been rendered tolerant to herbicides by genetic engineering methods include e.g.
glyphosate- and glufosinate-resistant maize varieties commercially available under the trade names RoundupReady® and LibertyLink®, respectively.

Crops are also to be understood as being those which have been rendered resistant to harmful insects by genetic engineering methods, for example Bt maize (resistant to European corn borer), Bt cotton (resistant to cotton boll weevil) and also Bt potatoes (resistant to Colorado beetle). Examples of Bt maize are the Bt 176 maize hybrids of NK® (Syngenta Seeds). The Bt toxin is a protein that is formed naturally by Bacillus thuringiensis soil bacteria. Examples of toxins, or transgenic plants able to synthesize such toxins, are described in EP-A-451 878, EP-A-374 753, WO 93/07278, WO 95/34656, WO 03/052073 and EP-A-427 529. Examples of transgenic plants comprising one or more genes that code for an insecticidal resistance and express one or more toxins are KnockOut® (maize), Yield Gard® (maize), NuCOTIN33B® (cotton), Bollgard® (cotton), NewLeaf® (potatoes), NatureGard® and Protexcta®. Plant crops or seed material thereof can be both resistant to herbicides and, at the same time, resistant to insect feeding ("stacked" transgenic events). For example, seed can have the ability to express an insecticidal Cry3 protein while at the same time being tolerant to glyphosate.

Crops are also to be understood as being those which are obtained by conventional methods of breeding or genetic engineering and contain so-called output traits (e.g. improved storage stability, higher nutritional value and improved flavor).

Any method of application to weeds/crop of useful plant, or locus thereof, which is routinely used in agriculture may be used, for example application by spray or broadcast method typically after suitable dilution of a compound of formula (1) (whether said compound is formulated and/or in combination with one or more further active ingredients and/or safeners, as described herein).

At the time of formulation or spraying, the compounds of the present invention can also as necessary be used mixed with other types of herbicide, various insecticides, bactericides, plant growth regulators or synergists and the like.

In particular, by using them mixed with other herbicides, broadening of the weed-killing spectrum and higher weed-killing efficacy can be expected due to cost reduction through dosage decreases, and the synergistic action of the mixed agents. In that case, combinations with a plurality of known herbicides simultaneously are also possible.
Specific examples of mixtures of compounds of formula (1) with other herbicides include (wherein "1" represents a compound of formula (1)): 1 + 2,4-D (including the choline salt and 2-ethylhexyl ester thereof), 1 + acetochlor, 1 + acifluorfen-sodium, 1 + aclofifen, 1 + alachlor, 1 + alloxynid, 1 + alloxynid sodium, 1 + ametryn, 1 + amicarbazone, 1 + amidosulfuron, 1 + aminocyclopyrachlor, 1 + aminocyclopyrachlor salts and esters, 1 + aminopyralid, 1 + aminopyralid salts and esters, 1 + amiprophos-methyl, 1 + amitrol, 1 + anilofos, 1 + asulam, 1 + atrazine, 1 + azafenidin, 1 + azimsulfuron, 1 + beflubutamid, 1 + benazolin ethyl, 1 + bencarbazone, 1 + benfluralin/benefin, 1 + benfuresate, 1 + bensulide, 1 + bentazone, 1 + bentazone sodium, 1 + bentazon salts, 1 + benthiocarb, 1 + benzfendizone, 1 + benzobicyclon, 1 + benzofenap, 1 + bialaphos, 1 + bialaphos-sodium, 1 + bicyclpyrone, 1 + bifenox, 1 + bispyribac, 1 + bispyribac-sodium, 1 + bromacil, 1 + bromobutide, 1 + bromofenoxim, 1 + bromoxynil, 1 + bromoxynil salts and esters, 1 + butachlor, 1 + butafenacil, 1 + butamifos, 1 + butenachlor, 1 + butralin, 1 + butoxydim, 1 + butylate, 1 + cafenstrole, 1 + carbamid, 1 + carfentrazone ethyl, 1 + chloethoxyfen, 1 + chloethoxydin, 1 + chloramben, 1 + chloramben salts and esters, 1 + chloransulam-methyl, 1 + chlorflurenol-methyl, 1 + chloridazon, 1 + chlorimuron-ethyl, 1 + chlorobromuron, 1 + chlorotoluron, 1 + chloroxuron, 1 + chlorptalim, 1 + chlorpropham, 1 + chloro IPC chlorpropham, 1 + clorsulfuron, 1 + chlorthal dimethyl, 1 + chlorthiamid, 1 + cinidon ethyl, 1 + cinmethylin, 1 + cinosulfuron, 1 + clorsulfuron, 1 + clethodim, 1 + clodinafop, 1 + clodinafop propargyl, 1 + clomazone, 1 + clomeprop, 1 + clopyralid, 1 + clopyralid salts and esters, 1 + CNP, 1 + cumyluron, 1 + cyanazin, 1 + cycloate, 1 + cyclosulfuron, 1 + cycloxydim, 1 + cyhalofop butyl, 1 + daimuron, dalapon, 1 + dazomet, 1 + desmedipham, 1 + desmetryn, 1 + dicamba, 1 + dicamba salts and esters, 1 + dichlobenil, 1 + diclofop, 1 + diclofop methyl, 1 + dichlorprop, 1 + dichlorprop salts and esters, 1 + P dichlorprop (dichlorprop-P), 1 + P dichlorprop salts and esters (dichlorprop-P salts and esters), 1 + diclosulam, 1 + difenzoquat, 1 + diflufenican, 1 + diflufenopyr, 1 + diflufenopyr-sodium, 1 + dimepiperate, 1 + dimethametryn, 1 + dimethachlor, 1 + dimethenamid, 1 + P dimethenamid (dimethenamid-p), 1 + dimethipin, 1 + dinitramine, 1 + dinoseb, 1 + dinoterb, 1 + DNOC, 1 + diphenamid, 1 + diquat, 1 + dithiopyl, 1 + diuron, 1 + DSMA, 1 + dymron, 1 + endothal, 1 + EPTC, 1 + esprocarb, 1 + ethalfluralin, 1 + ethametsulfuron methyl, 1 + ethofumesate, 1 + etobenzanid, 1 + ethoxysulfuron, 1 + flazasulfuron, 1 + fenoxaprop, 1 + fenoxaprop-ethyl, 1 + fenoxasulfone, 1 + fenquinotrione, 1 + fentrazamide, 1 + flamprop, 1 + flazasulfuron, 1 + florasulam, 1 + fluazifop, 1 +
fluazifop butyl, 1 + fluazolate, 1 + flucarbazone sodium, 1 + flucetosulfuron, 1 + flucloralm, 1 + fluencacet, 1 + flufenpyr ethyl, 1 + flumetralin, 1 + flumetsulam, 1 + flumiclorac-pentyl, 1 + flumioxazin, 1 + flumeturon, 1 + fluoroxyfop, 1 + fiupoxam, 1 + flurenol, 1 + fluridone, 1 + fiurochloridone, 1 + fluroxypyr, 1 + fluroxyfop esters, 1 + flurprimidol, 1 + fiuramalane, 1 + fiuthoxifluor, 1 + fluron, 1 + foramsulfuron, 1 + fosamine, 1 + glufosinate, 1 + glufosinate ammonium, 1 + glyphosate, 1 + glyphosate ammonium, 1 + glyphosate isopropylammonium, 1 + glyphosate potassium, 1 + glyphosate sodium, 1 + glyphosate trimesium, 1 + halauxifen, 1 + halauxifen salts and esters, 1 + halosafen, 1 + halosulfuron, 1 + halosulfuron methyl, 1 + haloxyfop, 1 + haloxyfop methyl, 1 + hexazinone, 1 + imazamethabenz methyl, 1 + imazamox, 1 + imazapic, 1 + imazapyr, 1 + imazethapyr, 1 + imazaquin, 1 + imazosulfuron, 1 + indanofan, 1 + indaziflam, 1 + isodosulfuron methyl sodium, 1 + isofensulfuron, 1 + isofensulfuron-sodium, 1 + isoxynil octanoate, 1 + isoxynil salts and esters, 1 + ipfencarbazone, 1 + isoproturon, 1 + isouron, 1 + isoxaben, 1 + isoxaflutole, 1 + karbutilate, 1 + KUH-1 10 (test name), 1 + lactofen, 1 + lenacil, 1 + linuron, 1 + maleic hydrazide, 1 + MCPA, 1 + MCPA salts and esters, 1 + MCPB, 1 + MCPB salts and esters, 1 + mecoprop, 1 + MCP, 1 + mecoprop salts and esters, 1 + mecoprop P, 1 + MCPP-P, 1 + mecoprop P salts and esters, 1 + mefenacet, 1 + mefluicid, 1 + mesosulfuron methyl, 1 + mesotrione, 1 + metam, 1 + metamifop, 1 + metamitron, 1 + metazachlor, 1 + metobromuron, 1 + methabenzthiazuron, 1 + methazosulfuron, 1 + methiozolin, 1 + methyl azide, 1 + methyl bromide, 1 + methyl dymron, 1 + methyl iodide, 1 + metobenzuron, 1 + metolachlor, 1 + S-metolachlor, 1 + metosulam, 1 + metribuzin, 1 + metursulam methyl, 1 + metoxuron, 1 + molinate, 1 + mono linuron, 1 + monosulfuron, 1 + monosulfuron methyl, 1 + MSMA, 1 + naproanilide, 1 + napropamide, 1 + naptalam, 1 + naptalam sodium, 1 + neburon, 1 + nicosulfuron, 1 + norflurazon, 1 + OK-701 (test name), 1 + oleic acid, 1 + orbencarb, 1 + orthosulfamuron, 1 + oryzalin, 1 + oxadiargyl, 1 + oxadiazon, 1 + oxasulfuron, 1 + oxaziclolomefene, 1 + oxyfluorfen, 1 + paraquat, 1 + pelargonic acid, 1 + pendimethalin, 1 + penoxsulam, 1 + pentanochlor, 1 + penoxazone, 1 + pethoxamid, 1 + phenmedipham ethyl, 1 + picloram, 1 + picloram salts and esters, 1 + picolinam, 1 + pinoxaden, 1 + piperophos, 1 + pretillachlor, 1 + primisulfuron methyl, 1 + prodiame, 1 + profiuazol, 1 + profoxydim, 1 + prometyn, 1 + propachlor, 1 + propanil, 1 + propaquizafop, 1 + propazin, 1 + proham, 1 + propochlor, 1 + propoxycarbazone sodium, 1 + propyrisulfuron, 1 + propyzamide, 1 + prosulfocarb, 1 + prosulfuron, 1 + pyraclonil, 1 + pyrafluifen ethyl, 1 + pyrasulfotole, 1 +
pyrazolynate, 1 + pyrazosulfuron, 1 + pyrazosulfuron ethyl, 1 + pyrazoneyy, 1 + pyribenzoim, 1 + pyributicarb, 1 + pyridafol, 1 + pyridate, 1 + pyrifalid, 1 + pyriminobac methyl, 1 + pyrimisulfan, 1 + pyrithiobac sodium, 1 + pyroxasulfone, 1 + pyroxsulam, 1 + quinclorac, 1 + quinmerac, 1 + quinclorac, 1 + quinoline, 1 + quizalofop, 1 + quizalofop ethyl, 1 + quizalofop tefuryl, 1 + quizalofop-P, 1 + quizalofop-P ethyl, 1 + quizalofop-P tefuryl, 1 + rimsulfuron, 1 + saflufenacil, 1 + sethoxydim, 1 + siduron, 1 + simazine, 1 + simetryn, 1 + sulcotrione, 1 + sulfentrazone, 1 + sulflometuron methyl, 1 + sulfoxaflur, 1 + cyclopyrimate, 1 + SW-065 (test name), 1 + TCBA (2,3,6-TBA ), 1 + TCBA salts and esters (2,3,6-TBA salts and esters), 1 + TCPT (chlorothal-dimethyl, tetracloroethoiphene) , 1 + tebutam, 1 + tebuthiuron, 1 + tefurylitrone, 1 + tembotrione, 1 + tepraloxydim, 1 + terbacil, 1 + terbumeton, 1 + terbuthylazine, 1 + terbutryn, 1 + tetrapion (fluopropanate), thenylchlor, 1 + thiaflurofuran, 1 + thiazipyr, 1 + thidiazimin, 1 + thidiazuron, 1 + thienecarbazone methyl, 1 + thifensulfuron methyl, 1 + tiafenacil, 1 + tolpyralate, 1 + topramezone, 1 + tralkoxydim, 1 + trietazine, 1 + triafamone, 1 + triallate, 1 + triasulfuron, 1 + triaziflam, 1 + tribenuron methyl, 1 + triclopyr, 1 + triclopyr salts and esters, 1 + triphane, 1 + trietazine, 1 + trifloxysulfuron-sodium, 1 + trifledimoxazin, 1 + trifluralin, 1 + triflusulfuron methyl, 1 + tritosulfuron, 1 + 2,4-PA, 1 + 2,4-PA salts and esters, 1 + 2,4-DB, 1 + 2,4-DB salts and esters, 1 + 2-[[8-chloro-3,4-dihydro-4-(4-methoxyphenyl)-3-oxo-2-quinoxaliny1]carbony1]l,3-cyclohexanedione (CAS RN 1342891-70-6), 1 + [3-[2-chloro-4-fluoro-5-(1-methyl-6-trifluoromethyl-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-3-yl)phenoxy]-2-pyridyloxy]acetic acid ethyl ester) and the like are mentioned. These components can be used alone or by mixing 2 or more types, and the ratio when they are mixed can also be freely selected.

In particular, the following mixtures are important:

Mixtures of a compound of the formula (1) with a triazine (e.g. 1 + ametryn, 1 + atrazine, 1 + cyanazine, 1 + dimethadryn, 1 + metribuzin, 1 + prometon, 1 + prometryn, 1 + propazine, 1 + simazine, 1 + simetryn, 1 + terbumeton, 1 + terbuthylazine, 1 + terbutryn, 1 + trietazine).

Mixtures of a compound of formula (1) with an HPPD inhibitor (e.g. 1 + isoxaflutole, 1 + mesotrione, 1 + pyrasulfotole, 1 + sulcotrione, 1 + tembotrione, 1 + topramezone, 1 +
bicyclopyrone, 1 + benzobicyclon or 1 + 2-[[8-chloro-3,4-dihydro-4-(4-methoxyphenyl)-3-oxo-2-quinoxalinyl]carbonyl],3-cyclohexanedione (CAS RN 1342891-70-6)).

Mixtures of a compound of formula (1) with an auxin (e.g. 1 + dicamba, 1 + 2,4-D, 1 + 2,4-DB, 1 + MCPA, 1 + fluoroxypr, 1 + picloram, 1 + triclopyr, 1 + quinclorac, 1 + clopyralid, 1 + aminopyralid, 1 + amincyclopyrachlor, 1 + halaxifen, 1 + halaxifen-methyl).

Mixtures of a compound of formula (1) with a VLCFA inhibitor (e.g. 1 + metolachlor, 1 + S-metolachlor, 1 + acetochlor, 1 + dimethenamid-P, 1 + pyroxasulfone, 1 + dimethachlor, 1 + flufenacet, 1 + metazachlor, 1 + napropamide, 1 + pretilachlor).

Mixtures of a compound of formula (1) with a triazolinone (e.g. 1 + amicarbazone).

Mixtures of a compound of formula (1) with an ALS inhibitor (e.g. 1 + chlorsulfuron, 1 + cinosulfuron, 1 + cloransulam, 1 + ethametsulfuron, 1 + flazasulfuron, 1 + foramsulfuron, 1 + flumetsulam, 1 + imazamethabenz, 1 + imazamox, 1 + imazapic, 1 + imazapyr, 1 + imazethapyr, 1 + iodosulfuron, 1 + iofensulfuron, 1 + metsulfuron, 1 + nicosulfuron, 1 + oxasulfuron, 1 + primisulfuron, 1 + prosulfuron, 1 + pyrithiobac, 1 + pyroxsulam, 1 + rimsulfuron, 1 + sulfosulfuron, 1 + thifensulfuron, 1 + triasulfuron, 1 + tribenuron, 1 + trifloxysulfuron, 1 + thiencarbazone, 1 + tritosulfuron, 1 + bispyribac-sodium, 1 + pyibenoxizim, 1 + pyrifladil, 1 + flucarbazone-sodium, 1 + bensulfuron-methyl, 1 + chlorimuron-ethyl, 1 + sulfometuron-methyl, 1 + diclosulam, 1 + florasulam, 1 + penoxsulam).

Mixtures of a compound of formula (1) with a PPO inhibitor (e.g. 1 + fomesafen, 1 + flumioxazin, 1 + sulfentrazone, 1 + acifluorfen-sodium, 1 + lactofen, 1 + oxyfluorfen, 1 + oxadiazon, 1 + butafenacil, 1 + carfentrazone-ethyl, 1 + [3-[2-chloro-4-fluoro-5-(1-methyl-6-trifluoromethyl-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-3-yl)phenoxy]-2-pyridyloxy]acetic acid ethyl ester).

Mixtures of a compound of formula (1) with and ACCase inhibitor (i.e. 1 + clodinafop, 1 + fluazifop, 1 + fenoxaprop, 1 + clethodim, 1 + quizalofop, 1 + haloxyfop, 1 + pinoxaden, 1 + cycloxydim, 1 + sethoxydim).

In addition, the following mixtures are also preferred: 1 + glyphosate, 1 + glufosinate, 1 + paraquat, 1 + diquat, 1 + pendimethalin, 1 + trifluralin, 1 + metamitron, 1 + clomazone, 1 +
prodiamine, 1 + saflufenacil, 1 + prosulfocarb, 1 + diflufenican, 1 + isoxaben, 1 + beflubutamide, 1 + flurtamone, 1 + benfluralin, 1 + chlorotoluron, 1 + linuron, 1 + isoproturon, 1 + triallate, 1 + hexazinone, 1 + diuron, 1 + propanil, 1 + indaziflam.

Thus, in particular, the following mixtures are preferred: 1 + ametryn, 1 + atrazine, 1 + cyanazine, 1 + dimethametryn, 1 + metribuzin, 1 + prometon, 1 + prometryn, 1 + propazine, 1 + simazine, 1 + simetryn, 1 + terbumeton, 1 + terbuthylazine, 1 + terbutryn, 1 + trietazine, 1 + isoxaflutole, 1 + mesotrione, 1 + pyrasulfotole, 1 + sulcotrione, 1 + tembotrione, 1 + topramezone, 1 + bicyclopyrone, 1 + benzobicyclon, 1 + 2-[[8-chloro-3,4-dihydro-4-(4-methoxyphenyl)-3-oxo-2-quinoxalinyl]carbonyl] 1,3-cyclohexanedione (CAS RN 1342891-70-6), 1 + dicamba, 1 + 2,4-D, 1 + 2,4-DB, 1 + MCPA, 1 + fluoroxypry, 1 + picloram, 1 + triclopyr, 1 + quinclorac, 1 + clopyralid, 1 + aminopyralid, 1 + aminocyclopyrachlor, 1 + halaxifen, 1 + halaxifen-methyl, 1 + metolachlor, 1 + S-metolachlor, 1 + acetochlor, 1 + dimethamid-P, 1 + pyroxasulfone, 1 + dimethachlor, 1 + flufenacet, 1 + metazachlor, 1 + napropamide, 1 + pretilachlor, 1 + amicarbazone, 1 + chlorsulfuron, 1 + cinosulfuron, 1 + cloransulam, 1 + ethametsulfuron, 1 + flazasulfuron, 1 + foramsulfuron, 1 + flumetsulam, 1 + imazamethabenz, 1 + imazamox, 1 + imazapic, 1 + imazapyr, 1 + imazethapyr, 1 + iodosulfuron, 1 + iofensulfuron, 1 + metsulfuron, 1 + nicosulfuron, 1 + oxasulfuron, 1 + primisulfuron, 1 + prosulfuron, 1 + pyrithiobac, 1 + pyroxasulam, 1 + rimsulfuron, 1 + sulfosulfuron, 1 + thifensulfuron, 1 + triasulfuron, 1 + tribenuron, 1 + trifloxysulfuron, 1 + thiencarbazone, 1 + tritosulfuron, 1 + bispyribac-sodium, 1 + pyribenzoxim, 1 + pyrifenate, 1 + flucarbazone-sodium, 1 + bensulfuron-methyl, 1 + chlorimuron-ethyl, 1 + sulfometuron-methyl, 1 + diclosulam, 1 + florasulam, 1 + penoxsulam, 1 + fomesafen, 1 + flumioxazin, 1 + sulflurazone, 1 + acifluorfen-sodium, 1 + lactofen, 1 + oxyfluorfen, 1 + oxadiazon, 1 + butafenacil, 1 + carfentrazone-ethyl, 1 + [3-[(2-chloro-4-fluoro-5-[(1-methyl-6-trifluoromethyl-2,4-dioxo-1,2,3,4-tetrahydropyrimidin-3-yl)phenoxy]-2-pyridyloxy] acetic acid ethyl ester, 1 + clodinafop, 1 + fluazifop, 1 + fenoxaprop, 1 + clethodim, 1 + quizalofop, 1 + haloxyfop, 1 + pinoxaden, 1 + cycloxydim, 1 + sethoxydim, 1 + glyphosate, 1 + glufosinate, 1 + paraquat, 1 + diquat, 1 + pendimethalin, 1 + trifluralin, 1 + metamitron, 1 + clomazone, 1 + prodiamine, 1 + saflufenacil, 1 + prosulfocarb, 1 + diflufenican, 1 + isoxaben, 1 + beflubutamide, 1 + flurtamone, 1 + benfluralin, 1 + chlorotoluron, 1 + linuron, 1 + isoproturon, 1 + triallate, 1 + hexazinone, 1 + diuron, 1 + propanil, 1 + indaziflam.
The following mixtures are particularly preferred: 1 + atrazine, 1 + terbuthylazine, 1 + isoxaflutole, 1 + mesotrione, 1 + S-metolachlor, 1 + acetochlor, 1 + pyroxsulfone, 1 + dimethachlor, 1 + flufenacet, 1 + nicosulfuron, 1 + fomesafen, 1 + glyphosate, 1 + glufosinate, 1 + paraquat, 1 + saflufenacil, 1 + prosulfocarb.

For the avoidance of doubt, the present invention also includes three-way mixtures of a compound of formula (1), a herbicide as defined above and a further herbicide. In particular, the following three-way mixtures are preferred: 1 + atrazine + mesotrione, 1 + atrazine + S-metolachlor, 1 + S-metolachlor + mesotrione, 1 + glyphosate + mesotrione, 1 + glufosinate + mesotrione, 1 + atrazine + isoxaflutole, 1 + S-metolachlor + isoxaflutole, 1 + glyphosate + isoxaflutole, 1 + glufosinate + isoxaflutole, 1 + glyphosate + fomesafen.

In addition, the present invention also includes four-way mixtures of a compound of formula (1), a herbicide as defined above and two further herbicides. In particular, the following four-way mixture is preferred: 1 + atrazine + mesotrione + S-metolachlor.

The mixing partners of the compound of formula (1) may also be in the form of esters or salts, as mentioned e.g. in The Pesticide Manual, 14th Edition (BCPC), 2006. For example, the reference to acifluorfen-sodium also applies to acifluorfen, the reference to dimethenamid also applies to dimethenamid-P, the reference to glufosinate-ammonium also applies to glufosinate, the reference to bensulfuron-methyl also applies to bensulfuron, the reference to cloransulam-methyl also applies to cloransulam, the reference to flumetsulam also applies to flumetsulam, and the reference to pyrithiobac-sodium also applies to pyrithiobac, etc.

The mixing ratio of the compound of formula (1) to the mixing partner is preferably from 1 : 100 to 1000:1.

Compounds of formula (1) may also be combined with herbicide safeners. As combinations with safeners, are preferred, for example, (wherein "I" represents a compound of formula (1)) 1+ AD-67, benoxacor, 1+ cloquintocet-mexyl, 1+ cymerinil, 1+ dichlorid, 1+ dicyclonone, 1+ cyprosulfamid, 1+ diethorate, 1+ DKA-24, dymron, 1+ fenclorazole ethyl, 1+ fenclorim, 1+ HEXIM, 1+ flurazole, 1+ fluoxfenim, 1+ furilazole, 1+ isoxadifen, 1+ isoxadifen ethyl, 1+ MCPA, 1+ mecoprop, 1+ mefenpyr, 1+ mefenpyr ethyl, 1+ mefenpyr diethyl, 1+ mephenate, 1+ MG-191, NA (naphthalic anhydride), 1+ OM (octamethylene diamine), 1+ oxabetrinil, 1+ PPG-1292, 1+ R-29148,
1 + N-(2-methoxybenzoyl)-4-[(methylaminocarbonyl)amino]benzenesulfonamide and the like are mentioned. These components can be used alone or by mixing 2 or more types, and the ratio when they are mixed can also be freely selected.

In particular, the following compound/safener combinations are preferred: 1 + cloquintocet-mexyl, 1 + cyprosulfamide, 1 + N-(2-methoxybenzoyl)-4-[(methylaminocarbonyl)amino]benzenesulfonamide, 1 + isoxadifen-ethyl, 1 + benoxacor, 1 + dichlormid and 1 + fluxofenim.

The safeners of the compound of formula (1) may also be in the form of esters or salts, as mentioned e.g. in The Pesticide Manual, 14th Edition (BCPC), 2006. For example, the reference to cloquintocet-mexyl also applies to cloquintocet and to a lithium, sodium, potassium, calcium, magnesium, aluminium, iron, ammonium, quaternary ammonium, sulfonium or phosphonium salt thereof as disclosed in WO02/34048 and the reference to fenchlorazole-ethyl also applies to fenchlorazole, etc.

Preferably the mixing ratio of compound of formula (1) to safener is from 100:1 to 1:10, especially from 20:1 to 1:1.

The mixtures can advantageously be used in the above-mentioned formulations (in which case "active ingredient" relates to the respective mixture of compound of formula (1) and any further active ingredient, in particular a further herbicide, with the safener).

It is possible that the safener and a compound of formula (1) and one or more additional herbicide(s), if any, are applied simultaneously. For example, the safener, a compound of formula (1) and one or more additional herbicide(s), if any, might be applied to the locus pre-emergence or might be applied to the crop post-emergence. It is also possible that the safener and a compound of formula (1) and one or more additional herbicide(s), if any, are applied sequentially. For example, the safener might be applied before sowing the seeds as a seed treatment and a compound of formula (1) and one or more additional herbicides, if any, might be applied to the locus pre-emergence or might be applied to the crop post-emergence.

When the compounds of the present invention are used as herbicides, they are usually mixed with a suitable solid carrier or liquid carrier, and moreover surfactants, penetrants, spreading agents, thickeners, antifreeze agents, binders, anticaking agents, disintegrants,
stabilizing agents and the like are added as desired, and they can be put to use in formulations of any type, such as wettable powders, emulsions, flowables, dry flowables, liquids, powders, granules or gels. Further, to save labour and increase safety, the aforesaid formulations of any type can be sealed into waterproof packages.

As solid carriers, for example natural mineral substances such as quartz, kaolinite, pyrophylite, sericite, talc, bentonite, acidic clay, attapulgite, zeolite and diatomaceous earth, inorganic salts such as calcium carbonate, ammonium sulphate, sodium sulphate, potassium chloride, synthetic silicic acid and synthetic silicate salts are mentioned.

As liquid carriers, for example alcohols such as ethylene glycol, propylene glycol and isopropanol, aromatic hydrocarbons such as xylene, alkylbenzenes and alkylnapth-halenes, ethers such as butyl cellosolve, ketones such as cyclohexanone, esters such as γ-butyrolactone, acid amides such as N-methylpyrrolidone and N-octylpyrrolidone, plant oils such as soya bean oil, rapeseed oil, cottonseed oil and castor oil, and water, are mentioned.

These solid and liquid carriers can be used alone or 2 or more can be used together.

As surfactants, for example nonionic surfactants such as polyoxyethylene alkyl ethers, polyoxyethylene alkyl aryl ethers, polyoxyethylene styryl phenyl ethers, polyoxyethylene polyoxypropylene block copolymers, polyoxyethylene fatty acid esters, sorbitan fatty acid esters and polyoxyethylene sorbitan fatty acid esters, anionic surfactants such as alkyl sulphate salts, alkylbenzenesulphonate salts, lignin-sulphonate salts, alkylsulphosuccinate salts, naphthalenesulphonate salts, alkylnaphthalenesulphonate salts, naphthalenesulphonic acid formalin condensate salts, alkylnaphthalenesulphonic acid formalin condensate salts, polyoxyethylene alkyl aryl ether sulphate and phosphate salts, polyoxyethylene styryl phenyl ether sulphate and phosphate salts, polycarboxylic acid salts and polystyrenesulphonate salts, cationic surfactants such as alkylamine salts and quaternary alkylammonium salts and amphoteric surfactants such as amino acid types and betaine types are mentioned.

Although there is no particular restriction as to the content of these surfactants, usually from 0.05 to 20 parts by weight per 100 parts by weight of the formulation of the present invention is preferable. Further, these surfactants can be used alone, or 2 or more can be used together.
At the time of formulation or spraying, the compounds of the present invention can also as necessary be used mixed with other types of herbicide, various insecticides, bactericides, plant growth regulators or synergists and the like.

In particular, by using them mixed with other herbicides, broadening of the weed-killing spectrum and higher weed-killing efficacy can be expected due to cost reduction through dosage decreases, and the synergistic action of the mixed agents. During this, combinations with a plurality of known herbicides simultaneously are also possible.

The dosage of the compounds of the present invention may differ depending on the use location, time of use, method of use, crop grown and the like, but in general from 0.005 to about 50 kg as active substance weight per hectare (ha) is suitable.

Next, compounding examples of formulations when the compounds of the present invention are used are shown. However, compounding examples of the present invention are not limited only to these. It should be noted that in the following compounding examples "parts" means parts by weight.

**Wettable powder**

<table>
<thead>
<tr>
<th>Component</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound of present invention</td>
<td>0.1-80</td>
</tr>
<tr>
<td>Solid carrier</td>
<td>5-98.9</td>
</tr>
<tr>
<td>Surfactant</td>
<td>1-10</td>
</tr>
<tr>
<td>Others</td>
<td>0-5</td>
</tr>
</tbody>
</table>

As others, for example anticaking agents, stabilizing agents and the like are mentioned.

**Emulsion**

<table>
<thead>
<tr>
<th>Component</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound of present invention</td>
<td>0.1-30</td>
</tr>
<tr>
<td>Liquid carrier</td>
<td>45-95</td>
</tr>
<tr>
<td>Surfactant</td>
<td>4.9-15</td>
</tr>
<tr>
<td>Others</td>
<td>0-10</td>
</tr>
</tbody>
</table>

As others, for example spreading agents, stabilizing agents and the like are mentioned.

**Flowable**

<table>
<thead>
<tr>
<th>Component</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound of present invention</td>
<td>0.1-70</td>
</tr>
<tr>
<td>Liquid carrier</td>
<td>15-98.89 parts</td>
</tr>
<tr>
<td>Surfactant</td>
<td>1-12 parts</td>
</tr>
<tr>
<td>Others</td>
<td>0.01-30 parts</td>
</tr>
</tbody>
</table>

As others, for example antifreeze agents, thickeners and the like are mentioned.

**Dry flowable**

| Compound of present invention | 0.1-90 parts |
| Solid carrier                | 0-98.9 parts |
| Surfactant                   | 1-20 parts   |
| Others                       | 0-10 parts   |

As others, for example binders, stabilizing agents and the like are mentioned.

**Liquid formulation**

| Compound of present invention | 0.01-70 parts |
| Liquid carrier                | 20-99.99 parts |
| Others                        | 0-10 parts   |

As others, for example antifreeze agents, spreading agents and the like are mentioned.

**Granule formulation**

| Compound of present invention | 0.01-80 parts |
| Solid carrier                 | 10-99.99 parts |
| Others                        | 0-10 parts   |

As others, for example binders, stabilizing agents and the like are mentioned.

**Powder formulation**

| Compound of present invention | 0.01-30 parts |
| Solid carrier                 | 65-99.99 parts |
| Others                        | 0-10 parts   |

As others, for example antidrift agents, stabilizing agents and the like are mentioned.
At the time of use, the aforesaid formulations are sprayed as such or after 1-10,000-fold dilution with water.

**Formulation Examples**

Next, specific pesticide formulations having a compound of the present invention as active component are shown, but it is not limited only to these. It should be noted that in these compounding examples "parts" means parts by weight.

**Compounding Example 1 Wettable powder**

<table>
<thead>
<tr>
<th>Compound of present invention No.1-01</th>
<th>20 parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrophyllite</td>
<td>76 parts</td>
</tr>
<tr>
<td>Sorbol 5039</td>
<td>2 parts</td>
</tr>
<tr>
<td>(Anionic surfactant: Toho Chemical Industries (Corp.) brand name)</td>
<td></td>
</tr>
<tr>
<td>Carplex # 80</td>
<td>2 parts</td>
</tr>
<tr>
<td>(Synthetic silicic acid: Shionogi &amp; Co. (Ltd.) brand name)</td>
<td></td>
</tr>
</tbody>
</table>

The above are made into a wettable powder by uniformly mixing and grinding.

**Compounding Example 2 Emulsion**

<table>
<thead>
<tr>
<th>Compound of present invention No.1-01</th>
<th>5 parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylene</td>
<td>75 parts</td>
</tr>
<tr>
<td>N-methylpyrrolidone</td>
<td>15 parts</td>
</tr>
<tr>
<td>Sorbol 2680</td>
<td>5 parts</td>
</tr>
<tr>
<td>(Anionic surfactant: Toho Chemical Industries (Corp.) brand name)</td>
<td></td>
</tr>
</tbody>
</table>

The above are made into an emulsion by uniformly mixing.

**Compounding Example 3 Flowable**

<table>
<thead>
<tr>
<th>Compound of present invention No.1-01</th>
<th>25 parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrisol S-710</td>
<td>10 parts</td>
</tr>
<tr>
<td>Lunox 1000C</td>
<td>0.5 parts</td>
</tr>
<tr>
<td>(Anionic surfactant: Toho Chemical Industries (Corp.) brand name)</td>
<td></td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>0.02 parts</td>
</tr>
<tr>
<td>(Nonionic surfactant: Kao (Corp.) brand name)</td>
<td></td>
</tr>
</tbody>
</table>
Water 64.48 parts

The above are made into a flowable by uniformly mixing and then wet-grinding.

**Compounding Example 4 Dry flowable**

Compound of present invention No. 1-01 75 parts

5 HitenoNE-15 5 parts

(Anionic surfactant: Dai-Ichi Kogyo Seiyaku (Corp.) brand name)

Vanillex N 10 parts

(Anionic surfactant: Nippon Paper Industries (Corp.) brand name)

Carplex # 80 10 parts

10 (Synthetic silicic acid: Shionogi & Co. (Ltd.) brand name)

After uniformly mixing and grinding the above, a little water is added, and after stirring, mixing and kneading, a dry flowable is made by granulating in an extruding granulator and drying.

**Compounding Example 5 Granule formulation**

15 Compound of present invention No. 1-01 1 part

Bentonite 55 parts

Talc 44 parts

After uniformly mixing and grinding the above, a little water is added, and after stirring, mixing and kneading, a granule formulation is made by granulating in an extruding granulator and drying.

**Practical Examples**

Below, the present invention is explained in more detail by specifically stating synthetic examples and test examples of the haloalkylsulphonamide derivatives represented by the formula (1) used as active components in the herbicides of the present invention, but the present invention is not limited by these.

Further, the proton nuclear magnetic resonance chemical shift values in the practical examples were measured at 300 MHz using Me4Si (tetramethylsilane) as the reference substance. Further, the solvents used for the measurements are stated in the following
synthetic examples. Further, the symbols in the proton nuclear magnetic resonance chemical shift values in the practical examples have the following meanings.

s: singlet, brs: broad singlet, d: doublet, t: triplet, q: quintet, m: multiplet.

**Synthetic Examples**

5 Synthetic Example 1

Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]-3-(hydroxyimino)-piperidin-2-one (Compound of present invention No. 1-02)

Hydroxylamine hydrochloride (26 mg, 0.37 mmol) was added at room temperature to a mixed solution of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]piperidin-2,3-dione (0.13 g, 0.31 mmol) and 3 ml ethanol. After the end of the addition, the said reaction mixture was stirred for 1 hr at room temperature. After the end of the reaction, the solvent in the said reaction liquid was distilled off under reduced pressure. The residue obtained was purified by silica gel chromatography [n-hexane : ethyl acetate = 9:1 to 1:9 (volume ratio, likewise below)], and 67 mg of the desired product was obtained as a pale yellow solid.

m. p.: 72-75°C

5 Synthetic Example 2

Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]-3-(methoxyimino)piperidin-2-one (Compound of present invention No. 1-04)

Methoxyamine hydrochloride (24 mg, 0.29 mmol) and sodium acetate (49 mg, 0.60 mmol) were added at room temperature to a mixed solution of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]piperidin-2,3-dione (101 mg, 0.24 mmol) and 3 ml ethanol. After the end of the addition, the said reaction mixture was stirred overnight at room temperature. After the end of the stirring, the reaction was stopped by addition of 30 ml of a saturated aqueous solution of potassium hydrogen sulphate, and the said reaction liquid was extracted with ethyl acetate (30 ml x 2). The organic layer obtained was dried with anhydrous sodium sulphate, and the solvent distilled off under reduced pressure. The residue obtained was purified by silica gel chromatography (n-hexane : ethyl acetate = 9:1 to 1:9) and 80 mg of the desired product was obtained as a white solid.
m. p.: 72-75°C

Synthetic Example 3

Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]-3-
[(ethoxycarbonyloxy)imino]piperidin-2-one  (Compound of present invention No. 1-27)

Ethyl chloroformate (0.06 g, 0.55 mmol) was added at room temperature to a mixed solution
of 1-[2-(N-trifluoromethanesulphonyl)aminobenzyl]-3-(hydroxyimino)-piperidin-2-one  (0.04
g , 0.11 mmol), sodium hydrogen carbonate (0.05 g, 0.60 mmol) and 5 ml acetonitrile. After
the end of the addition, the said reaction mixture was stirred for 6 hrs with heating under
reflux. After the end of the stirring, the reaction was stopped by addition of 10 ml water, and
the said reaction liquid was extracted with toluene (10 ml x 2). The organic layer obtained
was dried with anhydrous sodium sulphate, and the solvent distilled off under reduced
pressure. The residue obtained was purified by silica gel chromatography (n-hexane : ethyl
acetate = 9:1 to 3:7), and 7 mg of the desired product was obtained as a resinous material.

1H NMR (CDCl3, Me4Si, 300 MHz); δ 7.49-7.35 (m, 3H), 7.23-7.18 (m, 1H), 4.99 (d, J = 15.5 Hz, 1H), 4.63 (d, J = 15.5 Hz, 1H), 4.44-4.31 (m, 4H), 3.38-3.29 (m, 2H), 2.97-2.85 (m, 2H), 2.01-1.89 (m, 2H), 1.45-1.29 (m, 6H).

Reference Example 1

1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]piperidine-2,3-dione

Stage 1: Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)amino-benzyl]-
3-bromopiperidin-2-one

Trimethylsilyl trifluoromethanesulphonate  (9.47 g, 42.6 mmol) was added with ice cooling
to a mixed solution of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)-
aminobenzyl]piperidin-2-one  (14.5 g, 35.5 mmol), triethylamine (5.37 g, 53.2 mmol) and 50
ml dichloromethane. After the end of the addition, the said reaction mixture was stirred for 1
hr with ice cooling. After the end of the stirring, phenyltrimethylammonium tribromide (20.0
g, 53.2 mmol) was added with ice cooling to the said reaction mixture. After the end of the
addition, the said reaction mixture was stirred overnight at room temperature. After the end
of the stirring, the reaction was stopped by addition of 100 ml of IN aqueous hydrochloric
acid solution, and the said reaction liquid was extracted with ethyl acetate (100 ml x 2). The
organic layer obtained was washed with saturated sodium bicarbonate solution, then dried
with anhydrous sodium sulphate, and the solvent distilled off under reduced pressure. The
solid deposited was washed with diisopropyl ether and collected by filtration and 15.9 g of
the desired product was obtained as a pale yellow solid.

m. p.: 97-99°C

Stage 2: Synthesis of 1-[2-(N-trifluoromethanesulphonyl)aminobenzyl]-3-acetoxy-piperidin-
2-one

1,4,7,10,13,16-hexaoxacyclooctadecane (164 mg, 0.62 mmol) and potassium acetate (8.05 g,
82.0 mmol) were added at room temperature to a mixed solution of 1-[2-(N-ethoxycarbonyl-,
N-trifluoromethanesulphonyl)aminobenzyl]-3-bromopiperidin-2-one (10.0 g, 20.5 mmol)
and 50 ml acetonitrile. After the end of the addition, the said reaction mixture was stirred
with heating under reflux for 3 hrs. After the end of the reaction, the solvent was distilled off
from the said reaction liquid under reduced pressure. The residue obtained was purified by
silica gel chromatography (n-hexane : ethyl acetate = 9:1 to 1:9), and 8.76 g of the desired
product was obtained as a white solid.

m. p.: 106-108°C

Stage 3: Synthesis of 1-[2-(N-trifluoromethanesulphonyl)aminobenzyl]-3-hydroxy-piperidin-
2-one

Potassium carbonate (1.50 g, 10.9 mmol) was added at room temperature to a mixed solution
of 1-[2-(N-trifluoromethanesulphonyl)aminobenzyl]-3-acetoxy-piperidin-2-one (8.55 g, 21.7
mmol) and 20 ml methanol. After the end of the addition, the said reaction mixture was
stirred for 4 hrs at room temperature. After the end of the stirring, the reaction was stopped
by addition of 30 ml of saturated aqueous potassium hydrogen sulphate solution, and the said
reaction liquid was extracted with ethyl acetate (100 ml x 2). The organic layer obtained was
dried with anhydrous sodium sulphate, and the solvent distilled off under reduced pressure.
The residue obtained was purified by silica gel chromatography (n-hexane : ethyl acetate =
9:1 to 1:9), and 7.04 g of the desired product was obtained as a colourless liquid.

1H NMR (CDCl3, Me4Si, 300 MHz): δ 11.25 (brs, 1H),  7.62 (d, 1H, J = 8.0 Hz),  7.41 (t,
1H, J = 8.0 Hz),  7.35-7.15 (m, 2H),  4.61 (d, 1H, J = 14.6 Hz),  4.38 (d, 1H, J = 14.6 Hz,
4.20-4.05 (m, 1H), 3.55-3.40 (m, 2H), 2.30-2.20 (m, 1H), 2.05-1.80 (m, 2H), 1.80-1.60 (m, 2H).

Stage 4: Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)amino-benzyl]-3-hydroxypiperidin-2-one

Ethyl chloroformate (3.55 g, 32.7 mmol) was added at room temperature to a mixed solution of 1-[2-(N-trifluoromethanesulphonyl)aminobenzyl]-3-hydroxypiperidin-2-one (7.68 g, 21.8 mmol), sodium hydrogen carbonate (2.75 g, 32.7 mmol) and 20 ml acetonitrile. After the end of the addition, the said reaction mixture was stirred for 3 hrs with heating under reflux. After the end of the stirring, the reaction was stopped by addition of 100 ml of water, and the said reaction liquid was extracted with ethyl acetate (100 ml x 2). The organic layer obtained was dried with anhydrous sodium sulphate, and the solvent distilled off under reduced pressure. The residue obtained was purified by silica gel chromatography (n-hexane : ethyl acetate = 9:1 to 1:9), and 5.54 g of the desired product was obtained as a colourless liquid.

1H NMR (CDCl3, Me4Si, 300 MHz): δ 7.55-7.15 (m, 4H), 5.00-4.80 (m, 1H), 4.55-4.25 (m, 3H), 4.20-4.05 (m, 1H), 3.76 (d, 1H, J = 8.8 Hz), 3.25-3.10 (m, 2H), 2.40-2.20 (m, 1H), 1.95-1.65 (m, 3H), 1.33 (t, 3H, J = 7.1 Hz).

Stage 5: Synthesis of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)amino-benzyl]piperidin-2,3-dione

1,1,l-triacetoxy-l-dihydro-l,2-benzoiodoxol-3-(lH)-one (0.31 g, 0.73 mmol) was added with ice cooling to a mixed solution of 1-[2-(N-ethoxycarbonyl-N-trifluoromethanesulphonyl)aminobenzyl]-3-hydroxypiperidin-2-one (0.26 g, 0.61 mmol) and 10 ml dichloromethane. After the end of the addition, the said reaction mixture was stirred for 3 hrs at room temperature. After the end of the stirring, the reaction was stopped by addition of 50 ml of saturated aqueous sodium hydrogen carbonate, and the said reaction liquid was extracted with chloroform (50 ml x 2). The organic layer obtained was dried with anhydrous sodium sulphate, and the solvent distilled off under reduced pressure. The residue obtained was purified by silica gel chromatography (n-hexane : ethyl acetate = 9:1 to 1:9), and 0.27 g of the desired product was obtained as a white solid.

m. p.: 95-97°C
The compounds of the present invention can be synthesized on the basis of the aforesaid synthetic examples. Examples of compounds of the present invention produced similarly to synthetic examples 1 to 3 are shown in tables 2 to 5, but the present invention is not limited only to these. It should be noted that the entry Me in the tables represents methyl group, and similarly below Et represents ethyl group, Pr propyl group, Bu butyl group, Ph phenyl group, n- normal and i- iso respectively.

Further, in the tables, the entry "m. p." means "melting point", and the entry “*1” means resinous state.

Further, the substituent represented by D-7a in the tables has the following structure

![Structure of D-7a](image)

**Table 2**

<table>
<thead>
<tr>
<th>No.</th>
<th>R²</th>
<th>R⁵</th>
<th>m.p. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-01</td>
<td>H</td>
<td>H</td>
<td>124-128</td>
</tr>
<tr>
<td>1-02</td>
<td>C(0)OEt</td>
<td>H</td>
<td>72-75</td>
</tr>
<tr>
<td>1-03</td>
<td>H</td>
<td>Me</td>
<td>137-138</td>
</tr>
<tr>
<td>1-04</td>
<td>C(0)OEt</td>
<td>Me</td>
<td>72-75</td>
</tr>
<tr>
<td>1-05</td>
<td>H</td>
<td>Et</td>
<td>131-133</td>
</tr>
<tr>
<td>1-06</td>
<td>C(0)OEt</td>
<td>Et</td>
<td>*1</td>
</tr>
<tr>
<td>1-07</td>
<td>H</td>
<td>n-Pr</td>
<td>122-130</td>
</tr>
<tr>
<td>1-08</td>
<td>C(0)OEt</td>
<td>n-Pr</td>
<td>*1</td>
</tr>
<tr>
<td>1-09</td>
<td>H</td>
<td>i-Pr</td>
<td>124-134</td>
</tr>
<tr>
<td>1-10</td>
<td>C(0)OEt</td>
<td>i-Pr</td>
<td>*1</td>
</tr>
</tbody>
</table>
Table 3

<table>
<thead>
<tr>
<th>No.</th>
<th>R₁</th>
<th>R₂</th>
<th>m.p. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-01</td>
<td>C(0)OEt</td>
<td>Me</td>
<td>*1</td>
</tr>
</tbody>
</table>

Table 4
The 1H NMR data for those compounds of the present invention with no melting point entry are shown in Table 6.

Further, the proton nuclear magnetic resonance chemical shift values in the practical examples were measured in deuterochloroform solvent at 300 MHz using Me4Si (tetramethylsilane) as the reference substance. Further, the symbols in Table 6 have the following meanings, s: singlet, brs: broad singlet, d: doublet, t: triplet, q: quintet, m: multiplet.

Table 6

<table>
<thead>
<tr>
<th>No.</th>
<th>R²</th>
<th>R³</th>
<th>m.p. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-06</td>
<td>δ 7.45-7.30 (m, 3H), 7.20 (d, J = 8.1 Hz, 1H), 4.98 (d, J = 15.9 Hz, 1H), 4.60 (d, J = 15.9 Hz, 1H), 4.45-4.25 (m, 4H), 3.29 (t, J = 6.3 Hz, 2H), 2.85-2.65 (m, 2H), 1.95-1.80 (m, 2H), 1.33 (t, J = 7.2 Hz, 3H), 1.31 (t, J = 7.2 Hz, 2H)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1-08 \( \delta \) 7.50-7.30 (m, 3H), 7.21 (d, \( J = 7.8 \) Hz, IH), 4.98 (d, \( J = 15.6 \) Hz, IH), 4.60 (d, \( J = 15.6 \) Hz, IH), 4.45-4.25 (m, 4H), 3.29 (t, \( J = 5.1 \) Hz, 2H), 2.85-2.65 (m, 2H), 1.95-1.80 (m, 2H), 1.75 (q, \( J = 7.2 \) Hz, 2H), 1.31 (t, \( J = 7.2 \) Hz, 3H), 0.96 (t, \( J = 7.2 \) Hz, 3H).

1-10 \( \delta \) 7.50-7.30 (m, 3H), 7.21 (d, \( J = 7.5 \) Hz, IH), 4.99 (d, \( J = 15.6 \) Hz, IH), 4.70-4.60 (m, IH), 4.59 (d, \( J = 15.6 \) Hz, IH), 4.45-4.25 (m, 2H), 3.28 (t, \( J = 5.1 \) Hz, 2H), 2.85-2.65 (m, 2H), 1.90-1.80 (m, 2H), 1.31 (d, \( J = 6.6 \) Hz, 6H), 1.31 (t, \( J = 7.2 \) Hz, 3H).

1-12 \( \delta \) 7.50-7.30 (m, 3H), 7.21 (d, \( J = 7.8 \) Hz, IH), 4.99 (d, \( J = 15.6 \) Hz, IH), 4.58 (d, \( J = 15.6 \) Hz, IH), 4.45-4.25 (m, 4H), 3.29 (t, \( J = 5.1 \) Hz, 2H), 2.85-2.65 (m, 2H), 1.90-1.80 (m, 2H), 1.75-1.65 (m, 2H), 1.50-1.35 (m, 2H), 1.32 (d, \( J = 7.2 \) Hz, 3H), 0.94 (t, \( J = 7.2 \) Hz, 3H).

1-14 57.50-7.30 (m, 3H), 7.21 (d, \( J = 7.5 \) Hz, IH), 4.98 (d, \( J = 15.6 \) Hz, IH), 4.59 (d, \( J = 15.6 \) Hz, IH), 4.45-4.25 (m, 2H), 4.10 (d, \( J = 6.9 \) Hz, 2H), 3.29 (t, \( J = 5.4 \) Hz, 2H), 2.85-2.65 (m, 2H), 2.20-2.00 (m, IH), 1.95-1.80 (m, 2H), 1.31 (t, \( J = 7.2 \) Hz, 3H), 0.94 (d, \( J = 6.9 \) Hz, 6H).

1-15 57.50-7.35 (m, 3H), 7.22 (d, \( J = 7.8 \) Hz, IH), 4.95 (d, \( J = 15.6 \) Hz, 1H), 4.88 (s, 2H), 4.63 (d, \( J = 15.6 \) Hz, IH), 4.45-4.25 (m, 2H), 3.76 (s, 3H), 3.31 (t, \( J = 5.1 \) Hz, 2H), 2.95-2.75 (m, 2H), 1.95-1.80 (m, 2H), 1.31 (t, \( J = 7.2 \) Hz, 3H).

1-17 57.48-7.18 (m, 9H), 5.36 (s, 2H), 4.98 (d, \( J = 15.5 \) Hz, IH), 4.60 (d, \( J = 15.5 \) Hz, IH), 4.41-4.27 (m, 2H), 3.33-3.22 (m, 2H), 2.85-2.70 (m, 2H), 1.96-1.83 (m, 2H), 1.34-1.27 (m, 3H).

1-18 511.1 (brs, IH), 7.62 (d, \( J = 7.5 \) Hz, IH), 7.38-7.30 (m, IH), 7.24-7.11 (m, 2H), 4.59 (s, 2H), 4.49-4.41 (m, 2H), 3.74-3.66 (m, 2H), 3.54-3.47 (m, 2H), 3.35 (s, 3H), 2.78-2.69 (m, 2H), 1.95-1.87 (m, 2H).

1-19 57.49-7.33 (m, 3H), 7.23-7.18 (m, IH), 4.97 (d, \( J = 15.4 \) Hz, IH), 4.61 (d, \( J = 15.4 \) Hz, IH), 4.50-4.29 (m, 4H), 3.73-3.68 (m, 2H), 3.40 (s, 3H), 3.30-3.26 (m, 2H), 2.87-2.77 (m, 2H), 1.93-1.82 (m, 2H), 1.35-1.29 (m, 3H).

1-21 57.49-7.33 (m, 3H), 7.24-7.18 (m, IH), 4.95 (d, \( J = 15.4 \) Hz, IH), 4.63 (d, \( J = 15.4 \) Hz, IH), 4.57-4.51 (m, 2H), 4.44-4.29 (m, 2H), 3.82-3.76 (m, 2H), 3.33-3.26 (m, 2H), 2.86-2.77 (m, 2H), 1.94-1.82 (m, 2H), 1.39-1.27 (m,
Test Examples

Next, the usefulness of the compounds of the present invention as herbicides is specifically explained in the following test examples, but the present invention is not limited only to these.

Test Example 1

Test of herbicidal efficacy by pre-emergence treatment under flooded conditions

4 cm depth flooded conditions were created by introducing alluvial soil into 1/30000 are polystyrene cups then introducing water and mixing. After mixing and sowing seeds of barnyard grass, bulrush and oval-leafed pondweed in the aforesaid cups, 2.5 leaf stage rice
seedlings were transplanted. On the day of planting, emulsions of compounds of the present invention prepared according to Compounding Example 2 were diluted with water to give the specified dosages, and applied to the water surface. The cups were placed in a greenhouse at 25 to 30°C and the plants were grown, and 3 weeks after the pesticide treatment the herbicidal effect against each plant type was assessed according to the following assessment criteria. The results are shown in Table 7.

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>% weed control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>90% or more</td>
<td>(practically complete withering)</td>
</tr>
<tr>
<td>4</td>
<td>70% to 90%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>40% to 70%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20% to 40%</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5% to 20%</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>less than 5%</td>
<td>(practically no effect)</td>
</tr>
</tbody>
</table>

**Test Example 2**

Test of herbicidal efficacy by growth stage treatment under flooded conditions

4 cm depth flooded conditions were created by introducing alluvial soil into 1/30000 are polystyrene cups then introducing water and mixing. Barnyard grass, bulrush and oval-leafed pondweed seeds were mixed and sown in the aforesaid cups, placed in a greenhouse at 25 to 30°C and the plants were grown. When the barnyard grass, bulrush and oval-leafed pondweed had reached the 1-2 leaf stage, emulsions of compounds of the present invention prepared according to Compounding Example 2 were diluted with water to give the specified dosages and applied to the water surface. 3 weeks after the pesticide treatment, the herbicidal effect against each plant type was assessed in accordance with the assessment criteria of Test Example 1. The results are shown in Table 8.

**Test Example 3**

Test of herbicidal efficacy by soil treatment
Sterilized alluvial soil was introduced into 21 cm wide, 13 cm deep, 7 cm high plastic boxes, seeds of barnyard grass, hairy fingergrass, green foxtail, wild oat, short awn foxtail, Italian ryegrass, black-grass, Indian mallow, ragweed, blue cockscomb, white goosefoot, tufted knotweed, common chickweed, goosegrass, speedwell, maize, soya bean, rice, wheat and beet were sown at respective spots, and covered with ca. 1.5 cm of soil. Next, emulsions of compounds of the present invention prepared according to Compounding Example 2 were diluted with water to give the specified dosages, and uniformly applied onto the soil surface with a small sprayer. 3 weeks after the pesticide treatment the herbicidal effect against each plant type was assessed according to the assessment criteria of Test Example 1. The results are shown in Table 9.

Test Example 4

Test of herbicidal efficacy by foliage treatment

Sterilized alluvial soil was introduced into 21 cm wide, 13 cm deep, 7 cm high plastic boxes, seeds of barnyard grass, hairy fingergrass, green foxtail, wild oat, short awn foxtail, Italian ryegrass, black-grass, Indian mallow, ragweed, blue cockscomb, white goosefoot, tufted knotweed, common chickweed, goosegrass, speedwell, maize, soya bean, rice, wheat and beet were sown at respective spots, and after covering with ca. 1.5 cm of soil, the plants were grown in a greenhouse at 25 to 30°C. After 14 days growing, emulsions of compounds of the present invention prepared according to Compounding Example 2 were diluted with water to give the specified dosages, and uniformly applied onto the foliage with a small sprayer. 3 weeks after the pesticide treatment the herbicidal effect against each plant type was assessed according to the assessment criteria of Test Example 1. The results are shown in Table 10.

It should be noted that the symbols in Tables 7 to 10 have the following meanings.


Further, the dosage (g/a) reflects the fact that, when converting to the per are (la) basis, the concentrations were adjusted so that treatment was with the stated number of grams.

Table 7
<table>
<thead>
<tr>
<th>No.</th>
<th>Dosage (g/a)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>a</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-01</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-02</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-03</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-04</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-05</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>1-06</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-07</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-08</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-09</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-10</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-11</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-12</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-13</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-14</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-15</td>
<td>2.52</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1-16</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-17</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-18</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-19</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-20</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-21</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-22</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-23</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-24</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-25</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-26</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1-27</td>
<td>1.62</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2-01</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3-01</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4-01</td>
<td>2.00</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 8

<table>
<thead>
<tr>
<th>No.</th>
<th>Dosage (g/a)</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-01</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1-02</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-03</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-04</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-05</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-06</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-07</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-08</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-09</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-10</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-11</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-12</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-13</td>
<td>2.52</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-14</td>
<td>2.52</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-15</td>
<td>2.52</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>1-16</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-17</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-18</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-19</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-20</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-21</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-22</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-23</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-24</td>
<td>2.52</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-25</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-26</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-27</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2-01</td>
<td>2.52</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3-01</td>
<td>2.52</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4-01</td>
<td>2.00</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 9

<table>
<thead>
<tr>
<th>No.</th>
<th>Dos</th>
<th>A</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-01</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-02</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-03</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>1-04</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1-05</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>1-06</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-07</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1-08</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1-09</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1-10</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1-11</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1-12</td>
<td>3.2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1-13</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-14</td>
<td>3.2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1-15</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-16</td>
<td>3.2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1-17</td>
<td>3.2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1-18</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1-19</td>
<td>3.2</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-20</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1-21</td>
<td>3.2</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1-22</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-23</td>
<td>3.2</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1-24</td>
<td>3.2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1-25</td>
<td>3.2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1-26</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1-27</td>
<td>2.0</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Table 10

<table>
<thead>
<tr>
<th>No.</th>
<th>Dos</th>
<th>A</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(g/a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-01</td>
<td>3.2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1-02</td>
<td>3.2</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1-03</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>1-04</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1-05</td>
<td>3.2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1-06</td>
<td>3.2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1-07</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1-08</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1-09</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1-10</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1-11</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1-12</td>
<td>3.2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1-13</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1-14</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>1-15</td>
<td>3.2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1-16</td>
<td>3.2</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1-17</td>
<td>3.2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1-18</td>
<td>3.2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1-19</td>
<td>3.2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1-20</td>
<td>3.2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1-21</td>
<td>3.2</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>1-22</td>
<td>3.2</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>1-23</td>
<td>3.2</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1-24</td>
<td>3.2</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
The haloalkylsulphonamide derivatives of the present invention are novel compounds and are useful as selective herbicides for rice, maize, soya bean, wheat/barley and rape.

For the avoidance of doubt, where a literary reference, patent application, or patent, is cited within the text of this application, the entire text of said citation is herein incorporated by reference.
CLAIMS

1. A herbicidal compound of formula 1:

   ![Chemical Structure](image)

   wherein

   A represents -CH=CH- or a sulphur atom, W represents an oxygen atom or a sulphur atom,

   X represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, C₂-C₆ alkenyl, C₂-C₆ haloalkenyl, C₂-C₆ alkynyl, C₂-C₆ haloalkynyl, cyano, -C(0)R⁴⁻⁶, hydroxy, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, amino, nitro or -S(0)ₗR⁴⁻⁹, and when m represents a whole number 2 or more, the respective X may be the same or different, further, if 2 X are adjacent, the 2 adjacent X, by forming -CH₂CH₂CH₂-, -CH₂CH₂O-, -CH₂OCH₂-, -CH₂CH₂S-, -CH₂CH₂CH₂CH₂-, -CH₂CH₂CH₂O-, -CH₂CH₂OCH₂-, -CH₂OCH₂O-, -CH₂CH₂O-, -CH₂CH₂CH₂S-, -CH₂CH₂S- or -CH=CH=CH-, can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 X, and in this case the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with halogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl,

   m represents a whole number 0, 1 or 2,

   n represents a whole number 1, 2, 3 or 4,

   p represents a whole number 0 or 1,

   R¹ represents Ci-C₆ haloalkyl,
R² represents a hydrogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R¹⁰, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R¹⁰, C₂-C₆ alkenyl, (C₂-C₆) alkenyl optionally substituted with R¹⁰, C₂-C₆ alkynyl, (C₂-C₆) alkynyl optionally substituted with R¹⁰, -C(0)R₁¹ or -S(0)₂R₁².

R³ and R⁴ each independently represent a hydrogen atom, halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, Ci-C₆ alkoxy or Ci-C₆ haloalkoxy or else R³ by forming a C₂-C₆ alkyne chain together with R⁴ can form a 3 to 7-membered ring together with the carbon atom linking R³ and R⁴.

R⁵ represents a hydrogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R²⁷, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R²⁷, C₂-C₆ alkenyl, (C₂-C₆) alkenyl optionally substituted with R²⁷, C₂-C₆ alkynyl, (C₂-C₆) alkynyl optionally substituted with R²⁷, -C(0)R₂⁸, -S(0)₂R₃⁵ or D₁ to D₉.

R⁶ and R⁷ each independently represent a hydrogen atom, halogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R³⁹, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R³⁹, C₂-C₆ alkenyl, (C₂-C₆) alkenyl optionally substituted with R³⁹, C₂-C₆ alkynyl, (C₂-C₆) alkynyl optionally substituted with R³⁹, phenyl, phenyl substituted with (R⁴⁰)ₕ₅, -C(0)R₄¹, cyano, -OR₄² or -S(0)ₙ₆R₄₃ or else R⁶ and R⁷ on the same carbon, by together forming a C₂-C₆ alkyne chain, can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, or else R⁶ and R⁷ on the same carbon atom can link together and form =CH₂ or carbonyl, further, when n = 2 to 4, R⁶ and R⁷ by forming a C₂-C₆ alkyne chain together with an R⁶ or R⁷ on a different carbon can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and further, R⁶ and R⁷ can be the same as or different from R⁶ or R⁷ on different carbons, and R⁶ and R⁷ together with an R⁶ or R⁷ on an adjacent carbon can represent a bond.

R⁸ and R⁹ each independently represent a hydrogen atom, halogen atom, Ci-C₆ alkyl, (Ci-C₆) alkyl optionally substituted with R³⁹, C₃-C₆ cycloalkyl, (C₃-C₆) cycloalkyl optionally substituted with R³⁹, C₂-C₆ alkenyl, (C₂-C₆) alkenyl optionally substituted with R³⁹, C₂-C₆ alkynyl, (C₂-C₆) alkynyl optionally substituted with R³⁹, phenyl,
phenyl substituted with \((R^{40})_{q5}\), \(-C(0)R^{41}\), cyano, \(-OR^{42}\) or \(-S(0)^{q6}R^{43}\) or else \(R^9\) together with \(R^9\) on the same carbon, by forming a \(C_2-C_6\) alkyne chain, can form a 3 to 7-membered ring together with the linking carbon atom, and in this case this alkyne chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, or \(R^8\) and \(R^9\) on the same carbon can join together forming \(=CH_2\) or carbonyl,

D-1 to D-9 represent the rings shown in the respective following structural formulae,

\[
\begin{align*}
\text{D-1} & \quad (R^{29})_{t1} \\
\text{D-2} & \quad (R^{29})_{t2} \\
\text{D-3} & \quad (R^{29})_{t2} \\
\text{D-4} & \quad (R^{29})_{t2} \\
\text{D-5} & \quad (R^{29})_{t3} \\
\text{D-6} & \quad (R^{29})_{t3} \\
\text{D-7} & \quad (R^{29})_{t4} \\
\text{D-8} & \quad (R^{29})_{t4} \\
\text{D-9} & \quad (R^{29})_{t4}
\end{align*}
\]

\(R^{10}\) represents a halogen atom, phenyl, phenyl substituted with \((R^{13})_{q1}\), \(-C(0)R^{14}\), \(-OR^{15}\) or \(-S(0)^{q2}R^{19}\),

\(R^{11}\) represents \(Ci-Ci\) alkyl, \((Ci-Ci)\) alkyl optionally substituted with \(R^{20}\), \(C_3-C_6\) cycloalkyl, \((C_3-C_6)\) cycloalkyl optionally substituted with \(R^{20}\), \(C_2-C_6\) alkenyl, \((C_2-C_6)\) alkenyl optionally substituted with \(R^{20}\), \(C_2-C_6\) alkynyl, \((C_2-C_6)\) alkynyl optionally substituted with \(R^{20}\), phenyl, phenyl substituted with \((R^{13})_{q1}\), \(-OR^{21}\), \(-N(R^{22})R^{23}\) or \(-SR^{24}\),

\(R^{12}\) represents \(Ci-C_6\) alkyl, \(Ci-C_6\) haloalkyl, phenyl, phenyl substituted with \((R^{13})_{q1}\) or \(-N(R^{25})R^{26}\),

\(R^{13}\) represents a halogen atom, \(Ci-C_6\) alkyl, \(Ci-C_6\) haloalkyl, \(Ci-C_6\) alkoxy, \(Ci-C_6\) haloalkoxy, amino or nitro and when \(q1\) represents a whole number 2 or more, the respective \(R^{13}\) may be the same or different, further, if \(2 \ R^{13}\) are adjacent, the \(2\) adjacent \(R^{13}\), by forming \(-CH_2CH_2CH_2-\), \(-CH_2CH_2O-\), \(-CH_2OCH_2-\), \(-OCH_20-\), -
CH2CH2S-, -CH2SCH2-, -CH2CH2CH2-, -CH2CH2CH2O-, -CH2CH2OCH2-, -CH2OCH2O-, -OCH2CH2O-, -CH2CH2CH2-, -CH2CH2OCH2-, -CH2CH2CH2O-, -OCH2CH2O-,

form a 5-membered ring or 6-membered ring together with the carbon atom linking the
2 R13, and in this case, the hydrogen atoms bound to each carbon atom forming the ring
can optionally be replaced with a halogen atom, Ci,C6 alkyl or Ci,C6 haloalkyl,

R14 represents Ci,C6 alkyl, Ci,C6 haloalkyl, Ci,C6 alkoxy, Ci,C6 haloalkoxy, phenyl or
phenyl substituted with (R13)q,i,

R15 represents a hydrogen atom, Ci,C6 alkyl, Ci,C6 haloalkyl, phenyl, phenyl
substituted with (R13)q,i or -C(0)R16,

R16 represents Ci,C6 alkyl, phenyl, phenyl substituted with (R13)q,i, Ci,C6 alkoxy or
-N(R17)R18,

R17 and R18 each independently represent a hydrogen atom, Ci,C6 alkyl or Ci,C6
haloalkyl or else R17, together with R18, by forming a C2-C6 alkylene chain, can form a
3 to 7-membered ring together with the linking nitrogen atom, and in this case this
alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can
optionally be substituted with a halogen atom, Ci,C6 alkyl group, Ci,C6 haloalkyl
group, Ci,C6 alkoxy group, formyl group, Ci,C6 alkylcarbonyl group, Ci,C6
alkoxy carbonyl group or oxo group,

R19 represents Ci,C6 alkyl, Ci,C6 haloalkyl, phenyl or phenyl substituted with (R13)q,i,

R20 represents a halogen atom, C3-C6 cycloalkyl, phenyl, phenyl substituted with
(R13)q,i, Ci,C6 alkoxy, Ci,C6 haloalkoxy or phenoxy,

R21 represents C1-C12 alkyl, (C1-C12) alkyl optionally substituted with R20, C3-C6
cycloalkyl, (C3-C6) cycloalkyl optionally substituted with R20, C2-C6 alkenyl, (C2-C6)
alkenyl optionally substituted with R20, C2-C6 alkenyl, (C2-C6) alkenyl optionally
substituted with R20, phenyl or phenyl substituted with (R13)q,i,

R22 and R23 each independently represent a hydrogen atom, Ci,C6 alkyl or Ci,C6
haloalkyl or else R22, together with R23, by forming a C2-C6 alkylene chain, can form a
3 to 7-membered ring together with the linking nitrogen atom, and in this case this
alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can
optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R²⁴ represents Ci-C₆ alkyl or Ci-C₆ haloalkyl,

R²⁵ and R²⁶ each independently represent a hydrogen atom or Ci-C₆ alkyl or else R²⁵, together with R²⁶, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, C₁-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group,

R²⁷ represents a halogen atom, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, -C(0)R ³¹, -OR², -N(R³³)R³⁴, -S(0)qR³⁵, tri(Ci-C₆ alkyl)silyl or D-I to D-9,

R²⁸ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, C₃-C₆ cycloalkyl, C₃-C₆ halocycloalkyl, Ci-Cg alkoxy, Ci-C₆ haloalkoxy, -N(R³⁶)R³⁷ or -SR³⁸,

R²⁹ represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, Ci-C₆ alkoxy, Ci-C₆ haloalkoxy, amino or nitro and when q³ represents a whole number 2 or more, the respective R²⁹ may be the same or different, further, if 2 R²⁹ are adjacent, the 2 adjacent R²⁹, by forming -CH₂CH₂CH₂-, -CH₂CH₂₂-, -CH₂OCH₂-, -OCH₂₂-, -CH₂CH₂₂S-, -CH₂SCH₂-, -CH₂CH₂CH₂CH₂-, -CH₂CH₂CH₂₂-, -CH₂CH₂CH₂O-, -CH₂CH₂OCH₂-, -CH₂OCH₂₂-, -OCH₂₂CH₂-, -CH₂CH₂₂S-, -OCH₂₂CH₂S- or -CH=CH-CH=CH-, can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 R²⁹, and in this case, the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with a halogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl,

R³⁰ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R²⁹)q³.

R³¹ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, Ci-C₆ alkoxy or Ci-C₆ haloalkoxy,

R³² represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R²⁹)q³.
R\(^{33}\) and R\(^{34}\) each independently represent a hydrogen atom or Ci-C\(_6\) alkyl or else R\(^{33}\), together with R\(^{34}\), by forming a C\(_2\)-C\(_6\) alkyene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C\(_6\) alkyl group, Ci-C\(_6\) haloalkyl group, Ci-C\(_6\) alkoxy group, formyl group, Ci-C\(_6\) alkylcarbonyl group, Ci-C\(_6\) alkoxy carbonyl group or oxo group,

R\(^{35}\) represents Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, phenyl or phenyl substituted with (R\(^{29}\))\(^q\),

R\(^{36}\) and R\(^{37}\) each independently represent a hydrogen atom, Ci-C\(_6\) alkyl or Ci-C\(_6\) haloalkyl or else R\(^{36}\), together with R\(^{37}\), by forming a C\(_2\)-C\(_6\) alkyene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkyene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C\(_6\) alkyl group, Ci-C\(_6\) haloalkyl group, Ci-C\(_6\) alkoxy group, formyl group, Ci-C\(_6\) alkylcarbonyl group, Ci-C\(_6\) alkoxy carbonyl group or oxo group,

R\(^{38}\) represents Ci-C\(_6\) alkyl or Ci-C\(_6\) haloalkyl,

R\(^{39}\) represents a halogen atom, C\(_3\)-C\(_6\) cycloalkyl, phenyl, hydroxy, Ci-C\(_6\) alkoxy or Ci-C\(_6\) haloalkoxy,

R\(^{40}\) represents a halogen atom, Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, Ci-C\(_6\) alkoxy, Ci-C\(_6\) haloalkoxy, amino or nitro, and when q\(^5\) represents a whole number 2 or more, the respective R\(^{40}\) may be the same or different, further, if2 R\(^{40}\) are adjacent, the 2 adjacent R\(^{40}\), by forming -CH\(_2\)CH\(_2\)CH\(_2\), -CH\(_2\)CH\(_2\)O-, -CH\(_2\)OCH\(_2\), -OCH\(_2\)O-, -CH\(_2\)CH\(_2\)S-, -CH\(_2\)SCH\(_2\), -CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\), -CH\(_2\)CH\(_2\)CH\(_2\)O-, -CH\(_2\)CH\(_2\)OCH\(_2\)-, -CH\(_2\)OCH\(_2\)O-, -OCH\(_2\)CH\(_2\)O-, -CH\(_2\)CH\(_2\)S-, -OCH\(_2\)CH\(_2\)S- or -CH=CH=CH- can form a 5-membered ring or 6-membered ring together with the carbon atom linking the 2 R\(^{40}\), and in this case the hydrogen atoms bound to each carbon atom forming the ring can optionally be replaced with a halogen atom, Ci-C\(_6\) alkyl or Ci-C\(_6\) haloalkyl,

R\(^{41}\) represents Ci-C\(_6\) alkyl, Ci-C\(_6\) haloalkyl, C\(_3\)-C\(_6\) cycloalkyl, C\(_3\)-C\(_6\) halocycloalkyl, hydroxy, Ci-C\(_6\) alkoxy, Ci-C\(_6\) haloalkoxy or -N(R\(^{44}\))R\(^{45}\),
R represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R⁴⁰)₄⁵.

R³ represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R⁴⁰)₄⁵.

R⁴⁴ and R⁴⁵ each independently represent a hydrogen atom, Ci-C₆ alkyl or Ci-C₆ haloalkyl or else R⁴⁴, together with R⁴⁵, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group.

R⁴⁶ represents a hydrogen atom, Ci-C₆ alkyl, Ci-C₆ alkoxy or -N(R⁴⁷)R⁴⁸.

R⁴⁷ and R⁴⁸ each independently represent a hydrogen atom or Ci-C₆ alkyl or else R⁴⁷, together with R⁴⁸, by forming a C₂-C₆ alkylene chain, can form a 3 to 7-membered ring together with the linking nitrogen atom, and in this case this alkylene chain may contain 1 oxygen atom, sulphur atom or nitrogen atom, and can optionally be substituted with a halogen atom, Ci-C₆ alkyl group, Ci-C₆ haloalkyl group, Ci-C₆ alkoxy group, formyl group, Ci-C₆ alkylcarbonyl group, Ci-C₆ alkoxy carbonyl group or oxo group.

R⁴⁹ represents Ci-C₆ alkyl or Ci-C₆ haloalkyl.

q¹ represents a whole number 1, 2, 3, 4 or 5.

q² represents a whole number 0, 1 or 2.

q³ represents a whole number 1, 2, 3, 4 or 5.

q⁴ represents a whole number 0, 1 or 2.

q⁵ represents a whole number 1, 2, 3, 4 or 5.

q⁶ and q⁷ each independently represent a whole number 0, 1 or 2.

t¹ represents a whole number 0, 1, 2, 3, 4 or 5.

t² represents a whole number 0, 1, 2, 3 or 4.
t^3 represents a whole number 0, 1, 2, 3, 4, 5, 6 or 7,

t^4 represents a whole number 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9 or salt thereof.

2. The compound as claimed in claim 1, wherein A represents -CH=CH-.

3. The compound as claimed in claim 1 or claim 2, wherein W represents an oxygen atom.

4. The compound as claimed in any one of claims 1 to 3, wherein R^2 represents a hydrogen atom, Ci-C_6 alkyl, (Ci-C_6) alkyl optionally substituted with R^{10}, C_2=C_6 alkenyl, C_2-C_6 alkynyl, -C(0)R^{11} or -S(0)\_2R^{12}.

5. The compound as claimed in any one of claims 1 to 4, wherein R^3 represents hydrogen.

6. The compound as claimed in any one of claims 1 to 5, wherein R^4 represents hydrogen.

7. The compound as claimed in any one of claims 1 to 6, wherein R^5 represents a hydrogen atom, Ci-C_6 alkyl, (Ci-C_6) alkyl optionally substituted with R^{27}, C_3-C_6 cycloalkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, -C(0)R^{28} or D-7.

8. The compound as claimed in any one of claims 1 to 7, wherein R^6 and R^7 each independently represent a hydrogen atom, halogen atom, Ci-C_6 alkyl, (Ci-C_6) alkyl optionally substituted with R^{39}, phenyl, -C(0)R^{11}, cyano, -OR^{42} or -S(0)\_q R^{43} or else R^6 and R^7 on the same carbon, by together forming a C_2 alkyne chain, can form a 3-membered ring together with the linking carbon atom, or else R^6 and R^7 on the same carbon atom can link together and form =CH_2 or carbonyl, further, when n = 2 to 4, R^6 and R^7 by forming a C_2-C_6 alkyne chain together with an R^6 or R^7 on a different carbon can form a 4 to 6-membered ring together with the linking carbon atom, and further, R^6 and R^7 can be the same as or different from R^6 or R^7 on different carbons, and R^6 and R^7 together with an R^6 or R^7 on an adjacent carbon can represent a bond.

9. The compound of any one of claims 1 to 8, wherein R^8 and R^9 each independently represent a hydrogen atom, halogen atom, Ci-C_6 alkyl, (Ci-C_6) alkyl optionally substituted with R^{39}, phenyl, -C(0)R^{11}, cyano, -OR^{42} or -S(0)\_q R^{43} or else R^8 and R^9...
on the same carbon, by together forming a C₂ alkenylene chain, can form a 3-membered ring together with the linking carbon atom, or else R⁸ and R⁹ on the same carbon atom can link together and form =CH₂ or carbonyl.

10. The compound of any one of claims 1 to 9, wherein R¹⁰ represents phenyl, -C(0)R¹⁴, -OR¹⁵ or -S(O)₂R¹⁹.

11. The compound of any one of claims 1 to 10, wherein R¹¹ represents Ci-Ci₂ alkyl, (Ci-Ci₂) alkyl optionally substituted with R²⁰, C₃-C₆ cycloalkyl, C₂-C₆ alkenyl, phenyl, -OR²¹ or -SR²⁴.

12. The compound of any one of claims 1 to 11, wherein R¹² represents Ci-C₆ alkyl, Ci-C₆ haloalkyl, phenyl or phenyl substituted with (R¹³)q,i.

13. The compound of any one of claims 1 to 12, wherein R¹³ represents a halogen atom, Ci-C₆ alkyl, Ci-C₆ haloalkyl or Ci-C₆ alkoxy.

14. The compound of any one of claims 1 to 13, wherein R¹⁴ represents Ci-C₆ alkoxy or phenyl.

15. The compound of any one of claims 1 to 14, wherein R¹⁵ represents a hydrogen atom, Ci-C₆ alkyl or -C(0)R¹⁶.

16. The compound of any one of claims 1 to 15, wherein R¹⁶ represents Ci-C₆ alkyl or Ci-C₆ alkoxy.

17. The compound of any one of claims 1 to 16, wherein R¹⁷ represents Ci-C₆ alkyl.

18. The compound of any one of claims 1 to 17, wherein R²⁰ represents a halogen atom or phenoxy.

19. The compound of any one of claims 1 to 18, wherein R²¹ represents Ci-Ci₂ alkyl, (Ci-Ci₂) alkyl optionally substituted with R²⁰, C₂-C₆ alkenyl, C₂-C₆ alkynyl or phenyl. Preferably, R²⁴ represents Ci-C₆ alkyl.

20. The compound of any one of claims 1 to 19, wherein R²⁷ represents a halogen atom, -C(0)R³¹, -OR³², tri(Ci-C₆ alkyl)silyl or D-l.
21. The compound of any one of claims 1 to 20, wherein \( R_{28} \) and \( R_{31} \) each independently represent Ci-C\(_6\) alkoxy.

22. The compound of any one of claims 1 to 21, wherein \( R_{32} \) represents Ci-C\(_6\) alkyl.

23. The compound of an one of claims 1 to 22, wherein \( R_{39} \) represents a halogen atom, phenyl, hydroxy or Ci-C\(_6\) alkoxy.

24. The compound of any one of claims 1 to 23, wherein \( R_{41} \) represents hydroxy or Ci-C\(_6\) alkoxy.

25. The compound of any one of claims 1 to 24, wherein \( R_{42} \) represents a hydrogen atom, Ci-C\(_6\) alkyl or phenyl.

26. The compound of any one of claims 1 to 25, wherein \( R_{43} \) represents Ci-C\(_6\) alkyl or phenyl.

27. A herbicidal composition comprising a compound of formula 1 as defined in any one of claims 1 to 26 together with at least one agriculturally acceptable adjuvant or diluent.

28. A composition according to claim 27, which comprises a further herbicide in addition to the compound of formula 1.

29. The composition of claim 28, wherein the further herbicide is selected from atrazine, terbuthylazine, isoxaflutole, mesotrione, S-metolachlor, acetochlor, pyroxasulfone, dimethachlor, flufenacet, nicosulfuron, fomesafen, glyphosate, glufosinate, paraquat, saflufenacil and prosulfocarb.

30. A composition according to any one of claims 27 to 29 which comprises a safener.

31. Use of a compound of formula 1 as defined in any one of claims 1 to 26 or a composition as defined in any one of claims 27 to 30 as a herbicide.

32. A method of controlling weeds in crops of useful plants, comprising applying to said weeds or to the locus of said weeds, or to said useful plants or to the locus of said...
useful plants, a compound of formula 1 as defined in any one of claims 1 to 26 or a composition as claimed in any one of claims 27 to 30.
INTERNATIONAL SEARCH REPORT

PCT/EP2014/078594

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07D211/86 C07D405/12 C07D207/38 C07D223/12 A01N43/40
A01N43/36...

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07D A01N

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

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

EPO-internal, BEI LSTEIN Data, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category* Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No.

Y EP 2 336 104 A1 (NISSAN CHEMICAL IND LTD [JP]) 22 June 2011 (2011-06-22) cited in the application on compounds of formula I where ni R₅ and R₆ or R₇ and R₈ together form an oxo group; claims 1,3,10; table 18

Y WO 2013/061973 A1 (ISHIHARA SANGYO KAISHA [JP]) 2 May 2013 (2013-05-02) cited in the application on compounds of formula I where ni R₄ and R₅, R₆ and R₇, R₈ and R₉ or R₁₀ and R₁₁ together form an oxo group; claims 1-3

-/-

X Further documents are listed in the continuation of Box C.

X See patent family annex.

* Special categories of cited documents:

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

”E” earlier application or patent but published on or after the international filing date

”F” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

”O” document referring to an oral disclosure, use, exhibition or other means

”P” document published prior to the international filing date but later than the priority date claimed

”T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

”X” document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

”Y” document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

”A” document member of the same patent family

Date of the actual completion of the international search

6 February 2015

Date of mailing of the international search report

13/02/2015

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer

Ladenburger, Claude

Form PCT/ISA/210 (second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>JP 2005 314407 A (NIHON NOHYAKU CO LTD) 10 November 2005 (2005-11-10) compounds of formul a l wherei n G i s -C0-; or -C(=N0R10) -; claims 1,4,5; compounds 3.14-3.17</td>
<td>1-32</td>
</tr>
</tbody>
</table>

- - - - -

Form PCT/ISA/210 (continuation of second sheet) (April 2005)
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WO 2013061973 A1</td>
<td>02-05-2013</td>
<td></td>
<td>NONE</td>
</tr>
<tr>
<td>JP 2005314407 A</td>
<td>10-11-2005</td>
<td></td>
<td>NONE</td>
</tr>
</tbody>
</table>