(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 July 2024 (11.07.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/146879 A1

(51) International Patent Classification:
A01N 35/06 (2006.01) *A01N 47/06* (2006.01)
A01N 37/06 (2006.01) *A01P 13/00* (2006.01)

(21) International Application Number:
PCT/EP2024/050015

(22) International Filing Date:
02 January 2024 (02.01.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
23150401.0 05 January 2023 (05.01.2023) EP

(71) Applicant: SYNGENTA CROP PROTECTION AG [CH/CH]; Rosentalstrasse 67, 4058 Basel (CH).

(72) Inventors: DAVIS, Sarah Jane; Syngenta, Jealott's Hill International Research Centre, Bracknell Berkshire RG42 6EY (GB). KAUNDUN, Shiv Shankhar; Syngenta, Jealott's Hill International Research Centre, Bracknell Berkshire RG42 6EY (GB).

(74) Agent: SYNGENTA IP; Rosentalstrasse 67, 4058 Basel (CH).

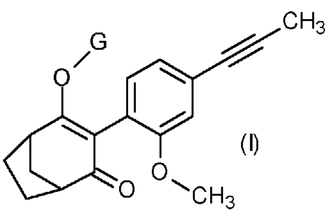
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*
— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

(54) Title: WEED CONTROL METHOD



(I)

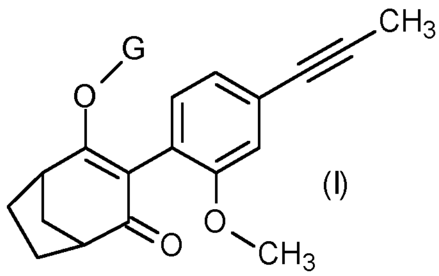
(57) Abstract: The present invention relates to a method of controlling the growth of monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I) at a locus, said method comprising applying to the locus a herbicide composition comprising a compound of Formula (I).

WO 2024/146879 A1

Weed Control Method

Herbicides which inhibit acetyl-CoA carboxylase (ACCase) were introduced in the mid-1970s and are now widely used to control grass (monocotyledonous) weeds in many crops including, for example, small-grain cereal crops and rice as well as dicotyledonous crops, such as soybean. Given their convenience for managing grass weeds post-emergence, ACCase-inhibiting herbicides (ACCase herbicides) were quickly adopted as they provided a marked improvement over the then commonly used method of selective grass weed control. Over time, however, extensive and recurrent use of ACCase herbicides has selected for resistance in key grass weed species and resistance to ACCase herbicides is now documented in numerous grass weeds and is particularly problematic in *Lolium*, *Alopecurus* and *Avena* species.

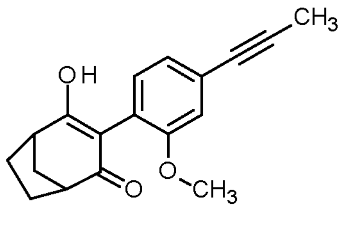
Accordingly, there exists a need to provide further agricultural methods that can provide sufficient control of these problematic monocotyledonous weeds that are resistant to ACCase-inhibiting herbicides (ACCase-resistant weeds) that are currently available. Surprisingly, it has now been found that certain ACCase herbicides provide exceptionally good control of such ACCase-resistant weeds. Thus, according to the present invention there is provided a method of controlling the growth of monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I) at a locus, said method comprising applying to the locus a herbicide composition comprising a compound of Formula (I)

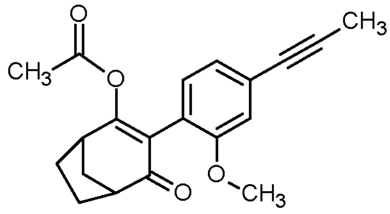


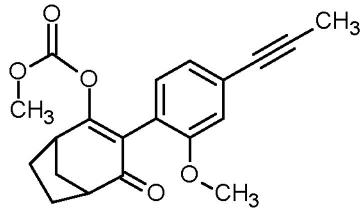
(I)

wherein G is selected from the group consisting of hydrogen, $-C(O)CH_3$ and $-C(O)OCH_3$.

Compounds of Formula (I) are known from WO2015/197468. In a preferred embodiment of the present invention the compound of Formula (I) is selected from the group consisting of Formula (Ia), (Ib) and (Ic).


(Ia)


(Ib)


(Ic)

In one embodiment of the present invention the compound of Formula (I) is a compound of Formula (Ia), including agrochemically acceptable salts thereof. In another embodiment of the present invention the compound of Formula (I) is a compound of Formula (Ib). In another embodiment of the present invention the compound of Formula (I) is a compound of Formula (Ic).

The term “locus” is simply taken to mean a location where the ACCase-resistant monocotyledonous weeds are present. Examples include gardens, pathways, railway tracks but more often the locus will be a crop cultivation area, for example a field. For the avoidance of doubt it should be understood that the locus can further comprise other weeds, including those susceptible to ACCase herbicides. Where the locus is a crop cultivation area the methods of the present invention have broad utility in the control monocotyledonous ACCase-resistant weeds in a wide variety of crop plants. For example, the herbicide composition can be applied pre-planting (before the crop is planted in the field) to control monocotyledonous ACCase-resistant weeds in a wide range of crops that are planted subsequently at the locus, including, for example, corn, cereal, cotton and soybean crops. It should be understood that the crop plant may optionally comprise a herbicide tolerance and/or insect tolerance and/or nematode tolerance trait. Furthermore, it should be appreciated that some dicotyledonous crops plants are inherently resistant to the compounds of Formula (I) and thus in this situation it is possible for the herbicide compositions to be applied whilst the crop plant is present at the locus. Such application may be made pre-emergence (where the crop has been planted at the locus but not yet emerged) or post-emergence (or “over-the-top” where the crop has emerged at the locus). It should be appreciated that a combination of pre-plant, pre-emergent and post-emergent applications are utilised, depending on the particular needs of the grower.

Thus, in a preferred embodiment of the present invention there is provided a method wherein the locus further comprises a dicotyledonous crop plant and wherein said method selectively controls the growth of the ACCase-resistant monocotyledonous weeds at the locus. Examples of such dicotyledonous crop plants include canola, cotton, sugar beet and sunflower as well as legumes, such as soybeans, peanuts, peas, beans and pulses such as chickpeas and lentil. Soybean is particularly preferred, including genetically modified soybean such as

Liberty Link® Soybeans (A2704-12/ACS-GM005-3, A5547-127/ACS-GM006-4); RoundUp Ready® Soybeans (GTS 40-3-2); Roundup Ready 2 Yield® Soybeans (MON89788); Roundup Ready™ 2 Xtend® Soybeans (MON87708); XtendFlex® Soybeans (MON87708xMON89788xA5547-127); Enlist®E3 Soybeans (DAS44406); SYHT0H2 Soybeans (SYN-000H2-5), GMB151 Soybeans (BCS-GM151-6), FG72 Soybeans, MON94313 Soybeans and GM_CSM63714 Soybeans (WO2023/212564).

Several ACCase herbicides (HRAC Group 1) have now been commercialised to help growers tackle grass weeds and include, for example, cyclohexanediones ("Dims") such as clethodim, cycloxydim, tepraloxydim; aryloxyphenoxy-propionates ("Fops") such as clodinafop-propargyl, fenoxaprop-ethyl, haloxyfop-methyl, cyhalofop-butyl, fluazifop-P-butyl and quizalofop-ethyl; and "Dens" such as pinoxaden. ACCase-resistant weeds are characterised using suitable dose response comparisons. Such weeds can be divided into target- and non-target-based-mechanisms. Non-target-site-mechanisms (NTSR) are, for example, metabolism-based resistance mechanisms, which can be mediated, for example, via cytochrome p450 and/or glutathione-S-transferase metabolism. The methods of the present invention can be used to control monocotyledonous ACCase-resistant weeds which feature target-site and/or non-target site resistance and have particular utility in controlling weeds that are resistant to the ACCase herbicides clethodim and/or haloxyfop-methyl, especially clethodim.

Genetic studies have shown that resistance to ACCase herbicides can be conferred by target-site mutations within the ACCase, and the methods of the present invention are particularly suited to controlling monocotyledonous ACCase-resistant weeds featuring such target-site resistance. Target-site resistance is caused by single amino acid changes in the carboxyltransferase domain of the ACCase. Much of the early resistance work was conducted using *Alopecurus myosuroides* and thus the single amino acid changes, although typically conserved between species, are often characterised with regard to the plastidic *Alopecurus* ACCase sequence. The skilled person is well aware of sequence alignment software that can be used to identify corresponding amino acids in other species.

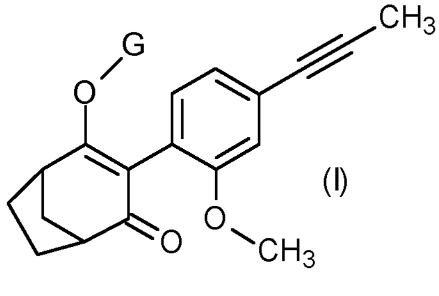
Thus seven different single point mutation sites have now been identified within ACCase that confer resistance: Ile1781 (I1781); Typ1999 (W1999); Typ2027 (W2027); Ile2041 (I2041); Asp2078 (D2078), Cys2088 (C2088) and Gly2096 (G2096). Furthermore, at least 14 allelic variants have thus been implicated in resistance, namely I1781L/V/A/T; W1999C/L/S; W2027C; I2041N/V; D2078G, C2088R and G2096A/S. It's further understood that species can be homozygous or heterozygous for the resistance trait. It is anticipated that the compounds of Formula (I) will also be effective in controlling weeds comprising other target-site mutations within the ACCase. The skilled person will appreciate the level of resistance observed will depend on, amongst other things, the particular herbicide, recommended field rates, weed species, plant growth stages, specific amino acid changes and the number of gene copies and mutant ACCase alleles.

According to the International Herbicide-Resistant Weed Database (www.weedscience.org), as of 2022 over 250 unique cases of ACCase resistant weeds have been reported, including over 30 unique cases of clethodim-resistant weeds. These include *Alopecurus* sp. (e.g *Alopecurus myosuroides*), *Avena* sp. (e.g *Avena fatua*), *Bromus* sp. (e.g *Bromus diandrus*, *Bromus rigidus*, *Bromus tectorum*), *Digitaria* sp. (e.g *Digitaria insularis, Digitaria sanguinalis*), *Ehrharta* sp. (e.g *Ehrharta longiflora*), *Echinochloa* sp. (e.g *Echinochloa crus-galli, Eleusine* sp. (e.g *Eleusine indica*), *Hordeum* sp. (e.g *Hordeum murinum* ssp. *leporinum*), *Lolium* sp. (e.g *Lolium rigidum*, *Lolium perenne, Lolium multiflorum*), *Phalaris* sp. (e.g *Phalaris minor*, *Phalaris paradoxa*), *Polypogon sp. (e.g Polypogon fugax*), *Sorghum* sp. (e.g *Sorghum halepense*), *Setaria* sp. (e.g *Setaria faberi*, *Setaria viridis*). Thus the methods of the present invention are particularly suited to controlling these resistant weeds. In an especially preferred embodiment, the methods of the present invention are used to control ACCase resistant *Digitaria insularis, Eleusine indica, Echinochloa crus-galli, Lolium perenne, Lolium multiflorum* and/or *Sorghum halepense* in soybean. Even more preferably the methods of the present invention are used to control ACCase resistant *Digitaria insularis, Eleusine indica* and/or *Sorghum halepense* in soybean. In many soybean growing regions, in particular Latin America, clethodim is often used to control grass weeds in soybean. However, resistance to clethodim is now widely reported and is expected to grow further due to intensification and lack of alternative solutions. Methods of the present invention are particularly suited to controlling ACCase-resistant weeds, especially clethodim-resistant weeds, and especially those comprising a I1781, D2078, C2088 and/or G2096 mutation. The ACCase-resistant weeds controlled by the methods of the present invention may also be resistant to non-ACCase herbicides, for example glyphosate and/or acetolactate synthase (ALS) inhibitors.

The methods of the present invention can also be used to control ACCase-resistant "volunteer" monocotyledonous weeds especially in dicotyledonous crops such as soybean, cotton, canola, sugarbeet and sunflower. Examples of such "volunteer" monocotyledonous weeds include corn which has been engineered to be resistant to ACCase-inhibiting herbicides. For example, Enlist® Corn (DAS40278) is resistant to ACCase herbicides such as fluazifop and haloxyfop, but is readily controlled using the methods of the present invention in which compounds of Formula (I) are employed. Maize lines which are tolerant to cycloxydim and sethoxydim have also been developed via *in vitro* selection and feature a mutation in the plastid encoded ACCase (see for example US 5,162,602) and such lines are also readily controlled using the methods of the present invention in which compounds of Formula (I) are employed. The “volunteer” monocotyledonous weeds e.g corn may also comprise resistance to other herbicides, such as glyphosate, glufosinate, dicamba, 2,4-D and/or protoporphyrinogen oxidase (PPO)-inhibiting herbicides.

In the methods of the present invention, the compound of Formula(I), (Ia), (Ib) or (Ic) may be applied to the locus a rate from 25 to 500 g/ai. The actual rate applied will depend on a number of considerations including, for example, the timing of application, the ACCase-resistant weed to be controlled and the growth stage etc. For pre-plant application the typical application rate could be from 25 to 500 g/ha, more preferably from 100 to 400g/ha; for a post-emergent application the typical application rate could be from 25 to 200 g/ha. Split applications to the locus of the compound of Formula (I) are envisaged, for example 200g/ha could be applied to the locus in a given growing season as a one-pass 200 g/ha application, or 2x100g/ha applications etc. It should be further understood that the herbicide compositions used in the methods of the present invention may further comprise one or more additional pesticides, for example herbicides, fungicides, insecticides and/or nematicides. In a preferred embodiment of the present invention, the herbicide composition further comprises one or more herbicides selected form the group consisting of glyphosate, glufosinate (or glufosinate-P) 2,4-D, dicamba, S-metholachlor, pyroxasulfone, flumioxazin, trifludimoxazin, saflufenacil, tiafenacil or an agrochemically acceptable salts of any of the aforementioned herbicides that would be well known to the skilled person. This is particularly the case where the locus further comprises a crop plant which has been engineered to be resistant to any of these herbicides. The herbicide composition may also comprise and additional ACCase-inhibiting herbicides such as clethodim, fenoxaprop-ethyl and/or fluazifop-P-butyl. The composition may also contain adjuvants, such as Tris(2-ethylhexyl)phosphate (TEHP), methylated rape seed oil adjuvants such as Adigor® or ethoxylated sorbitan esters such as Tween®20 and Tween®80. Other tank mix adjuvants may be also be employed, such as Assist and Ochima.

The present invention further provided the use of a compound of Formula (I)



(I)

wherein G is selected from the group consisting of hydrogen, -C(O)CH_3 and -C(O)OCH_3, to control monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I).

Biological Examples

Seeds of a variety of test species are sown in standard soil in pots. For each treatment, three replicate pots containing 10-15 plants per one-inch pot were sprayed at the 2-3 leaf stage. Clethodim and Compound (Ic) were each applied at 15, 30, 60 and 120 g ai/ha. The test plants are then grown in a glasshouse under controlled conditions in a glasshouse (at 24/16ºC, day/night; 14 hours light; 65% humidity) and watered twice daily. Plants were assessed for visual damage compared to the untreated control 14 days after application (0 = 0% damage; 100 = 100% damage).

Table B1-1 *Lolium multiflorum*

Biotype*	Rate (g/ha)	Clethodim	Compound Ic
Sensitive	15	53	100
	30	73	100
	60	99	100
	120	100	100
LL1781	15	23	100
	30	37	100
	60	60	100
	120	70	100
SS1999[a]	15	27	85
	30	98	100
	60	100	100
	120	100	100
CC2027	15	53	100
	30	77	100
	60	100	100
	120	100	100
NN2041	15	70	47
	30	100	100
	60	100	100
	120	100	100
GG2078	15	0	40
	30	20	100
	60	20	100
	120	50	100
RR2088	15	0	100
	30	20	100
	60	60	100
	120	60	100

*Homozygous lines.

[a] 21 DAA

Table B1-2 *Eleusine indica*

Biotype	Rate (g/ha)	Clethodim	Compound Ic
Sensitive	15	87	100
	30	100	100
	60	100	100
	120	100	100
**I2041N	15	82	70
	30	100	100
	60	100	100
	120	100	100
**D2078G + W2027C	15	50	87
	30	60	100
	60	70	100
	120	80	100
**D2078G + W2027C	15	63	83
	30	67	100
	60	93	100
	120	100	100
87% **I1781L	15	80	97
	30	77	100
	60	100	100
	120	100	100
***NTSR	1	0	20
	2	33	40
	4	43	60
	8	77	73

** Heterozygous lines.

*** Non-target site resistance.

Table B1-3 ***Eleusine indica***

Biotype	Rate (g/ha)	Clethodim	Compound Ic
Sensitive	15	100	100
	30	100	100
	60	100	100
	120	100	100
Pop1*	15	10	98
	30	33	100
	60	47	100
	120	63	100
Pop2*	15	10	86
	30	33	100
	60	76	100
	120	77	100

Pop1 and Pop2 are distinct populations which comprise different proportions of sensitive, D2078G and G2096A biotypes.

Table B1-4 ***Digitaria sanguinalis***

Biotype	Rate (g/ha)	Clethodim	Compound Ic
Sensitive	15	87	90
	30	90	100
	60	100	100
	120	100	100
**I1781L	15	20	73
	30	20	90
	60	53	100
	120	67	100

** Heterozygous lines.

Table B1-5 ***Setaria viridis***

Biotype	Rate (g/ha)	Clethodim	Compound Ic
Sensitive	15	90	87
	30	98	93
	60	100	100
	120	100	100
*II1781	15	80	70
	30	100	90
	60	100	98
	120	100	100
*LL1781	15	50	60
	30	60	90
	60	60	98
	120	53	100
*GG2078	15	30	50
	30	60	73
	60	63	98
	120	67	98

** Homozygous lines.

Table B1-6 Volunteer corn

26 field trials were conducted to examine the performance of compounds of Formula (I) compared to clethodim in controlling volunteer corn. The results are shown below.

Compound	Rate (g/ha)	Control (14d)	Control (28d)
Check (Untreated)	0	0	0
Ic	25	93	99
	50	99	100
	100	99	100
	200	99	100
Clethodim	100	90	96

Further tests were employed to test the efficacy of a compound of Formula I versus other ACCase-inhibiting herbicides. The five main targets were *Lolium multiflorum*, *Eleusine indica*, *Digitaria insularis*, *Sorghum halepense* and *Echinochloa Crus-galli*. Collectively, the populations contained all the major target-site resistance mutations affecting ACCase herbicides. Two *L. multiflorum* (LM-NTSR-1 and LM-NTSR-2) and one *E. crus-galli* (ECG-NTSR-1) populations were characterised exclusively by non-target-site resistance (“NTSR”). The target-site resistant *L. multiflorum* and *E. indication* populations were 100% homozygous for different ACCase mutations whilst the *D. insularis*, *S. halepense* and *E. crus-galli* samples contained a mixture of homozygous wild and mutant individuals at different genotypic frequencies. Additional underlying NTSR cannot be ruled out in the populations characterised by target-site resistance.

Around 50 seeds of each of the 24 weed populations were sown in 12-cm pots containing a mixture of peat and compost in a 1:1 ratio. The pots were watered, fertilised and kept in controlled glasshouse conditions set at 24ºC / 16 hr day, 18ºC night, 65% relative humidity, and a photon flux density of approximately 250 µmol quanta m^{-2} s^{-1} for *Lolium multiflorum*. The *E. indica*, *D. insularis*, *S. halepense* and *E. crus-galli* plants were kept in a separate glasshouse bay characterised by a 17 H photoperiod of 180 µmol m^{-2} s^{-1} with temperatures of 25°C day and 19°C night and 65% relative humidity. When the plants were at the two to four-leaf stage, they were treated with the various ACCase-inhibiting herbicides at 0, 15, 30, 60, 120 and 240 g ai ha^{-1} in a spray cabinet mounted with a single mobile Teejet flat fan nozzle (11002VS) calibrated to deliver 200 L ha^{-1} at 200 kPa. The *L. multiflorum* populations were treated by a compound of Formula Ic, clodinafop-propargyl, pinoxaden, cycloxydim and clethodim and the warm season grass weeds *E. indica*, *D. insularis*, *S. halepense* and *E. crus-galli* were sprayed with a Compound Ic and the commonly employed haloxyfop-methyl and clethodim. Three replicate pots were used per population. Plants were assessed for visual damage compared to the untreated control 21 days after application (0 = 0% damage; 100 = 100% damage).

Table B2-1 *Lolium multiflorum*

Biotype*	Rate (g/ha)	Clethodim	Clodinafop-propargyl	Cycloxydim	Pinoxaden	Compound Ic
Sensitive	15	100	67	0	100	100
	30	100	98	0	100	100
	60	100	100	0	100	100
	120	100	100	88	100	100
	240	100	100	100	100	100
I1781L	15	23	7	0	7	100
	30	53	7	0	7	100
	60	70	7	7	27	100
	120	100	10	13	73	100
	240	100	33	13	98	100
W1999S	15	27	0	0	0	85
	30	98	0	0	0	100
	60	100	0	0	0	100
	120	100	0	0	7	100
	240	100	0	0	33	100
W2027C	15	63	0	0	0	88
	30	100	0	0	10	100
	60	100	0	0	62	100
	120	100	0	0	93	100
	240	100	0	50	100	100
D2078G	15	10	0	0	3	20
	30	17	0	0	3	90
	60	27	0	0	10	100
	120	70	0	3	45	100
	240	100	0	7	90	100
C2088R	15	0	0	0	0	100
	30	13	0	0	0	100
	60	40	0	0	0	100
	120	90	0	0	3	100

Biotype*	Rate (g/ha)	Clethodim	Clodinafop-propargyl	Cycloxydim	Pinoxaden	Compound Ic
	240	100	7	0	30	100
LM-NTSR-1	15	63	0	0	30	93
	30	97	0	0	85	100
	60	100	0	0	97	100
	120	100	27	3	100	100
	240	100	52	60	100	100
LM-NTSR-2	15	3	0	0	0	48
	30	55	0	0	0	82
	60	70	0	0	0	87
	120	75	0	0	65	100
	240	95	0	0	53	100

Table B2-2 *Eleusine indica*

Biotype*	Rate (g/ha)	Clethodim	Haloxyfop-p-methyl	Compound Ic
Sensitive	15	92	100	100
	30	100	100	100
	60	100	100	100
	120	100	100	100
	240	100	100	100
W2027C	15	93	0	100
	30	100	0	100
	60	100	17	100
	120	100	30	100
	240	100	33	100
I2041N	15	60	0	50
	30	27	7	98
	60	53	0	100
	120	100	10	100
	240	100	0	100
D2078G	15	10	0	88
	30	27	0	100
	60	53	60	100
	120	100	95	100
	240	100	88	100
G2096A	15	7	3	93
	30	30	3	98
	60	78	23	100
	120	100	30	100
	240	100	53	100

Table B2-3 *Digitaria insularis*

Biotype*	Rate (g/ha)	Clethodim	Haloxyfop-p-methyl	Compound Ic
Sensitive	15	100	100	100
	30	100	100	100
	60	100	100	100
	120	100	100	100
	240	100	100	100
W2027C	15	78	76	100
	30	100	53	100
	60	100	93	100
	120	100	100	100
	240	100	100	100

Table B2-4 *Sorghum halepense*

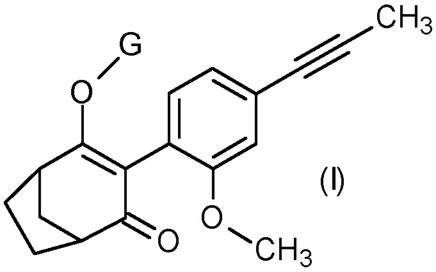
Biotype*	Rate (g/ha)	Clethodim	Haloxyfop-p-methyl	Compound Ic
Sensitive	15	83	93	95
	30	98	100	97
	60	100	100	100
	120	93	100	100
	240	98	100	100
W2027C	15	50	38	65
	30	92	50	80
	60	100	68	98
	120	100	68	100
	240	100	78	100

Table B2-5 *Echinochloa Crus-galli*

Biotype*	Rate (g/ha)	Clethodim	Haloxyfop-p-methyl	Compound Ic
Sensitive	15	100	100	100
	30	100	100	100
	60	100	100	100
	120	100	100	100
	240	100	100	100
W2027C	15	83	3	100
	30	100	75	100
	60	100	73	100
	120	100	100	100
	240	100	100	100
ECG-NTSR-1	15	95	73	90
	30	98	87	100
	60	100	100	100
	120	100	100	100
	240	100	100	100

CLAIMS

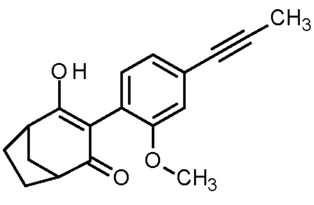
1. A method of controlling the growth of monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I) at a locus, said method comprising applying to the locus a herbicide composition comprising a compound of Formula (I)



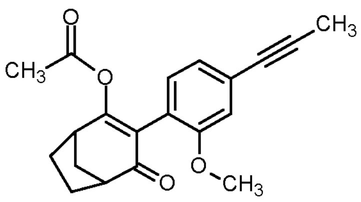
(I)

wherein G is selected from the group consisting of hydrogen, -C(O)CH_3 and -C(O)OCH_3.

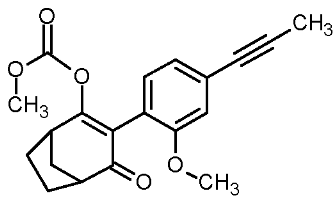
2. A method according to claim 1, wherein the compound of Formula (I) is selected from the group consisting of Formula (Ia), (Ib) and (Ic).



(Ia)



(Ib)



(Ic)

3. A method according to claim 1 or claim 2, wherein the compound of Formula (I) is Formula (Ic).

4. A method according to any one of the previous claims, wherein the locus further comprises a dicotyledonous crop plant and wherein said method selectively controls the growth of the monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I) at the locus.

5. A method according to claim 4, wherein the dicotyledonous crop is soybean.

6. A method according to any one of the previous claims, wherein the monocotyledonous weeds are resistant to clethodim and/or haloxyfop.

7. A method according to any one of the previous claims, wherein monocotyledonous weeds comprise one or more mutations in the ACCase at an amino acid position selected from the group consisting of I1781, W1999, W2027, I2041, D2078, C2088 and G2096.

8. A method according to claim 7, wherein the monocotyledonous weeds comprise one or more mutations in the ACCase at an amino acid position selected from the group consisting of I1781, D2078 and C2088.

9. A method according to any one of the previous claims, wherein the monocotyledonous weeds are selected from the group consisting of *Alopecurus* sp., *Avena* sp., *Bromus* sp., *Digitaria* sp., *Echinochloa* sp., *Ehrharta* sp., *Eleusine* sp., *Lolium* sp., *Phalaris* sp., *Polypogon sp.*, *Sorghum* sp. and *Setaria* sp.

10. A method according to claim 9, wherein the monocotyledonous weeds are selected from the group consisting of *Digitaria insularis, Eleusine indica, Echinochloa crus-galli, Lolium perenne, Lolium multiflorum* and/or *Sorghum halepense.*

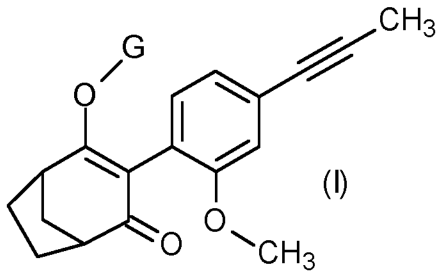
11. A method according to claim 1, wherein the the monocotyledonous weeds comprise corn which is resistant to fluazifop and/or haloxyfop.

12. A method according to any one of the previous claims, wherein the compound of Formula (I) is applied to the locus at a rate of 50 to 500 g/ha.

13. A method according to any one of the previous claims wherein the herbicide composition comprises one or more additional herbicidal compounds.

14. A method according to claim 13, wherein the one or more additional herbicides is selected from the group consisting of glyphosate, glufosinate, 2,4-D, dicamba and S-metolachlor.

15. Use of a compound of Formula (I)



(I)

wherein G is selected from the group consisting of hydrogen, $-C(O)CH_3$ and $-C(O)OCH_3$, to control monocotyledonous weeds that are resistant to an ACCase-inhibiting herbicide other than a compound of Formula (I).

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/050015

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01N35/06 A01N37/06 A01N47/06 A01P13/00
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)
A01N A01P

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

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

EPO-Internal, 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.
X	WO 2015/197468 A1 (SYNGENTA PARTICIPATIONS AG [CH]) 30 December 2015 (2015-12-30) cited in the application page 83, line 23 - line 32 Compound A1; page 138 Compound P1; page 143 Compound P7; page 144	1-15
X,P	WO 2023/280701 A1 (SYNGENTA CROP PROTECTION AG [CH]) 12 January 2023 (2023-01-12) tables B1, B2, B3 page 1, paragraph 1 - paragraph 3 page 2 page 9, paragraph 2 - paragraph 3	1-15

-/--

[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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 March 2024	28/03/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Zanobini, Alessandra

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2023/280702 A1 (SYNGENTA CROP PROTECTION AG [CH]) 12 January 2023 (2023-01-12) tables B1, B2, B3, B4, B5, B6 page 1, line 1 - page 2, line 9 -----	1-15
X,P	WO 2023/280703 A1 (SYNGENTA CROP PROTECTION AG [CH]) 12 January 2023 (2023-01-12) page 1, paragraph 1 - page 10, paragraph 1 page 21, paragraph 1 - page 22, paragraph 1 tables B1-B13 -----	1-15
A	EP 3 954 211 A1 (BASF AGRO BV [NL]) 16 February 2022 (2022-02-16) claims 1, 4-6 tables 1-3 -----	1-15
A	WO 2021/229464 A1 (UPL CORPORATION LTD [MU]; UPL EUROPE LTD [GB]) 18 November 2021 (2021-11-18) page 1, line 5 - line 9 page 3, line 5 - line 12 page 5, line 15 - line 20 -----	1-15
A	WO 2018/024906 A1 (RICETEC AG [LI]) 8 February 2018 (2018-02-08) paragraphs [0028], [0087] -----	1-15

1

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015197468 A1	30-12-2015	AU 2015279453 A1	17-11-2016
		BR 112016030443 A2	17-07-2018
		BR 122022003603 B1	22-11-2022
		CA 2948977 A1	30-12-2015
		CN 106458958 A	22-02-2017
		DK 3160950 T3	03-08-2020
		EA 201790077 A1	31-05-2017
		EP 3160950 A1	03-05-2017
		ES 2807802 T3	24-02-2021
		HR P20200946 T1	18-09-2020
		HU E049921 T2	30-11-2020
		JP 6592018 B2	16-10-2019
		JP 2017520568 A	27-07-2017
		PL 3160950 T3	02-11-2020
		PT 3160950 T	08-07-2020
		UA 119778 C2	12-08-2019
		US 2017183281 A1	29-06-2017
		WO 2015197468 A1	30-12-2015
WO 2023280701 A1	12-01-2023	AR 126377 A1	11-10-2023
		AU 2022308319 A1	07-12-2023
		CA 3222087 A1	12-01-2023
		CN 117615651 A	27-02-2024
		CO 2024000025 A2	25-01-2024
		UY 39842 A	31-01-2023
		WO 2023280701 A1	12-01-2023
WO 2023280702 A1	12-01-2023	AR 126372 A1	11-10-2023
		AU 2022306931 A1	07-12-2023
		CA 3221821 A1	12-01-2023
		CN 117651488 A	05-03-2024
		CO 2024000023 A2	05-02-2024
		UY 39843 A	31-01-2023
		WO 2023280702 A1	12-01-2023
WO 2023280703 A1	12-01-2023	AR 126376 A1	11-10-2023
		AU 2022309104 A1	07-12-2023
		CA 3221686 A1	12-01-2023
		CN 117545355 A	09-02-2024
		CO 2024000022 A2	25-01-2024
		UY 39845 A	31-01-2023
		WO 2023280703 A1	12-01-2023
EP 3954211 A1	16-02-2022	AU 2023201264 A1	06-04-2023
		CL 2018000080 A1	24-08-2018
		DK 3319442 T3	20-12-2021
		EP 3954211 A1	16-02-2022
		EP 3954212 A1	16-02-2022
		EP 3957176 A1	23-02-2022
		EP 3987933 A1	27-04-2022
		ES 2902056 T3	24-03-2022
		JP 7325484 B2	14-08-2023
		JP 7328294 B2	16-08-2023
		JP 2022003068 A	11-01-2022
		JP 2022003069 A	11-01-2022
		JP 2022003070 A	11-01-2022
		JP 2022003071 A	11-01-2022
		JP 2022003072 A	11-01-2022

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2024/050015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		JP 2022003073 A	11-01-2022
		JP 2022003074 A	11-01-2022
		JP 2022003075 A	11-01-2022
		JP 2022003076 A	11-01-2022
		JP 2023145693 A	11-10-2023
		JP 2024012480 A	30-01-2024
		JP 2024012481 A	30-01-2024
		JP 2024012482 A	30-01-2024
		JP 2024012488 A	30-01-2024
		JP 2024012489 A	30-01-2024
		JP 2024012490 A	30-01-2024
		LT 3319442 T	27-12-2021
		MA 43069 A	16-05-2018
		PL 3319442 T3	07-02-2022
		SI 3319442 T1	31-01-2022
		UA 124414 C2	15-09-2021
WO 2021229464 A1	18-11-2021	AU 2021269939 A1	15-12-2022
		BR 112022023150 A2	14-02-2023
		CA 3183457 A1	18-11-2021
		CN 115811938 A	17-03-2023
		US 2023217928 A1	13-07-2023
		WO 2021229464 A1	18-11-2021
WO 2018024906 A1	08-02-2018	AR 109292 A1	14-11-2018
		AU 2017305561 A1	09-08-2018
		AU 2019204538 A1	18-07-2019
		BR 112019002342 A2	01-10-2019
		CN 108884471 A	23-11-2018
		CO 2019000873 A2	29-03-2019
		CR 20190080 A	09-04-2019
		EC SP19014676 A	31-05-2019
		EP 3494224 A1	12-06-2019
		EP 4086348 A1	09-11-2022
		ES 2915407 T3	22-06-2022
		KR 20190043551 A	26-04-2019
		PH 12019500222 A1	15-05-2019
		PT 3494224 T	02-06-2022
		US 2018066276 A1	08-03-2018
		US 2021324403 A1	21-10-2021
		UY 37355 A	23-03-2018
		WO 2018024906 A1	08-02-2018