Renewal Assessment Report

Dimethenamid-P

BAS 656 12 H

Volume 3 – B.3 Data on application and efficacy

Rev. 0 - 10 August 2016

Rapporteur Member State: Germany

Co-Rapporteur Member State: Bulgaria

Version history

When	What
10 August 2016	First version submitted to EFSA

Table of contents

B Summary, evaluation and assessment of the data and information

B.3 Data on application and efficacy 4
B.3.1 Field of use envisaged 4
B.3.2 Effects on harmful organisms 4
B.3.3 Details of intended use 5
B.3.4 Application rate and concentration of the active substance 8
B.3.5 Method of application 8
B.3.6 Number and timing of applications and duration of protection 8
B.3.7 Necessary waiting periods or other precautions to avoid phytotoxic effects on succeeding crops 8
B.3.8 Proposed instructions for use 8
B.3.9 Effectiveness 10
B.3.10 Information on the development of resistance 14
B.3.11 Adverse effects on treated crops 15
B.3.12 Observations on other undesirable or unintended side-effects 15
B.3.13 References relied on 15

B.3 Data on application and efficacy

B.3.1 Field of use envisaged

Agriculture

B.3.2 Effects on harmful organisms

Dimethenamid-P is providing soil residual and, to little extend, foliar activity with application either before or shortly after weed emergence, leading to the inhibition of cell division. In germinating monocotyledonous weed species dimethenamid-P is predominantly absorbed via the emerging coleoptile. In dicotyledonous weed species dimethenamid-P enters the plant primarily via root uptake (radicule) and via the germinating shoots (hypocotyls). After uptake dimethenamid-P is hardly translocated within the plant. Typical symptoms of the aerial parts of broadleaf weed species that emerge include severe stunting, intense green coloration and a leathery appearance of the cotyledons. Emerged grasses are stunted and twisted.

B.3.3 Details of intended use

Table B.3.3-1: GAP table - Summary of representative uses evaluated, for which all risk assessments needed to be completed

List of representative uses evaluated - BAS 656 12 H

GAP rev., date: 2014-July-4

PPP (product name/code)	BAS 656 12 H	**Formulation type:**	SE
active substance 1	DMTA-P	**Conc. of as 1:**	720 g/L
active substance 2	n.a.	**Conc. of as 2:**	-
active substance	n.a.	**Conc. of as:**	-
safener	n.a.	**Conc. of safener:**	n.a.
synergist	n.a.	**Conc. of synergist:**	n.a.
Applicant:	BASF	**professional use**	☒
Zone(s):	central/southern **EU**	**non professional use**	☐
Verified by MS:	**yes**		

1	2	3	4	5	6	7	8	10	11	12	13	14
Use-No.	**Member state(s)**	**Crop and/ or situation** **(crop destination / purpose of crop)**	**F G or I**	**Pests or Group of pests controlled** (additionally: developmental stages of the pest or pest group)	**Application**			**Application rate**			**PHI** (days)	**Remarks:** e.g. safener/synergist per ha e.g. recommended or mandatory tank mixtures
					Method / Kind	Timing / Growth stage of crop & season	Max. number (min. interval between applications) a) per use b) per crop/ season	kg, L product / ha a) max. rate per appl. b) max. total rate per crop/season	g as/ha a) max. rate per appl. b) max. total rate per crop/season	Water L/ha min / max		
Core												
1	EU	Maize - ZEAMX	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 00-09	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible

1	2	3	4	5	6	7	8	10	11	12	13	14
Use-No.	**Member state(s)**	**Crop and/ or situation** **(crop destination / purpose of crop)**	**F G or I**	**Pests or Group of pests controlled** (additionally: developmental stages of the pest or pest group)	**Application**			**Application rate**			**PHI** (days)	**Remarks:** e.g. safener/synergist per ha e.g. recommended or mandatory tank mixtures
					Method / Kind	Timing / Growth stage of crop & season	Max. number (min. interval between applications) a) per use b) per crop/ season	kg, L product / ha a) max. rate per appl. b) max. total rate per crop/season	g as/ha a) max. rate per appl. b) max. total rate per crop/season	Water L/ha min / max		
2	EU	Maize - ZEAMX	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 10-16	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
3	EU	Sugar Maize - ZEAMS	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 00-09	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
4	EU	Sugar Maize - ZEAMS	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 10-16	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
5	EU	Soybean - GLXMA	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 00-09	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
6	EU	Sunflower - HELAN	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 00-09	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
7	EU	Sugar Beet - BEAVA	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 00-09	a) 1 b) 1	a) 1.2 b) 1.2	a) 864 b) 864	100-400	F	Range 0.8-1.2 L/ha possible
8	EU	Sugar Beet - BEAVA	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 16-18	a) 1 b) 1	a) 1.0 b) 1.0	a) 720 b) 720	100-400	F	Range 0.9-1.0 L/ha possible
9	EU	Sugar Beet - BEAVA	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 12-18	a) 2 (5-10d) b) 2	a1) 0.6 a2) 0.7 b) 1	a1) 432 a2) 504 b) 720	100-400	F	Max rate 1 L product/year Splitting: 2 applications BBCH 12 – BBCH 15: 0.3-0.6 L product/ha From BBCH 16: 0.3-0.7 L product/ha
10	EU	Sugar Beet - BEAVA	F	Annual monocotyledonous and dicotyledonous weeds	Spraying	BBCH 12-18	a) 3 (5-10d) b) 3	a1) 0.4 a2) 0.4 a3) 0.4 b) 1	a1) 288 a2) 288 a3) 288 b) 720	100-400	F	Max rate 1 L product/year Splitting: 3 applications 0.3-0.4 L product/ha

1	2	3	4	5	6	7	8	10	11	12	13	14
Use-No.	**Member state(s)**	**Crop and/ or situation** **(crop destination / purpose of crop)**	**F G or I**	**Pests or Group of pests controlled** (additionally: developmental stages of the pest or pest group)	**Application**			**Application rate**			**PHI** (days)	**Remarks:** e.g. safener/synergist per ha e.g. recommended or mandatory tank mixtures
					Method / Kind	Timing / Growth stage of crop & season	Max. number (min. interval between applications) a) per use b) per crop/ season	kg, L product / ha a) max. rate per appl. b) max. total rate per crop/season	g as/ha a) max. rate per appl. b) max. total rate per crop/season	Water L/ha min / max		

Remarks:
(1) Numeration of uses in accordance with the application/as verified by MS
(2) Member State(s) or zone for which use is applied for
(3) For crops, the EU and Codex classifications (both) should be used; where relevant, the use situation should be described (*e.g.* fumigation of a structure)
(4) Outdoor or field use (F), glasshouse application (G) or indoor application (I)
(5) e.g. biting and suckling insects, soil born insects, foliar fungi, weeds, developmental stages
(6) Method, e.g. high volume spraying, low volume spraying, spreading, dusting, drench
Kind, e.g. overall, broadcast, aerial spraying, row, individual plant, between the plants - type of equipment used must be indicated
(7) Growth stage of treatment(s) (BBCH Monograph, Growth Stages of Plants, 1997, Blackwell, ISBN 3-8263-3152-4), including where relevant, information on season at time of application
(8) The maximum number of applications possible under practical conditions of use for each single application and per year (permanent crops) or crop (annual crops) must be provided
(8) Min. interval between applications (days) were relevant
(10) The application rate of the product a) max. rate per appl. and b) max. total rate per crop/season must be given in metric units (e.g. kg or L product / ha)
(11) The application rate of the active substance a) max. rate per appl. and b) max. total rate per crop/season must be given in metric units (e.g. g or kg / ha)
(12) The range (min/max) of water volume under practical conditions of use must be given (L/ha)
(13) PHI - minimum pre-harvest interval
(14) Remarks may include: Extent of use/economic importance/restrictions/minor use etc.

B.3.4 Application rate and concentration of the active substance

Dimethenamid-P is evenly distributed by spray application at dose rates up to 864 g as/ha using water as a spray carrier to control a wide range of annual broadleaf weeds and grasses in different crops.

B.3.5 Method of application

The intended method of application is spraying by means of each type of spraying equipment which is normally used for applying herbicides in practical plant production. The diluent is water.

B.3.6 Number and timing of applications and duration of protection

The number of applications is 1 (maize, sugar maize, sunflower, soybean) and 1 up to 3 in sugarbeets. The timing of the application is between the pre-emergence of weed/crop and early post- emergence (1st true leaf of annual monocotyledonous weeds, cotyledon stage of annual dicotyledonous weeds) at the latest. It is independent of the growth stage of the crop.

B.3.7 Necessary waiting periods or other precautions to avoid phytotoxic effects on succeeding crops

After regular harvest of a crop treated with BAS 656 12 H all crops can be sown within the normal crop rotation. For grasses a deep tillage of 20 cm is required if seeded less than 4 months after application of BAS 656 12 H.

In the event of a crop failure certain precautions should be taken into account before a follow-crop is sown.

Maize, oilseed rape and related cruciferous crops can be replanted at any time after application of BAS 656 12 H with either plough or thorough soil cultivation to a depth of approximately 15-20 cm to ensure that any residues are evenly dispersed throughout the soil or 30-45 days after application with shallow cultivation.
Cereals and legume crops require a waiting period of 45 days with deep soil cultivation or 75 days with shallow soil cultivation.

A final recommendation in the event of a crop failure may vary between regions and adapted depending on cultural practices, climatic conditions, registered uses and dose rates, etc.

B.3.8 Proposed instructions for use

Spectrum is a herbicide for control of annual monocotyledonous and annual dicotyledonous weeds. It is absorbed through cotyledones, hypocotyl and roots. At pre-emergence applications, BAS 656 12 H is absorbed by germinating weeds and causes them to die off before or shortly after emergence. A fine-crumbled, moist seedbed supports efficacy.
In post-emergence, BAS 656 12 H will control weeds up to maximum 2-leaf stage. Good success is achieved when the active substance is diluted and consequently distributed in sufficient moisture in the soil and thus uptake of the active substance is also possible via the root system of the weeds. On highly organic soils, reduced efficacy may occur. If BAS 656 12 H is applied on dry surface soil, the

main effect occurs after onset of precipitation. Weeds emerging from deeper soil layers under dry conditions may not be controlled satisfactorily.

Directions for use

Maize

Application in pre-emergence against annual mono- and dicotyledonous weeds
Use rate: **1.2 L/ha**
Max. 1 treatment per crop and per year

Application in early post-emergence against annual mono- and dicotyledonous weeds
Use rate: **1.2 L/ha**
Max. 1 treatment per crop and per year
The application can be done regardless of the stage of development of maize from seeding (BBCH 00) to the unfolding of the 6th leaf (BBCH 16). The development stage of weeds should not exceed the 2-leaf stage.

Sunflower

Application in pre-emergence against annual mono- and dicotyledonous weeds
Use rate: **1.2 L/ha**
Max. 1 treatment per crop and per year

Soybean

Application in pre-emergence against annual mono- and dicotyledonous weeds
Use rate: **1.2 L/ha**
Max. 1 treatment per crop and per year

Sugar and fodder beets

Application in pre-emergence against annual mono- and dicotyledonous weeds
Use rate: **1.2 L/ha**
Max. 1 treatment per crop and per year

Application against late-emerging weeds
Prerequisite for the success of the treatment is that the weeds emerging before the use of BAS 656 12 H are successfully controlled with other beet herbicides in pre- or post-emergence. Usually, three applications of common beet herbicides are required for this purpose. Then, BAS 656 12 H prevents the new emergence of the weeds listed in the spectrum of activity over a period of several weeks.
Use rate: **0.9-1.0 L/ha**
Max. 1 treatment per crop and per year in the 6- to8-leaf stage of the beets (BBCH 16-18) or
Max. 3 treatments per crop and per year from BBCH 12 onwards
At earlier application timings lower dose rates need to be applied, depending on the crop growth stage and the agronomical conditions.

Spray Volume: 100 – 400 L/ha water

Preharvest interval: Maize, sunflower, soybean, sugar and fodder beets (F)

(F) = covered by the directions of use and/or the interval between application and use/harvest. Setting of a specific interval expressed in days after application are not required.

The application of 1.2 L/ha BAS 656 12 H = 864 g/ha dimethenamid-P is possible in maize in BBCH range 00-16 and in soybean and sunflower in BBCH range 00-09. The 'standard practice' for sugar beets can differ between the concerned countries as it is frequently used in combination with residual and foliar herbicides over a wide range of weed stages in pre- and post-emergence, providing residual activity against newly emerging weeds. Overall, the dose rate is depending on the growth stage of the crop. When BAS 656 12 H is applied in pre-emergence of the crop (BBCH range 00-09), a dose rate range of 0.8-1.2 L/ha can be applied. When BAS 656 12 H is applied in post-emergence, the maximum dose rate range of 0.9-1.0 L/ha can be applied from BBCH 16-18 of the crop when applied at once. When applied in 2 or 3 application timings, a reduced dose rate will be needed depending on the crop growth stage. The application sequences follow with an interval of 5 -10 days. Independent on the number of applications in post-emergence the maximum application rate per ha and year is 1.0 L/ha = 720 g/ha dimethenamid-P.

On the specific country labels additional guidance for the use of the product in regard to filling and application, tank cleaning and field use are given according to the local requirements, that does not have to be mentioned within that document.

B.3.9 Effectiveness

Dimethenamid-P, contained in the herbicide BAS 656 12 H, has been tested in field development trials, which demonstrated efficacious activity.

Dimethenamid-P, contained in the herbicide BAS 656 12 H, has been registered in many EU countries based on detailed national assessments of the efficacy package in compliance with Regulation (EC) No 545/2011 and according to the Uniform Principles (Regulation (EC) No 546/2011), with which Member States authorities were satisfied.

This document summarises the information related to the efficacy of dimethenamid-P, which was included in Annex I by Commission Directive No 2003/84/EC of 25 September 2003 and for which a dossier is now submitted for the renewal of the approval.

Table B.3.9-1 identifies representative uses which have been selected to support renewing the approval of dimethenamid-P with the representative formulation BAS 65612H:

These uses are representative because of

- their wide geographical coverage, with registration or registration in progress in 17 of the 28 EU countries stretching from North- to South-Europe and from Western to Eastern Europe with different climatic conditions including the countries AT, BE, BG, CZ, DE, ES, FR, GR, HR, HU, IT, NL, LU, PT, RO, SI, SK,
- their use at different application timings from pre-sowing, pre-emergence to post-emergence of the crop covering soil- and foliar application
- their different application period throughout the year from spring to autumn application
- their use in a single or split application
- crops with a variety in use of harvested goods, from bulk commodity for feed, food processing and fresh consumption

Overview of Current Registrations

The active substance dimethenamid-P was discovered by Sandoz, in 1971. Dimethenamid-P was first introduced 1975 in the USA for the use in corn and cotton, followed by registration in other crops like soybeans, tobacco, potato, grain sorghum, peanuts, sunflowers, rice, beans, cereals and many other in the following years.

It has since become widely authorised in 21 of the 28 EU countries with the extension of use to include currently a broad range of different crops including cereals, oilseed crops, beet roots, legume crops used as dry pulses or legume vegetables, vegetables, root & tuber vegetables, stem vegetables, fruiting vegetables, leafy vegetables & herbs, biannual / perennial crops and other crops.
Authorisations for a range of different formulation have been achieved in Europe. This includes different formulation types (EC, SC) of products including only dimethenamid-P as the active substance but also a range of ready-mixtures with different other active substances such as:

- + terbuthylazine (AKRIS)
- + pendimethalin (WING-P)
- + topramezone (CLIO SUPER)
- + metazachlor (BUTISAN, SPRINGBOK)
- + metazachlor and quinmerac (BUTISAN GOLD)

Harmful organisms controlled and crops treated

Dimethenamid-P is used at rates as shown in Table B.3.9-2 for the control of most important annual dicotyledonous weeds such as *Aethusa cynapium*, *Amaranthus* sp., *Ambrosia artemisiifolia*, *Anagallis arvensis*, *Atriplex patula*, *Capsella bursa-pastoris*, *Chenopodium album*, *Datura stramonium*, *Fumaria officinalis*, *Galeopsis tetrahit*, *Galinsoga parviflora*, *Galium aparine*, *Lamium* sp., *Matricaria* sp., *Melandrium noctiflorum*, *Polygonum lapathifolium*, *Polygonum persicaria*, *Portulaca oleracea*, *Solanum nigrum*, *Senecio vulgare*, *Sinapis* sp., *Sonchus arvensis*, *Stellaria media*, *Thlaspi arvense*, *Veronica* sp.,
and annual monocotyledonous such as *Avena fatua, Digitaria* sp., *Echinochloa* sp., *Lolium* sp., *Panicum* sp., *Poa annua* and *Setaria* sp..

The area of use covers a broad range of crops including cereals (m**aize, s**orghum, millet, miscanthus), oilseed crops (**sunflower, soybeans, winter oilseed rape, o**ilseed pumpkin), **b**eet roots (**sugarbeet, r**ed beets, cichory roots), legume crops used as dry pulses/dry harvest such as beans (field beans), peas (chickpeas, field peas, chickling vetch, lupines) or used as legume vegetables/fresh harvest such as beans with & without pods (green beans, french beans, snap beans, scarlet runner bean, slicing bean), peas with & without pods (garden pea, green pea, sugar peas), vegetables (brassica vegetables, head cabbage, leafy cabbage, flowering cabbage, stem cabbage, bulb vegetables (onion, Welsh onions, shallot, garlic, chives, salad onions), root & tuber vegetables (carrots, potato, horse radish, turnips, swedes, parsnip, celeriac), stem vegetables (leek, celery, asparagus, fennel, rhubarb), fruiting vegetables (cucumber, gherkin, pattison, melon, pumpkin, zucchini), leafy vegetables & herbs (lettuce, cichory, witloof), biannual / perennial crops (berries & small fruits, currants, raspberries), pomefruits, stonefruits, tree nuts and others such as ornamentals, tree nursery and temporary fallow fields.

BAS 656 12 H has been registered and introduced into commercial practice many years ago. Dimethenamid-P is available both as solo formulation and co-formulation together with other active substances. In the process of developing these products extensive studies have been conducted in order to determine the required rates for solo products and for co-formulations with different partners. In this respect it was seen, that in commercial practice the currently maximum registered use rate of 1.4 L/ha = 1008 g as/ha of dimethenamid-P in maize has been rarely used. Most of the time the product is tank

mixed with other herbicides in order to complement the weed spectrum or in order to improve foliar activity. As a consequence, 1.2 L/ha = 864 g/ha of dimethenamid-P only is applied for in the renewal process. This rate is similar to the one, which is used in co-formulations with other herbicides (840 – 850 g as/ha). For the solo product BAS 656 12 H at 1.2 L/ha a slight reduction in performance against some weeds, and more likely at later evaluation timings, might be noted under certain agronomic conditions when compared to the currently registered dose rate of 1.4 L/ha. However the majority of weeds are still effectively controlled by the reduced dose rate of 1.2 L/ha Spectrum.

In sugar beets BAS 656 12 H is used only as a supplement to standard herbicides in order to prevent late emerging weeds and to improve overall control levels. Precondition for the successful use of BAS 656 12 H is its application in combination with standard programs with regionally adapted product combinations and use rates.

As shown in Table B.3.9-1 below in 25 trials across Europe the dose rates of 1.2 L/ha and 1.4 L/ha BAS 656 12 H were tested in an orthogonal comparison from 1998-2013 in different crops, at different application timings and under various agronomical conditions (soil types, temperature, rainfall).

Table B.3.9-1: Overview of the trial distribution with 1.2 and 1.4 L/ha BAS 656 12 H

Crop/timing	year	country	EPPO zone	No. of trials
Maize pre	1998	France	Maritime	1
		France	Mediterranean	2
		Belgium	Maritime	1
	1999	France	Maritime	3
		France	Mediterranean	2
		Austria	Maritime	5
	2000	France	Maritime	4
		France	Mediterranean	1
	2001	France	Maritime	1
	2003	France	Maritime	1
	2013	France	Maritime	1
Maize post	1999	Austria	Maritime	1
Soybean pre	2003	France	Mediterranean	1
Soybean post	1999	Switzerland	Maritime	1
Total				25

The tables below present an overview of the efficacy data at the dose rates of 1.2 L/ha and 1.4 L/ha BAS 656 12 H tested in an orthogonal comparison against different annual dicotyledonous (see Table B.3.9-2) and annual monocotyledonous weeds (see Table B.3.9-3). The latest evaluation timing was chosen in order to guarantee the long lasting effect of BAS 656 12 H with its prevention of new weed emergences.

Table B.3.9-2: Orthogonal efficacy comparison of 1.2 and 1.4 L/ha BAS 656 12 H against dicotyledonous weeds

scientific name	common name	EPPO Code	number of data	1.2 L/ha BAS 656 12	1.4 L/ha BAS 656 12
Chenopodium sp.	fat-hen sp.	CHESS	24	**85**	**87**
Amaranthus sp.	amaranth sp.	AMASS	16	**98**	**97**
Polygonum sp.	knotweed sp.	POLSS	14	**84**	**88**
Solanum nigrum	black nightshade	SOLNI	9	**92**	**94**
Stellaria media	chickweed	STEME	6	**95**	**97**
Galinsoga parviflora	gallant soldier	GASPA	3	**99**	**99**
Matricaria chamomilla	mayweed	MATCH	2	**100**	**100**
Mercurialis annua	annual mercury	MERAN	6	**56**	**59**
Capsella bursa-pastoris	shepherd's purse	CAPBP	1	**100**	**100**
Rorippa sylvestris	yellowcress	RORSY	1	**100**	**100**
Thlaspi arvense	field penny-cress	THLAR	1	**87**	**90**
Viola arvensis	field pansy	VIOAR	1	**88**	**90**
	dicotyledonous weeds	TTTDD	84	**90**	**92**

Table B.3.9-3: Orthogonal efficacy comparison of 1.2 and 1.4 L/ha BAS 656 12 against monocotyledonous weeds

scientific name	common name	EPPO Code	number of data	1,2 L/ha BAS 656 12	1,4 L/ha BAS 656 12
Echinochloa crus-galli	barnyard grass	ECHCG	17	**98**	**98**
Digitaria sp.	crab grasses	DIGSS	8	**94**	**96**
Setaria sp.	foxtail grasses	SETSS	8	**96**	**97**
Panicum miliaceum	panic grass	PANMI	2	**96**	**97**
Poa annua	annual meadowgrass	POAAN	1	**93**	**97**
	monocotyledonous weeds	TTTMM	36	**96**	**97**

As shown in Table B.3.9-2 and Table B.3.9-3 a reduction of the dose rate from 1.4 L/ha BAS 656 12 H to 1.2 L/ha BAS 656 12 H does not significantly reduce the efficacy against the broad range of weeds tested in 25 field trials. A slight reduction is visible in average as the minimum effective dose in the past was 1.4 L/ha BAS 656 12 H. Practically, the herbicide is used in pre-emergence applications where leaf active herbicides usually follow in post-emergence. Where BAS 656 12 H is used in post-emergence applications it is combined with leaf active herbicides. Here the function is the prevention of new waves of weeds emerging during the vegetation period.

Method of Application

The dimethenamid-P based product BAS 656 12 H are applied in a water based spray carrier at a volume of 100-400 L/ha. Application can be made in different ways such as pre-sowing, pre-emergence, post-emergence, pre-transplanting or post-transplanting either as broadcast or directed spray.

Mode of action – Effects on Harmful Organisms

Dimethenamid-P, classified by HRAC into group K3, belongs to the chemical class of chloroacetamides. The mode of action of the chloroacetamide herbicides is believed to function through the inhibition of the synthesis of very-long-chain fatty acids (VLCFAs) in the lipid biosynthesis pathway. In contrast to other representatives of this chemical family dimethenamid-P is not based on a benzene ring, but contains a sulphur based thiophene ring.

The activity is based on the influence on cell division and cell growth. A major effect in inhibiting the cell division is the alkylation of sulfhydryl groups in different enzymes. However, the molecular mechanism of dimethenamid-P has not yet been clarified in detail. To date inhibitions of fatty acid and lipid biosynthesis are known. Results from recent studies indicate that in particular the elongation of C_{18} fatty acids to very long-chain fatty acids is blocked by chloroacetamides. The interaction with the fatty acid or lipid biosynthesis possibly explains the observed reductions in the cuticular waxlayer on seedlings after treatment with chloroacetamides. Furthermore, chloroacetamides affect protein synthesis and inhibit flavonoid (including anthocyane) and isoprenoid biosynthesis. From this metabolic pathway the phytohormone gibberelline derives from and its synthesis is affected by chloroacetamides at the level of hydroxylation. In the plant dimethenamid-P is split into several metabolites, which in turn are detoxified by glutathion compounds.

The currently popular hypothesis which offers a possible explanation for the individual effects is based on the alkylating properties of chloroacetamides and the formation of conjugates with acetyl-coenzymeA as well as with other molecules of the SH-groups. As a result of these interventions, the plant cell division and cell elongation processes as well as tissue differentiation are inhibited. The root and shoot growth is suppressed. The result is shortened seedlings with reduced growth, subsequently giving rise to stunting, deformation and death of weed seedlings.

In summary, BAS 656 12 H achieves a good herbicidal activity when an appropriate concentration of the active substance reaches the important sites of uptake. Optimum constellation is influenced by the following factors, requesting an adjustment in dose rate for best performance:

- different binding characteristics to soil types with diverse texture and content of organic material
- activation of active substance by sufficient soil moisture or rainfall after application
- germination of weeds from deeper soil levels with less exposure of sensitive plant parts to the active substance
- different exposure of growing points to direct application due to morphological variation in plant architecture.

Thus, depending on local or regional differences in weed spectrum, length of germination period of weeds, growing conditions, period of application, cultivation practices, soil types, soil moisture, rainfall, etc. dose rate of BAS 656 12 H to provide the required activity can vary.

B.3.10 Information on the development of resistance

The resistance risk assessment submitted by the applicant in principal follows the EPPO Standard 1/213.

Mechanism of resistance
Dimethenamid-P belongs to the Herbicide-Resistance Action Committee (HRAC) group K3 (inhibitors of very-long-chain-fatty-acids (VLCFA)). For dimethenamid-P, no information on potential resistance mechanism is available.

Evidence of resistance and cross resistance
Four grass weed species with resistance to HRAC group K3 active substances are reported worldwide (www.weedscience.org, Nov 2014): *Alopecurus myosuroides* (Germany), *Echinochloa crus-galli var. crus-galli* (China, Thailand, Philippines), *Lolium perenne ssp. multiflorum* (US) and *Lolium rigidum*

(Australia). For all reported resistant species, multiple resistance to up to seven different modes of action has been confirmed in at least one resistant biotype. The resistant biotype of *Alopecurus myosuroides* shows resistance to flufenacet and additional resistance to ACCase, ALS and PSII inhibitors. No case of resistance to dimethenamid-P has so far been reported worldwide.

Analysis of the inherent risk
Only one case of resistance to HRAC group K3 (in *Alopecurus myosuroides*) has been reported in Europe although herbicides in this group have been used for many decades. As dimethenamid-P is not intended for the control of *Alopecurus myosuroides,* the inherent risk of the active substance can therefore be regarded as low. In general, there are some target weed species of dimethenamid-P that exhibit a high resistance risk, namely *Echinochloa crus-galli* (for which resistance to HRAC group K3 has been reported) and *Amaranthus* species. However, resistance to HRAC group K3 has not been reported for these species so far.

Analysis of the agronomic risk
Dimethenamid-P is used for the control of certain grasses and dicotyledonous species in maize, soybeans, sugar beet, sunflower and winter oilseed rape. In many European cropping systems, cereals are grown in monoculture situations or constitute a high percentage of the respective crop rotation. The application frequency of dimethenamid-P can therefore be increased in certain crop rotations. However, other herbicides with alternating mode of action are commonly applied in cereals which reduced the agronomic risk of herbicide resistance. The agronomic risk of dimethenamid-P can be assessed as being low.

Summary and conclusion
Due to the low inherent and agronomic risk, the overall resistance risk of dimethenamid-P can be assessed as low.

B.3.11 Adverse effects on treated crops

Spectrum is selective in all tested maize, sunflower, soybean, sugarbeet varieties.
Incompatibilities of BAS 656 12 H with certain varieties are not known.
Based on the long term experiences the risk of phytotoxicity is considered as acceptable.

B.3.12 Observations on other undesirable or unintended side-effects

BAS 656 12 H can be considered as sufficiently safe for adjacent crops. The most sensitive plants like lettuce may be affected in pre emergence applications to a maximum distance of 5 m from the treated field, if no drift reducing application technique is used.

B.3.13 References relied on

None.