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FENOXAPROP-P-ETHYL

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B.3. DATA ON APPLICATION

B.3.1. USE OF THE ACTIVE SUBSTANCE

Fenoxaprop-P-ethyl is the herbicidal effective R-enantiomer of the racemic substance fenoxapropethyl. It is a herbicide from the chemical class of aryloxyphenoxy-propionates which is especially effective against annual grass weeds from the two-leaf stage up to full tillering, for use in spring and winter cereals, rice, turf and broadleaf crops.

B.3.2. FUNCTION

Fenoxaprop-P-ethyl acts as a post emergence herbicide.

B.3.3. EFFECTS ON HARMFUL ORGANISMS

By contact with the target plants fenoxaprop-P-ethyl is rapidly taken up via the leaves and stems and transported to the sites of action. Within the plant, the active ingredient is very rapidly split to the free acid, which is the compound with the main herbicidal efficacy. Symptoms are chlorosis and eventually necrosis of young tissue.

B.3.4. FIELD OF USE ENVISAGED

Fenoxaprop-P-ethyl is an active substance with herbicidal activity used for weed control in different agricultural crops.

B.3.5. HARMFUL ORGANISMS CONTROLLED AND CROPS OR PRODUCTS PROTECTED OR TREATED

In the representative uses winter and spring cereals fenoxaprop-P-ethyl is applied for the control of: *Avena spp., Apera spica venti, Alopecurus myosuroides, Echinochloa crus galli* and other annual grass weeds.
Fenoxaprop-P-ethyl is especially effective against annual grass weeds from the two-leaf stage up to full tillering, which makes, it very flexible to use.

B.3.6. MODE OF ACTION

Fenoxaprop-P-ethyl, once in the plant, is quickly converted into the free D+ acid fenoxaprop-P, which inhibits the biosynthesis of fatty acids. The further formation of cell membranes in the growing points of the weed plants is inhibited eventually causing the plant death. In addition this inhibition of fatty acid biosynthesis causes further changes within the weed plant, such as an increase in soluble sugars and free amino acids in the stem tissues of the grass weed plants and also a reduction in the chlorophyll content as a consequence of the reduction of thylakoid membranes.
Based on the comparison of the in vitro efficacy of Fenoxaprop-P-ethyl compared to its free acid it could be shown that the free acid showed the main herbicidal activity. However, due to the significantly reduced uptake of the free acid in vivo and better uptake together with the fast hydrolysis in the plant, Fenoxaprop-P-ethyl is used for the application.

B.3.7. INFORMATION ON THE OCCURRENCE OR POSSIBLE OF THE DEVELOPMENT OF RESISTANCE AND APPROPRIATE MANAGEMENT STRATEGIES

In the action mechanism classification of the HRAC, fenoxaprop-P-ethyl is listed in group A - Inhibition of acetyl CoA carboxylase (ACCase). As some naturally occurring weed biotypes resistant to ACCase herbicides may exist through normal genetic variability in any weed population the resistant individuals will not be controlled and can eventually dominate the weed population if these herbicides are used repeatedly, the following use patterns is recommended to avoid and/or delay the development of resistance in the field:

- No use of fenoxaprop-P-ethyl containing herbicides on locations where resistance of monocotyledonous weeds to compounds of the HRAC group A are suspected.
- Fenoxaprop-P-ethyl containing herbicides should be applied in tank-mixtures with other herbicides, to increase the efficacy on special weed species, which are insufficiently controlled.
- Fenoxaprop-P-ethyl should be used alternately with other compounds (compound change) from different HRAC-groups in cereals as well as within the whole crop rotation.
- The recommended dose rate should not be reduced, in order to obtain an efficacy level as high as possible. Increase of the seed bank of the local weed population should be absolutely avoided.
- A wide and diverse crop rotation (including cereal/dicot crops, winter and spring crops) should be favored. All additional agronomic measures should be implemented i.e. ploughing cultivation, stale seedbed etc.

Summary information on the active substance fenoxaprop-P-ethyl

IUPAC name:	(D+)-ethyl-2-(4-(6-chloro-2-benzoxazolyl-oxy)-phenoxy-propanoate
Chemical group:	Aryloxyphenoxy-propionate (“fop”)
Mode of action:	Inhibition of the acetyl CoA carboxylase (ACCase) HRAC group A
Plant translocation:	Systemic apo- and symplastic
Biological action: Harmful organism, plant growth regulator, etc.	Foliar systemic Inhibition of fatty acid biosynthesis
Root-uptake, foliar-uptake, systemic etc.	Foliar uptake, Systemic with translocation in roots and leaves

Inherent risk-related to the active substance

In Europe, 34 resistance cases are reported to be resistant against Fenoxaprop-P-ethyl. These weed species are listed in the following table below (www.weedscience.com, 03-04-2017). The inherent risk related to the active substance Fenoxaprop-p-ethyl is considered high.

1	2009 *Avena sterilis*	Greece	ACCase inhibitors (A/1)		clodinafop-propargyl, diclofop-methyl, fenoxaprop-P-ethyl, pinoxaden, tralkoxydim
2	2009 *Avena fatua*	Germany	ACCase inhibitors (A/1), ALS inhibitors (B/2)		cycloxydim, fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium, mesosulfuron-methyl, pinoxaden
3	2011 *Avena fatua*	Poland	ACCase inhibitors (A/1), ALS inhibitors (B/2)		fenoxaprop-P-ethyl, iodosulfuron-methyl-sodium, metsulfuron-methyl, pinoxaden, propoxycarbazone-sodium, sulfometuron-methyl
4	1994 *Avena fatua*	United	ACCase inhibitors (A/1), ALS		fenoxaprop-P-ethyl, flamprop-M-

			Kingdom	inhibitors (B/2), Antimicrotubule mitotic disrupter (Z/25)	isopropyl, fluazifop-P-butyl, imazamethabenz-methyl, mesosulfuron-methyl, pinoxaden, pyroxsulam, tralkoxydim
5	1999	*Alopecurus myosuroides*	Netherlands	ACCase inhibitors (A/1), ALS inhibitors (B/2)	clodinafop-propargyl, cycloxydim, fenoxaprop-P-ethyl, penoxsulam
6	1983	*Alopecurus myosuroides*	Germany	ACCase inhibitors (A/1), PSII inhibitor (Ureas and amides) (C2/7)	chlorotoluron, fenoxaprop-P-ethyl, isoproturon
7	1996	*Alopecurus myosuroides*	Belgium	ACCase inhibitors (A/1)	clodinafop-propargyl, fenoxaprop-P-ethyl
8	1993	*Alopecurus myosuroides*	France	ACCase inhibitors (A/1)	clodinafop-propargyl, cycloxydim, diclofop-methyl, fenoxaprop-P-ethyl, haloxyfop-P-methyl, sethoxydim
9	1996	*Avena sterilis ssp. ludoviciana*	France	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl
10	1996	*Avena fatua*	France	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl
11	1996	*Avena fatua*	Belgium	ACCase inhibitors (A/1)	clodinafop-propargyl, fenoxaprop-P-ethyl
12	1996	*Alopecurus myosuroides*	Belgium	ACCase inhibitors (A/1), ALS inhibitors (B/2), Microtubule inhibitors (K1/3), Photosystem II inhibitors (C1/5), PSII inhibitor (Ureas and amides) (C2/7)	atrazine, chlorotoluron, clodinafop-propargyl, fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium, pendimethalin, propaquizafop
13	1996	*Alopecurus myosuroides*	Netherlands	ACCase inhibitors (A/1), PSII inhibitor (Ureas and amides) (C2/7)	chlorotoluron, clodinafop-propargyl, fenoxaprop-P-ethyl, isoproturon
14	1997	*Avena sterilis*	Turkey	ACCase inhibitors (A/1)	clodinafop-propargyl, diclofop-methyl, fenoxaprop-P-ethyl, tralkoxydim
15	2003	*Alopecurus myosuroides*	Germany	ACCase inhibitors (A/1)	clethodim, cycloxydim, fenoxaprop-P-ethyl, fluazifop-P-butyl
16	2011	*Alopecurus myosuroides*	Sweden	ACCase inhibitors (A/1)	clodinafop-propargyl, cycloxydim, fenoxaprop-P-ethyl
17	2007	*Alopecurus myosuroides*	Germany	ACCase inhibitors (A/1), ALS inhibitors (B/2), Long chain fatty acid inhibitors (K3/15), PSII inhibitor (Ureas and amides) (C2/7)	chlorotoluron, fenoxaprop-P-ethyl, flufenacet, isoproturon, mesosulfuron-methyl, pinoxaden
18	2010	*Apera spica-venti*	Poland	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl, pinoxaden
19	2009	*Apera spica-*	Germany	ACCase inhibitors (A/1), ALS	fenoxaprop-P-ethyl, iodosulfuron-

		venti		inhibitors (B/2), PSII inhibitor (Ureas and amides) (C2/7)	methyl-sodium, isoproturon, mesosulfuron-methyl, pinoxaden, pyroxsulam, sulfosulfuron
20	2009	*Alopecurus myosuroides*	Germany	ACCase inhibitors (A/1), ALS inhibitors (B/2)	cycloxydim, fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium, mesosulfuron-methyl, pinoxaden
21	2011	*Avena fatua*	Turkey	ACCase inhibitors (A/1)	diclofop-methyl, fenoxaprop-P-ethyl, tralkoxydim
22	2012	*Avena fatua*	Germany	ACCase inhibitors (A/1)	clodinafop-propargyl, fenoxaprop-P-ethyl, pinoxaden
23	2001	*Alopecurus myosuroides*	Denmark	ACCase inhibitors (A/1), ALS inhibitors (B/2)	clodinafop-propargyl, fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium
24	2009	*Alopecurus myosuroides*	Italy	ACCase inhibitors (A/1)	clodinafop-propargyl, fenoxaprop-P-ethyl, pinoxaden
25	1982	*Alopecurus myosuroides*	United Kingdom	ACCase inhibitors (A/1)	clethodim, clodinafop-propargyl, cycloxydim, diclofop-methyl, fenoxaprop-P-ethyl, fluazifop-P-butyl, pinoxaden, quizalofop-P-ethyl, sethoxydim clodinafop-propargyl, fenoxaprop-P-ethyl
26	2014	*Alopecurus myosuroides*	Sweden	ACCase inhibitors (A/1), ALS inhibitors (B/2)	cycloxydim, fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium, iodosulfuron-methyl-sodium, mesosulfuron-methyl, pyroxsulam
27	2011	*Alopecurus myosuroides*	Sweden	ACCase inhibitors (A/1), ALS inhibitors (B/2), Lipid Inhibitors (N/8)	fenoxaprop-P-ethyl, flupyrsulfuron-methyl-sodium, prosulfocarb, pyroxsulam
28	2011	*Alopecurus myosuroides*	Poland	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl, pinoxaden
29	1993	*Avena sterilis*	United Kingdom	ACCase inhibitors (A/1), ALS inhibitors (B/2), Antimicrotubule mitotic disrupter (Z/25)	fenoxaprop-P-ethyl, flamprop-methyl, fluazifop-P-butyl, imazamethabenz-methyl, iodosulfuron-methyl-sodium, mesosulfuron-methyl, tralkoxydim
30	2001	*Alopecurus myosuroides*	Denmark	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl
31	2004	*Phalaris minor*	Iran	ACCase inhibitors (A/1)	clodinafop-propargyl, diclofop-methyl, fenoxaprop-P-ethyl, pinoxaden, tralkoxydim
32	2011	*Avena fatua*	Poland	ACCase inhibitors (A/1)	fenoxaprop-P-ethyl, pinoxaden
33	2011	*Apera spica-venti*	Poland	ACCase inhibitors (A/1), ALS inhibitors (B/2)	chlorsulfuron, fenoxaprop-P-ethyl, pinoxaden, sulfometuron-methyl, sulfosulfuron
34	2012	*Alopecurus myosuroides*	Poland	ACCase inhibitors (A/1), ALS inhibitors (B/2)	fenoxaprop-P-ethyl, iodosulfuron-methyl-sodium, mesosulfuron-methyl, pinoxaden, sulfometuron-methyl

Table was provided by the RMS Austria.

Inherent risk of target weeds to develop resistance to herbicides

Major target weeds of winter and spring cereals are *Apera spica venti*, *Alopecurus myosuroides*, *Poa annua*, *Bromus* species for winter cereals and especially *Avena fatua* in spring cereals. Following confirmed resistance cases (resistance to Fenoxaprop-p-ethyl) were observed in Europe: *Apera spica venti* (3 cases), *Alopecurus myosuroides* (18 cases), *Poa annua* and *Bromus specis* (0 cases), *Avena fatua* (8 cases).
The inherent risk related to target weeds is considered high by the RMS.

Comment RMS:	Data provided for the active substance in chapter B.3.1.-B.3.7. are considered acceptable. In chapter B.3.7., an overview table of current resistance cases of Fenoxaprop-p-ethyl was added by the RMS. It can be concluded that the overall risk of resistance development (Fenoxaprop-p-ethyl) is high.

B.3.8. REFERENCES RELIED ON

Data Point	Author(s)	Year	Title Compagny Report No. Source (where different from company) GLP or GEP status Published or not	Vertebrate study Y/N	Data protection claimed Y/N	Justification if data protection is claimed	Owner	Previous evaluation