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## KORVETA™ - a new herbicide for the control of a wide range of broadleaf weeds in winter oilseed rape applied in spring

KORVETA™ - ein neues Herbizid zur Bekämpfung eines breiten Spektrums dikotyler Unkräuter in Winterraps im Frühjahr

Agnes Zotz\*, Ulrich Bernhard, Jürgen Bonin

Dow AgroSciences GmbH, Truderinger Straße 15, 81677 München, Germany

\*Corresponding author, azotz@dow.com

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### Abstract

KORVETA™ herbicide is a novel selective post-emergence herbicide for use on winter oilseed rape applied as a spring application. KORVETA provides superior control of a wide range of important annual broad-leaved weeds in winter oilseed rape, including *Centaurea cyanus*, *Galium aparine*, *Matricaria* spp. and *Papaver rhoeas*, combined with a robust crop safety. KORVETA combines both actives Arylex and clopyralid and therefore contains two non-ALS mode of actions. While clopyralid has been widely used in oilseed rape in recent years, Arylex is a new auxinic herbicide for the post-emergence weed control of key broad-leaved weeds. Arylex is the first member of the 'Arylpicolinate' structural class, a new class within the HRAC Group O. The ISO common name of Arylex is 'halauxifen-methyl' (Dow AgroSciences, 2013). With a maximum use rate of 1 L/ha, KORVETA will deliver 4.8 g ae/ha of Arylex and 120 g ae/ha of clopyralid. KORVETA is formulated as an emulsifiable concentrate (EC). KORVETA will be applied as a single application from crop stage BBCH 30 up to BBCH 50 and will give growers a new tool to control the key broad-leaved weeds occurring in oilseed crop in the spring.

**Keywords:** Arylex, broadleaf weed control, clopyralid, KORVETA, winter oilseed rape

### Zusammenfassung

KORVETA™ ist ein neues selektives Nachauflaufherbizid in Winterraps zur Anwendung im Frühjahr. KORVETA wird mit einmaliger Anwendung ab Vegetationsbeginn eingesetzt. Korveta kontrolliert ein breites Spektrum an wichtigen Unkräutern in Winterraps, einschließlich *Centaurea cyanus*, *Galium aparine*, *Matricaria* spp., und *Papaver rhoeas* und weist eine sehr gute Kulturpflanzenverträglichkeit auf. KORVETA enthält die beiden aktiven Wirkstoffe Arylex (4,8 g ae/L) und Clopyralid (120 g ae/L) und ist als Emulsionskonzentrat (EC) formuliert. Clopyralid wird schon seit vielen Jahren erfolgreich im Winterraps eingesetzt, der Wirkstoff Arylex ist ein neuer Wirkstoff aus der Gruppe der Auxin-ähnlichen Herbizide für die Nachauflauf-Bekämpfung von wichtigen zweikeimblättrigen Unkräutern. Arylex ist der erste Vertreter der Wirkstoffgruppe der 'Arylpicolinate', einer neuen Gruppe innerhalb der HRAC-Gruppe O. Der wissenschaftliche Name von Arylex ist 'Halauxifen-methyl' (Dow AgroSciences, 2013). Mit einer maximalen Aufwandmenge von 1 L/ha werden 4,8 g ae/ha Arylex und 120 g ae/ha Clopyralid ausgebracht. Mit KORVETA bietet sich dem Anwender in Zukunft ein neues Bekämpfungskonzept zur Unkrautbekämpfung im Frühjahr im Winterraps.

**Stichwörter:** Arylex, Bekämpfung dikotyler Unkräuter, Clopyralid, KORVETA, Winterraps

### Introduction

Dow AgroSciences has developed the new herbicide Arylex™ active, which targets important broadleaf weeds.

### Chemical properties of Arylex™ active

Common name	Halauxifen-methyl
Chemical family	Arylpicolinate
Empirical formula	C <sub>14</sub> H <sub>11</sub> Cl <sub>2</sub> FN <sub>2</sub> O <sub>3</sub>
Molecular weight	345.17 g/mol
Vapor pressure	5.9 × 10 <sup>-9</sup> Pa at 20°C
Solubility (water 20°C; in mg/L)	pH 5: 1,67; pH 7: 1,67; pH 9: 1,69
Octanol/Water Partition Co-Efficient (log P <sub>ow</sub> )	pH 7 = 3.76
Soil Adsorption Constant (K <sub>oc</sub> )	473 – 2659 mL/g (average = 1418 mL/g)

Beside the currently ongoing development of the active in the cereal segment (Dziukowski et al., 2016), two new products are developed for the use in winter oilseed rape based on this molecule.

The ready-to-use mix of Arylex in combination with the active clopyralid will have the trade name KORVETA™ herbicide. KORVETA will be available for the use as a spring application in winter oilseed rape. Arylex in combination with the active picloram will have the trade name BELKAR™ herbicide.

### **Characteristics of the formulated product KORVETA**

Active ingredients	Halauxifen-methyl 4.8 g ae/L; clopyralid 120 g ae/L
Target crop	Winter oilseed rape
Formulation type	EC (Emulsifiable concentrate)
Mode of action	Synthetic auxins – both compounds; HRAC-group O
Application timing	Spring application; from beginning of vegetation until crop stage BBCH 50
Recommended dose rate	1.0 L/ha

KORVETA™ is a selective herbicide for the control of dicotyledonous weeds in winter oilseed rape. The product contains 120 g ai/L clopyralid and 4.8 g ae/L halauxifen-methyl and is formulated as an emulsifiable concentrate (EC). Both actives Arylex and clopyralid belong to the class HRAC O, so that KORVETA is a product without an active exhibiting an ALS mode of action. With a maximum use rate of 1 L/ha, the product will deliver 4.8 g ae/ha of Arylex and 120 g ae/ha of clopyralid. The application timing of KORVETA is a spring treatment.

### **Materials and Methods**

Development trials with KORVETA as a spring applied herbicide from crop stage BBCH 30 with a dose rate of 1.0 L/ha were conducted in 2014 and 2015. Trials were carried out in the maritime EPPO zone in the Czech Republic, Germany, United Kingdom, Denmark and Sweden. Trials were set up by the Dow AgroSciences internal field research and development department and by contract research organisations in accordance with GEP guidelines. Most of the trials followed a randomized complete block design with 4 replicates and plot sizes between 15m<sup>2</sup> and 40m<sup>2</sup>. Visual assessments of the herbicidal efficacy of KORVETA and a commercial standard reference product were made in regular intervals during spring after the application. The commercial reference product used in the trials was Effigo™ applied with the registered dose rate of 0.35 L/ha. Effigo contains the 2 actives picloram and clopyralid and is well known in Germany for the use in winter oilseed rape as a spring application for several years now. The weed control was rated visually as an overall score of the percentage control relative to the non-treated check.

The potential impact of KORVETA on the selectivity of winter oil seed rape has been evaluated in specific weed free trials. Trials from the maritime EPPO zone (Czech Republic, Germany, United Kingdom and Denmark) imitated in spring 2015 are taken into account. The trials followed a randomized complete block design with 4 replicates and plot sizes between 24m<sup>2</sup> and 38m<sup>2</sup>. Two application timings were chosen according to two different targeted crop stages: Timing A with targeted crop stage BBCH 30, timing B with targeted crop stage BBCH 50. Furthermore KORVETA™ herbicide was applied at the target dose rate of 1 L/ha and the double dose rate of 2 L/ha. The selectivity on the crop was rated visually as % injury and yield was recorded.

### **Results**

Efficacy spectrum of KORVETA when applied as a single spring application

When applied as a single spring application from crop stage BBCH 30, KORVETA provides very good control of key weed species such as *Centaurea cyanus*, *Galium aparine*, *Cirsium arvense*, *Fumaria officinalis* and *Lamium purpureum* (>93% control). *Matricaria chamomilla*, *Geranium dissectum* and *Geranium pusillum* are also susceptible and sufficiently controlled (>92% control). *Papaver rhoeas* showed moderately susceptible with >88% control.

The standard reference product used in the trials was Effigo™ herbicide applied with the registered dose rate of 0.35 L/ha. As data show, KORVETA shows a broader spectrum of activity

compared to the activity spectrum of the reference standard Effigo, including hard to control weeds such as *Geranium* spp., *Papaver rhoeas*, *Fumaria officinalis* and *Lamium* spp. Furthermore the level of control of key weeds such as *Centaurea cyanus*, *Galium aparine* and *Matricaria* spp. is by trend higher as the tested standard.

#### Crop selectivity and yield response

The potential impact of KORVETA on the selectivity of winter oil seed rape has been evaluated in specific weed free trials carried out in the maritime EPO zone. In all trials, KORVETA showed very good crop safety when applied in spring at crop stages BBCH 30 resp. BBCH 50. Crop phytotoxicity symptoms > 5% were not seen in any trial at single or double dose rate tested. Injuries - if any - were transient and did not impact crop yield statistically significant.

**Tab. 1** Efficacy of KORVETA applied once as a spring application with a dose rate of 1.0 L/ha in winter oilseed rape at crop stage BBCH 30. Data from Germany, Czech Republic, United Kingdom, Denmark and Sweden are summarized.

**Tab. 1** Wirkung von KORVETA bei einmaliger Anwendung im Frühjahr mit 1.0 L/ha zu Raps im BBCH Stadium 30. Datengrundlage sind Versuche aus Deutschland, Tschechien, Vereinigtes Königreich, Dänemark und Schweden.

Weed species	Weed EPO code	Number of trials	Efficacy of KORVETA at 1.0 L/ha [% control]	Efficacy of Effigo at 0.35 L/ha [% control]
<i>Lamium purpureum</i>	LAMPU	11	97.6	29.3
<i>Centaurea cyanus</i>	CENCY	10	96.1	87.0
<i>Fumaria officinalis</i>	FUMOF	3	93.6	29.2
<i>Galium aparine</i>	GALAP	18	93.1	86.2
<i>Cirsium arvense</i>	CIRAR	2	93.0	91.1
<i>Geranium dissectum</i>	GERDI	5	92.1	37.3
<i>Geranium pusillum</i>	GERPU	12	92.0	33.4
<i>Matricaria chamomilla</i>	MATCH	6	91.5	90.3
<i>Papaver rhoeas</i>	PAPRH	17	87.9	34.9
<i>Descurainia sophia</i>	DESSO	5	80.1	25.1

**Tab. 2** Yield response of KORVETA™ herbicide applied once as a spring application with a dose rate of 1.0 L/ha resp. 2 L/ha in winter oilseed rape at crop stage BBCH 30 and BBCH 50. Yield data from Germany, Czech Republic, United Kingdom and Denmark are taken into account.

**Tab. 2** Ertrag von KORVETA bei einmaliger Anwendung im Frühjahr mit 1.0 L/ha bzw. 2 L/ha zu Raps BBCH 30 sowie BBCH 50. Datengrundlage sind Ertragsversuche aus Deutschland, Tschechien, Vereinigtes Königreich und Dänemark.

Treatment	Application timing (targeted BBCH stage crop)	Dose rate KORVETA	% yield relative to untreated	Number of trials
KORVETA	BBCH 30	1 L/ha	101.9	10
KORVETA	BBCH 30	2 L/ha	103.1	10
KORVETA	BBCH 50	1 L/ha	102.9	10
KORVETA	BBCH 50	2 L/ha	99.4	10
untreated			100	10

#### Discussion

Dow AgroSciences has developed the new herbicide Arylex™ active, which targets dicotyledonous weeds in various crops. For specific use in winter oilseed rape as a spring application, the product KORVETA™ herbicide is developed. The product contains 120 g ai/L clopyralid and 4.8 g ae/L Arylex and is formulated as an emulsifiable concentrate (EC). The product can be applied as a spring treatment at a dose rate of 1 L/ha from crop stage BBCH 30 up to BBCH 50.

KORVETA provides very good control of key weed species such as *Centaurea cyanus*, *Galium aparine*, *Cirsium arvense*, *Fumaria officinalis* and *Lamium purpureum*. *Matricaria chamomilla*,

*Geranium dissectum* and *Geranium pusillum* are also susceptible and sufficiently controlled. *Papaver rhoeas* showed moderately susceptible with >88% control.

KORVETA shows a broader spectrum of activity compared with the weed spectrum of the standard reference product Effigo™ herbicide, including control of key weeds such as *Geranium* spp., *Papaver rhoeas*, *Fumaria officinalis* and *Lamium* spp.. Efficacy against *Centaurea cyanus*, *Galium aparine* and *Matricaria chamomilla* is also by trend higher than the tested standard. Furthermore KORVETA shows very good crop safety when applied in spring at crop stage BBCH 30 up to crop stage BBCH 50. KORVETA will give growers a new tool for the ALS- free control of important broad-leaved weeds occurring in oilseed crop in the spring.

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