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## Milestone – a selective herbicide for the control of important grasses and broad-leaved weeds in winter oilseed rape

*Milestone – ein selektives Herbizid zur Bekämpfung wichtiger Ungräser und Unkräuter in Winterraps*

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### Abstract

Milestone<sup>TM</sup> herbicide contains the active substance propyzamide (500 g/L) and aminopyralid (5.3 g a.e./L) and is formulated as a suspension concentrate (SC). Registration for Milestone for the use in winter oilseed rape was granted in Germany in July 2014.

The active substance propyzamide is well known from the product Kerb<sup>TM</sup> FLO (containing 500 g/L propyzamide, suspension concentrate, SC) which is widely used in winter oilseed rape (WITTRÖCK et al., 2008). Aminopyralid is formulated in the commercial product Runway (clopyralid + picloram + aminopyralid). Milestone is applied with a use rate of 1.5 L/ha as a post-emergence herbicide from growth stage BBCH 14 of the crop at the beginning of November until February. Kerb FLO is applied with a use rate of 1.875 L/ha at the same timing.

The efficacy of Milestone and Kerb FLO was tested in randomised and replicated plot trials in Germany, France and the United Kingdom. Milestone and Kerb FLO showed comparable and very high control levels against monocotyledonous species such as *Alopecurus myosuroides*, *Apera spica-venti*, *Bromus* species and volunteer cereals. Milestone shows a broader spectrum of activity vs. Kerb FLO against dicotyledonous weeds such as *Matricaria chamomilla*, *Papaver rhoeas* and *Centaurea cyanus*. The use of Milestone in dense crops (as the situation was in autumn 2014 for many areas in Germany) shows very high efficacy levels as well. The comparison of various application timings between end of October until beginning of December confirms the application date early November for best results.

Milestone controls herbicide-resistant weed populations and can be considered an important part of a resistance management program not only in winter oilseed rape but as a component of an integrated weed management strategy in cropping systems.

**Keywords:** Aminopyralid, Kerb FLO, Milestone, propyzamide, winter oilseed rape

### Zusammenfassung

Milestone<sup>TM1</sup> enthält die beiden herbiziden Wirkstoffe Propyzamid (500 g/l) und Aminopyralid (5,3 g a.e./l) und ist als Suspensionskonzentrat (SC) formuliert. Die Zulassung in Deutschland für die Anwendung von Milestone in Winterraps wurde im Juli 2014 erteilt.

Der Wirkstoff Propyzamid ist aus dem Produkt Kerb FLO<sup>TM1</sup> (400 g/l Propyzamid, Suspensionskonzentrat, SC) im Winterraps bekannt (WITTRÖCK et al., 2008). Aminopyralid ist in dem Produkt Runway (Clopyralid + Picloram + Aminopyralid) enthalten.

Mit einer Aufwandmenge von 1,5 l/ha erfolgt die Anwendung von Milestone im Nachauflauf in Winterraps ab Entwicklungsstadium BBCH 14 der Kultur von Anfang November bis Februar. Kerb FLO wird mit 1,875 l/ha ebenfalls zu diesem Termin eingesetzt.

Die Wirkung von Milestone und Kerb FLO wurde in Parzellenversuchen in Deutschland, Frankreich und Großbritannien geprüft. Milestone und Kerb FLO zeigten in den Versuchen vergleichbare und sehr gute Wirkungsgrade gegen monokotyle Arten wie *Alopecurus myosuroides*, *Apera spica-venti*, *Bromus*-Arten oder Ausfallgetreide. Im Vergleich zu Kerb FLO weist Milestone jedoch ein wesentlich breiteres Wirkungsspektrum gegen dikotyle Unkräuter wie etwa Kamille-Arten, Klatschmohn oder Kornblume auf. Auch eine Anwendung des Produktes in überwachsenen Rapsbeständen (wie im Herbst 2014 häufig zu beobachten) zeigt sehr hohe und sichere Wirkungsgrade. Ein Vergleich unterschiedlicher Applikationstermine zwischen Ende Oktober und Anfang Dezember bestätigt den optimalen Anwendungstermin Anfang November.

<sup>TM1</sup> Trademark of the Dow Chemical Company ("Dow") or an affiliated company of Dow

Milestone erfasst auch resistente Unkrautpopulationen auf Problemstandorten und ist damit ein wichtiger Baustein für ein erfolgreiches Anti-Resistenzmanagement, nicht nur im Raps, sondern im Rahmen der gesamten ackerbaulichen Fruchtfolge.

**Stichwörter:** Aminopyralid, Kerb FLO, Milestone, Propyzamid, Winterraps

## Introduction

Milestone is a selective herbicide for the control of mono- and dicotyledonous weeds in winter oilseed rape. The product contains 500 g/L propyzamide and 5.3 g/L acid equivalent of aminopyralid and is formulated as a suspension concentrate (SC) (Tab.1). The use rate of 1.5 L/ha Milestone delivers 750 g a.i./ha propyzamide and 8 g a.i./ha aminopyralid. Propyzamide acts mainly through root uptake, aminopyralid is taken up through both leaves and roots.

**Tab. 1** Characteristics of the active ingredients in Milestone.

**Tab. 1** Charakteristika der Wirkstoffe in Milestone.

Active ingredient	Chemical family	Mode of action	HRAC-group
Propyzamide	benzamide	inhibition of cell division	K1
Aminopyralid	pyridine carboxylic acid	Synthetic Auxin	O

The application timing of Milestone is between November and February, but for best results Milestone is applied at the beginning of November as post-emergence treatment from crop development stage BBCH 14 onwards. In field trials conducted during the development program of the product, Milestone proved excellent crop selectivity in a wide range of winter oilseed rape varieties.

The active propyzamide in the product Milestone belongs to the HRAC-group K1, the active aminopyralid to the HRAC-group O. Milestone has a very low risk of developing resistance and no reduced sensitivity levels of grasses (KLINGENHAGEN, 2013) or broad leaf weeds have been observed for both actives. Furthermore Milestone provides reliable control of resistant biotypes of blackgrass (*Alopecurus myosuroides*), *Bromus* spp., *Apera spica-venti* as well as ALS resistant *Matricaria* spp. types (BERNHARD et al., 2014).

## Materials and Methods

Development trials with Milestone, as a single application at 1.5 L/ha, were conducted in Germany, France and the United Kingdom 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. An efficacy comparison was made to Kerb FLO, which was applied at 1.875 L/ha, delivering 750 g ai/ha of the active substance propyzamide. The weed control was rated visually as a percentage.

In a testing program set up in autumn 2014, the direct comparison of different application timings on the efficacy of Milestone was made. Milestone was applied at 1.5 L/ha in winter oilseed rape once either at an early timing (timing A) or a late timing (timing B). Applications for timing A were carried out between October 25<sup>th</sup> and November 7<sup>th</sup> 2014, applications for timing B between November 22<sup>nd</sup> and December 5<sup>th</sup> 2014. Applications were carried out with spray volumes of 200 L/ha. The winter oilseed rape development stage ranged from BBCH 18-30. Due to favourable weather conditions in autumn 2014, the winter oilseed rape had developed dense crops with lots of leaf biomass and almost full ground coverage at both application timings A and B. Plant growth continued well into the autumn 2014.

## Results

In the trials carried out during the development program in winter oilseed rape, Milestone and Kerb FLO showed very high control levels against monocotyledonous species such as *Alopecurus myosuroides*, *Apera spica-venti* and *Lolium* spp. as well as volunteer cereals. Milestone provided >98% control, Kerb FLO provided >95% control. In addition to very good (>90%) control of annual grasses, Milestone provided very good control of annual dicotyledonous weeds such as *Matricaria* spp., *Papaver rhoeas*, *Centaurea cyanus*, *Stellaria media* and *Viola arvensis* (Tab.2).

**Tab. 2** Milestone and Kerb FLO – efficacy spectrum when applied once in winter oilseed rape between end of October and February.

**Tab. 2** Milestone und Kerb FLO – Wirkungsspektrum und Wirkungsvergleich bei einmaliger Anwendung in Winterraps zwischen Ende Oktober und Februar.

Weed species	Weed code	Number of trials	Efficacy of Milestone at 1.5 L/ha	Efficacy of Kerb FLO at 1.875 L/ha
<b>Volunteer cereals</b>	NNNGA	10	98	95
<i>Alopecurus myosuroides</i>	ALOMY	15	98	96
<i>Apera spica-venti</i>	APESV	3	100	100
<i>Lolium multiflorum</i>	LOLMU	4	98	98
<i>Matricaria</i> spp.	MATSS	15	98	28
<i>Papaver rhoeas</i>	PAPRH	12	94	27
<i>Centaurea cyanus</i>	CENCY	4	94	29
<i>Stellaria media</i>	STEME	5	93	92
<i>Viola arvensis</i>	VIOAR	9	91	66

The impact of different application timings on the efficacy of Milestone was tested in a trial program initiated in autumn 2014. Milestone was applied once with 1.5 L/ha in winter oilseed rape either at an early timing (timing A: application between Oct 25<sup>th</sup> - Nov 7<sup>th</sup> 2014) or a late timing (timing B: application between Nov 22<sup>nd</sup> - Dec 5<sup>th</sup> 2014).

For both application timings, Milestone showed a very high level of efficacy against *Bromus* spp. and *Matricaria* spp. Against *Alopecurus myosuroides*, Milestone showed superior efficacy at the early application timing A (98% control) vs. the later application timing B (89% control) (Tab. 3).

**Tab. 3** Efficacy of Milestone (1.5 L/ha) when applied once at timing A resp. B.

**Tab. 3** Wirkung von Milestone (1,5 L/ha) bei einmaliger Anwendung zu Anwendungstermin A bzw. B.

Weed species	Weed code	Number of trials	Efficacy of Milestone 1,5 L/ha applied at Timing A (Oct 25 <sup>th</sup> – Nov 7 <sup>th</sup> 2014)	Efficacy of Milestone 1,5 L/ha applied at Timing B (Nov 22 <sup>nd</sup> – Dec 5 <sup>th</sup> 2014)
<i>Alopecurus myosuroides</i>	ALOMY	1	98	89
<i>Bromus</i> spp.	BROSS	2	96	97
<i>Matricaria</i> spp.	MATSS	2	99	99

## Discussion

During the development phase of Milestone, an efficacy comparison between Milestone (containing 500 g/L propyzamide and 5.3 g a.i./L aminopyralid) and Kerb FLO (containing 400 g/L propyzamide) was made. Milestone and Kerb FLO showed comparable and very high control levels against monocotyledonous species such as *Alopecurus myosuroides*, *Apera spica-venti*, *Bromus* species and volunteer cereals. In comparison with Kerb FLO, the combination of the two actives propyzamide and aminopyralid (Milestone) exhibited increased spectrum of activity against dicotyledonous weeds such as *Matricaria* spp., *Papaver rhoeas* and *Centaurea cyanus*.

In a trial program initiated in autumn 2014, the use of Milestone in dense stands of winter oilseed rape with almost complete ground coverage (as the situation was in autumn 2014 in many areas in Germany) provided very high efficacy levels against *Bromus* spp. and *Matricaria* spp.. Against *Alopecurus myosuroides* an early application timing beginning of November proved slightly superior control to later application timing towards end of November through early December. The comparison of application timings confirmed that the application date in early November of Milestone provide maximum control of grass and broad leaf weeds.

## References

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