Two new cereal herbicides containing new Arylex™ active: Zypar™ and Pixxaro™ EC against various *Geranium* species

Zwei neue Getreideherbizide mit dem neuen Wirkstoff Arylex™ active: Zypar™ und Pixxaro™ EC gegen verschiedene Storchschnabel-Arten

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Abstract

In recent years, various *Geranium* species have increased their significance in many important crops in Germany. The most important reason for this situation is the increased use of no-till farming as well as a smaller selection of herbicides used to control weeds. Dow AgroSciences has recently developed two cereal herbicides containing the new active Arylex™ (halauxifen-methyl), Zypar™ und Pixxaro™ EC. Dow AgroSciences initiated trials in Germany to investigate the potential of both products to control *Geranium* species to recommend the most effective products to farmers. Trials were carried out in greenhouses and in the field. Both products controlled various *Geranium* species and controlled *Geranium pusillum* and *G. dissectum* particularly well. The most difficult to control of the *Geranium* species was *Geranium molle*.

Zypar und Pixxaro EC provided excellent control of several *Geranium* species in cereals.

Keywords: Arylex, *Geranium*, Pixxaro EC, Zypar

Zusammenfassung

In den letzten Jahren haben die Storchschnabel-Arten in Deutschland in verschiedenen Kulturen immer mehr an Bedeutung gewonnen. Die Gründe hierfür sind hauptsächlich der Verzicht auf wendende, intensive Bodenbearbeitung sowie eine immer kleinere Auswahl an Herbizidwirkstoffen für die Unkrautbekämpfung. Dow AgroSciences hat in den letzten Jahren zwei neue Getreideherbizide mit dem neuen Wirkstoff Arylex entwickelt: Zypar und Pixxaro EC. Beide sind sehr gut geeignet, verschiedene Storchschnabel-Arten zu bekämpfen. Dow AgroSciences hat in Deutschland Versuche initiiert, um die Bekämpfungsleistung beider Produkte gegen Storchschnabel-Arten zu untersuchen und daraus Empfehlungen für die Praxis ableiten zu können. Die Versuche wurden sowohl im Gewächshaus als auch im Feld angelegt und haben gezeigt, dass beide Produkte verschiedene Storchschnabel-Arten sehr gut bekämpfen können. Hinsichtlich der Wirkung gegen unterschiedliche Storchschnabel-Arten hat sich gezeigt, dass der Kleine Storchschnabel (*Geranium pussilum*) von beiden am besten zu bekämpfen ist, gefolgt vom Schlitzblättrigen Storchschnabel (*Geranium dissectum*). Am schwierigsten zu bekämpfen scheint Weicher Storchschnabel (*Geranium molle*) zu sein. Dies zeigt sich besonders bei reduzierten Aufwandmengen oder bei weiter entwickelten Storchschnabel-Pflanzen.

Insgesamt zeigen beide Produkte eine sehr gute Wirkung gegen verschiedene Storchschnabel-Arten und stellen daher zukünftig eine interessante Lösung für die Storchschnabel-Bekämpfung im Getreide dar.

Stichwörter: Arylex™, Pixxaro EC, Storchschnabel, Zypar

Introduction

Species in the *Geranium* genera are often difficult to control. Only few herbicides registered in the European Union are able to fully control this species. Furthermore, the selection of actives in herbicides available for farmers is limited due to regulatory constraints (ANONYMOUS, 2017). In winter oilseed rape and corn it is difficult to find herbicides to control these weeds. As these two crops are in rotation with cereals, it is clear that *Geranium* weed species are becoming a greater problem in cereals (GEHRING et al., 2012; KLINGENHAGEN, 2012).

The new herbicide active ingredient Arylex™ (halauxifen-methyl) provides excellent efficacy on *Geranium* spp. (GERSS) and many other dicotyledonous weeds including *Centaurea cyanus* (CENCY), *Chenopodium album* (CHEAL), *Descurainia sophia* (DESSO), *Galeopsis tetrahit* (GAETE), *Fumaria officinalis* (FUMOF), *Galium aparine* (GALAP), *Lamium* sp. (LAMSS), *Papaver rhoeas* (PAPRH) and *Stellaria media* (STEME). Arylex in combination with florasulam in Zypar, and fluroxypyr in Pixxaro EC, further extend dicotyledonous weed control spectrum.

Zypar™ is a new cereal herbicide containing Arylex (6 g ae/L) and florasulam (5 g ai/L). At a maximum dose rate of 1 L/ha this herbicide product controls a broad spectrum of dicotyledonous weeds. Zypar is formulated as an OD (oil dispersion) with an incorporated MSO adjuvant that enables excellent efficacy even during cold weather conditions. Zypar has a built-in safener (cloquintocet-mexyl) that ensures high level selectivity to wheat, rye, triticale and barley with a wide application window (BBCH 13-45) (EPP et al., 2015; DZIKOWSKI et al., 2016).

Pixxaro™ EC is a new cereal herbicide product containing Arylex (12 g ae/L) and fluroxypyr (280 g ae/L). At a maximum dose rate of 0.5 L/ha, Pixxaro EC controls a broad spectrum of dicotyledonous weeds. Pixxaro EC is formulated as a new type of EC (emulsifiable concentrate) formulation that contains MSO adjuvant to maximized Pixxaro EC performance during cold weather conditions. Pixxaro EC also contains the safener cloquintocet-mexyl that ensures high level of selectivity to wheat, rye, triticale and barley with a wide application window (BBCH 13-45) (EPP et al., 2015; DZIKOWSKI et al., 2016).

Materials und Methods

Trials targeting various *Geranium* species were established in Germany in 2016 (greenhouse phase) and in 2017 (field phase). A greenhouse trial was carried out by a contractor company, while field trials were carried out by Dow AgroSciences GmbH and two contractor companies. All trials were conducted with 4 replications, according to EPPO guidelines and in accordance to GEP.

Tab. 1 Characteristics of Zypar.

***Tab. 1** Produktprofil Zypar.*

Characteristics of Zypar™ herbicide		
Active ingredients	Arylex 6 g ae/L	Florasulam 5 g ai/L
Target dose rate	1.0 L/ha	Winter- and Spring cereals
Application timing	BBCH 13-45	Winter cereals
	BBCH 13-39	Spring cereals
Mode of action	Auxin-like (HRAC O)	Acetolactate synthase inhibitor (ALS, HRAC B)

Tab. 2 Characteristics of Pixxaro EC.

***Tab. 2** Produktprofil Pixxaro EC.*

Characteristics of Pixxaro™ EC herbicide		
Active ingredients	Arylex™ 12 g ae/L	Fluroxypyr 280 g ae/L
Target dose rate	0.5 L/ha	Winter- and Spring cereals
Application timing	BBCH 13-45	Winter cereals
	BBCH 13-39	Spring cereals
Mode of action	Auxin-like (HRAC O)	Auxin-like (HRAC O)

Tab. 3 Characteristics of Artus.

***Tab. 3** Produktprofil Artus.*

Characteristics of Artus		
Active ingredients	Carfentrazone 400 g ai/kg	Metsulfuron 100 g ai/kg
Target dose rate	50 g/ha	Winter- and Spring cereals
Application timing	BBCH 13-32	Winter wheat
	BBCH 13-29	Winter rye, winter barley, triticale, spring barley, spring wheat
	BBCH 12-25	Spring oats
Mode of action	PPO inhibitor (HRAC E)	Acetolactate synthase inhibitor (ALS, HRAC B)

Each trial was conducted with 2 application timings. In greenhouse trial *Geranium* plants were sprayed at early application timing (BBCH 12-13) and at late timing (BBCH 18-19). In field trials, *Geranium* plants were between BBCH 14-25 at early application timing and between BBCH 17-31 at late application timing. Greenhouse trial targeted *Geranium dissectum* (GERDI) and *Geranium*

pusillum (GERPU) while among 5 field trials two targeted GERDI, two targeted GERPU and one targeted *Geranium molle* (GERMO).

Results

Greenhouse trial

Zypar™ herbicide was applied at 1.0 L/ha and Pixxaro™ EC herbicide was applied at 0.5 L/ha. These two herbicides were compared to Artus (see Tab. 3) at 50 g/ha. All treatments were applied at early and late timing. Zypar and Pixxaro EC provided very high efficacy (98 and 99%) against GERDI, comparable to Artus (Fig. 1). There was no difference in efficacy between early and late applications.

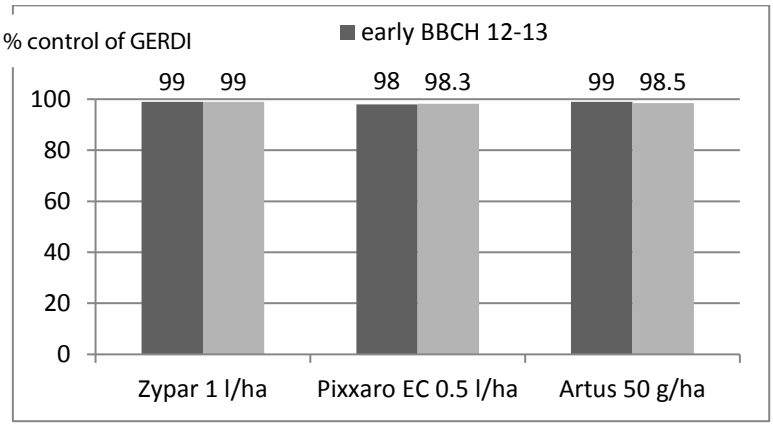

Fig. 1 Efficacy of Zypar and Pixxaro EC against GERDI in comparison to standard 4 weeks after application in greenhouse.

Abb. 1 *Wirkung von Zypar und Pixxaro EC gegen Schlitzblättrigen Storchschnabel im Vergleich zum Standard 4 Wochen nach der Behandlung im Gewächshaus.*

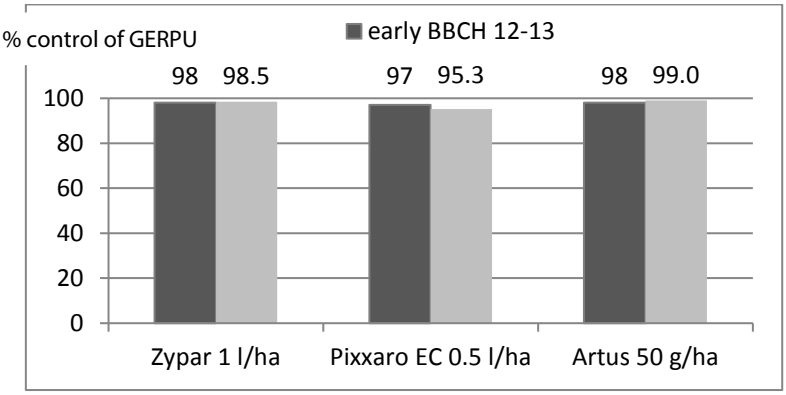

Fig. 2 Efficacy of Zypar and Pixxaro EC against GERPU in comparison to standard 4 weeks after application in greenhouse.

Abb. 2 *Wirkung von Zypar und Pixxaro EC gegen Kleinen Storchschnabel im Vergleich zum Standard 4 Wochen nach der Behandlung im Gewächshaus.*

Against GERPU, Zypar™ herbicide reached similar efficacy to Artus that ranged from 98 to 99%. The efficacy of Pixxaro™ EC herbicide was slightly lower, particularly when applied late (95.3%) while at early timing 97% control was achieved.

Field trials

The efficacy of 2 trials ranged from 91 to 99% against GERDI (Fig. 3). All products performed better at the second application timing than at the first. Zypar™ herbicide controlled 91% of GERDI at early application and 99% at the late timing.

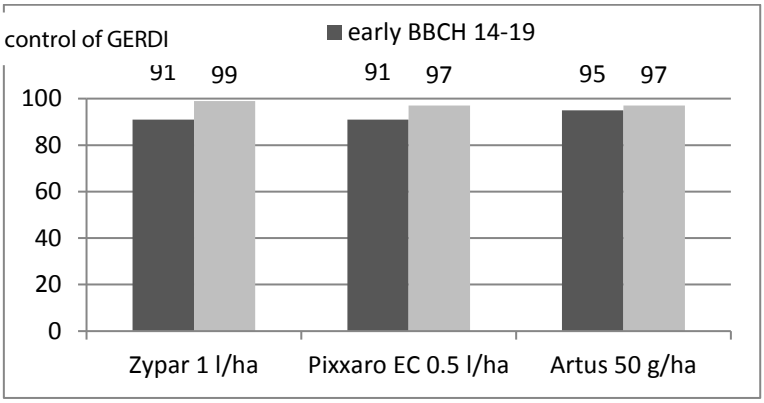

Fig. 3 Efficacy of Zypar and Pixxaro EC against GERDI in comparison to standard 4 weeks after application in the field trials (n=2).

Abb. 3 *Wirkung von Zypar und Pixxaro EC gegen Schlitzblättrigen Storchschnabel im Vergleich zum Standard 4 Wochen nach der Behandlung im Feldversuch (n=2).*

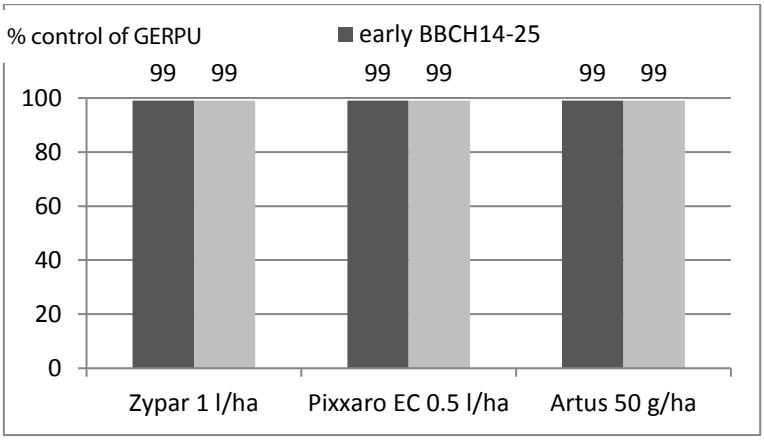

Fig. 4 Efficacy of Zypar and Pixxaro EC against GERPU in comparison to standard 4 weeks after application in the field trials (n=2).

Abb. 4 *Wirkung von Zypar und Pixxaro EC gegen Kleinen Storchschnabel im Vergleich zum Standard 4 Wochen nach der Behandlung im Feldversuch (n=2).*

Pixxaro™ EC herbicide applied early controlled 91% while 97% late. Artus provided 95% efficacy at early application and 97% at late application. At early application timing the highest efficacy was reached by Artus and at the late application by Zypar.

All products showed an efficacy of 99% against GERPU at both application timings in 2 trials (Fig. 4).

The results of one trial showed that the efficacy of the tested products against GERMO ranged from 85 to 98.5% (Fig. 5).

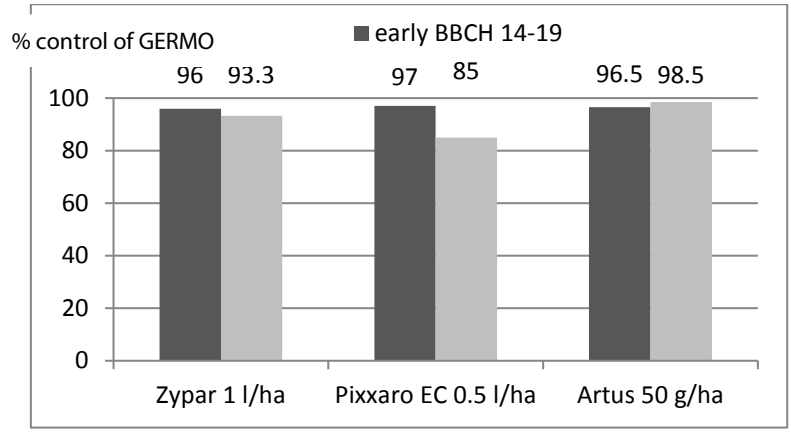

Fig. 5 Efficacy of Zypar and Pixxaro EC against GERMO in comparison to standard 4 weeks after application in the field trials (n=1).

Abb. 5 *Wirkung von Zypar und Pixxaro EC gegen Weichen Storchschnabel im Vergleich zum Standard 4 Wochen nach der Behandlung im Feldversuchen (n=1).*

Zypar™ and Pixxaro™ EC herbicides performed better at the early application timing than at the late one. Zypar applied early controlled 96% of GERMO while applied late 93.3%. Pixxaro EC applied early 97% and late only 85%. Artus performed similarly at both timings at 96.5% at early timing and 98.5% at late timing.

Discussion

Zypar™ and Pixxaro™ EC are new herbicide products containing the new active ingredient Arylex™ active. *Geranium* spp. weeds are increasing in importance in all major crops in Germany (GEHRING, 2012; KLINGENHAGEN, 2012). Zypar and Pixxaro EC applied in spring in cereals controlled a broad spectrum of broad leaved weeds including various species of *Geranium*. A greenhouse trial showed that both herbicides can control *Geranium pusillum* and *Geranium dissectum* at very high level, when *Geranium* plants were at the growth stage between BBCH 12 and 19. In field trials excellent control of *Geranium pusillum* and *Geranium dissectum* was achieved when Zypar and Pixxaro EC were applied at growth stages up to BBCH 30/31. *Geranium molle* was controlled by Zypar and by Pixxaro EC when applied early. Both products performed excellently against Geranium species, on similar level as standard herbicide Artus. Both herbicides from Arylex active family offer much wider spectrum of controlled weeds, very long application window and significantly better selectivity profile than Artus.

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