Flufenacet an interesting mix partner for Viper™ Compact and GF-1546 against grass weeds in autumn

Flufenacet als interessanter Mischpartner für Viper™ Compact und GF-1546 gegen Ungräser im Herbst

Matthias Donner*, Marcin Dzikowski, Wolfgang Dietrichs, Jörg Becker

Dow AgroSciences GmbH Truderinger str. 15, 81677 München
*Corresponding author, mdonner@dow.com

DOI 10.5073/jka.2018.458.052

Abstract

Viper™ Compact herbicide consists of the three active ingredients penoxsulam (15 g/L), florasulam (3.75 g/L) and diflufenican (100 g/L). It is a broad-spectrum herbicide used to control loose silky-bent (*Apera spica venti*), mono- and dicotyledonous weeds in winter wheat, winter barley, winter rye and winter triticale in the autumn. Penoxsulam and florasulam belong to the HRAC group B (ALS inhibitor), diflufenican to the HRAC group F1. Many loose silky-bent populations have a high risk of developing resistance to herbicides in the HRAC group B. For an effective resistance management, it is necessary to use herbicides from low resistance risk groups as mixing partner. A common mixing partner is the active substance flufenacet from the HRAC group K3.

In 2015, mixtures of Viper™ Compact (0.5 - 0.75 L/ha) with flufenacet (125-240 g/ha) were tested in field trials. While Viper™ Compact is able to control sensitive grass populations, the addition of flufenacet was able to successfully control less sensitive *Apera spica-venti* (APESV) biotypes. Furthermore, with the increased flufenacet application rate of 240 g/ha + Viper™ Compact, blackgrass was also controlled successfully. Overall the mixture was selective in the tested cultures. The tank mix of Viper™ Compact + flufenacet thus offers a high effectiveness against grasses and weeds, while at the same time reducing the risk of resistance development.

Keywords: APESV, ALOMY, flufenacet, penoxsulam, weed control

Zusammenfassung

Viper™ Compact bestehend aus den drei Wirkstoffen Penoxsulam (15 g/l), Florasulam (3,75 g/l) und Diflufenican (100 g/l) ist ein breit wirksames, im Herbst einzusetzendes Herbizid, zur Bekämpfung von Windhalm, sowie ein- und zweikeimblättrigen Unkräutern in Winterweizen, Wintergerste, Winterroggen und Wintertriticale. Ein weiteres Herbizid ist GF-1546 welches aus der Wirkstoffkombination von Penoxsulam (15 g/l) und Diflufenican (100 g/l) besteht. Penoxsulam und Florasulam gehören der HRAC-Gruppe B (ALS-Hemmer) an, Diflufenican der HRAC-Gruppe F1. Da viele Windhalmpopulationen ein hohes Resistenzrisiko gegenüber Herbiziden der HRAC-Gruppe B aufweisen, ist es im Rahmen des Resistenzmanagements geboten Herbizide als Mischpartner einzusetzen, welche aus einer weniger resistenzgefährdeten HRAC-Gruppe stammen. Ein praxisüblicher Mischpartner ist hierbei der Wirkstoff Flufenacet aus der HRAC-Gruppe K3.

In 2015 wurden in Feldversuchen Mischungen von Viper™ Compact (0.5 - 0.75 l/ha) mit Flufenacet (125 - 240 g/ha) getestet. Während Viper™ Compact sensitive Gräserpopulationen sicher erfasst, konnten nun durch die Zugabe von Flufenacet auch weniger sensitive *Apera spica-venti* (APESV) Biotypen erfolgreich bekämpft werden. Desweiteren konnte mit der erhöhten Flufenacet Aufwandmenge von 240 g/ha + Viper™ Compact, Ackerfuchsschwanz erfolgreich bekämpft werden. Insgesamt war die Mischung verträglich in den getesteten Kulturen. Die Tankmischung von Viper™ Compact + Flufenacet bietet somit eine hohe Wirksamkeit gegenüber Ungräsern und Unkräutern bei gleichzeitig verringertem Resistenzrisiko gegenüber Ungräsern.

Stichwörter: Ackerfuchsschwanz, Flufenacet, Penoxsulam, Windhalm, Unkrautbekämpfung

Introduction

Viper™ Compact is an autumn herbicide which can be applied at a max use rate of 1 L/ha from BBCH 10-23 to winter wheat, winter barley, winter rye, and winter triticale. It consists of the three active ingredients penoxsulam (15 g/L), florasulam (3.75 g/L) and diflufenican (100 g/L). Viper™ Compact can be used on a broad spectrum of weeds in autumn sown cereals and provides consistent control on problematic weeds such as *Centaurea cyanus* (CENCY), *Matricaria sp.* (MATSS), *Galium aparine* (GALAP) and all Brassica weeds including volunteer oil seed rape. Furthermore, Viper™ Compact can control sensitive *Apera spica-venti* (APESV) populations. GF-

1546 is also an autumn herbicide which contains only penoxsulam (15 g/L) and diflufenican (100 g/L) and can be applied to winter cereals from BBCH 10-29.

Penoxsulam and florasulam belong to the HRAC group B (ALS inhibitor), diflufenican to the HRAC group F1. The grass weed APESV has a high inherent resistance risk towards herbicides belonging to the ALS (HRAC B) and ACCase (HRAC A) mode of action herbicides. To reduce the resistance risk it is necessary to use herbicides from a less resistant HRAC group as a mixed partner (RETZINGER et al., 1997; BALGHEIM, 2006). A common mixing partner is the active substance flufenacet from the HRAC group K3. APESV did not show any resistance to cell division inhibitors (HRAC K3) yet (HRAC, 2017). The mixture of Viper™ Compact/ GF-1546 + flufenacet (SPU5410) was evaluated in field trials to test selectivity and completeness of weed spectrum.

Materials and Methods

Trials with Viper™ Compact and GF-1546 in tank mix with SPU5410 (flufenacet) were conducted in Germany and in Austria by Dow AgroSciences in autumn of 2016. Weed control and crop tolerance were rated as % effect on a 0-100 scale by visual assessments in comparison with untreated control plots. Phytotoxicity assessments to cereal crops were started one week after application and continued as long as symptoms were visible. Viper™ Compact was applied at 0.75 L/ha in tank mix with 125 g/ha flufenacet against APESV and broadleaf weeds at crop stage BBCH 10-12. Against ALOMY and broadleaf weeds Viper™ Compact and GF-1546 were tested at the rate of 0.75 L/ha and with increased flufenacet rate of 240 g/ha applied at crop stage BBCH 10-11. In total 16 trials were conducted in winter wheat and 2 in winter barley.

Tab. 1 Tested products in the trial.

Tab. 1 *Verwendete Produkte in den Versuchen.*

Product	Formulation type	Active ingredients	HRAC-code of each a.s.
Viper™ Compact	SC	Diflufenican (100 g/L)	F1
		Penoxsulam (15 g/L)	B
		Florasulam (3.75 g/L)	B
GF-1546 (Dow AgroSciences)	SC	Diflufenican (100 g/L)	F1
		Penoxsulam (15 g/L)	B
SPU 5410	SC	Flufenacet (500 g/L)	K3

Results

Viper™ Compact herbicide applied at 0.75 L/ha in tank mix with 0.25 L/ha SPU5410 (125 g/ha flufenacet) performed very well in winter cereals with high levels of efficacy (>95%) against the weeds and grasses on *Apera spica-venti* (APESV), *Matricaria chamomilla* (MATCH), *Stellaria media* (STEME), *Centaurea cyanus* (CENCY), *Papaver rhoeas* (PAPRH), *Veronica hederifolia* (VERHE), *Viola arvensis* (VIOAR) and *Poa annua* (POAAN) (Fig. 1).

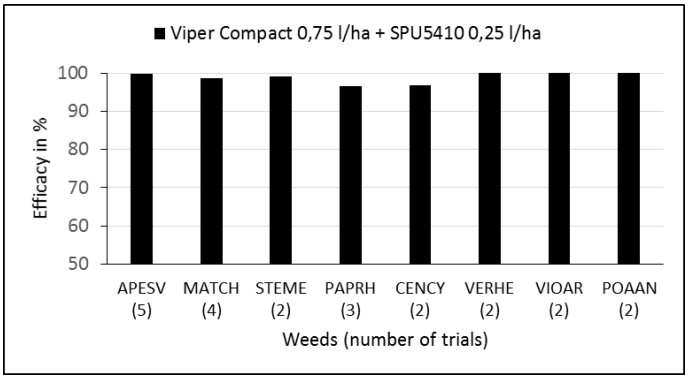

Fig. 1 Efficacy of Viper™ Compact in tank mix with SPU5410 (flufenacet) at 0.75 L/ha + 0.25 L/ha applied against grasses and broadleaf weeds applied at BBCH 10-12.

Abb. 1 *Wirkung von Viper™ Compact in Tankmischung mit SPU5410 (Flufenacet) mit einer Aufwandsmenge von 0,75 l/ha + 0,25 l/ha gegen Ungräser und Unkräuter appliziert BBCH 10-12.*

The application of the tank mix Viper™ Compact + SPU5410 (flufenacet) in winter wheat and winter barley also demonstrated good crop selectivity when applied at BBCH 10-13.

Viper™ Compact and GF-1546 each applied at 0.75 L/ha in tank mix with SPU5410 at 0.48 L/ha (240 g/ha flufenacet) controlled ALOMY over 97% when applied at BBCH 10-11 (Fig. 2).

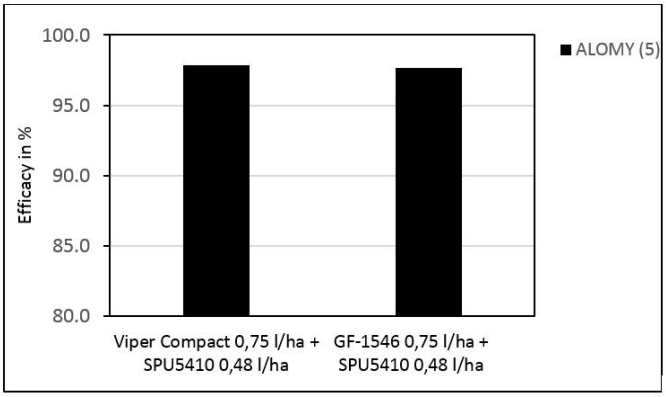

Fig. 2 Efficacy of Viper™ Compact or GF-1546 in tank mix with SPU5410 (flufenacet) at 0.75 L/ha + 0.48 L/ha applied against *Alopecurus myosuroides* applied at BBCH 10-11.

Abb. 2 *Wirkung von Viper™ Compact oder GF-1546 in Tankmischung mit SPU5410 (Flufenacet) mit einer Aufwandsmenge von 0,75 l/ha + 0,48 l/ha gegen Alopecurus myosuroides appliziert BBCH 10-11.*

Discussion

The tank mix of either Viper™ Compact herbicide or GF-1546 with SPU5410 showed high efficacies against all tested grasses and broadleaf weeds and can be applied very safely to winter cereals. Viper™ Compact has a broad weed spectrum among autumn applied cereal herbicides and in combination with flufenacet the herbicidal efficacy against *A. myosuroides* can be improved significantly. *A. spica-venti* populations showing some ALS resistance can also be sufficiently controlled with this tank-mix combination. The application timing against loose silky-bent is flexible, meaning that it is also possible to apply later than BBCH 10 because flufenacet provides good control on that grass weeds in post-em situations and supported by the fact that florasulam

in Viper™ Compact is used to its fullest potential against important weeds like CENCY when weeds have been emerged. Against blackgrass, early-applied applications of these tank-mixtures should be prioritized in order to tap the full potential of flufenacet against that grass weed.

The combination of Viper™ Compact or GF-1546 with SPU5410 not only provides more protection against important weeds, it can be also an important resistance management tool in autumn by reducing the resistance risk. Viper™ Compact and GF-1546 consist of penoxsulam of the HRAC group B and diflufenican of the HRAC F1 (MENNE et al., 2012). Viper™ Compact additionally contains florasulam which belongs also to the HRAC group B. Loose silky-bent has a high inherent resistance risk towards graminicides belonging to ALS herbicides (HRAC B). By combining flufenacet with Viper™ Compact and GF-1546 the resistance risk can be reduced since flufenacet belongs to the HRAC group K3 (RETZINGER et al., 1997; BALGHEIM, 2006). So far, no resistance was reported for flufenacet to *A. spica-venti* in Europe (HRAC, 2017).

Literatur

BALGHEIM, R., 2006: Herbizidresistenz vermeiden, Wirkstoffe erhalten - Eine Gemeinschaftsaufgabe von Beratung, Forschung und Praxis am Beispiel des Ackerfuchsschwanz (*Alopecurus myosuroides* Huds.). J. Plant. Dis. Prot. **XX**, 49-56.

RETZINGER, JR., E.J. and C. MALLORY-SMITH, 1997: Classification of herbicides by site of action for weed resistance management strategies. Weed Technology **11**, 384-393.

MENNE, H. and H. KÖCHER, 2012: HRAC classification of herbicides and resistance development. Modern Crop Protection Compounds **1-3**, Second Edition, 5-28.

HERBICIDE RESISTANCE ACTION COMMITTEE (HRAC), HTTP://www.weedscience.org, 2017.