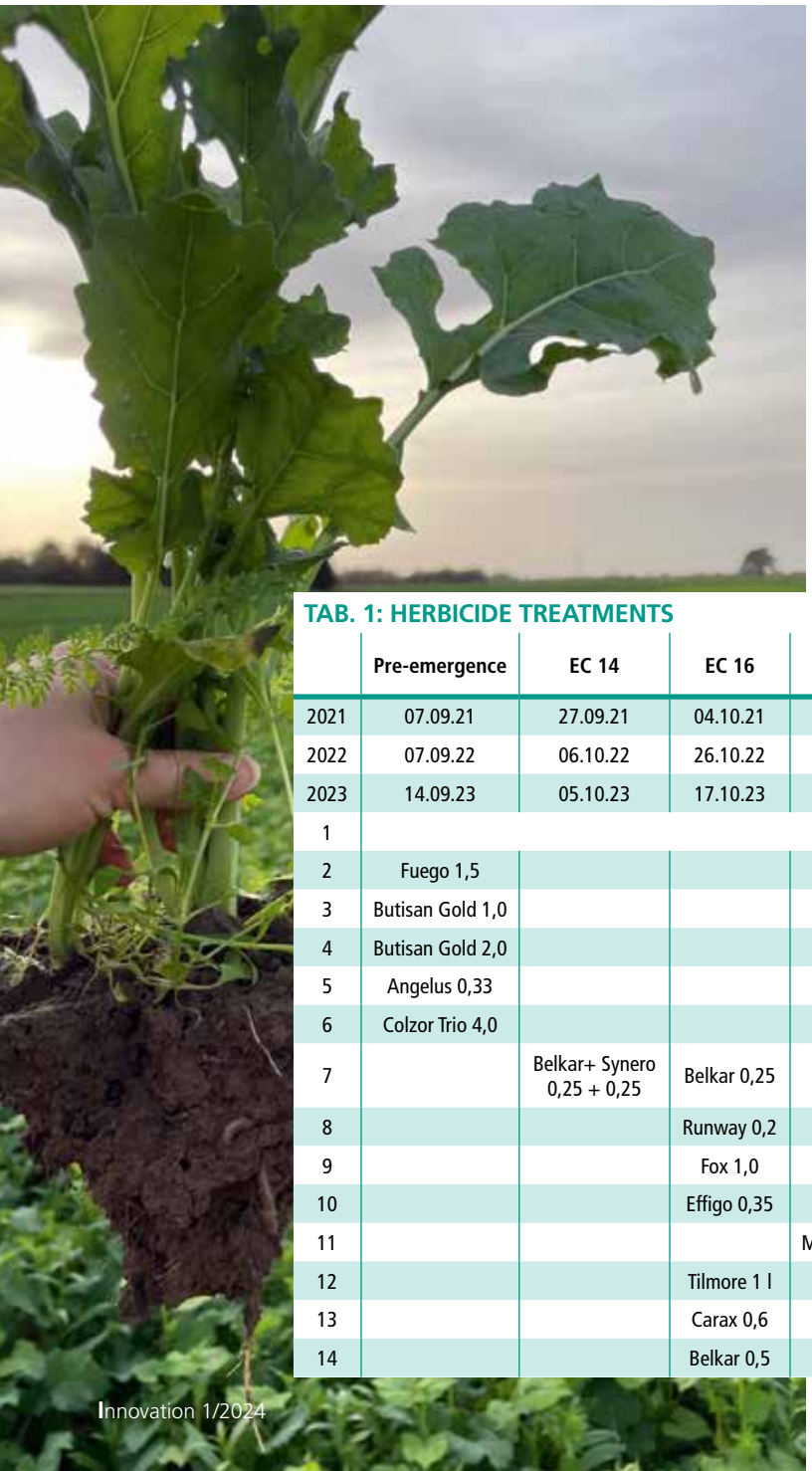
To the first article on the herbicide tolerance of oilseed rape seed

USE OF HERBICIDE ON OILSEED RAPE COMPANION CROPS

What can I use companion crops for, what do they do and what do I have to consider when using them in my herbicide management? Prof Dr Verena Haberlah-Korr from the South Westphalia University of Applied Sciences in Soest answers these questions in this article.



Why companion crops?

It is increasingly noticeable in autumn: Oilseed rape that is not sown in pure seed, but has several larger or smaller „companions“. What is the reason for growing such companion crops? They are intended to help reduce insect infestation, suppress weeds and feed the soil life in a variety of ways without competing with the oilseed rape. In terms of plant cultivation, the companion crops root through different soil layers, which promotes the stability of the soil structure and helps with nutrient availability. They bind or build nitrogen (in the case of legumes) and serve to protect against erosion or, after freezing, to build up humus.

A common example of this is the companion crop mixture TerraLife®-BrassicaPro, a freezing mixture that was specially developed for oilseed rape cultivation and contains linseed, niger and legumes in the form of

TAB. 1: HERBICIDE TREATMENTS

	Pre-emergence	EC 14	EC 16	End of v egetation	Active substances	Trial years		
2021	07.09.21	27.09.21	04.10.21	ohne Appl.				
2022	07.09.22	06.10.22	26.10.22	29.11.22		21	22	23
2023	14.09.23	05.10.23	17.10.23	06.12.23				
1	unbehandelte Kontrolle							
2	Fuego 1,5				Metazachlor	x	x	x
3	Butisan Gold 1,0				Metazachlor + Quinmerac + Dimethenamid	x	x	x
4	Butisan Gold 2,0				Metazachlor + Quinmerac + Dimethenamid		x	x
5	Angelus 0,33				Clomazone	x	x	x
6	Colzor Trio 4,0				Clomazone + Dimethenamid + Napropamid	x	x	x
7		Belkar+ Synero 0,25 + 0,25	Belkar 0,25		Halauxifen + Picloram; Aminopyralid	x	x	x
8			Runway 0,2		Aminopyralid	x	x	x
9			Fox 1,0		Bifenox	x	x	x
10			Effigo 0,35		Clopyralid + Picloram		x	x
11				Milestone 1,5 l	Propyzamid + Aminopyralid		x	x
12			Tilmore 1 l		Tebuconazol + Prothioconazol		x	x
13			Carax 0,6		Mepiquat + Metconazol + Prothioconazol		x	x
14			Belkar 0,5		Halauxifen + Picloram	x	x	x

Oilseed rape companion crops for flea control in autumn, consisting of linseed, garden cress & buckwheat (visible) and white clover & fenugreek (underneath)
Source: Haberlah-Korr, Merklingsen 26.10.2021

serradella, egyptician clover and persian clover. In addition, the field bean was included in the trial (otherwise blue lupin). Deutsche Saatveredelung AG (DSV) generally sees a significant increase in interest in the cultivation of companion crops in oilseed rape, although the actual area realised in this innovative segment is still below 5 %, according to conservative estimates.

Companion crops are also important as an instrument of integrated crop protection and thus for reducing the use of pesticides. Trials are currently being carried out at the Merklingsen experimental farm of the South Westphalia University of Applied Sciences near Soest to distract or deter insect pests such as the oilseed rape flea beetle and the oilseed rape shining beetle. In other trials, the suitability of companion crops for weed suppression is being tested.

Herbicide use depends on companion crops and location

If everything goes well, the companion crops develop optimally in autumn and the location does not have high weed pressure, ideally no herbicides are necessary in such cultivation systems. Often, however, natural weed infestation, e.g. with common ragweed, causes problems that should be selectively eliminated without causing too much damage to the companion crops. But the opposite is also conceivable: The companion crops develop too strongly and compete with the oilseed rape, so they should be curbed.

Three years of research

In order to investigate the effect of common oilseed rape herbicides on the individual companion crops, field trials were carried out in cooperation with DSV on the Merklingsen trial farm in the Soester Börde. At the same time as the oilseed rape was sown in September 2021, 2022 and 2023, companion crops were sown in pure seed in 3 m wide strips. Different herbicide treatments were also applied in a checkerboard pattern over 3 m on four dates. Untreated con-trols not only formed the first plot as a scoring reference, but also lay as 130 cm wide untreated strips between the individual herbicide variants.

Although it has been carried out for 3 years, the informative value of these trials is unfortunately limited. There are no replicates and the plots are quite small at 9 square metres. Some companion crops such as fenugreek, linseed and ribwort-plantain do not develop well in pure seed when young, which can lead to high weed pressure, which makes scoring even more difficult. In addition, pigeons, rabbits and deers also appreciated the new food supply and literally „grazed“ one or two plots, such as field beans and buckwheat in 2023. Red clover and white clover were only grown in 2023, false flax only in 2021 and 2022. Despite these challenges, useful conclusions can be drawn from the trial. The circumstances of the trial must be taken into account.

The autumn weather in Merklingsen varied greatly in the years 2021-2023. Compared to the long-term average, it became increasingly warmer. While autumn 2021 was very dry and autumn 2022 was dry, autumn 2023 was extremely wet with 149% precipitation compared to the long-term average. This significantly influenced the effect of the herbicides. Humid and warm weather, as in 2023, increased the effectiveness of soil herbicides in particular and thus also their potential harmfulness (phytotoxicity) to companion crops. In dry autumn weather, as in 2021 and 2022, the herbicides were significantly less effective and therefore also better tolerated.

Fig. 1 shows the tested herbicide variants and their application dates between pre-emergence and end of vegetation, which were based on the development stage of the winter oilseed rape from plot 1. Not all variants were tested in all three trial years.

The 224 test plots were regularly evaluated by various students as part of project and bachelor theses (2023: Niels Deele) with regard to the damage to the companion crops. The first frost ended the assessments in each case. Niger and buckwheat are particularly susceptible to frost, and phacelia and field beans also died in severe frosts.

Which herbicides are compatible?

Due to the different significance of the individual trial years due to weather conditions, it was decided not to present an average value for the degree of damage over the trial years. When sowing, the farmer does not know what the weather will be like, so the „worst-case year“ 2023 was taken into greater consideration for the recommendation in Table 2. A green light (no or lowdamage up to 10 %) was only given if the herbicides were tolerated in these warm and humid conditions.

Grass herbicides such as Agil-S (Propaquiza-fop) and Select 240 EC (Cletodim) were only tested in 2021 and, as expected, were easily tolerated by the dicotyledonous companion crops. Failure cereals could thus be removed relatively easily.

TAB. 2: HERBICIDE TOLERANCE OF COMPANION CROPS, RECOMMENDATION FROM THE TRIAL RESULTS 2021-2023

Companion crops Herbicides/Spray sequence	2 Seradella	3 Linseed	4 Niger	5 Phacelia	6 Egypt-clover	7 Persian-clover	8 Fenu greek	9 Red clover	10 False flax	11 Ribwort plantain	12 White clover	13 Blue lupin	14 Field bean	15 Buck wheat	16 Brassica Pro + oilseed rape
Seed density 2023 (kg/ha)	**6,0**	**2,5**	**3,0**	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**	**5,0**	**3,5**	**84,0**	**287,4**	**39,1**	**23,4 + 3,4**
T1: Fuego 1,5															
T1: Butisan Gold , 1,0															
T1: Butisan Gold 2,0															
T1: Angelus 0,33															
T1: Colzor Trio 4,0															
T2: Belkar+Synero 0,25 + 0,25 T3: Belkar 0,25															
T3: Runway 0,2									?	?					
T3: Fox 1,0												?	?		
T3: Effigo 0,35															
T3: Tilmore 1,0 (Fungicide)															
T3: Carax 0,6 (Fungicide)															
T3: Belkar 0,5				?											

T1: Pre-emergence; T2: EC 14; T3: EC 16; 0–10 % Damage; 11–50 % Damage; > 50 % Damage; ? Very contradictory results, no statement possible

Recommendations for practical use

Vorauflaufherbizide:

- **Fuego:** relatively tolerable in the dry years ,21 and ,22 except for Phacelia. The light changed to yellow for other species in 2023.
- **Butisan Gold:** while for 1 litre/ha under dry conditions the damage is reasonably acceptable for most species (yellow in Fig. 2, up to max. 50 %), the risk increases at 2 litres/ha.
- **Angelus:** well tolerated, except for Seradella, buckwheat and false flax.
- **Colzor Trio:** not recommended, except for field beans and fenugreek.

Post-emergence:

- **Belkar:** proved to be completely incompatible in all years, even in splitting applications. On the other hand, companion crops that have become too lush can be safely eliminated with it.
- **Runway:** was incompatible, except for linseed. False flax and ribwort-plantain showed only moderate damage in 2023, but surprisingly more significant damage in dry 2022, up to total loss of ribwort-plantain.
- **Fox:** the clovers showed only moderate damage. For blue lupin and field beans the results were completely inconsistent, in dry years well tolerated for blue lupin and consistently for linseed.
- **Effigo:** was only tested in ,22 and ,23, harmful in niger, clover and ribwort-plantain, but relatively well tolerated in Phacelia.

In 2022 and 2023, the fungicides Tilmor and Carax were included in the trials to test whether there were any interactions with the companion crops. Both were compatible. Another experimental question was whether the products used as growth regulators in oilseed rape also influence the growth and thus the winter hardiness of companion crops, especially in Phacelia. After -10 degrees Celsius in January 2024, however, all phacelia plots were equally frozen.

It is not yet possible to report on the influence of treatment with Milestone (2023 only), as this assessment is not due until the start of vegetation in 2024. However, damage would also be seen as less problematic here, as the companion crops would have already done most of their „job“, e.g. with regard to oilseed rape flea defence, and, if not frozen off, should soon be overgrown by the oilseed rape.

Conclusion

The results on the herbicide tolerance of oilseed rape companion crops should certainly not be regarded as generally favourable given the limitations described above. Pre-emergence treatments with metazachlor or clomazone such as Angelus or 1 litre/ha Butisan Gold proved to be the most tolerable with some restrictions. A residual risk remains, especially under humid conditions. For post-emergence, the decision must be made depending on the companion crops used.

Prof. Dr. Verena Haberlah-Korr
South Westphalia University of Applied Sciences,
Faculty of Agriculture, Plant Protection
E-Mail: haberlah-korr.verena@fh-swf.de