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Undercropping options for winter rapeseed in relation to herbicide treatment

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Background

Rapeseed is the third most important oilseed crop in the world in terms of oil production and is the most important in Europe. Worldwide, mainly spring oilseed rape is grown, but winter oilseed rape predominates in the European Union, where the total area of rapeseed was 5.72 million ha producing 19.7 million t in 2023/2024 (Eurostat).

Objective

In oilseed rape, opportunities are being sought to reduce damage from cabbage stem flea beetle, promote biodiversity, reduce herbicide rates and supply nitrogen to rapeseed plants. One option is undersowing, where legumes are the main component. The problem arises with herbicide control, where the full dose of some herbicides has to be reduced or eliminated completely.

Methods

Small-plot experiments with winter rapeseed were established at the research station of Czech University of Life Sciences, Czech Republic (geographical coordinates: 50.0772189N, 14.1744758E) in 2023/24. The variety LID Ultimo was used. The experimental treatments tested were **1) V0 – without undersowing**, **2) undersowing VF+** (59 % *Vicia ervilia*, 40 % *Trigonella foenum-graecum*, 1 % very early flowering rapeseed ES Alicia) in sowing rate 25 kg/ha, **3) undersowing LFA+** (49 % *Lens culinaris*, 40 % *Trigonella foenum-graecum*, 10 % *Trifolium alexandrinum*, 1 % very early flowering rapeseed ES Alicia) in sowing rate 20 kg/ha.

We tested a non-herbicide application and four herbicide combinations for these treatments. Preemergent herbicide applications for these treatments were **1) no herbicide**, **2) *Dimethenamid-P + Quinmerac + Metazachlor*** (1.25 l/ha, i.e. dose reduced by 50 %), **3) *Dimethenamid-P + Metazachlor*** (1.5 l/ha, i.e. dose reduced by 50 %), **4) *Quinmerac + Metazachlor*** (1.2 l/ha, i.e. dose reduced by 50 %), **5) *Pethoxamid*** (2 l/ha, full dose).

Results

Effect of undercropping

- Differences between treatments (V0, LFA+ a VF+) were observed in growth characteristics of winter rapeseed, in some cases statistically significant (% root dry matter, leaf length, root length and root neck diameter). However, the differences in seed yield between the undersowing treatments were minimal (Graph 1).
- For the treatments without herbicide application, the highest yield was LFA+ (3.83 t/ha), then VF+ (3.79 t/ha) and finally V0 (3.71 t/ha).
- After winter 2022/23, when temperatures fell to -13°C (without snow) in January, we did not observe any surviving support crops in spring.
- No differences were observed in plant damages by cabbage stem flea beetle or other pests between undersowing variants V0, LFA+ a VF+.

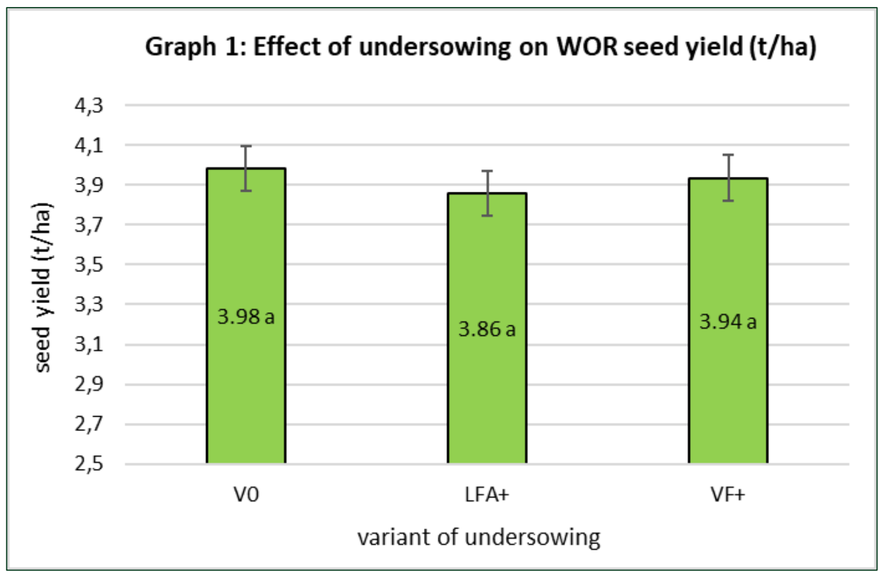
Effect of preemergent herbicide application

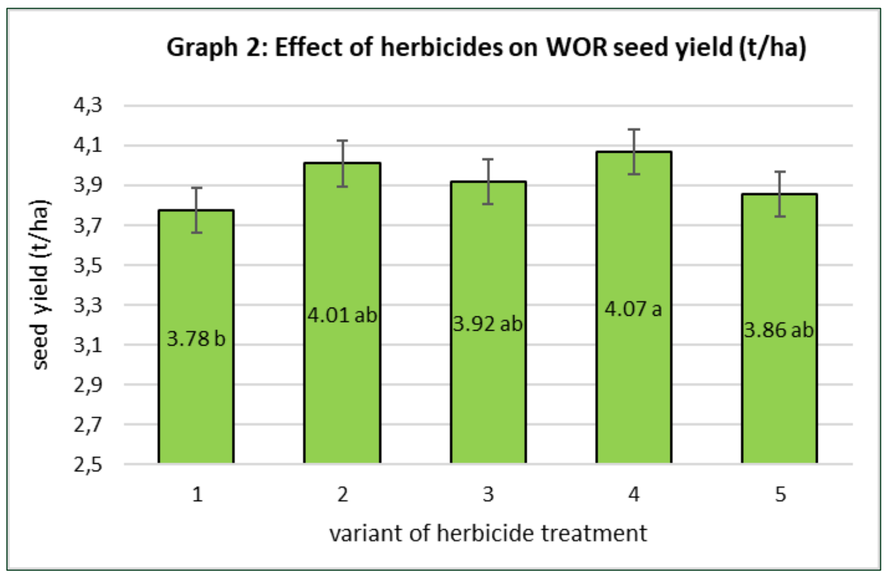
- Differences in winter oilseed rape growth were observed between herbicide treatments, but only in the case of leaf length were statistically significant. However, in seed yield, herbicide treatments performed better than the no-herbicide control (Graph 2).
- All herbicide treatments (except *Pethoxamid* on LFA+) achieved higher seed yield than the non-herbicide controls. *Quinmerac + Metazachlor* performed best for the V0, *Dimethenamid-P + Quinmerac + Metazachlor* for the VF+ and *Quinmerac + Metazachlor* for the LFA+.
- In herbicide treatments 2 (*Dimethenamid-P* + *Quinmerac* + *Metazachlor*) and 4 (*Quinmerac* + *Metazachlor*), the number of support crops and their biomass weight were lower than in the other herbicide treatments. Herbicide treatment 5 (*Pethoxamid*) was the most gentle on the support crops (Table 1).
- The best effect on weeds was achieved with herbicide treatments 2 (*Dimethenamid-P* + *Quinmerac* + *Metazachlor*) and 4 (*Quinmerac* + *Metazachlor*). Although these applications were at ½ dose, the effect was better than treatment 5 (*Pethoxamid*) at full dose.

Table 1: Summary results of number and weight of biomass of support crops per 1 m², on 10 November 2023

treatment (undersowing / herbicide)	Number of support crops and their biomass weight [g]											
	Lens			*Trigonella*			*Vicia*			*Trifolium*		
	[pc]	biomass [g]	roots [g]	[pc]	biomass [g]	roots [g]	[pc]	biomass [g]	roots [g]	[pc]	biomass [g]	roots [g]
VF+/ 1				27	33.3	5.1	31	46.7	7.9			
VF+/ 2				36	22.3	6.3	33	31.5	8.3			
VF+/ 3				37	42.8	22.3	48	60.9	11.3			
VF+/ 4				24	20.4	5.2	31	24.3	6.4			
VF+/ 5				44	63.9	11.2	47	73.3	11.9			
LFA+/ 1	41	40.3	8,3	15	18.5	3.1				25	36.8	10.1
LFA+/ 2	17	9.5	2,5	9	6.7	1.6				21	10.3	4.8
LFA+/ 3	39	26.0	4,8	12	12.8	2.1				29	28.0	8.5
LFA+/ 4	21	12.0	4,7	5	5.1	1.1				23	22.7	8.8
LFA+/ 5	41	40.8	6,9	17	25.7	4.4				44	59.2	17.1

Winter oilseed rape with undersowing VF+





Winter oilseed rape with undersowing LFA+

Statistical evaluation by Multifactor ANOVA, 95% LSD. Different letters mean a statistically significant difference between variants.

Conclusions

Based on the results, we can conclude that the use of support crops did not significantly affect the yield of winter rapeseed. Unfortunately, our evaluation did not show that support crops had any effect on the infestation of winter rapeseed by cabbage stem flea beetle. According to our results, the preemergent application of *Pethoxamid* is the most gentle on the support crops. The use of support crops is the way to support biodiversity and can also reduce the use of herbicides and thus contribute to the greening of this otherwise very intensive crop.

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