Organic winter OSR production – increased nitrogen availability and biodiversity though legume intercropping

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Winter oilseed rape (OSR) is an important constituent in organic production

On farm pressing

Background

- Available soil mineral N in early growth stages in spring important for crop development and high yield
- Organic amendments difficult to spread early in the season depending on soil type
- Organic OSR is subject to a pressure of insect pests as the cabbage stem flea beetle (CSFB)

Hypothesis

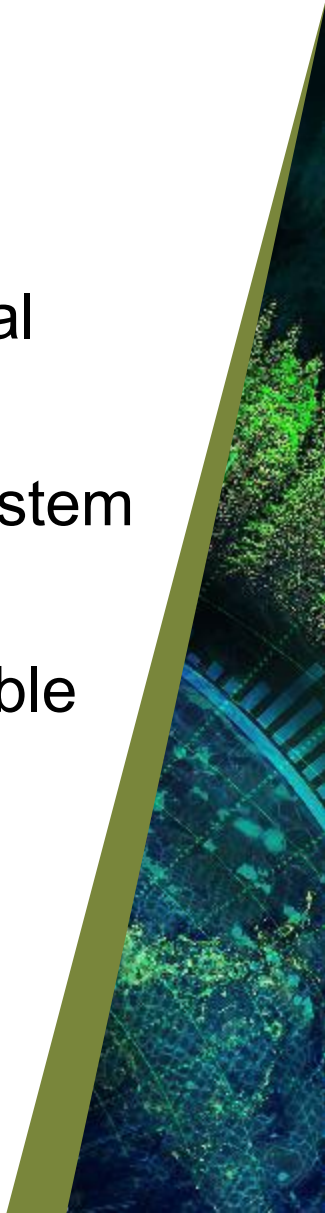
- Legume crops that provide biological nitrogen fixation and freeze during winter will contribute with an early supply
- Increased biodiversity will affect the prevalence of CSFB

Projectgroup

- **Crop advisors:** Kerstin Andersson, Per Modig, Per Ståhl, Henrik Nätterlund,
- Rural Economy and Agricultural Societies (Scania, East Gothia, Central Sweden)
- **Nitrogen specialist**: Dr. Lena Engström, Dept. Soil and Environment, SLU, Skara
- **Insect specialist**: Dr. Ola Lundin, Dept. Ecology, SLU, Uppsala
- **Plant Pathologist:** Dr. Eva Edin, Rural Economy and Agricutulral Society, Västerås

Objectives

- To develop a concept to improve N management by intercropping annual legume crops
- To assess the influence of intercrops on the prevalence of the cabbage stem flea beetle (CSFB)
- To present solutions for seeding techniques of legumes that are applicable in different regions of Sweden



Legume species and seed density

Legume species	Cultivar (species of clover)	Seed density (kg ha^{-1})	Rate of normal seed rate
2. *Vicia faba*, faba Bean	Tiffany	139	50%
3. *Lupinus angustifolius*, blue lupine	Boregine	100	50%
4. *Vicia sativa*, common vetch	Tempy	50	50%
5. Clover mixture *Trifolium resupinatum* *Trifolium alexandrinum* *Trifolium squarrosum*	Persian clover 33 % Berseem clover 33% Squarrose clover 33%	6	

Field trial plan 2021

Treatment	Row space cm	Seeding technique
A1. Winter OSR	12.5	
A2-4. Blue lupin, faba bean, Fodder vetch	12.5	Simultaneous seeding of WOR and legumes with the fertilizer coulter
A5. Clover mixture	12.5	Clover seeds mixed with rapeseed
B1. Winter OSR	50	
B2-4. as A2- A4	50	Simultaneous seeding between the rows
B5. Clover mixture	50	Simultaneous seeding of WOSR and legumes between rows

Pre-crop requirements: Soils low in nitrogen; cereal crop or grass swards

OSR cultivar: Explicit 45 seeds per m

Fertiliser: 50 kg N per ha as Ekoväx 8-3-5-3 spread before seeding and at the start of growth

Row spacing as large plot and legumes randomised within large plot. Three replicates.

* Clover mixture was seeded simultaneously as the WOR in the same row but seeding of legumes occurred simultaneously as row hoeing at the field trial in Skåne, southern Sweden.

OSR at 50 row distance intercropped with blue lupin, faba bean, fodder vetch and clover mixture 4 October 2021. Seeded at 9 August, Linköping.

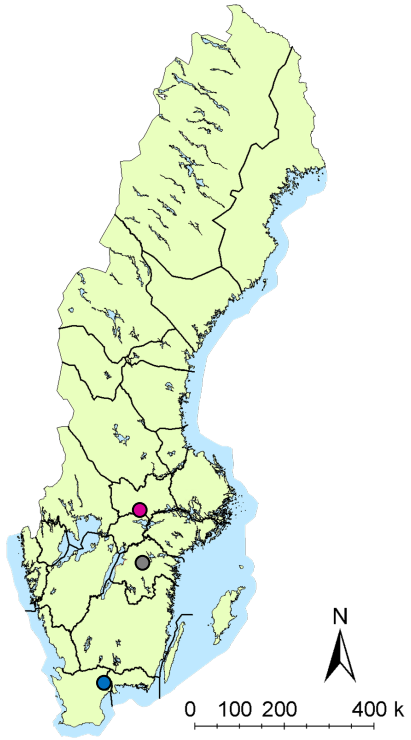
Blue lupin

Faba bean

Fodder vetch

Clover mixture

Soil mineral nitrogen at seeding



Sampled soil layer, cm	Örebro Pre-crop: rye	Linköping Pre-crop: fallow	Kristianstad Pre-crop: barley
	57°17'N 15°04'E	58°29'N 15°30'E	56°01'N 14°03'E
	(kg ha^{-1})	(kg ha^{-1})	(kg ha^{-1})
0-30	16	82	33
30-60	11	50	41
60-90	7	35	17
Total N content	**34**	**167**	**91**
Date of seeding	25 August	25 August	1 Sep

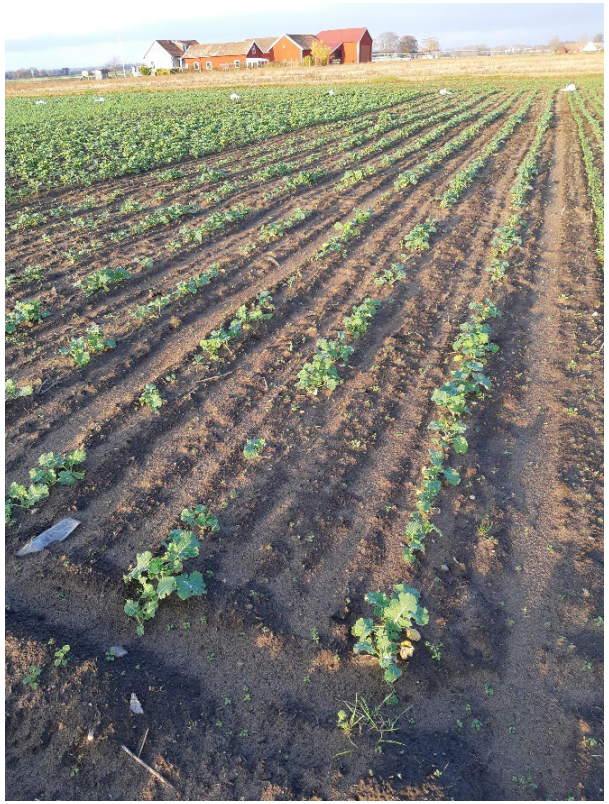
Analyses

- N-uptake and C-uptake in above ground biomass in 2 m^2 cutouts in each plot
  - ✓Before first frost, Nov/Dec
  - ✓Early budding at the end of April
  - ✓End of flowering BBCH 69

  - ✓Injuries of cabbage stem flea beetle assessed in autumn and early spring

Results

Development of winter OSR and legume crops during autumn 2021



Winter OSR 50 cm row distance
Kristianstad, 3 November

Winter OSR and field vetch, 12,5 cm row distance, Linköping, 18 November

Clover mixture (left), fodder vetch (middle) and blue lupin (right), Örebro 22 November

Nitrogen uptake in winter oil seed rape

Treatment	Örebro (kg N ha^{-1})	Linköping (kg N ha^{-1})	Kristianstad (kg N ha^{-1})
Spring assessment			
Row space 12.5 cm	-	22 a	21 a
Row space 50 cm	-	23 a	18 a
1. No legume intercrop	-	25 a	21 a
2. Faba bean	-	20 b	19 a
3. Blue lupine	-	20 b	20 a
4. Common vetch	-	25 a	19 a
5. Clover mixture	-	23 ab	19 a
Summer, BBCH69			
Row space 12.5 cm	13 a	48 b	35 a
Row space 50 cm	16 a	84 a	30 b
1. No legume intercrop	15 a	67 ab	33 a
2. Faba bean	13 a	58 b	31 a
3. Blue lupine	15 a	66 ab	35 a
4. Common vetch	17 a	68 ab	33 a
5. Clover mixture	12 a	71 a	32 a

* The same letters are not significantly different, Tukey´s HSD-test, $p < 0.05$

Seed yield

Seed yield of WOR, 9% ww
Average of row distances (12.5 and 50 cm)

Sampled soil layer, cm	Örebro (kg ha^{-1})	Linköping (kg ha^{-1})	Kristianstad (kg ha^{-1})
1. No legume intercrop	468	2485 a*	1464
2. Faba bean	508	2097 b	1340
3. Blue lupine	625	2141 b	1350
4. Common vetch	710	2500 a	1364
5. Clover mixture	591	2556 a	1276
p-value	*ns*	*0.0003*	*ns*

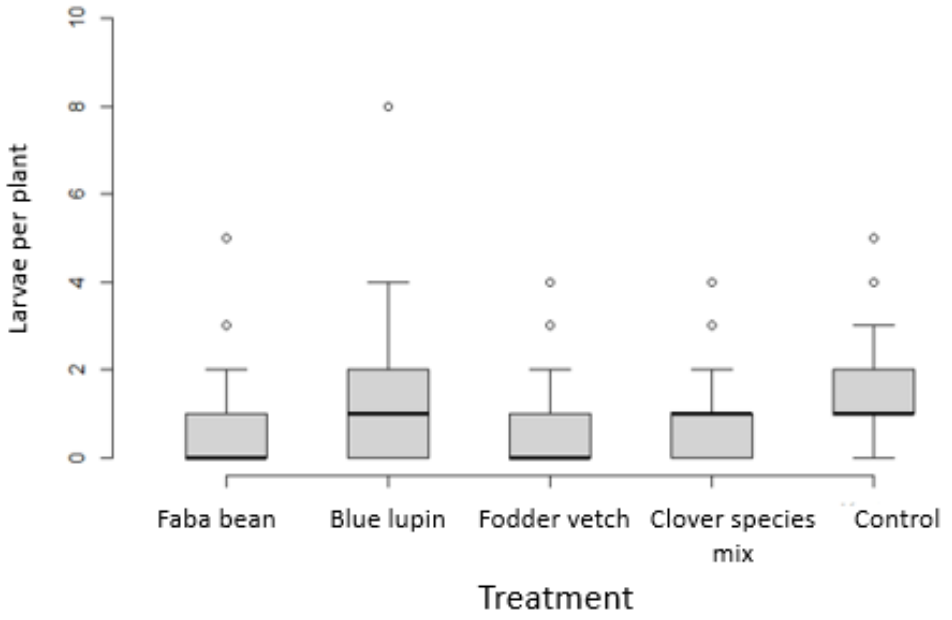
* The same letters are not significantly different, Tukey´s HSD-test, $p < 0.05$

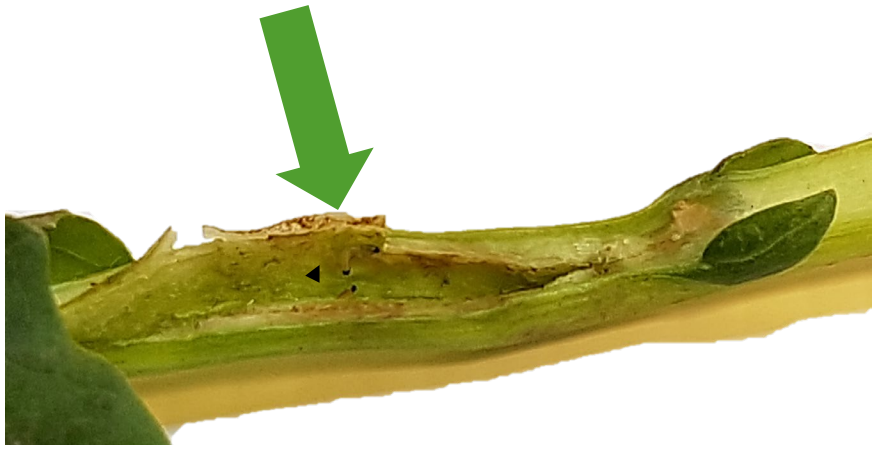
Seed yield of WOR, 9% ww
Average of treatment within row space

Row space cm	Örebro (kg ha^{-1})	Linköping (kg ha^{-1})	Kristianstad (kg ha^{-1})
12,5	548	2047 b*	1461 a
50	613	2665 a	1256 b
p-value	*ns*	*0.0117*	*0.0022*

* The same letters are not significantly different, Tukey´s HSD-test, $p < 0.05$

Occurrence of cabbage stem flea in spring 2023





Summary

- ✓Competition about light affects OSR growth negatively
- ✓Growth of legume species is limited if seeded after interrow hoeing in September
- ✓The benefit of legume intercropping (IC) is pronounced in soils low in nitrogen
- ✓This study indicate that IC has an impact on larval abundance of CSFB

Thank you for your attention!

Clover mixture: squarrose clover, berseem clover and persian clover