



Identifying cropping strategies for sustainable ley farming systems based on legumes

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Introduction

Legume species are recognized as an important component for production of high-protein forage. Red clover (RC; *Trifolium pratense* L.) is the main legume species in mixed swards in Sweden, whereas lucerne, (LU; *Medicago sativa* L.) has been confined to dryer regions with high soil pH. Yield and nitrogen fixation can be severely reduced over time due to root rot, especially in red clover. The objective was to identify strategies for sustainable legume cropping in production cycles. Persistence and production of RC and LU grown in mixed swards with timothy (TI; *Phleum pratense* L.) were compared at one field site where RC and LU were grown for two years and thereafter re-established with RC or LU as pre-crop, four combinations in total.



Figure 1. Root rot symptoms in A) red clover, after 1st harvest year; B) lucerne, after 1st harvest year; and C) lucerne, after 4th harvest year

Conclusions

Lucerne in mixture with TI showed highest total yield whereas yield of RC in mixture with TI were 35% lower than that of LU.

There is a tendency for higher total yield after another legume species.

Lucerne was more tolerant for root rot pathogens compared to RC, however, inocula will be maintained in the soil.

Material & methods

- One large plot field trial was established at Ullberga farm, Nyköping, in central Sweden in 2015: 2 plots of RC, 2 plots of LU and Farmer's choice of species, all including timothy. The plots of RC and LU was re-established after two years with either RC or LU as pre-crop. The crop rotation of farmer's choice was harvested for the fourth year.
- Yield and dry matter content were determined by a three-cut harvest regime by cutting above ground biomass on 8th June, 19th July and 21st September 2019.
- Visual assessment of disease symptoms was performed in 10 roots per plot. DNA was extracted and analysed by qPCR for identification of *Fusarium avenaceum*, *Cylindrocarpon destructans* and *Phoma* spp according to Almquist *et al* (2016).

Results

The yield of RC+TI for 2nd and 3rd cut, as well as the total yield, was significantly lower than the yield of LU+TI (Table 1). Red clover was severely infected by root rot when sown after RC and LU, whereas there was no difference in infection for LU sown after RC or LU.

Table 1. Results for the first harvest year of the second cycle 2019. Total yield for 3-cuts, legume content, disease severity index (DSI) expressed as external (E) and internal (I), and the abundance of *F. avenaceum* (F.a.), *C. destructans* (C.d.) and *Phoma* spp. (Ph.)

	Total yield kg DM ha ⁻¹	Legume content %	DSI _E	DSI _I	F.a.*	C.d.*	Ph.*
RC+TI after RC	7 367 b	91.7	73	35	0.0	2 278	980
RC+TI after LU	8 607 b	98.7	70	38	0.0	2 480	211
LU+TI after RC	13 633 a	98.3	35	23	0.0	294	451
LU+TI after LU	12 547 a	99.3	35	15	0.0	328	3 674
FC (LU)	11 873 a	68.3	53	24	19.0	4 389	10 056
<i>p</i> -value	<0.001						
Coeff. of variance	6.8						

*The abundance of the pathogens is expressed as the number of gene copies per 10⁶ copies of the plant cox gene. LU: lucerne, RC: red clover, TI: timothy, FC: farmer's choice (LU). ANOVA-procedure were used for the statistical analyses. Different characters indicate significant differences according to Tukey's HSD test (p<0.05).



Reference

Almquist, C., Stoltz, E., Wallenhammar, A.C., 2016. Incidence of root pathogens associated to clover root rot in Sweden. Grassland Science in Europe 21, 786–788