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Introduction

Legume cover crops can be used in rotation with winter wheat and grain corn to reduce nitrogen (N) losses in the fall and increase available nitrogen in the soil prior to corn planting¹. With increased understanding of which management options result in optimal nitrogen conservation in cropping systems, grain corn growers could integrate legume cover crops into their systems. This practice could reduce the amount of nitrogen available for loss in the fall and increase available nitrogen to the corn crop, thereby allowing a reduction in nitrogen fertilizer use.

Objective: Quantify the effect of legume cover crops on plant available nitrogen in the fall and spring prior to planting of grain corn.

Results and Discussion

- Cover crops can reduce the amount of soil mineral N available for loss in October (Table 1)
- Alfalfa and red clover have higher plant available N (soil and plant N content) in May as compared to the control when the cover crop is spring terminated (Figure 1)

Table 1: Effect of cover crop species on soil mineral N (SMN) and plant available N (PAN) in October at 0-60cm depth

Crop	SMN	PAN
	kg N ha ⁻¹	
No Cover	24.1 a	26.3 c
Crimson clover	13.8 b	49.3 bc
Alfalfa	13.1 b	65.5 ab
Red clover	14.3 b	85.0 a

a-c: Means in each column followed by the same letter were not significantly different based on LSD treatment contrast



Photo 2: Cover crop biomass sampling in Fall 2013

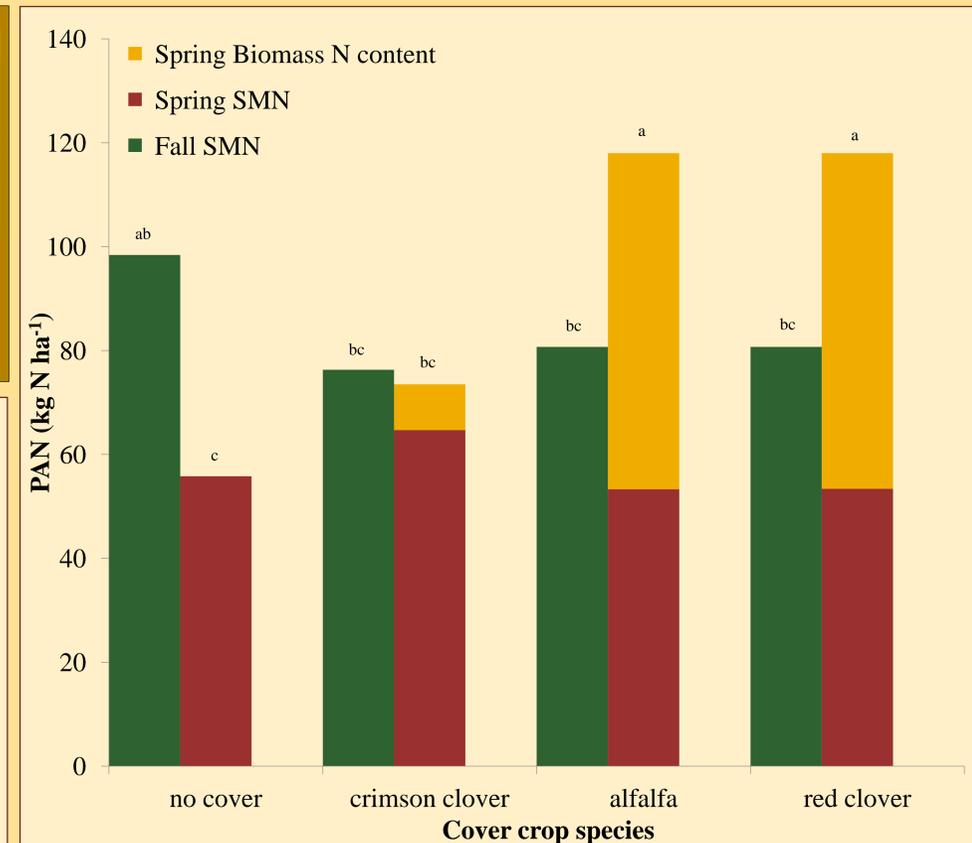


Fig 1: Total plant available N (PAN) under three cover crops and no cover with fall and spring termination.

a-c: Bars followed by different letters were significantly different based on LSD treatment contrasts

Materials and Methods

Design:

- 4 fields on Ridgetown Campus: 2 Brookston clay loam and 2 Brookston sandy loam
- Randomized complete block design with 4 reps
- 2 field sites each 2012-2013 and 2013-2014
- 3 cover crop species and control (no cover)
 - Red clover (*Trifolium pratense* L.)
 - Crimson clover (*Trifolium incarnatum* L.)
 - Alfalfa (*Medicago sativa* L.)



Photo 1: cover crop biomass sampling in October 2012

- Termination of fields done in late October and May via tillage

Sampling:

- Soil and biomass samples collected at fall and spring termination of cover crops
- ½ m² of cover crop above-ground biomass per plot
- 4 soil cores per plot at depths of 0-15 cm, 15-30 cm, and 30-60 cm

Analysis:

- Biomass samples dried at 60° C, weighed and analyzed for C and N content using dry combustion
- Soil samples were sieved, KCl extracted and analyzed for NO₃⁻-N and NH₄⁺-N using an autoanalyzer²
- Statistical analysis by ANOVA in PROC MIXED using S.A.S. version 9.4

Table 2: Effect of year, month and cover crop species on plant growth and nitrogen characteristics

Year	Month	Crop	Above ground	N content	C:N
			biomass (kg ha ⁻¹)	(kg N ha ⁻¹)	
2012	Oct	Crimson clover	1190 bcd	38.4 bcd	11.0 bc
		Alfalfa	814 bcd	29.5 cd	9.80 de
		Red clover	734 cd	24.2 d	10.6 cd
2013	May	Crimson clover	496 de	11.1 e	13.5 a
		Alfalfa	1530 b	52.8 ab	9.60 ef
		Red clover	1520 b	44.6 bc	10.5 cd
2013	Oct	Crimson clover	617 cd	8.14 e	14.2 a
		Alfalfa	1260 b	45.0 bc	10.1 de
		Red clover	3140 a	85.9 a	11.7 b
2014	May	Crimson clover	22.6 e	.	.
		Alfalfa	1210 bcd	57.0 ab	8.90 f
		Red clover	1570 b	60.0 ab	9.40 ef

a-f: Means in each column followed by the same letter were not significantly different based on LSD treatment contrast
. Means were not estimated due to limited plant growth in these plots

← Red clover had the highest above-ground biomass. Crimson clover had limited growth and winter survival.



Photos 3 and 4: Cover crop plots in May 2014 after fall tillage (left) and prior to spring tillage (right)



Conclusions

- The tested cover crops have the potential to reduce N available for loss during the usual fallow period (July-May)
- Red clover and alfalfa increase the total amount of N in the system and this increase is most noticeable with spring termination of cover crops
- Crimson clover did not produce the same results as red clover and alfalfa because of poor growth and low winter survival. Caution must be taken when interpreting the N dynamics of crimson clover

For more information

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Acknowledgements: The authors would like to acknowledge the funding sources (listed above and to the side) and the assistance of Mike Zink, Jessica Turnbull, summer students, co-op student and all Ridgetown graduate students.



References:

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