Cover Crops Before Sweet Corn: Does This Mean Less Nitrogen Fertilizer?

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Introduction

Early season crops, like peas, can leave fields fallow for up to nine months, which can lead to soil erosion and nitrate leaching. Post-harvest planted cover crops can absorb and store N, thereby potentially reducing N losses[1]. Cover crops are currently part of nutrient management plans; however, their ability to minimize N leaching and supply N to following crops is not known in vegetable production. Information regarding N credits of cover crops in horticultural systems needs to be gathered and assessed to improve N best management practices.

Methodology

- A field experiment was established in 2006 in a pea – cover crop – sweet corn rotation near the University of Guelph Ridgetown Campus
- Crops included: 1) peas "Encore" and 2) sweet corn "Temptation"
- Cover crop treatments included: 1) oats, 2) fall rye, 3) oilseed radish + rye (OSR+rye) and 4) no cover control (Fig.1)
- Cover crops were planted August 4, 2006
- Nitrogen treatments in the sweet corn were 0 and 125 lb N/ac.
- Soil N was measured in the fall during cover crop growth and during the following sweet corn growing season
- Cover crop biomass and N content was quantified in the fall and spring
- Marketable and total sweet corn yields were determined in both nitrogen treatments

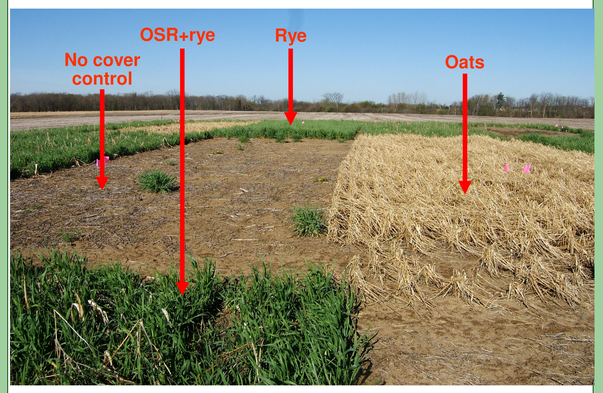

Figure 1. Cover crop treatments in May 2007.

Objectives

1. To quantify N uptake by cover crops
2. To estimate N release from different cover crops to the next season's sweet corn crop
3. To determine if cover crops contribute an N credit to the following crop

Soil N Concentrations

- By October, 2.5 months after cover crop planting, compared to the no cover control, all cover crops had lower soil mineral N in the fall due to N uptake in the shoots (Fig.2&4)
- By December, soil mineral N was lower in oats and rye, while soil mineral N in the oilseed radish + rye was not different from the control (Fig.2)
- The following spring, soil nitrate levels in the top 30cm were lower in rye compared to the no cover crop control (Fig.3)
- With 125 lb N/ac applied to the sweet corn crop, there were no differences between cover crops in soil mineral N (not shown)
- Soil nitrate levels peaked in June, during the sweet corn growing season (Fig.3)

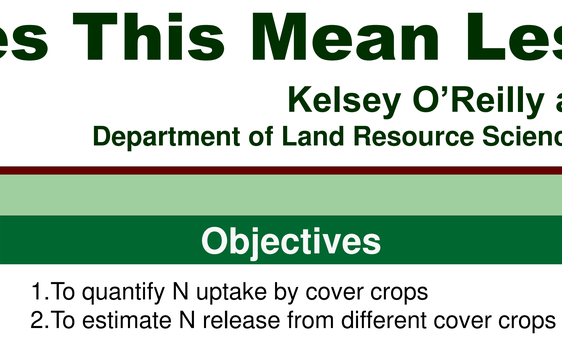

Figure 2. Soil mineral N (nitrate-N and ammonium-N) content from 0-90cm depth in the pea-cover crop rotation in 2006. At each sample date, cover crops with different letters indicate a statistically significant difference.

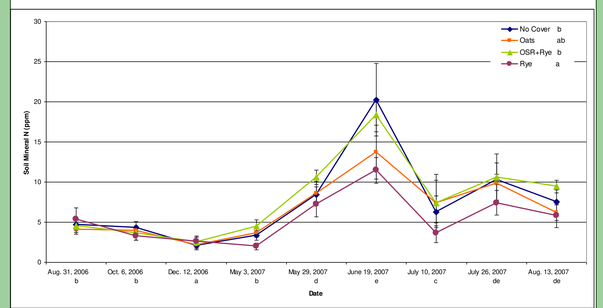

Figure 3. Soil mineral N (nitrate-N) content from 0-30cm depth under the 0 lb N/ac treatment. Cover crops and dates with different letters indicate a statistically significant difference.

Cover Crop N Uptake

- In October there was no difference in N uptake between the three cover crops (Fig.4)
- In December, oats had higher N uptake than rye, due to higher biomass production (Fig.4&6)
- In the spring, rye had significantly higher plant N uptake than the other two cover crops, which was consistent with rye growth (Fig.5&6)

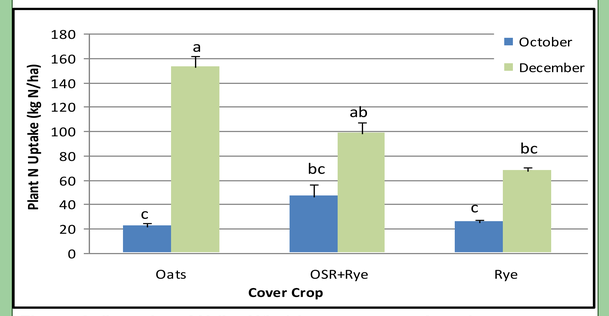

Figure 4. Quantity of N (kg N/ha) in cover crop plant tissue collected in October and December after cover crop planting in August 2006. Cover crops with different letters indicate a statistically significant difference.

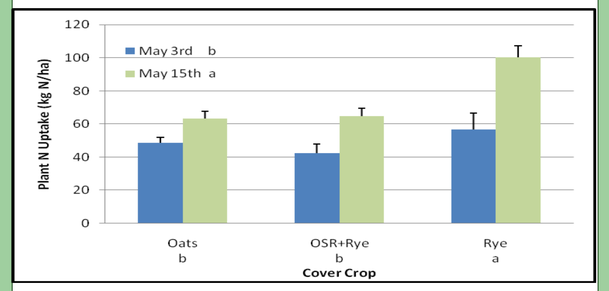

Figure 5. Quantity of N (kg N/ha) in cover crop plant tissue collected in May after cover crop planting in August 2006. Cover crops and dates with different letters indicate a statistically significant difference.

Cover Crop Biomass Production

- Overall, all three of the cover crops established well and produced significant biomass to provide protection from wind and water erosion (Fig.6)

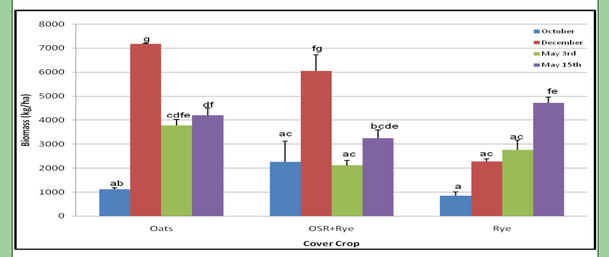

Figure 6. Cover crop biomass production (kg/ha) collected in October, December and May. Cover crops with different letters indicate a statistically significant difference.

Cover Crop & N Rate Effect on Sweet Corn Yields

- Cover crop treatments had no impact on marketable or total sweet corn yield (Table 1)
- As expected, the 125 lb N/ac N rate had significantly higher total and marketable yields than the 0 N rate (Table 1)

Table 1. Total yields for each cover crop treatment under the 0 and 125 lb N/ac treatments. Treatments with different letters indicate a statistically significant difference.

Cover Crop	Total Yield (t/ha)	
	0 lb N/ac	125 lb N/ac
No Cover	5.0 a	9.3 b
Oats	8.6 a	11.6 b
OSR+Rye	8.6 a	10.7 b
Rye	5.1 a	10.4 b
Average	6.8	10.5

Discussion

- All cover crops established well, produced significant biomass and trapped N in the fall
- Compared to oats or rye, oilseed radish + rye was considered "leaky" because soil mineral N levels increased in December due to the rapid break down of oilseed radish residues. Therefore, N leaching may be delayed, not prevented
- Cover crops did not positively or negatively affect sweet corn yields
- The dry 2007 growing season impacted overall sweet corn yields
- Under 0 N control, in the sweet corn crop, there was lower soil nitrate in the rye treatment due to N immobilization. However, this was not observed when N fertilizer was applied
- In the fertilized sweet corn crop, there appears to be no N credit or penalty to planting the cover crops tested

References

1. Huntington, T.G., J.H. Grove, and W.W. Frye. 1985. Release and recovery of nitrogen from winter annual cover crops in no-till corn production. Commun. in Soil Sci. Plant Anal. 16(2):193-211.

Acknowledgements

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