# Which cover crop type you grow could impact cucumber yield

Lindsey Cartier[1], Gary W. Parkin[1] and Laura L. Van Eerd[2]
[1]School of Environmental Science, University of Guelph, Ridgetown Campus,
[2 1]School of Environmental Science, University of Guelph

## Introduction

Short season crops, such as cucumbers, provide an opportunity for growers to plant a cover crop. Beyond soil quality considerations, cover crops absorb soil mineral N over the fall growing season. Although knowledge of N uptake and release in Ontario vegetable production has increased recently[1,2,3], there is still a large knowledge gap in the contribution of cover crops to N cycling in the subsequent crop. Moreover, there is very little information on cover crop effect on horticultural crop yield. In May 2008, a field study in a cucumber – cover crop – cucumber rotation was initiated with the objective of determining the effect of cover crop type, planting date and rye biomass removal on N dynamics of over the rotation.

## Materials and Methods

- Field experiment established in a cucumber – cover crop – cucumber rotation at the University of Guelph, Ridgetown Campus from May 2008 to July 2010.
- Randomized split-split plot design with 4 replicates, split-plot size 9 x 9 m, split-split-plot size 9 x 4.5 m.
- Main effect: cover crop type

| | Seeding rate (lb ac$^{-1}$) |
|---|---|
| - No cover control | - |
| - Oilseed radish (OSR, winter-kill) | 12 |
| - Cereals: - Oats (winter-kill) | 72 |
| - Cereal rye (overwinter) | 120 |
| - Legumes:- Forage peas (winter-kill) | 200 |
| - Hairy vetch (overwinter) | 25 |

- After cucumber harvest, the crop was stock-chopped, incorporated, and cover crop seed drilled in.
- Secondary effects: cover crop planting date and spring rye biomass removal
  – Early and late planted the first week of August and first week of September in 2008 and 2009.
  – Spring rye removal on April 27 2009, where the cover crop aboveground growth was mowed and harvested from the field plot.
- Cover crop aboveground biomass was collected from two ½ m$^2$ quadrants in Oct. and Apr. and one ½ m$^2$ quadrant in November.
- Total N content determined by dry combustion method using a LECO CN determinator.

## Results and Discussion

**Table 1.** Quantity of cover crop aboveground tissue and recoverable residue in the fall and following spring, respectively. Dates with different letters indicate a significant difference between treatments.

| Cover Crop | Planting Date | *Biomass (kg ha$^{-1}$) | | |
|---|---|---|---|---|
| | | Fall 2008 | Spring 2009 | Fall 2009 |
| OSR | Early | 4597 a | 3753 abc | 5307 a |
| OSR | Late | 1469 de | 1134 e | 2330 b |
| Oats | Early | 3856 ab | 3304 abcd | 5314 a |
| Oats | Late | 672 f | 1661 cde | 1293 c |
| Peas | Early | 3355 abc | 3391 abc | 4747 a |
| Peas | Late | 656 f | 1248 de | 1241 c |
| Rye | Early | 2588 bc | 3895 ab | 2360 b |
| Rye | Late | 1121 e | 4720 a | 1799 bc |
| Rye Removed | Early | | | 2142 b |
| Rye Removed | Late | | | 2072 b |
| Vetch | Early | 2212 cd | 3845 ab | 2632 b |
| Vetch | Late | 658 f | 2342 bcde | 562 d |

* All biomass data was analyzed separately for 2008 and 2009.

- All cover crops established well, producing significant amounts of biomass (Table 1).
- Early planted cover crops accumulated significantly more biomass in October compared to November in 2008. While in
- 2009, early planted cover crops had accumulated more biomass
- by November (data not shown).
- In both years the early planted OSR, oats and peas all produced more biomass compared to the same cover crops planted one month later.

- By November in 08/09 the early-planted oats, OSR and peas were in the reproductive stage of development (data not shown).
- In the fall 08, there was a planting date by sample time interaction, with late-planted cover crops having lower N content than early-planted cover crops (data not shown).
- In the fall 09, there was a planting date by cover crop interaction, with the peas and vetch having a higher N content when sampled in November compared to October (data not shown).

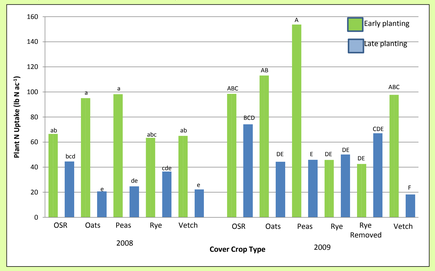


**Figure 1.** Quantity of nitrogen in cover crop aboveground tissues and recoverable residue collected in the fall 2008 and 2009. Different letters indicate a statistically significant difference.

- The early planted vetch, oats and peas had higher N content compared to the same cover crops planted one month later (Fig. 1).
- In the fall 08, there was no difference in N uptake among late-planted cover crops, but late-planted OSR had higher N uptake than oats and vetch (Fig. 1).
- In the fall 09, all late-planted cover crops had higher N uptake compared to vetch (Fig. 1).

- As expected, cover crop % N content in the fall was higher than in the spring (data not shown).
- In the following spring, late-planted rye had higher N uptake than other late-planted cover crops, which was consistent with spring rye biomass production (Table 1; Fig. 2).

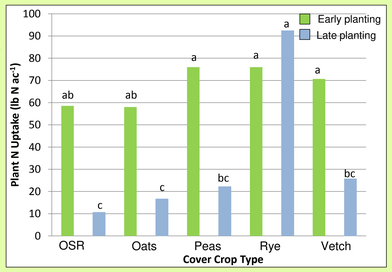


**Figure 2.** Quantity of nitrogen in cover crop aboveground tissues and recoverable residue collected in April, 251 and 291 DAP. Different letters indicate a statistically significant difference.

**Table 2.** Cucumber yield (t ha$^{-1}$) and yield income ($ ha$^{-1}$)* in 2009. Cover crop treatments with different letters indicate a statistically significant difference.

| Cover Crop | Marketable yield (t ha$^{-1}$) | Marketable yield income ($ ha$^{-1}$) |
|---|---|---|
| No Cover | 7.17 cd | 2235 cde |
| No Cover + N | 12.25 a | 3405 a |
| OSR + 0N | 10.10 ab | 2933 ab |
| Oats + 0N | 9.19 bc | 2988 ab |
| Peas + 0N | 9.89 abc | 2569 bc |
| Rye + 0N | 6.13 d | 1871 e |
| Rye Removed + 0N | 7.35 bcd | 1975 de |
| Vetch + 0N | 9.32 bc | 2474 bcd |

*Yield income was determined by the total grade weight and the 2009 grower- industry agreement for purchasing for hand harvested cucumbers (as described by the Smucker Foods of Canada Co./Strub Brothers Agreement and Award for Marketing the 2009 Crop of Cucumbers for Processing) from the harvest area measuring 2.5 x 3 m.

- The no cover + N received 278 lbs N ac$^{-1}$ (27-0-0).
- The higher yield in the No Cover + N did not translate into a significantly higher marketable yield income compared to OSR + 0N and oats + 0N (Table 2).
- The lower yield in the rye + 0N resulted in a lower marketable yield income which was not different from the rye removed. This is likely due to N immobilization or late spring biomass incorporation resulting in a reduced cucumber stand count (data not shown).

- Cucumber marketable yield among the cover crop treatments was higher in the OSR and oats compared to the No Cover (Table 2).

## Conclusions

- Biomass growth alone is not a good indication of N uptake.
- Cover crop biomass growth and N uptake suggests that the effect of planting date may be specific to cover crop type.
- Early planting is preferred for optimizing cover crop biomass and N uptake, but if planting is delayed then OSR is recommended.
- The reduced cucumber yield and income shown under the rye treatments may not be a direct result of the cover crop, but rather the result of the importance of a timely spray and biomass incorporation.
- The impact of cover crop N uptake on the subsequent cucumber crop will be evaluated.


Figure 3. a,b) Early-planted cover crops 31 DAP

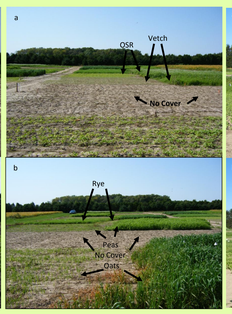


Figure 4. a,b) Early- and late-planted cover crops 60 & 29 DAP, respectively

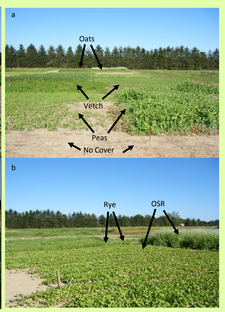


Figure 5. a,b) Early- and late-planted cover crops 90 & 59 DAP, respectively

## Acknowledgements & References

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