Adjusting nutrient management when using cover crops

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Multi-site and multi-year research is underway to evaluate cover crops as funded by the WI Fertilizer Research Council.

Objectives:

• Evaluate growth of fall seeded cover crops and their effect on soil nitrate
  • post corn silage harvest and manure application
  • no-till

• Determine yield and optimal N rate for corn following different cover crops
Research was conducted at UW Agricultural Research Stations

- **Arlington, South Central WI**
  - Plano silt loam
  - Very deep, well drained

- **Marshfield, North-central WI**
  - Withee silt loam
  - Somewhat poorly drained

- **Lancaster, SW “Driftless” WI**
  - Fayette silt loam
  - Well-drained
  - 2-6% slopes; moderately eroded
Evaluating cover crops following corn silage harvest and fall manure application

Four treatments:
• No cover crop
• Spring Barley (71-140 lb/ac)
• Winter rye (75-120 lb/ac) – terminated in spring
• Triticale (69-173 lb/ac)
  • Harvested as a forage crop
Evaluate the effects of cover crops on key parts of the production system

• Fall erosion control – how well does it grow and cover?
• Fall soil nitrate – how much less nitrate was potentially leached?
• Presidedress nitrate test – did the cover crop take away from this estimate of the manure N credit?
• Yield – were the covers a benefit or cause a drag?
• Response to N – is more or less N required to achieve optimal yields?
All fall manure is not alike.
Cover crop growth
Fall growth of cover crop ranges from minimal to excessive.

<table>
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<th>Date</th>
<th>Fall’14</th>
<th>Date</th>
<th>Fall’15</th>
<th>Date</th>
<th>Fall’16</th>
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November 13, 2014
Lancaster ARS
1/8 ton DM biomass
November 14, 2014

Arlington ARS

1/3 ton DM biomass
November 16, 2016

Marshfield ARS

\(\frac{3}{4}\) to 1 ton DM biomass
Fall Soil nitrate
One-third of a ton of biomass can lead to a decrease of 25 lb-N/ac in the upper 2’ of soil

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<th>Fall 2014 nitrate-N reduction</th>
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<td></td>
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<tr>
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<td>1</td>
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<td>2</td>
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Manure nitrogen credits
Cover crops wipe out some of the manure N credit based on PSNT

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<th>ARL N credit</th>
<th>LAN ppm</th>
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<th>MAR ppm</th>
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<tr>
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<td>0</td>
<td>6</td>
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Yields
Yield drag flowing covers, although with spring barley can be reduced with more N

<table>
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<th>Nitrogen Rate (lb-N/ac)</th>
<th>Corn Yield (bu/ac)</th>
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<tr>
<td>0</td>
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<tr>
<td>50</td>
<td>10</td>
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<td>100</td>
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<td>150</td>
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<td>200</td>
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<tr>
<td>250</td>
<td>260</td>
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<tr>
<td>300</td>
<td>280</td>
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- None
- Winter Rye (1.5 ton DM/ac)
- Spring Barley (0.75 ton DM/ac)

Arlington ARS
Flat responses at LAN, but still yield drag with spring barley. Larger yield drag (+30 bu/ac) with winter rye.
Same trend at MAR with small yield drag with barley, larger drag with rye.
No yield drag, but different optimum N rate for winter rye (Lancaster 2015)
No statistical difference in yields among no cover and winter-killed covers (Arlington 2015)

\[ R^2 = 0.85 \]

\[ R^2 = 0.90 \]
Corn

Average Yield Difference of the 50 trials displayed: **0.0** bu/acre.

90% Confidence Interval for the Average Yield Difference: from **-1.0** to **1.0** bu/acre.

Soybean

Average Yield Difference of the 12 trials displayed: **0.2** bu/acre.

90% Confidence Interval for the Average Yield Difference: from **-0.6** to **1.0** bu/acre.
Corn yields, 2009-2014

Cover crop resulted in:
- Yield improvement
- No change
- Yield reduction

Soybean yields, 2009-2013

Figure 2. Trends with respect to cover crop effect on corn yields at 28 site-years from 2009 to 2014.

Figure 3. Trends with respect to cover crop effect on soybean yields at 18 site-years from 2009 to 2013.
2013 Corn Yields
Washington County, WI
No-till corn following winter wheat
Yield response from Janesville in 2010 shows a 46 lb-N/ac N credit from red clover (plus yield gains)
What nutrient management adjustments should I make when using cover crops

• With grass cover crops –
  • Use nitrogen in starter fertilizer
  • Don’t expect residual soil nitrate (i.e. no PPNT credit)
  • If excessive growth, reduce the N credit you are taking with fall applied manure (how much – I don’t know yet)

• With radish –
  • No change

• With legumes –
  • Can take a 40 to 60 pound N credit with good growth
Questions?
Comments?
Concerns?
Grasses

Winter rye (or cereal rye)
Annual ryegrass
Oat
Barley
Triticale

- Establish and grow quickly
- Scavenge soil nitrogen
- High C:N ratio
Brassicas

Radish
Mustard
Turnip

• Slower to establish
• Scavenge soil nitrogen (even more than the grasses if given enough time)
• Medium C:N ratio
Legumes

Red Clover
Berseem Clover
Crimson Clover
Hairy Vetch

• Slower to establish
• Fix N from atmosphere
• Low C:N ratio