Late Summer Cover Crops after Small Grains or Vegetables

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Webinar Outline

Moving Toward Soil Health – Maximizing the Growing Season
Jamie Patton – NPM

Cover Crops Following Short Season Crops – Common Species, Mixes, Management Tips
Daniel H. Smith – NPM

The Power of Legumes
Mike Ballweg – Extension Sheboygan County

Small Grains for Forages and Covers – Management, Varieties and Yields
Kevin Shelley – NPM
Moving Towards Soil Health – Maximizing the Growing Season

Jamie Patton

University of Wisconsin – Madison, Nutrient and Pest Management Program
Late Summer Crop Harvest... The Potential

- The potential of bare soil...

Photo credit – Brad Rybicki
Late Summer Crop Harvest...

The Potential

• The potential of late summer cover crops...
Plenty of Precipitation to Come…

Protect and Store

Average Monthly Rainfall (inches) – Stevens Point, WI

Total average rainfall – 33 inches

Jan 1 to July 31 – 19.2 inches
Aug 1 to Dec 31 – 13.8 inches

Aug 1 to May 1
21 inches of precipitation
58 events

Average Monthly Rainfall Totals – Stevens Point, WI - NOAA
Portage County - Annual Growing Degree Days

Total Annual GDDs – 4264

Jan 1 to July 31 – 2422
Aug 1 to Dec 31 – 1842

GDDs Base 40 for (44.4, -89.5) – Average 2016-2019, [https://agweather.cals.wisc.edu/thermal_models/degree_days](https://agweather.cals.wisc.edu/thermal_models/degree_days)
Cover Crops Following Short Season Crops – Common Species, Mixes, Management Tips

Jamie Patton and Daniel H. Smith

University of Wisconsin – Madison, Nutrient and Pest Management Program
So Many Cover Crop Species...  
What do I Plant?

• Matches goals for:
  • Economic outlay
  • Cost share requirements
  • Cover cropping goals
  • Management options
    • What equipment do you have?
    • Are you going to use herbicides for termination?
    • How much time for management do you have?
    • How comfortable are you with risk?
    • Do you have manure to apply?
    • ...
Plenty of Water and GDDs...

Opportunity for Diverse Mixes

- Soil cover during April-June

- Diversity in:
  - Root architecture
  - Plant exudates
  - Temporal growth
  - C:N ratios

Endless possibilities:

- Grasses
  - Cereal grains
  - Grasses
- Legumes
  - Clovers
  - Vetch
  - Peas/beans
- Broadleaves
  - Brassica
  - Sunflowers
Get the Basics Right...

Use Your Resources

- Extension
- Demo Farms/Farmer-led Watersheds
- Agronomists
- Co-op/Seed Representatives
- Midwest Cover Crop Council
  - [http://mccc.msu.edu/covercroptool/covercroptool.php](http://mccc.msu.edu/covercroptool/covercroptool.php)
Cover Crop Seeding Methods

After Small Grains

Photo: Ted Bay
Seed as Soon as Possible

Watch Seeding Depth!

Photo: Ted Bay
A Month After Seeding

Volunteer wheat control may be desired (alternative: use volunteer wheat as part of cover crop mix). However, we do not recommend waiting for volunteer wheat emergence and termination to seed a cover crop.
A Few More Considerations

Seeding, Tillage, Manure
A Few More Considerations

Herbicide Persistence/Carryover

- May result in cover crop damage and stand failure
- Can be avoid by careful selection of herbicides

Influence Factors

- Chemical properties of the herbicide
- Rate of application
- Soil pH
- Organic matter content
- Amount of surface plant residue
- Temperature
- Rainfall
- Microbial degradation

Citation: Walsh, Joseph D., Michael S. Defelice, and Barry D. Sims. "Soybean (Glycine Max) Herbicide Carryover to Grain and Fiber Crops." Weed Technology 7 (1993): 625-32
# A Few More Considerations

## Termination

<table>
<thead>
<tr>
<th>Winterkill</th>
<th>Crimping</th>
<th>Mowing</th>
<th>Tillage</th>
<th>Herbicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola/Radish</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Red Clover</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>?</td>
</tr>
<tr>
<td>Crimson Clover</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>Berseem Clover</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>Winter Pea</td>
<td>Maybe</td>
<td>No</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Sweet Clover</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>?</td>
</tr>
<tr>
<td>Hairy Vetch</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>Legume</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate + dicamba or 2,4-D</td>
</tr>
<tr>
<td>Grasses/Small Grains</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate 4.5 lb ae per gal, 16-32 fl oz per acre</td>
</tr>
</tbody>
</table>

- **Tillage Note:** May require multiple passes and tillage should fully incorporate cover crop to prevent regrowth.
The Power of Legumes After Short Season Crops

Mike Ballweg
University of Wisconsin – Madison, Division of Extension, Crops and Soils Educator Sheboygan County

Matt Ruark
University of Wisconsin – Madison Soil Science Department
Berseem, Crimson Clovers, Barley & No Cover Crop
3 year study – Sheboygan County

• Soil – Kewaunee Silt Loam

  – Berseem clover – (10 – 12) lbs./ac
  – Crimson clover - (10 -12) lbs./ac
  – Barley - 60 lbs./ac

• Sethoxydim application to clover and no cover treatments

• Biomass harvesting – early November all years (after a hard freeze - end of growth)

• Nitrogen fertilizer, broadcast urea with Agrotain®
  8 N rates (0, 40, 80, 120, 160, 200, 240, 280 lbs./ac

• Solid stands to help understand the contribution to cropping system
Crimson Clover

Nov. 12, 2014
Crimson Clover—Spring Residue

April 23, 2014
Berseem Cover Crop
Barley Crop Residue

No Cover Crop

April 30, 2015
Cover Crop DM Yields After Wheat

Crimson – 1.13 DM/Ton/ac
Berseem – 1.36 DM/Tons/ac
Barley – 1.80 DM/Tons/ac
Barley Cover Crop

Barley
40 lbs – N/ac in AGB
C:N 35

Mike Ballweg
UWEX - Sheboygan County
November 9, 2016
Carbon/Nitrogen Ratio

November Biomass Harvest

Carbon: Nitrogen – Neutral 25:1

38.56

2013 2014 2015 2016

Crimson
Berseem Oats Barley

Both crimson and berseem clovers provide yield benefits - 2015 - Sheboygan County

Means and stats excluding N = 0

<table>
<thead>
<tr>
<th>Cover Crop</th>
<th>Yield (bu/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CC</td>
<td>174 b</td>
</tr>
<tr>
<td>Crimson</td>
<td>191 a</td>
</tr>
<tr>
<td>Berseem</td>
<td>188 a</td>
</tr>
<tr>
<td>Barley</td>
<td>154 c</td>
</tr>
</tbody>
</table>

Clover Covers vs. No CC 15.5
N Credit, 55 lb/acre

Yield (bu/a)

N Rate (lb/a)

Clover

\[ y = 176.8 + 0.5318x - 0.0021x^2 \]

\[ r^2 = 0.3083 \]

N max = 127

No clover

\[ y = 104.9 + 0.9459x - 0.0026x^2 \]

\[ r^2 = 0.9021 \]

N max = 182
The graph shows the relationship between corn yield (bu/ac) and nitrogen rate (lb/ac) for different cover crops. The graph includes three lines representing the yield for no cover, crimson clover, and berseem clover. The y-axis represents the corn yield in bushels per acre (bu/ac), and the x-axis represents the nitrogen rate in pounds per acre (lb/ac).
2015 corn yields showed an increase of 9% (15.5 bu./ac) when following Berseem and Crimson Clovers compared to no-cover crop. 2016 showed a very similar yield trend with a 7% (13.4 bu./ac) increase when corn followed clovers as compared to no cover crop. The 2017 yield advantage when corn followed clovers was 4.3% (9 bu/ac) when compared to not covers.
Berseem, Crimson, Barley Mix

- Berseem: 4 lb/ac
- Crimson: 4 lb/ac
- Barley: 40 lb/ac

Planted 8/15/2014
DM on 11/12: 1.6 ton/ac
Berseem and Crimson Mix

Berseem: 6 lb/ac
Crimson: 6 lb/ac

Planted 8/15/2014
DM on 11/12: 1.4 ton/ac
Corn yield response to winter cover crops based on cover crop species and region. Miguez and Bollero (2005). Results adapted by: Heggenstaller, DuPont Pioneer
In Summary - Things to consider

- Corn following annual clovers yielded 10 – 15 bu/ac (6.8%) more than no cover crop...rotational benefits.
  - studies show ~ a 10% yield increase when corn follows alfalfa due to rotational benefits

- Corn yields following barley were lower yielding 2 of 3 years. N immobilization

- Greater amounts of carbon (biomass) may result in immobilization of N thus requiring additional N for optimal yields.

- N immobilization (following barley) may have been lessen if no-tilled into the barley residue....no data
Remember the Inoculant
Acknowledgments

• Matt Ruark, UW-Madison, Soil Science Department
• Jamie West, Research Specialist, UW-Madison Soil Science Department
• Richard Proost, UW-Madison, NPM
• Many UW-Madison students
Summer Planted Spring Cereal Grains for Fall Cover and Forage

Kevin Shelley

University of Wisconsin – Madison, Nutrient and Pest Management Program
Summer Planted Spring Cereal Grains for Fall Cover and Forage

- Winter cereal grains (rye, wheat, triticale)
  - Winter hardy with rapid spring growth
  - Vernalization required for stem elongation
- Spring grains yield more for fall harvest
  - Stem elongation occurs
  - Growth continues well into October
  - But they will not over-winter
- Forage yields (biomass) highest in WI forage trials = oats or barley
  - 1.5 to 3.0 TDM per-acre biomass/forage yield
Spring planted cereal grains

- Fast early-season growth through vegetative stages
- Long-day photoperiod induces flowering
- Yield and nutritional quality optimized at “boot stage,” after which there is rapid:
  - Decrease in protein, energy and digestible fiber
  - Increase in un-digestible fiber
  - Increase in yield (of lower quality forage)
- Harvest window = narrow

<table>
<thead>
<tr>
<th>Harvest Stage</th>
<th>Crude Protein</th>
<th>NDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boot</td>
<td>16-18</td>
<td>52-54</td>
</tr>
<tr>
<td>Heading</td>
<td>14-16</td>
<td>56-58</td>
</tr>
<tr>
<td>Milk</td>
<td>12-14</td>
<td>59-61</td>
</tr>
<tr>
<td>Dough</td>
<td>10-12</td>
<td>59-61</td>
</tr>
</tbody>
</table>
Summer planted spring cereal grains

- Slower growth through vegetative stages
- Long-day requirement for flowering disrupted
- Cereals undergo hardening process as winter approaches
  - Cellular accumulation of sugars
  - More stable concentrations of fiber (NDF) and energy (TDN)
- Wider harvest window

Source: Coblentz, Wayne, USDA ARS Dairy Forage Research Center
• Seed oats at 2.5 to 3 bu/acre (80 – 100 lbs/acre)
  • $25 - $45 per-acre seed cost
• Drill 1-2” deep or broadcast and lightly till-in.
• Requires **40-60 lbs N**, 20 lbs P₂O₅, 90 lbs K₂O
  • $25 - $35 per acre fertilizer N cost, or
  • Manure application 5000-7000 gal or 25 tons per-acre
Effect of planting date and variety on yield of fall-grown oat (Marshfield, WI; 2007-2009)

Source: Coblentz, Wayne, USDA ARS Dairy Forage Research Center
Oat cultivar yields from mid-August planting: 2-year means at Prairie du Sac, WI

Coblentz, Wayne and Mike Bertram, 2012. Fall grown oat forages: Cultivars, planting dates and expected yields.
Variety according to planting date

- **Objective:** maximize forage/biomass yield, but not heading

- **Central WI**
  - July 20 to August 5 - late maturing or forage-type varieties.
  - August 5 to 15 – plant earlier maturing grain-type varieties
# Fall forage oats – enterprise budgets

<table>
<thead>
<tr>
<th>Yield TDM/acre</th>
<th>1.5&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2.0&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2.5&lt;sup&gt;b&lt;/sup&gt;</th>
<th>3.0&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value $/TDM</td>
<td>120</td>
<td>120</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>Value ($/acre)</td>
<td>180</td>
<td>240</td>
<td>325</td>
<td>390</td>
</tr>
<tr>
<td>Seed (100 lbs)</td>
<td>28</td>
<td>28</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Planting</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Nutrient inputs</td>
<td>52</td>
<td>56</td>
<td>60</td>
<td>64</td>
</tr>
<tr>
<td>Harvest&lt;sup&gt;c&lt;/sup&gt;</td>
<td>70</td>
<td>89</td>
<td>108</td>
<td>127</td>
</tr>
<tr>
<td>Mowing=$12.50/acre + $38/TDM chopping, hauling bagging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest, pre-feeding&lt;sup&gt;d&lt;/sup&gt;</td>
<td>3.39</td>
<td>3.85</td>
<td>4.59</td>
<td>5.05</td>
</tr>
<tr>
<td>Cost ($/acre)</td>
<td>173</td>
<td>196</td>
<td>234</td>
<td>258</td>
</tr>
<tr>
<td>Return $/acre</td>
<td>7.11</td>
<td>43.65</td>
<td>90.91</td>
<td>132.45</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mid-maturity, grain type variety  
<sup>b</sup> Late maturity, forage type variety  
<sup>c</sup> Mowing =$12.50/acre + $38/TDM chopping, hauling bagging  
<sup>d</sup> 4% annual operating for 6 mos.
Resources / References


- UW-Nutrient and Pest Management Program Cover Crop Resources https://ipcm.wisc.edu/covercrops/