Introduction to Cover Crops for Vegetables

Practical Farmers of Iowa Annual Conference

January 21, 2017
Mark Quee
Scattergood Friends School
farm@scattergood.org
Scattergood Friends School and Farm

Nurturing Mind, Body, Community and Soil
The neighbor’s land

Scattergood Farm
Wood Lot

- Peaches
- Field 1
- Restored Prairie
- Field 2
- Field 3
- Field 4
- Apples and Windbreak
- Pears and Sour Cherries
- Raspberries and Strawberries
- Packing Shed
- High Tunnel
Field 1
2017: Cover
2018: Brass/Cuke/Corn
2019: Nightshades/Pots/SweetPots
2020: Legume/Roots/Allia/Salad/Herbs

Field 2
2017: Nightshades/Pots/Sweet Pots
2018: Legume/Roots/Allia/Salad/Herbs
2019: Cover
2020: Brass/Cuke/Corn

Field 3
2017: Brass/Cuke/Corn
2018: Nightshades/Pots/Sweet Pots
2019: Legume/Roots/Allia/Salad/Herbs
2020: Cover

Field 4
2017: Legumes/Roots/Allia/Salad/Herbs
2018: Cover
2019: Brass/Cuke/Corn
2020: Nightshades/Pots/Sweet Pots

Group together: Brass/Cuc/Corn/Herbs::
Legumes/Roots/Allia/Salad/Cilantro:: Nightshades/Potatoes/Sweet
Potatoes::approximately 1/4-1/3 of the gardens will be in covercrops
• Why?
• What?
  • Fallow Year
  • Cash Crop Year
• How/When?
• Resources
• Why?
  • What?
    • Fallow Year
    • Cash Crop Year
  • How?
  • Resources
Important considerations:

Know why you’re using cover crops.

Don’t treat cover crops as an afterthought. Treat them as you do your cash crops:

  Schedule plantings. Map your fields. Group together plantings with similar terminal dates. Order your seeds.

Know how you’re going to terminate cover crops.

  Mowing with a bush hog and tilling works for us.

Be aware of allelopathic and disease host issues.
Why does Scattergood use cover crops?

• Add Organic Matter and fix Nitrogen
• Protect the soil from erosion
• Encourage pollinators and beneficials
• Weed control
• Forage for sheep/pigs/turkeys
SARE’s Benefits of Cover Crops:

• **Cut fertilizer costs** (fix N + scavenge nutrients)
• **Reduce the need for herbicides/pesticides** (weed suppression + natural herbicidal effects + host beneficial microbial life)
• **Improve yields by enhancing soil health** (OM, compaction)
• **Prevent soil erosion** (surface protection, better infiltration)
• **Conserve soil moisture** (increased infiltration, less evaporation)
• **Protect water quality** (less erosion, sequestering nutrients)
• **Help safeguard personal health** (use fewer chemical inputs)
• Why?

• What?
  • Fallow Year
  • Cash Crop Year

• How?

• Resources
Cover Crops Scattergood Currently Uses

Spring: Chickling Vetch/Oats (March-April)

Summer: Field Peas/Oats
          Buckwheat
          Sorghum Sudangrass (late May)

Fall:    Hairy Vetch/Oats (before Sept 20)
          Field Peas/Oats
          Oats
Other Cover Crop species that we have tried:

- Tillage Radish
- Oilseed Radish
- Japanese Millet
- Berseem Clover
- Sweet Clover
- Crimson Clover
- Red Clover
- Sunn Hemp
- Cereal Rye
- Cow Peas
• Why?

• What?
  • Fallow Year
  • Cash Crop Year

• How?

• Resources
Group together: Brass/Cuc/Corn/Herbs:
Legumes/Roots/Allia/Salad/Cilantro:: Nightshades/Potatoes/Sweet Potatoes::approximately 1/4-1/3 of the gardens will be in covercrops
Fallow Year Cover Cropping

Fall Prior (September): sow hairy vetch/oats mix where possible (sometimes cash crops are in the way).

March/April: sow chickling vetch or field peas/oats in places with no hairy vetch.

Mid May: mow and till; sow sorghum sudangrass.

Summer: graze/mow up to 3 times.

Fall: mow in September, till strips for early spring planting. Drill hairy vetch/oats where later crops are going (corn, pumpkins and late brassicas).
### SARE-Sponsored Green/Brown Manure Trial 2011-2015

#### 2012

<table>
<thead>
<tr>
<th>TIME</th>
<th>BED 1</th>
<th>BED 2</th>
<th>BED 3</th>
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<tr>
<td>April-July</td>
<td>Beets</td>
<td>Broccoli</td>
<td>Zucchini</td>
<td>Zucchini</td>
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<tr>
<td>July-Aug</td>
<td>Chickens</td>
<td></td>
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<td>None</td>
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<tr>
<td>Aug-April</td>
<td>Oats/field peas grazed by sheep then hogs</td>
<td>None</td>
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#### 2013

<table>
<thead>
<tr>
<th>TIME</th>
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<th>BED 4</th>
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<tbody>
<tr>
<td>May-August</td>
<td>Zucchini</td>
<td>Beets</td>
<td>Broccoli</td>
<td>Broccoli</td>
</tr>
<tr>
<td>August-Sept</td>
<td>Turkeys</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sept-May</td>
<td>Hairy Vetch/Oats + 1-2 loads of composted manure</td>
<td>None</td>
<td></td>
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</table>

(CONTROL)
Green Manure vs. Brown Manure in an Organic Vegetable System

Final Report

Summary

PROJECT DESCRIPTION AND RESULTS
Project Duration: This is an on-going experiment, though for purposes of the grant, it will conclude on March 15, 2012

Background and description of previous sustainable agriculture activities: I have been the Farm Manager at Scattergood Friends School since 2003. We raise 10
• Why?
• What?
  • Fallow Year
  • Cash Crop Year
• How?
• Resources
Cover Crops used after/between cash crops

Chickling Vetch in areas that might have a N deficit--where hairy vetch died or didn’t fit (March-April)

Buckwheat or Field Peas/Oats when spring and summer cash crops come out (June-Aug).

As things wind down late summer/early fall, Hairy Vetch/Oats where the following year allows a later spring sowing, or Field Peas/Oats for an early spring sowing.
Quick Turnaround Cover Crops
2013, 2014

Buckwheat
Japanese Millet
Sorghum Sudangrass
Cowpeas
Sunn Hemp
Chickling Vetch
Oats/Field peas
Quick Turnaround Cover Crops for Horticulture -- Update 2014

Staff Contact:
Liz Kolbe – (515) 232-5661
liz@practicalfarmers.org

Web Link:

In a Nutshell

- Fruit and Vegetable farmers use cover crops to improve nutrient cycling and control weeds for increased production efficiency.
- Summer cover crops can be challenge due to dry conditions.
- Four farms evaluated summer cover crops to determine aboveground biomass production, carbon and nitrogen produced, effects on subsequent cash crop germination and effects on subsequent weed seed germination.

Key findings:
- Summer-seeded cover crops produced between 192 and 14,157 lb of 
  biomass per acre, which continued to accumulate up to 4 months after 
  ridge-tilling the cover crop.
- Both cover crops had similar carbon and nitrogen content.
- The cover crop with the higher biomass production had a higher 
  nitrogen content, indicating that the nutrients were being retained 
  within the cover crop.

Cooperators:
- Rob and Tammy Faux – Tripoli
- Rick and Stacy Hartmann – Minburn
- Nicholas Leete and Alice McGary – Ames
- Mark Quee – West Branch

Funding By:
The Ceres Foundation

LEOPOLD CENTER
Transplanting into mowed rye: 2015
• Why?
• What?
  • Fallow Year
  • Cash Crop Year

• How/When?
• Resources
Approximate Planting Times (east-central Iowa, Zone 5a)

Chickling Vetch/Oats: March 1-April 15
Field Peas/Oats: April 15-Sept 15
Buckwheat: May 1-Aug 15
Sorghum Sudangrass: May 15-June 1
Hairy Vetch/Oats: Aug 15-Sept 15
Oats: Sept 15-Oct 15
Important considerations:

Know why you’re using cover crops.

Don’t treat cover crops as an afterthought. Treat them as you do your cash crops:

Schedule plantings. Map your fields. Group together plantings with similar terminal dates. Order your seeds.

Know how you’re going to terminate cover crops.

Mowing with a bush hog and tilling works for us.

Be aware of allelopathic and disease host issues.
• Why?
• What?
  • Fallow Year
  • Cash Crop Year

• How?

• Resources
Resources:
(most of our seeds come from Welter Seeds in Onslow, IA)
Research Reports

Read and download reports of novel on-farm research projects designed and led by farmers in field crops, horticulture, livestock, energy and more.

Research reports are written by Practical Farmers staff to ensure consistency and quality, and are available to view or download for free below.

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<th>Title</th>
<th>Date</th>
<th>Member Priorities</th>
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<td>Oat Cover Crop vs. Straw Mulch for Garlic ...</td>
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<td>Summer Squash Following Winter Rye With Strip ...</td>
<td>11/30/15</td>
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<td>Quick Turnaround Cover Crops for Horticulture</td>
<td>12/05/14</td>
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<td>Role of Cover Crops in Converting Perennial ...</td>
<td>01/31/12</td>
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<td>Assessing Tillage Radish for Weed Control In ...</td>
<td>06/09/11</td>
<td>C</td>
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<td>Effectiveness of White Mustard on Spring Weeds</td>
<td>02/07/11</td>
<td>C</td>
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<td>Tillage Radish to Control Weeds in Horticulture ...</td>
<td>11/03/10</td>
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**Chart 2 PERFORMANCE AND ROLES**

<table>
<thead>
<tr>
<th>Species</th>
<th>Legume N Source</th>
<th>Total N (lb./A)¹</th>
<th>Dry Matter (lb./A/yr.)</th>
<th>N Scavenger²</th>
<th>Soil Builder³</th>
<th>Erosion Fighter⁴</th>
<th>Weed Fighter</th>
<th>Good Grazing⁵</th>
<th>Quick Growth</th>
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<td>2,000–9,000</td>
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<tr>
<td>Barley <em>p. 77</em></td>
<td></td>
<td>2,000–10,000</td>
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<td>Oats <em>p. 93</em></td>
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<td>2,000–10,000</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Rye <em>p. 98</em></td>
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<td>3,000–10,000</td>
<td></td>
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<tr>
<td>Wheat <em>p. 111</em></td>
<td></td>
<td>3,000–8,000</td>
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<tr>
<td>Buckwheat <em>p. 90</em></td>
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<td>2,000–4,000</td>
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<td>Sorghum-sudan. <em>p. 106</em></td>
<td></td>
<td>8,000–10,000</td>
<td></td>
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<tr>
<td>Mustards <em>p. 81</em></td>
<td></td>
<td>30–120</td>
<td>3,000–9,000</td>
<td></td>
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<tr>
<td>Radish <em>p. 81</em></td>
<td></td>
<td>50–200</td>
<td>4,000–7,000</td>
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# Chart 3A CULTURAL TRAITS

<table>
<thead>
<tr>
<th>Species</th>
<th>Aliases</th>
<th>Type</th>
<th>Hardiness through Zone</th>
<th>Tolerances</th>
<th>Habit</th>
<th>pH (Pref.)</th>
<th>Best Established</th>
<th>Min. Germin. Temp.</th>
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<td><strong>Nonlegumes</strong></td>
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<td>Annual ryegrass <em>p. 74</em></td>
<td>Italian ryegrass</td>
<td>WA</td>
<td>6</td>
<td>best</td>
<td>U</td>
<td>6.0–7.0</td>
<td>ESP, LSu, EF, F</td>
<td>40F</td>
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<tr>
<td>Barley <em>p. 77</em></td>
<td></td>
<td>WA</td>
<td>7</td>
<td>drought, shade</td>
<td>U</td>
<td>6.0–8.5</td>
<td>F, W, Sp</td>
<td>38F</td>
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<tr>
<td>Oats <em>p. 93</em></td>
<td>spring oats</td>
<td>CSA</td>
<td>8</td>
<td>flood</td>
<td>U</td>
<td>4.5–7.5</td>
<td>LSu, ESP W in 8+</td>
<td>38F</td>
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<tr>
<td><strong>Cassia</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Rye <em>p. 98</em></td>
<td>winter, cereal, or grain rye</td>
<td>CSA</td>
<td>3</td>
<td>best</td>
<td>U</td>
<td>5.0–7.0</td>
<td>LSu, F</td>
<td>34F</td>
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<tr>
<td>Wheat <em>p. 111</em></td>
<td></td>
<td>WA</td>
<td>4</td>
<td>drought, shade</td>
<td>U</td>
<td>6.0–7.5</td>
<td>LSu, F</td>
<td>38F</td>
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<tr>
<td>Buckwheat <em>p. 90</em></td>
<td></td>
<td>SA</td>
<td>NFT</td>
<td></td>
<td>U/SU</td>
<td>5.0–7.0</td>
<td>Sp to LSu</td>
<td>50F</td>
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<td>Sorghum-sudan. <em>p. 106</em></td>
<td>Sudax</td>
<td>SA</td>
<td>NFT</td>
<td></td>
<td>U</td>
<td>6.0–7.0</td>
<td>LSp, ES</td>
<td>65F</td>
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<tr>
<td>Mustards <em>p. 81</em></td>
<td>brown, oriental white, yellow</td>
<td>WA,</td>
<td>7</td>
<td></td>
<td>U</td>
<td>5.5–7.5</td>
<td>Sp, LSu</td>
<td>40F</td>
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<tr>
<td>Species</td>
<td>Depth</td>
<td>Drilled</td>
<td>Seeding Rate</td>
<td>Broadcast</td>
<td>Cost (S/lb.)¹</td>
<td>Cost/A (median)²</td>
<td>Inoc. Type</td>
<td>Reseeds³</td>
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<td></td>
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<td>lb./A</td>
<td>bu/A</td>
<td>lb./A</td>
<td>oz./100 ft²</td>
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<td>10–20</td>
<td>.4–.8</td>
<td>20–30</td>
<td>.8–1.25</td>
<td>.70–1.30</td>
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<td>3/4–2</td>
<td>50–100</td>
<td>1–2</td>
<td>80–125</td>
<td>1.6–2.5</td>
<td>.17–.37</td>
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<td>27</td>
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<td>Oats</td>
<td>1/2–1 1/2</td>
<td>80–110</td>
<td>2.5–3.5</td>
<td>110–140</td>
<td>3.5–4.5</td>
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<td>25</td>
<td>33</td>
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<td>Rye</td>
<td>3/4–2</td>
<td>60–120</td>
<td>1–2</td>
<td>90–160</td>
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<td>.18–.50</td>
<td>25</td>
<td>35</td>
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<td>Wheat</td>
<td>1/2–1 1/2</td>
<td>60–120</td>
<td>1–2</td>
<td>60–150</td>
<td>1–2.5</td>
<td>.10–.30</td>
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<td>Buckwheat</td>
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<td>48–70</td>
<td>1–1.4</td>
<td>50–90</td>
<td>1.2–1.5</td>
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<td>Sorghum-sudangrass</td>
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<td>35</td>
<td>1</td>
<td>40–50</td>
<td>1–1.25</td>
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<td>10–20</td>
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<td>1.50–2.50</td>
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<td>5–10</td>
<td>8–14</td>
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<td>1.00–2.00</td>
<td>11</td>
<td>16</td>
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### Chart 4A POTENTIAL ADVANTAGES

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<th>Species</th>
<th>Soil Impact</th>
<th>Soil Ecology</th>
<th>Other</th>
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<tr>
<td></td>
<td>subsoiler</td>
<td>free P&amp;K</td>
<td>loosen topsoil</td>
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<td>0.2</td>
<td>0.3</td>
<td>0.6</td>
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<tr>
<td>Barley p. 77</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Oats p. 93</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Rye p. 98</td>
<td>0.1</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Wheat p. 111</td>
<td>0.2</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Buckwheat p. 90</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
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<tr>
<td>Sorghum-sudangrass p. 106</td>
<td>0.6</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Mustards p. 81</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
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<tr>
<td>Radish p. 82</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
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</table>
### Chart 4B: Potential Disadvantages

Note change in symbols  

- ○ = problem  
- ■ = not a problem

<table>
<thead>
<tr>
<th>Species</th>
<th>Increase Pest Risks</th>
<th>Management Challenges</th>
<th>Comments Pro/Con</th>
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<tr>
<td></td>
<td>weed plant</td>
<td>insect/</td>
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<td></td>
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<td>nematodes</td>
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</table>

#### NONLEGUMES

- **Annual ryegrass**  
  - weed plant: ○  
  - insect/nematodes: ○  
  - crop disease: ○  
  - harvest: ○  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ○  
  - rust: ●  
  - Comments: If mowing, leave 3-4" to ensure regrowth.

- **Barley**  
  - weed plant: ○  
  - insect/nematodes: ○  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ●  
  - rust: ○  
  - Comments: Can be harder than rye to incorporate when mature.

- **Oats**  
  - weed plant: ●  
  - insect/nematodes: ●  
  - crop disease: ●  
  - harvest: ○  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ○  
  - rust: ○  
  - Comments: Cleaned, bin-run seed will suffice.

- **Rye**  
  - weed plant: ○  
  - insect/nematodes: ○  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ●  
  - rust: ○  
  - Comments: Can become a weed if tilled at wrong stage.

- **Wheat**  
  - weed plant: ○  
  - insect/nematodes: ○  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ○  
  - rust: ●  
  - Comments: Absorbs N and H₂O heavily during stem growth, so kill before then.

- **Buckwheat**  
  - weed plant: ○  
  - insect/nematodes: ●  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ●  
  - rust: ○  
  - Comments: Buckwheat sets seed quickly.

- **Sorghum-sudangrass**  
  - weed plant: ○  
  - insect/nematodes: ●  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ○  
  - rust: ○  
  - Comments: Mature, frost-killed plants become quite woody.

- **Mustards**  
  - weed plant: ○  
  - insect/nematodes: ●  
  - crop disease: ○  
  - harvest: ●  
  - control: ●  
  - establishment: ●  
  - till/kill: ●  
  - mow/adj: ●  
  - mature: ●  
  - rust: ○  
  - Comments: Great biofumigation potential; winterkills at 25° F.
HAIRY VETCH

Vicia villosa

**Type:** winter annual or summer annual legume

**Roles:** N source, weed suppressor, topsoil conditioner, reduce erosion

**Mix with:** small grains, field peas, bell beans, crimson clover, buckwheat

See charts, p. 66 to 72, for ranking and management summary.

Few legumes match hairy vetch for spring residue production or nitrogen contribution. Widely adapted and winter hardy through Hardiness Zone 4 and into Zone 3 (with snow cover), hairy vetch is a top N provider in temperate and subtropical regions.

The cover grows slowly in fall, but root development continues over winter. Growth quickens in spring, when hairy vetch becomes a sprawling vine up to 12 feet long. Field height rarely exceeds 3 feet unless the vetch is supported by another crop. Its abundant, viney biomass can be a benefit and a challenge. The stand smotheres emerging crops for few days, but its nutrient concentration can also be a liability when sown too early.

Corn planting date comparison trials with cover crops in Maryland show that planting *as late* as May 15 (the very end of the month-long local planting period) optimizes corn yield and profit from the system. Spring soil moisture was higher under the vetch or vetch-rye mixture than under cereal rye or no cover crop. Killed vetch left on the surface conserved summer moisture for improved corn production (80, 82, 84, 85, 173, 243).

Even without crediting its soil-improving benefits, hairy vetch increases N response and produces enough N to offset its own in many systems.
Thank You!

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