Adapting Cover Crops in Southeastern Idaho

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“A cover crop is a crop planted primarily to manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity and wildlife in an agroecosystem.”

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Cover Crops

Hairy vetch

Turnip

Yellow mustard

Cover crop mix at Gooding, ID October, 2015

http://fromfieldtofield.com/2011/12/05/turnip-cover-crops/
• 40 year old dryland, Bannock County
• No-till into spring wheat stubble 9/30/2014
• Terminate after fall green up and plant spring wheat in 2016.

• Cover crop mix:
  • Triticale
  • Hairy Vetch
  • Forage Pea
  • Winter Lentil
  • Kale
  • Rapeseed

Photos from Marlon Winger, State Agronomist, NRCS, Boise, Idaho
Soil Compaction and Water Movement

- What is soil made of?
- When we compact the soil, what are we losing?

http://aces.nmsu.edu/pubs_circulars/CR672/welcome.html
http://soilquality.org/indicators/soil_structure.html
https://louisianariceinsects.wordpress.com/2010/03/19/horizon-ag-strip-trial-planted-in-crowley/
Cover Crops Break up Soil Compaction

http://rlsnyder.us/blog/category/gardening-methods/page/2/
Cover Crops Break up Soil Compaction

http://www.tillageradish.com/benefits/reduced-compaction.php
Cover Crops Improve Infiltration

Infiltration through tunnels created by roots

Subsoil moisture increases after radish winterkills, perhaps because water flows down root channels

Solid line: radish
Dot line: fallow

Cover Crops Improve Infiltration

Infiltration through tunnels created by roots
Cover Crops Prevent Soil Moisture Evaporation

http://notillveggies.org/cover-crops-and-soil-moisture/
Cover Crops Reduce Runoff

- Water penetrated to deep depths under cover crops
- The more infiltrated, the less runoff (the water balance)
- Lower runoff under cover crops


https://laulima.hawaii.edu/access/content/group/2c084cc1-8f08-442b-80e8-ed89faa22c33/book/chapter_7/balance.htm
All organic matter in soil is not equal. Scientists describe 3 pools of soil organic matter:

- Passive SOM
  - Very stable organic material
  - Extremely slow decomposition
  - 60 – 80% of SOM
  - 500 – 5000 yrs
  - C/N ratio 7 – 10

- Time

Tillage begins

25 years after tillage began

Permanent sod begins

% of native organic matter level

100%

50%
Why Are Soil Organic Matters Important?

- Plant available water increases with soil organic matters.

http://www.hgtv.com/design/outdoor-design/landscaping-and-hardscaping/choosing-the-right-potting-mix-pictures
http://irrigatedag.wsu.edu/soil-organic-matter-boosts-water-holding-capacity/
USDA Software for Soil Properties
<table>
<thead>
<tr>
<th>Species</th>
<th>Potential fixed N (lb/A)</th>
<th>Seeding rate (lb/A)</th>
<th>% N in biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legumes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crimson clover</td>
<td>50-60, 35-120</td>
<td>12-20, 20-25</td>
<td>2.4-3</td>
</tr>
<tr>
<td>Austrian peas</td>
<td>30-100</td>
<td>75-150</td>
<td>3-4</td>
</tr>
<tr>
<td>Hairy vetch</td>
<td>60-180, 35-150</td>
<td>20-35, 20-30</td>
<td>4</td>
</tr>
<tr>
<td><strong>Brassicas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forage turnip</td>
<td>-----</td>
<td>3-5</td>
<td>3.3 leaf, 1.6 root</td>
</tr>
<tr>
<td>Oilseed radish</td>
<td>-----</td>
<td>25</td>
<td>3.8 leaf, 2.5 root</td>
</tr>
<tr>
<td>White mustard</td>
<td>-----</td>
<td>15</td>
<td>2.8-3.5</td>
</tr>
<tr>
<td>Canola</td>
<td>-----</td>
<td>15</td>
<td>1.3</td>
</tr>
</tbody>
</table>
## Cover Crop Chart

### Growth Cycle
- **A** = Annual
- **B** = Biennial
- **P** = Perennial

### Plant Architecture
- **=** Upright
- **=** Upright-Spreading
- **=** Prostrate

### Relative Water Use
- **=** Low
- **=** Medium
- **=** High

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## Chart

<table>
<thead>
<tr>
<th>Cool</th>
<th>Warm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grass</strong></td>
<td><strong>Broadleaf</strong></td>
</tr>
</tbody>
</table>

### Grass
- Barley (A)
- Oat (A)
- Wheat (A)
- Cereal Rye (A)
- Triticale (A)
- Annual Fescue (B)
- Saline Tolerant (A/B)

### Broadleaf
- Canola (A/B)
- Camelina (A/B)
- Mustard (A/P)
- Flax (A)
- Radish (A)
- Turnip (B)
- Beet (A)
- Carrot (A/B)

### Legume
- Field Pea (A)
- Berseem Clover (A/B)
- Crimson Clover (A)
- Lentil (A)
- Lupin (B/P)
- Red Clover (A/B)
- Sweet Clover (A)
- Medic (A/P)
- Roundhead Lespedeza (A/P)
- Kura Clover (A/P)
- Alfalfa (P)
- Pigeonpea (A/P)

### Cool Grass
- Amaranth (A)
- Buckwheat (A)
- Pearl Millet (A)
- Foxtail Millet (A)

### Warm Grass
- Cluster Bean (A)
- Quinoa (A)
- Proso Millet (A)
- Grain Sorghum (A)
- Sudan Grass (A)
- Teff (A)

### Cool Broadleaf
- Sunnhemp (A)
- Cluster Bean (A)

### Warm Broadleaf
- Chickpea (A)
- Fava Bean (A)
- Chicory (A)
- Mung Bean (A)
- Cucurbita (A)
- Soybean (A)
- Sunflower (A)
- Corn (A)
Cover crop selection based on your needs

Planting small areas for the first trial
Cover Crops in Dryland Areas-CIG Project

To evaluate the effects of incorporating a cover crop mix into a cereal-based dryland cropping system by:

- Determining the establishment and growth of cover crops;
- Measuring soil water dynamics (i.e., infiltration rates and water use) as affected by cover crop integration in comparison to standard grower practices;
- Monitoring soil health (i.e., soil physical, chemical, and biological properties and organism diversity) as affected by cover crop integration over time.
Cover Crops in Dryland Areas-CIG Project

• Locations:
  • Arbon Valley (Hans Hayden)
  • Rockland (Cory Kress)

• Cover crop mix: turnip, radish, vetch, spring pea, and field pea with a ratio of 1:1:5:10:10

• Cover crop seeding rate: 30 lb/acre

<table>
<thead>
<tr>
<th>Trt</th>
<th>F2015-S2016</th>
<th>F2016</th>
<th>S-S2017</th>
<th>Fall 2017</th>
<th>S–S2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WW</td>
<td>Fallow</td>
<td>Fallow</td>
<td>WW</td>
<td>WW</td>
</tr>
<tr>
<td>2</td>
<td>WW</td>
<td>CC</td>
<td>CC</td>
<td>WW</td>
<td>WW</td>
</tr>
<tr>
<td>3</td>
<td>WW</td>
<td>Fallow</td>
<td>CC</td>
<td>WW</td>
<td>WW</td>
</tr>
</tbody>
</table>
• Cover crop growth at Rockland and Arbon Valley. Photos were taken in June 2016.
• Cover crop species survived the winter were different at the two locations.
Cover crop emergence approximately three weeks after planting at Rockland (up) and Arbon Valley (down).
Measurements

- Soil moisture sensors and data loggers were installed in the Rockland field.
- Data will be used to quantify the soil moisture changes due to cover crops.
Measurements

- Measurements of soil physical, chemical and biological properties.
- A wireworm trap in the winter wheat field.
Cost

- Seeds: $30/acre (including mixing of seed/inoculants and bagging) at a seeding rate of 30 lb/acre
- Planting
- Harvesting

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Price Each</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5 acre Research Plot</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>CSBR020 - Purple Top Turnip: VNS Lot#: 1745-01-15-09 test: Feb 22, 2016 Origin: ID Pure: 99.95 Germ: 99 Weed: 0 Other: 0 Inert: 0.05</td>
<td>1.65</td>
<td>8.25</td>
</tr>
<tr>
<td>5</td>
<td>CSBR010 - Diakon Radish: Nitro Radish Lot#: NVV3844.t test: Jul 1, 2016 Origin: NZ Pure: 99.28 Germ: 85 Weed: 0.05 Other: 0.05 Hard: 0 Inert: 0.62</td>
<td>1.95</td>
<td>9.75</td>
</tr>
<tr>
<td>50</td>
<td>CSLG020 - Spring Pea: 4010 Lot#: AG-NE-16.1 test: Aug 11, 2016 Origin: NE Pure: 99.5 Germ: 98 Weed: 0.05 Other: 0.05 Inert: 0.4</td>
<td>0.40</td>
<td>20.00</td>
</tr>
<tr>
<td>50</td>
<td>CSLG010 - Winter Peas:Austrian Winter Lot#: TD-MT-16.1 test: Aug 11, 2016 Origin: MT Pure: 99.63 Germ: 80 Weed: 0 Other: 0 Inert: 0.37</td>
<td>0.55</td>
<td>27.50</td>
</tr>
<tr>
<td>16</td>
<td>NOC011 - Micro Noc Pea/Vetch/Lentil</td>
<td>0.80</td>
<td>12.80</td>
</tr>
<tr>
<td>135</td>
<td>Mixing - Mixing of seed/app. of inoculants (if any)</td>
<td>0.15</td>
<td>20.25</td>
</tr>
<tr>
<td>135</td>
<td>Bagging - Bagging into 50# bags</td>
<td>0.05</td>
<td>6.75</td>
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<tr>
<td>135</td>
<td>Shipping - Shipping Cost</td>
<td>0.65741</td>
<td>88.75</td>
</tr>
</tbody>
</table>
Summary

- Cover crops
  - Suitable species
  - Biomass production
  - Soil health
  - Wireworm control
  - Soil water relations
  - Grain yield of winter wheat following cover crops