COVER CROPS WITH DIRECT SEED ROTATION IN NORTH CENTRAL IDAHO

University of Idaho Extension
Research and Demonstration Project

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GOALS

Demonstrate cover crop benefits including enhanced soil biology, improved crop rotation diversity, improved soil structure, nutrient cycling, forage production, and reduced erosion.

**Demonstrate cover crops seeded in the fall and sprayed out for spring seeded cereal crop production.**

Demonstrate cover crops seeded in the late spring and sprayed out in fall for fall seeded cereal crop production, with and without grazing component.

Increased knowledge by livestock producers on the potential to extend their grazing season using unconventional forages seeded as cover crops.

Study the effect of cover crops on the following cereal crop productivity.

Producers will be more willing to try cover crops due to the availability of current, local research information.
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COVER CROP STUDY PROJECTS

• On-farm test of fall-seeded cover crops followed by spring crop (canola), 2012-13
• On-farm test of spring-seeded cover crops followed by fall sown crop (wheat), with and without grazing treatment, 2013-14
• Cover crop variety demonstration, 2014-16
• Cover crop seeding date study, 2014, 2016
• Cover crop seeding rate study, 2015
• Cover crops in five-year rotation study, 2014-2019
• On-farm cover crop grazing demonstrations, 2014-2016
FALL SEEDED COVER CROPS

March 15, 2013
**FALL SEEDED COVER CROPS**

**Cover Crop Planting – Fall Seeded**

Cover crops were direct seeded on 10-12-12. Plots were planted in 45’ x 800’ strips.

Treatments included:

1) Chemical Fallow (control)

2) Nitrogen Mix (winter peas, winter oats, common vetch, red clover, and winter lentil)

3) Soil Enhancement Mix (Crimson clover, red clover, winter pea, hairy vetch, winter lentil, winter triticale, spring barley, winter oats, purple top turnip, nitro radish, winter canola)

Cover crops terminated in March and spring canola was direct seeded. Strips were harvested in the fall of 2013.

<table>
<thead>
<tr>
<th>Canola Yields</th>
<th>% difference from fallow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment 1 – Chemical Fallow = 1782.7 lb/ac</td>
<td>0</td>
</tr>
<tr>
<td>Treatment 2 – Nitrogen Mix = 1794.8 lb/ac</td>
<td>+1</td>
</tr>
<tr>
<td>Treatment 3 – Soil Enhancement Mix = 1661.7 lb/ac</td>
<td>-7</td>
</tr>
</tbody>
</table>
SPRING SEEDED COVER CROPS
Cover crops were direct seeded in 45’ x 1200’ strips in winter wheat stubble on May 20, 2013. Crop development was monitored throughout the growing season.

Treatments included:

1) No cover crop (chemical fallow, control)
2) Nitrogen mix (*Lentils, common vetch, spring forage peas, rapeseed, flax*)
3) Grazing mix (*Common vetch, spring forage peas, crimson clover, spring oats, spring barley, rapeseed, forage turnips, forage radish, pearl millet*)
4) Soil enhancement mix (*Crimson clover, soybean, winter pea, hairy vetch, spring forage peas, spring triticale, spring barley, pearl millet, oats, purple top turnip, rapeseed, nitro radish, forage brassicas, sunflower, buckwheat*)

Plots were grazed three times with target dates of August 1, August 15 and September 1. Each time a 200’ plot length was exposed to grazing. The final 600’ of plot length was not be grazed. All plots were be sprayed out on about September 15 prior to direct seeding winter wheat after September 25. Winter wheat yields will be evaluated in fall 2014.
## Forage Tests

### Forage Analysis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>As Rcvd.</th>
<th>Crude</th>
<th>Acid Det.</th>
<th>aNDF %</th>
<th>Ash % (ppm)</th>
<th>MCAL/LB</th>
<th>NE/LACT</th>
<th>TDN Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average 2</td>
<td>6.6</td>
<td>13.6</td>
<td>30.5</td>
<td>35.7</td>
<td>9.5</td>
<td>550</td>
<td>0.67</td>
<td>55.5</td>
</tr>
<tr>
<td>Average 3</td>
<td>6.5</td>
<td>9.0</td>
<td>32.5</td>
<td>45.4</td>
<td>8.7</td>
<td>544</td>
<td>0.64</td>
<td>51.5</td>
</tr>
<tr>
<td>Average 4</td>
<td>5.0</td>
<td>8.2</td>
<td>30.6</td>
<td>45.3</td>
<td>8.2</td>
<td>538</td>
<td>0.67</td>
<td>51.5</td>
</tr>
</tbody>
</table>

### Sample Date - 7/30/2013

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Moisture %</th>
<th>Protein %</th>
<th>Fiber %</th>
<th>Nitrate</th>
<th>NE/LACT</th>
<th>TDN Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - Nitrogen</td>
<td>6.6</td>
<td>13.6</td>
<td>30.5</td>
<td>35.7</td>
<td>9.5</td>
<td>550</td>
</tr>
<tr>
<td>3 - Grazing</td>
<td>6.5</td>
<td>9.0</td>
<td>32.5</td>
<td>45.4</td>
<td>8.7</td>
<td>544</td>
</tr>
<tr>
<td>4 - Soil</td>
<td>5.0</td>
<td>8.2</td>
<td>30.6</td>
<td>45.3</td>
<td>8.2</td>
<td>538</td>
</tr>
</tbody>
</table>

### Forage by Treatment (lbs/ac)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Production</th>
<th>Post Graze</th>
<th>Consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - Nitrogen</td>
<td>5569.93</td>
<td>896.31</td>
<td>4673.62</td>
</tr>
<tr>
<td>3 - Grazing</td>
<td>6668.98</td>
<td>1920.67</td>
<td>4748.32</td>
</tr>
<tr>
<td>4 - Soil</td>
<td>5175.13</td>
<td>1931.34</td>
<td>3243.79</td>
</tr>
</tbody>
</table>
Grazing

- 24 head stocked at a rate of 1.4 AUM's per acre.
- Turned the cattle in on the cover crop trial on August 13th.
- They were removed the third week of September.
- The cattle were moved to a new paddock every other day. They had access to the paddocks previously grazed.
- The rate of gain was 1.5 pounds per day per head.
Winter Wheat (bu/acre) after Spring-Sown Cover Crops

TREATMENTS:
1. No cover crop (chemical fallow)
2. Nitrogen mix (Lentils, common vetch, spring forage peas, rapeseed, flax)
3. Grazing mix (Common vetch, spring forage peas, crimson clover, oats, spring barley, rapeseed, Appine forage turnips, GroundHog forage radish)
4. Soil enhancement mix (Crimson clover, soybean (non-GMO), winter pea, hairy vetch, spring forage peas, winter triticale, spring barley, pearl millet, oats, purple top turnip, rapeseed, nitro radish, Pacific Gold mustard, sunflower, buckwheat)
<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficial insect mix</td>
<td></td>
</tr>
<tr>
<td>Austrian winter pea</td>
<td></td>
</tr>
<tr>
<td>“Flex” forage pea</td>
<td></td>
</tr>
<tr>
<td>“Nutrigreen” forage pea</td>
<td></td>
</tr>
<tr>
<td>Spring barley</td>
<td></td>
</tr>
<tr>
<td>Bob winter oat</td>
<td></td>
</tr>
<tr>
<td>“Everleaf” oat</td>
<td></td>
</tr>
<tr>
<td>Winter triticale</td>
<td></td>
</tr>
<tr>
<td>“Boyer” barley</td>
<td></td>
</tr>
<tr>
<td>Hairy vetch</td>
<td></td>
</tr>
<tr>
<td>“Morton” winter lentil</td>
<td></td>
</tr>
<tr>
<td>Spring lentil</td>
<td></td>
</tr>
<tr>
<td>“Daikon” radish</td>
<td></td>
</tr>
<tr>
<td>“Groundhog” radish</td>
<td></td>
</tr>
<tr>
<td>“Appin” turnip</td>
<td></td>
</tr>
<tr>
<td>“Athena” canola</td>
<td></td>
</tr>
<tr>
<td>Rape</td>
<td></td>
</tr>
<tr>
<td>Teff</td>
<td></td>
</tr>
<tr>
<td>Pearl millet</td>
<td></td>
</tr>
<tr>
<td>Sorghum Sudan grass</td>
<td></td>
</tr>
<tr>
<td>“Winfred” forage brassica</td>
<td></td>
</tr>
<tr>
<td>“Graza” forage brassica</td>
<td></td>
</tr>
<tr>
<td>“Hunter” forage brassica</td>
<td></td>
</tr>
<tr>
<td>“Corrine” Ethiopian cabbage</td>
<td></td>
</tr>
<tr>
<td>Mustard mix</td>
<td></td>
</tr>
<tr>
<td>Buckwheat</td>
<td></td>
</tr>
<tr>
<td>Sunflower</td>
<td></td>
</tr>
<tr>
<td>Safflower</td>
<td></td>
</tr>
<tr>
<td>Phacelia</td>
<td></td>
</tr>
<tr>
<td>Flax</td>
<td></td>
</tr>
<tr>
<td>Red clover</td>
<td></td>
</tr>
<tr>
<td>Ladino clover</td>
<td></td>
</tr>
<tr>
<td>Crimson clover</td>
<td></td>
</tr>
<tr>
<td>Yellow blossom sweet clover</td>
<td></td>
</tr>
<tr>
<td>Soybean</td>
<td></td>
</tr>
<tr>
<td>Bell bean</td>
<td></td>
</tr>
<tr>
<td>Common vetch</td>
<td></td>
</tr>
<tr>
<td>Sunn hemp</td>
<td></td>
</tr>
<tr>
<td>Cowpea</td>
<td></td>
</tr>
</tbody>
</table>
Cover Crop

Cocktail Mixes

- Oats
- 2- oats, forage pea
- 5- oats, forage pea, radish, sorghum sudan grass, soybean
- 8- oats, forage pea, radish, sorghum sudan grass, soybean, buckwheat, turnip, flax
- 12- way oats, forage pea, radish, sorghum sudan grass, soybean, buckwheat, turnip, flax, proso millet, crimson clover, sunflower, lentil
COVER CROP SEEDING DATE

Oats, 2- (oats, forage pea), 5- (add radish, sorghum sudan grass, soybean), 8- (add buckwheat, turnip, flax), and 12-way (add proso millet, crimson clover, sunflower, lentil)

Seeded May 15 and June 6-9

Harvested August 1 and August 26

Yield and Protein
Tukey-Kramer all pairs comparisons, 5% significance level:
• Early-seeded oats significantly higher yield than all late-seeded mixes and the early-seeded 8- and 12-species mixes.
• Early-seeded 2-species mix significantly higher yield than late-seeded 8-species mix.
Tukey-Kramer all pairs comparisons, 5% significance level:
• Late-seeded 12-species mix significantly higher protein than all early-seeded 5-species and 12-species mixes.
FIVE YEAR ROTATION STUDY

Fallow, 2, 5, 8, 12 way mixes
Two management levels
  a) Traditional spray out
  b) No spray out until weed spray application
Full and 50% fertility
Rotation: cover crops, winter wheat, cc, spring barley, cc, spring peas, winter wheat
Do Cover Crops in Rotation...

Affect Annual Crop Performance

Reduce Fertilizer Requirements

?
DIRECT SEED WINTER WHEAT - 2014

- Dry Conditions
- Residue an issue but...
  - Volunteer bindweed bound in shanks

10/13/14
• Abrupt Hard Winter
• High PPT Events
• Vole Damage
Cover Crop Mix

- Ever Leaf Oats
- Turnips
- Radishes
- Forage Peas
- Triticale
- Crimson Clover
- Canola
THOMPSON FARM COVER CROP GRAZING

2014
• 10 acres planted early June.
• Cattle turned out mid July.
• Fresh Quality test = 19.2% CP, 58.5% TDN
• Small paddocks used.
• Cattle moved daily.
• Cattle gained over 2 pounds per day.
• Estimated net return = $300 per acre

2015
• Seeded a 67 acre field – May 4th
• June 23rd – turned in 22 head – yearling heifers & bull
• Paddock grazed
• July 17th – cut 10 acres of hay = 12 tons
• July 22-25th – swathed remainder of field into windrows.
• Windrows grazed
• Aug. 15 – Added 28 cow calf pairs
• Sept. 1 – Moved herd to CRP
2014
- 46 acres planted early May
- 46 cow/calf pairs turned out late June
- Estimated pounds of forage needed per day = 2000 pounds. 50 pounds as fed per pair per day. Estimated production per acre = 4 tons
- At 50% utilization = 2 tons of forage available per acre
- Recommended paddock size = 2 acres
- Duration = 4 days per paddock 23 paddocks
- Grazing time 92 days
- Approx. 1/3 of field swathed and windrow grazed.
- Approx. 1/3 of field swathed and bale grazed

2015
- 150 acres planted with six way species, early May
- 75 head of spayed heifers and 105 head of cows & calves grazed 50 acres for 65 days.
- 75 spayed heifer grazed for 65 days
- ADG was 1.7
- Grazed on a per pound of gain basis
- $$ at least $0.50 per pound of gain or higher
- Paddock grazed and windrow grazed 50 acres for 65 days.
- Yrlg. Heifers removed
- 105 cows & calves grazed the windrows & bales on total 150 acres as of Nov. 1st.
PLANTING SPECIFICS

Seeding rate = 65 lbs total – even out species by weight.

Estimated seed cost = $30/acre

Fertilizer = 100 lbs of 16-20-0

Fencing = depending on type of fence

CONSIDERATIONS

Water source

Increase in labor to move fences

Availability of cattle/livestock

Haying equipment

Market for forage
Fence Installation
Shade and Water
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