Cover Crops Update

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Definition of Soil Health

“The capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health.”

(Doran and Zeiss, 2000).
Cover Crop Definition

• A close-growing crop, that provides soil protection, seeding protection and soil improvement between periods of normal crop production…” (SSSA, 2008).

• A cover crop is grown during the dormant period following a cash crop and terminated before the planting of the next crop. (Hartwig and Ammon, 2002).
Cover Crop History

• The past:
  • In 1938, the USDA Yearbook of Agriculture recommended cover crops to maintain soil organic matter (Pieters and McKee, 1938).

• Present-day Kansas estimates:
  • Cover Crops were planted on 2,498 farms, 322,454 acres (US Census of Ag 2012)
    – Out of 21 million acres of cropland harvested/year
    – 1.5% of acres cover cropped each year
Farmer Survey: SARE 2015-16

Top Benefits of Cover Crops

- Improves Soil Health: 458
- Erosion Control: 407
- Increases Organic Matter: 228
- Better Farm Mgt.: 115
- Grazing: 83
- Weed Control: 69
- Reduces Compaction: 40
- Water Quality / Quantity Benefits: 38
- Economic Benefits: 38
- Other: 36
- Increases Yields: 19
- Nothing: 14
- Insect Benefits: 11
- Planting / Seeding: 2

Number of Responses
KSU Research with Cover Crops

- 10-year study of Cover Crops in a No-till Wheat-Sorghum-Soybean Rotation
- Multi-Species Cover Crop Mixtures
- Forage Quality
10-year No-till (Crop rotation) Conclusions

- On average cover crops had little affect on yields of soybean and wheat in a rotation of Wheat-CC/Sorghum/Soybean
- 2012 drought year (sorghum yields <70 bu/a)
  - Yields of all grain crops were equal or better if summer double or cover crops were in the rotation
  - Winter cover crops reduced yield of sorghum
- Sorghum yields could be maximized with less fertilizer N with a legume cover crop or double crop planted after wheat
  (Average of 20 to 30 lb N/acre contributed by DCSB and FSB)
  - Yield differences with and without cover crops could be overcome with additional N
  - Implies that water is not an issue on average
  - Water extraction from deep in profile in 2015 and 2016 (good sorghum yields, up to 150 bu/a) might be effecting sorghum yield
10-year No-till (Crop rotation) Conclusions

• Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but the 5-ft. soil profile was recharged before sorghum planting in 2015.

• Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but only tillage radish and crimson clover maintained a significant reduction in the 9-ft. soil profile before sorghum planting in 2016.

• Both years had substantial April and May precipitation.
10-year No-till (Crop rotation) Conclusions

• Cover crops could be incorporated into a NT rotation with minimal negative and some positive effect on yields of the cash crops.
  ✓ In this environment (36” annual precipitation), cover crops typically didn’t deplete soil water enough to reduce cash crop yield.
  ✓ Residue composition (C:N) influenced sorghum yield.
• Cover crops were slowly building soil carbon near the surface (3”).
• Nutrient stratification might have been influenced by cover crops, implying adjustments to nutrient rates and placement.
Multi-Species Cover Crop Mixtures and Forage Quality

- Many cover crop species produce excellent quality forage
- Grazing a cover crop may offset management costs
  - Cover crop establishment and termination
- High quality supplemental forage allows a rest period for pastures
- Diversify crop rotation
### Treatment Combinations

**Brassica**
- Turnip
- Radish

**Grass**
- Wheat
- Rye
- Oat
- Barley

**Legume**
- Winter Pea
- Berseem Clover

**Turnip (2.3) or Radish (3)**

**Wheat, Rye, Barley (30) or Oat (37.5)**

****Numbers reflect seeding rates in lbs./acre****
# Planting and Clipping Dates

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>Planting</td>
<td>August 12</td>
<td>August 21</td>
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<tr>
<td>45-day Clip</td>
<td>September 26</td>
<td>October 6</td>
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<td>74-day Clip</td>
<td>October 25</td>
<td>November 3</td>
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<td>91-day Clip</td>
<td>November 11</td>
<td>November 23</td>
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</table>
# Seeding rates and cost per acre

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rate (lb/acre)</th>
<th>Cost per acre</th>
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<tbody>
<tr>
<td>Wheat</td>
<td>30</td>
<td>$8.88</td>
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<tr>
<td>Rye</td>
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<td>Barley</td>
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<td>$10.96</td>
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<td>Oat</td>
<td>37.5</td>
<td>$8.68</td>
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<tr>
<td>Radish</td>
<td>3</td>
<td>$7.04</td>
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<tr>
<td>Turnip</td>
<td>2.3</td>
<td>$4.12</td>
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<tr>
<td>Winter pea</td>
<td>19</td>
<td>$11.83</td>
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<tr>
<td>Berseem clover</td>
<td>3.7</td>
<td>$8.31</td>
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</table>
Partial budget analysis comparison of individual species: biomass vs. seed cost

- Turnip = Radish
- Oat > Barley > Wheat or Rye
- Most pea we ever saw was 20% of the biomass
Conclusions (Grazing/Quality)

• Careful selection of species, and seeding rates, is important
  – Berseem clover was not competitive in these mixes
  – Turnips were more frost tolerant than radishes

• Species expression changed vastly each year likely due to weather

• Biomass was different in each year
  – Froze before the 91-day clipping in 2014

• During fall vegetative growth, legume didn’t increase total biomass or forage quality
Conclusions Economic Comparison

• The most economical mixtures contained turnip and oat species. Both of these species produced the greatest biomass in relation to dollars spent on seed.

• Barley and oat produced more biomass in both years over wheat and rye, likely due to early planting (planted in mid August instead of mid to late September).

• Adding a legume did not increase protein or overall biomass, but it did increase the cost of the mix.
Midwest Cover Crop Council

- Created and supported by several (17) land-grant universities including KSU.
- ONLINE Interactive Cover Crop tool in helping with the selection progress in the Midwest U.S.
- Allows many different options for the selection process including identifying your goals.
- http://mccc.msu.edu/covercroptool/covercroptool.php
Midwest Cover Crop Council
# Midwest Cover Crop Council

## Midwest Cover Crops Council - Cover Crop Decision Tool

### Kansas: Osborne County Seeding Dates

<table>
<thead>
<tr>
<th>Location Information</th>
<th>Cash Crop Information</th>
<th>Soil Information</th>
<th>Attribute Information</th>
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<tbody>
<tr>
<td>Location Information</td>
<td>Kansas</td>
<td>Osborne</td>
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### Reliable Establishment

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<thead>
<tr>
<th>Cash Crop Growing Period</th>
<th>Requires Aerial Seeding or Interseeding of Cover Crop</th>
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Questions?

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