Cover Crop Water Use

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Texas A&M AgriLife Research – Vernon

2014 No-Till Oklahoma Conference
March 11-12th, 2014
Norman, OK
Texas Rolling Plains

- Rainfall
  - 18 to 30 in; 22 to 26 in
- Monoculture Cropping Systems
  - Cotton
  - Wheat (graze and grain)
- <15% of crop acres irrigated
Cover Crops in West Texas

- Winter cover crops do not appear to be a viable option in the Rolling Plains due to limited soil moisture for establishment and the removal of soil moisture by cover crops will likely hinder subsequent crop yields due to increased moisture deficit at planting (Dozier et al., 2008).

- Baughman et al. (2007) reported that cotton lint yields were reduced in the Rolling Plains when a cover crop was used in combination with no-till cotton.

- Keeling et al. (1996) concluded that it could be expected to obtain a protective ground cover 69% of the time in the Southern High Plains if the proper species is sown and that fall rainfall is adequate for germination and plant survival. Several legume species failed due to inadequate moisture.

- Dozier et al. (2008) concluded that legume cover crops do not provide adequate biomass or N contributions to justify the seed and planting costs.
Cover Crops in West Texas

- Research has noted higher soil moisture availability in conservation tillage systems with cover crops compared to conservation tillage systems without cover crops and conventional tillage systems in the Rolling Plains (Sij et al., 2004).

- Multiple year studies in the Rolling Plains have also shown no impact of cover crops on cotton lint yields (Sij et al., 2004; DeLaune et al., 2012).

- Time of termination becomes more critical as the probability of precipitation decreases (Unger et al., 1998).

- Practices that are perceived to reduce the capability of soils to capture rainfall will hinder adoption.
Drought Severity

- Abnormally Dry
- Moderate
- Severe
- Extreme
- Exceptional

Texas A&M AgriLife Research

May 3, 2011

July 5, 2011

May 8, 2012

July 10, 2012
U.S. Drought Monitor
CONUS

May 14, 2013
(Released Thursday, May. 16, 2013)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

<table>
<thead>
<tr>
<th></th>
<th>None</th>
<th>D0-D4</th>
<th>D1-D4</th>
<th>D2-D4</th>
<th>D3-D4</th>
<th>D4</th>
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<tbody>
<tr>
<td>Current</td>
<td>38.27</td>
<td>61.73</td>
<td>47.65</td>
<td>32.30</td>
<td>13.64</td>
<td>4.40</td>
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<td>Last Week</td>
<td>37.58</td>
<td>62.42</td>
<td>48.06</td>
<td>32.88</td>
<td>14.12</td>
<td>4.38</td>
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<tr>
<td>3 Months Ago</td>
<td>34.11</td>
<td>65.89</td>
<td>55.73</td>
<td>37.74</td>
<td>17.71</td>
<td>6.61</td>
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<td>Start of</td>
<td>27.22</td>
<td>72.78</td>
<td>61.09</td>
<td>42.05</td>
<td>21.31</td>
<td>6.75</td>
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<td>Calendar Year</td>
<td></td>
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<tr>
<td>1/2013</td>
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<tr>
<td>Start of</td>
<td>23.41</td>
<td>76.59</td>
<td>65.45</td>
<td>42.12</td>
<td>21.48</td>
<td>6.12</td>
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<td>Water Year</td>
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<tr>
<td>9/25/2012</td>
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<td></td>
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<tr>
<td>One Year Ago</td>
<td>45.21</td>
<td>54.79</td>
<td>33.64</td>
<td>18.39</td>
<td>5.71</td>
<td>1.02</td>
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<tr>
<td>5/15/2012</td>
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</table>

Intensity:
- **D0 Abnormally Dry**
- **D1 Moderate Drought**
- **D2 Severe Drought**
- **D3 Extreme Drought**
- **D4 Exceptional Drought**

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

**Author(s):**
Richard Tinker
CPC/NOAA/NWS/NCEP

http://droughtmonitor.unl.edu/
Cover Crop Studies

- Cool-Season cover crops in dryland cotton systems (Fall 2011; Chillicothe Research Station)

- Cool-Season cover crops in irrigated cotton systems (Fall 2012; Chillicothe Research Station)

- Warm-Season cover crops in dryland wheat systems (Summer 2013; Smith/Walker Research Unit)
Methods

- Soil samples (fall and spring)
  - Nitrate, ammonium, TN, TC, SOC, MIII-P

- Forage Samples
  - Biomass, N content, C:N

- Crop Yields

- Soil Moisture
  - Neutron Probes (140 cm)
Cool-Season Cover Crops in Dryland Cotton (Fall 2011)

- No-Till without a cover (1st year No-Till)
- No-Till without a cover + N
- No-till with cover
  - Austrian winter field pea (35 lb/ac)
  - Crimson clover (15)
  - Hairy Vetch (20)
  - Wheat (30)
  - Sunn Hemp (15; Planted March 29, 2012)

- Cover Plant Date – October 31, 2011; 4 reps/trt
- Termination Date – (4/30 legumes; 4/10 wheat; 5/31 Sunn hemp)
- Cotton planted June 8, 2012 (DP 1044 B2RF)
Biomass Production – Spring 2012

Biomass (kg/ha)

- Sunn Hemp
- Crimson Clover
- Hairy Vetch
- AWF. Pea
- Wheat

Texas A&M AgriLife Research
Gravimetric Water Content*

*June 2012, 0-30 cm soil cores following 7.5cm precipitation
Cool-Season Cover Crops in Cotton (Fall 2012)

- No-Till without a cover
- Conventional Till without a cover
- No-till with cover
  - Austrian winter field pea (35 lb/ac)
  - Crimson clover (20)
  - Hairy Vetch (20)
  - Wheat (30)
  - Mix (40 lb/ac: Rye-10, Wheat-10, Turnip-2, Crimson clover-3, Austrian winter field pea-10, and Hairy vetch-5)
- Terminated cover with glyphosate April 24, 2013
- Planted cotton June 6, 2013; DP 1219 B2RF
February 12, 2013
Biomass Production – Spring 2013

Biomass (kg/ha)

- Crimson Clover
- Wheat
- Hairy Vetch
- AWF. Pea
- Mixed

The graph shows the biomass production for various crops and mixed combinations. The bars indicate the biomass production in kilograms per hectare for each category. The categories are ranked from lowest to highest biomass production as follows:

- Mixed
- AWF. Pea
- Hairy Vetch
- Wheat
- Crimson Clover

The bars are color-coded to distinguish between the different crops and mixed combinations.
Stored Soil Water in Top 140 cm

Stored Soil Moisture (mm)

- Austrian pea
- Conv. Till
- Crimson clover
- Hairy Vetch
- Mixed cover
- No-Till
- wheat

Cover Termination

2013 Dryland Lint Yield

![Bar chart showing the comparison of different farming practices in terms of lint yield in 2013. The practices include AWF Pea, Mixed, Vetch, No-Till, Conv. Till, Wheat, and Crimson. The chart indicates the yield in lb/ac.](chart.png)
Stored Soil Water in Top 140 cm
Cool-Season Cover Crops in Irrigated Cotton (Fall 2012)

- No-Till without a cover
- Conventional Till without a cover
- No-till with cover
  - Wheat
  - Mix (Rye, Wheat, Turnip, Crimson clover, Austrian winter field pea, and Hairy vetch)

- 4 Replications per treatment
- Terminated with glyphosate April 24, 2013
- Plant Date June 3, 2013; DP 1219 B2RF
Biomass and N Uptake - 2013

Biomass

- A
- B

Mixed

Wheat

N Uptake

A

B
Stored Soil Water in Top 140 cm

- Stored Soil Moisture (mm)

- conv.Till
- mixed cover
- No.Till
- wheat

- Cover Termination
- 0.5” irrigation 5/31
- 0.4” irrigation 6/4
- 2.7” precipitation 6/6
- 0.7” precipitation 6/8


- Texas A&M Agrilife Research
Irrigated Cotton Yield - 2013

- Mixed
- Conv. Till
- Wheat
- No-Till

Lint Yield (lb/ac)
Cover Crops in Wheat

- Conventional till
- No-till with no cover
- No-till with no cover, intercropped (Turnip, Radish each @ 0.5 lb/ac)
- No-Till with mixed cover, no-graze
- No-till with mixed cover, grazed
- No-till with mixed cover, intercropped, no-graze
- No-till with mixed cover, intercropped, grazed

- 4 reps; each plot 0.5 ac
- Planted Cover June 9, 2013
- Grazed August 26-29th; 15 pairs for 24 hours per 1 ac
### Warm Season Cover Crop Mix in Wheat at Vernon

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rate (lb/ac)</th>
<th>Cost ($/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron &amp; Clay Cowpea</td>
<td>6</td>
<td>0.90</td>
</tr>
<tr>
<td>Catjang Pea</td>
<td>6</td>
<td>0.90</td>
</tr>
<tr>
<td>Lablab Bean</td>
<td>1</td>
<td>2.10</td>
</tr>
<tr>
<td>Forage Soybean</td>
<td>8</td>
<td>1.20</td>
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<tr>
<td>Browntop Millet</td>
<td>1.5</td>
<td>0.90</td>
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<tr>
<td>G. Foxtail Millet</td>
<td>1.5</td>
<td>1.00</td>
</tr>
<tr>
<td>Sorghum Sudan</td>
<td>2.5</td>
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<tr>
<td>Buckwheat</td>
<td>3</td>
<td>1.00</td>
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<tr>
<td>Sesame</td>
<td>0.5</td>
<td>2.10</td>
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<tr>
<td>Inoculant</td>
<td>-</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>30 lb/ac</strong></td>
<td><strong>$32.95/ac</strong></td>
</tr>
</tbody>
</table>
Conclusions

- Not all cover crops are equal, establishment can be difficult depending on climatic conditions and management decisions. Multi-species mix (6, 8, 14, 20)?

- Cover crops can use a significant amount of soil moisture.

- However, loss of soil moisture due to cover crops during the period prior to planting does not necessarily translate to reduced cash crop performance.

- Termination timing can be critical.

- What’s in it for the producer? Time interval to expect benefits?
Questions?

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