Converting CRP Land to Crop Production

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Challenge of Cropping

- Prevent Soil Erosion
- Maintain Soil Quality
- Provide Farm Profitability
- Maintain Wildlife Habitat
Total Soil Organic C (SOC)

Data from CSU Long-Term Dryland Rotation Study
Dan Manter, USDA-ARS, Ft. Collins

Soil Microbial Biomass (SMB-C)

Data from CSU Long-Term Dryland Rotation Study
Dan Manter, USDA-ARS, Ft. Collins
Soil Biology: abundance

*Bacteria (16S rRNA) and Fungal (18S rRNA)*

- biomass increases with cropping intensity
- biggest change the high ET potential site

### Bacteria

<table>
<thead>
<tr>
<th></th>
<th>Sterling</th>
<th>Stratton</th>
<th>Walsh</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCF</td>
<td>149%</td>
<td>197%</td>
<td>1022%</td>
</tr>
<tr>
<td>CC</td>
<td>243%</td>
<td>347%</td>
<td>1580%</td>
</tr>
<tr>
<td>CRP</td>
<td>402%</td>
<td>602%</td>
<td>26669%</td>
</tr>
</tbody>
</table>

### Fungi

<table>
<thead>
<tr>
<th></th>
<th>Sterling</th>
<th>Stratton</th>
<th>Walsh</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCF</td>
<td>408</td>
<td>79</td>
<td>515</td>
</tr>
<tr>
<td>CC</td>
<td>496</td>
<td>264</td>
<td>632</td>
</tr>
<tr>
<td>CRP</td>
<td>769</td>
<td>693</td>
<td>2404</td>
</tr>
</tbody>
</table>

Data from CSU Long-Term Dryland Rotation Study
Dan Manter, USDA-ARS, Ft. Collins

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**Considerations**

- **Residue Removal**
  - Burn, mow, or leave stand

- **Elimination of CRP grasses**
  - Tillage vs. chemical

- **Soil Water**

- **Soil Nutrients – Fertilizer Placement**

- **Perennials weeds**
CRP Observations from across the Great Plains Region

(some of which are old)

Other Experiences in the Region - Texas

• Difficult to control warm season grass in no-till.
• Soil water depleted, necessary to fallow prior to crop.
• Perennial weeds still present, if present before CRP.

Unger, 1995
Other Experiences in the Region - Colorado

- Tillage more effective than herbicides for controlling cool season grasses.
- 35% grass infestation in no-till following summer.

Anderson, 1995

Other Experiences in the Region - Nebraska

- Tillage controlled grasses
  - But difficult to prepare seedbed

Lyon, 1996
Other Experiences in the Region - Oklahoma

- Residue removal required for herbicide effectiveness.
- Adequate grass suppression with two herbicide applications.
- Only grass suppression not elimination required before cropping.

Dao, 1995

Objective

- Determine best management practices for returning CRP land to crop production in western Kansas.
CRP Grasses

Primary species:
sideoats grama
blue grama
buffalograss
little bluestem
switchgrass

Treatments

• Residue Pretreatment
  – Burn, Mow, or Leave stand
• Grass Controls Methods
  – Tillage, chemical, or both
Burning CRP grass??

- Residue removal
  - Required for herbicide effectiveness?
  - Little difference between removing residue by mowing or burning
- Effect on soil nutrients?

Range grasses - nutrient content
- Lose feed value, nutrients during weathering

- Cr Protein ...... 2.1 – 5.9%
- Phosphorus ... 0.01 – 0.05%
- Potassium ..... 0.26 – 0.78%
- Sulfur ........... 0.08 – 0.15%

- N ........... 5.7 – 16.0 lb/ton
- P<sub>2</sub>O<sub>5</sub> .... 0.4 – 1.9
- K<sub>2</sub>O ..... 5.1 – 15.4
- S .......... 1.6 – 2.9
What goes up in smoke?

- N ........ 100% loss
- P₂O₅ ..... 20%
- K₂O ...... 35%
- S .......... 75%

Nutrients remaining
- N ........ 0.0 lb/ton
- P₂O₅ .... 0.3 – 1.6
- K₂O ..... 3.3 – 10.0
- S .......... 0.4 – 0.7
Organic matter changes after CRP

- Study from 28 fields in southwest Texas Panhandle
  - loamy sand to clay loam soil types
  - CRP for 9 to 15 years
    - soil sampled - fall 2000, spring 2001
- Compared 5 “agroecosystems”
  - Native range
  - CRP
  - cotton – irrigated & dryland (*conventional till*)
  - cotton w/ small grain cover crop (*reduced till*)
Conclusions

• OM in native range differed from cropland at all depths

• OM in CRP differed from cropland in surface 2”

• no difference in 2” to 12” depth
Colorado

- Organic matter in CRP vs. WF
  - 4 sites OM higher in CRP
  - 3 sites OM the same
  - 2 sites OM higher in WF
Grain Sorghum

• Conventional Tillage
  Disc: July & August
  Sweep Plow: September & June

• No-Till
  Glyphosate: July (2qt/a)
  Glyphosate: September (2qt/a)
  Glyphosate: June (1 qt/a)
## Sorghum Planting

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Burn</th>
<th>Mow</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conv. Till</td>
<td>6.7</td>
<td>7.9</td>
<td>9.6</td>
</tr>
<tr>
<td>Reduced Till</td>
<td>7.1</td>
<td>9.4</td>
<td>--</td>
</tr>
<tr>
<td>No-till</td>
<td>5.7</td>
<td>8.3</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Available water/6' profile

Kuttler S96
### Grain Sorghum after Fallow

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Residue Treatment</th>
<th>Burn</th>
<th>Mow</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>grain yield, bu/acre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conv. Till</td>
<td>31</td>
<td>26</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Till-Chem</td>
<td>22</td>
<td>18</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Chem-Till</td>
<td>12</td>
<td>14</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>No-till</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

LSD$_{0.05}$ 7 bu/a

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### Sideoats Grama Control

**90 DAT July 1**

<table>
<thead>
<tr>
<th>RoundUp Ultra</th>
<th>Burn</th>
<th>Mow</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 qt/a</td>
<td>54%</td>
<td>60%</td>
<td>53%</td>
</tr>
<tr>
<td>2</td>
<td>81%</td>
<td>82%</td>
<td>69%</td>
</tr>
<tr>
<td>3</td>
<td>86%</td>
<td>87%</td>
<td>81%</td>
</tr>
</tbody>
</table>

Cramer, 1996
### Little Bluestem Control
#### 90 DAT July 1

<table>
<thead>
<tr>
<th>RoundUp Ultra</th>
<th>Burn</th>
<th>Mow</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 qt/a</td>
<td>21%</td>
<td>38%</td>
<td>37%</td>
</tr>
<tr>
<td>2</td>
<td>47%</td>
<td>61%</td>
<td>55%</td>
</tr>
<tr>
<td>3</td>
<td>70%</td>
<td>69%</td>
<td>72%</td>
</tr>
</tbody>
</table>

Cramer, 1996

### Switch Grass Control
#### 90 DAT July 1

<table>
<thead>
<tr>
<th>RoundUp Ultra</th>
<th>Burn</th>
<th>Mow</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 qt/a</td>
<td>33%</td>
<td>35%</td>
<td>66%</td>
</tr>
<tr>
<td>2</td>
<td>73%</td>
<td>47%</td>
<td>74%</td>
</tr>
<tr>
<td>3</td>
<td>82%</td>
<td>60%</td>
<td>82%</td>
</tr>
</tbody>
</table>

Cramer, 1996
Wheat

• Conventional Tillage:
  – July —Disc
  – August —Disc
  – September —Sweep Plow
  – June —Sweep Plow
  – July —Sweep Plow
  – September —Sweep Plow

Wheat

• No-Till:
  – July —Glyphosate (2qt/a)
  – June —Glyphosate (2qt/a)
  – August —Glyphosate (2qt/a)
Soil Nitrate

- 2 ppm in surface foot of soil.

- < 1 ppm in 2-6 feet.

<table>
<thead>
<tr>
<th>Wheat Grain Yield (bu ac⁻¹)</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Rate (lb ac⁻¹)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conv. Till</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>44</td>
</tr>
<tr>
<td>No-Till</td>
<td>7</td>
<td>16</td>
<td>28</td>
<td>34</td>
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</tbody>
</table>
### Wheat Following CRP

#### Residue Mowed

<table>
<thead>
<tr>
<th>Wheat Grain Yield (bu ac(^{-1}))</th>
<th>N Rate (lb ac(^{-1}))</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conv. Till</td>
<td></td>
<td>17</td>
<td>29</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Reduced Till</td>
<td></td>
<td>10</td>
<td>18</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>No-Till</td>
<td></td>
<td>8</td>
<td>17</td>
<td>27</td>
<td>32</td>
</tr>
</tbody>
</table>

### Wheat Following CRP

#### Residue Burned

<table>
<thead>
<tr>
<th>Wheat Grain Yield (bu ac(^{-1}))</th>
<th>N Rate (lb ac(^{-1}))</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conv. Till</td>
<td></td>
<td>16</td>
<td>27</td>
<td>34</td>
<td>37</td>
</tr>
<tr>
<td>Reduced Till</td>
<td></td>
<td>12</td>
<td>23</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>No-Till</td>
<td></td>
<td>4</td>
<td>15</td>
<td>21</td>
<td>28</td>
</tr>
</tbody>
</table>
CRP going to Wheat:
Leave stand, mow, or burn

- No clear differences between methods in Tribune study, with a slight numerical advantage to leaving residue standing
- Recall in the sorghum study, there was more soil water at sorghum planting where CRP residue was left standing

Wheat

- Reduced Tillage:
  - July — Glyphosate (2qt/a)
  - August — Disc
  - September — Disc
  - June — Sweep Plow
  - July — Sweep Plow
  - September — Sweep Plow
Wheat Following CRP: Averaged Across Residue Treatments

<table>
<thead>
<tr>
<th>Wheat Grain Yield (bu ac⁻¹)</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
</tr>
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<tbody>
<tr>
<td>N Rate (lb ac⁻¹)</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>150</td>
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<td>Conv. Till</td>
<td>19</td>
<td>29</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Reduced Till</td>
<td>11</td>
<td>21</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>No-Till</td>
<td>6</td>
<td>16</td>
<td>25</td>
<td>31</td>
</tr>
</tbody>
</table>

If you are going to do tillage, does it matter when?
Residue Treatment and Timing of Initial Tillage

- Time of Initial Tillage:
  - Fall vs. Spring
- Tillage:
  - Disc vs. Sweep Plow
- Residue Treatment:
  - Leave stand or burn
- Second tillage was the opposite of first.
- All then received sweep plow twice.
- N Rates: 0, 50, 100, and 150 lb N ac\(^{-1}\)

Winter Wheat Following CRP

<table>
<thead>
<tr>
<th>Fall Tillage</th>
<th>Leave Residue Stand</th>
<th>Wheat Grain Yield (bu ac(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nitrogen Rate (lb ac(^{-1}))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Tillage Method</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Disc</td>
<td>10</td>
<td>21</td>
</tr>
<tr>
<td>Sweep</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Control:</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

LSD\(_{0.05}\) treatment=10  N rate=2
## Winter Wheat Following CRP

### Spring Tillage Leave Residue Stand

<table>
<thead>
<tr>
<th>Nitrogen Rate (lb ac⁻¹)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage Method</td>
<td></td>
</tr>
<tr>
<td>Disc</td>
<td>8</td>
</tr>
<tr>
<td>Sweep</td>
<td>11</td>
</tr>
<tr>
<td>Control:</td>
<td>1</td>
</tr>
</tbody>
</table>

LSD₀.₀₅ treatment=10  N rate=2

---

## Winter Wheat Following CRP

### Spring Tillage Burn Residue

<table>
<thead>
<tr>
<th>Nitrogen Rate (lb ac⁻¹)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage Method</td>
<td></td>
</tr>
<tr>
<td>Disc</td>
<td>9</td>
</tr>
<tr>
<td>Sweep</td>
<td>10</td>
</tr>
<tr>
<td>Control:</td>
<td>1</td>
</tr>
</tbody>
</table>

LSD₀.₀₅ treatment=10  N rate=2
Challenge of Cropping

• Prevent Soil Erosion

• Maintain Soil Quality

• Provide Farm Profitability

• Maintain Wildlife Habitat

From 1997 Tribune Study to On-Farm Observations in 2009

• In 2008-2011 I was involved with several producers in bringing CRP back into production in west-central Kansas.

• We took lessons learned from the Tribune studies and tried to apply them
  – High rates of N
  – Left the grass standing
  – No-till practices, despite earlier results
Producer Comments

• SC – “The one thing I’ll adamantly stand behind is that tillage is never necessary. Sometimes the first year fails such as in 2011-2013 but after that the best yields on our farm consistently come from no-tilled CRP and no-tilled native sod.”

Producer Comments

• WA – “I would still recommend starting with wheat when breaking CRP or sod... Having a fallow period to get the grass under control and recover water is important”
• SC – Budget for a glyphosate spraying every 4 weeks, the first should be happening as soon as the first sprigs of CRP grass shoot through
Nutrient management

• Soil test
  – Eroded soils?
    • Low test to start?
    • Time won’t help!
      – Haying = nutrient removal
  – Profile nitrate will likely be very low
  – Phosphorus, zinc may be low or very low

Things to Consider - Fertility

• Nitrogen, Nitrogen, Nitrogen, Nitrogen…. 
  – Subsurface placement would be best
  – Dry urea would be next best
  – Broadcast spray UAN would be the worst option
  – Yields were still going up at 150 lb/ac in the Tribune studies, both wheat and sorghum
• Banded application of Phosphorus
Things to Consider - Fertility

- Immobilization is a major concern
  - CRP grass is around 100:1 C:N ratio
  - Wheat Stubble is around 80:1
  - Immobilization occurs at ratios above 40:1
- It will take a large amount of N to bring that ratio down so that the Nitrogen cycle can function

Things to Consider - Field Management

- Consider the grass has likely utilized all available profile water, a fallow period prior to planting is likely to be beneficial
- Crop Selection
  - Wheat (maybe use a Clearfield variety?)
  - RR/GT Corn
  - Forage Sorghum
  - Soybeans?
    - Will you get enough canopy closure?
  - Grain Sorghum
    - Please don’t do this, what would you do for in-season grass control if there are escapes
Things to Consider – Time

- The longer the window of opportunity to get grasses under control and have the ground in a fallow period, the higher the chances of success.

- Economics of early buyout? I think it would pay in many cases.

- The first crop could very well be a challenge, by many accounts, productivity increases with subsequent crops.

Questions

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