Project Objectives

Continue the 2009-2010 study, documenting:

1. wheat stubble burning impacts (SOM; C, N, P losses);
2. crop rotations and sequences that benefit from retaining winter wheat residues in DS systems;
3. effects of wheat straw management and rotation alternatives on root pathogens.
4. enterprise budget for economic analyses.
**Field Studies and Lab Analyses**

**DOE-1 Field Study (12 x 12 ft plots)**
- 15 sites with 6 treatments (Fall ‘11 Burn, Spg. ‘12 Burn, Control, Fertilized/Nonfert.)

**DOE-2 Field Study (12 x 12 ft plots)**
- Rotations after Fall Burn: (1) ww-sb-sw; (2) ww-cp-sw; (3) ww-ww-sw.

**DOE-3 Field Study (10 x 50 ft plots)**
- 2 rotations (ww and ww-l) and 3 tillage
Cook Agronomy Farm
Direct Seed and Precision Farming Systems

Location of Field Studies based on the 3 Objectives

2009-2010 DOE 1 & 2 Field A

2009-2010 DOE 3 Field

2011-2012 DOE 1 & 2 Field B
Laying out of Test Plots for DOE-1 and DOE-2 sites (Fall 2011 Burn is shown).
DOE-3 Plots with the various rotations and tillage treatments.

Fall 2011 Burns
DOE-3 Test Plots after burning & seeding.
DOE 1: Spring 2012 Burn Plots
DOE-1 Burn Plots: Fall 2011 and Spring 2012

Spring Burn  Fall Burn
Repeated Methodology Used to Accomplish the Objectives

- Measure soil chemical and physical characteristics (soil pH, POM, bulk density, water content, nutrient contents).
- Assess the residue loads (biomass, yields, C and N contents, net collected weights).
- Compute C, N, and P losses (mass balance on soil, plants, and residue).
- Evaluate micronutrient fluxes (PRS probes).
Transformation of Pre-planted Fall Burn Test Plots...
... to Test Plots with 3-Treatments with the 2 Fertilizer Applications.
Progress Made Since Feb. Meeting

• Laid out 3-treatment locations (fert. and non-fert.) for DOE-1; performed Spg Burn.
• Assessing the Spg 2012 burn residue loads.
• Conducted a battery of DOE-1 soil sampling.
• Computing C, N, and P losses (mass balance on soil, plants, and residue).
• Evaluating micronutrient fluxes with the PRS probes (6 field sites are being monitored).
Progress Being Made (... continued)

- Completed some soil analyses (bulk density and water content).
- Spg 2012 burn residue analyses will be done after we finish processing samples.
- Finish performing the physical and chemical testing on the soil and plant samples.
- Will shortly begin PRS probe lab incubations (Spg Burn & Con) compared to field deployed.
Soil Nitrogen Cycling

Plant Uptake

- Plant Uptake
- living biomass

N Gases
- denitrification
- leaching
- fertilizer

organic N

active

stable

NH$_4^+$

NO$_3^-$

mineralization

immobilization

death
Soil sampling for each of the test plots.
Composited the soil samples from each test plot.
Some results were presented at Feb 7th meeting. The residue load data for Spring 2012 Burn was collected and will soon be analyzed.

Testing that still needs to be performed includes:

- **Soil**: pH, POM, nutrient content, N mineralization
- **Residue**: C & N and burn removal loads (Spg ‘12)
- **Plant**: N, biomass, staging data, yield, protein
Residue Loads Studies

Fall ‘11 & Spring ‘12 Burns and Nutrient Analyses Results
Collected 1 m² of PreBurn and PostBurn residue from each plot.
• The spring 2012 residue samples data is preliminary; they still need to be sorted.

• Residue mass lost to burning ranged 54 – 91% (Fall 2011) and 40 – 80% (Spring 2012).

• Average residue lost to burning (15 sites) was:
  - **Fall 2011**: 78% (compared to 64% fall 2009)
  - **Spring 2012**: 55% (vice 56% for spring 2010).
Seeding and Fertilizer Concord Drill used for DOE-1 Plots
DOE-1 test plot split into fertilized and non-fertilized sections
After DOE-1 test plots were planted with Concord, the areas between plots were ‘filled-in’ using Horsch Drill.
PRS Probes Deployed Monitoring Nutrient Flux
PRS Probes Placed in both Fall Burn & Control sites

Initial Deployment on 5/10/12; Plot #4
PRS probes placed in the non-fertilized split-plot between planted rows
Week-2 Field Deployment of PRS Probes
Week-2 Plot #9
Fall Burn w/ PRS
Week-3 Plot #8
Fall Burn w/ PRS
Week-3 Plot #12
Fall Burn w/ PRS
Week-4 Plot #4
Fall Burn w/ PRS
Items to Complete (next 6 mon.)

• Analyze residue C & N contents for Spring 2012 Burn (30 samples).
• Complete PRS probe field deployment and lab incubation testing; work up the data.
• Analysis of acquired data (nutrient loss relationships for burn vs. non-burn sites).
• Soil erosion and condition index estimates.
• Plan for harvest collection in Aug/Sept.
• Economic assessment of lost residue.
Residue Loads for Fall 2009, Spring 2010, and Fall 2011 Burns

Residue Remaining after Burning

PostBurn Residue (lb/ac)

PreBurn Residue (lb/ac)

Slope = 0.27
R² = 0.25

Slope = 0.63
R² = 0.67

Slope = 0.56
R² = 0.68

Fall 2009
Spring 2010
Fall 2011
Concord Drill Opener and Fertilizer Tube
### Residue Load Impacts from Burn Treatments

<table>
<thead>
<tr>
<th>Winter Wheat Residue</th>
<th>Fall 2009 Burn</th>
<th>Spring 2010 Burn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-burn</td>
<td>Post-burn</td>
</tr>
<tr>
<td>Residue Load (lbs/ac)</td>
<td>8093a</td>
<td>3059c</td>
</tr>
<tr>
<td>Residue N (%)</td>
<td>0.44d</td>
<td>0.78a</td>
</tr>
<tr>
<td>Residue C (%)</td>
<td>39.9b</td>
<td>39.9b</td>
</tr>
<tr>
<td>Residue C/N</td>
<td>92.0a</td>
<td>54.5b</td>
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<tr>
<td>Residue N (lbs/ac)</td>
<td>35.9a</td>
<td>24.2c</td>
</tr>
<tr>
<td>Residue C (lbs/ac)</td>
<td>3228a</td>
<td>1218c</td>
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</tbody>
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