



Straw Management and Crop Rotation Alternatives to Stubble Burning: Assessing Economic and Environmental Trade-offs

DOE Presentation – June 12, 2012

by Gerard Birkhauser

Co-Principle Investigators

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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)

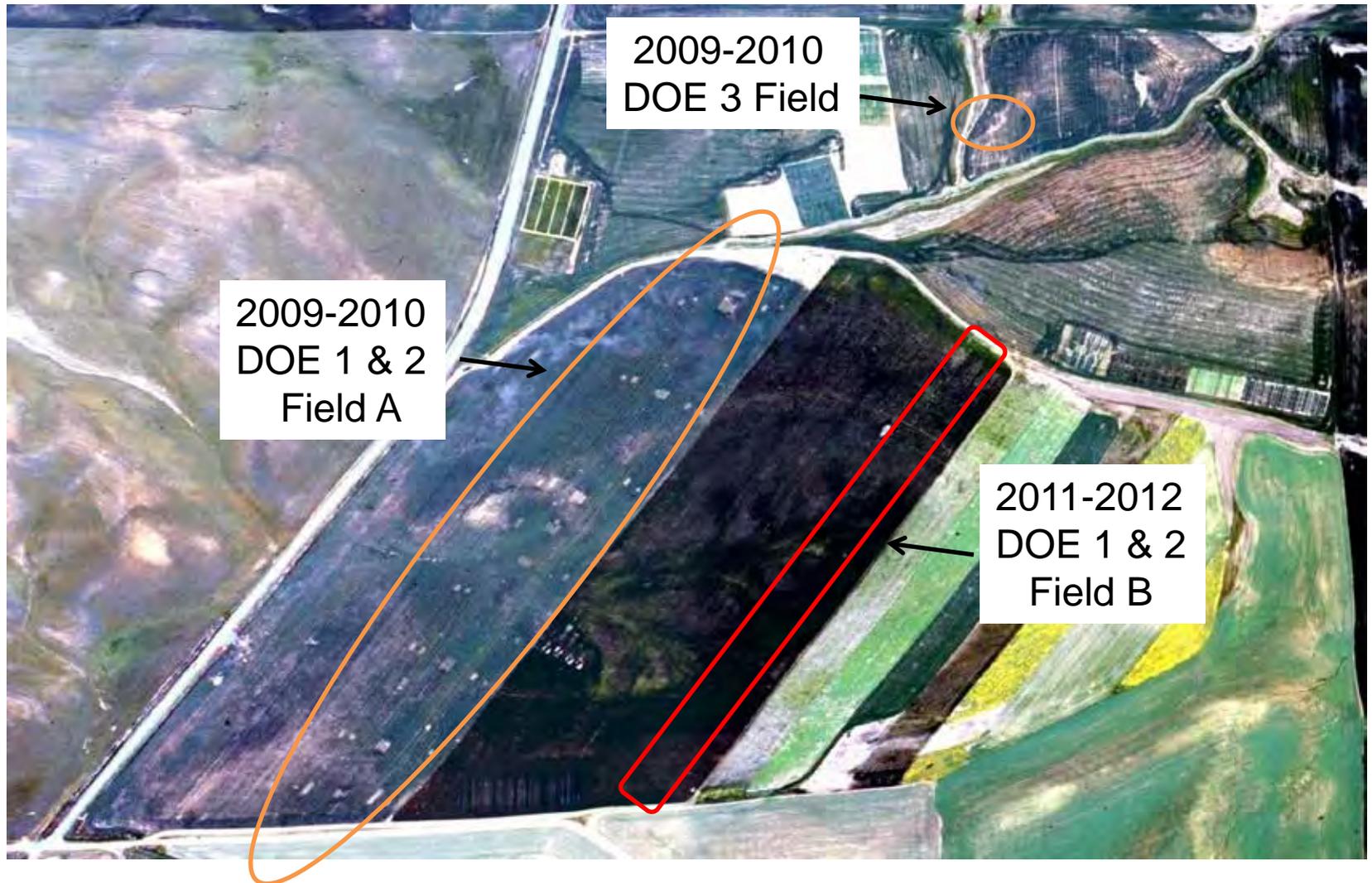
- Rotations after Fall Burn: (1) ww-sb-sw; (2) ww-cp-sw; (3) ww-ww-sw.

DOE-3 Field Study (10 x 50 ft plots)

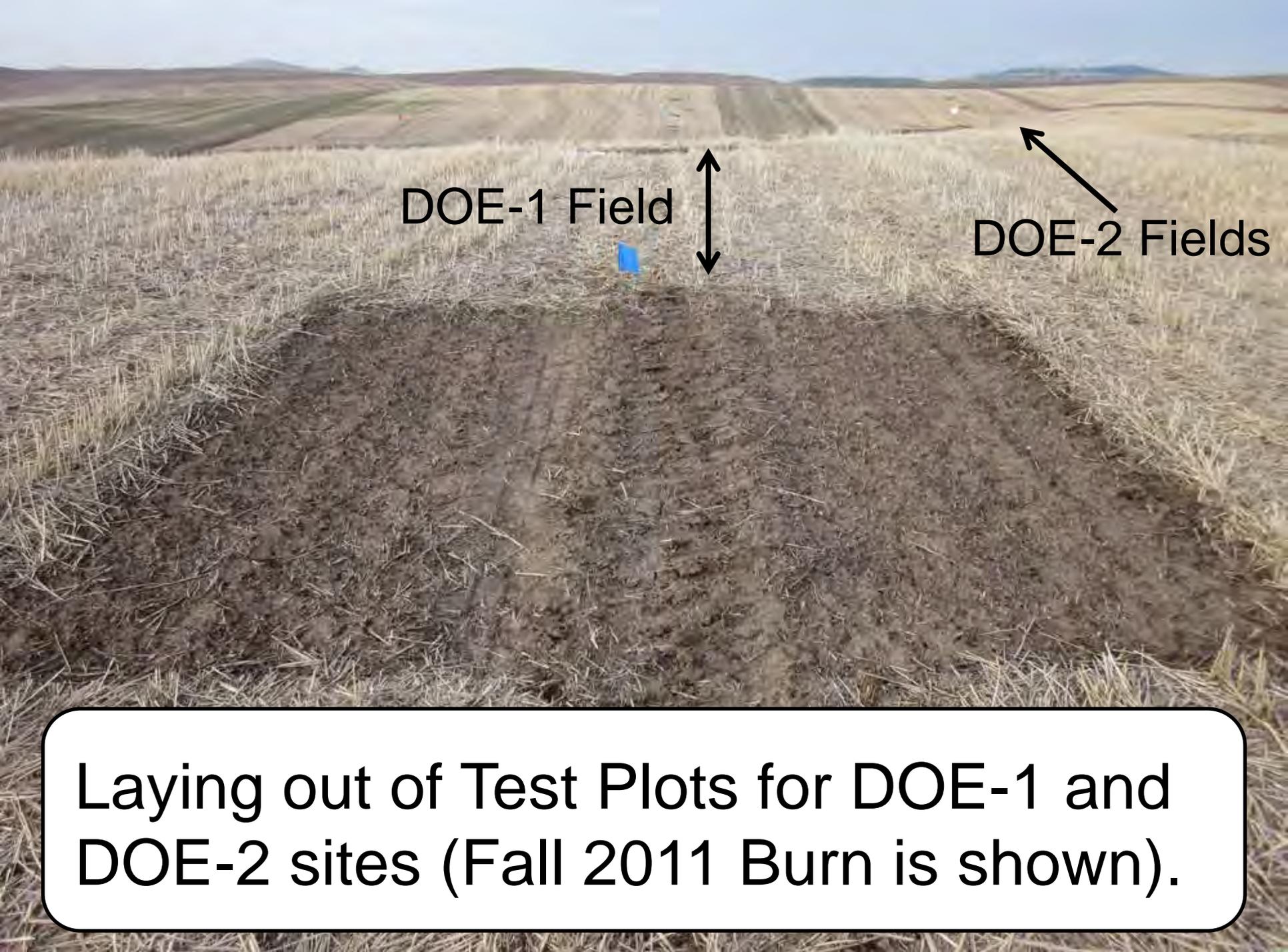
- 2 rotations (ww and ww-l) and 3 tillage

Cook Agronomy Farm

Direct Seed and Precision Farming Systems



Location of Field Studies based on the 3 Objectives

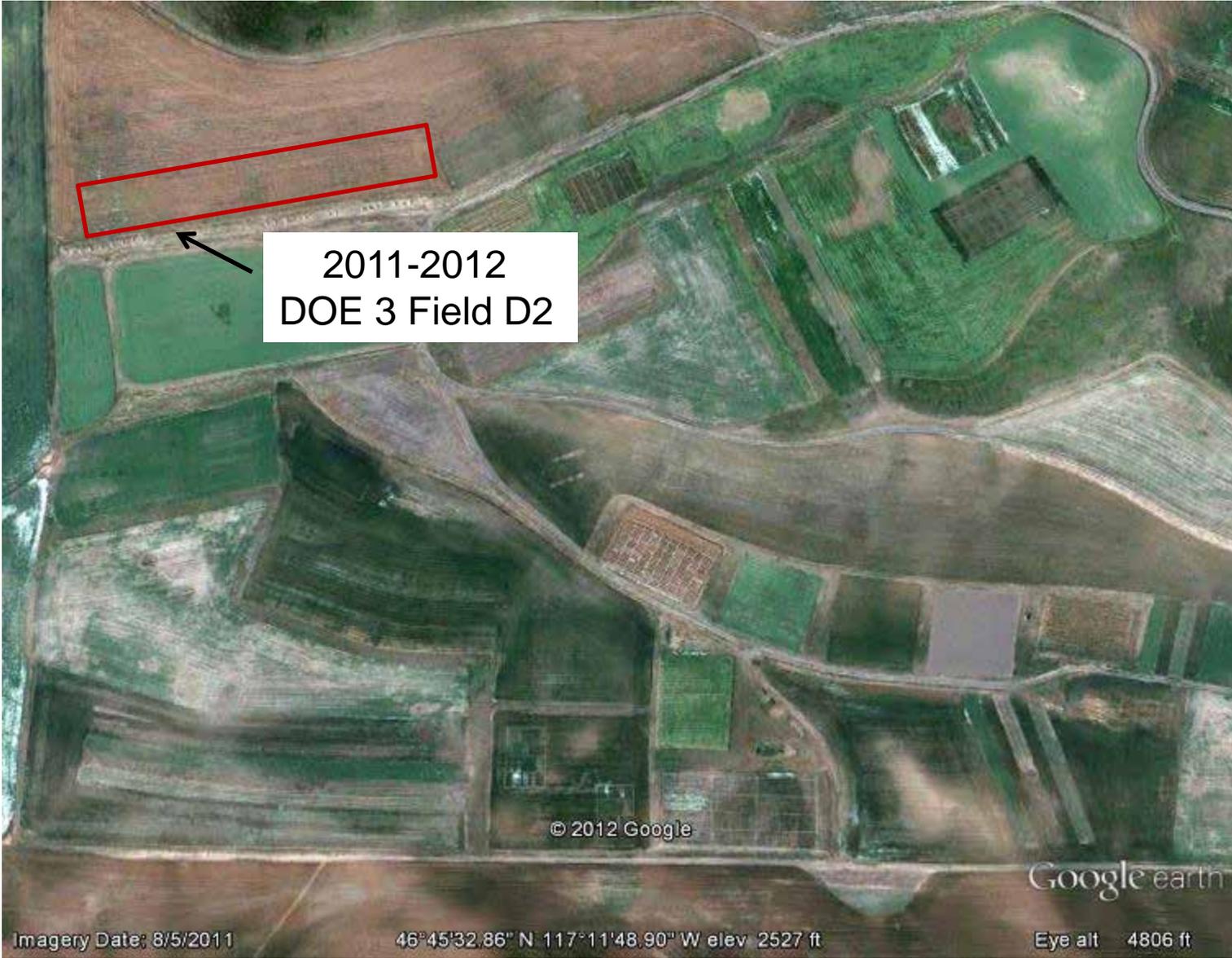


DOE-1 Field

DOE-2 Fields

Laying out of Test Plots for DOE-1 and DOE-2 sites (Fall 2011 Burn is shown).

USDA Palouse Conservation Field Station



2011-2012
DOE 3 Field D2

© 2012 Google

Google earth

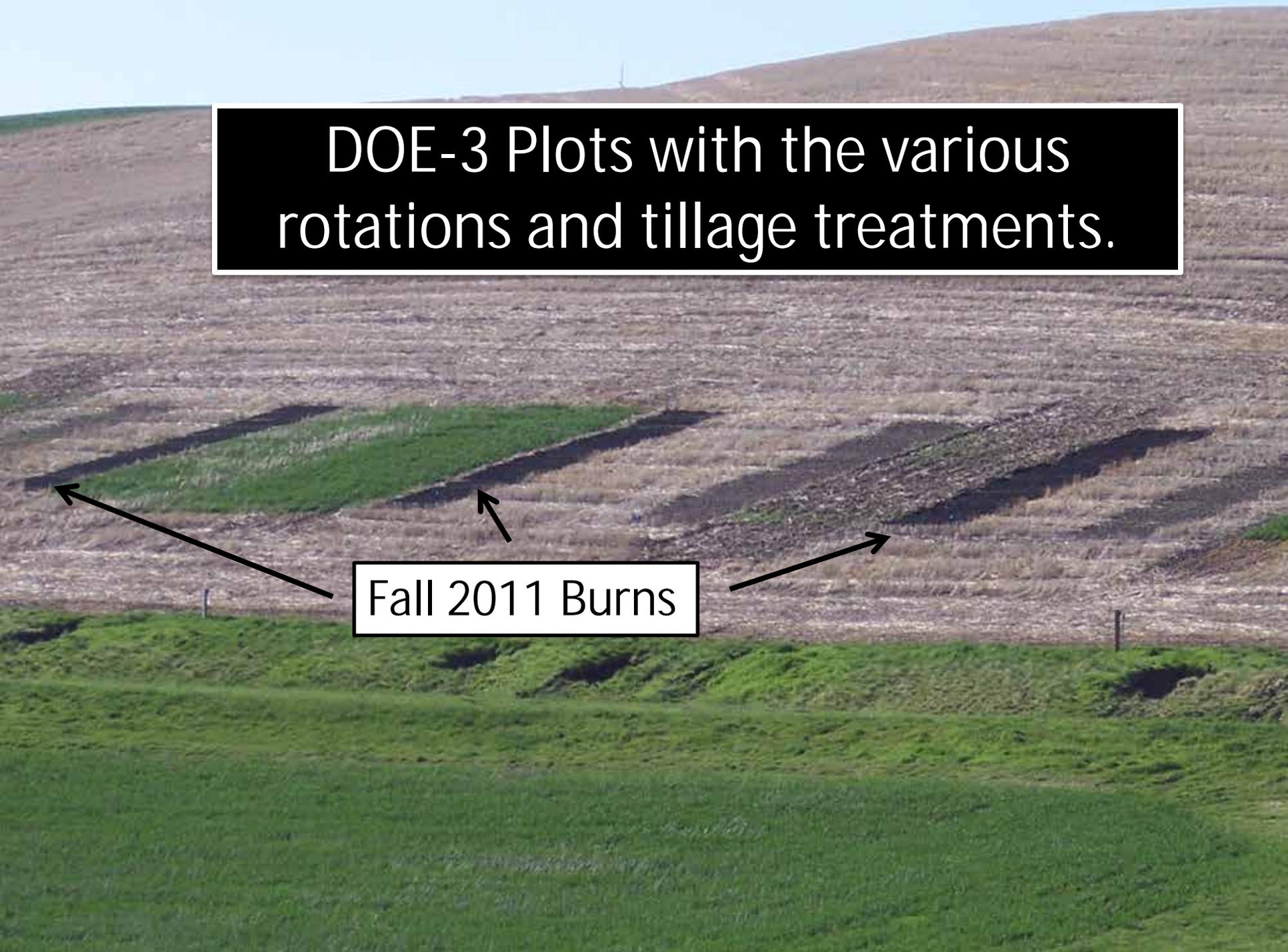
Imagery Date: 8/5/2011

46°45'32.86" N 117°11'48.90" W elev 2527 ft

Eye alt 4806 ft

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



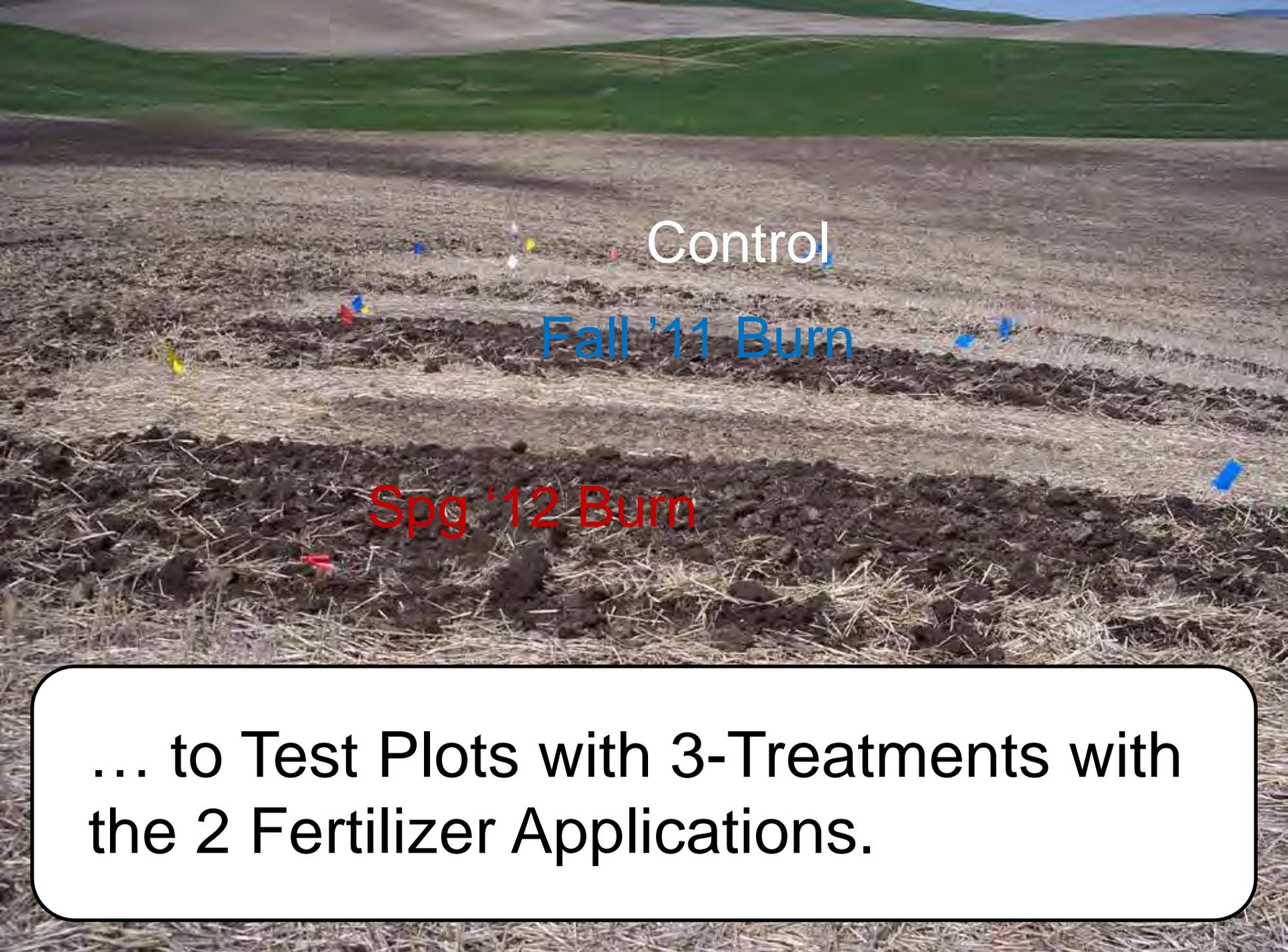
Repeated Methodology Used to Accomplish the Objectives

- 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).

A photograph of a field with a dirt path and blue markers. The field is covered in dry, yellowish-brown grass. A dirt path runs through the center of the field. There are several blue markers placed on the path. In the background, there are some small white and red markers on the horizon. The sky is a clear, light blue.

Transformation of Pre-planted Fall Burn Test Plots...

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Control

Fall '11 Burn

Spg '12 Burn

... to Test Plots with 3-Treatments with
the 2 Fertilizer Applications.

Progress Made Since Feb. Meeting

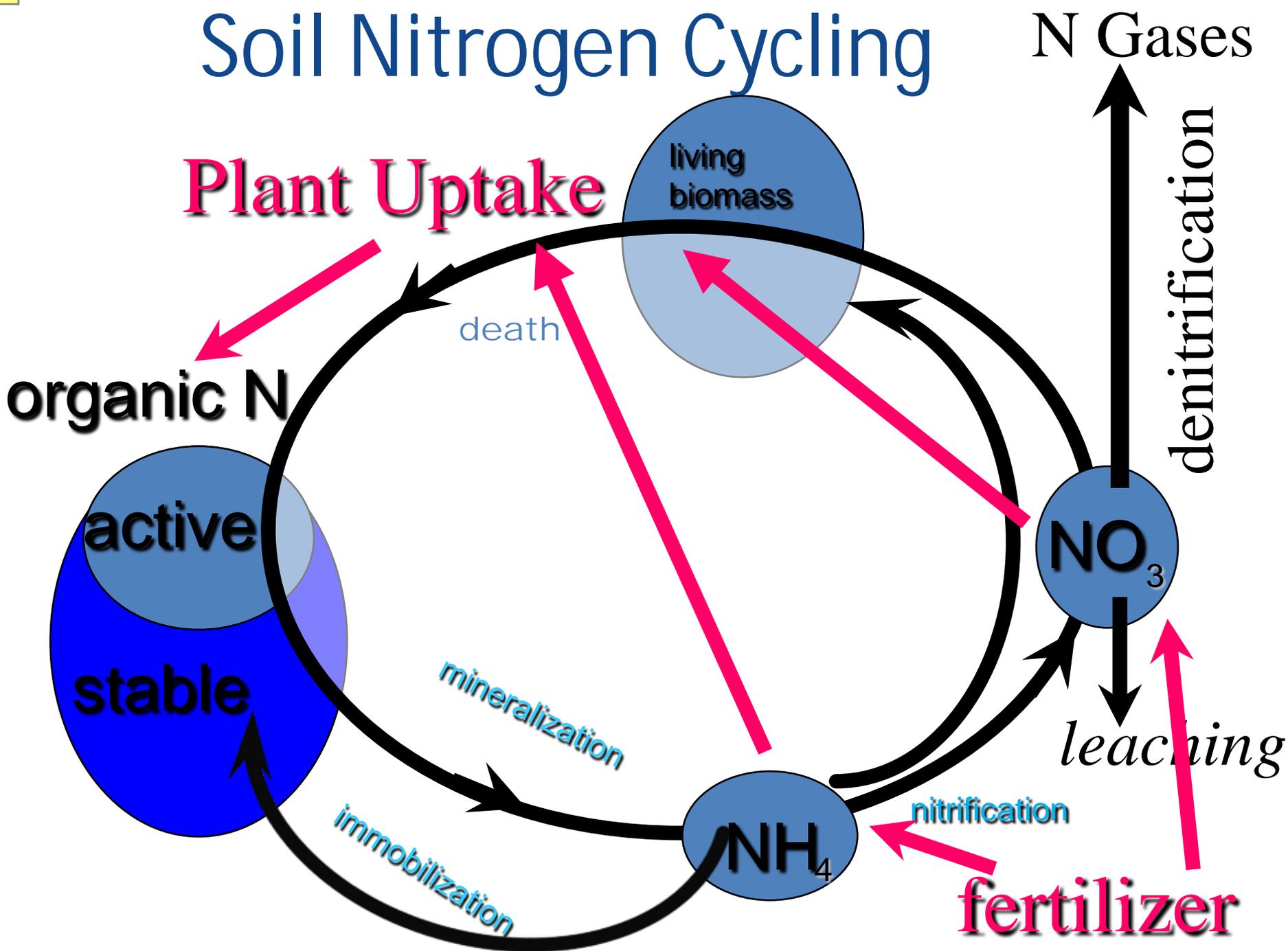
- Laid out 3-treatment locations (fert. and non-fert.) for DOE-1; performed Spg Burn.
- Assessing the Spg 2012 burn residue loads.
- Conducted a battery of DOE-1 soil sampling.
- Computing C, N, and P losses (mass balance on soil, plants, and residue).
- Evaluating micronutrient fluxes with the PRS probes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



Soil sampling for each of the test plots.



Composited the soil samples from each test plot.



Soil, Residue, & Plant Chemical and Physical Characteristics

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:

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

Residue Loads Studies

A photograph showing a person in a white t-shirt and dark pants kneeling in a field of straw. The person is positioned next to a blue plastic bin and a yellow bag, appearing to be collecting or organizing samples. The field is covered with a thick layer of straw, and a large, dark, rectangular area of the straw has been removed or charred, creating a contrast with the surrounding unburned straw. The scene is set outdoors under bright sunlight.

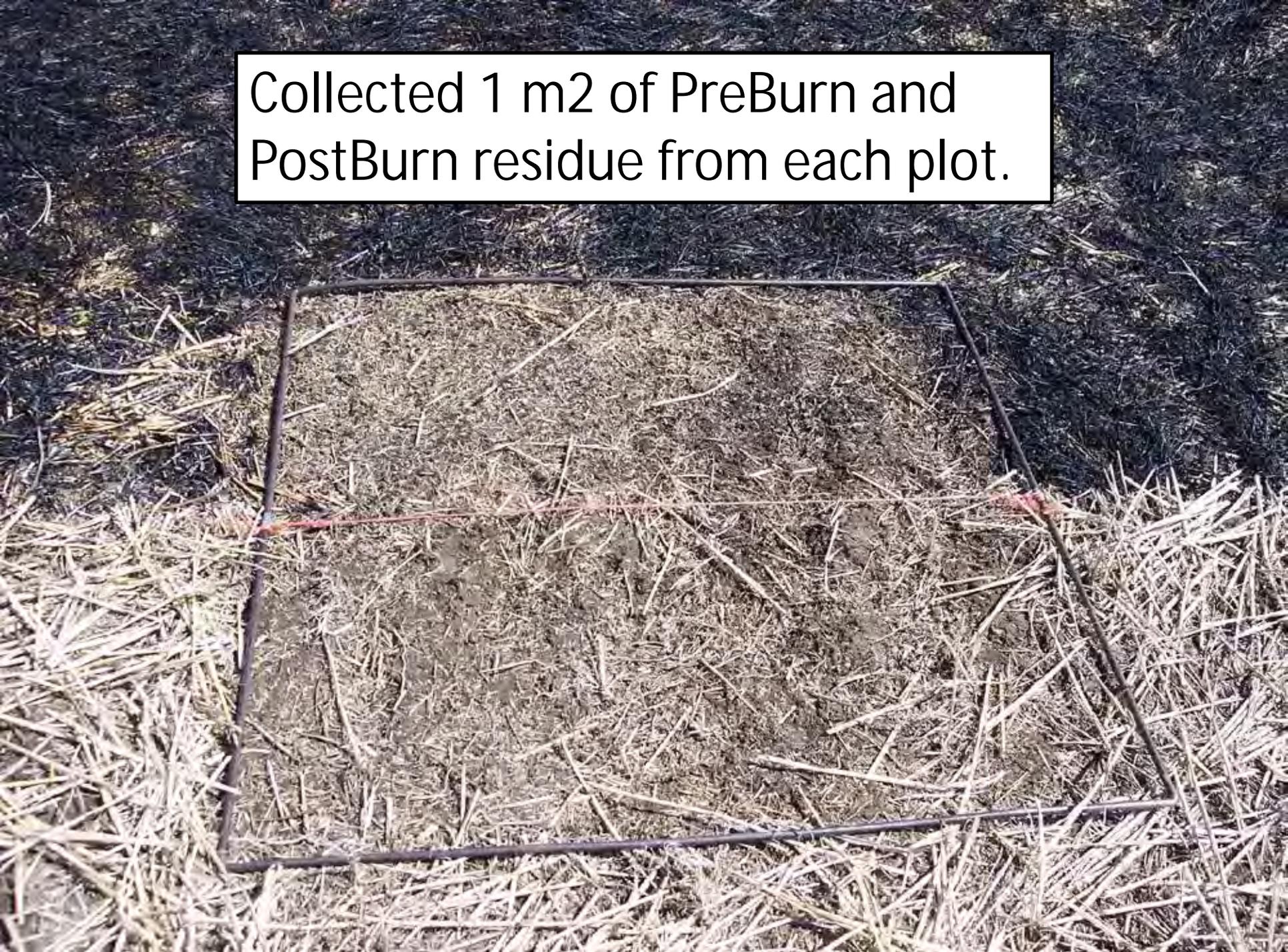
Fall '11 & Spring '12
Burns and Nutrient
Analyses Results

Spring 2012 Burn

Fall 2011 Burn



Collected 1 m² of PreBurn and PostBurn residue from each plot.



Residue Loss from '11 & '12 Burns

- The spring 2012 residue samples data is preliminary; they still needs 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).



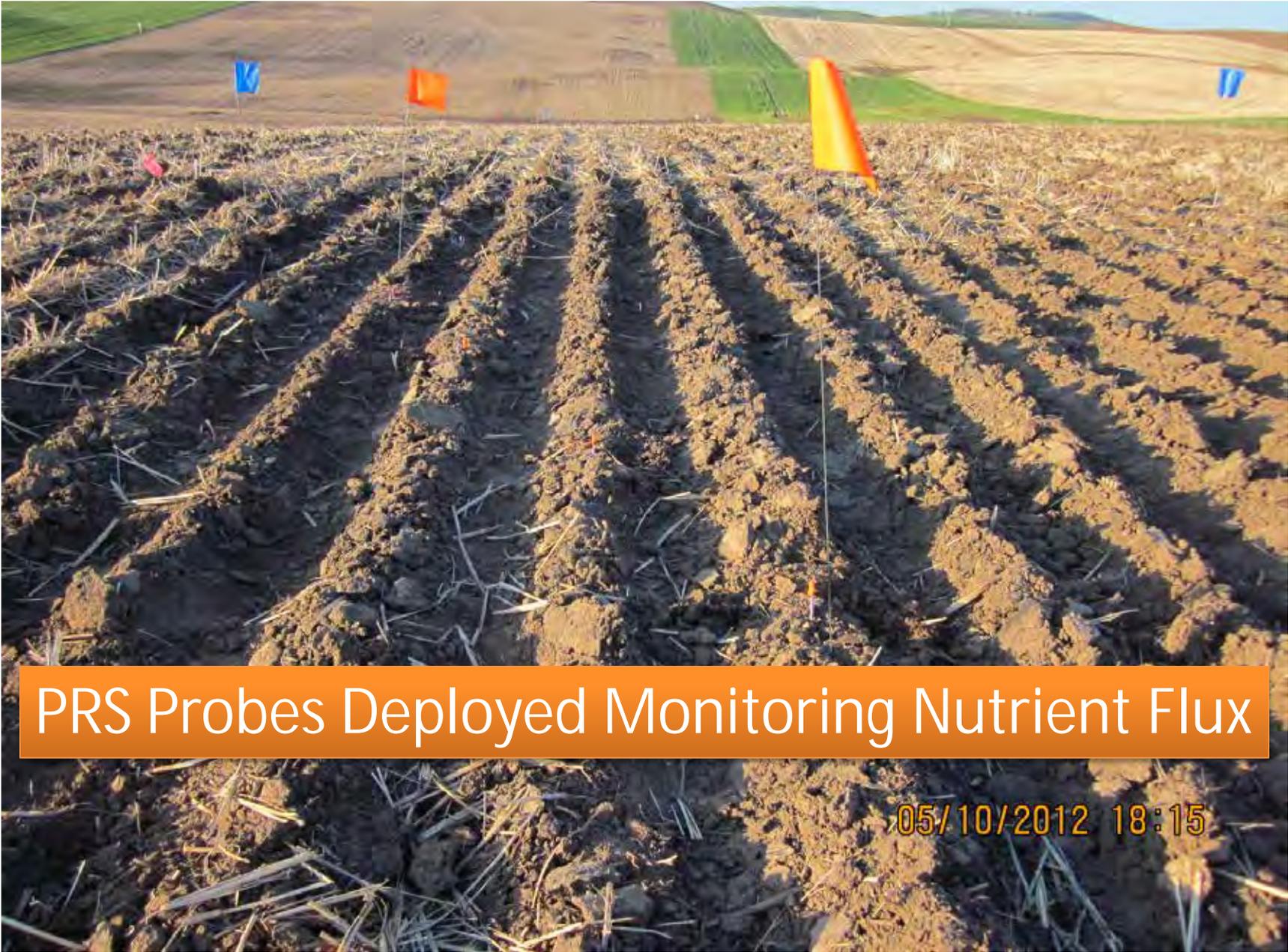
Seeding and Fertilizer Concord Drill used
for DOE-1 Plots



DOE-1 test plot split into fertilized and non-fertilized sections

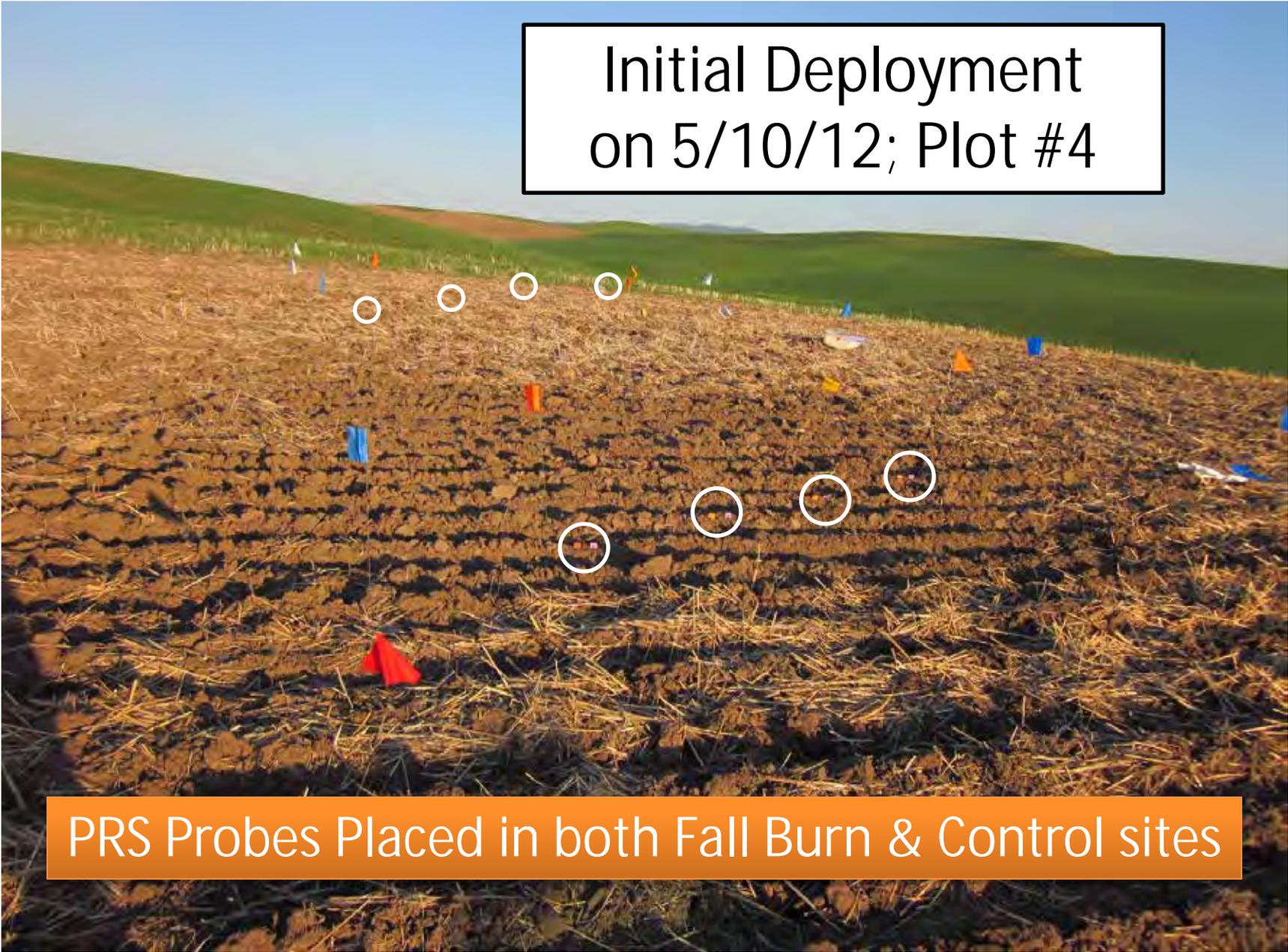


After DOE-1 test plots were planted with Concord, the areas between plots were 'filled-in' using Horsch Drill.



PRS Probes Deployed Monitoring Nutrient Flux

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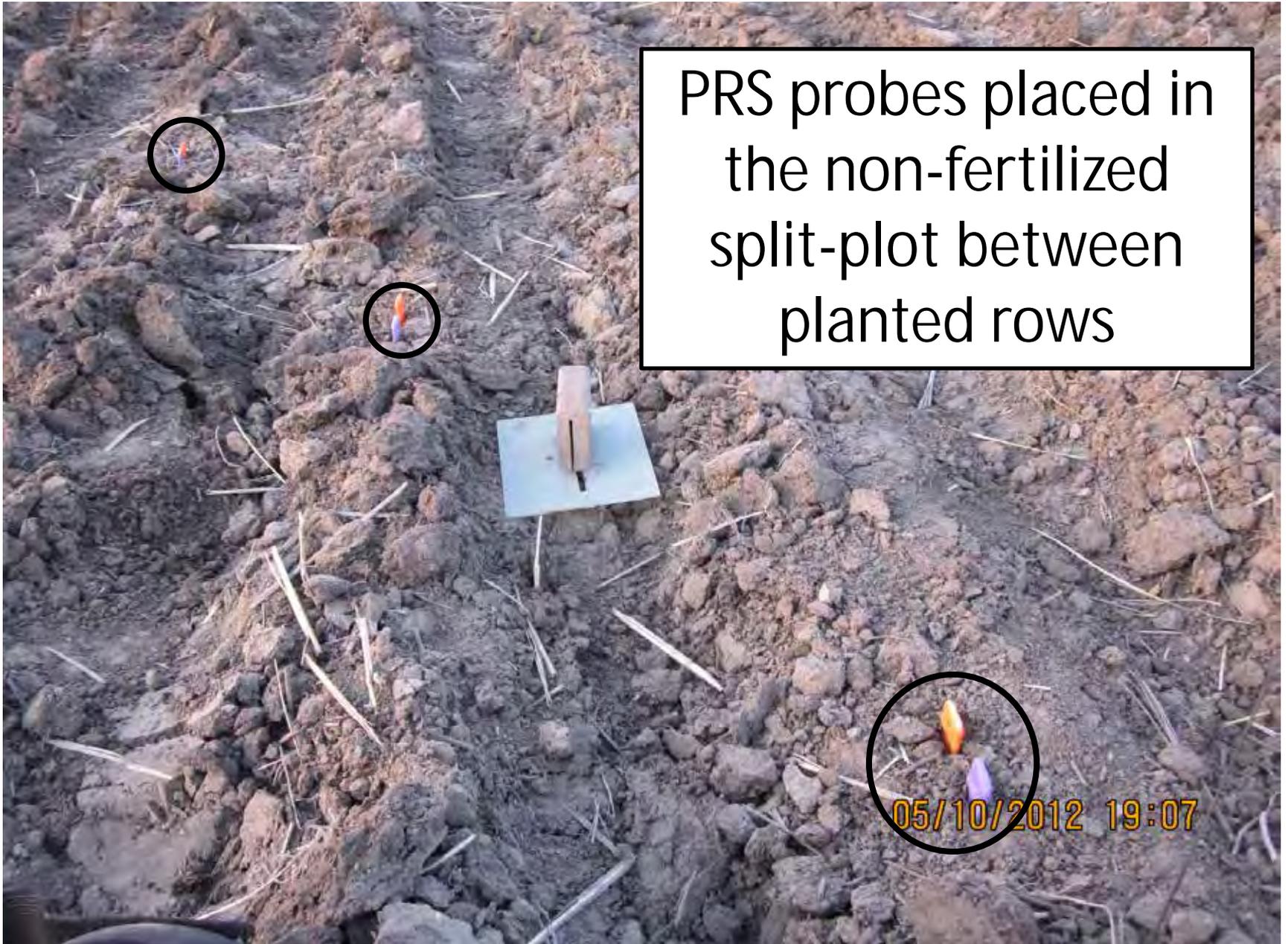


Initial Deployment
on 5/10/12; Plot #4

PRS Probes Placed in both Fall Burn & Control sites

PRS probes placed in
the non-fertilized
split-plot between
planted rows

05/10/2012 19:07





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Week-2 Field Deployment of PRS Probes

Week-2 Plot #9
Fall Burn w/ PRS

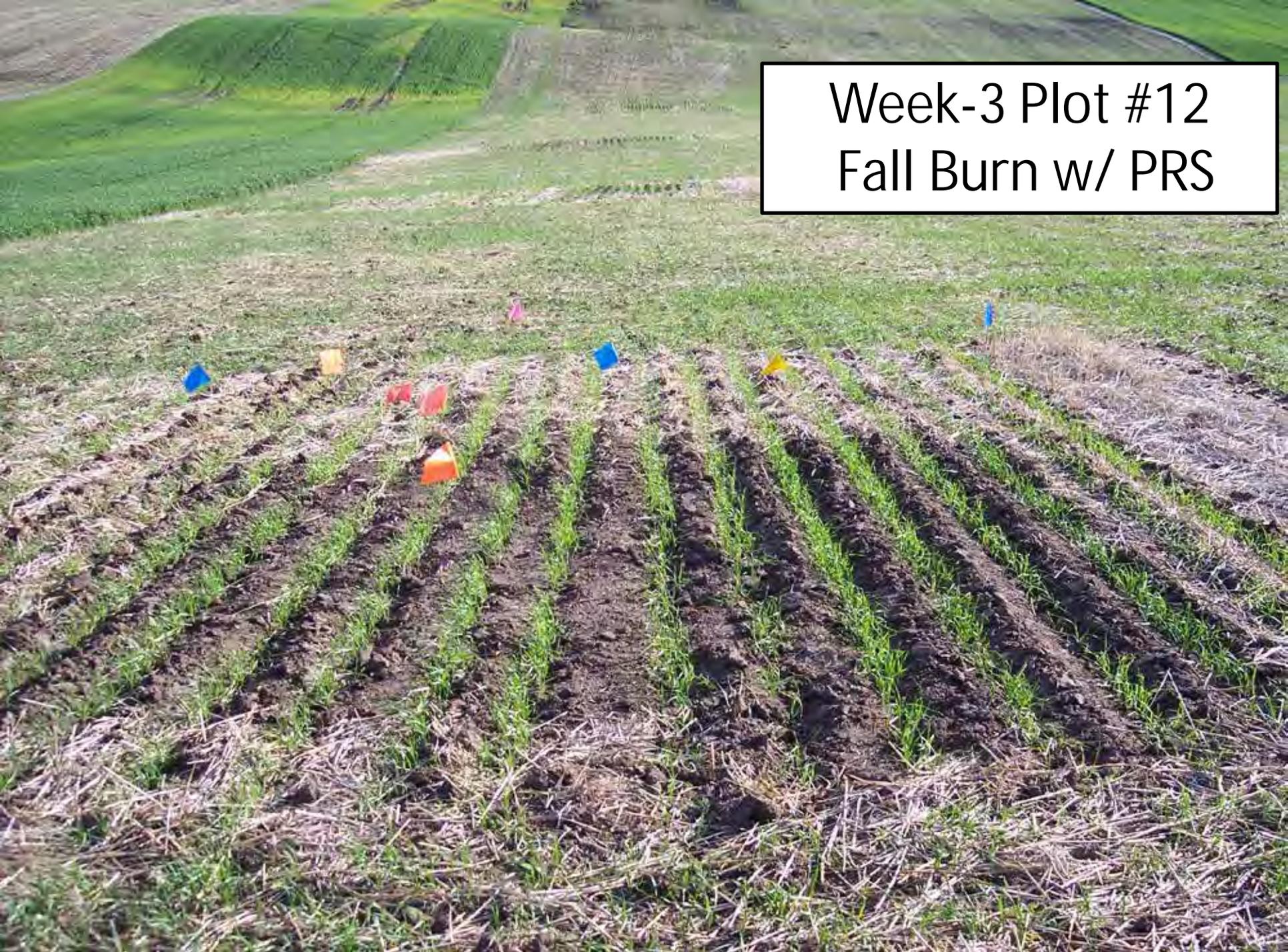


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Week-3 Plot #8
Fall Burn w/ PRS



Week-3 Plot #12
Fall Burn w/ PRS



Week-4 Plot #4
Control w/ PRS



06/08/2012 15:20

Week-4 Plot #4
Fall Burn w/ PRS

06/08/2012 15:19



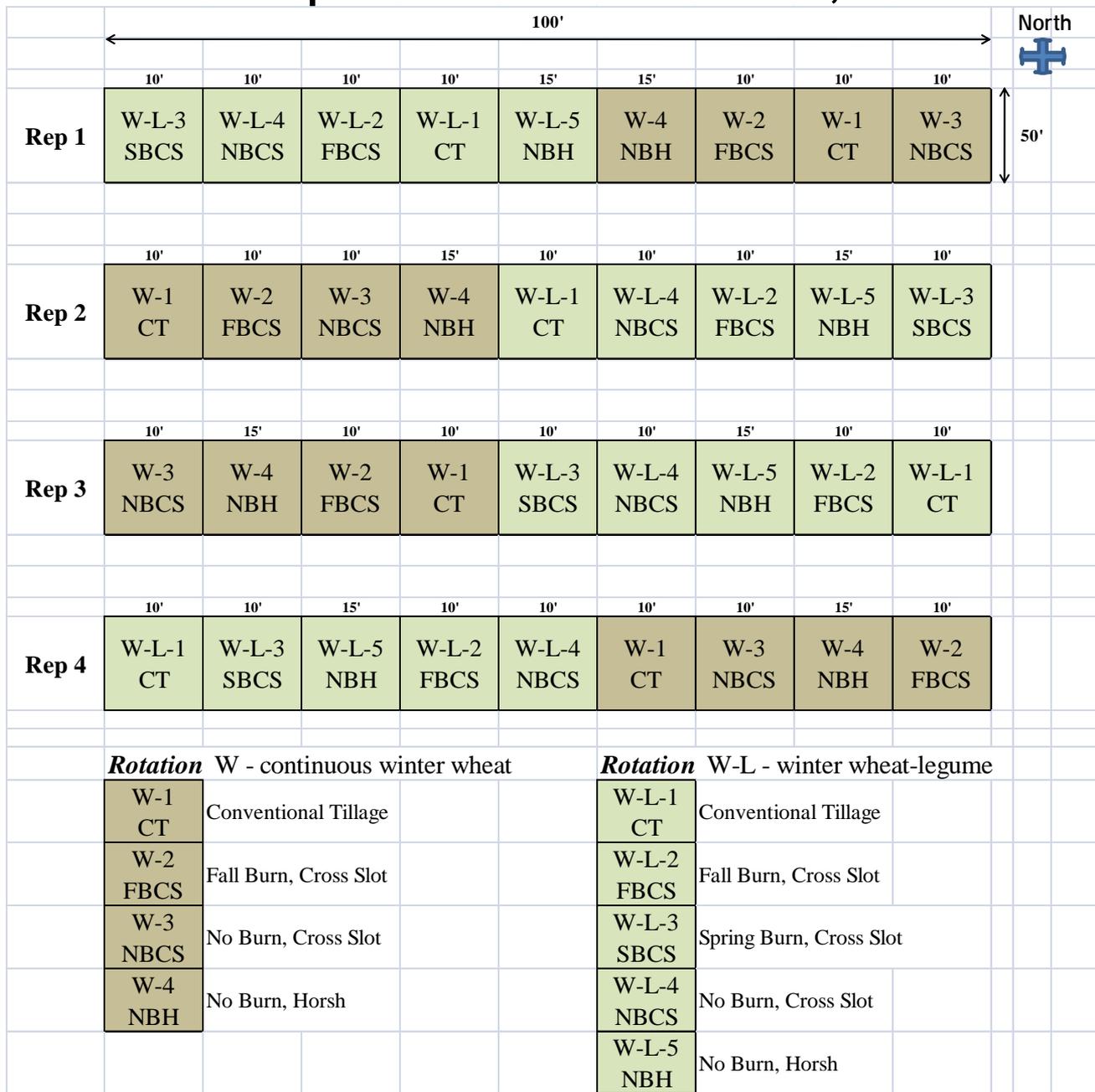
Items to Complete (next 6 mon.)

- 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.



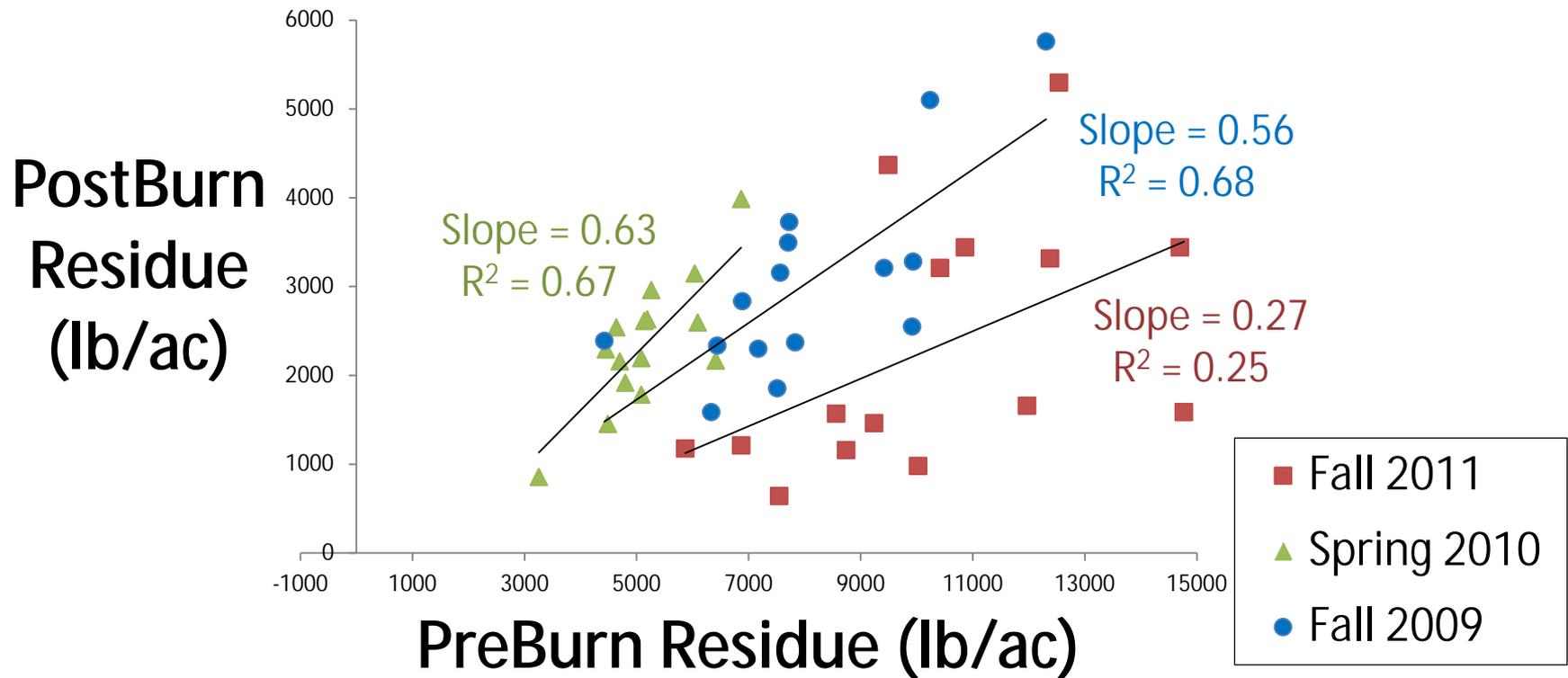
Presentation Back-up Information

DOE 3 Plot Map SY2011-HY2012, PCFS Field



Residue Loads for Fall 2009, Spring 2010, and Fall 2011 Burns

Residue Remaining after Burning







Concord Drill
Opener and
Fertilizer Tube

Residue Load Impacts from Burn Treatments

Winter Wheat Residue	Fall 2009 Burn		Spring 2010 Burn	
	Pre-burn	Post-burn	Pre-burn	Post-burn
Residue Load (lbs/ac)	8093a	3059c	5168b	2354c
Residue N (%)	0.44d	0.78a	0.52c	0.69b
Residue C (%)	39.9b	39.9b	43.0a	40.5b
Residue C/N	92.0a	54.5b	84.6a	59.5b
Residue N (lbs/ac)	35.9a	24.2c	27.3b	16.3d
Residue C (lbs/ac)	3228a	1218c	2226b	955c