

1 Overcoming critical crop production issues

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Critical issues

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- **Critical issues**
 - **Reducing nutrient losses,**
 - **Increasing yield and N efficiency,**
 - **Diversity of organisms,**

 - **Maintaining soil quality,**
 - **Sodic soil development,**
 - **Weed control,**
 - **Non-drainage options,**
 - **Wildlife habitat**

Energy efficiency and nutrient loss

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- **Can cover crops help increase nutrient and energy efficiency.**

Winter

- **Wheat → Cover crop → Corn**

Spring

- **Cover crop + corn**

During the year

- **Corn + cover crop**

Need to provide an economic return

- Cover crop seeded after wheat provide the opportunity to winter grazing.
- Increase bird populations
- Reduce inputs and increase outputs

Fall 2010 Cover Crops

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Fall 2010 Cover Crop Rates and Seed Costs

	Plant Date	Radish	Winter Canola lbs/ A	Turnips	Cost US\$
Andover Summit & Footslope	8/17/10	2	3	2	\$16.03

Based on: Radish, \$3.75/lb; Winter Canola, \$1.21/lb;
Turnips, \$2.50

Andover, Fall 2010 Cover Crop

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Andover, May 2011, Soil N, 0-24 inches

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Landscape			
Position	May 2011 Soil N, lbs / A		
Summit	NO ₃	NH ₄	Total N
No CC	32	20	52
Fall CC	15	19	34
P value	0.003	0.411	0.006
Footslope			
No CC	37	26	63
Fall CC	27	27	54
P Value	0.013	0.170	0.016

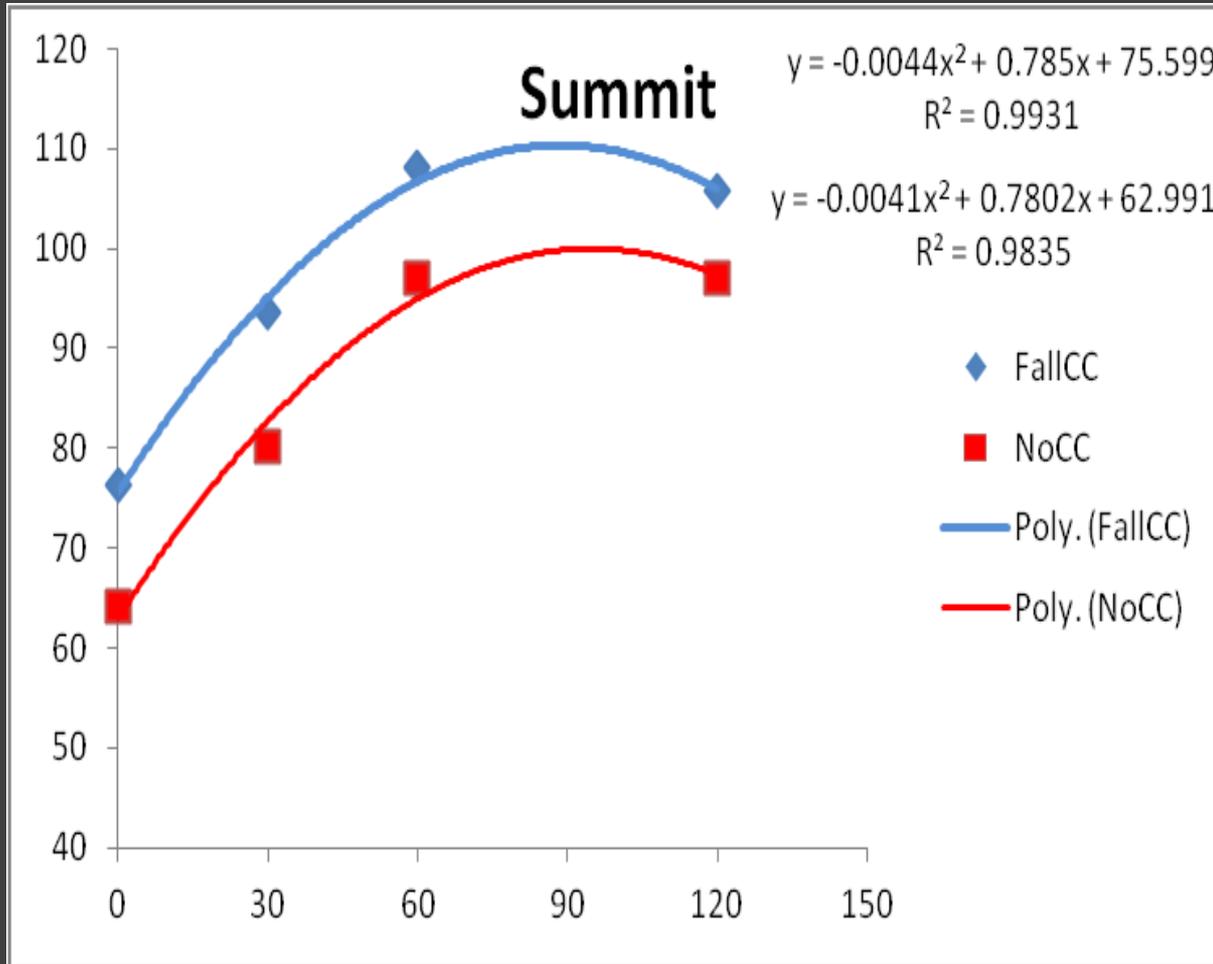
Trail City, May 2011, Soil N, 0-24 inches

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Landscape Position	May 2011 Soil N, kg ha ⁻¹		
Summit	NO₃	NH₄	Total N
No CC	23	30	53
Fall CC	18	31	50
P value	0.005	0.149	0.093
Footslope			
No CC	29	29	58
Fall CC	30	34	63
P Value	0.938	0.026	0.330

Trail city: Summit Yield Response (N Rates)

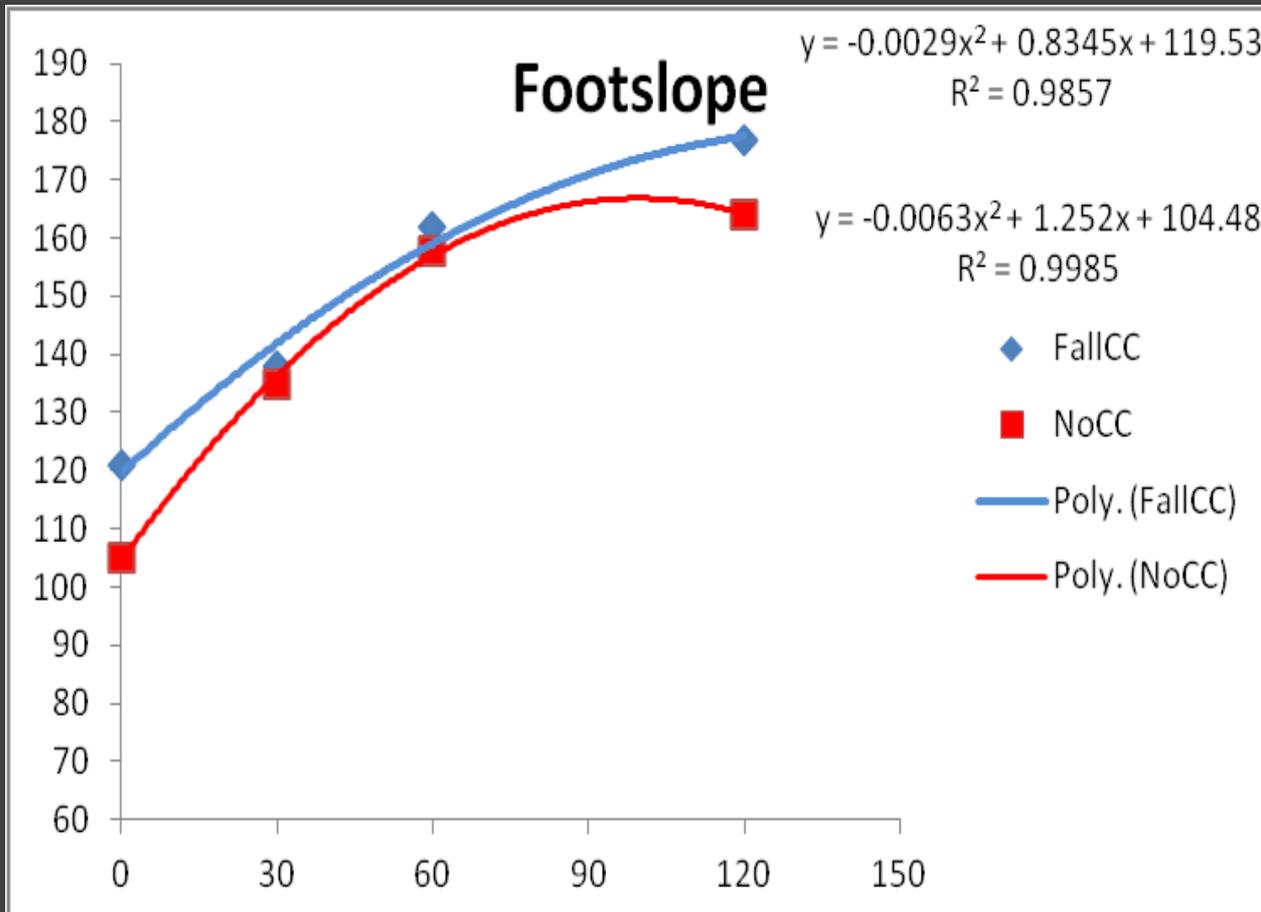
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- **Fall CC (Blue)**
- **Yield greater at all N rates.**
- **NoCC (Red)**

Footslope Yield Response

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- **Fall CC (Blue)**

- **NoCC (Red)**

- **~95 lbs N was sufficient.**

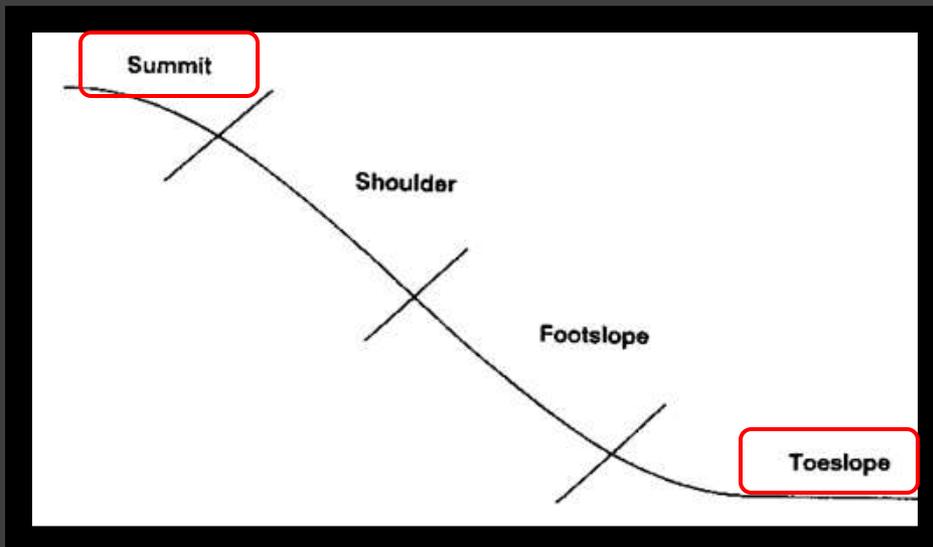
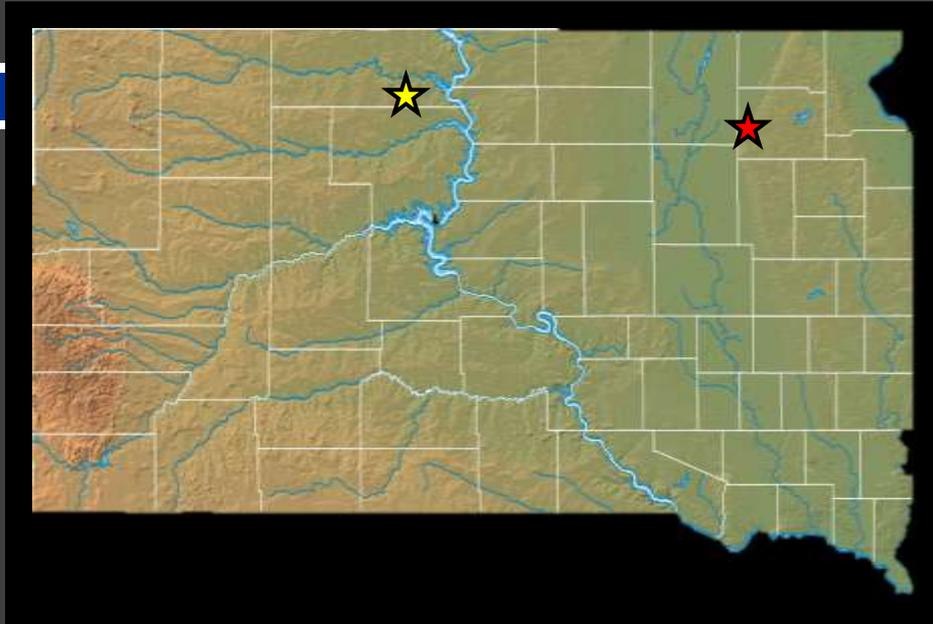
- **Did we change:**

- **Soil biology?**
Mineralization?

- **Between treatments?**

Cover crops impact on water cycling

- Andover, SD (AN) (2010 and 2011)
 - Day County, SD
- Trail City, SD (TC) (2011)
 - Corson County, SD
- Research Location Farming Practices:
 - No-tillage farming systems
 - Wheat-corn rotations
- 2 Field Positions per Location
 - Summit
 - Toeslope



Fall 2010 Root Depth, Purple Top Turnips and Grazing Radishes

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2 in.

12 in.

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PS Dept.

Andover:

Fall 2010 Soil Moisture

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Treatments	Soil Moisture (%)		
	0-6 in. (0-15 cm)	6-12 in. (15-30 cm)	12-24 in. (30-60 cm)
Field Position			
Summit	19.6	19.5	20.7
Footslope	29.3	27.7	24.1
P value	<0.001	<0.001	<0.01
LSD (0.05)	1.8	1.8	2
Cover Crop			
No Fall Cover Crop	29.7	29.3	24.6
Fall Cover Crop	29.0	26.0	23.6
P Value	NS	<0.05	NS
LSD (0.05)		2.6	

- **5.0 inches (12.7 cm) rainfall from 9/1/2010 to 11/17/2010.**
- **Normal for this period is about 3.5 inches.**
- **Rainfall 42% greater than average, still observed difference**

**Spring 2011
Andover, SD**



**Note earthworm
associated with
decomposing radish root.
THIS WAS COMMON!**

Isopods (beneficial) found in brassicas in footslope conditions and moist soil

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Jonathan Lundgren, USDA-ARS, Research Entomologist

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	Values	
Row Labels	Average of # mites	Average of # other arthropods
No Cover Crop	323	62
Footslope	421	89
Summit	226	35
Cover crop	401	246
Footslope	581	430
Summit	221	62
Grand Total	362	154

Arthropods

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- **Provide food for many different birds including pheasants .**
- **We do not want to provide nesting habitat because these areas can become a trap that can result in the destruction during corn seeding.**

Cover crop

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- **Cover crops may provide a missing tool that can be added to our tool box that can help overcome many problems.**
- **They may help reduce nutrient losses**
- **They may help increase biodiversity**
 - **insects and birds**
- **They may help increase yields**
- **Can be used for winter cattle feed**
- **Farmers are excited about this technology**

Critical gaps

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- **To what extent can it be used to reduce water and salt transport to footslope areas**
- **Does it improve soil organic carbon and N cycling**
- **How much does it reduce erosion**
- **What is its impact on wildlife, does it behave as a trap.**
- **Can we develop the mathematics needed to implement this BMP.**

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Thank you

Questions

Research Plot Design

- **Randomized Split-Split Design**
- **Main Treatment: Cover Crops**
 - A mixture of crimson clover (*Trifolium incarnatum*), lentil (*Lens culinaris*), and winter wheat (*Triticum aestivum*)
 - 11 lbs. per acre (lentils)
 - \$0.99/lb. (\$9.90/ac)
 - 10 lbs. per acre (winter wheat)
 - \$0.23/lb. (\$2.30/ac)
 - 6 lbs. per acre (crimson clover)
 - \$1.00/lb. (\$6.00/ac)
 - \$18.20/ac (Total Cost)
 - **Subplots: Cover Crop Planting Procedure**
 - Drill (DRL)
 - Broadcast (BRD)