



# Understanding Soil Health

## Measuring Success and Reducing Risk

By Aaron Hird, NE NRCS Soil Health Specialist



# Extreme Weather



No Cover



Cover



Resilient Soil



# Soil Health Defined:

- ▶ The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals, and humans.





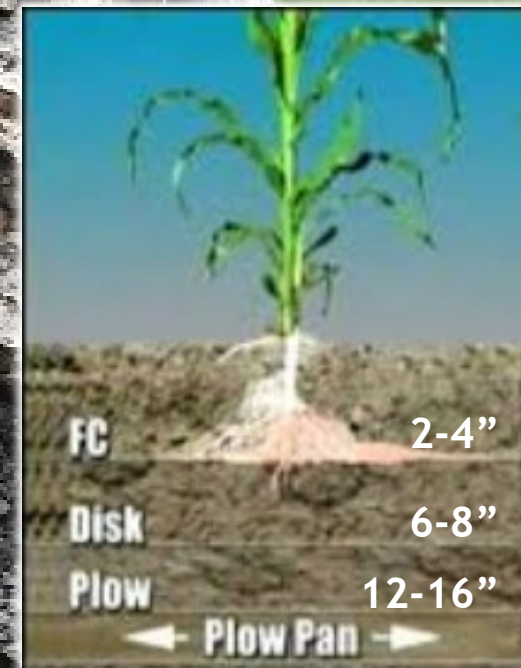


# Is the Soil Healthy?

- ▶ Soil Health is changed over time by natural processes and manipulated with management.
- ▶ Every Soil has Unique Physical Properties developed by the 5 Soil Forming Factors: **Time, Aspect, Parent Material, Climate, Biology.**
- ▶ Soil Function is influenced by biology which is impacted by management. (90% of Soil Function is mediated by soil microbes)
- ▶ Supporting the biological activities can improve the Functions of the Soil.



# A Common problem in Nebraska: Tillage Induced, Root Restrictive, Compaction Layers



In many soil types we have farmed the soil's ability to withstand disturbance out of the top soil!

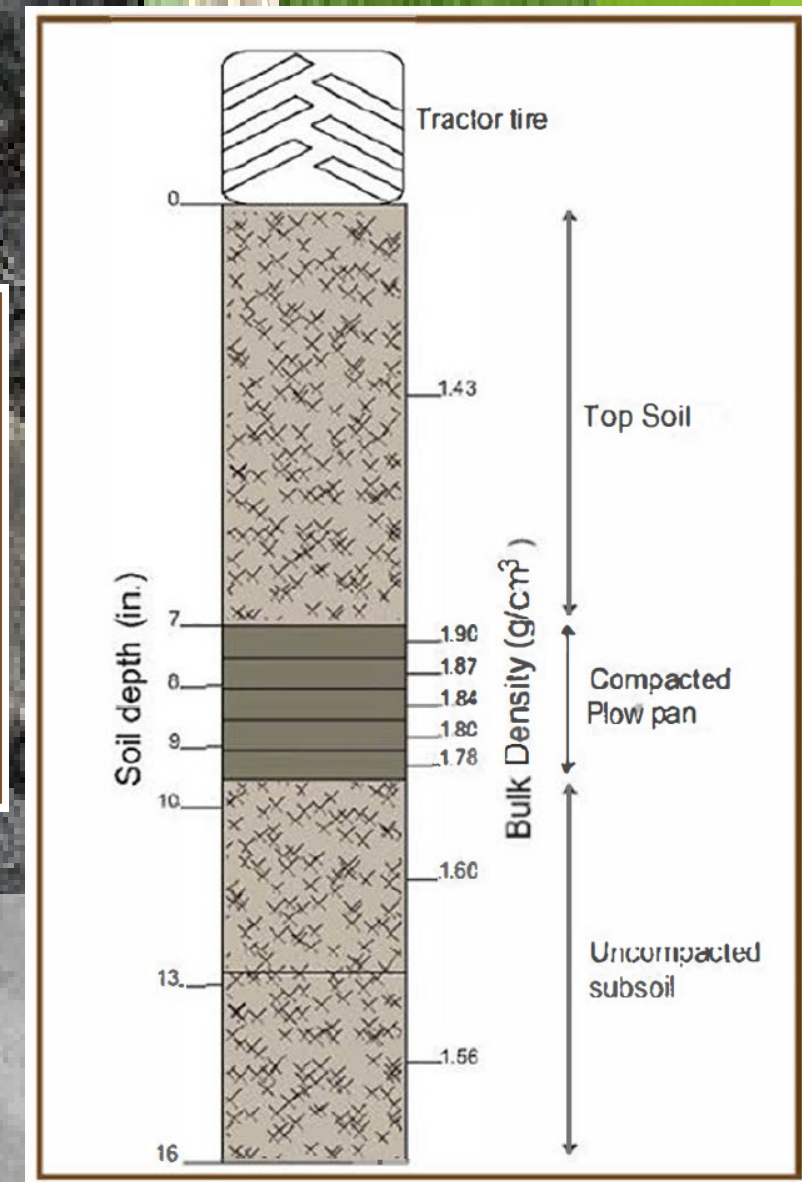


# Root Restrictive Bulk Density

Soil Texture	Ideal bulk densities for plant growth (grams/cm <sup>3</sup> )	Bulk densities that affect root growth (grams/cm <sup>3</sup> )	Bulk densities that restrict root growth (grams/cm <sup>3</sup> )
Sands, loamy sands	< 1.60	1.69	> 1.80
Sandy loams, loams	< 1.40	1.63	> 1.80
Sandy clay loams, clay loams	< 1.40	1.60	> 1.75
Silts, silt loams	< 1.40	1.60	> 1.75
Silt loams, silty clay loams	< 1.40	1.55	> 1.65
Sandy clays, silty clays, clay loams	< 1.10	1.49	> 1.58
Clays (> 45% clay)	< 1.10	1.39	> 1.47

Note: The engineering standard soil bulk density is 1.33

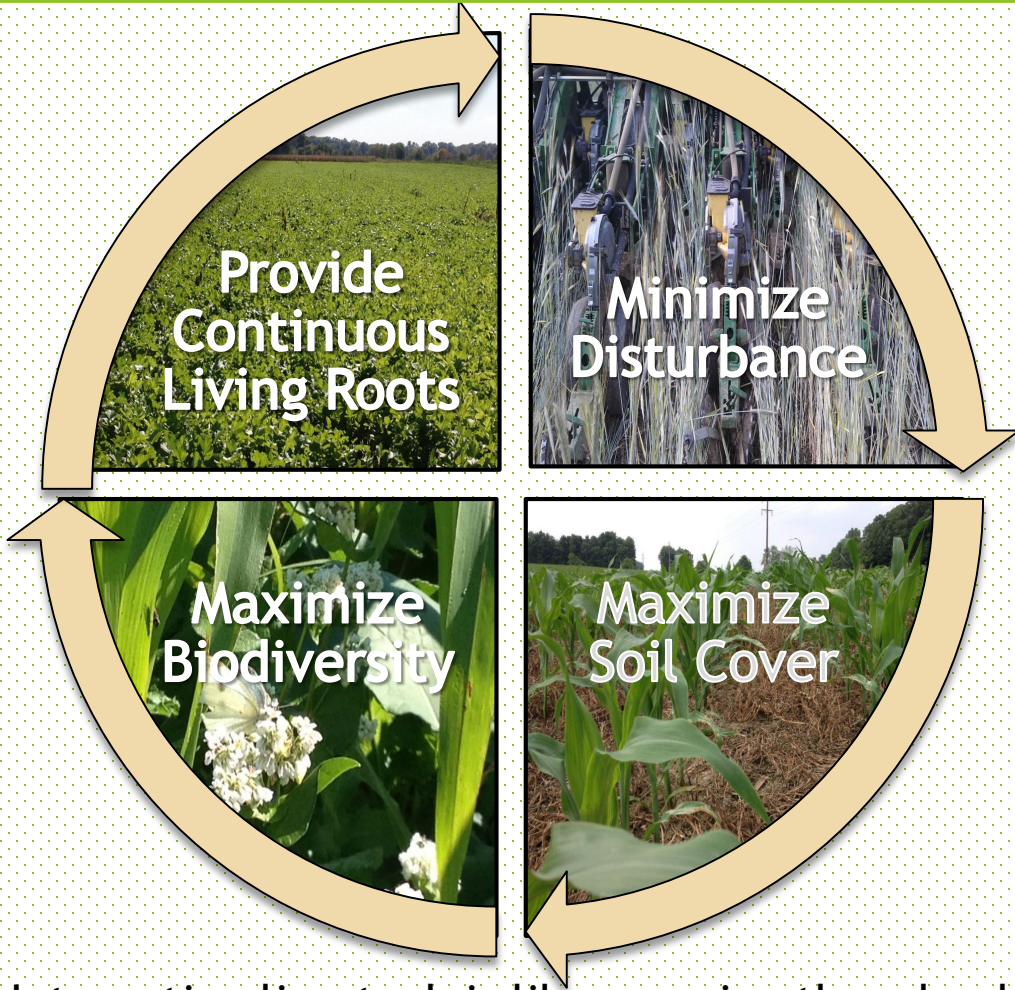
- Top Soil = 1.43, Plow Pan starts at 1.90, ends at 1.78
- No Tillage systems **Retain or Sustain** soil structure.
- Biological Activity **Regenerates** soil structure.
- Cover Crops can have a **HIGHER** Rooting Pressure Tolerance



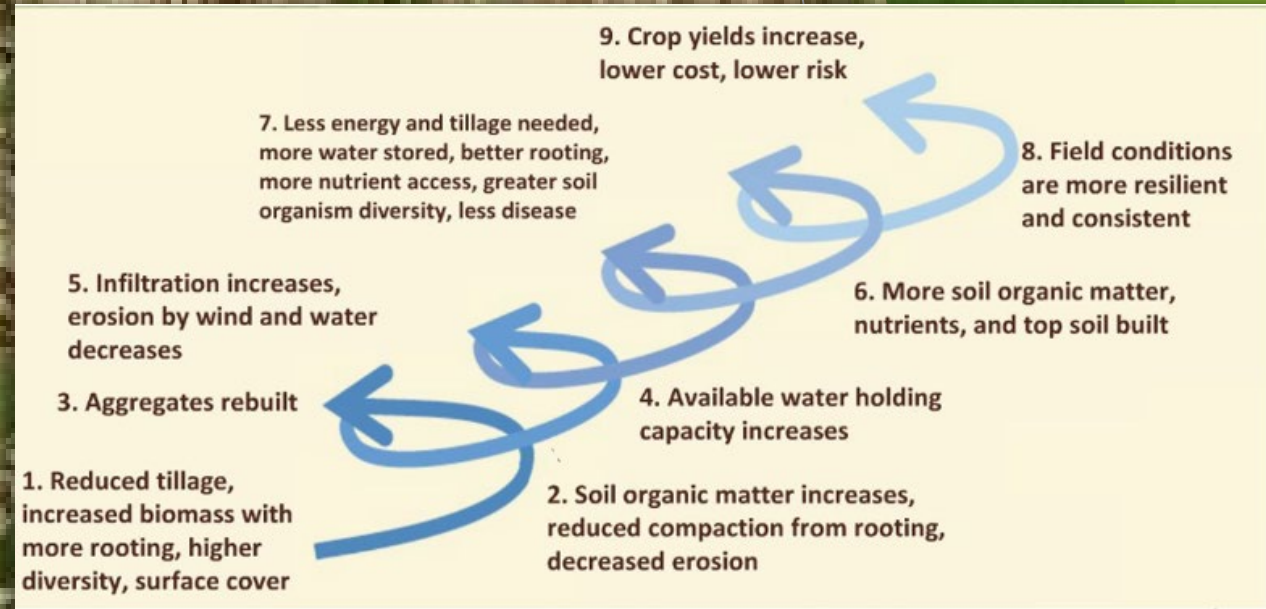


# Building Resilient Soil is achieved by taking Step 1 - Implement the Soil Health Principles.

## Soil Health Principles



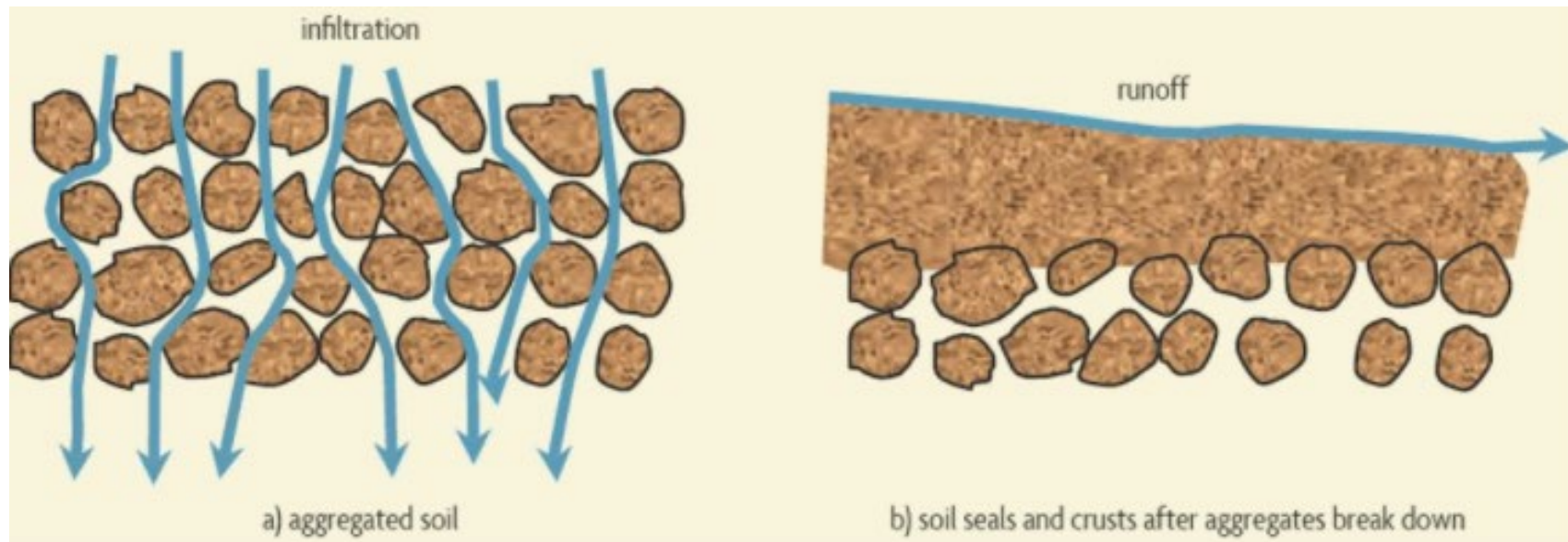
Integrating livestock is like greasing the wheels



Handouts provided



Manage for Habitat; organisms will form Wet Stable Aggregates, increasing water infiltration, drainage, aeration and building Soil Organic Matter.





# Soil Health Assessment is based on Dynamic Soil Properties

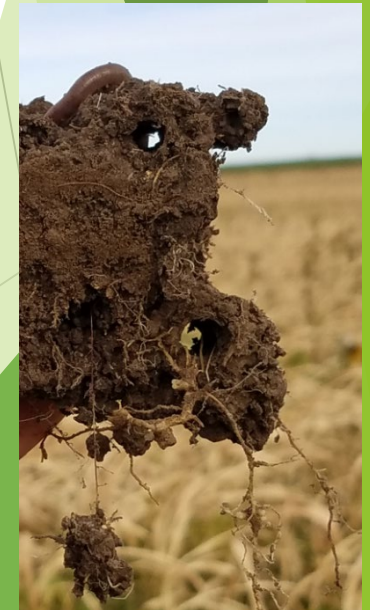
- As the Dynamic Soil Properties change the Soil Functions change

## Dynamic Soil Properties

Biological Activity  
Bulk Density  
Color  
Aggregate Stability  
Structure

## Soil Functions

Nutrient cycling  
Water (infiltration & storage)  
Filtering and Buffering  
Physical Stability and Support  
Habitat for Biological Activity





- Expand the Oscillation C-B to include Field Peas.  
Here is the opportunity after Harvest





# USDA/NRCS Conservation Programs

- ▶ Environmental Quality Incentives Program (EQIP)
  - ▶ Conservation Practice Incentives
    - ▶ Physical Structures and Management Practices
- ▶ Conservation Stewardship Program (CSP)
  - ▶ Conservation Stewardship Incentives
    - ▶ Management Enhancements
- ▶ Regional Conservation Partnership Program (RCPP) & Conservation Innovation Grant (CIG)
  - ▶ Regionally funded, targeted, Conservation Initiative
    - ▶ Matching the Conservation Investment of Partners
- ▶ National Water Quality Initiative (NWQI)
  - ▶ Regionally funded, targeted, Conservation Initiative
  - ▶ Focused use of EQIP funds in to address critical concerns
- ▶ Conservation Technical Assistance (CTA)
  - ▶ Conservation Planning, Design and Application
    - ▶ Voluntary participation





# Program Incentives Reduce Risk during the Learning Curve

- ▶ The USDA/NRCS conservation incentives reduce the financial risk of the application of conservation work.
- ▶ EQIP - 3 year contracts with incentive money
  - Representing 50% of the estimated cost of the Conservation Practice
- ▶ CSP - 5 year contracts providing stewardship payments
  - Representing the cost of enhancing the Stewardship Practice
- ▶ CTA - Technical Advice offered upon voluntary requests





# Nebraska NRCS Soil Health Initiative

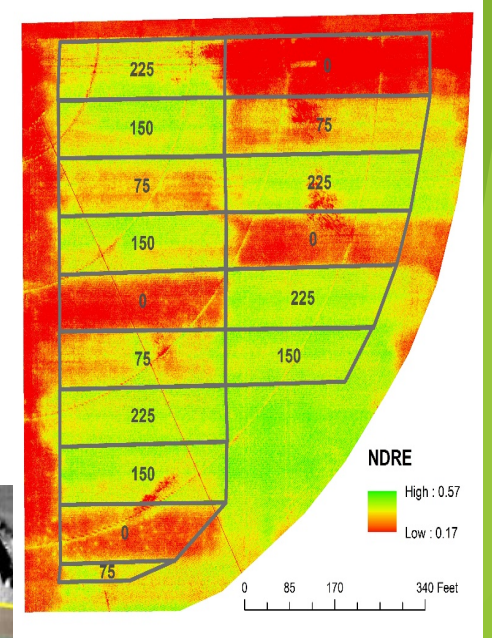
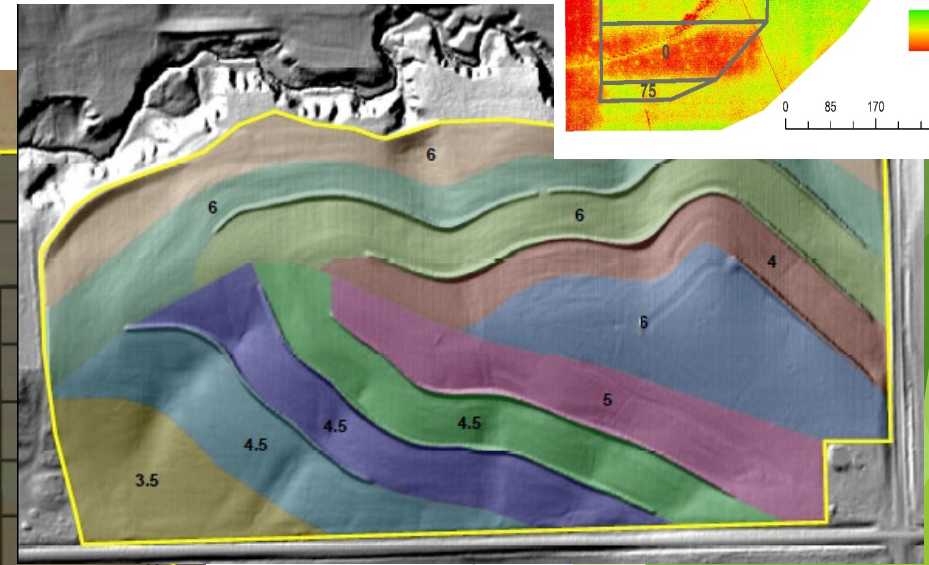
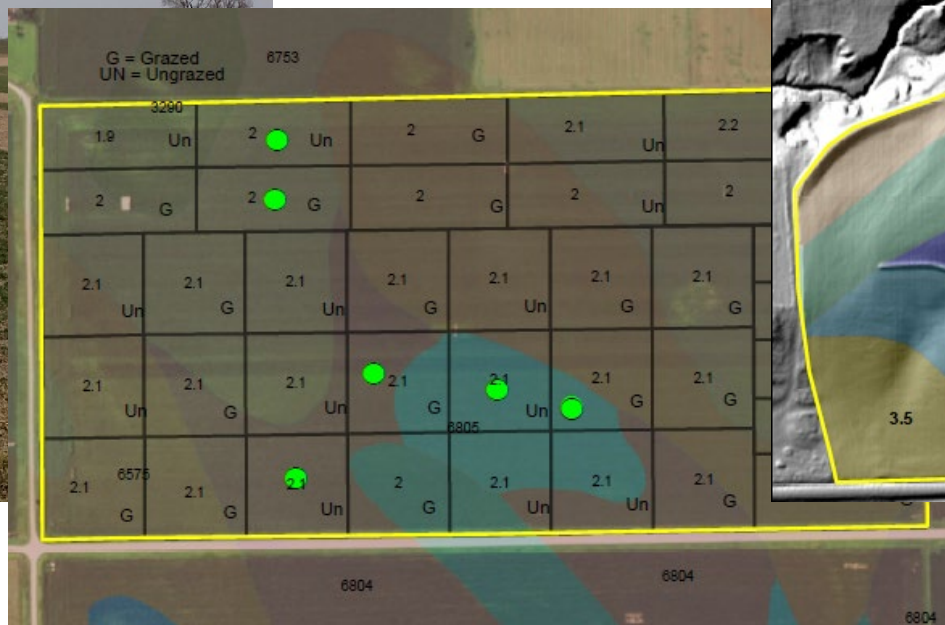
- ▶ Partnerships remain our central focus.
- ▶ Continue to geographically distribute key outreach and educational resources.
- ▶ Example: Fund and monitor a network of **Demonstration Farms** across the state.
- ▶ The Goals of the EQIP Demonstration Farms
  - ▶ Provide a local source of information to answer common questions
  - ▶ Validate Soil Health Management Systems locally via case studies and field days.
  - ▶ Focus on the Communication about Soil Health through outreach, education, training and partnership opportunities





# Demonstration Farms = On Farm Research

- ▶ A 5 year, field scale, comparison of two Cover Crop Adaptive Management Activities
- ▶ A system comparison throughout an 5 year expanded crop rotation
- ▶ Randomized and Replicated Plots
- ▶ Soil Health Assessments, Soil Lab Analysis and Economic Evaluations
- ▶ Opportunity to include partners, including UNL Extension & NE On Farm Research Network.



NDRE Source: NE ON FARM RESEARCH



# Nebraska Soil Health Demonstration Ranch Initiative

## ► 9 Locations:

- Boyd County - Stock Density and Duration Study
- Lincoln County - High Intensity/Short Duration vs Standard Density/Duration
- Lincoln County - Rangeland Renovation Study, Standard Native Seeding vs High Diversity
- Nuckolls County - Rotation Grazing Comparison
- Otoe County - Patch Burning vs No Treatment
- Pierce County - Stock Density Comparison
- Scottsbluff County - Grazing Timing Comparison
- Stanton County - Stock Density Comparison
- Thayer County - Burning vs no burning

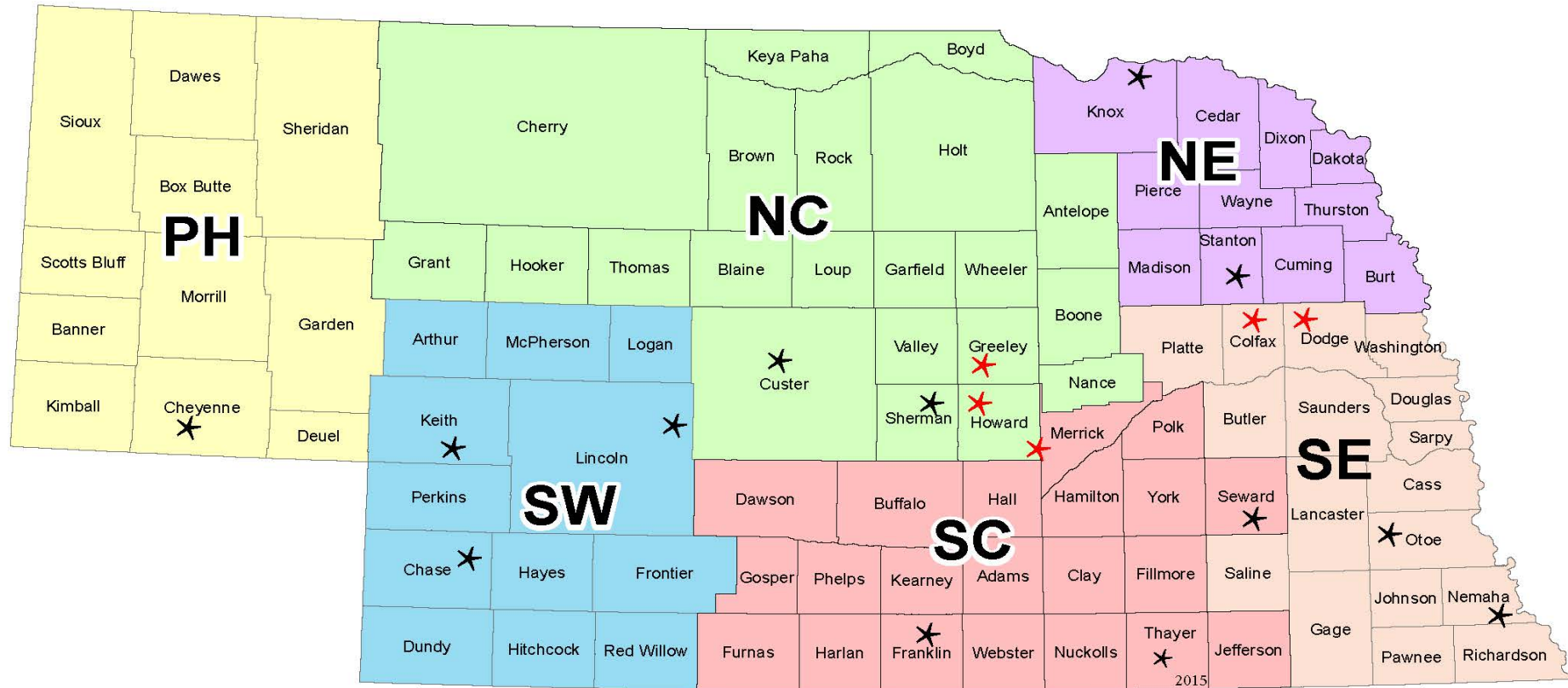


# 17 In Field Projects - 21 comparisons

- ▶ Cover Crop Vs No Cover Crop (5)
- ▶ Cover crop Mix comparisons (4)
- ▶ Grazed Vs Not Grazed (3)
- ▶ Drilled Vs Broadcast (2)
- ▶ High Carbon Cover Crop vs Low Carbon Cover Crop (2)
- ▶ Nitrogen Study, When and How Much from the Cover Crop(1)
- ▶ Early Termination vs Late Termination (1)
- ▶ Frost Terminated Cover Crop vs Winter Hardy Cover Crop (1)
- ▶ Companion Cover Crop vs Dormant Seeded Cover Crop (1)
- ▶ Monoculture Cover Crop vs Multispecies Cover Crop (1)



# Nebraska NRCS Soil Health Initiative EQIP Demonstration Fields



★ 5 - 2017 Demonstration Fields

★ 12 - 2016 Demonstration Fields



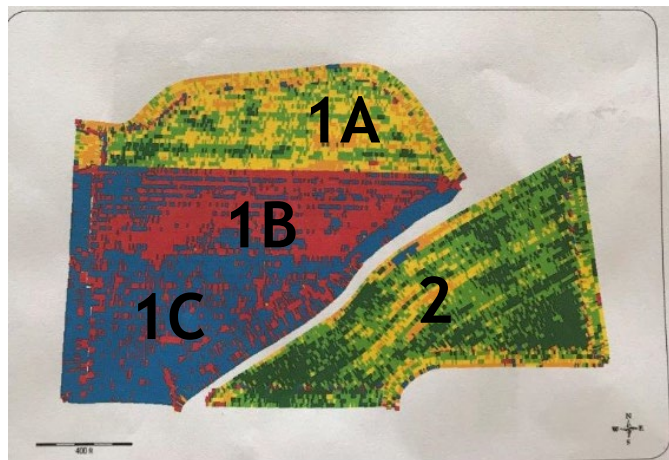
# 2018 Corn Following Winter Terminated Cover Crop vs Winter Hardy Cover Crop

Nemaha County - Daryl Obermeyer - in Partnership with the University of Nebraska - Lincoln,

## Field 1C

On Farm Research Network

- ▶ Judson Silt Loam 0-2% slope, Judson Silt Loam 2-6% slopes
- ▶ Planting Date: 4/17/18
- ▶ Harvest Date: 9/14/18
- ▶ Cover Crop planted after harvest
- ▶ Row Spacing: 30"
- ▶ Hybrid: Pioneer 0363AM
- ▶ Reps: 7
- ▶ Previous Crop: **Wheat**
- ▶ Tillage: No-Till
- ▶ **Herbicides:** *Pre*: 3 qt/ac FulTime® NXT, 16 oz/ac 6# 2,4-D, and 16 oz/ac Buccaneer 5 Extra® on 4/4/18
- ▶ **Seed Treatment:** PONCHO®/VOTiVO®
- ▶ **Foliar Insecticides:** 3.84 oz/ac Lambda-Cy 1EC aerial applied on 7/7/18; 3.84 oz/ac Lambda-Cy 1 EC aerial applied on 7/26/18
- ▶ **Foliar Fungicides:** 10.5 oz/ac Azoxystrobin Xtra aerial applied on 7/7/18; 10.5 oz/ac Azoxystrobin Xtra aerial applied on 7/26/18
- ▶ **Fertilizer:** 1 gal/ac Kugler KQ-KRN™ (28% N) aerial applied on 7/7/18, and 1 gal/ac Kugler KS2075 (20% N, 7.5% P, 5% S) aerial applied on 7/26/18
- ▶ **Irrigation:** None, Note: Drought conditions prevailed in August and September in SE Nebraska





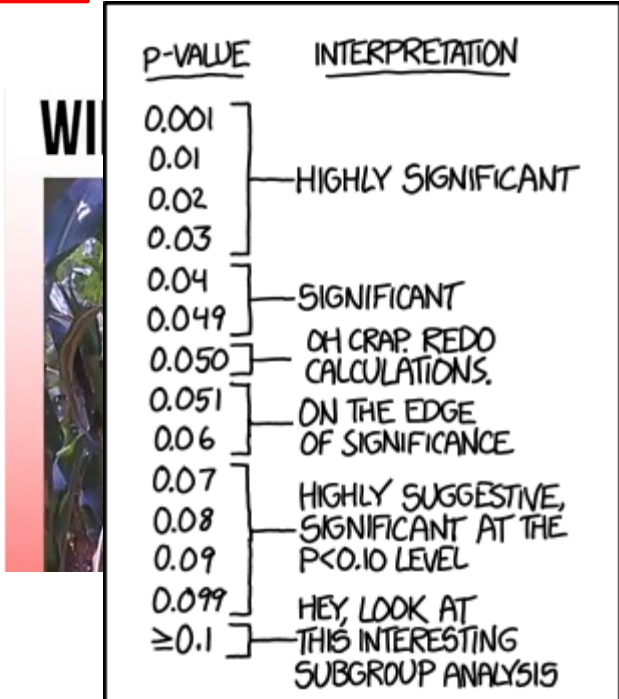
# 2018 Corn Following Winter Terminated Cover Crop vs Winter Hardy Cover Crop

Nemaha County - Daryl Obermeyer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network

Field 1C	-----2017 Soybean-----					-----2018 Corn-----				
Cover Crop Treatment	Stand Count (plants/ac)	Test Weigh t	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ (\$/ac)	Stand Count (plants/ac)	Test Weigh t	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ (\$/ac)
Winter Terminated	102,178 A*	56 A	10.6 A	62 A	518.84 A	29,710 A*	56 A	20.7 A	243 A	759.43 A
Winter Hardy	102,178 A	56 A	10.6 A	61 A	516.42 A	29,515 A	56 A	20.9 A	240 A	748.71 A
P-Value	1	0.489	1	0.735	0.735	0.677	0.226	0.516	0.281	0.283

## Summary:

- In 2017, there were no differences in soybean yield, moisture, test weight, or harvest stand counts when cover crops were winter terminated or winter hardy. Harvest stand counts were notably lower than the planting population.
- In 2018, there were no differences in corn yield, moisture, test weight, harvest stand counts, or net return between the winter terminated or winter hardy cover crop treatment. Corn following winter terminated cover crops stayed green longer.



## WINTER TERMINATED





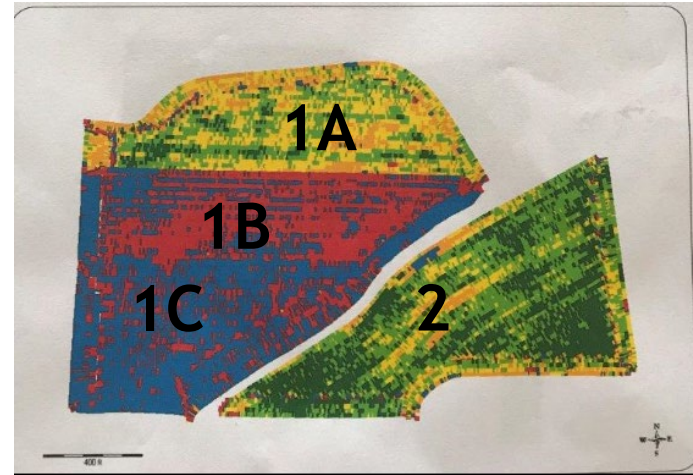
# 2018 Soybeans Following Winter Killed Cover Crop vs Winter Hardy Cover Crop

Nemaha County - Daryl Obermeyer - in Partnership with the University of Nebraska - Lincoln,

## Field 1A

On Farm Research Network

- ▶ **Soil Type:** Judson silt loam 0-2% slope; Judson silt loam 2-6% slopes
- ▶ **Planting Date:** 5/7/18
- ▶ **Harvest Date:** 9/17/18
- ▶ Cover crop planted after harvest
- ▶ **Row Spacing (in):** 15
- ▶ **Hybrid:** Pioneer 24T19R
- ▶ **Reps:** 4
- ▶ **Previous Crop:** Corn
- ▶ **Tillage:** No-Till
- ▶ **Herbicides:** 6 oz/ac Sonic®, 16 oz/ac generic Dual, 16 oz/ac 2,4-D 6#, 8 oz/ac Absorb 100, and 16 oz/ac Buccaneer 5 Extra® on 4/17/18 **Post:** 16 oz/ac Shafen Star, 8 oz/ac Clethodim 2EC, 32 oz/ac Buccaneer 5 Extra®, 8 oz/ac Absorb 100, and 4 oz/ac N-Tense on 6/16/18
- ▶ **Foliar Insecticides:** 3.84 oz/ac Lambda-Cy 1 EC aerial applied on 7/26/18
- ▶ **Foliar Fungicides:** 10.5 oz/ac Azoxystrobin Xtra aerial applied on 7/26/18
- ▶ **Fertilizer:** 1 gal/ac Kugler KS2075 (20% N, 7.5% P, 5% S) aerial applied on 7/26/18
- ▶ **Irrigation:** None - Note: Drought conditions prevailed in Aug. & Sept.





# Soybeans Following Winter Killed Cover Crop vs Winter Hardy Cover Crop

Nemaha County - Daryl Obermeyer - in Partnership with the University of Nebraska - Lincoln, On Farm Research Network

Field 1A	-----2017 Corn-----					-----2018 Soybeans-----				
Cover Crop Treatment	Stand Count (plants/ac)	Test Weight	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ (\$/ac)	Stand Count (plants/ac)	Test Weight	Moisture (%)	Yield† (bu/ac)	Marginal Net Return‡ (\$/ac)
Winter Terminated	30,355 A*	54 A	18.0 B	183 A	546.97 A	120,744 A*	56 B	11.3 A	65 A	452.80 A
Winter Hardy	30,023 A	52 B	19.1 A	168 B	498.00 B	120,246 A	56 A	11.2 A	59 B	410.75 B
P-Value	0.802	0.021	0.003	0.0003	0.0003	0.872	0.096	0.200	0.002	0.002



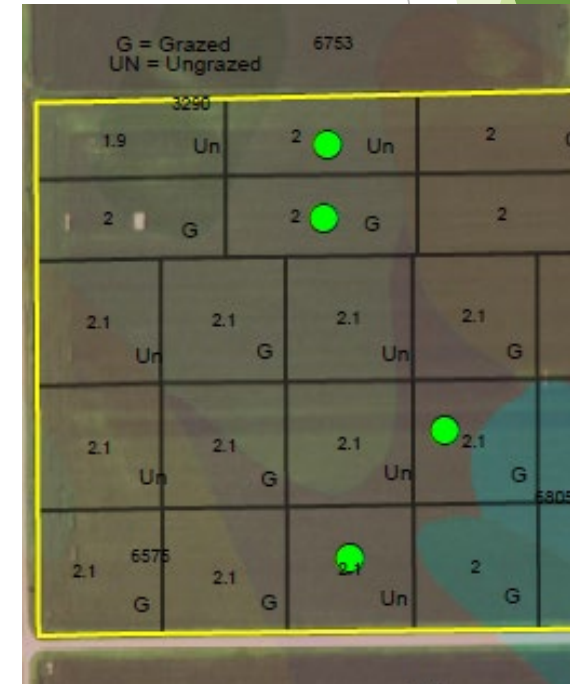
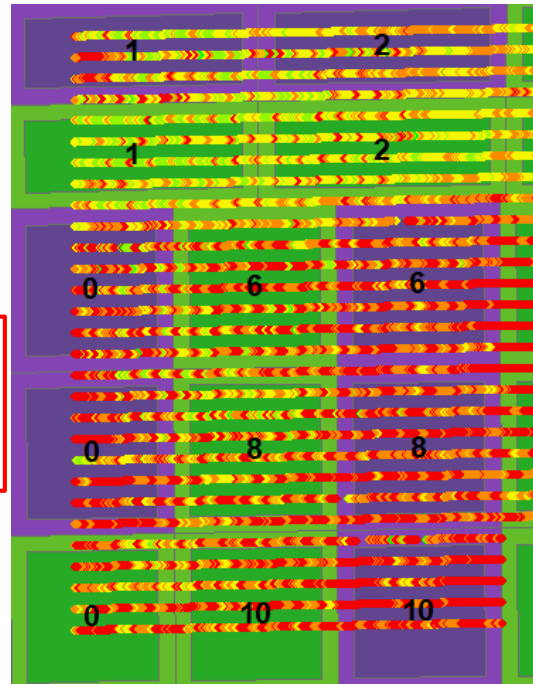
In 2018, soybeans planted after winter terminated cover crops had a higher yield, lower test weight, and higher net return than the winter hardy cover crops. There were visible differences between the winter terminated and winter hardy cover crops, with the winter terminated having a darker green appearance longer.



## 2018 Wheat after Grazed vs Non-Grazed Cover Crop

Knox County - Doug Steffen - in Partnership with the University of Nebraska - Lincoln  
On Farm Research Network

- ▶ **Soil Type:** Trent silt loam 0-2% slope; Nora silt loam 2-6% slopes; Moody loam 0-2% slope; Moody loam 2-6% slopes; Paka loam 11-20% slopes; Alcester silty clay loam 2-6% slopes
- ▶ **Planting Date:** 11/4/17
- ▶ **Harvest Date:** 7/25/18
- ▶ **Population:** 2 bu/ac
- ▶ **Reps:** 10
- ▶ **Previous Crop:** Field Peas,  
Harvested July 26, 2017
- ▶ **Tillage:** No-Till
- ▶ **Irrigated:** No



Snap shot of just 40 acres of total 80 ac



## 2018 Wheat after Grazed vs Non-Grazed Cover Crop

Knox County - Doug Steffen - in Partnership with the University of Nebraska - Lincoln  
On Farm Research Network

### Baseline Soil Quality Measures from 2016:

	Bulk Density (g/cm <sup>3</sup> )	NRCS Soil Health Assessment Worksheet Field Indicator Score	OM %
Cover Crop-Non Grazed	1.23	2.45	3.0
Cover Crop-Grazed	1.21	2.48	2.9

### Soil Quality Measures 2018:

	Bulk Density (g/cm <sup>3</sup> )	NRCS Soil Health Assessment Worksheet Field Indicator Score	OM %
Cover Crop-Non Grazed	0.98	2.80	3.5
Cover Crop-Grazed	0.96	2.75	3.4

### 2018 Wheat Yield:

	Yield† (bu/acre)
Cover Crop-Non Grazed	46 A*
Cover Crop-Grazed	47 A
P-Value	0.220

†Yield values are from cleaned yield monitor data.

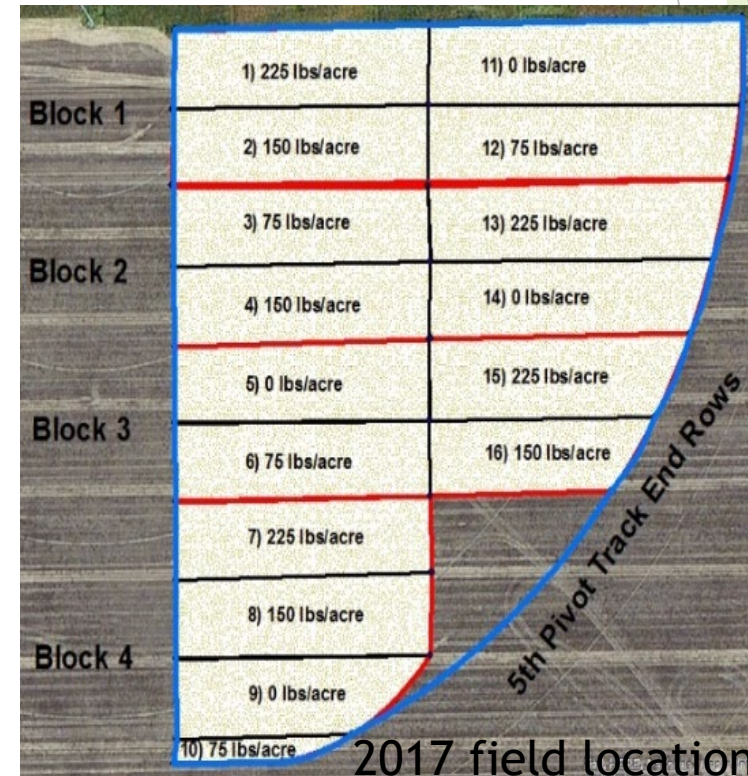
**Summary:** There was no wheat yield difference for the grazed versus non-grazed treatment. Soil health parameters will continue to be monitored. Dry Forage samples were collected/measured in 2017 with a total production of 9,380 lb/ac. 180 cows were grazed for 8 days on the grazing treatment areas totalling 40 acres.



# 2017 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network

- ▶ **Soil Type:** Kenesaw silt loam 0-1% slope; Kenesaw silt loam 1-3% slope
- ▶ **Planting Date:** 5/8/18
- ▶ **Harvest Date:** 11/1/18
- ▶ **Population:** 30,000
- ▶ **Row Spacing (in):** 30
- ▶ **Hybrid:** Cropland
- ▶ **Reps:** 4
- ▶ **Previous Crop:** Soybean
- ▶ **Tillage:** No-Till
- ▶ **Herbicides:** *Pre:* Roundup® & post Status®-Impact®
- ▶ **Foliar Insecticides:** None
- ▶ **Foliar Fungicides:** None
- ▶ **Irrigation:** Pivot, Total: 4", This area had well timed rains in 2017.



# 2017 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,

On Farm Research Network

Treatment lb N/acre	Solvita CO2 Burst, ppm C	Total Nitrogen, ppm N	Organic Nitrogen, ppm N	Total Organic Carbon, ppm C	Nitrate, ppm NO3- N	Ammonium, ppm NH4-N	Inorganic Nitrogen, ppm N	Organic C : Organic N	Nitrogen Mineralization, ppm N	Organic Nitrogen Release, ppm N	Organic Nitrogen Reserve, ppm N	Soil Health Calculation
0	113.0	20.7	16.8	203	3.3	1.5	4.8	12.0	16.3	16.8	0.0	13.09
75	128.0	20.5	17.8	225	2.0	1.6	3.7	12.7	16.7	17.8	0.0	14.14
150	102.0	18.7	15.5	186	2.7	1.3	4.0	12.0	14.8	15.5	0.0	11.89
225	123.0	19.5	16.7	228	2.3	1.5	3.9	13.6	13.5	16.7	0.0	12.98

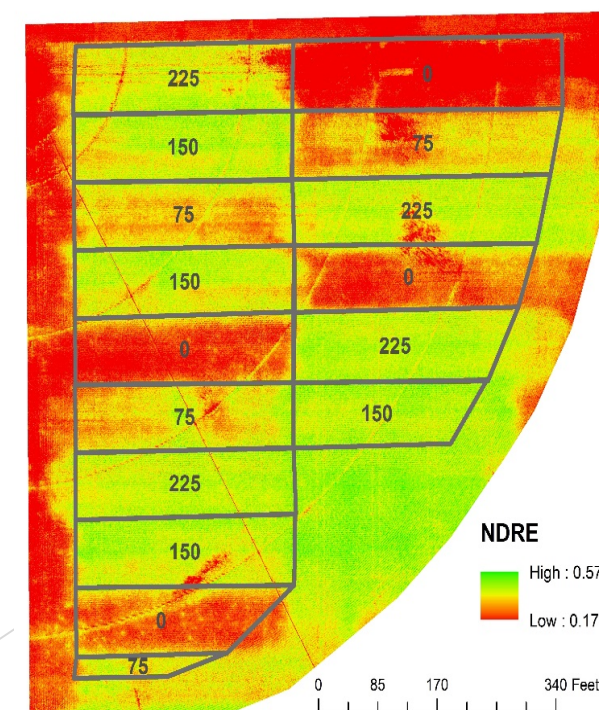
**Above:** Soil health tests from each treatment area taken in April, prior to N application and planting.

**To the Right:** NDRE (normalized difference red edge) index imagery of the plot area on August 1, 2017. Difference in NDRE values for the various N treatments are apparent.

Yield was collected via hand harvesting. Significant yield and marginal net return are apparent. The highest yield and net return was obtained in the 225 lb N/ac treatment.

**Below:** Yield and net return for the four nitrogen rates measured.

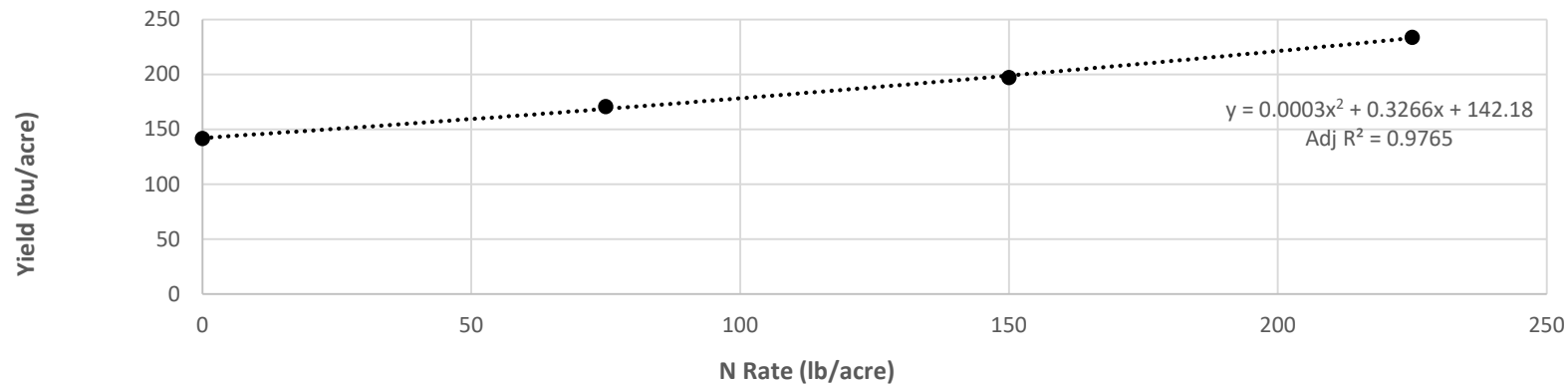
	Yield (bu/acre) †	Marginal Net Return‡ (\$/ac)
0 lb N/ac	142 D	445.86 D
75 lb N/ac	171 C	500.29 C
150 lb N/ac	197 B	552.88 B
225 lb N/ac	234 A	637.89 A
P-Value	<0.0001	<0.0001





# 2017 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network



**Summary:** A maximum N rate of 225 lb N/ac was selected with a goal of providing an excess of N so that the plateau of yield response to N could be identified. However, results indicated that the highest N rate resulted in the highest yield; it is unknown if higher N applications would have resulted in greater yields.

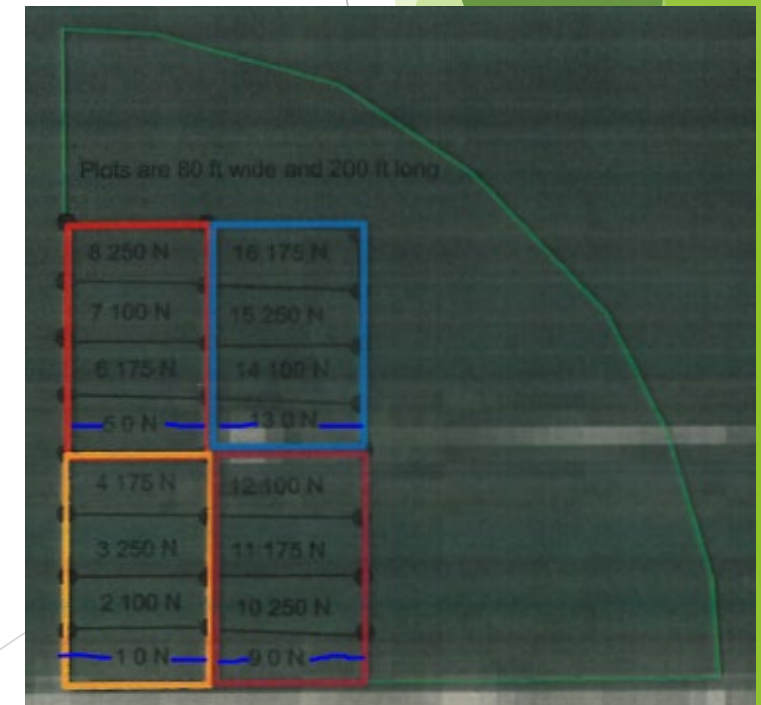
# 2018 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network

- ▶ **Soil Type:** Kenesaw silt loam 1-3% slope
- ▶ **Planting Date:** 5/8/18
- ▶ **Harvest Date:** 11/1/18
- ▶ Cover crops planted after harvest: 40# Rye, 10# Wheat, 5# winter pea, 1# rapeseed, 2# spring barley, 2# crimson clover
- ▶ **Population:** 30,000
- ▶ **Row Spacing (in):** 30
- ▶ **Hybrid:** Curry
- ▶ **Reps:** 4
- ▶ **Previous Crop:** Soybean
- ▶ **Tillage:** No-Till
- ▶ **Herbicides:** *Pre:* Roundup® for burn down *Post:* Impact® and Status® on 6/25/18
- ▶ **Seed Treatment:** Poncho®
- ▶ **Foliar Insecticides:** None
- ▶ **Foliar Fungicides:** None
- ▶ **Irrigation:** Pivot, Total: 4"
- ▶ **Rainfall (in):** Dry June, Ave. July, Aug. Wet Sept, Oct.



## 2018 Comparison location in Field





# 2018 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network

- Soil samples were taken for each plot in June 2018.

Rep	Treatment	Soil pH (1:1)	Soluble Salts 1:1 (mmho/ cm)	OM (%)	Nitrate (ppm)	Nitrate Lbs (0-8")	MP3 (ppm)	-----Ammonium Acetate-----					--% Base Saturation--				
								K (ppm)	Ca (ppm)	Mg (ppm)	Na (ppm)	Sulfate (ppm)	H	K	Ca	Mg	Na
1	0 (no cover crop)	5.9	0.17	1.8	10.3	25	25	341	1550	253	20	11.7	5	8	68	18	1
1	0	5.8	0.14	2.0	6.9	17	21	366	1596	277	25	13.7	20	7	56	16	1
1	100	5.7	0.12	1.5	8.3	20	18	228	1252	192	15	11.0	12	6	64	16	1
1	250	5.8	0.13	1.7	7.0	17	14	284	1743	306	22	12.0	8	6	65	20	1
1	175	5.8	0.14	1.5	7.5	18	31	300	1645	295	24	13.2	7	6	66	20	1
2	0 (no cover crop)	5.2	0.15	1.7	12.7	30	27	226	1362	249	21	15.3	19	5	57	18	1
2	0	5.9	0.25	3.6	20.9	50	44	307	1717	267	27	17.4	13	6	64	16	1
2	175	5.7	0.1	1.6	13.1	31	26	297	1346	232	18	10.8	19	7	57	17	1
2	100	5.8	0.09	1.5	7.4	18	18	380	1470	261	18	13.7	17	8	57	17	1
2	250	5.9	0.16	2.5	17.0	41	54	443	1704	266	17	14.2	14	8	61	16	1
3	0 (no cover crop)	5.8	0.21	2.3	11.3	27	43	373	1947	345	29	14.6	21	6	55	17	1
3	0	6.0	0.17	2.8	11.0	26	50	380	2107	362	28	14.6	9	6	65	19	1
3	250	6.0	0.16	2.3	7.2	17	19	293	1743	306	22	12.0	13	5	63	18	1
3	175	6.0	0.17	2.1	13.4	32	8	230	1608	275	25	12.7	8	5	67	19	1
3	100	5.8	0.16	2.0	9.1	22	26	292	1710	302	24	13.4	14	5	62	18	1
4	0 (no cover crop)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0	5.5	0.19	3.1	13.2	32	52	318	1529	233	23	16.3	24	6	55	14	1
4	100	6.0	0.1	2.3	12.5	30	28	259	1427	219	20	11.7	7	6	68	18	1
4	250	6.2	0.17	2.8	13.5	32	45	367	1925	323	24	13.4	7	7	66	19	1
4	175	5.6	0.17	2.8	17.1	41	111	441	2109	379	41	14.2	22	6	55	16	1

# 2018 Nitrogen Application to Corn Following Cover Crops

Franklin County, Dennis Bauer - in Partnership with the University of Nebraska - Lincoln,  
On Farm Research Network

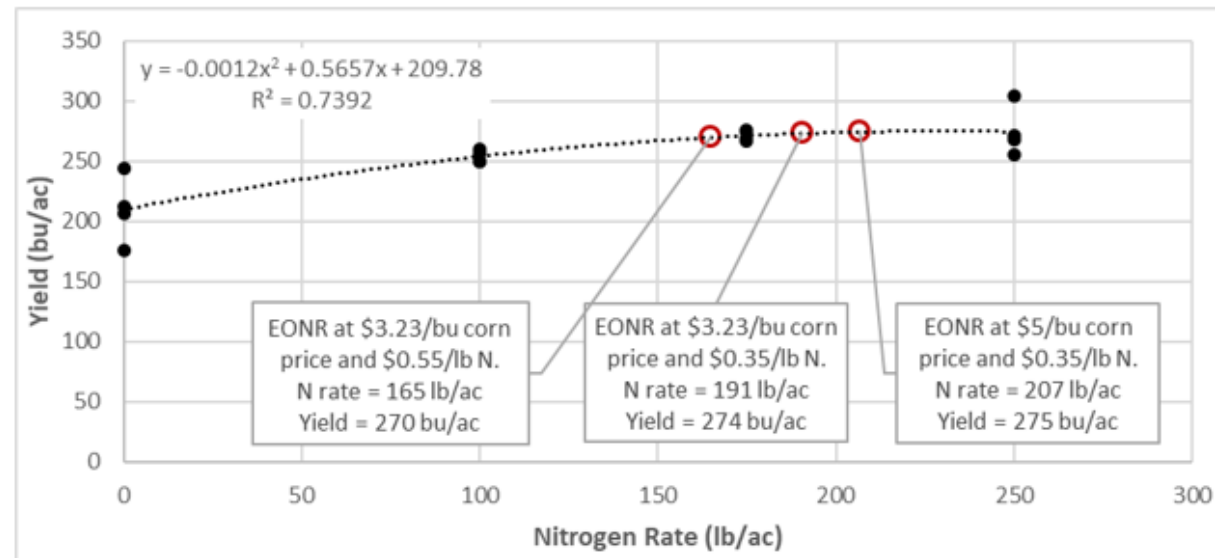
	Yield† (bu/acre)	Marginal Net Return‡ (\$/ac)
0 lb N/ac Following No Cover Crop	188 B*	606.34 C
0 lb N/ac Following Rye Cover Crop	210 B	677.78 BC
100 lb N/ac Following Rye Cover Crop	254 A	785.00 AB
175 lb N/ac Following Rye Cover Crop	272 A	815.78 A
250 lb N/ac Following Rye Cover Crop	275 A	799.30 A
P-Value	0.0001	0.001

\*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 15.5% moisture.

‡Marginal net return based on \$3.23/bu corn and \$0.35/lb N.

A regression with economic optimum nitrogen rates was calculated for the four nitrogen rates which all had cover crops (Figure 1).



**Figure 1.** Yield versus nitrogen rate based on the four cover crop nitrogen rate treatments. Economic optimum nitrogen rates (EONR) for several price scenarios are indicated.

## Summary:

- At a corn price of \$3.23/bu and N price of \$0.35/lb, the optimum N rate was 191 lb/ac.
- There was no yield difference between the 0 lb N/ac rate which was preceded by cover crops and the 0 lb N/ac rate that did not have cover crops.



# The Big Picture: The Compounding Effects of Applying the Principles

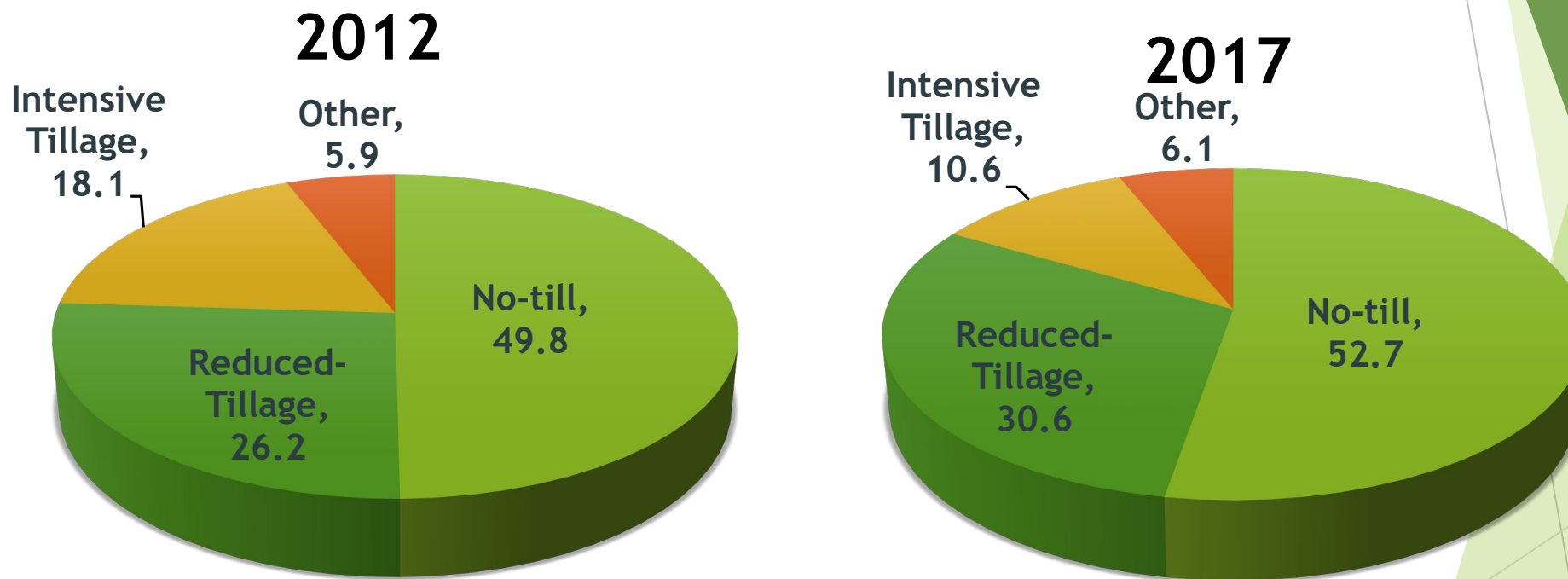
Bulk Density Change with Soil Health Management				
Demonstration Farm	Years of Cover Crops Use	Soil Survey Determined Ideal Density (g/cm <sup>3</sup> )	Average Benchmark Bulk Density	Average 2018 Bulk Density
Nemaha County - Obermeyer	3	Silty clay loam < 1.40	1.25	1.22
Otoe County - McDonald	7	Silty clay loam < 1.40	1.15	1.07
Seward County - Ficke	3	Silty clay loam < 1.40	1.23	1.19
Stanton County - Pestel	6	Silty clay loam < 1.40	1.09	1.09
Knox County - Steffen	5	Silt loam < 1.40	1.22	1.32
Sherman County - Obermiller	3	Silt loam < 1.40	1.17	1.16
Franklin County - Bauer	3	Silt loam < 1.40	1.37	1.31
Keith County - Dyck	5	Sandy loams < 1.40	1.37	1.19
Merrick County - Seim	2	Loamy sands < 1.60	1.35	1.41
Howard County - Sack	2	Silty Clay Loam < 1.40	1.08	1.23

# 2017 Census of Agriculture Survey Data

- ▶ The Director NASS explained, The Census **allows for America to tell the changing story of agriculture** by gathering information directly from farmers across the nation and has been conducted since 1840!
- ▶ The Census of Agriculture provides the only source of comprehensive agricultural data for every State and county in the nation.
- ▶ There was a 74.5% response rate in 2017, nationally.
- ▶ The Census provides a key “Measurement of Success”.



## Percentages of Harvested Nebraska Cropland By Tillage Practices, 2012 and 2017<sup>1</sup>



Total cropland acres rose from 21,597,393 to 22,242,599 from 2012 to 2017.

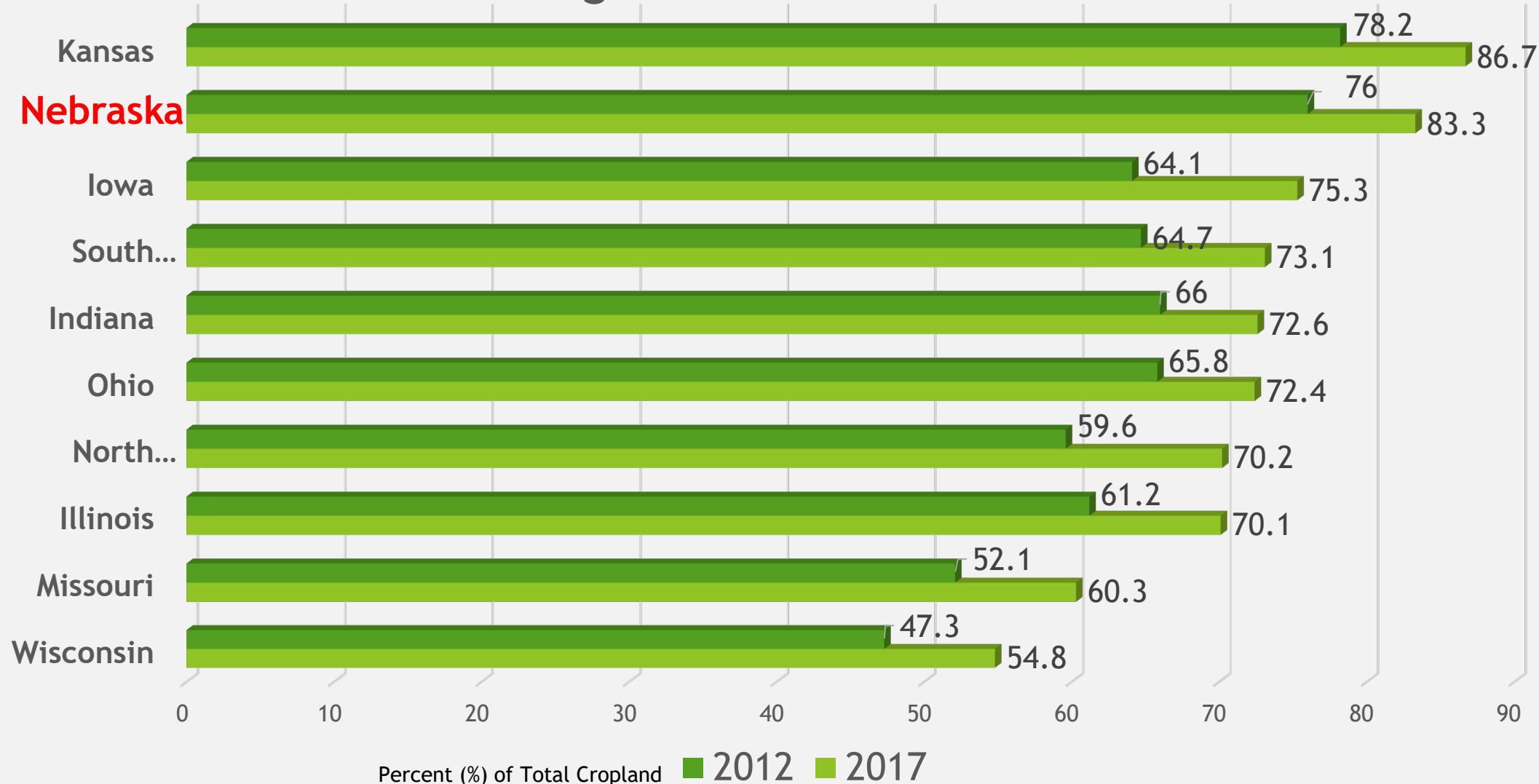
<sup>1</sup> Source: USDA, National Agricultural Statistics Service. 2017 Census of Agriculture - Nebraska, Author: Diane Wasser, UNL

# Definitions

- ▶ No-till: Using no-till or minimum till is a practice used for weed control and helps reduce weed seed germination by **not disturbing the soil**.
- ▶ Reduced tillage: “**Tillage operations**” which conserves the soil by reducing erosion and decreasing water pollution used.
- ▶ Intensive tillage: **Tillage operations** that use standard practices for a specific location and crop to **bury crop residues**.
- ▶ Cover crop: A crop planted primarily to manage soil fertility, soil quality, water, weeds, pests, diseases, or wildlife. This item does not include CRP acres.

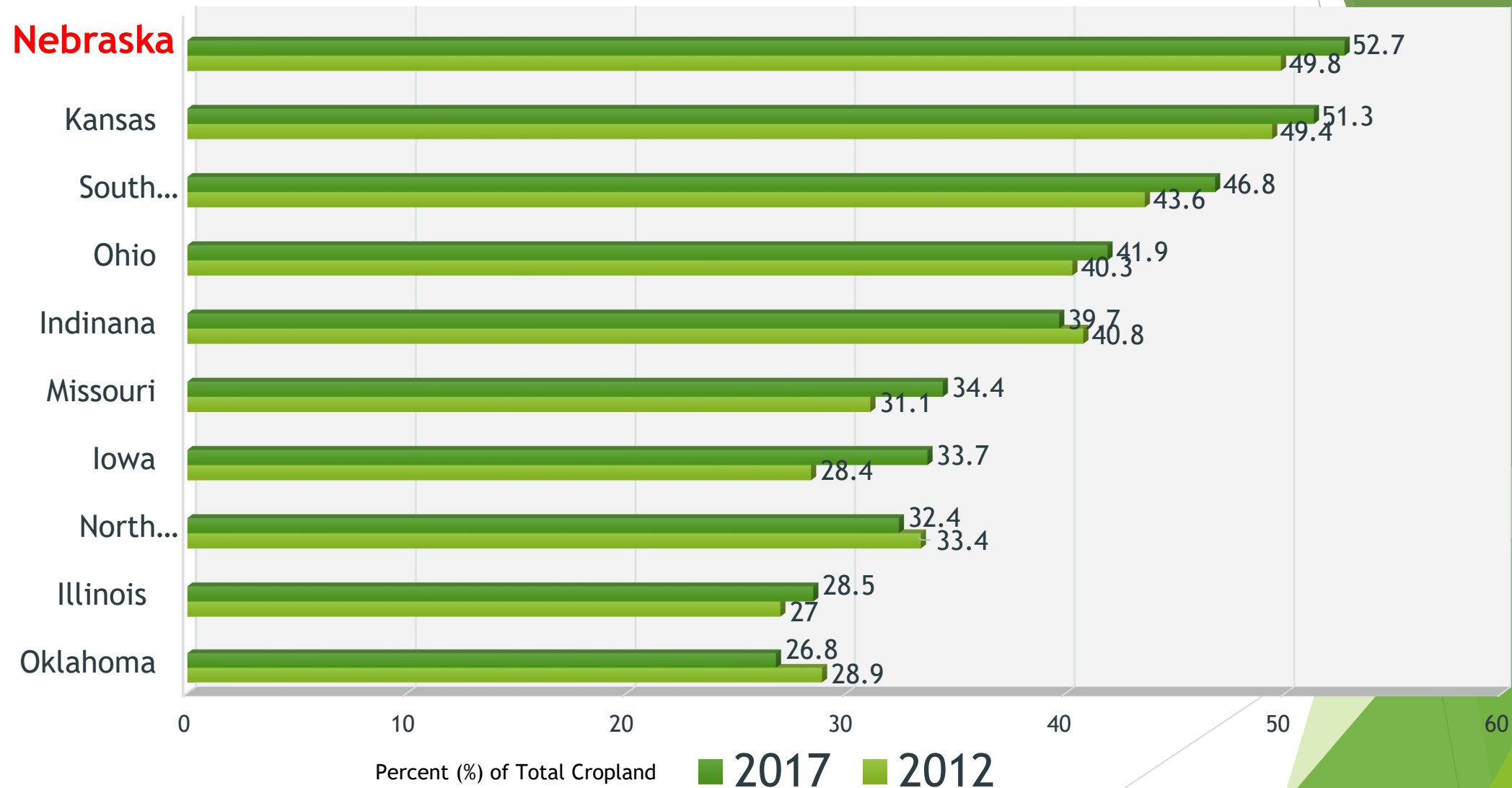


## Top Ten States for Percentage of Harvested Cropland Under Either No-Till or Reduced Tillage Practices: 2012 and 2017



Source: USDA National Agricultural Statistics Service. 2017 Census of Agriculture, Author: Diane Wasser, UNL

## Top Ten State for Percentage of Harvested Cropland under No-Till Practices: 2017 and 2012





# The Big Picture: The Compounding Effects of Applying the Principles

Bulk Density Change with Soil Health Management					
Demonstration Farm	Years No-Till	Years of Cover Crops Use	Soil Survey Determined Ideal Density (g/cm <sup>3</sup> )	Average Benchmark Bulk Density	Average 2018 Bulk Density
Nemaha County - Obermeyer	25+	3	Silty clay loam < 1.40	1.25	1.22
Otoe County - McDonald	8+	7	Silty clay loam < 1.40	1.15	1.07
Seward County - Ficke	25+	3	Silty clay loam < 1.40	1.23	1.19
Stanton County - Pestel	25+	6	Silty clay loam < 1.40	1.09	1.09
Knox County - Steffen	10+	5	Silt loam < 1.40	1.22	1.12
Sherman County - Obermiller	10+	3	Silt loam < 1.40	1.17	1.16
Franklin County - Bauer	25	3	Silt loam < 1.40	1.37	1.31
Keith County - Dyck	18	5	Sandy loams < 1.40	1.37	1.19
Merrick County - Seim	Strip till	2	Loamy sands < 1.60	1.35	1.41
Howard County - Sack	2	2	Silty Clay Loam < 1.40	1.08	1.23

# Top Ten States for Harvested Cropland Acres with Cover Crops: 2017 and 2012<sup>1</sup>

State/Year		Acres In Cover Crops <sup>2</sup>	% of Total Harvested Acres
Texas:	2017	1,014,145	5.8
	2012	911,061	5.5
Iowa:	2017	973,112	4.0
	2012	379,614	1.5
Indiana:	2017	936,118	7.6
	2012	596,060	4.9
Missouri:	2017	842,178	6.2
	2012	390,114	3.0
<b>Nebraska:</b>	<b>2017</b>	<b>747,903</b>	<b>3.8</b>
	<b>2012</b>	<b>357,264</b>	<b>1.9</b>
Ohio:	2017	717,759	7.0
	2012	357,292	3.5
Illinois:	2017	708,105	3.1
	2012	318,636	1.4
Michigan:	2017	673,205	7.3
	2012	437,200	6.2
Wisconsin:	2017	611,231	6.6
	2012	553,005	6.0
Pennsylvania:	2017	595,309	15.1
	2012	446,295	11.3

<sup>1</sup> Source: USDA National Agricultural Statistics Service, 2017 Census of Agriculture - State Data , Author: Diane Wasser, UNL

<sup>2</sup> Excluding CRP Acres



## Percent of Nebraska Farms Reporting Cover Crops by Acreage - Size Class of Farms, 2012 and 2017 <sup>1</sup>

Farm Acreage Size Class	Year		% Change 2012-2017
	2012	2017	
1 to 99 acres	1851 - 65%	2300 - 52%	24.3%
100 to 499 acres	837 - 30%	1792 - 40%	114.1%
500 to 999 acres	95 - 3%	238 - 5%	150.5%
1000 to 1999 acres	37 - 1%	82 - 2%	121.6%
2000 or more acres	6 - <1%	7 - <1%	16.7%

The total number of farms in Nebraska: 49,969 in 2012, 46,332 in 2017.

<sup>1</sup> Source: USDA, National Agricultural Statistics Service, 2017 Census of Agriculture - Nebraska , Author: Diane Wasser , UNL

# Nebraska **Cover Crops Acres** Reported within each “Acreage - Size” Class of Farms, 2012 and 2017 <sup>1</sup>

Total Harvested Ac & # using Cover Crops

Total Harvested & # 2017

Farm Acreage Size Class by harvested acres				% Change	Total acres	Total #
Year	2012	# of Farms	2017	2012-2017	2017	2017
	----- Acres -----			Percent	Acres	#
1 to 99 acres	62,593	2300 - 87,308		39.5%	369,244	11,199
100 to 499 acres	167,267	1792-390,340		133.4%	2,894,779	11,323
500 to 999 acres	60,360	238 - 150,782		149.8%	3,882,969	5,450
1000 to 1999 acres*	46,156	82 - 98,707		113.9%	4,555,895	3,140
2000 or more acres*	20,888	7 - 20,766		0.69%	7,757,335	3,057
TOTAL	357,264	747,903		109.3%	19,460,222	34,169

<sup>1</sup> Source: USDA, National Agricultural Statistics Service, 2017 Census of Agriculture - Nebraska , Author: Diane Wasser , UNL

\* Acres and Number Totals divided into two brackets based on operation size percentages.





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# ON-FARM RESEARCH NETWORK

WORKING WITH PRODUCERS TO ADDRESS CRITICAL PRODUCTION, PROFITABILITY, AND NATURAL RESOURCES QUESTIONS.



# SOIL HEALTH INITIATIVE

DEMONSTRATING SOIL HEALTH MANAGEMENT ACROSS NEBRASKA

The University of Nebraska, the Natural Resources Conservation Service, and Nebraska farmers and ranchers are participating in a state-wide effort to enhance the adoption of soil health and rangeland health management systems through the Soil Health Demonstration Farms and Ranch Initiatives. These initiatives will establish in-field management comparisons across the state to showcase grazing management and cropping system comparisons.

## SOIL HEALTH INITIATIVE

[About the Soil Health Initiative](#)





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