Knowledge Check: Poll Question

What's the current perception of Soil Health in your area?

This Poll can be done during the break and then go over before start of the module

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Strategizing & Implementing a Soil Health Management System

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District Conservationist – Butler County

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Objectives

1. Identify key components of practices and activities to develop a Soil Health Management System
2. Describe the interaction, dependency and synergy between practices in a SHMS
3. Recognize barriers to implementation
4. Describe an entry level strategy to develop a SHMS

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Soil Health Management System

- Collection of NRCS conservation practices, BMPs, activities, that focus on maintaining or enhancing soil health
- Address all 4 of the soil health principles
- Create a “synergistic” effect
- Cropping system specific

Best Accepted New Technology

- Conservation activities that might not be in an NRCS conservation practice standard. Examples:
  - Companion cropping
  - Traffic management
  - Precision application of nutrients and pesticides
  - Use of floatation tires or tracks

Soil Health Management System

- Achieving soil health through:
  - A Quality No-till/ Strip-till System
  - Diverse and Strategic Cover Crops
  - Adapted Nutrient Management
  - Integrated Weed & Pest Management
  - Diverse Crop Rotations
  - Precision Farming Technology
  - Prescriptive Buffers
  - Livestock integration

Soil Health is not a destination…it's a ***Journey***


Quality no-till/strip-till


Adapted nutrient management


New technology
and
integrated weed &
pest management


Prescribed cover crops


Diverse crop rotation

Quality no-till/strip-till

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No-Till / Strip-Till

Planter set-up and maintenance is critical


Goal: Every seed at the exact same depth…

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Spread the Weight!

Spread the Residue!

Knowledge Check: Poll Question

What Issues with No-till have you seen or heard of in your location?

Quality no-till vs no-till

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Quality no-till vs no-till

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Planting Green

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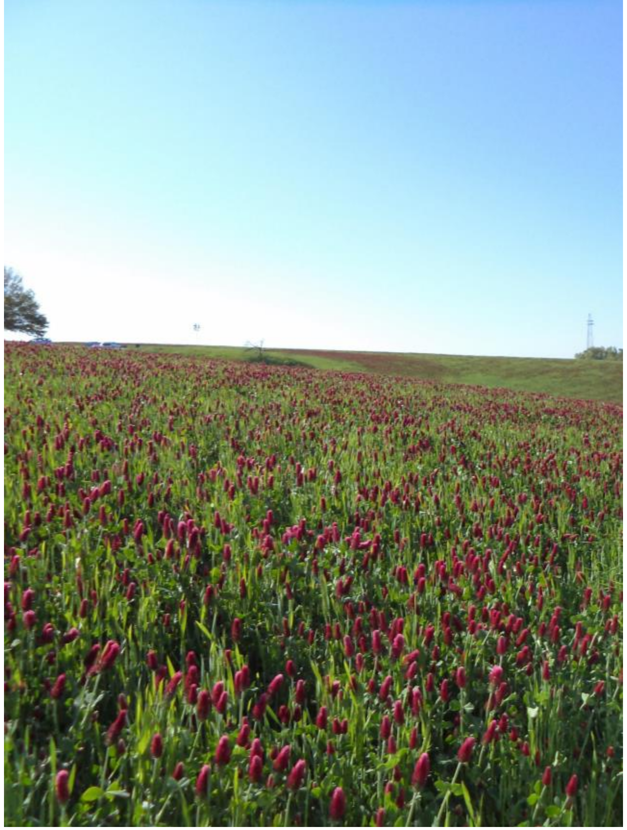
Poor Structure = Yield Loss

No-Till Planter Attachments

Adapted nutrient management

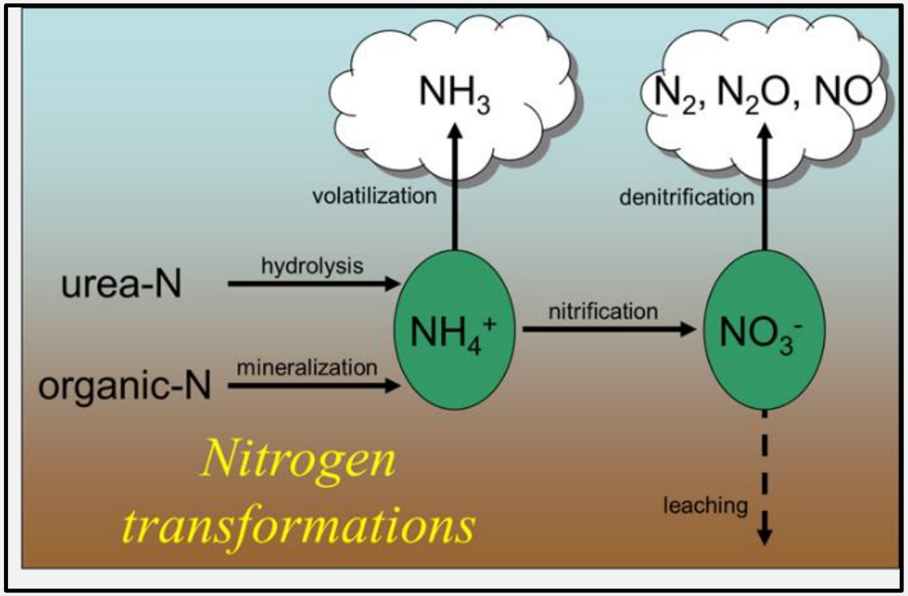
Compounding extent of soil degradation and effect on other cycles

Denitrification:

- Anaerobic conditions cause Losses of N_2, NO and N_2O

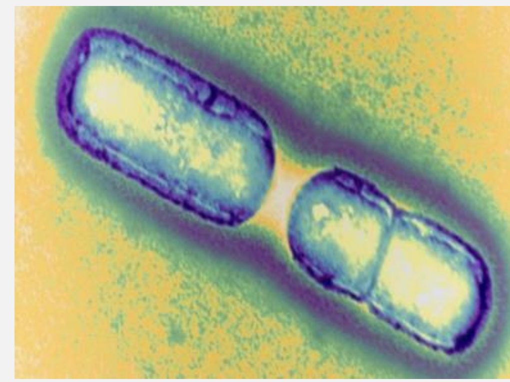
Leaching

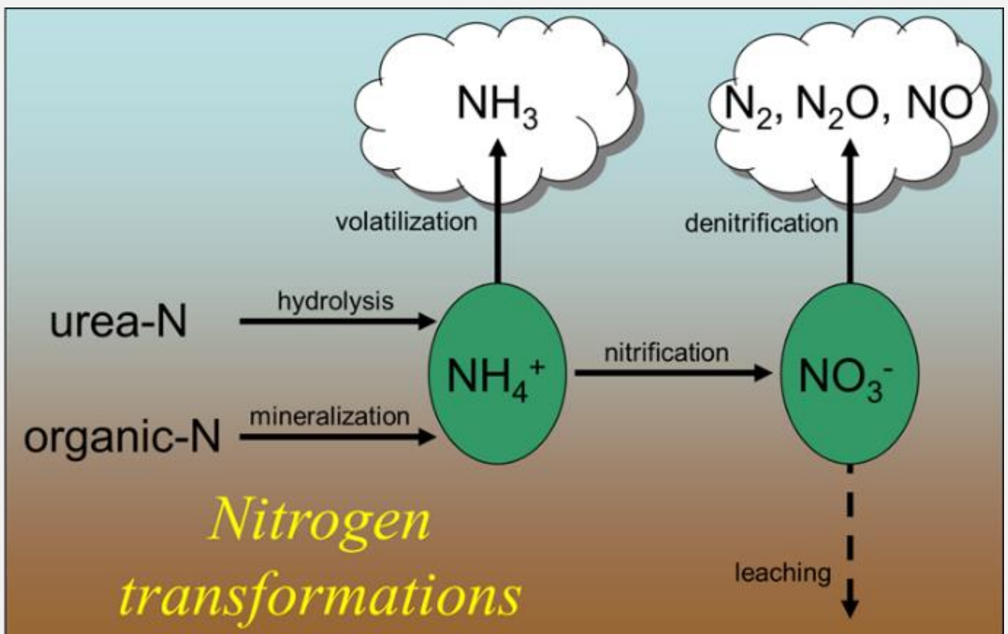
- Plenty of heat to convert ammonium to nitrate
- Nitrate leaves with the water



Both applied and soil available N are at risk of loss

Nitrogen Mineralization and Immobilization





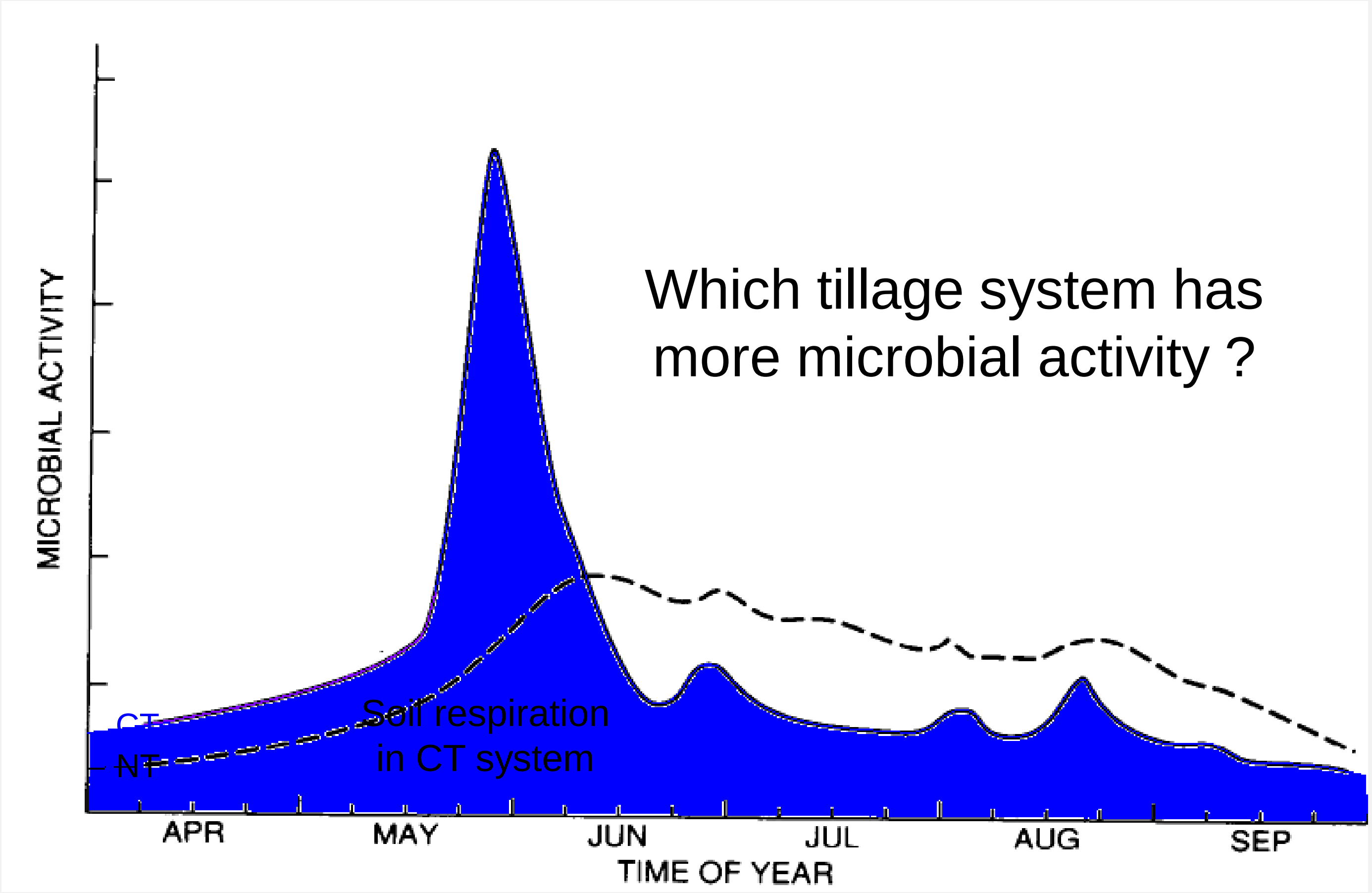
Biology

Only 30-55% of Inorganic Fertilizer is Directly Used by Plants

Fertilizer N applied (lb/ac)	Corn grain yield (Bu/ac)	Total N in corn plant (lb/ac)	Fertilizer-derived N in corn (lb/ac)	Soil-derived N in corn (lb/ac)	Fertilizer-derived N in corn as % of total N in corn
45	62	76	25	54	33
89	73	130	49	81	38
178	88	140	77	63	55

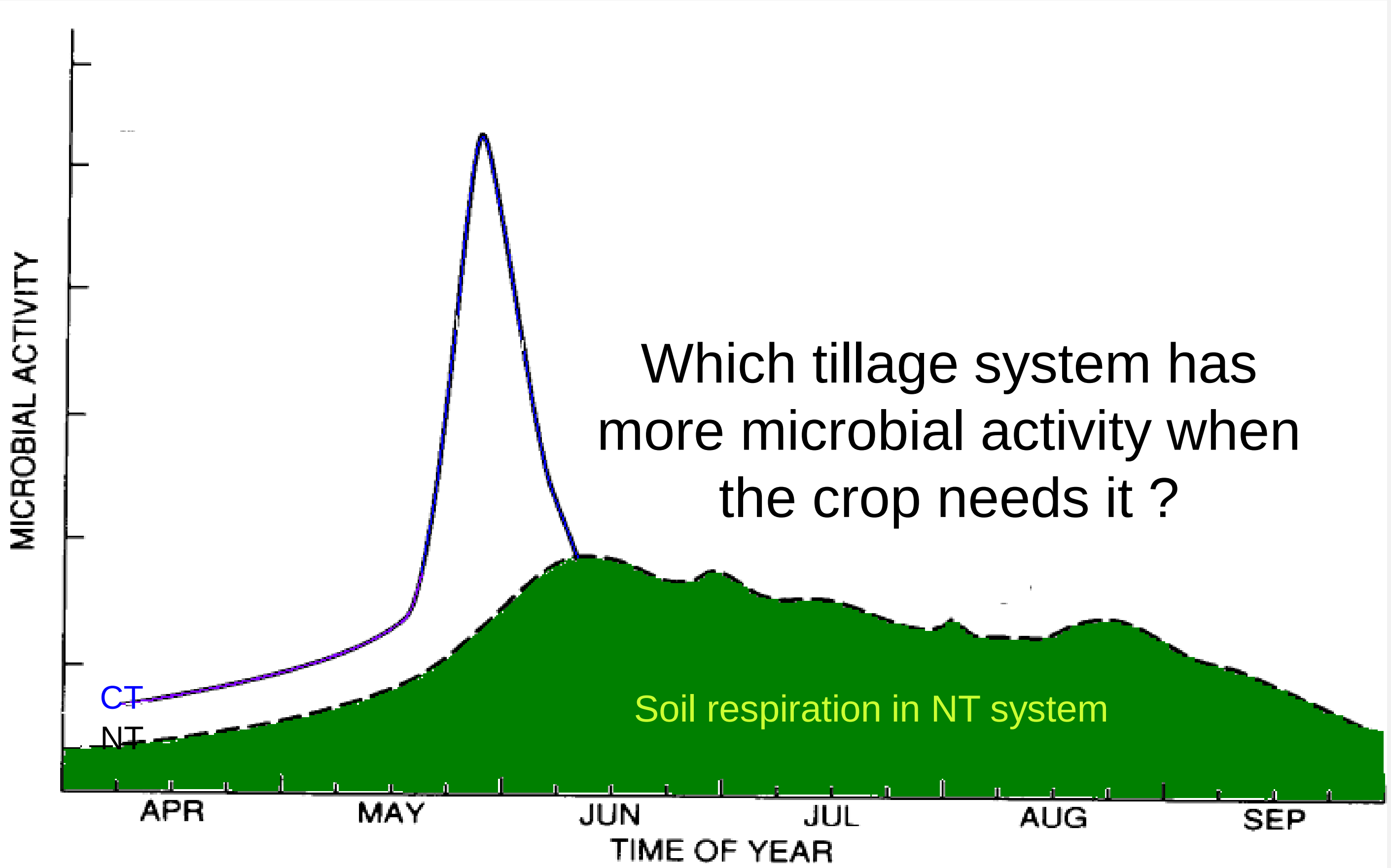
Calculated from Reddy and Reddy, 1993 and modified from Weil & Brady, The Nature and Properties of Soils, 15th ed.

Effect of tillage on microbial activity



Havlin et al. (1999)

Effect of tillage on microbial activity



Which tillage system has more microbial activity when the crop needs it ?

Havlin et al. (1999)

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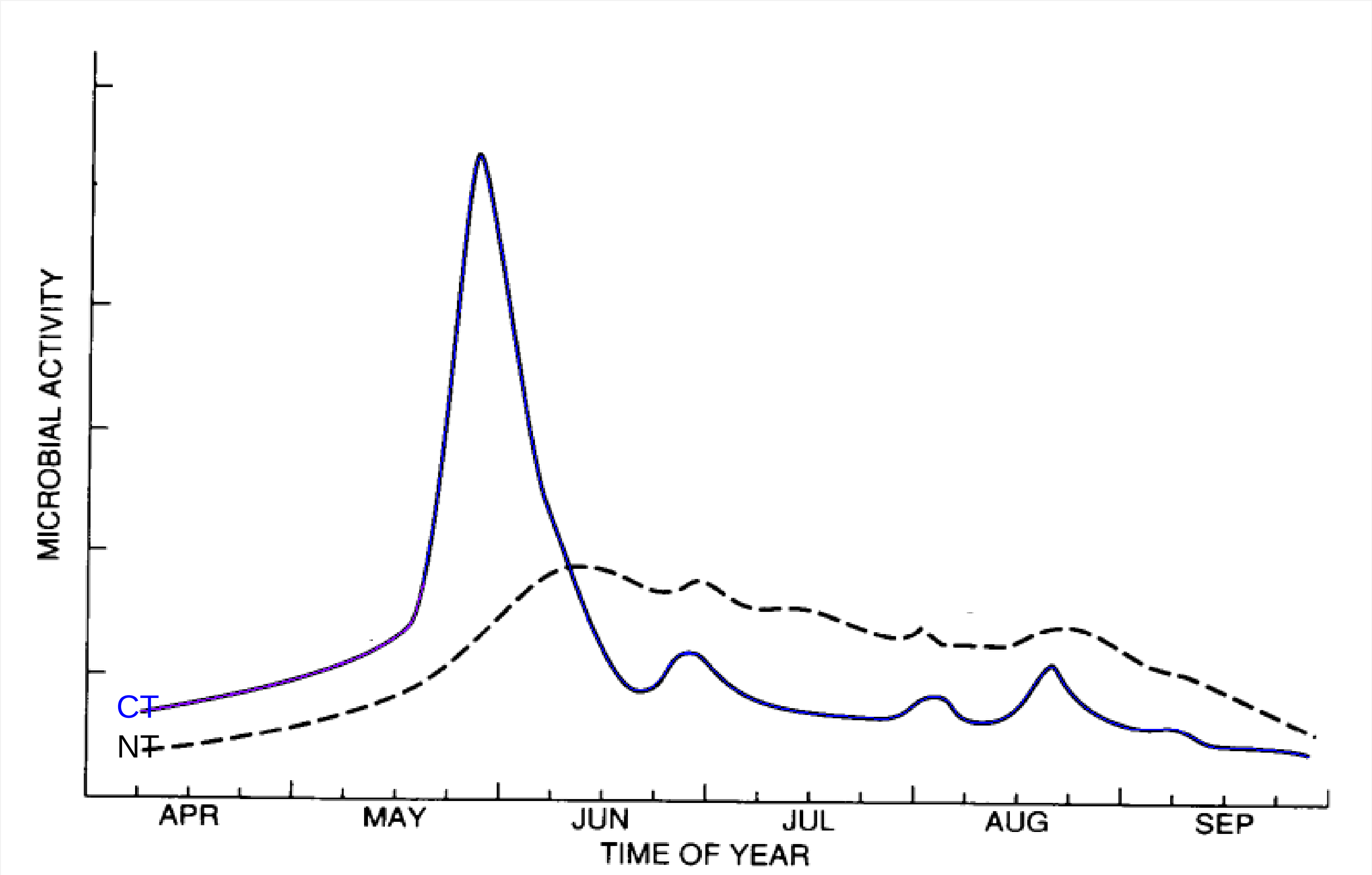
What are the yield determination times for corn? What should your N application protocol be?



Havlin et al. (1999)

Nitrogen Fixing Differences in Legumes

• Crimson Clover	70 – 150 lbs.
• Balansa Clover	60 – 100 lbs.
• Berseem Clover	60 – 120 lbs.
• Red Clover	70 – 150 lbs.
• Hairy Vetch	90 – 180 lbs.
• Winter Peas	90 – 150 lbs.
• Sunn Hemp	80 – 125 lbs. (summer/early fall)
• Cowpeas/Field Peas	90 – 150 lbs. (summer/early fall)

Harvesting plant for grain and/or forage removes a HUGE portion of the N that was fixed. However, over half the harvested N can be recovered with the right cropping and/or livestock system.

Assume only 50% of this N will be available.

These estimates assume biomass is maximized and growing conditions for these legumes are matched agronomically to their growing season. Many variables exist that affect N production (including when these species are terminated)….this is only a guide.

SOURCE: Penn State University, Colorado State University, Kansas State University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New technology and integrated weed & pest management

No-Till Planters

Precision nutrient placement and rate

With Adapted 4

Precision

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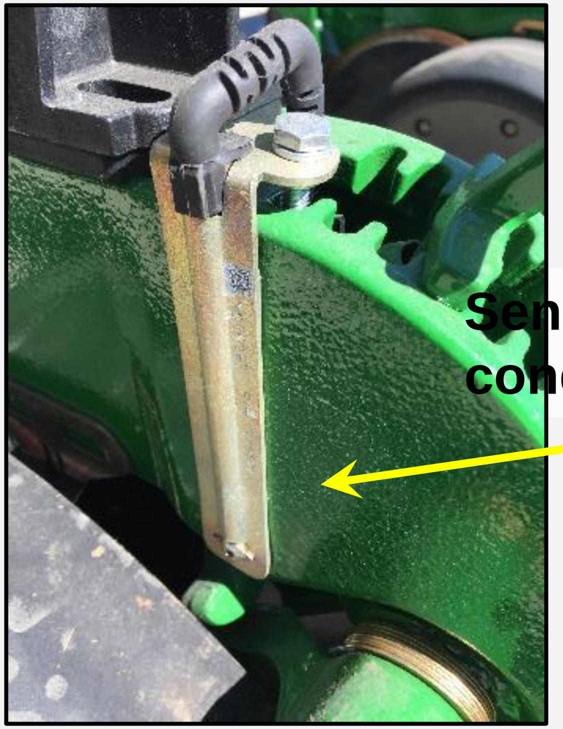
No-Till Planters



Sense and adapt to field conditions on the go!

With Space Shuttle Tech

Precision downforce

in sub inch increments.

New Technology using Nature for Weed Management

South Dakota Corn Insect Survey

107 "insect" species found (just in the canopy)

7% were primary pests (none at economically damaging levels)

13% have some impact on corn

Source: Jonathan Lundgren – Blue Dasher farm

Integrated Pest Management

Integrated Pest Management

- A short-term Canadian study found bees' presence was associated with much higher yields in food-grade soybeans.
- Australian researchers demonstrated yield increases of 10-40% in honey bee-pollinated soybeans, compared to self-pollinated beans.
- In 2005, a Brazilian research project compared soybean seed production with and without honey bee colonies by raising plants in cages, and reported 50% higher yields when bees were present.

https://www.farmprogress.com/soybeans/can-bees-build-soybean-yields

Source: Jonathan Lundgren Blue Dasher Farm

Intergrated Pest Management


Prescribed cover crops

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Strategically…CC Should Complement the Following Crop

What about Corn?

Strategically…CC should match desired C:N Ratio

Material	C:N Ratio	
Rye Straw	82:1	Good for Soybean
Wheat Straw	80:1	Good for Soybean
Oat Straw	70:1	Good for Soybean
Corn Stover	57:1	Good for Soybean
Rye Cover Crop (Anthesis)	37:1	Good for Soybean
Rye Cover Crop (Vegetative)	26:1	Good for Soybean
Mature Legumes	25:1	Good for Soybean
Balanced Microbial Diet	24:1	
Daikon Radish	19:1	Good for Corn
Crimson Clover	17:1	Good for Corn
Ryegrass (Vegetative)	15:1	Good for Corn
Young Alfalfa	13:1	Good for Corn
Hairy Vetch Cover Crop	11:1	Good for Corn
Microbes (Average)	8:1	Good for Corn

Strategically…CC should complement the following crop …Which is better?

Corn into:

- High Carbon (Cereals Rye/Wheat)

…or

- High Nitrogen (Protein)
- Cover Crop (Clover/Peas)

Strategically…CC Should Complement the Following Crop

Corn into:

- High N (Protein)
- Cover Crop (Clover/Peas)
- Contributes high quality N
- Less likely to harbor disease pathogens

Strategically…CC Should Complement the Following Crop

To Raise N (Protein%)

- Select forage type grasses
- Add Clover/Peas if…
- Terminate Grass early when protein is high

…and consider adding:

- Oilseed Radish, Rapeseed if…

Strategically…CC Should Complement the Following Crop

Corn after

High C (Corn)

plus

High N (Protein)

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Strategically…

CC should complement the following crop

Corn strategy:

- Strip planting
  - Easy spring management
- Other innovations

Strategically…CC Should Complement the Following Crop

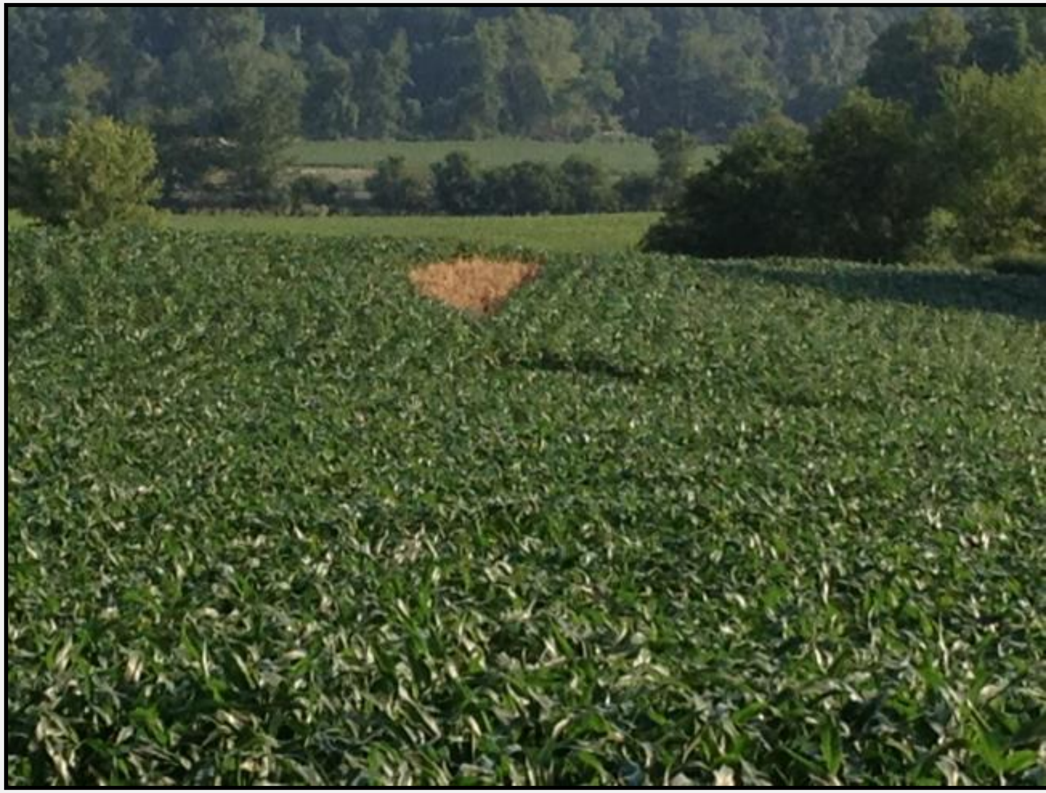
Corn into a mix:

High Protein

Can Provide:

- Optimum Nutrient Release
- Extra water

During rapid demand



Strategically…CC Should Complement the Following Crop

Corn into a mix:

High Carbon (Rye)

Provides:

- Erosion Control
- Moisture Savings

Uses/ immobilizes:

- Nitrogen/ nutrients
- Disease?

Starter N a must!

Strategically…What about Soybeans?

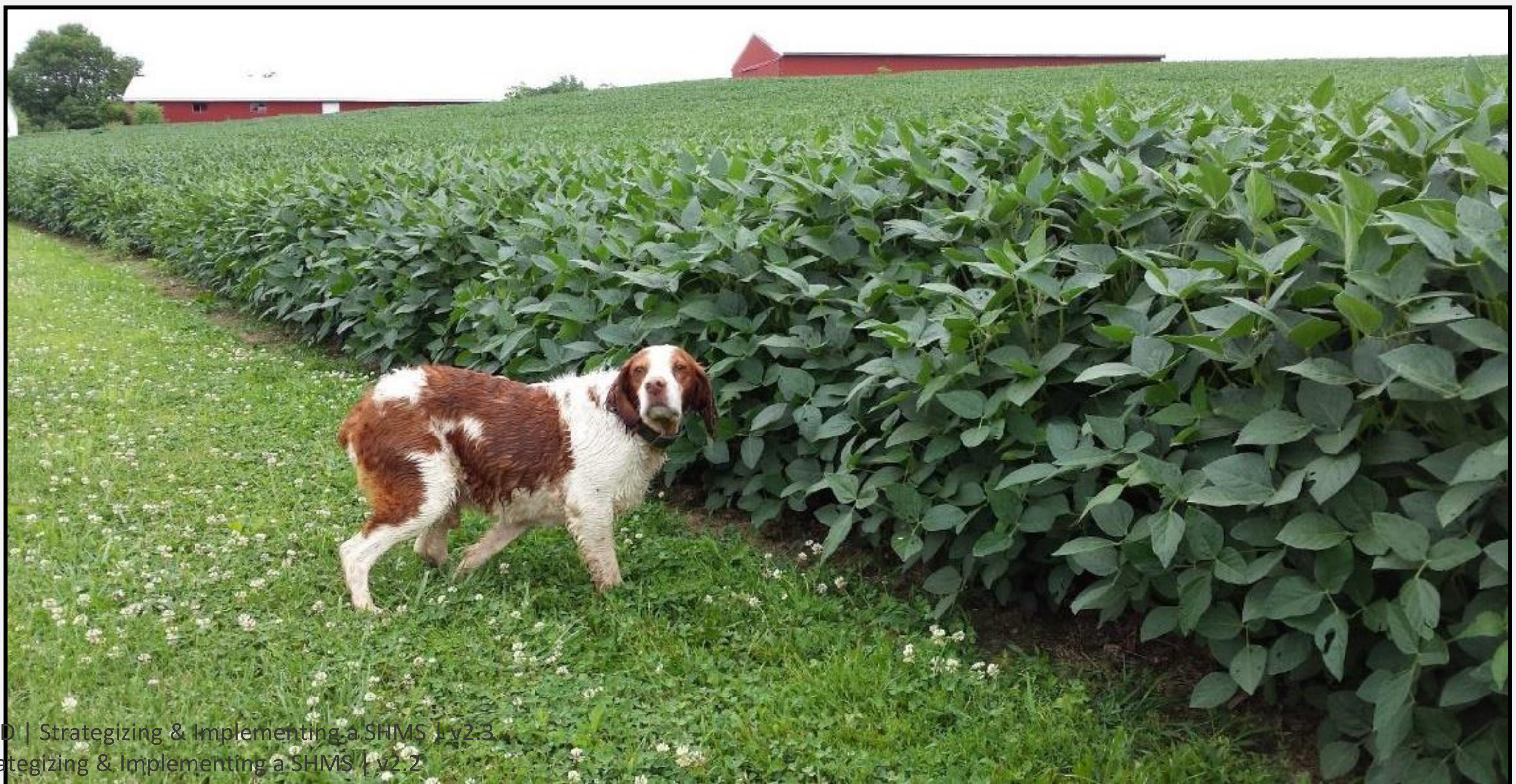
Choices

Do Soybeans need N ?

…Sure, but they capture their own!

Strategically…

- Soybeans do well into a high carbon Cover Crop.
  …Why?
- Weed Control, Late Season Water and Nutrient Cycling



Knowledge Check: Poll Question

What is your experience with farmers planting green?

Strategically…Planning the System Using the Step by Step Approach

1. **Drill or Aerial Seed Cereal Rye or Annual Ryegrass into Corn Stalks**

Strategically…Planning the System

2. Terminate the Cereal Rye at 12”…

Strategically…Planning the system

2. **Plant a short season Soybean into the Rye (preferably early in the season)**

Strategically…Planning the system

3. **Plant a low C:N mix into or after Soybean**

Strategically… Planning the system

18 months into the system we have had:

Three no-till plantings (Minimized Disturbance)

Year round ground cover (Maximized Ground Cover)

Added diversity that was lacking (Maximized Diversity)

Two winters of a living root (Maximized Living Roots)

Strategically…Planning the system

4. **NT Corn into a: Biologically active high functioning soil**

Strategically…Planning the system… for a higher level?

5. Add a Small Grain and make it a true rotation

A Small Grain gives endless options…

Strategically…Planning the system… for a higher level?

6. Maximize Diversity by companion cropping…

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Strategically…Planning the system… for a higher level?

7. Maximize Diversity by adding livestock…with high end grazing systems

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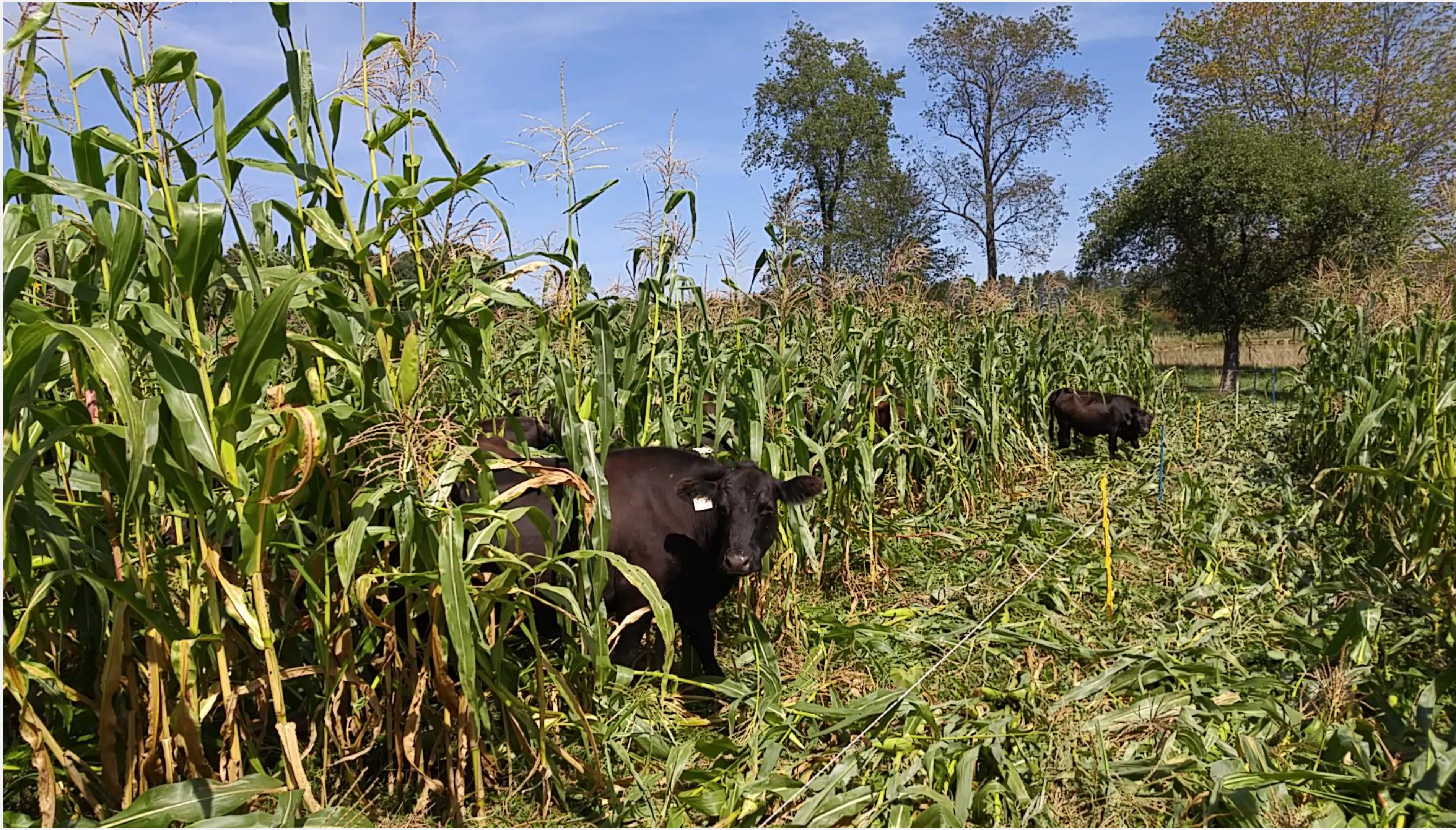

LAB SAMPLES FOR-
[redacted]

AGRI-KING LABORATORY SAMPLES
AREA MGR.= ROBERT [redacted]
CLIENT NO.=[redacted]

AS OF 09/16/16

* D A I R Y / B E E F * ----PERCENT---- / -PPM-

Sample	Date	MST	CP	SP	NHCP	ADIP	NDF	DNDF	ADF	LIG	NFC	STRH	6CSG	HEM	OIL	IVDMD	NDFD	CAL	LAC	ACE	BUT	NIT-N
BERGAMONT 1316036	09/16/16	69.8	12.1	25		5.9	43.8		36.6	7.62	35.5			7.2	6.1	63.6		468				1
SMOOTH BLUE ASTER 1316035	09/16/16	74.9	15.3	31		1.5	40.2	17.5	30.0	5.57	36.8		4.2	10.2	2.9	67.6	43.5	452				1
GRAY CONE FLOWER 1316034	09/16/16	83.6	23.4	30		0.8	26.0	12.0	22.2	3.85	38.3		5.8	3.8	3.0	83.8	46.3	631				93
MOUNTAIN MINT 1316033	09/16/16	71.7	12.1	20		7.4	48.8		40.3	7.65	33.9			8.5	4.1	62.1		442				1
LEAVES F15 1316032	09/16/16	83.2	13.8	18		0.8	39.4	18.2	30.9	4.28	40.8		10.8	8.5	2.0	83.0	46.3	653				1287
NEW ENGLAND ASTER 1316031	09/16/16	79.5	24.5	27		1.4	32.8	18.2	25.1	4.65	34.3		5.0	7.7	3.3	78.0	55.4	588				327
PENTSMEN 1316030	09/16/16	72.7	14.8	24		1.2	34.3	11.7	27.1	5.24	42.1		3.5	7.2	3.0	73.9	34.0	511				1
WING STEM 1313371	09/02/16	75.6	21.7	31		1.5	32.4	10.3	25.7	4.86	35.1		0.4	6.7	3.7	80.3	31.8	608				96
NARROW LEAF MOUNT MINT 1313370	09/02/16	73.8	15.6	37	14.6	5.9	57.1	12.5	54.0	12.5	21.5		0.8	3.0	2.8	42.5	22.0	333	0.40	1.07		8
LEAVES STIFF GOLDEN ROD 1313369	09/02/16	74.0	13.2	20		1.6	32.3	20.1	27.6	4.97	42.2		8.3	4.7	3.6	79.2	62.2	620				8

Sample	CA	P	MG	K	S	NA	CL	ASH	PROLA	STDIG	ANE	RFQ	RFV	PH	FE
BERGAMONT 1316036	1.80	0.36	0.31	2.00	0.28	0.01	0.02	8.2			8.06		128		103
SMOOTH BLUE ASTER 1316035	1.13	0.48	0.26	2.97	0.12	0.02	0.46	10.4			6.41	136	152		260
GRAY CONE FLOWER 1316034	1.67	0.50	0.35	3.97	0.17	0.02	0.14	13.5			6.93	238	257		176
MOUNTAIN MINT 1316033	0.99	0.34	0.51	1.87	0.20	0.01	0.10	7.7			7.86		110		118
LEAVES F15 1316032	1.43	0.21	0.50	2.46	0.16	0.02	0.11	8.6			6.85	146	153		744
NEW ENGLAND ASTER 1316031	1.14	0.43	0.21	3.99	0.18	0.02	1.25	11.9			7.07	205	197		219
PENTSMEN 1316030	1.07	0.30	0.33	1.29	0.17	0.02	0.09	9.0			6.47	150	184		194
WING STEM 1313371	2.24	0.37	1.05	1.60	0.23	0.00	0.31	12.6			6.44	155	198		85
NARROW LEAF MOUNT MINT 1313370	1.38	0.20	0.51	1.59	0.13	0.03	0.21	7.2			3.84	43	76	5.1	110
LEAVES STIFF GOLDEN ROD 1313369	1.48	0.26	0.48	1.92	0.13	0.02	0.50	13.2			7.31	222	194		228

***NOTE-ALL VALUES, EXCEPT MOISTURE ARE ON A 100% DRY MATTER BASIS.

[redacted] E-MAIL [redacted]* 0000006 * 09/16/16 * 14:51:35

Strategically… Planning the system

8. Enjoy The Rewards of Soil Health!

Implementing A Plan

Kellogg Farms

Kellogg Farms

Kellogg Farms

Thiele Farm

Thiele Farm

United States Department of Agriculture

Managing for a Living Ecosystem is Key to Optimum Production

"We can take production and conservation further with management systems that *continually* build Soil Health"

Capture the potential!

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