Building A *Successful* Conservation System To Regenerate Soil Health

Barry Fisher
NRCS Soil Health Division
2017

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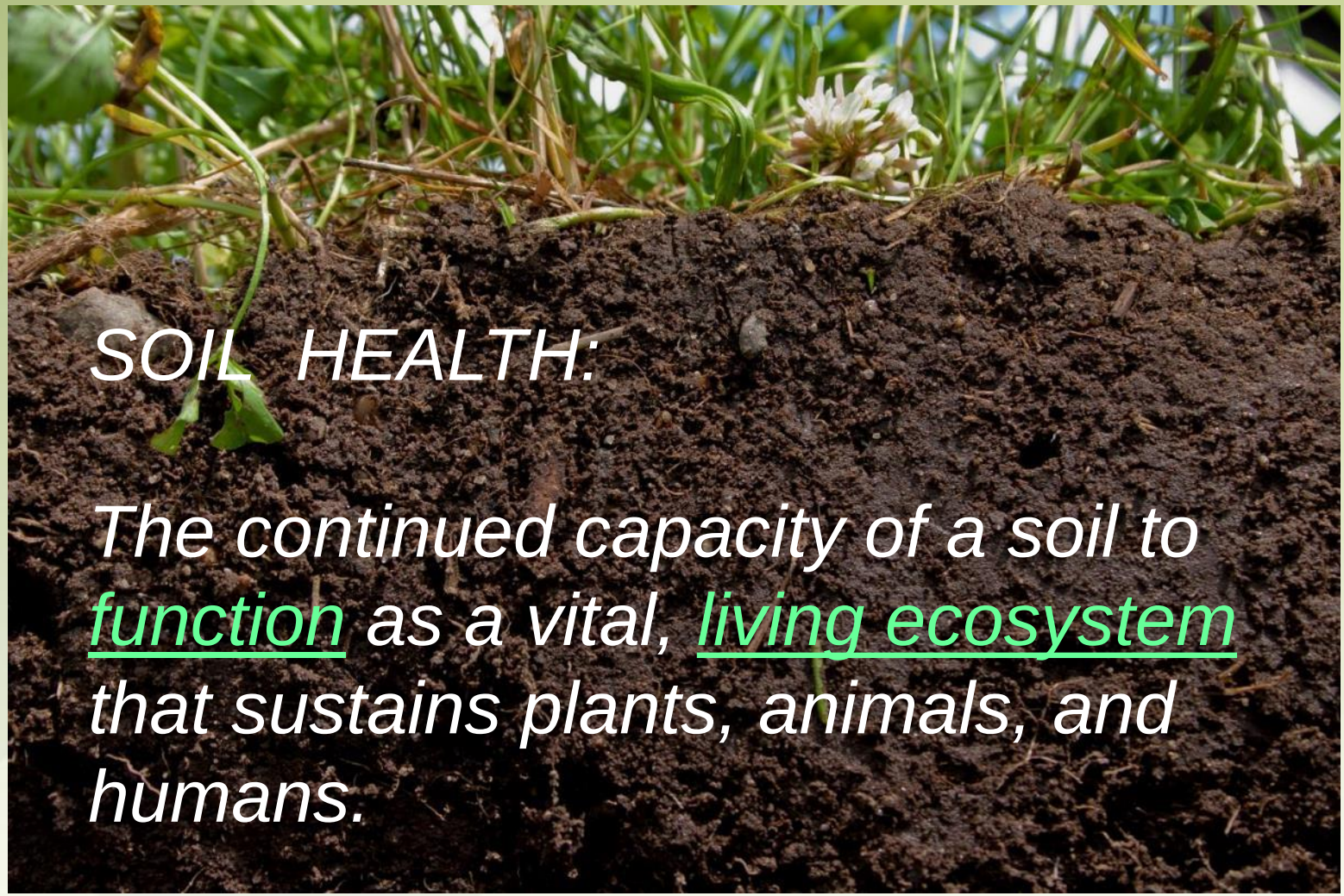

SOIL HEALTH:

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

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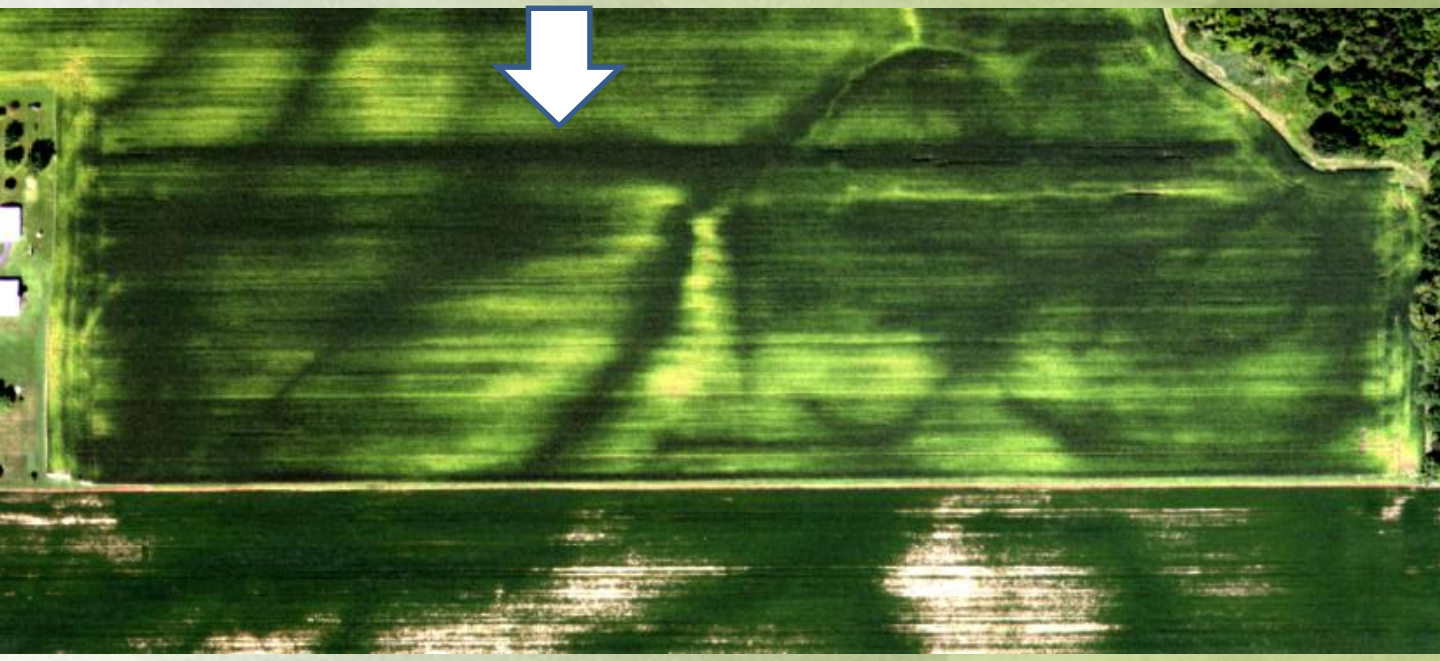
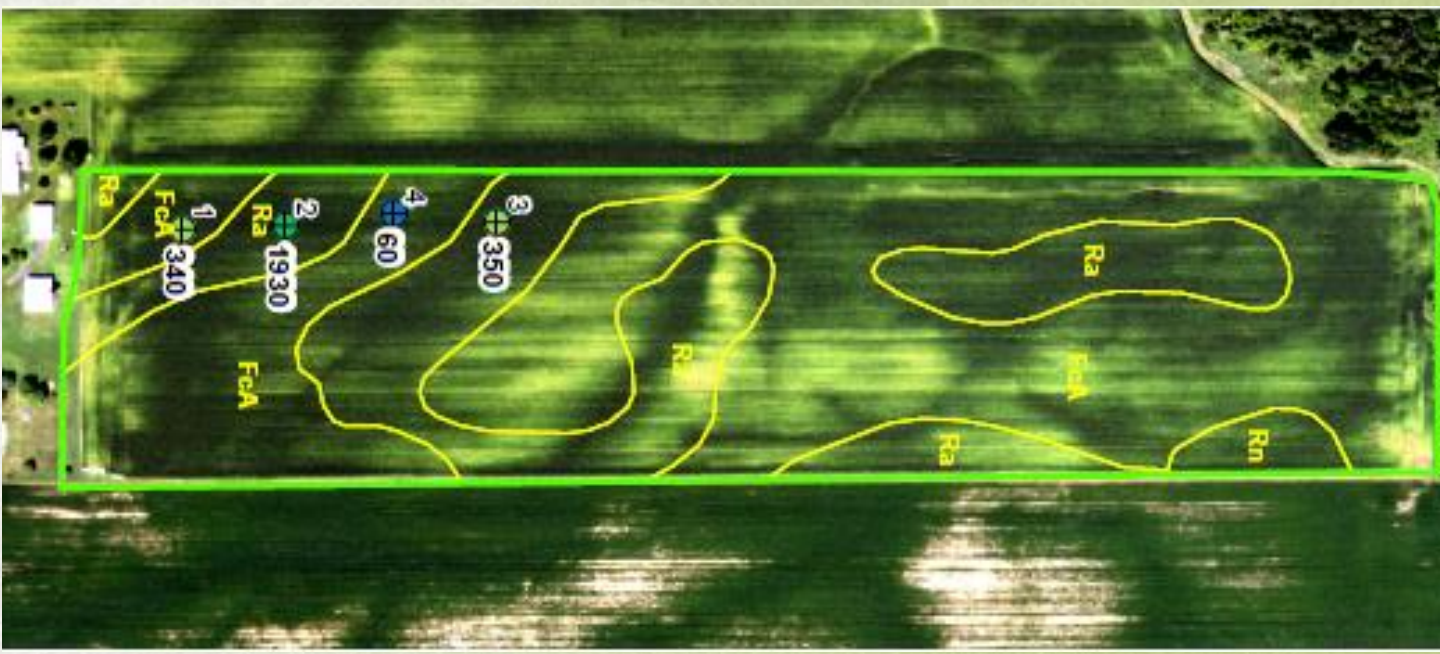
Soil Health Principles

unlock the SECRETS IN THE SOIL



The Fence Row Effect



Principles at work

Soil Health Management System

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

Soil Health Management System

- **Achieving soil health through:**
  - **A <u>Quality</u> No-till System**
  - **<u>Diverse</u> and <u>Strategic</u> Cover Crops**
  - **<u>Adapted</u> Nutrient Management**
  - **<u>Integrated</u> Weed & Pest Management**
  - **<u>Diverse</u> Crop Rotations**
  - **<u>Precision</u> Farming Technology**
  - **<u>Prescriptive</u> Buffers and supportive practices**

Soil Health is not a destination...it's a <u>Journey</u>

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Quality No-Till/Strip-till


Adapted Nutrient Management


New Technology
and
Integrated Weed &
Pest Management


Prescribed Cover Crops


Diverse Crop Rotation


Quality No-Till


Ecological Nutrient Management


Integrated Weed &
Pest Management
and
Precision Technology


Prescribed Cover Crops & Grazing


Diverse Crop Rotation

Making Soil Health A Priority!

unlock the SECRETS IN THE SOIL

- **What does *Soil Health* mean?**
- **Key Indicators =**
  - Improv**ing** organic matter
  - Improv**ing** aggregate stability
  - Increas**ing** water infiltration
  - Increas**ing** available water
  - Improv**ing** nutrient cycling
  - Balanc**ing** and diversifying soil biology

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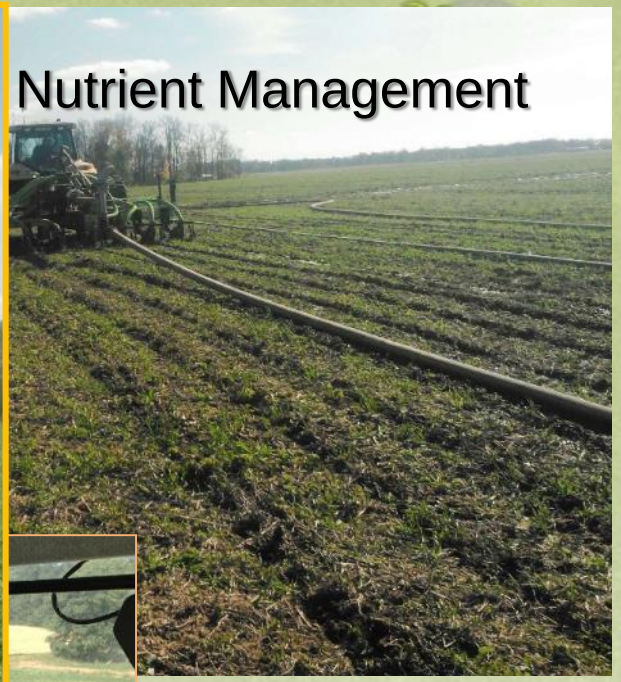
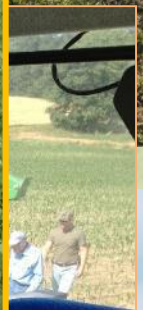
Quality No-Till/Strip-till


Nutrient Management




New Technology
and
Integrated Weed &
Pest Management


Prescribed Cover Crops


Diverse Crop Rotation


No-Till / Strip-Till
Planter set-up and maintenance is critical


Every seed at the exact same depth…


…every seed the exact same environment


Yetter

No-Till planters

unlock the SECRETS IN THE SOIL

Precision nutrient placement and rate

Sense and adapt to field conditions on the go!

With Space Shuttle Tech

Quality No-Till/Strip-t

Adapted Nutrient Management

Prescribed Cover Crops

and
Integrated Weed &
Pest Management

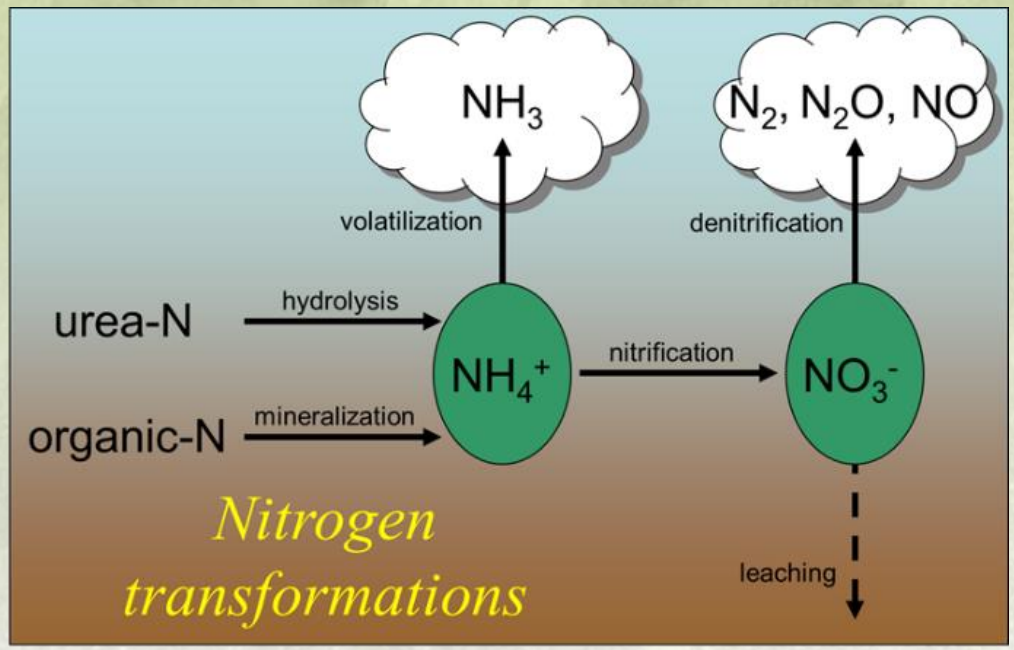
Diverse Crop Rotation

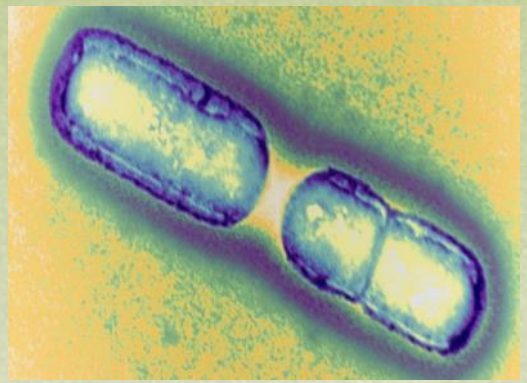
Developing Nutrients Management Strategies for Soil Health Cropping Systems

- 4-Rs

Must include SOM and Organic Nutrient Contribution

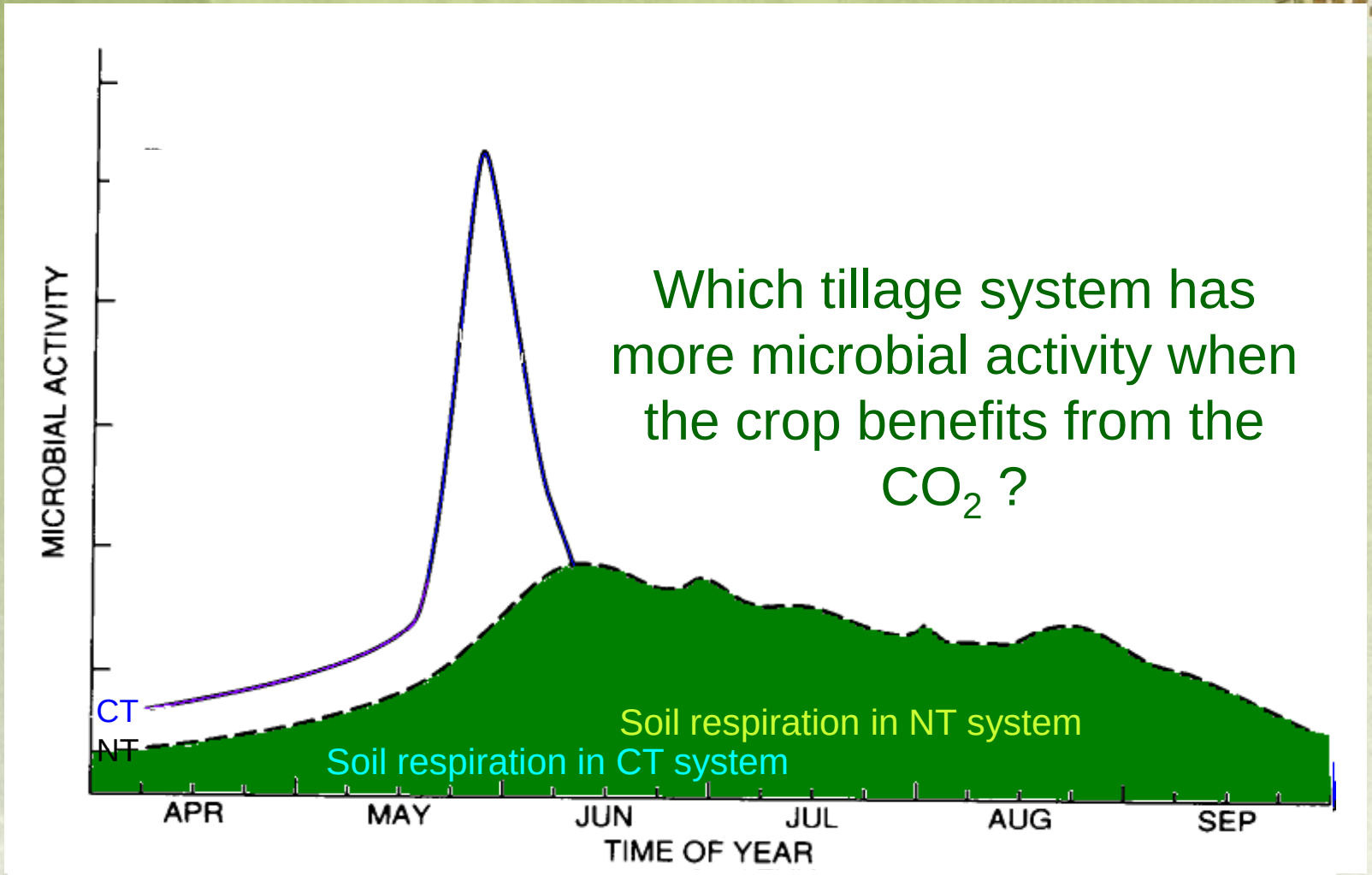
Nitrogen Mineralization and Immobilization





Biology

Effect of tillage on microbial activity



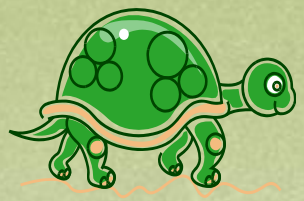
Which tillage system has more microbial activity when the crop benefits from the CO_2 ?

Havlin et al. (1999)

Strategically…
CC should match desired C:N Ratio

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

Good for Soybean



Good for Corn

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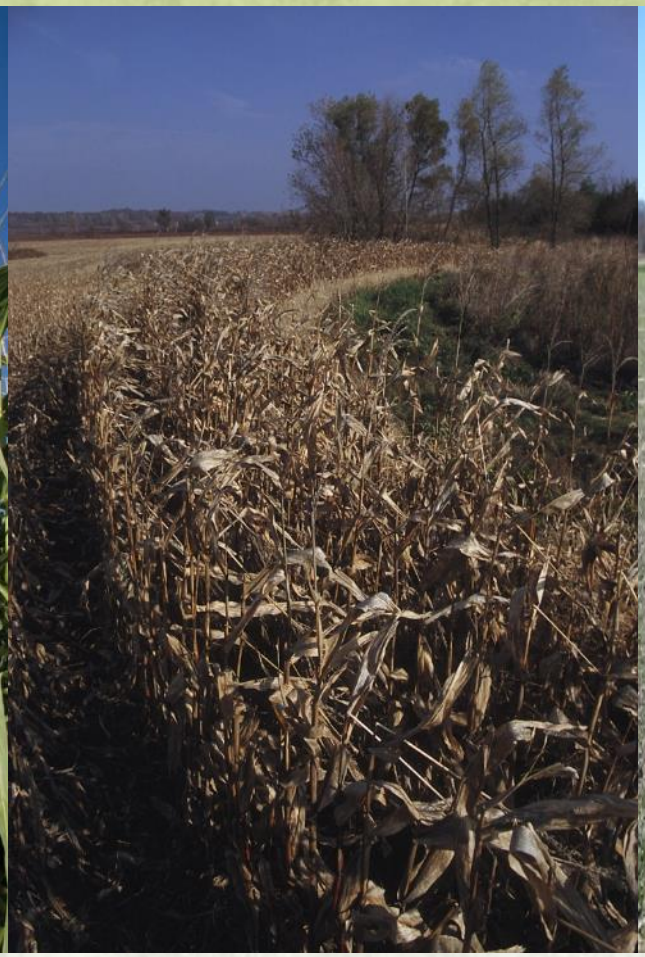
Plant available Nitrogen, exactly what we want…right???



“Catch and Release” Nutrients

Cover Crop Mgt for N Retention

Strategically…
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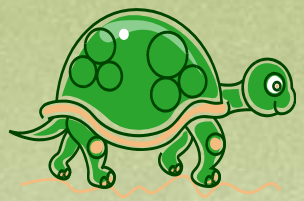

Good for Corn

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Quality No-Till/Strip-till

Adapted Nutrient Management

Prescribed Cover Crops

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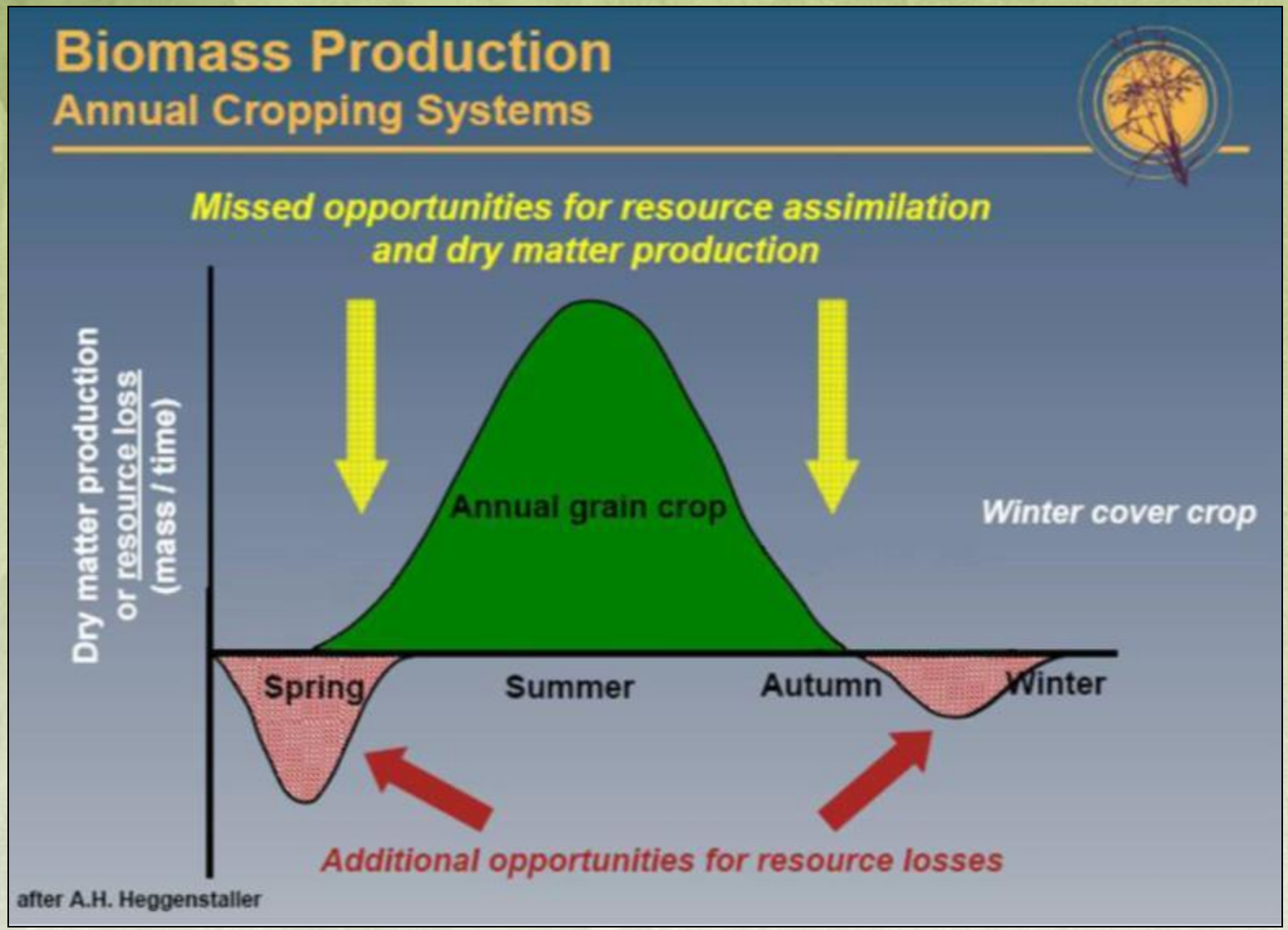
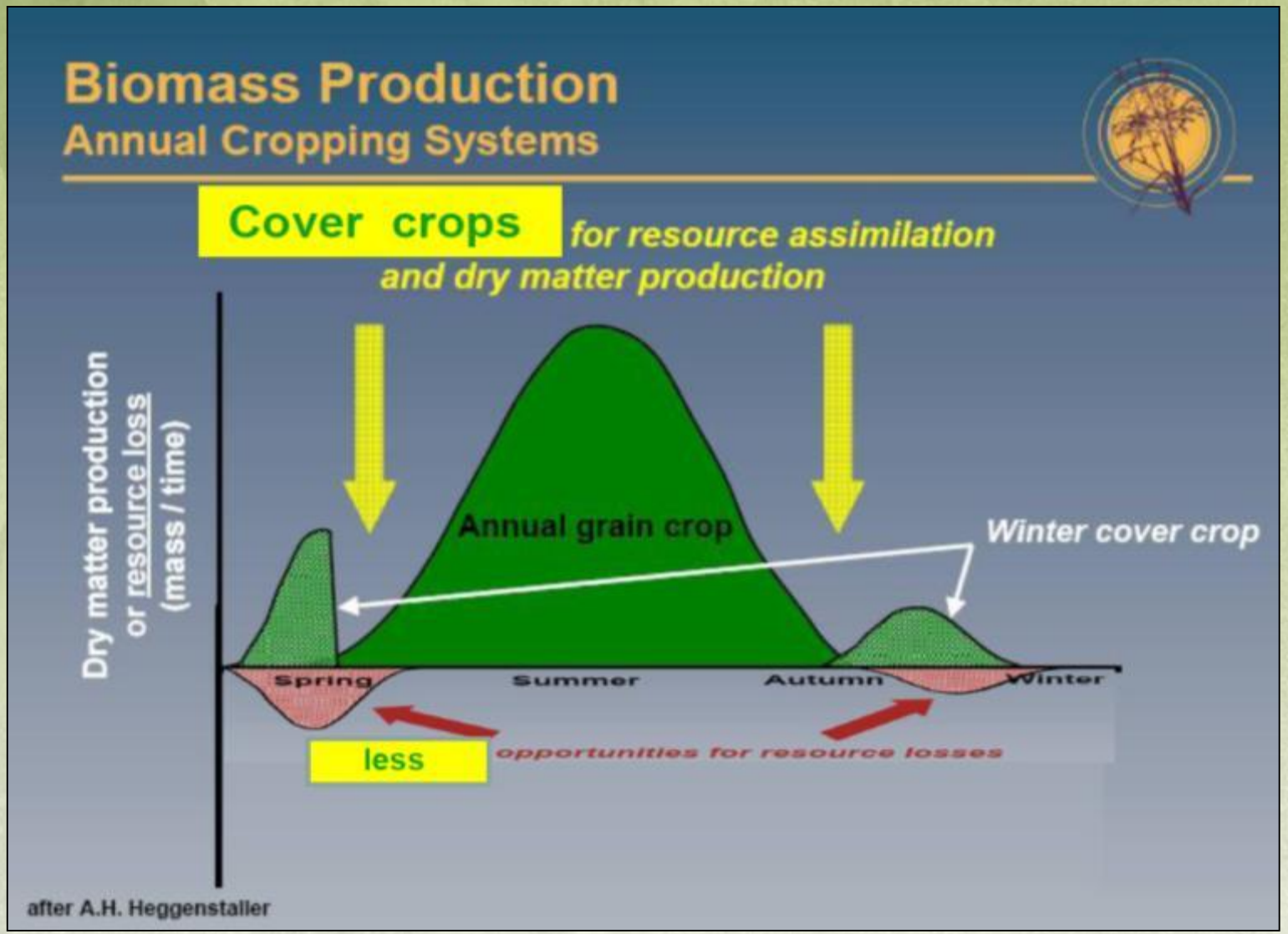
Diverse Crop Rotation


Why all the buzz about Cover Crops?
Less Carbon Loss Here
It's all about the Carbon! (Organic Matter)
We want more Carbon here

unlock the SECRETS IN THE SOIL

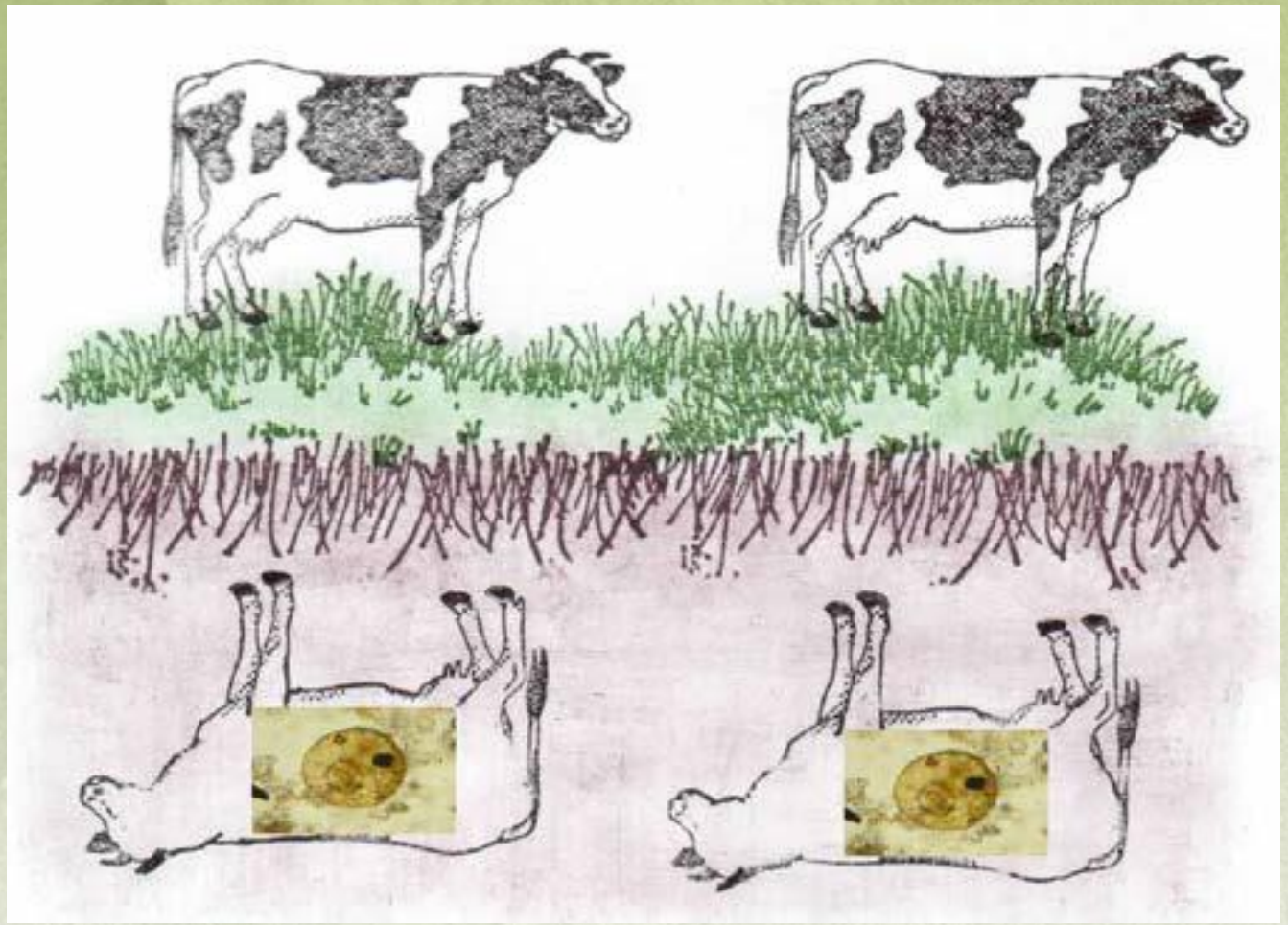


A. H. Heggenstaller, University of Alberta



A. H. Heggenstaller, University of Alberta

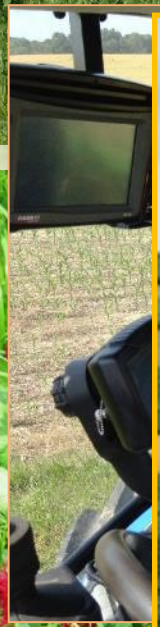
To Build Organic Matter We need to Feed the Herd



A acre of healthy soil has over 4 cows worth of microorganisms living in it. (Illustration by Eve Stika)

Quality No-Till/Strip-till

Adapted Nutrient Management



Prescribed Cover Crops

Diverse Crop Rotation

Soil Health Cropping Systems

...Strategy Example: for a (not so diverse) Corn-Soybean Rotation

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unlock the SECRETS IN THE SOIL

Strategically…
CC should complement the following crop

What about Corn?

Strategically…
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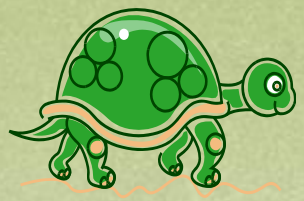

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Strategically…
CC should complement the following crop
…Which is better?

Corn into:

High Carbon (Cereals Rye/Wheat)

…or

High N (Protein)

Cover Crop (Clover/Peas)

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…
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 when protein is high
- and consider adding:
  - Oilseed Radish, Rapeseed if…

Strategically…
CC should complement the following crop

Corn into
a Balanced Mix
High C (carbon)
and
High N (Protein)

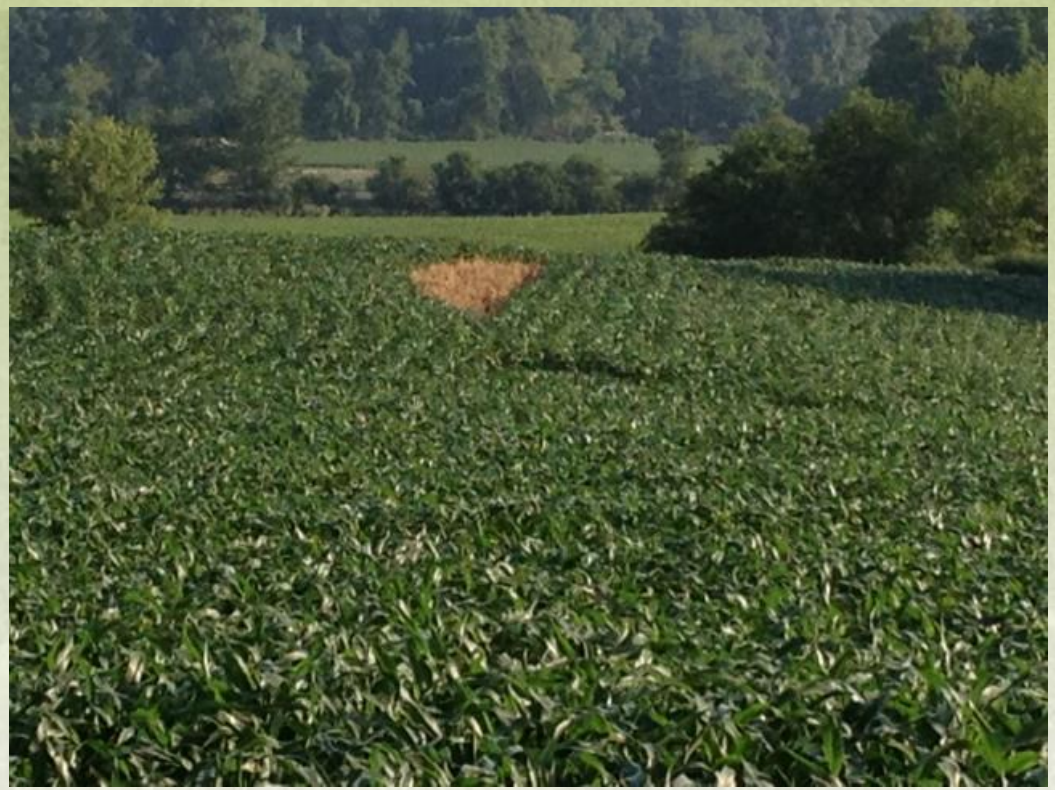
Strategically…
CC should complement the following crop

Corn into a mix:

High Protein

Can Provide:

- Optimum Nutrient Release
- Extra water during rapid demand



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

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 Using the Step by Step Approach

2. Terminate the Cereal Rye at 12”… Or…

Strategically…
Planning the System Using the Step by Step Approach

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

Strategically…
Planning the System Using the Step by Step Approach

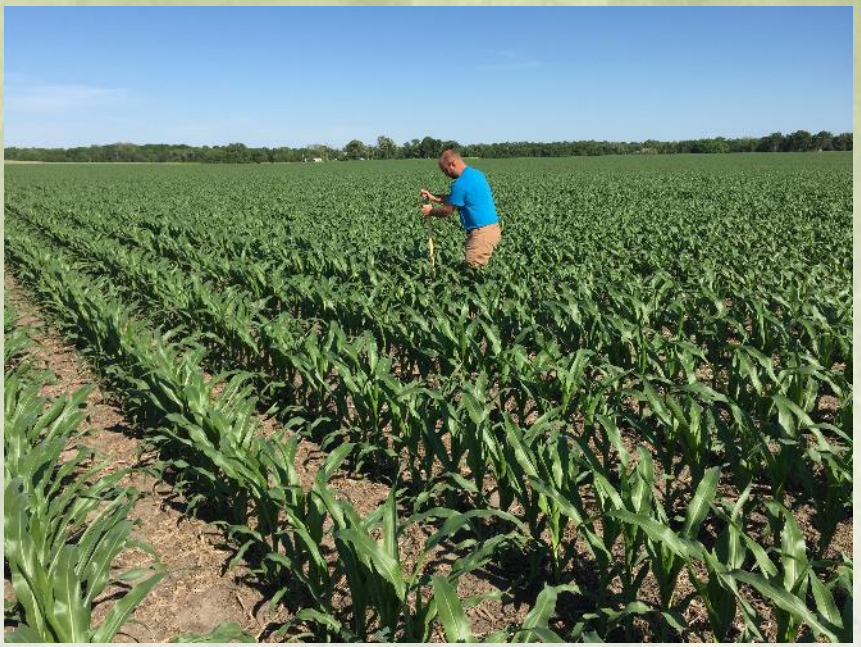
3. Plant a low C:N mix into or after Soybean

Strategically…
Planning the System Using the Step by Step Approach

4. NT Corn into a:
   - Biologically Active
   - High Function Soil

Strategically…
Planning the System Using the Step by Step Approach

5. Enjoy The Rewards of Soil Health!



Managing for a Living Ecosystem Requires Dynamic Management

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MORE INFORMATION ABOUT SOIL HEALTH –

Google = “NRCS Soil Health”

Soil Health Campaign

- Raised awareness
- Expanded demand for system adapted information
- Raising many good questions

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Natural Resources Conservation Service

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