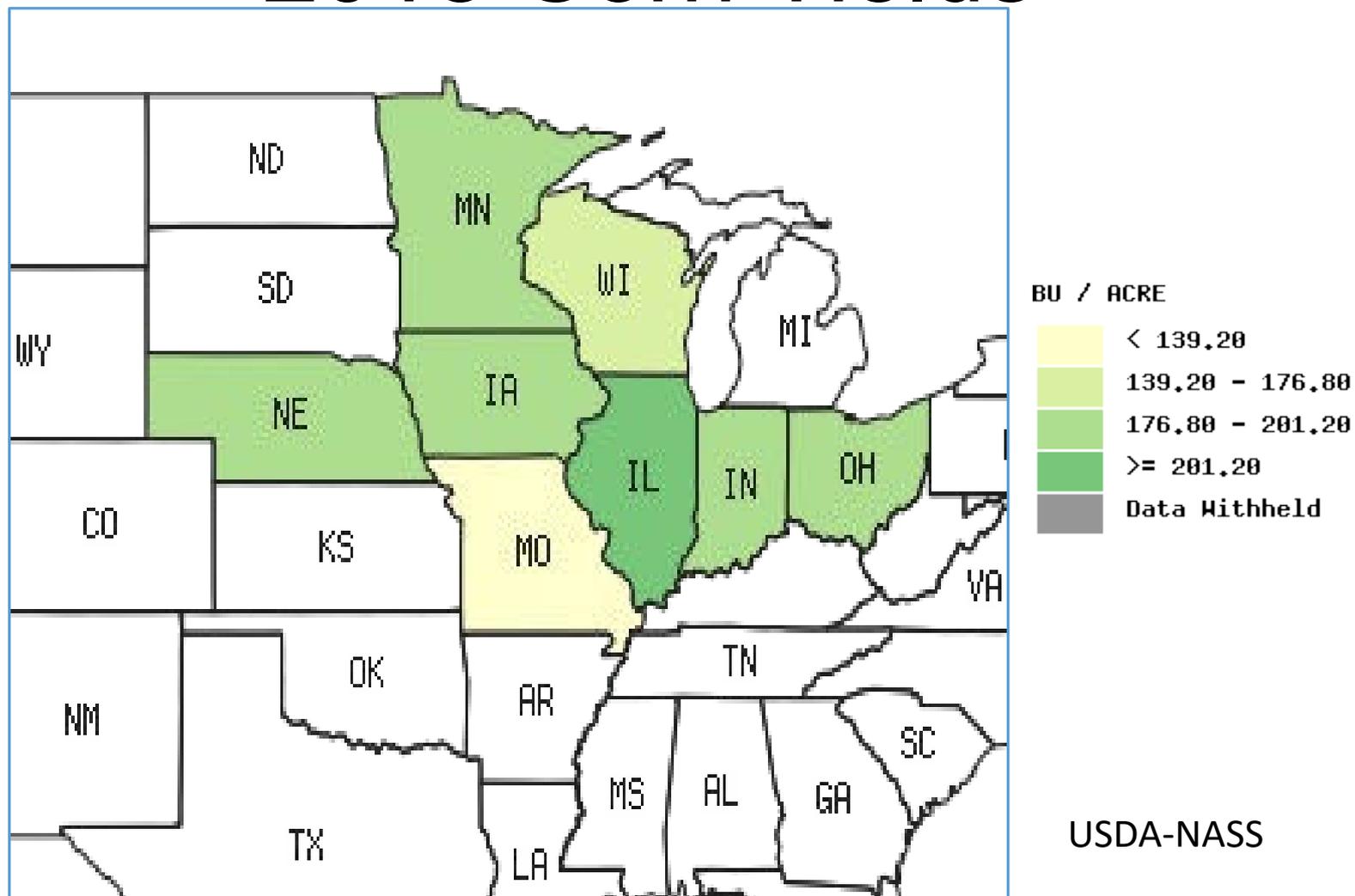


Building Your Soil Health System on Sound Principals.



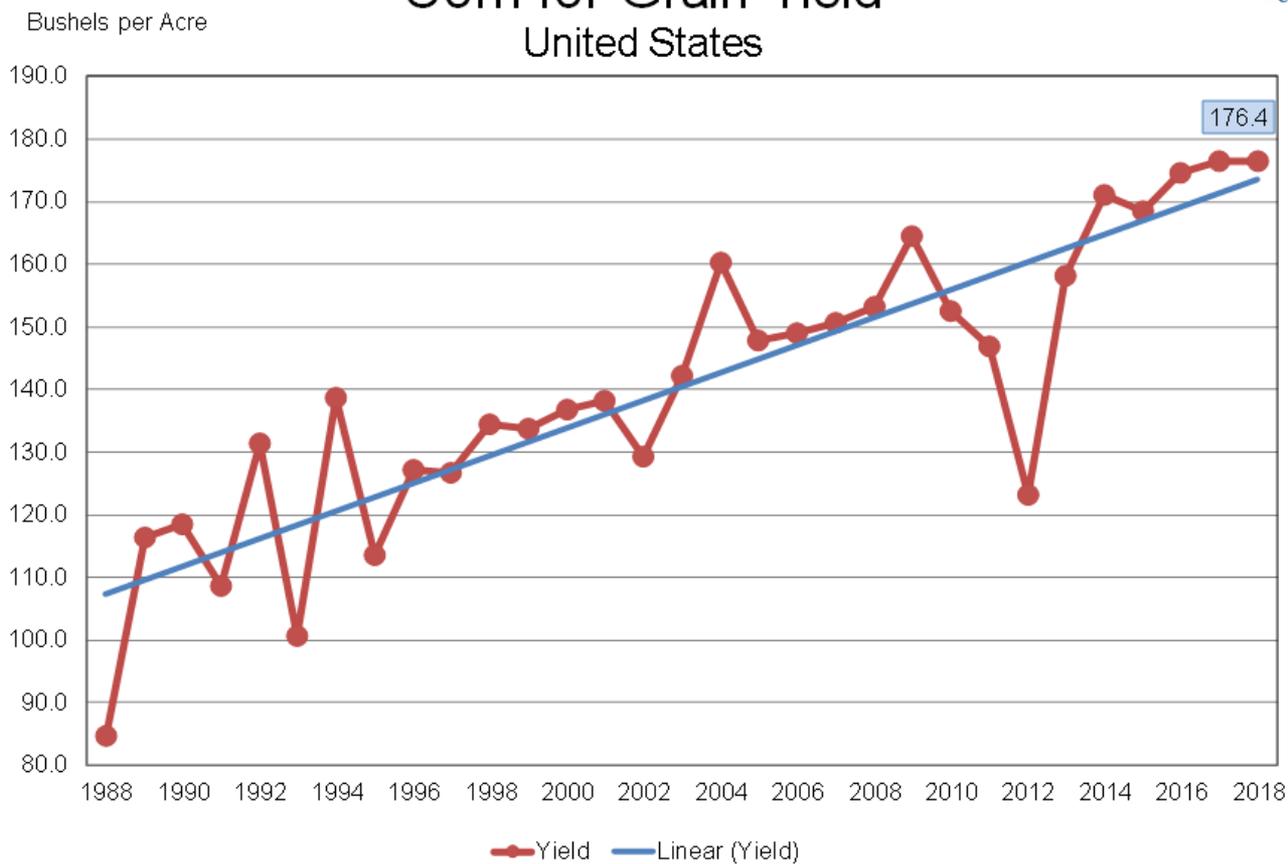
2018 Corn Yields



2018 Corn Yields

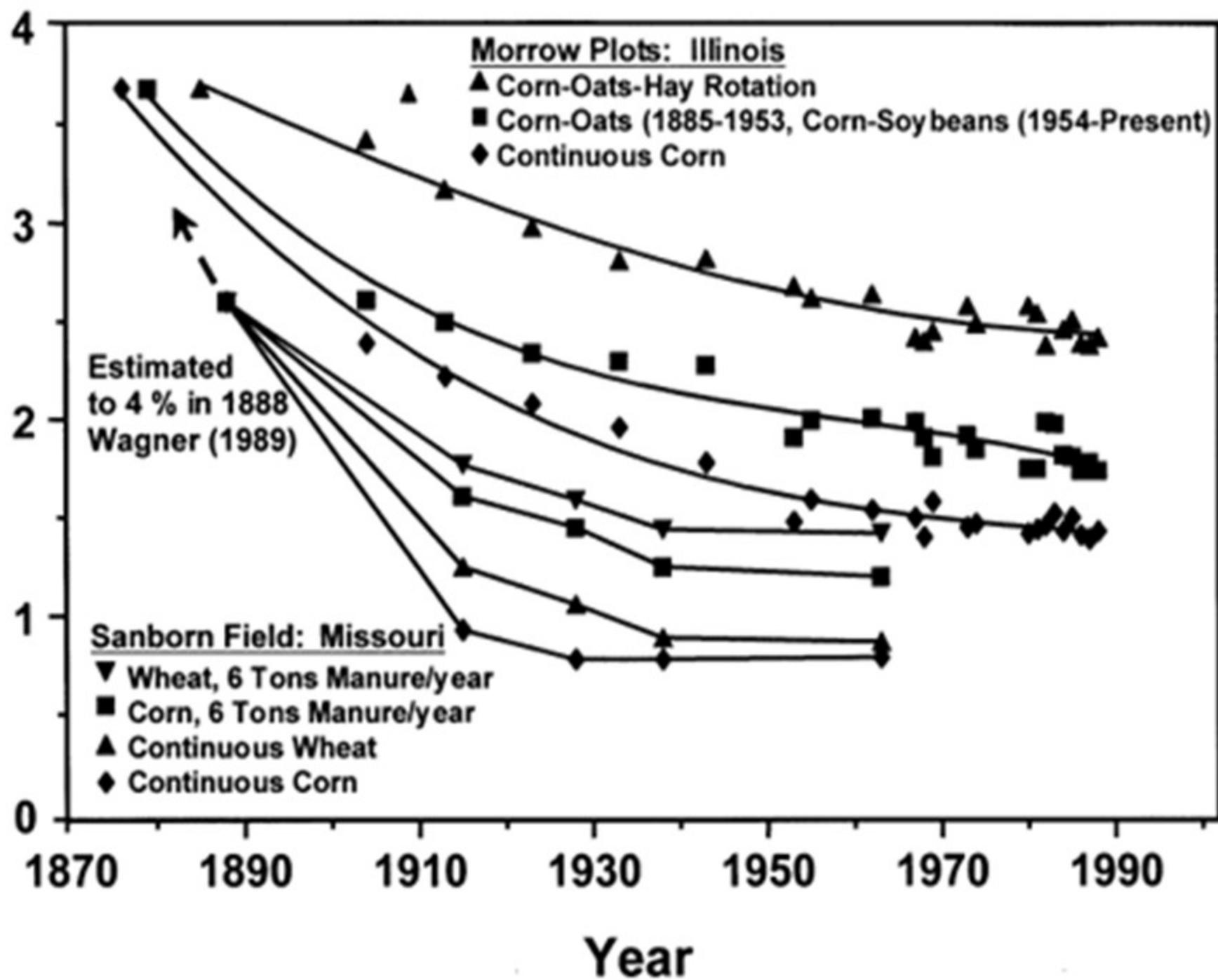


Corn for Grain Yield United States



USDA-NASS
2-8-19

Soil Organic Carbon (%)

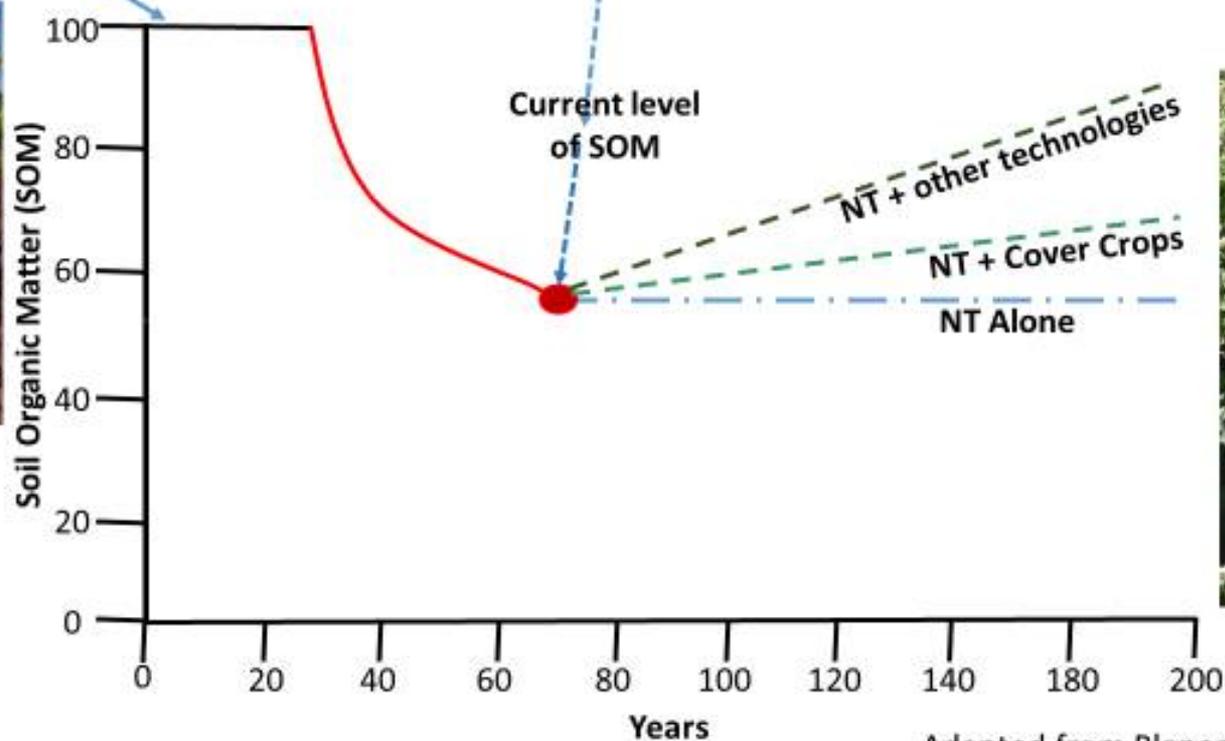




**Have We Lost Soil
Function?**

Can We Regenerate Functions

Tallgrass Prairies are the most productive ecosystems in USA



Adapted from Blanco-Canqui, H. et al. 2015



SOIL HEALTH:

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

SOIL HEALTH:

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

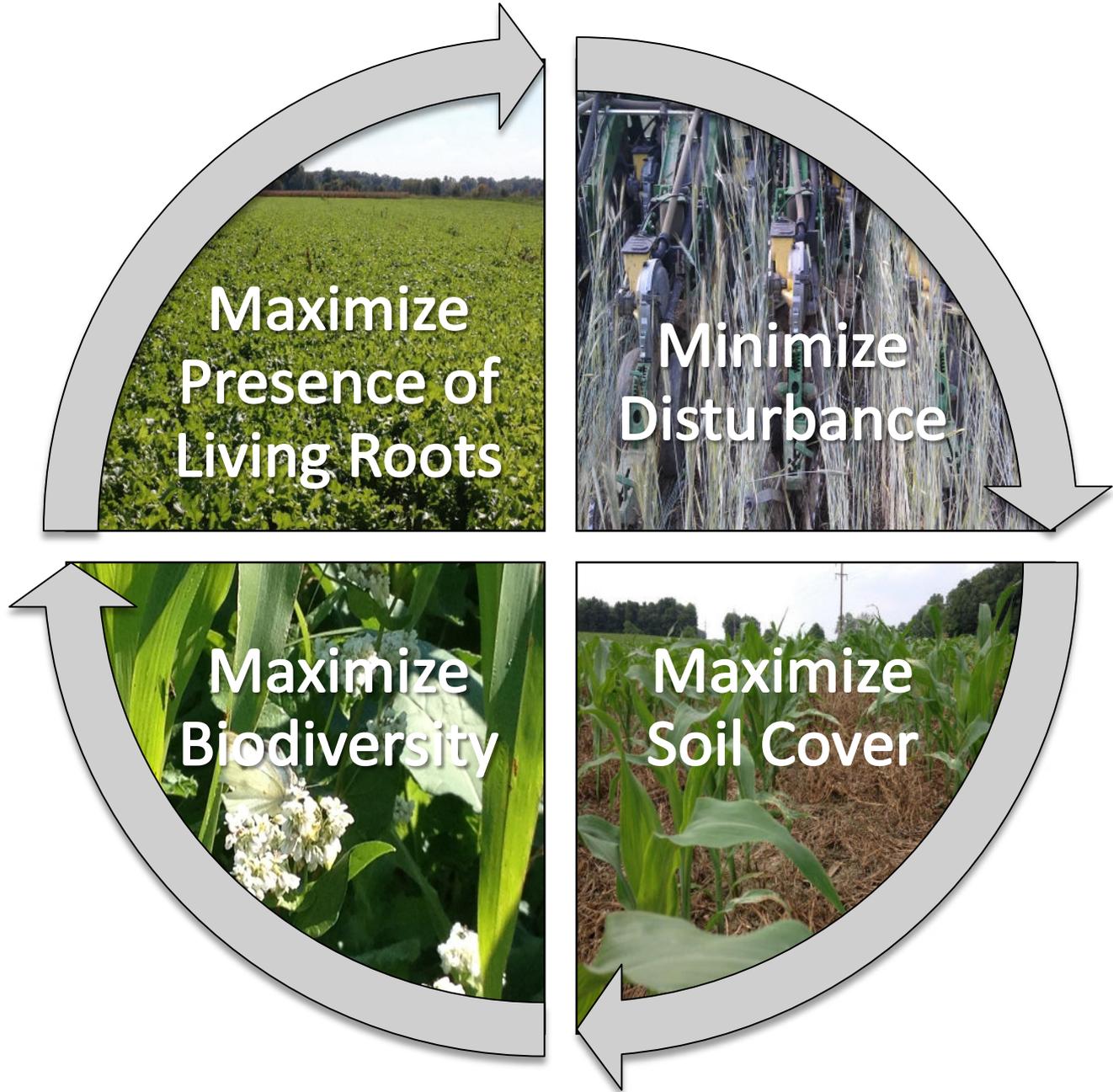
- Nutrient cycling
- Water (infiltration & availability)
- Filtering and Buffering
- Physical Stability and Support
- Habitat for Biodiversity (90% is mediated by soil microbes)

A changing vision of soil...

- The concept of “fixed” soil properties has been shattered by **soil health farmers.**
- They have **CHANGED** the health and function of their soil.

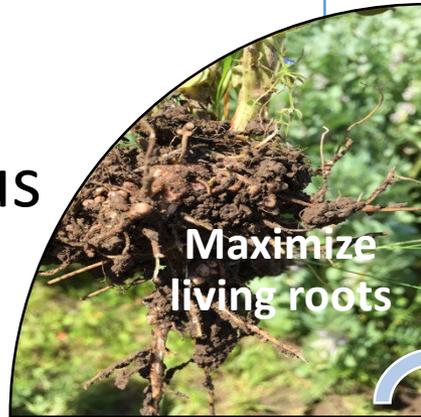


Soil Health Principles



Soil Health Principles To Support High Functioning Soils

- **Feed**
diverse,
continuous
inputs (C
sources,
energy)



- **Protect**
habitat
(aggregates
and organic
matter)



The Fence Row Effect



Principles at work

An aerial photograph of a vast agricultural landscape. The foreground and middle ground are dominated by a large, rectangular field of crops, likely corn, planted in neat, parallel rows. A prominent, winding canal or road cuts through the field, starting from the left and curving towards the right. The background shows a hilly, brownish landscape, possibly a different type of terrain or a different crop. The overall scene is a testament to large-scale agricultural operations.

J. Maloney Brownsburg, IN

Neighbor



Quality No-Till



Ecological Nutrient Management



Integrated Pest Management



Prescribed Cover Crops & Grazing



Diverse Crop Rotation

Principles for Success ... We Must have a Game Plan

Game Plan Principles for:

- Nutrient Management
- Cover Crop Termination
- Pest Management
- Weather- read the defense!



Principle Nutrients Management Strategies for Soil Health Cropping Systems

Game-Plan Principles for:

- **Nutrient Management**



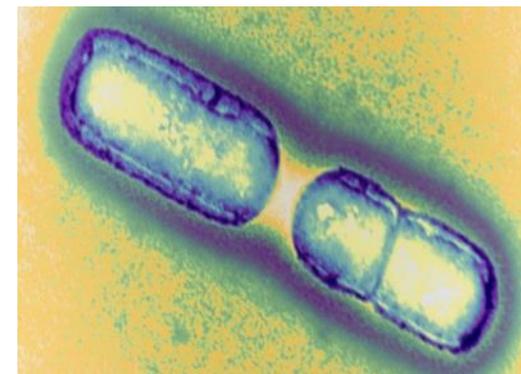
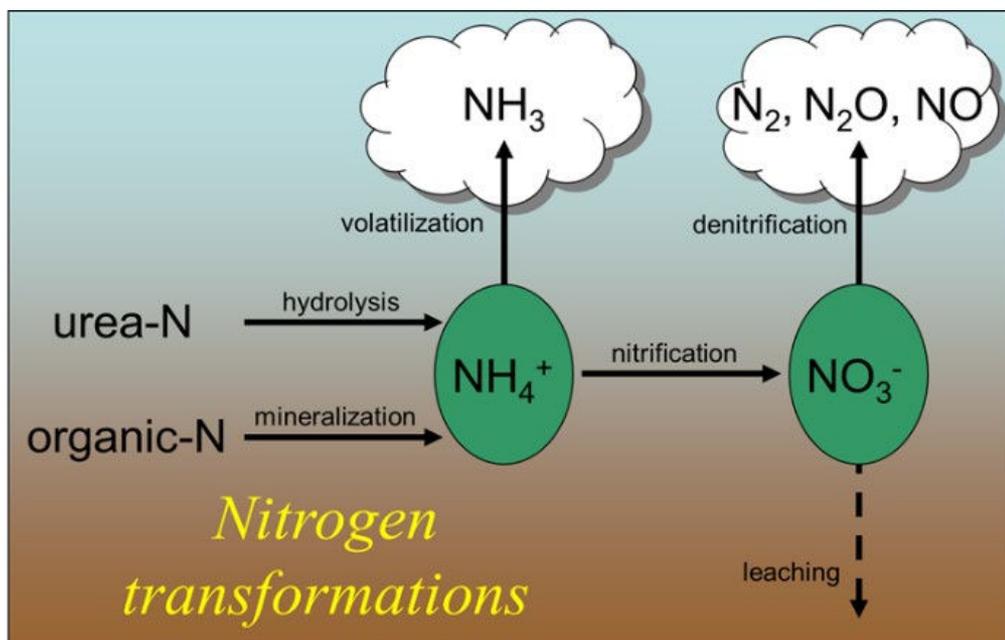
- **Adaptive Management**

Principles for Success ... We Must Adapt the Game Plan



Must include SOM and
Organic Nutrient Contribution

Understanding Nitrogen Mineralization and Immobilization



Biology

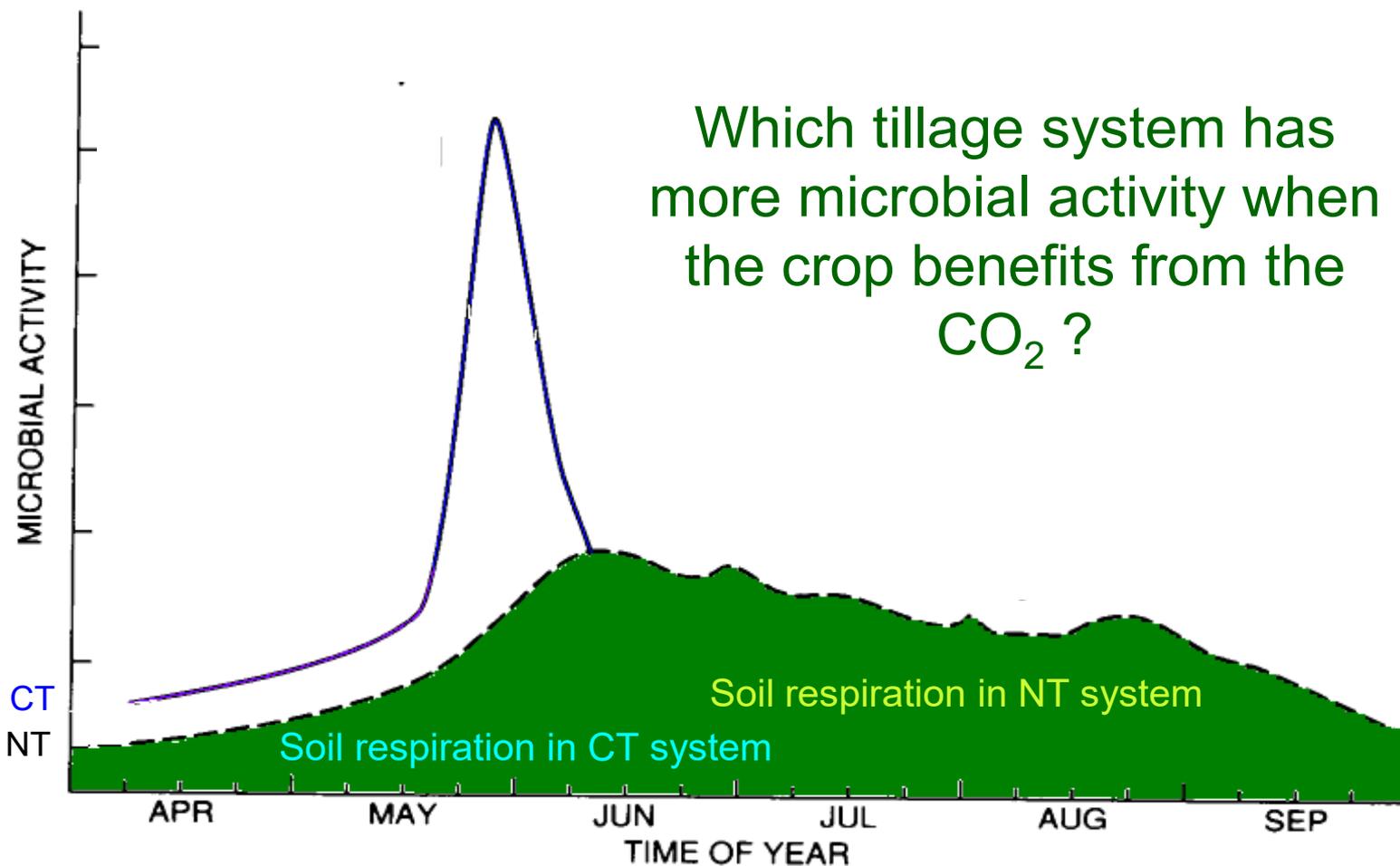


Only 30-55% of Inorganic Fertilizer is Directly Used by Plants

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)

No-Till planters



Precision nutrient placement and rate



Starter Nitrogen + S

Strategically...

CC should complement the following crop

What about Corn?



Strategically...

CC should match desired C:N Ratio

<u>Material</u>	<u>C:N Ratio</u>		
Rye Straw	82:1	} Good for Soybean	N Immobilization 
Wheat Straw	80:1		
Corn Stover	57:1		
Rye Cover Crop (Anthesis)	37:1		
Rye Cover Crop (Vegetative)	26:1		
Mature Legumes	25:1	} Good for Corn	N Mineralization 
Balanced Microbial Diet	24:1		
Daikon Radish	19:1		
Crimson Clover	17:1		
Ryegrass (Vegetative)	15:1		
Hairy Vetch Cover Crop	11:1		
Soil Microbes (Average)	8:1		

Strategically...

CC should complement the following crop

...Which is better?

Corn into:

High Carbon (Cereals
Rye/Wheat)

...or

Low Carbon C:N

Cover Crop (Vegetative),
Winter Kill or Legume
(Clover/Peas)



Strategically...

CC should complement the following crop

Corn into a mix:

Low C:N (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



Principles for Success ... We Must have a Game Plan

Game-Time Decisions for:

- Nutrient Management
- **Cover Crop Termination**
- Pest Management
- **Weather**



Planning the System Using the If >than / Then Approach

Terminate the Cereal Rye at 12" ... Or...



Planning the System Using the If > than / Then Approach

...Or...> than 16"- Then

- Plant green
 1. Spray 1-2 days BEFORE planting or
 2. Spray AFTER planting (same day or within 1-2 days)
 3. Advantages and risks with each option
(see Table 1 in Purdue AY-353-W)





Principles for Success ... We Must have a Game Plan

Game-Time Decisions for:

- Nutrient Management
- Cover Crop Termination
- Pest Management
- Weather- read the defense!



Pest Management Game Plan-

- Integrated (and Adaptive) Pest Management Systems
 - Utilizes holistic management
 - Limit pest opportunities
 - Integrates predator/ prey relationships
 - Employs beneficial biology and cultural practices
 - Are seldom based on preventative chemistry
 - Utilize technology and chemical treatments when necessary



THE XERCES SOCIETY GUIDE
**Farming with
Native
BENEFICIAL
INSECTS**

PREDATORY INSECTS
Firefly Beetles, Fireflies, Lightning Bugs
 ORDER: Coleoptera
 FAMILY: Lampyridae



0.2 TO 0.8 INCH
(5 TO 20 MM) LONG



ADULT FIREFLIES have soft, leathery wing covers. They superficially resemble soldier beetles, but most can be distinguished by the light-producing segments near the end of the abdomen. Female fireflies have shorter wings and fewer luminous segments than males, and many species are wingless. The predatory larvae have strong, sicklelike jaws, and are referred to by some as "glowworms" because they are also luminescent.

COMMON PREY: Snails, slugs, caterpillars, and other soft-bodied insects in soil and moist or

ADDITIONAL HABITAT: Larvae reside in damp areas where prey is found, and under bark. Fireflies pupate in soil, under rocks, or in leaf litter.

CONSERVATION STRATEGIES: Tall grass in field edges or nearby habitat can shelter adults and should be protected or supplemented. Reduce tillage to protect egg-laying sites as well as larval habitat and overwintering sites. Flowers with an open structure and exposed nectaries, such as those in the sunflower family, may attract pollen- and nectar-seeking adults.



Provide habitat for beneficial insects with hedgerows and buffer strips





...Let it bee



Principles for Success ... We Must have a Game Plan

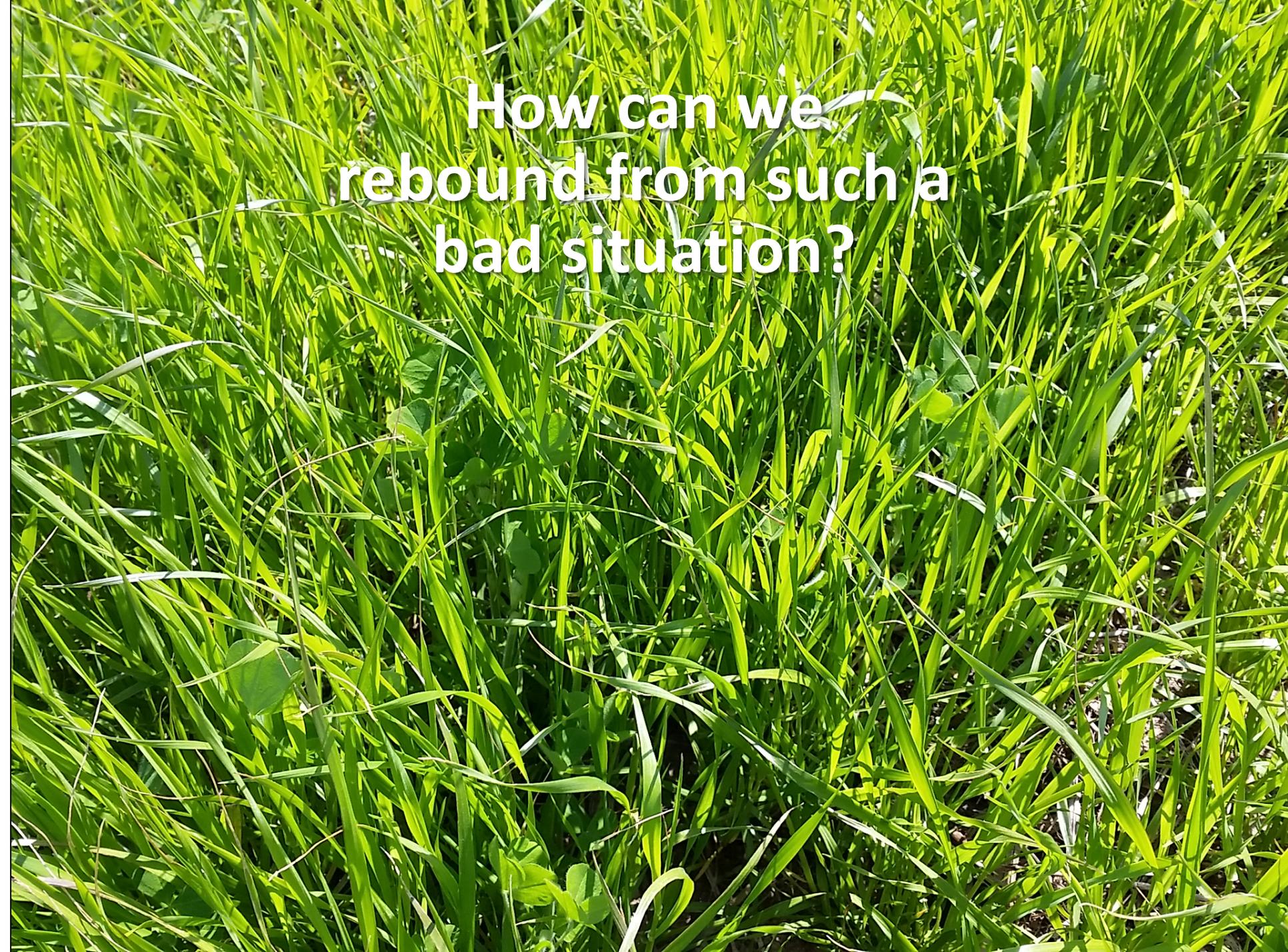
Game-Time Decisions for:

- Nutrient Management
- Cover Crop Termination
- **Pest Management**
- **Weather- read the defense!**



Sometimes it just rains...



A close-up, high-angle photograph of a dense field of bright green grass. The blades are long and narrow, with some showing signs of being cut or broken. The lighting is bright, creating a vibrant green color. Overlaid on the center of the image is white text.

**How can we
rebound from such a
bad situation?**





Do you have a Plan for variable situation?

Feb. 25



Early Establishment is Usually Better! ...Plan for it.



How can we gain
resilience to
harsh weather?



When in
doubt...
Plant!

Soil Health Principles



A man in a blue shirt and khaki pants is working in a cornfield. He is standing in the middle of a row of young corn plants, using a tool to check the soil. The field is vast and green, with a clear blue sky in the background.

I feel great!

A close-up photograph of a corn plant's root system. The roots are white and fibrous, extending into dark, rich soil. A hand is visible on the right side, holding the plant. The background shows more green corn leaves.

Thanks for the nice soil!

Crop Talk!

- Listen to what the crop is telling you...

**The Golden Principle-
Lack of cover is
seldom a good thing!**



Things don't always go
the way you plan....



Plan anyway

Plans Following Sound Principles Lead to Good Soil Health Decisions

USDA is an equal opportunity provider, employer, and lender."

