

Tackling the **Invisible** Benefits of Continuous No-Till

**Randall Reeder, Alan Sundermeier,
and Rafiq Islam**

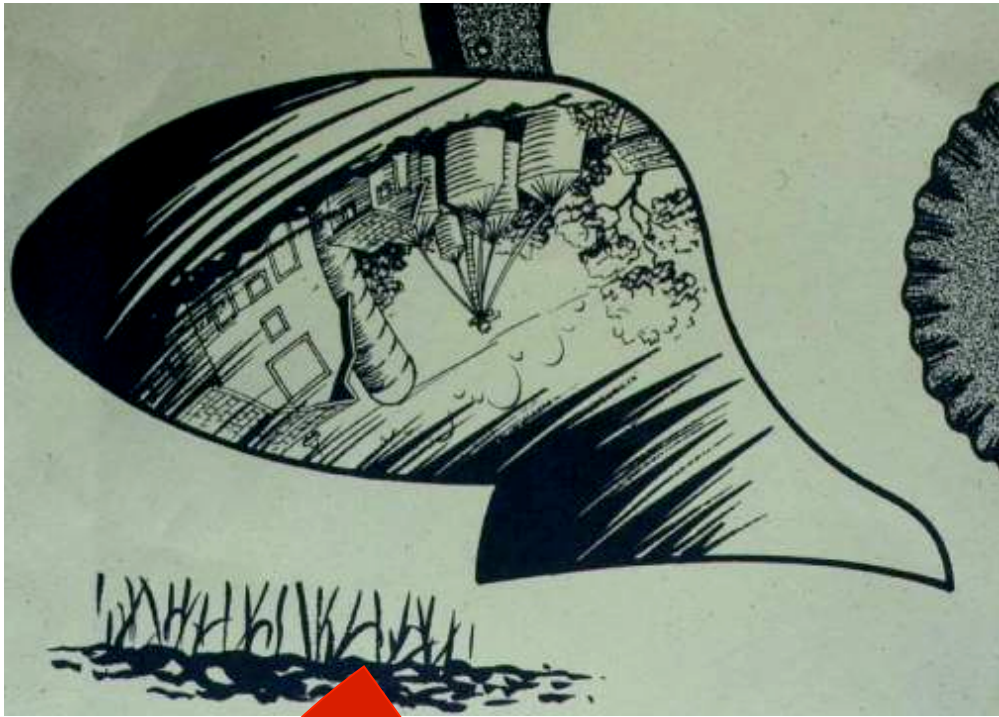


Ohio State University Extension



33 Invisible Benefits of No-Till



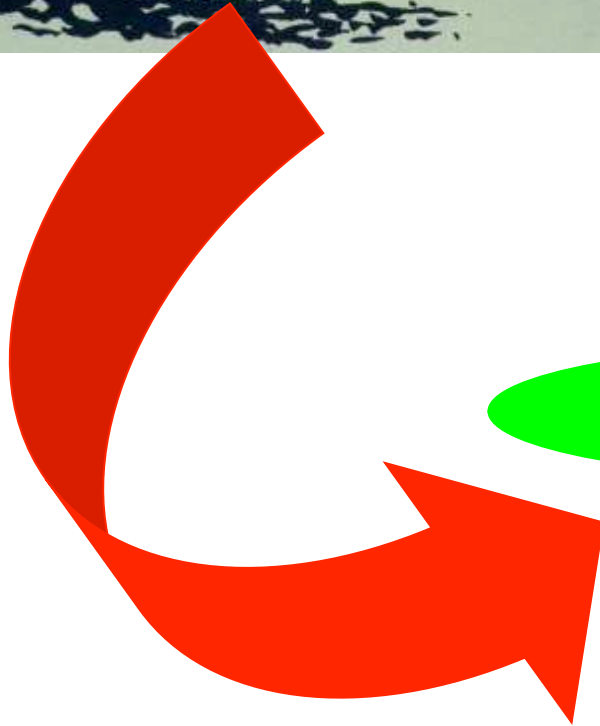


Soil quality

Chemical quality

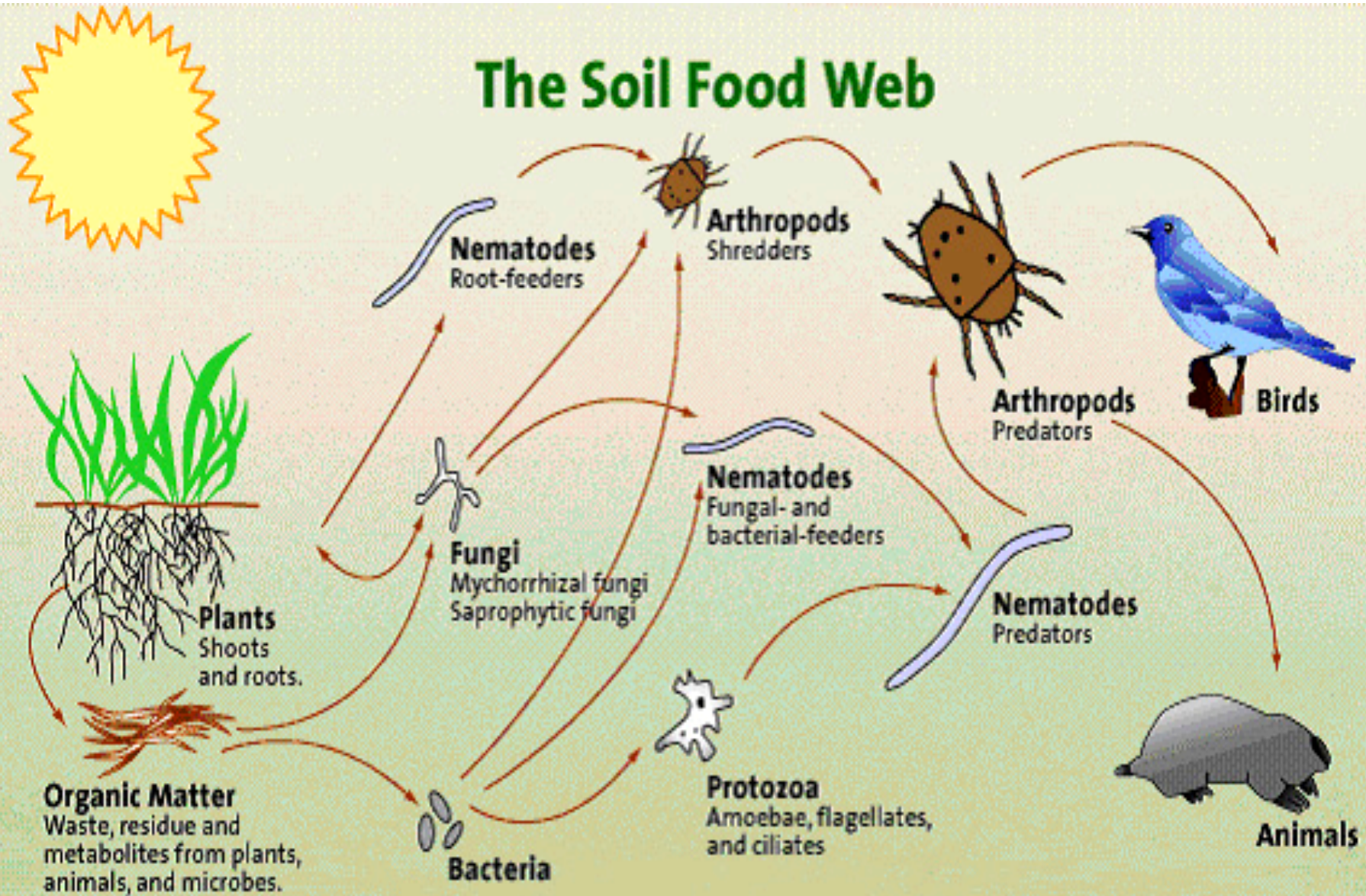
Physical quality

Biological quality
(Physical quality)





The Soil Food Web



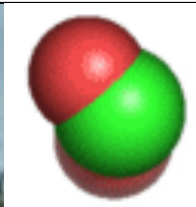
First trophic level:
Photosynthesizers

Second trophic level:
Decomposing Mutualists
Pathogens, Parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth & higher trophic level:
Higher level predators



Carbon dioxide



Subsoil tillage

Moldboard plow

Chisel plow



Burning of Soil Organic Matter



Plowed soil without
any cover crops



Blocks



Compacted soil



Soil clod



As if we are squeezing the soil for more and more...



Plow

**Continuous
No-Till**



Roots and beneficial fungus association - **mycorrhizae**



Fungus

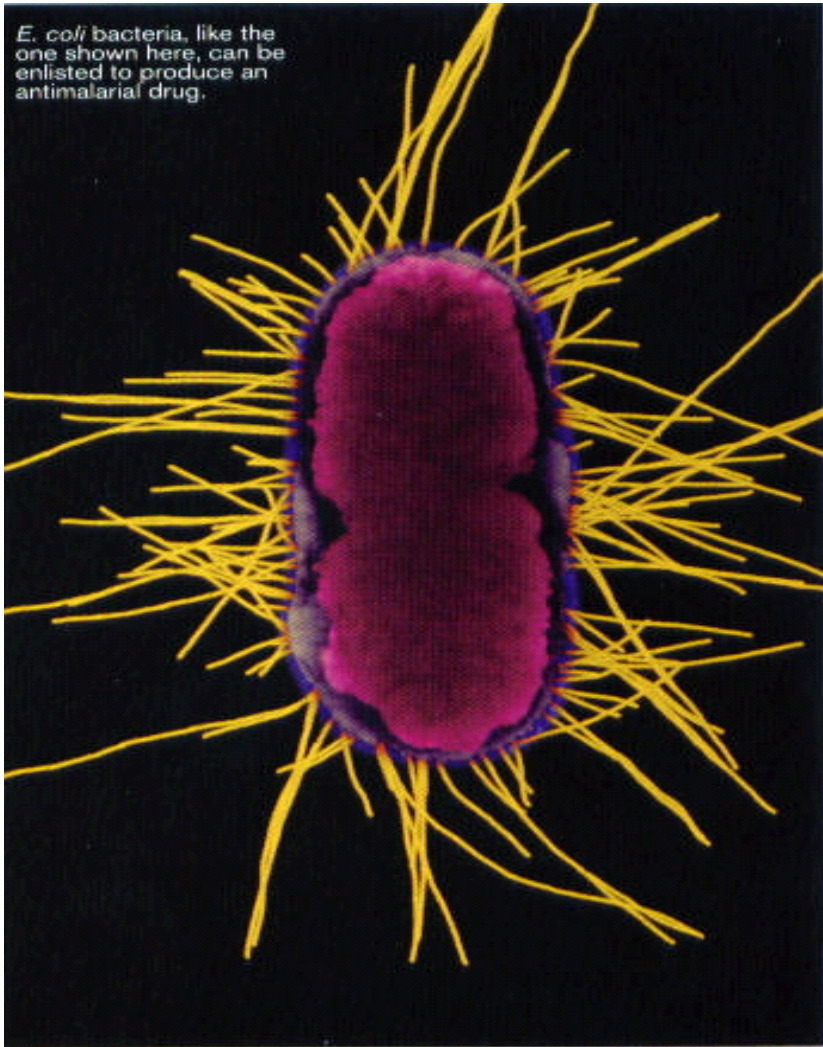


Carbon and nutrient accumulation in fungal hyphae



Vesicles Nutrient Storage

E. coli bacteria, like the one shown here, can be enlisted to produce an antimalarial drug.



No-till dominated by fungal food web (35 - 55% C-use efficiency)



Plowed soil dominated by bacterial food-web (15-35% C-use efficiency)

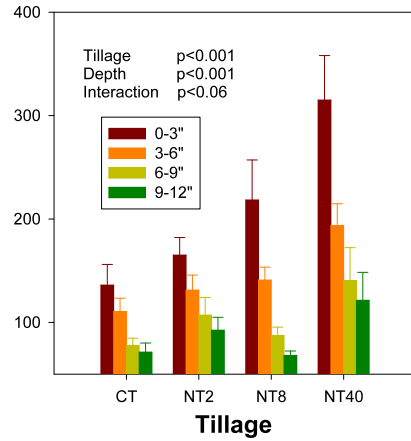


NORTHWEST AGRICULTURAL RESEARCH STATION

**OHIO AGRICULTURAL RESEARCH
and DEVELOPMENT CENTER**

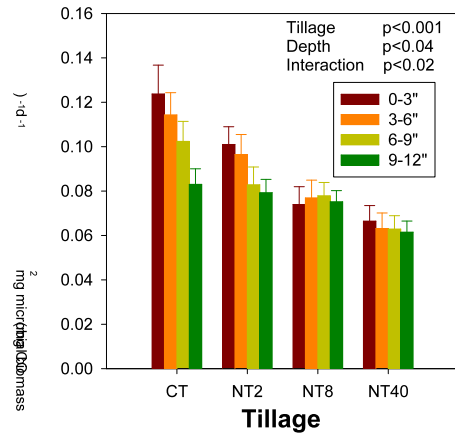
4240 RANGE LINE ROAD, CUSTAR

Long-term No-Till increases Microbial biomass



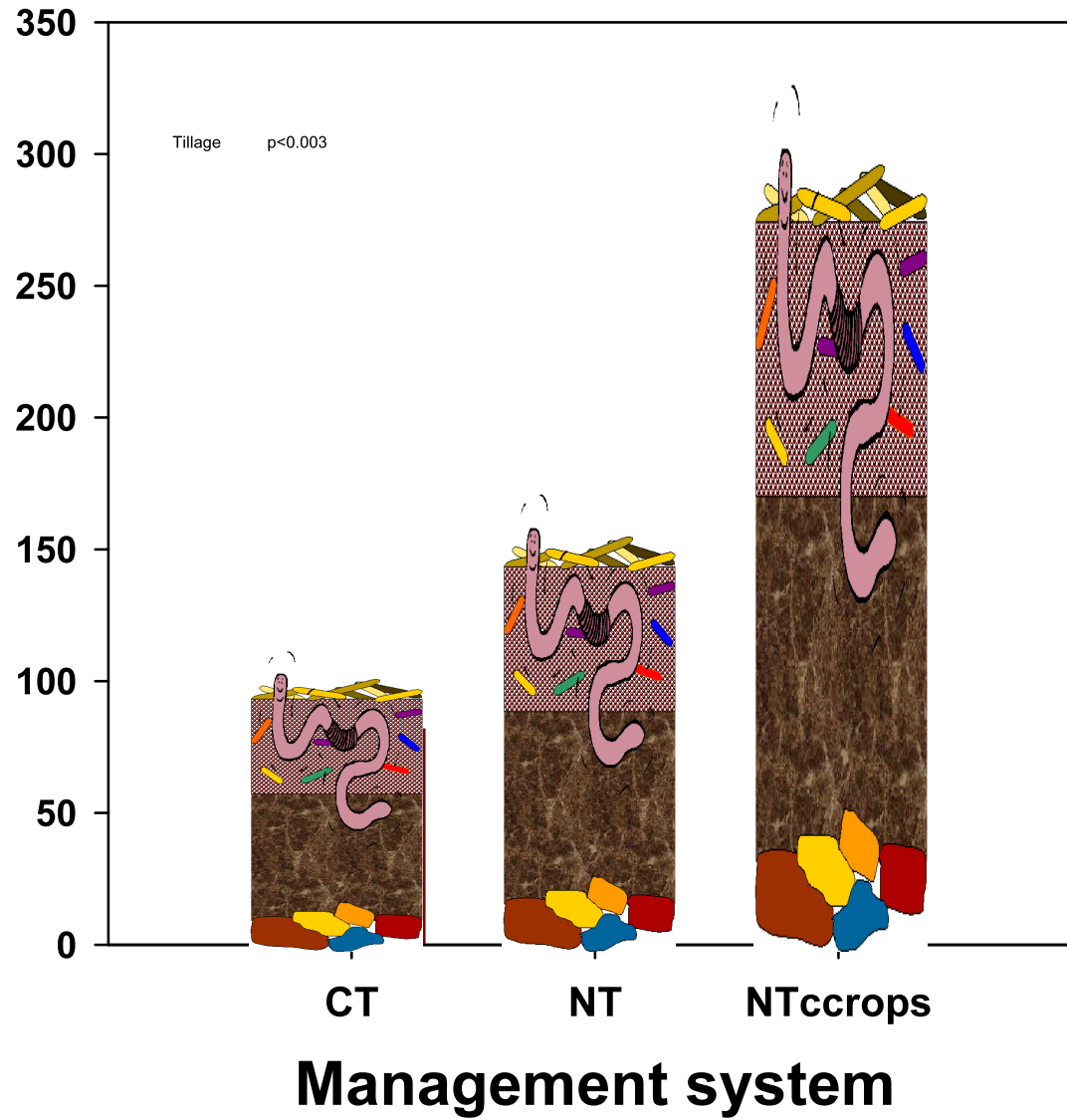
NT23

Long-term No-Till gives less Carbon loss



NT23

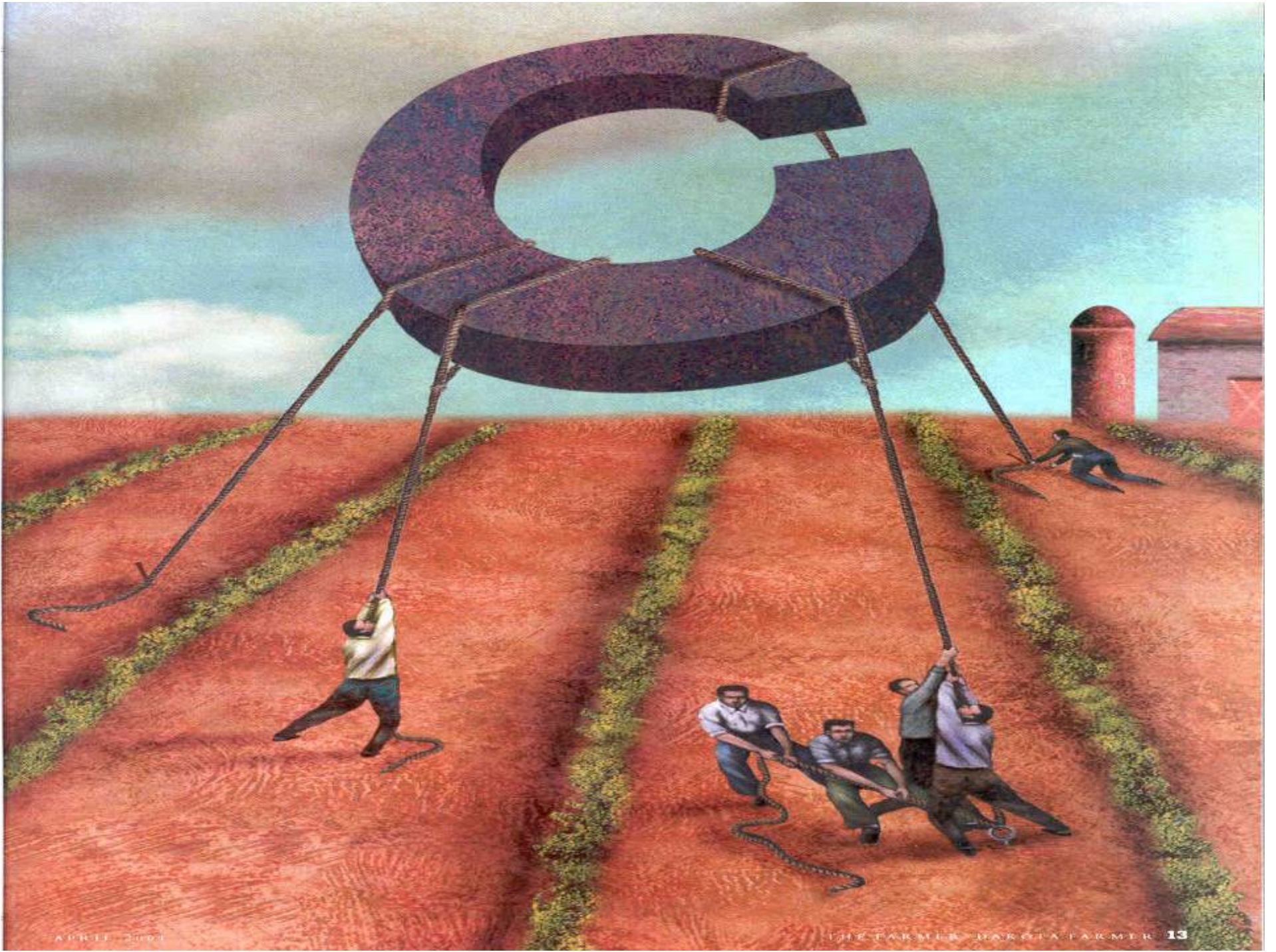
Long-term no-till increases Earthworms



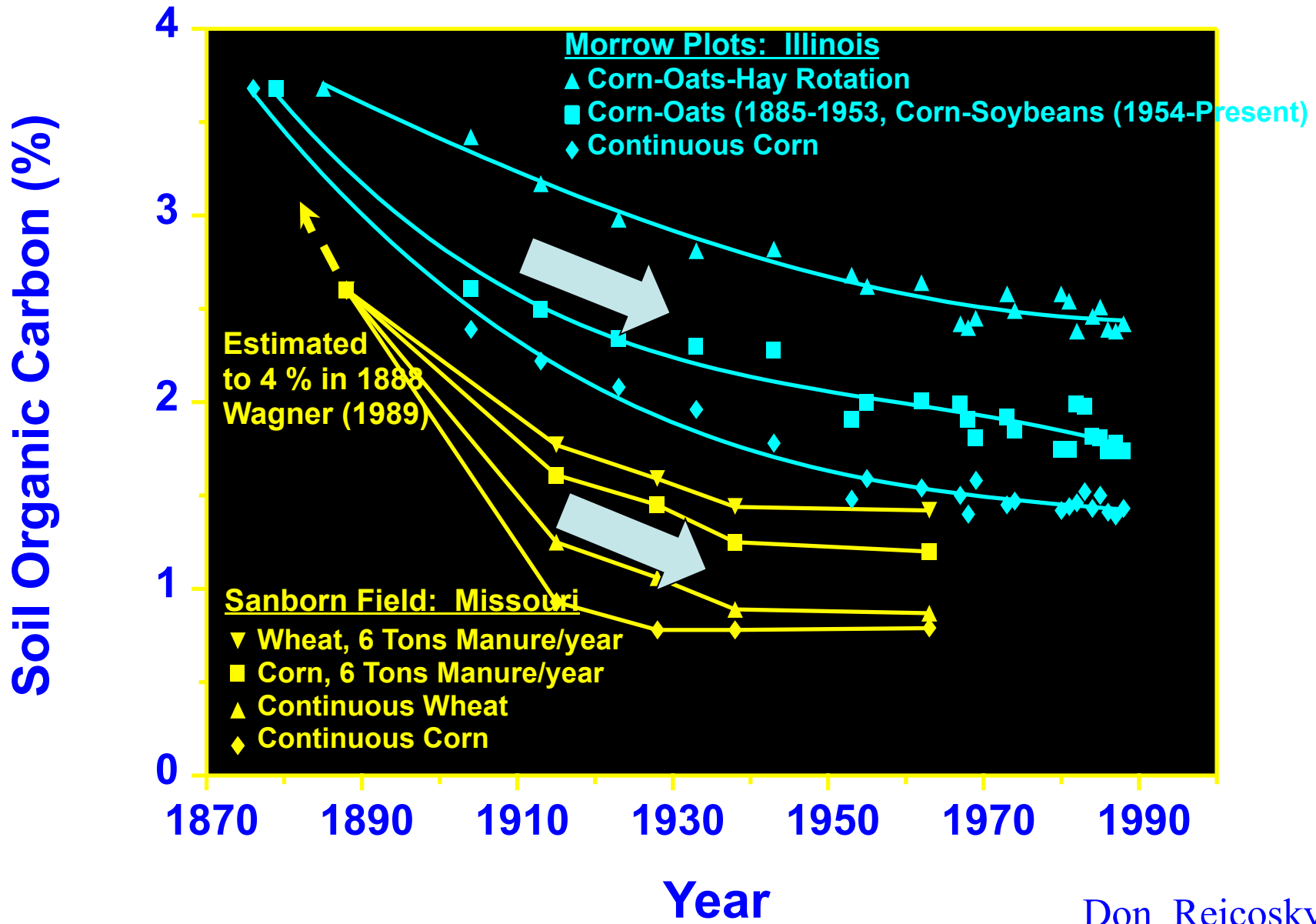


Nature's (Vertical) Tillage Machine



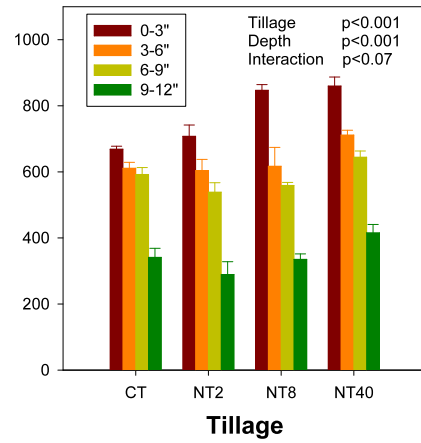


Tillage over time reduces soil carbon



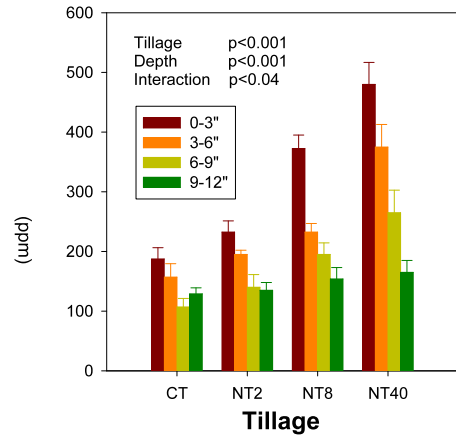
Long Term Effects of Various Crop Rotations

Long-term No-Till increases Active Carbon



NT23

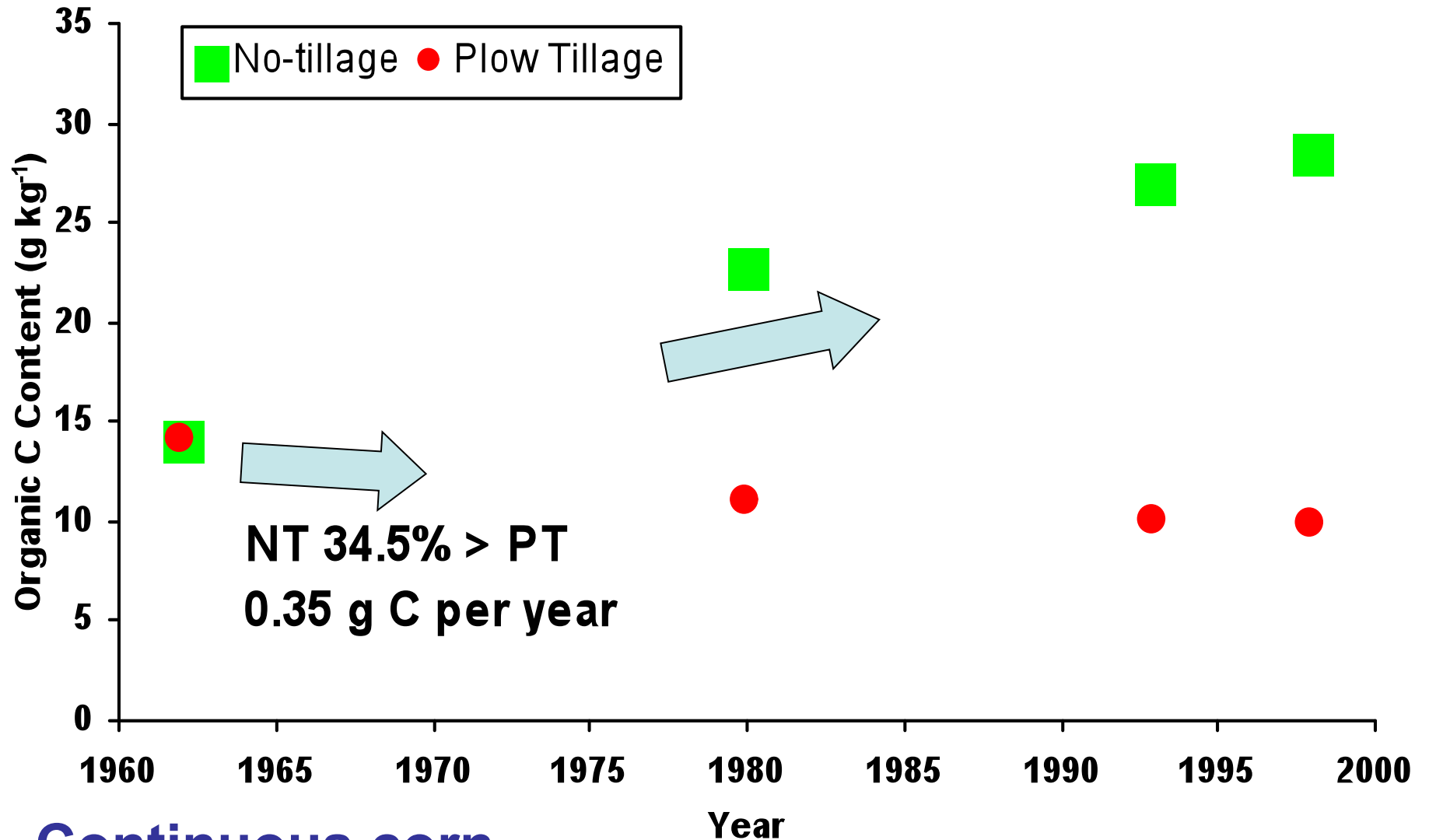
Long-term NT increases Carbon within aggregates



NT23

Wooster, Ohio: Carbon (0-2 inches)

Wooster 1962-1998



Continuous corn

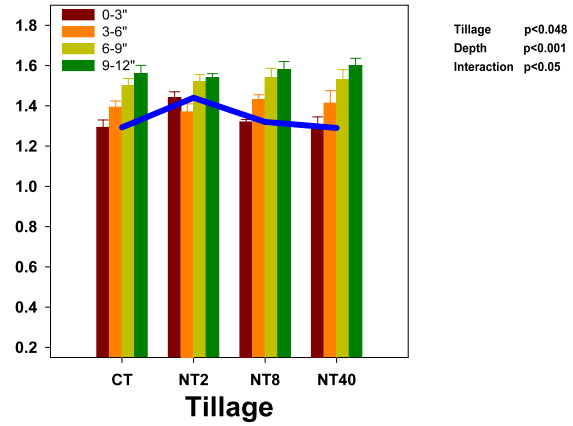




Growing radish in controlled traffic lane to reduce compaction

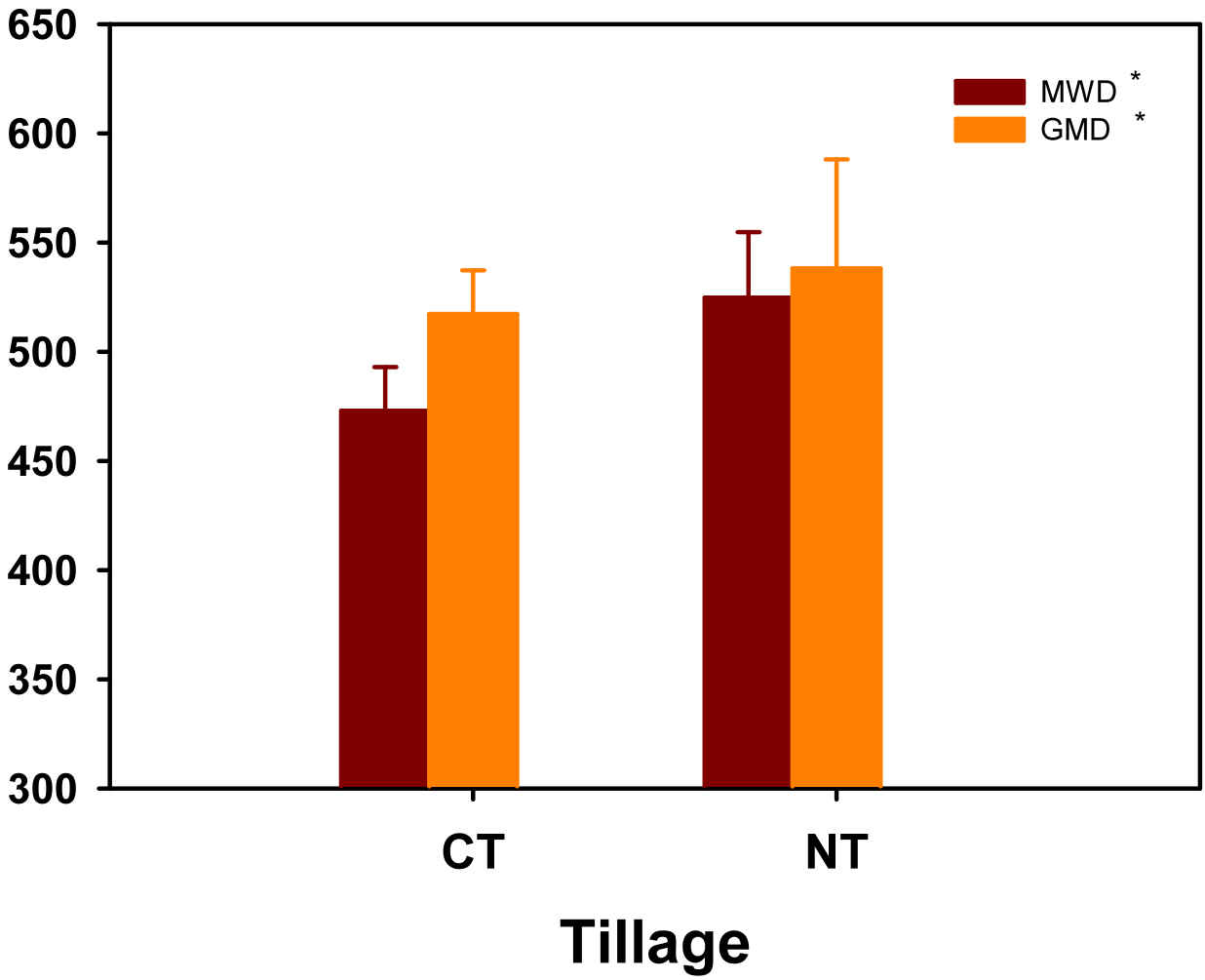


Long-term NT effects on soil bulk density

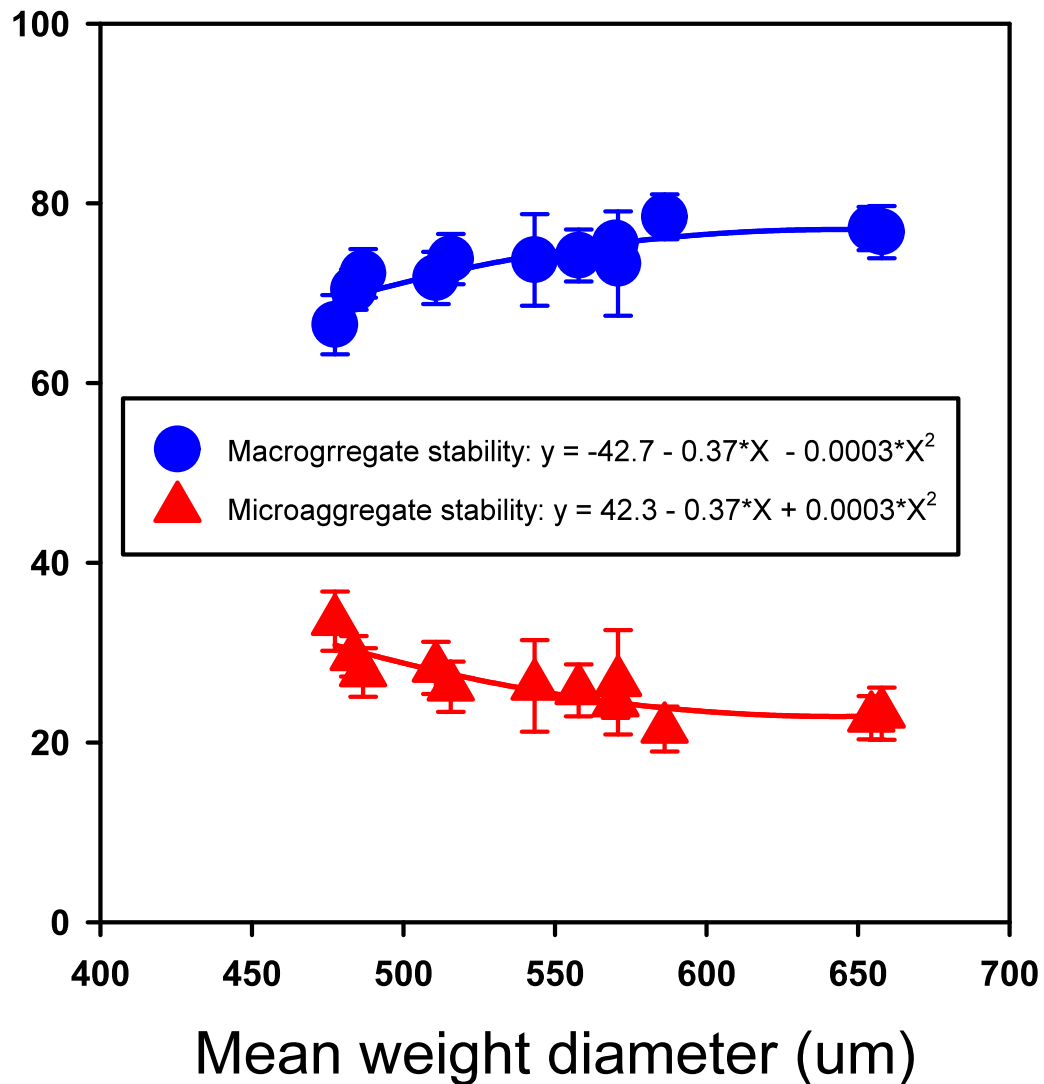


NT23

With NT, more large aggregates, fewer small ones



Macro-aggregate stability increased and
Micro-aggregate stability decreased.





If we add cover crops, then

2010 NW Ag Research Station,
Wood County, OH

Red Clover: No-Till

Treatment	Corn Yield
No-Till	130 A
No-Till & Clover	139 B

LSD_{p=0.10}

5.8

07.21.2010

2009 NW Ag Research Stn, Wood Co., OH
Red Clover, N Rate, No-till

Cover Crops Trts.	Side-dress N rate (lbs/a)	Corn Yield (bu/a)
No clover	0	40 D
Clover	0	48 D
No clover	80	93 C
Clover	80	103 B
No clover	160	129 A
Clover	160	135 A

LSD_{P=0.10}

6.3 07.21.2010

2008 NW Ag Research Stn, Wood Co., OH

Red Clover, N Rate, No-till

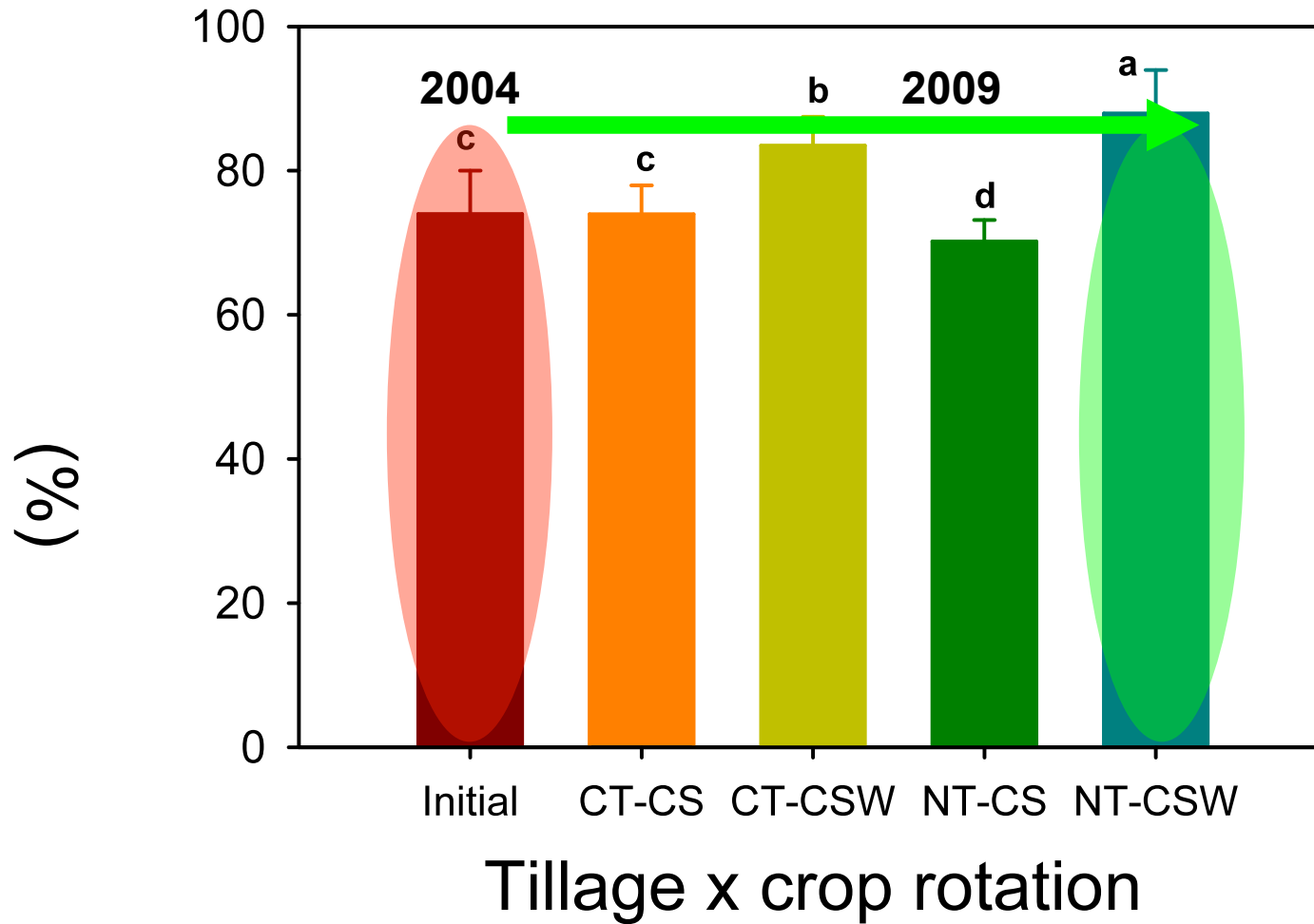
Cover Crops Trts.	Side-dress N rate (lbs/a)	Corn Yield (bu/a)
No clover	0	29 E
Clover	0	30 E
No clover	80	84 D
Clover	80	95 C
No clover	160	115 B
Clover	160	125 A

LSD_{p=0.10}

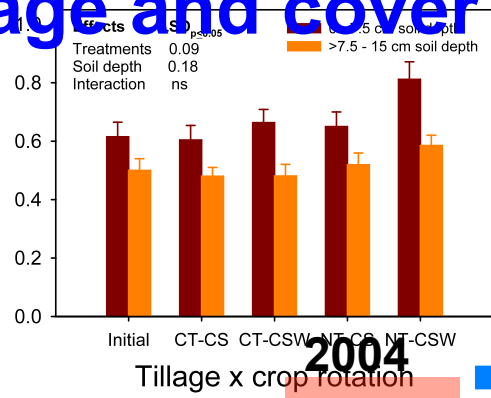
9.4

07.21.2010

Tillage and cover crops impact on crop yield

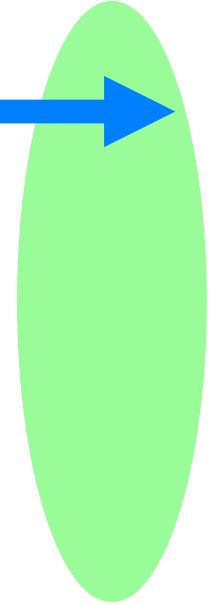


Tillage and cover crops improve soil quality



2004

2009



Conclusions:

- **No-Till** exerts significant positive impact on soil quality, carbon sequestration, and crop yields.
- Soil active carbon is a good leading indicator of total carbon increases (organic matter).

- **Improvements** in crop yields lag behind improvements in No-Till soil quality.
- **When switching to No-Till**, adopt crop rotation with cover crops to maintain yields.



No-Till and cover crops
enhance soil ecosystem services

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