



Natural Resources Conservation Service
United States Department of Agriculture



Residue Regulations

Louisiana Agricultural Technology & Management Conference

What is Residue Management ?





Managing the amount, orientation, and distribution of crop and other plant residues on the soil surface during a specified period of the Year.

0%



Louisiana Standard and Specifications for the four Residue Management Practices

All four practice state there must be a minimum of **30%** ground cover from crop residue spread evenly across the soil surface

0%

30 percent ground cover from crop residue, cover crop, volunteer vegetation helps control 70% of the sheet and rill erosion that occurs on the field.





Highly Erodible Cropland fields the crop residue and volunteer vegetation shall be maintained on the soil surface until 3 weeks before the succeeding crop in rotation is planted

Soil Quality: Defining, Measuring, and Managing



"RULES IN THE REAL WORLD"

Farmer rules of thumb "wisdom"

- ✓ *Water Runs Downhill*
- ✓ *Everything is Related to everything else*
- ✓ *There is no Free Lunch*
- ✓ *Nature always Bats Last*

Consequences of ignoring rules:

"Today's Solutions often become tomorrow's Problems"

(Tom Frantzen, Farmer)

Soil is the Foundation

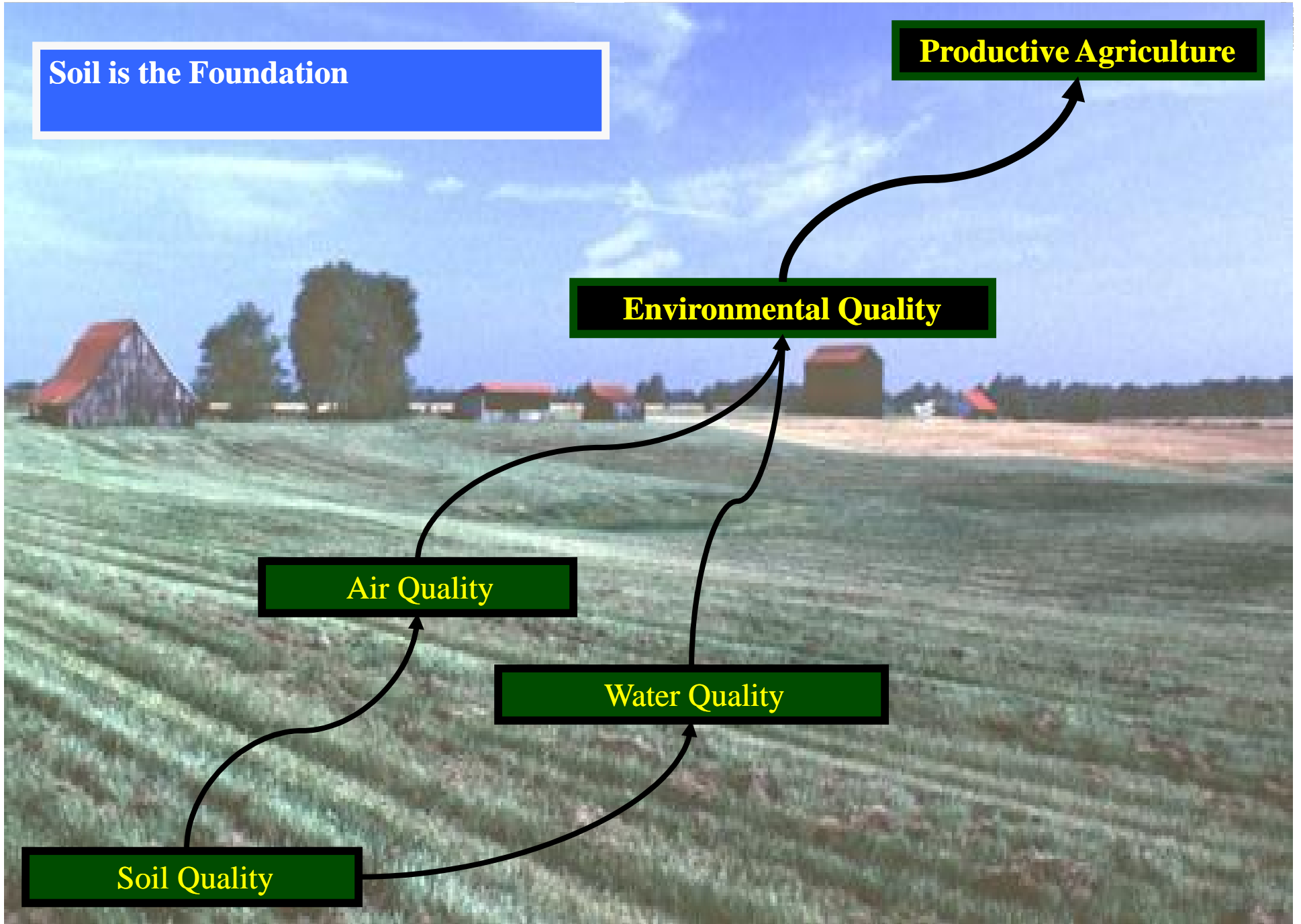
Productive Agriculture

Environmental Quality

Air Quality

Water Quality

Soil Quality





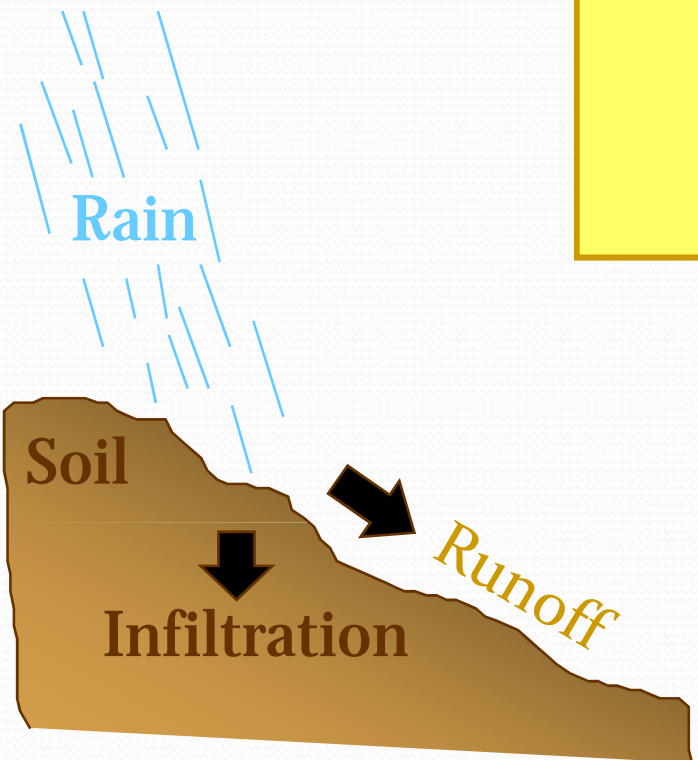
Soil quality is...

“the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation.”

(Karlen et al., 1997)

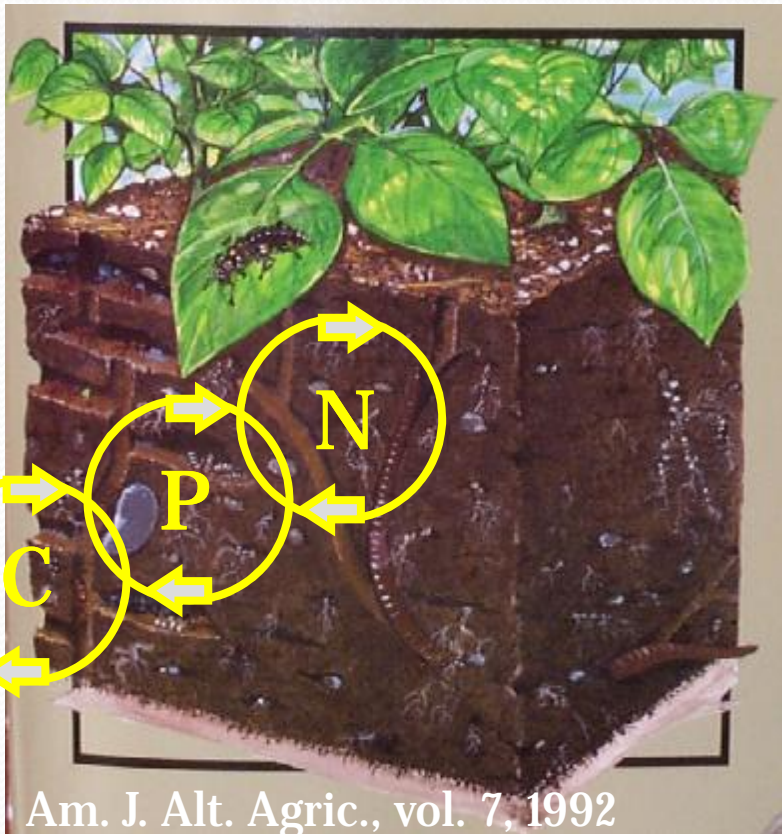
Soil Quality...

It's about function...
and management



Redistributing water

Growing plants



Am. J. Alt. Agric., vol. 7, 1992



Functions of Soil

- Sustaining biological activity and productivity
- Regulating and partitioning water
- Filtering and buffering
- Storing and cycling nutrients
- Structural support

(Karlen et al., 1997)

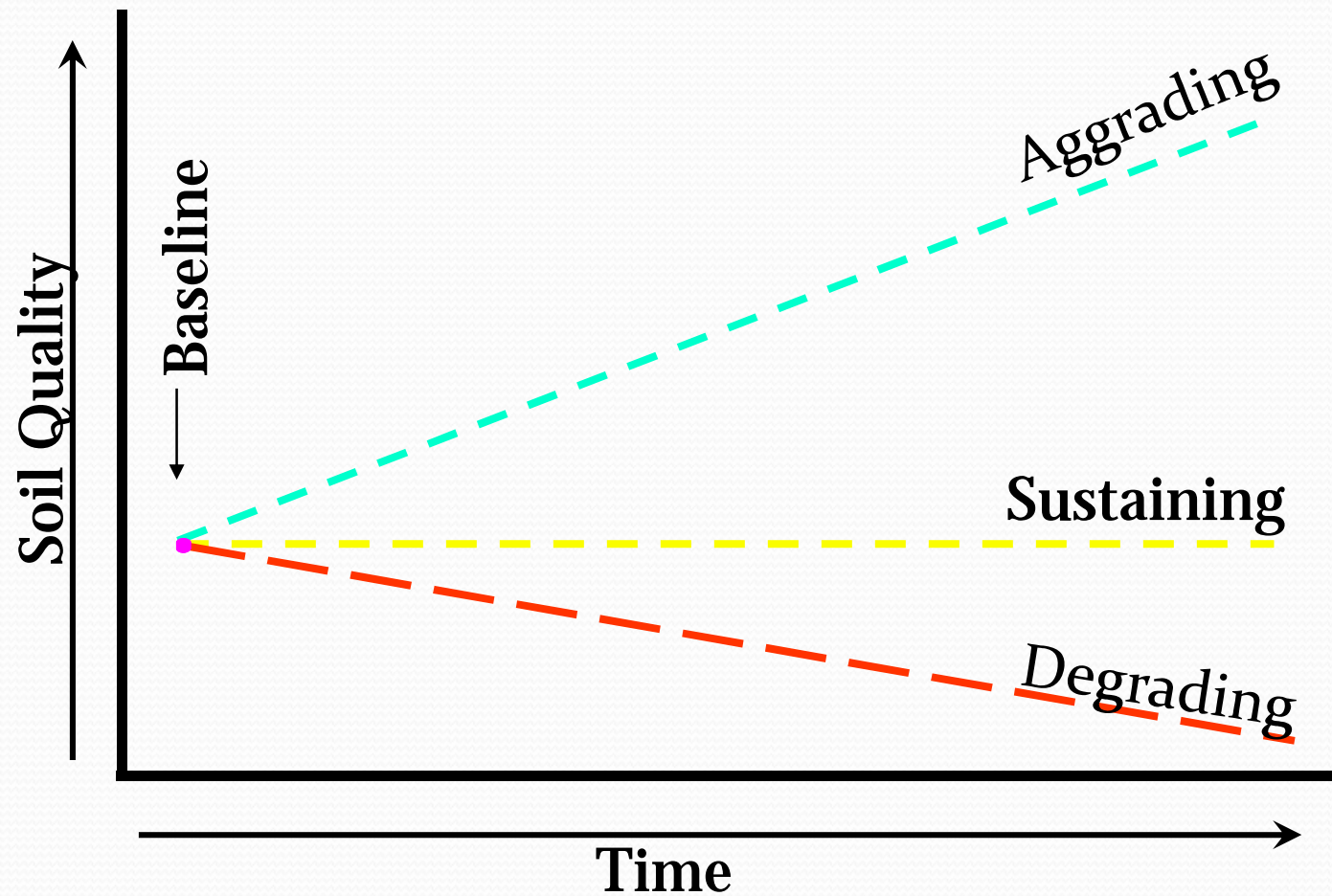
Soil Functions

- Sustaining biological activity and productivity
- Regulating and partitioning of water flow
- Filtering and buffering
- Storing and cycling nutrients
- Structural support

Indicators

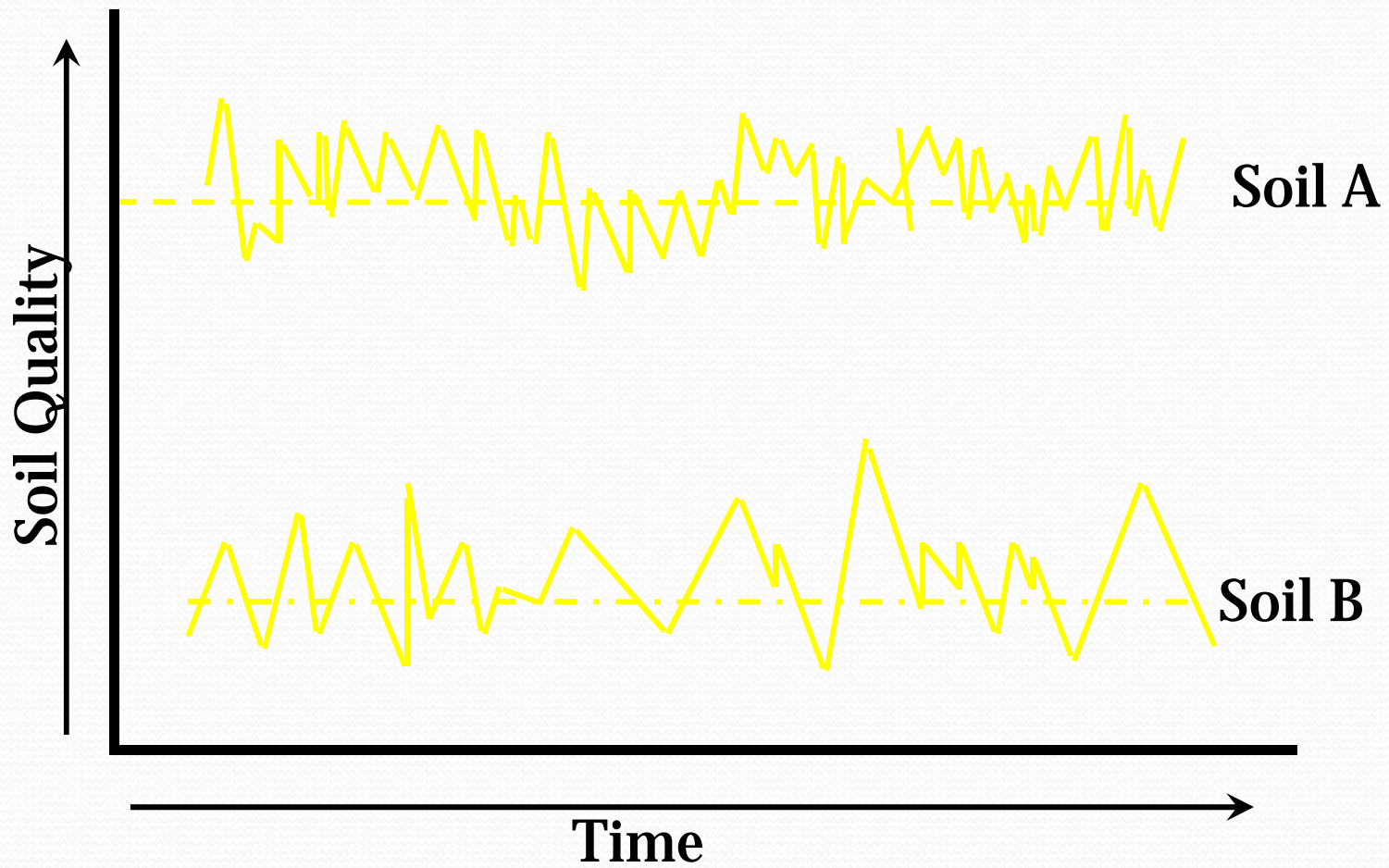
- Texture
- Depth of soil
- Infiltration & bulk density
- Water holding capacity
- Aggregate stability
- Soil organic matter
- pH
- Extractable N,P, & K
- Microbial biomass C & N
- Potentially mineralizable N
- Soil respiration

Monitoring of Trends



(Seybold et al., 1998)

No Change Trends (Sustaining)



(Seybold et al., 1998)

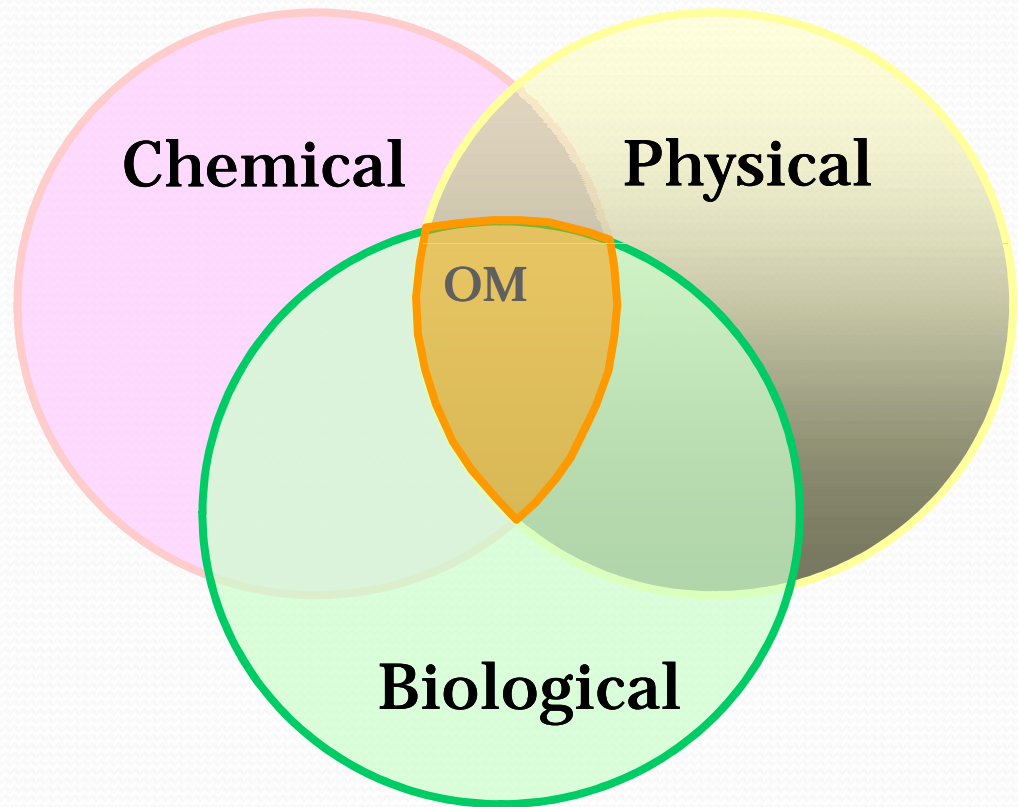
Soil Properties

– Physical

Chemical

Biological

Organic Matter



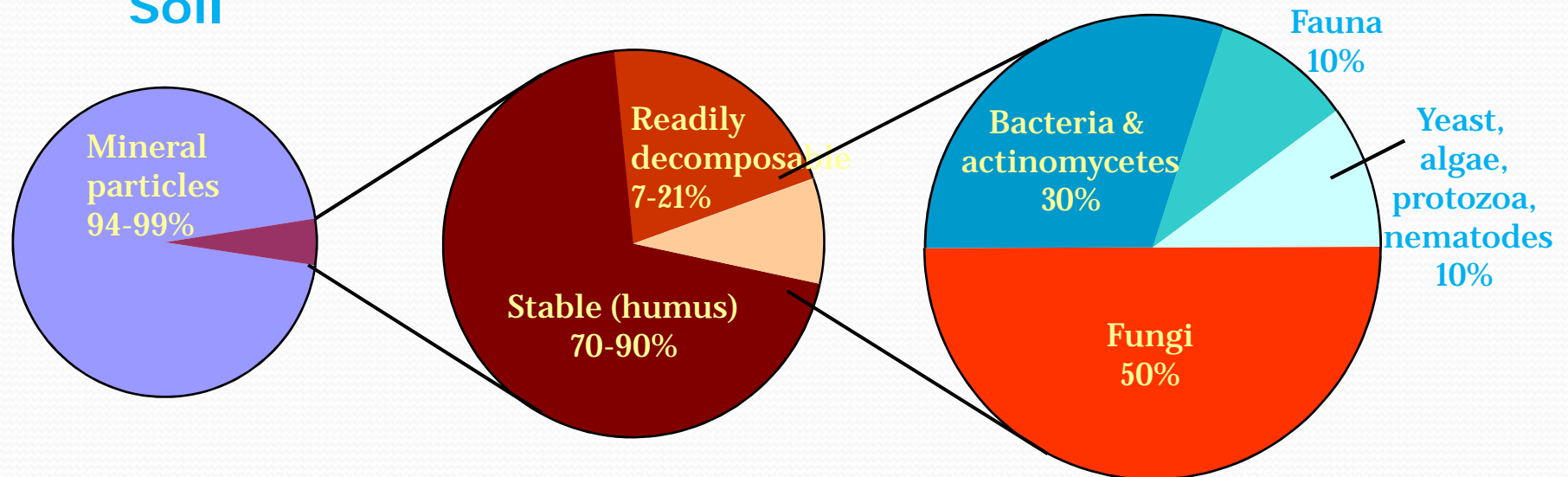
Soil Composition & Organisms

Soil microbial biomass

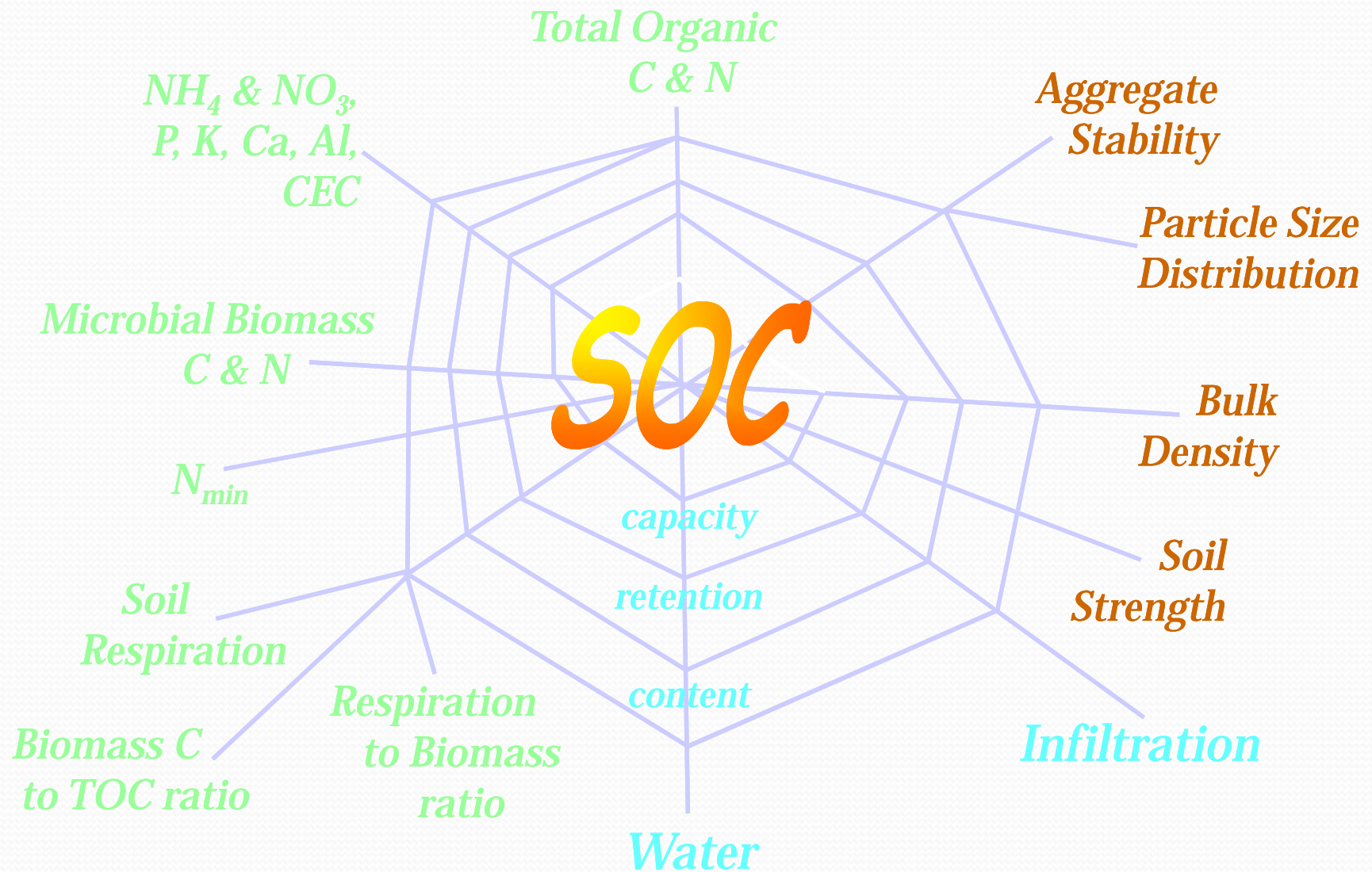
3-9% of total SOM mass

Soil organic matter
1-6% of total soil mass

Soil



Soil C is at the base of Soil Quality



from Doran et al., 1993



SOM or SOC

SOC = 58% SOM

$1.72 \times \text{SOC} = \text{SOM}$



Stages of Soil Organic Matter

Dr. Fred Magdoff



The
living



The Dead

The
Very
Dead

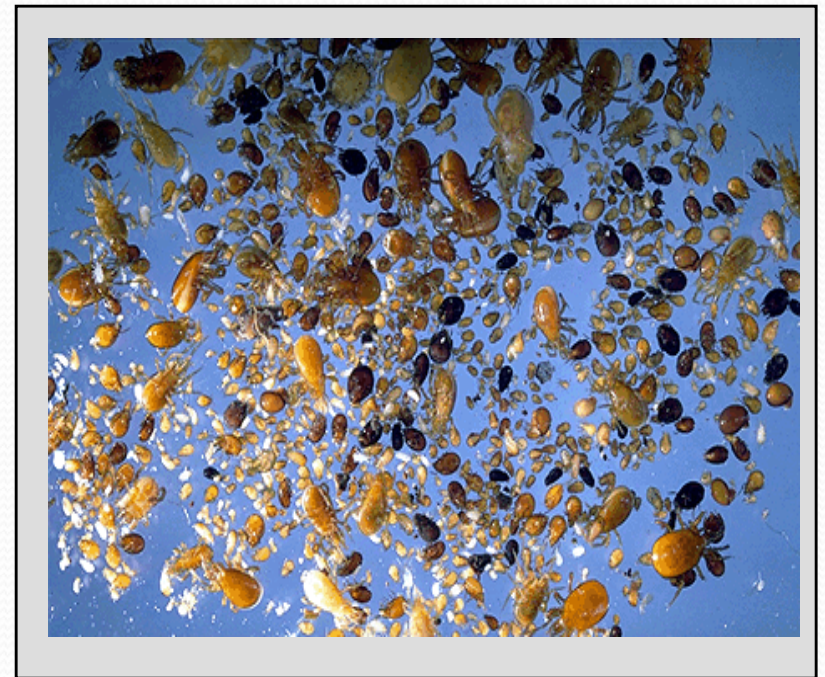


Soil Organic Matter



Roots and mycorrhizae

The Living



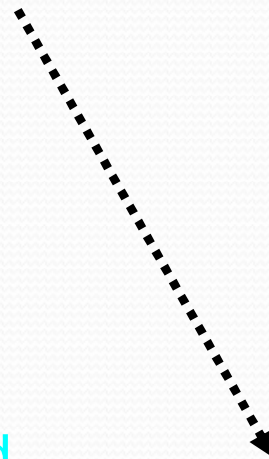
Soil mites, other insects, bacteria, nematodes, protozoa, & earthworms

Soil Organic Matter

The Dead



Crop residue, dead roots, & dead animals, etc. recently added to the soil



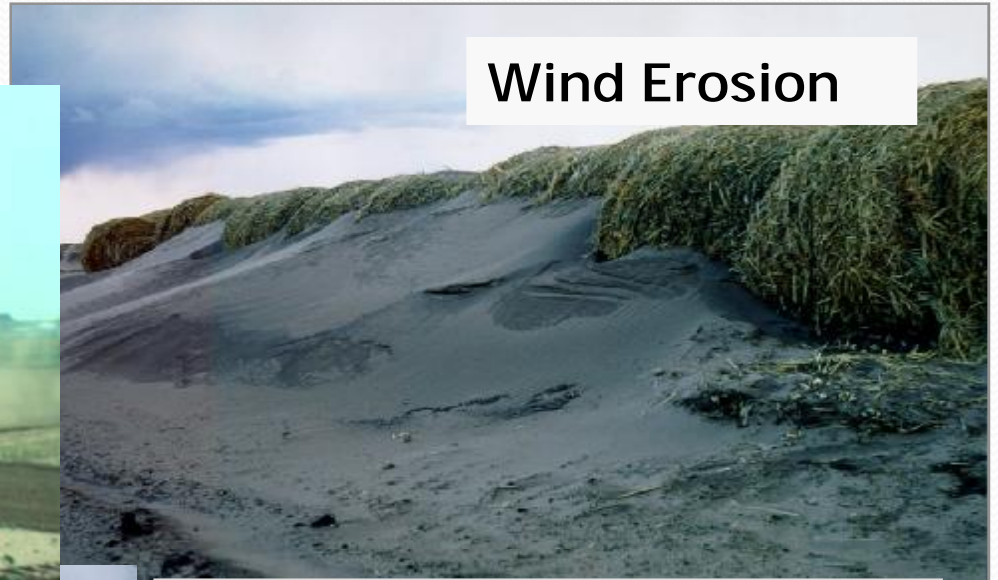
The Very Dead

Humus - stabilized OM, humic and fulvic acids - not readily decomposed

Agricultural Practices can cause Loss of Carbon:



Tillage



Wind Erosion

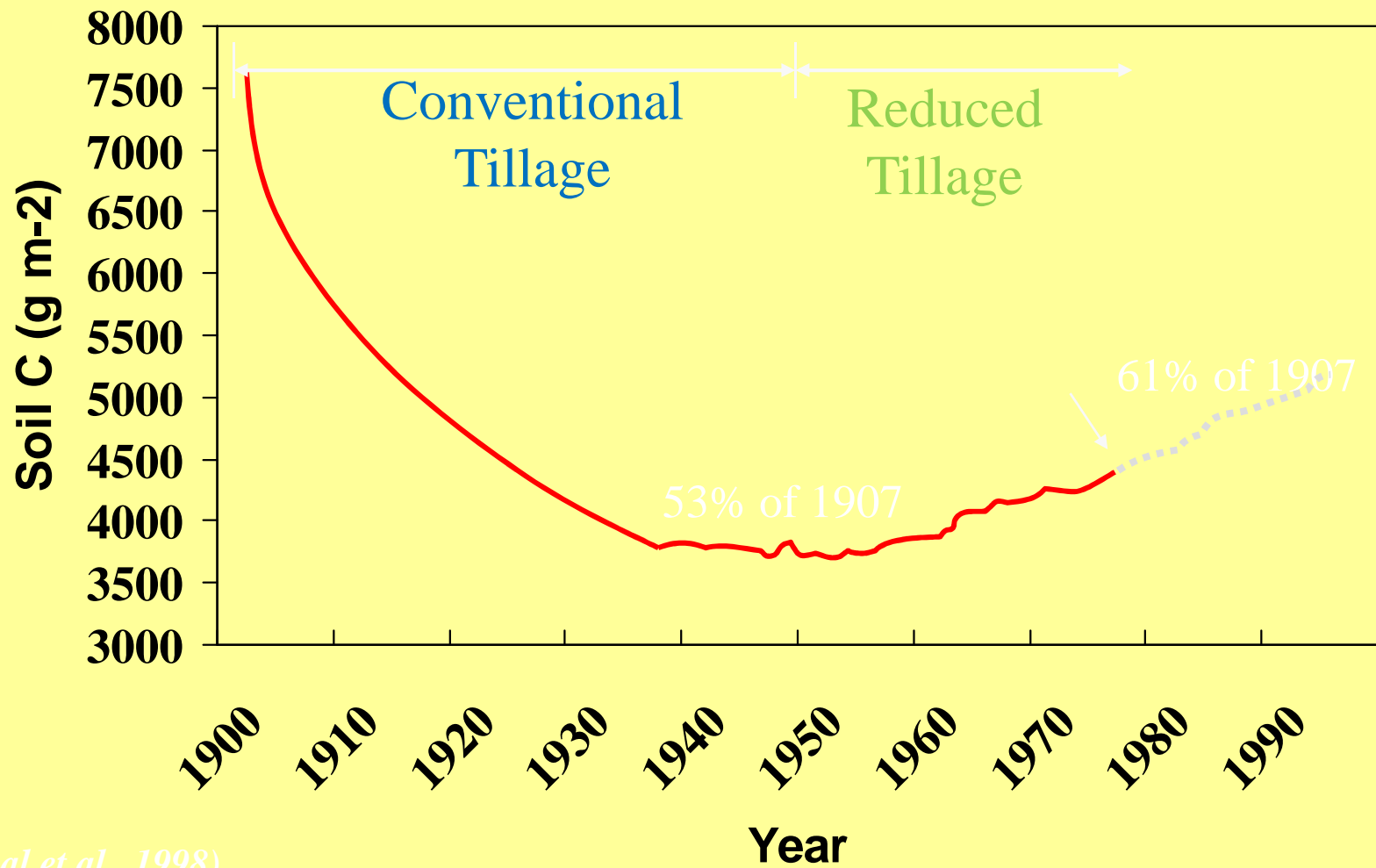


Burning



Water Erosion

Historic Loss of Soil Carbon



(Lal et al., 1998)

Organic Matter Makes a Difference



Recently in Pasture

Old Field

How to Improve Soil Quality

1. Conservation Tillage

- ü Reduces erosion
- ü Reduces CO₂ loss
- ü Improves soil structure
- ü Increases infiltration
- ü Decreases fossil fuel use



**Conservation Tillage restores
productivity on eroded land.**

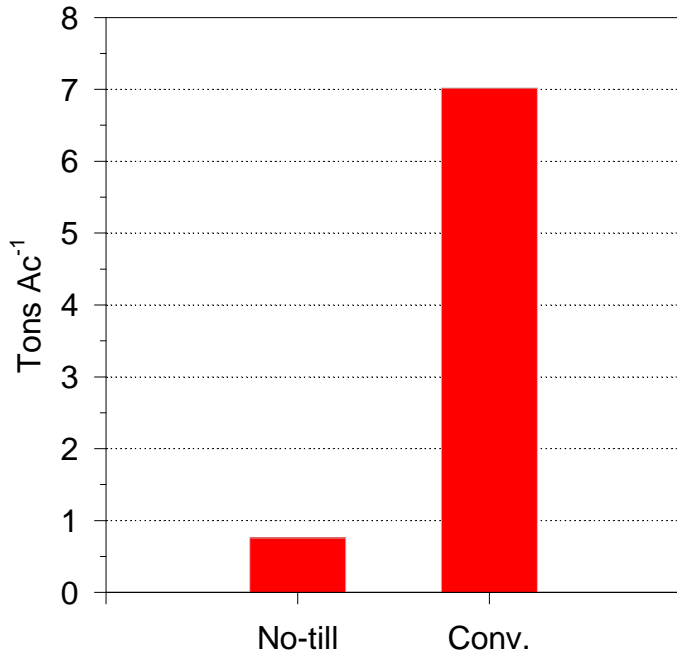
Uniform crop growth will result.



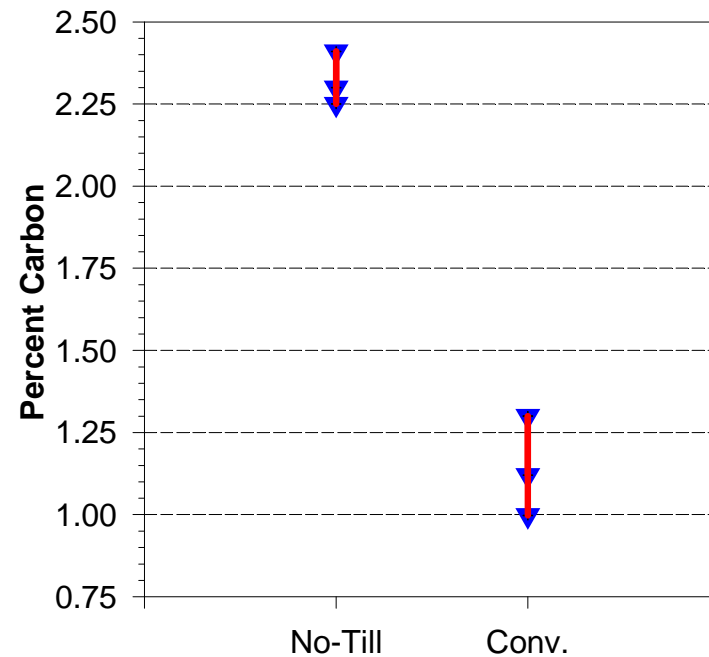
Effects of Tillage!

Compass Loamy Sand

2" hr⁻¹ Rain for 1 hr on Pre-Wet Soil



% Carbon - Memphis Silt Loam (High, Low, Mean; 0-3 inches)



P1 Watershed
No-Tilled Since 1975
Oconee County, GA
7 acres and 4% slope



Conventional Tillage



No-Till

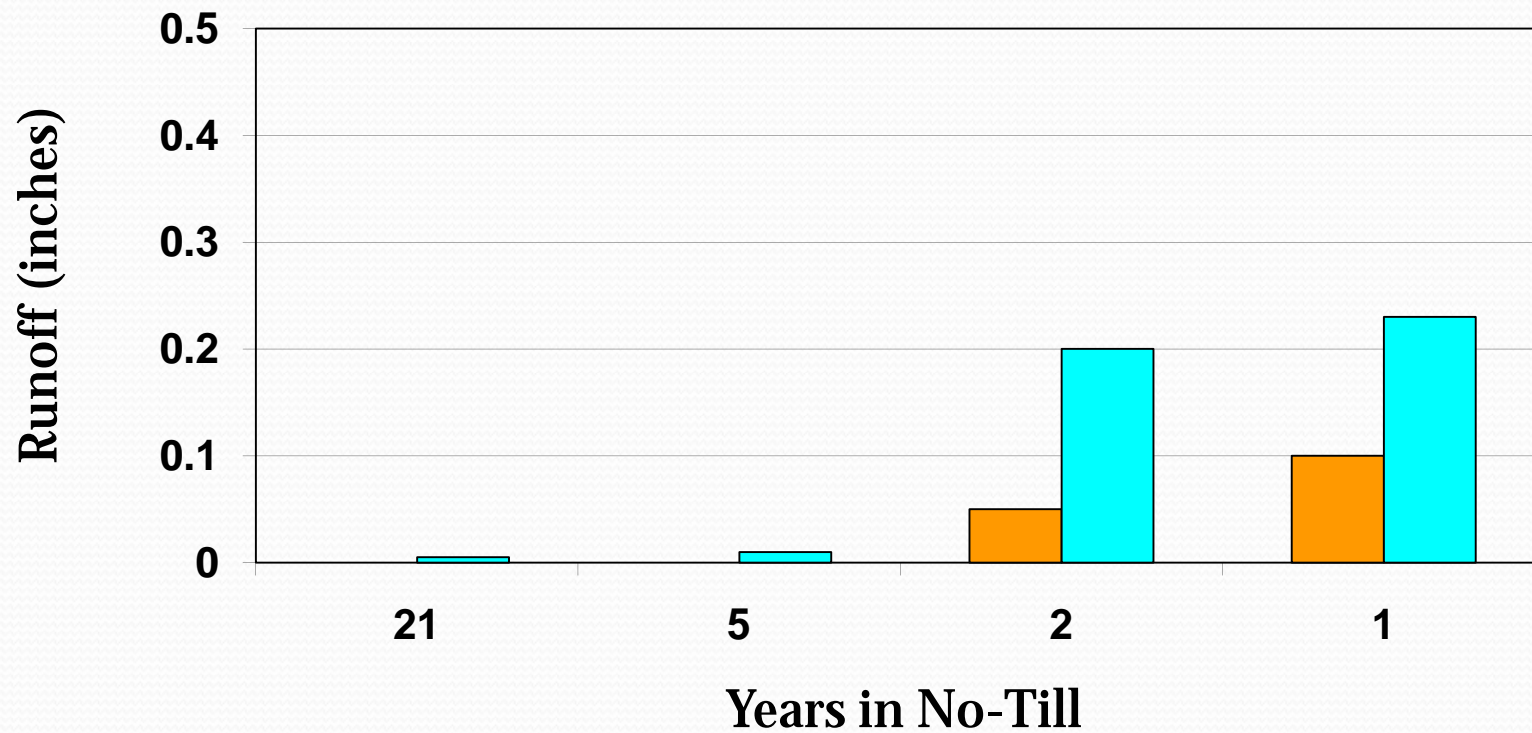


No runoff last 3 years
No soil loss in last 10 years
Higher crop yields

Watershed near Watkinsville, GA

Conservation Tillage, Rainfall, and Runoff

- Hurricane Erin 8-28-95, rainfall = 5.89"
- Hurricane Opal 10-4-95, rainfall = 5.0"



Attitude Adjustment...

Soil C and Crop Residues are the key to making conservation tillage work.

It's not the lack of tillage, but the production and conservation of crop residues that offer the most benefit to productivity.



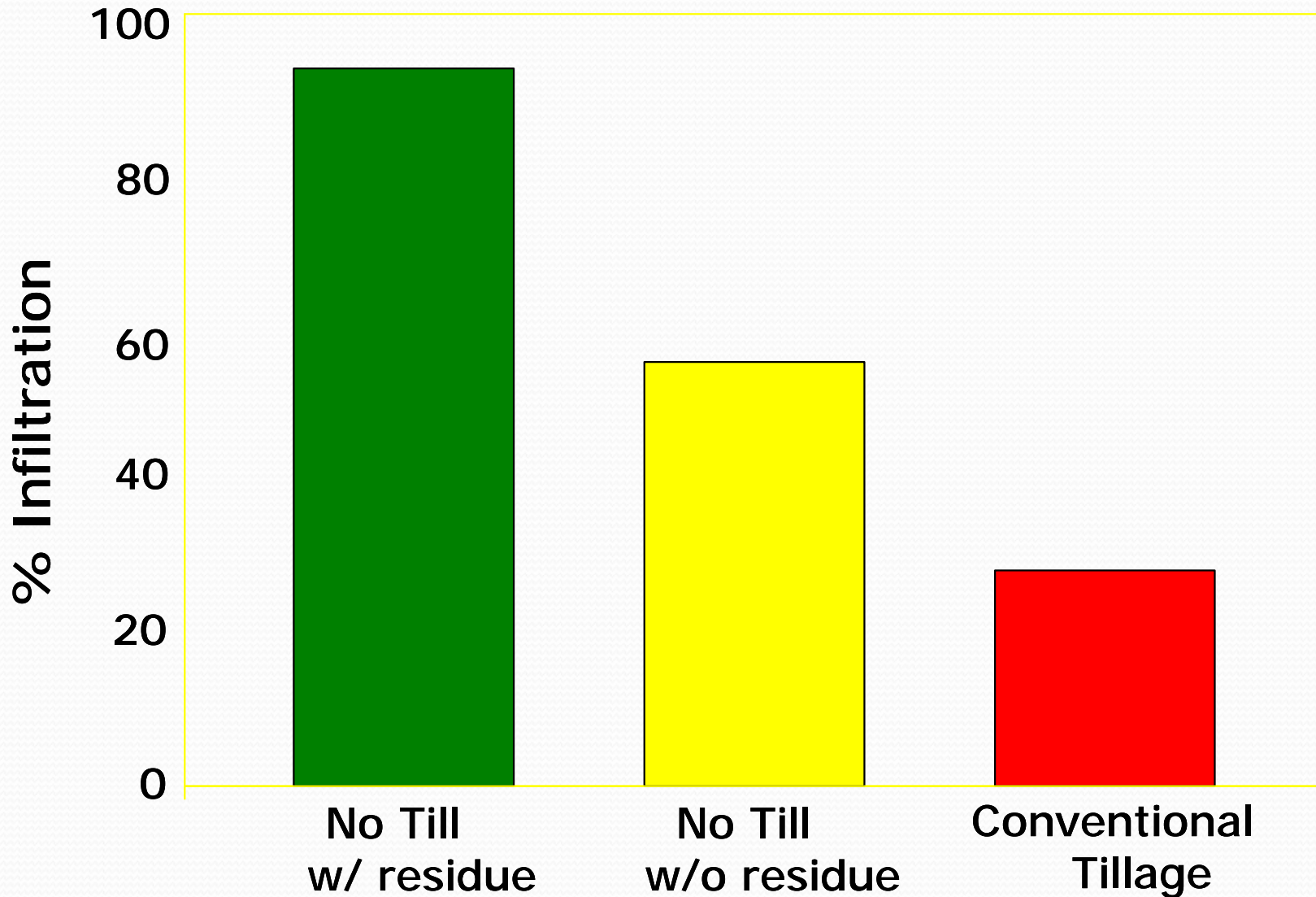
~~How to Improve Soil Quality~~

2. Cover Crops

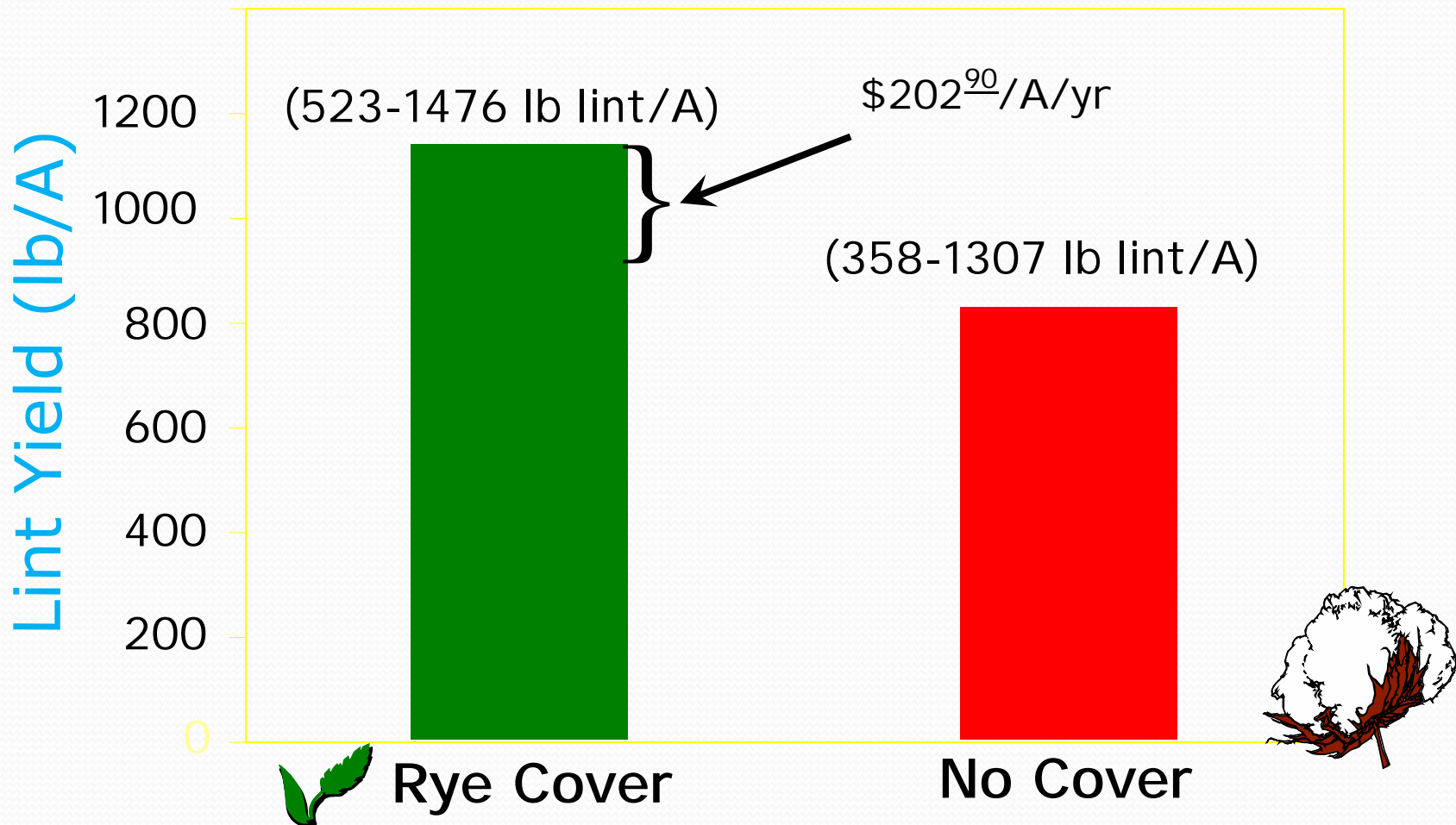
- ü Increases residue production
- ü Erosion protection
- ü Varied root types
 - ø soil microbes
 - ø soil structure
- ü Nutrient cycling



Tillage and Residue effects on infiltration of a Coastal Plain Soil (2-inch rain event)



Conservation Tillage and Cover Crops!



Rye cover crop @\$19.01/A

3 yr avg. price = \$0.714/lb

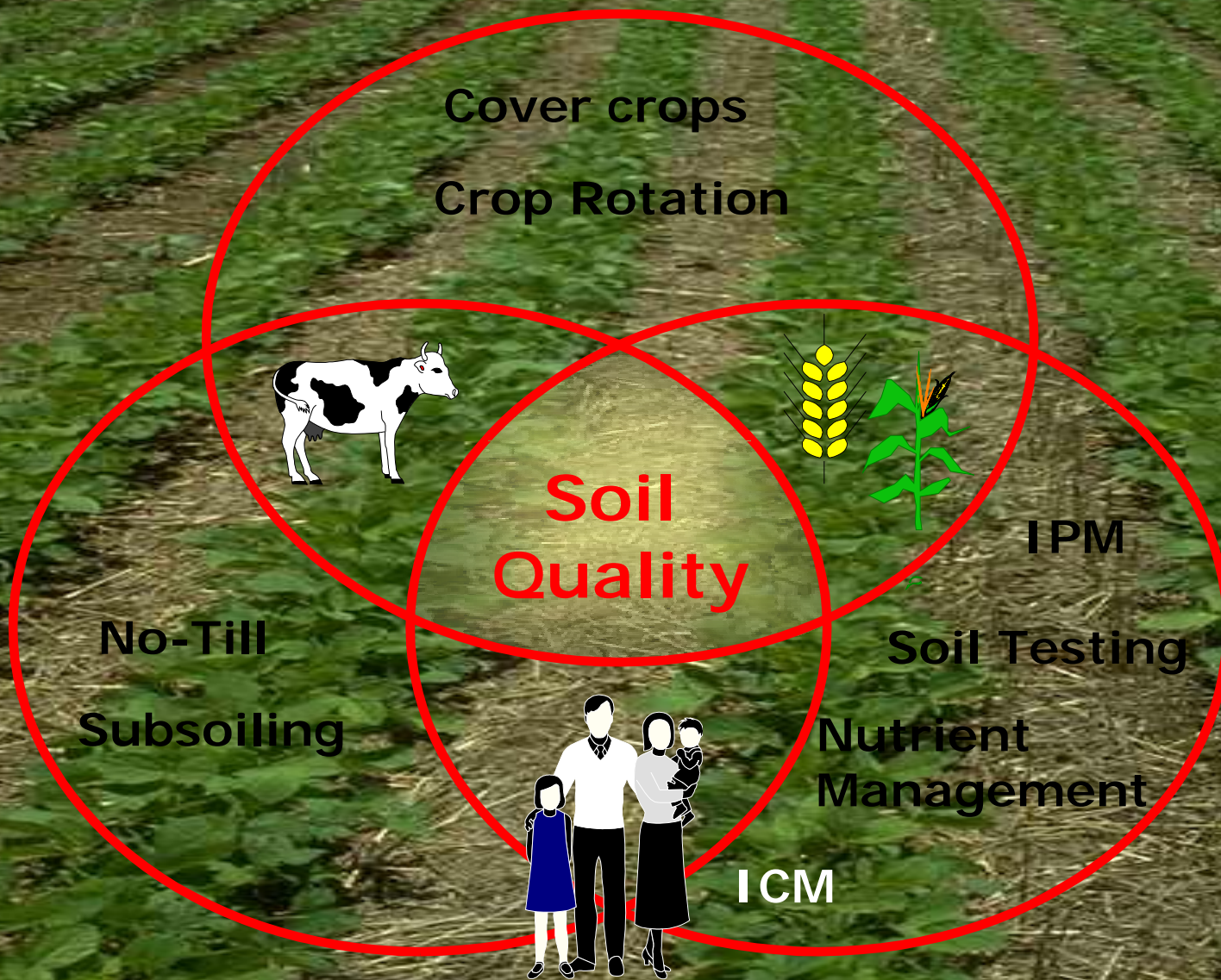
~~How to Improve Soil Quality~~

3. Crop Rotation

- ü Interrupts cycles
 - ø disease
 - ø weeds
 - ø insects
- ü Varies root types
- ü Improves soil structure
- ü Reduces airborne sediment



No-Till is a system with many important parts



Soil Organic Matter

Test Plot Results in Georgia

	Average of 4 fields	
	<u>Top 1/2"</u>	<u>1/2 - 2"</u>
Conventional	0.5%	0.5%
18 years no-till/strip-till (lightly disked in fall)	1.8%	1.6%
3 years no-till/strip-till (no disking)	2.7%	2.0%

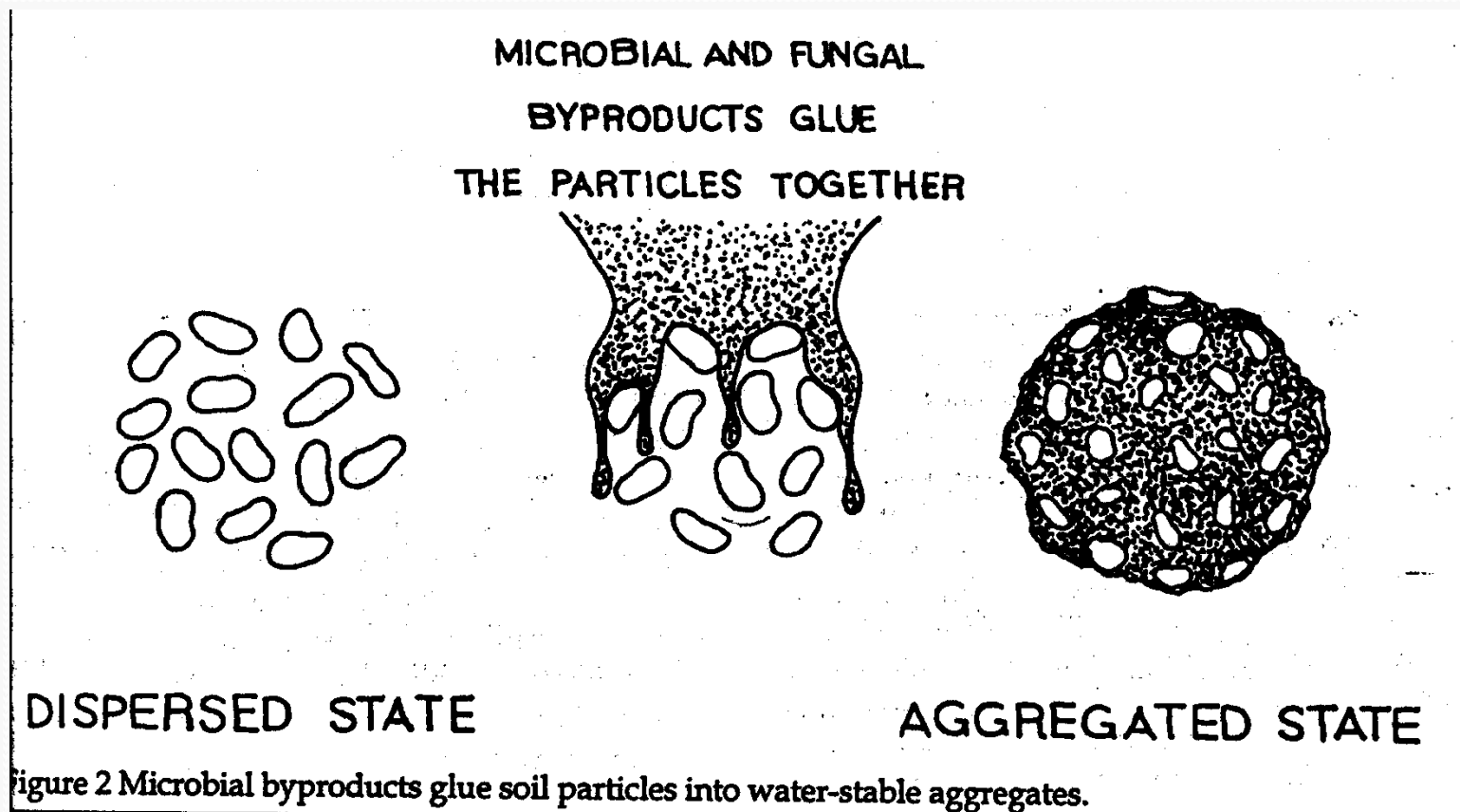
Conservation Tillage & Runoff in a Farmer's Field

<u>Tillage Type</u>	<u>Irrigation Rate</u>	<u>Runoff</u>
Conventional	0.5"	Yes
Strip-tilled for 3 years	1.5"	No
Strip-tilled for 10 years	2.5"	No

(Dothan loamy sand, 2% slope)

Lamar Black, Millen, GA

Water Stable Aggregates



From ATTRA - Soil Quality Publication

Water Stable Aggregates

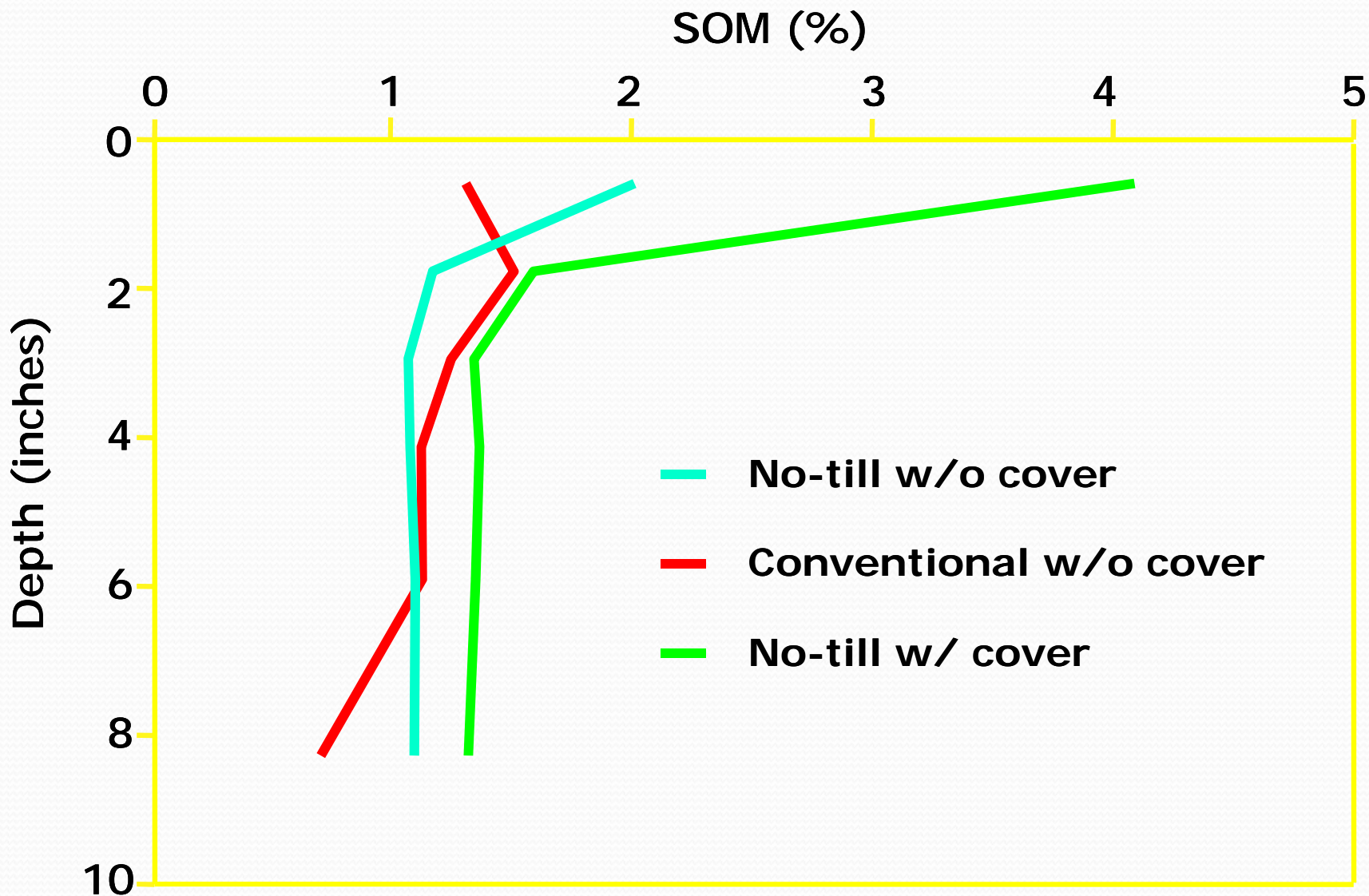
Create soil structure

Reduce erosion

Protects OM



Effect of tillage and rye cover crop on SOM (after 5 years)





Soil Organic Carbon % (2003)



Treatment (initial SOC 0-12 in: 0.47%)	0-2 in	2-6 in	6-12 in	0-12 in
Conventional	0.75	0.60	0.37	0.50
Conventional + Manure	1.15	0.75	0.40	0.65
Conservation	1.10	0.58	0.38	0.58
Conservation + Manure	2.00	0.65	0.40	0.75

Value of Soil Organic Matter

Assumption of 2,000,000 pounds soil in top 6 inches with each 1% SOM = 20,000 lbs.

Nitrogen (5% of SOM) @ \$0.50 lb N.....	\$500
Phosphorus (0.5% of SOM)@ \$1.03 lb P.....	\$103
Potassium (0.5% of SOM) @ \$0.30 lb K.....	\$ 30
Sulfur (0.6% of SOM) @ \$0.30 lb S.....	\$ 36
Carbon (60% of SOM) @ \$0.002 lb C.....	\$ 24

Value of each 1% SOM for selected nutrients = \$593

Data taken from Jim Kinsella and Terry Taylor, 2006

To Protect Soil Function and Soil Health

Maintain or increase litter cover on the field.

Increase or maintain plant production.

Promote diverse crops with high root biomass.

Decrease the time fields are bare.

MANAGEMENT

To Protect Soil Function and Soil Health

Reduce soil surface disturbance

Minimize traffic when the soil is wet.

Assess and monitor soil quality and vegetation for early indication of changes in soil function and soil health.

MANAGEMENT

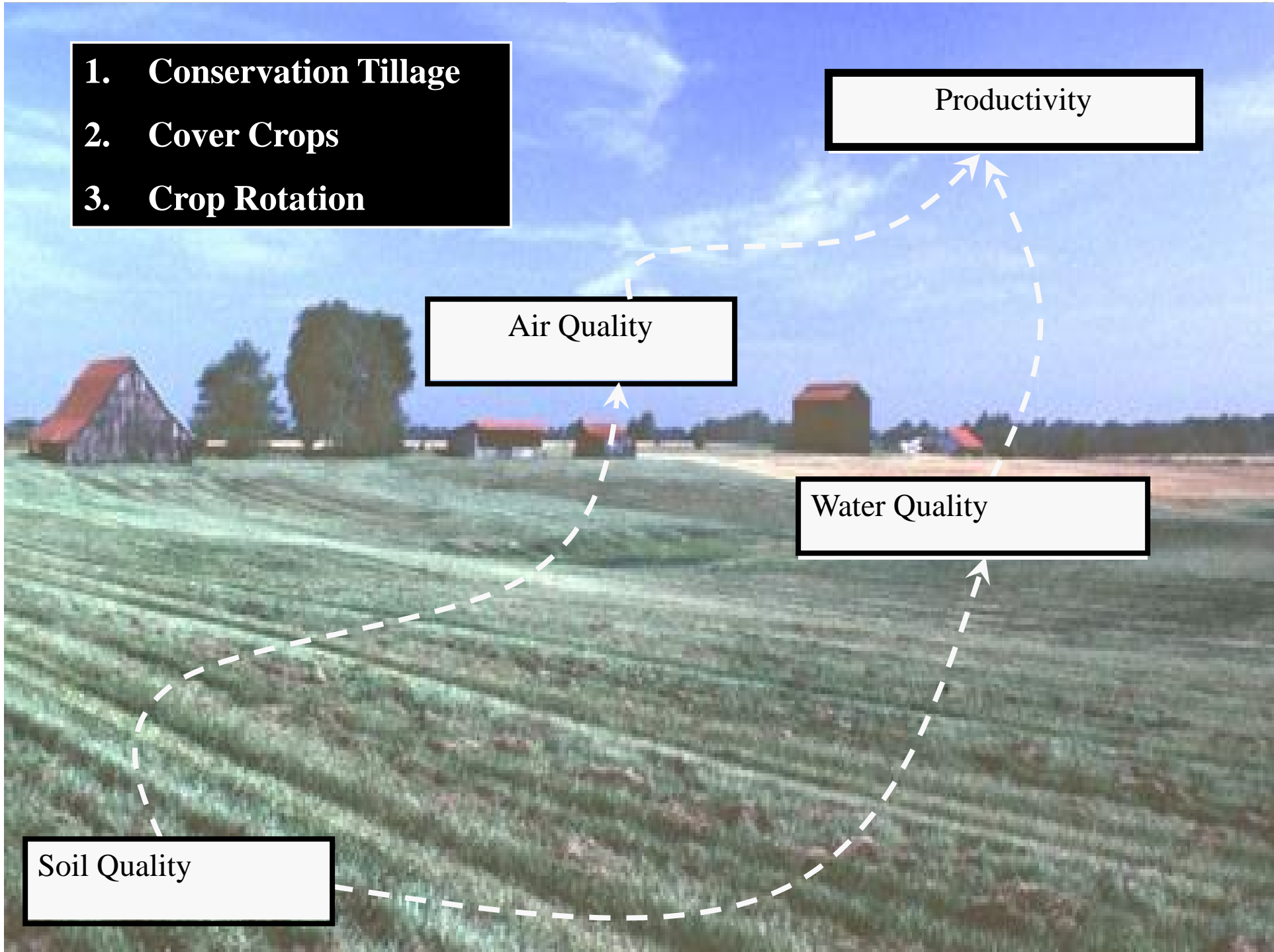
1. Conservation Tillage
2. Cover Crops
3. Crop Rotation

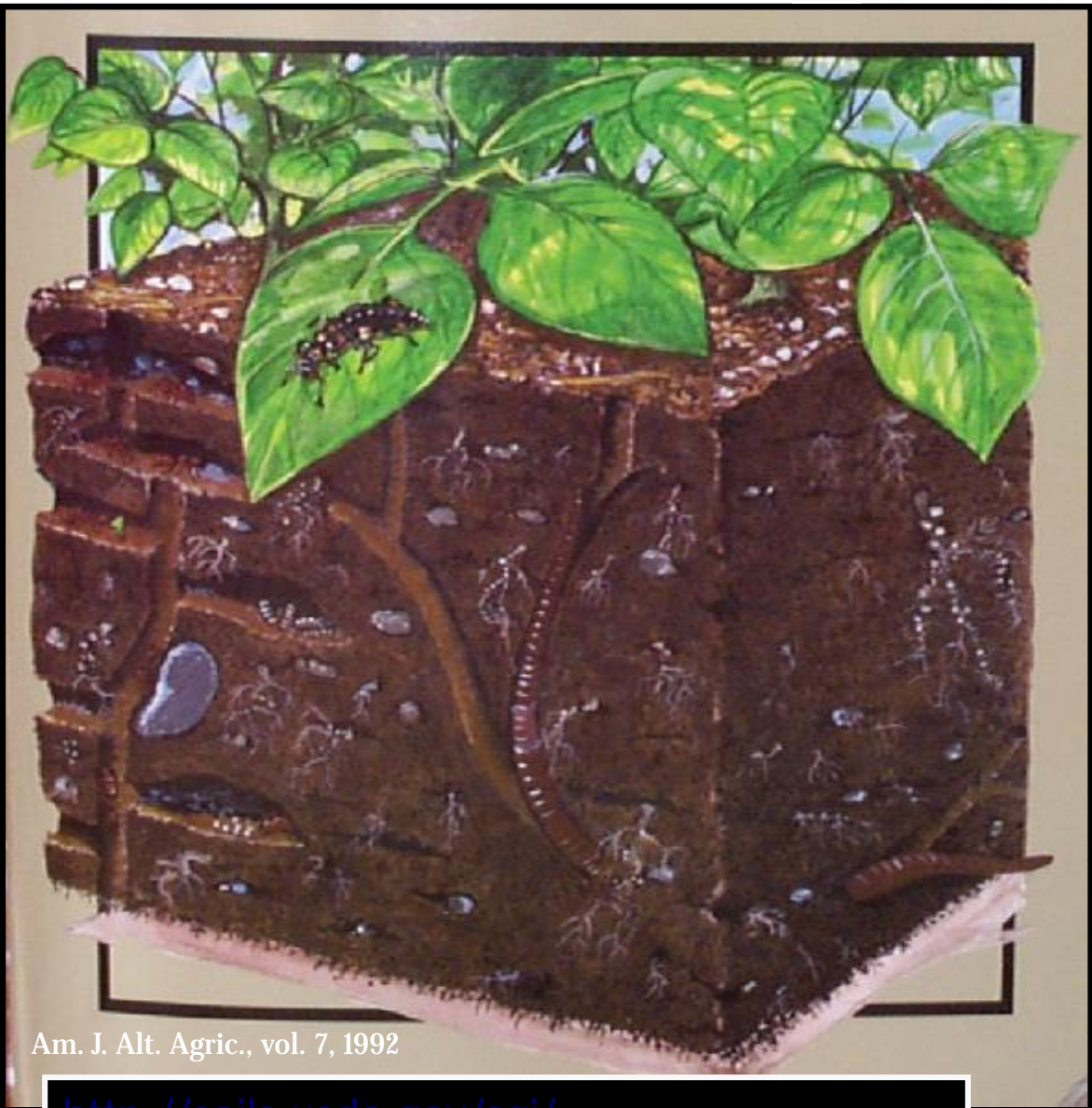
Soil Quality

Air Quality

Water Quality

Productivity





Am. J. Alt. Agric., vol. 7, 1992

<http://soils.usda.gov/sqi/>

Our Soil Is Our Strength



<http://www.nrcs.usda.gov/>



NRCS

Natural Resources Conservation Service
United States Department of Agriculture



Louisiana Agricultural Technology & Management Conference

Residue Regulations

Soil Quality Test Kit

Measures three components
in the soil

- Biological
- Chemical
- Physical



Improved Agricultural Practices Sequester Carbon

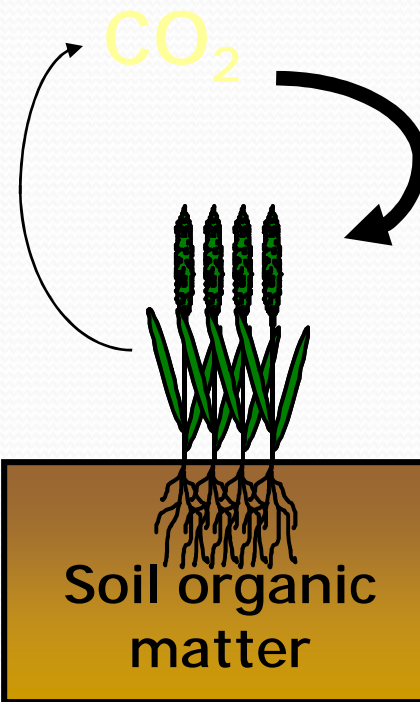
Conservation Tillage



Cover Crops



Conservation Buffers



Crop Rotations

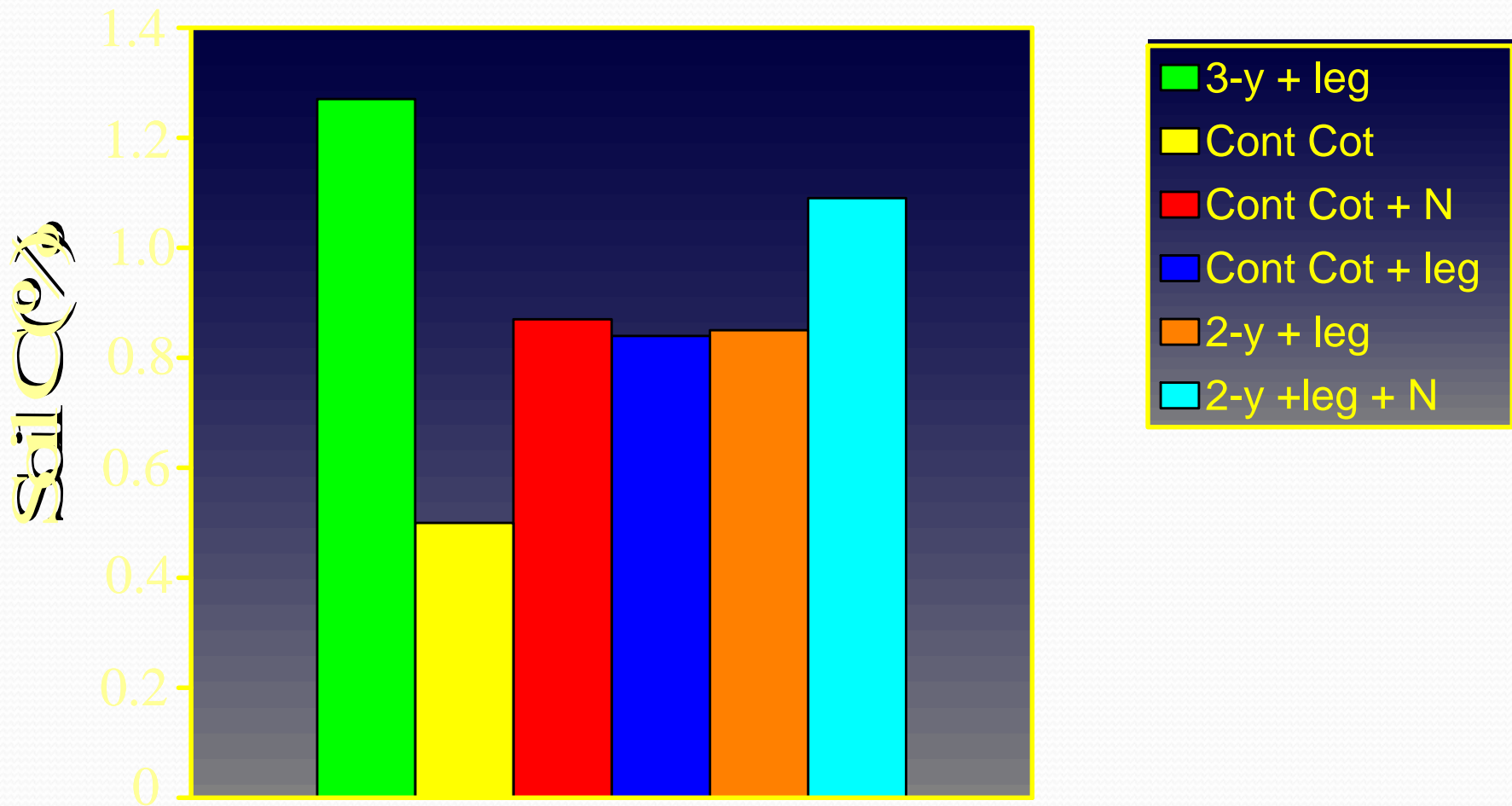






The Old Rotation

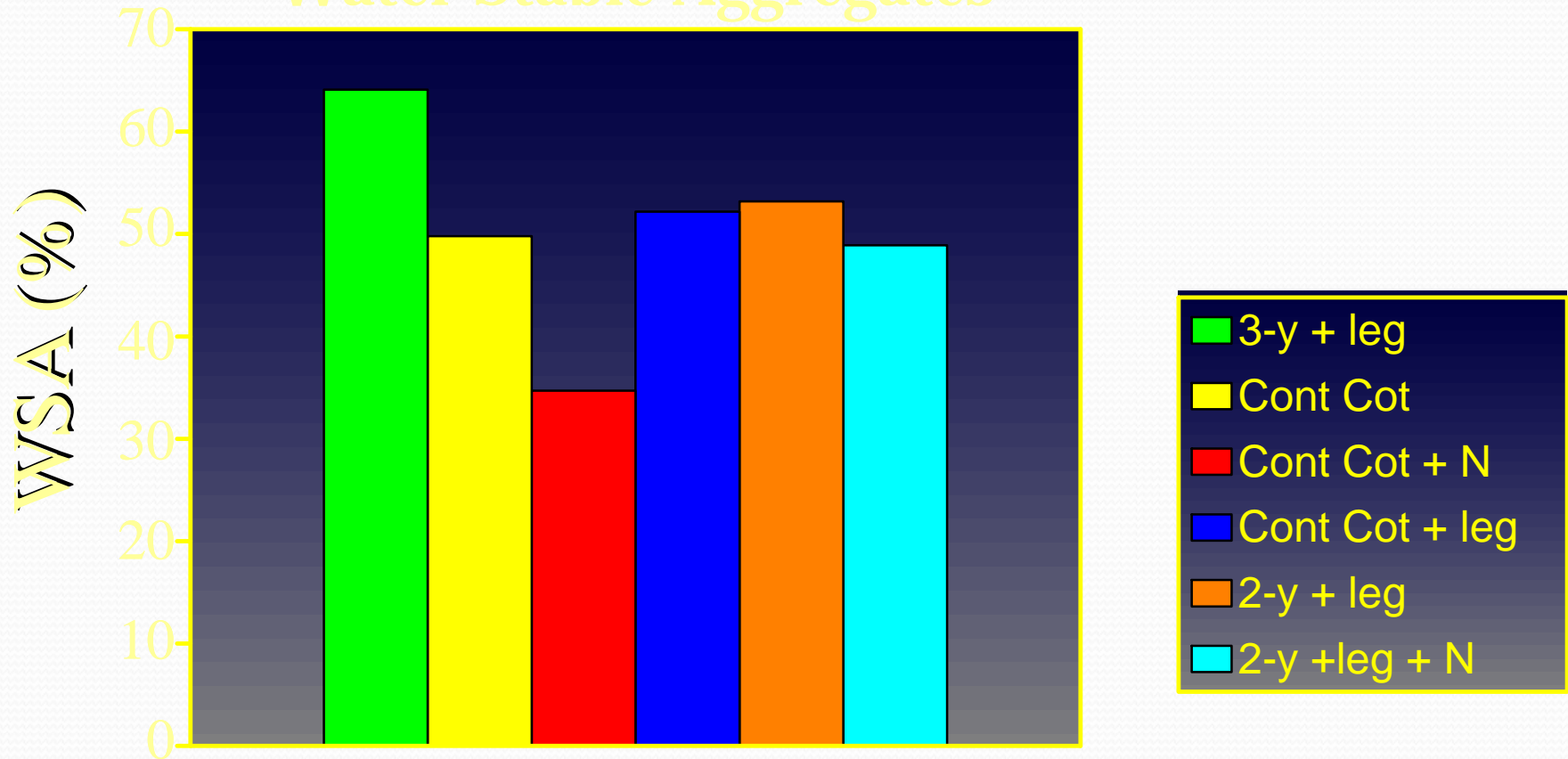
Soil Carbon





The Old Rotation

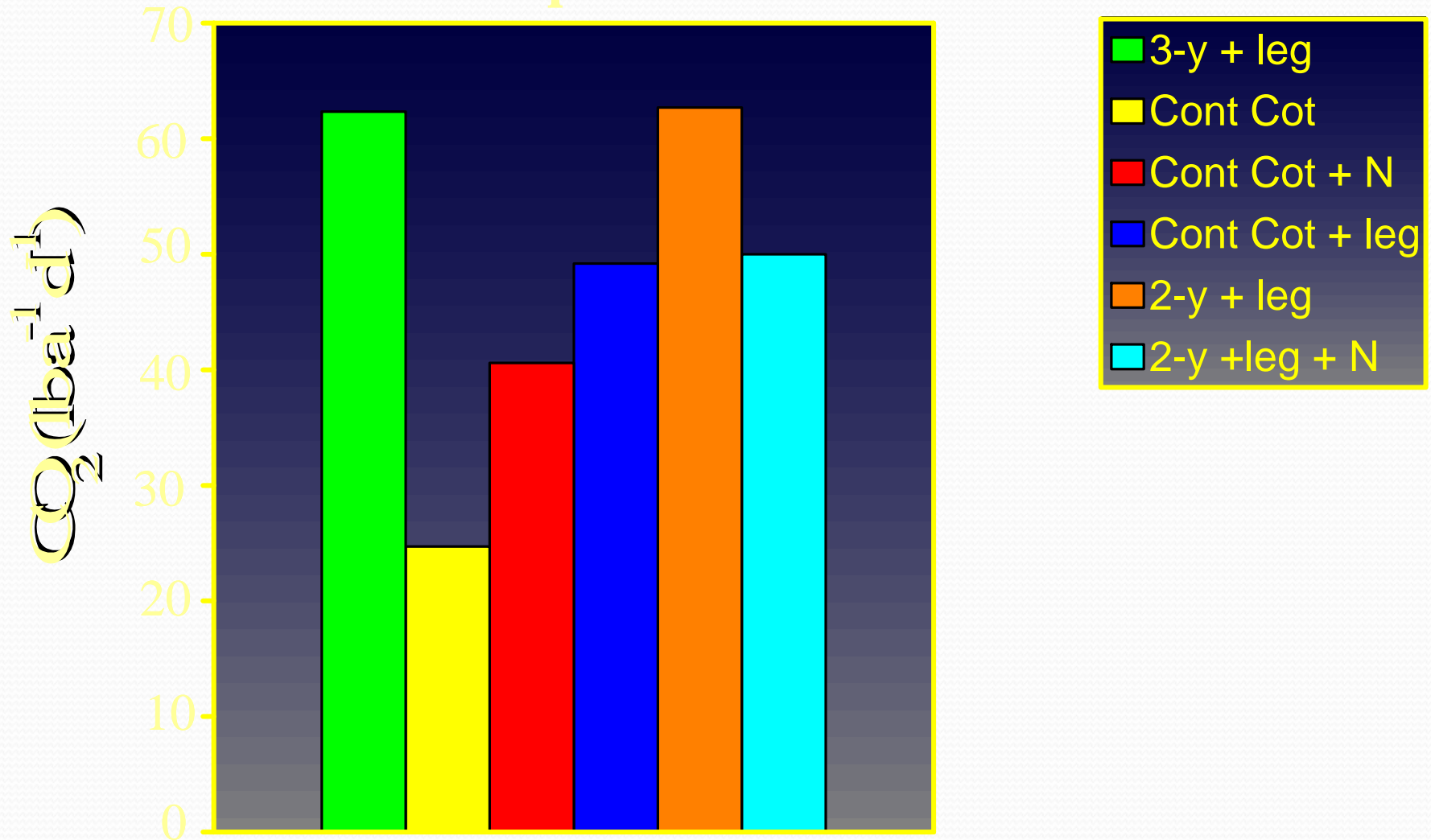
Water Stable Aggregates





The Old Rotation

Soil Respiration



Water Stable Aggregates















50%





























Rolling Cover Crops

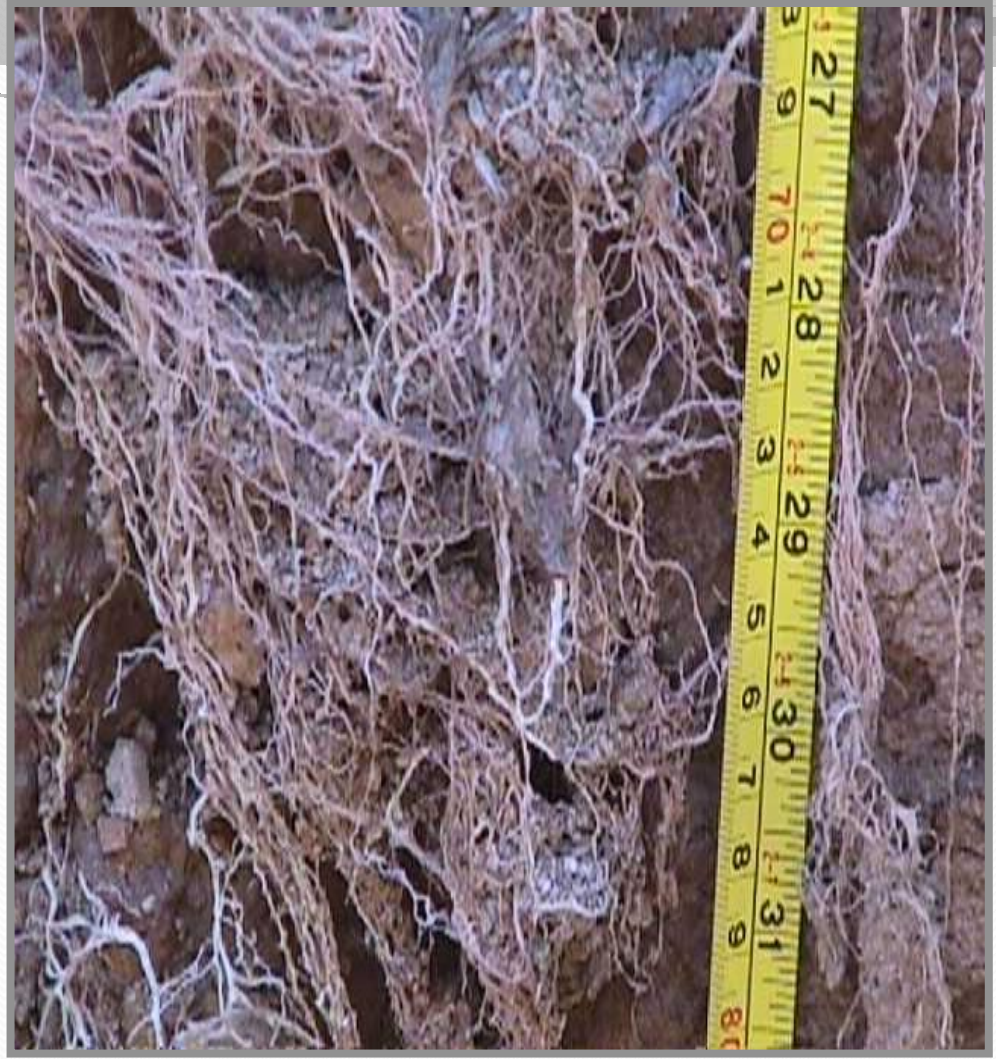








Disk and field cultivate



6 years no-till
plus cover crop of hairy vetch

Roller Variations



With no-till, soil quality changes become visible in 2-3 years



Conventional Tillage

No-Till



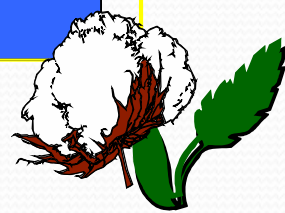
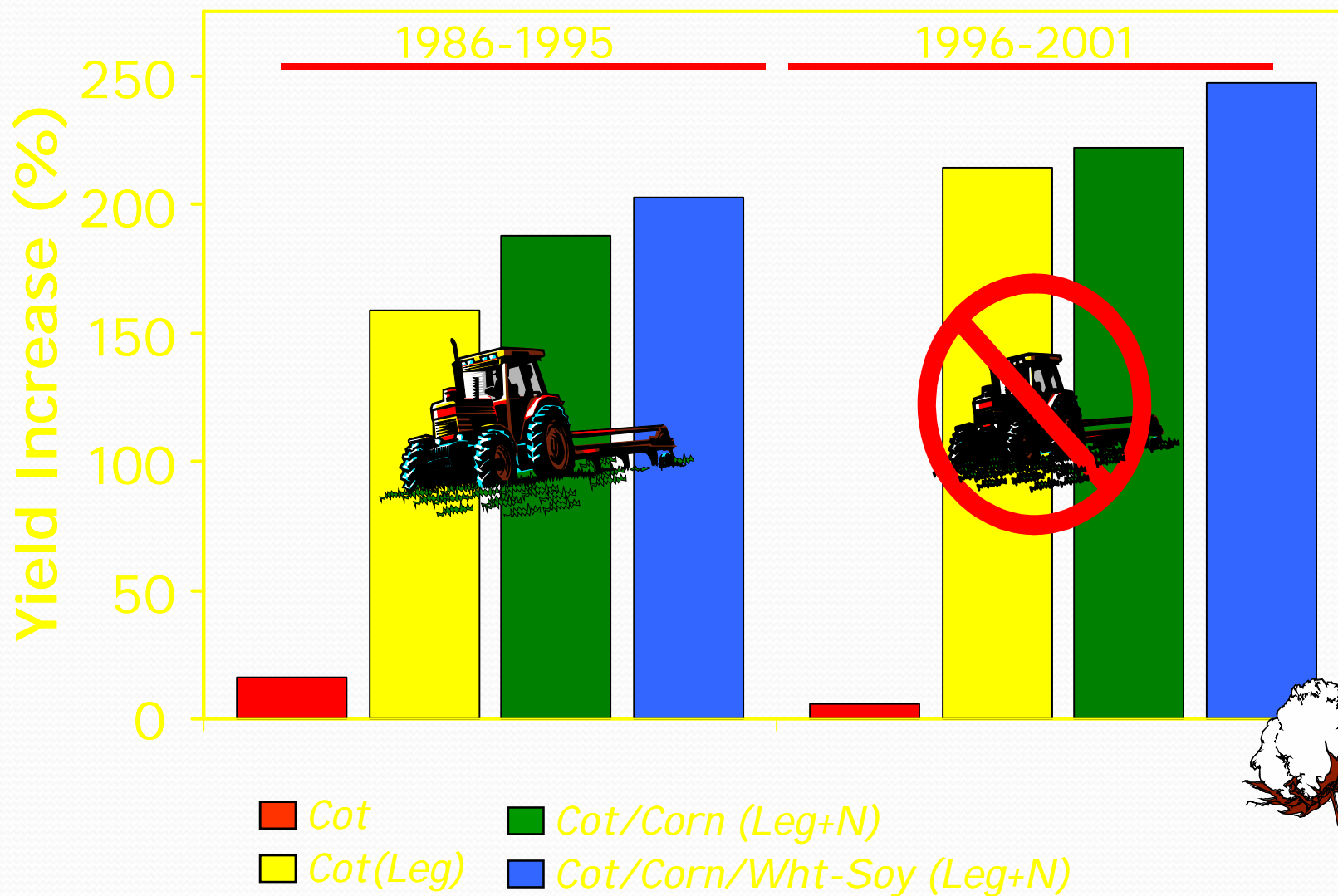
**South Georgia soil
after 3 years of no-till**

**Long-term changes
are more evident**

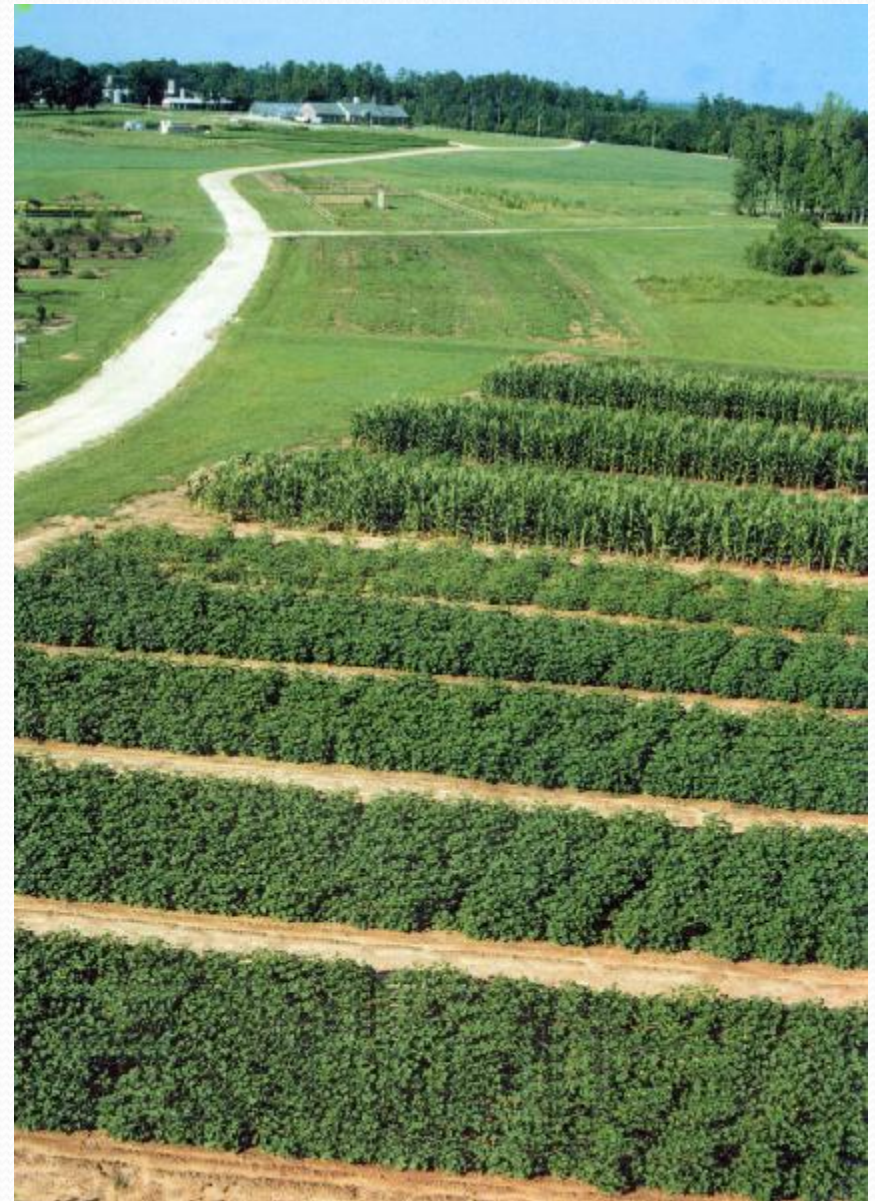
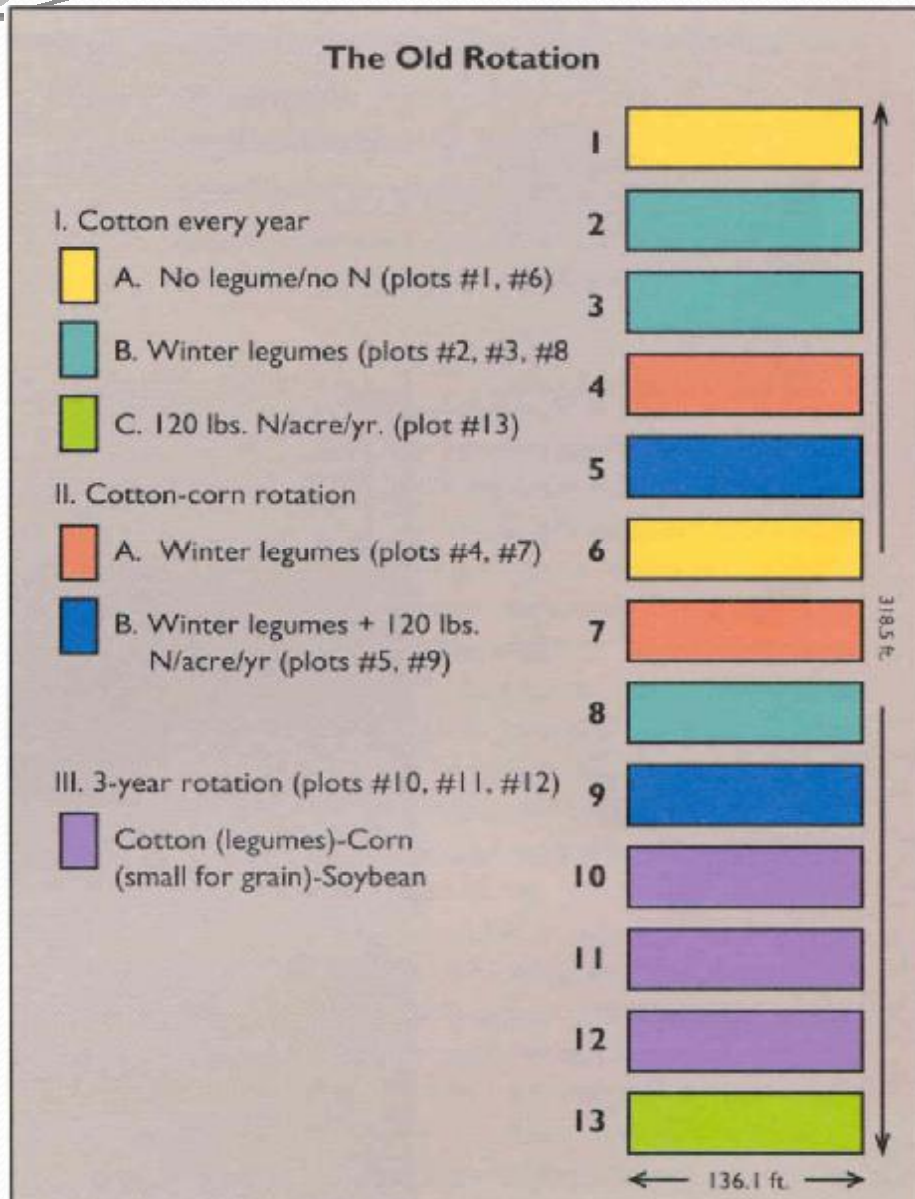
Important factors
Soil texture
Management
amount of residue
residue mgt.
no tillage
cover crops



"Old Rotation" yield increase (1986-2001)



Old Rotation Experiment





CORN Yield Results (2001-03)



Treatment	2001 (Bu/A)	2002 (Bu/A)	2003 (Bu/A)
Conventional	153	113	196
Conventional + Manure	163	115	200
Conservation	163	145	208
Conservation + Manure	161	151	210



COTTON Lint Yield (2001-03)



Treatment	2001 (lb/A)	2002 (lb/A)	2003 (lb/A)
Conventional	799	373	871
Conventional + Manure	848	409	898
Conservation	904	479	933
Conservation + Manure	911	472	1000

Soil Health Card

- Qualitative
- Self Assessment Tool
- Developed by Farmers for Farmers
- Uses Farmer-Based Descriptive Terms
- Helps Promote Awareness of Soil Quality
- Based on Wisconsin Health Card
(Romig et al., 1995)

