LAND USE CHANGE AND SOIL MANAGEMENT IMPACTS ON SOIL BIOLOGICAL AND PHYSICAL PROPERTIES INVOLVED IN ECOSYSTEM CARBON SEQUESTRATION

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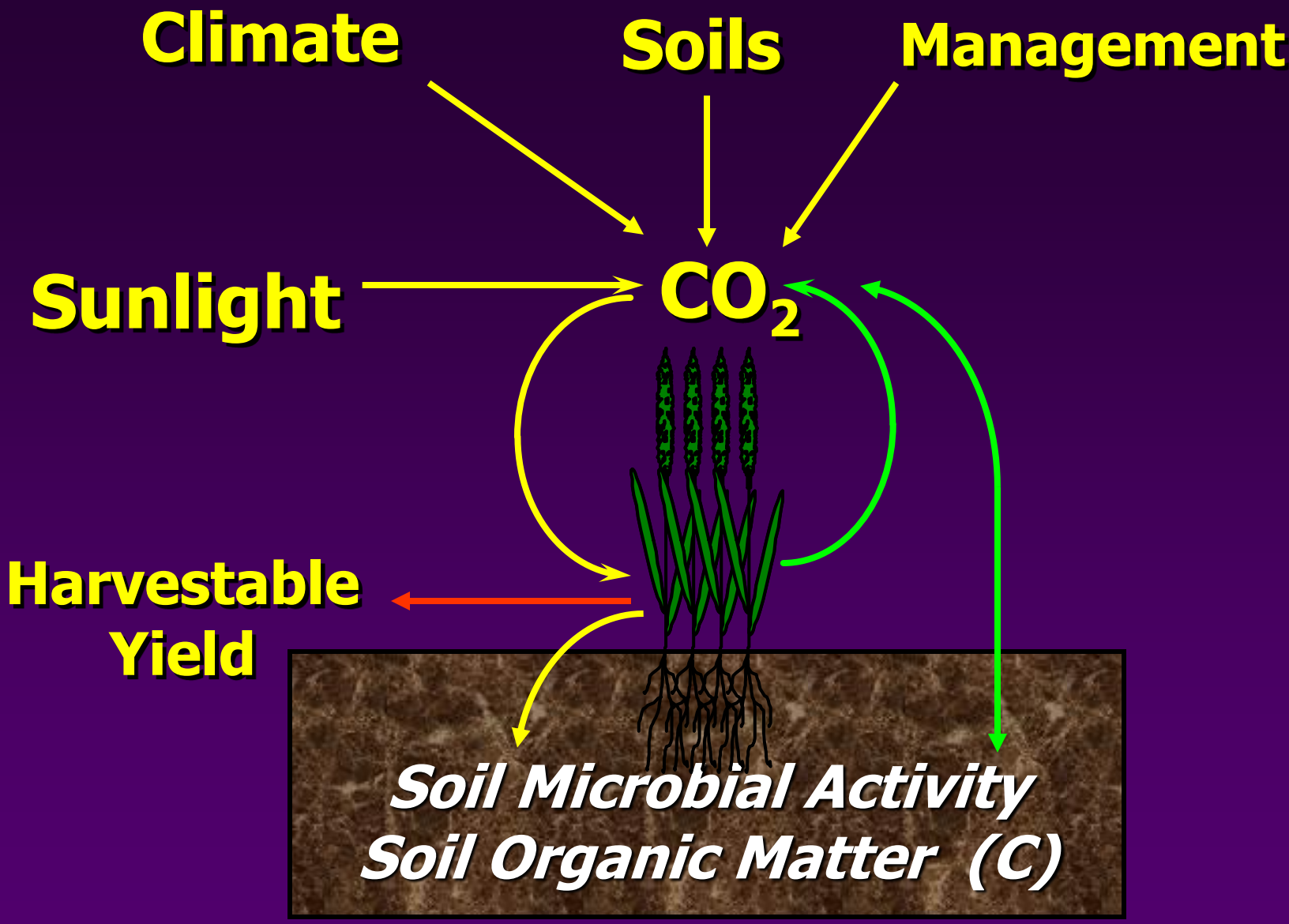
Agriculture

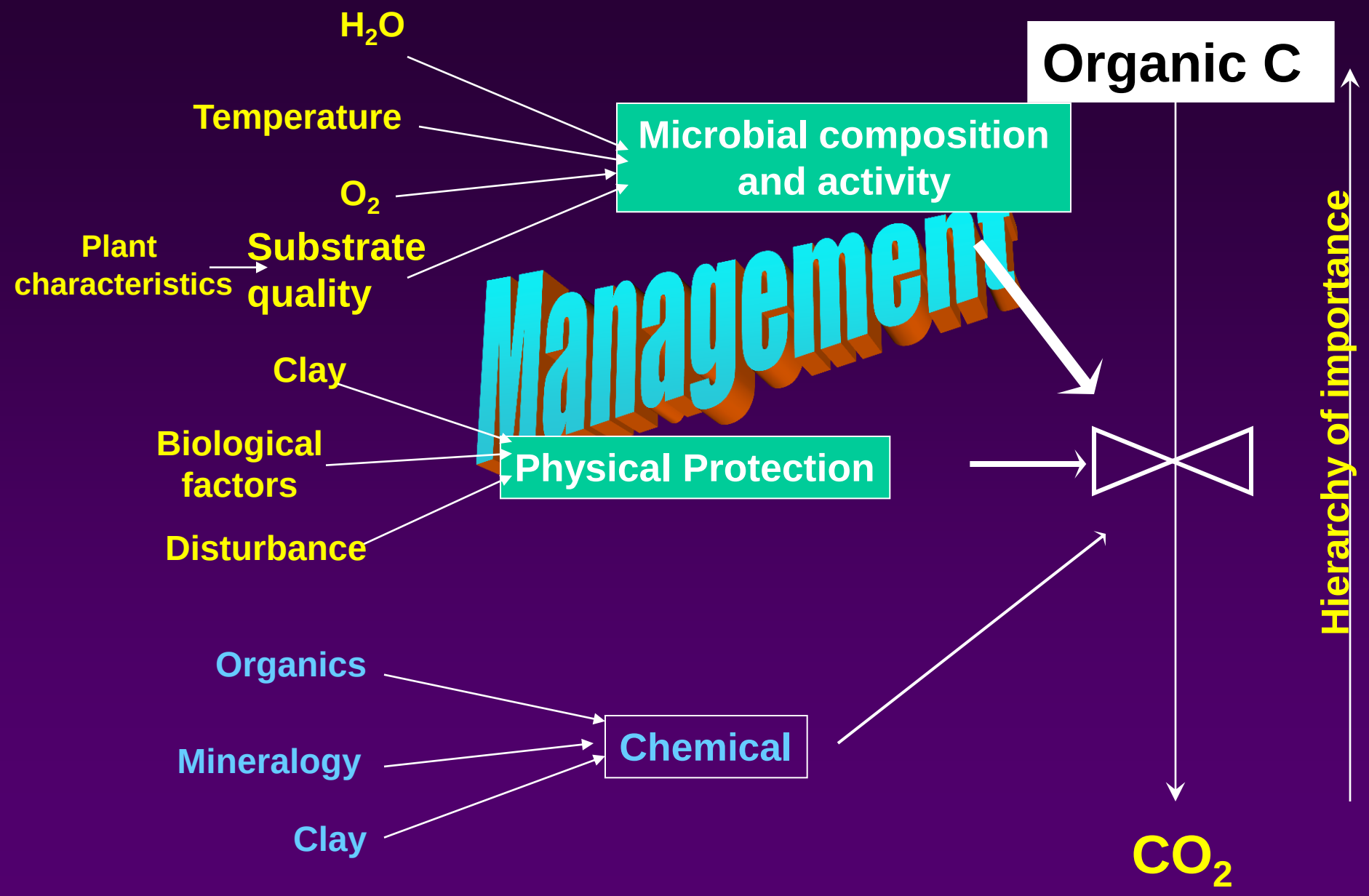
- A large proportion of the mitigation potential of agriculture (excluding bioenergy) arises from soil C sequestration, which has strong synergies with sustainable agriculture and generally reduces vulnerability to climate change.

- Agricultural practices collectively can make a significant contribution at low cost
  - By increasing soil carbon sinks,
  - By reducing GHG emissions,
  - By contributing biomass feedstocks for energy use

IPCC Fourth Assessment Report, Working Group III, 2007

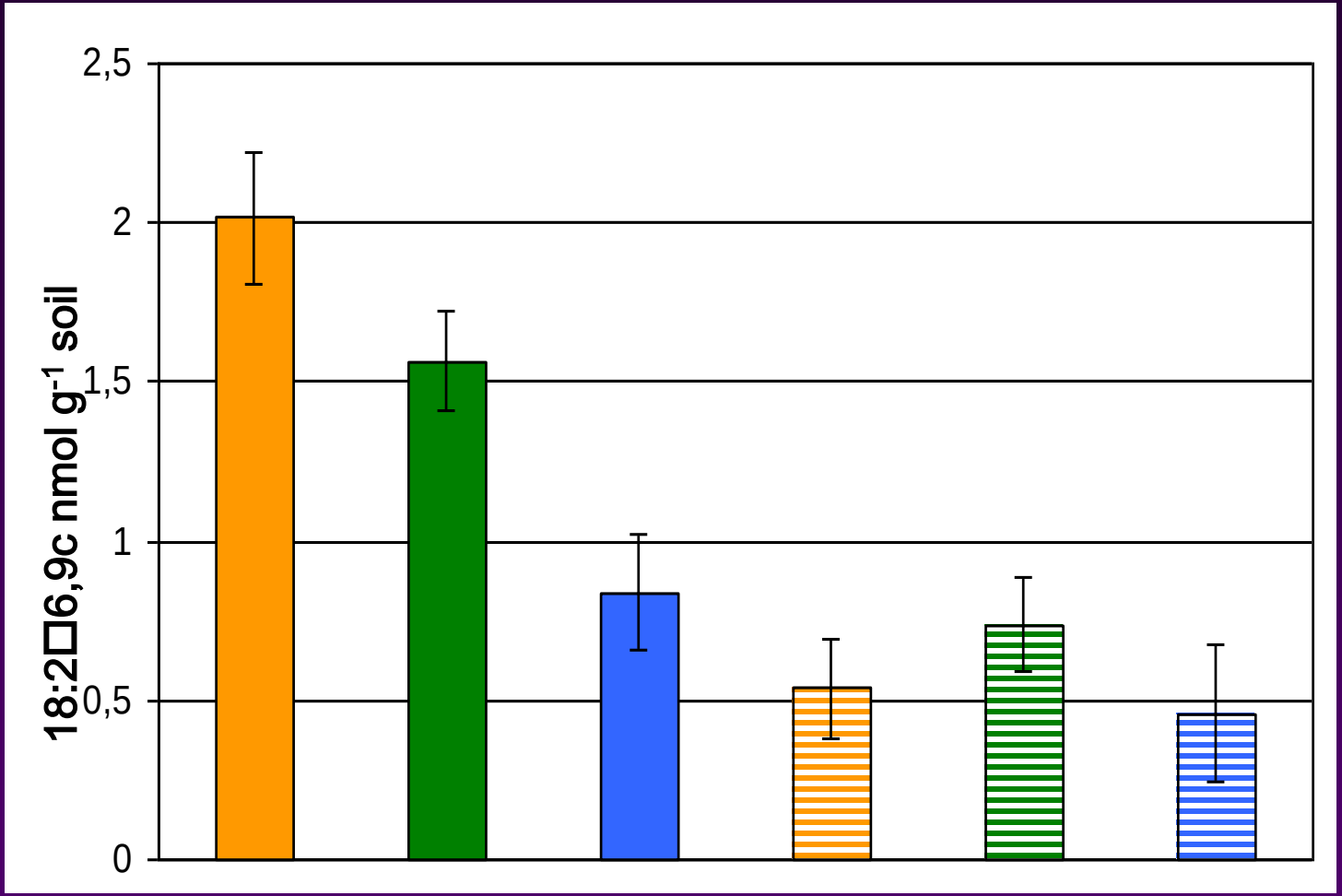

Climate
Soils
Management
Sunlight
CO_2
Harvestable Yield
Soil Microbial Activity
Soil Organic Matter (C)

Conservation of Soil Carbon

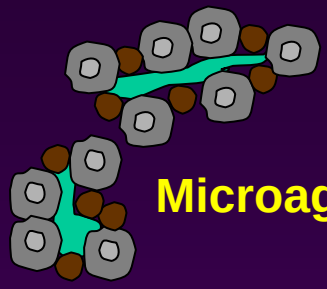



No-till promotes fungal activity
5 cm
Fonte: Juca Sá

Fungal biomass indicator



Conceptual diagram of soil aggregate hierarchy



Microaggregate 20-90 and 90-250 mm

Plant and fungal debris

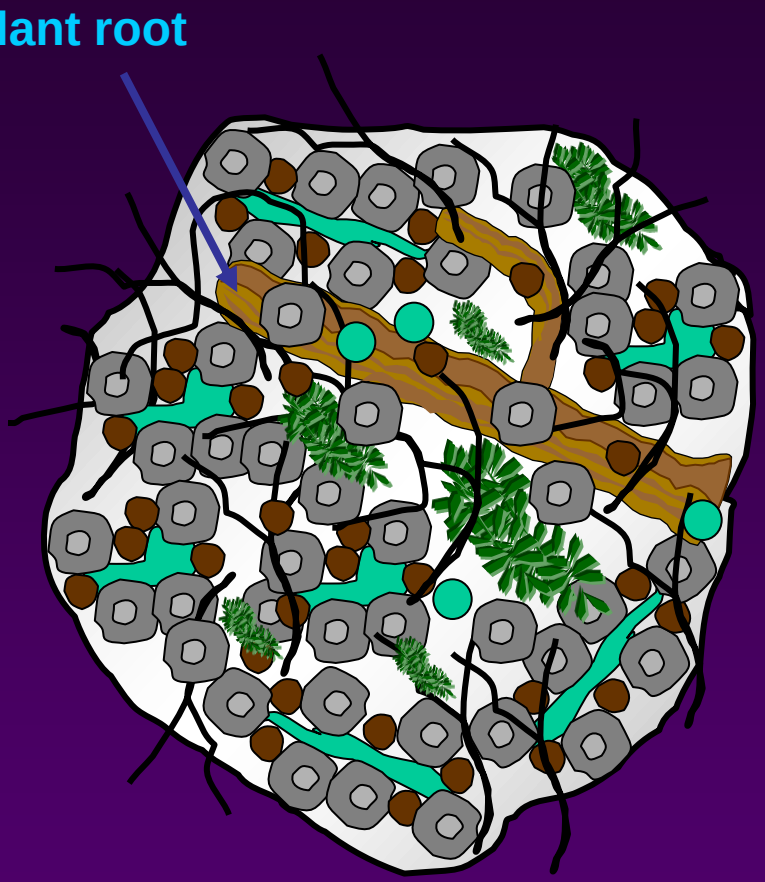
Silt-size microaggregate with microbially derived organomineral associations

Clay microstructures

Particulate organic matter colonized by saprophytic fungi

Mycorrhizal hyphe

Pore space; polysaccharides and other amorphous interaggregate binding agents



Jastrow & Miller 1997

Materials and Methods

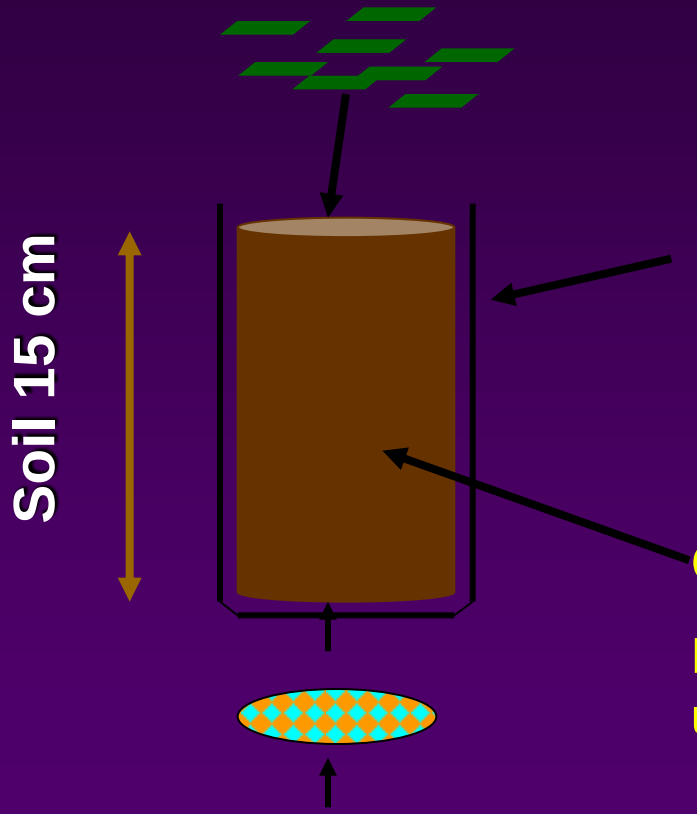
Ashland Bottoms – Near Manhattan, KS

- **Muir silt loam soil**
- **Continuous grain sorghum for 29 y.**
- **2 Tillage regimes: No-Tillage and tillage (Fall chisel, spring disc)**

White and Rice, 2007

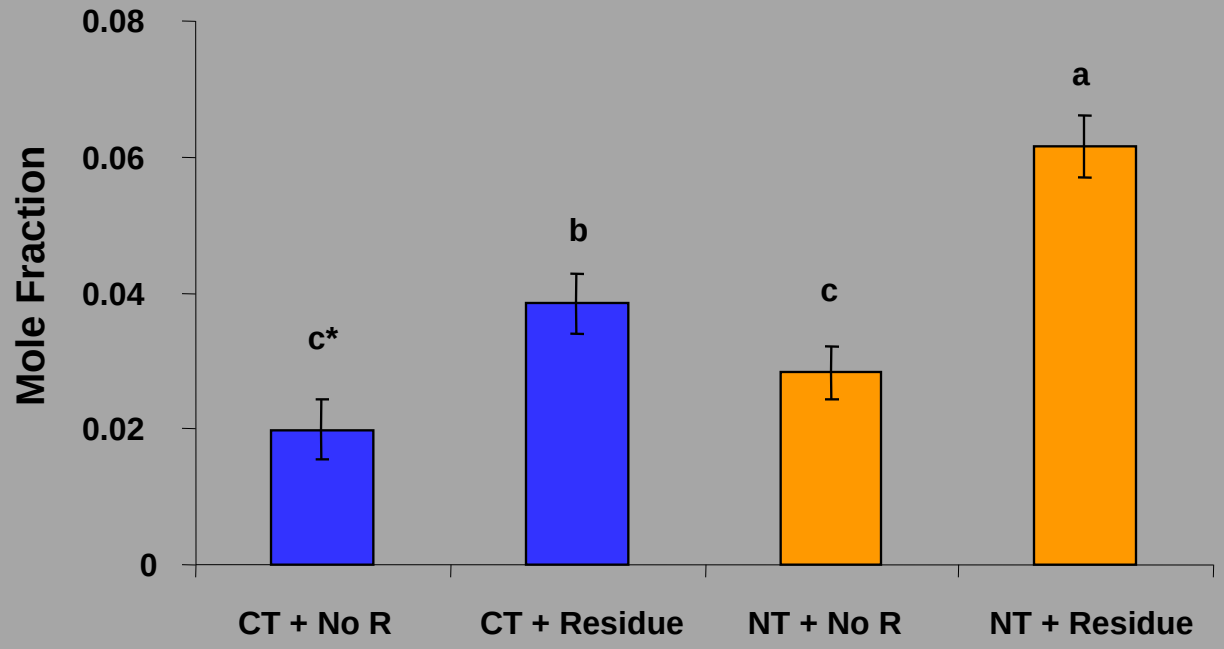
Materials and methods

NT 2.1 g residue placed on soil surface (10.7 Mg/ha surface basis)



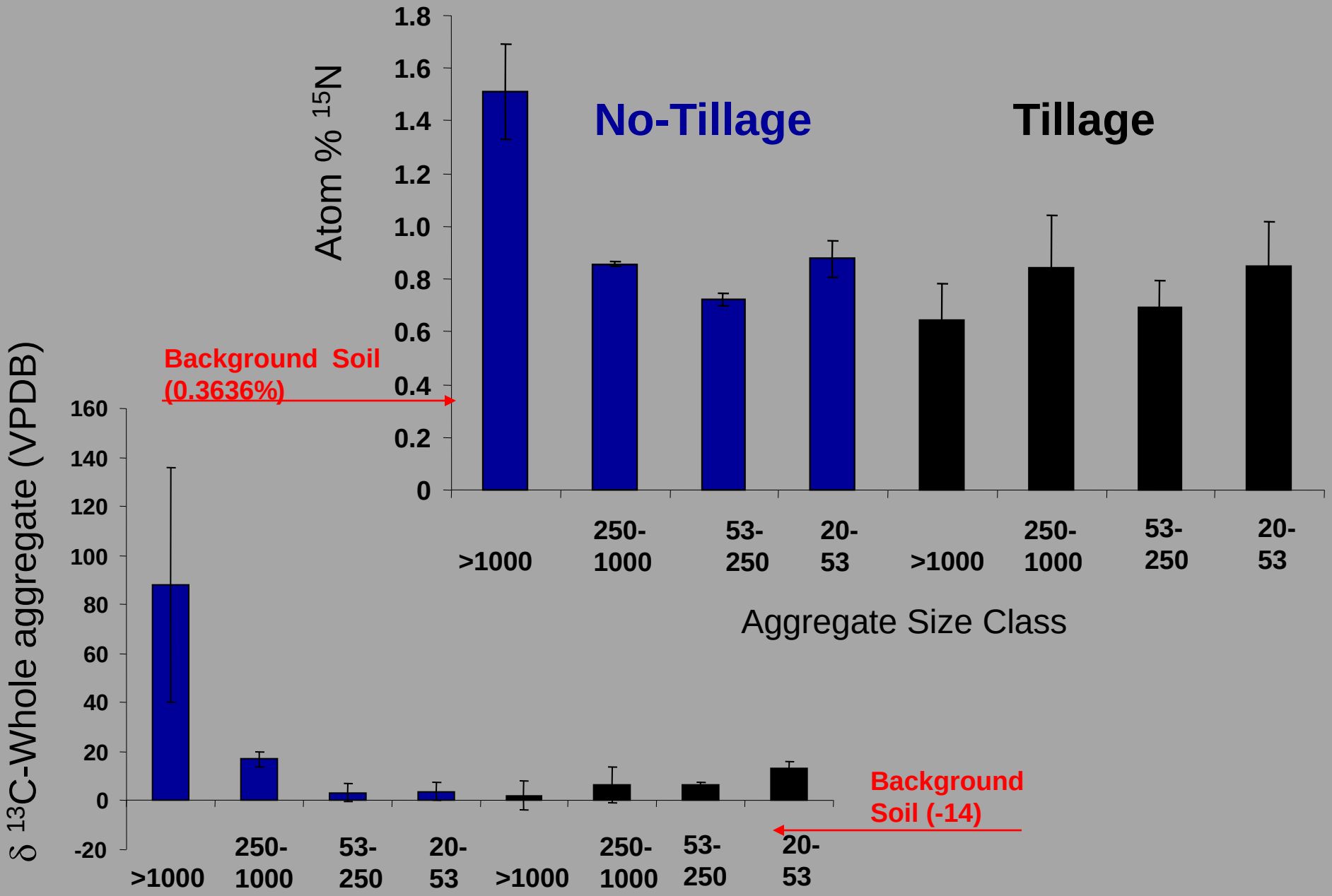
White and Rice, 2007

- Fungal Role (18:2w6 biomarker)
- Significant tillage X residue interaction ($p<0.05$)



Frey et al. (1999) found greater fungal networks optically in NT as compared to CT for the same soil.

White and Rice, 2007



White and Rice, 2007

Konza Ecosystems Experiment

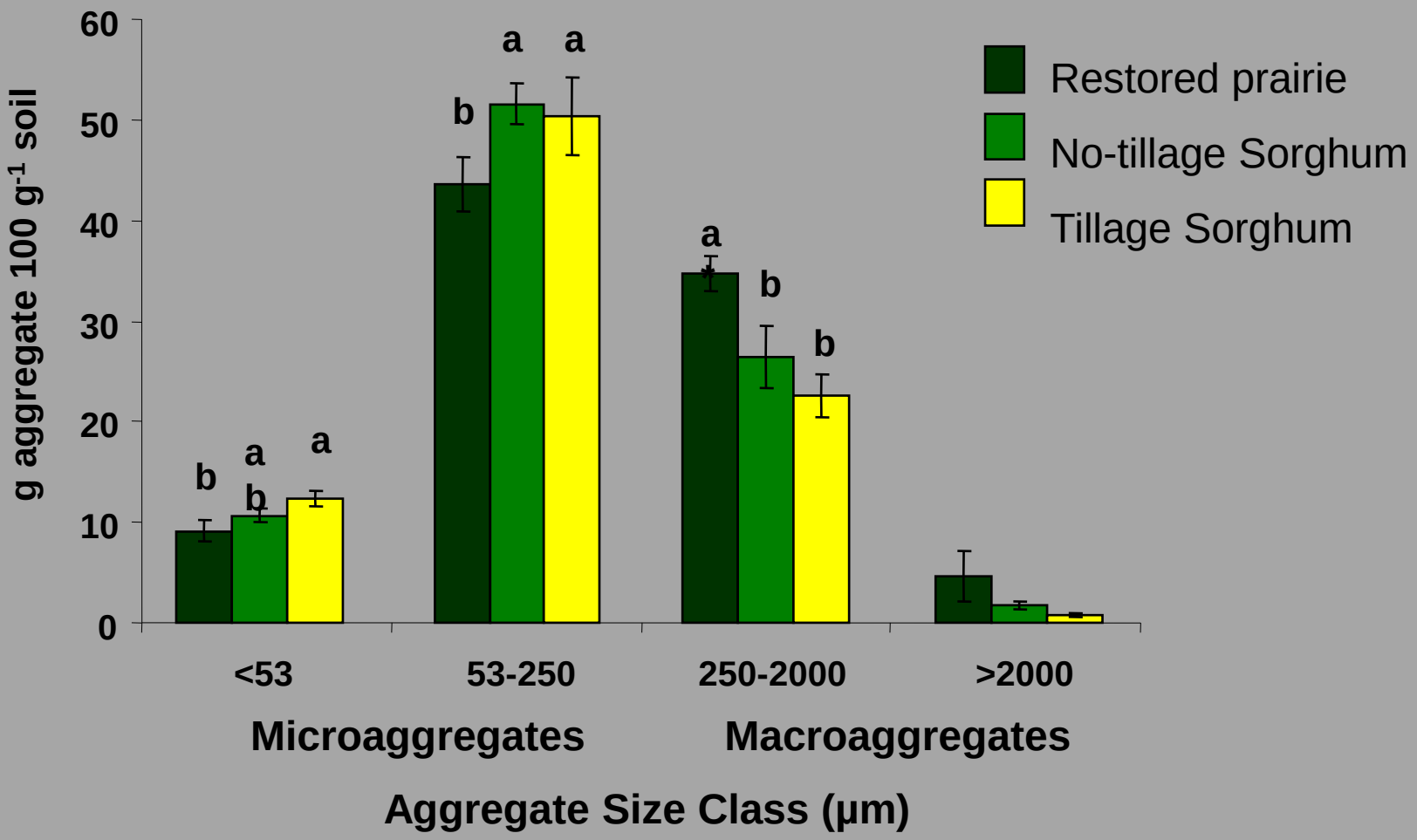
1. Tilled Grain Sorghum
2. No-Till Grain Sorghum
3. Native Warm Season Tallgrass Prairie

C_3 Soil $\delta^{13}C$ = -19.0 ‰ and C_4 plant $\delta^{13}C$ ~ -12 to -14‰

Monitor soil C turnover over time (Gregorich et al., 2005).

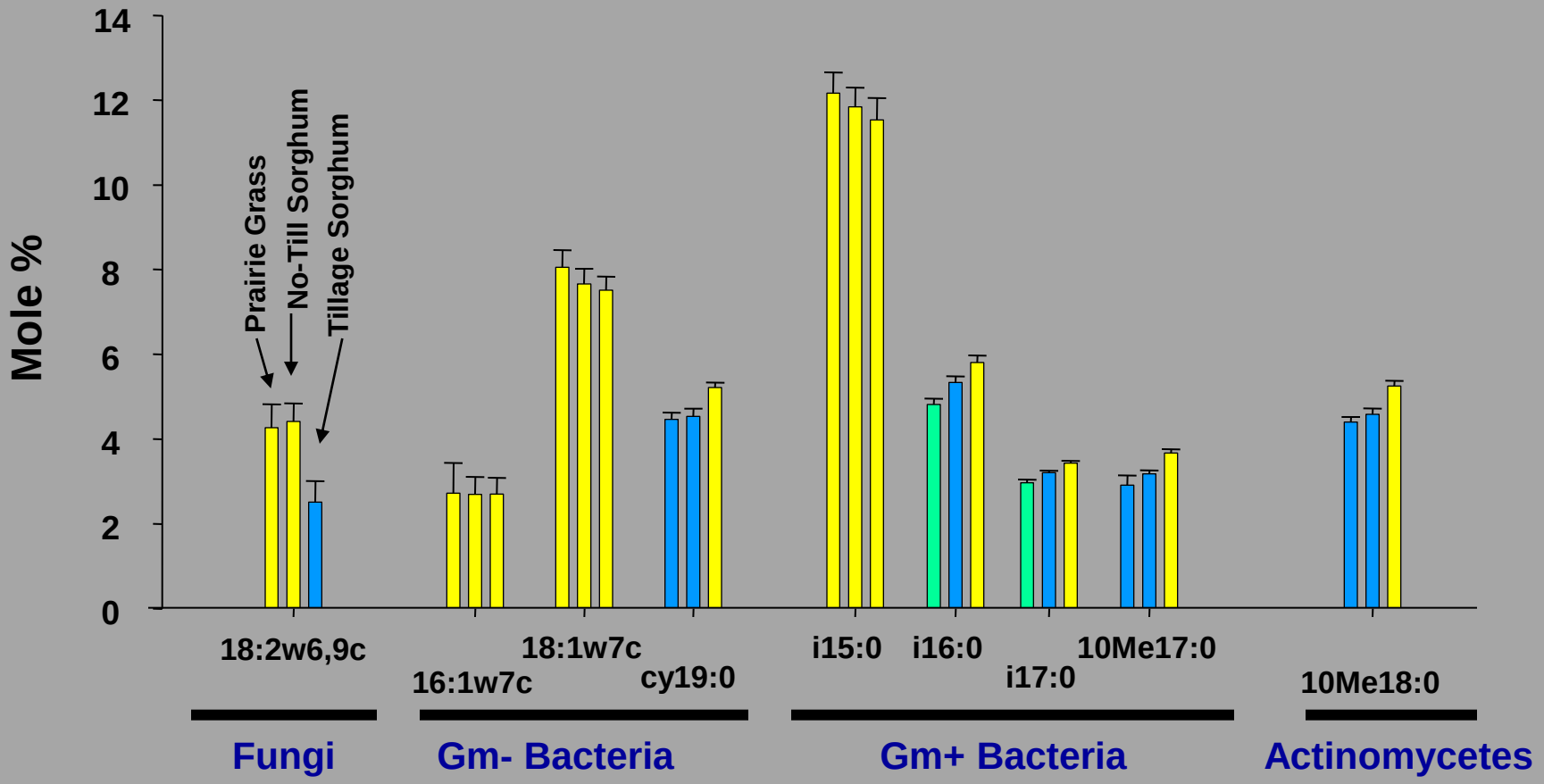
White and Rice, 2007

Soil Aggregation



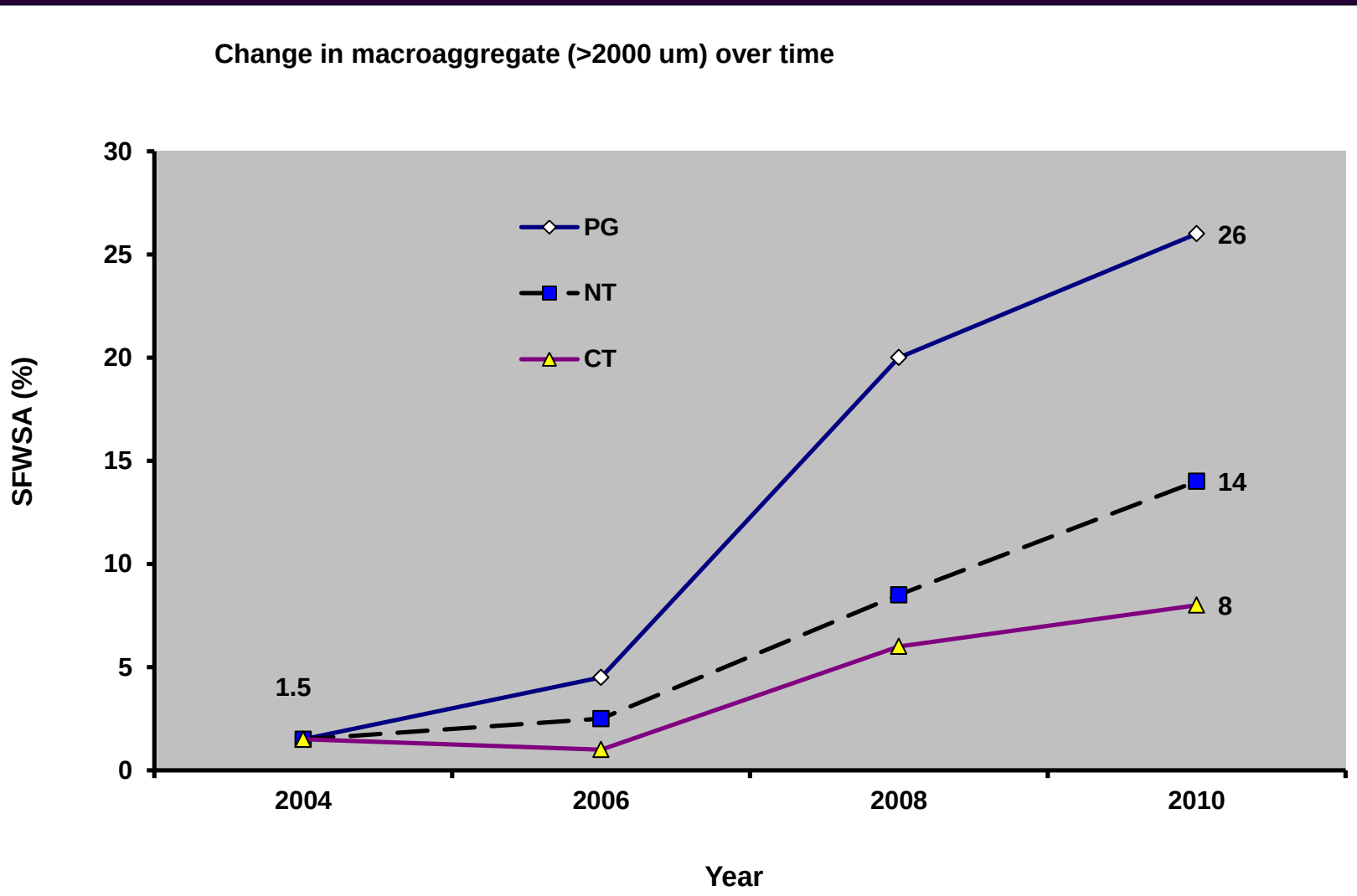
White and Rice, 2007

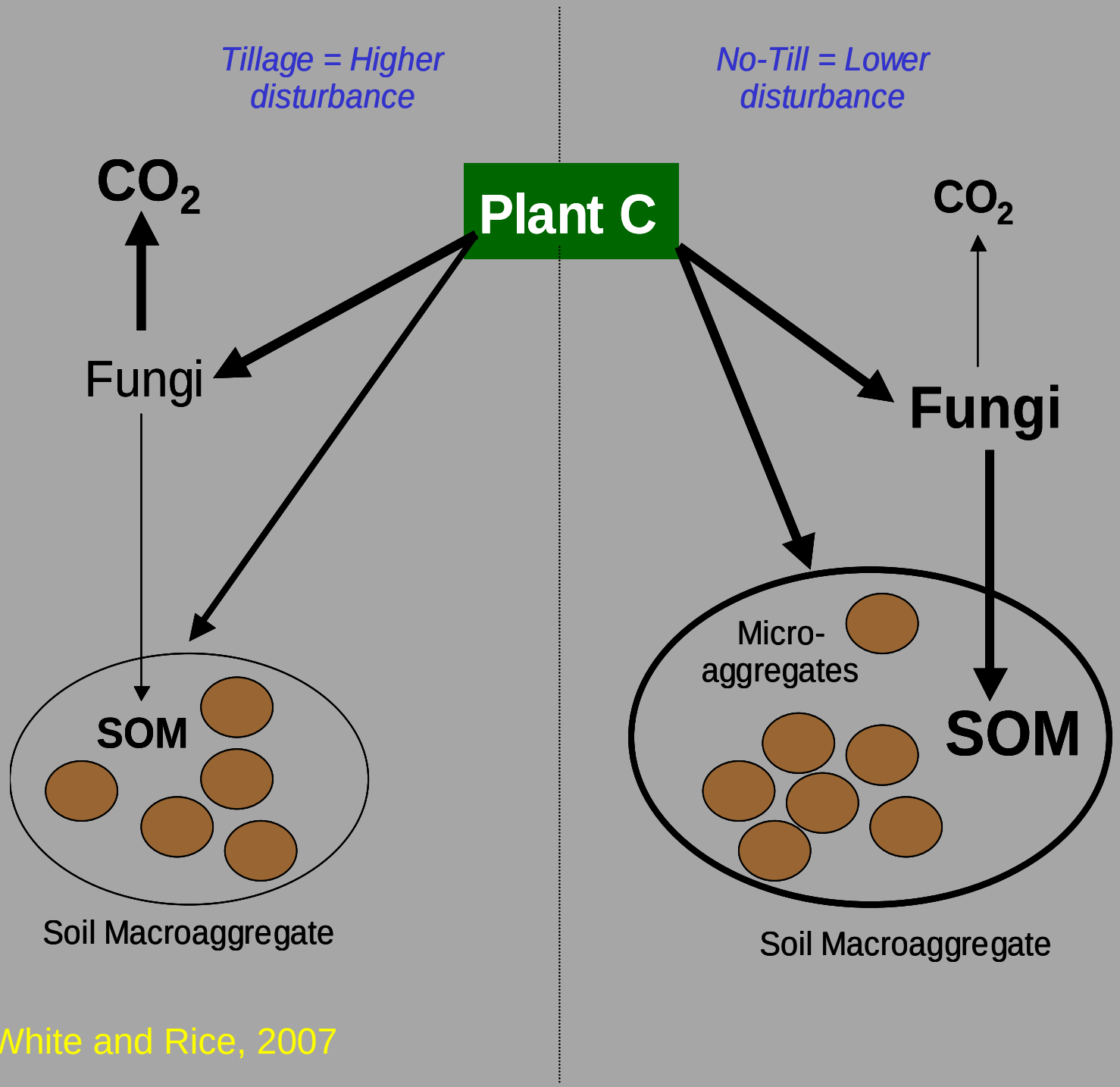
Microbial community - Phospholipid fatty acid levels (0-5 cm depth)



Bars of the same color for a given PLFA biomarker are not different ($p \leq 0.10$).
Lines are ± 1 standard error.

White and Rice, 2007


Change in macroaggregate (>2000 um) over time
SFWSA (%)
30
25
20
15
10
5
0
PG
NT
CT
26
14
8
1.5
2004
2006
2008
2010
Year



White and Rice, 2007

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