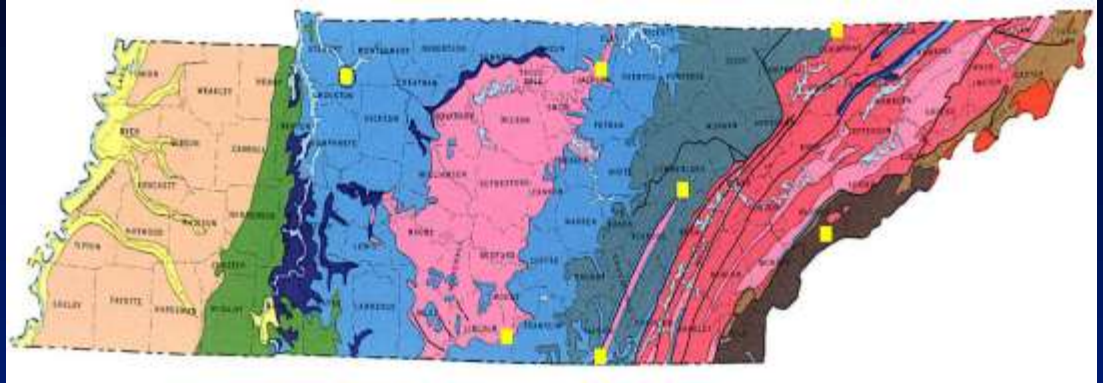


# Effect of Nitrogen, Cover Crops and Tillage on Population Sizes of Nitrogen- Cycling Bacteria Under a Long-term Continuous No-till Cotton Experiment in West Tennessee

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# Tennessee



Humid, temperate climate: 1200 mm rainfall, 180 to 220 frost free days.

Winter wheat, soybean, maize, cotton

Loess derived soils in west (very prone to erosion)

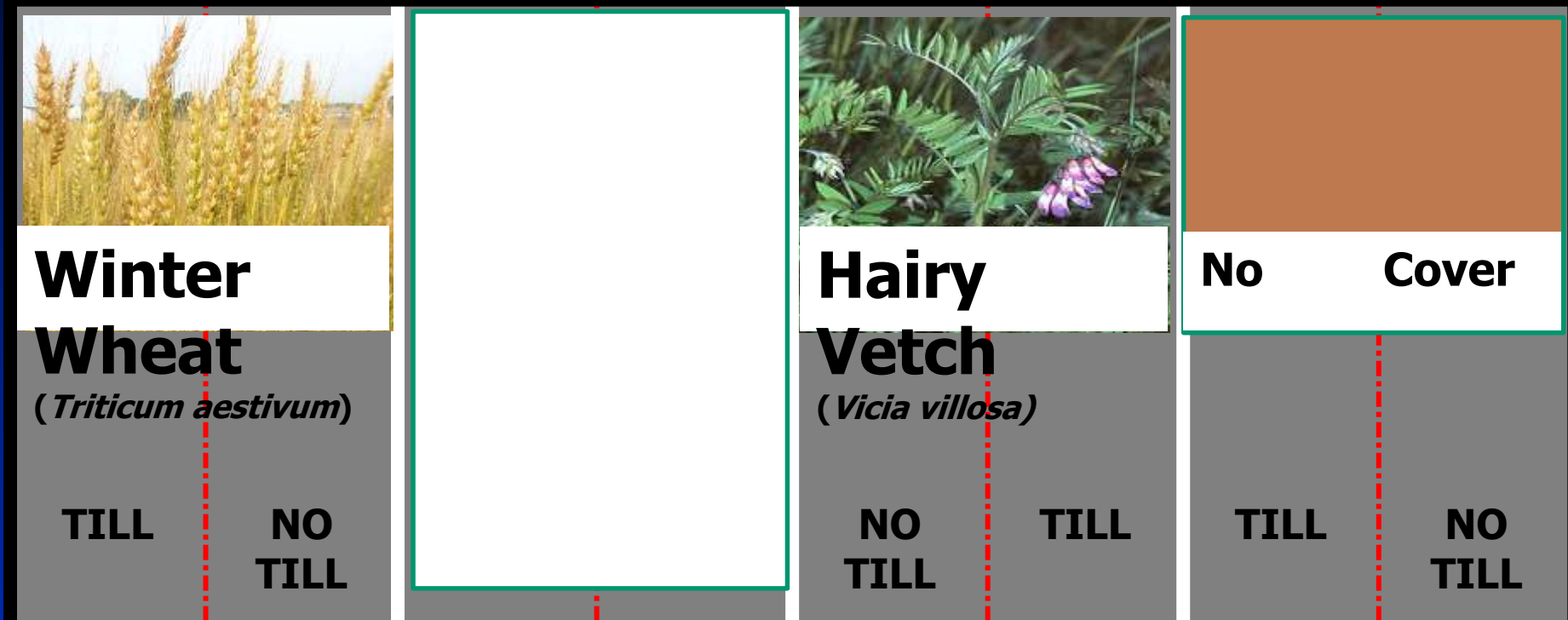
# Objectives

- Long term cotton x cover crop x nitrogen x no-till / tillage experiment, established 1981
- Determine the effect of tillage, cover crops and N fertilizer rates on N cycling microbial groups by measuring net N mineralization and net nitrification rates
- Assess microbial biomass carbon (C) dynamics during cotton growing season as affected by N fertilizer , cover cropping and tillage.



# Experimental setup since 1981 (32 yrs.)

## Treatment selection



- Two cover crop spp. (Hairy Vetch; Winter wheat)
- Three N-rates (0, 34, 101 N kg/ha)
- Till and NoTill

# Material and Methods

- **Study site:**
  - West Tennessee research and education center.
- **Soil Classification:**
  - Lexington silty loam (*fine-silty, mixed, thermic, Ultic hapludalf*)
- **Slope at the site:**
  - 2 %
- **Main crop:**
  - Cotton (*Gossypium hirsutum* .L)



- **Sampling:** (during 2013 cotton growing season)

$T_1$  – June ;  $T_2$  – July;  $T_3$  – September;  $T_4$  – October

- Sampling depth: 7.5 cm



# Material and Methods

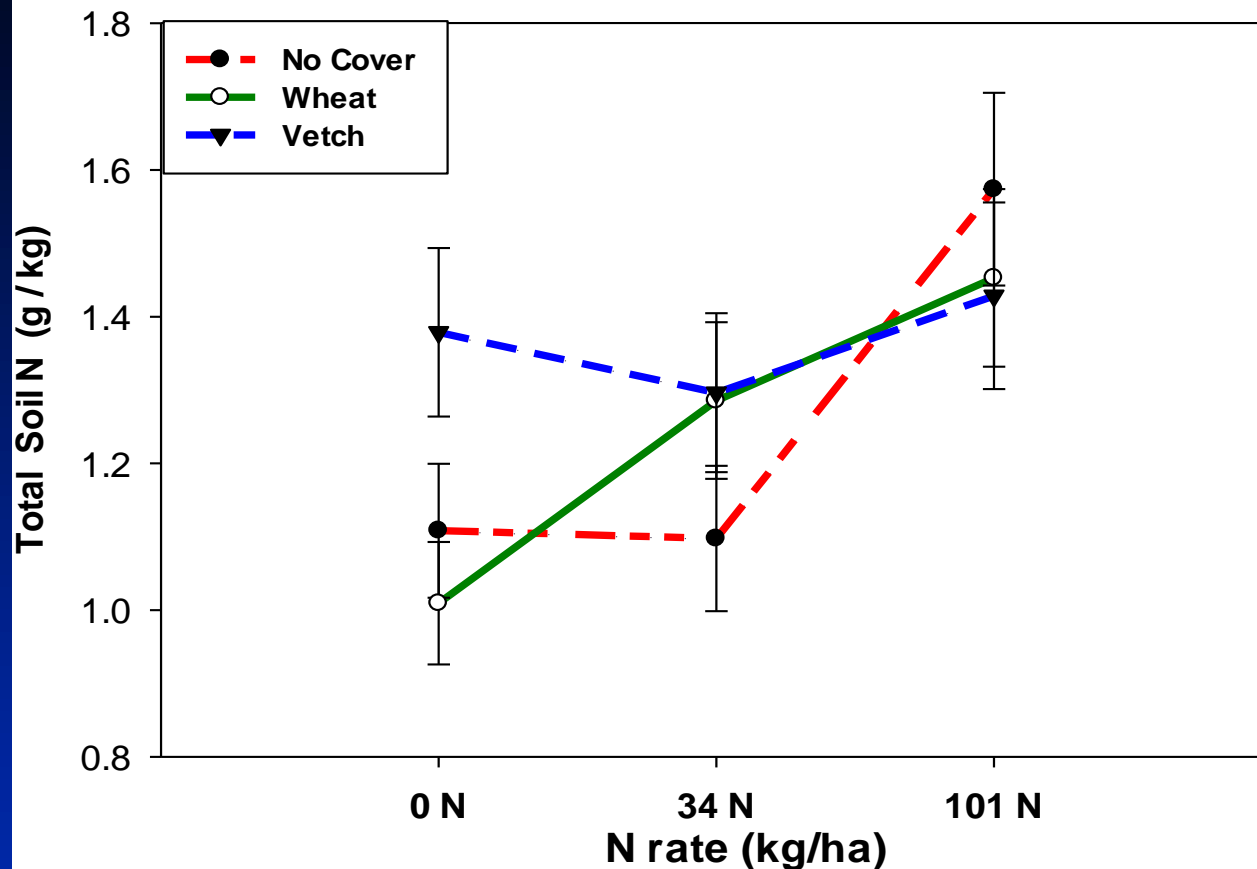
- **Net N mineralization and nitrification rate**
  - By: *In situ* resin core incubation (from Distefano, 1986)
- **Soil microbial biomass Carbon (SMBC):**
  - By Chloroform slurry extraction (Fierer and Schimel 2002)
- **Total soil N and Total soil carbon:**
  - By dry combustion

# Results: Soil Microbial Biomass

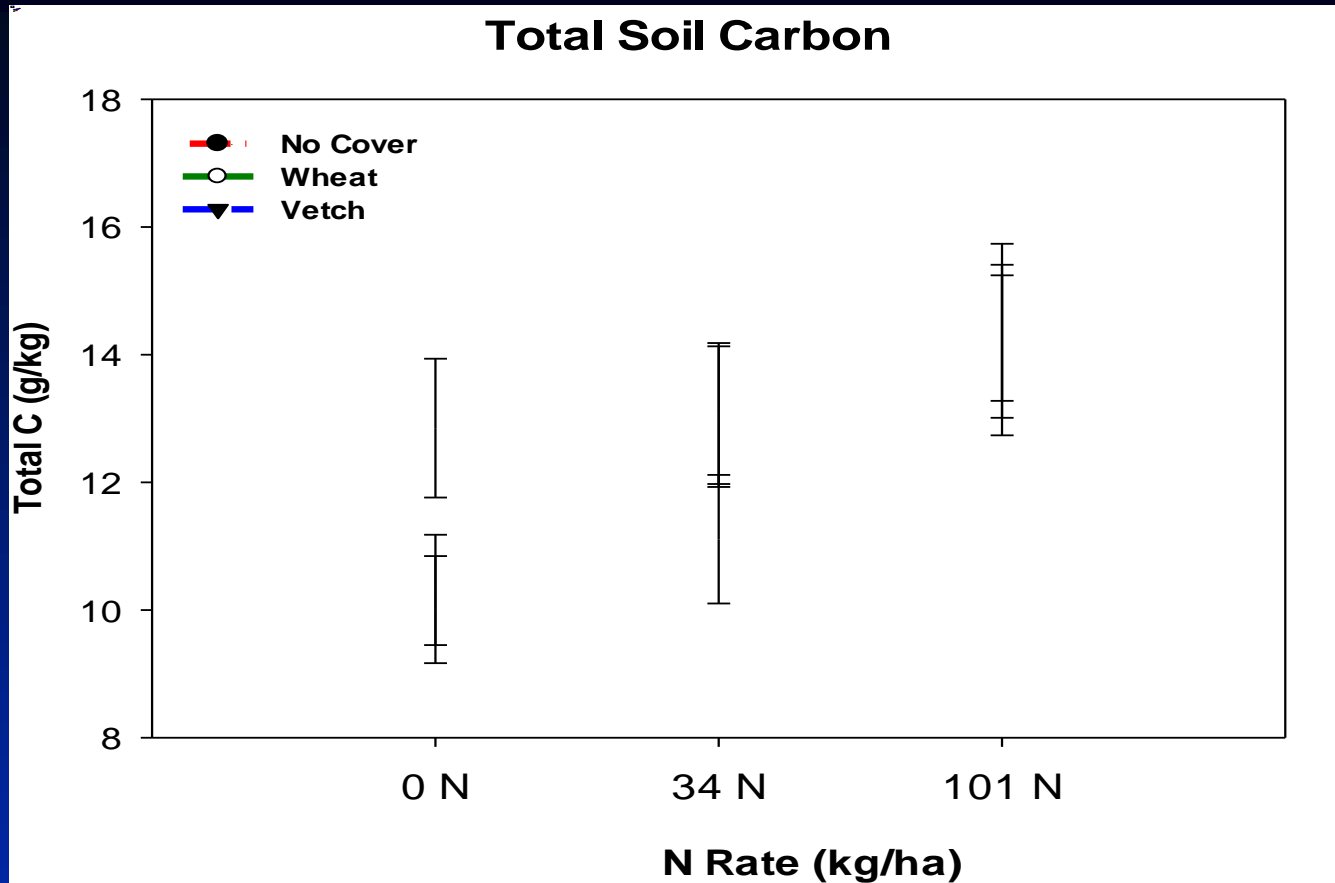
	SMB	SMB	SMB	SMB	SMB
			mg/kg soil		
	June	July	September	October	Seasonal
N Rate (kg N/ha)					
<b>0N</b>	87.95	72.51	115.67	107.52	95.91
<b>34N</b>	91.84	97.18	123.77	113.37	106.54
<b>101N</b>	111.74	125.53	108.35	111.90	114.38
Cover Crop					
<b>No Cover</b>	93.92	93.24	116.93	100.31	101.1
<b>Wheat</b>	82.99	98.79	105.36	108.74	98.97
<b>Vetch</b>	114.62	103.18	125.51	123.74	116.76
Tillage					
<b>No-till</b>	86.40	98.20	<b>142.61 a</b>	106.56	108.44
<b>Till</b>	107.96	98.61	<b>89.26 b</b>	115.30	102.78



## Total Soil Nitrogen

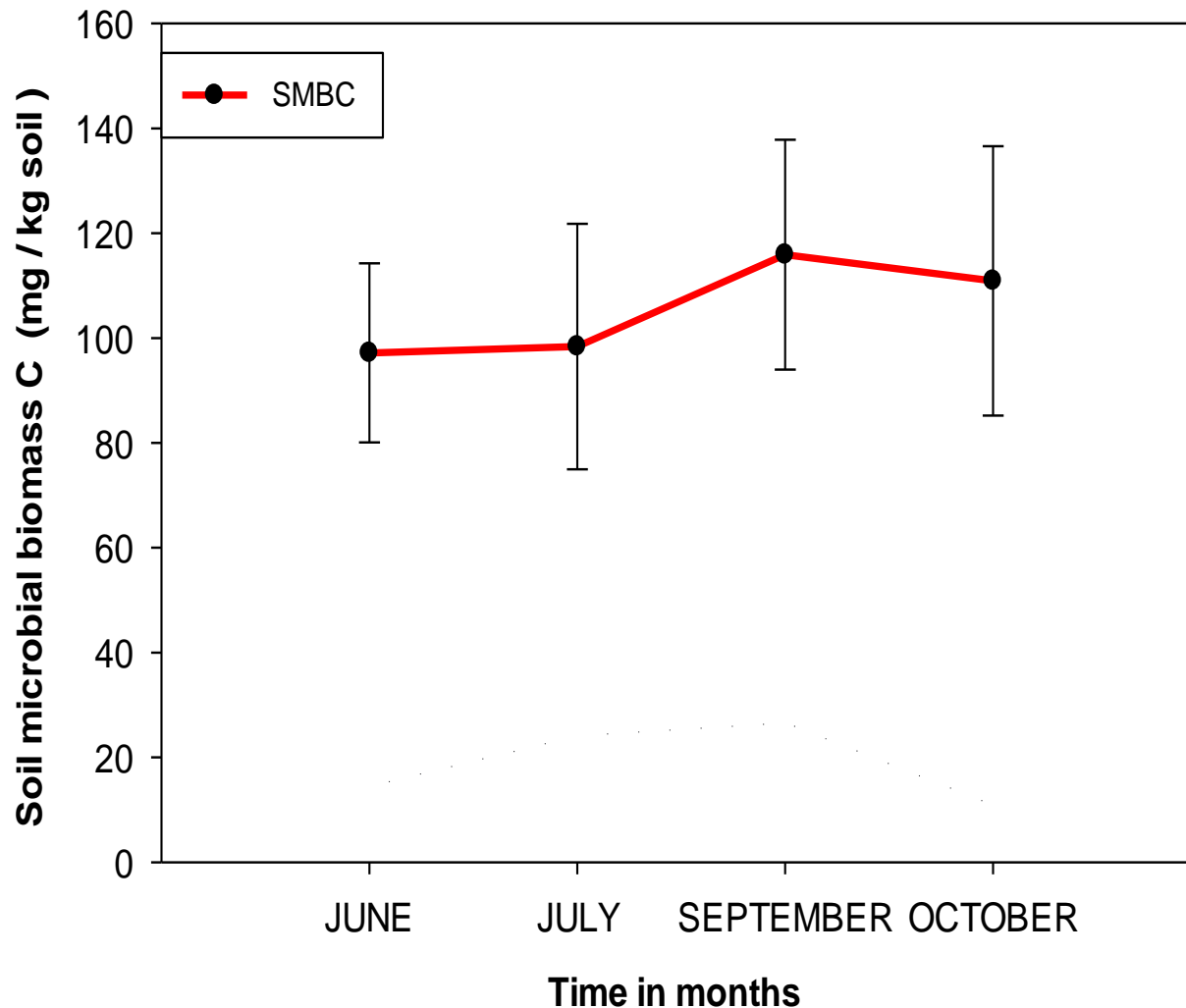


More C with legume (vetch) - unfertilized  
With N no difference with cover crops  
Soil N is fertilizer rate dependent



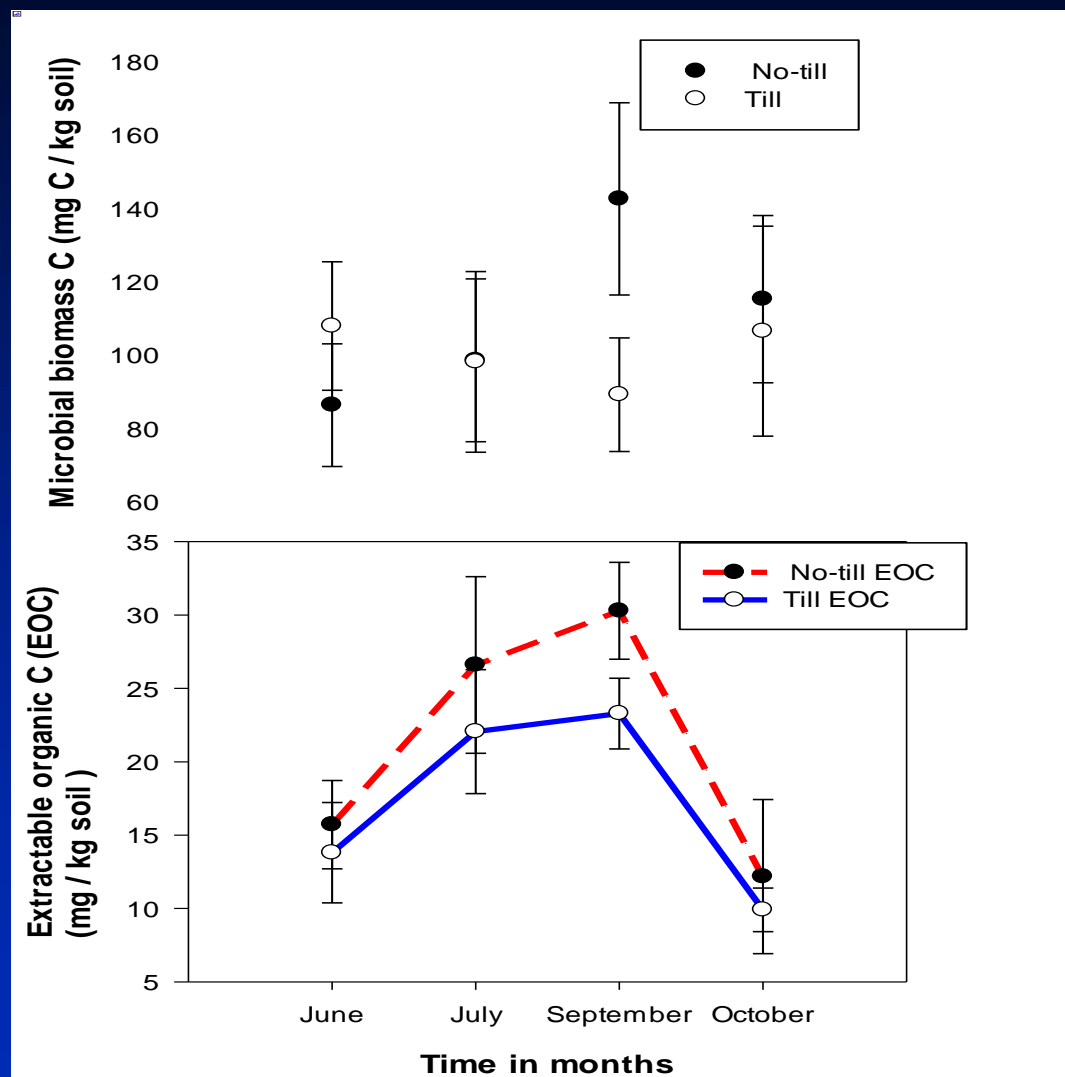
More C with unfertilized vetch than wheat or control  
C sequestered in wheat or control increases with N

# Microbial biomass C – during season

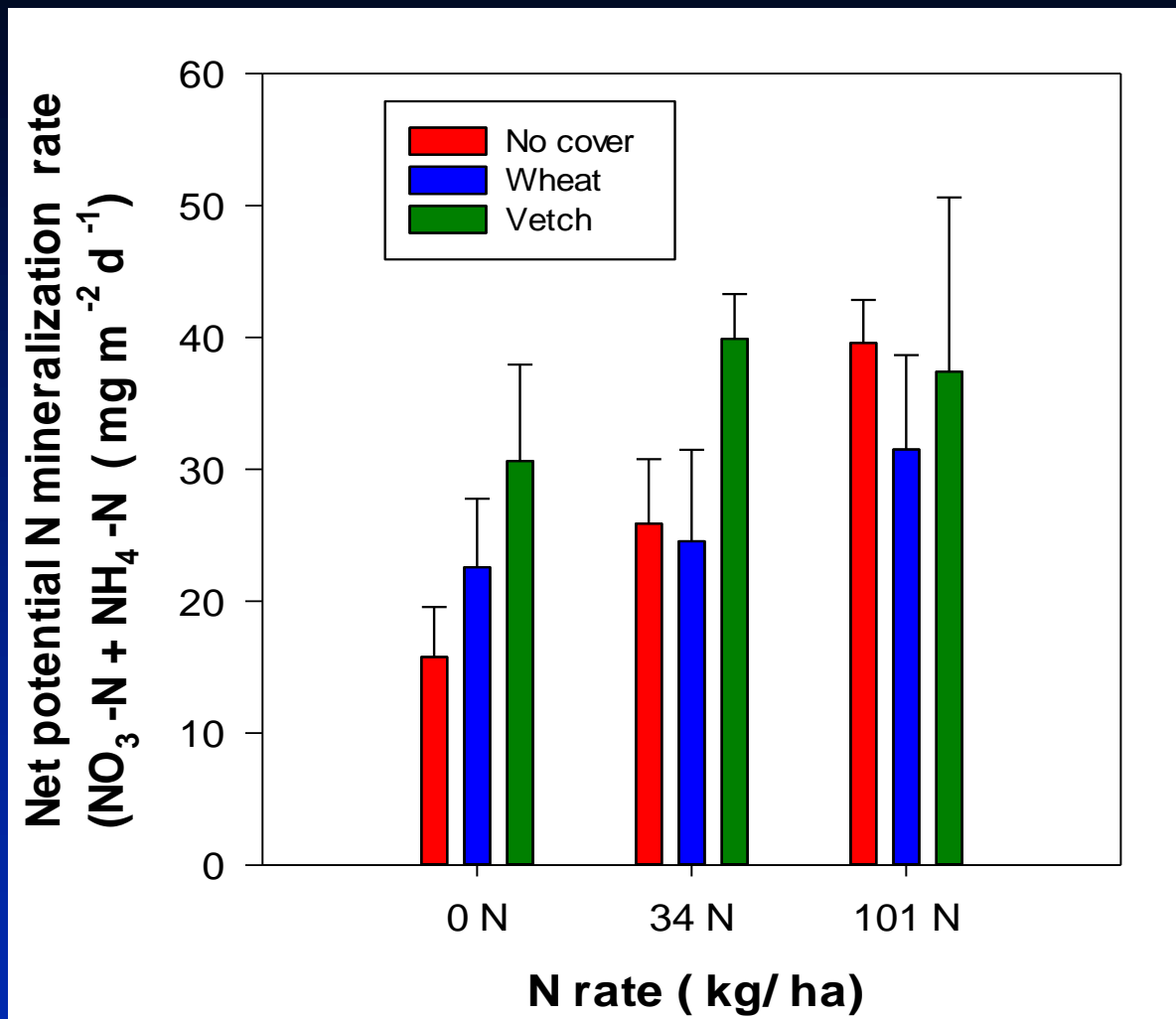


# Tillage and seasonal interaction effect on soil microbial biomass C

- Less biomass C and extractable organic C under tillage in September

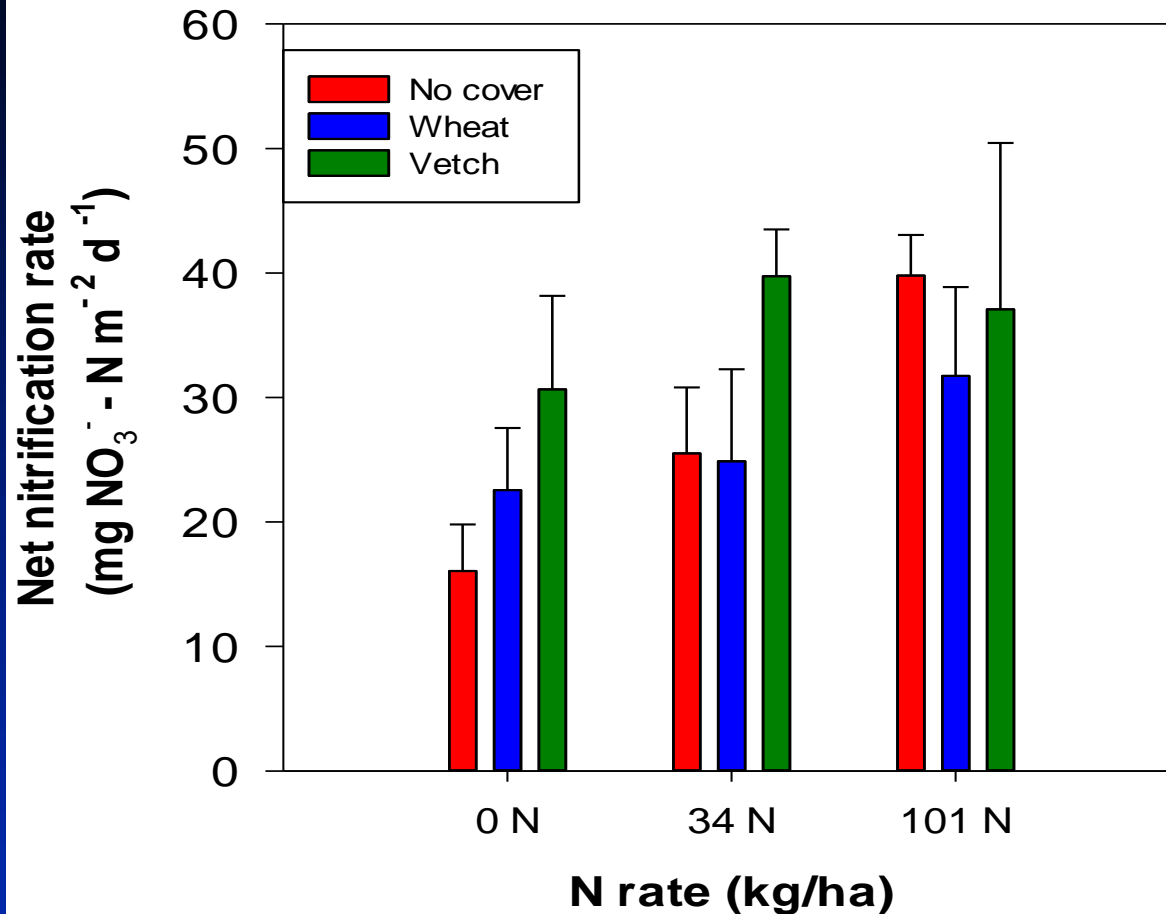


# Net N mineralization rate



Mineralization depends on the N rate and cover crop. No difference at highest N rate

# Net nitrification rate



More nitrification with vetch compared to no cover in unfertilized plots. No difference at highest N rate

# Conclusions

- Cotton is a low residue crop – very little residue remains over the winter months
- In unfertilized plots more biomass C and N under vetch compared to wheat or control
- Higher microbial biomass C under no-till in September – when crop is in most active growth stage. Otherwise no significant differences early or late season (June, July and October)
- More nitrification under vetch compared to control and lower N rate

# Thank you!







Thursday, July 24, 2014  
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