

Microbial Community Structure After Long-Term (33 Years) of Conservation Tillage under Continuous Cotton in West Tennessee

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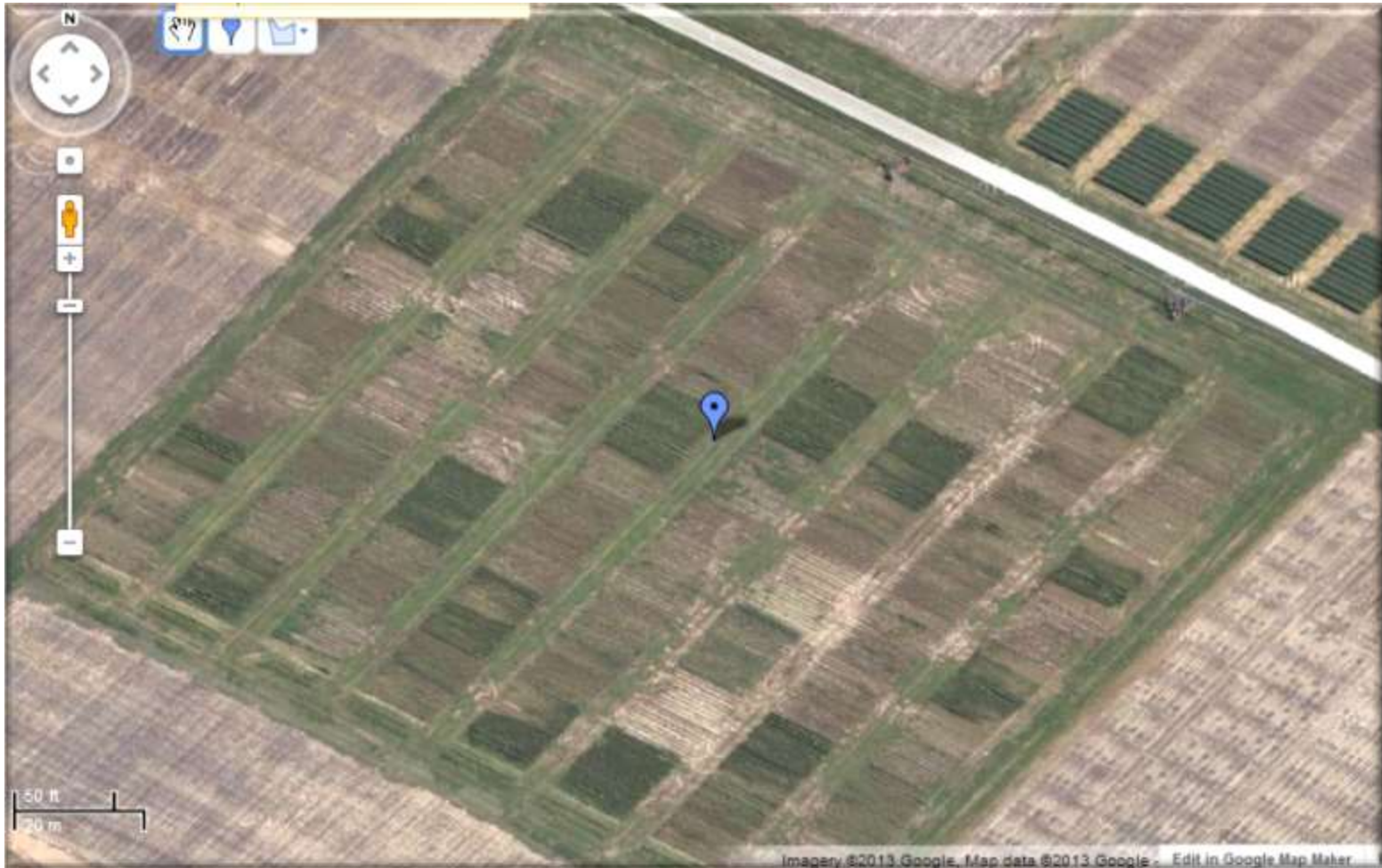
Objective

Compare microbial community structure, diversity, composition and activity under till and CA management systems

- Long term shifts
- Till-NT
- Cover crop species
- Various nitrogen regimes

} Interactions

MATERIALS AND METHODS

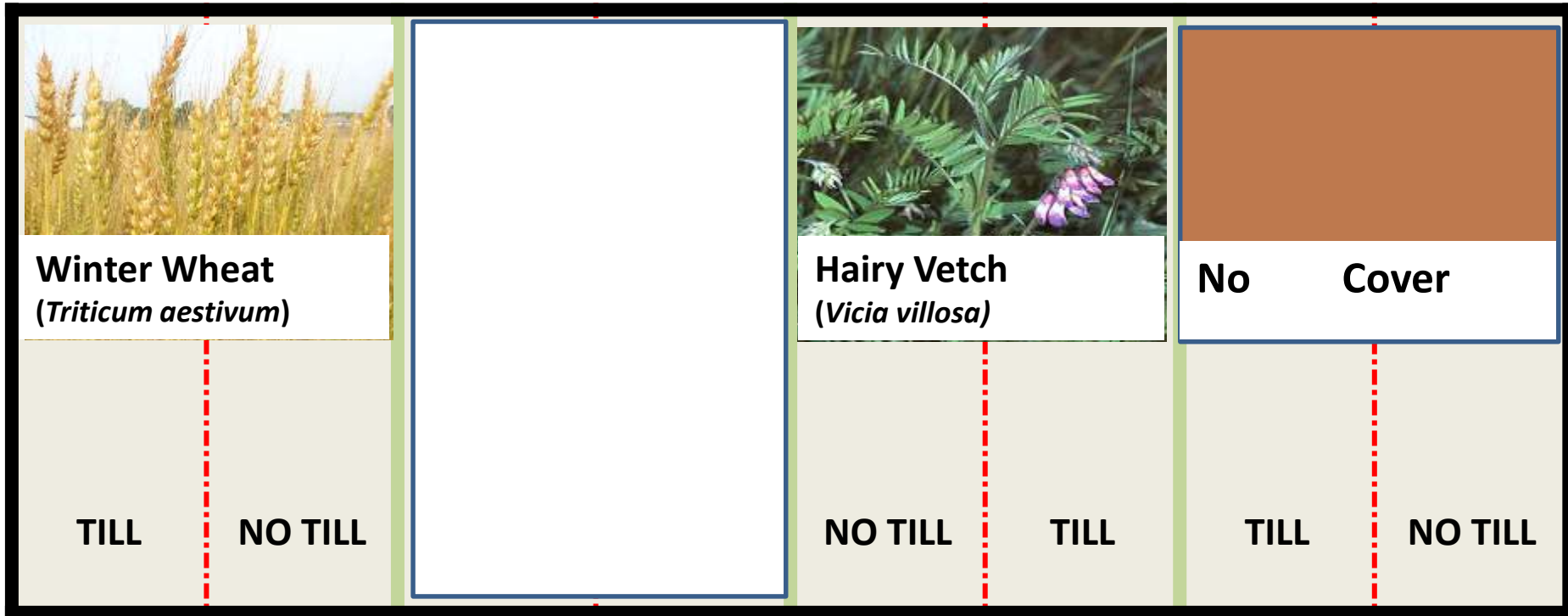


Project site: West Tennessee Research and Education Center (WTREC) Jackson, Tennessee

Soils: Lexington silt loam (fine-silty, mixed, thermic, Ultic Hapludalf)

Experiment initiated in 1981

Treatment selection



- Two cover crop spp. (Hairy Vetch; Winter wheat)
- Four N-rates (0, 34, 67, 101 N kg/ha)
- Till and NoTill

Microbial Characterization

MICROBIAL BIOMASS C AND N

**Microbial
Community
pool**

Total Fatty acid methyl Ester
(FAME)

**Fungal
Populations**
(Sapro, arbuscular
mycorrhiza fungi (AMF))

**Bacterial
Populations**
(G+, G-, actino)

**Community
Structure**

Basal microbial respiration

**Microbial
Activity**

Enzyme assays
Acid phosphatase,
 β -glucosidase and
 β -glucosaminidase

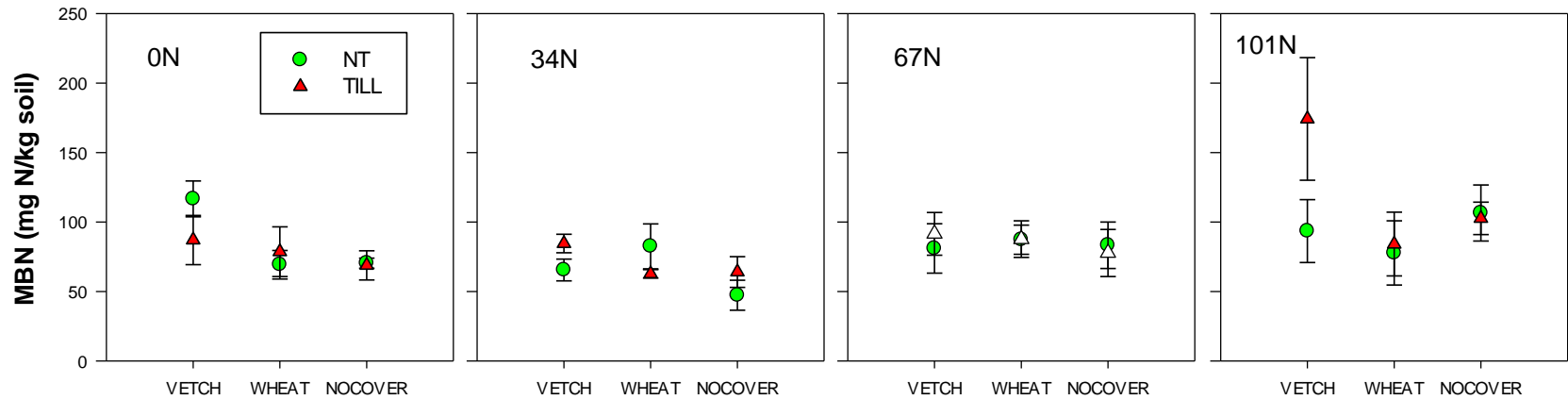
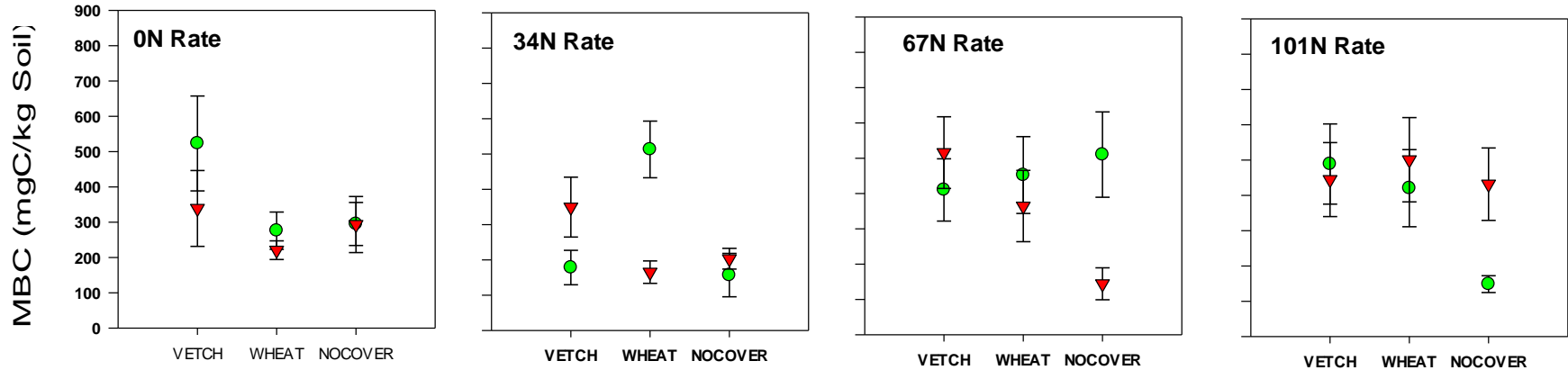
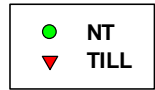
TC; TN; pH; bulk density

**Soil physicochemical
properties**

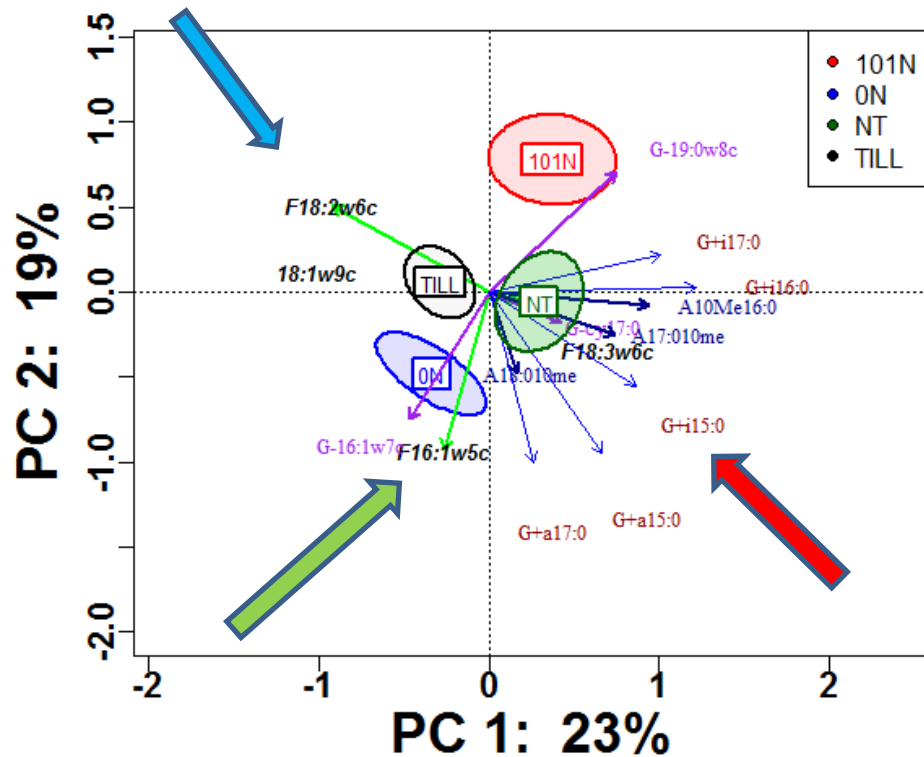
Extractable P, K, Ca and Mg

Microbial biomass C and N

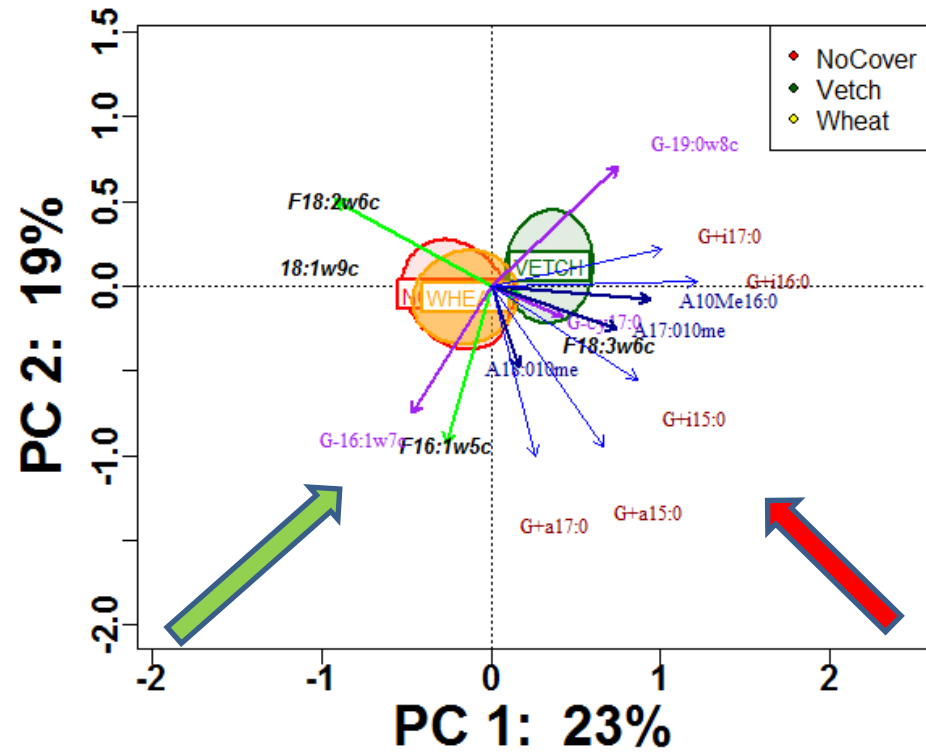
MICROBIAL BIOMASS JUNE



NITROGEN AND TILLAGE EFFECT



COVERCROP EFFECT

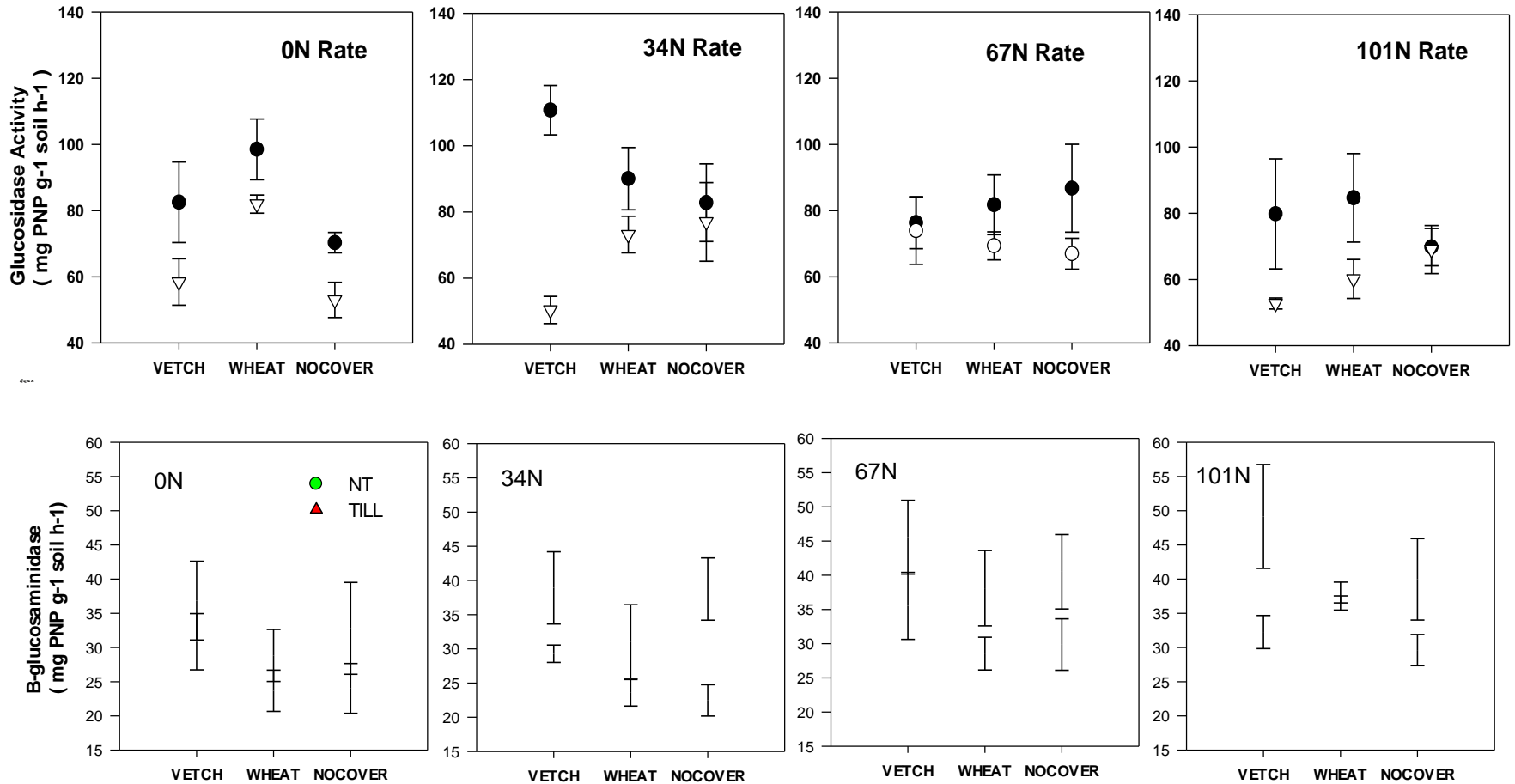


→ Gram + ; Actinomycetes and AMF) higher under NoTill and Vetch

→ Saprophytic fungi
Fungi: bacteria ratio higher under Till than NT

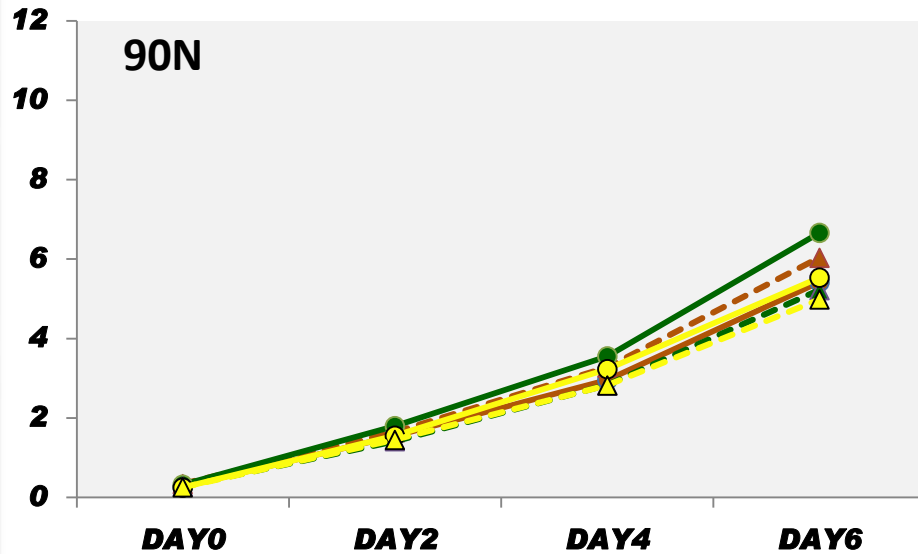
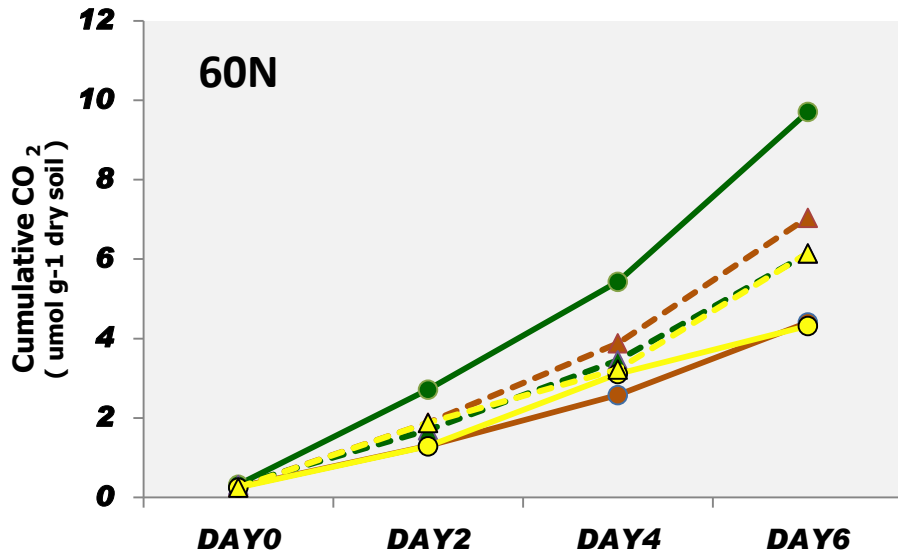
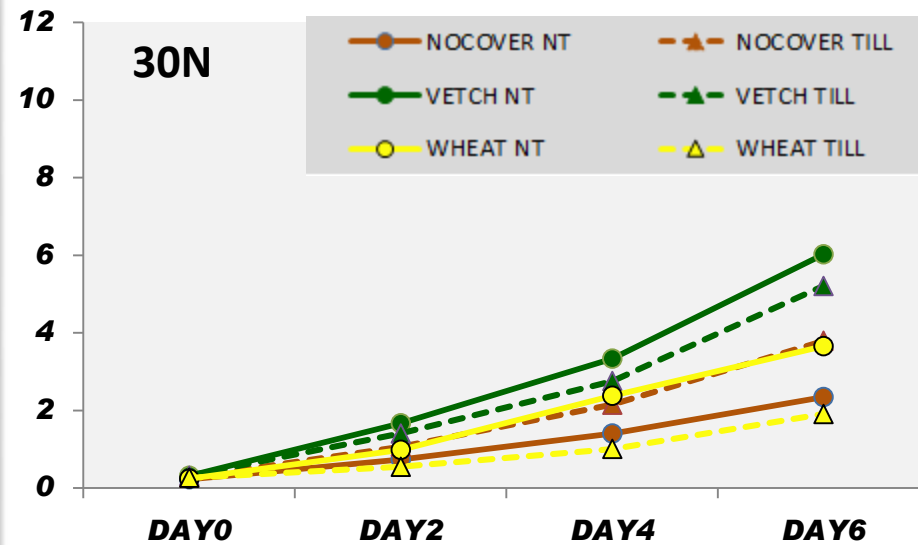
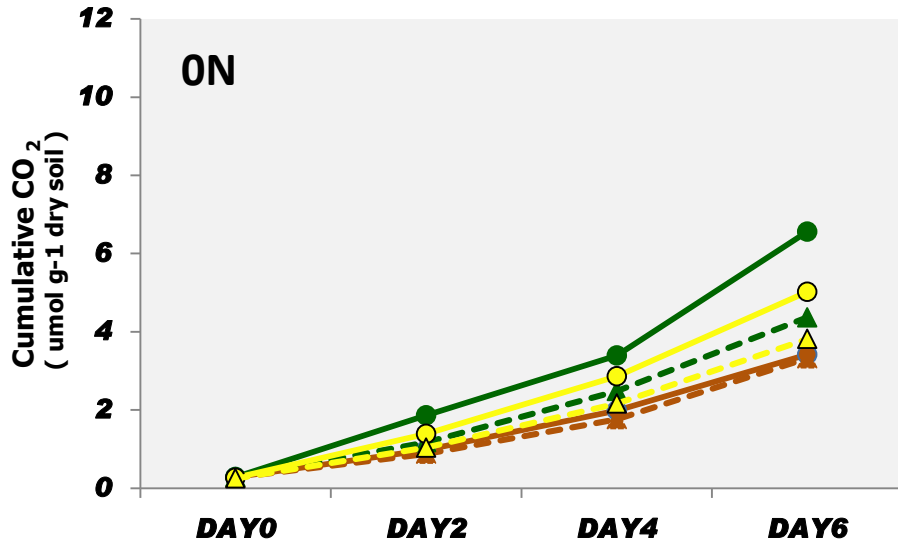
→ Mycorrhiza fungi decrease with increase in N and under vetch

Enzyme Activity

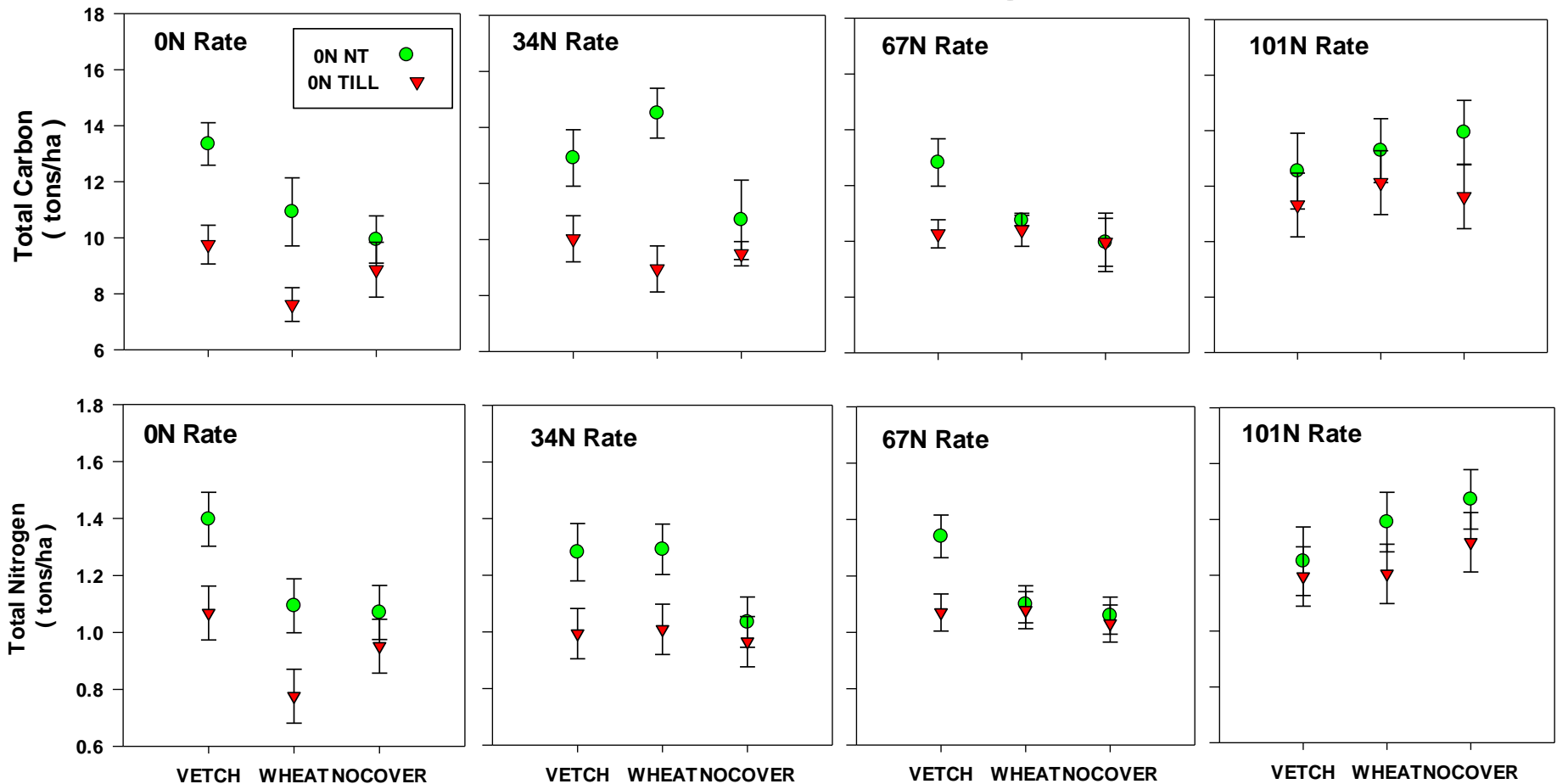


Generally Higher Enzyme activity under NT than TILL
-Nrate and vetch cover effect with the N-cycling enzyme (

Basal Microbial Respiration



Total Carbon and Nitrogen

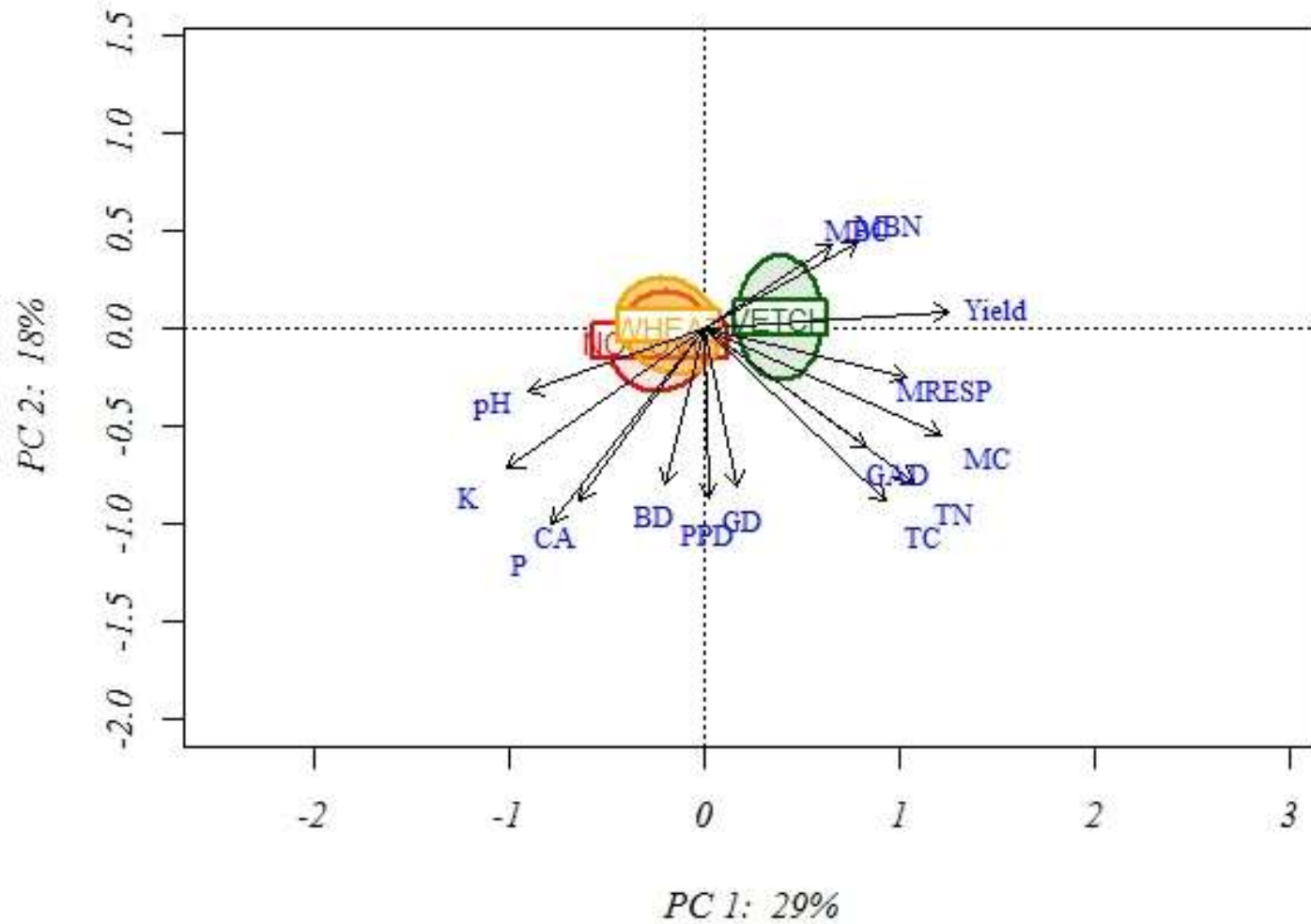


Higher Total C and N under NT and under cover crop treatments

Total C and N highest at the high N-rate (101 N) regardless of cover or tillage treatment

Total C and N under vetch constantly high regardless of N-rate while wheat and No-cover respond to N-fertilization

COVER CROP EFFECT



Conclusions

Shifts in microbial community structure drive changes in soil quality factors under cotton cropping after 33 years

- Microbial structure
 - Higher relative abundance of bacteria and mycorrhiza fungi under NT and vetch cover crop
 - Saprophytic Fungi: higher relative abundance under till probably because of the interaction of stress factors
- Higher microbial activity under NT than till
- Higher total C and N ratio under NT and cover crop
- Substrate quality and quantity impact microbial structure, diversity, composition and activity