
Establishment of an Organic Apple Orchard

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Program Overview

Goals of Research Program

- To develop sustainable and organic production systems for AR (and region) producers to capture high value markets
- Small scale, or scale neutral technologies

Sustainable and Organic Production of Fruits

- Project is a result of the Southern Organic Fruit Initiative/Working Group
 - SR-SARE Project LS05-176: *Best Management Practices for Ground Cover and Nutrient Management in Establishment of Organic Apples for the Southern Region*



Objective

Project Goals:

- Develop best management practices for establishment of sustainable organic apple orchard for the south

Project Objectives:

- Evaluate tree and soil response to:
 - Organic Ground Cover Management System
 - Organic Nutrient Sources



Experimental Protocol

- Experimental design:
 - Factorial Experiment
 - Ground Cover (4 trts) x Nutrient source (3trts)
 - $4 \times 3 = 12$ total treatment combinations
 - 6 replications
 - Random Complete Block Design (Ground cover); block by row
 - Split Plot Design (Nutrient source)



Treatments

Ground Cover

1. Mow-n-blow (MB)
2. Paper (SP)
3. Woodchip (WC)
4. Municipal green compost (GC)

Nutrient Sources

1. Untreated control (nutrients derived from GC) (NF)
2. Composted manure (poultry litter) (PL)
3. Commercial Organic Fertilizer (poultry based) (CF)



Planting Design

- Orchard spacing
 - Distance between rows: 2m
 - Distance between trees: 4m
- Plot Size
 - Consisted of 3 trees; center tree was designated experimental unit for treatment data collection
 - Total of 36 trees per block; 72m plot length
- Guard rows were planted on each side of the orchard
- Guard trees were planted at the end of each plot



Plant Material and Management

- Cultivar: Enterprise
- Rootstock: M.26
- Tree numbers:
 - 3 sample trees per treatment subplot
 - 36 trees per plot
 - 324 trees total
- Tree training: Vertical axis
- Tree support: 2 wire trellis system with vertical tree supports
- Management: Certified Organic
 - Land Prepared: 2005
 - Trees Planted: 2006
 - Treatments employed at planting
- Ground Cover; fescue (K-31)



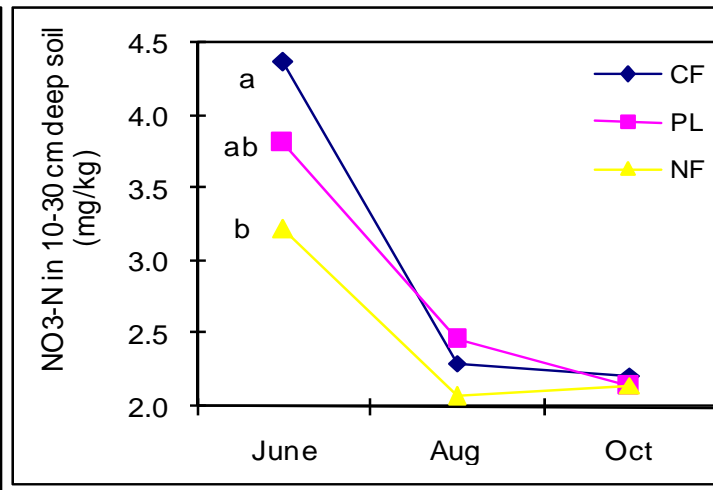
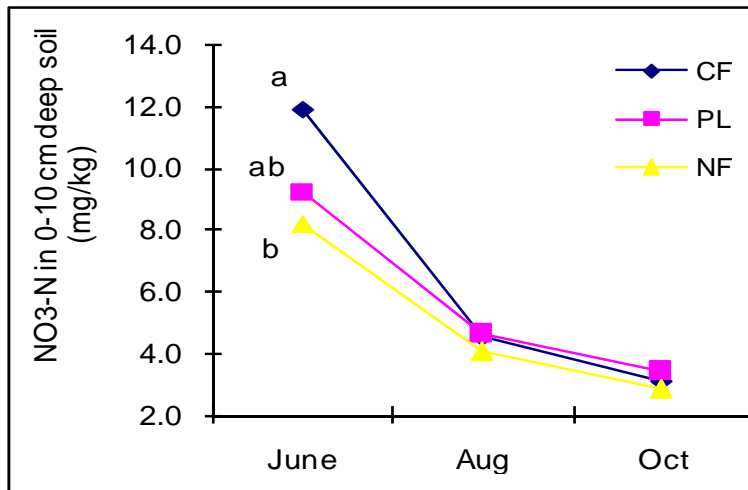
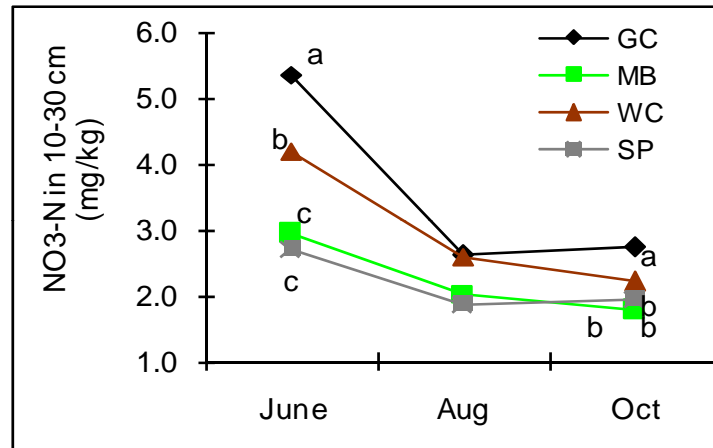
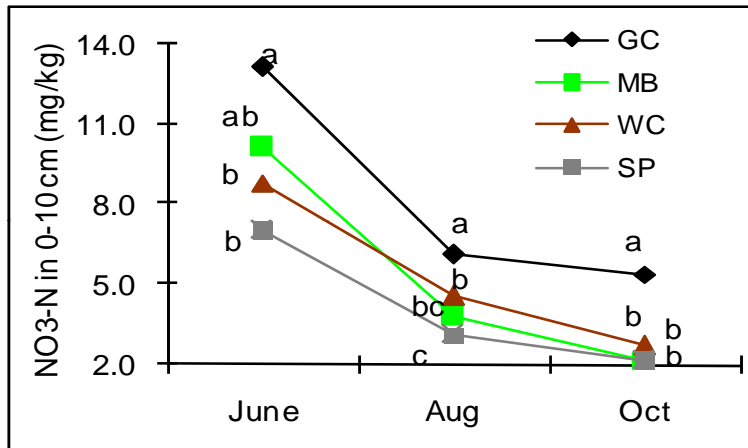
Summary Comments

- Ground cover effects more pronounced during establishment than nutrient source
- Nutrient source effects apparent in both soil and foliar nutrient level, and soil chemistry
- No significant nutrient effect on tree growth



Soil NO₃-N

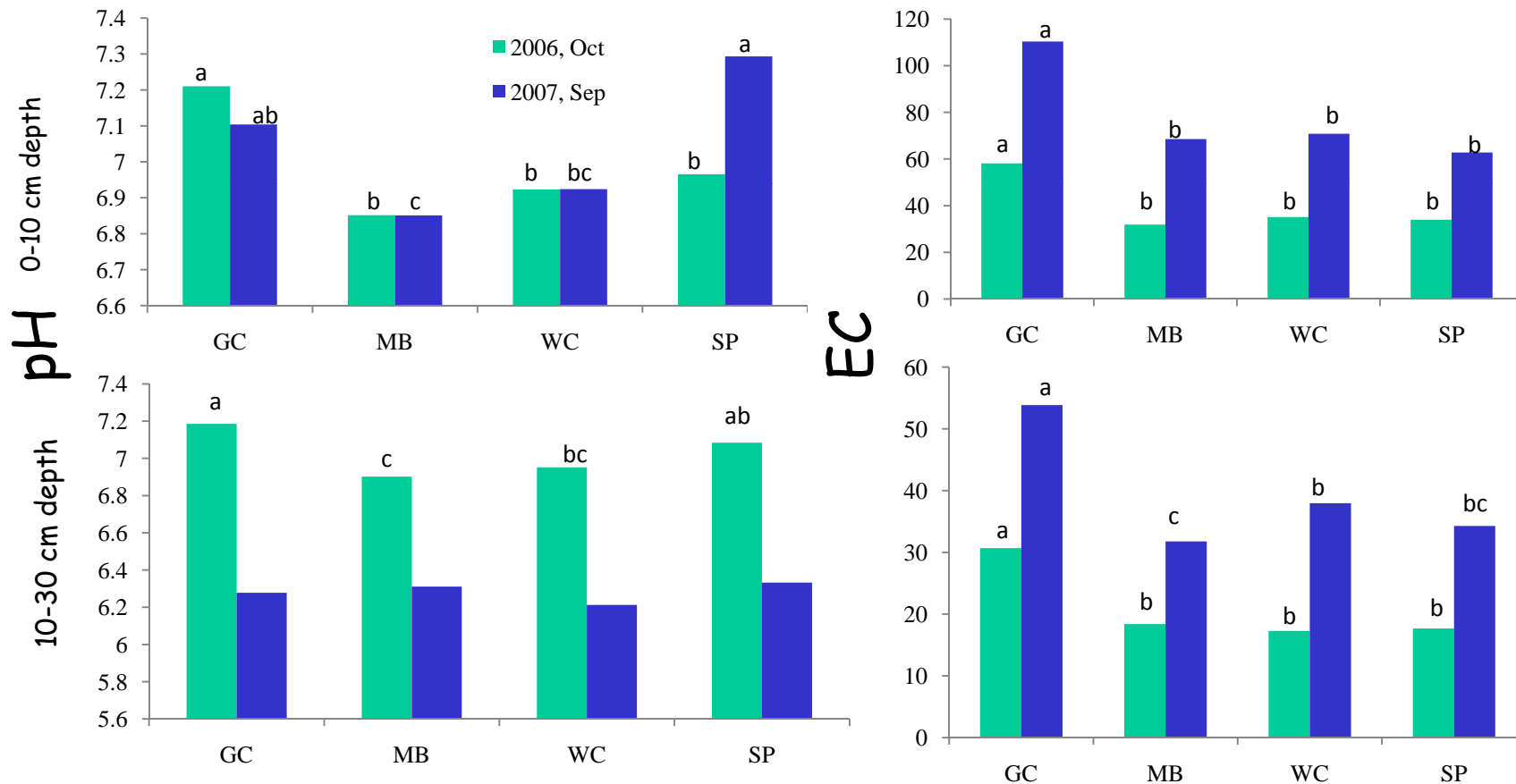
0-10 cm depth



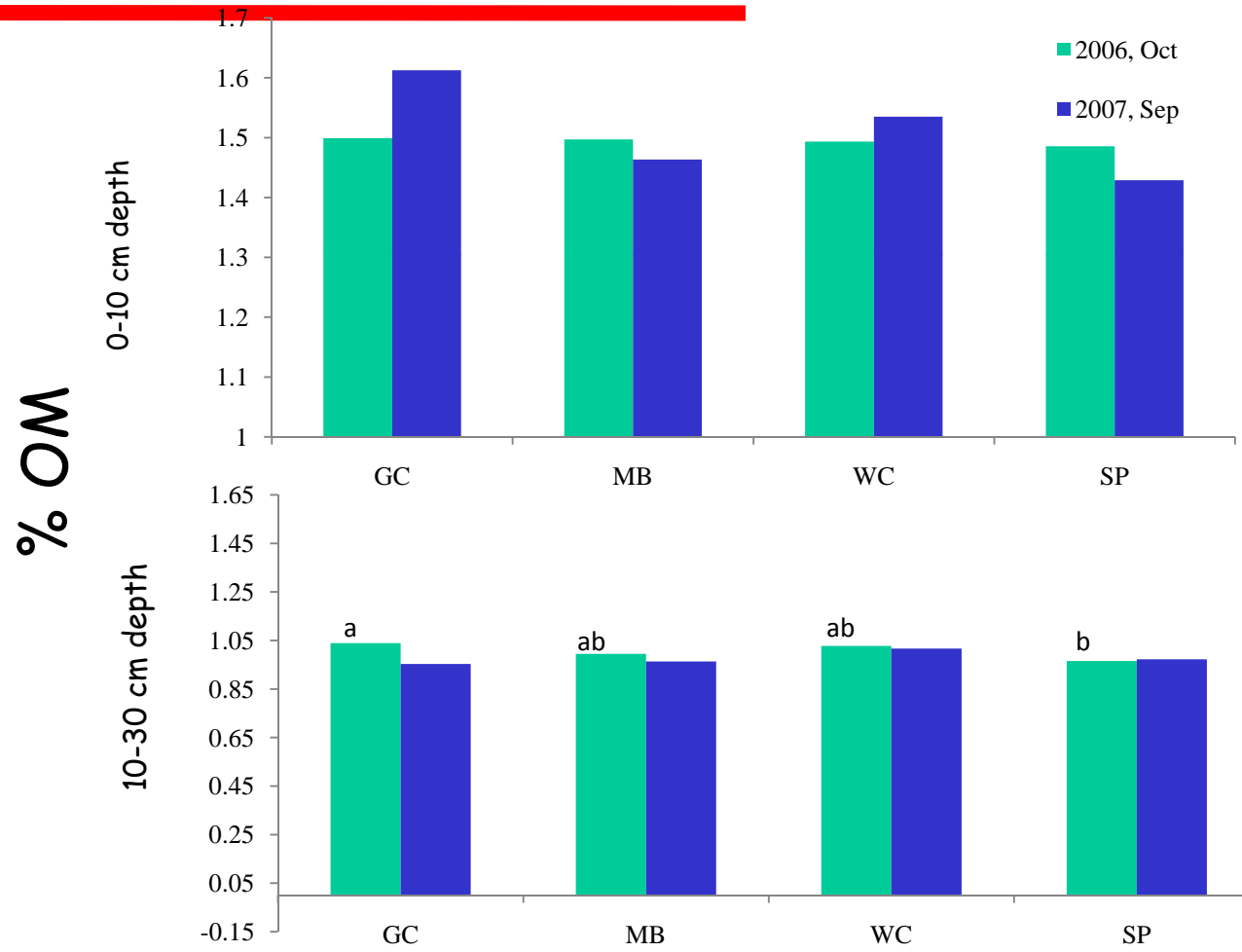
10-30 cm depth



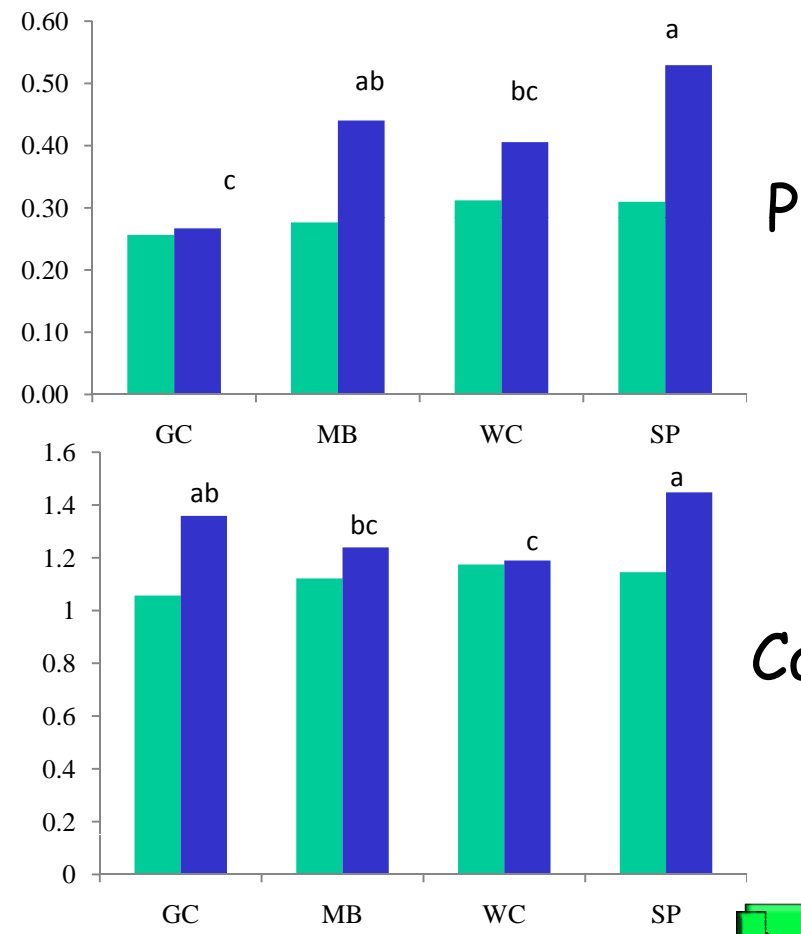
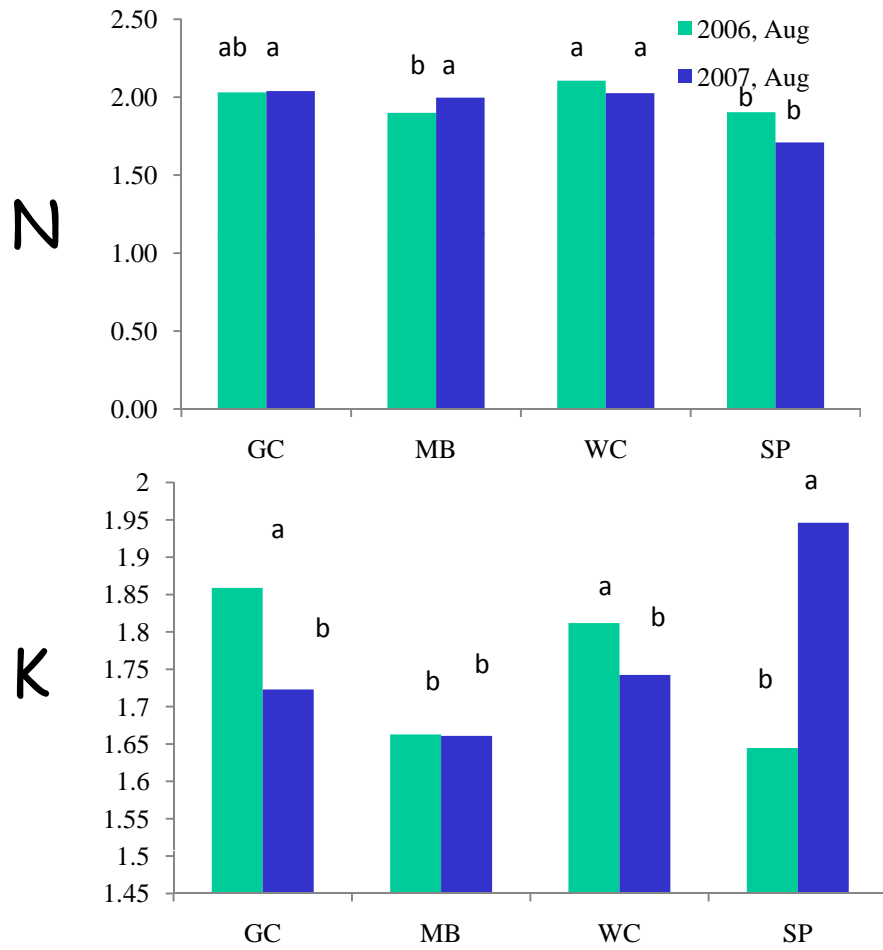
Soil pH and EC



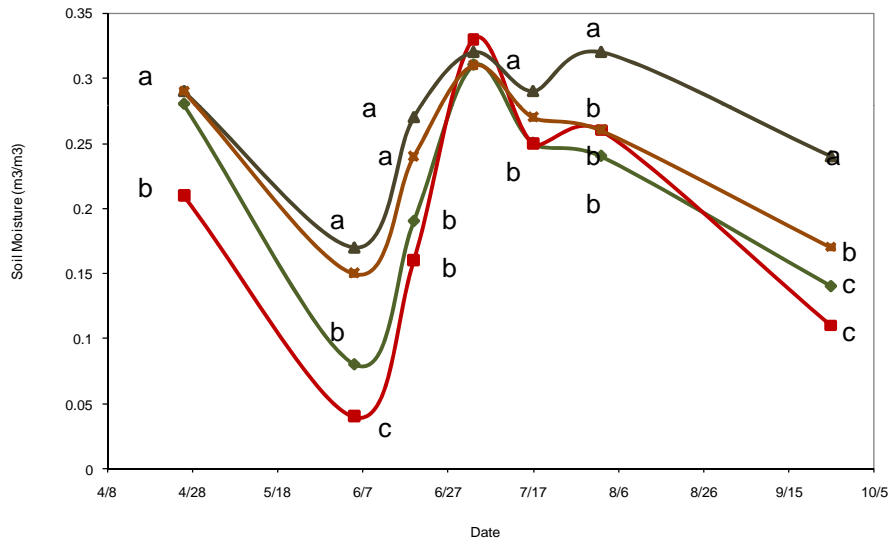
Soil Organic Matter



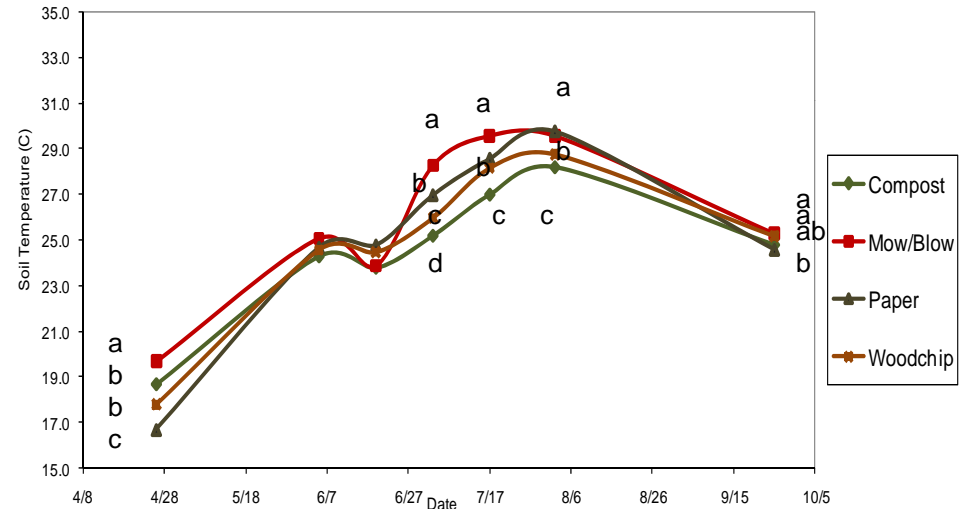
Foliar nutrient effects



Soil Moisture and Temperature



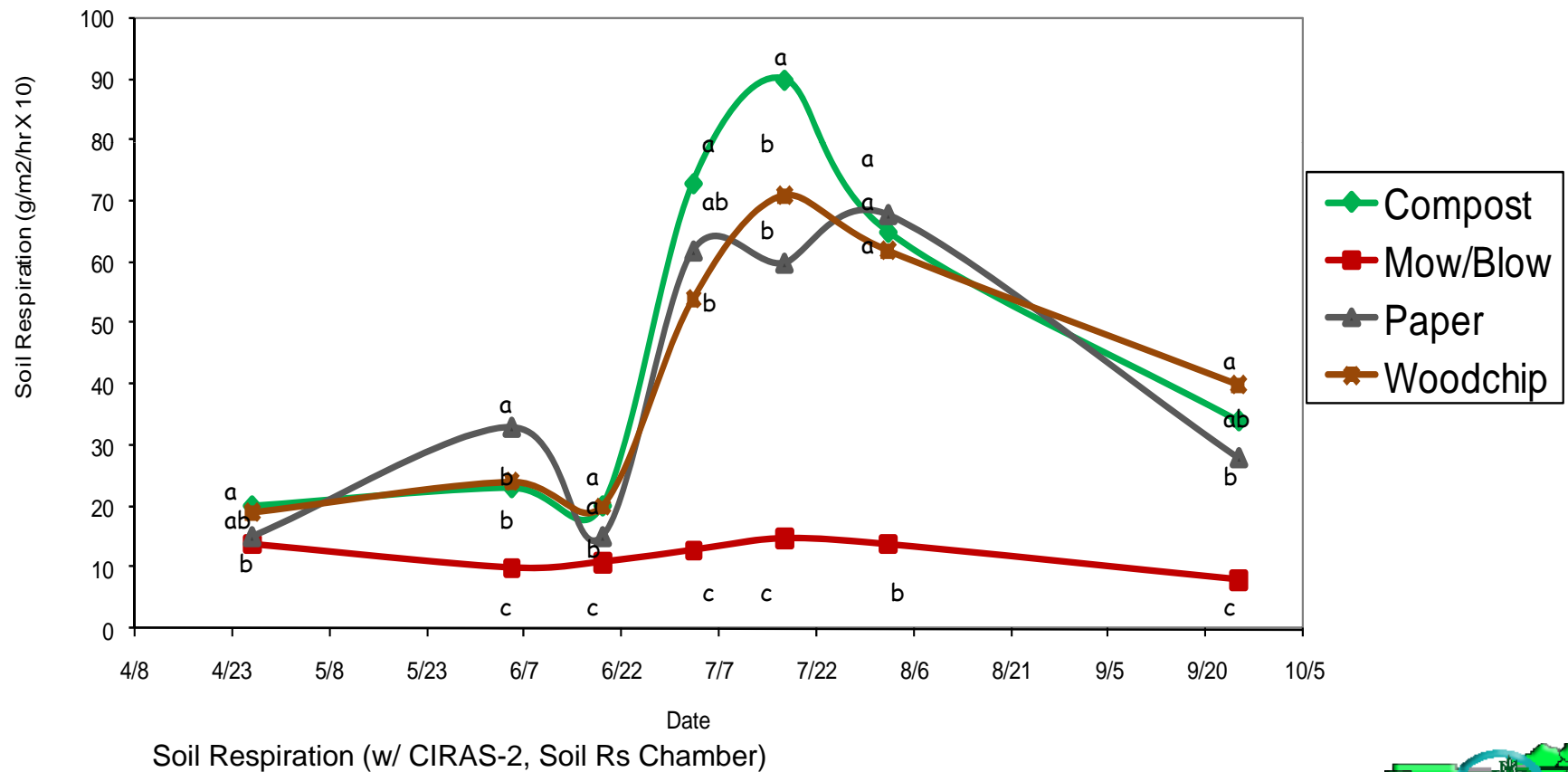
Soil Moisture
(w/ TDR Probe)



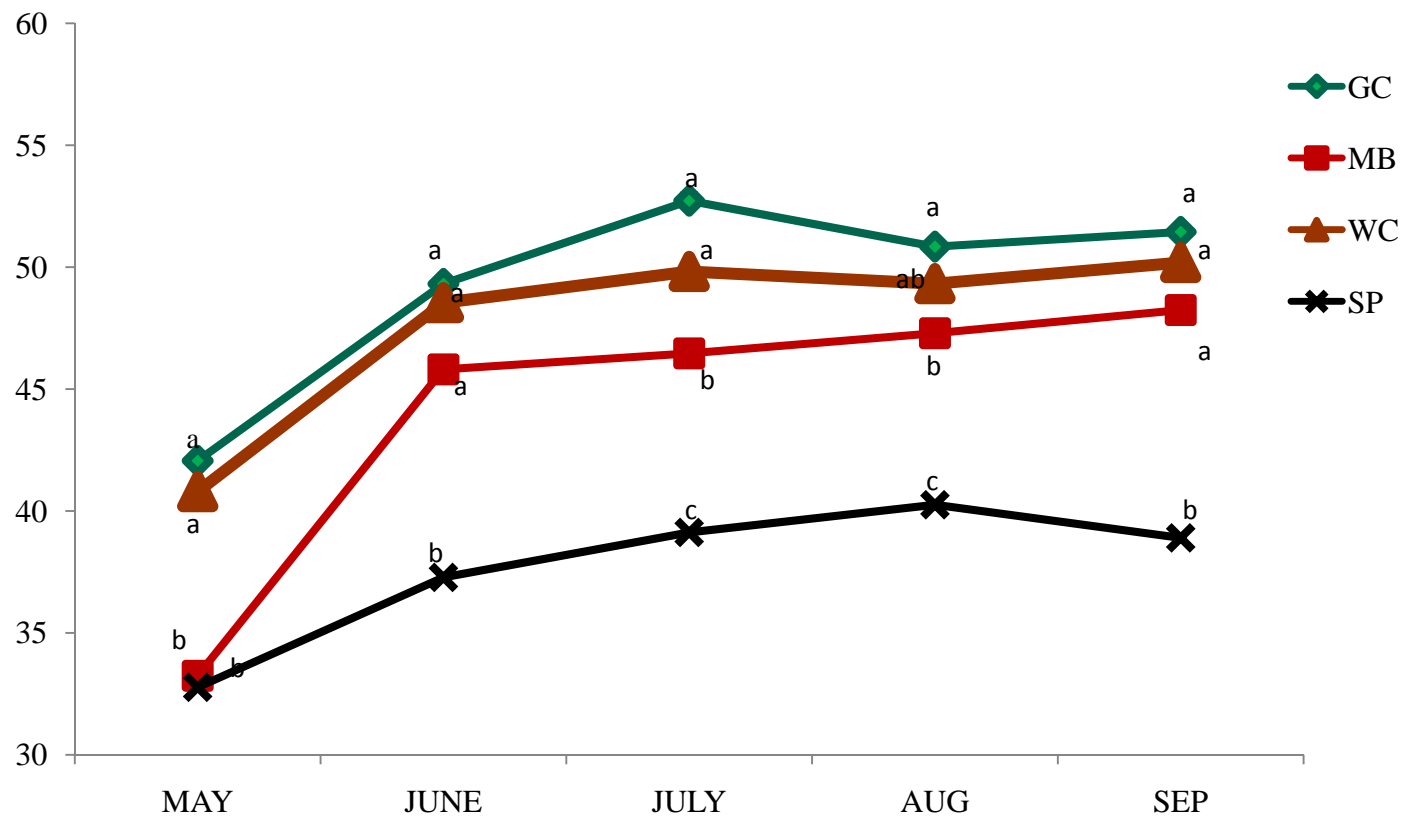
Soil Temperature
(w/ thermocouple probe)



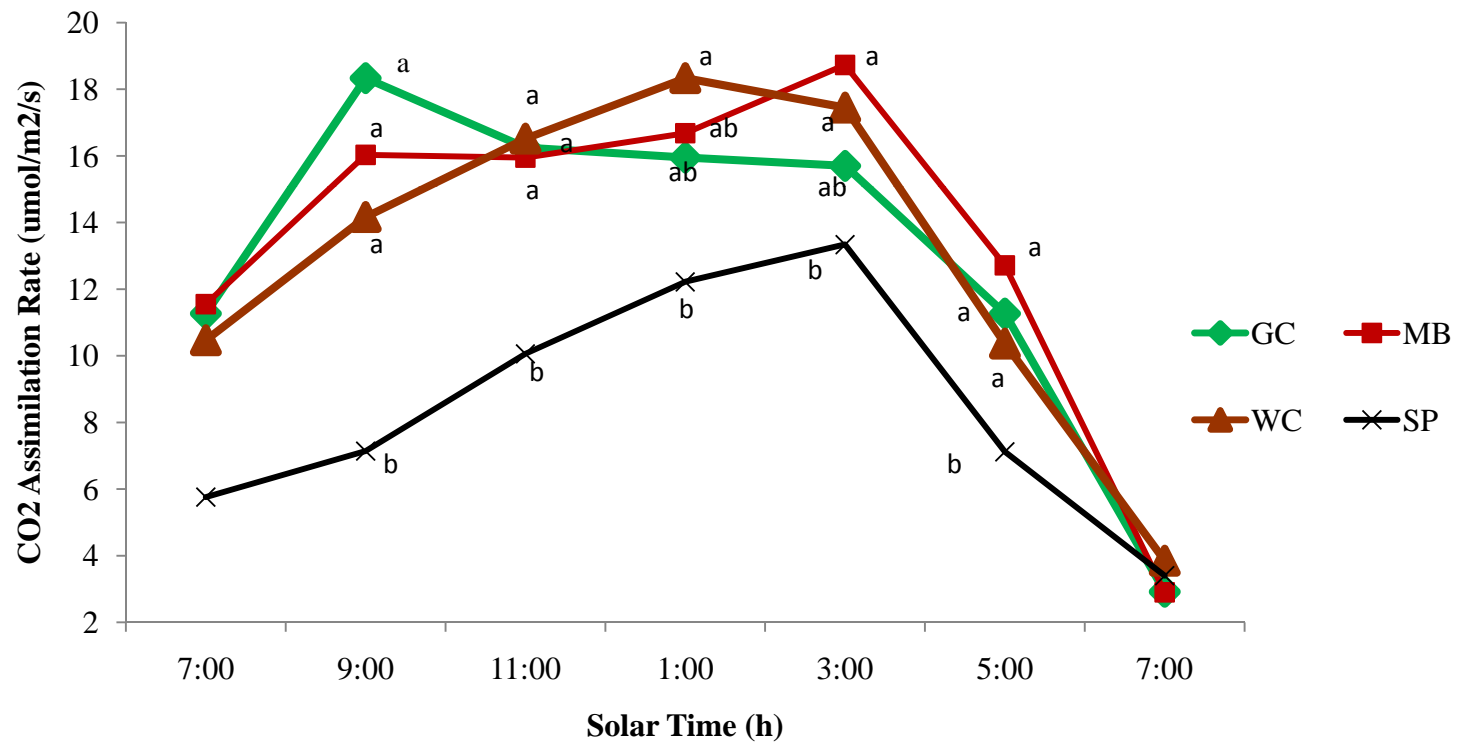
Soil Respiration



Seasonal Chl (est) - SPAD



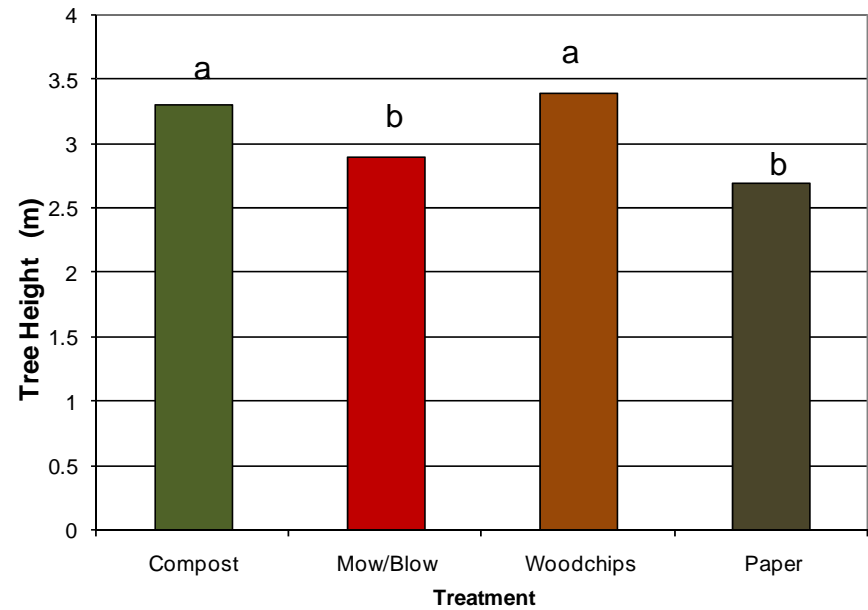
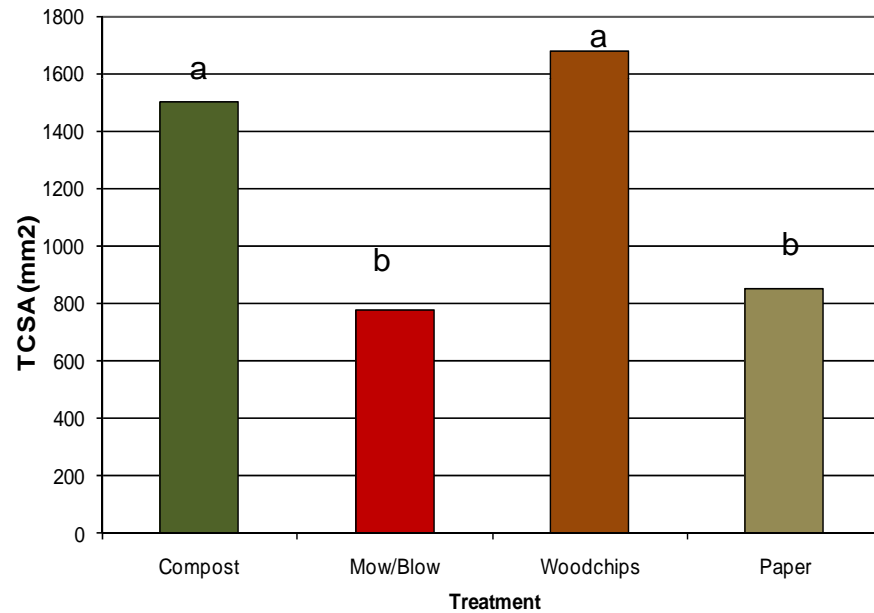
Pn - Mid-summer



Individual Leaf Photosynthesis (w/ CIRAS-2, PLC broadleaf Chamber)



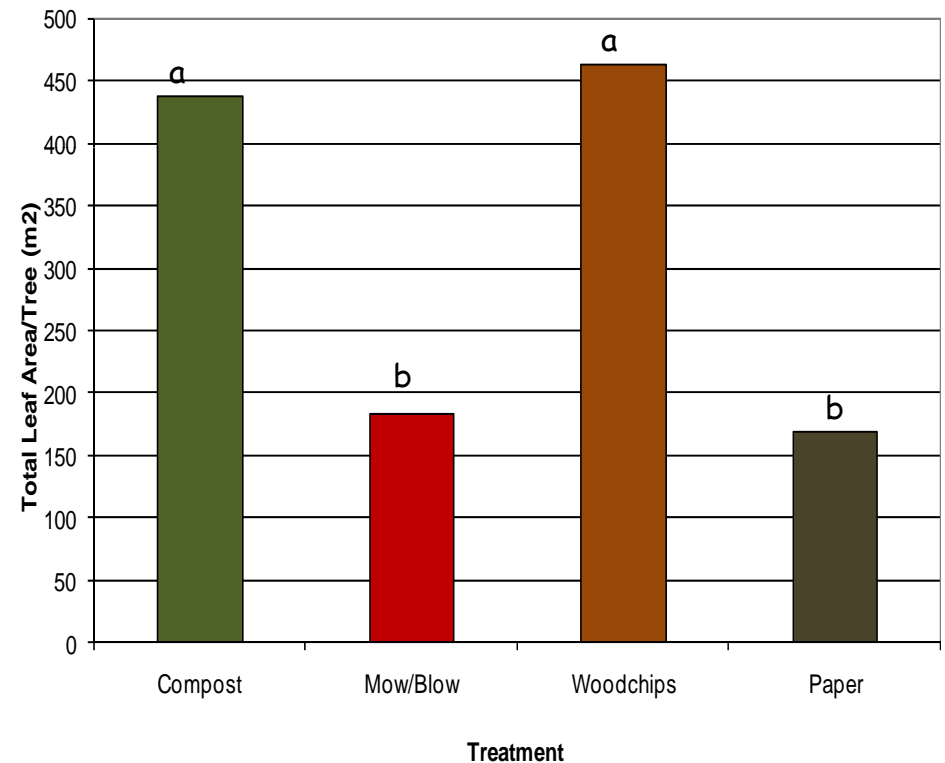
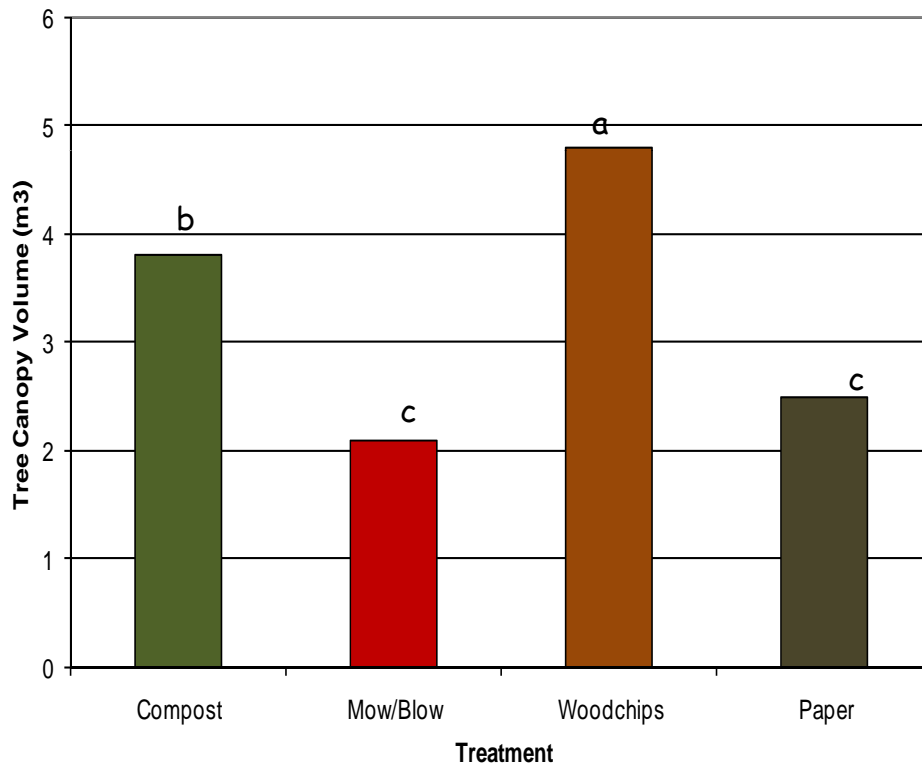
Effects on Tree Size



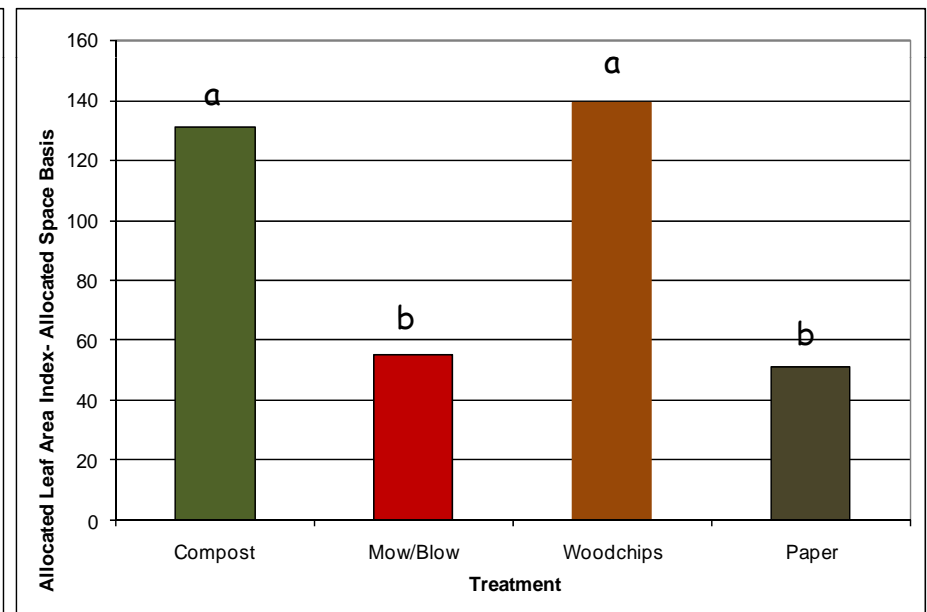
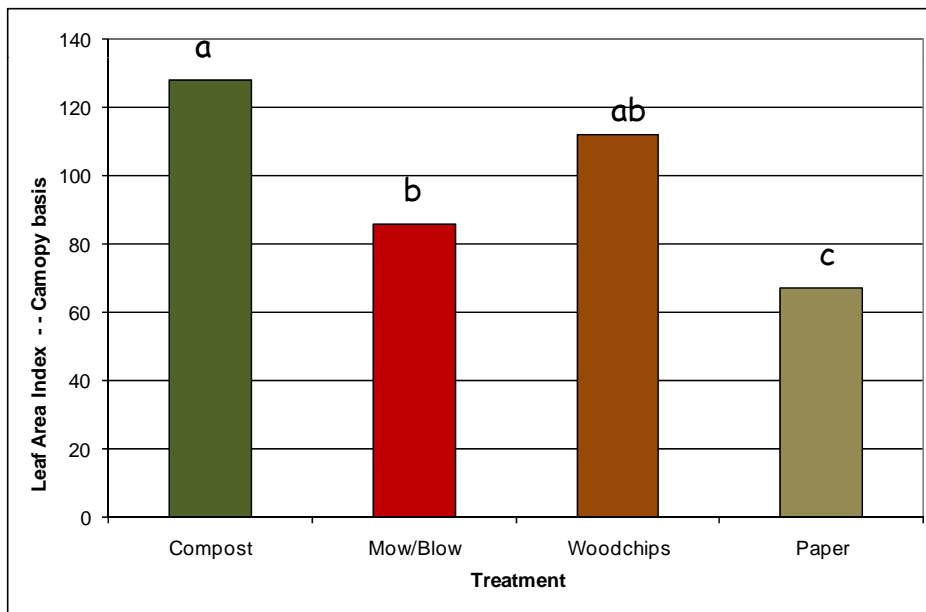
TCSA – Trunk cross-sectional area; 25cm above soil line.



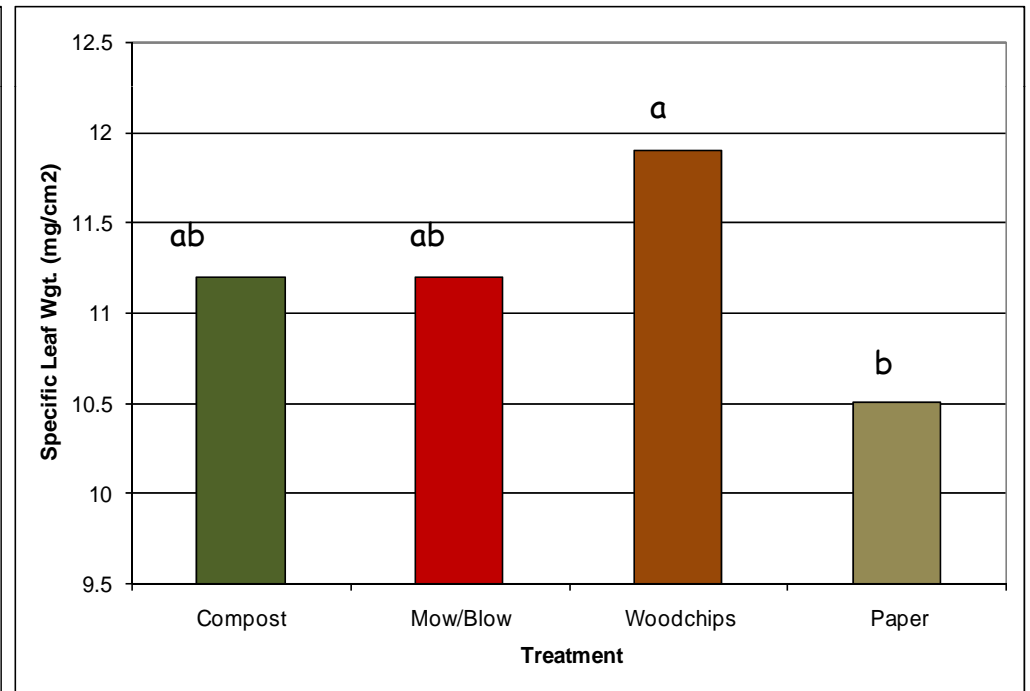
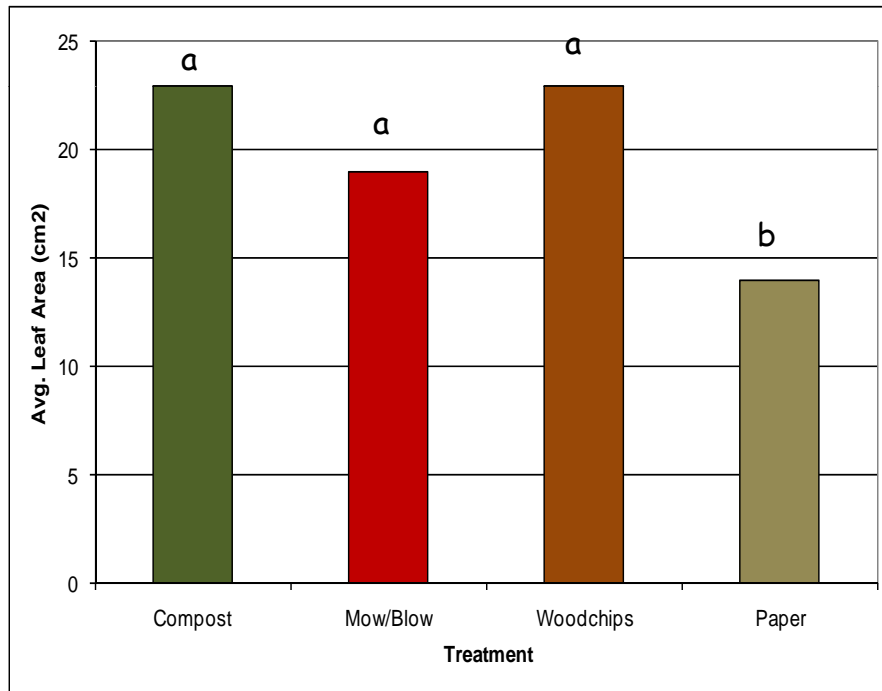
Tree Canopy Development



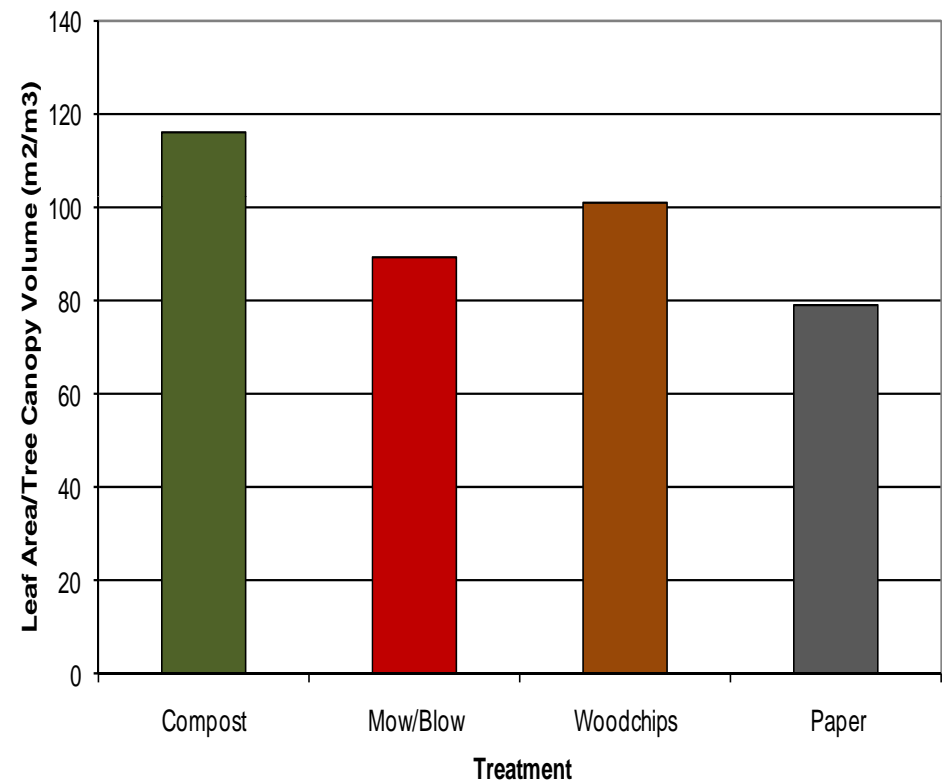
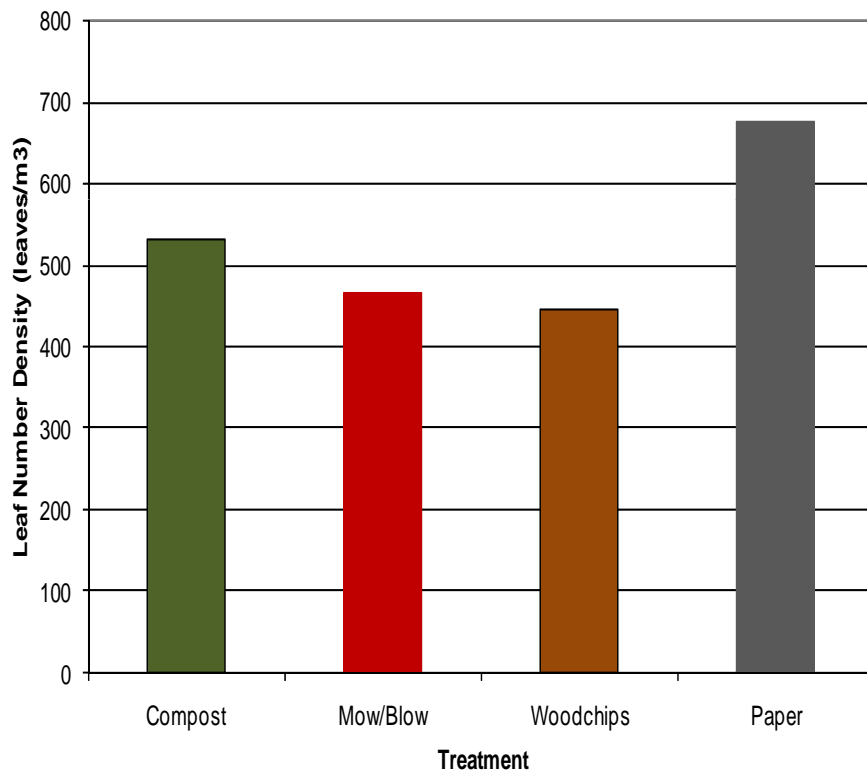
Leaf Area Index



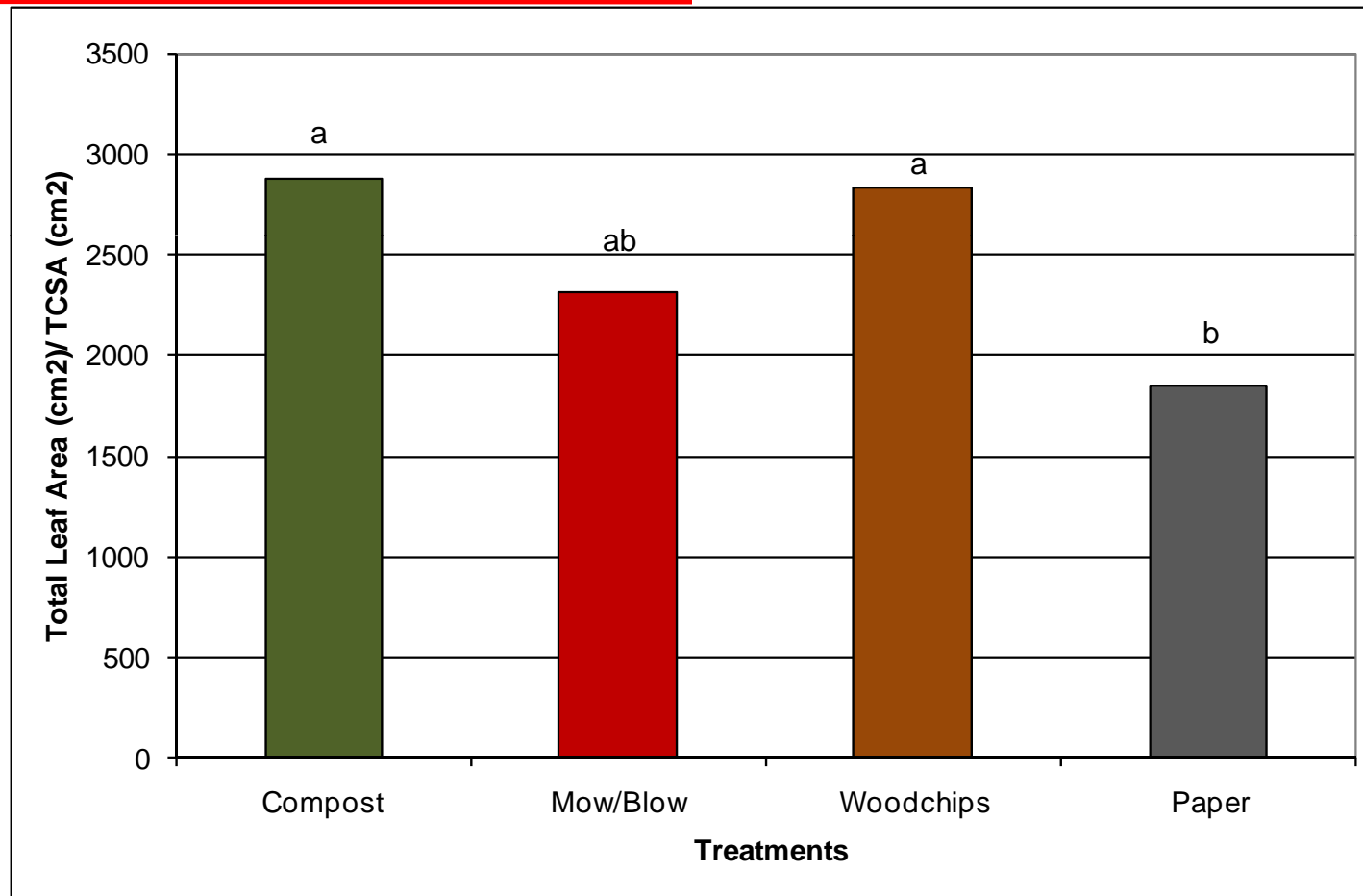
Leaf Development



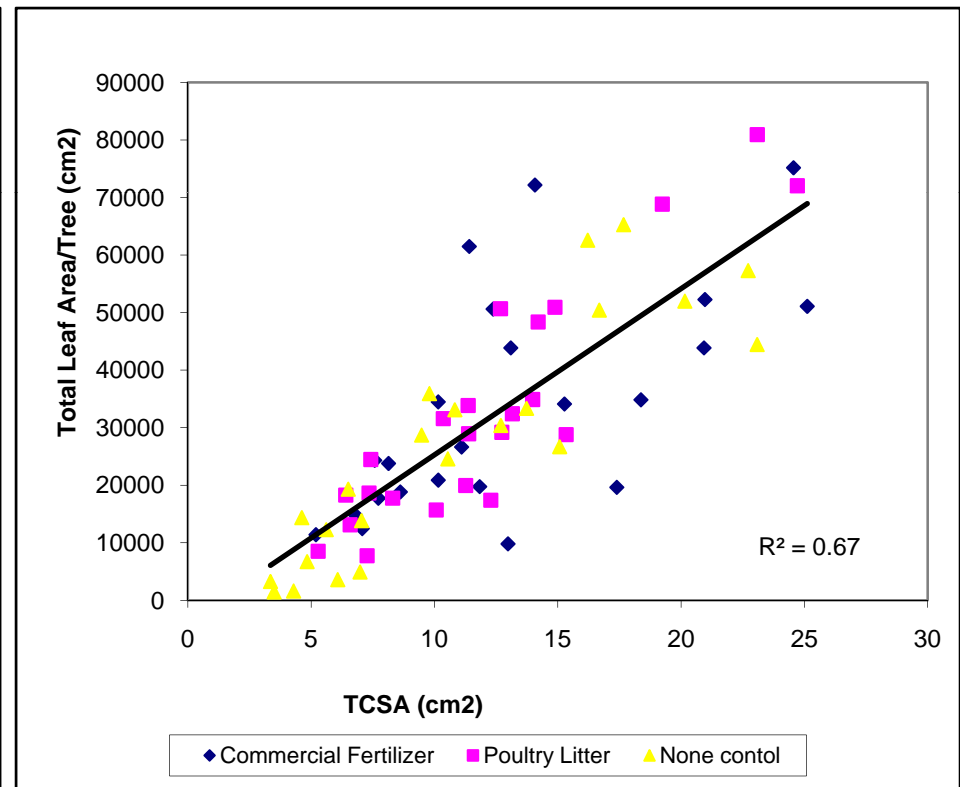
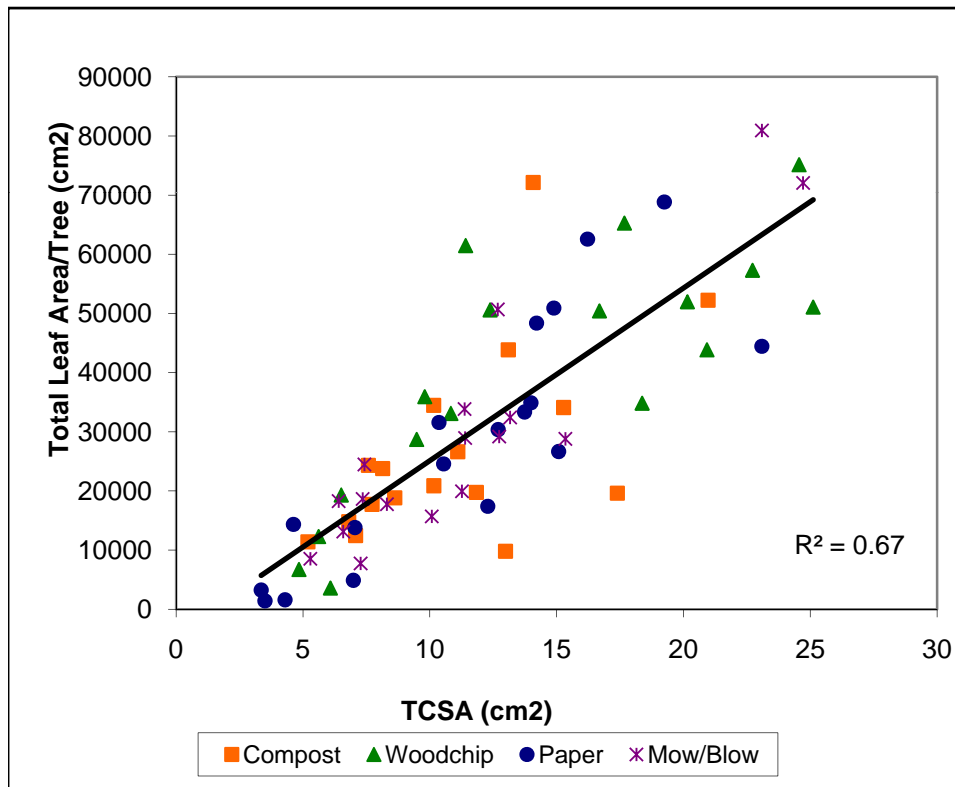
Leaf Density



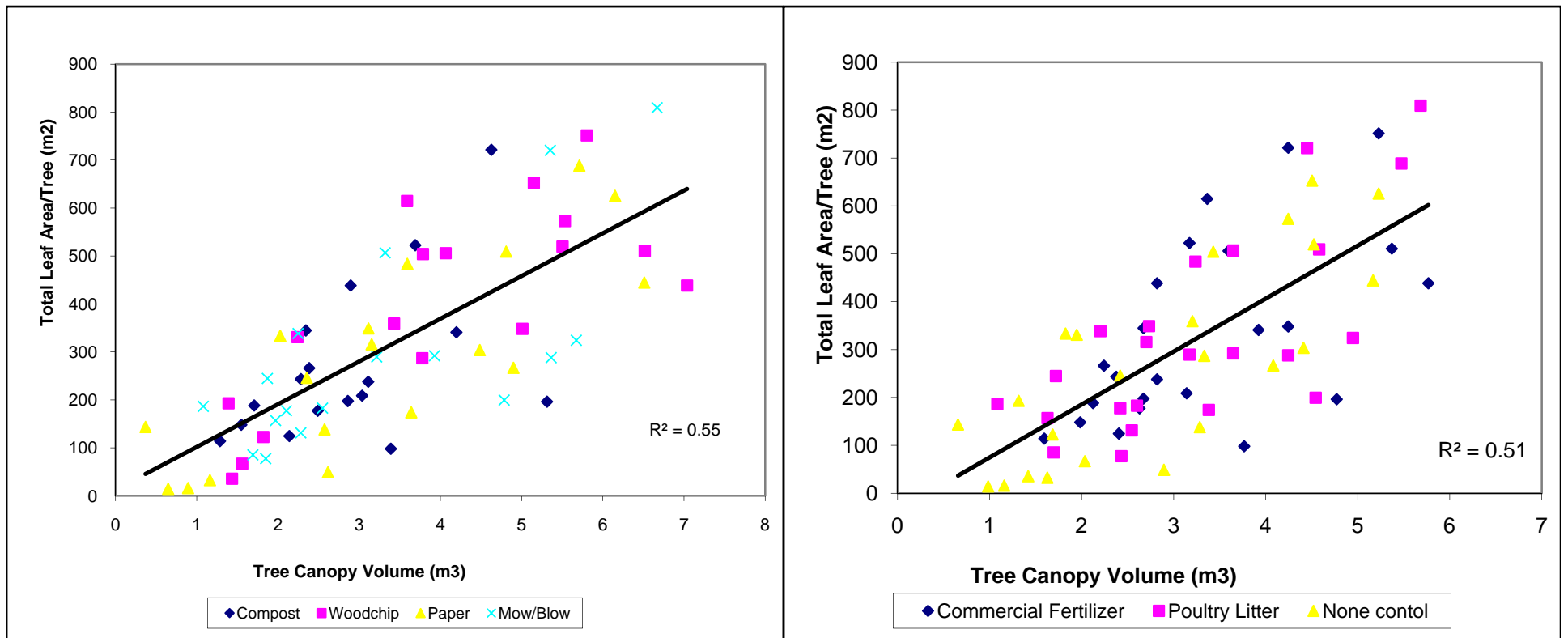
Leaf Area/TCSA



Leaf Area / TCSA



Leaf Area/Canopy Volume



Summary

- Ground cover effects more pronounced during establishment than nutrient source
- Nutrient source effects apparent in both soil and foliar nutrient level, and soil chemistry
- No significant nutrient effect on tree growth



Summary

- GC and CF increased soil N
 - Observed significant late season release of N
- GC increased EC and some increase of pH
- MB and WC did not effect soil pH
- GC and WC increased soil OM
- MB had lowest seasonal soil moisture
- SP had greatest seasonal soil moisture and lowest seasonal soil temperature
- GC had greatest soil respiration late



Summary

- GC, WC increased tree size
 - Achieved size goals;
 - filled space in 2 growing seasons
- SP reduced Chl, Pn, tree size, leaf size
- GC, WC increased LAI, and Canopy Density



Other Observations

- Correlation of Jap Beetle damage to undertree ground cover; to lack of tree vigor
- SP trees and NF trees had more spring freeze injury
- Late season N in soil from GC; delayed defoliation
- WC and SP provided good weed control
 - Increased weeds in GC
- Lack of nutrient source effect interesting



Conclusion

- The WC and SP provided adequate weed control
 - But, SP treatment suppressed growth
 - GC had significant weeds
- GC and WC treatments resulted in trees ready to crop in year 3
 - estimated to produce 180-240 bu/acre



Thank you

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