Management Practices for Organic Orchard Ground Cover and Nutrition

Curt R. Rom, Heather Friedrich, Jason McAfee, E. Garcia, D. Johnson, J. Popp, and M. Savin

Department of Horticulture, University of Arkansas, Fayetteville, Arkansas, 72701 USA

UNIVERSITY OF ARKANSAS DIVISION OF AGRICULTURE Agricultural Experiment Station

Project Overview and Summary

Orchard nutrition and groundcover management are two significant issues facing organic apple growers. Because of the interaction between nutrition and groundcover, these management practices must be studied simultaneously. Studies have begun to understand current management practices and to test the interaction of nutrition and groundcover management practices in organic orchards.

Objectives

SARE sponsored research was initiated in 2005 to investigate practices used by organic growers and to establish best practices for ground cover and nutrient management during organic orchard establishment.

The objectives of the research were:

A. To **identify successful nutrient management practices** used by southern organic fruit growers.

B. To work with southern organic tree fruit growers to **assess the impact of their nutrient management practices** on soil quality, tree nutrient content, fruit yield and quality, pest incidence, and management costs.

C. To **conduct a controlled, replicated study** to evaluate ground cover and nutrient management practices and develop recommendations for southern organic fruit tree growers.

Process and Procedures

Three studies were conducted to address the project objectives.

Study A. Producer Survey of Current Practices

Organic apple producers were surveyed in 10 southern states to determine practices used for ground cover and nutrition management. There was a 17% response rate.

Study B. Producer Soil and Foliar Nutrient Survey

Survey participants were asked to participate in a voluntary soil and foliar nutrient sampling project for two seasons.

Study C. Trial of Ground Cover Management System and Nutrient Source on Organic Orchard Establishment

A replicated trial (n=6) of 'Enterprise'/M26 apple trained to modified vertical axis, planted at 2m x 4m (600 trees/acre) were given one of the following ground cover and nutrient source treatments:

Ground Cover Management Treatments

- Municipal Green Compost (GC)
- Mow and Blow (MB)
- Wood Chips (WC)
- Shredded Paper (SP)

Nutrient Source Treatments

- Control (the ground cover treatment provides nutrition) (NF)
- Composted Poultry Litter (PL)
- Certified Pelletized Commercial Fertilizer (CF)

Key Discoveries and Observations

Study A. Producer Survey

- Most (85%) of the respondents indicated they were increasing production; 15% of the orchards were not yet producing.
- 100% of respondents conducted biannual or annual soil testing.
- Few respondents used foliar analyses to determine fertility needs.
- Commonly applied nutrient source included composted mulches (71%), composted manures (43%), rock minerals (43%), calcium, boron, and magnesium sulfate (43%).
- Most growers used mowing or mulches in a mixed species groundcover.

Study B. Grower Soil and Foliar Sampling

- Cooperating growers had soil pH in acceptable to high range; soils were high in P and K
- Cooperating growers both had sufficient, albeit in a low range, of N, P, K in foliar samples.

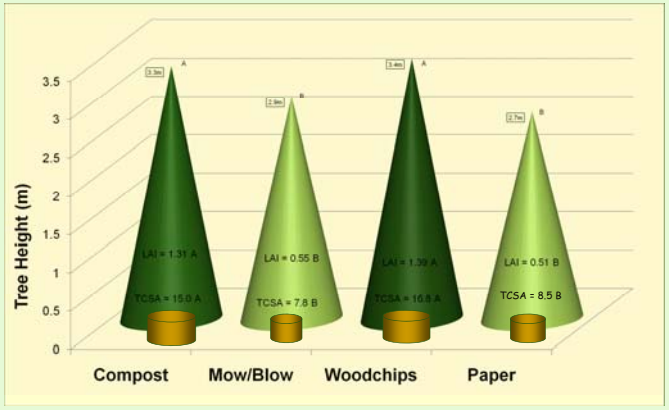

Figure 1 Tree Height, trunk cross-sectional area (TCSA), and leaf area index (LAI) of 'Enterprise'/M26 apple trees grown in three organic ground cover management systems after 2 seasons growth.

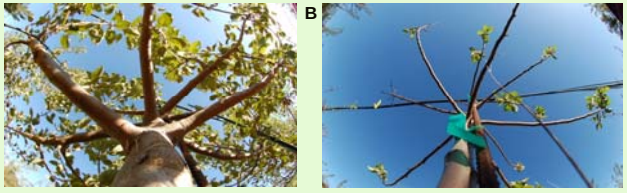

Figure 2. Hemispherical photographs of tree canopies after two years growth. A. Tree receiving municipal green compost mulch. B. Tree receiving shredded paper mulch

Key Discoveries and Observations

Study C. Replicated trial: Ground Cover and Nutrient Management on Orchard establishment

Effects of Nutrient Source

- Ground cover treatment effects were more pronounced during establishment than nutrient source treatments
- Nutrient source effects apparent in both soil and foliar nutrient level, and soil chemistry
  - Trees receiving NF had significantly smaller and less dense leaves, but had higher concentration of N , P, K, S, and Fe, likely due to dilution effects of size, but lower Mg and Ca
- No significant nutrient source effects on tree growth

Effects of Ground Covers on Soils

- GC increased EC, nutrient salt content
- MB and WC did not affect soil pH; GC and SP slightly increased soil pH
- GC and CF increased late season soil N
- 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; MB had lowest

Effects of Ground Covers on Trees

- GC, WC increased tree size; height, trunk cross-sectional area, and leaf development (fig. 1, fig. 2)
  - Achieved size goals of 3m height; filled space in 2 growing seasons
- SP reduced chlorophyll, photosynthesis, tree size, leaf size
- GC, WC increased LAI, and canopy leaf density
- SP reduced foliar N, Mg, and S, but increased P, K, and Ca
- MB had significantly increased vole damage than GC or WP in winter 2008

Other Observations

- Japanese Beetle damage was correlated to undertree ground cover
- 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
- GC increased weeds; SP had significantly fewer weeds
- Nutrient source lacked significant effects

Conclusions and Next Steps

Conclusions

- Although there was limited effect on nutrient source on tree growth and development, there was an additive effect of applied nutrition (PL or CF) in combination with mulches (GC or WC) producing the largest trees.
- Sufficient tree growth in GC and WC in first two seasons will allow a crop in third season; MB or WP should not be cropped in third season due to insufficient growth.
- Beginning in 2008 season, the study will begin the "production phase" evaluation.

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