Irrigation management strategy for mature citrus trees affected by HLB

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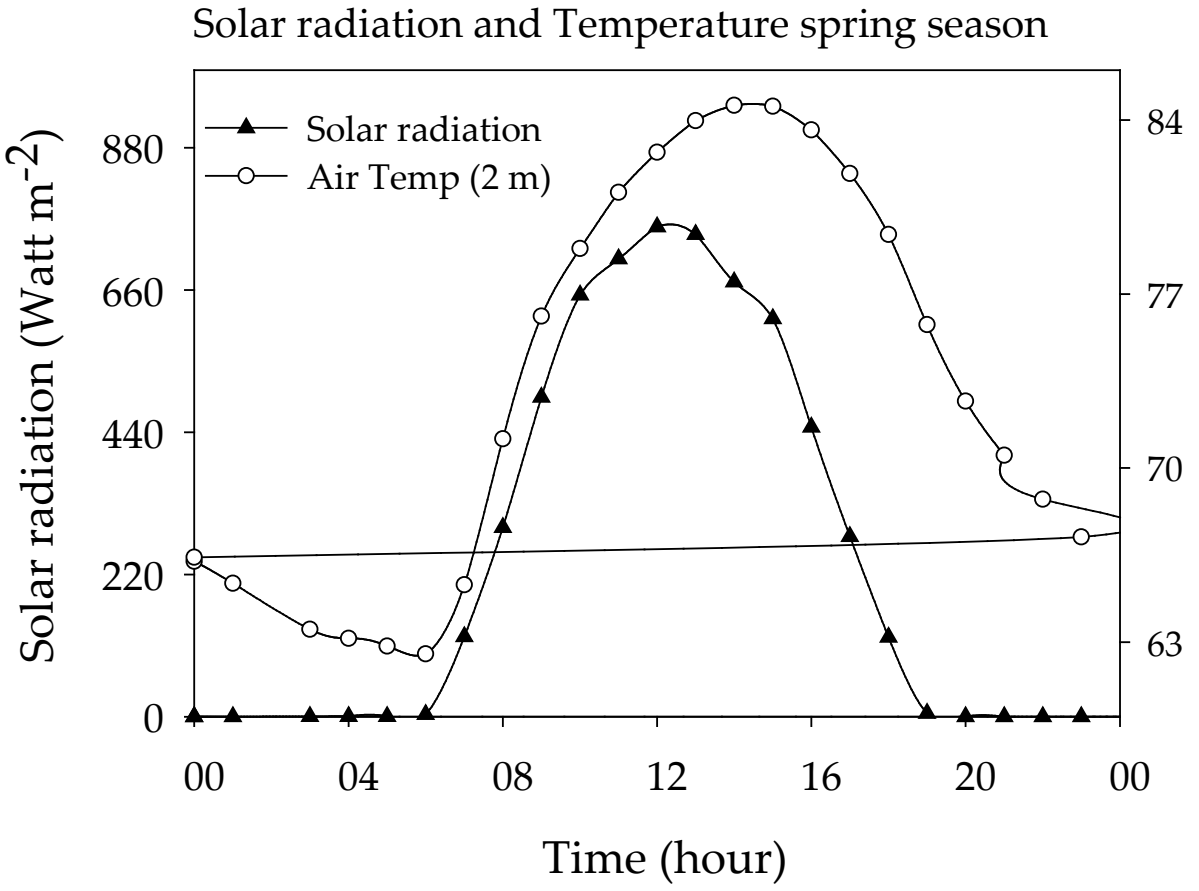
Lake Alfered, FL

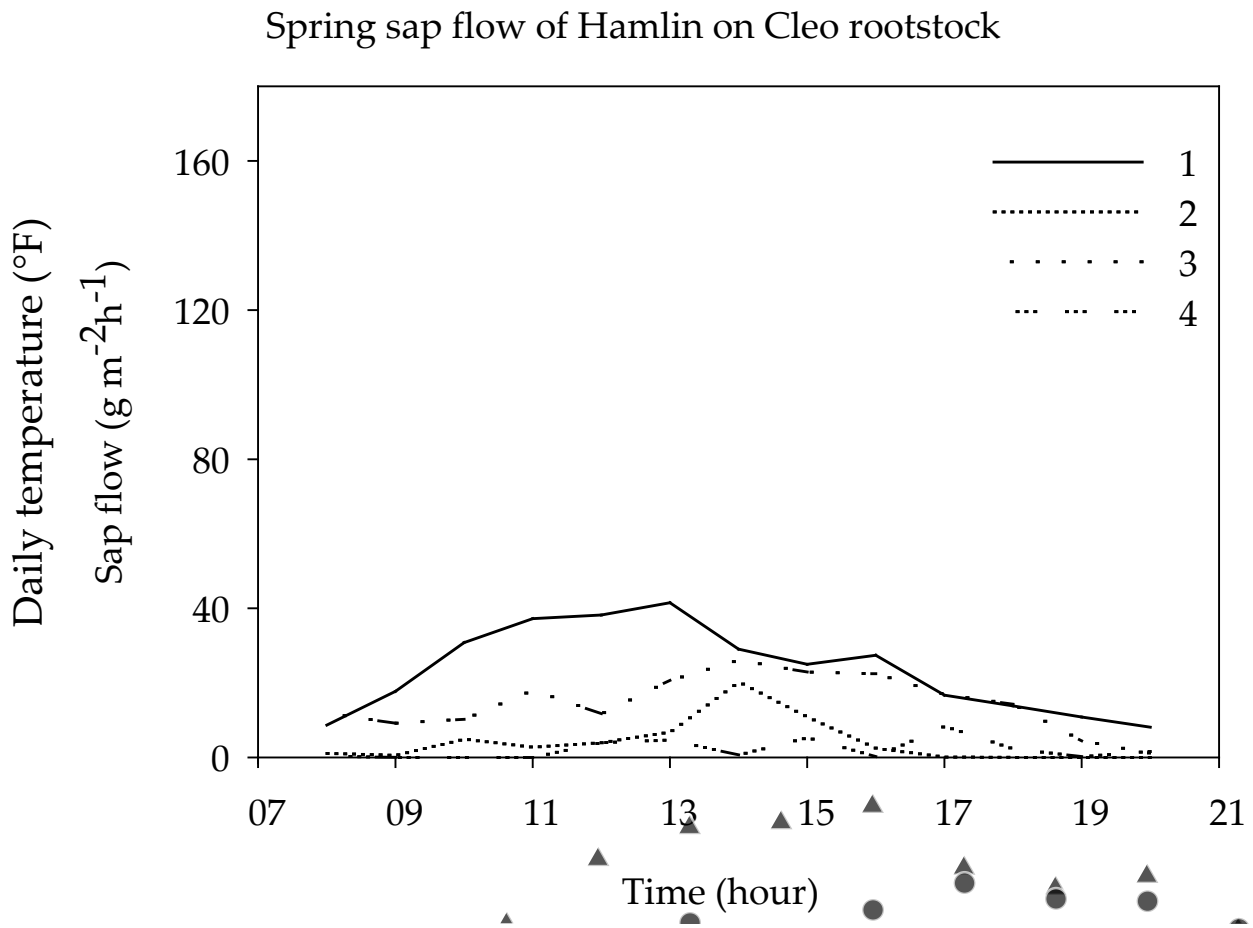
Introduction objectives M&M Result and discussion

- Worldwide, the agriculture industry consumes accounts for about 70% of freshwater withdrawals (Mbabazi et al., 2017)
- The citrus industry accounts for about 30% of Florida irrigated cropland acreage (Han et al., 2016)
- In a 5 years estimate, Florida state wide demand by cropland is about 24%
- Therefore, developing management approaches to control irrigation rates, which increases water use efficiency are urgently needed.

Introduction objectives M&M Result and discussion

- The relationship of sun-light, temperature and sap flow





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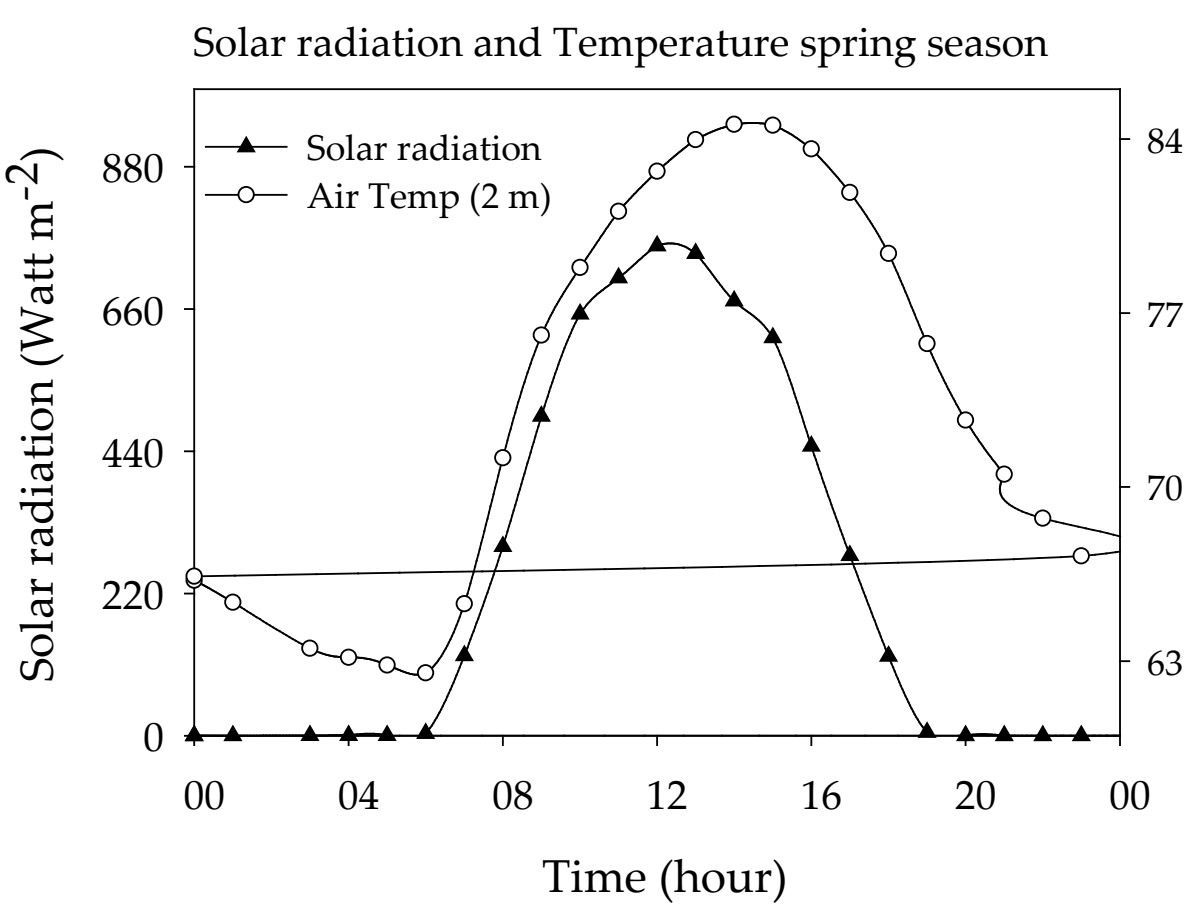
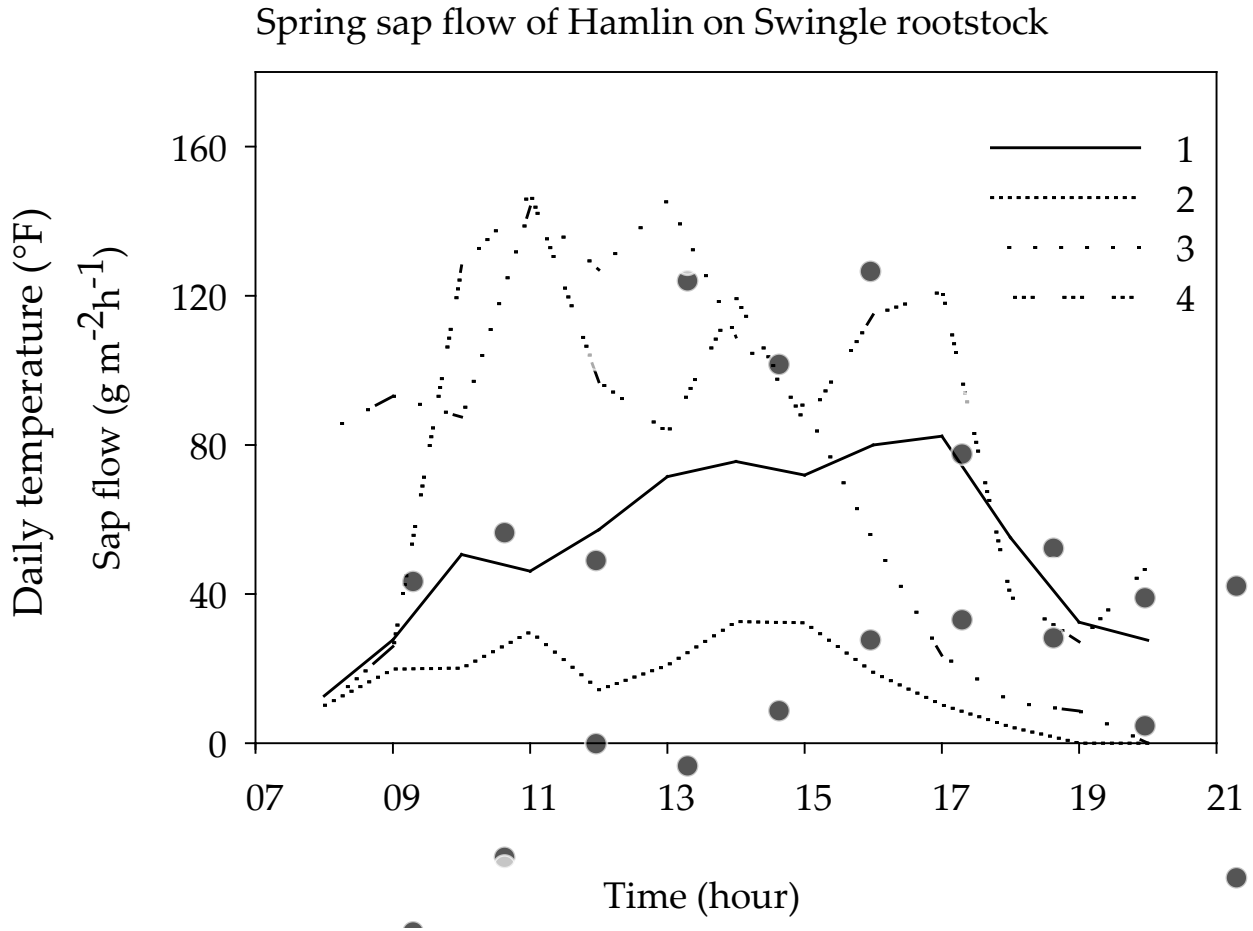
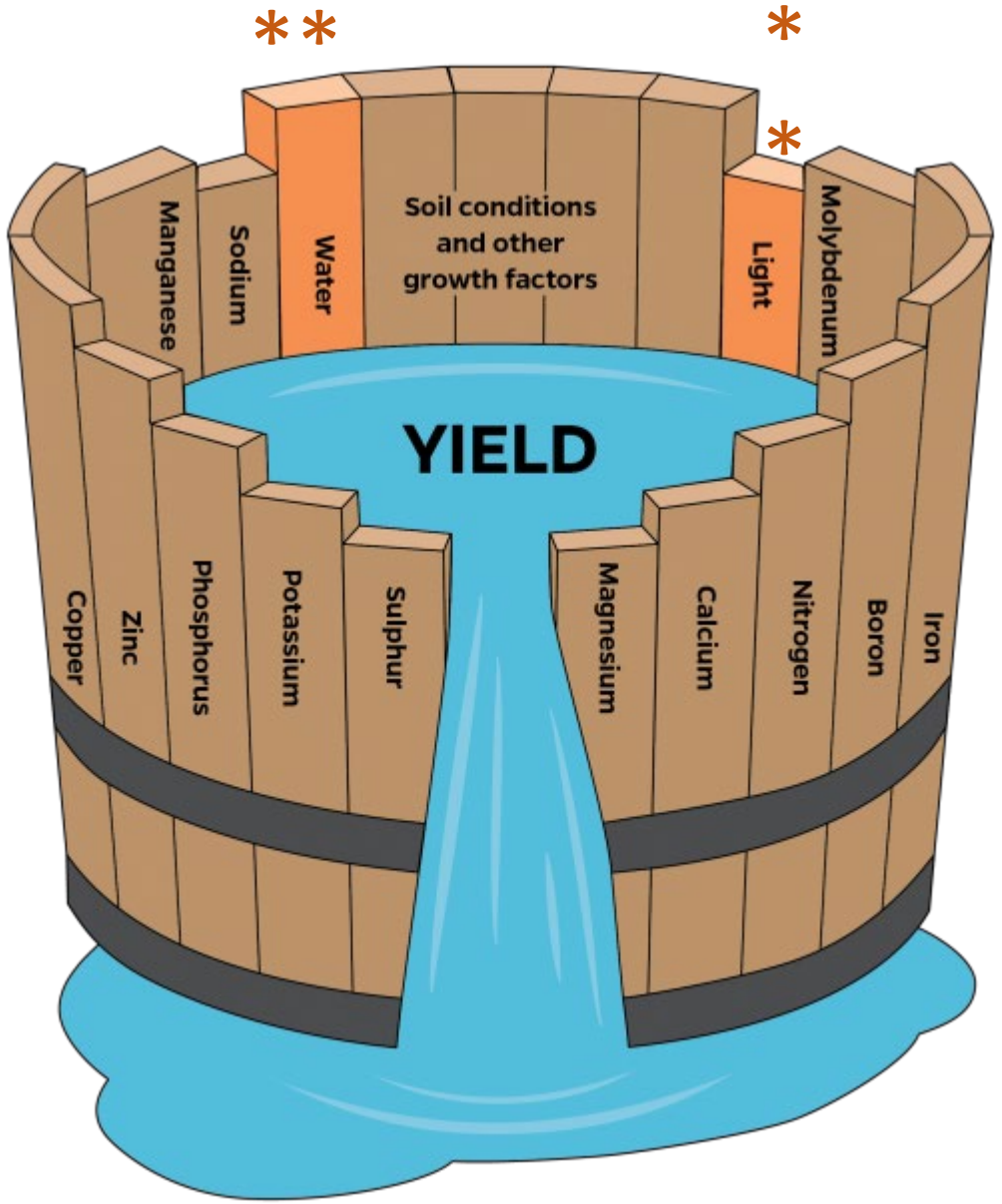




Introduction objectives M&M Result and discussion

- Nutrient dynamics is a concomitant with water management a long the seasons
- Irrigation and competition with other industry
- Increasing point source pollution concerns
- Optimum irrigation is a focus of study nowadays



https://arcosaspecialtymaterials.com/liebigs-law-of-minimum/

- Research developed several strategies ~ water conservation strategies:

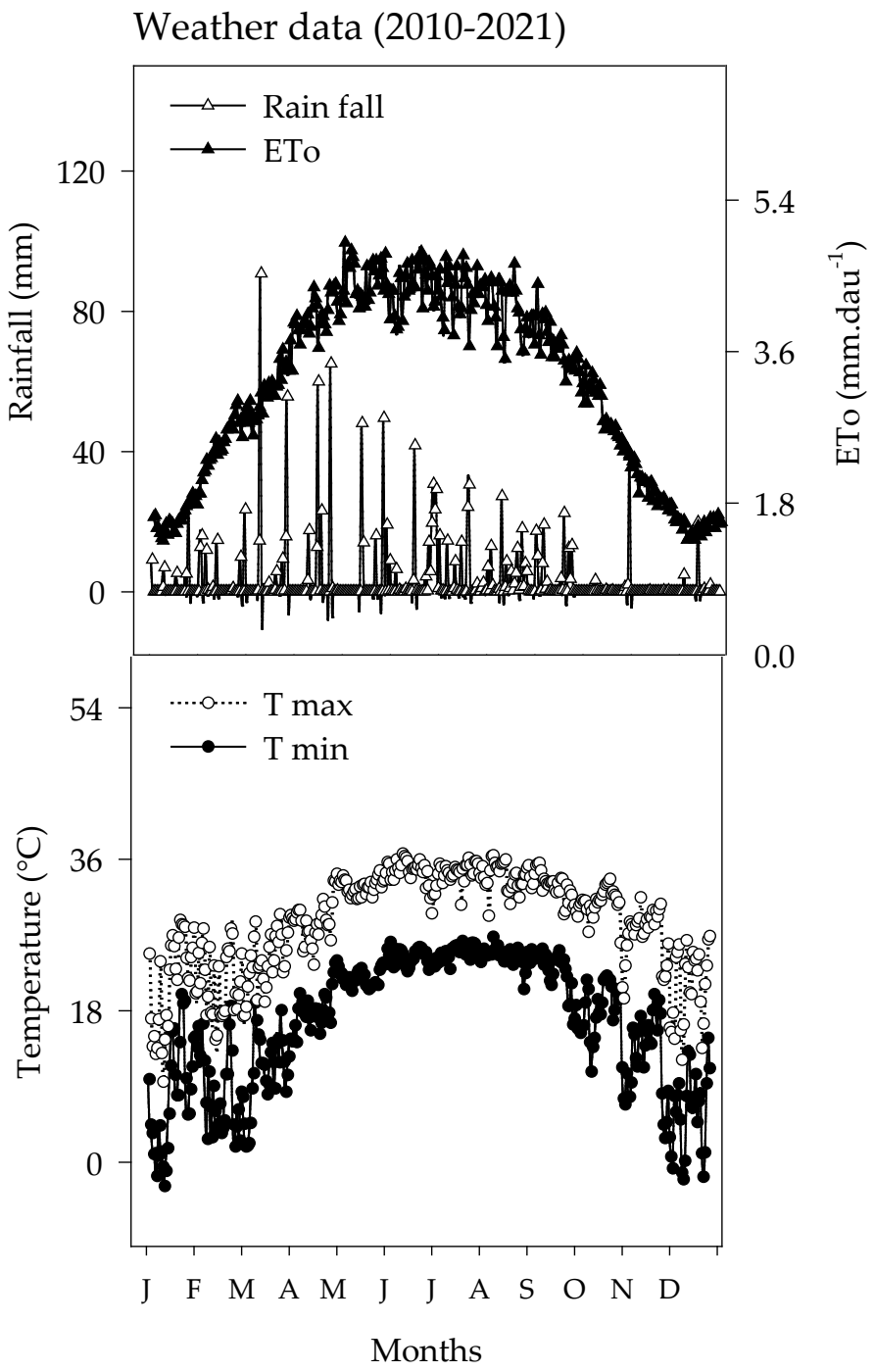
1. Grove design (Low – Medium – High tree densities)
2. Irrigation practices (Low – Medium – High irrigation rates)
3. Rootstock type (small – Medium)

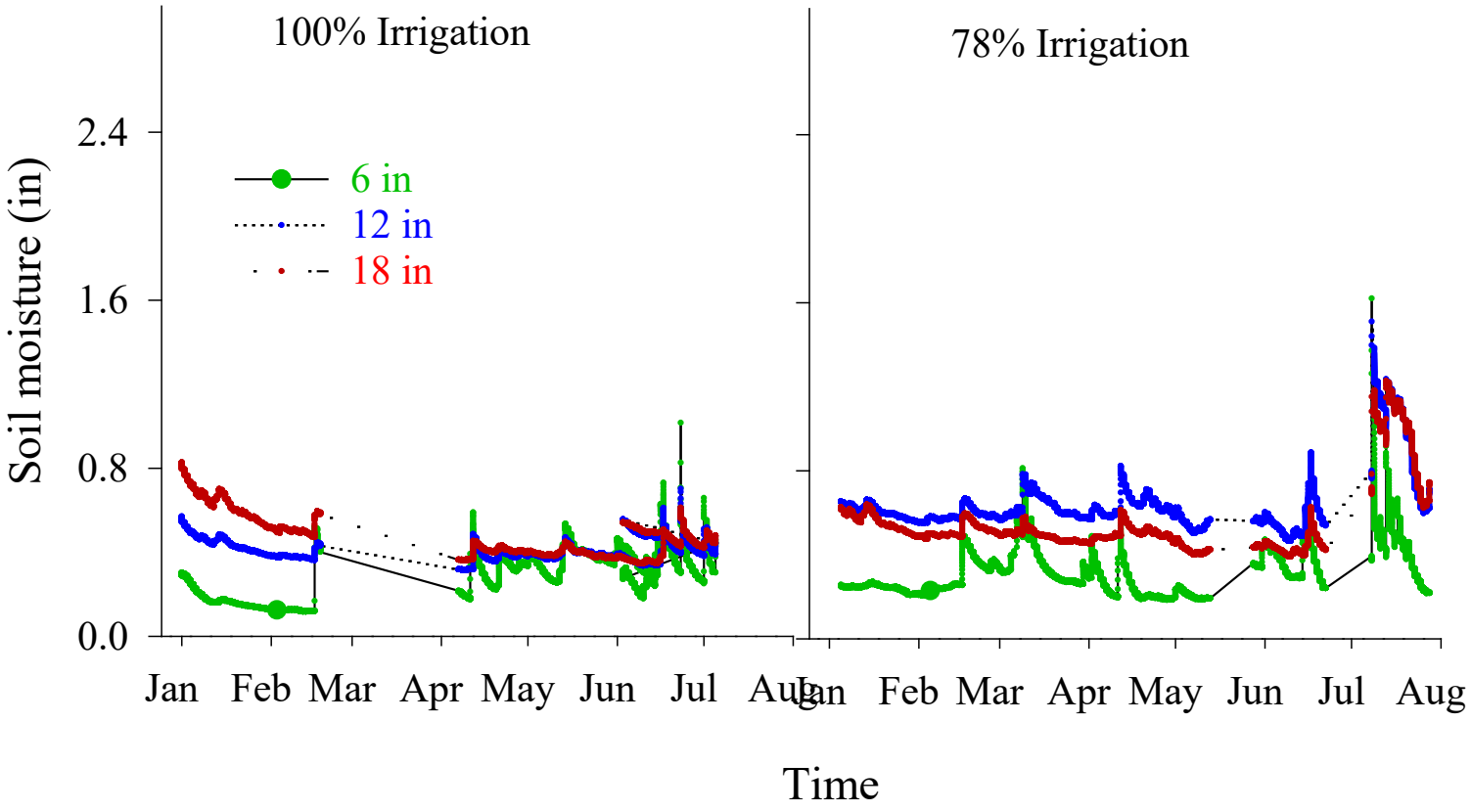
- The objective of the study were to:
  - identify best commercial citrus grove tree density with respect to water use efficiency
  - Investigate the impact of irrigation rate on tree growth based on crop water requirement, and
  - Determine the best water use efficiency techniques at selected irrigation rates and tree densities.

Introduction objectives M&M

- Research design:
  - Three tree densities (trees acre^{-1}):
    - 146 and 196 trees (2 rows per bed)
    - 373 trees (3 rows per bed)
  - Within the three tree densities ~
    - Three irrigation rates were applied:
      - 50%
      - 78%
      - 100% (grower) of ETo applied daily

      * ETo = Reference evapotranspiration

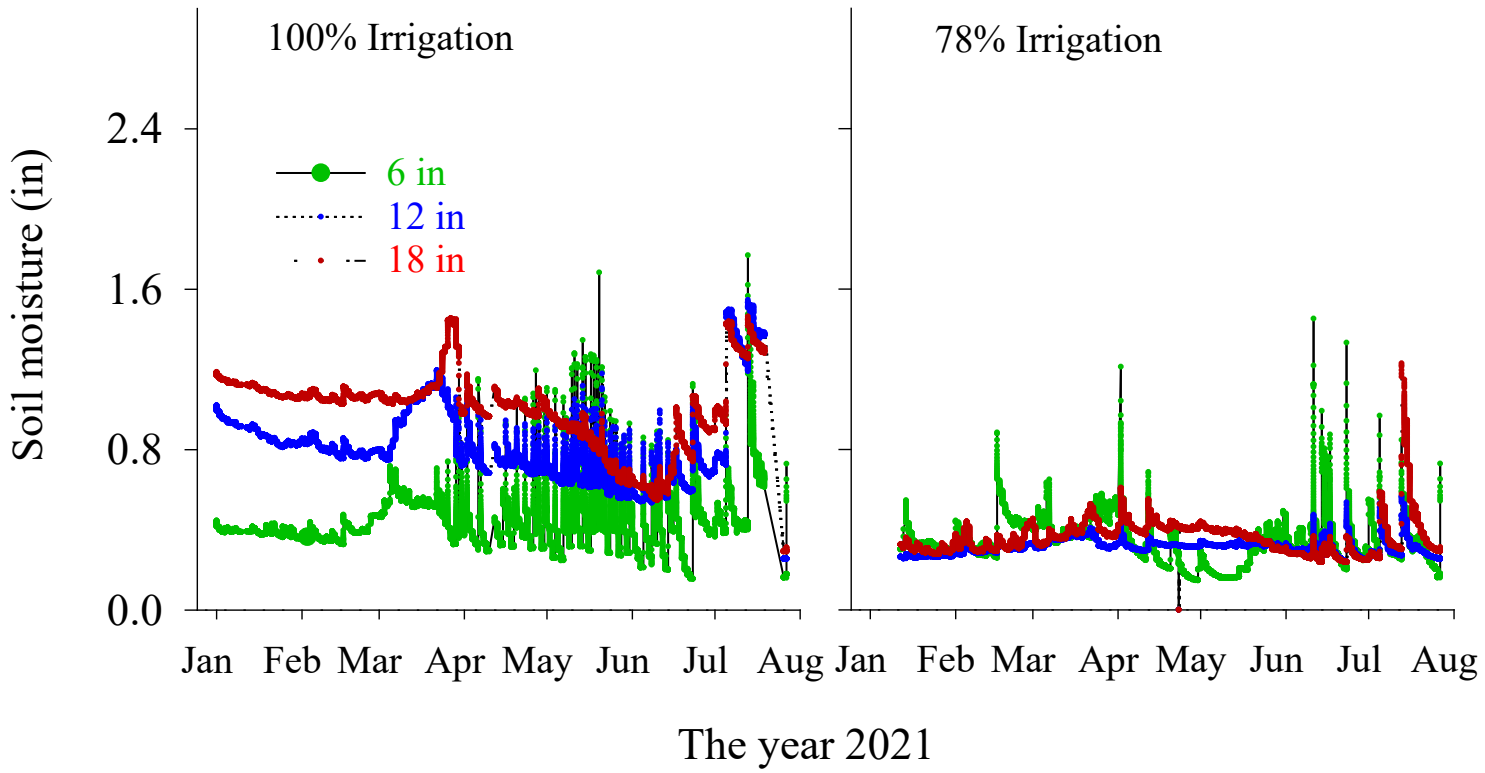




Soil moisture (146 trees acre^{-1})

- At the **highest** and **lowest** irrigation rates water distribution were not uniform across the three soil profiles.
- Water uniformly distributed at 78% ETo across the three depths.

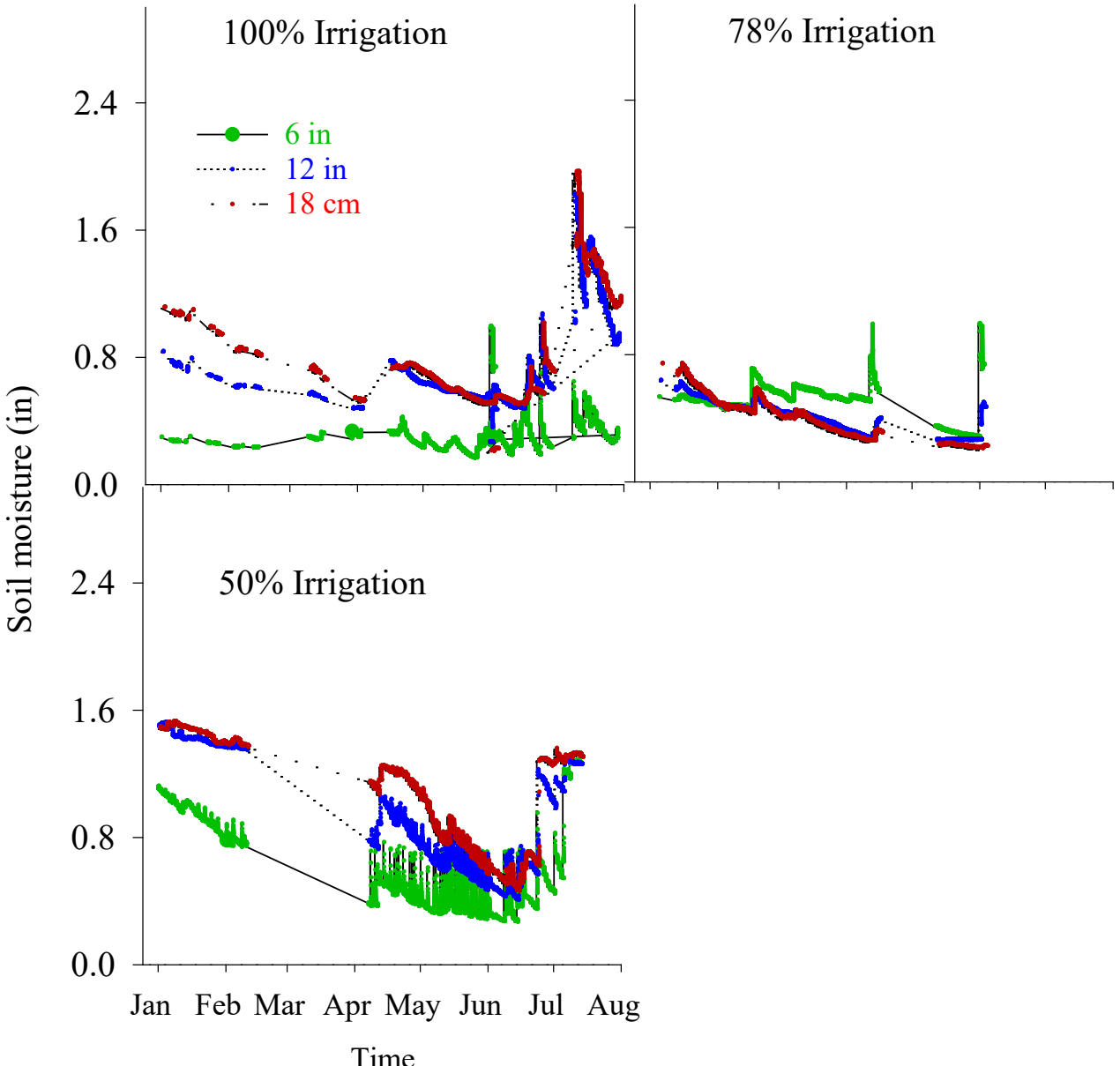
 Result and discussion



Soil moisture (196 trees acre^{-1})

- At the **higher** irrigation water accumulate at lower depth (during the spring season)
- The lower irrigation had uniform water distribution across the three soil profiles
- Higher water accumulation at 100% ETo
  - High leaf area index
  - Less evaporation during summer,
  - Raising water table

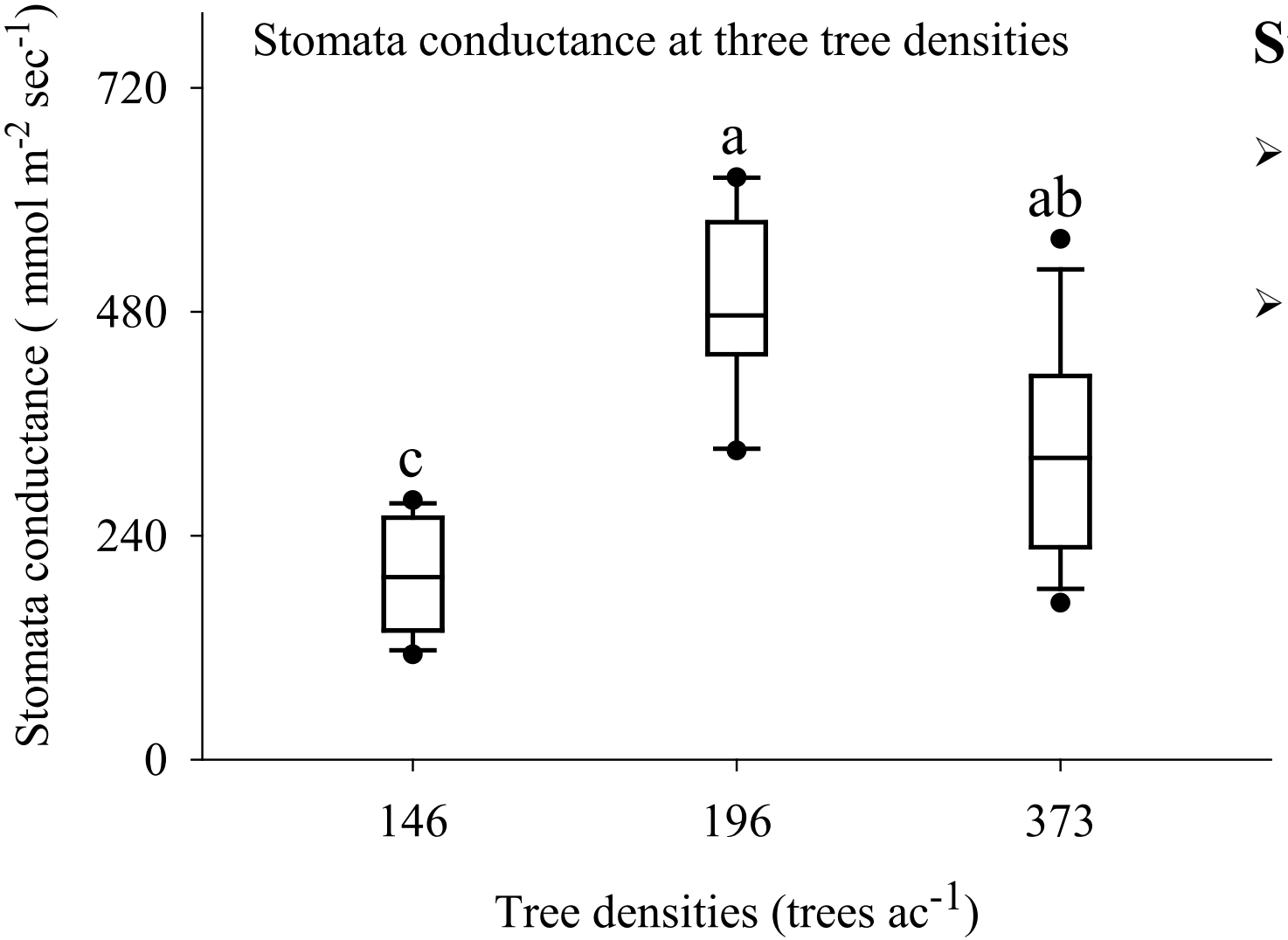
 Result and discussion



Soil moisture (373 trees acre^{-1})

- At the **highest** and **lowest** irrigation rates water distribution were not uniform across the three soil profiles:
  - Top 15 cm
  - 15-30
  - 30-45 cm
- Water uniformly distributed at 78% ETo across the three depths.

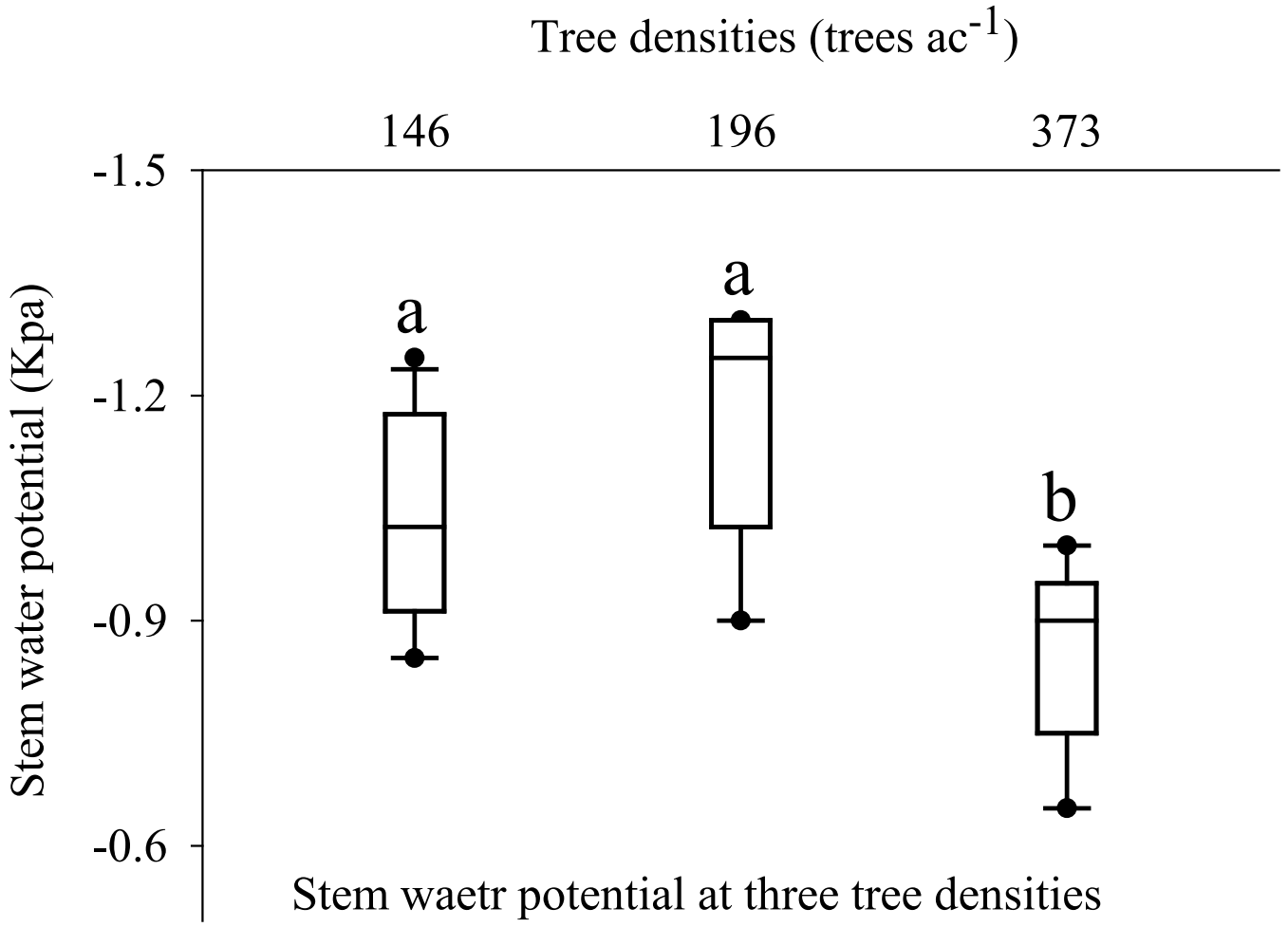
 Result and discussion



Stomata conductance

- Low stomata conductance was with the biggest canopy volume.
- The relative increase water use per unit area With moderate irrigation

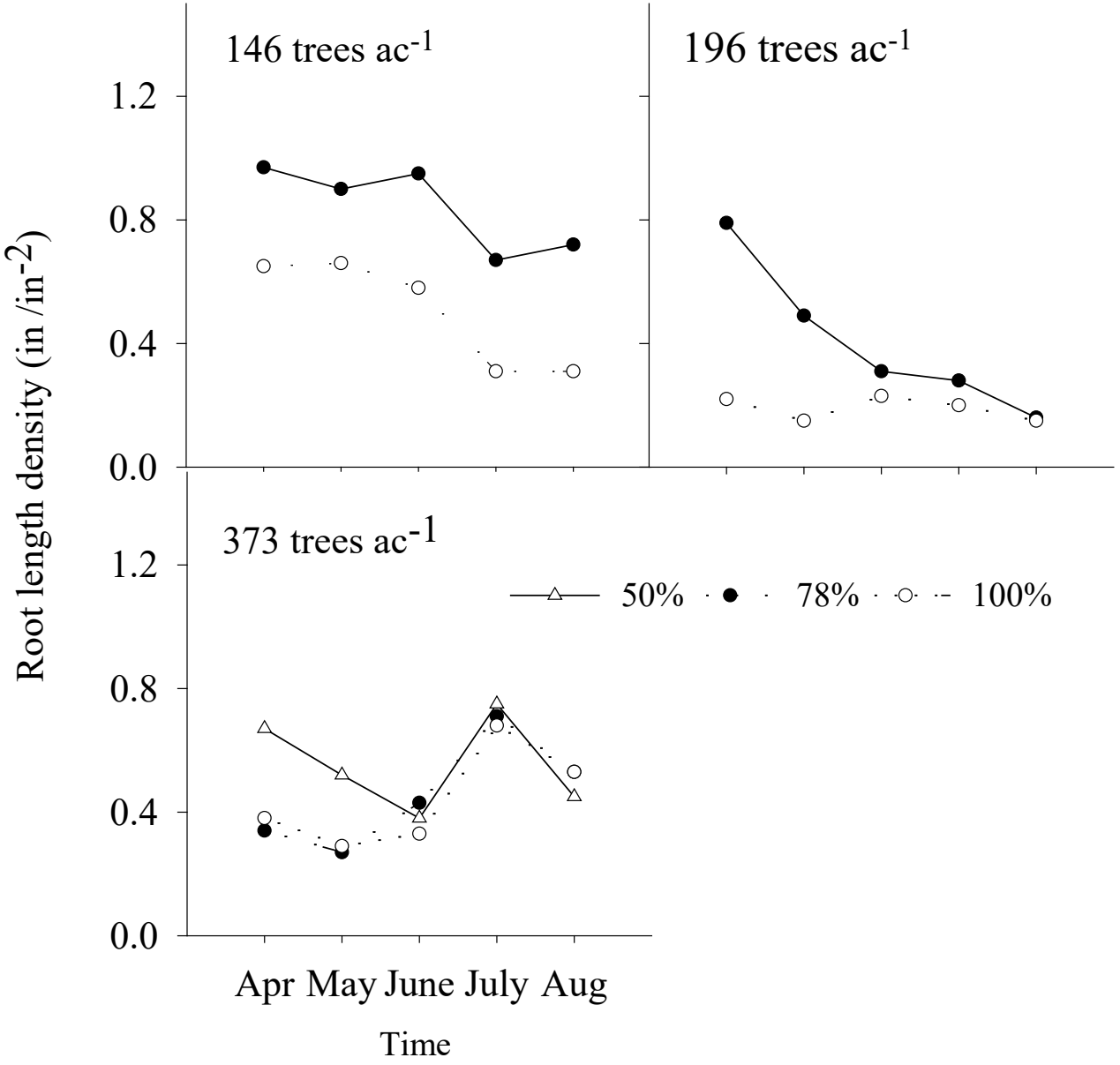
 Result and discussion



Stem water potential

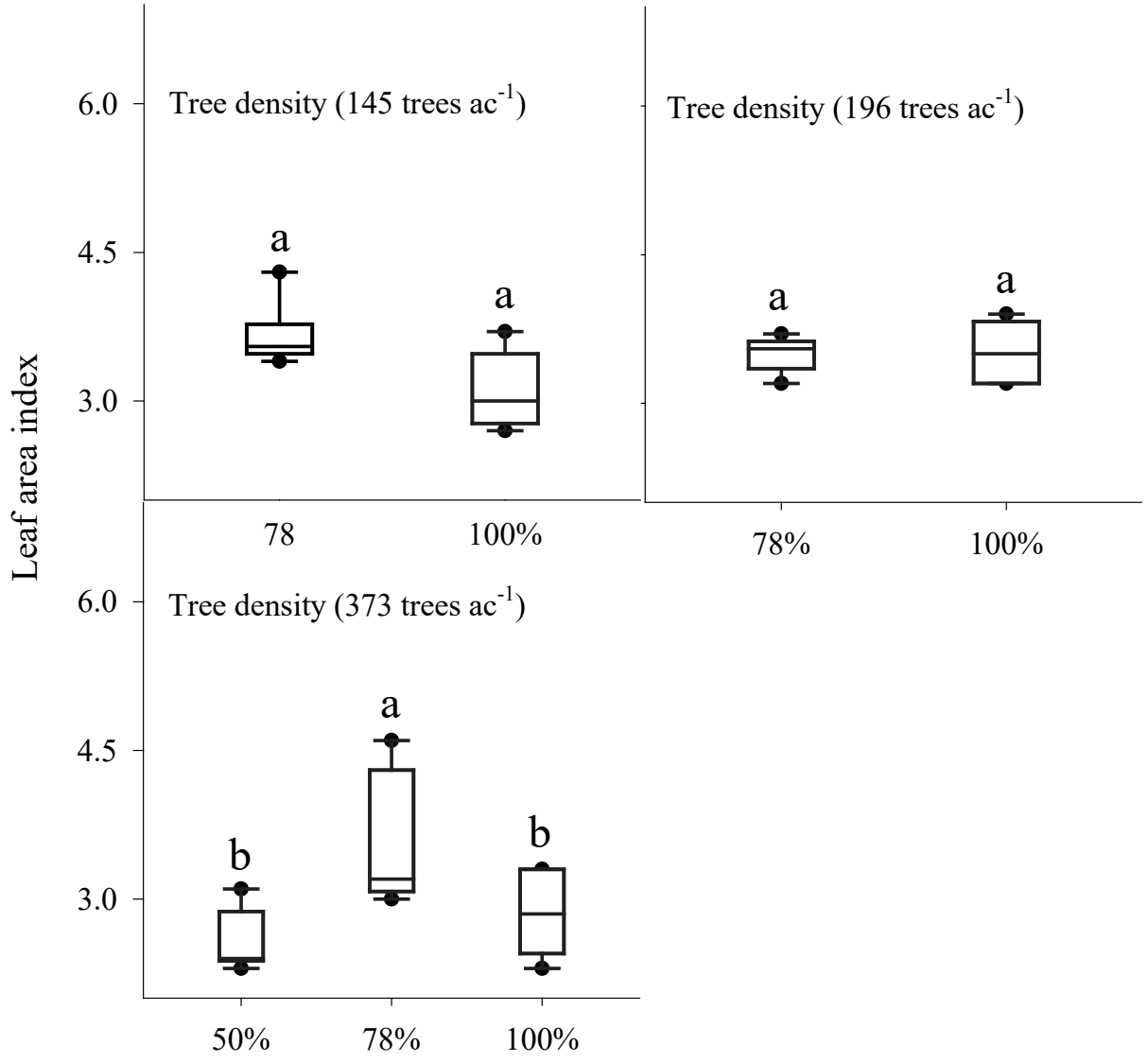
- Lower stem water potential at the highest tree density.
- Potential highest water uptake and Evapo-transpiration

 Result and discussion



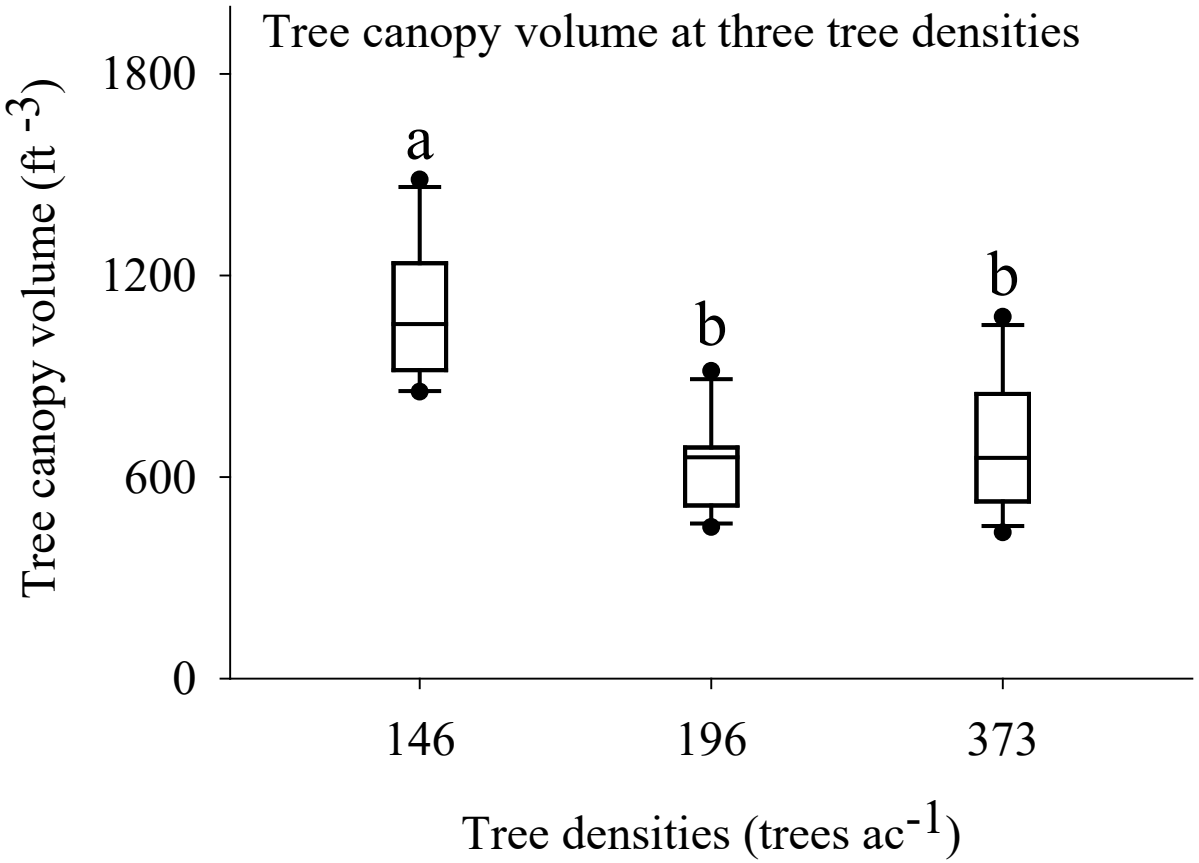
Root length density (RLD)

- At lower tree densities, the RLD was higher at lower irrigation rates
- At higher tree density, the lowest irrigate rate (50% ETo) showed the highest RLD
- Variation in RLD was higher during the spring than the summer season



Leaf area index (LAI)

- At lower tree densities, no significant different in LAI
- At higher tree density, the moderate irrigation rate (78%) had the highest LAI
- Variation in RLD was higher during the spring than the summer season


Tree canopy volume at three tree densities
Tree canopy volume (ft -3)
1800
1200
600
0
a
b
b
146
196
373
Tree densities (trees ac-1)

Preliminary Remarks

- At moderate tree density (196 trees acre^{-1}):
  - The moderate irrigation rate showed uniform water distribution across the 3 soil profiles
  - Highest stomata conductance and highest water potential
  - Higher RLD and leaf area LAI
- At higher tree density (373 trees acre^{-1})
  - Lower irrigation rater (50%) showed the highest RLD but the least LAI
- Lower irrigation rater (50%) showed the highest RLD but the least LAI
- The lowest tree density had: ~ the highest water consumption
  - highest TCV, RLD, lowest stomata conductance

Acknowledgement

- Ranch I Cooperation Farms

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Thank you

Reference:

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