

Assessing Citrus Water-Use with Lysimetry using Evapotranspiration-based Irrigation Scheduling in Florida

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Objective

To assess water-use dynamics of young Huanglongbing (HLB)-affected 'Valencia' orange (*Citrus sinensis*) trees in Florida under controlled environment

Introduction



Graham, 2016
Photo: Tyler Jones

- Greater than 40% root loss as a result of HLB (Graham et al., 2013; Kadyampakeni et al., 2014; Hamido et al., 2017)

- Good irrigation scheduling is necessary to minimize leaching (Morgan and Kadyampakeni, 2020)

Hypothesis

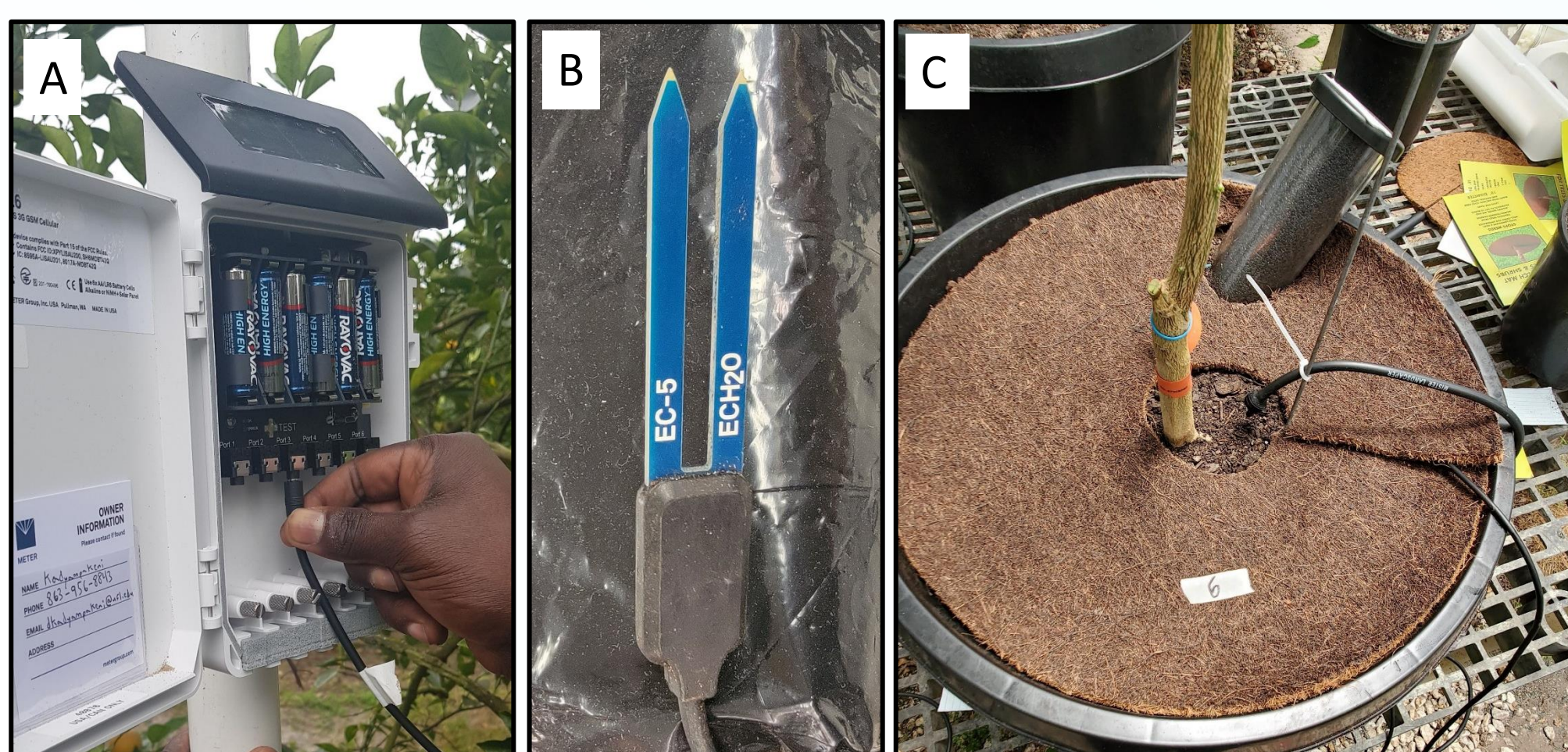
HLB-affected citrus trees with reduced irrigation (80% evapotranspiration (ET)) may show similar water use and water stress levels to HLB-affected trees with full irrigation (100% ET).

Why this study matters

- Citrus growers in Florida could reduce irrigation water use thereby cutting irrigation expenses and saving water for other domestic and non-agricultural uses

- There could be low leaching potential for nutrients within the root zone due to improved irrigation

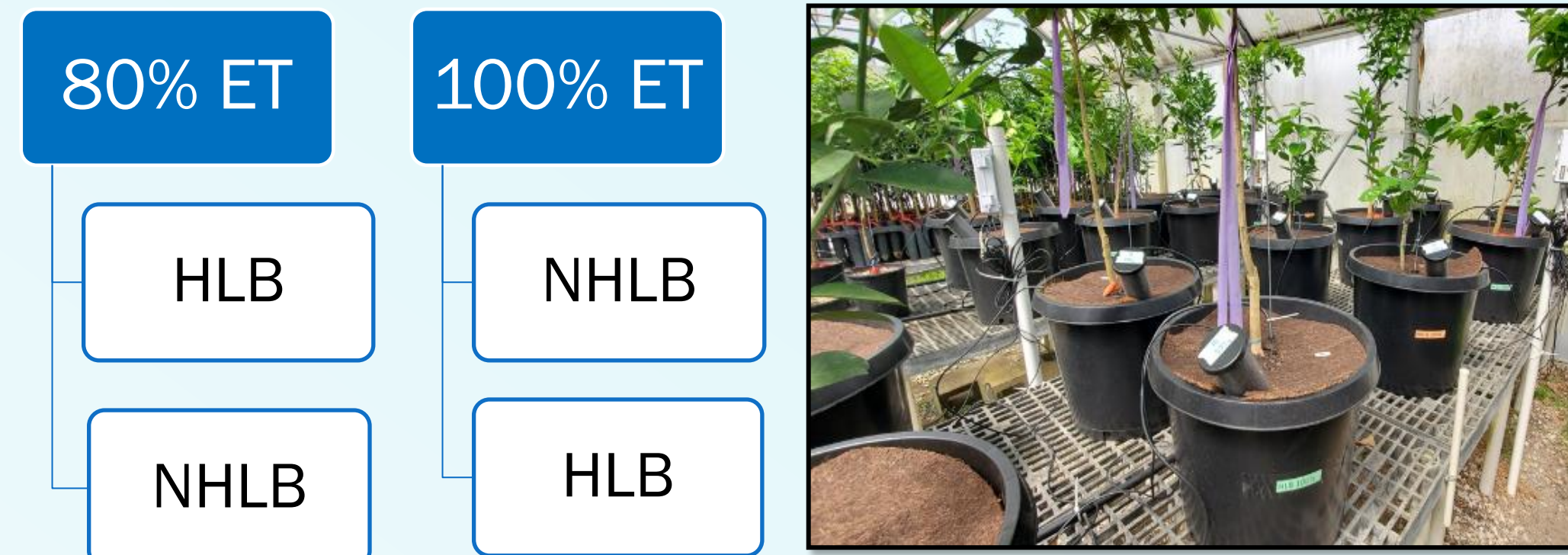
Materials



A= Data logger, B= EC-5 moisture sensor, C= Pot with plant, mulch and minirhizotron

- EC-5 moisture sensors were used to measure moisture content & ZL6 data loggers were used to record data
- Minirhizotrons were installed to take images of root growth at 50 cm depth

Methodology

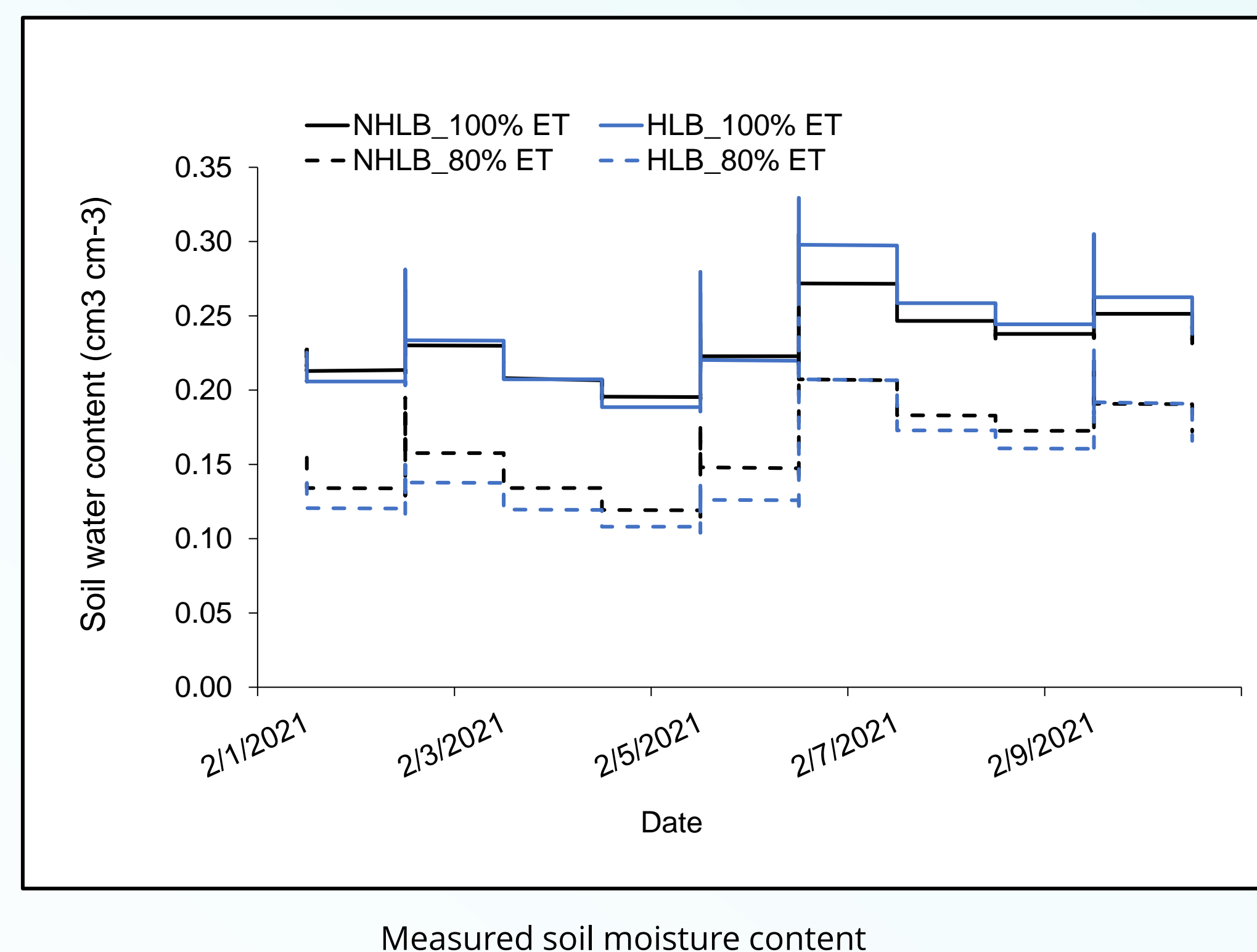


Treatment structure and experimental design for HLB-affected (HLB) and non-HLB-affected trees (NHLB)



A= Root image, B=Sap Flow, C= Stem water potential (SWP)

Results



- Soil water content at the irrigated zone was between 0.10 and 0.35 cm³ cm⁻³ in all the pots

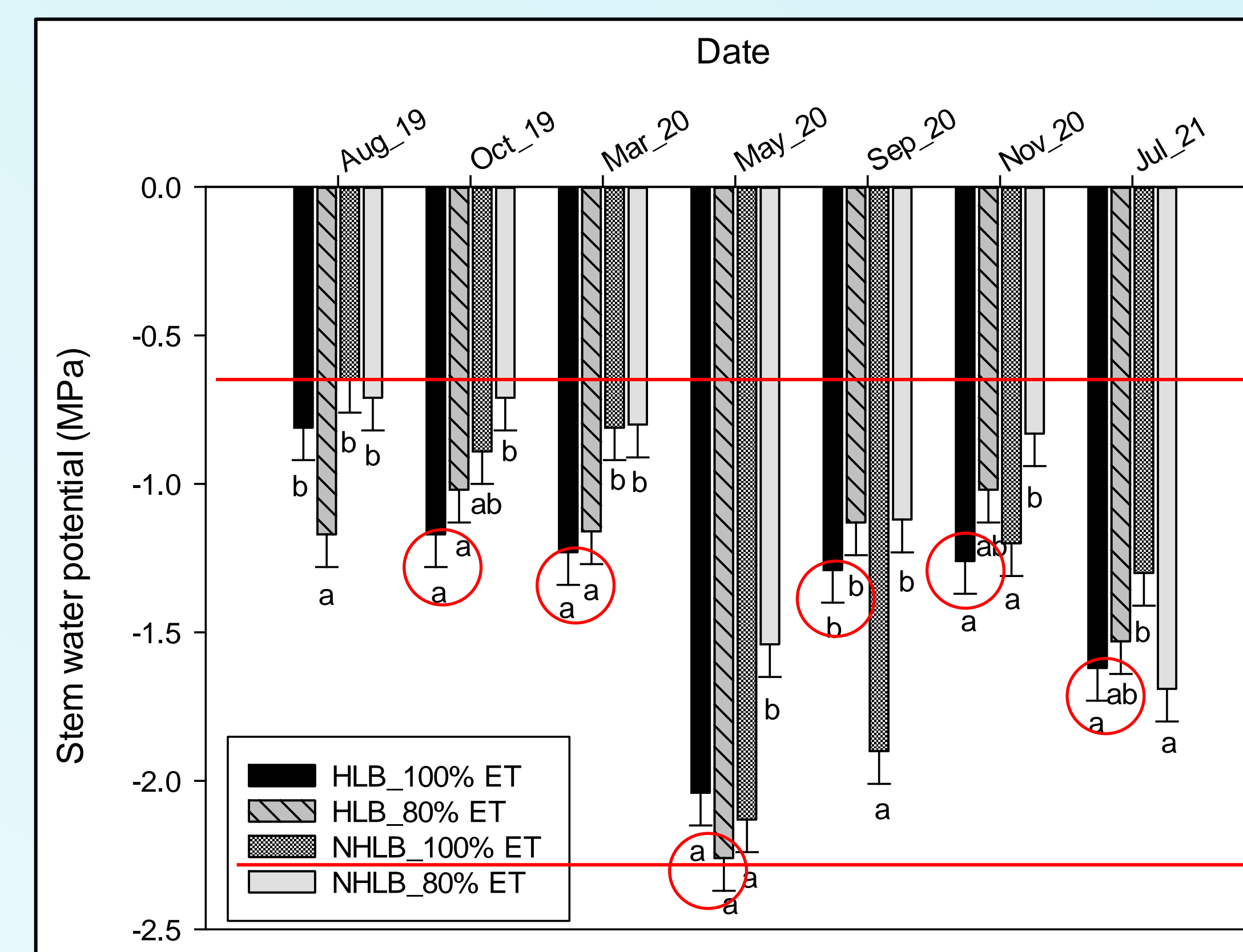
- The trees irrigated at 100% ET had about 30% greater moisture content than those at 80% ET

- SWP was significantly different (P < 0.001) among treatments

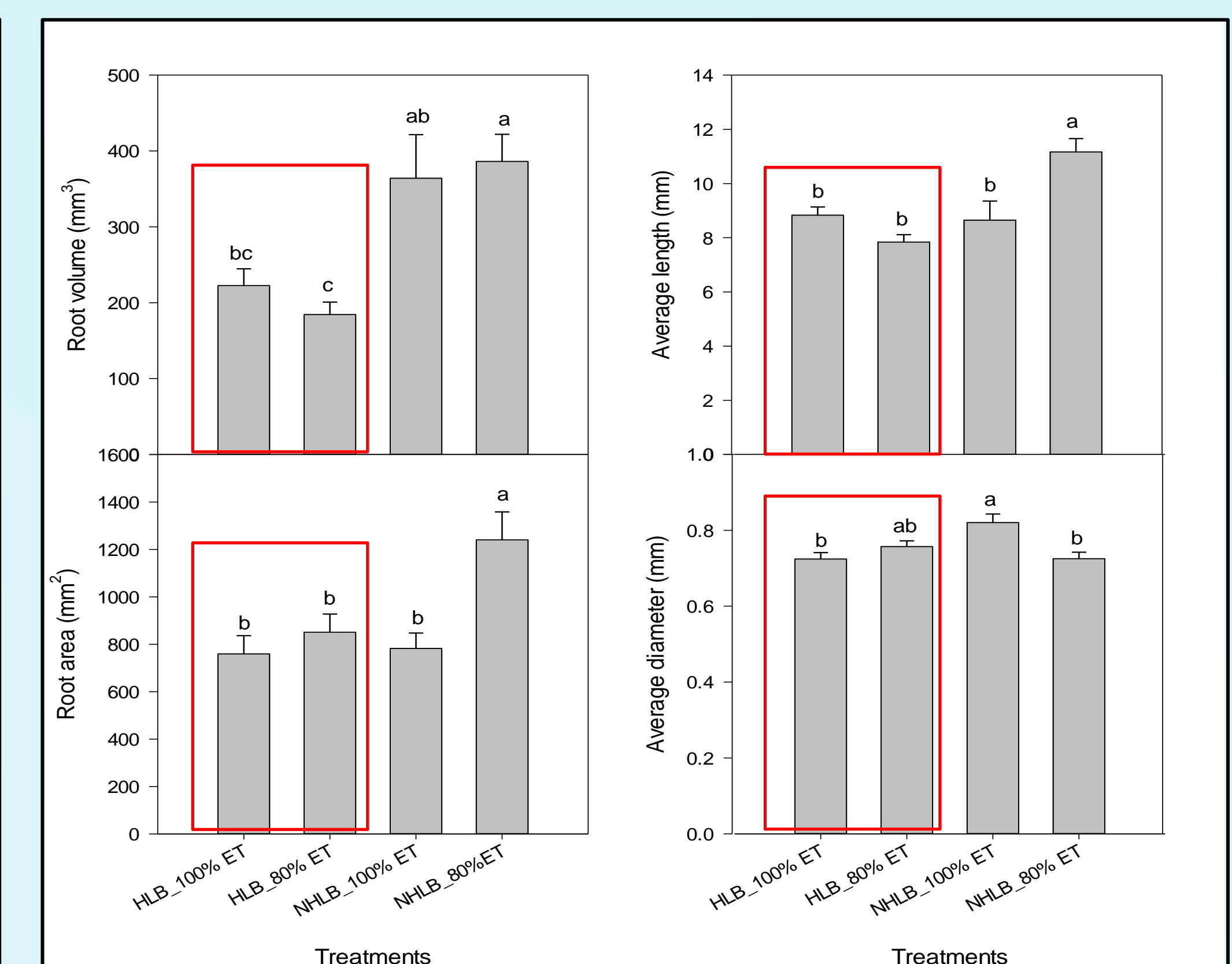
- SWP ranged from -2.4 and -0.6 MPa

- The HLB-affected trees under both 80% and 100% ET had similar SWP for all but Aug 2019

Results



Effect of treatments on stem water potential (SWP)



Effect of treatments on citrus root growth

- Root volume for NHLB trees at 80% ET was 50-60% greater than HLB trees at 100% and 80% ET

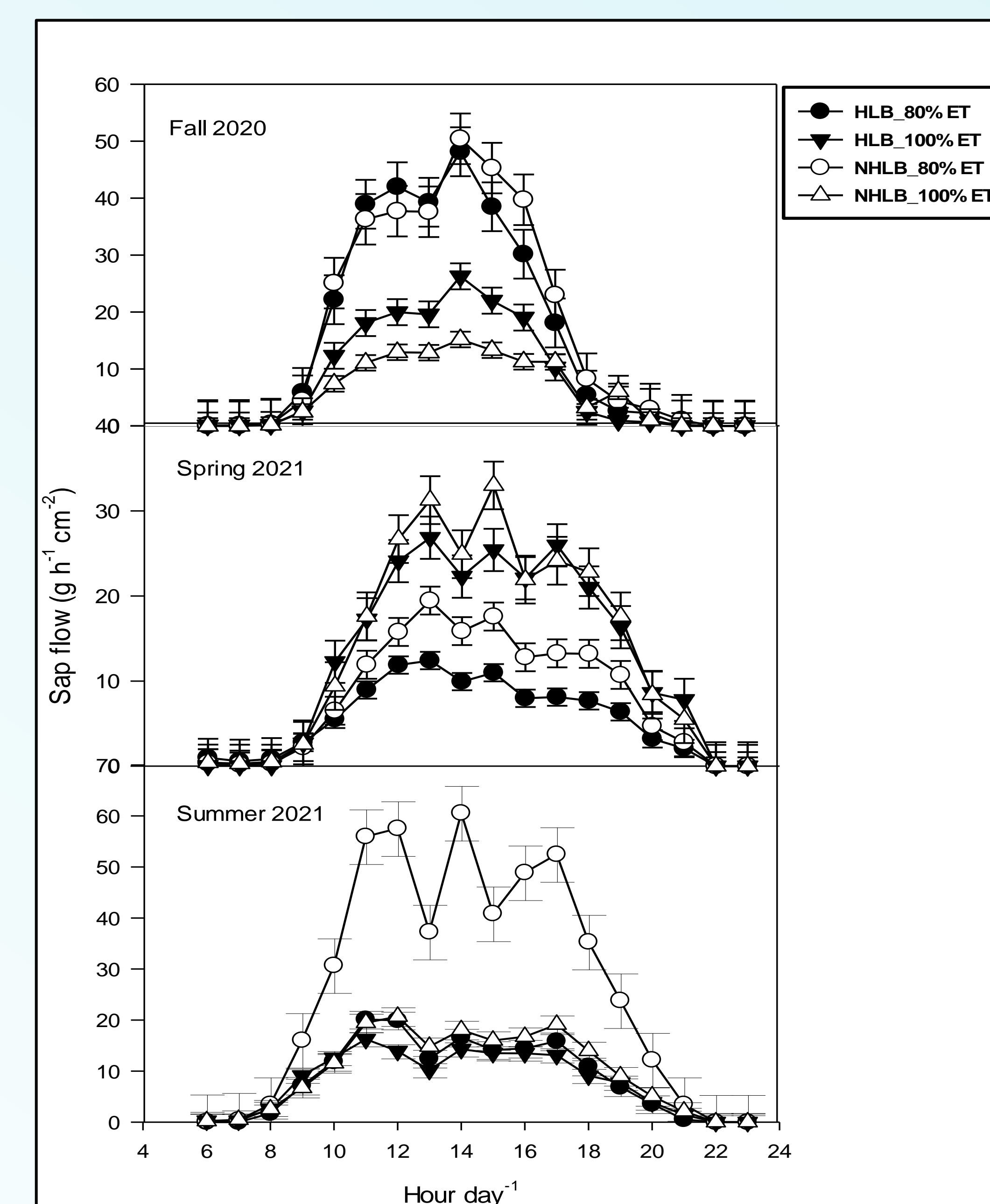
- Root area, length, and diameter were not different between HLB-affected trees subjected to 80% and 100% ET

Conclusion

- HLB-affected trees subjected 80% and 100% ET had similar SWP for most measured periods
- Sap flow (g h⁻¹ cm⁻²) peaked around 1200 and 1500 h
- Trees irrigated at 80% ET had at least 30% greater sap flow than those at 100% ET in Fall 2020
- However, in Spring 2021 trees irrigated at 80% ET had at least 28% greater sap flow than those at 100% ET for both HLB and NHLB trees
- There was no significant difference between HLB-affected trees at 80% and 100% ET for above, below and total dry weight biomass
- For young HLB-affected citrus trees, irrigating at 80% ET and irrigating daily prior 9 am is appropriate for improving water use efficiency

Acknowledgments

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Effect treatment on sap flow

- Generally, sap flow occurred between 8 and 20 h daily

- Sap flow (g h⁻¹ cm⁻²) peaked around 12 and 15 h

- Trees irrigated at 80% ET had at least 30% greater sap flow than those at 100% ET in Fall 2020

- However, in Spring 2021 trees irrigated at 80% ET had at least 28% greater sap flow than those at 100% ET for both HLB and NHLB trees