Shading Effects on the Physiology, Growth and Yield of HLB-infected ‘Hamlin’ Sweet Orange Trees

ANIRBAN GUHA* AND CHRISTOPHER VINCENT*

University of Florida, Horticultural Sciences Department, Citrus Research and Education Center, University of Florida, 700 Experiment Station Road, Lake Alfred, FL

Additional index words. citrus, HLB disease, shade, yield

The citrus juice industry of Florida has been incurring huge economic losses due to HLB disease which is spread by an insect vector (Asian citrus psyllid; Diaphorina citri Kuwayama; ACP). To improve the management of infected trees, one of our ongoing field-based strategies deals with optimizing whole-tree light environment throughout the year. An earlier study (Jifon and Syvertsen, 2003) and a survey (Vincent et al., 2021) indicated benefits of shaded environments on citrus photosynthetic performance, but empirical data on shading effects on HLB-infected trees are not available. At the University of Florida, Institute of Food and Agricultural Science Citrus Research and Education Center at Lake Alfred, a field experiment was initiated in Oct. 2018. In a randomized block design, four-year-old, 1–1.5 m tall ‘Hamlin’ (Citrus sinensis) trees (naturally infected by Candidatus Liberibacter asiaticus (CLas.) were treated with different levels of shade (0, 30, 50, and 70% shade) using shade structures consisting of black polyethylene nets with different mesh sizes. Our major objective was to investigate whether shade environments positively affect whole-plant physiology, growth, and yield characteristics of citrus trees. We also assessed what percentage of shade is optimum for citrus growth and productivity. Measurements of tree canopy architecture indicated significant differences in important growth characteristics across treatments. Among the shading levels, 30% shade showed significant positive impacts on tree growth and yield performance. Within two years of treatment onset, the 30% shade grown trees manifested higher magnitude of plant volume, density, biomass, and area compared to the non-shaded cohorts. Yield data from years 2019 and 2020 indicated an increasing trend in fruit quantity in 30% shaded trees, though longer term data collection is needed to confirm this. Physiological measurements conducted in past two years indicate better photosynthetic efficiency, higher carbon and water fluxes, safer range of leaf operational temperature and more balanced source-sink relationship in the 30% shade grown trees compared to their non-shaded counterparts.

Our study provides evidence at the whole-plant and leaf physiological levels that shade ameliorates the symptoms of HLB disease, resulting in enhanced growth and yield. The agronomic conclusion is that mild to moderate shade treatments may be a valuable tool in dealing with HLB disease which is endemic in several citrus-producing regions. Future work should address the economic cost-benefit of shading commercial citrus groves, as well as identify the optimum shading deployment for HLB-affected trees. Further, different colored shade nets could be tested to examine if they alter light quality and induce differential shading impacts on citrus physiology and yield performance. Future work should also address the degree to which shading impacts ACP vector pressure and populations of CLas. in the plant.

Literature Cited


*Corresponding authors. Email: anirbanguha@ufl.edu; cvince@ufl.edu