# Made in the Shade



*Yield per tree over two years (2019, 2020). Trees were 5-8 year-old 'Hamlin' trees on Kuharske, HLB-affected trees, infected before the start of the shade in December 2018. 15 kg per plant is approximately 240 boxes per acre.*
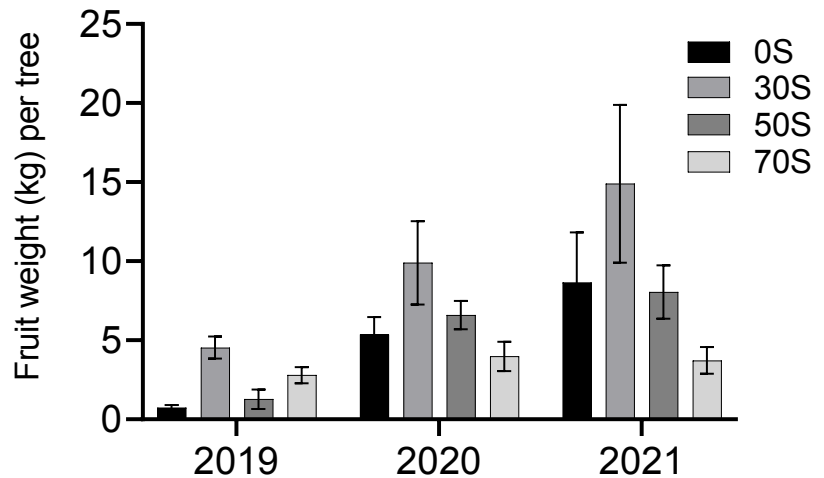
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Mild shade reduces stress, increases growth and yield, and may improve pest management under HLB. It reduces high temperature and water stresses. It may reduce HLB transmission, by making the trees less "apparent" to ACP. It also appears to reduce the severity of HLB symptoms in already infected trees. We began our research to test whether shade could be used horticulturally to reduce HLB transmission and severity in the field and improve yield. Shade reduced many symptoms of HLB in infected trees in the field. Under continuous 30% shade, trees produced more than 2x the yields of full sun trees for three years. Too much shade, though, (50% and 70% shade) reduced yields relative to the 30% level. Shade improved water relations and enhanced photosynthesis in HLB-positive trees. It also made trees more heat tolerant. This may be because the combination of high light and HLB pushes trees beyond their capacity to acclimate. Overall, shade trees were less stressed and grew more than full-sun trees. This information may be used in the future in three ways: 1) Approaches that already use netting (CUPS, IPCs) can be optimized to provide the healthiest amount of shade. 2) Particle film technology (kaolin clay) can be similarly dosed. 3) It may be worthwhile to invest in approaches to shade netting for production of high-value varieties.

We are continuing work on this project to understand the impacts of shade on HLB transmission and to know whether the effects of shade on HLB-affected trees are different from shade's effect on healthy trees. We are also looking at how to make cost-effective shade structures that have the best effects on citrus trees.