Foiling the yellow dragon

Aluminized plastic mulch repels psyllids, reduces HLB spread and accelerates growth of young citrus trees.

By Scott Croxton and Phil Stansly

INTRODUCTION

Huanglongbing (HLB), or "greening," is a debilitating disease of citrus that occurs in most growing regions of the world except the Mediterranean and Australia. The Asian form, caused by a phloem-limited bacteria, *Candidatus* Liberibactor asiaticus, is vectored by the Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama. It has now spread throughout most of the Americas where citrus is grown, including Brazil, Mexico, Florida, Texas, and most recently, California.

Vector control is key to slowing spread of the disease, and is especially critical in new plantings which flush frequently and are especially susceptible to the disease. ACP requires young flush to reproduce and develop, so systemic neonicotinoid insecticides applied to the soil have been the primary means of safeguarding young trees from ACP. However, protection is not complete, and reliance on a single mode of action almost assures insecticide resistance. Therefore, additional tactics are needed to protect new plantings from ACP and ultimately HLB.

We tested the ability of metalized polyethylene film used as mulch to repel adult ACP. We also evaluated effects on incidence of HLB and early tree growth. Metalized polyethylene mulch is also known as aluminized, silver or ultraviolet (UV) reflective plastic mulch.

HOW REFLECTIVE MULCH WORKS

Reflective mulch has long been used to prevent day-flying, visually orienting insect pests such as aphids, thrips and whiteflies from colonizing a variety of young crop plants. The theory is that the insects become disoriented by sunlight emanating from below, which impairs their ability to locate the host plant. Early successes spurred the use of metalized reflective mulches, which has become common practice in many crops like tomato and pepper. Therefore, we tested the use of metalized polyethylene mulch to protect a new citrus planting from ACP and consequently HLB. We also assessed its impact on soil moisture and weed pressure as possible benefits of mulching to young citrus.

Hamlin orange trees grafted to US-802 rootstock were transplanted May 18, 2010 at the Southwest Florida Research and Education Center located in Immokalee at a spacing of 8 feet within rows and 18 feet between rows. Plots consisting of 10 trees each were assigned using a randomized complete-block design to one of three treatments: white-faced polyethylene mulch, metalized polyethylene mulch and a bare-ground control. Each treatment was replicated four times. Trees were irrigated with two Toro Turbo-Key® drip emitters placed within 6 inches of the trunk, each providing 2 gallons per hour. Comparisons were also made with alternate rows irrigated with microsprinklers emitting 16 gallons per hour shared between two trees. Drip irrigated trees received liquid fertilizer 8-2-8 injected in the irrigation water weekly at the equivalent recommended rate (0.75 pounds of 8-2-8 granular fertilizer every six weeks). Microsprinkler irrigated trees received the recommended granular fertilizer rate once every six weeks. A 5-foot-wide plastic was laid flat on the ground before planting with a standard Kennco vegetable bedder and holes were melted into the plastic with heated metal rings.

We wanted to observe effects of the mulch under heavy ACP pressure, so the normal soil-applied neonicotinoids were not used. However, two foliar sprays of contact insecticides were applied when three quarters of total flush inspected were found to be infested with ACP. In addition, Intrepid®2F was applied approximately once a month to control citrus leafminer, whose adults fly at night and orient mostly by smell. A mixture of Krovar® and glyphosate was applied as needed in the microsprinkler irrigation for weed control. Main treatments

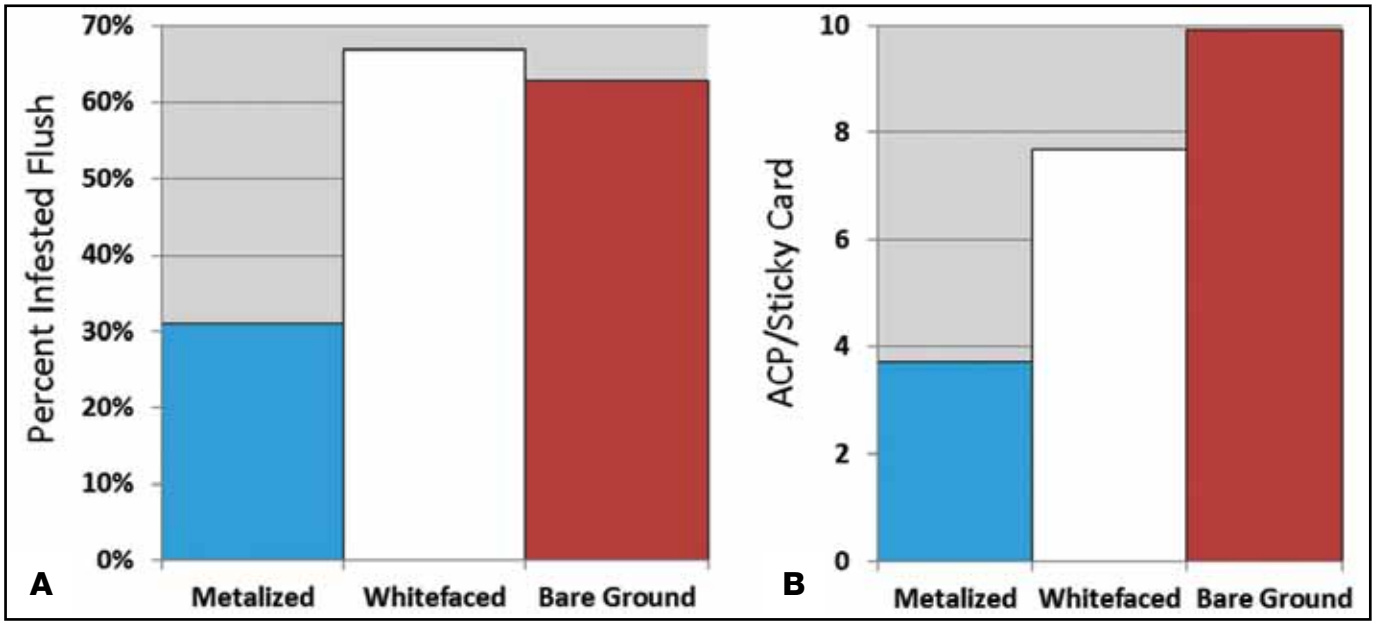

Figure 1. *Percentage infested flush on young citrus trees (A) and average ACP per sticky card (B) on metalized mulch, whitefaced mulch or bare ground*

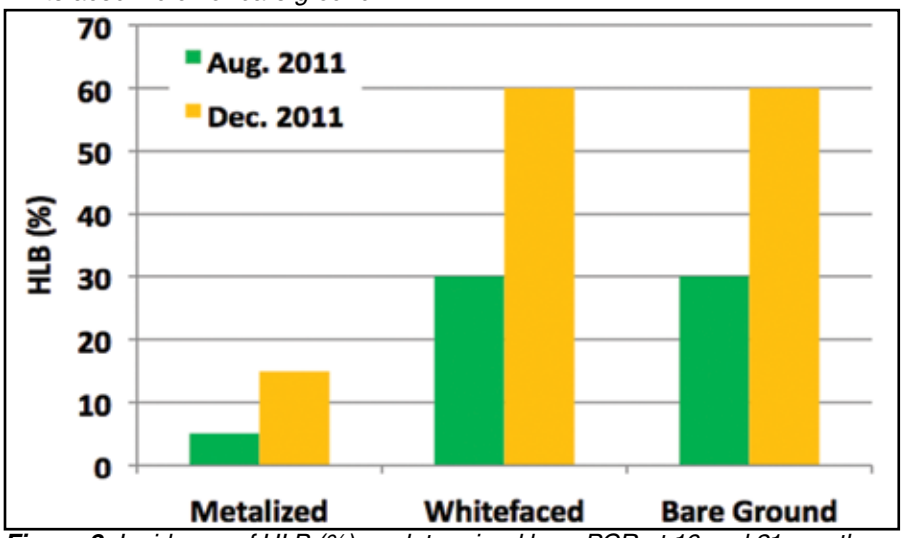

Figure 2. *Incidence of HLB (%) as determined by q-PCR at 16 and 21 months after planting under high ACP pressure*

received only spot sprays of glyphosate. ACP was monitored every other week by flush inspection and sticky cards placed within the plots to assess ACP movement among trees. Other observations included a weed biomass assessment, weekly soil moisture readings, HLB testing using q-PCR (DNA fingerprinting) every six months and trunk measurements every six months.

TEST RESULTS

A significant treatment effect was observed in the percentage of flush infested with ACP. Less than half as many flush over all dates were infested with ACP on trees growing on metalized mulch compared to trees on whitefaced mulch or bare ground, with no significant difference between these latter two (Figure 1a). ACP movement between trees, as indicated by sticky card captures, showed even greater dissimilarities among treatments, with almost three times more ACP captured by traps placed between trees on bare ground compared to metalized mulch (Figure 1b). Captures on whiteface mulch were intermediate and significantly different from either of the other two treatments. No effect was seen on populations of beneficials such as lacewing, ladybeetle and spiders, although populations were generally low.

Results of q-PCR analysis mirrored those for ACP, with the lowest rates of HLB incidence among trees on metalized mulch and the highest rates on bare ground. Incidence of PCR positive trees sampled Aug. 5, 2011 was 30 percent on bare ground and whitefaced mulch, six times higher than on metalized mulch (Figure 2). By the second sample date of Dec. 13, 2011, incidence had doubled to 60 percent

in bare ground and whitefaced mulch plots, still four times greater than on metalized mulch.

The system of plastic mulch, drip irrigation and fertigation altered growing conditions in ways that had positive effects on young tree development. Highest soil moisture levels (5.5 percent) were maintained under metalized mulch, followed by whiteface mulch (4.9 percent), bare drip-irrigated ground (4.5 percent), and finally trees irrigated with microsprinklers (3.6 percent). Most weeds (13.8 pounds dry weight per plot) were harvested from microsprinkler irrigated trees compared to 6.2 pounds from bare ground plots and only 0.09 pound from mulched plots. Tree growth as indicated by trunk cross section area above the bud union was three times greater on metalized mulch 19 months after transplanting compared to microsprinkler irrigated trees (figures 3 and 4) and trees were twice as tall (figures 5 and 6, see page 11).

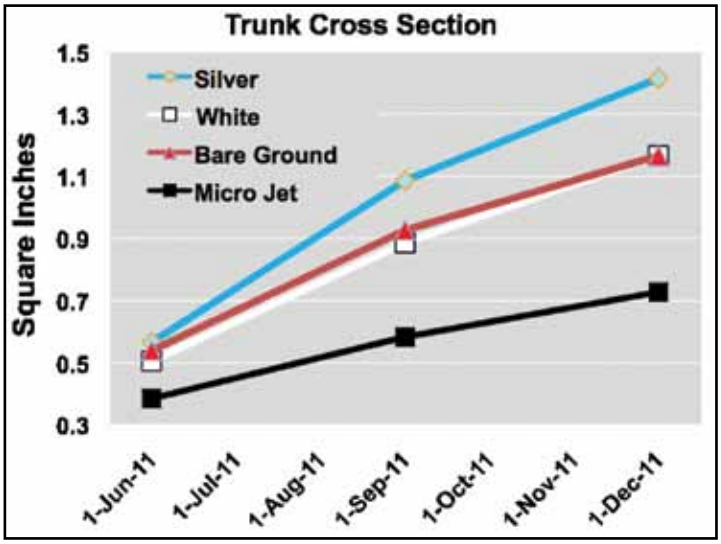

Figure 3. *Trunk cross-sectional area in square inches, 13 to 19 months after transplanting*

Metalized mulch decreased colonization by ACP and consequent HLB infection for two years. Toward the end of that period, canopy growth began shading out the mulch and ACP numbers increased, especially in the upper canopy. Nevertheless, together with drip irrigation and fertigation, the mulch almost doubled growth rates of young trees compared to the current standard, in part due to increased soil moisture and better weed control.

OTHER THINGS WE'VE LEARNED

Planting citrus on plastic mulch is new technology which will require much trial and error to perfect. We have learned to make the plant holes more quickly with a post-hole digger. Also, we have learned that raising the bed in the middle allows water to run off and prevents accumulation of soil. The 1.25 mil (a mil is a thousandth of an inch) film used in vegetable production did not last long, and we had to replace it by hand. We are presently testing a more durable 3 mil product which includes a clear plastic coating to protect the aluminum coat.

Our experiment was conducted without systemic insecticides that are


Figure 4. *Trunks of trees grown on metalized mulch with drip emitters and on bare ground with microsprinklers*

Figures 5 and 6. *Scott Croxton (6 feet tall) with trees grown on metalized mulch using drip irrigation (left) and trees without mulch and irrigated with microsprinklers*

typically used to control ACP and reduce HLB spread in young citrus. It is likely that rates of infection would be much lower if systemic insecticides were used to further reduce psyllid populations. Effectiveness of these tactics should only improve by scaling up from small plot to block. Furthermore, much lower vector pressure would be expected in a commercial grove where ACP was being controlled.

The mulch itself is not expensive, but in areas subject to freezes, an alternate irrigation system could be necessary. At least some of these additional costs could be compensated for by reduced need for weed control, more efficient application of systemic insecticides through the drip, and increased growth rate which would shorten time to crop profitability. Getting trees off to a healthy start by maintaining them free of HLB during the first two years in the field could pay big dividends later on.

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