

CALIFORNIA CITRUS NURSERY BOARD

Final Grant Report November 2019

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Project Title: Annual citrus tristeza virus index at the University of California Lindcove Research & Extension Center.

Objectives:

Provide funds for the leaf collection, direct tissue blot testing by LREC staff to detect CTV-positive trees at the Lindcove Research & Extension Center.

Report

To protect the Citrus Clonal Protection Program (CCPP) field plantings and other research programs from citrus tristeza virus infections (CTV), an annual index of all trees is conducted each year at the 175 acre University of California Lindcove Research & Extension Center (LREC). During the period of 1990-2006, an average of 3 CTV-positive infected trees were found and removed each year in the research blocks and for a 14 year period, no CTV-positive trees were found in the CCPP foundation blocks, demonstrating that infected tree removal at the Center provided protection of the foundation block from this disease (Fig. 1). This low level of CTV incidence at LREC and the lack of CTV in the foundation block allowed budwood to be released from the field trees in the foundation block 2-3 times/year. During 2007 and 2008, 52 and 83 CTV-infected trees were found. The epidemic of CTV at LREC had two consequences; 1) it caused the CCPP program to stop releasing budwood from the foundation blocks and instead release budwood from the LREC screenhouses and 2) the removal of many infected trees from research blocks began to affect research results, especially in scion and rootstock trials. There had been no CTV-infected tree removal in the commercial citrus orchards surrounding LREC since 1998. Surveys of the citrus orchards in the ½ mile surrounding LREC indicate that the incidence of CTV increased from an estimated 0.14% of trees in 1998 to 1.2% in 2007. Thus, there was a 10 fold increase number of CTV-infected trees surrounding LREC and it has likely increased significantly since then.

Since 2008, primarily the Tulare County Pest Control District (TCPCD), but also periodically other Pest Control Districts, have provided funding for pesticide treatments to control the aphid vectors in a 1-2 mile radius around LREC. Citrus around LREC is being treated in the spring with an effective foliar Assail (acetamiprid), Actara (thiamethoxam), Exirel (cyantraniliprole), or Sivanto (flupyradifurone) and in the fall with systemic Admire Pro or generic. Citrus in backyards in the town of Lindcove is also treated with systemic imidacloprid in the fall. Treatments started in the fall of 2008 and during 2010-2017 an average of 18 CTV positive trees were found and removed each year. In 2018, however, there was a much higher number of CTV-infected trees (61 trees) concentrated in

young orchards and an orchard (Field 24) that was untreated because it is part of the entomology program. To mitigate this, all the trees in Field 24 were removed and treatments in the young trees were intensified. However, in 2019 we again found a high number of infected trees (38), indicating that tree removal is no longer slowing the spread of CTV.

The TCPCD also provides funding for the CCTEA to sample trees using ELISA in a 0.5-1 mile radius around LREC to monitor for severe strains of CTV that respond positively to MCA13. During 2010-2019 a total of 83 trees were found to be MCA13+ and growers voluntarily removed 100% of these trees. Thus, the TCPCD and the growers around LREC are taking steps to reduce the incidence of severe CTV strains in this district and further protecting LREC.

In August 2019, a committee of researchers was convened and tasked with making decisions about next steps for testing and tree removal at Lindcove. The full report is attached. A key recommendation was to stop removing mild strain CTV-infected trees at LREC because mild forms of CTV are endemic in the area, not every block at LREC can be treated with pesticides, tree removal is no longer stopping spread of CTV and cumulative tree removal is having a negative impact on the usefulness of blocks. The committee did recommend that the TCPCD continue funding aphid control around LREC and the surveys for the severe strains of CTV and removal of those trees both on and off of the Center. The committee also recommended that CCNB funding to detect CTV-infected trees at LREC needs to continue both to detect severe strains and to provide researchers with information about which trees have CTV, because it may affect their results. The TCPCD is continuing the funding for aphid treatments and severe strain surveys. We request that the CCNB continue funding testing of all trees at LREC for both mild and severe strains.

Fig. 1. Number of CTV-infected trees removed at the Lindcove Research and Extension Center.

**Number of CTV-infected trees removed
at the Lindcove Research and Extension Center
Collection in April-May**

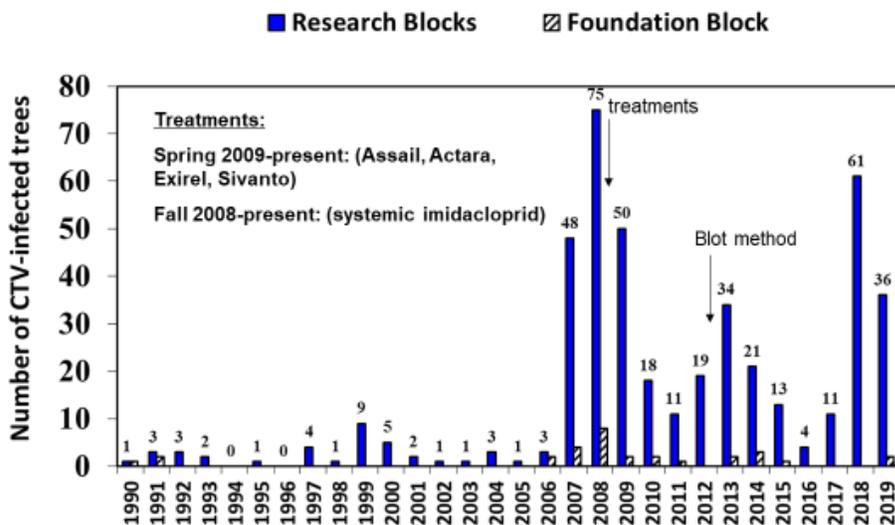


Fig. 2. The number of MCA13+ tree removals per year 2010-2019 in the 1 mile area around LREC.

**Number of MCA13 positive trees removed
in the 1 mile region around Lindcove Research and Extension Center**

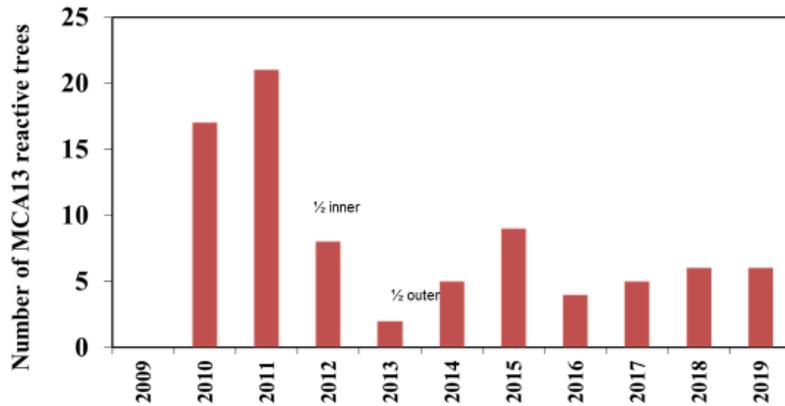
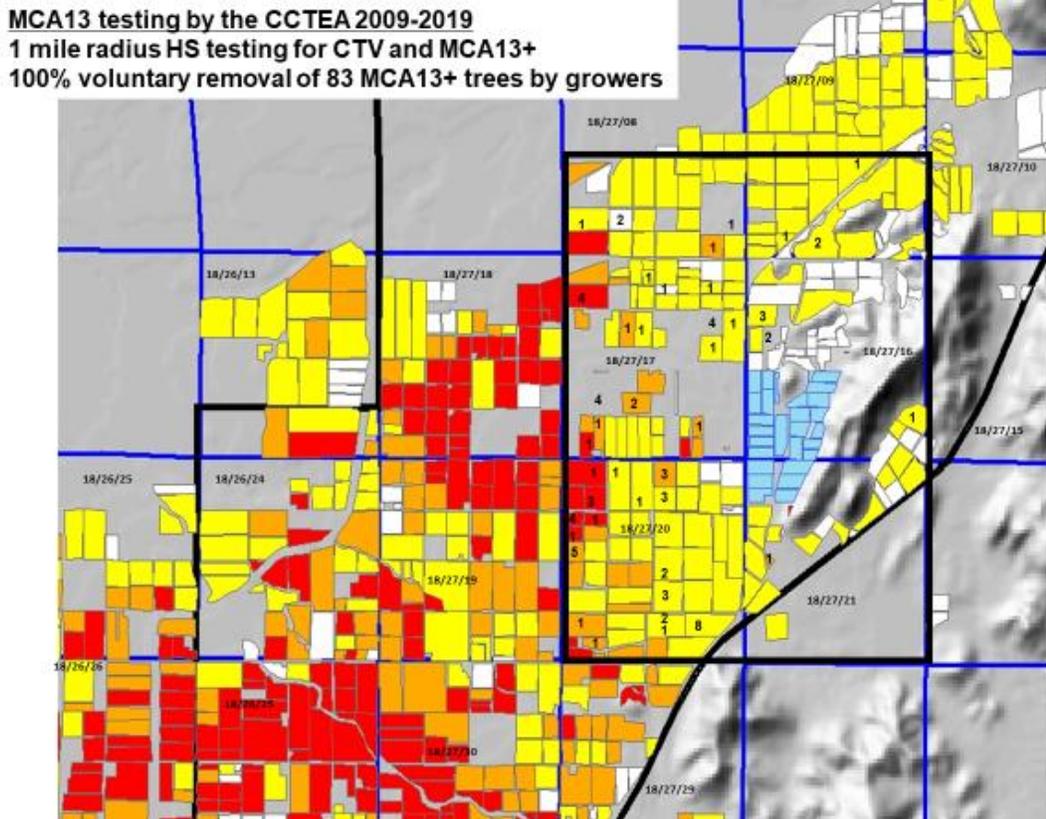


Fig. 3. The location and number per block of MCA13 positive CTV-infected trees that have been voluntarily removed in the 1 mile region (black square) around Lindcove REC (blue) since 2010-2019 (total of 83 trees).



Lindcove Research and Extension Center Protection against CTV
August 12, 2019

Committee: Beth Grafton-Cardwell, Jill Barnier, Greg Douhan, Subhas Hajeri, Marylou Polek, Georgios Vidalakis, Ray Yokomi, Judy Zaninovich

Since the initiation of aphid treatments around Lindcove REC and CTV-infected tree removal at the Center, the number of infected trees found and removed at LREC has averaged 19/year during 2010-2017 (Fig. 1). During 2018 and 2019, 61 and 37 CTV-infected trees, respectively, were found, suggesting that there is internal spread of the disease within LREC. In addition, the recent high number of tree removals as well as the cumulative tree removals over time are having a significant negative impact on some of the research plots. A committee of experts met on Aug. 12, 2019 to discuss what should be done with regard to CTV and the protection of LREC research.

Current CTV activities (2008 through the spring of 2019):

- Aphid control with insecticides in commercial and residential citrus 1-2 miles around the center during spring and fall.
- Hierarchical sampling of citrus blocks within 1 mile around LREC to detect MCA13 strains followed by more detailed sampling and voluntary grower tree removal.
- 100% testing of the 12,000 trees at LREC followed by removal of CTV-infected trees (tree removal has not yet occurred in 2019).

Recommendations of the committee

1. **Suspend tree removal of CTV-infected trees at LREC, except for MCA13 reactive (potential severe strain) trees.** *Rationale:* Tree removal is not keeping up with new infections and tree removal is impacting research projects. Mild strains of CTV are found throughout California and so the presence of these strains in the research blocks at LREC is representative of the area. MCA13 reactive trees, however, could result in disease symptoms in the trees and are not common in California and so these trees should continue to be removed. LREC has not had any MCA13 strain detections up to this point.
2. **Continue 100% DTBIA testing of all trees at LREC, with follow up testing of any positive trees tested via PCR for strain identification.** *Rationale:* It is important for researchers to know which of their trees are CTV-infected and what strain is involved so that they can take this into consideration when analyzing the results of trials. If MCA13 reactive strains are found, these trees would be removed.
3. **Continue MCA13 survey in the 1 mile radius of commercial citrus around LREC.** MCA13 testing continues to be the best method for detecting severe strains. It is very important to remove potentially severe strains in the area around Lindcove to protect the research blocks. Since 2009, 77 MCA13+ trees have been detected and voluntarily removed by the neighboring citrus growers.
4. **Conduct HS survey of a representative sample of low, med and high CTV-level blocks inside and outside the aphid treatment program to determine the rate of spread of the disease (additional funds required).** Comparing the rate of spread of CTV inside and outside the aphid treatment area will help the TCPCD determine the effectiveness of the vector control program and confirm that the funds provided by the PCD are being well-spent. Blocks inside

the aphid treatment area are already being sampled for MCA 13 and the polyclonal test could be done as well (#3). Additional blocks (6-9) outside the treatment area would also need to be sampled.

5. **Periodically test all blocks in the 1 mile region around LREC for the polyclonal CTV response as well as MCA13 reactivity (additional funds required).** Currently the trees in the 1 mile radius around LREC are tested only for MCA13. Periodically, the trees should also be tested for polyclonal CTV to monitor the rate of increase of the CTV and to provide data for #4.
6. **Continue vector control twice yearly in the 1-2 miles commercial and residential citrus around LREC.** The committee unanimously supported continuing vector control around the Center to help slow the spread of CTV and in particular MCA13 onto the Center.

Fig. 1.

