Thirty Years of Preimmunized Pera Sweet Orange in the Citriculture in São Paulo State, Brazil

G. W. Müller, M. L. P. N. Targon, and M. A. Machado

ABSTRACT: Brazil is the world largest citrus juice exporter and Pera sweet orange, a late season variety, is its main variety. In the late 1950’s, many Pera orchards, already growing on citrus tristeza virus (CTV) tolerant rootstocks, were badly damaged by a CTV strain that caused stem pitting, small fruits, and stunted tree growth. In 1961, an extensive research project was begun to find mild isolates of CTV which could be used to cross protect citrus. Release of the best protecting Pera clone, #66, started 30 yr ago and was rapidly increased by growers. Since then, many experiments in São Paulo and other Brazilian states, showed that this Pera clone was superior to other clones. Large-scale propagation of this Pera clone has resulted in almost no breakdown in protection in successive clonal generations and presently, some 80 millions of trees descend from the original Pera clone. More recently, however, there have been a few cases where orchards with the protecting Pera clone have a great number of trees showing severe CTV symptoms. Studies are now underway to investigate the reasons for this breakdown and to find new mild isolates to protect Pera, mainly in the Southern part of São Paulo where the severe CTV strain known as the Capão Bonito complex occurs.

Index words. CTV, severe isolates, segregation.
inoculated with isolate #66 was begun.

- In 1974, the great majority of growers who had received this budwood responded in a questionnaire that these trees grew satisfactorily. There were approximately 1,000,000 trees at that time.
- In 1977 the cross-protected Pera ranked first in an experiment with several other Pera clones (18). Protection is maintained through successive clonal propagations (3). Occurrence of low percentage of bad plants was explained by CTV rootstock infection prior to budding with the Pera IAC isolate (3).
- By 1982, there were 20,000,000 protected Pera trees (13). In 1987, the number grew to 50,000,000 trees in São Paulo State.
- In 1990, the Pera IAC was one of the clones used to establish registered open field budwood increase nurseries by the São Paulo Government.
- In 1996, the good results of Pera IAC was reported to other Brazilian States (14, 15).
- In 1997, molecular biology studies indicate that the #66 isolate multiplies quicker in the tissues than the severe “Barão B” CTV isolate (17).
- In 1998, Pera IAC is the first Pera clone selected in the citrus certification program of São Paulo (1).
- In 1997, it was estimated that more than 80,000,000 protected Pera trees in nurseries, young as well as bearing orchards attested its high performance.
- In 1998, plants of STG Pera Bianchi clone are inoculated with CTV isolate #66 (20), and are now performing extremely well in the south of the São Paulo State.

**PROBLEMS AND THE FUTURE**

The stem pitting control in Pera was satisfactorily achieved by using only the single mild CTV isolate labeled #66. This isolate afforded good protective effect and stability that holds now for nearly three decades. However, basing all protection of trees on only one mild isolate poses a risk of breakdown, as was observed more recently. There are some instances in which orchards propagated from the cross-protected Pera now have a greater than expected number of trees that are stunted, show stem pitting, and have uneconomic yields. Studies are now underway to investigate the reasons for this breakdown. Furthermore, the spread of citriculture to the Southwest region of São Paulo State, where the severe Capão Bonito CTV complex is prevalent (8), poses a problem to all sweet oranges and to the Rangpur lime rootstock. Also, in some instances, the cross-protected Pera have never done well (11). The above mentioned problems indicate that there is a need to identify new and better isolates for cross protection and that, besides protecting against the common severe isolates, new isolates must also be able to protect against the Capão Bonito CTV complex in Pera and other cultivars such as Natal, Valencia, and Hamlin. These cultivars form the bulk of the Brazilian citrus industry. Finally, there is a necessity to try to understand the mechanism of CTV cross protection.

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