A Further Report on the Grapefruit Tristeza Preimmunization Trial at Mildura, Victoria

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This preimmunization trial, established in 1961, was designed to test the effectiveness of protection against severe tristeza strains by mild strain inoculation using leaf implantation. Tristeza-free Marsh grapefruit on sour orange was selected as the susceptible host combination.

Symptom development and tree performance up to 1974 were reported at the Seventh I.O.C.V. Conference (Thornton and Stubbs 1976). This paper describes further developments within the trial, and reports on yield performance, particularly since 1974.

MATERIALS AND METHODS

Trees in the trial were planted in September 1961 at the Mildura Horticultural Research Station. Two months prior to planting, 35 trees were inoculated with a mild-strain isolate derived from a Lisbon lemon (Stubbs 1964). These trees, together with 25 trees uninoculated (controls), and 22 trees of Marsh grapefruit on sweet orange, considered a district standard, were planted in three adjacent blocks. The site and management of these trees have been described (Thornton and Stubbs, 1976).

Yield, by weight and fruit number, has been recorded every year for each tree. Size of trees, presented as surface area (π x d x h), was measured in 1964, 1967, 1975 and 1979.

Selected trees were indexed for tristeza on Mexican lime indicators in 1979 to determine movement of tristeza within the planting.

RESULTS AND DISCUSSION

The mean surface areas of Marsh grapefruit on sour orange, preimmunized and controls, and of Marsh grapefruit on sweet orange are compared in fig. 1. Performance of Marsh grapefruit on sweet orange is presented to indicate the relationship between the tristeza trial trees on sour orange and a scion/rootstock combination commonly used in the district. Trees on sweet orange were larger. Control trees tended to be larger than preimmunized trees in the early years of the trial; were similar in 1975, but were significantly smaller in 1979.

The mean annual yields are presented in fig. 2. Standard error indicates yield differences from 1975 to 1978, years not reported previously. Yields of control trees have declined dramatically due to tristeza infection since 1974, whereas yields of preimmunized trees are still similar to those of trees on sweet orange, although tending to be out of phase in their alternate-bearing patterns. Yield of control trees was only 41 per cent of that on preimmunized trees in 1978.

The yield decline of control trees is further represented in fig. 3, which depicts the number of fruit per kilogram, from the 1965-66 biennium to 1977-78 biennium. Bienniums have been used to even out alternate-bearing fluctuations. Although fruit sizes were similar for the three blocks of trees up to 1974, fruit size on control trees started to diminish rapidly and by 1978 was 37 per cent smaller than that from preimmunized trees. In 1976 and 1978, there was no significant difference between fruit sizes from preimmunized trees and those from trees on sweet orange.

Tree inspections in January 1979 indicated the extent of tristeza spread and development throughout the trial. All 25 control trees were in advanced stages of decline or were nearly dead, while 11 of the 35 preimmunized trees were affected to some extent. No trees on sweet orange were affected.

To date, no stem pitting has been observed. However, indexing tests confirmed the presence of tristeza virus in preimmunized and control trees. Further indexing on grafted combinations of seedling sweet orange on sour orange is continuing.

Observations suggest that decline is due to the natural spread of tristeza which, since 1975, has increased from 20 to 25 of the 25 control trees and from three to 11 of the 35 preimmunized trees.

The time period between noticeable canopy symptoms and significant yield decline appears to be 2 to 3 years. As was forecast by Thornton and Stubbs (1976) the yields and fruit sizes of control trees have diminished dramatically compared with the other trees. As the infection of some trees in the preimmunized block occurred 3 to 5 years later than those in the control trees, the question of comparative yield performances is not fully resolved at this stage. Some breakdown of protection apparently occurred in some preimmunized trees since the last report, but the extent of this trend will only be resolved by continuation of the trial.

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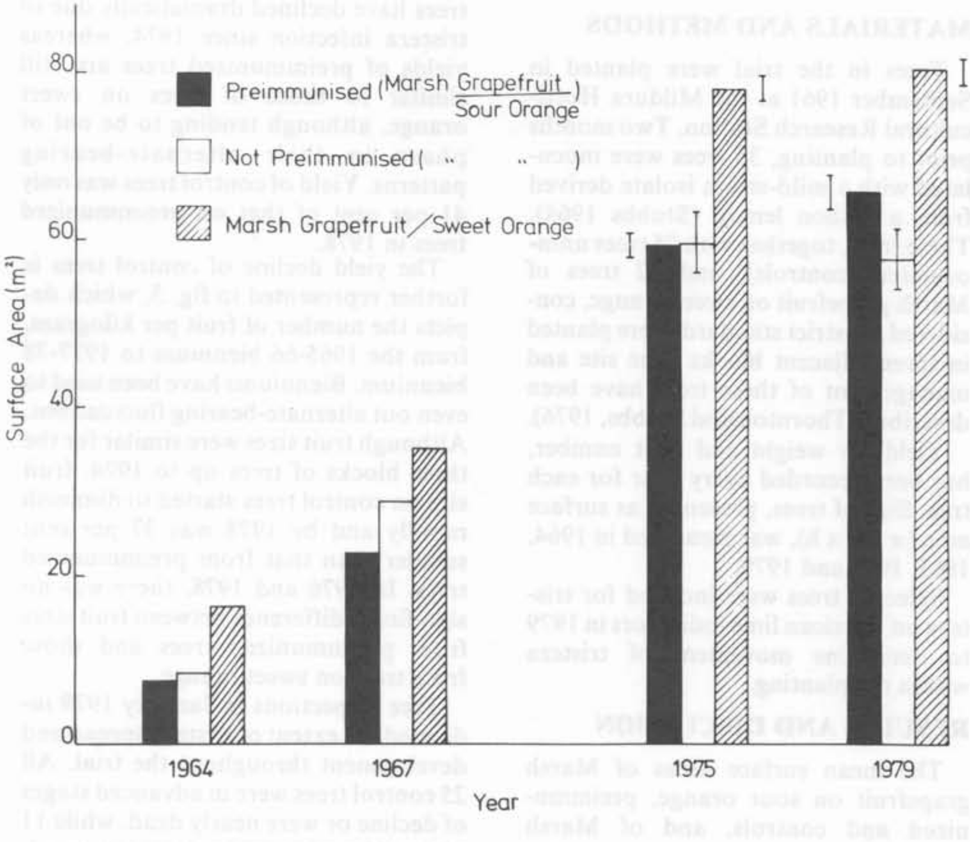

Fig. 1. Surface area of preimmunized grapefruit trees on sour orange rootstock, and control trees on sour and sweet orange rootstock, 1964, 1967, 1975 and 1979.

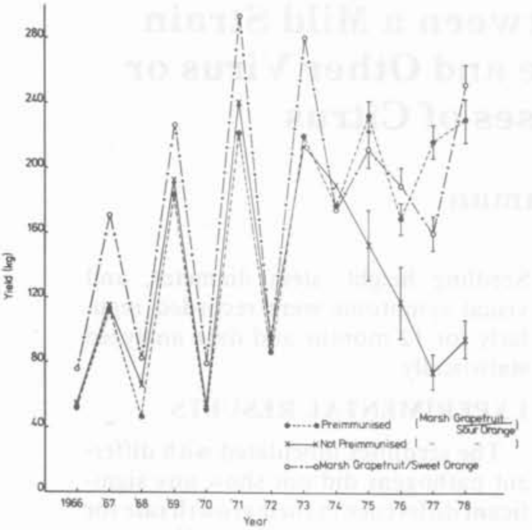

Fig. 2. Mean annual yields of preimmunized grapefruit trees on sour orange rootstock, and control trees on sour orange and sweet orange rootstocks, 1966-78.

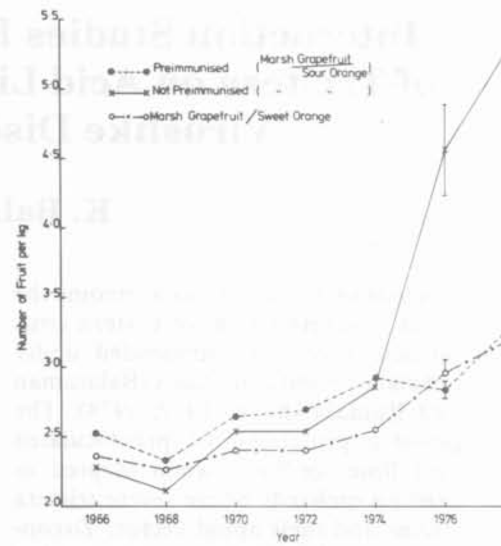

Fig. 3. Number of grapefruit per kg on preimmunized trees on sour orange rootstock, and control trees on sour orange and sweet orange rootstocks for each biennium, 1966-78.

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