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# *Stem Pitting Problem in a Pera Sweet Orange Fertilization Experiment*

TREES OF THE PERA ORANGE [*Citrus sinensis* (L.) Osbeck], a late ripening variety of major importance in São Paulo and Rio de Janeiro states, Brazil, are affected by tristeza virus (1, 2). In the present paper, the authors report the influence of fertilizers on the growth of Pera orange trees when they are infected with tristeza virus.

## *Materials and Methods*

In Salto County, state of São Paulo, Brazil, in a sandy-clay soil of low fertility, a Pera orange grove on Rangpur lime (*C. limonia* Osbeck) rootstock planted in 1956 has been submitted since 1957 to a factorial fertilization experiment involving N, P, and K. The three doses of each element per plant were respectively, 0, 25, and 50g in the first two years. The fertilizers used were ammonium sulfate, superphosphate, and potassium chlorate. In 1959, the doses of N and P were quadrupled to 0, 100, and 200g. In 1960 and 1961, all the doses of N, P, and K were doubled (0, 200, and 400g for N and P and 0, 50, and 100g for K) and in 1962 the doses for K only were increased to 0, 90, and 180g per plant, remaining the same as in 1961 for N and P.

All the plants were found to be free from exocortis, xyloporosis, and psorosis viruses. Measurements of trunk diameter and size of the trees, soil and foliar analyses, observations of nutritional disorders, and pitting in the wood were recorded for evaluating the reaction of the plants.

## *Experimental Results and Discussion*

The general appearance of the plants was very poor even in the heavily fertilized plots. Foliar deficiencies of Mg, Mn, and Zn were very common. The level of Mg (0.26 and 0.27%) as shown in Table 1 is

considered to be low. Comparisons of the height of the Pera orange trees (approximately 2.40 m) with that of Barão (nucellar), Lima, and Bahia sweet orange varieties (average 3.2 m) under similar conditions in the same area showed that the Pera orange trees were making poor growth. Production of small fruit was another common symptom observed in trees of all plots. Stem pitting in the branches and in the trunks was constantly present. Weak sprouts was another indication that the plants were not healthy.

Tables 1 and 2 summarize the experimental results. Despite the dif-

TABLE 1. MEANS OF TRUNK DIAMETER (T)[a] 8 CM ABOVE THE BUD UNION, HEIGHT OF TREES (H)[b], SOIL (S)[c], AND FOLIAR ANALYSES (F)[d] FROM A PERA ORANGE/RANGPUR LIME EXPERIMENTAL PLOT IN SALTO COUNTY.

| | T | | | | S | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dose of element | N | P | K | int. pH | N | $PO_4$--- | $K^+$ | $Ca^{++}$ | $Mg^{++}$ |
| | cm | cm | cm | | % | mg e | mg e | mg e | mg e |
| 0 | 5.96 | 5.89 | 6.06 | 5.20 | .15 | .77 | .24 | 2.55 | .97 |
| 1 | 6.05 | 6.11 | 6.26 | 5.25 | .15 | .87 | .21 | 3.30 | 1.13 |
| 2 | 6.38 | 6.38 | 6.07 | 5.39 | .15 | 1.31 | .23 | 3.82 | 1.16 |

| | H | | | F | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | N | P | K | Ca | Mg |
| | m | m | m | % | % | % | % | % |
| 0 | 2.47 | 2.34 | 2.39 | 2.68 | .116 | 1.77 | 2.67 | .27 |
| 1 | 2.31 | 2.39 | 2.38 | 2.70 | .123 | 1.88 | 2.75 | .27 |
| 2 | 2.39 | 2.44 | 2.39 | 2.75 | .129 | 1.84 | 2.95 | .26 |

[a] *Mean of five measurements during 6 years (1957-62).*
[b] *Mean of one measurement in 1962.*
[c] *Mean of one analysis of samples of each treatment.*
[d] *Mean of one analysis of leaves six months old.*

ferences in trunk diameter being correlated with level of fertilization, the diameters do not reflect satisfactorily the heavy fertilization given to the trees. The height of the trees was about 2.40 m, reflecting the fact that the heavy fertilization was not capable of influencing the growth of the plants in the presence of tristeza virus. The trees were stunted and practically equal in growth irrespective of the treatment. Samples of four branches of the two last growth flushes from each plant were collected and peeled. Based on the number of stem pits, the branches were classified as severely, moderately, and slightly pitted. In Table 2 we present these data and those of wood pits observed on the trunks without

removing the bark. The results obtained are not correlated with the level of fertilization.

TABLE 2. FREQUENCY OF STEM PITS SHOWING IN 10 PEELED BRANCHES A, B, C OF THE TWO LAST GROWTH FLUSHES AND EXTERNALLY ON THE TRUNK ABOVE THE BUD-UNION D, E, F OF THE 4 PLANTS OF EACH OF THE 27 TREATMENTS

| Dose of element | Branches | | | | | | | | | Trunk | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | | | P | | | K | | | N | | | P | | | K | | |
| | a | b | c | a | b | c | a | b | c | d | e | f | d | e | f | d | e | f |
| 0 | 2 | 2 | 5 | 3 | 5 | 1 | 2 | 5 | 2 | 2 | 4 | 3 | 0 | 3 | 6 | 1 | 2 | 6 |
| 1 | 3 | 1 | 5 | 1 | 7 | 1 | 3 | 4 | 2 | 2 | 2 | 5 | 1 | 2 | 6 | 2 | 3 | 4 |
| 2 | 1 | 1 | 7 | 2 | 5 | 2 | 1 | 8 | 0 | 2 | 1 | 6 | 3 | 3 | 3 | 1 | 3 | 5 |

[a] *Severely pitted.*
[b] *Medium pitted.*
[c] *Slightly pitted.*
[d] *Pittings well visible externally.*
[e] *Few visible.*
[f] *Not visible.*

## *Conclusions*

Data from measurements of the trunk, size of the trees, foliar analyses, and observations on the occurrence of nutritional disorders and stem and wood pitting showed that the Pera orange trees infected with severe tristeza virus do not respond satisfactorily to fertilization.

Many groves of Pera orange trees in Brazil are making fairly good development. This may be due to the presence of mild strains of the tristeza virus. This fact emphasizes the importance of budwood selection of Pera orange to be used by nurserymen.

### *Literature Cited*

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