Behavior of Nucellar and Old Clones of Hamlin Sweet Orange on Rangpur Lime Rootstock

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Studies on reduction in tree size and yield of citrus trees infected by exocortis virus as compared with healthy or nucellar trees have been reported. However, Mendel (1956, 1968) demonstrated that, though the yield of a tree increases with its size, the relative yield per unit volume of the top decreases. Cohen (1969, 1970) reported relatively good yields produced by trees infected with exocortis virus and suggested the use of exocortis virus to obtain small trees in keeping with the present tendency toward close tree spacing. Our paper reports results from the first 10 years of an investigation started in 1961 to determine the effect of exocortis on the size and yield of Hamlin sweet orange trees on Rangpur lime rootstock.

MATERIALS AND METHODS

In December 1961, eight different clones of Hamlin orange including four nucellar clones, two old clones free from exocortis virus, and two exocortis virus-infected old clones (one with a mild and the other with a severe exocortis strain) were budded on Rangpur lime. All clones were free from xyloporosis and psorosis viruses. The trees were planted in December 1962, 6 x 6 meters spacing at the Limeira Citrus Experiment Station of the Instituto Agronomico, Campinas, Brazil. A randomized design was used with 3 plants per plot and 4 replications. The orchard was grown without irrigation.

Yield data were collected for six years, 1967-1972. Measurements of the tree tops were made only in 1972. The tree-top volumes were calculated by using the formula

$$V = \frac{2}{3}R^2H,$$

where R is one half of the top diameter and H is the tree height.

The theoretical optimal planting density and calculated theoretical yields were based on the assumption that no reduction in size or yield was due to close spacing. The theoretical optimal spacing for the trees was calculated on the basis that adjacent trees should touch in the row and that there should be 2 meters of open space between the rows.

RESULTS

Tree sizes, yield data, desirable planting density, and calculated potential yields are shown in table 1. Precocious fruit production was noted on old-clone trees in 1965 and 1966 but the yield was small and not economically significant.

In 1968 a severe drought occurred after the blooming period and affected fruit set. All clones produced few fruits in 1969 but the reduction in yield was more significant on nucellar-clone trees than on old-clone trees and the exocortis-infected

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TABLE 1
BEHAVIOR OF EIGHT CLONES OF HAMLIN SWEET ORANGE ON RANGPUR LIME ROOTSTOCK: ACTUAL YIELD AND TREE SIZE, THEORETICAL OPTIMAL PLANTING DENSITY, AND THEORETICAL POTENTIAL YIELD PER HECTARE.

Scion*	Avg. production per tree 1967-72	Avg. canopy diameter	Avg. tree height	Avg. production per cubic meter of scion	Theoretical optimal planting density	Theoretical potential cumulative yield
	kg	m	m	kg	trees/ha	metric tons/ha
N 1	112.7	3.4	3.4	5.3	544	367.6
N 2	95.7	3.3	3.3	4.7	571	327.9
N 3	102.0	3.3	3.4	4.9	571	349.2
N 4	97.3	3.3	3.5	4.6	571	332.7
O 1	61.8	2.5	2.6	6.9	888	329.4
O 2	83.5	2.8	2.9	6.6	744	373.0
E M	60.5	2.4	2.4	7.8	946	343.5
E S	48.8	2.2	2.2	7.8	1082	316.9

*N 1 to N 4, nucellar clones; O 1 and O 2, old clones free from exocortis virus; E M, old clone infected with mild exocortis virus; E S, old clone carrying severe exocortis virus.

trees yielded more fruits than the healthy old-clone trees, showing they were less affected by the drought.

In all of the six crops studied, nucellar-tree production was larger than that of the old-clone trees; the healthy old clones were superior to the exocortis-infected clones; and every year the trees infected with the mild strain of exocortis virus produced more than those infected with the severe strain.

Now all trees, including those with exocortis, have good colored leaves but the infected trees have thinner foliage than the exocortis-free trees.

CONCLUSIONS

Statistical analyses of the data obtained leads to the following conclusions: 1) trees of nucellar clones yielded more and had larger scions than those of the old clones; 2) among the nucellar clones, three were statistically comparable but the fourth gave significantly lower yields than the others; 3) trees of the exocortis-free old clones yielded more and had larger tops than those of the old clones infected with exocortis virus; 4) trees infected with the mild strain gave higher yields and had larger tops than trees infected with the severe strain of exocortis virus; 5) trees of clones infected with exocortis virus had the smallest scion diameter and tree height; 6) the relative yield per volume of tree top was greatest in trees infected with exocortis virus and smallest for the nucellar clones.

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