ODY RODRIGUEZ and SYLVIO MOREIRA

Nucellar Baianinha Orange as Top in a Rootstock-Fertilization-Spacing Experiment

AFTER THE MISFORTUNE caused by tristeza and the abandonment of sour orange (*Citrus aurantium* L.) as a rootstock, other virus diseases, such as exocortis and xyloporosis, called for a reformulation of the rootstock problem. Nucellar clones, free from viruses, are being used extensively in Brazil and they must behave differently from old lines on the various rootstocks (2). A rootstock experiment with a nucellar top was, therefore, laid out at the Limeira Citrus Experiment Station in 1957 to determine the behavior of various rootstocks. Different spacings and levels of fertilization were used. This paper reports the results already obtained.

Materials and Methods

A nucellar line of the Baianinha sweet orange [*Citrus sinensis* (L.) Osbeck] was used as the scion variety. Baianinha is a selection of the Brazilian Bahia orange, internationally known as Washington Navel, that produces smaller fruits with closed navels. All buds were taken from a single tree, 15 years old, a first multiplication from the nucellar seedling. This tree was tested and found to be free from exocortis, xyloporosis, and psorosis viruses.

Five rootstock varieties, all tolerant of tristeza virus, were included in this study: Rangpur lime (*C. limonia* Osbeck), Caipira sweet orange (*C. sinensis*), Cleopatra tangerine [*C. reshni* (Engl.) Hort. ex Tanaka], trifoliate orange (*Poncirus trifoliata* Raf.), and Troyer citrange (*C. sinensis* x *P. trifoliata*). Many nursery trees were prepared for each stionic combination but only the uniform ones were used in the experi-

ment. These trees were planted in the field in January, 1957, with a factorial layout of 3 x 5 x 3 and 2 replications. Three different spacings—7 x 3.5 m, 7 x 5.5 m, and 7 x 7.5 m—were used in this study. The soil where the planting was made is a very deep laterite having the following characteristics of fertility: int. pH 5.60, N 0.14 per cent, PO_4 0.08 me, K 0.43 me, Ca 2.5 me, and Mg 0.67 me. This soil loses humidity suddenly. Three fertilizer levels were employed, 60 g N, 30 g P, and 10 g K per plant, being based on a neighboring fertilizer experiment eight years old. These dosages were multiplied by two constant factors, 0.75 and 0.60, to obtain comparable situations of different spacings with the same fertilization and, on the contrary, three levels of nutrients to study the influence of heavier nutrition and so compensate for the density of the planting. In 1959 and 1960 the plants received double the initial dose. In 1961, 1962, and 1963 the dosage of 1960 was increased by one-third. Chilean nitrate, calcium phosphate, and potassium chlorate were the fertilizers used to supply, respectively, N, P, and K.

Results

Crop records from 1961 to 1963 were obtained. The corresponding average production in kg per plant, independently of the spacing and the level of fertilization, was, respectively, in 1961, 1962, and 1963 for each one of the rootstocks as follows: Rangpur lime (17.1, 34.5, and 121.8), Caipira sweet orange (1.2, 22.6, and 69.4), Cleopatra tangerine (3.0, 14.1, and 75.0), Troyer citrange (1.2, 34.5, and 55.5), and trifoliate orange (3.9, 26.9, and 41.7). The total production in these three years for each of the five rootstocks was 173.4, 93.2, 92.1, 91.2, and 72.5, respectively. The superior production of the trees on Rangpur lime rootstocks is evident, the weight of the fruit being practically double that produced by the trees on the other rootstocks.

Measurements of trunk circumferences above and below the bud-union (Table 1) revealed great differences among trees of the various stionic combinations.

The amount of fruit produced by the trees on the different rootstocks, in the first three bearing years, was not correlated with the size of the trees, based on the trunk circumferences. The trees on Rangpur lime and Caipira sweet orange rootstock were practically the same size, but much more fruit was produced on trees of Rangpur lime. Since the experiment was conducted without irrigation, the higher drought resistance of Rangpur lime may account for its greater cropping.

TABLE 1. AVERAGE TRUNK CIRCUMFERENCE IN CM, TAKEN 8 CM ABOVE (A) AND BELOW (B) THE BUD-UNION, IN A BAIANINHA SWEET ORANGE ROOTSTOCK EXPERIMENT LAID OUT IN JANUARY, 1957, AT THE LIMEIRA EXPERIMENT STATION, SÃO PAULO

Rootstock		February, 1958	June, 1960	February, 1962
Rangpur lime	A	9.4	23.3	38.6
	B	10.5	28.8	44.8
Caipira orange	A	6.5	19.5	37.6
	B	8.6	24.2	45.1
Cleopatra tangerine	A	6.4	18.9	36.2
	B	7.5	22.1	41.9
Troyer citrange	A	5.7	16.1	29.7
	B	7.8	20.8	39.0
Trifoliate orange	A	4.7	11.7	21.1
	B	7.2	17.2	30.2

The trees on trifoliate orange made consistently less vigorous growth and appeared stunted as compared to those on other rootstocks.

Discussion and Conclusions

The data recorded in the first three years show that Rangpur lime induced the greatest yields of any of the rootstocks studied. The trees on the other rootstocks, Caipira sweet orange, Cleopatra tangerine, Troyer citrange, and trifoliate orange, induced decreasing production in the order of their enumeration, independently of the spacing and fertilization. A similar rootstock experiment with scions of old-line Baianinha orange infected with exocortis and psorosis viruses laid out in 1936 at the same station, gave different results (1). The rootstocks intolerant of exocortis virus (Rangpur lime and trifoliate orange) produced smaller amounts of fruits than tolerant rootstocks.

There was no proportional correlation between trunk measurements above and below the bud-union of the trees and fruit production of the respective stionic combinations. The trees on Rangpur lime reached comparable size with those on Caipira sweet orange rootstock but were

far more productive. The average size of the trees was very strongly influenced by the rootstock and followed the same range as for production.

Literature Cited

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