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Further Study of the Tolerance to Tristeza Virus of Citrus Varieties Suitable for Rootstocks in Brazil

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THE PRESENT PAPER reports additional results, obtained from 1963 to 1968, from a trial laid out in 1950 at the Limeira Citrus Experimental Station to study the tolerance of rootstocks to tristeza virus. Results obtained earlier have been reported elsewhere (2, 3, 4, 5). The occurrence of a new strain of tristeza virus that severely damages Rangpur lime in the Capão Bonito area (7) emphasized the need for studying the tolerance to tristeza virus of various rootstocks suitable for the many commercial varieties of citrus known in Brazil. The symptoms of hassaku dwarf described in Japan have many similarities to tristeza Capão Bonito. The two diseases may be caused by the same virus complex.

Materials and Methods

Nucellar lines of Valencia and Barão sweet orange, Dancy tangerine, Duncan and Foster grapefruit, and Beledy lime were budded on seedlings of 400 rootstock varieties and inoculated in the nursery with a severe strain of tristeza virus (2). Trees of 77 stionic combinations found to be tolerant of the virus were transplanted to the field in 1950-51. Three trees of each scion variety on each different rootstock were planted in a soil classified as

Ortho Dark Red Latosol, with no irrigation. The area is frost free with annual temperatures ranging from -0.5°C to 39.2°C . The rainfall oscillates from 1100 to 1400 mm per annum, occurring mainly from September through March.

The yield of each tree in the experiment was obtained by counting the number of fruit. The vigor was determined by measuring the trunk circumference and the height of trees.

Results and Discussion

Only data from the trees on rootstocks with superior performances, with each scion variety studied, are reported here (Tables 1 and 2).

The varieties in decreasing order of yield from 1955 to 1962 were Dancy tangerine, Barão orange, and Valencia orange (5). In the period 1963 to 1968, the decreasing order was Valencia orange, Dancy tangerine, and Barão orange. The total production of Barão orange, however, was almost 70 per cent less than that of Valencia orange. This alteration in productivity reflects the intolerance of the Barão orange to tristeza virus. The best rootstocks for Valencia orange were Rangpur lime, Troyer and Morton citrange, mandarin 117477, citrumelo 4475, and Florida sweet orange. For Barão orange the best ones were Morton

TABLE 1. AVERAGE NUMBER OF FRUIT (N) PER TREE PER ANNUM FROM 1963 TO 1968 AND AVERAGE TRUNK CIRCUMFERENCE IN CENTIMETERS 10 CM ABOVE BUD UNION (C) OF THE TREES ON THE BEST ROOTSTOCKS STUDIED FOR 3 TOP VARIETIES

Rootstock group and variety	Valencia orange		Barão orange		Dancy tangerine	
	N	C	N	C	N	C
Tangerine types						
Rangpur lime	1868	107	1044	79		
Mandarin 117477	1694	95	925	81	1629	82
Sunki	1271	93	985	80		
Clementine	1100	94	679	77	1536	86
Cleopatra	906	87	901	80	1648	97
Sun Chu Sha Kat	685	99	1005	83	1493	96
Trifoliate orange types						
Troyer citrange	1815	80	870	56		
Morton citrange	1721	84	1091	75	1612	66
Citrumelo 4475	1542	80	855	51		
Sweet orange varieties						
Florida sweet seedling	1525	90	936	79		
Lue Gim Gong	456	68	879	59	925	75
Ruby Blood	733	88	756	74	1053	82
Homosassa			738	78	1135	88
Tangelo varieties						
Orlando	1319	96	692	73	1067	81
Sunshine	873	99	793	71		
Tangelo (18-H-6)			430	69	1463	95

TABLE 2. AVERAGE TRUNK CIRCUMFERENCE IN CENTIMETERS 10 CM ABOVE UNION (C) AND HEIGHT (H) OF THE TREES IN METERS ON THE BEST ROOTSTOCKS STUDIED FOR FOSTER AND DUNCAN GRAPEFRUIT AND BELEDY LIME

Rootstock group and variety	Duncan grapefruit		Foster grapefruit		Beledy lime	
	C	H	C	H	C	H
Tangerine types						
Rangpur lime	88	4.8	52	3.6		
Temple tangor	83	4.1	71	3.9		
Cleopatra	59	3.3	83	4.0	99	4.2
Mandarin 117477	83	4.0	65	3.4		
Pook Ling Ming	70	4.1	60	3.3	80	4.3
Trifoliate orange type						
Morton citrange	64	3.7	68	4.2	91	4.5
Tangelo varieties						
Orlando	54	3.1	87	4.3	69	3.7
Sampson	55	3.3	75	4.2		
Tangelo 18-H-6	87	3.6				
Swanee	78	3.6				
Sweet orange varieties						
Hamlin			82	4.2		
Caipira	81	3.6				
Homosassa	81	3.6	80	3.6		
Shamouti	75	3.7			64	3.4

citrange, Rangpur lime, Sun Chu Sha Kat, and sunki. Cleopatra mandarin, mandarin 117477, Morton citrange, Clementine mandarin, Sun Chu Sha Kat, and 18-H-6 tangelo induced the best reaction as rootstocks for Dancy tangerine.

Trees on the various sweet orange types used as rootstocks always produced less than those on the best rootstocks of the other groups, except for the trees on Florida sweet orange (Table 1). This rootstock variety was not used with Dancy tangerine as a scion.

Pera and Lamb Summer orange as rootstocks induced poor vigor and productivity in all trees except those of Dancy tangerine. Sweet orange trees on Lamb Summer orange rootstock died after a few years of growth. The fair growth of the trees of Dancy tangerine on this rootstock indicates that the scion variety affected the intolerance of the rootstock to tristeza virus (1).

However, all 6 tangelo and miscellaneous varieties, including Florida rough lemon, used as rootstocks induced lower yields than the best rootstocks of the other groups.

Duncan and Foster grapefruit and Beledy lime trees developed severe wood-pitting symptoms due to tristeza virus. Growth and production

of these trees were reduced, and the fruit were always of small size and of no commercial value. More recent experiments demonstrated, however, that the preimmunization of virus-free clones of these varieties with mild strains or complexes of tristeza virus provides protection against severe strains, which make possible their commercial cultivation (6).

Duncan grapefruit trees grew better than those of Foster grapefruit when budded on the rootstocks of the tangerine group. Rangpur lime, Temple tangor, and mandarin 117477 were superior rootstock varieties for Duncan grapefruit. Foster grapefruit trees were better on Cleopatra tangerine rootstock.

Orlando and Sampson tangelo rootstocks induced fairly good growth of Foster grapefruit trees, but not of Duncan grapefruit. The best tangelo rootstocks for Duncan grapefruit were 18-H-6 and Swanee.

Within the sweet orange group, the Hamlin, Homosassa, and Cai-pira varieties resulted in better growth of the grapefruit tops.

The best Beledy lime trees were those on Morton citrange rootstock, followed by those on Pook Ling Ming (Rangpur lime type) and Cleopatra tangerine. All other Beledy lime rootstocks made poor growth.

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