canopy. Over 50% of the transplanted trees can set fruit in the second year. The transplanted orchard can be in full production in the third year after transplanting.

During the period 1972-82, further research was carried out on citriculture on the coastal sandy, windy arid land. It showed that citriculture on the arid sandy, windy land is possible. About 275 hectares of citrus orchards have been established in the coastal sandy area. Citrus trees growing in these highly porosis, sandy soils had vigorous growth, early fruit setting, and high productivity. In an area of 3.3 mu (about 0.22 hectares) of the 'Fujie' 8-year-old test orchard in the Dahe brigade in Changle County, an average yield of 10,506 jin (5,253 kg) per mu has been obtained. The wind-protecting and sand-arresting shelter belts have been constructed on vast areas along the coast. This area is more suitable for planting prolific and high quality cultivars, i.e., 'Ponkan,' satusma, 'Fujie,' 'Tankan' (*Citrus tankan*), 'Sekkan' (*C. sinensis*), 'Anliucheng' (*C. sinensis*), navel orange (*C. sinensis*), etc.

In summary, it is possible to develop citriculture on the coastal sandy, windy, arid land if suitable irrigation and good management are provided and the expansion of citrus in this area is expected.

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Studies on Citrus Rootstocks for Sweet Orange

Zhao Xue-Yuan[1]

Abstract: The results of a citrus rootstock experiment with sweet orange tops from 1952 to 1977 are reported in this paper. The effects of 19 rootstocks on the growth, fruit production, yield, fruit quality, cold and drought resistance of the cultivar, 'Xianfeng,' are given. Experimental results showed that for 'Xianfeng' orange grown in the Sichuan hilly lands, trifoliate orange is an excellent rootstock. Tugan, Xianggan and Jiangan mandarins are suitable stocks; Tangcheng is a semi-dwarfing stock, and Ichang papeda is a dwarfing stock.

Introduction

Studies on the selection of the rootstock are of great importance for the production of citrus. In order to find suitable rootstocks for sweet orange in the hilly land of Sichuan, a citrus rootstock test was planted in 1952 and evaluated for 24 years.

Materials and Methods

The tests were conducted on the experimental farm of the Fruit Insti-

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tute located in a hilly area of Jiangjin County along the Yangtze River in Sichuan. The altitude is 250 to 300 m, with a slope of 10 to 30 degrees. The soil is a slightly acid loam, colored purple and has a depth of 0.3 to 0.4 m, not exceeding 0.7 m. An impervious hardpan is usually loosened by explosives prior to the planting of citrus trees. A native cultivar, 'Xianfeng' (*Citrus sinensis* (L.) Osbeck) was used. The rootstocks used (Table 1) are common in Sichuan.

The experiment was arranged in 4 groups of 5 blocks, 2 to 4 replications for each rootstock, with 4 to 30 trees in each plot. The total number of trees was 1,375, excluding guard rows, arranged according to the terrace, and tree spacing was 3 × 3 m. Rootstock effects on growth, yield, fruit quality, cold hardiness, drought tolerance, and citrus gummosis were recorded and studied. The root systems of different rootstocks were also observed.

Experimental Results

I. **Effect of rootstocks on growth of the scion cultivar.** Effects of the rootstocks on tree size and structure of the canopy were significant. Comparisons of tree height, canopy diameter and tree size of 'Xianfeng' orange trees 17 to 20 years old are given in Table 2. The tree canopies of 'Xianfeng' orange on Gou Dou sour orange (*C. aurantium* L.), trifoliate orange (*Poncirus trifoliata* Raf.), Hsiangcheng (*C. junos* Tanaka), and Xianggan (*C. reticulata*) rootstocks are larger than those grafted on sweet orange rootstocks. The tree canopies of 'Xianfeng' orange on Jiangan (*C. reticulata* Blanco), Hung

Table 1. Rootstocks used for the 'Xianfeng' orange field experimental test.

Species	Variety	Note for reference
Poncirus trifoliata Raf.		Large flower and large leaf whose origin is to be investigated
Citrus junos Tanaka	Tangchen	From Kwangtung
C. ichangensis Swing.		Native cultivar of southeast Sichuan, round fruit type
	Tangerine	Native cultivar of Sichuan, Tahungpao type
	Jiangnangan	Native cultivar of Sichuan, early-maturing tangerine type
	Jiangan	Native cultivar of Hubei, whose character is similar to Tugan
C. reticulata Blanco	Xianggan	Native cultivar of Jiangjin
	Tugan	Native cultivar of Jiangjin
	Suanju	From Kwangtung
C. sinensis (L.) Osb.	Guanggan	Native cultivar of Jiangjin
	Jiangjin sour orange	Native cultivar of Jiangjin
C. aurantium L.	Gou Dou sour orange	
	Xingshan sour orange	
C. grandis Osbeck	Yanggao shaddock	From Chentuh, 'Shatian' shaddock type
	Jiangjin sour shaddock	Native cultivar of Jiangjin
C. paradisi Macf.	'Marsh' grapefruit	From abroad
C. limon Burm. f.	'Eureka' lemon	From abroad
C. limonia Osbeck	Hung lemon	From Kwangtung
Citrus sp.	Kwigan	Natural hybrid of mandarin and shaddock, originated in Sichuan

lemon (*C. limonia* Osbeck) and lemon (*C. limon* Burm. f.) rootstocks are relatively taller and bigger, somewhat like that on sweet orange rootstock, attaining a smaller size. The tree canopy of 'Xianfeng' orange on grapefruit (*C. paradisi* Macf.), Suanju (*C. reticulata*) (Sunki), Tangcheng, Jiangjin sour orange (*C. aurantium*) rootstocks are comparatively smaller, semi-dwarfing types. And the canopy of 'Xianfeng' orange on Yanggao shaddock (*C. grandis* Osbeck), Xingshan sour orange (*C. aurantium*), Kwigan (*Citrus* sp.), Jiangjin sour shaddock (*C. grandis* Osbeck) and Ichang papeda (*C. ichangensis* Swing.) rootstock are small, semi-dwarfing types. The tree canopies of 'Xianfeng' orange on Jiangjin sour shaddock and Ichang papeda rootstock are most dwarfed with a height of about half of that on sweet orange rootstock. Trunk size appears to be correlated with canopy volume. 'Xianfeng' orange trees on trifoliate rootstock grow high and wide with a comparatively slender trunk. Canopy size, tree height, and trunk girth on lemon rootstock is the largest of the rootstocks compared.

Various growth rates of 'Xianfeng' orange on different rootstocks were observed. 'Xianfeng' orange on the Gou Dou sour orange stock grew the fastest, while 'Xianfeng' orange on trifoliate orange rootstock grows slowly initially and rapidly in older trees. Some combinations grow vigorously at the earlier stages with retarded growth as the tree age increased, such as 'Xianfeng' orange on Hung lemon rootstock. The growth tendency of 'Xianfeng' orange on Tangchen tangerine (*C. reticulata*), Xiangchen, Jiangan, Tugan and sweet orange rootstock is a steadily increasing rate. However, the growth of 'Xianfeng' orange tree on Yanggao shaddock, Xing-

Table 2. Tree size of 'Xianfeng' orange trees 17 to 20 years old propagated on 19 rootstocks, June 1973.

Rootstock	Tree height (cm)	Canopy diameter (cm)	Tree girth (cm)[z]	Trunk cross-section (cm^2)	Canopy volume (m^3)[y]
Gou Dou sour orange	391.8	393.4	40.8	132.5	32.4
Trifoliate orange	374.2	367.1	34.4	94.2	26.8
Tangerine	366.2	344.0	41.0	133.8	23.2
Xianggan	360.4	357.7	41.3	135.8	24.2
Jiangan	350.9	351.2	41.5	137.1	22.5
Sweet orange	348.5	342.4	38.6	118.6	21.3
Hung lemon	342.9	325.4	37.8	113.8	19.0
Tugan	340.6	322.4	37.1	109.6	18.6
Lemon	340.0	319.5	46.8	174.4	18.2
Jiangnangan	324.2	299.3	36.8	107.8	15.4
Grapefruit	305.3	303.1	34.4	94.2	14.0
Suanju	300.4	285.3	33.0	86.7	12.4
Tangchen	282.3	249.7	28.7	65.6	8.9
Jiangjin sour orange	280.2	264.7	26.5	55.9	10.4
Yanggao shaddock	237.0	234.9	27.6	60.7	6.0
Xingshan sour orange	236.6	219.3	27.9	62.0	5.3
Kwigan	225.4	215.0	23.2	42.9	4.7
Jiangjin sour orange	182.5	156.0	16.1	20.6	1.8
Ichang papeda	169.4	133.1	14.6	17.0	1.3

[z]Trunk girth measured at 5 cm above the union.
[y]The canopy volume = (D/2)(H − D/6). D = canopy diameter, H = the green leaf of canopy.

shan sour orange, Kwigan, Jiangjin sour shaddock and Ichang papeda rootstock is less vigorous. 'Xianfeng' orange grafted on shaddock types such as Yanggao shaddock, grapefruit, Kwigan and Jiangjin sour shaddock rootstocks exhibited chlorotic leaves on the autumn growth flush, especially Jiangjin sour shaddock rootstock.

II. **Budunion characteristics.** Following the classification used by Webber, most of trifoliate and Gou Dou sour orange in this test are C+2 C+3 types. Trifoliate rootstock is vertically and slimly furrowed, whereas the Gou Dou sour orange rootstock is a rough prism in shape. Most of Jiangjin sour shaddock, Yanggao shaddock, grapefruit, Kwigan, Jiangjin sour orange, Ichang papeda, Xiangcheng and Tugan rootstocks are of C+1 to C+2 types with the scions cylindrical in shape. Xingcheng and Tangcheng rootstocks are prismatically shaped, while scions are slightly prismatic. Jiangnan mandarin (*C. reticulata* Blanco), Jangan, and Tugan are of C+1 type with prismatically shaped rootstock. Sweet orange, Xingshan sour orange and Hung lemon rootstocks appear cylindrical in shape. There are shallow prisms on Hung lemon rootstock. Many Suanju rootstocks are of C+1 type with both scion/rootstock prismly furrowed.

The union of 'Xianfeng' orange on different rootstocks changes in appearance as the trees increase in age; trifoliate rootstock in the earlier stage is of a C+1 to C+2 type and changes to a C+2 to C+3 type; tangerine rootstock in the earlier stage is of C type, later changing to a C+1 type.

III. **Comparison of root systems of different rootstocks.** The root systems of 15-year-old 'Xianfeng' orange trees on 12 rootstocks were studied. The results showed that the root system of the Gou Dou sour orange, Tugan and tangerine are thick and well developed. Their air dry weight reached 72.5 to 94.5 jin/tree, respectively, which accounts for 170.5% to 222.4% of the root weight of sweet orange rootstock. The skeleton roots of the Gou Dou sour orange are particularly thick and long, few in quantity, but well distributed with small lateral and fibrous roots. The skeleton roots of tangerine are well developed, numerous and well distributed. The vertical roots of Tugan are small, the horizontal skeleton roots are strong and crowded with well developed, small lateral and fibrous roots. The root system of Jiangan, Xianggan, trifoliate, Suanju, Hung lemon, and Tangcheng rootstocks are comparatively better developed, similar to those of sweet orange rootstocks with an air dry weight of 35 to 48 jin/tree. The small lateral and fibrous roots of trifoliate orange are thick and extremely well developed. The skeleton roots of Jiangan are relatively large and crowded. The skeleton roots of Xianggan are numerous but smaller and small lateral and fibrous roots are well developed. The vertical roots of Hung lemon are poorly developed, and its lateral roots are numerous, long and thin, with small lateral and fibrous roots which are well developed. The skeleton roots of Tangcheng are numerous and weak, sparsely distributed with fewer lateral and fibrous roots. The root systems of Ichang papeda and Jiangjin sour orange rootstock are weakest with an air dry weight of only 11.0 and 18.5 jin, which equals to 25.9% and 43.5% of that of the root weight of sweet orange rootstock. The small lateral and fibrous roots of Ichang papeda rootstock are also few in quantity.

IV. **Effect of rootstock on the period of fruit bearing.** 'Xianfeng' orange trees on most rootstocks began to bear in the third year after grafting except the Gou Dou sour orange rootstock. The difference in the percentage of fruit-bearing trees on different rootstocks was statistically significant. 'Xianfeng' orange scions on Hung lem-

on, Suanju and trifoliate orange rootstocks are very prolific as 18.4 to 19.4% of the 3-year-old trees produce fruit. Trees on Hung lemon rootstock begin fruiting in their fourth year and attain 100% fruiting in their sixth year; 6.5 to 8.1% of the 'Xianfeng' orange trees on Tangcheng, Xiangcheng and Ichang papeda reach the fruit-bearing stage at 3 years of age.

'Xianfeng' orange trees on sweet orange, Tugan, Jiangjin sour orange and Jiangan rootstock begin fruiting the latest, as only 3.3 to 3.8% of the 3-year-old trees produce fruit. 'Xianfeng' on sweet orange reaches the bearing stage in the third year, but fruit production is low in subsequent years. 'Xianfeng' orange trees on Gou Dou sour orange and tangerine rootstocks are slow bearers; they do not fruit in the third year, and only produce a few fruit when they are 5 to 6 years old.

V. **Effect of different rootstocks on yield of 'Xianfeng' orange.** The difference in yield of 'Xianfeng' orange on various rootstocks was statistically significant as shown in Table 3 for the accumulated mean yields from 1959 to 1977. 'Xianfeng' orange trees on trifoliate rootstock yielded the highest, about 167.4% of the yields on sweet orange rootstock, which was two times greater than the yields on Ichang papeda. Gou Dou sour orange ranks next in fruit yield. The yields on Xianggan, Jiangan, Hung lemon, and tangerine rootstock are all higher than those on sweet orange rootstock. However, those on the other rootstocks are lower than those on sweet orange stock. The yields on Ichang papeda and Jiangjin sour shaddock are the lowest.

VI. **Effect of different rootstocks on the main economical characters of 'Xianfeng' fruit.**

Table 3. Effect of rootstocks on the yield of 'Xianfeng' orange.

	Accumulated yield, 1959 to 1977			Yield per unit volume		
Rootstock	Yield (jin)	Compared to sweet orange rootstock (%)	Mean annual yield/tree 1971-1974 (jin)	Canopy size (m^3)	Yield (jin/m^3)	Compared to sweet orange rootstock (%)
Trifoliate orange	946.0	167.4	107.2	226.8	4.00	143.4
Gou Dou sour orange	794.3	140.5	80.1	32.4	2.47	88.5
Xianggan	747.7	140.5	77.8	24.2	3.20	114.6
Jiangan	706.4	124.9	74.9	22.5	3.33	119.4
Hung lemon	663.5	117.4	67.6	19.0	3.56	127.6
Tangerine	621.6	110.0	67.5	23.2	2.91	104.3
Sweet orange	565.2	100.0	59.5	21.3	2.79	100.0
Tugan	556.6	98.5	49.2	18.6	2.65	95.0
Suanju	522.0	92.4	50.7	12.4	4.09	146.6
Grapefruit	505.0	89.3	50.5	14.0	3.60	126.9
Lemon	495.1	87.6	45.3	18.2	2.49	89.2
Jiangnangan	477.5	84.5	46.4	15.4	3.00	107.9
Tangchen	453.7	80.1	44.6	8.9	5.01	179.6
Jiangjin sour orange	345.0	61.0	38.3	10.4	3.68	131.8
Xingshan sour orange	304.8	53.9	29.8	5.3	5.62	201.4
Kwigan	235.1	41.6	18.9	4.7	4.02	144.1
Yanggao shaddock	158.4	28.0	11.6	6.0	1.93	69.2
Ichang papeda	85.6	15.1	6.3	1.3	4.85	173.8
Jiangjin sour shaddock	82.7	14.7	4.2	1.8	2.32	83.2

1) Effect on the characters of fruit appearance. The fruit of 'Xianfeng' orange on Hung lemon and Suanju rootstock was heavier with an average weight of 130.1 and 131.1 g each which is 7.2 and 7.9% heavier than that on sweet orange rootstock. The fruit produced on Yanggao and grapefruit, and Xingshan sour orange rootstock was the lightest, with fruit weighing 106.8 to 110.3 g. The fruit on trifoliate, Tangcheng, and Jiangan were red colored. That on grapefruit, lemon and Xingshan sour shaddock were orange colored. And those on other rootstocks were red to orange color. The fruit surface produced on trifoliatae and Tangcheng is somewhat rough; that on the others is relatively smooth.

2) Effect of rootstock on fruit quality (Table 4). Percentages of the edible portion and juice content were highest on grapefruit and lemon rootstock followed by Jiangan, and Jiangjin sour orange had the lowest.

3) Sugar/acid content of fruit and its ratio. The sugar content of the fruit on Xiangshan sour orange, Jiangjin sour shadock, Ichang papeda, Kwigan, trifoliate, and Tugan rootstock is the highest, but the acid content is low. The sugar/acid ratio of the fruit on trifoliate rootstock is slightly lower due to its high acid content. The sugar content of the fruit on tangerine, Hung lemon and grapefruit rootstock is low, but acid content is high with a low sugar/acid ratio. Fruits from trees on other rootstocks are slightly higher or near to that of the fruit on sweet orange rootstock.

Soluble solids. Fruits on trifoliate, Ichang papeda, Tugan, Jiangjin sour shaddock, and grapefruit had relatively higher total soluble solids than that of the fruit on sweet orange. Fruit from trees on Hung lemon rootstock has the lowest total soluble solids, accounting for 97.2% of that of the fruit on sweet orange rootstock.

Vitamin C content of the fruit on shaddock and rootstocks related to shaddock, such as Kwigan, sour shaddock and Yanggao shaddock, is the highest, reaching 57.066 to 58.891 mg/100 ml. Fruit on Hung lemon rootstock produced the lowest, similar to that on sweet orange rootstock. Vitamin C content of fruit from trees on other rootstocks is higher than that on sweet orange rootstock as shown in Table 4.

VII. **Effect of different rootstocks on disease-pest resistance.** Investigation reveals that the infestation of longhorn beetles on trifoliate, Jiangan, Jiangnangan, Yanggao shaddock, grapefruit, sour shaddock, and lemon rootstocks were very low. Suanju and Jiangjin sour orange rootstocks were also relatively resistant to longhorn beetle with an infested ratio of only 2.7 to 2.9%. Xingshan sour orange and Gou Dou sour orange rootstocks were susceptible to the longhorn beetle with an infested ratio of 50% and 38.5%, respectively. Trifoliate, Jiangan and Xianggan are comparatively resistant to gummosis with an infested ratio of 0 to 4.1%, while lemon, sour shaddock and Jiangnangan rootstock are relatively susceptible with infested ratios of 50 to 66.7%. Root rot affects the Gou Dou sour orange, Xianggan, tangerine, Jiangjin sour orange, and Suanju rootstocks to a limited extent.

Discussion and Conclusion

The tested rootstocks can be divided into four groups based on the growth of the 'Xianfeng' orange scion and the use of sweet orange as the standard rootstock: 1) standard rootstock (tree height more than 3.5 m) includes Gou Dou sour orange, trifoliate, tangerine, and Xiangcheng; 2) semi-standard rootstock (tree height 3.0 to 3.5 m) includes Jiangan, sweet orange, Hung lemon, Tugan, lemon, Jiangnangan; 3) semi-dwarfing rootstock (tree height 2.5 to 3.0 m) includes grapefruit, Suanju, Tangcheng, Jiangjin sour orange;

Table 4. Comparison of fruit quality of 'Xianfeng' orange on different rootstocks, mean level for 1962, 1965, 1972 and 1974.

Rootstock	Edible portion (%)	Juice content (%)	Soluble solid (%)	Total sugar (g/100 ml)	Titratable acid (g/100 ml)	Sugar/ acid ratio	Vitamin C (mg/100 ml)
Trifoliate orange	75.0	55.8	11.3	8.017	0.970	8.6:1	53.025
Ichang papeda	73.6	54.0	10.6	8.109	0.713	12.2:1	51.092
Tugan	75.9	55.6	10.5	8.002	0.873	10.3:1	50.607
Suanju	74.7	54.9	9.9	7.809	0.937	9.3:1	52.975
Jiangan	75.5	57.2	10.0	7.731	0.881	9.5:1	49.107
Xianggan	74.4	56.0	9.7	7.576	0.871	9.2:1	52.026
Jiangjin sour orange	72.0	52.3	9.3	7.448	0.789	9.8:1	51.815
Gou dou sour orange	75.6	55.8	9.3	7.436	0.784	10.1:1	49.942
Tangchen	73.2	53.4	10.0	7.435	0.901	8.9:1	51.816
Sweet orange	74.0	55.2	9.6	7.213	0.878	8.7:1	48.346
Grapefruit	77.3	57.4	10.3	7.134	1.001	7.6:1	52.984
Hung lemon	74.4	54.9	8.9	7.094	0.949	8.5:1	48.006
Tangerine	73.9	56.6	9.5	7.133	1.012	7.7:1	52.994
Xingshan sour orange	73.8	55.0	10.0	8.312	0.753	11.3:1	51.011
Jiangjin sour shaddock	74.2	57.6	10.5	8.304	0.671	12.4:1	58.557
Kwigan	74.8	54.7	9.3	8.079	0.737	11.2:1	58.591
Jiangnangan	74.3	52.8	9.5	7.881	0.913	9.1:1	52.109
Lemon	76.8	57.9	10.0	7.686	0.794	10.3:1	52.935
Yanggao shaddock	74.2	54.5	9.6	7.666	0.990	8.0:1	57.066

[z]Soluble solids is the mean level of the 2 years from 1971 and 1974.
[y]Vitamin C is the mean level of the years from 1974 and 1977.

and 4) dwarfing rootstock (tree height less than 2.5 m) includes Yanggao shaddock, Xingshan sour orange, Kwigan, Jiangjin sour shaddock, and Ichang papeda.

The yield of individual trees on various rootstocks may be arranged as follows: standard stock > semi-standard > semi-dwarfing > dwarfing stock.

Poncirus trifoliate (large leaf and large flower type) was a satisfactory rootstock for 'Xianfeng' orange. The tree grows vigorously with a well-developed root system. It is resistant to cold, drought and gummosis, and is early bearing, productive, and excellent in fruit quality and storage life. According to the investigation, 'Glorious' orange, 'Valencia' late, 'Washington' navel, blood orange, satsuma and tangerine on trifoliate orange rootstock perform very well. However, when trifoliate orange is used as a rootstock for 'Eureka' lemon, navel blood orange, and 'Cadenera' sweet orange, exocortis may present a problem as trifoliate orange is susceptible to this disease.

Tangchen (*C. junos Tanaka*) is a semi-dwarfing rootstock for sweet orange. The tree grows vigorously though slower than on sweet orange rootstock, and fruiting is prolific and of good quality. Variability in fruit production occurs among mature trees, therefore, clonal selection should be practiced.

Ichang papeda (*C. ichangensis*) is a dwarfing rootstock for 'Xianfeng' orange. The root system is weak and trees are slow growing. Trees are prolific with good fruit quality. Ichang rootstock is suitable for closely planted trees. Seedling progeny are variable in this species, therefore, further work of selection for unifomity should be carried out.

Tugan (*C. reticulata*) is a semi-dwarfing rootstock for 'Xianfeng' orange with a compact type of growth. The root system is well developed. Tugan is resistant to drought and adaptable to soils of low fertility. Fruit production and quality of the orange scion are satisfactory. The fruit of Tugan contains many seeds, which are necessary in propagation.

Tangerine (*C. reticulata*) is a commonly used rootstock for 'Xianfeng' sweet orange. The tree grows vigorously and has a well-developed root system, adaptable to soils of low fertility. Since it is late bearing, the fruit is low in sugar and high in acid content producing poor quality fruit and it should be used in limited areas.

Rootstock Development Screening and Selection for Disease Tolerance and Horticultural Characteristics

D. J. HUTCHISON[1]

The propagation of citrus trees by budding began in Florida in the 1830's. By the 1940's approximately 80% of the citrus trees were propagated on rough lemon (*Citrus jambhiri* Lush.) and sour orange (*C. aurantium* L.) rootstocks. Over the 11-year period of 1973-1983, 24,425,100 registered and validated nursery trees were sold in Florida (Table 1). Of these trees, 30.2% were propagated on sour orange, 0.6% on rough lemon, 9.5% on Cleopatra (*C. reticulata* Blanco), 39.5% on Carrizo citrange (a hybrid of *C. sinensis* (L.) Osb. X *Poncirus trifoliata* (L.) Raf.), 8.1% on Swingle citrumelo (a hybrid of *C. paradisi* Macf. X *P. trifoliata*), 6.2% on Milam and 4.2% on miscellaneous rootstocks. Significantly, these statistics reveal that 45.7% of the citrus trees in Florida were propagated on two hybrid rootstocks, Carrizo citrange and Swingle citrumelo, originated and developed by the United States Department of Agriculture in Florida. Disease susceptibility is the reason for this change in rootstock usage. Sour orange is susceptible to the citrus tristeza virus and rough lemon is susceptible to blight

Table 1. Rootstocks used to propagate registered and validated nursery trees in Florida, 1953-1983.[z]

	Percent			
	1953-1962	1963-1972	1973-1983	Overall
Sour orange	42.0	36.8	30.2	33.9
Rough lemon	41.0	37.5	0.6	18.9
Cleoptra	8.0	12.3	9.5	10.4
Carrizo citrange	0.3	6.7	39.5	22.9
Poncirus trifoliata	1.6	2.8	1.7	2.1
Milam lemon		1.9	6.2	3.9
Swingle citrumelo			8.1	4.2
Miscellaneous	9.6	2.0	4.2	3.7
Number of trees — total	5,292,000	17,594,800	24,425,100	47,311,900

[z]Data furnished by Citrus Budwood Registration Program, Division of Plant Industry, Florida Department of Agriculture, Winter Haven, Florida.

[1]U.S. Department of Agriculture, Agricultural Research Service, Orlando, FL 32803.