

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Washington, D.C. 20250

NOTICE TO FRUIT GROWERS AND NURSERYMEN RELATIVE TO THE NAMING AND
RELEASE OF THE US-812 CITRUS ROOTSTOCK

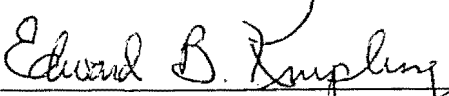
The Agricultural Research Service, U.S. Department of Agriculture hereby releases to nurserymen and growers the US-812 citrus rootstock. This rootstock selection originated from a cross of Sunki mandarin (*Citrus reticulata*) × Benecke Trifoliolate Orange (*Poncirus trifoliata*) made by Dr. Joe Furr (deceased) of the USDA Date and Citrus Station at Indio, California. Field testing of US-812 was planned and conducted by Drs. Don Hutchison, Heinz Wutscher, and Kim Bowman (all of USDA, ARS, USHRL, Florida) in collaboration with or support from industry partners, including Florida Citrus Research Foundation, Bentley Brothers Citrus, U.S. Sugar Corporation, Becker Groves, Florida Citrus Production Research Advisory Council, University of Florida, and University of Puerto Rico. During field testing, this rootstock was identified by code numbers FF1-132-46, HRS-812, or US-812. In some Florida trials, performance of US-812 was outstanding in comparison to common commercial rootstocks in yield and fruit quality over multiple years. In all Florida trials US-812 performance was good, and trees on US-812 grew, survived well, and produced good crops of excellent quality fruit. The major attributes of this new rootstock are ease of seed propagation, resistance to several important diseases, and favorable effects on scion tree size, health, fruit quality, and productivity.

US-812 rootstock has been field tested at several locations and with several different scions (Tables 1-18). At a replicated cooperative trial in Polk County (Florida); 24 ‘Valencia’ sweet orange trees on US-812 rootstock were compared with a similar number of trees on 20 other

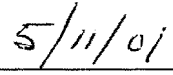
rootstocks through the first six harvest seasons. Fruit production of US-812 in this trial was outstanding and significantly better during most time intervals than the commercial rootstocks Swingle, Carrizo, Sun Chu Sha, Sour Orange, and Gou Tou. Fruit quality (soluble solids concentration) of trees on US-812 rootstock was also excellent. Trees on US-812 rootstock in this trial were generally of good health and medium stature, similar in size to trees on Carrizo. Performance of 'Valencia' trees on US-812 rootstock has also been good in Hendry County (403 trees on US-812) and on a high pH site in St. Lucie County (42 trees on US-812). In addition, US-812 rootstock has shown good growth, yield, and fruit quality in replicated trials with 'Fallglo', 'Sunburst', and 'Ambersweet' in Lake County, 'Marsh' grapefruit in Martin County, and 'Dancy' and 'Chironja' scions in Puerto Rico.

Preliminary test data suggests that US-812 is resistant to some of the most common citrus disease and pest problems in Florida, including citrus tristeza virus (CTV), citrus nematode (*Tylenchulus semipenetrans*), and *Phytophthora nicotianae* foot and root rot. A low incidence of a citrus blight-like decline has been observed among the trees on US-812 in the Polk and Hendry County trials, while much higher incidences of blight symptoms have been observed on other rootstocks at these same locations. This suggests that US-812 is resistant but not immune to citrus blight. Greenhouse tests with *Diaprepes abbreviatus* weevil indicate that US-812 is equal to Swingle in susceptibility to *Diaprepes* larvae feeding. US-812 rootstock is expected to be sensitive to exocortis and only scion sources free of viroid diseases should be used for propagations with this rootstock. Observations on soil adaptation, pest and disease resistance will need to be confirmed by more widespread and long-term studies in the field environment. Meaningful evaluations of US-812 resistance to other potential biotic and abiotic problems have not yet been completed.

Source plant material for US-812 has been tested and found free of citrus viroids, psorosis, and CTV by the Florida Bureau of Citrus Budwood Registration, Winter Haven, and at the USDA, ARS, USHRL, Ft. Pierce. Budwood for source trees of US-812 will be distributed by the Florida Bureau of Citrus Budwood Registration, 3027 Lake Alfred Road (Highway 17), Winter Haven, Florida 33881. Limited quantities of seed will be distributed by the Florida Citrus Research Foundation (A.H. Whitmore Foundation Farm, 23402 USDA Road, Groveland, Florida 34736) and the Florida Bureau of Citrus Budwood Registration. Small quantities of US-812 plant material for professional research and additional information may be obtained from Kim D. Bowman, USDA, ARS, USHRL, 2001 South Rock Road, Ft. Pierce, Florida 34945. Genetic material of this release will be deposited in the National Plant Germplasm System where it will be available for research purposes, including development and commercialization of new cultivars. Appropriate recognition should be made if this germplasm contributes to the development of a new breeding line or cultivar.



Administrator, Agricultural Research Service
U.S. Department of Agriculture



Date

Table 1. Mean fruit yield of 'Valencia' on US-812 and selected rootstocks in a cooperative trial with Bentley Brothers Citrus in Polk County. About 24 trees on each of 21 rootstocks were planted in 1991. Soil is Candler fine sand, pH 6.4-7.0; tree spacing is 2.4 m x 5.5 m.

<u>Rootstock</u>	<u>Fruit yield per tree (kg)</u>						<u>Cumulative</u>
	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	
US-812	39.8	63.8	88.8	113.3	122.3	103.3	531.3
Vangasay lemon	54.4	51.0	119.5	92.3	114.6	68.7	500.5
Swingle	38.0	39.4	75.1	87.2	90.3	90.9	420.9
Carrizo	25.2	29.2	75.3	86.3	109.1	81.8	406.9
Sun Chu Sha	28.9	28.5	66.3	60.3	104.4	63.1	351.5
Gou Tou	12.9	15.5	73.0	63.8	83.5	79.1	327.8
Sour orange	7.1	3.1	19.9	22.1	21.4	29.3	102.9

Table 2. Tree size and mean kg soluble solids per box of 'Valencia' on US-812 and selected rootstocks in cooperative trial with Bentley Brothers, Polk County. Height measured in April 1998.

<u>Rootstock</u>	<u>Tree height (m)</u>	<u>Kg soluble solids per field box</u>				<u>Average</u>
		<u>1995-98</u>	<u>1999</u>	<u>2000</u>		
US-812	3.5	2.37	2.92	2.63	2.64	
Vangasay lemon	3.9	2.01	2.63	2.38	2.34	
Swingle	3.2	2.34	2.86	2.52	2.57	
Carrizo	3.5	2.25	2.68	2.51	2.48	
Sun Chu Sha	3.6	2.40	2.88	2.44	2.57	
Gou Tou	3.2	2.11	2.52	2.34	2.32	
Sour orange	1.8	2.27	2.96	2.57	2.60	

Table 3. Mean yield of 'Valencia' on US-812 and selected rootstocks in Hendry County. About 400 trees on each rootstock were planted in 1989. Soil is Holopaw series, pH 6.8-7.5 (Data provided by U.S. Sugar Corporation.)

<u>Rootstock</u>	<u>Fruit per tree (kg)</u>						<u>Cumulative</u>
	<u>1994</u>	<u>1995</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	
US-812	30	101	171	130	44	85	563
Swingle	22	74	141	189	71	103	600
Carrizo	24	70	139	155	61	63	513
Sour orange	25	46	124	105	59	61	420
Gou Tou	15	23	97	100	76	60	371
Sun Chu Sha	16	47	113	99	44	38	359

Table 4. Mean soluble solids per box for 'Valencia' on US-812 and selected rootstocks in Hendry County. Trees planted in 1989. Samples harvested 5/18/98 and 5/18/99. (Data provided by U.S. Sugar Corporation.)

<u>Rootstock</u>	<u>Kg soluble solids per field box</u>		
	<u>1998</u>	<u>1999</u>	<u>Mean</u>
US-812	3.3	3.2	3.3
Swingle	3.0	3.1	3.0
Carrizo	3.4	3.2	3.3
Sour orange	3.3	3.2	3.3
Gou Tou	2.3	3.0	2.6
Sun Chu Sha	3.0	3.2	3.1

Table 5. Mean fruit yield of 'Valencia' orange on US-812 and Flying Dragon at high pH site with Becker Groves in St. Lucie County. About 42 trees on US-812 were planted in 1992. Soil pH values determined in September 1998.

<u>Rootstock</u>	<u>Rows</u>	<u>Soil pH</u>	<u>Fruit yield per tree (kg)</u>				
			<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>Cumulative</u>
US-812	21/22	8.1 – 8.2	40.8	46.2	27.1	47.0	161.1
US-812	15/16	8.3 – 8.4	40.8	42.0	35.1	65.5	183.4
Flying Dragon	15/16	8.3 – 8.4	12.5	14.2	3.2	10.2	40.1

Table 6. Tree height, fruit size, and kg soluble solids per box of 'Valencia' orange on US-812 and Flying Dragon on high pH site in St. Lucie County. Tree height determined in October 2000.

<u>Rootstock</u>	<u>Tree ht (m)</u>	<u>Individual Fruit wt (g)</u>	<u>Kg soluble solids per field box</u>		
			<u>1997-99</u>	<u>2000</u>	<u>Mean</u>
US-812	2.9	225	2.74	3.25	3.00
Flying Dragon	2.1	222	2.68	3.24	2.96

Table 7. Mean fruit yield of 'Fallglo' on US-812 and selected rootstocks at A.H. Whitmore Foundation Farm in Lake County. About 7 trees on each of 10 rootstocks were planted in 1992. Soil is Astatula fine sand, pH 6.2; tree spacing is 4.6 m x 6.1 m.

<u>Rootstock</u>	<u>Fruit yield per tree (kg)</u>					<u>Cumulative</u>
	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	
US-812	21.6	43.2	82.0	73.4	158.8	379.0
Carrizo	30.2	25.9	64.8	38.9	128.2	288.0
Swingle	34.5	21.6	60.5	38.9	118.8	274.3
Cleopatra	25.9	34.5	60.5	51.8	66.0	238.7
Sun Chu Sha	17.3	17.3	30.2	21.6	68.8	155.2

Table 8. Tree size and fruit quality of 'Fallglo' on US-812 and selected rootstocks in A.H. Whitmore Foundation Farm trial. Height measured in October 1998.

<u>Rootstock</u>	<u>Average fruit quality values at harvest for 1996-99</u>				
	<u>Tree ht (m)</u>	<u>Fruit diam. (cm)</u>	<u>Brix (%)</u>	<u>Acid (%)</u>	<u>Juice (%)</u>
US-812	3.0	7.86	9.8	0.97	49.8
Carrizo	3.0	8.19	10.0	0.99	44.9
Swingle	2.8	7.90	10.4	1.02	47.9
Cleopatra	2.8	8.10	10.0	0.95	46.1
Sun Chu Sha	2.4	8.23	9.9	0.99	42.7

Table 9. Mean fruit yield of 'Ambersweet' on US-812 and selected rootstocks at A.H. Whitmore Foundation Farm in Lake County. About 7 trees on each of 11 rootstocks were planted in 1992. Soil is Astatula fine sand, pH 6.2; tree spacing is 4.6 m x 6.1 m.

<u>Rootstock</u>	<u>Fruit yield per tree (kg)</u>					<u>Cumulative</u>
	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	
US-812	28.1	34.5	72.9	70.3	84.7	290.5
Carrizo	22.5	24.6	77.7	85.9	130.9	341.6
Sour #2	25.6	29.0	63.1	61.4	90.6	269.7
Cleopatra	23.0	33.2	67.8	65.2	71.6	260.8
Swingle	30.7	29.8	43.5	41.8	105.7	251.5
Sun Chu Sha	11.7	16.1	40.9	33.6	61.4	163.7

Table 10. Tree size and fruit quality of 'Ambersweet' on US-812 and selected rootstocks in A.H. Whitmore Foundation Farm trial. Height measured in April 1998.

<u>Rootstock</u>	<u>Average fruit quality values at harvest for 1996-99</u>				
	<u>Tree ht (m)</u>	<u>Fruit diam. (cm)</u>	<u>Brix (%)</u>	<u>Acid (%)</u>	<u>Juice (%)</u>
US-812	2.6	8.28	10.1	0.60	42.2
Carrizo	3.1	8.44	9.1	0.58	39.8
Sour #2	2.7	8.23	9.7	0.63	40.4
Cleopatra	2.8	8.26	9.5	0.57	41.0
Swingle	2.3	8.25	10.1	0.57	39.0
Sun Chu Sha	2.5	8.15	10.4	0.77	40.3

Table 11. Mean fruit yield of 'Sunburst' tangerine on US-812 and selected rootstocks at A.H. Whitmore Foundation Farm in Lake County. About 8 trees on each of 10 rootstocks were planted in 1992. Soil is Astatula fine sand, pH 6.2; tree spacing is 4.6 m x 6.1 m.

<u>Rootstock</u>	<u>Fruit yield per tree (kg)</u>					<u>Cumulative</u>
	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	
US-812	34.5	19.0	46.5	24.1	103.4	227.5
Carrizo	36.2	31.0	51.7	43.4	115.0	277.3
Cleopatra	28.2	32.9	41.4	44.2	79.0	225.6
Swingle	38.8	10.3	38.8	13.6	77.6	179.0
Sun Chu Sha	25.8	30.0	20.7	25.3	62.0	163.8

Table 12. Tree size and fruit quality of 'Sunburst' on US-812 and selected rootstocks in A.H. Whitmore Foundation Farm trial. Height measured in June 2000.

<u>Rootstock</u>	<u>Average fruit quality values at Dec. 7-10 for 1998 & 99</u>				
	<u>Tree ht (m)</u>	<u>Fruit diam. (cm)</u>	<u>Brix (%)</u>	<u>Acid (%)</u>	<u>Juice (%)</u>
US-812	3.0	6.74	11.9	1.16	48.8
Carrizo	3.4	6.76	11.5	1.14	45.2
Cleopatra	3.2	6.80	11.8	1.13	47.2
Swingle	3.0	6.77	11.8	1.15	47.6
Sun Chu Sha	3.1	6.80	12.1	1.17	42.6

Table 13. Mean fruit yield of 'Marsh' grapefruit on US-812 and selected rootstocks at cooperative trial with Becker Groves and University of Florida in Martin County. About 12 trees per rootstock were planted in 1995. Soil is Wabasso fine sand; tree spacing is 4.6 m x 6.9 m. Tree height measured in October 2000.

<u>Rootstock</u>	<u>Tree height (m)</u>	<u>Fruit yield per tree (number)</u>		
		<u>1999</u>	<u>2000</u>	<u>Cumulative</u>
US-812	2.75	162	289	451
Swingle	3.10	98	350	448
Carrizo	3.10	95	324	419

Table 14. Quality of 'Marsh' grapefruit on US-812 and selected rootstocks at cooperative trial in Martin County. Fruit samples taken Feb. 25, 2000. (Fruit quality analysis provided by University of Florida.)

<u>Rootstock</u>	<u>Soluble solids</u>	<u>Ratio</u>	<u>Percent juice</u>	<u>Pounds solids per box</u>
US-812	8.6	9.3	60.8	4.4
Swingle	7.6	8.0	57.0	3.7
Carrizo	7.8	8.8	54.1	3.6

Table 15. Mean canopy volume and fruit yield of 'Dancy' tangerine on US-812 and selected rootstocks at Isabela, Puerto Rico. About 8 trees per rootstock were planted in 1993. Soil is Coto series, pH 5.9; tree spacing is 4.9 m x 5.5 m. Canopy volume was determined in 1997. Fruit were lost prior to harvest in 1998 due to Hurricane Georges. (Data provided by University of Puerto Rico.)

<u>Rootstock</u>	<u>Canopy volume (m³)</u>	<u>Fruit yield (number) per tree</u>			
		<u>1995-96</u>	<u>1997</u>	<u>1999</u>	<u>Cumulative</u>
US-812	25.6	11	622	514	1147
Swingle	26.5	430	462	823	1715
Naronja	20.8	61	348	319	728
Cleopatra	23.2	36	73	92	201
Sun Chu Sha	30.0	1	72	465	538

Table 16. Mean canopy volume and fruit yield of 'Dancy' tangerine on US-812 and selected rootstocks at Corozal, Puerto Rico. About 8 trees per rootstock were planted in 1993. Soil is Corozal series, pH 6.5; tree spacing is 4.9 m x 5.5 m. Canopy volume was determined in 1997. Fruit were lost prior to harvest in 1998 due to Hurricane Georges. (Data provided by University of Puerto Rico.)

<u>Rootstock</u>	<u>Canopy volume (m³)</u>	<u>Fruit yield (number) per tree</u>			
		<u>1995-96</u>	<u>1997</u>	<u>1999</u>	<u>Cumulative</u>
US-812	30.9	352	988	700	2040
Swingle	33.3	532	926	602	2060
Naronja	33.8	156	719	659	1534
Cleopatra	34.6	144	586	585	1315
Sun Chu Sha	24.0	86	450	719	1255

Table 17. Mean canopy volume and fruit yield of 'Chironja' on US-812 and selected rootstocks at Isabela, Puerto Rico. About 8 trees per rootstock were planted in 1993. Soil is Coto series, pH 5.9; tree spacing is 4.9 m x 5.5 m. Canopy volume was determined in 1997. Trees on Swingle failed to grow from apparent incompatibility. Fruit were lost prior to harvest in 1998 due to Hurricane Georges. (Data provided by University of Puerto Rico.)

<u>Rootstock</u>	<u>Canopy volume (m³)</u>	<u>Fruit yield (number) per tree</u>			
		<u>1995-96</u>	<u>1997</u>	<u>1999</u>	<u>Cumulative</u>
US-812	37.3	93	253	340	686
Swingle	Dead				0
Naronja	43.9	73	54	274	401
Cleopatra	34.3	26	36	324	386
Sun Chu Sha	32.2	8	44	233	285

Table 18. Mean canopy volume and fruit yield of 'Chironja' on US-812 and selected rootstocks at Corozal, Puerto Rico. About 8 trees per rootstock were planted in 1993. Soil is Corozal series, pH 6.5; tree spacing is 4.9 m x 5.5 m. Canopy volume was determined in 1997. Trees on Swingle failed to grow from apparent incompatibility. Fruit were lost prior to harvest in 1998 due to Hurricane Georges. (Data provided by University of Puerto Rico.)

<u>Rootstock</u>	<u>Canopy volume (m³)</u>	<u>Fruit yield (number) per tree</u>			
		<u>1995-96</u>	<u>1997</u>	<u>1999</u>	<u>Cumulative</u>
US-812	33.4	286	255	305	846
Swingle	Dead				0
Naronja	30.6	100	246	279	625
Cleopatra	29.0	100	194	228	522
Sun Chu Sha	28.4	77	206	211	494
