

Supplementary materials

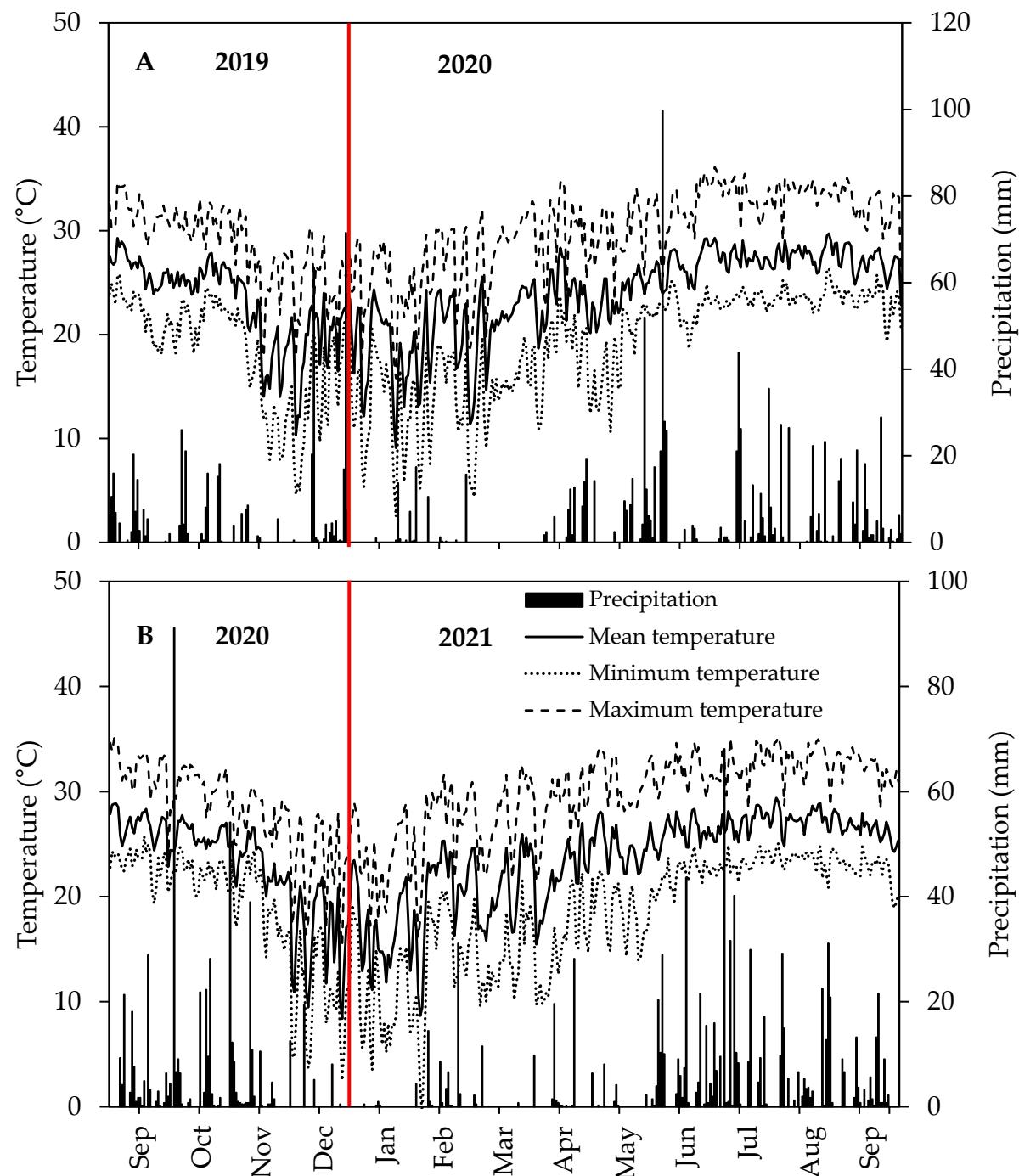


Figure S1. Temperature and precipitation data collected in 2019/20 (A) and 2020/21 (B) by the Florida Automated Weather Network (FAWN) using the St. Lucie West (Florida, USA) weather station. The red vertical line represents the end of the solar year.

Table S1. Macro- and micronutrients concentration in the leaves of 'Ray Ruby' grapefruit on multiple rootstocks.

Rootstock	N (g kg ⁻¹)	P (g kg ⁻¹)	K (g kg ⁻¹)	Mg (g kg ⁻¹)	Ca (g kg ⁻¹)	Fe (ppm)	Zn (ppm)	Mn (ppm)	B (ppm)	Cu (ppm)
2247×2075-02-26	29.0 ± 0.4 ^a ab	1.8 ± 0.1	14.4 ± 0.8 ac	4.8 ± 0.4 b	27.2 ± 1.1 ab	72.8 ± 5.4 a-c	34.3 ± 2.1 ab	41.0 ± 5.4 ab	80.5 ± 3.7 a-e	546.0 ± 72.2 a-c
2247×6070-02-2	30.0 ± 1.3 a	1.9 ± 0.1	17.1 ± 0.7 ab	4.4 ± 0.3 b	21.8 ± 1.1 b	58.5 ± 3.5 bc	27.8 ± 2.6 b	32.5 ± 2.2 ab	66.0 ± 2.1 a-f	379.3 ± 71.9 bc
46×20-04-42	27.4 ± 0.1 ab	1.7 ± 0.1	11.8 ± 0.6 bc	4.0 ± 0.2 b	28.8 ± 2.5 ab	71.5 ± 6.6 a-c	42.3 ± 10.0 ab	46.8 ± 10.0 ab	73.3 ± 6.3 a-f	709.8 ± 143.2 a-c
46×20-04-6	27.7 ± 0.8 ab	1.6 ± 0.0	13.9 ± 0.6 a-c	5.0 ± 0.6 a	33.0 ± 1.5 ab	62.8 ± 3.2 a-c	42.0 ± 3.2 ab	37.5 ± 4.2 ab	93.8 ± 7.8 a	436.0 ± 123.4 bc
A+Volk×Orange-19-11-8	30.1 ± 0.8 a	1.8 ± 0.1	15.3 ± 2.2 a-c	4.4 ± 0.3 b	25.0 ± 3.1 ab	75.0 ± 6.7 a-c	39.5 ± 5.3 ab	46.3 ± 4.9 ab	58.8 ± 2.6 cf	599.5 ± 141.8 a-c
C-22	28.2 ± 0.7 ab	1.4 ± 0.1	10.6 ± 0.9 c	4.4 ± 0.3 b	31.1 ± 3.5 ab	90.0 ± 4.5 ab	53.0 ± 4.1 ab	55.0 ± 7.0 ab	60.3 ± 5.0 cf	732.8 ± 144.5 a-c
C-54	29.1 ± 0.7 ab	1.6 ± 0.1	14.3 ± 0.8 a-c	4.6 ± 0.2 b	29.4 ± 1.3 ab	80.0 ± 3.8 a-c	49.5 ± 4.1 ab	69.8 ± 12.7 a	67.8 ± 5.3 a-f	419.5 ± 57.4 bc
Cunningham citrange	27.4 ± 0.1 ab	1.6 ± 0.1	13.1 ± 1.2 a-c	5.3 ± 0.2 a	30.9 ± 4.9 ab	84.3 ± 11.3 a-c	45.7 ± 2.8 ab	54.0 ± 4.6 ab	60.7 ± 6.7 b-f	389.0 ± 39.9 bc
Kuharske citrange	27.2 ± 0.7 ab	1.5 ± 0.1	12.0 ± 1.4 bc	5.5 ± 0.5 a	30.3 ± 3.3 ab	81.8 ± 8.8 a-c	47.5 ± 7.0 ab	57.5 ± 11.3 ab	67.5 ± 7.3 a-f	495.5 ± 165.5 bc
Orange 16	26.8 ± 0.9 ab	1.7 ± 0.2	14.6 ± 1.5 a-c	5.9 ± 0.3 a	25.5 ± 1.7 ab	70.0 ± 2.7 a-c	49.0 ± 7.0 ab	46.5 ± 5.3 ab	72.0 ± 1.4 a-f	1003.0 ± 114.2 ab
Sour orange	28.0 ± 0.7 ab	1.8 ± 0.1	15.9 ± 1.1 a-c	4.5 ± 0.4 b	25.0 ± 3.5 ab	72.5 ± 3.9 a-c	42.5 ± 7.3 ab	49.0 ± 7.0 ab	54.0 ± 3.0 ef	667.8 ± 185.4 a-c
UFR-1	28.7 ± 0.3 ab	1.6 ± 0.1	11.5 ± 0.9 bc	5.5 ± 0.3 a	30.0 ± 1.3 ab	69.8 ± 3.4 a-c	52.3 ± 5.2 ab	61.5 ± 5.6 ab	81.5 ± 5.4 a-e	401.5 ± 64.9 bc
UFR-15	26.4 ± 1.0 ab	1.9 ± 0.2	16.5 ± 0.8 a-c	4.2 ± 0.6 b	27.2 ± 3.7 ab	58.3 ± 5.2 bc	30.5 ± 4.3 ab	30.3 ± 5.1 b	62.8 ± 3.8 a-f	514.0 ± 69.7 a-c
UFR-16	25.7 ± 0.7 b	1.6 ± 0.1	14.6 ± 0.9 a-c	4.2 ± 0.4 b	28.4 ± 1.2 ab	53.3 ± 2.4 c	34.8 ± 3.6 ab	40.0 ± 4.1 ab	57.0 ± 2.9 d-f	512.8 ± 104.7 a-c
UFR-17	28.0 ± 0.3 ab	1.7 ± 0.1	15.4 ± 1.0 a-c	4.4 ± 0.4 b	24.8 ± 1.8 ab	72.5 ± 4.4 a-c	41.3 ± 6.2 ab	38.0 ± 8.2 ab	69.3 ± 1.1 a-f	778.3 ± 82.0 a-c
UFR-4	28.7 ± 0.3 ab	1.7 ± 0.2	11.9 ± 0.6 bc	5.5 ± 0.6 a	30.3 ± 1.2 ab	70.0 ± 2.7 a-c	45.8 ± 5.7 ab	49.0 ± 5.7 ab	84.8 ± 5.0 a-d	548.8 ± 141.6 a-c
UFR-5	27.7 ± 0.3 ab	1.5 ± 0.0	14.3 ± 1.0 a-c	5.3 ± 0.2 a	28.7 ± 1.2 ab	75.0 ± 4.1 a-c	57.8 ± 1.7 a	55.5 ± 2.3 ab	87.5 ± 5.1 a-c	1177.3 ± 28.4 a
US-802	27.9 ± 0.5 ab	1.6 ± 0.1	16.5 ± 2.1 a-c	4.5 ± 0.3 b	27.9 ± 3.7 ab	73.3 ± 7.8 a-c	48.5 ± 8.1 ab	55.0 ± 9.0 ab	83.5 ± 8.1 a-e	313.8 ± 75.3 c
US-812	29.2 ± 0.9 ab	1.5 ± 0.2	11.9 ± 1.9 bc	4.9 ± 0.2 a	28.5 ± 4.8 ab	75.5 ± 12.7 a-c	30.5 ± 5.2 ab	45.5 ± 8.9 ab	76.3 ± 13.4 a-f	264.8 ± 46.5 c
US-897	28.4 ± 0.3 ab	1.6 ± 0.1	12.4 ± 0.8 bc	4.8 ± 0.3 a	32.7 ± 3.2 ab	77.3 ± 6.1 a-c	40.0 ± 1.6 ab	61.3 ± 6.3 ab	60.8 ± 4.8 cf	373.3 ± 51.8 bc
US-942	30.5 ± 1.4 a	1.4 ± 0.1	11.3 ± 0.6 bc	3.9 ± 0.1 b	36.9 ± 2.0 a	94.5 ± 8.8 a	39.8 ± 3.1 ab	51.0 ± 4.9 ab	71.5 ± 2.7 a-f	469.8 ± 26.7 a-c
WGFT+50-7	30.6 ± 1.4 a	1.9 ± 0.1	18.5 ± 0.8 a	5.1 ± 0.4 a	21.0 ± 1.8 b	58.5 ± 4.3 bc	32.8 ± 6.2 ab	36.5 ± 5.3 ab	92.3 ± 4.4 ab	260.3 ± 71.0 c
x-639	28.2 ± 0.7 ab	1.7 ± 0.1	13.8 ± 1.3 a-c	5.1 ± 0.4 a	29.0 ± 4.1 ab	75.3 ± 5.7 a-c	44.5 ± 7.1 ab	54.8 ± 8.5 ab	50.3 ± 3.4 f	371.8 ± 102.7 c
F-ratio	2.6**	1.4 ^{ns}	3.3**	1.7*	1.7*	2.6**	1.9*	2.1*	4.7***	3.8**
Coefficient of variation	4.7	13.1	15.0	15.6	17.5	15.2	23.7	26.6	13.9	36.2

^aMeans ± standard error followed by at least one common letter are not significantly different at $P < 0.05$ by Tukey's honestly significant difference test. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; ^{ns}= not significant.

Table S2. Macro- and micronutrients concentration in the leaves of 'Glenn' navel orange F-56-11 on multiple rootstocks.

Rootstock	N (g kg ⁻¹)	P (g kg ⁻¹)	K (g kg ⁻¹)	Mg (g kg ⁻¹)	Ca (g kg ⁻¹)	Fe (ppm)	Zn (ppm)	Mn (ppm)	B (ppm)	Cu (ppm)
2247×2075-02-26	2.9 ± 0.9	1.9 ± 0.2	16.6 ± 0.9 a-c	3.6 ± 0.2	19.5 ± 0.9	75.3 ± 2.9	46.3 ± 2.2 ab	47 ± 5.9 ab	60.3 ± 2.5 a-c	863.0 ± 102.8 a-c
2247×6070-02-2	3.0 ± 0.5	1.9 ± 0.0	18.3 ± 0.6 ab	3.3 ± 0.2	19.1 ± 1.1	76.3 ± 5.1	50.8 ± 3.8 ab	53.3 ± 3.7 ab	51.0 ± 2.7 b-e	976.5 ± 83.9 a-c
46×20-04-6	2.8 ± 0.9	1.7 ± 0.1	16.7 ± 0.5 a-c	3.4 ± 0.1	22.0 ± 1.7	68.0 ± 2.4	44.0 ± 0.9 ab	43.0 ± 1.8 ab	69.5 ± 5.7 a	654.0 ± 182.1 a-c
A+Volk×Orange-19-11-8	2.8 ± 0.5	1.9 ± 0.1	17.1 ± 0.6 a-c	3.4 ± 0.1	20.3 ± 0.4	69.0 ± 2.5	42.3 ± 3.3 ab	49.5 ± 3.7 ab	44 ± 2.7 de	644.8 ± 140.0 a-c
C-22	2.7 ± 0.5	1.7 ± 0.1	17.0 ± 1.7 a-c	2.9 ± 0.2	19.6 ± 1.8	72.7 ± 4.1	38.3 ± 3.8 b	48.7 ± 4.0 ab	47.3 ± 2.5 b-e	473.7 ± 56.4 a-c
C-54	2.8 ± 0.6	1.7 ± 0.1	16.2 ± 0.8 a-c	3.2 ± 0.1	21.1 ± 0.6	76.3 ± 3.1	48.5 ± 2.9 ab	50.3 ± 2.0 ab	47.0 ± 3.1 c-e	910.5 ± 151.1 a-c
Cunningham citrange	2.8 ± 0.6	1.7 ± 0.1	15.6 ± 1.6 a-c	3.2 ± 0.1	19.4 ± 1.5	69.0 ± 4.9	41.0 ± 9.0 ab	35.5 ± 3.7 b	45.0 ± 1.6 b-e	701.5 ± 261.7 a-c
Kuharske citrange	2.8 ± 0.7	1.9 ± 0.1	17.9 ± 0.8 ab	3.1 ± 0.3	19.0 ± 0.6	71.3 ± 5.1	36.0 ± 3.4 b	37.5 ± 2.6 b	50.3 ± 0.8 b-e	602.8 ± 107.3 a-c
Orange 14	2.8 ± 0.2	1.8 ± 0.1	16.6 ± 0.6 a-c	3.6 ± 0.2	20.9 ± 1.1	66.8 ± 4.7	47.0 ± 4.6 ab	48.5 ± 4.3 ab	47.5 ± 3.5 ce	860.5 ± 162.6 a-c
UFR-1	2.8 ± 1.0	1.8 ± 0.1	16.0 ± 0.8 a-c	3.2 ± 0.1	19.9 ± 0.3	76.3 ± 0.8	53.3 ± 3.3 ab	46.3 ± 2.4 ab	49.5 ± 2.9 b-e	1162.0 ± 59.5 ab
UFR-15	2.8 ± 0.9	1.7 ± 0.0	17.0 ± 0.9 a-c	3.2 ± 0.1	22.2 ± 2.2	81.0 ± 1.8	45.5 ± 5.5 ab	53.3 ± 3.3 ab	55.5 ± 1.3 a-e	821.0 ± 210.6 a-c
UFR-16	2.8 ± 1.1	1.8 ± 0.1	17.2 ± 1.1 a-c	3.7 ± 0.4	24.5 ± 0.4	65.0 ± 4.8	47.8 ± 3.6 ab	54.5 ± 7.8 ab	61.5 ± 7.2 a-e	506.8 ± 113.3 a-c
UFR-17	2.9 ± 0.6	1.7 ± 0.0	18.4 ± 0.2 ab	3.0 ± 0.1	19.5 ± 0.8	74.0 ± 5.8	44.8 ± 5.1 ab	45.3 ± 2.3 ab	43.5 ± 0.6 de	834.5 ± 269.3 a-c
UFR-2	2.9 ± 0.5	1.9 ± 0.1	17.7 ± 0.1 a-c	3.5 ± 0.0	19.7 ± 1.6	71.0 ± 3.4	42.8 ± 3.0 ab	53.0 ± 1.8 ab	56.8 ± 3.1 a-d	616.3 ± 145.0 a-c
UFR-4	2.9 ± 1.0	1.7 ± 0.0	15.8 ± 0.5 a-c	3.6 ± 0.2	22.8 ± 1.3	73.3 ± 4.8	50.8 ± 2.9 ab	53.3 ± 2.5 ab	50.8 ± 4.6 b-e	906.8 ± 117.3 a-c
UFR-5	2.9 ± 0.7	1.9 ± 0.0	18.8 ± 0.4 a	3.3 ± 0.2	19.7 ± 0.7	67.0 ± 4.2	40.5 ± 5.2 b	41.8 ± 5.7 ab	57.3 ± 2.1 a-d	719.5 ± 202.4 a-c
US-802	2.7 ± 1.3	1.6 ± 0.1	14.5 ± 1.2 bc	3.3 ± 0.2	23.6 ± 1.3	81.8 ± 9.4	66.3 ± 10.0 a	62.8 ± 8.4 a	54.0 ± 2.3 a-e	1245.0 ± 198.9 a
US-812	2.9 ± 0.5	1.9 ± 0.0	19.4 ± 0.3 a	3.3 ± 0.1	19.4 ± 0.7	71.8 ± 5.4	33.8 ± 2.2 b	42.5 ± 4.0 ab	55.8 ± 3.5 a-e	366.5 ± 41.3 c
US-897	2.8 ± 1.4	1.6 ± 0.0	13.6 ± 1.0 c	3.1 ± 0.2	22.8 ± 1.5	84.8 ± 3.5	54.3 ± 7.0 ab	59.0 ± 5.9 ab	42.8 ± 2.4 de	1052.0 ± 252.9 a-c
US-942	3.0 ± 0.7	1.7 ± 0.1	16.2 ± 1.1 a-c	3.1 ± 0.1	23.0 ± 2.0	81.8 ± 4.2	51.5 ± 6.7 ab	51.0 ± 5.9 ab	53.8 ± 2.3 a-e	1130.0 ± 123.4 ab
Willits citrange	2.9 ± 0.5	1.8 ± 0.0	16.8 ± 0.8 a-c	3.7 ± 0.1	23.3 ± 1.1	75.3 ± 2.7	37.5 ± 1.3 b	45.5 ± 2.8 ab	63.5 ± 3.9 ab	426.5 ± 53.4 bc
x-639	2.9 ± 0.9	1.8 ± 0.1	17.1 ± 0.7 a-c	3.4 ± 0.1	19.9 ± 1.1	78.5 ± 1.0	50.3 ± 2.0 ab	52.0 ± 1.6 ab	40.3 ± 4.4 e	1177.3 ± 49.3 a
F-ratio	1.1 ^{ns}	1.4 ^{ns}	2.8***	1.3 ^{ns}	1.7 ^{ns}	1.6 ^{ns}	2.7**	2.2**	5.5***	2.8***
Coefficient of variation	5.1	8.3	8.9	9.2	10.4	10.6	17.6	15.7	10.2	33.5

^aMeans ± standard error followed by at least one common letter are not significantly different at $P < 0.05$ by Tukey's honestly significant difference test. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; ^{ns}= not significant.

Table S3. Macro- and micronutrients concentration in the leaves of 'UF 950' mandarin on multiple rootstocks.

Rootstock	N (g kg ⁻¹)	P (g kg ⁻¹)	K (g kg ⁻¹)	Mg (g kg ⁻¹)	Ca (g kg ⁻¹)	Fe (ppm)	Zn (ppm)	Mn (ppm)	B (ppm)	Cu (ppm)
2247×2075-02-26	2.9 ± 0.3	1.8 ± 0.1	17.9 ± 1.0 ab	4.0 ± 0.2 ab	22.4 ± 2.0	69.3 ± 6.5	30.5 ± 3.8	38.0 ± 6.5	70.5 ± 4.5	348.0 ± 67.0 a
2247×6070-02-2	3.0 ± 0.7	1.7 ± 0.0	19.3 ± 0.6 ab	4.1 ± 0.1 ab	19.8 ± 1.0	66.5 ± 1.8	44.5 ± 6.0	54.8 ± 4.9	60.0 ± 5.7	1161 ± 233.7 ab
46×20-04-6	2.8 ± 0.6	1.7 ± 0.0	18.8 ± 1.2 ab	4.3 ± 0.2 ab	22.9 ± 1.7	66.0 ± 1.5	37.5 ± 3.1	43.8 ± 4.7	78.0 ± 5.3	561.5 ± 117.4 ab
A+Volk×Orange-19-11-8	2.8 ± 0.5	1.9 ± 0.1	19.1 ± 0.5 ab	4.1 ± 0.1 ab	20.1 ± 0.6	64.8 ± 1.8	36 ± 6.7	43.0 ± 6.2	66.3 ± 4.7	685.3 ± 260.6 ab
C-22	2.7 ± 0.3	1.7 ± 0.0	17.5 ± 1.3 ab	4.0 ± 0.3 ab	23.8 ± 0.8	75.0 ± 1.5	43.8 ± 2.4	56.0 ± 3.7	63.0 ± 4.4	1226.3 ± 91.2 b
C-54	2.8 ± 0.6	1.8 ± 0.1	16.5 ± 0.7 b	4.3 ± 0.3 ab	23.5 ± 3.0	63.3 ± 2.9	38.0 ± 3.3	53.8 ± 5.8	59.0 ± 4.1	497.8 ± 37.7 ab
Cunningham citrange	2.8 ± 0.6	1.8 ± 0.1	17.2 ± 0.5 ab	4.2 ± 0.2 ab	23.4 ± 0.5	65.8 ± 2.4	40.0 ± 6.0	50.5 ± 5.8	59.0 ± 3.1	690.8 ± 234.6 ab
Kuharske citrange	2.8 ± 1.4	1.8 ± 0.0	17.8 ± 1.8 ab	4.2 ± 0.1 ab	22.4 ± 0.8	74.3 ± 2.1	37.0 ± 1.5	53.8 ± 5.2	65.3 ± 3.6	577.5 ± 107.2 ab
UFR-1	2.8 ± 0.0	1.9 ± 0.0	16.7 ± 0.0 ab	4.5 ± 0.0 ab	18.2 ± 0.0	60.0 ± 4.1	33.5 ± 3.7	48.5 ± 0.4	73.5 ± 4.5	755.0 ± 265.4 ab
UFR-15	2.8 ± 0.1	1.7 ± 0.1	16.5 ± 0.4 ab	4.2 ± 0.3 ab	26.6 ± 0.4	71.8 ± 5.2	34.3 ± 2.1	50.8 ± 5.0	83.3 ± 9.0	494.3 ± 72.5 ab
UFR-16	2.8 ± 0.4	1.8 ± 0.0	17.0 ± 0.8 ab	4.4 ± 0.2 ab	25.8 ± 1.7	63.8 ± 3.9	37.5 ± 1.2	49.0 ± 1.6	61 ± 3.6	488.8 ± 56.6 ab
UFR-17	2.9 ± 1.1	1.8 ± 0.0	21.2 ± 0.4 a	3.5 ± 0.1 b	18.0 ± 1.4	65.8 ± 2.7	40.8 ± 1.8	46.8 ± 2.6	58.5 ± 2.1	1211.5 ± 36.5 b
UFR-2	2.9 ± 0.4	1.7 ± 0.0	17.6 ± 0.1 ab	3.9 ± 0.1 ab	20.5 ± 1.2	102.0 ± 31.0	36.0 ± 0.7	58.8 ± 4.6	77.0 ± 4.1	664.0 ± 60.8 ab
UFR-4	2.9 ± 1.1	1.9 ± 0.1	18.7 ± 0.5 ab	4.6 ± 0.2 ab	18.4 ± 1.3	110.8 ± 43.2	40.0 ± 3.1	55.5 ± 4.9	61.5 ± 1.7	785.5 ± 140.6 ab
UFR-5	2.9 ± 1.0	1.7 ± 0.1	18.3 ± 0.8 ab	3.7 ± 0.4 ab	20.6 ± 1.5	64.3 ± 4.4	36.7 ± 4.5	47.0 ± 4.6	63.7 ± 2.3	812.3 ± 360.3 ab
US-802	2.7 ± 0.5	1.8 ± 0.1	19.8 ± 1.4 ab	3.9 ± 0.1 ab	22.6 ± 1.5	74.8 ± 2.9	54.8 ± 5.1	84.0 ± 18.5	77.0 ± 5.1	957.3 ± 193.6 ab
US-812	2.9 ± 0.3	1.7 ± 0.1	17.4 ± 0.6 ab	4.2 ± 0.2 ab	19.5 ± 1.5	68.8 ± 1.9	37.3 ± 3.9	50.3 ± 5.0	63.5 ± 4.7	919.8 ± 148.3 ab
US-897	2.8 ± 0.4	1.8 ± 0.1	16.3 ± 1.2 b	4.1 ± 0.1 ab	20.7 ± 1.3	62.8 ± 1.9	35.8 ± 0.5	52.8 ± 3.5	60.5 ± 4.3	860.5 ± 77.5 ab
US-942	3.0 ± 0.8	1.7 ± 0.1	18.0 ± 0.8 ab	3.9 ± 0.1 ab	20.1 ± 1.7	124.8 ± 31.8	40.0 ± 1.1	50.8 ± 4.0	68.8 ± 5.3	952.5 ± 127.0 ab
WGFT+50-7	2.9 ± 0.8	1.7 ± 0.0	19.1 ± 1.7 ab	4.0 ± 0.3 ab	17.6 ± 4.9	67.8 ± 4.2	28.3 ± 3.1	37.3 ± 4.6	73.3 ± 6.0	467.8 ± 62.0 ab
x-639	2.9 ± 1.3	1.8 ± 0.0	18.3 ± 0.8 ab	4.8 ± 0.2 a	20.9 ± 1.2	91.8 ± 16.5	37.5 ± 3.7	58.3 ± 3.8	61 ± 9.1	551.8 ± 70.0 ab
F-ratio	1.0 ^{ns}	1.7 ^{ns}	2.4 ^{**}	1.8 [*]	2 ^{ns}	0.9 ^{ns}	0.9 ^{ns}	1.1 ^{ns}	1.3 ^{ns}	3.0 ^{***}
Coefficient of variation	4.2	5.5	8.2	7.9	12.4	49.2	15.0	16.4	12.6	28.1

^aMeans ± standard error followed by at least one common letter are not significantly different at $P < 0.05$ by Tukey's honestly significant difference test. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; ^{ns}= not significant.