

# Vernia Rootstock Trial, LaBelle

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CREC Citrus Plant Improvement*

## Vernia Rootstock Trial, LaBelle - Description

Vernia sweet orange is the scion in this cooperator trial planted mostly in March 2010 in a flatwoods grove located south of LaBelle near Felda and west of Highway 29. The site is described by the cooperator as one of their better ones based on the high level of performance of the previous citrus planted on the site. The trial consists of trees on 76 rootstocks among which are the ES series from Spain, the C-series from California and various sexual and somatic hybrids produced by the CREC plant breeding team. Virtually all the rootstocks are those included in several other trials; thus, this trial is one of a network of trials intended to evaluate the rootstocks at multiple sites with different scions.

## Vernia Rootstock Trial, LaBelle - Summary

- Location: LaBelle – Felda, Hendry County
- Scion: Vernia
- Rootstocks: 76
- Date Planted: March 2010
- Design: Randomized complete-block with 1-7 replications planted in East-West rows
  - Plot size: mostly 2-8 trees
  - Spacing: 7.5 x 22 ft. @ 264 trees/acre.
- Data (*Although trees on 76 rootstocks were planted originally, there are some graphical results with only 48 rootstocks. That difference is the result of attrition especially among the smaller plots [1-3 trees] and to other factors like hurricanes or poor to no cropping.*)
  - 2013/14: Yield.
  - 2014/15: Yield, HLB rating, juice quality, PS/acre.
  - 2017/18: Yield, tree size, HLB rating,
  - 2018/19: Yield, HLB rating, juice quality, PS/acre.
  - 2019/20: Yield, HLB rating.
  - 2020/21: Yield, HLB rating, juice quality, PS/acre.
  - 2021/22: Tree height
  - 6-year cumulative yield.
- Trial status: **INACTIVE**

Table 1. Vernia rootstock trial - List of rootstocks, parentage and number of trees.

Rootstock	Parentage	Number of Trees
3-12-27	Cleo x Swingle	3
6-11-106	Thong Dee pum. x Minneola	4
6-18-34	Tahiti Swt x Argentine TO	1
6-18-5	Sanford sweet orange x Argentine TO	28
62-109-1, [PLN 1832]	Sunki x Flying Dragon trifoliolate	25
62-137-2, [PLN 1833,34]	Shekwasha x English trifoliolate	34
6-6-29	Nakon x Page	6
6-6-92	Pink Java x Page	4
Amb+HBJ	Ambly+HBJL2B Pummelo	7
B11 R1 T56, 11-1-56	Duncan x 9-6 TO	5
B11 R2 T23	17-47 x Ponderosa	3
B11 R2 T43, 11-2-43	US 17-47 x Ponderosa Lem.	4
B11 R2 T60	US 17-47 x Ponderosa Lem.	6
B11 R3 T38	B6R24T62 x Cleo	10
B11 R3 T48, 11-3-48	B6R24T62 x Cleo	9
B11 R4 T9, 11-4-9	Flying Dragon x Obovoidea	7
B11 R5 T35	Flying Dragon x Duncan	38
B11 R5 T36, 11-5-36	Flying Dragon x Duncan	2
B11 R5 T4	Flying Dragon x Obovoidea	6
B11 R5 T51, 11-5-51	Flying Dragon x Ridge Pineapple	4
B11 R5 T6	Flying Dragon x Obovoidea	2
B11 R5 T62, 11-5-62	Flying Dragon x Ridge Pineapple	1
B11 R5 T64, 11-5-64	Flying Dragon x Ridge Pineapple	3
B11 R5 T7, 11-5-7	Flying Dragon x Obovoidea	7
B11 R5 T91	Flying Dragon x 17-47	3

Table 1 [cont'd]. Vernia rootstock trial - List of rootstocks, parentage and number of trees.

Rootstock	Parentage	Number of Trees
B11 R6 T104, 11-6-104	Flying Dragon x sour orange	3
B11 R6 T2, 11-6-2	17-47 x Obovoidea	6
B11 R6 T85, 11-6-85	17-47 x Obovoidea	3
B11 R7 T17 , 11-7-17	17-47 x Obovoidea	5
B21 R1 T11, 21-1-11	Duncan x DPI 9-6	3
B21 R1 T18, 21-1-18	DPI 9-6 x LB-1-21 (Clem x Duncan)	26
B21 R1 T2	open-pollinated Flying Dragon bull (FG)	3
B21 R1 T6, 21-1-6	Duncan x DPI Dundee 9-6 TO	1
B21 R10 T26, 21-10-26	LB 6-1 (Clem x Hamlin) x DPI 9-6 TO	3
B21 R2 T10, 21-2-10	Duncan x DPI 9-6	7
B21 R2 T16, 21-2-16	DPI Flying Dragon x LB 1-21	12
B21 R2 T19	DPI FD x LB 1-21	5
B21 R2 T21, 21-2-21	DPI Flying Dragon x LB 1-21	11
B21 R2 T26 , 21-2-26	DPI Flying Dragon x LB 1-21	4
B21 R3 T23, 21-3-23	DPI FD x LB 1-21	3
B21 R3 T24, 21-3-24	DPI Flying Dragon x LB 1-21	7
B21 R3 T26, 21-3-26	DPI Flying Dragon x LB 1-21	3
B21 R4 T25, 21-4-25	DPI Flying Dragon x LB 1-21	5
B21 R4 T26, 21-4-26	DPI Flying Dragon x LB 1-21	8
B21 R9 T6	LB 6-1 (Clem x Hamlin) x DPI 9-6 TO	1
Blue 1	[Nova + HBPummelo] x [sour orange + Palestine sweet lime]	4
Blue 3	[Nova + HBPummelo] x [sour orange + Palestine sweet lime]	2
C-146 [PLN1831]	Sunki x Swingle TF	10
C-22 [PLN1828]	Sunki x Swingle TF	13
C-57 [PLN1830]	Sunki x Swingle TF	10

Table 1 [cont'd]. Vernia rootstock trial - List of rootstocks, parentage and number of trees.

Rootstock	Parentage	Number of Trees
Changsha + Benton	Changsha mandarin + Benton citrange	1
ES-1	Cleo x Poncirus trifoliata (Spain)	34
ES-2	Cleo x Poncirus trifoliata (Spain)	26
ES-3	Cleo x Poncirus trifoliata (Spain)	32
Green 7	[Nova + HBPummelo] x [sour orange + Carrizo]	5
N40 16-11-9	AP 66-68 x DPI Ichangensis	2
N40 16-6-13	AP 67-41 x DPI Ichangensis	5
Orange 1	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	2
Orange 13	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	6
Orange 16	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	5
Orange 2	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	4
RB24-16	Fiwicke Swt x FD TO	5
RB24-6	Ruby Swt x Argentine TO	4
SO+50-7	Sour orange + trifoliate orange 50-7	12
SR+SH99-11	tetrazygs SO+Rangpur, Sour orange + rangpur, open pollinated	1
SR+SH99-18	tetrazygs SO+Rangpur	3
SR+SH99-6	tetrazygs SO+Rangpur	10
SRxSH99-1	SO+Rangpur x Cleo+Trifol. Or	8
SRxSH99-4	sour orange + rangpur, open pollinated	8
UFR 1: Orange 3	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	37
UFR 2: Orange 4	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	8
UFR 4: Orange 19	[Nova + HBPummelo] x [Cleopatra + Argentine trifoliate orange]	39
UFR 5: White 4	[Nova + HBPummelo] x [Succari + Argentine trifoliate orange]	40
UFR 6: Changsha+TF 50-7	Changsha mandarin + trifoliate orange 50-7	43
WGFT+50-7 [PLN-1810]	White grapefruit + trifoliate orange	31
White 1	[Nova + HBPummelo] x [Succari + Argentine trifoliate orange]	6

## Vernia Rootstock Trial, LaBelle – Interpretive Summary [as of March 2021]:

This trial was planted in March 2010 and was comprised originally of trees on 76 rootstocks. What follows is a summary of those trees on about 48 rootstocks that had sufficient replication and growth and cropping to merit collecting data.

**General.** Most striking were not the differences among rootstocks, but the overall lower juice quality presumably because of HLB. Typically, Brix values were about 8-11 with some variability because of the time of year when fruit samples were harvested; acid was about 0.5; PS/box values were in the 4-6 range.

**Growth.** When the trees were about 7 years old, they had grown to about 5-8 ft. [Fig. 10]. Most trees were 6 ft or taller and only a few rootstocks were among the smallest.

**HLB.** Most trees had visible symptoms of HLB. Among those least affected were trees on White 1, C-22, C-146, 11-5-62, 11-5-4, 11-5-64, and 21-9-6.

**PS/acre.** Values were generally low, but among the rootstocks, relatively high values in a hypothetical calculation of 2018-19 [Fig. 15] and 2020-21 [Fig. 27] data were trees on ES-1, C-146, B21R4T26 and 62-137-2. The rootstock story changed somewhat across cumulative PS [Table 2].

**Cumulative yield.** One of the better measures of tree performance is cumulative yield, in this case, over 6 seasons [Fig. 33]. The top performers were the trees on 11-5-4, 62-137-2, 21-3-24, ES-1, C-146, C-57 and C-22.

## Vernia Rootstock Trial, LaBelle – Interpretive Summary [as of March 2021], Cont'd.

**Rootstocks.** Various factors, some mentioned previously, affected the trial outcomes in such a manner as to reduce the trial's precision. As a result, sharp or clear differences among rootstocks were not as evident as might otherwise occur. However, the trees on some rootstocks were consistently among the top performers and are worthy of further evaluation. Taking into consideration HLB ratings, PS/box and acre and cumulative yield, promising rootstocks were:

- **11-5-62**
- **11-5-4**
- **C-22**
- **ES-1**
- **C-146**

Fig. 1. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2014].

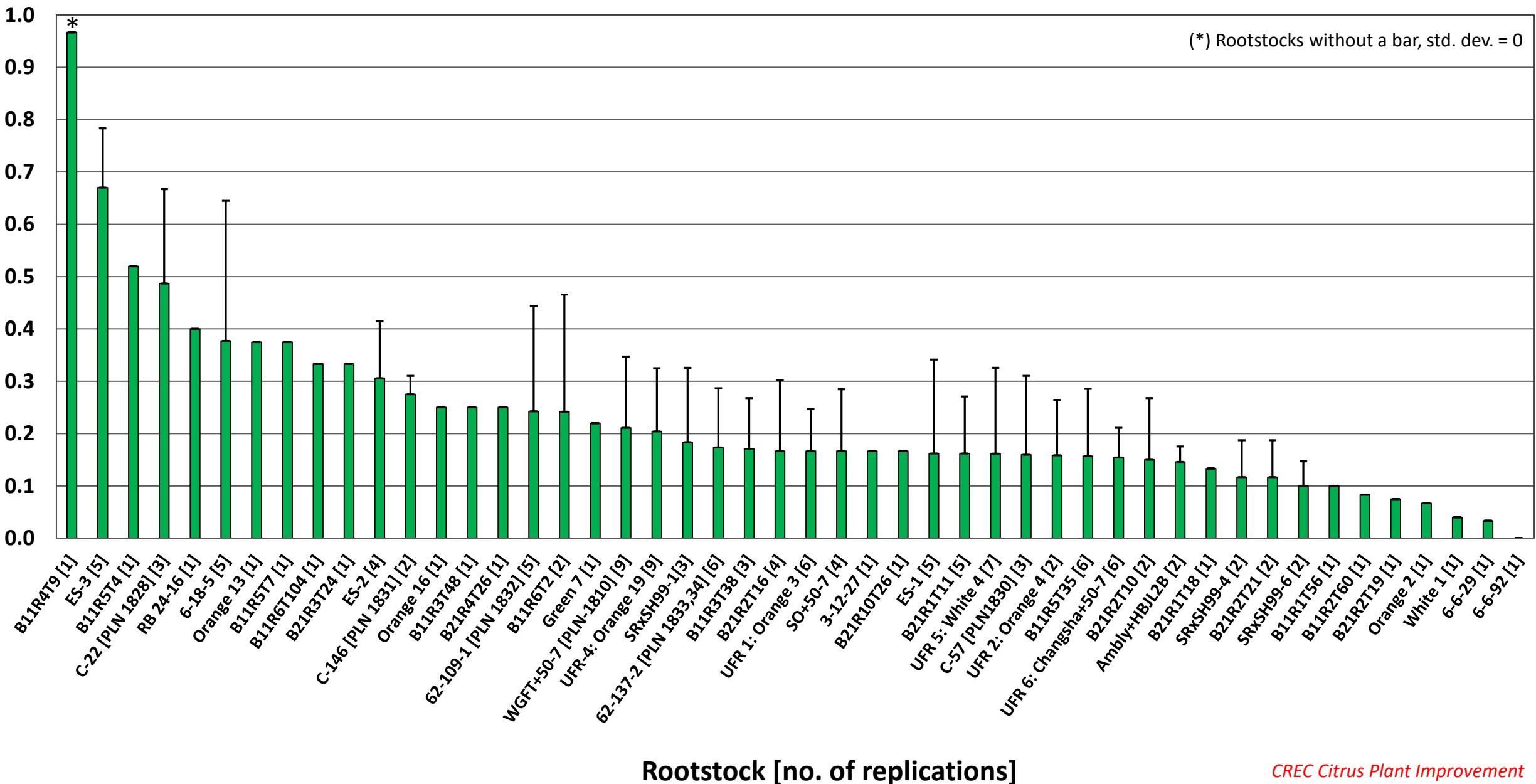


Fig. 2. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2015].

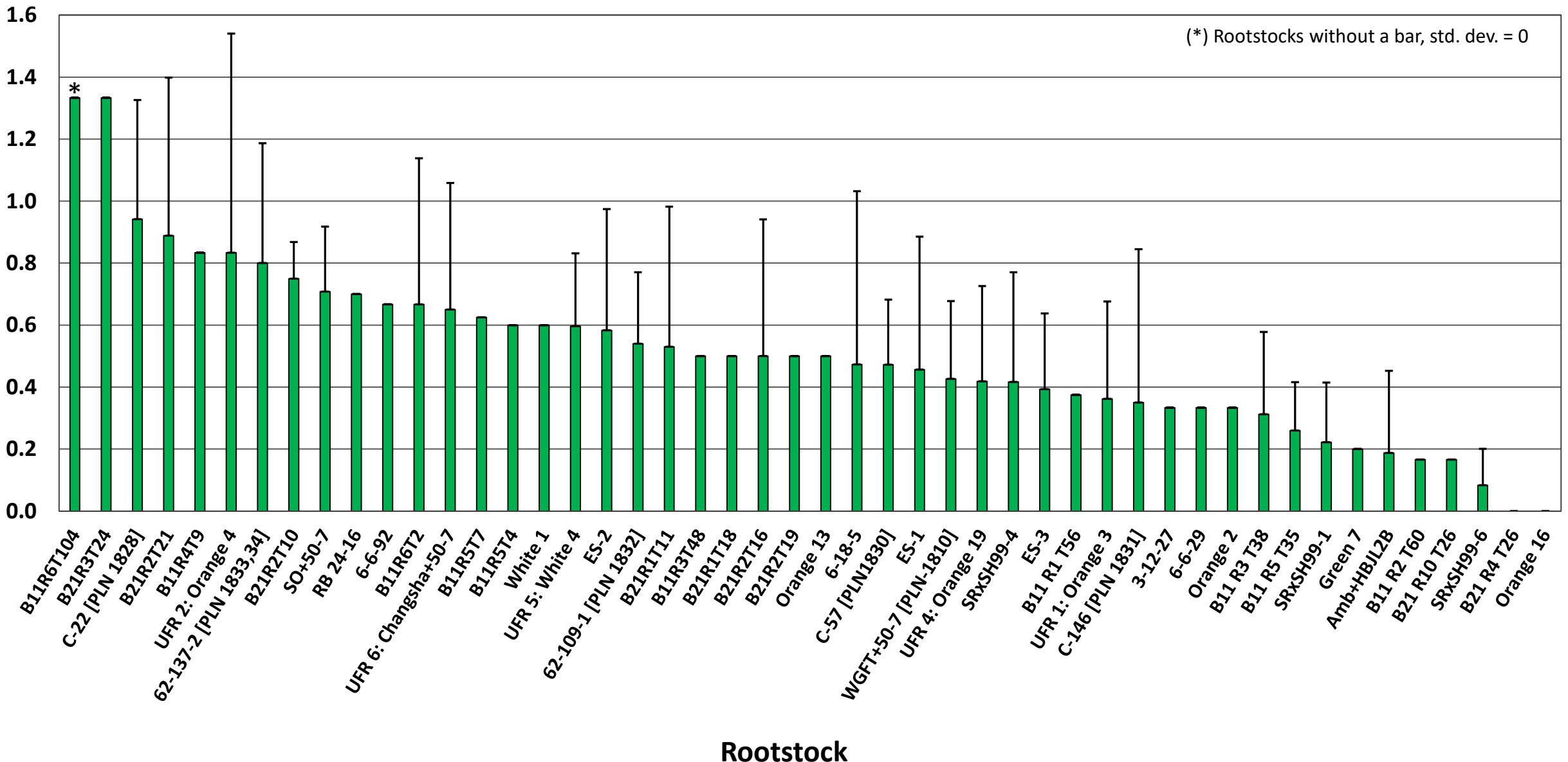
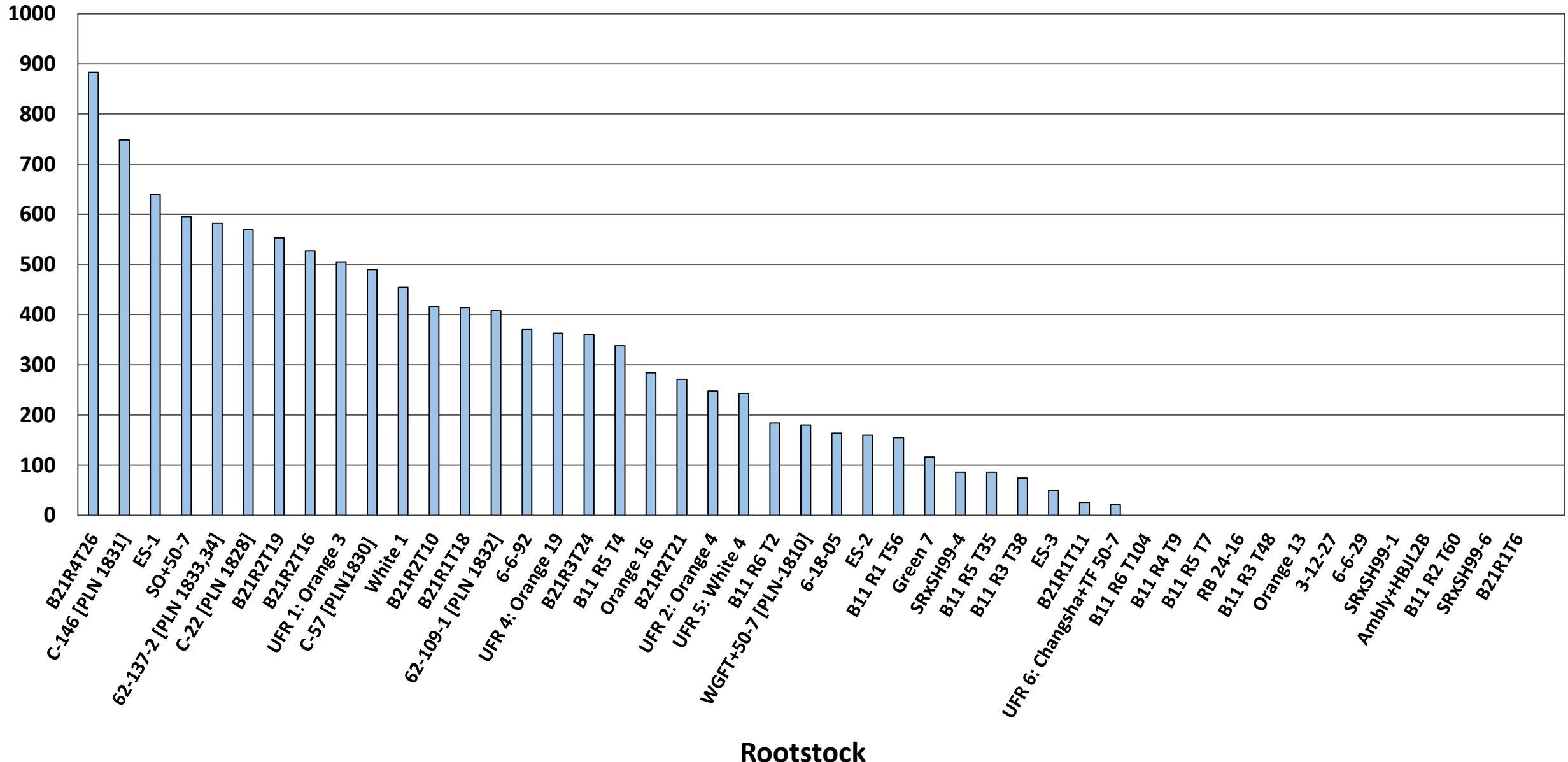


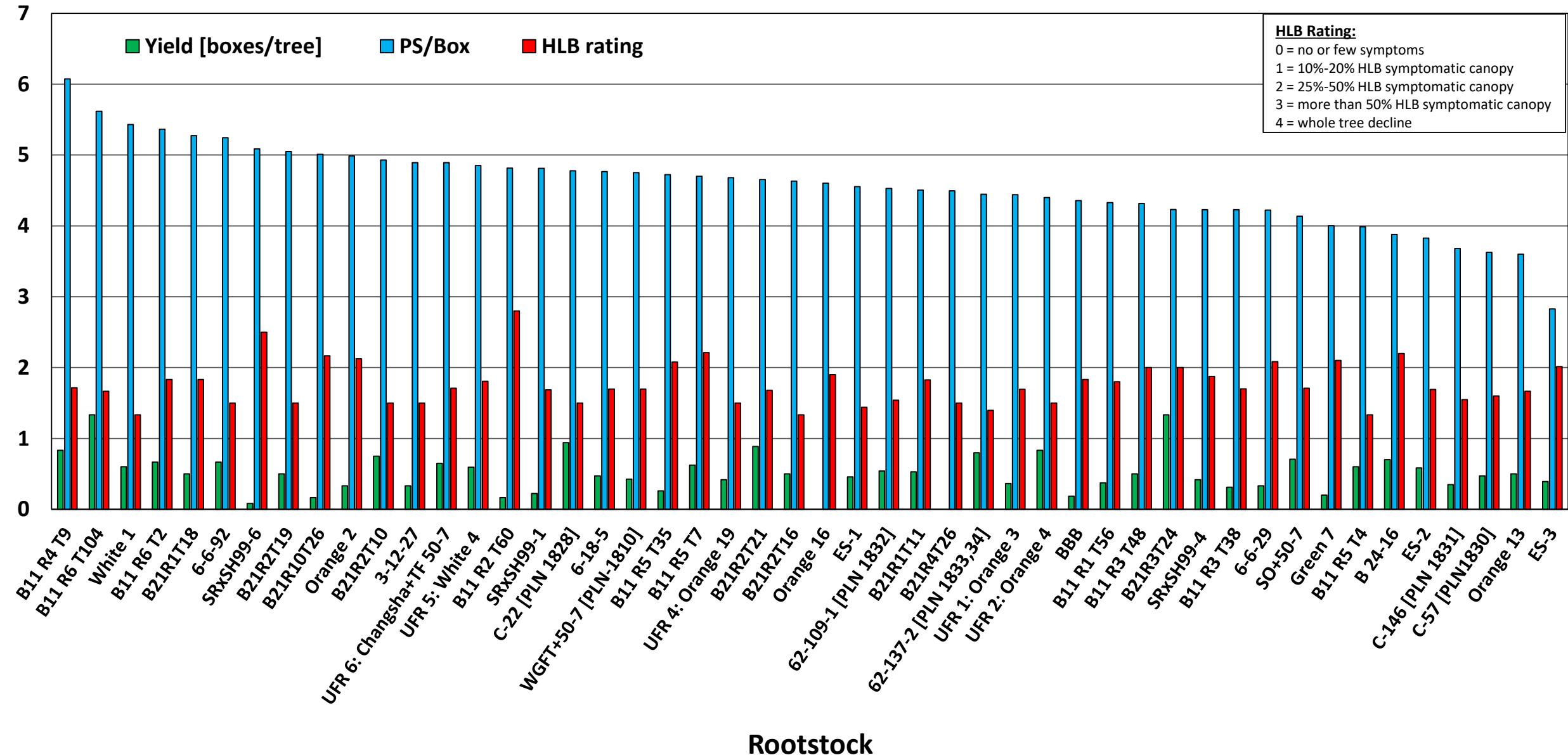
Fig. 3. Vernia rootstock trial – PS/acre [calculated @ 264 trees/acre, 7.5 x 22 ft.], 2014/15.



Rootstock

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Fig. 4. Vernia Rootstock Trial – Mean yield [boxes/tree], PS/box and HLB rating, sorted by PS/box [March 2015].



Rootstock

Fig. 5. Vernia rootstock trial – Mean yield [boxes/tree], PS/box and HLB rating, sorted by yield [March 2015].

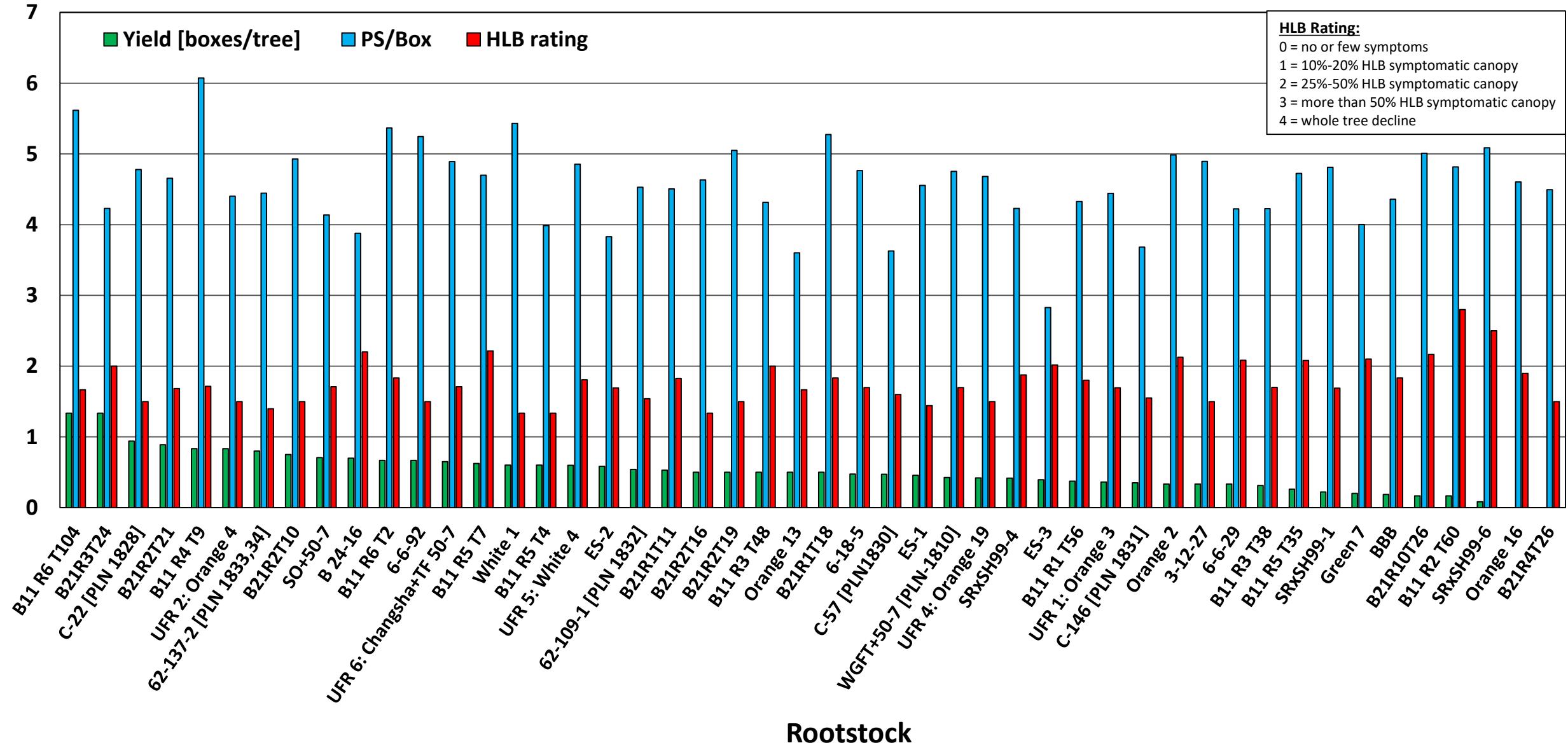


Fig. 6. Vernia Rootstock Trial – juice Acid: mean + std. dev. [March 2015].

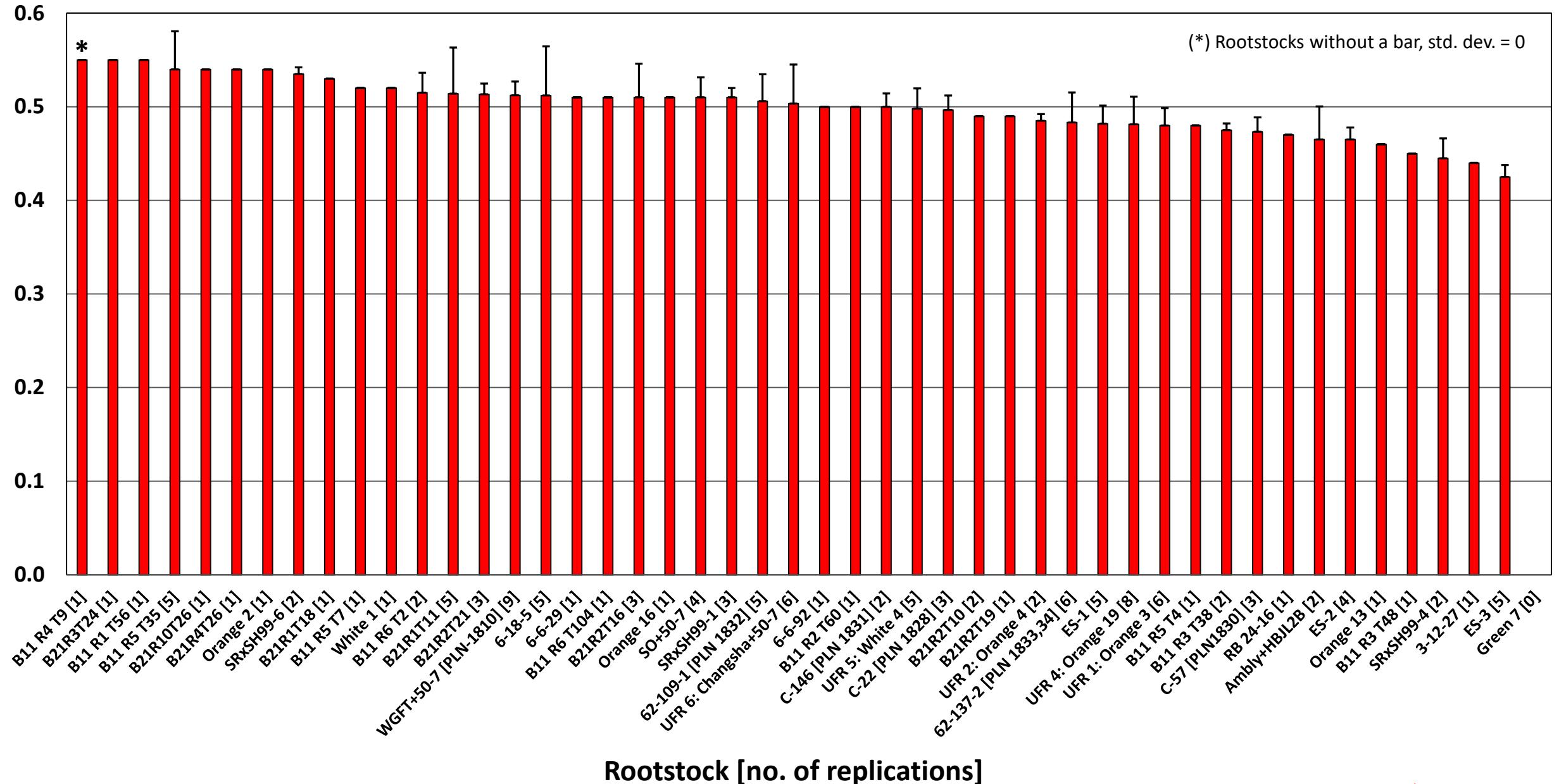


Fig. 7. Vernia rootstock trial – juice Brix: mean + std. dev. [March 2015].

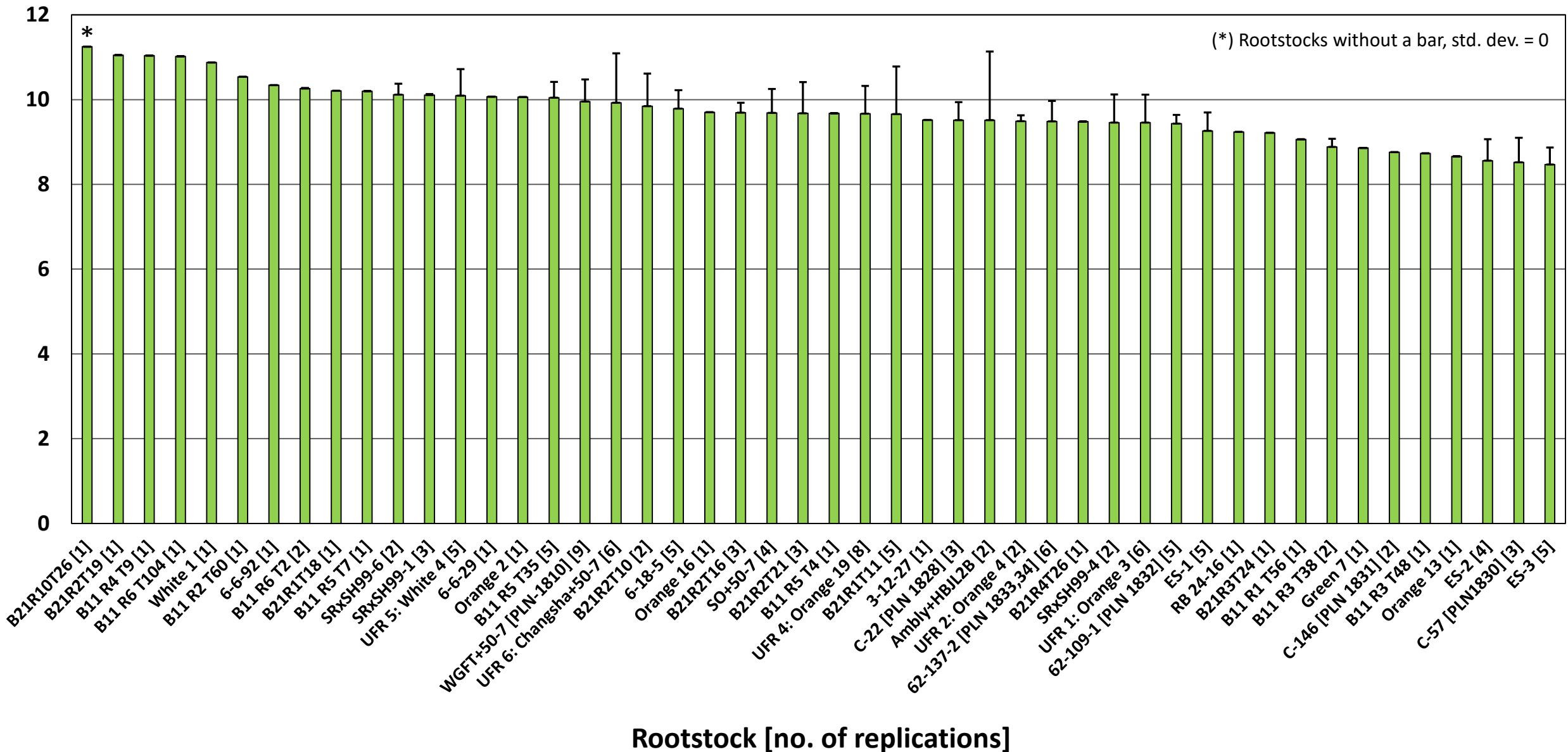


Fig. 8. Vernia rootstock trial – juice Ratio: mean + std. dev. [March 2015].

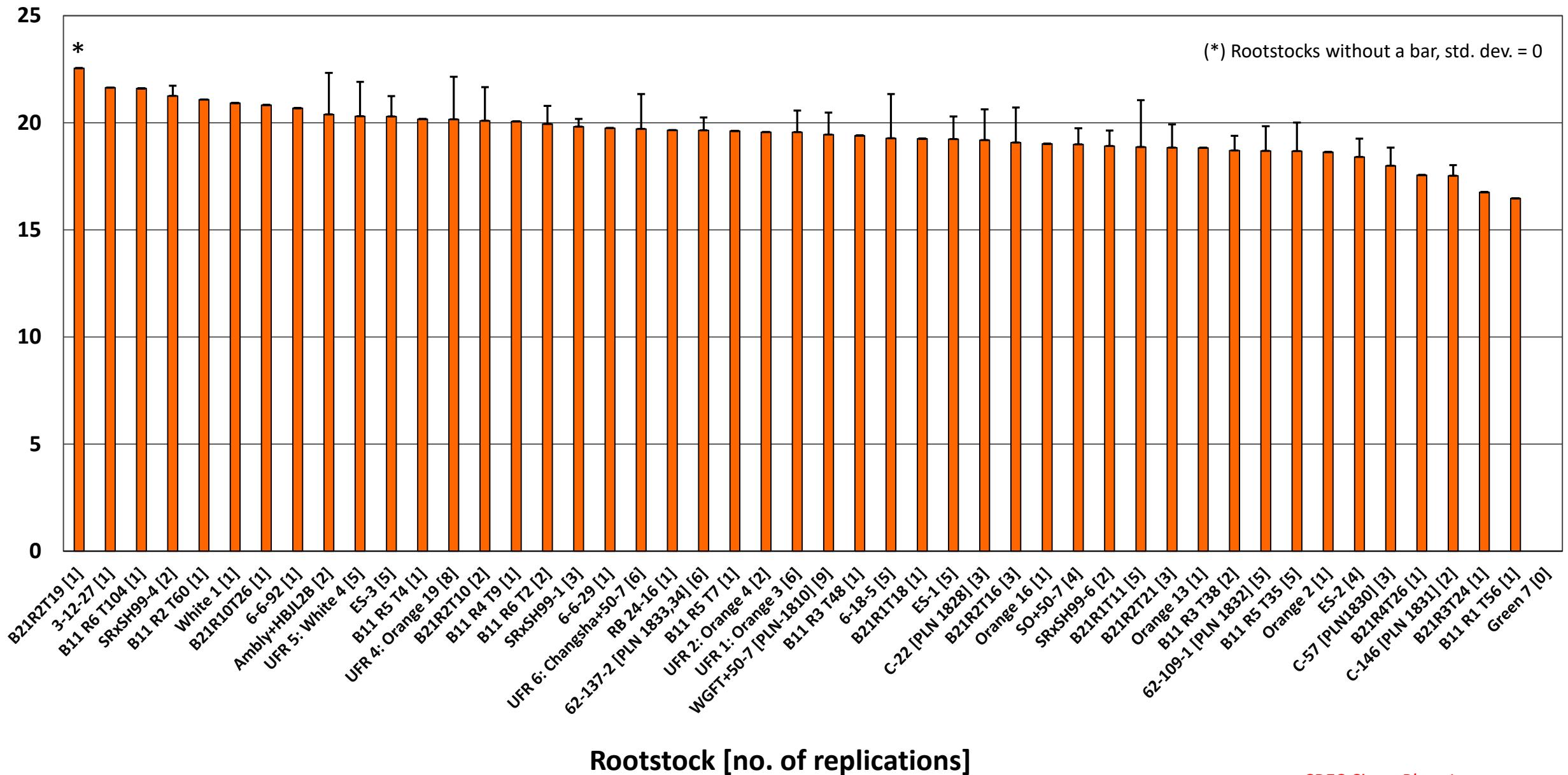


Fig. 9. Vernia rootstock trial – juice Color: mean + std. dev. [March 2015].

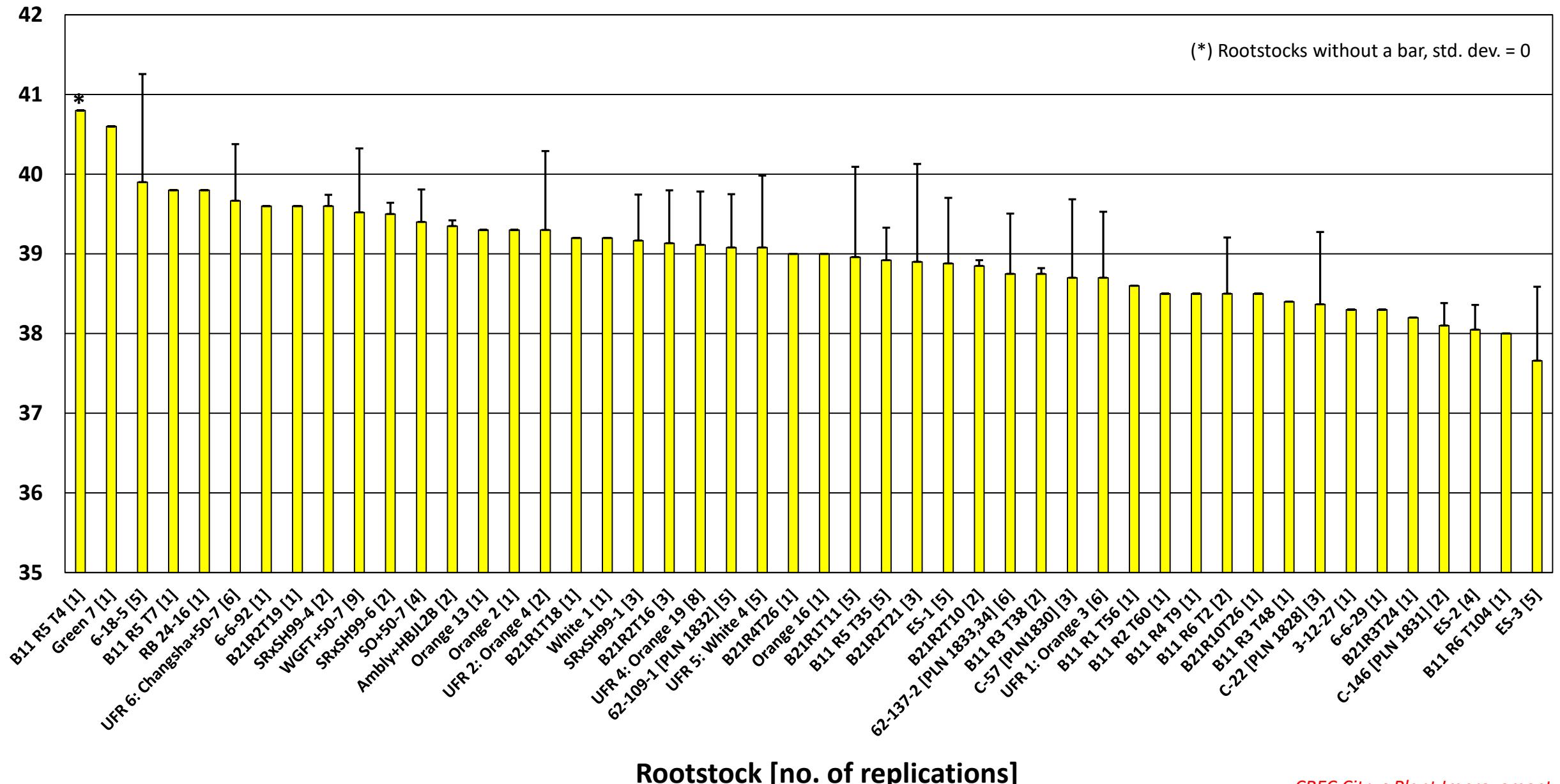
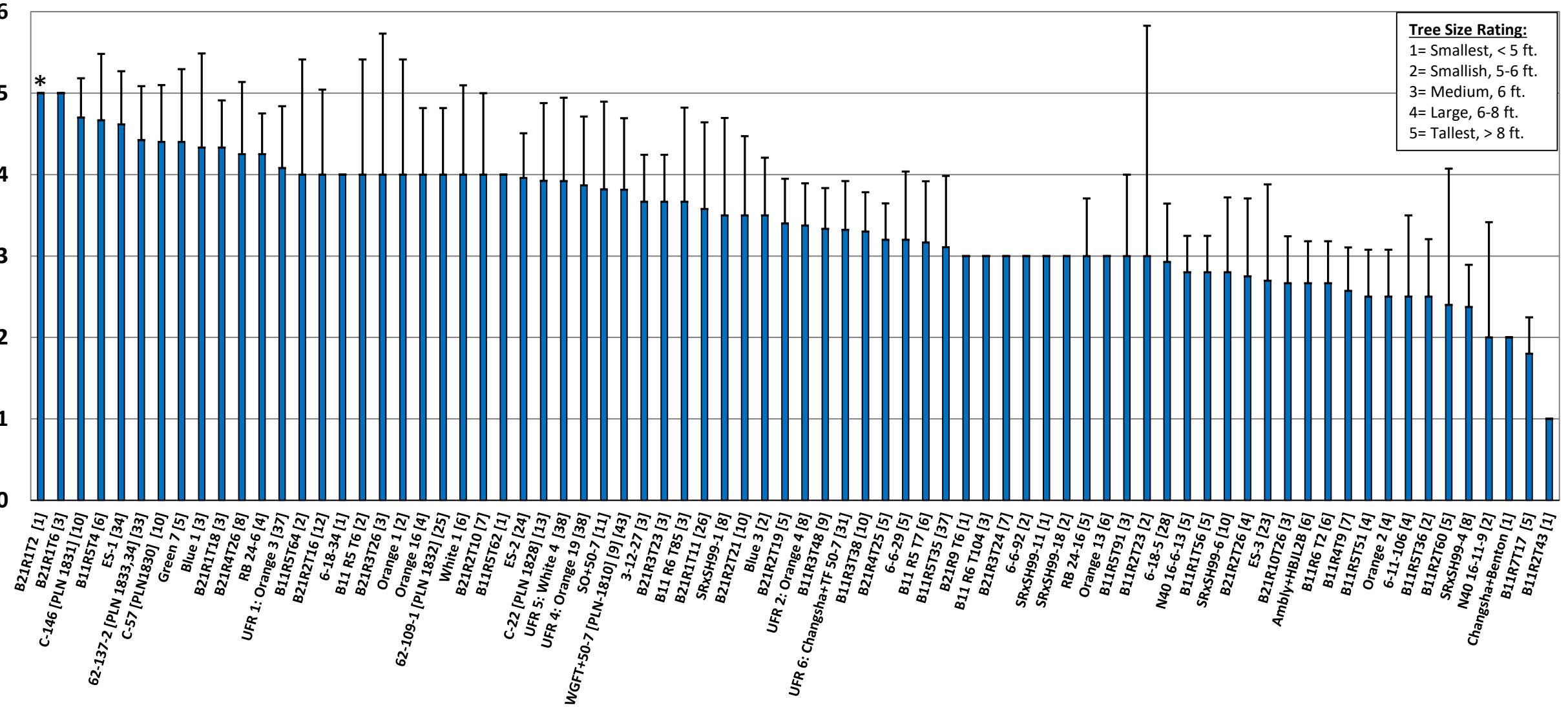


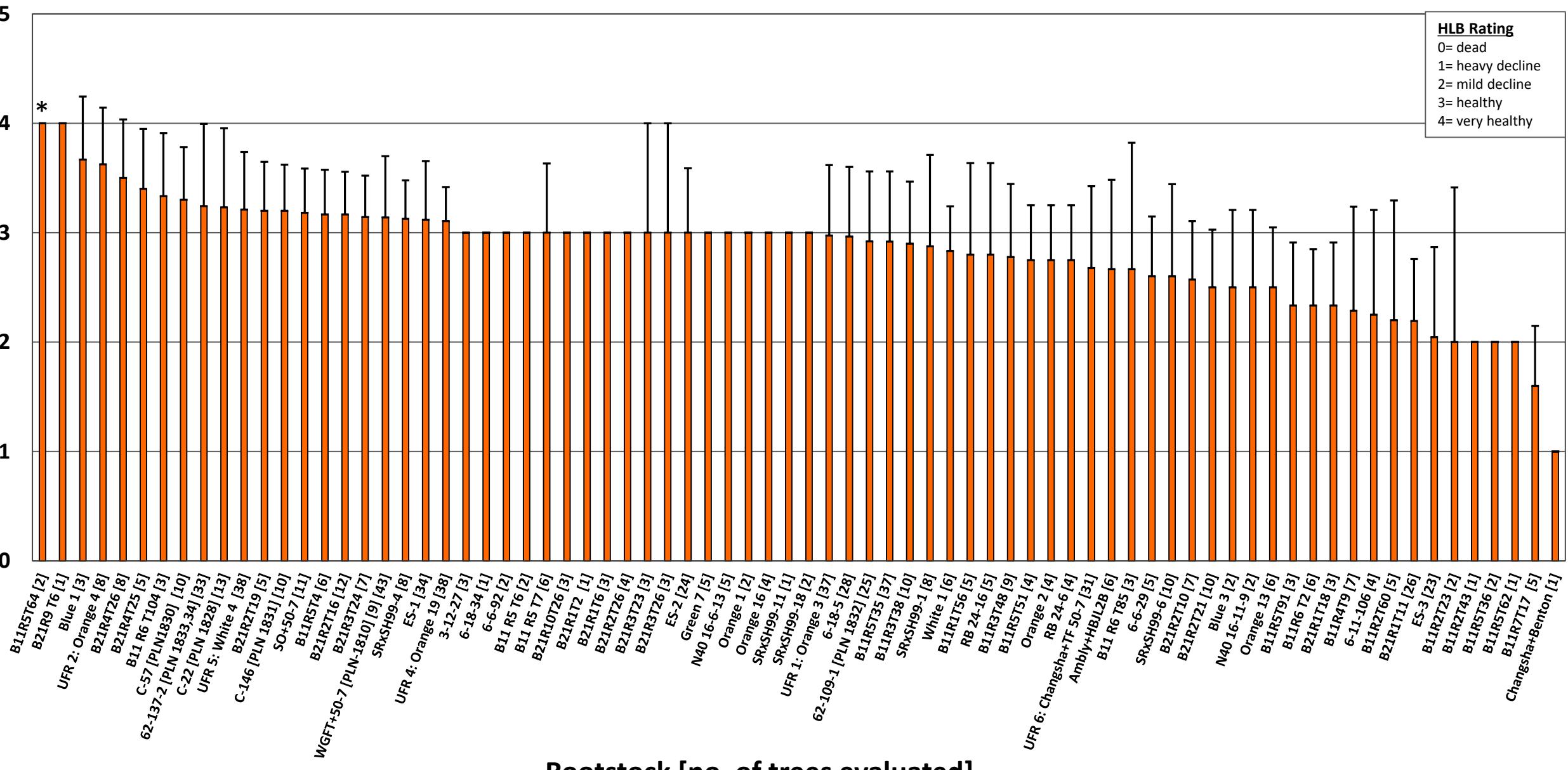
Fig. 10. Vernia rootstock trial – Tree size rating: mean + std. dev. [November 2017].



(\*) Rootstocks without a bar, std. dev. = 0

Rootstock [no. of trees evaluated]

Fig. 11. Vernia rootstock trial – HLB rating: mean + std. dev. [November 2017].



(\*) Rootstocks without a bar, std. dev. = 0

**Fig. 12. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, January 2018]** [Note that Hurricane Irma struck in September 2017 affecting yield and tree condition].

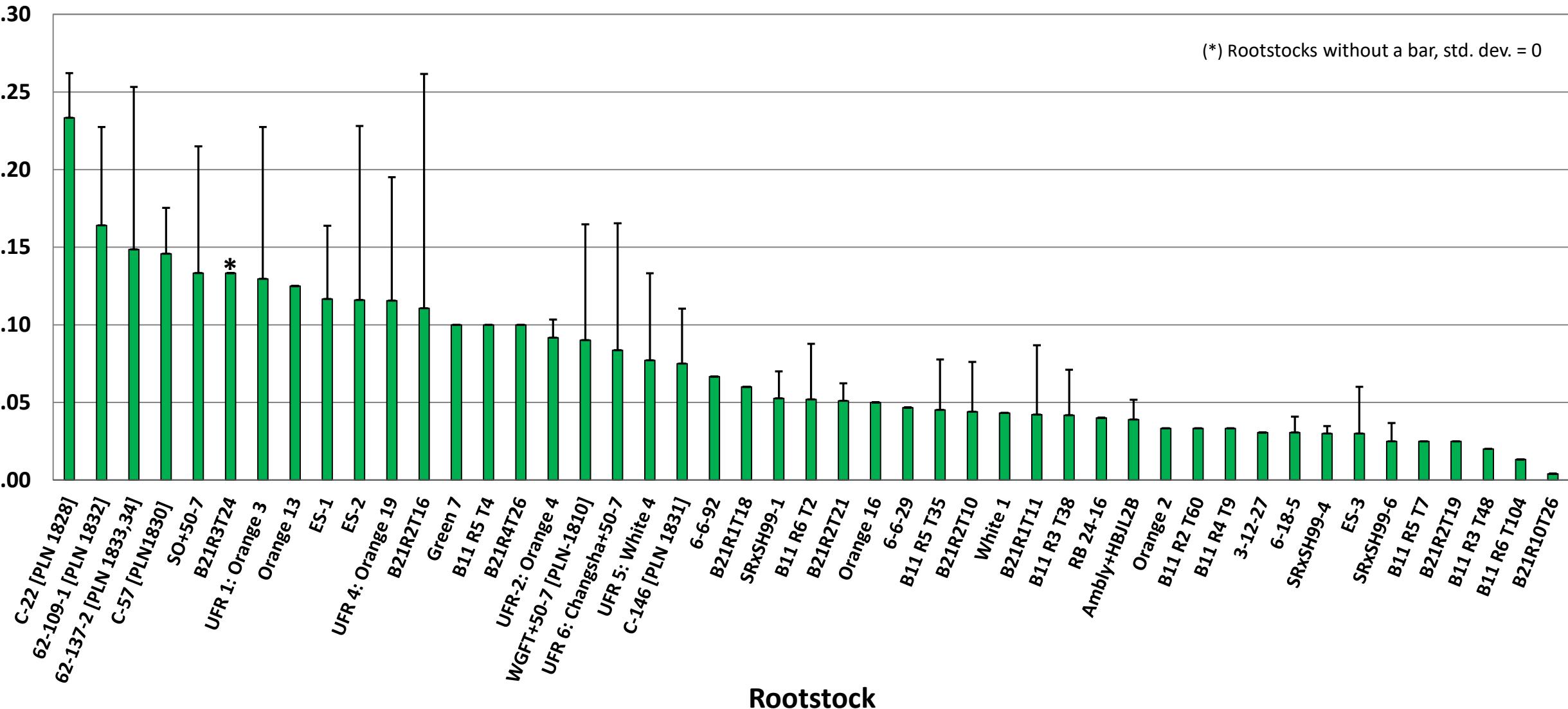


Fig. 13. Vernia rootstock trial – HLB rating: mean + std. dev. [October 2018].

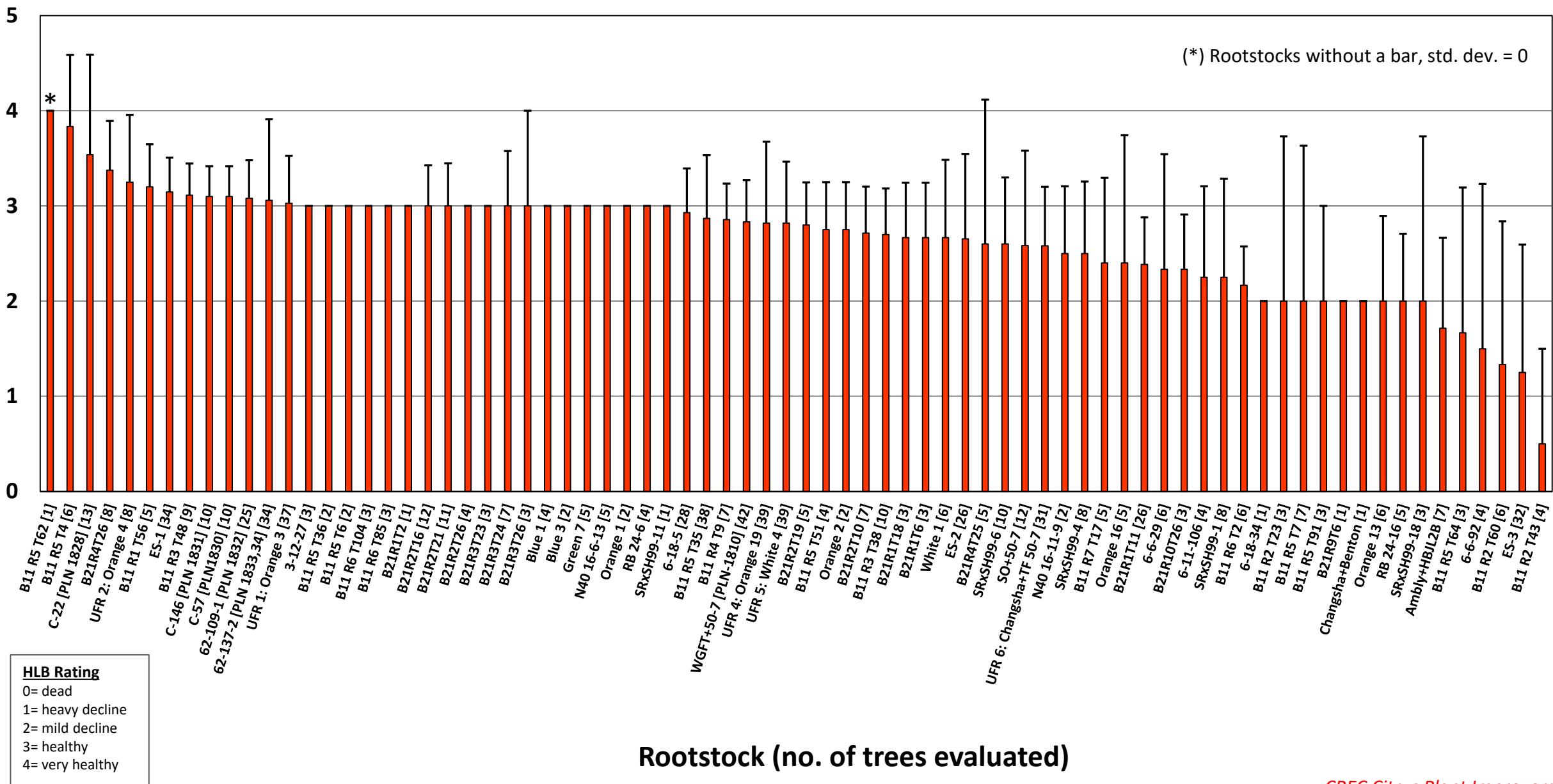


Fig. 14. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, February 2019].

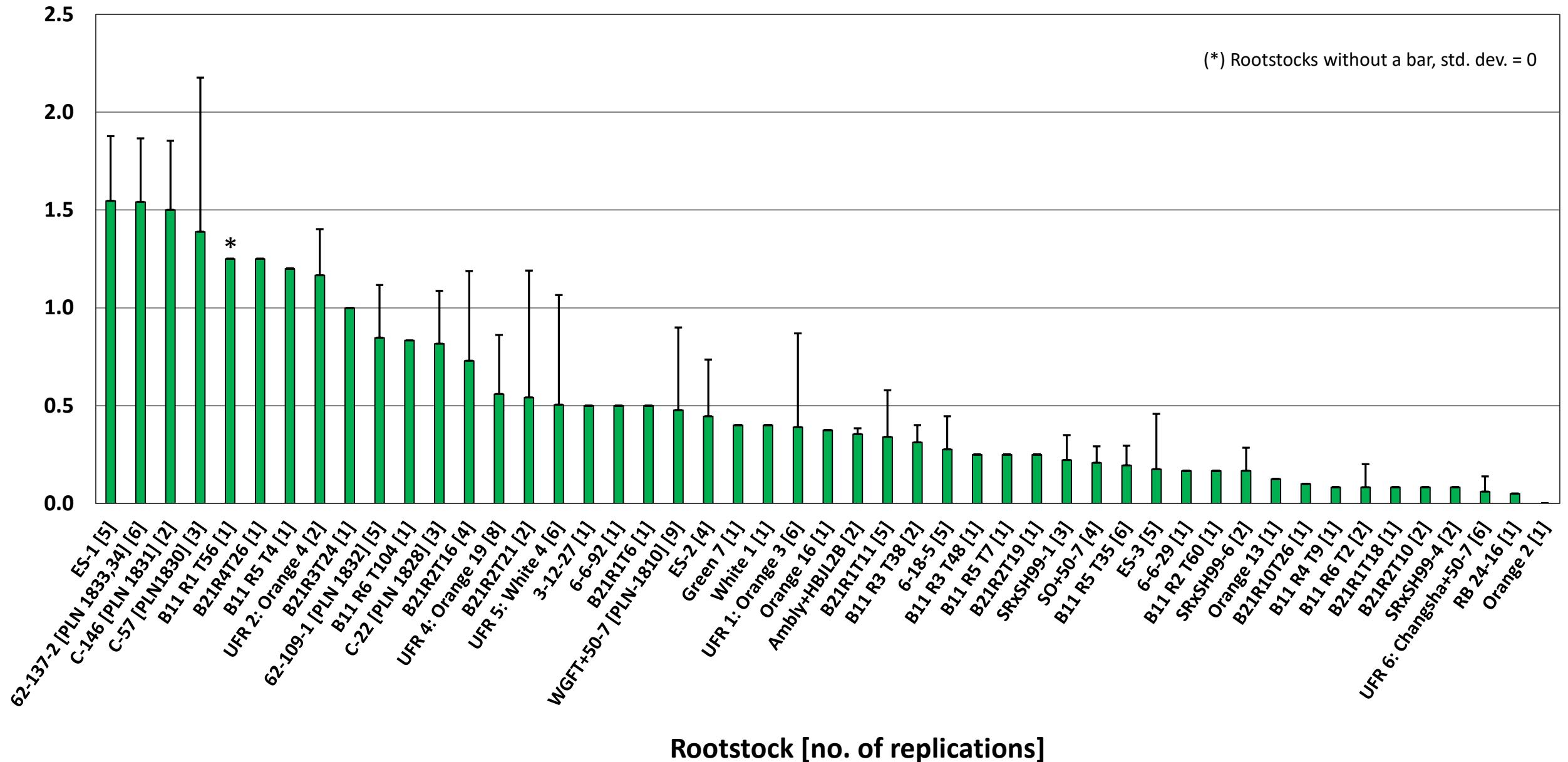


Fig. 15. Vernia rootstock trial – PS/acre [calculated @ 264 trees/acre, 7.5 x 22 ft.], 2018/19.

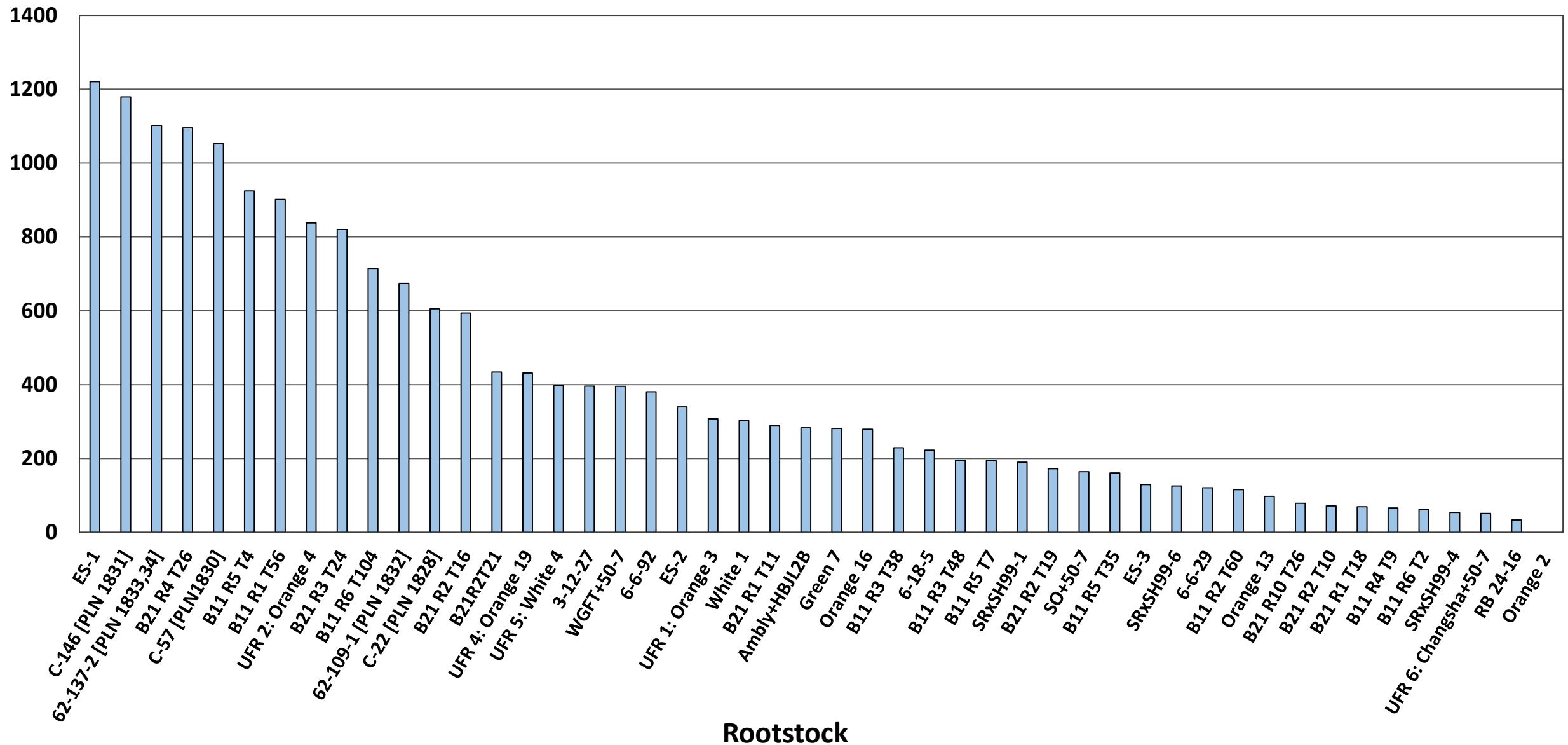


Fig.16. Vernia rootstock trial – juice quality, sorted by PS/box [February 2019].

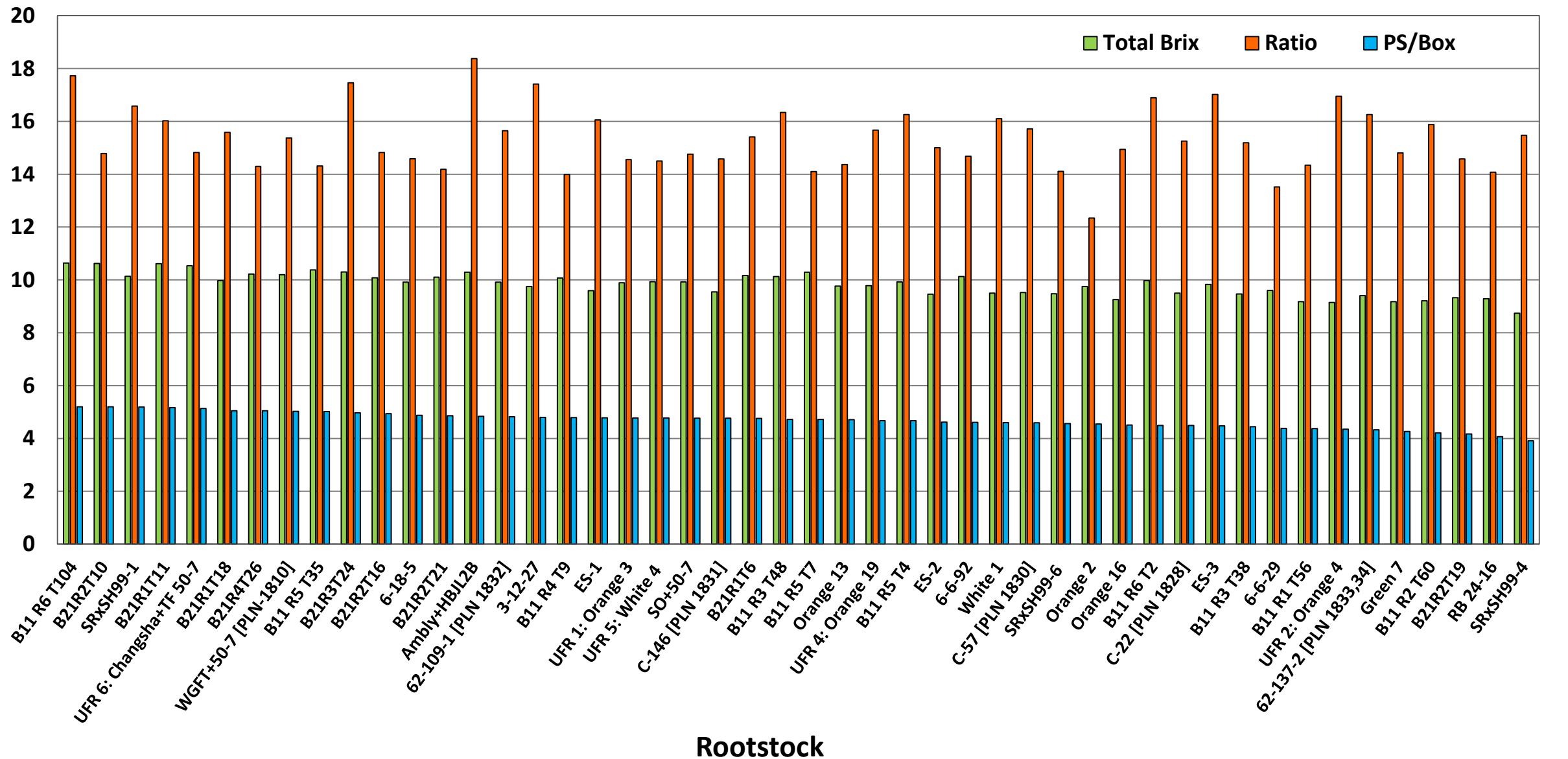


Fig. 17. Vernia rootstock trial – juice Acid: mean + std. dev. [February 2019].

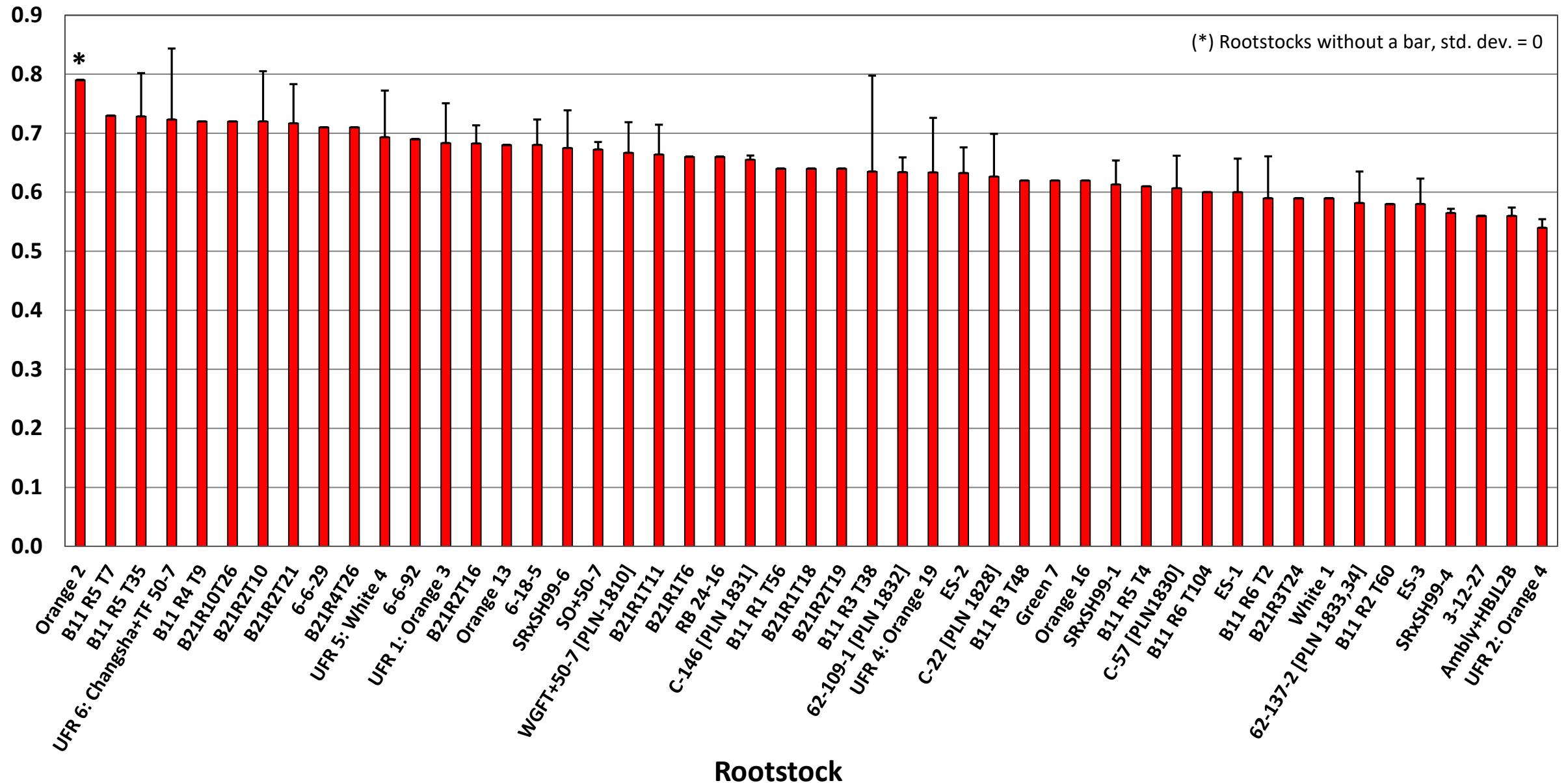


Fig. 18. Vernia rootstock trial – juice Brix: mean + std. dev. [February 2019].

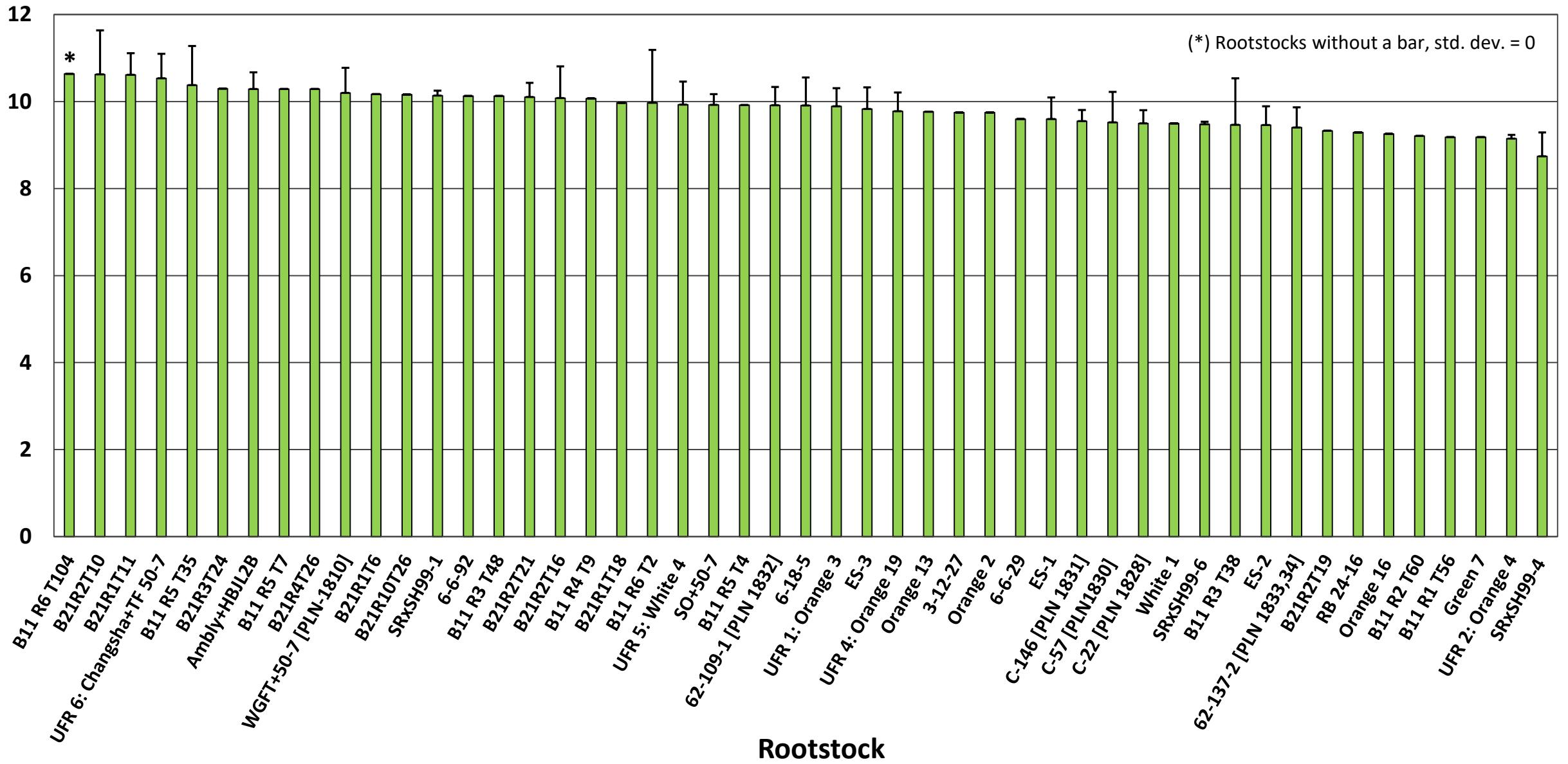


Fig. 19. Vernia rootstock trial – juice Ratio: mean + std. dev. [February 2019].

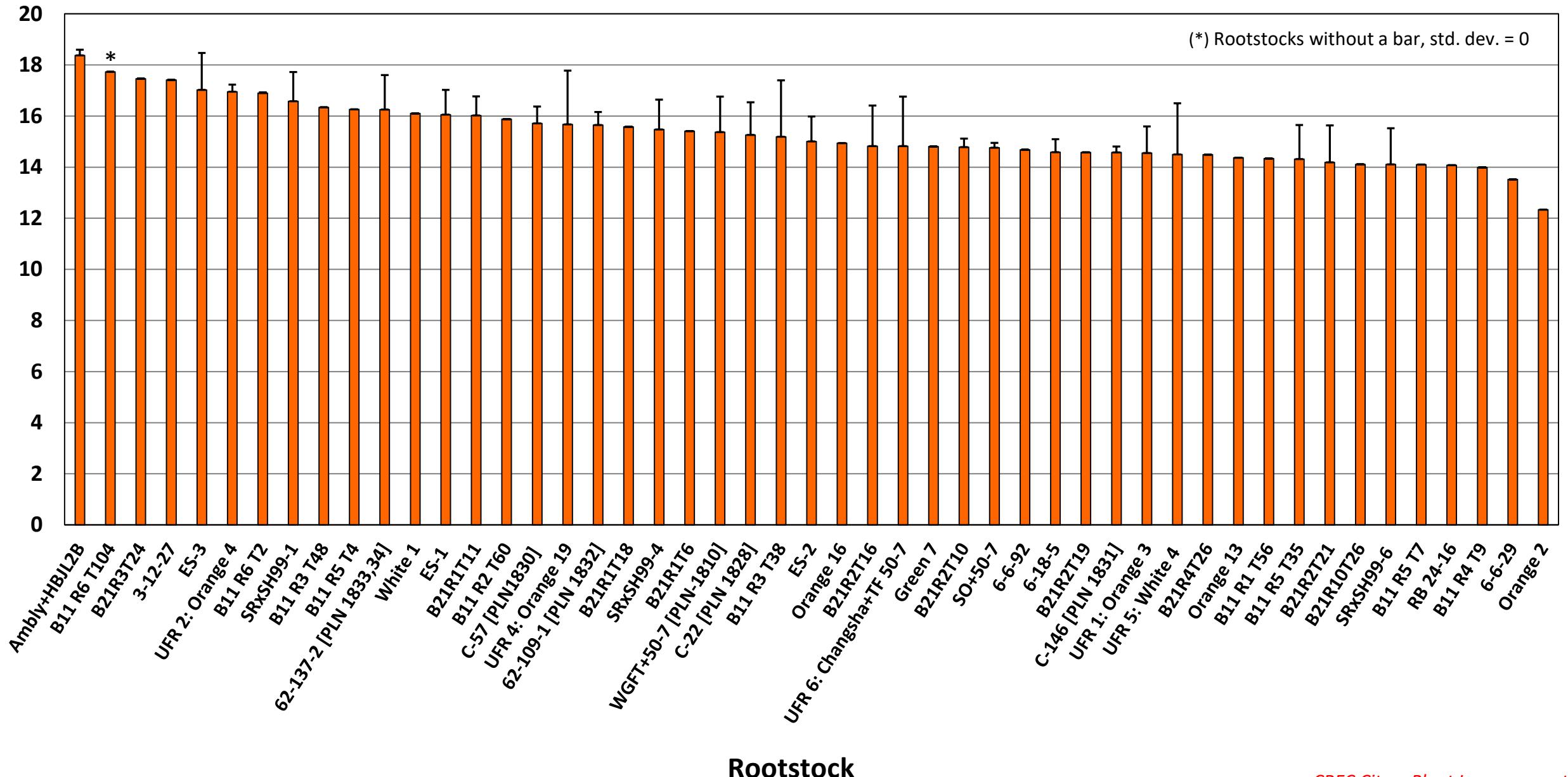


Fig. 20. Vernia rootstock trial – juice Color: mean + std. dev. [February 2019].

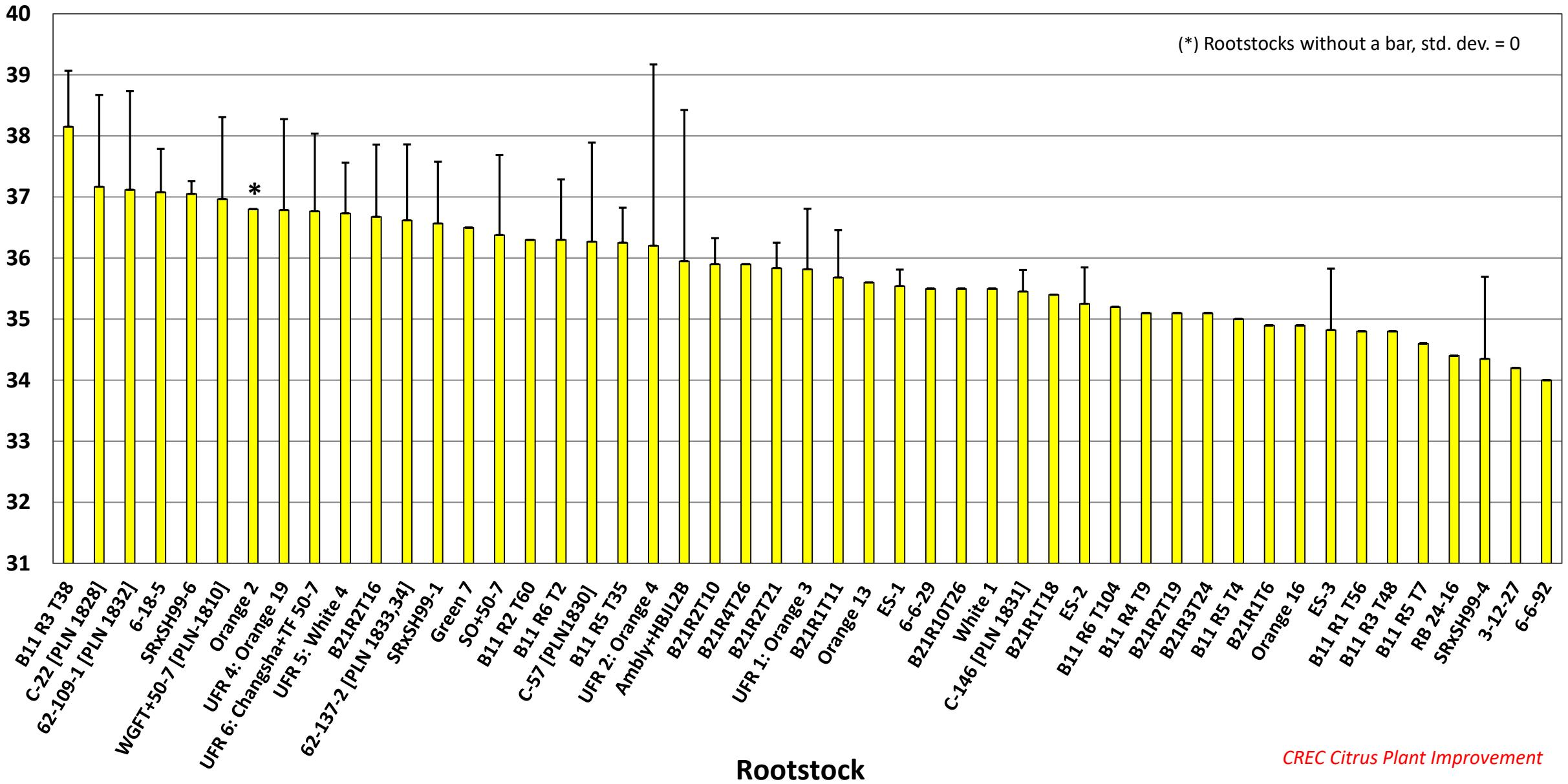


Fig. 21. Vernia rootstock trial – PS/box: mean + std. dev. [February 2019].

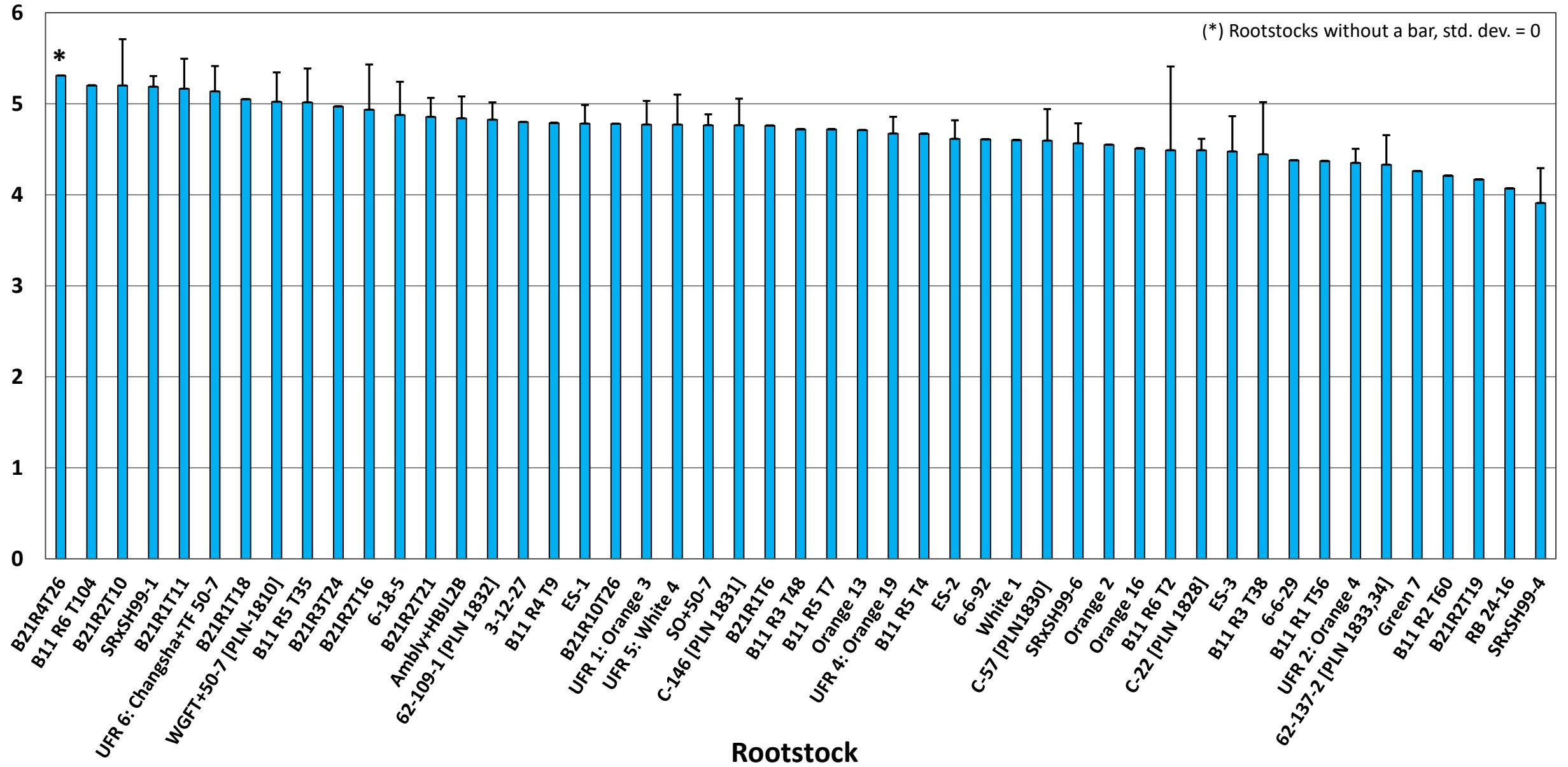


Fig. 22. Vernia rootstock trial – Yield [boxes/tree], PS/box and HLB rating; sorted by PS/box [February 2019].

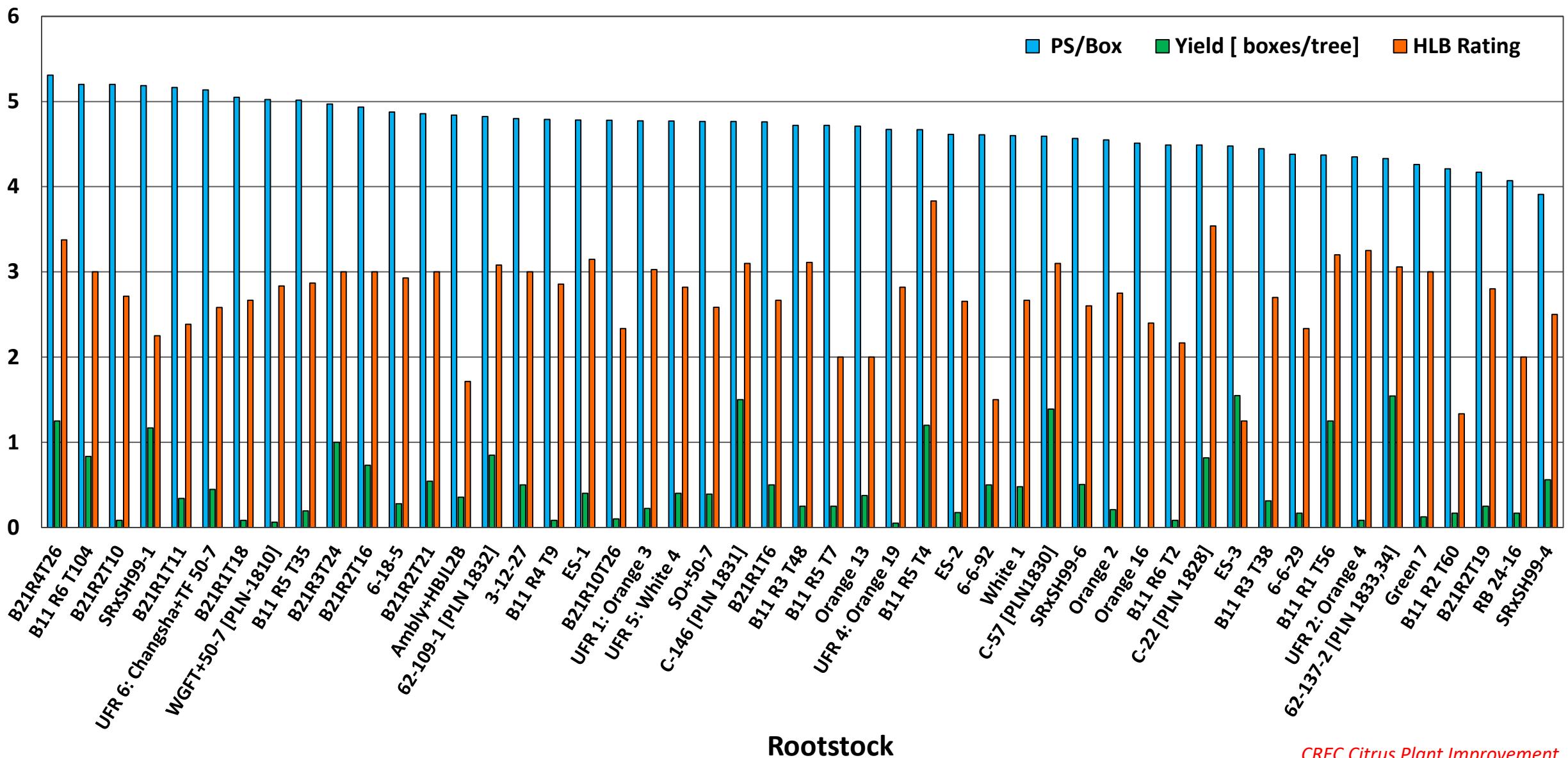
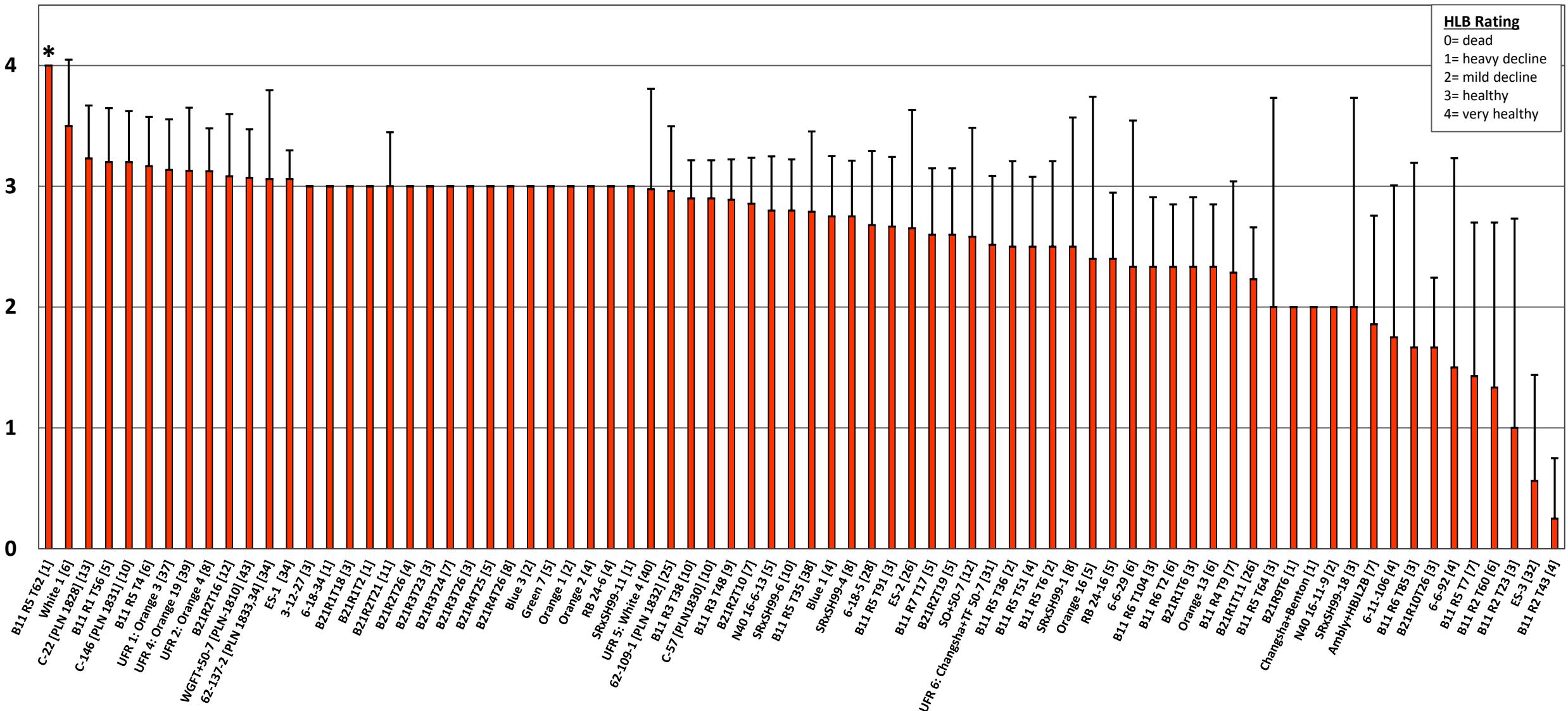


Fig. 23. Vernia rootstock trial – HLB rating: mean + std. dev. [October 2019].

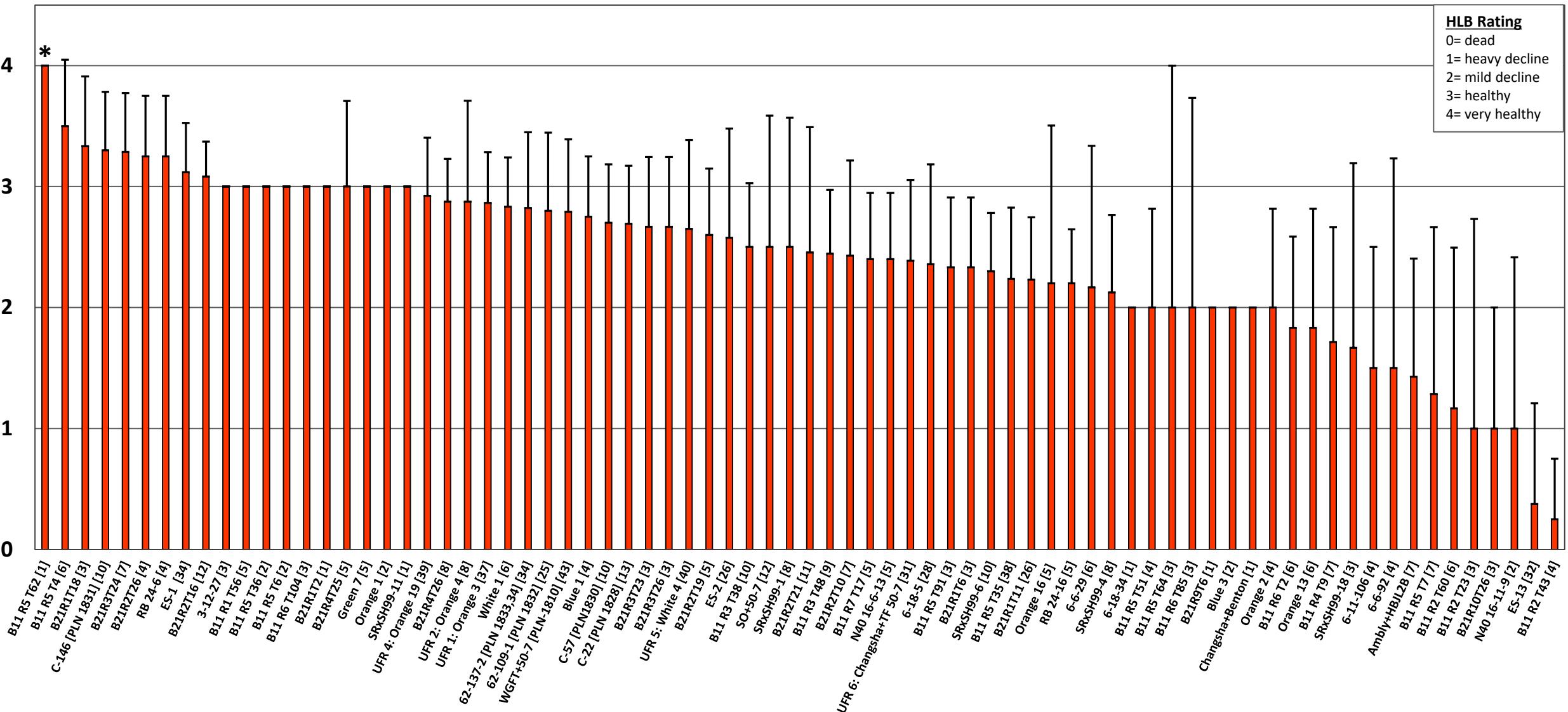


(\*) Rootstocks without a bar, std. dev. = 0

Rootstock [no. of trees evaluated]

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Fig. 24. Vernia rootstock trial – HLB rating: mean + std. dev. [October 2020].



(\*) Rootstocks without a bar, std. dev. = 0

Rootstock [no. of trees evaluated]

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Fig. 25. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, February 2020].

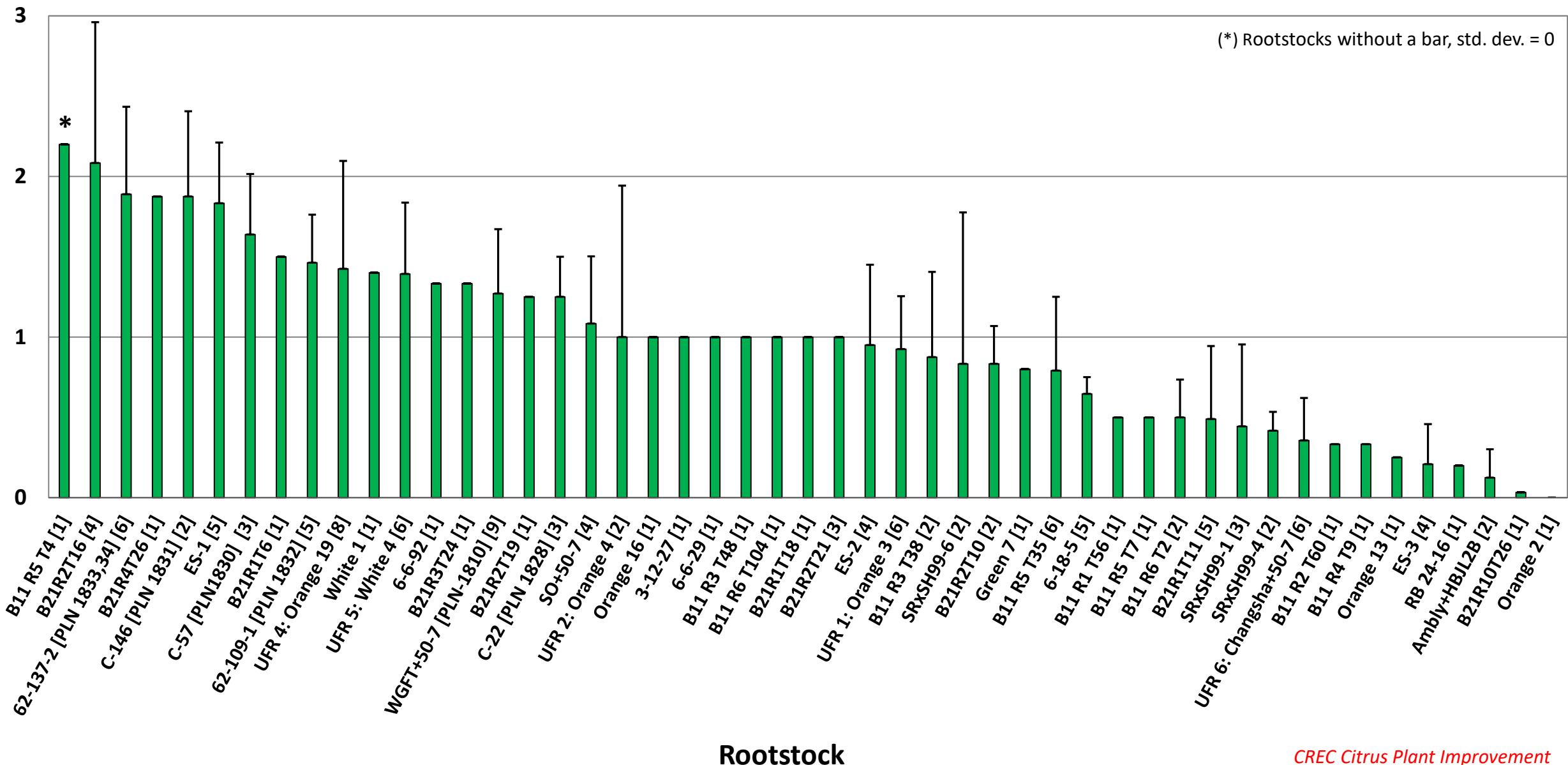


Fig. 26. Vernia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2021].

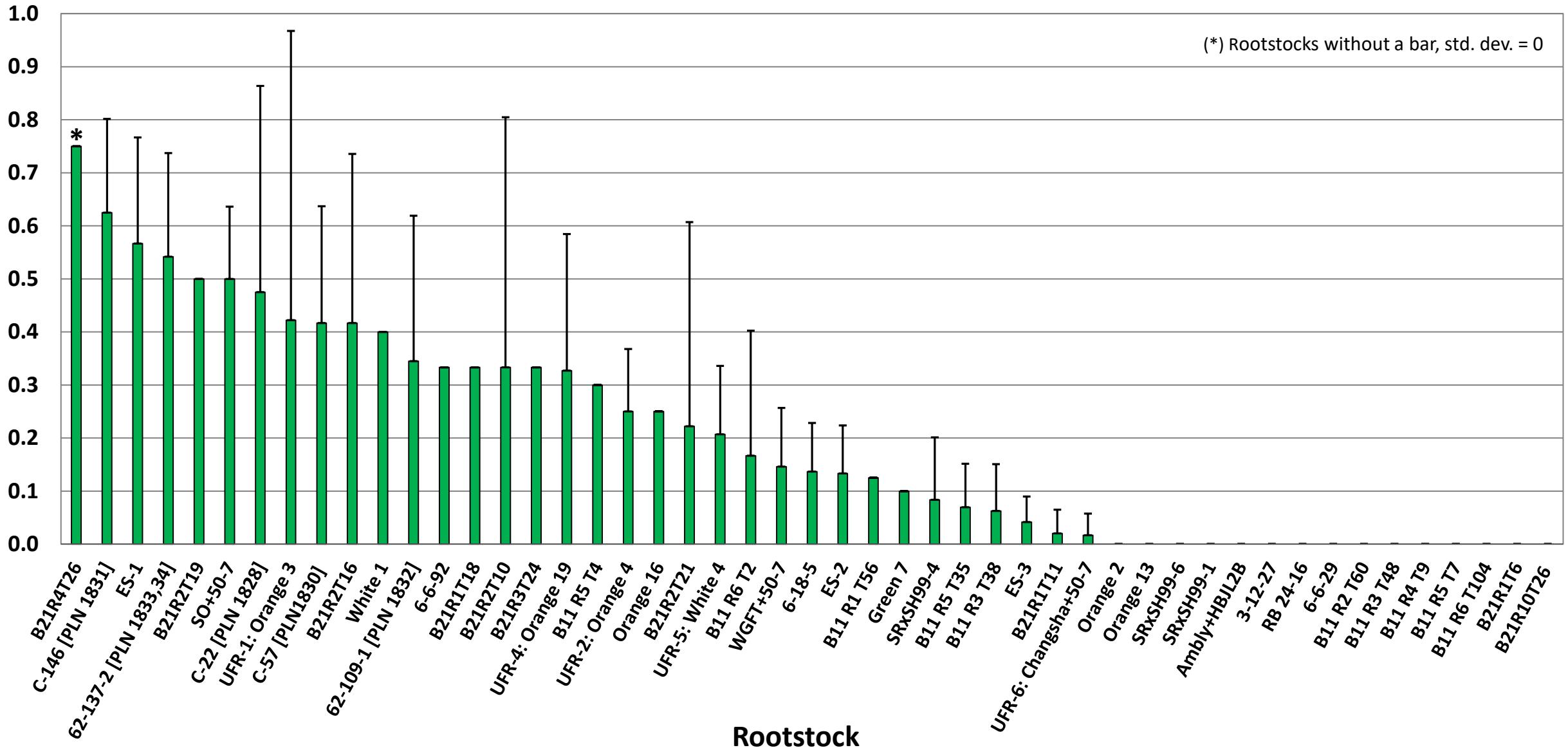
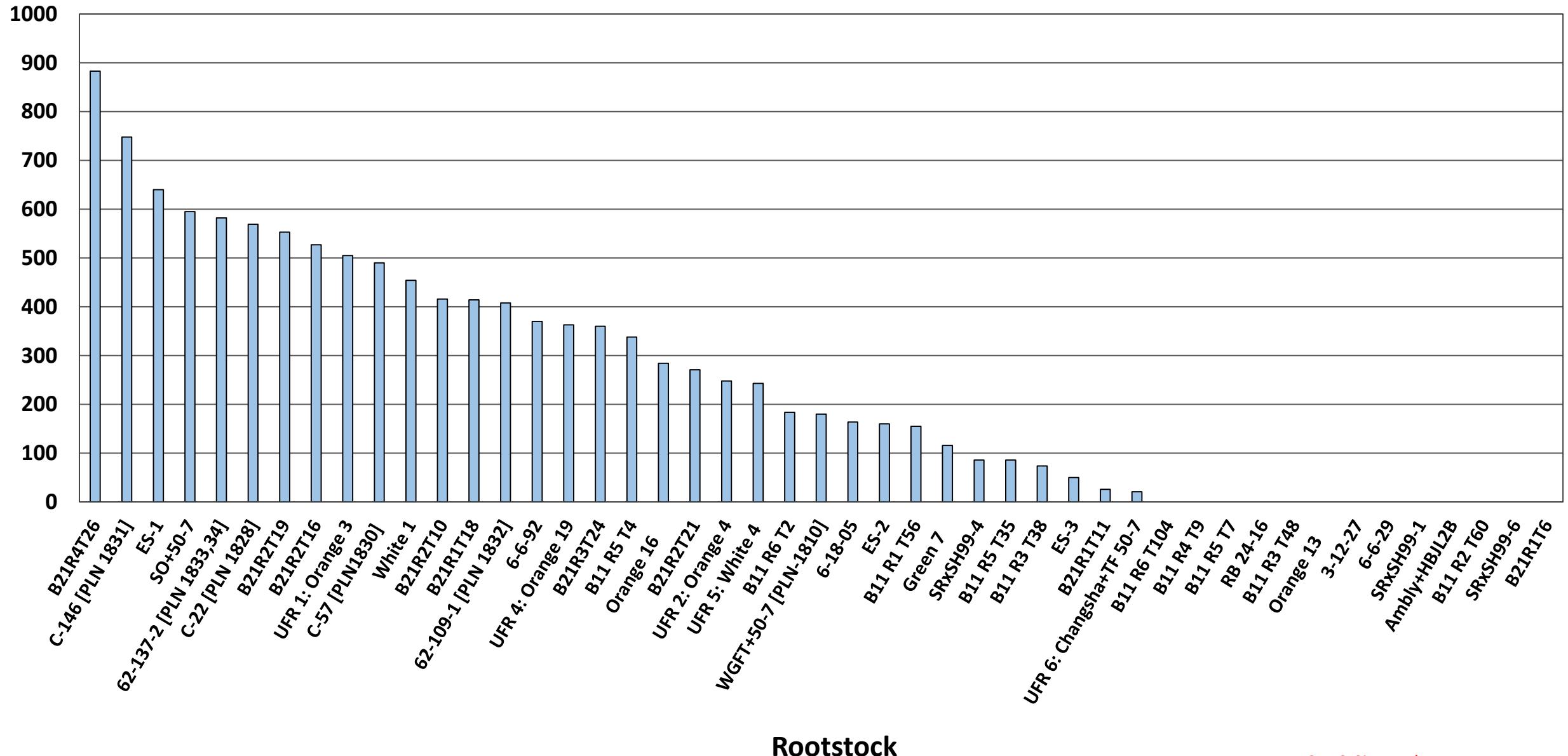


Fig. 27. Vernia rootstock trial – PS/acre [calculated @ 264 trees/acre, 7.5 x 22 ft.], 2020/21.



Rootstock

Fig. 28. Vernia rootstock trial – juice Acid: mean + std. dev. [January 2021].

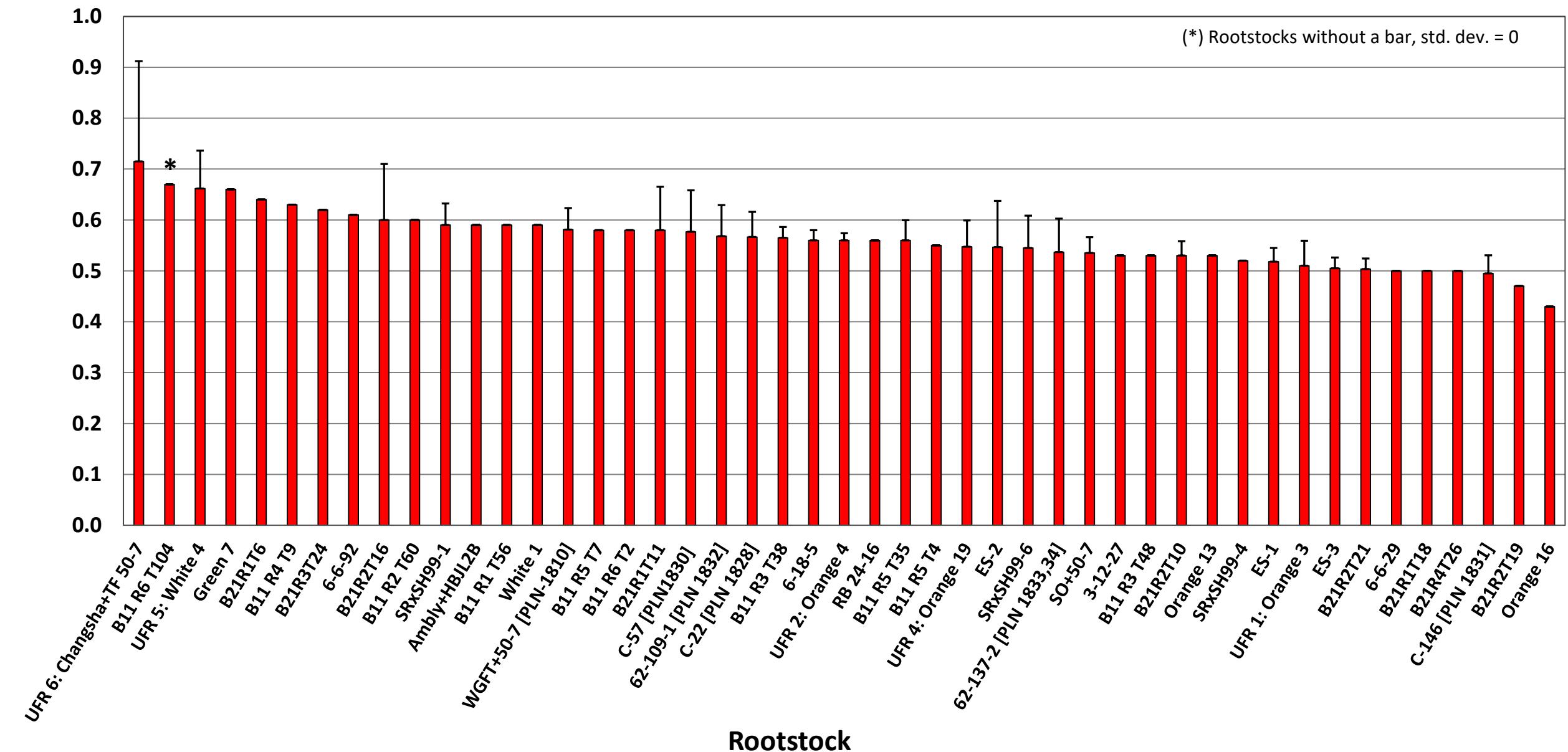


Fig. 29. Vernia rootstock trial – juice Brix: mean + std. dev. [January 2021].

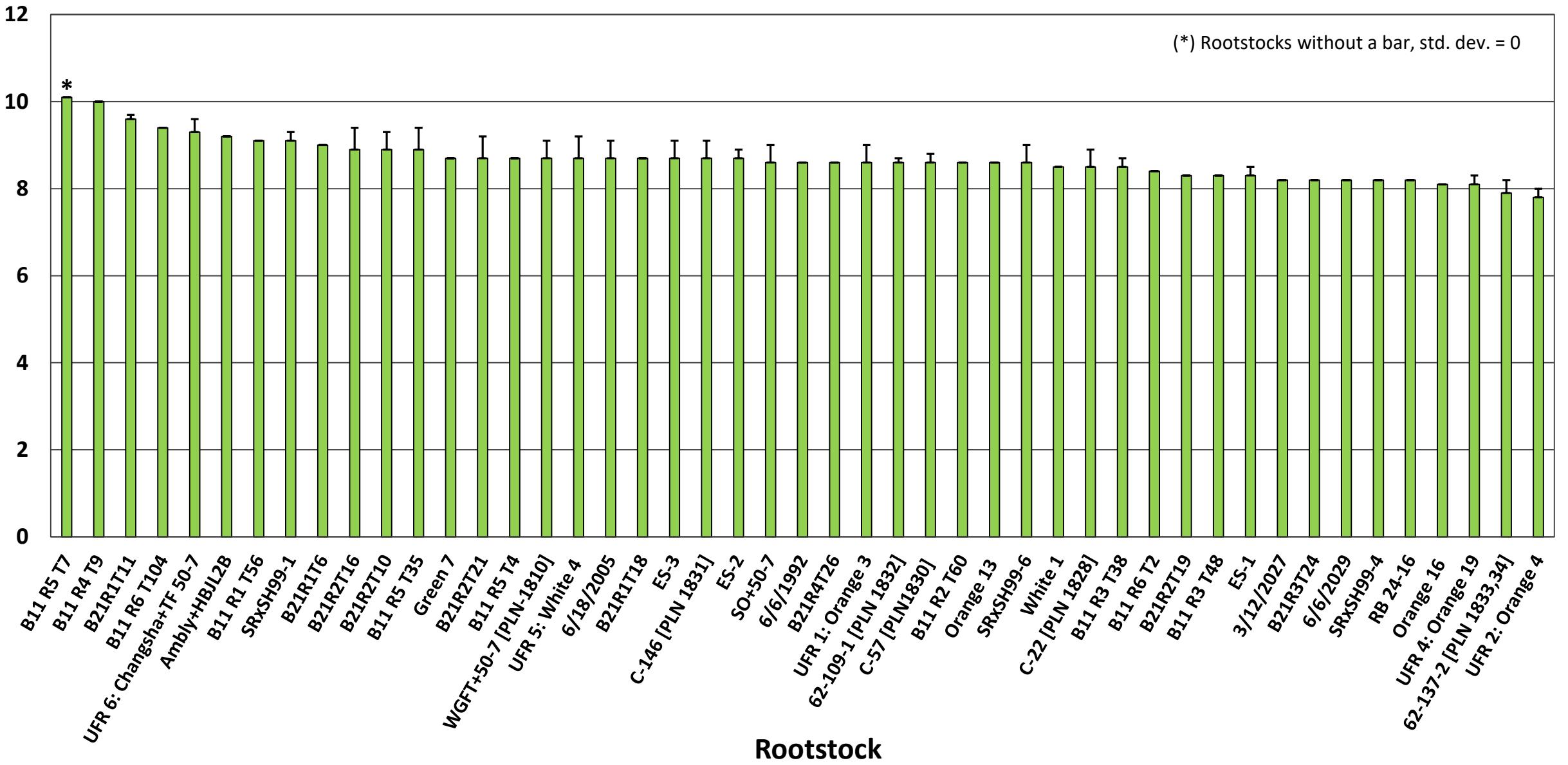


Fig. 30. Vernia rootstock trial – juice Ratio: mean + std. dev. [January 2021].

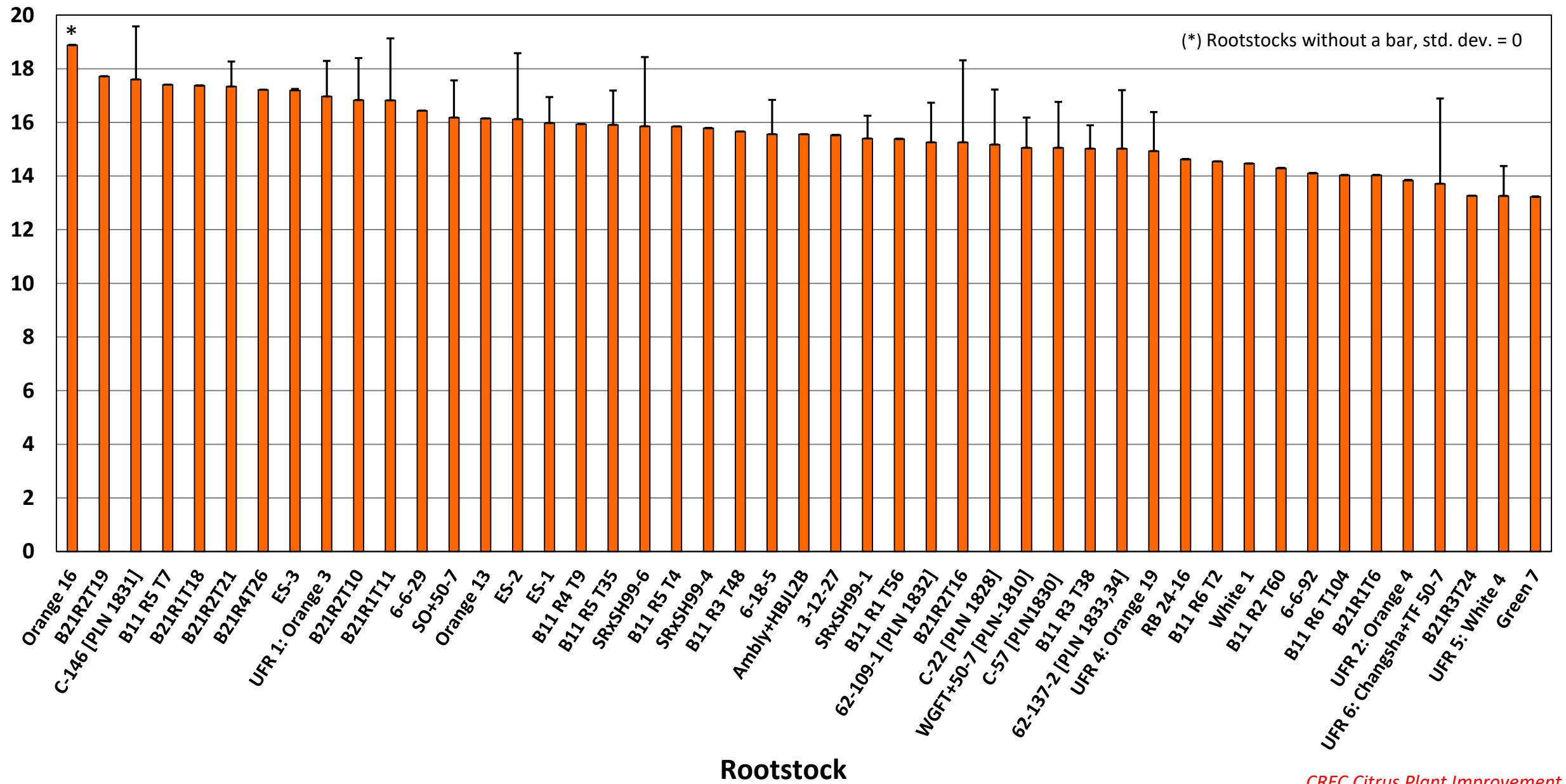


Fig. 31. Vernia rootstock trial – PS/box: mean + std. dev. [January 2021].

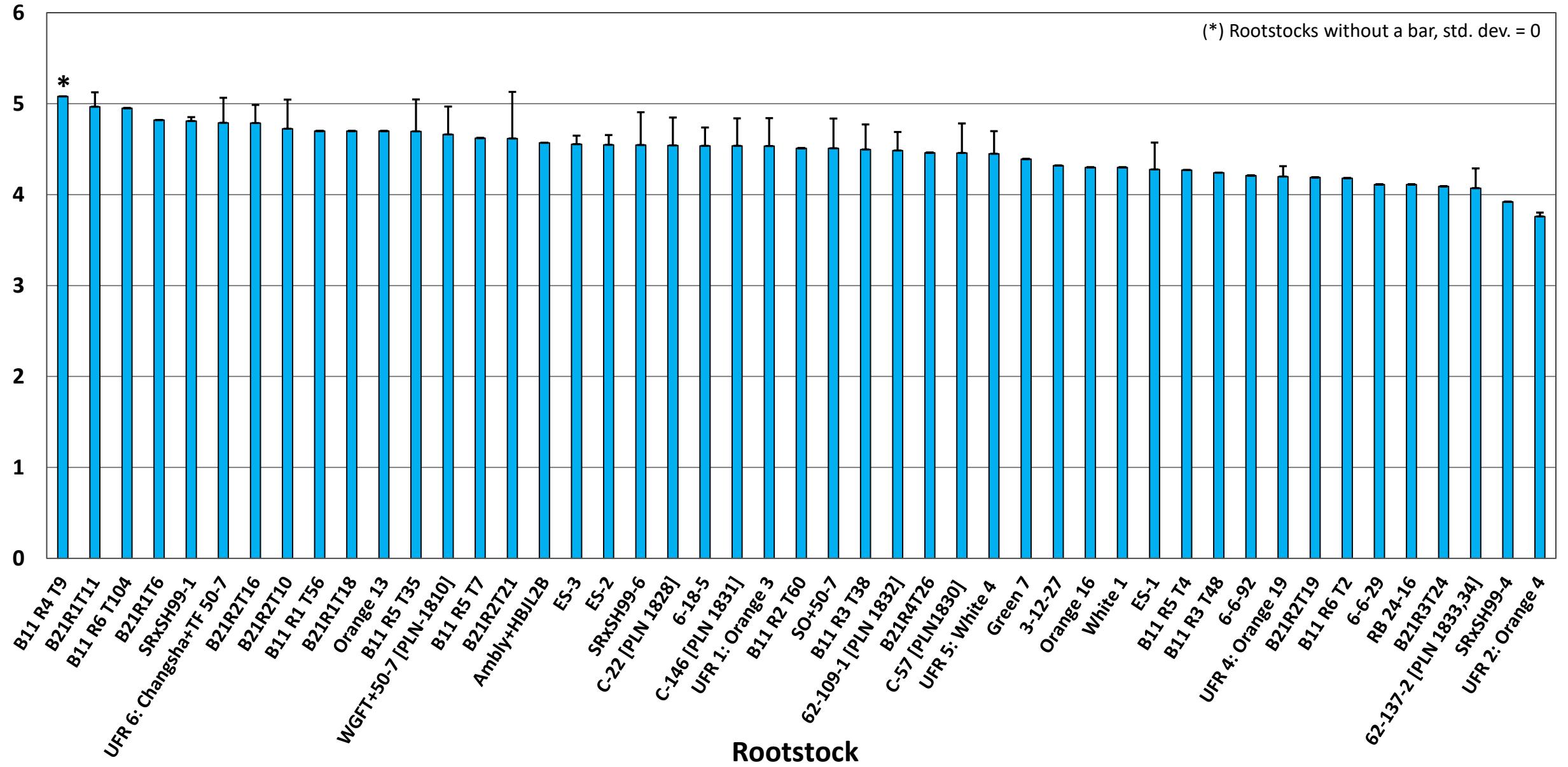


Fig. 32. Vernia rootstock trial – juice Color: mean + std. dev. [January 2021].

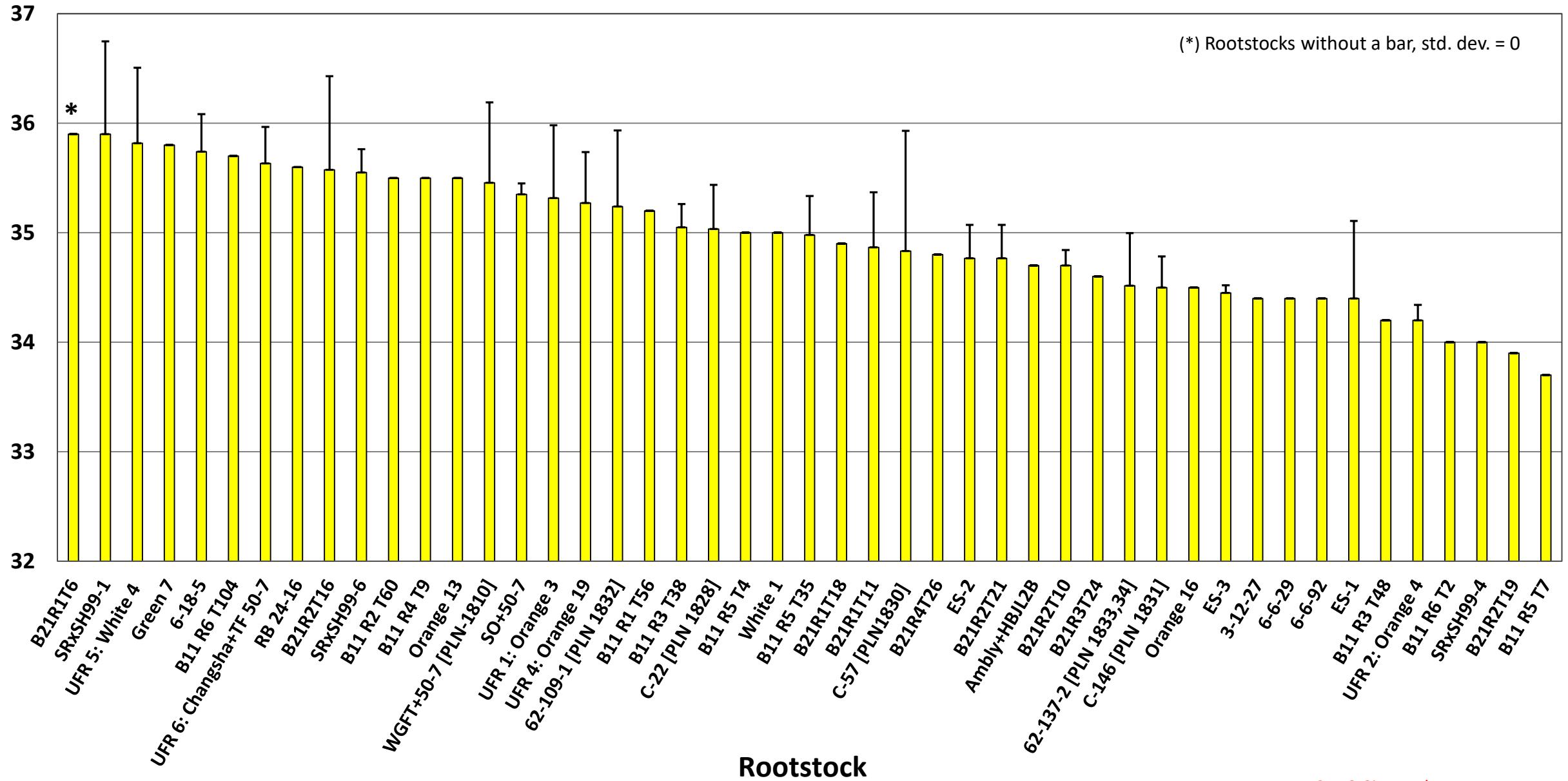


Fig. 33. Vernia rootstock trial – 6-year cumulative yield [boxes/tree, 2013/14, 2014/15, 2017/18, 2018/19, 2019/20 & 2020/21].

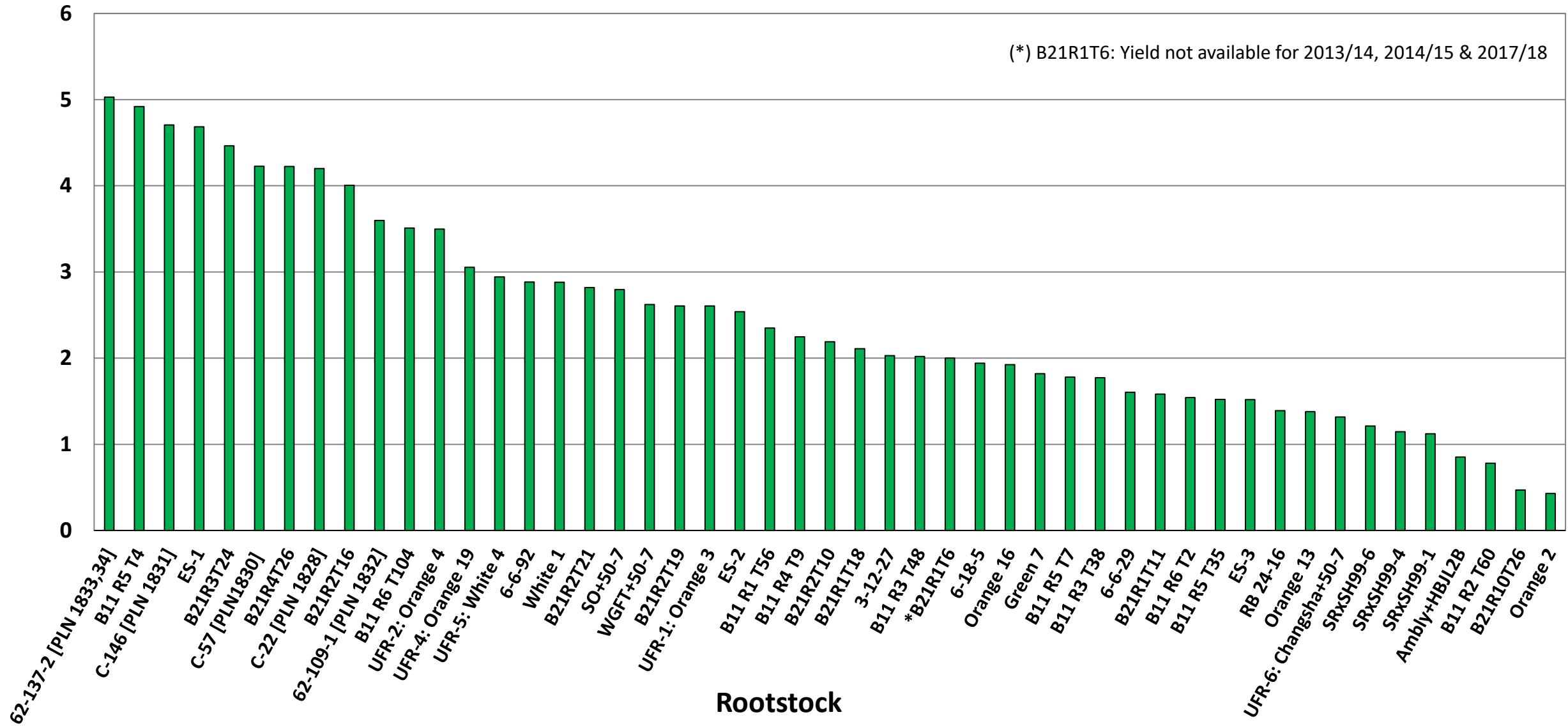


Fig. 34. Vernia rootstock trial – 6-year yield [boxes/tree], 2013/14, 2014/15, 2017/18, 2018/19, 2019/20 & 2020/21.

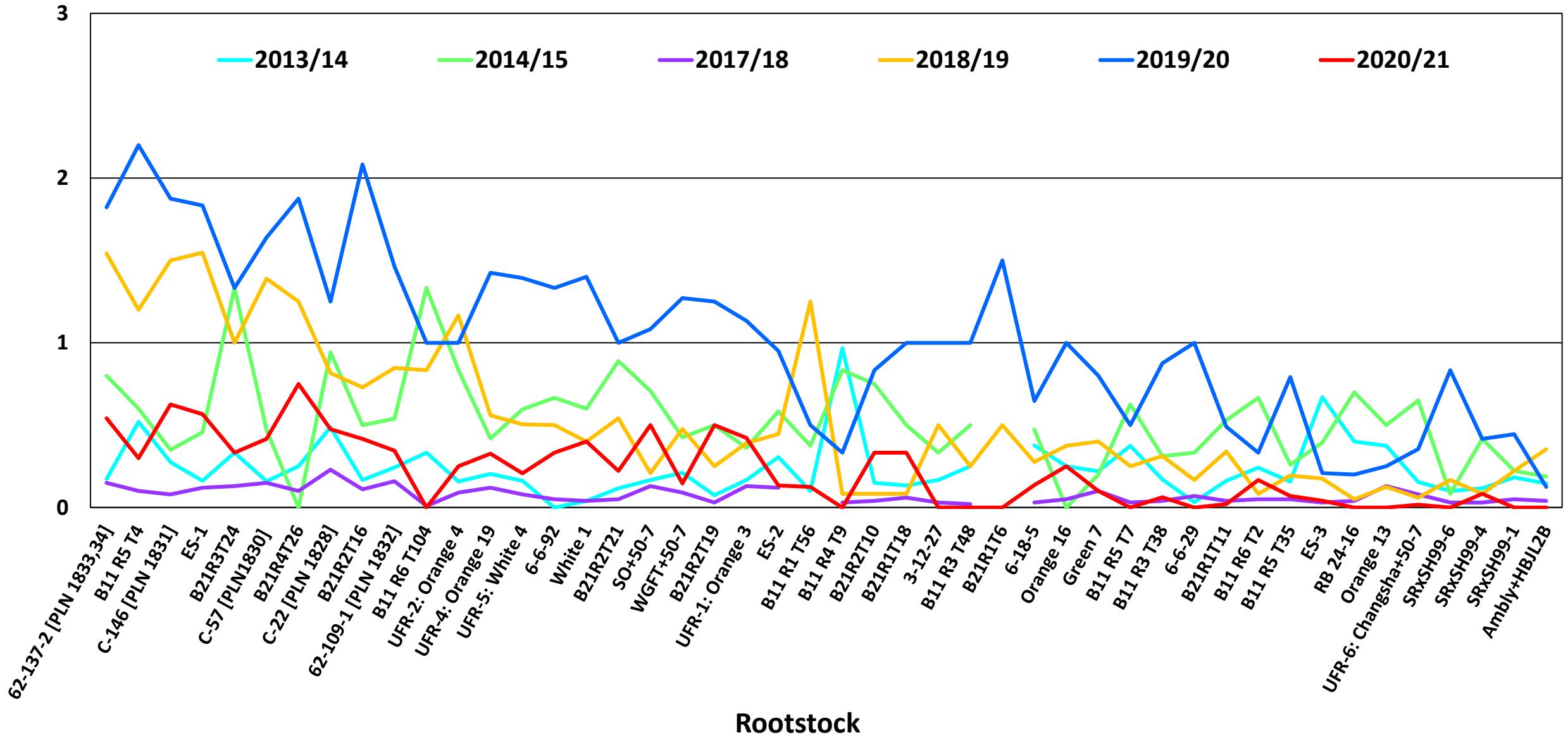


Fig. 35. Vernia rootstock trial – Tree size rating: mean + std. dev. [November 2017].

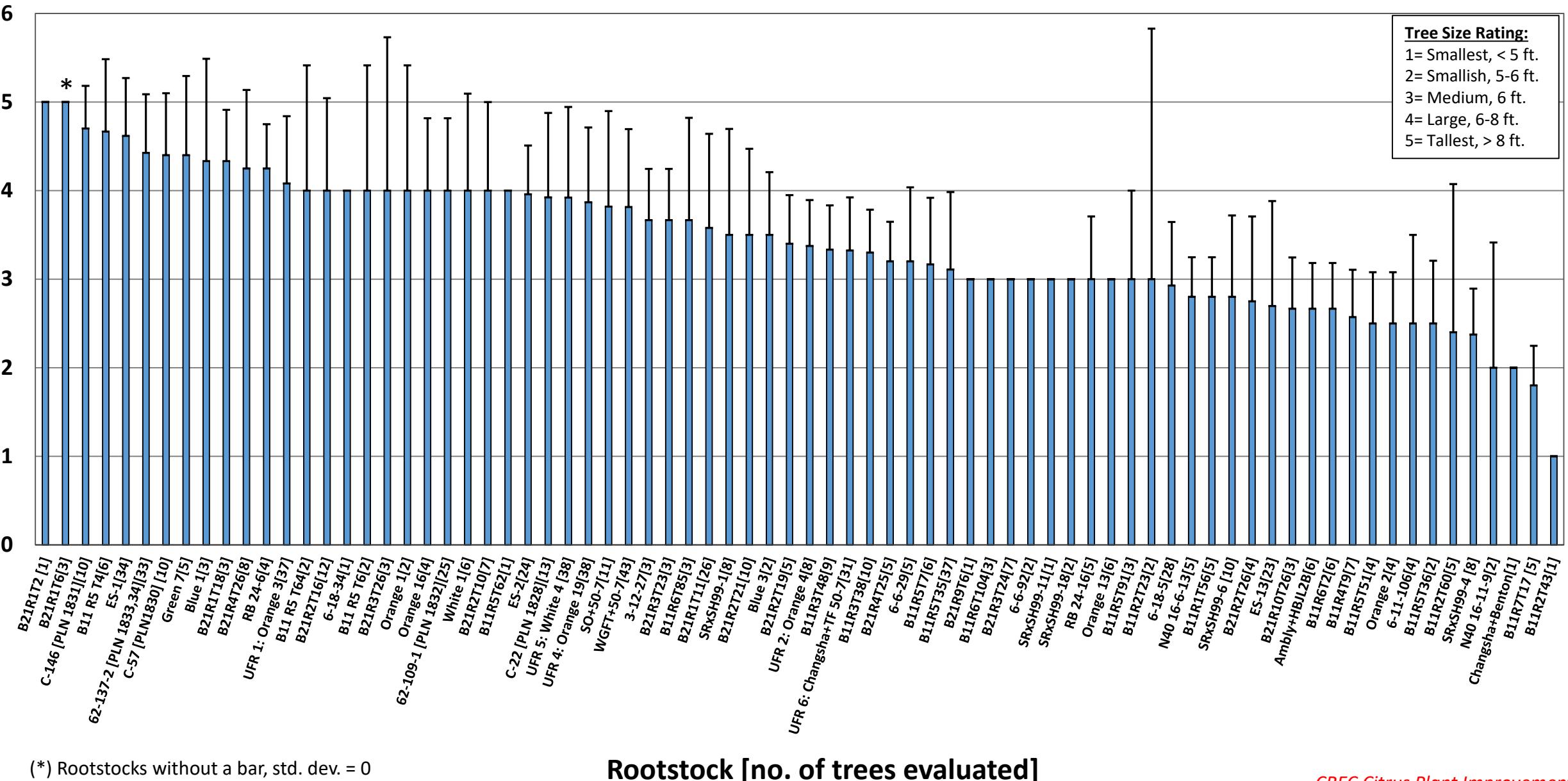
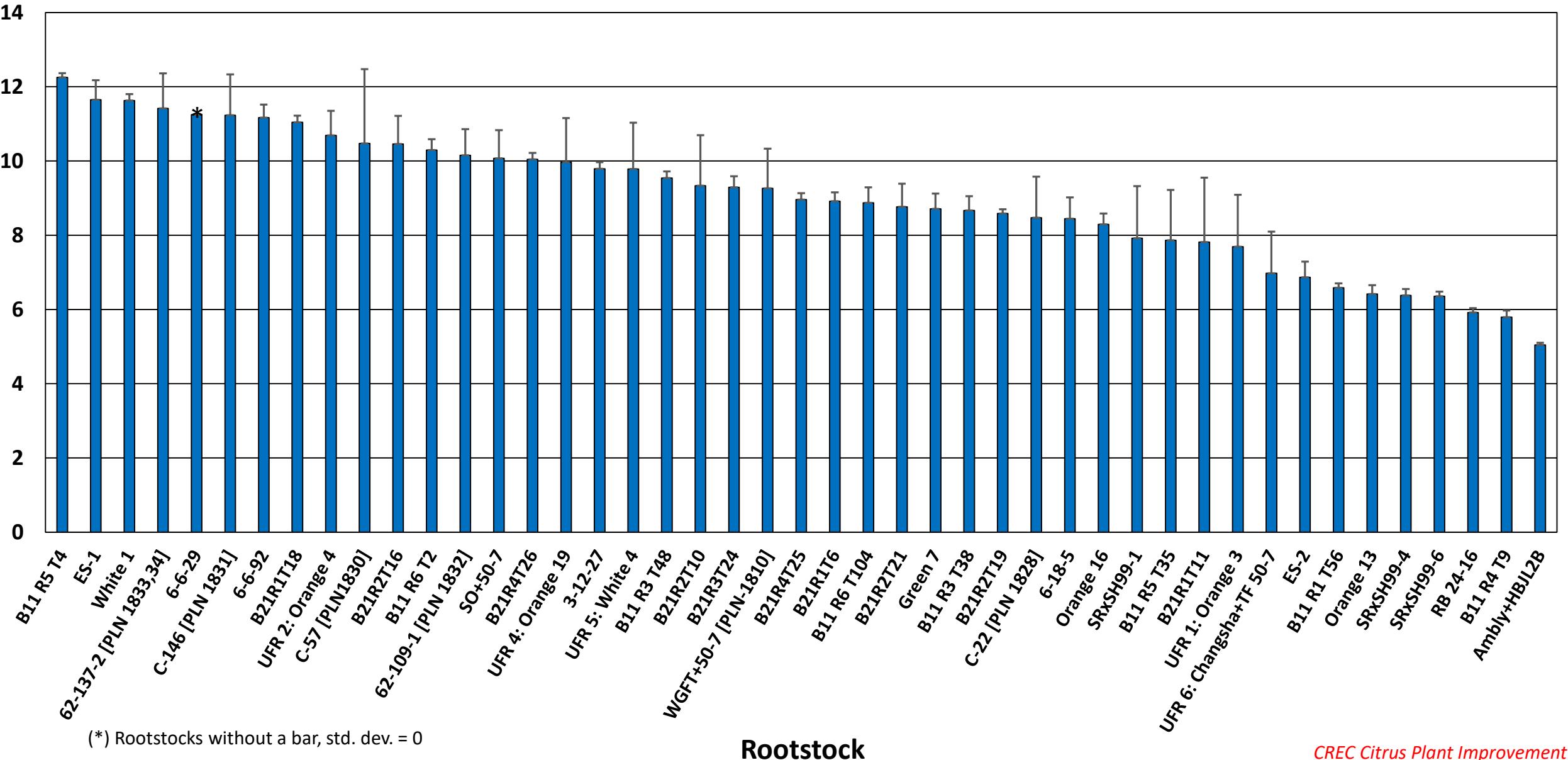


Fig. 36. Vernia rootstock trial – Tree size measurement (ft.): mean + std. dev. [September 2021].



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Table 2. Vernia rootstock trial - PS/acre [calculated @ 264 trees/acre],  
2014/15, 2018/19 & 2020/21.

Rootstock	2014/15	2018/19	2020/21	Cumulative
62-137-2 [PLN 1833,34]	929	1,762	582	3,274
B21R3T24	1,478	1,312	360	3,150
ES-1	555	1,953	640	3,147
B11 R6 T104	1,971	1,144	0	3,115
C-146 [PLN 1831]	342	1,887	748	2,977
C-22 [PLN 1828]	1,193	968	569	2,731
B21R4T26	0	1,752	883	2,635
C-57 [PLN1830]	449	1,684	490	2,623
UFR 2: Orange 4	968	1,340	248	2,556
B11 R5 T4	634	1,479	338	2,451
62-109-1 [PLN 1832]	642	1,078	408	2,128
B21R2T16	607	950	527	2,084
B21R2T21	1,103	695	271	2,068
B11 R1 T56	426	1,442	155	2,023
6-6-92	933	609	370	1,912
White 1	855	486	454	1,795
UFR 5: White 4	772	636	243	1,651
SO+50-7	767	262	595	1,624
UFR 4: Orange 19	520	690	363	1,572
B21R2T19	673	275	553	1,502
B21R2T10	970	114	416	1,500
B11 R4 T9	1,342	105	0	1,447
UFR 1: Orange 3	421	492	505	1,418
WGFT+50-7 [PLN-1810]	541	632	180	1,353
ES-2	585	543	160	1,288

Table 2 [cont'd.]. Vernia rootstock trial - PS/acre [calculated @ 264 trees/acre, 2014/15, 2018/19 & 2020/21.

<b>Rootstock</b>	<b>2014/15</b>	<b>2018/19</b>	<b>2020/21</b>	<b>Cumulative</b>
B11 R6 T2	950	99	184	1,233
B21R1T18	700	111	414	1,224
6-18-5	600	356	164	1,120
B21R1T11	630	464	26	1,119
B11 R5 T7	776	312	0	1,087
3-12-27	431	634	0	1,065
UFR 6: Changsha+TF 50-7	841	82	21	944
B11 R3 T48	568	312	0	879
B11 R3 T38	347	367	74	787
Green 7	211	450	116	777
RB 24-16	721	54	0	774
Orange 16	0	446	284	730
Ambly+HBJL2B	218	453	0	670
B11 R5 T35	323	257	86	666
SRxSH99-4	462	86	86	634
Orange 13	475	155	0	631
B21R1T6	NA	628	0	628
SRxSH99-1	282	304	0	586
6-6-29	370	193	0	562
ES-3	291	207	50	548
Orange 2	440	0	NA	440
B11 R2 T60	211	185	0	396
B21R10T26	220	126	NA	346
SRxSH99-6	112	201	0	313

Table 3. Vernia rootstock trial - PS/box, yield and PS/acre: 2014/15, 2018/19 & 2020/21.

Rootstock	2014/15			2018/19			2020/21		
	PS/box	Yield [boxes/tree]	PS/acre	PS/box	Yield [boxes/tree]	PS/acre	PS/box	Yield [boxes/tree]	PS/acre
62-137-2 [PLN 1833,34]	4.4	0.8	929	4.3	1.5	1762	4.1	0.5	582
B21R3T24	4.2	1.3	1478	5.0	1.0	1312	4.1	0.3	360
ES-1	4.6	0.5	555	4.8	1.5	1953	4.3	0.6	640
B11 R6 T104	5.6	1.3	1971	5.2	0.8	1144	5.0	0.0	0
C-146 [PLN 1831]	3.7	0.4	342	4.8	1.5	1887	4.5	0.6	748
C-22 [PLN 1828]	4.8	0.9	1193	4.5	0.8	968	4.5	0.5	569
B21R4T26	4.5	0.0	0	5.3	1.3	1752	4.5	0.8	883
C-57 [PLN1830]	3.6	0.5	449	4.6	1.4	1684	4.5	0.4	490
UFR 2: Orange 4	4.4	0.8	968	4.4	1.2	1340	3.8	0.3	248
B11 R5 T4	4.0	0.6	634	4.7	1.2	1479	4.3	0.3	338
62-109-1 [PLN 1832]	4.5	0.5	642	4.8	0.8	1078	4.5	0.3	408
B21R2T16	4.6	0.5	607	4.9	0.7	950	4.8	0.4	527
B21R2T21	4.7	0.9	1103	4.9	0.5	695	4.6	0.2	271
B11 R1 T56	4.3	0.4	426	4.4	1.3	1442	4.7	0.1	155
6-6-92	5.3	0.7	933	4.6	0.5	609	4.2	0.3	370
White 1	5.4	0.6	855	4.6	0.4	486	4.3	0.4	454
UFR 5: White 4	4.9	0.6	772	4.8	0.5	636	4.4	0.2	243
SO+50-7	4.1	0.7	767	4.8	0.2	262	4.5	0.5	595
UFR 4: Orange 19	4.7	0.4	520	4.7	0.6	690	4.2	0.3	363
B21R2T19	5.1	0.5	673	4.2	0.3	275	4.2	0.5	553
B21R2T10	4.9	0.8	970	5.2	0.1	114	4.7	0.3	416
B11 R4 T9	6.1	0.8	1342	4.8	0.1	105	5.1	0.0	0
UFR 1: Orange 3	4.4	0.4	421	4.8	0.4	492	4.5	0.4	505
WGFT+50-7 [PLN-1810]	4.8	0.4	541	5.0	0.5	632	4.7	0.1	180
ES-2	3.8	0.6	585	4.6	0.4	543	4.5	0.1	160

Table 3 [cont'd.]. Vernia rootstock trial - PS/box, yield and PS/acre: 2014/15, 2018/19 &amp; 2020/21\*.

Rootstock	2014/15			2018/19			2020/21		
	PS/box	Yield [boxes/tree]	PS/acre	PS/box	Yield [boxes/tree]	PS/acre	PS/box	Yield [boxes/tree]	PS/acre
B11 R6 T2	5.4	0.7	950	4.5	0.1	99	4.2	0.2	184
B21R1T18	5.3	0.5	700	5.1	0.1	111	4.7	0.3	414
6-18-5	4.8	0.5	600	4.9	0.3	356	4.5	0.1	164
B21R1T11	4.5	0.5	630	5.2	0.3	464	5.0	0.0	26
B11 R5 T7	4.7	0.6	776	4.7	0.3	312	4.6	0.0	0
3-12-27	4.9	0.3	431	4.8	0.5	634	4.3	0.0	0
UFR 6: Changsha+TF 50-7	4.9	0.7	841	5.1	0.1	82	4.8	0.0	21
B11 R3 T48	4.3	0.5	568	4.7	0.3	312	4.2	0.0	0
B11 R3 T38	4.2	0.3	347	4.4	0.3	367	4.5	0.1	74
Green 7	4.0	0.2	211	4.3	0.4	450	4.4	0.1	116
RB 24-16	3.9	0.7	721	4.1	0.1	54	4.1	0.0	0
Orange 16	4.6	0.0	0	4.5	0.4	446	4.3	0.3	284
Ambly+HBJL2B	4.4	0.2	218	4.8	0.4	453	4.6	0.0	0
B11 R5 T35	4.7	0.3	323	5.0	0.2	257	4.7	0.1	86
SRxSH99-4	4.2	0.4	462	3.9	0.1	86	3.9	0.1	86
Orange 13	3.6	0.5	475	4.7	0.1	155	4.7	0.0	0
B21R1T6	NA	NA	NA	4.8	0.5	628	4.8	0.0	0
SRxSH99-1	4.8	0.2	282	5.2	0.2	304	4.8	0.0	0
6-6-29	4.2	0.3	370	4.4	0.2	193	4.1	0.0	0
ES-3	2.8	0.4	291	4.5	0.2	207	4.6	0.04	50
Orange 2	5.0	0.3	440	4.6	NA	NA	NA	0.0	0
B11 R2 T60	4.8	0.2	211	4.2	0.2	185	4.5	0.0	0
B21R10T26	5.0	0.2	220	4.8	0.1	126	NA	0.0	0
SRxSH99-6	5.1	0.1	112	4.6	0.2	201	4.5	0.0	0

NA: not available

2020/21: sample for PS/box were taken in Jan 2021; yield was measured in March 2021.