

Navel Orange and Grapefruit Rootstock Trial, Vero Beach

Dr. Bill Castle – Dr. Fred Gmitter - Dr. Jude Grosser

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CREC Citrus Plant Improvement

Navel Orange and Grapefruit Rootstock Trial, Vero Beach - Description

This trial was planted in 2010 west of Vero Beach along Highway 60 and south on 146th Avenue. There are trees of Redblush, Ray Ruby and Star Ruby grapefruit and Cara Cara and standard navel orange clone 56-11 planted on 42 new hybrid rootstocks created in the UF/CREC plant improvement program or introduced from the USDA, the University of California, Riverside or Spain. There are also trees for comparison of Ray Ruby on Swingle citrumelo along with navel orange clone 56-11 on Swingle citrumelo. Tree numbers and rootstocks vary according to the scion.

Navel Orange and Grapefruit Rootstock Trial, Vero Beach - Summary

- Location: Vero Beach, Indian River County.
- Scion - Rootstocks:
 - Navel orange: Cara Cara [11 rootstocks]; standard clone 56-11 [15 rootstocks].
 - Grapefruit: Redblush [18 rootstocks], Ray Ruby [13 rootstocks], Star Ruby [11 rootstocks].
 - Additional comparison trees: Ray Ruby/Swingle citrumelo; Navel 56-11/Swingle citrumelo.
- Date Planted: April 2010
- Design:
 - Randomized complete-block with 2-4 replicates
 - Plot size: mostly 3-5 trees
 - Spacing: 7.5 x 22 ft. = 264 trees/acre.
- Data collected:
 - 2015/16: Navel orange juice quality.
 - 2017/18: Grapefruit juice quality.
 - 2018/19: Grapefruit HLB rating and yield. Navel orange HLB rating, juice quality, yield and PS/acre.
 - 2019/20: Grapefruit tree size, juice quality, yield and PS/acre. Navel orange tree size and yield.
 - 2020/21: Grapefruit & Navel orange: HLB rating, tree size and yield.
 - 2021/22: Grapefruit yield and juice quality. Navel orange juice quality, HLB rating and yield.
 - 4-year cumulative yield for grapefruit and navel orange.

Trial status: **ACTIVE.**

Table 1. Vero Beach rootstock trial – List of rootstocks, parentage and number of trees by Scion.

Rootstock	Parentage	Scion - Number of Trees				
		56-11	Cara Cara	Ray Ruby	Redblush	Star Ruby
11-1-71A	Siamese Sweet x 9-6 TO	10		4	12	4
11-2-72	Wainwright pummelo x 9-6 TO		12			4
11-3-48	B6R24T62 x Cleo					7
11-3-53	(Cleo x Ichang) x 17-47	12	10	7	7	
11-4-86	Duncan x 9-6 TO	7	10			
11-4-9	Flying Dragon x Obovoidea				4	
11-5-25	Flying Dragon x Duncan				2	
11-5-62	Flying Dragon x Ridge Pineapple	1				
11-5-64	Flying Dragon x Ridge Pineapple	2				
11-6-2	17-47 x Obovoidea		6			
21-1-11	Duncan x DPI 9-6		8			
21-1-18	DPI 9-6 x LB-1-21 (Clem x Duncan)				2	
21-2-10	Duncan x DPI 9-6		7			
21-2-16	DPI Flying Dragon x LB 1-21	13				
21-2-21	DPI Flying Dragon x LB 1-21	10			4	
21-3-24	DPI Flying Dragon x LB 1-21					7
21-4-25	DPI Flying Dragon x LB 1-21					5
6-18-34	Tahiti Swt x Argentine TO	12				
62-109-1 [PLN 1832]	Sunki x Flying Dragon trifoliolate				12	5
62-137-2 [PLN 1833]	Shekwasha x English trifoliolate				9	
6-6-29	Nakon x Page					5

Table 1 (cont'd). Vero Beach rootstock trial – List of rootstocks, parentage and number of trees by scion.

Rootstock	Parentage	Scion - Number of Trees				
		56-11	Cara Cara	Ray Ruby	Redblush	Star Ruby
6-6-92	Pink Java x Page					7
Blue 1	[Nova+HBPummelo] x [sour orange+Palestine sweet lime]				6	
CS-146 [PLN1831]	Sunki x Swingle TF			11	11	
CS-22 [PLN1828]	Sunki x Swingle TF	12				
CS-54 [PLN1829]	Sunki x Swingle TF	4	7			
CS-57 [PLN1830]	Sunki x Swingle TF	11	12			
Csha+Ben	Changsha mandarin+Benton citrange			8		
ES-1	Cleo x <i>Poncirus trifoliata</i>		14	7		
ES-11	Troyer citrange x mandarin(Sp)			5	2	
ES-2	Cleo x <i>Poncirus trifoliata</i>		10			11
ES-3	Cleo x <i>Poncirus trifoliata</i>	12	7	12	13	8
ES-9	Cleo x <i>Poncirus trifoliata</i>			11	2	
Orange 1	[Nova+HBPummelo] x [Cleopatra+Argentine trifoliolate orange]				4	
Orange 2	[Nova+HBPummelo] x [Cleopatra+Argentine trifoliolate orange]				7	
RB24-47	Fiwicke Swt x Argentine TO			8	4	
SO+50-7	Sour orange+trifoliolate orange 50-7	9				
SRXSH99-11	tetrazygs SO+Rangpur, Sour orange+rangpur, open pollinated			2	3	
SRXSH99-18	tetrazygs SO+Rangpur			2	6	5
SwC	Swingle citrumelo	9		14		
UFR 5: White 4	[Nova+HBPummelo] x [Succari+Argentine trifoliolate orange]			6		
UFR 6: Changsha+TF 50-7	Changsha mandarin+trifoliolate orange 50-7	9				

Navel orange and grapefruit rootstock trial, Vero Beach - Interpretive Summary [as of April 2022].

This trial was planted in April 2010 at 7.5 x 22 ft. and consisted of two navel orange and three grapefruit selections on various rootstocks with these caveats: [1] The overall trial was not balanced, i.e., the same rootstocks were not available for each scion. Even though there was good overlap, some rootstocks did not appear with one or more scions. As a result, a rootstock exhibiting good performance with, e.g., Ray Ruby grapefruit may not have been included in the Star Ruby part of the trial; and [2] HLB disease was present in the trial. Because greening-affected and unaffected fruit were not identified and separated at sampling, fruit samples likely consisted of unknown proportions of each type, an outcome that may influence how the data are interpreted. However, in the 2021/22 season, the navel orange and grapefruit crops were uniform in appearance, thus, sampling was conducted in the normal manner without any need to separate wholesome from HLB-affected fruit.

Tree ht. At about 11 years old, the grapefruit selections were mostly 8-12 ft. tall [Figs. 27, 42] with some of the tallest ones being on C-146, ES-1, 62-137-2, Blue 1 and 62-109-1. The shortest trees were on ES-11. Among the navel orange trees, tree height ranged from 9-11 ft [Figs. 34, 43].

Yield. Among the individual years of yield of the grapefruit selections, top performing rootstocks included C-146, 4-1-71, Blue-1, 6-6-29, 62-137-2, UFR-5 and 11-2-72; among the 3 years of navel orange yield, ES-2, ES-1, C-54, C-57, 11-5-64 and 21-2-10.

Cumulative yield. For grapefruit and navel orange trees, those rootstocks that produced the higher annual yields were the same ones that were the most productive cumulatively.

Navel orange and grapefruit rootstock trial, Vero Beach - Interpretive Summary cont'd [as of April 2022].

Juice quality. Given the caveat stated in the preceding slide, it is likely that the data do not support any specific conclusions.

HLB. Among grapefruit trees that displayed fewer visual symptoms were those on ES-1, ES-2, ES-9, 62-109-1, C-146 and those apparently more affected were on ES-11. When yield and HLB ratings of one year were combined [Fig. 14], some of the higher ranked [higher yield, lower HLB response] rootstocks were Blue-1, 62-109-1, 6-6-29 and 11-2-72. Among the navel orange trees, those with fewer symptoms were on 11-5-62, 11-5-64, C-22, C-54 and ES-1 with the same observations being true when yield was combined with HLB ratings [Fig. 24].

Rootstocks. A few rootstocks stood out for their consistent appearance among the trees with the best outcomes. The most obvious one for grapefruit was:

- 62-109-1 [Sunki mandarin x Flying Dragon trifoliolate orange]

Others were 11-1-71, 72; Blue-1; 6-6-29; 21-2-10; 11-5-64.

Among the navel orange trees, the larger, more productive ones were those on ES-1 and ES-3, C-54, C-57 and S+50-7.

Grapefruit Data

Fig. 1. Vero Beach rootstock trial – Grapefruit, HLB rating, mean + std. dev. [October/18].

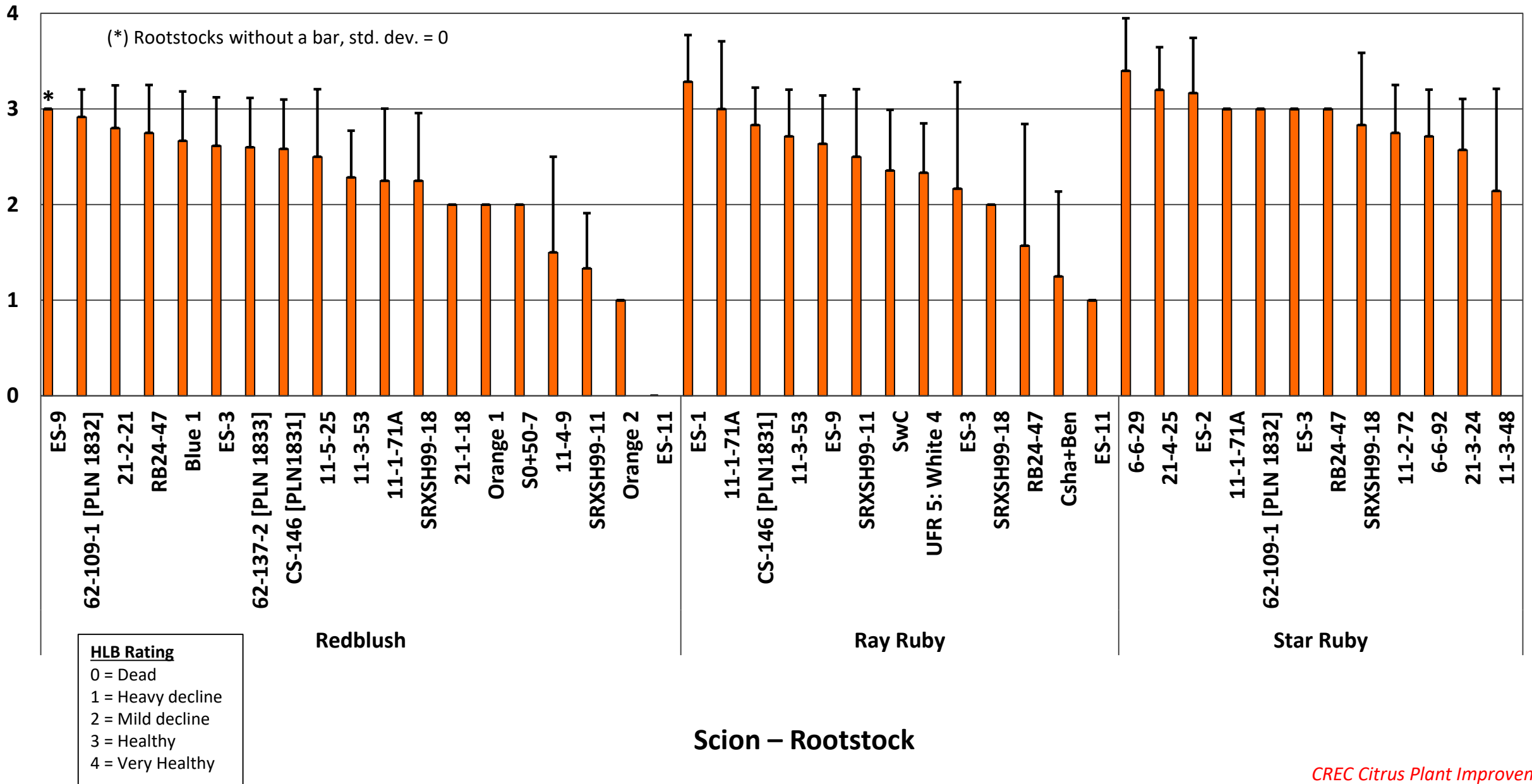


Fig. 2. Vero Beach rootstock trial – Grapefruit, HLB rating and yield, mean, 2018/19.

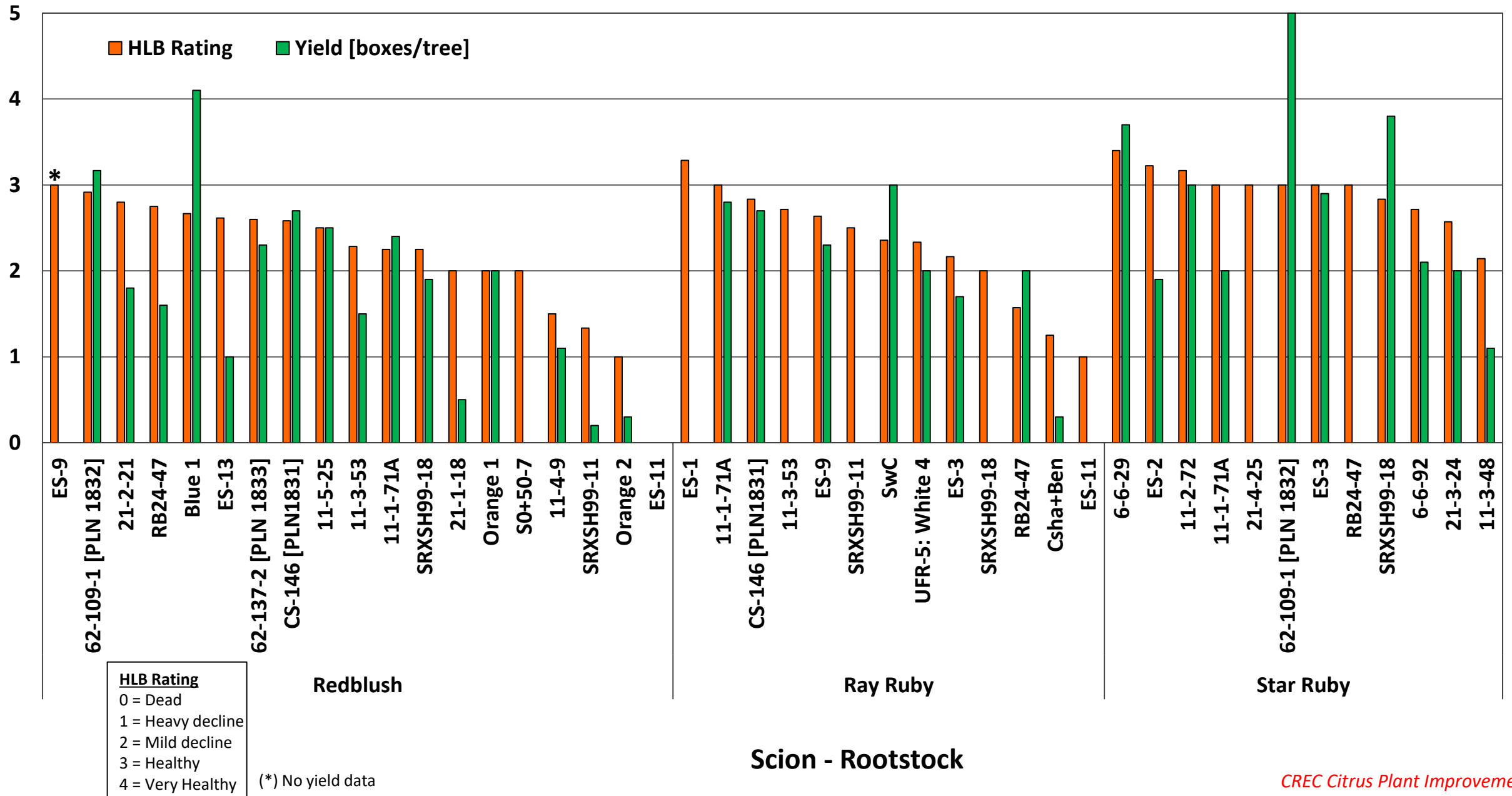


Fig. 3. Vero Beach rootstock trial – Grapefruit, PS/acre, mean, 2019/20 & 2021/22.

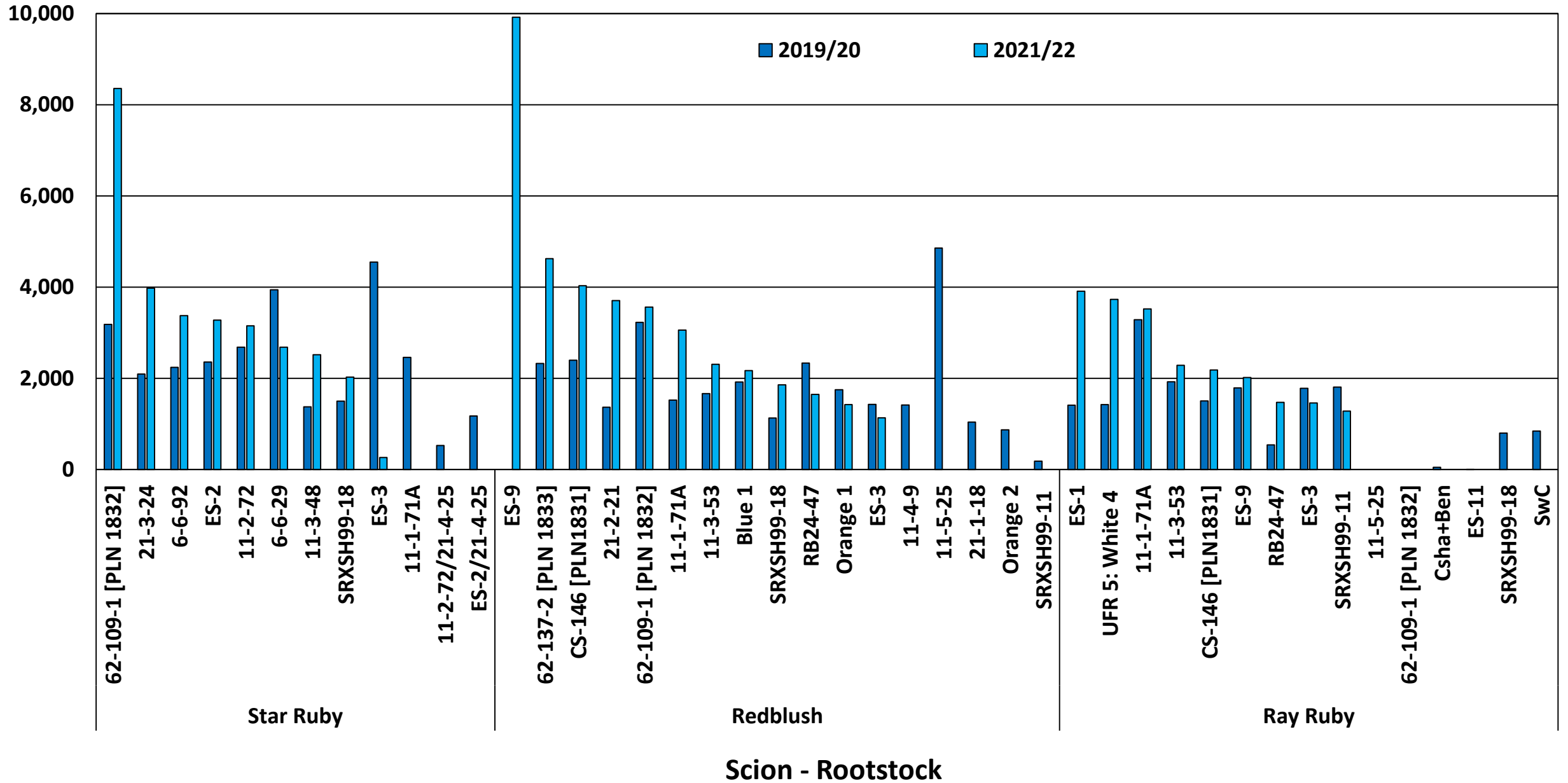
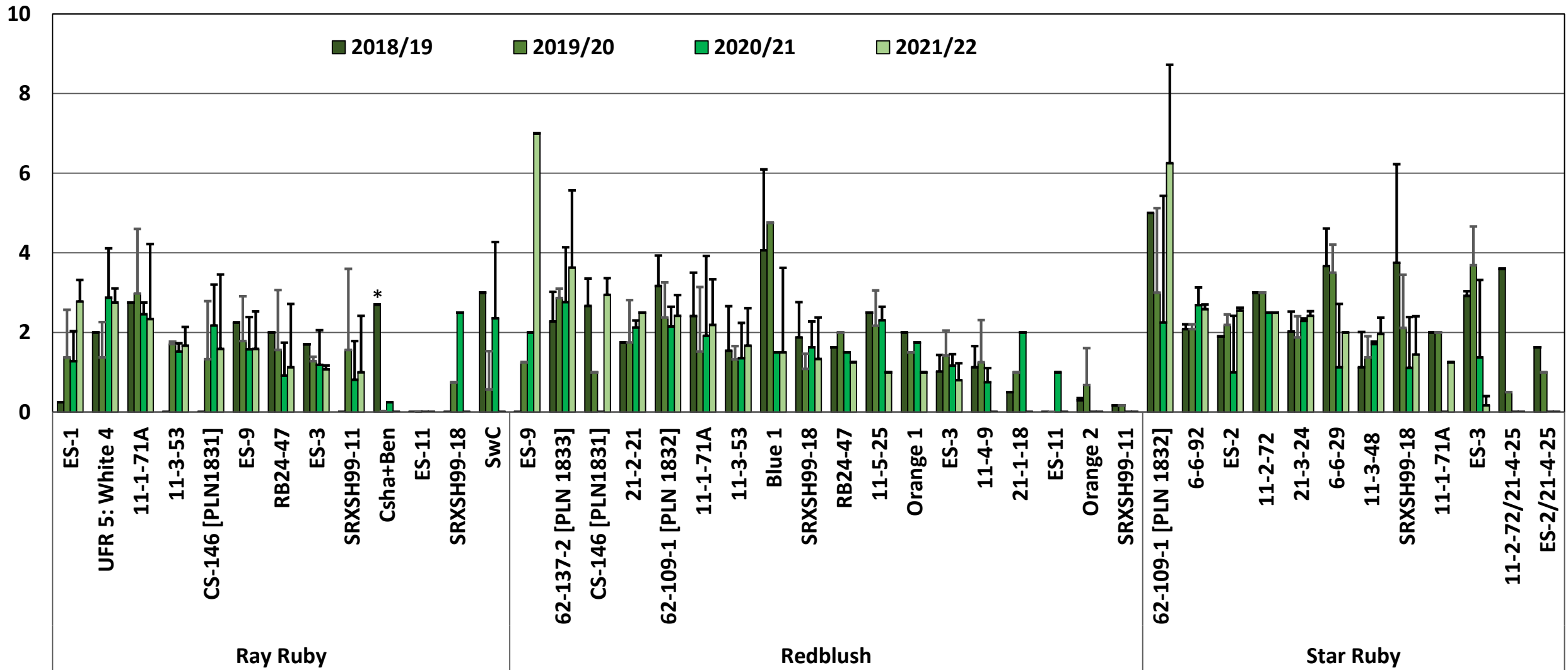


Fig. 4. Vero Beach rootstock trial – Grapefruit, yield: mean + std. dev. [boxes/tree, November/18, December/19, February/21 & January/22].



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

Scion - Rootstock

Fig. 5. Vero Beach rootstock trial – Grapefruit, 4-year cumulative yield [boxes/tree], 2018/19, 2019/20, 2020/21 & 2021/22.

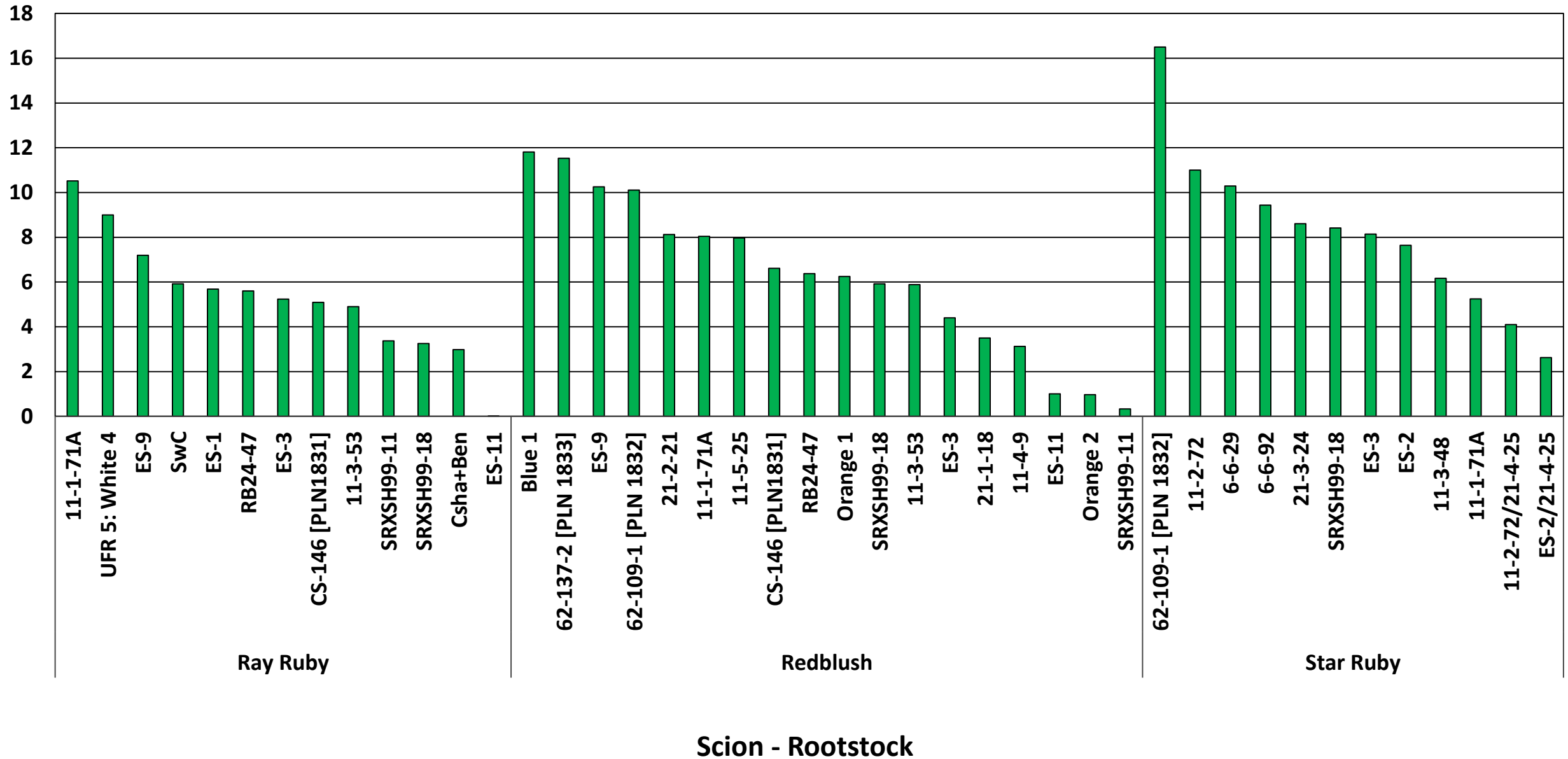


Fig. 6. Vero Beach rootstock trial – Grapefruit, Ray Ruby: 4-year Cumulative yield as % of Swingle [boxes/tree], 2018/19, 2019/20, 2020/21 & 2021/22.

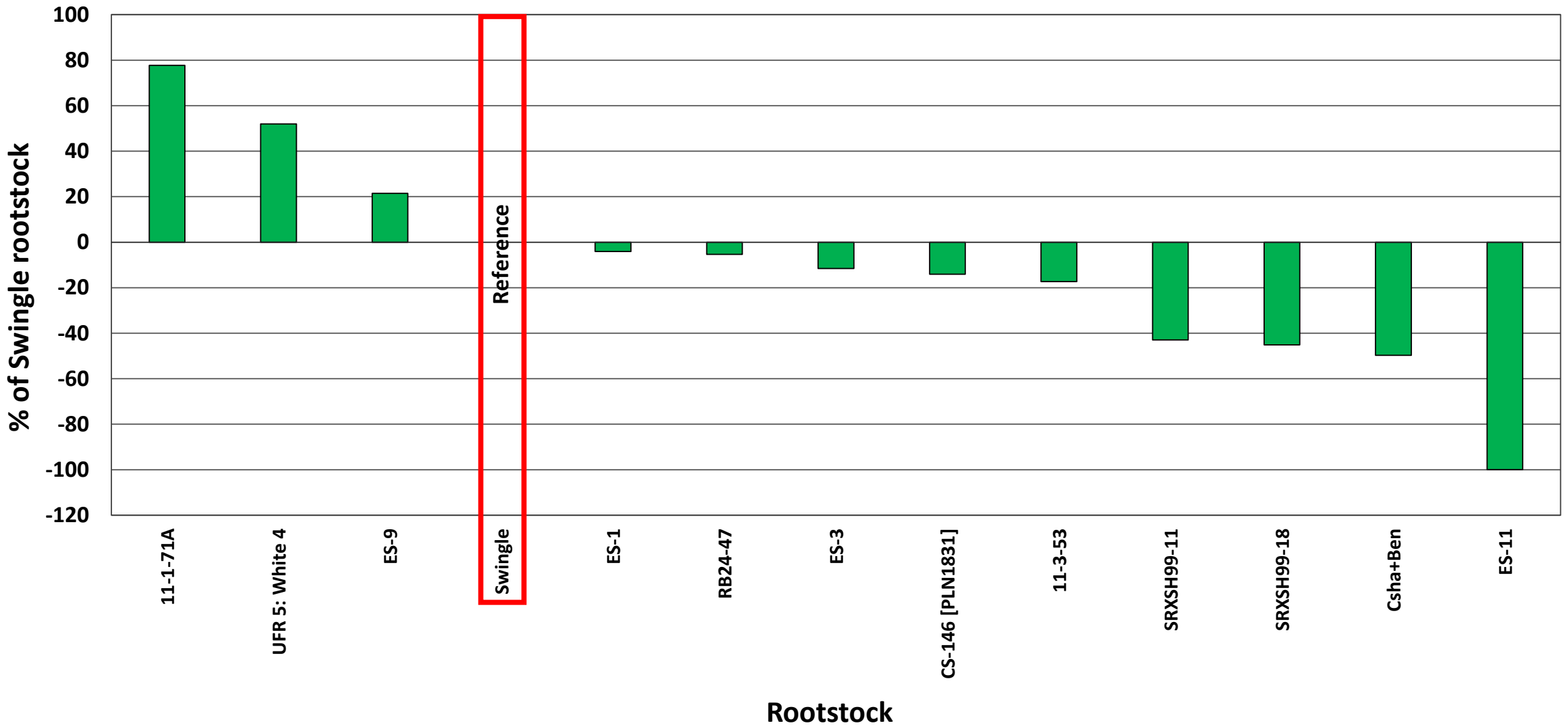


Fig. 7. Vero Beach rootstock trial – Grapefruit, HLB rating, mean + std. dev. [October/18, October/20 & December/21].

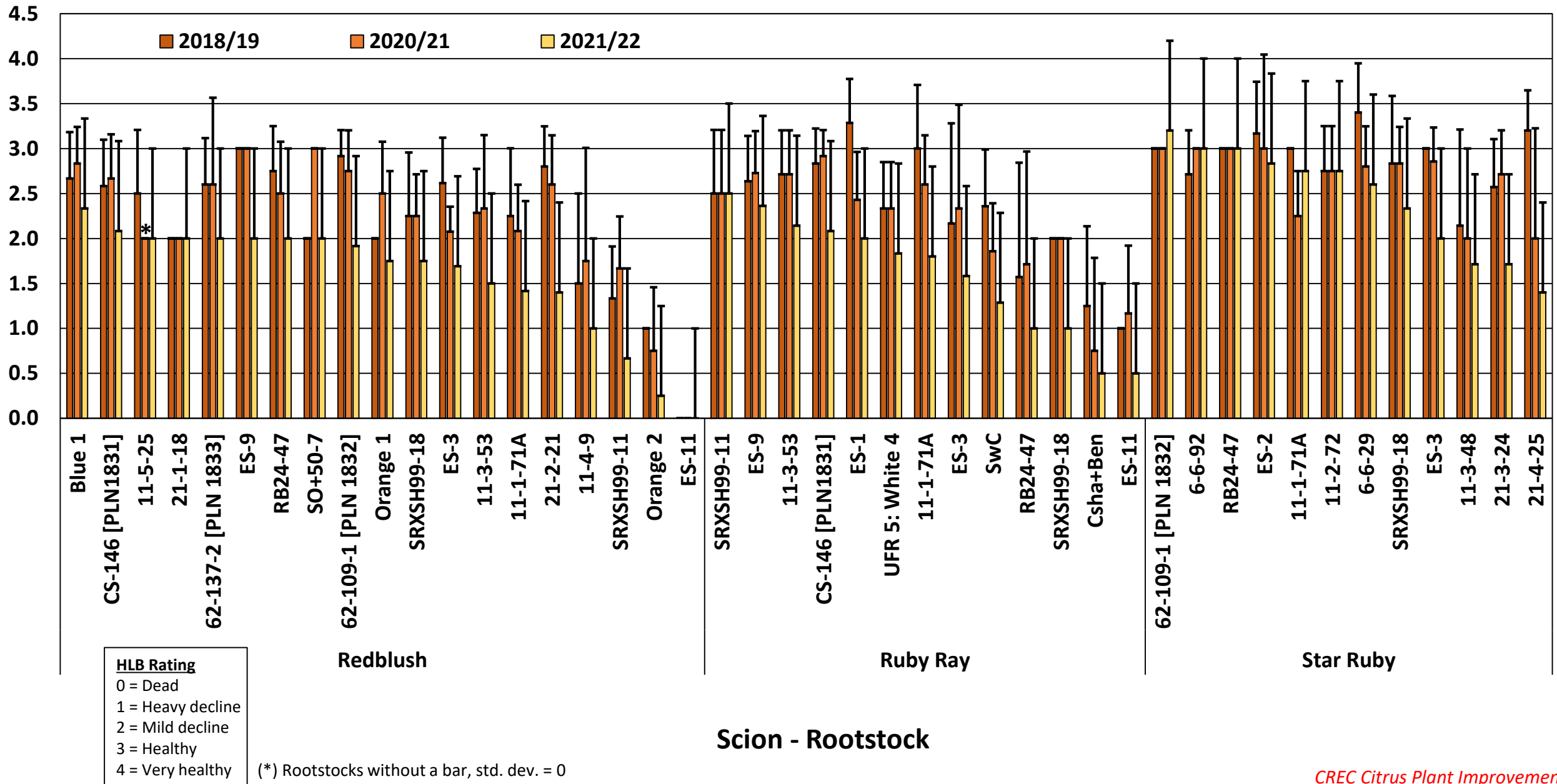
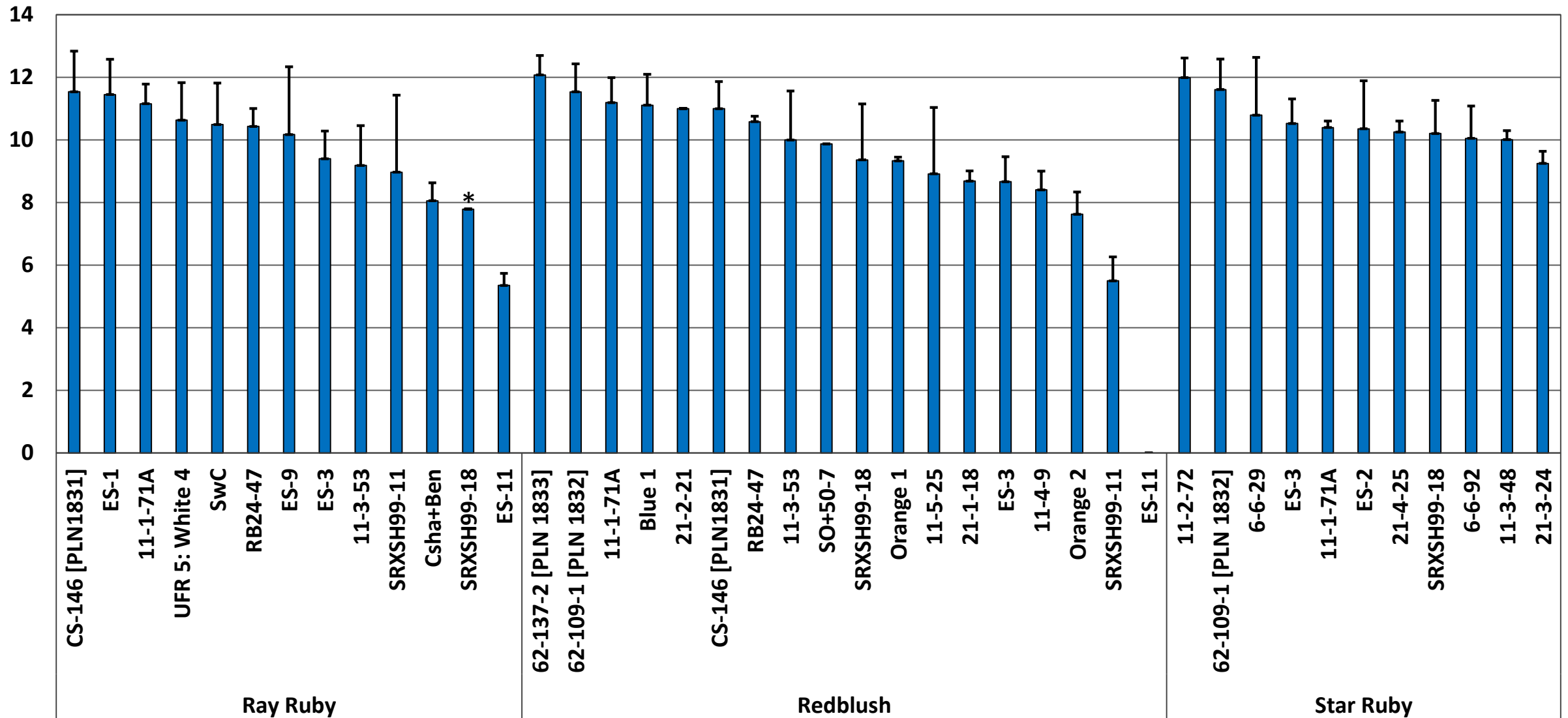


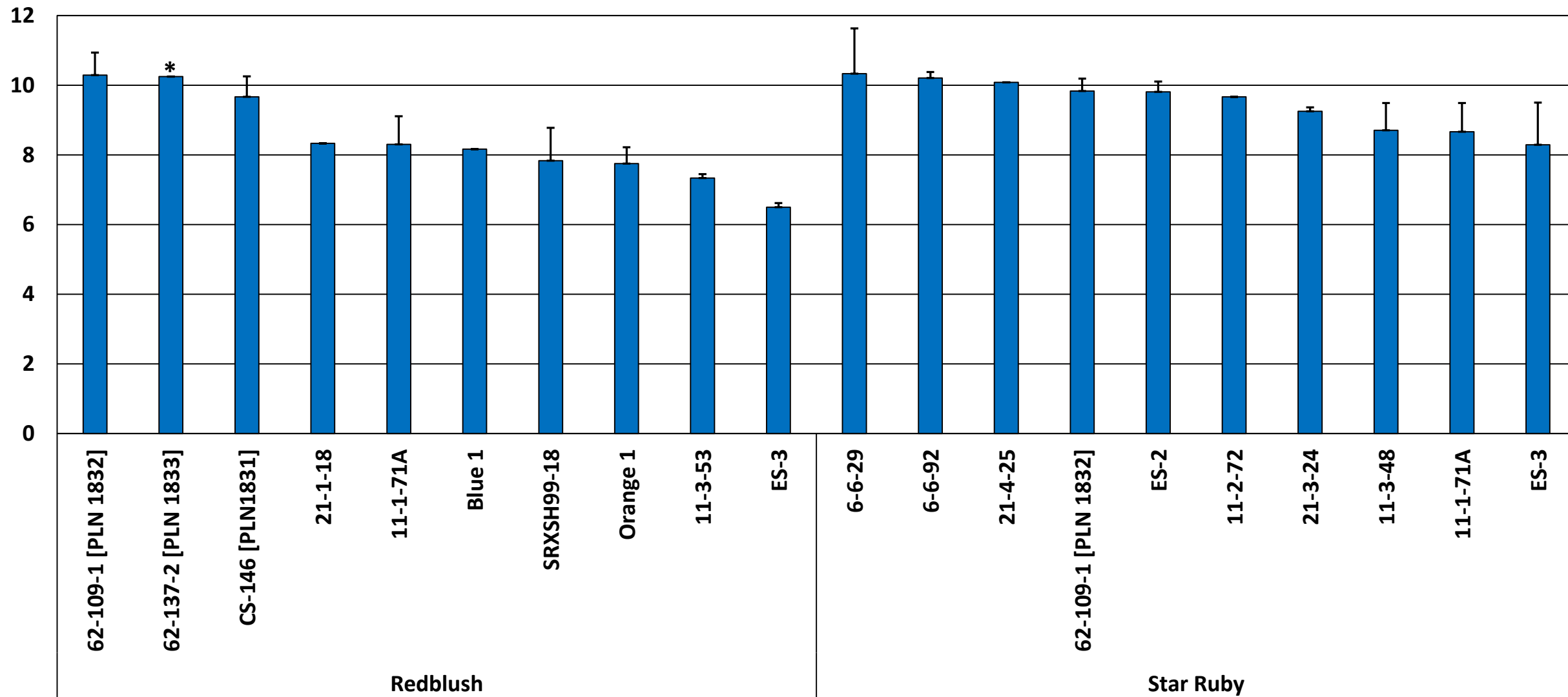
Fig. 8. Vero Beach rootstock trial – Grapefruit, tree size, ft., mean + std. dev. [November/19].



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

Scion – Rootstock

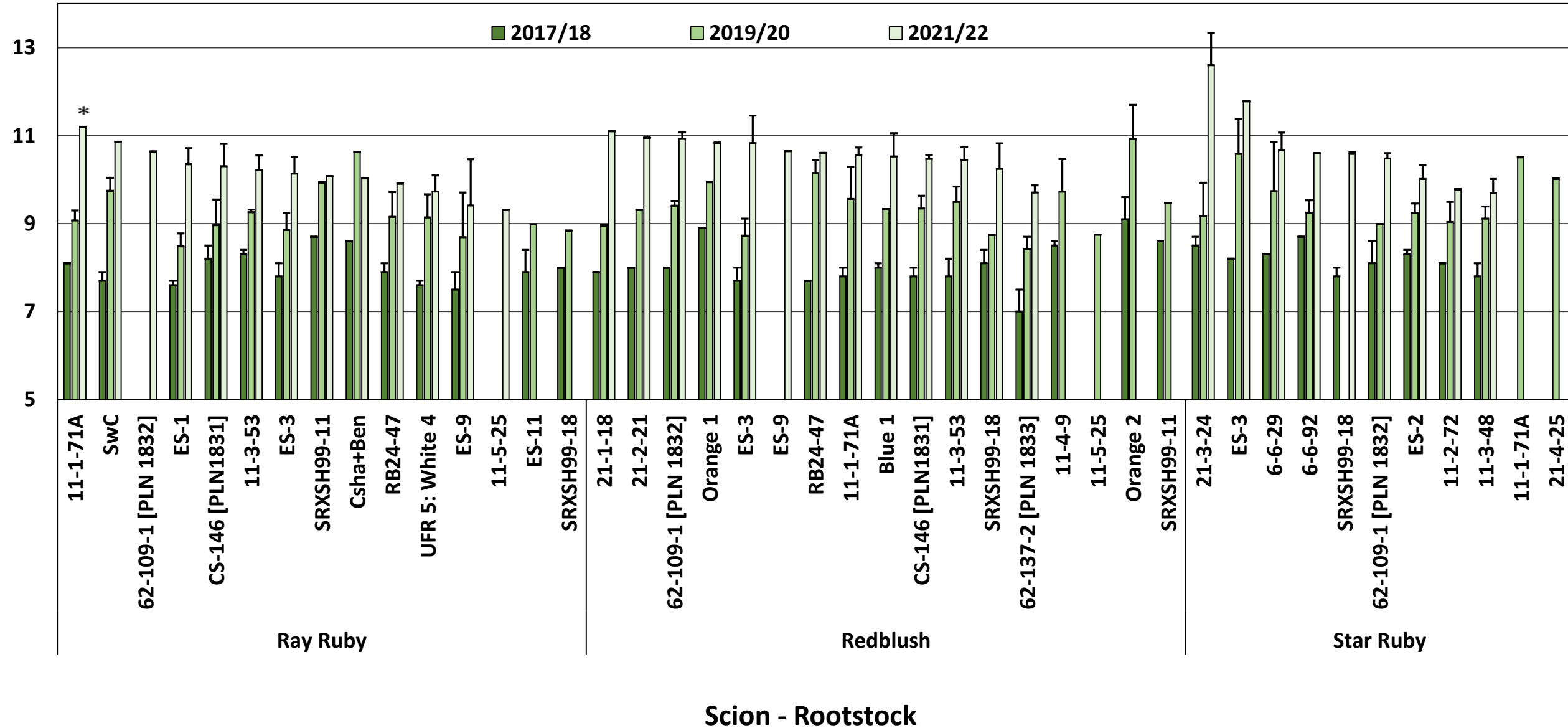
Fig. 9. Vero Beach rootstock trial – Grapefruit, tree size, ft., mean + std. dev. [July/21].



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

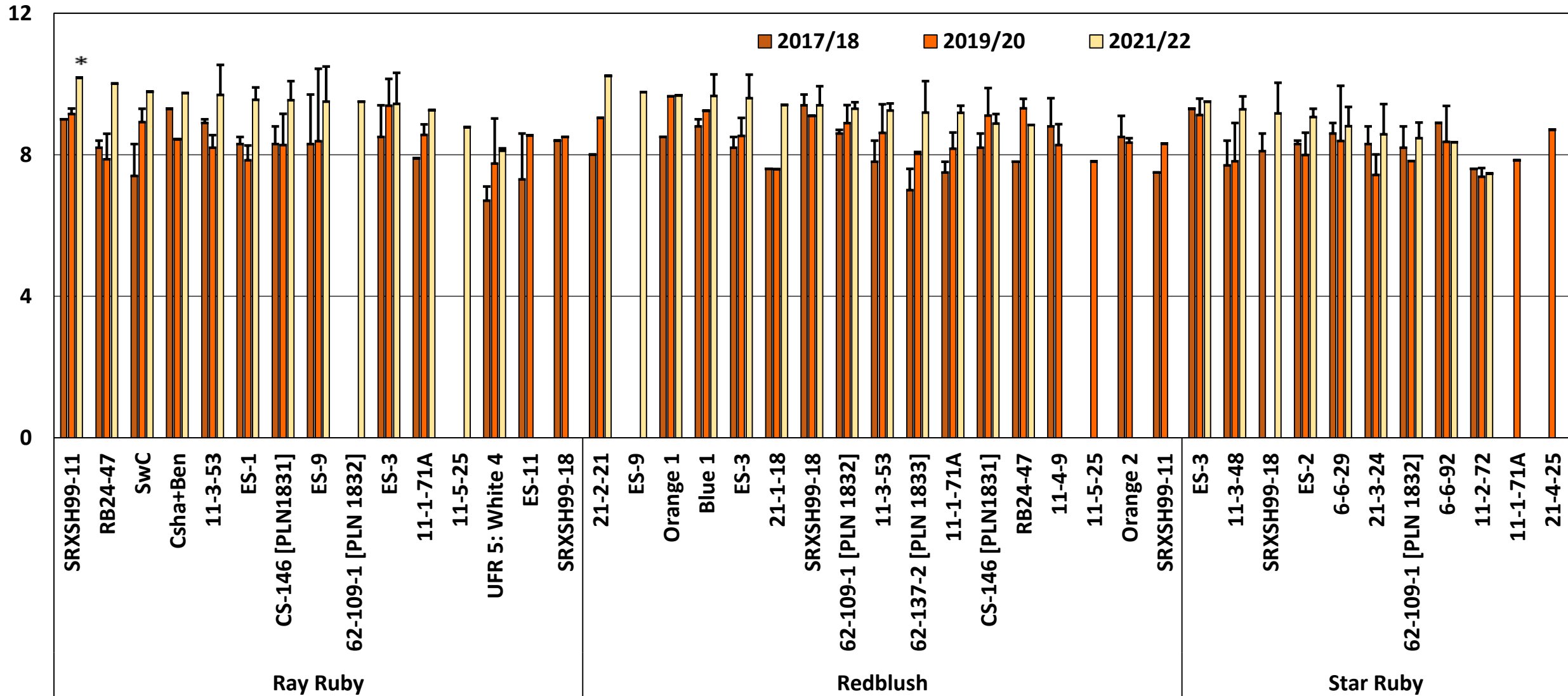
Scion - Rootstock

Fig. 11. Vero Beach rootstock trial – Grapefruit, juice brix, mean + std. dev. [January/18, November/19 & January/22].



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

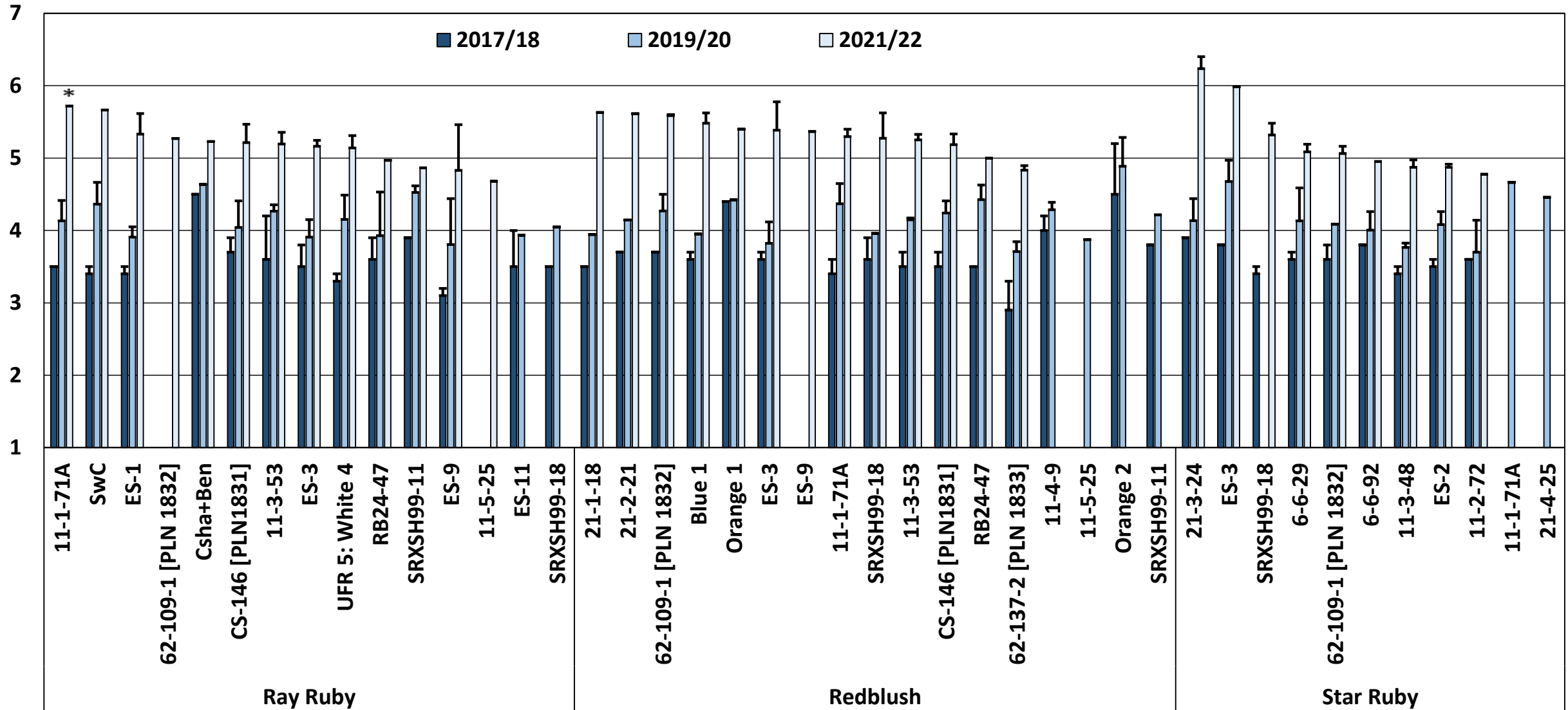
Fig. 12. Vero Beach rootstock trial – Grapefruit, juice ratio, mean + std. dev. [January 2018, November 2019 and January 2022].



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

Scion - Rootstock

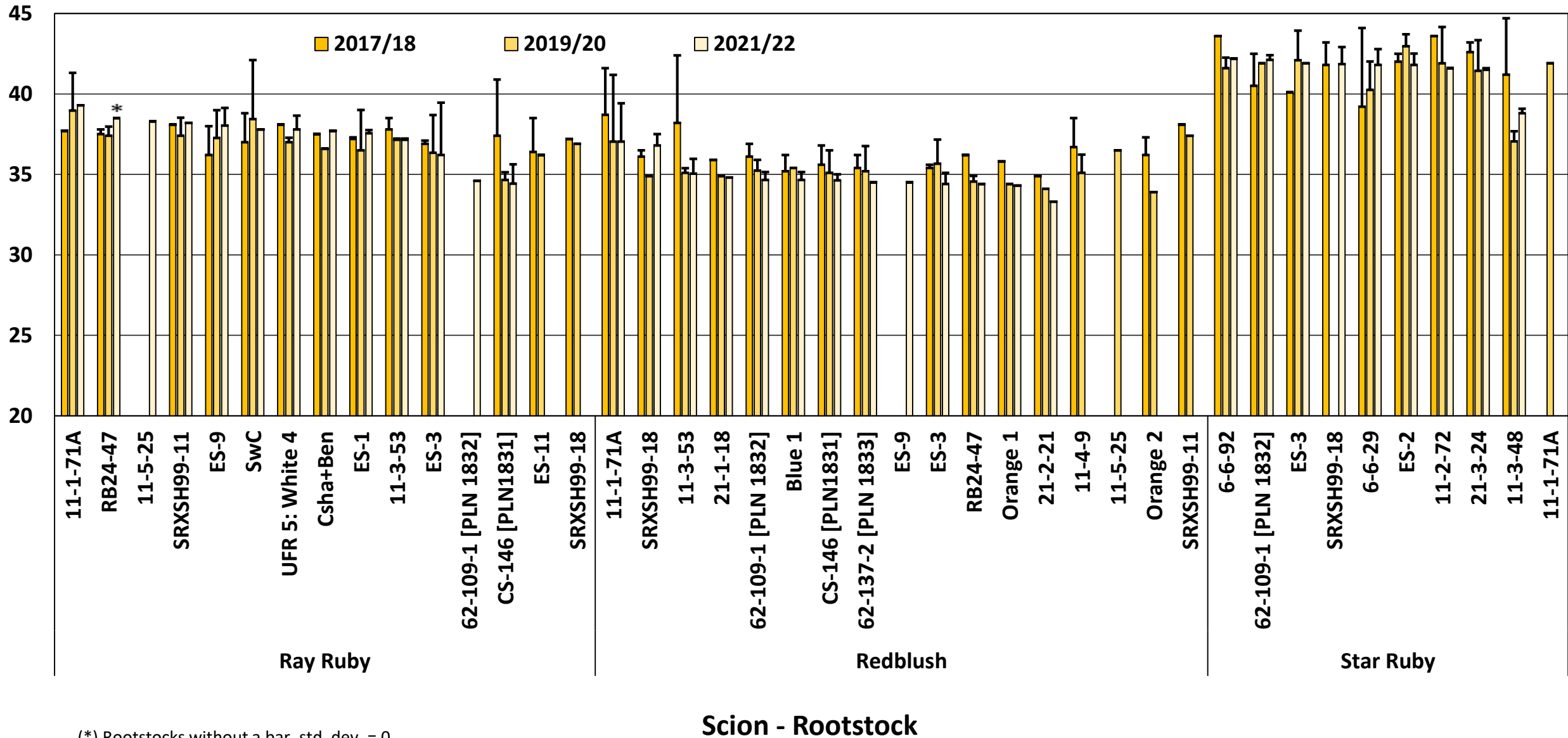
Fig. 13. Vero Beach rootstock trial – Grapefruit, juice PS/box , mean + std. dev. [January/18, November/19 & January/22].



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

Scion - Rootstock

Fig. 14. Vero Beach rootstock trial – Grapefruit, juice color , mean + std. dev. [January/18, November/19 & January/22].



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

Navel Orange Data

Fig. 15. Vero Beach rootstock trial – Navel, PS/acre, mean, 2018/19.

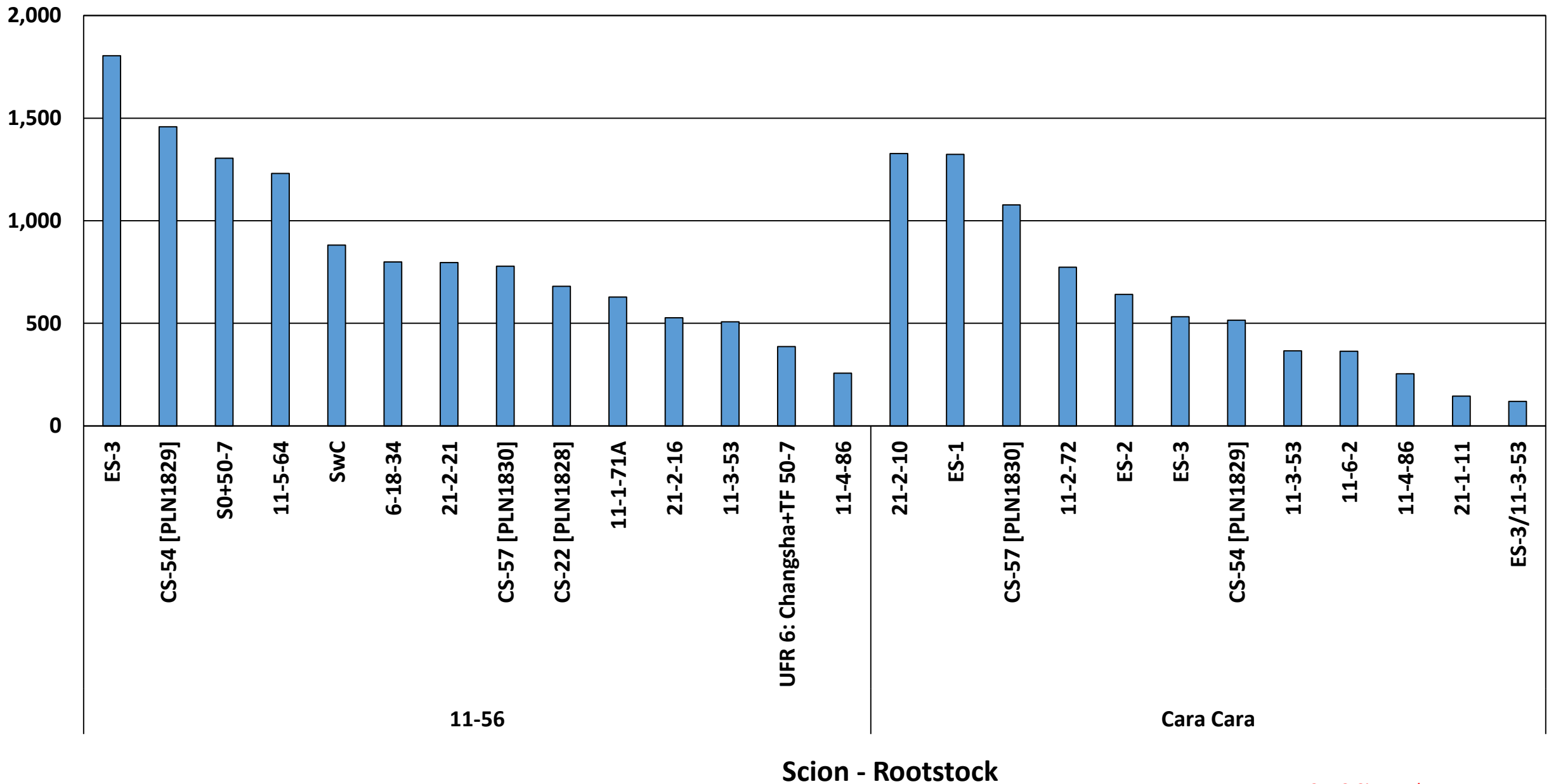


Fig. 16. Vero Beach rootstock trial – Navel orange, HLB rating, yield [boxes/tree] and PS/box, mean, 2018/19.

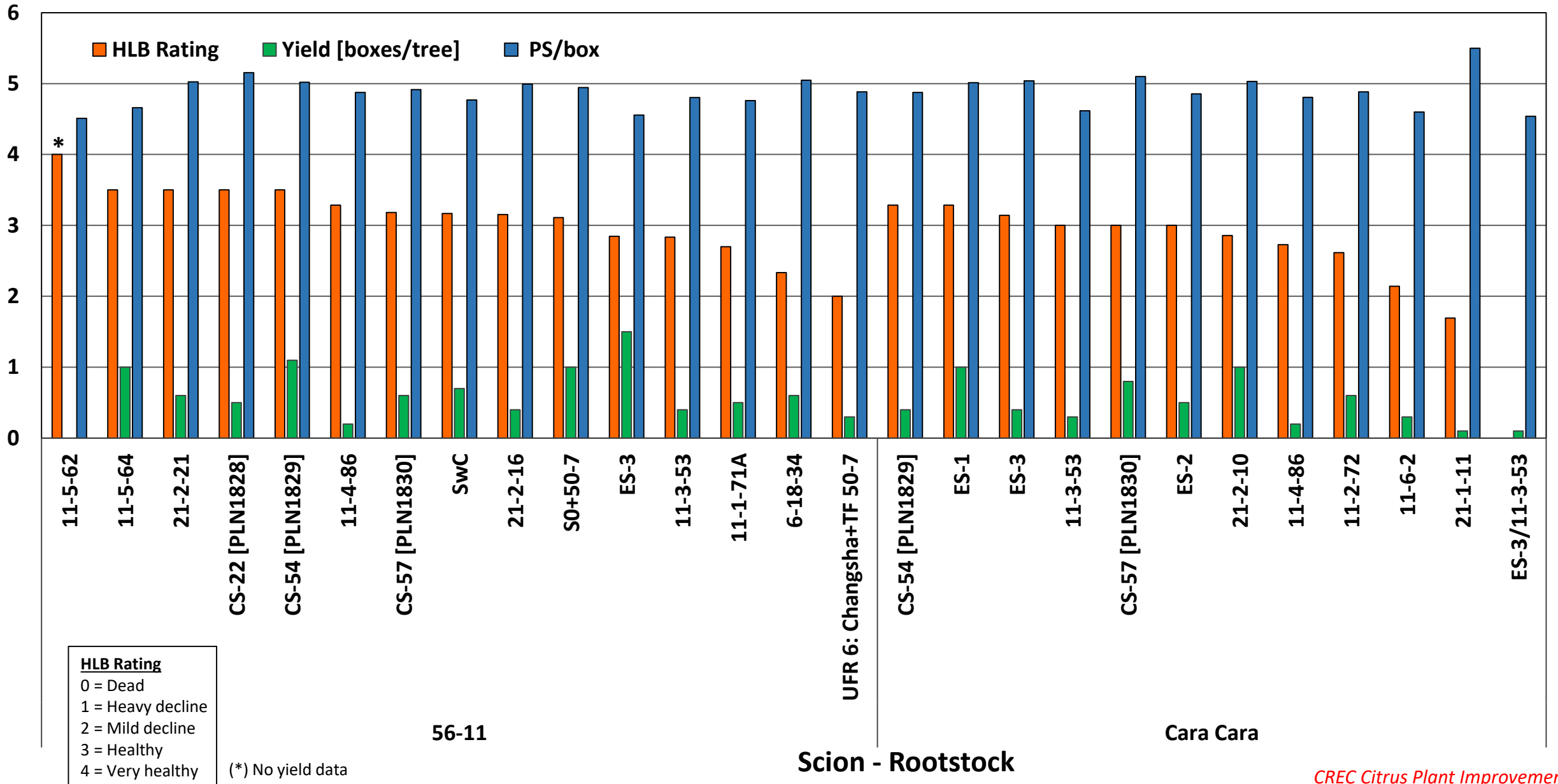
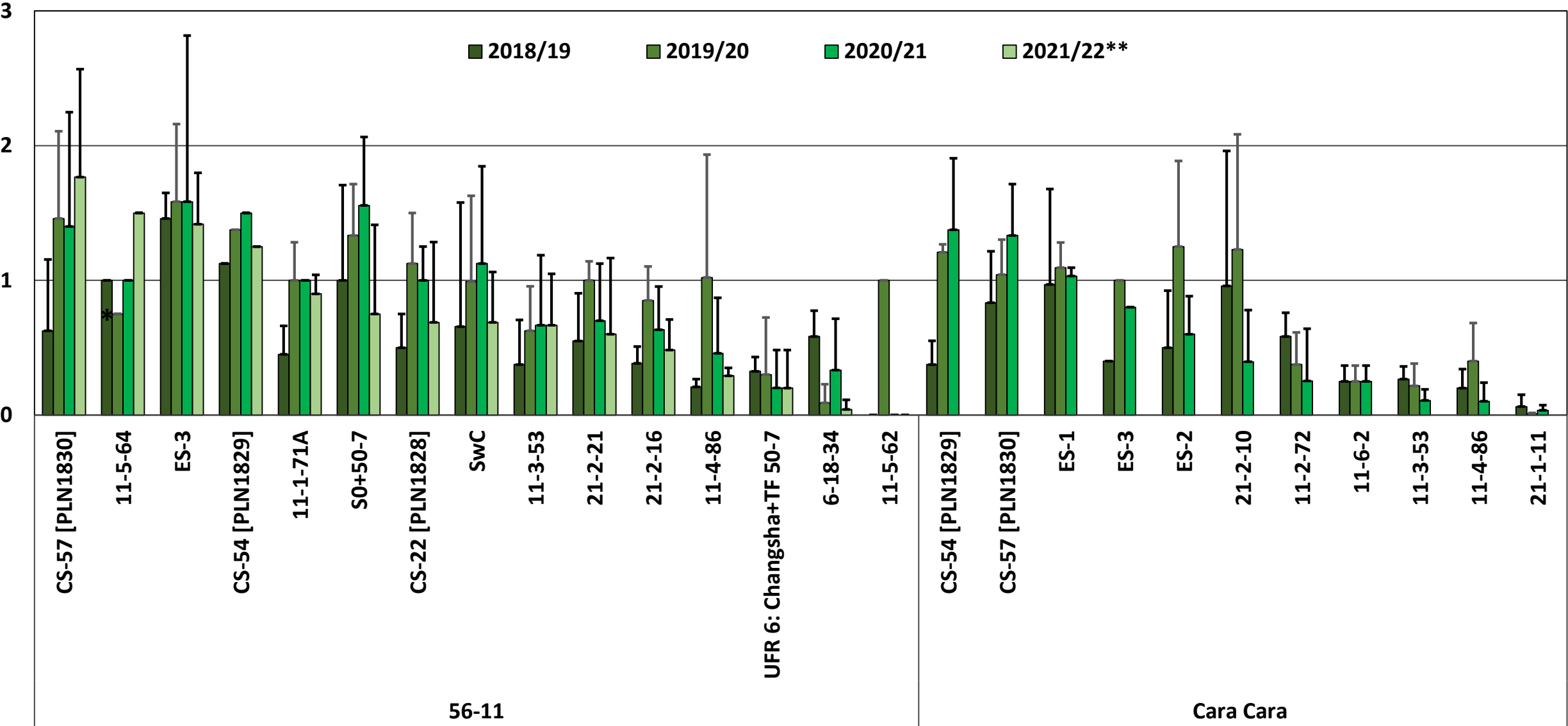


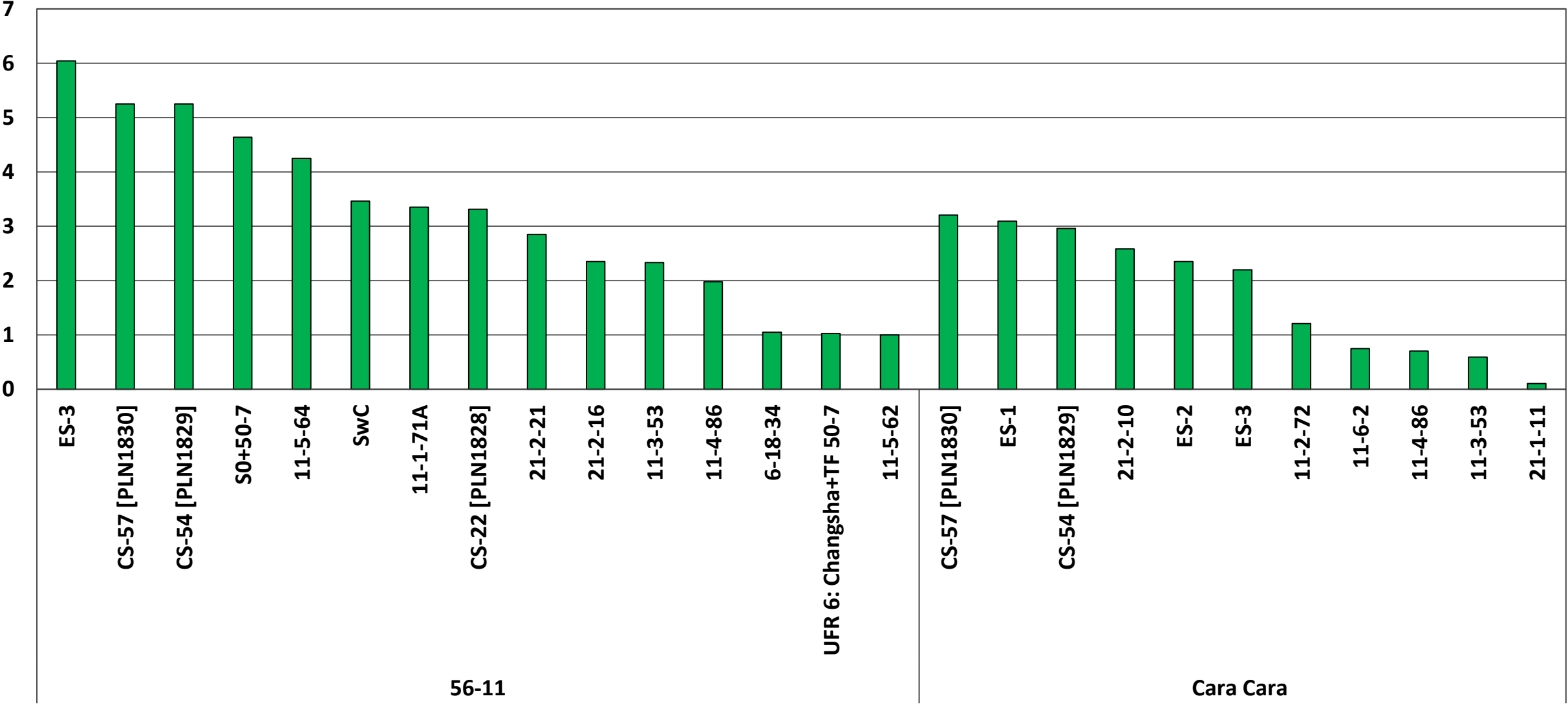
Fig. 17. Vero Beach rootstock trial – Navel , yield: mean + std. dev. [boxes/tree, December/18, December/19, October/20 & December/21].



(*) Rootstocks without a bar, std. dev. = 0
 (**) No yield for Cara Cara

Scion - Rootstock

Fig. 18. Vero Beach rootstock trial – Navel orange, 4-year cumulative yield* [boxes/tree], 2018/19, 2019/20, 2020/21 & 2021/22.



(*) 3-year cumulative yield for Cara Cara

Scion - Rootstock

Fig. 19. Vero Beach rootstock trial – Navel 56-11, 4-year Cumulative yield as % of Swingle [boxes/tree], 2018/19, 2019/20, 2020/21 & 2021/22.

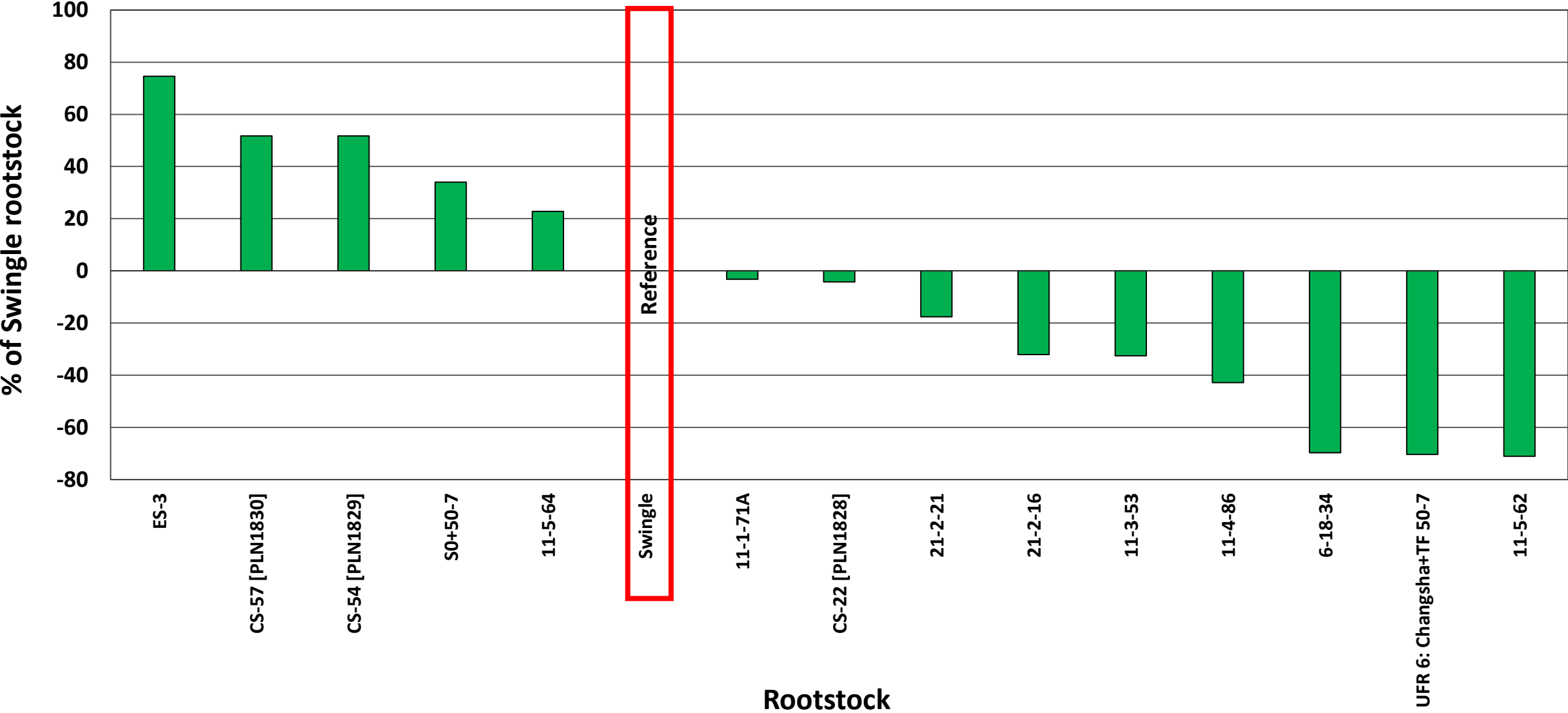


Fig. 20. Vero Beach rootstock trial – Navel orange, tree size, ft., mean + std. dev. [November/19].

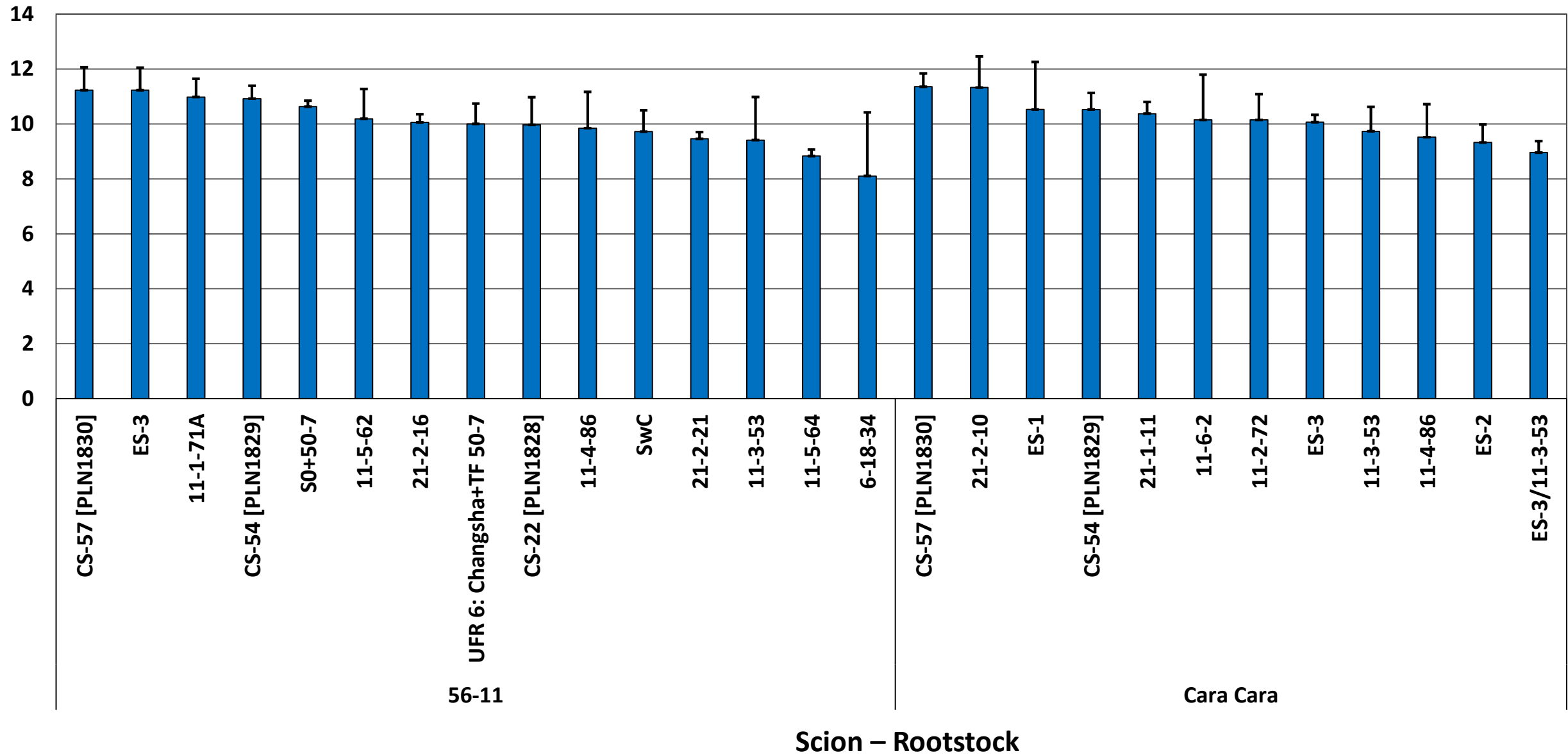
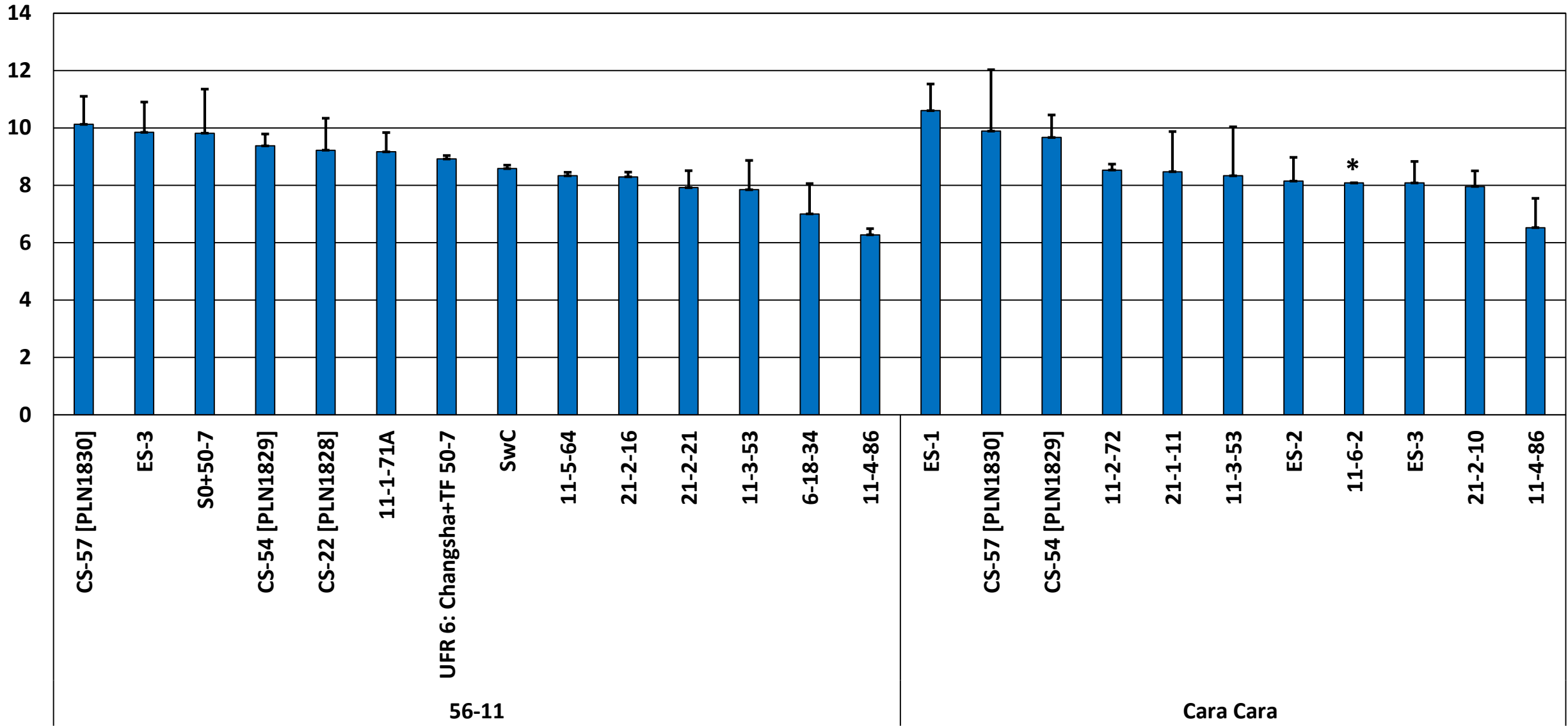


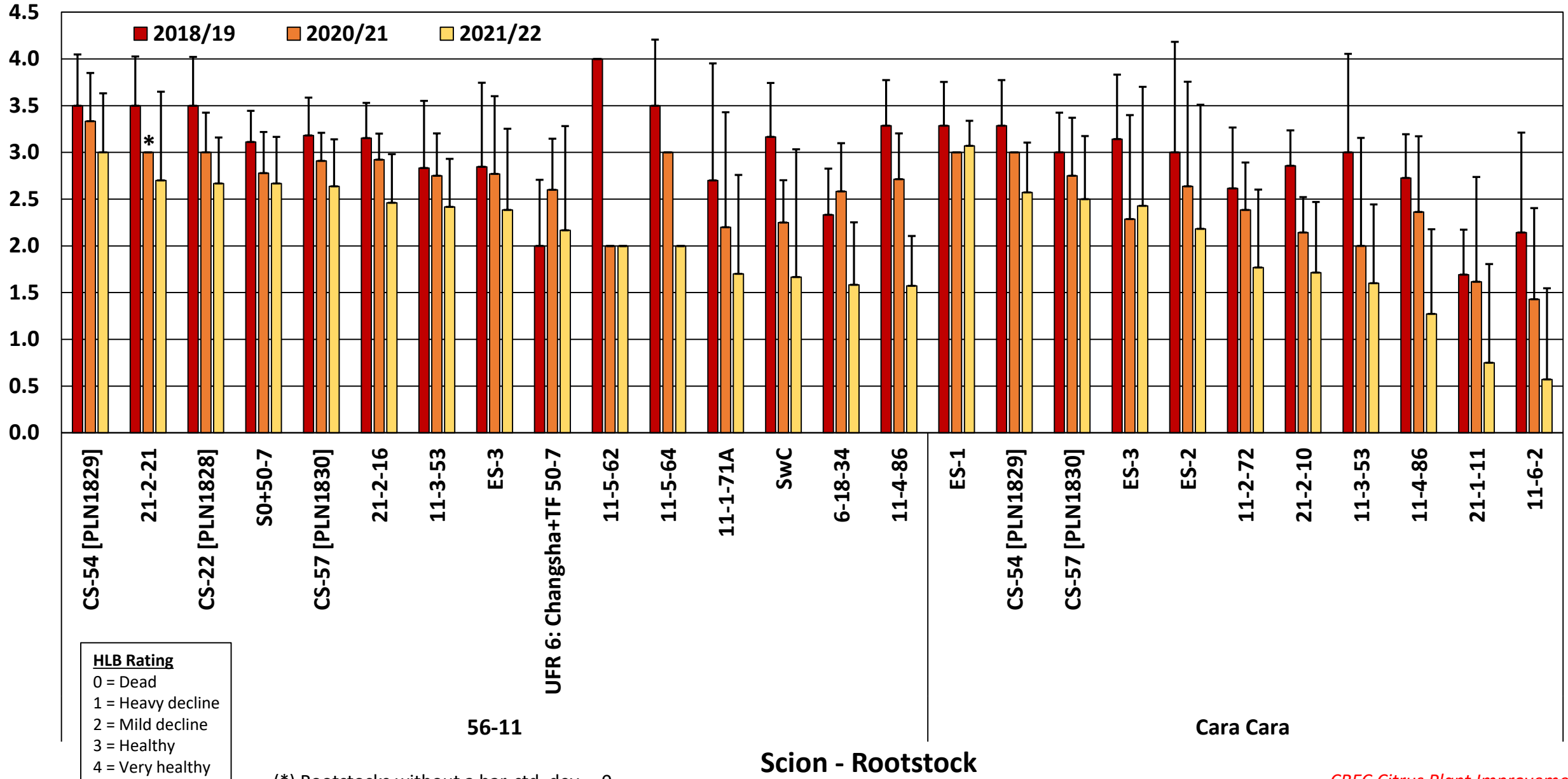
Fig. 21. Vero Beach rootstock trial – Navel orange, tree size, ft., mean + std. dev. [July/21].



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

Scion - Rootstock

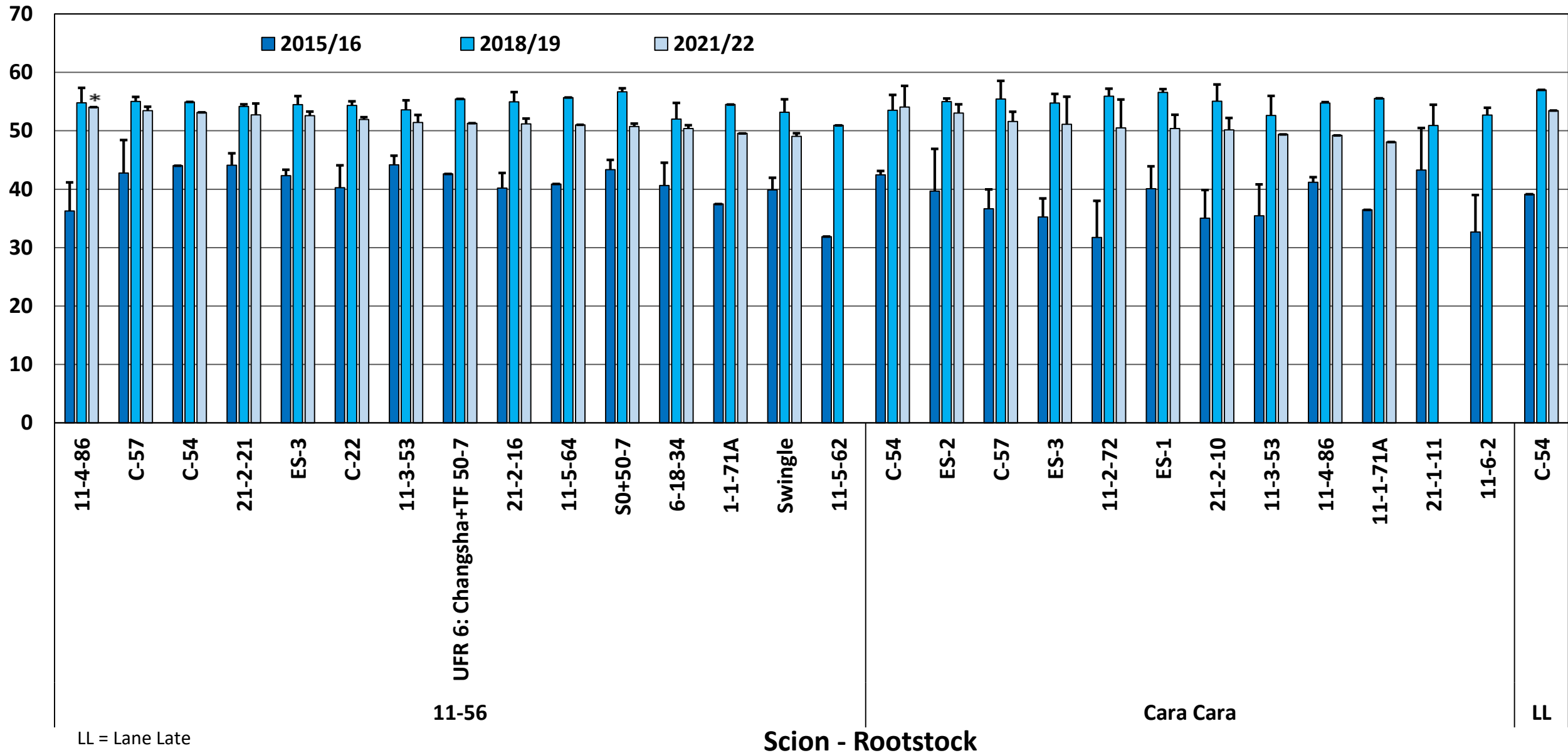
Fig. 22. Vero Beach rootstock trial – Navel orange, HLB rating, mean + std. dev. [October/18, October/20 & December/21].



Scion - Rootstock

Cara Cara

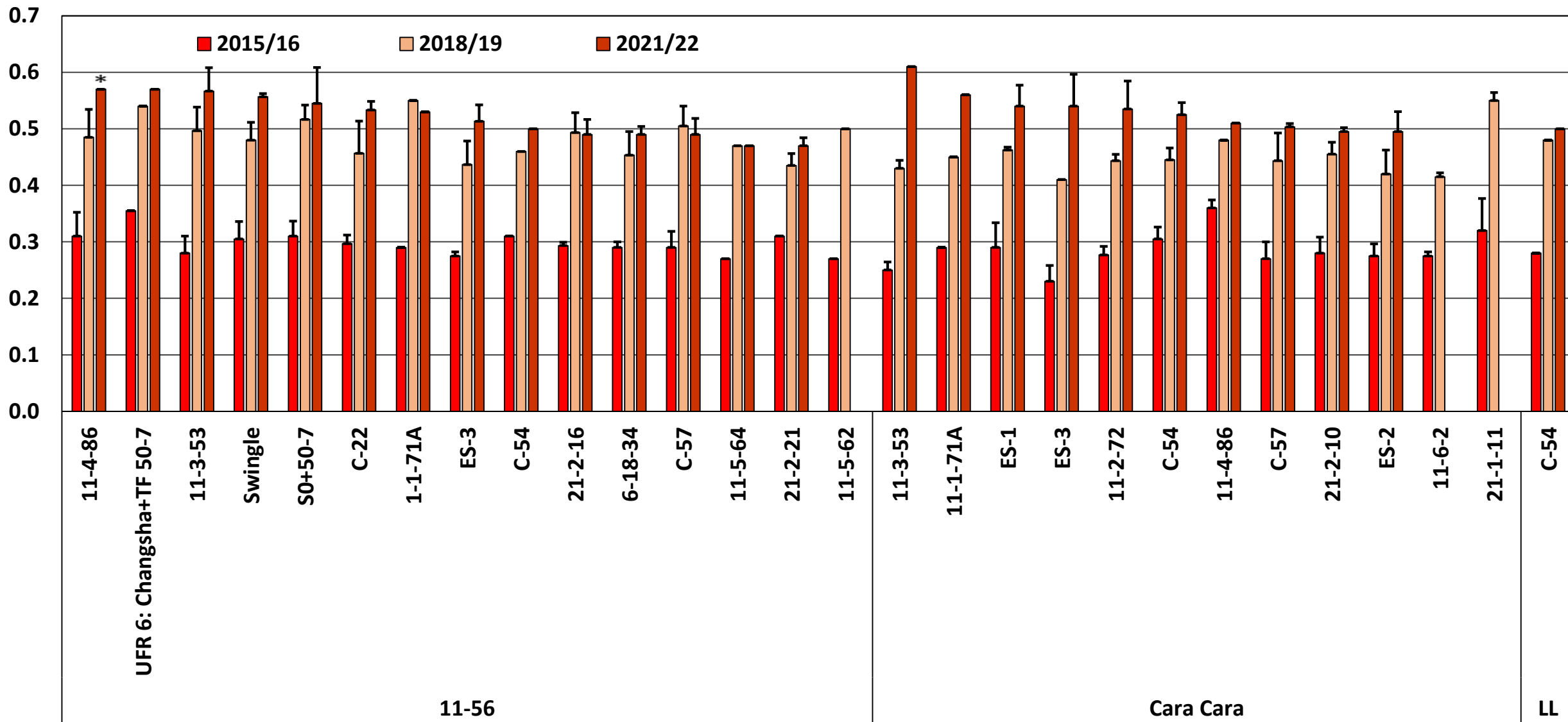
Fig. 23. Vero Beach rootstock trial – Navel orange, % juice, mean + std. dev. [December/15, November/18 & October/21].



LL = Lane Late

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

Fig. 24. Vero Beach rootstock trial – Navel orange, juice acid, mean + std. dev. [December/15, November/18 & October/21].

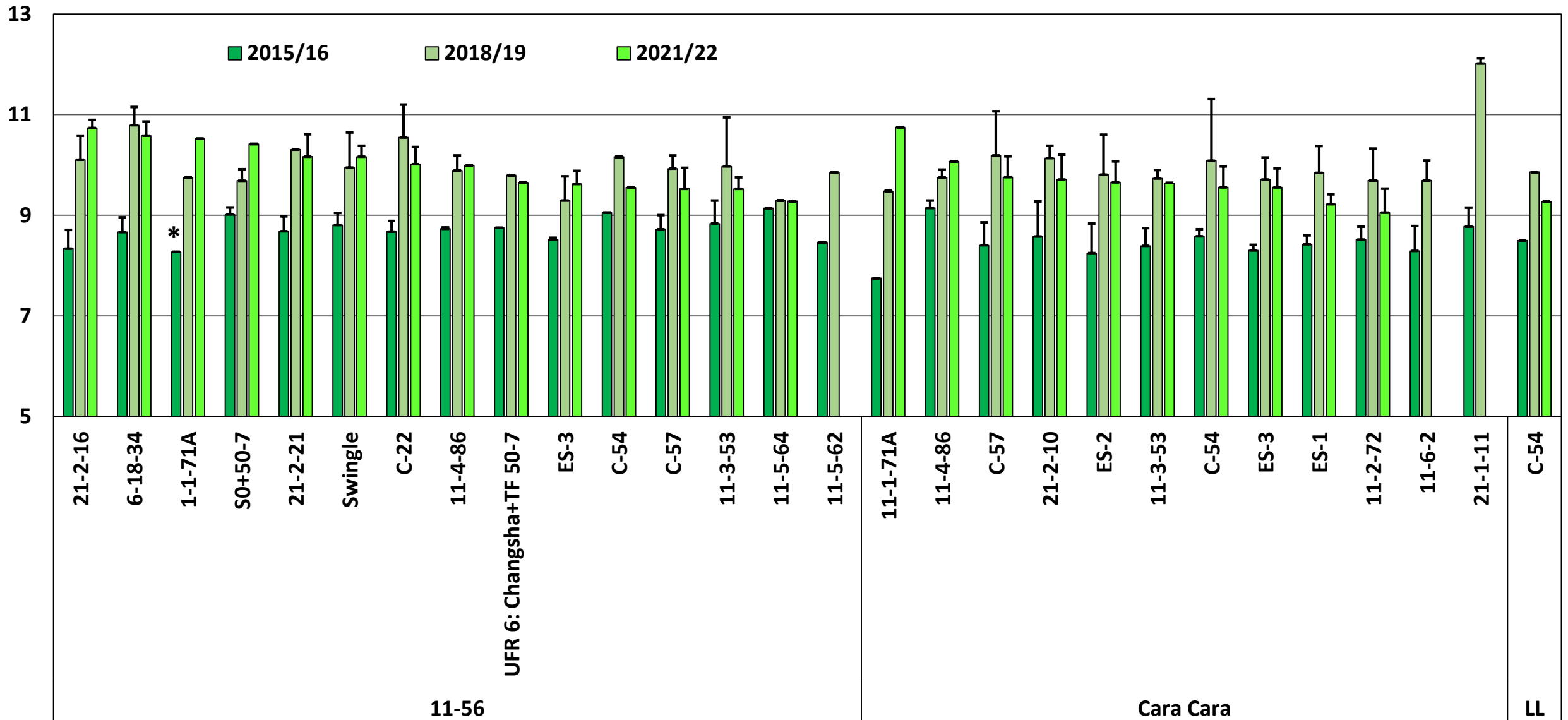


LL = Lane Late

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

Scion - Rootstock

Fig. 25. Vero Beach rootstock trial – Navel orange, Brix, mean + std. dev. [December/15, November/18 & October/21].



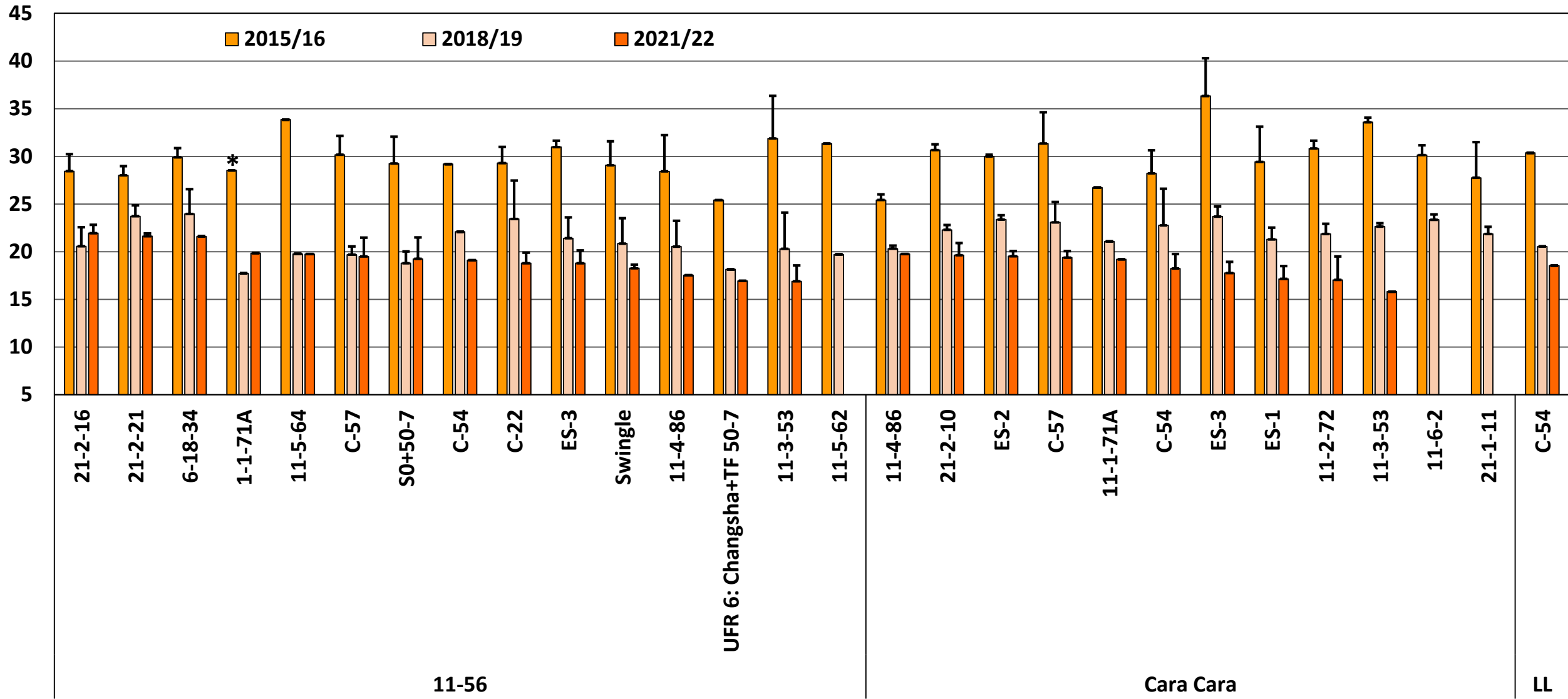
LL = Lane Late

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

Scion - Rootstock

CREC Citrus Plant Improvement

Fig. 26. Vero Beach rootstock trial – Navel orange, juice ratio, mean + std. dev. [December/15, November/18 & October/21].



LL = Lane Late

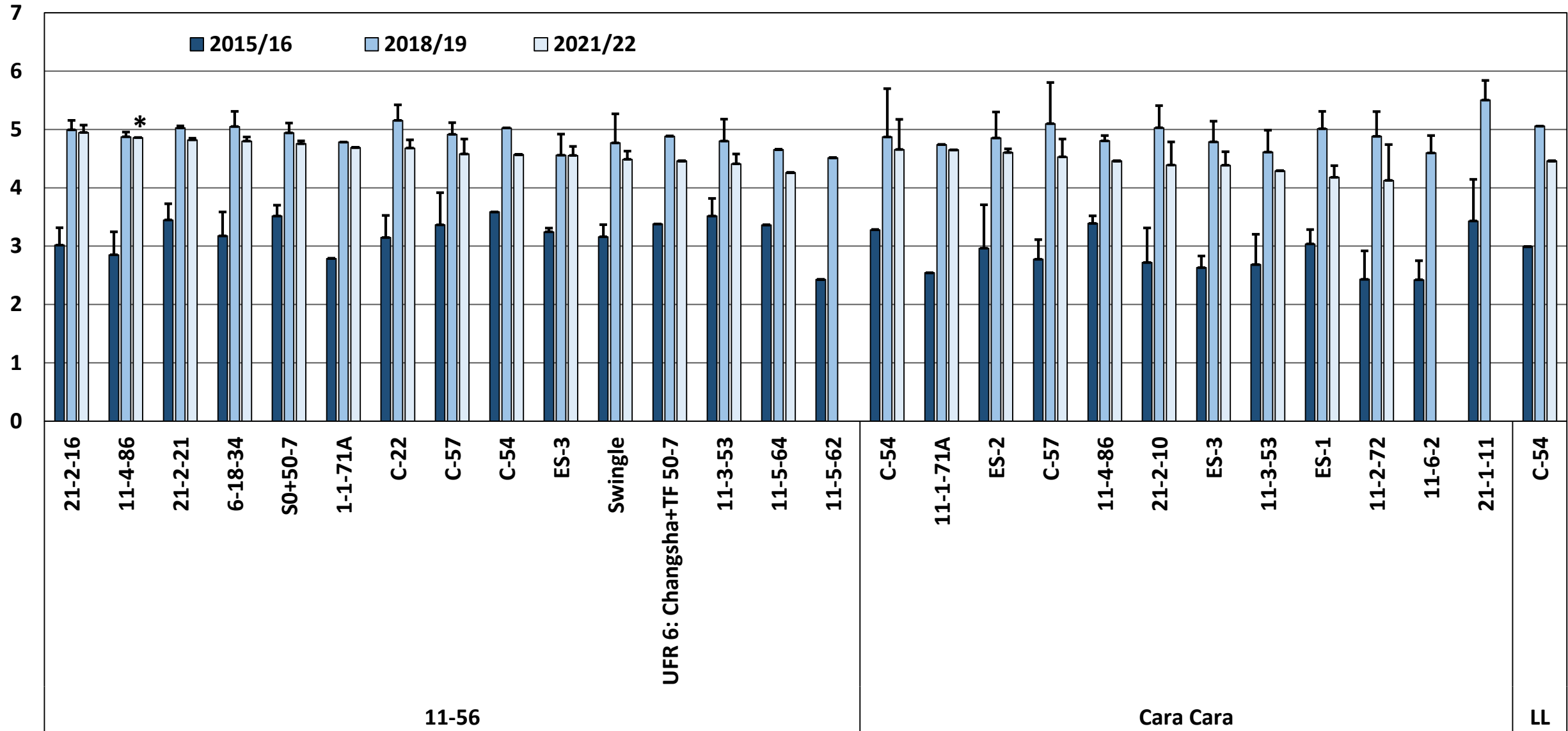
(*) Rootstocks without a bar, std. dev. = 0

Scion - Rootstock

Cara Cara

LL

Fig. 27. Vero Beach rootstock trial – Navel orange PS/box, mean + std. dev. [December/15, November/18 & October/21].

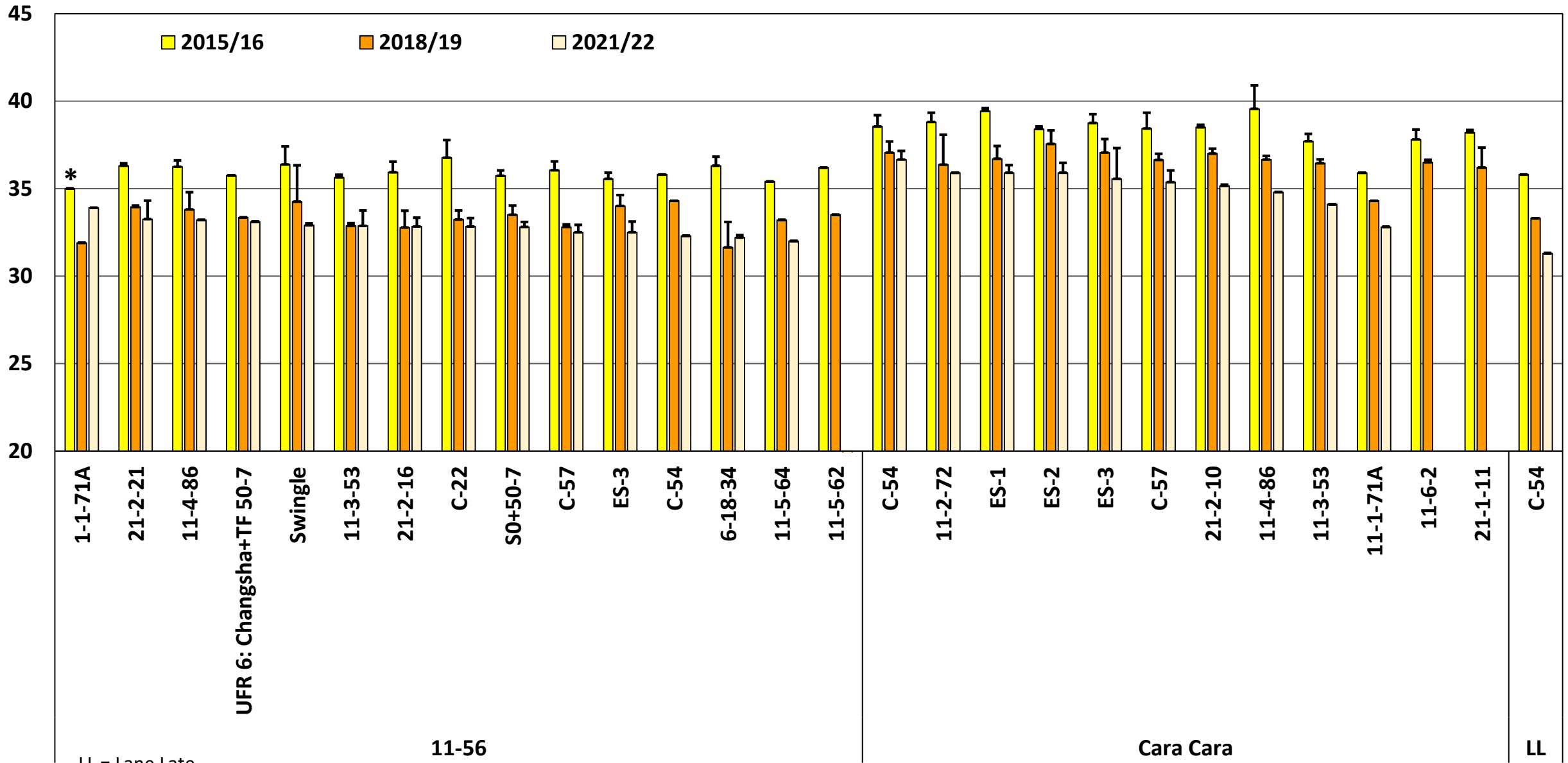


LL = Lane Late

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

Scion - Rootstock

Fig. 28. Vero Beach rootstock trial – Navel orange juice color, mean + std. dev. [December/15, November/18 & October/21].



LL = Lane Late

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

Scion - Rootstock

Cara Cara

LL