

Valencia Advanced Production System [APS] Rootstock Trial, LaBelle

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

March 29, 2021 - updated
November 18, 2020 - updated
November 22, 2019 - updated
September 6, 2019 - posted
CREC Citrus Plant Improvement



Valencia APS Rootstock Trial, LaBelle - Description

To evaluate rootstock potential for higher density planting [10 x 20 ft.; 218 trees/acre], Valencia trees on 31 rootstocks were established in the cooperator's old field nursery site in the flatwoods west of Highway 29, south of LaBelle. The site was first surrounded with a windbreak combining Eucalyptus and red cedar plants, then a fertigation system operated via drip irrigation was installed. The Valencia trees were propagated onto rootstocks from California, Spain and the CREC. This trial is part of a larger set of trees involving Vernia and Valencia planted on US 897, C-35 or Swingle at either 8 x 15 feet or 10 x 20 feet.

Valencia APS Rootstock Trial, LaBelle - Summary

- Location: Felda, Hendry County
- Scion: Valencia
- Rootstocks: 31
- Date planted: November 2009 and March 2010
- Design: Randomized complete-block; 4-10 replications
 - Plot size: 4 trees
 - Spacing: 10 x 20 ft. = 218 trees/acre
 - Drip fertigation
- Data:
 - 2012/13: Yield [pounds fruit/tree]
 - 2013/14: Yield [boxes/tree], juice quality, PS/acre
 - 2014/15: Yield [boxes/tree]
 - 2015/16: Yield [boxes/tree], juice quality, PS/acre
 - 2017/18: Yield [boxes/tree]
 - 2018/19: Yield [boxes/tree], HLB rating, juice quality, PS/acre
 - 2019/20: Yield [boxes/tree], HLB rating
 - 2020/21: Yield [boxes/tree], HLB rating, juice quality, PS/acre
 - 7-year cumulative yield [boxes/tree]
 - 4-year cumulative PS/acre
- Trial status: **ACTIVE**

Table 1. Valencia APS rootstock trial – List of rootstocks, parentage and number of trees.

| Rootstock | Parentage | Number of Trees |
|-------------------------|--|-----------------|
| 6-11-106 | Thong Dee pum. x Minneola | 16 |
| 62-109-1 | Sunki x Flying Dragon trifoliolate | 11 |
| 62-137-2 | Shekwasha x English trifoliolate | 8 |
| 6-5-56 | Nakon pum x Page | 12 |
| 6-6-29 | Nakon x Page | 14 |
| B11 R1 T37 | Ridge Pineapple x Flying Dragon | 9 |
| B11 R4 T9 | Flying Dragon x Obovoidea | 12 |
| B11 R5 T25 | Flying Dragon x Duncan | 11 |
| B11 R5 T36 | Flying Dragon x Duncan | 7 |
| B11 R5 T4 | Flying Dragon x Obovoidea | 19 |
| B11 R5 T6 | Flying Dragon x Obovoidea | 7 |
| B11 R5 T62 | Flying Dragon x Ridge Pineapple | 6 |
| B21 R2 T21 | DPI Flying Dragon x LB 1-21 | 7 |
| B21 R4 T25 | DPI Flying Dragon x LB 1-21 | 14 |
| C-146 [PLN1831] | Sunki x Swingle TF | 7 |
| C-22 [PLN1828] | Sunki x Swingle TF | 8 |
| C-54 [PLN1829] | Sunki x Swingle TF | 12 |
| C-57 [PLN1830] | Sunki x Swingle TF | 16 |
| ES-2 | Cleo x Poncirus trifoliata (Spain) | 8 |
| ES-3 | Cleo x Poncirus trifoliata (Spain) | 8 |
| ES-9 | Cleo x Poncirus trifoliata (Spain) | 16 |
| ES-1 | Cleo x Poncirus trifoliata (Spain) | 8 |
| RB24-16 | Fiwicke Swt x FD TO | 5 |
| RB24-6 | Ruby Swt x Argentine TO | 18 |
| SO+50-7 | Sour orange + trifoliolate orange 50-7 | 22 |
| SR+SH99-18 | tetrazygs SO+Rangpur | 19 |
| UFR 2: Orange 4 | [Nova + HBPummelo] x [Cleopatra + Argentine trifoliolate orange] | 12 |
| UFR 4: Orange 19 | [Nova + HBPummelo] x [Cleopatra + Argentine trifoliolate orange] | 20 |
| UFR 6: Changsha+TF 50-7 | Changsha mandarin + trifoliolate orange 50-7 | 12 |
| US 897 | Cleo x TF | 33 |
| WGFT+50-7 | White grapefruit + trifoliolate orange | 36 |

Valencia APS Rootstock Trial, LaBelle - Interpretive Summary

This summary covers the period from the beginning of cropping to the 2020-21 season. The Valencia trees on 31 rootstocks were planted in November 2009 at 10 x 20 ft. in a replicated trial.

- **Yield** in the 2nd crop year ranged from 0.5 to 2.0 boxes/tree; in later years, yield ranged from 1.0 to 2.5 which probably represents tree cropping at a mature stage, i.e., canopy containment for the 10 x 20 ft. spacing. Maximum yield of 3.0 boxes/tree was obtained in the 2018-19 season when the trees were about 8 years old. Thereafter, 2 to 3 boxes/tree appeared to be a reliable, stable yield which @ 218 trees/acre is about 430-650 boxes/acre.
- **Cumulative yield** over 7 seasons ranged from 6 to 11 boxes/trees with trees on 7 rootstocks producing 9 or more boxes [Fig. 38].
- **Juice quality.** The outcomes were not greatly influenced by rootstock. Brix was usually around 8-12 and varied only 10-15% among the trees on 31 rootstocks. Typical PS/box were generally low, about 5-6. Because sampling took place between February and May in any given year, it was likely a factor exceeding the effect of rootstock on juice quality.

Valencia APS Rootstock Trial, LaBelle - Interpretive Summary cont'd

- **HLB visual symptoms** were rated in 3 seasons. The results were variable within rootstock, but the relationship among rootstocks was unchanged from season to season, i.e., the trees on those rootstocks that rated low [more HLB symptoms] remained in that position and likewise for those trees that rated high [Figs. 18, 27, 29].
- **Rootstocks** used in this trial with Valencia scion did not produce dramatic differences in the variables measured; nevertheless, considering primarily cumulative PS and cumulative yield, there were some consistencies suggesting the following rootstocks be evaluated further:
 - **UFR 4**
 - **11-5-6**
 - **6-6-29**
 - **RB 24-16**
 - **B11-R1-T37**

Fig. 1. Valencia APS rootstock trial – Mean yield [pounds fruit/tree, April 2013].

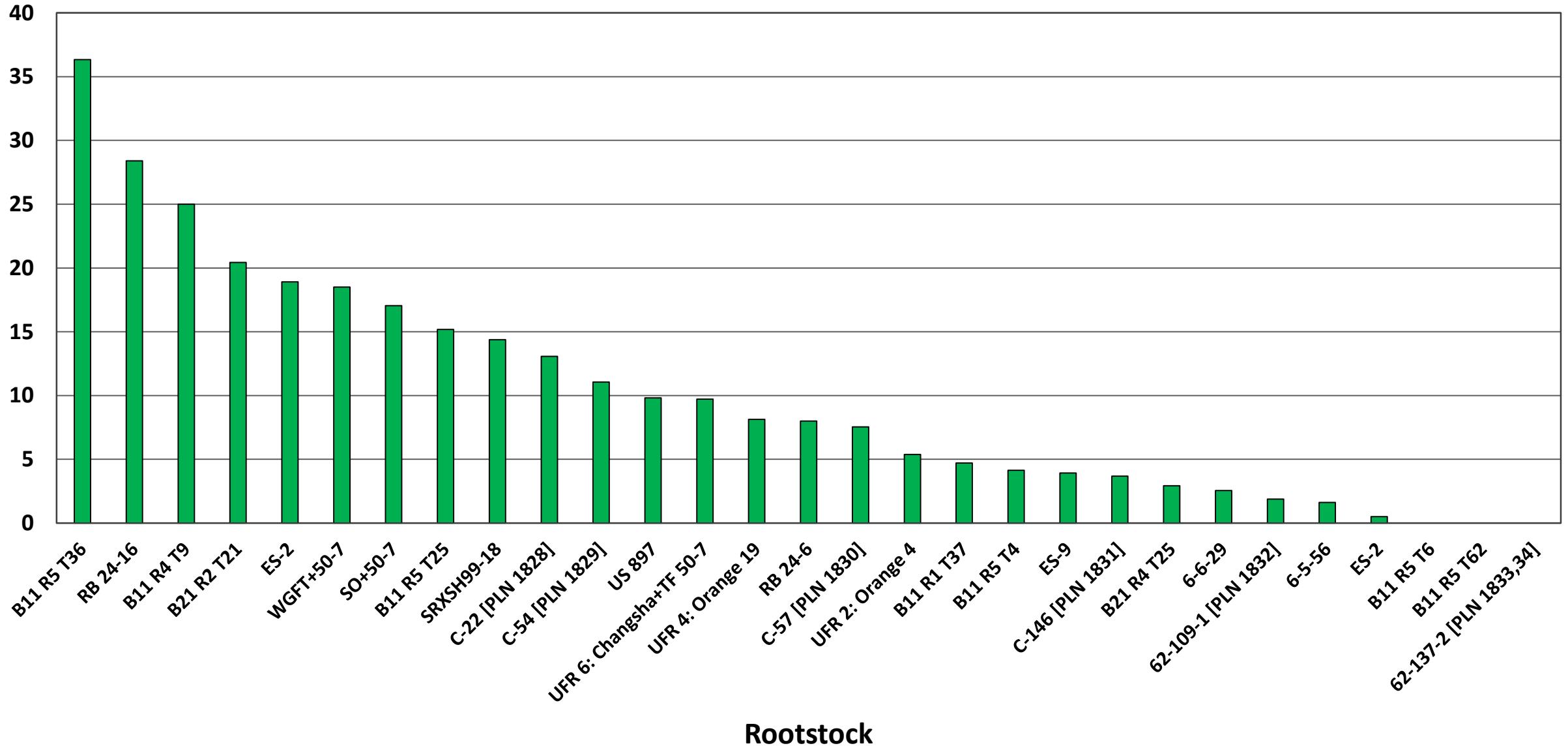


Fig. 2. Valencia APS rootstock trial – Yield: mean + std. dev. [boxes/tree, May 2014].

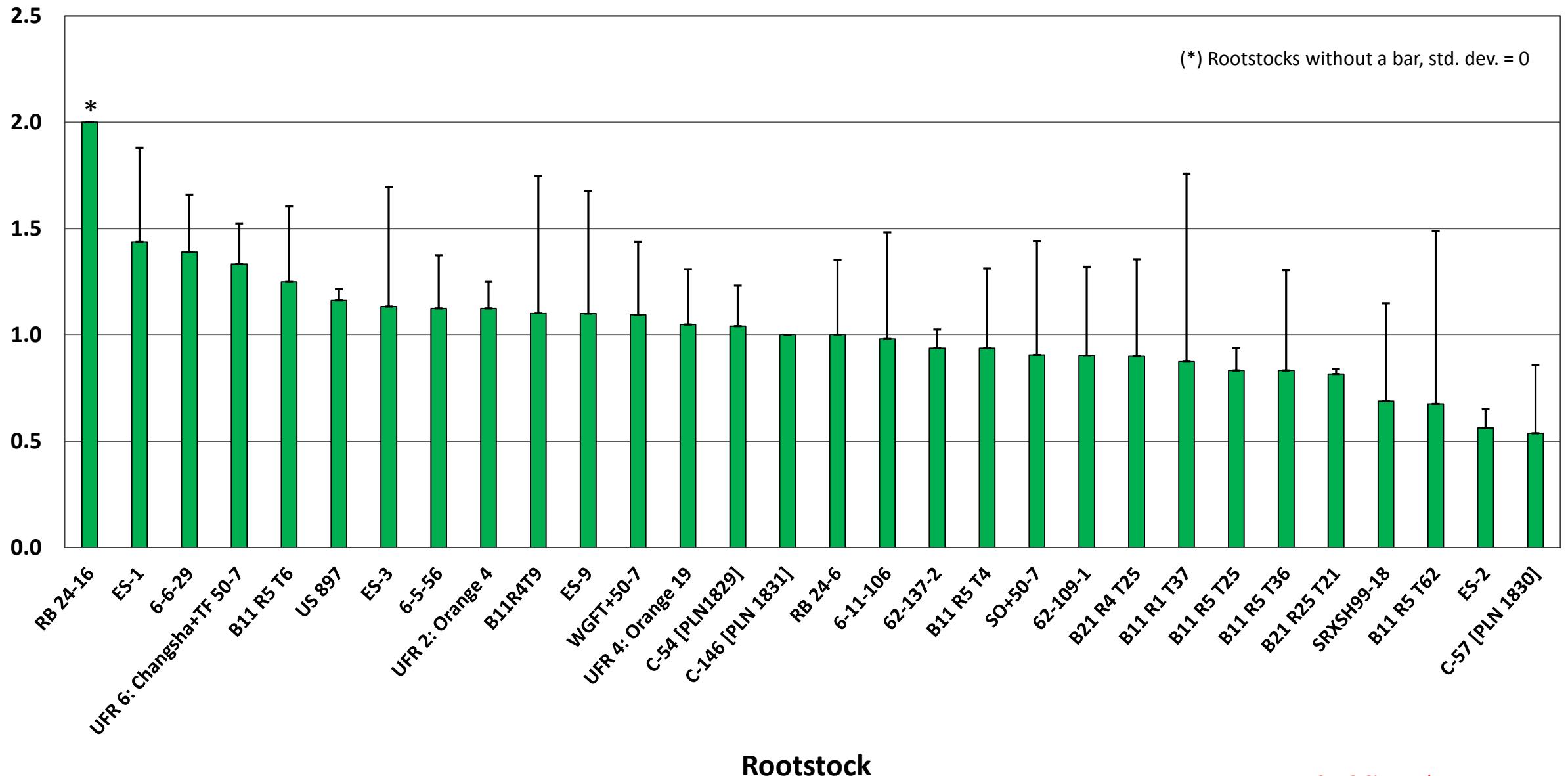
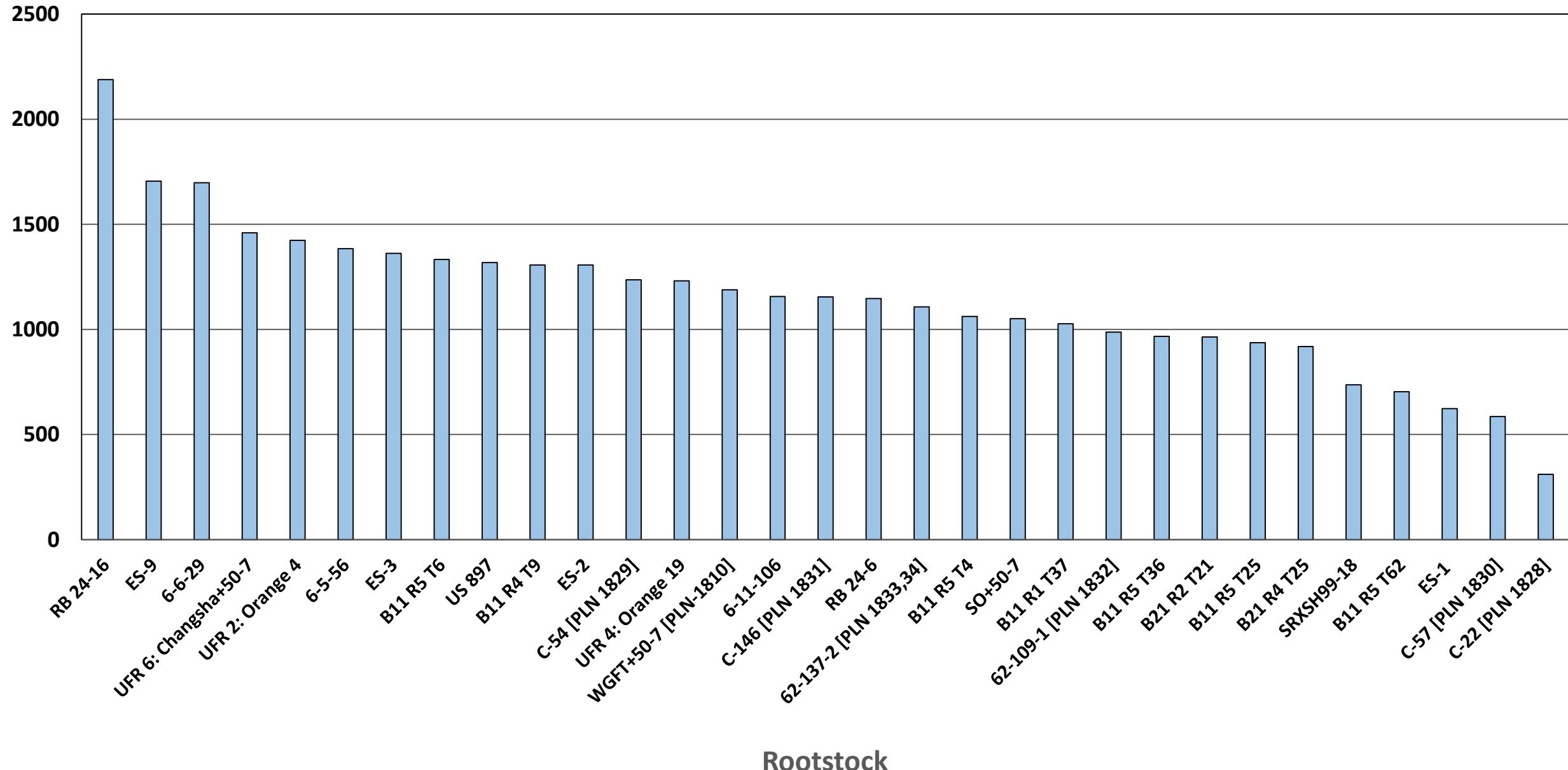
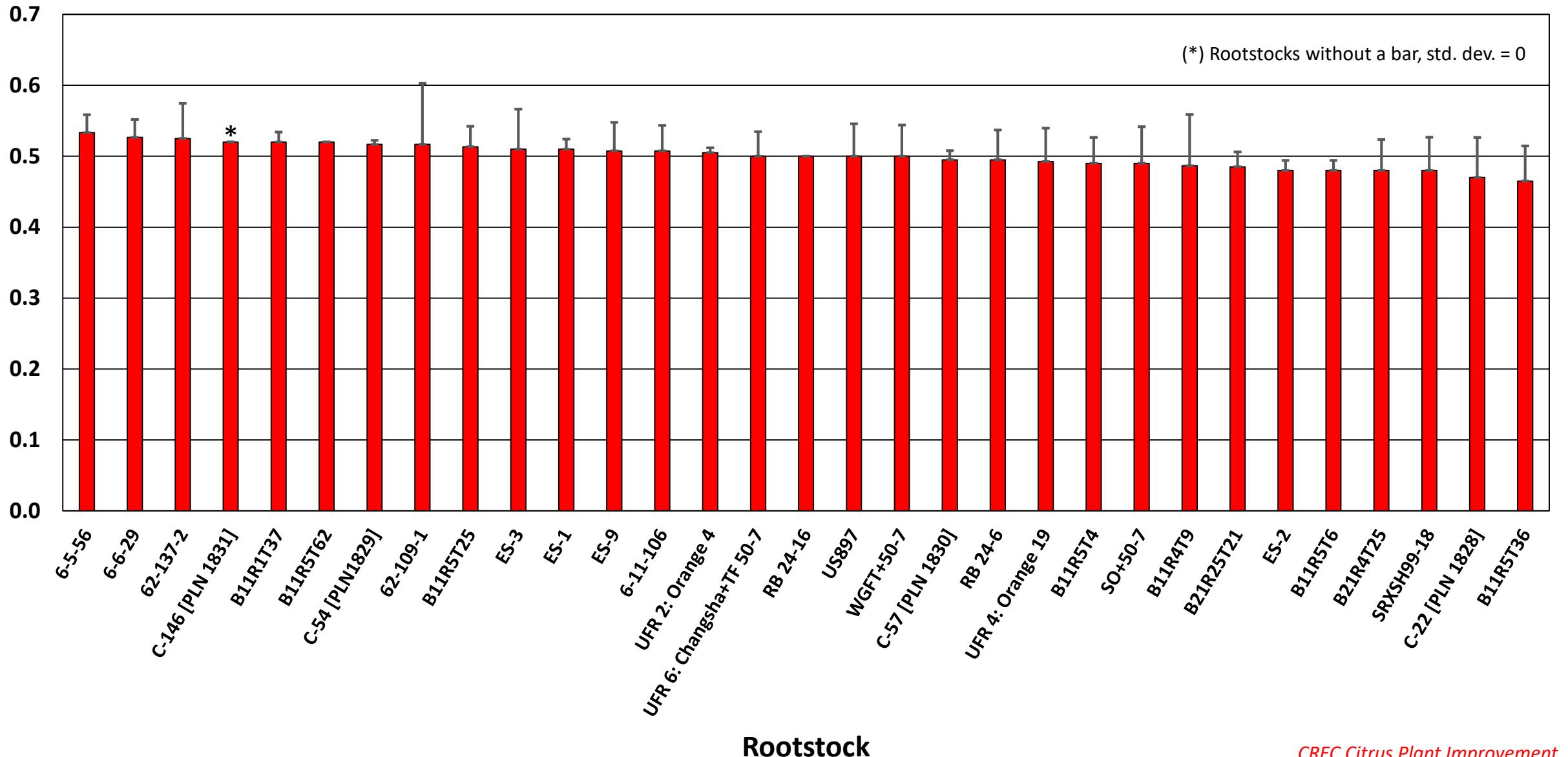


Fig. 3. Valencia Rootstock Trial – PS/acre [calculated @ 218 trees/acre, 10 x 20 ft., 2013/14].



Rootstock

Fig. 4. Valencia APS rootstock trial – juice Acid: mean + std. dev. [May 2014].



Rootstock

CREC Citrus Plant Improvement

Fig. 5. Valencia APS rootstock trial – juice Brix: mean + std. dev. [May 2014].

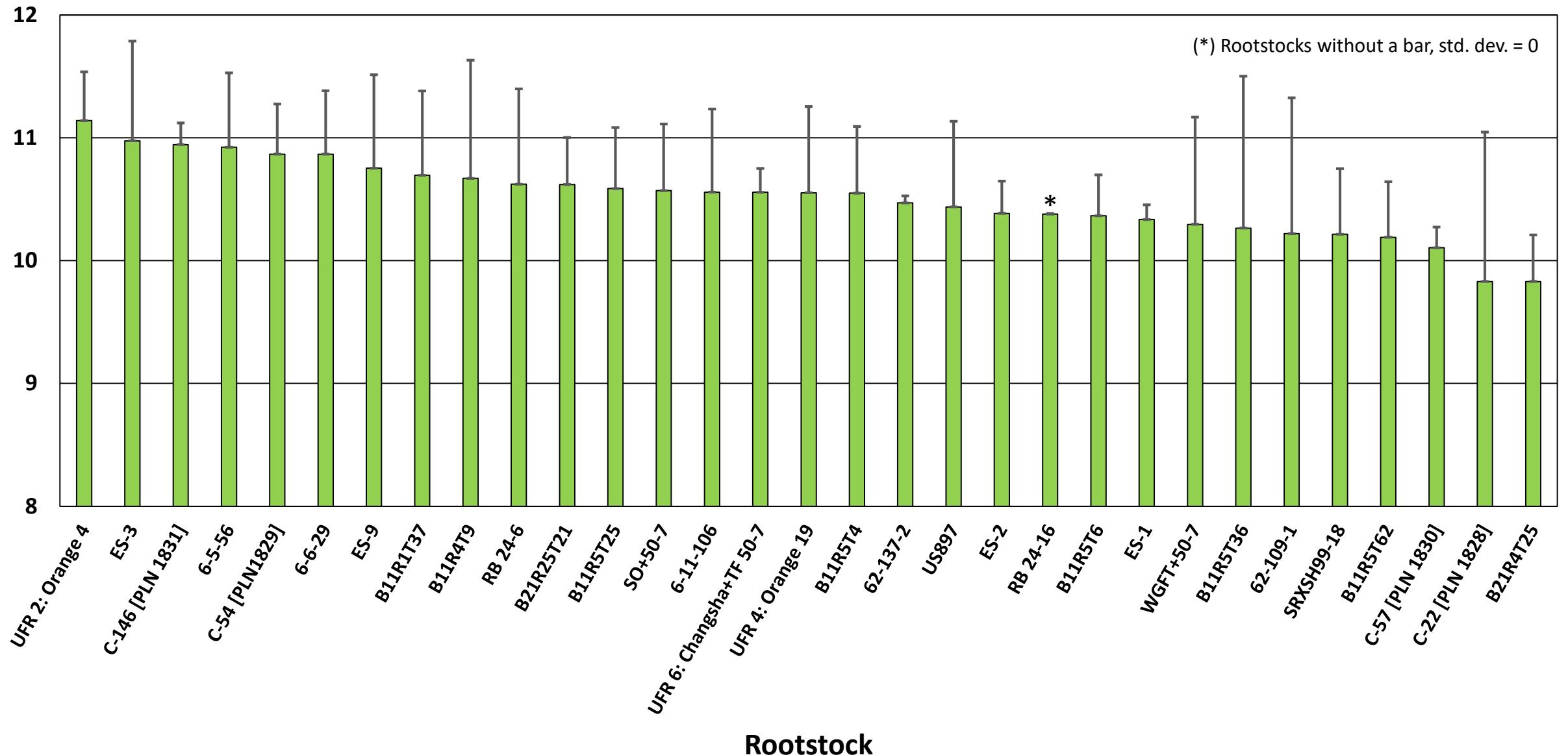


Fig. 6. Valencia APS rootstock trial – juice Ratio: mean + std. dev. [May 2014].

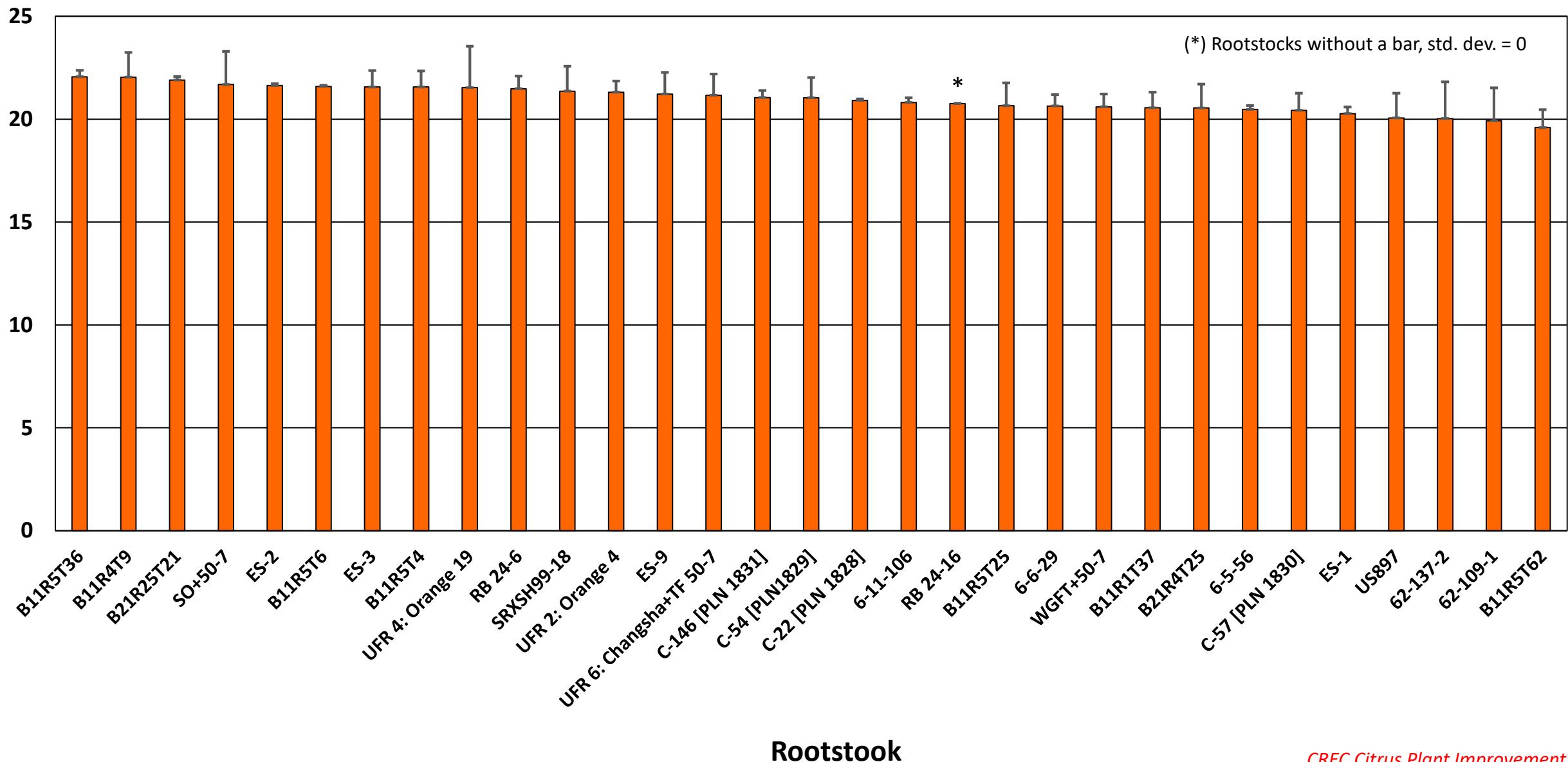


Fig. 7. Valencia APS rootstock trial – juice Color: mean + std. dev. [May 2014].

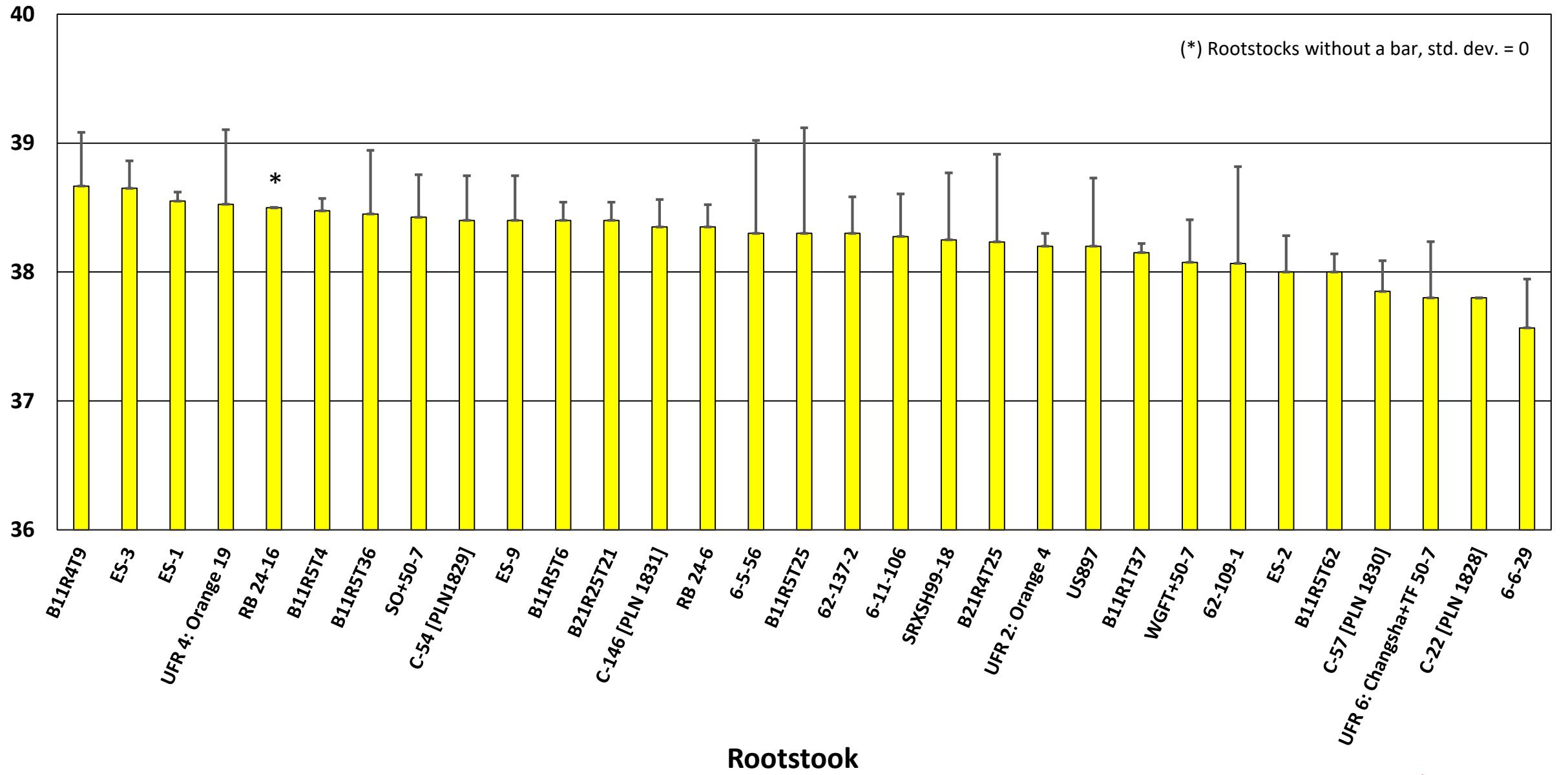


Fig. 8. Valencia APS rootstock trial – PS/box: mean + std. dev. [May 2014].

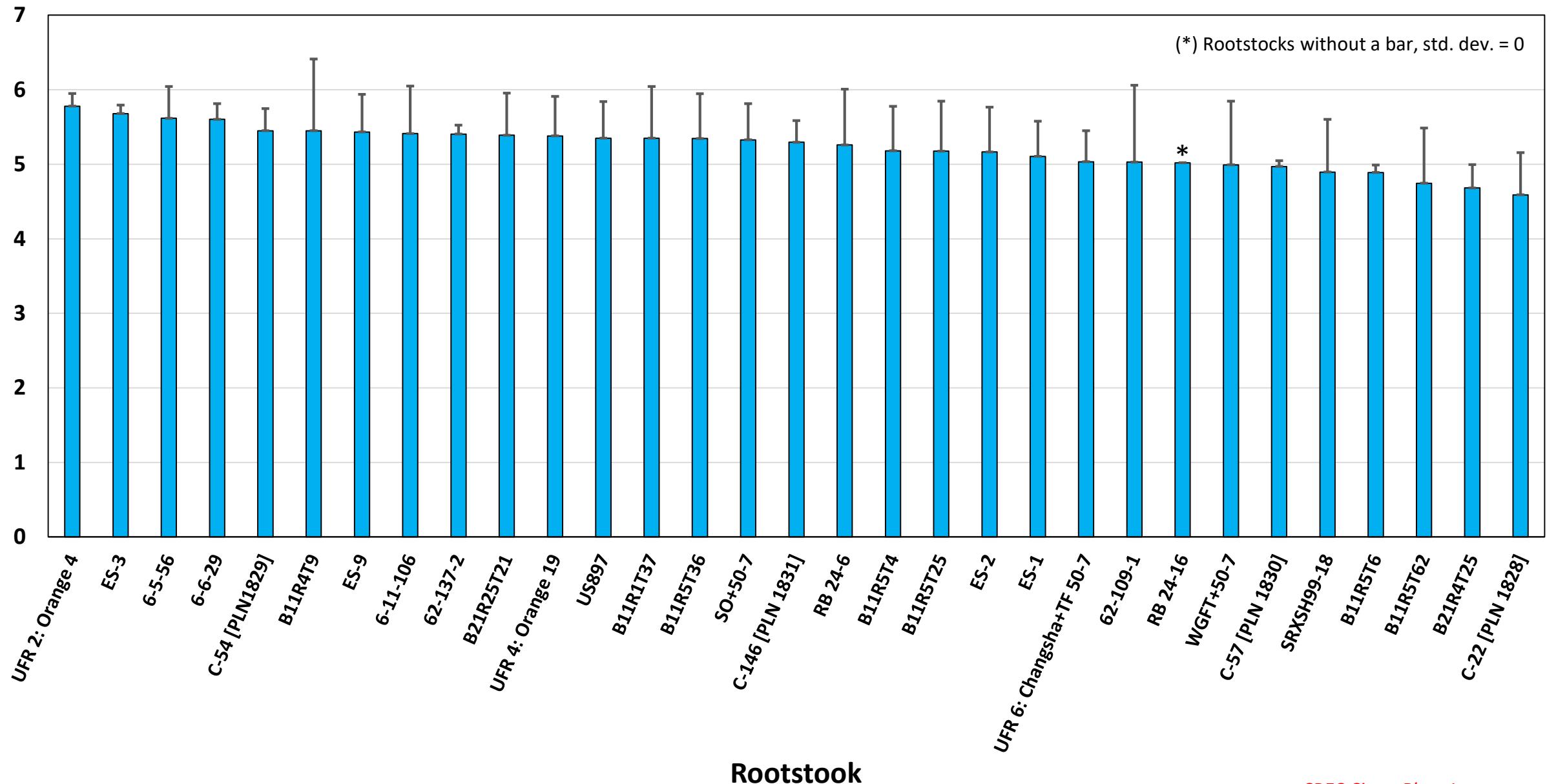
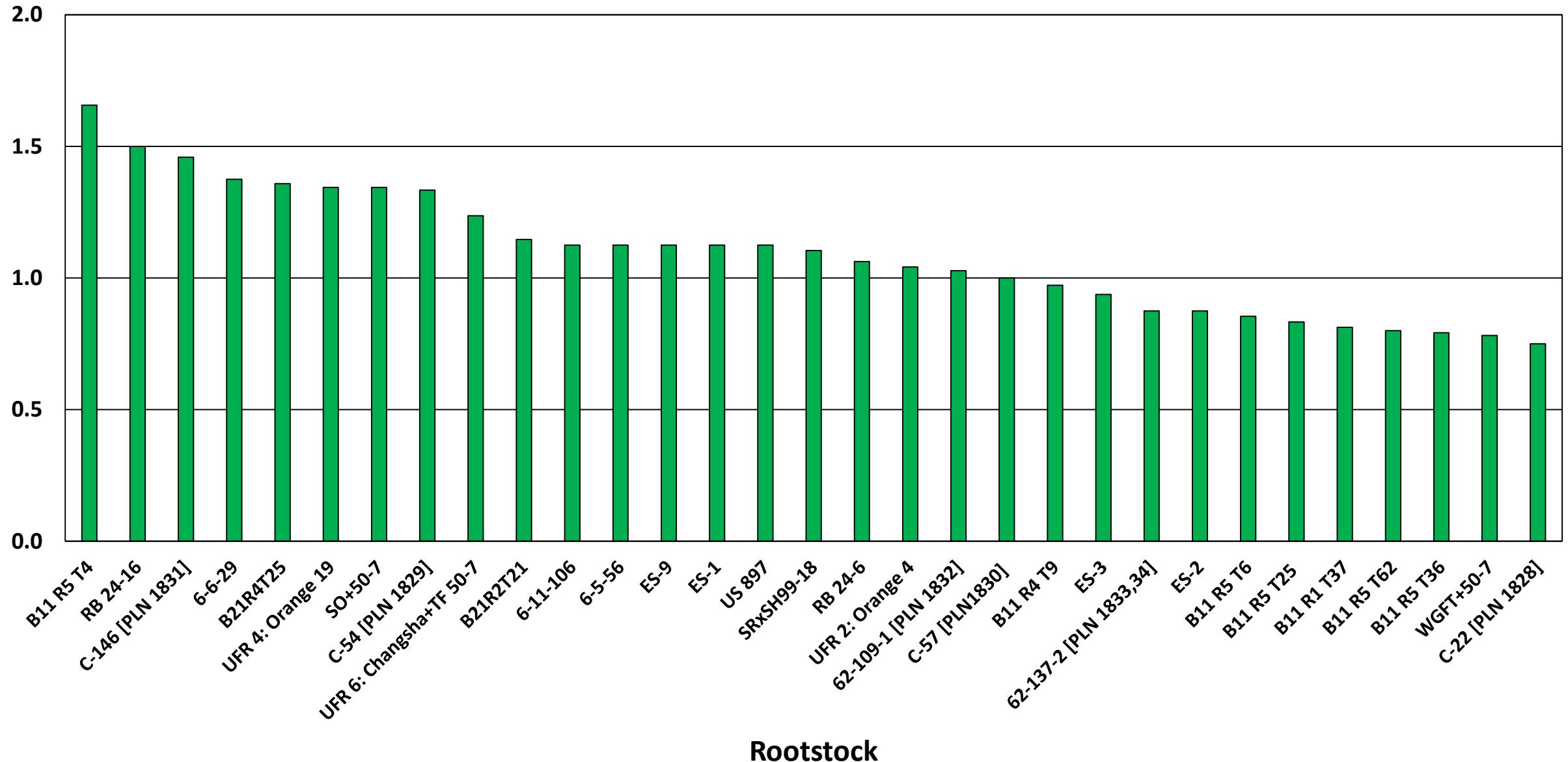


Fig. 9. Valencia APS rootstock trial – Yield: mean [boxes/tree, April 2015].



Rootstock

Fig. 10. Valencia APS rootstock trial – Yield: mean + std. dev. [boxes/tree, April 2016].

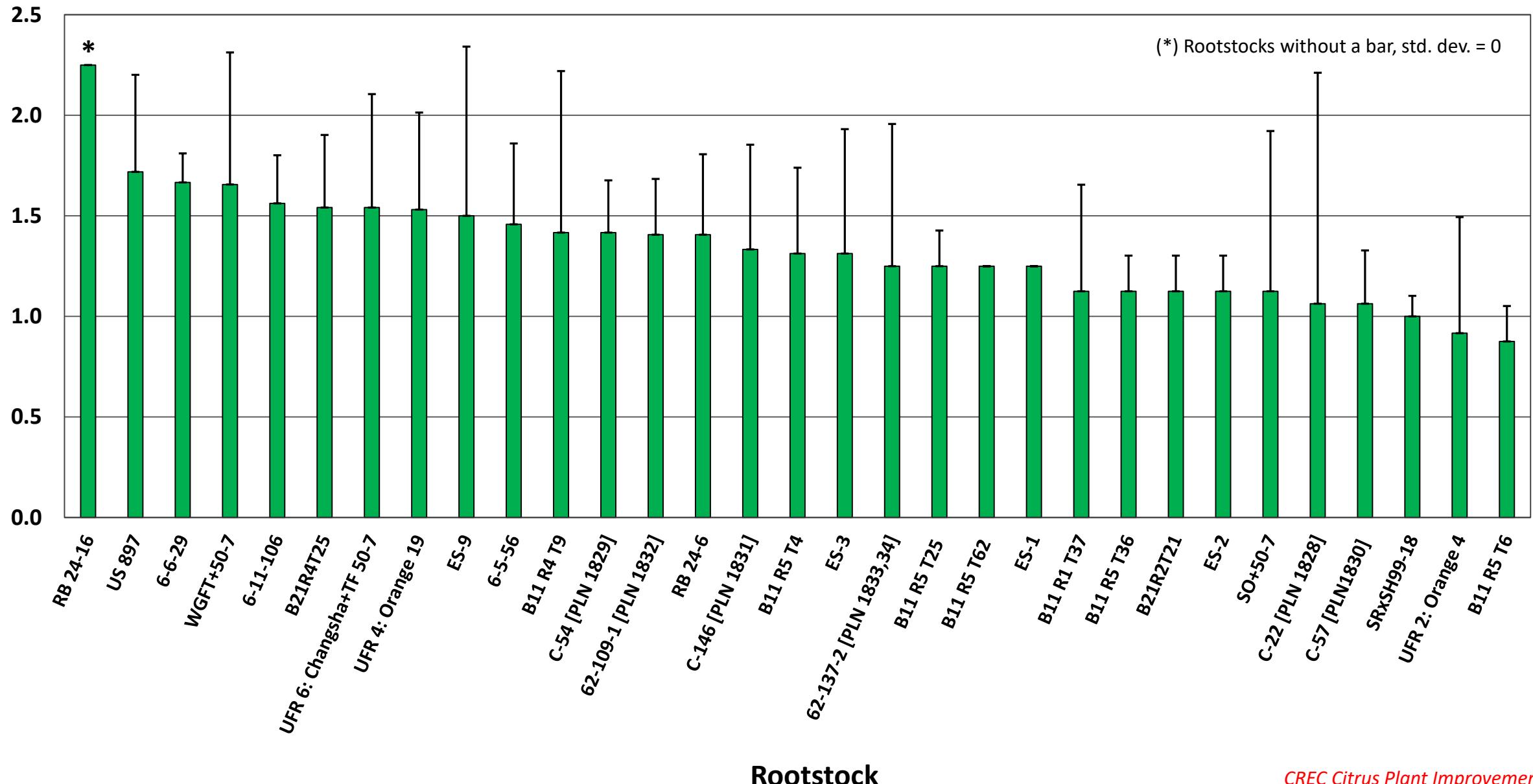


Fig. 11. Valencia Rootstock Trial – PS/acre [calculated @ 218 trees/acre, 10 x 20 ft., March 2016].

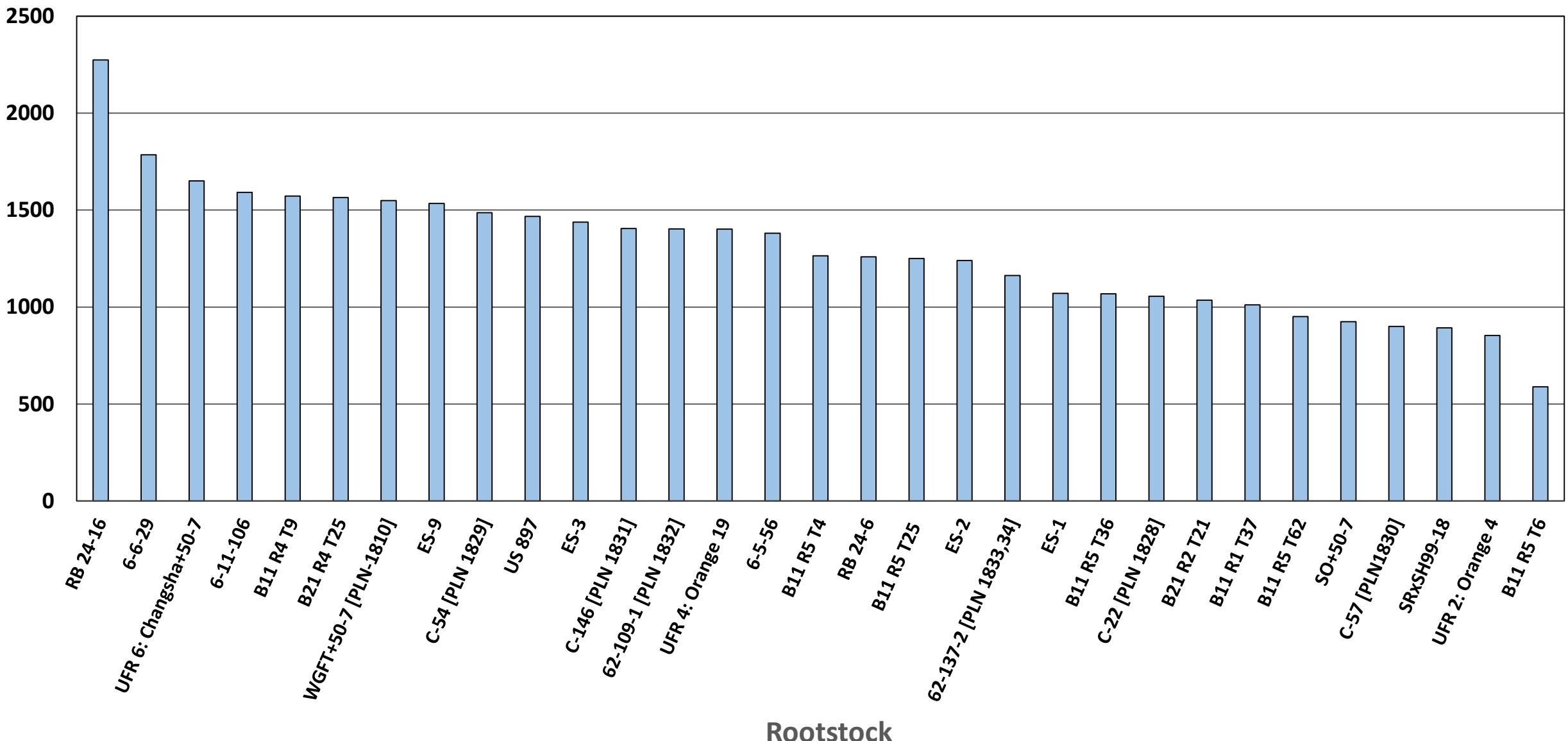


Fig. 12. Valencia APS rootstock trial – juice Acid: mean + std. dev. [March 2016].

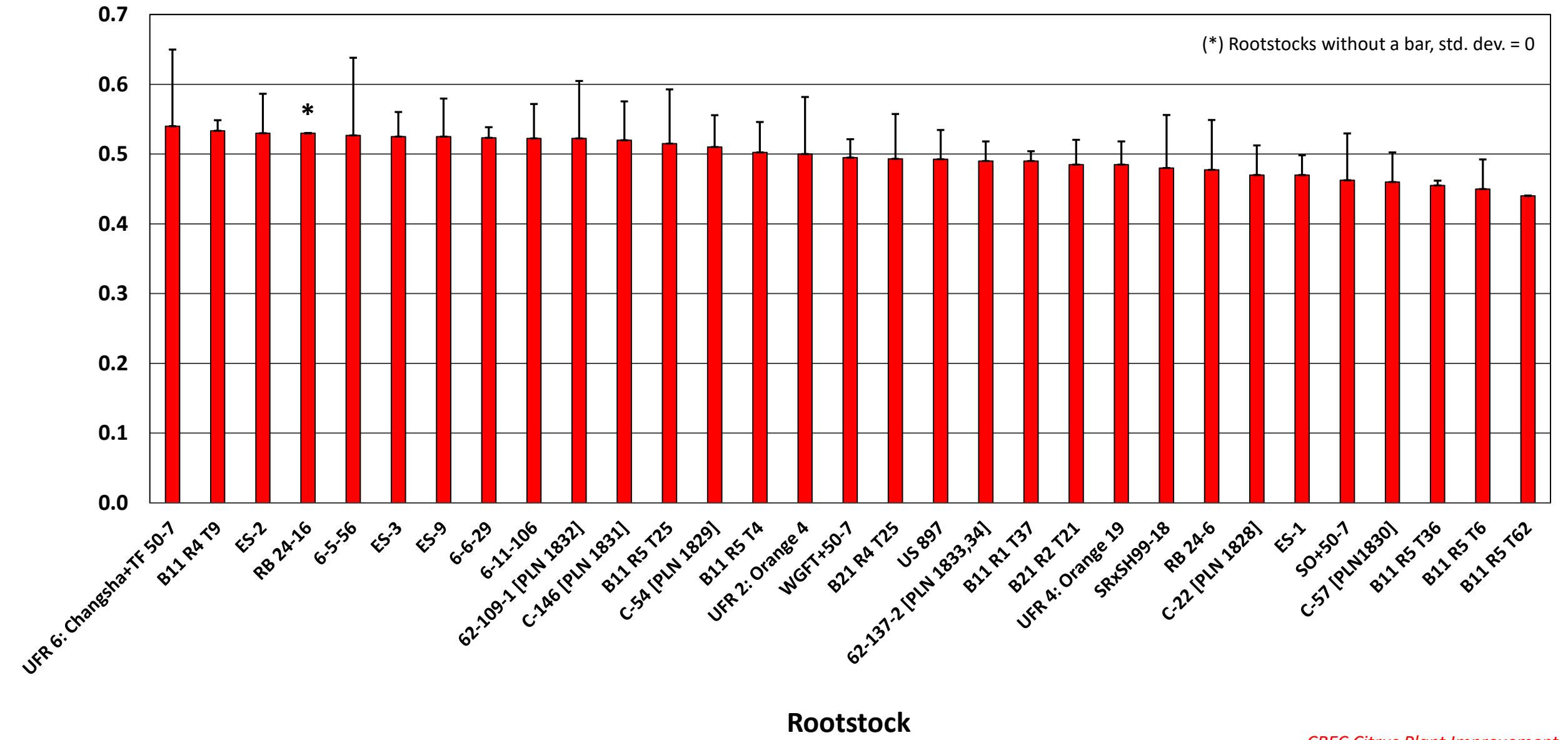


Fig. 13. Valencia APS rootstock trial – juice Brix: mean + std. dev. [March 2016].

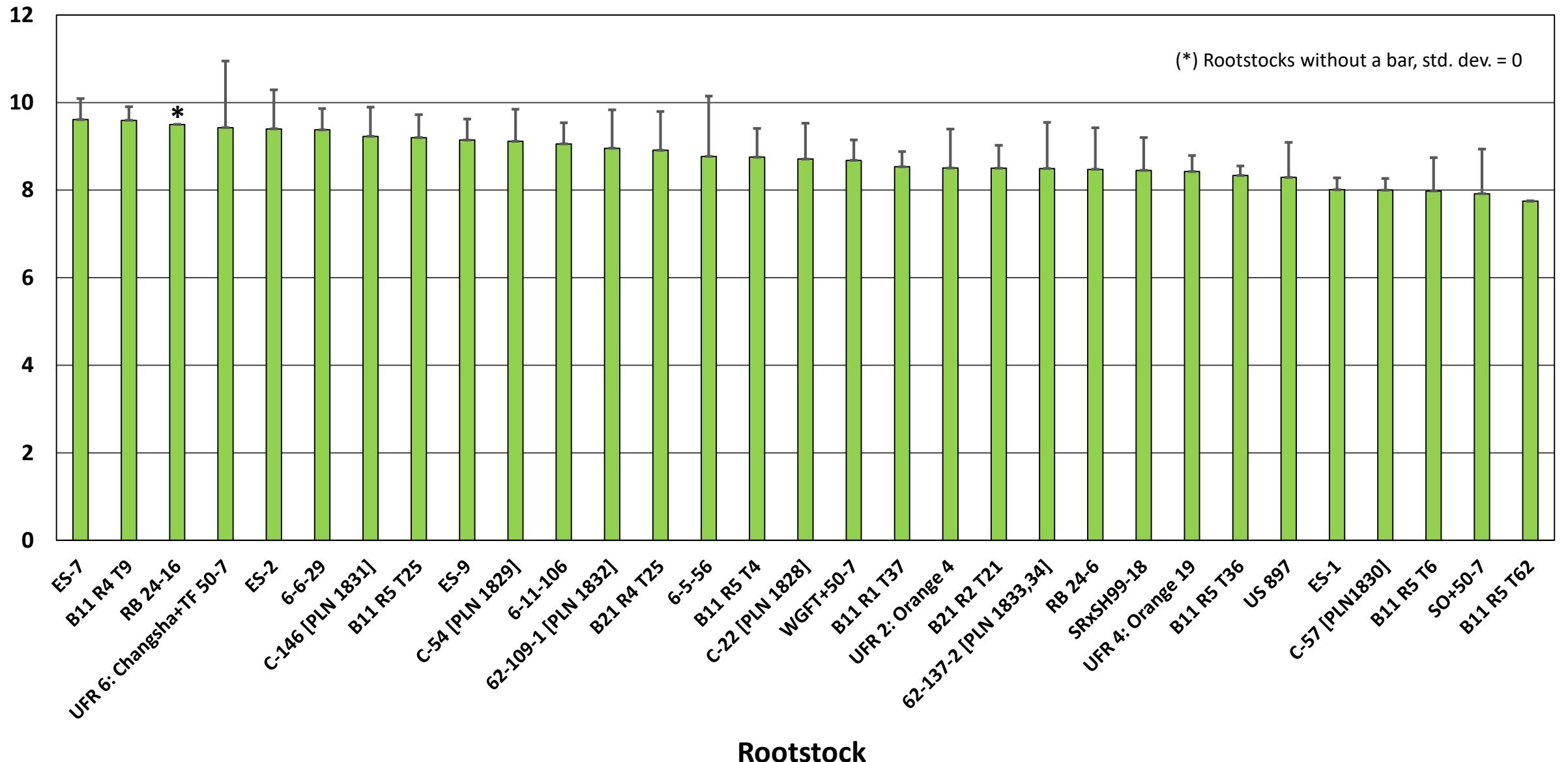
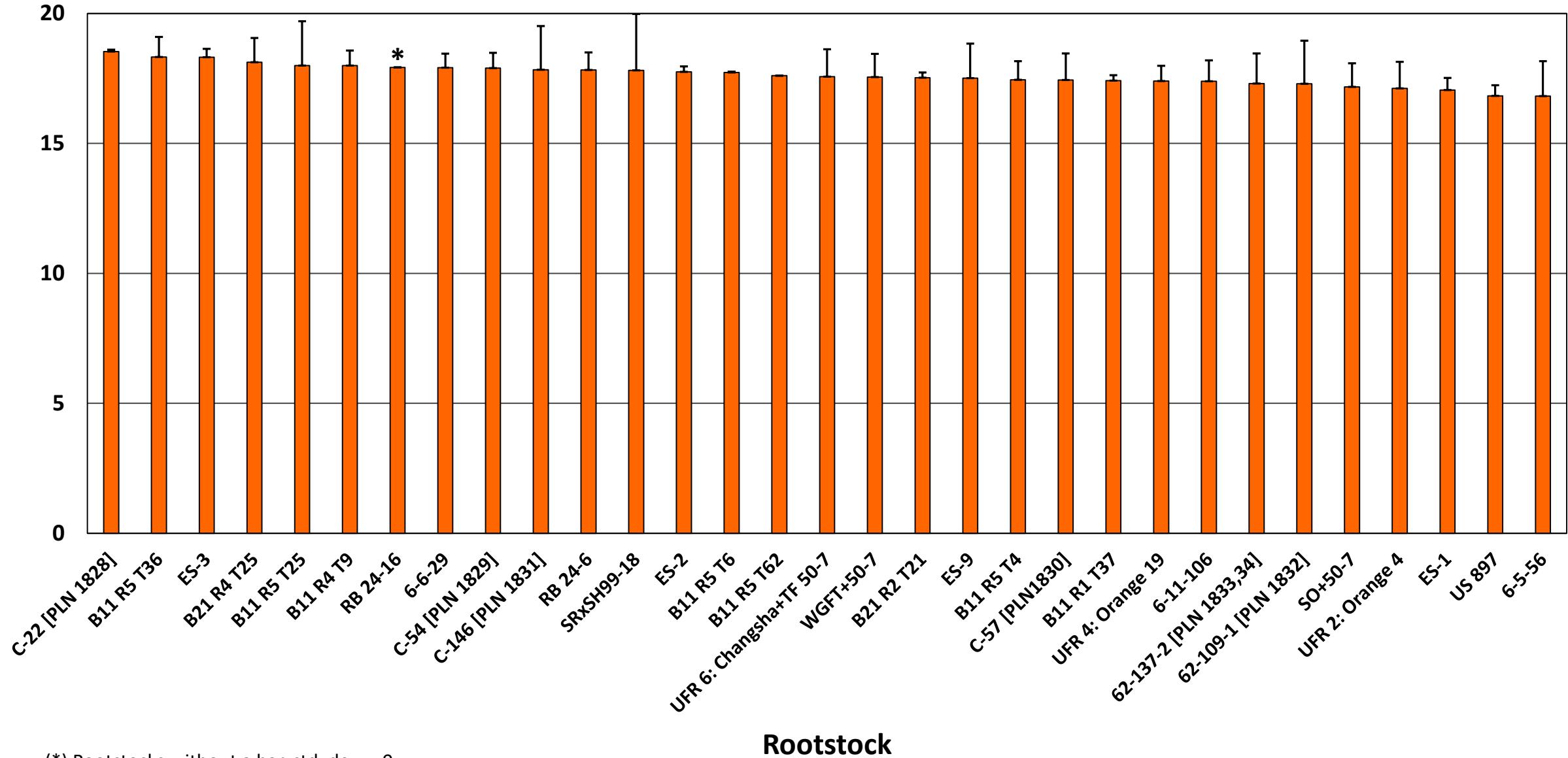


Fig. 14. Valencia APS rootstock trial – juice Ratio: mean + std. dev. [March 2016].



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

Fig. 15. Valencia APS rootstock trial – juice Color: mean + std. dev. [March 2016].

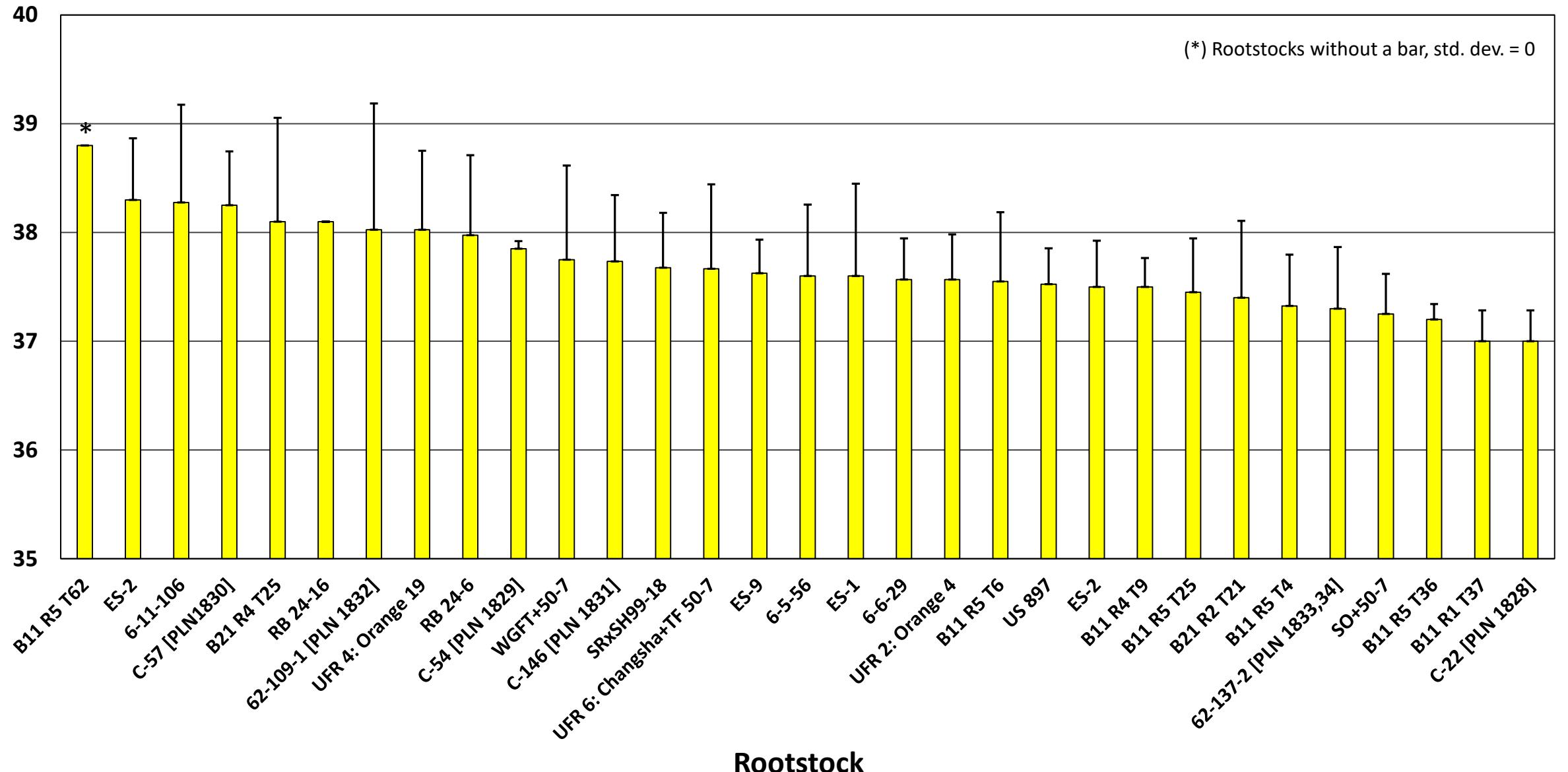


Fig. 16. Valencia APS rootstock trial – PS/box: mean + std. dev. [March 2016].

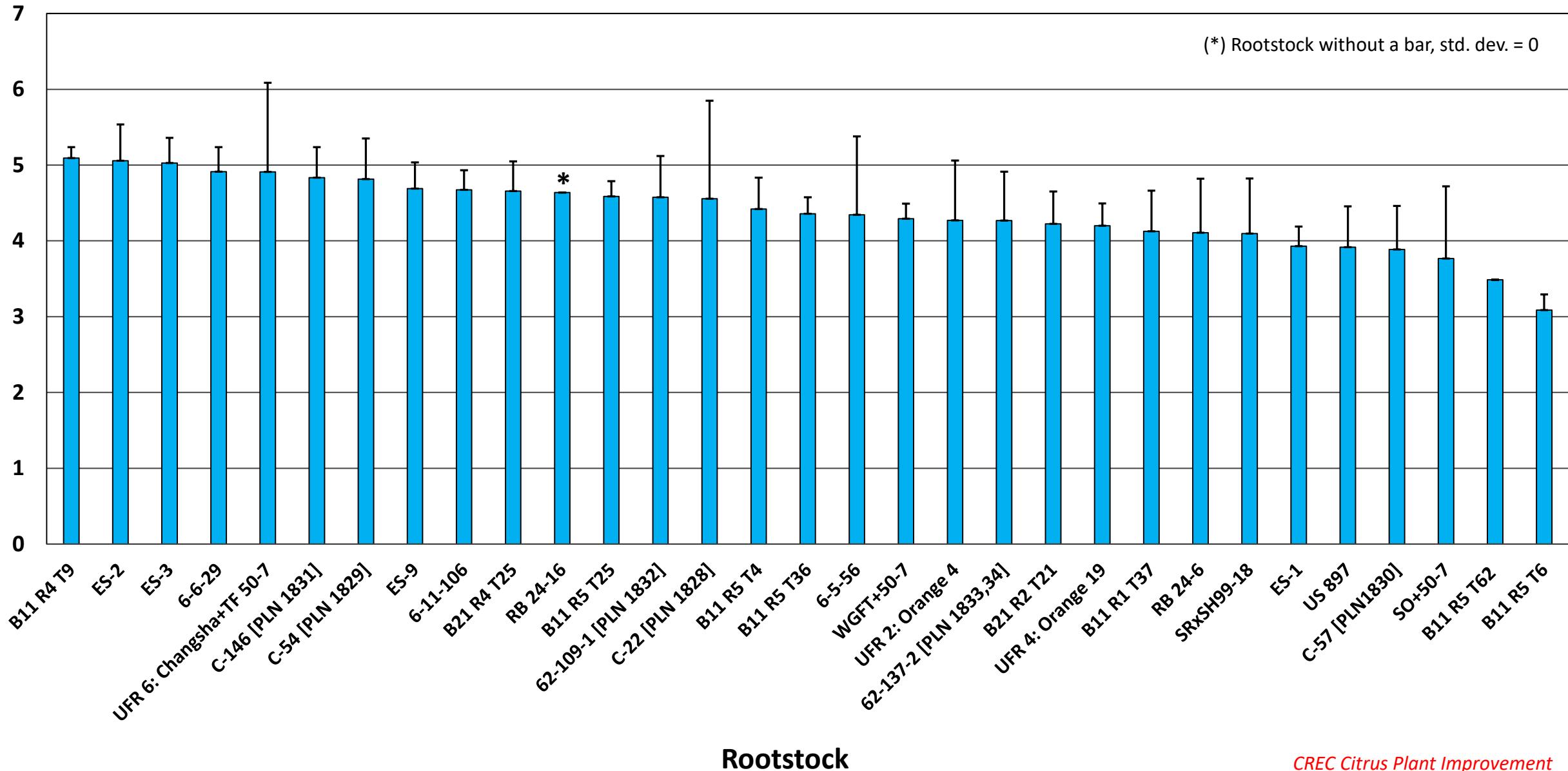


Fig. 17. Valencia APS rootstock trial – Yield: mean + std. dev., [boxes/tree, March 2018].

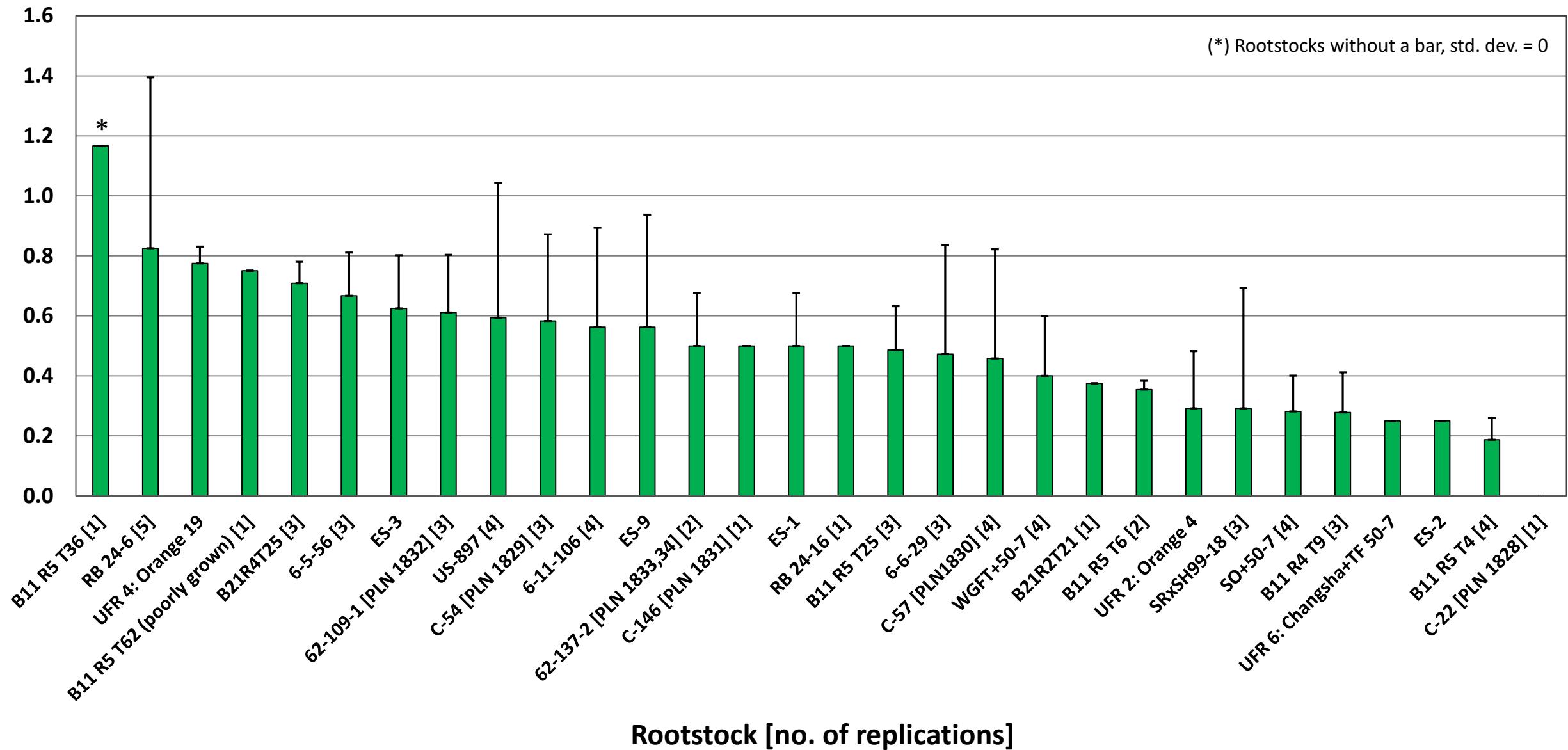


Fig. 18. Valencia APS rootstock trial – HLB rating: mean + std. dev. [October 2018].

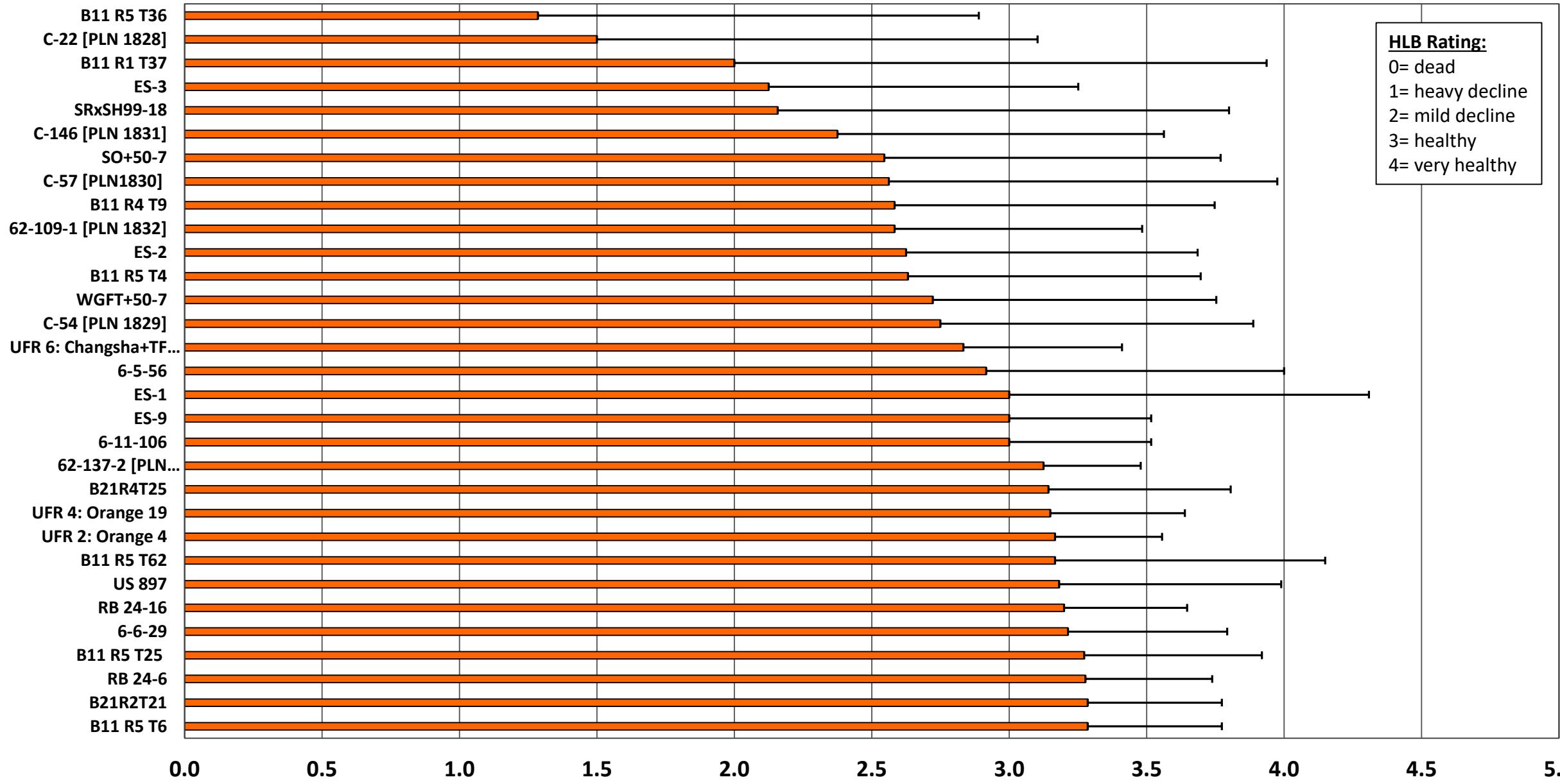


Fig. 19. Valencia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2019].

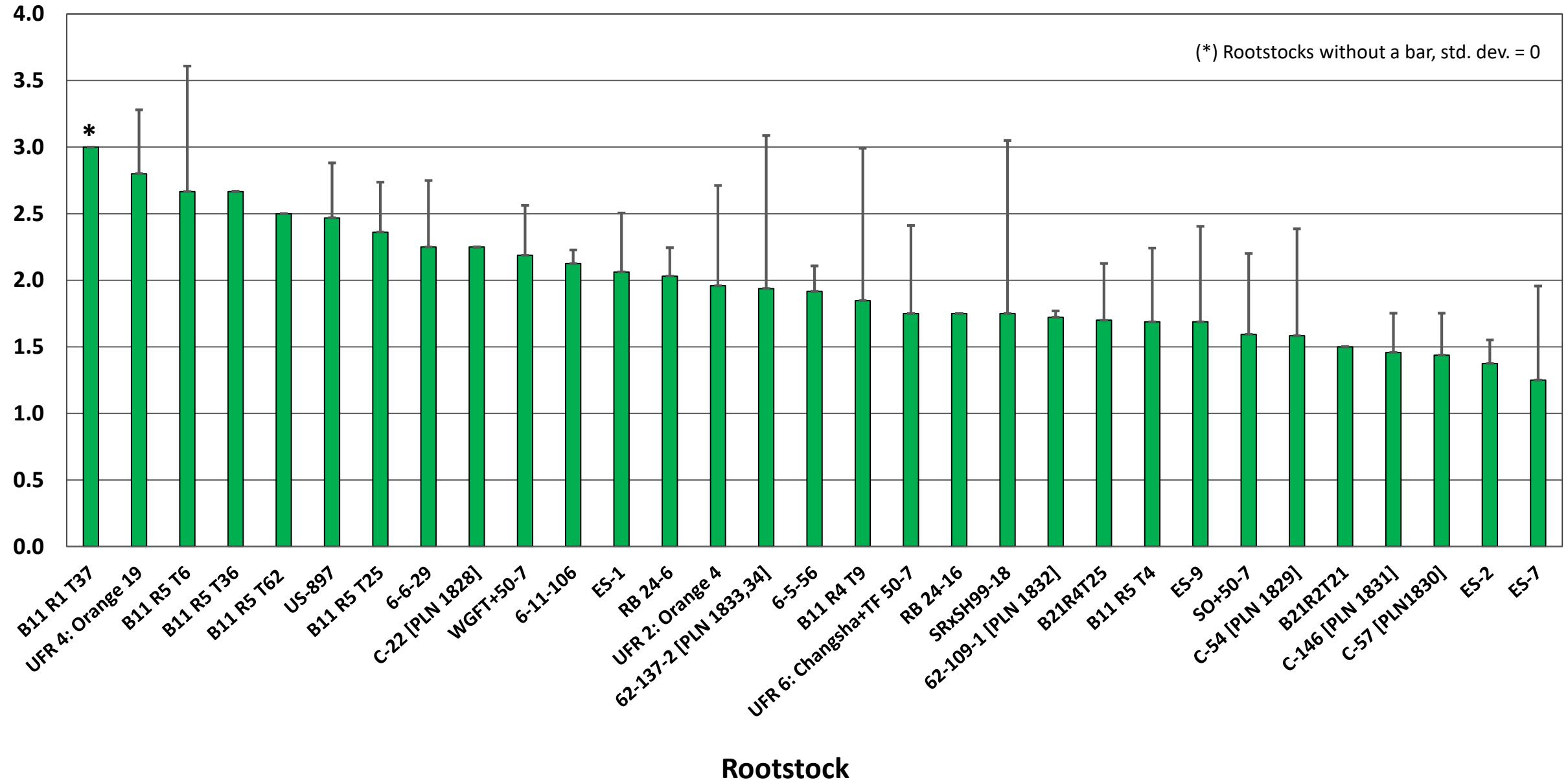


Fig. 20. Valencia Rootstock Trial – PS/acre [calculated @ 218 trees/acre, 10 x 20 ft., Season 2018/19].

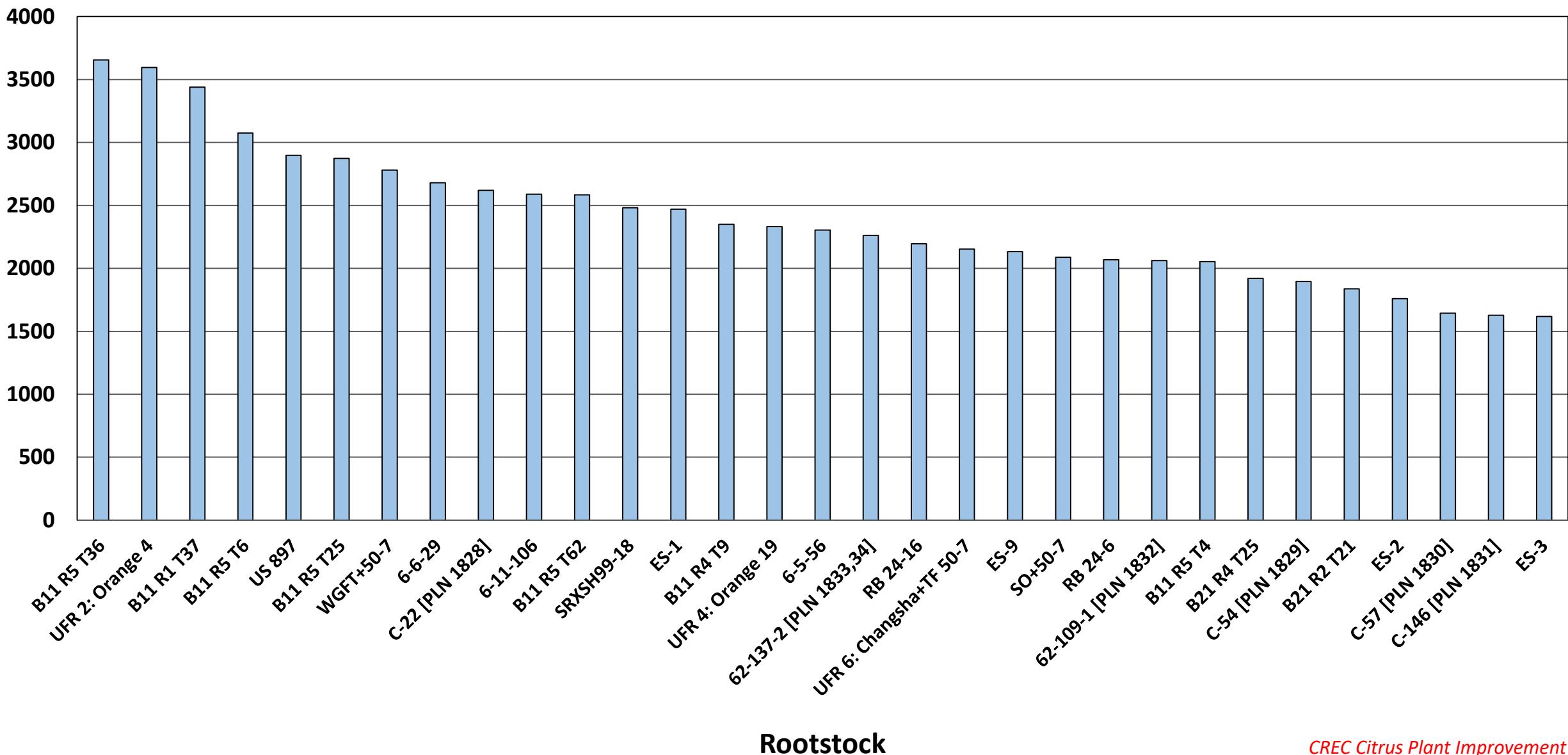


Fig. 21. Valencia rootstock trial – juice Acid: mean + std. dev. [March 2019].

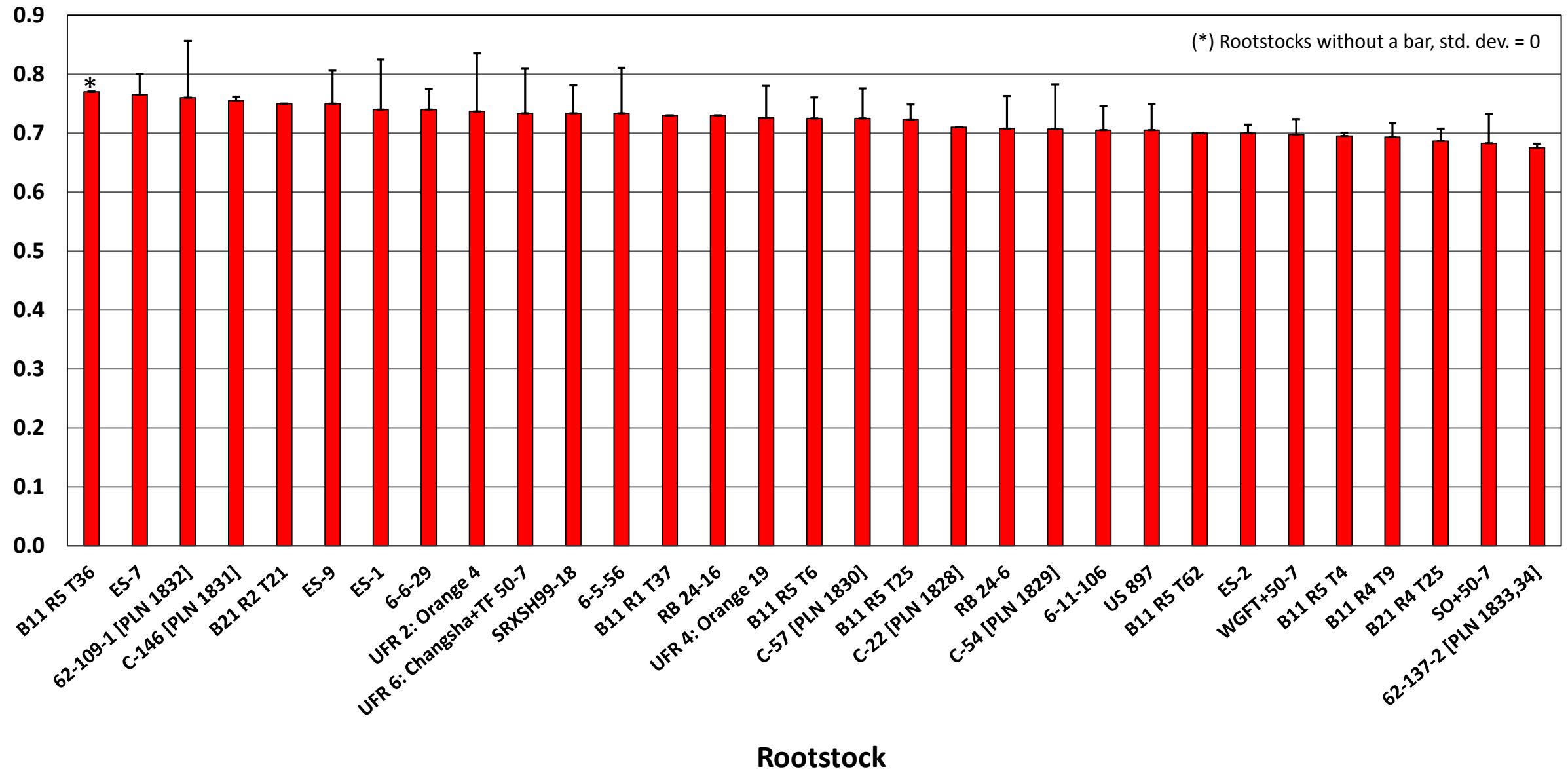


Fig. 22. Valencia rootstock trial – juice Brix: mean + std. dev. [March 2019].

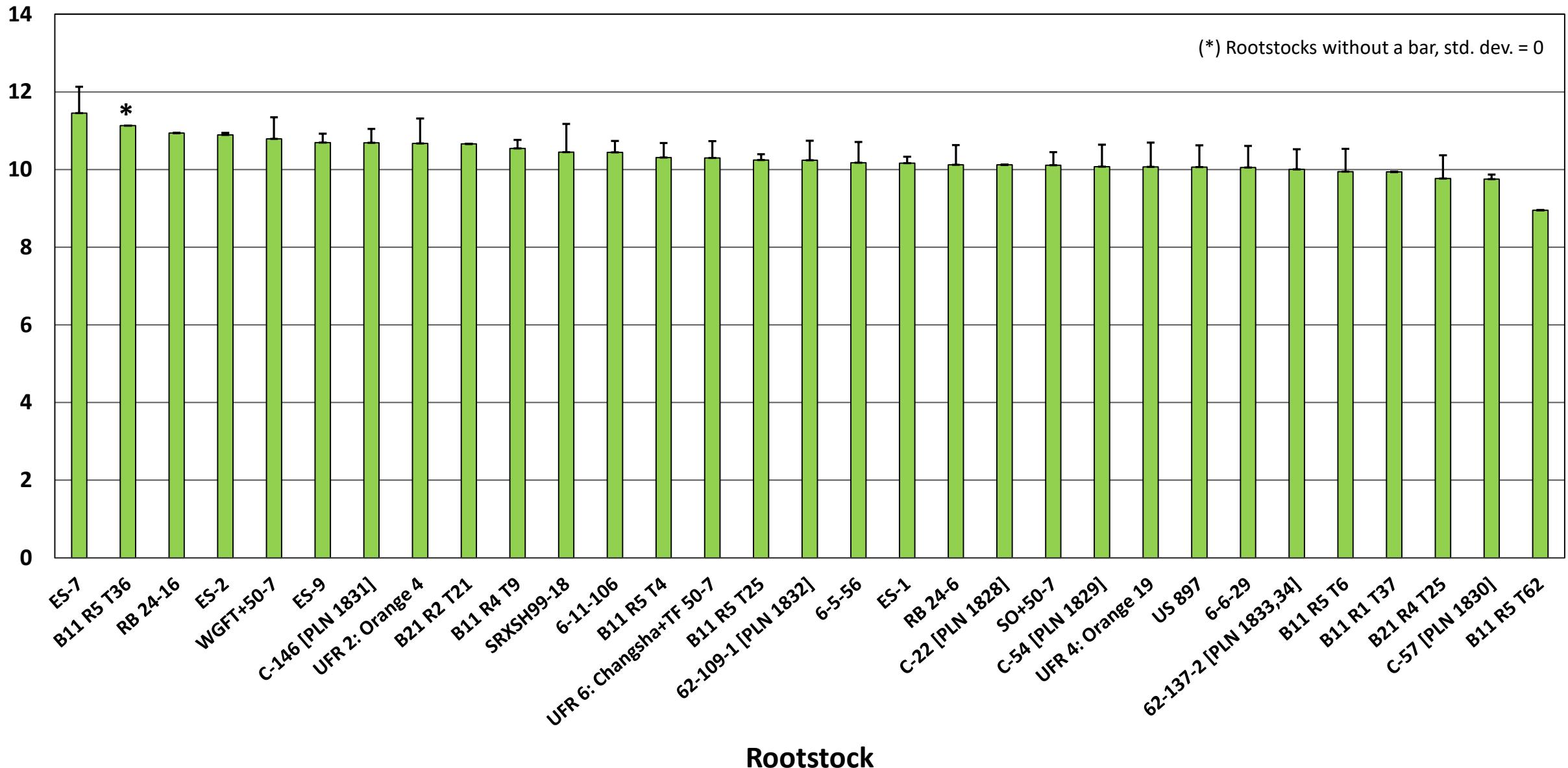


Fig. 23. Valencia rootstock trial – juice Ratio: mean + std. dev. [March 2019].

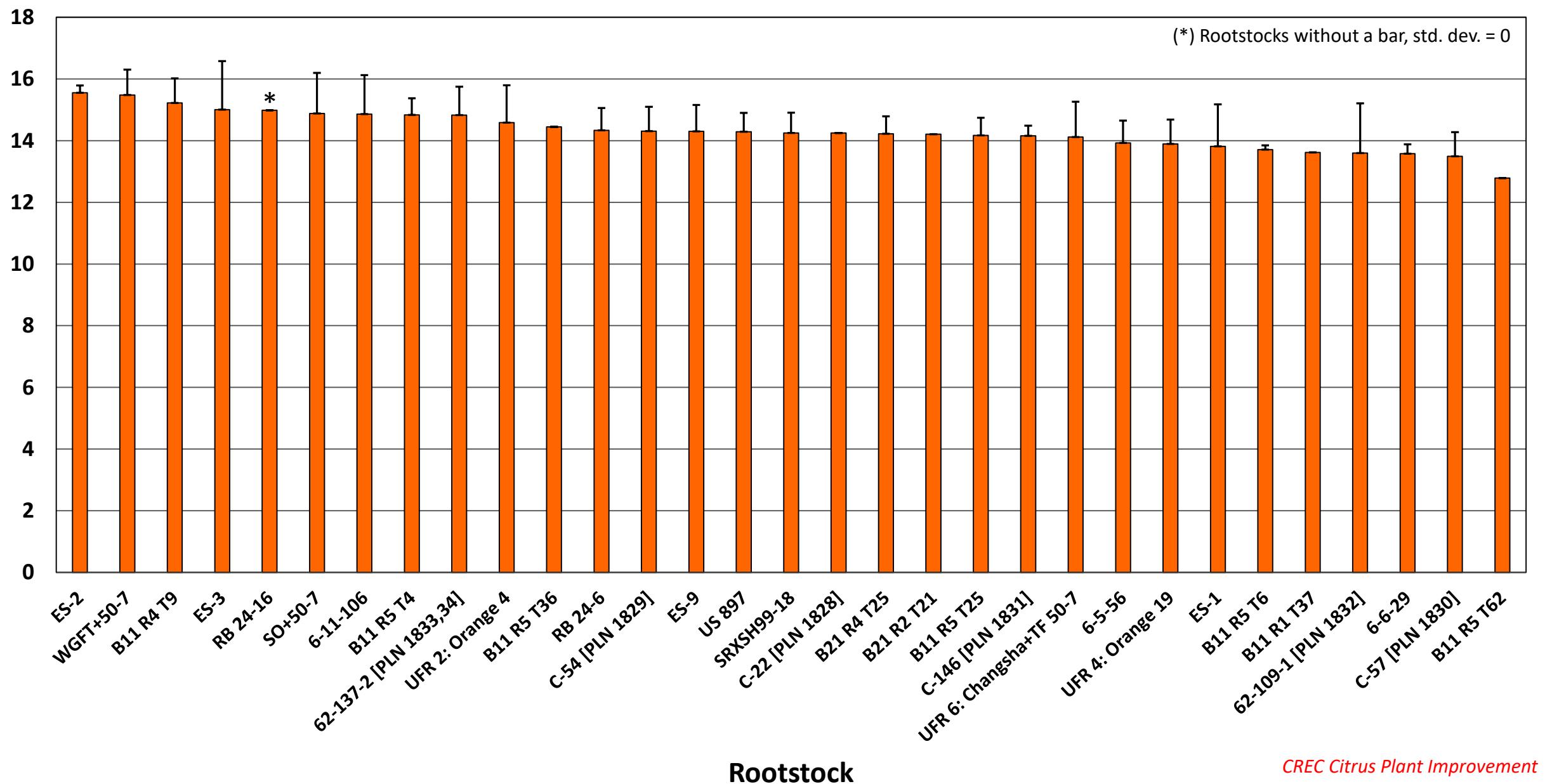


Fig. 24. Valencia rootstock trial – juice Color: mean + std. dev. [March 2019].

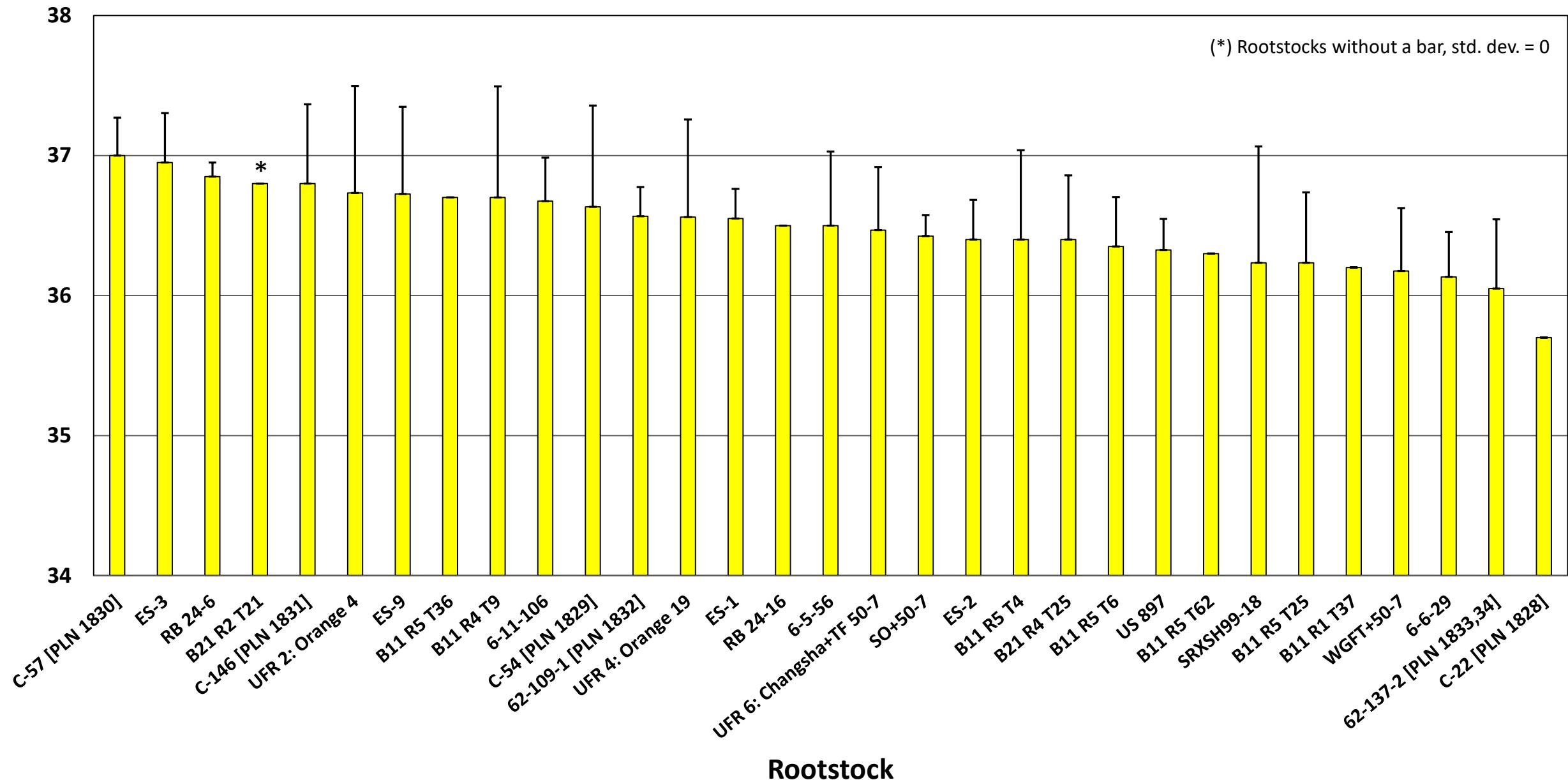


Fig. 25. Valencia Rootstock Trial – PS/box: mean + std. dev. [March 2019].

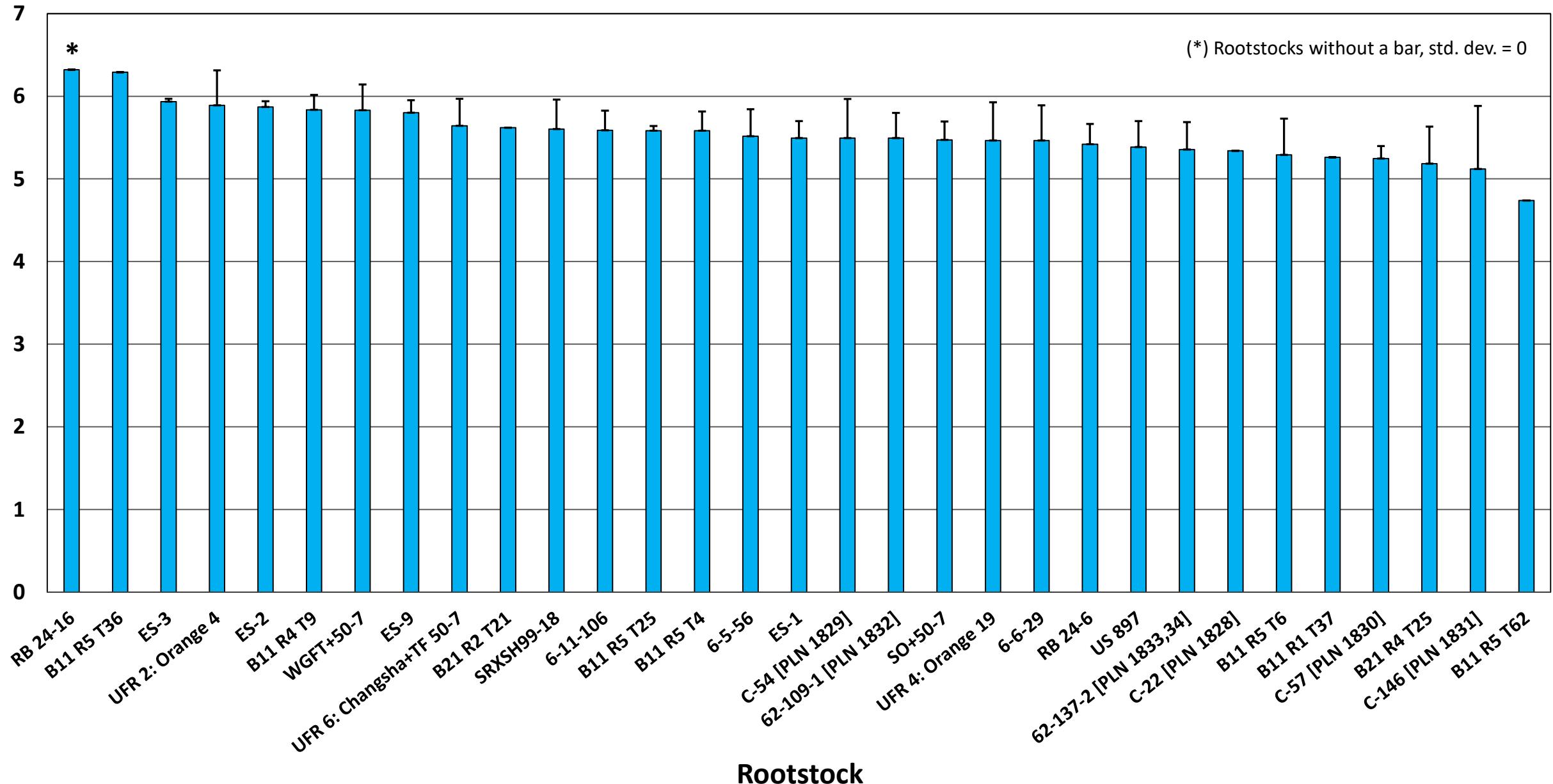


Fig. 26. Valencia Rootstock Trial – Yield [boxes/tree] and PS/box: mean [March 2019].

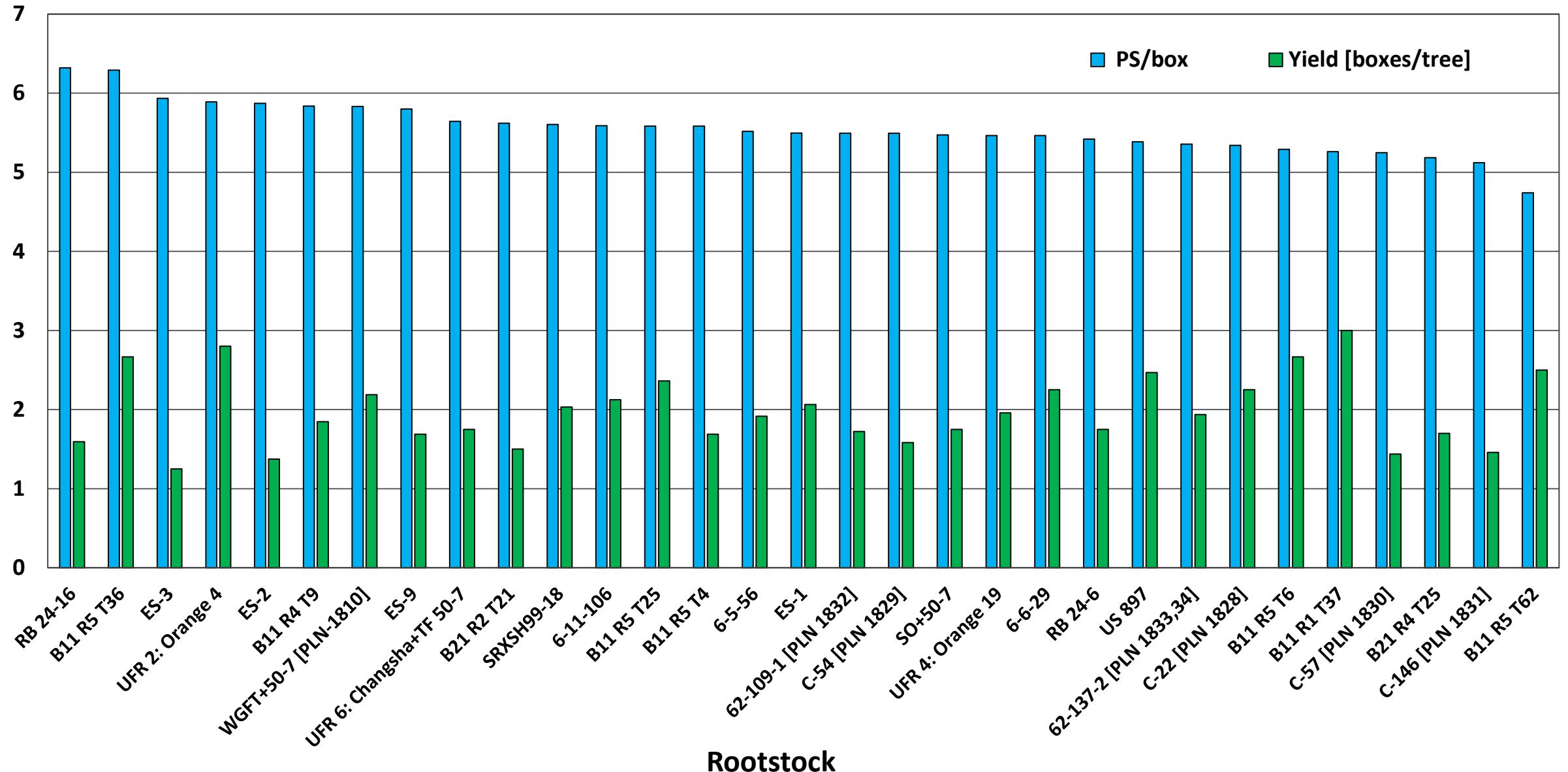
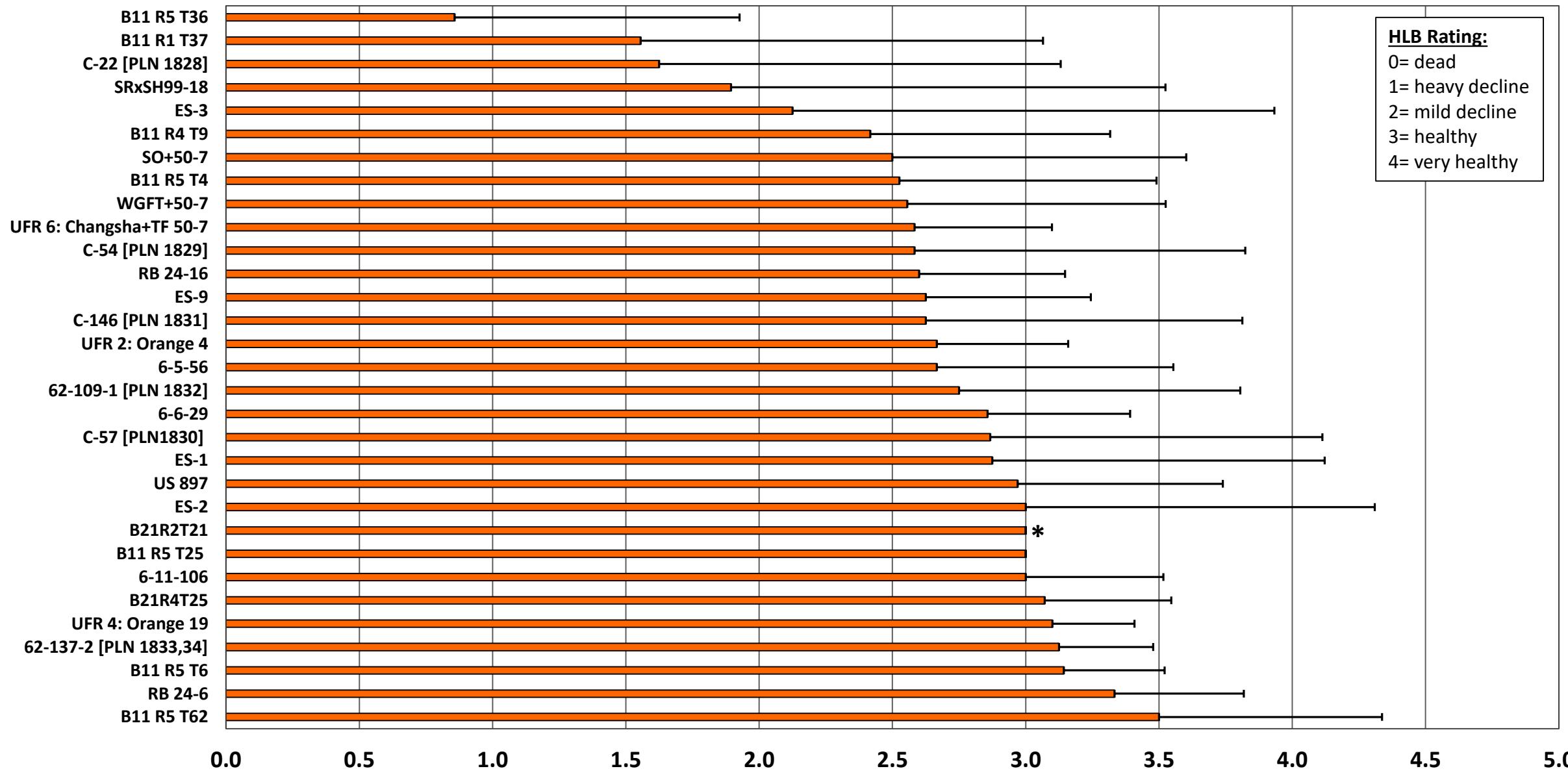


Fig. 27. Valencia APS rootstock trial – HLB rating: mean + std. dev. [October 2019].



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

Fig. 28. Valencia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2020].

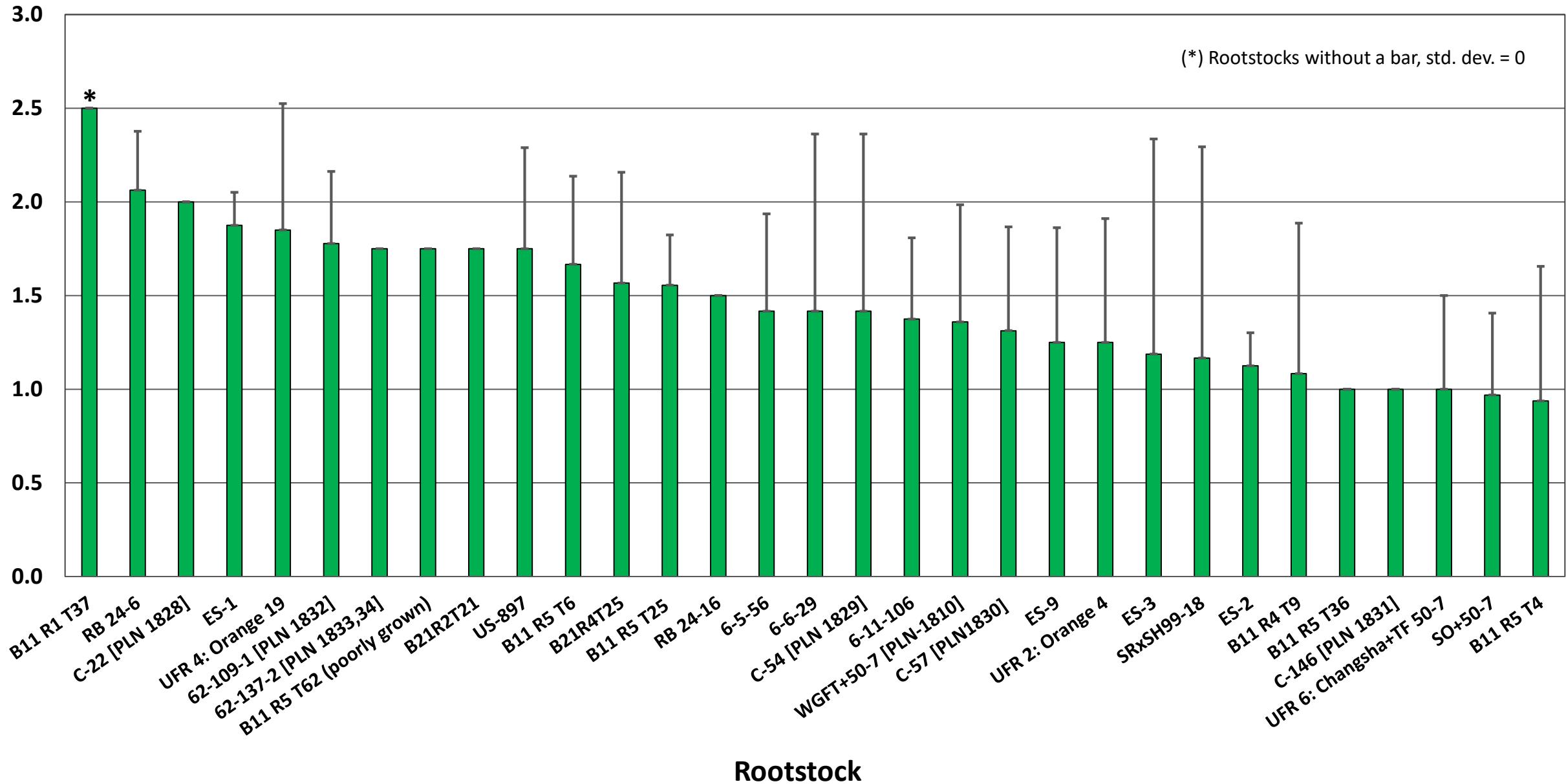


Fig. 29. Valencia APS rootstock trial – HLB rating: mean + std. dev. [October 2020].

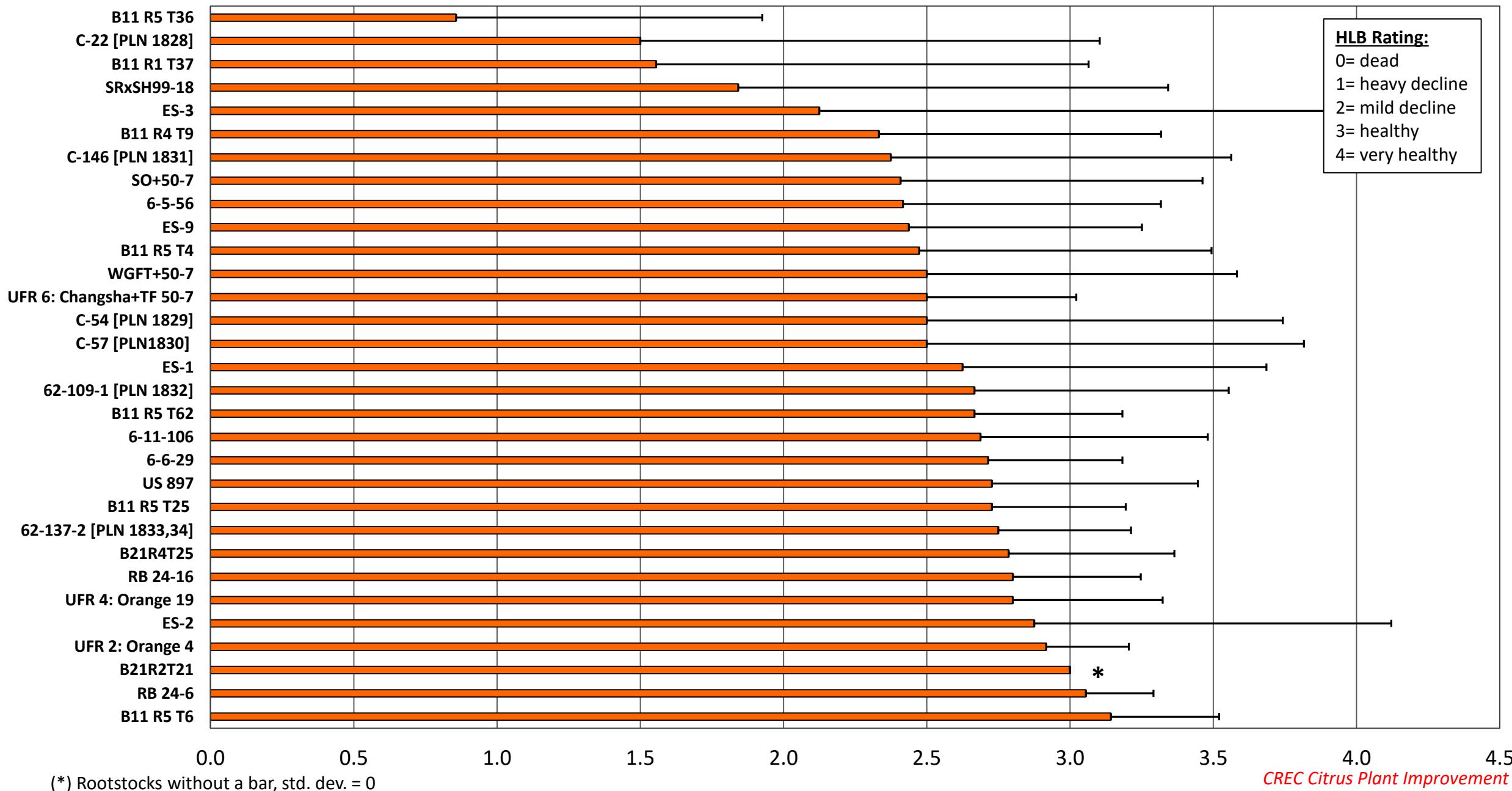


Fig. 30. Valencia APS rootstock trial – HLB rating: mean + std. dev. [October 2018, 2019 and 2020].

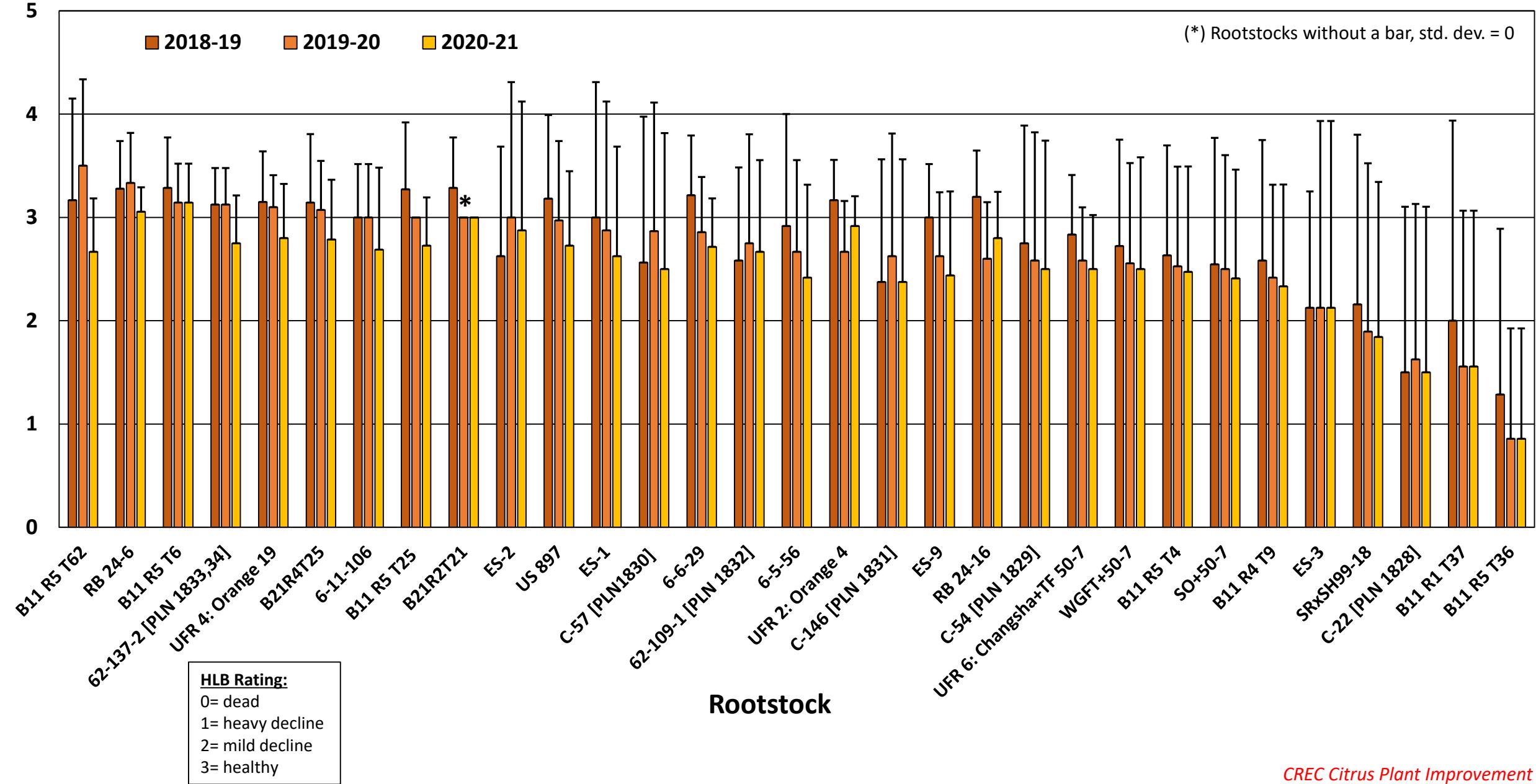


Fig. 31. Valencia rootstock trial – Yield: mean + std. dev. [boxes/tree, March 2021].

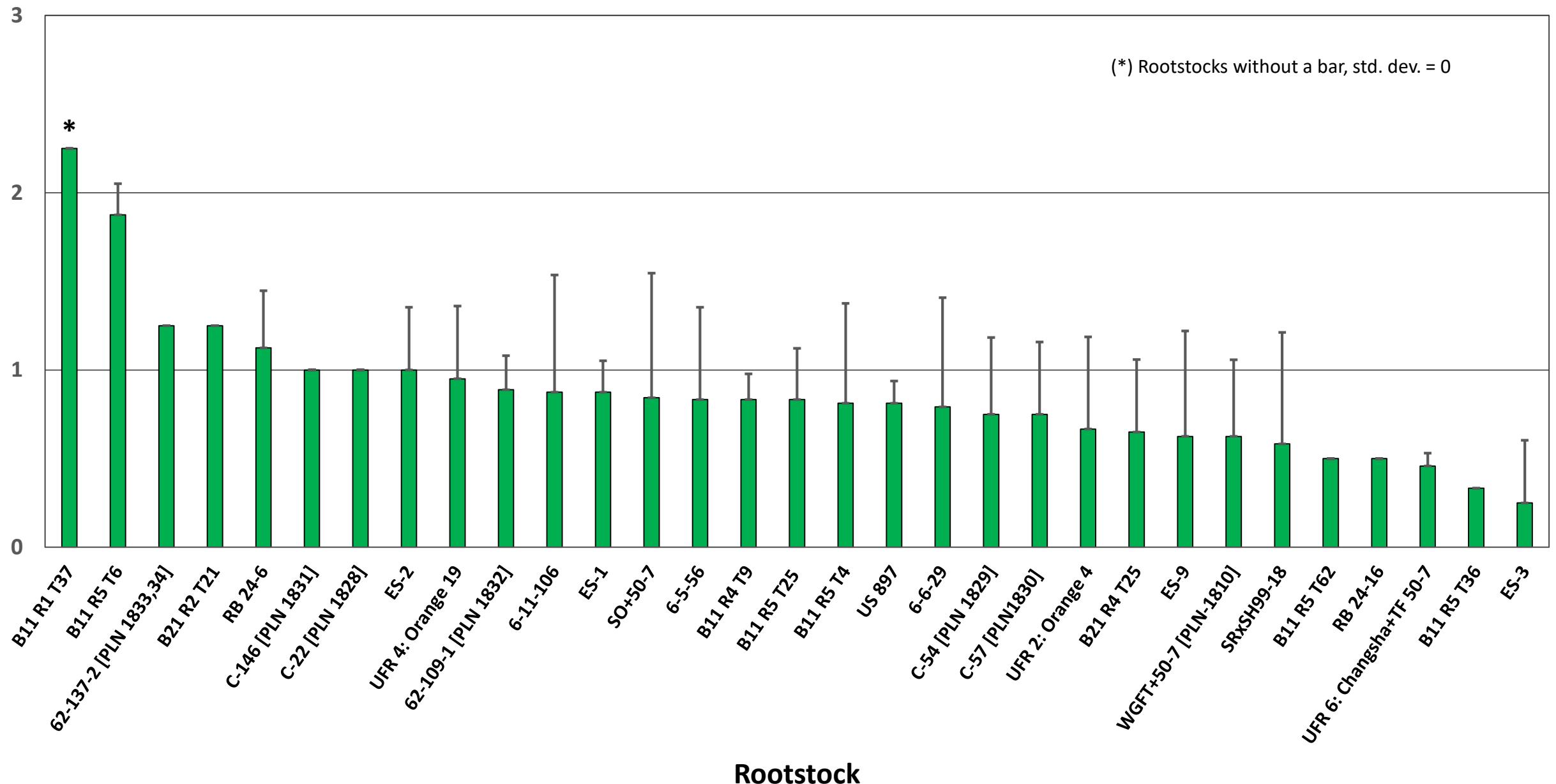


Fig. 32. Valencia Rootstock Trial – PS/acre [calculated @ 218 trees/acre, 10 x 20 ft., Season 2020/21].

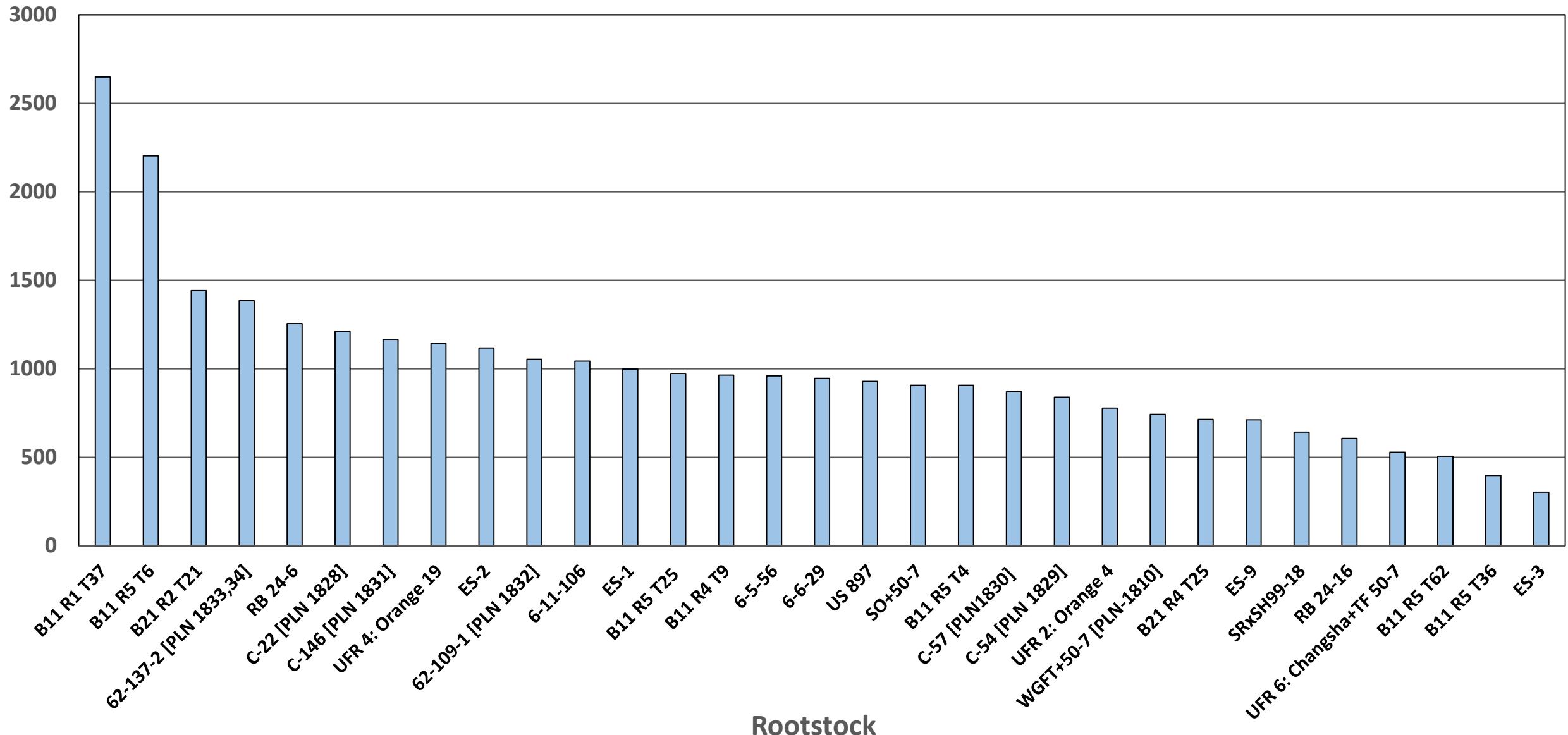


Fig. 33. Valencia APS rootstock trial – juice Acid: mean + std. dev. [February 2021].

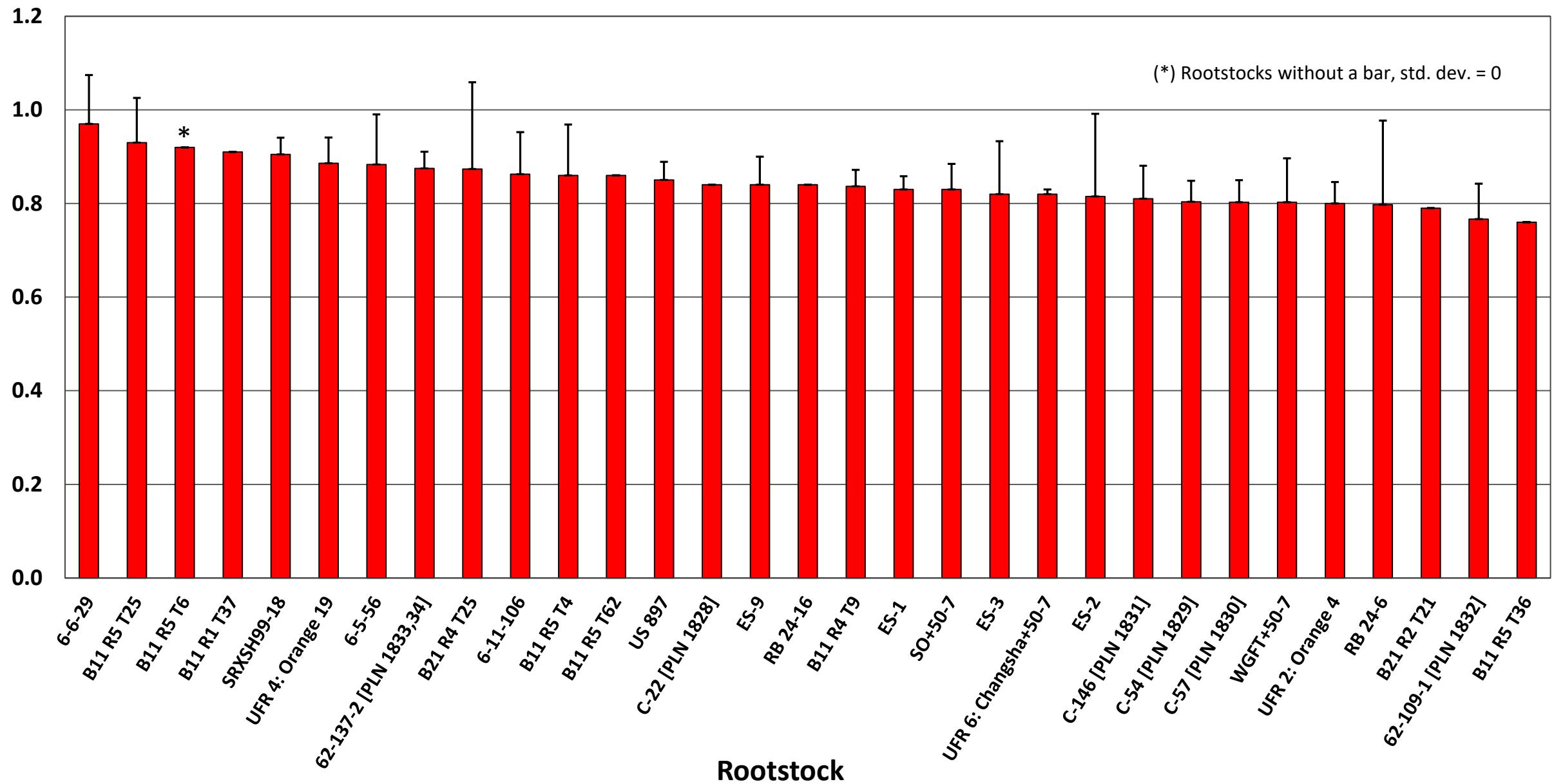


Fig. 34. Valencia APS rootstock trial – juice Brix: mean + std. dev. [February 2021].

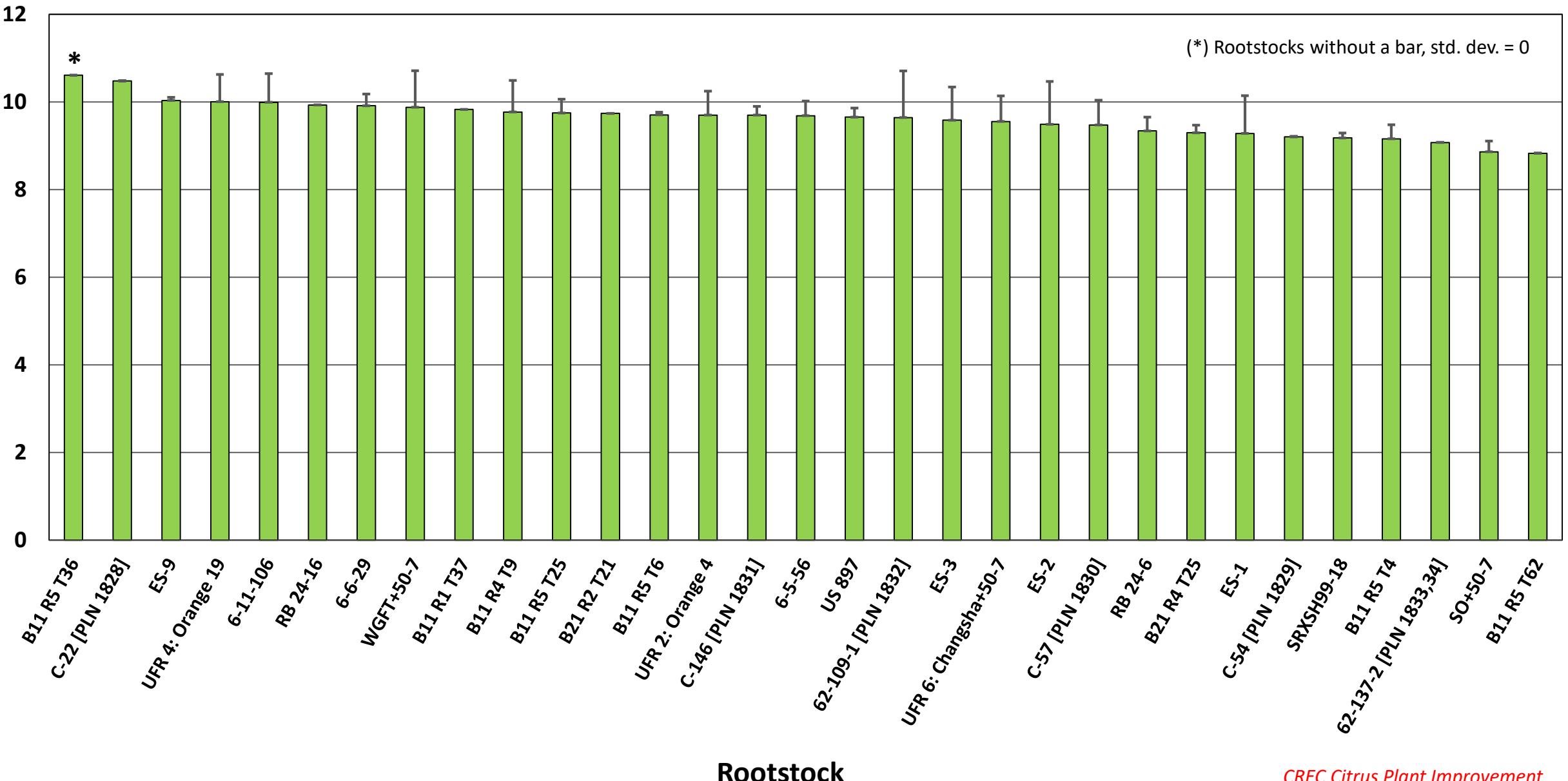


Fig. 35. Valencia APS rootstock trial – juice Ratio: mean + std. dev. [February 2021].

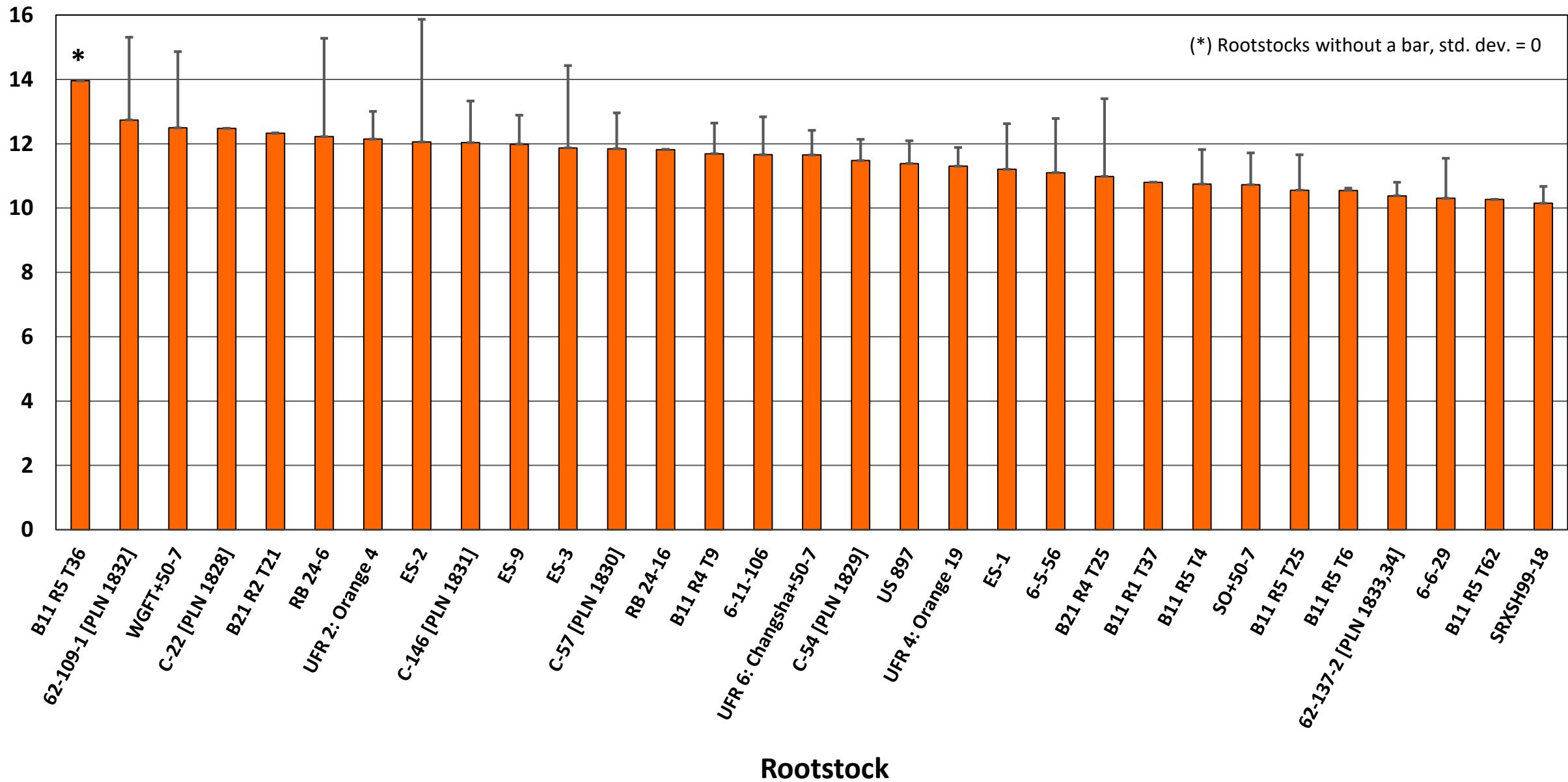


Fig. 36. Valencia APS rootstock trial – juice Color: mean + std. dev. [February 2021].

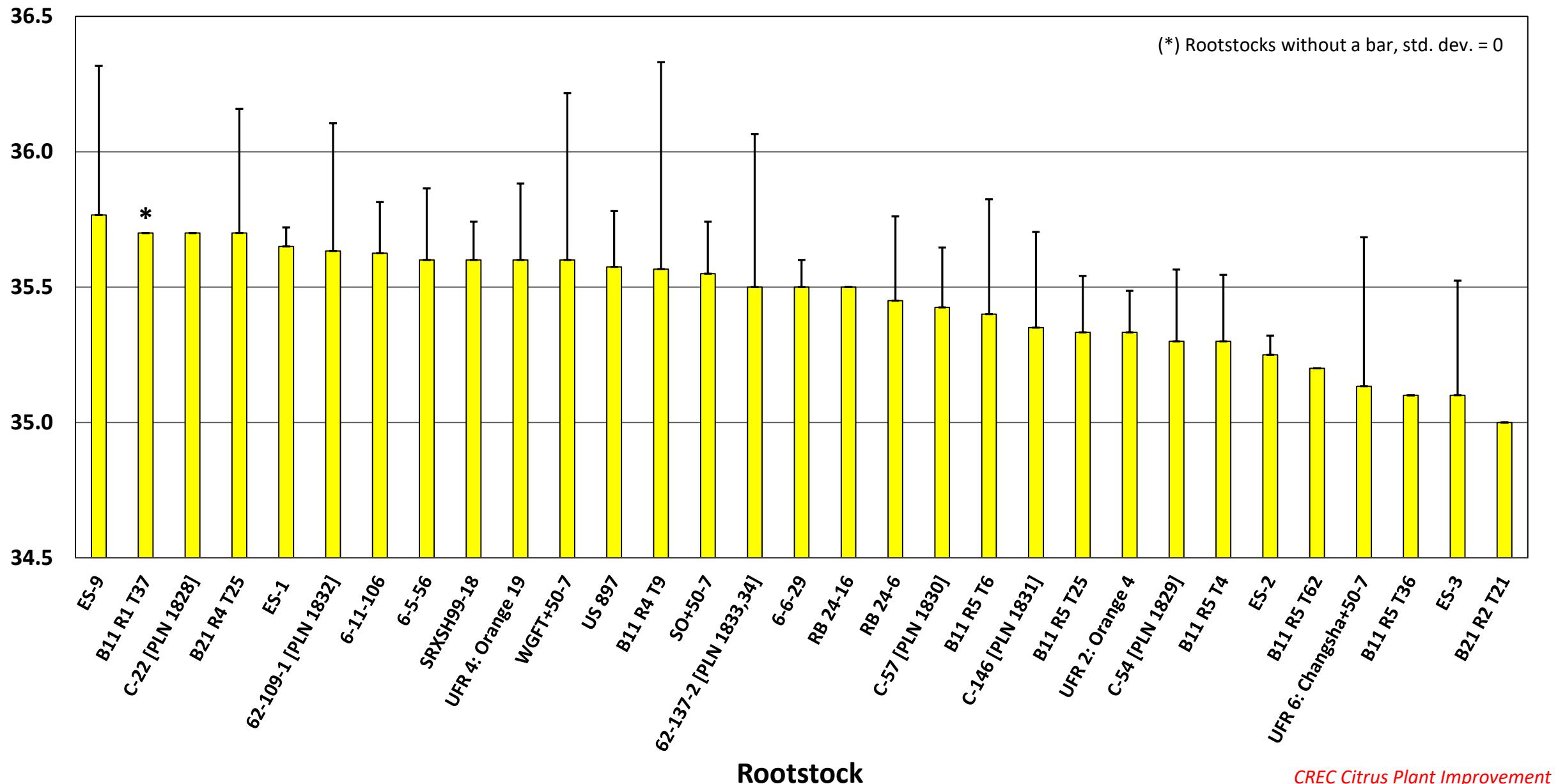


Fig. 37. Valencia APS rootstock trial – PS/box: mean + std. dev. [February 2021].

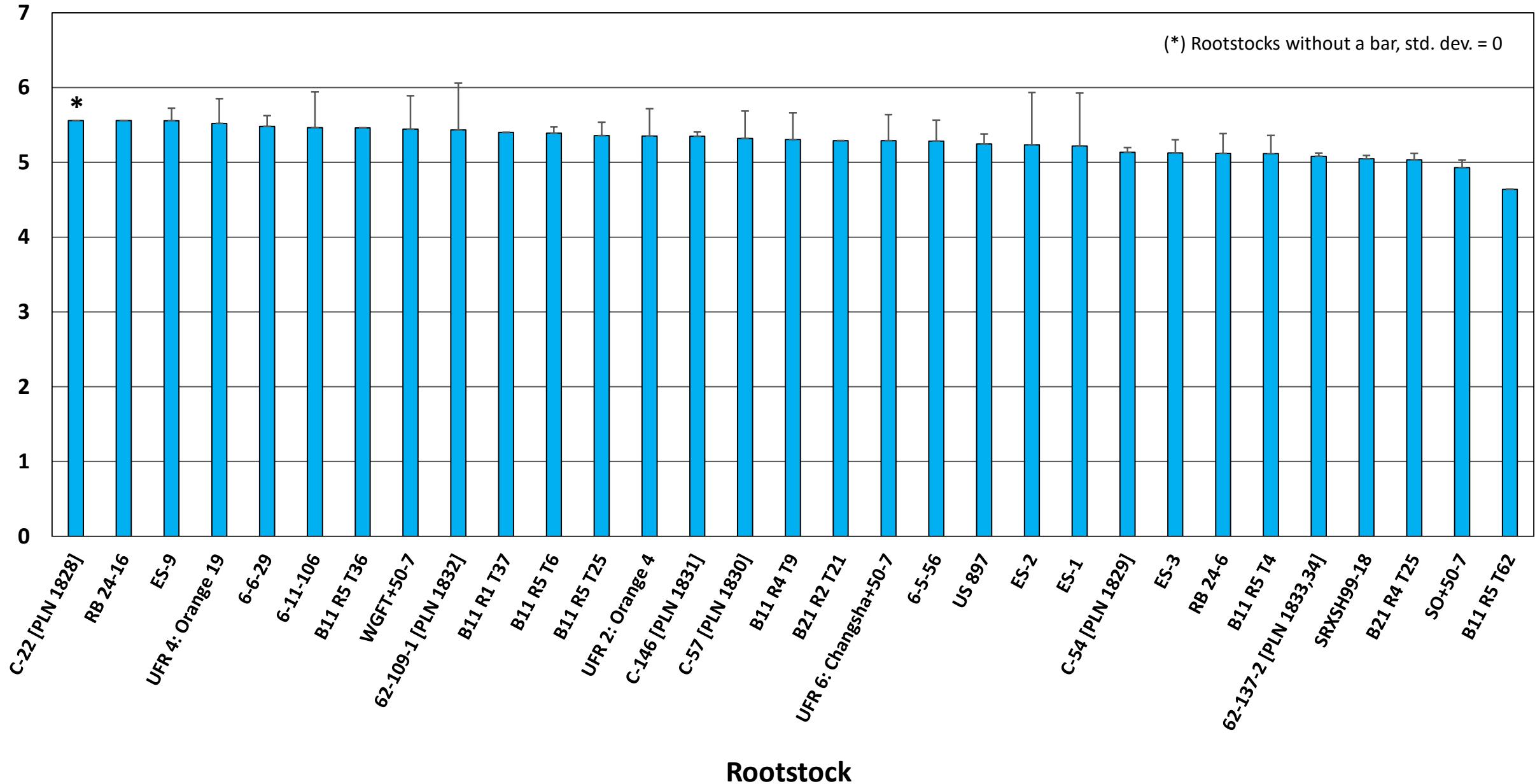


Fig. 38. Valencia APS rootstock trial. 7-year cum. Yield [boxes/tree, 2013/14 through 2020/21 seasons]. [First-year yields, 2012/13, were < 0.5 boxes/tree across the trial and not included in the cumulative yield].

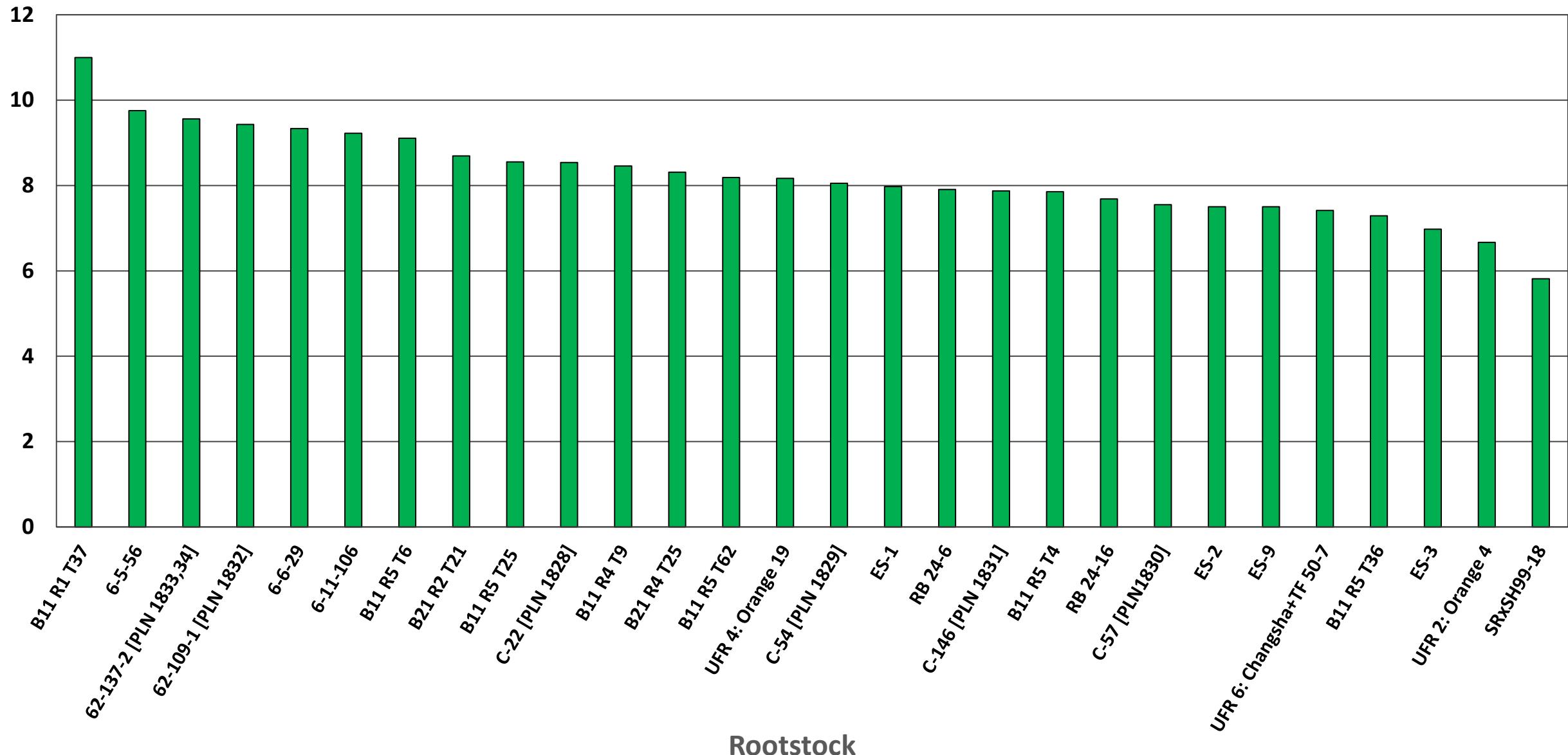


Fig. 39. Valencia APS rootstock trial. 7-year Yield [boxes/tree, 2013/14-2015/16; 2017/18-2020-21 seasons]. [First-year yields, 2012/13, were < 0.5 boxes/tree across the trial and not included in the cumulative yield].

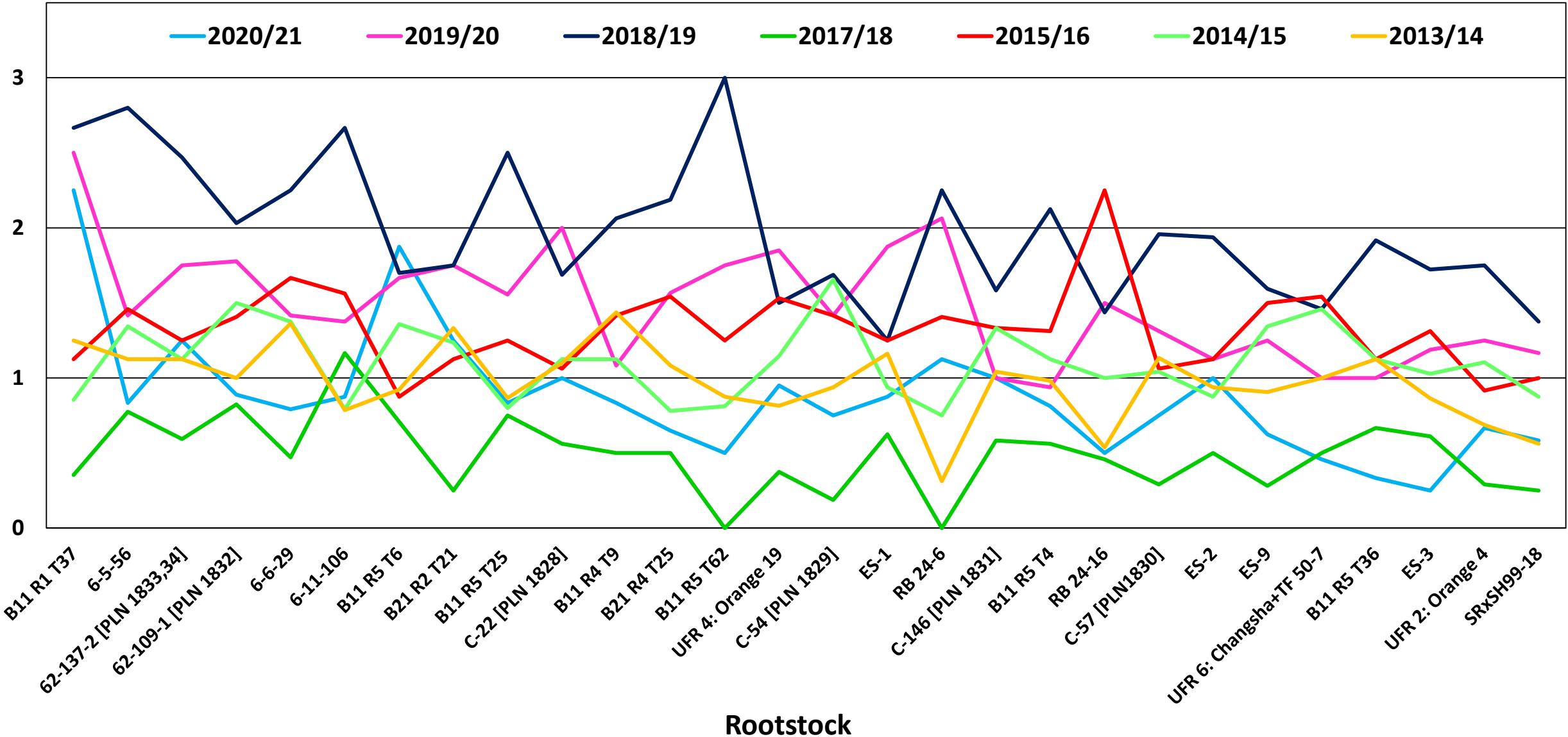


Table 2. Valencia APS rootstock trial. PS/acre for seasons: 2013/14; 2015/16; 2018/19 & 2020/21.

| Rootstock | 2013/14 | 2015/16 | 2018/19 | 2020/21 | Cumulative |
|------------------------|----------------|----------------|----------------|----------------|-------------------|
| B11 R1 T37 | 1,026 | 1,012 | 3,440 | 2,649 | 8,127 |
| RB 24-16 | 2,189 | 2,275 | 2,411 | 606 | 7,481 |
| B11 R5 T6 | 1,333 | 589 | 3,075 | 2,203 | 7,199 |
| UFR 4: Orange 19 | 1,231 | 1,402 | 3,335 | 1,144 | 7,113 |
| 6-6-29 | 1,698 | 1,785 | 2,680 | 946 | 7,108 |
| US 897 | 1,318 | 1,468 | 2,898 | 929 | 6,613 |
| 6-11-106 | 1,156 | 1,592 | 2,588 | 1,042 | 6,379 |
| WGFT+50-7 [PLN-1810] | 1,188 | 1,550 | 2,780 | 742 | 6,260 |
| B11 R4 T9 | 1,307 | 1,573 | 2,350 | 964 | 6,194 |
| B11 R5 T36 | 967 | 1,069 | 3,657 | 397 | 6,089 |
| ES-9 | 1,705 | 1,534 | 2,134 | 711 | 6,084 |
| RB 24-6 | 1,147 | 1,259 | 2,400 | 1,256 | 6,061 |
| B11 R5 T25 | 937 | 1,250 | 2,874 | 973 | 6,034 |
| 6-5-56 | 1,384 | 1,381 | 2,305 | 960 | 6,030 |
| 62-137-2 [PLN 1833,34] | 1,108 | 1,163 | 2,262 | 1,384 | 5,916 |
| UFR 6: Changsha+50-7 | 1,459 | 1,651 | 2,153 | 529 | 5,792 |
| UFR 2: Orange 4 | 1,424 | 853 | 2,515 | 778 | 5,570 |
| 62-109-1 [PLN 1832] | 987 | 1,403 | 2,062 | 1,053 | 5,505 |
| C-54 [PLN 1829] | 1,236 | 1,487 | 1,896 | 839 | 5,458 |
| ES-2 | 1,306 | 1,240 | 1,760 | 1,117 | 5,423 |
| C-146 [PLN 1831] | 1,154 | 1,405 | 1,628 | 1,166 | 5,353 |
| B11 R5 T4 | 1,061 | 1,265 | 2,054 | 906 | 5,286 |
| B21 R2 T21 | 964 | 1,036 | 1,838 | 1,442 | 5,279 |
| C-22 [PLN 1828] | 310 | 1,056 | 2,619 | 1,212 | 5,197 |
| ES-1 | 623 | 1,071 | 2,471 | 999 | 5,163 |
| B21 R4 T25 | 919 | 1,565 | 1,921 | 713 | 5,118 |
| SO+50-7 | 1,051 | 924 | 1,901 | 907 | 4,783 |
| B11 R5 T62 | 703 | 950 | 2,583 | 506 | 4,743 |
| ES-3 | 1,362 | 1,438 | 1,617 | 303 | 4,720 |
| SRXSH99-18 | 736 | 893 | 2,138 | 642 | 4,409 |
| C-57 [PLN 1830] | 585 | 900 | 1,644 | 870 | 4,000 |

Table 3. Valencia APS rootstock trial. PS/box, yield and PS/acre for seasons: 2013/14; 2015/16; 2018/19 & 2020/21.

| Rootstock | 2013/14 | | | 2015/16 | | | 2018/19 | | | 2020/21 | | |
|------------------------|---------|-----------------------|---------|---------|-----------------------|---------|---------|-----------------------|---------|---------|-----------------------|---------|
| | PS/box | Yield [boxes/tree] | PS/acre |
| B11 R1 T37 | 5.4 | 0.9 | 1026 | 4.1 | 1.1 | 1012 | 5.3 | 3.0 | 3440 | 5.4 | 2.3 | 2649 |
| RB 24-16 | 5.0 | 2.0 | 2189 | 4.6 | 2.3 | 2275 | 6.3 | 1.8 | 2411 | 5.6 | 0.5 | 606 |
| B11 R5 T6 | 4.9 | 1.3 | 1333 | 3.1 | 0.9 | 589 | 5.3 | 2.7 | 3075 | 5.4 | 1.9 | 2203 |
| UFR 4: Orange 19 | 5.4 | 1.1 | 1231 | 4.2 | 1.5 | 1402 | 5.5 | 2.8 | 3335 | 5.5 | 1.0 | 1144 |
| 6-6-29 | 5.6 | 1.4 | 1698 | 4.9 | 1.7 | 1785 | 5.5 | 2.3 | 2680 | 5.5 | 0.8 | 946 |
| US 897 | 5.4 | 1.1 | 1318 | 3.9 | 1.7 | 1468 | 5.4 | 2.5 | 2898 | 5.2 | 0.8 | 929 |
| 6-11-106 | 5.4 | 1.0 | 1156 | 4.7 | 1.6 | 1592 | 5.6 | 2.1 | 2588 | 5.5 | 0.9 | 1042 |
| WGFT+50-7 [PLN-1810] | 5.0 | 1.1 | 1188 | 4.3 | 1.7 | 1550 | 5.8 | 2.2 | 2780 | 5.4 | 0.6 | 742 |
| B11 R4 T9 | 5.5 | 1.1 | 1307 | 5.1 | 1.4 | 1573 | 5.8 | 1.8 | 2350 | 5.3 | 0.8 | 964 |
| B11 R5 T36 | 5.3 | 0.8 | 967 | 4.4 | 1.1 | 1069 | 6.3 | 2.7 | 3657 | 5.5 | 0.3 | 397 |
| ES-9 | 5.4 | 1.4 | 1705 | 4.7 | 1.5 | 1534 | 5.8 | 1.7 | 2134 | 5.2 | 0.6 | 711 |
| RB 24-6 | 5.3 | 1.0 | 1147 | 4.1 | 1.4 | 1259 | 5.4 | 2.0 | 2400 | 5.1 | 1.1 | 1256 |
| B11 R5 T25 | 5.2 | 0.8 | 937 | 4.6 | 1.3 | 1250 | 5.6 | 2.4 | 2874 | 5.4 | 0.8 | 973 |
| 6-5-56 | 5.6 | 1.1 | 1384 | 4.3 | 1.5 | 1381 | 5.5 | 1.9 | 2305 | 5.3 | 0.8 | 960 |
| 62-137-2 [PLN 1833,34] | 5.4 | 0.9 | 1108 | 4.3 | 1.3 | 1163 | 5.4 | 1.9 | 2262 | 5.1 | 1.3 | 1384 |
| UFR 6: Changsha+50-7 | 5.0 | 1.3 | 1459 | 4.9 | 1.5 | 1651 | 5.6 | 1.8 | 2153 | 5.3 | 0.5 | 529 |
| UFR 2: Orange 4 | 5.8 | 1.1 | 1424 | 4.3 | 0.9 | 853 | 5.9 | 2.0 | 2515 | 5.4 | 0.7 | 778 |
| 62-109-1 [PLN 1832] | 5.0 | 0.9 | 987 | 4.6 | 1.4 | 1403 | 5.5 | 1.7 | 2062 | 5.4 | 0.9 | 1053 |
| C-54 [PLN 1829] | 5.5 | 1.0 | 1236 | 4.8 | 1.4 | 1487 | 5.5 | 1.6 | 1896 | 5.1 | 0.8 | 839 |
| ES-2 | 5.2 | 1.2 | 1306 | 5.1 | 1.1 | 1240 | 5.9 | 1.4 | 1760 | 5.1 | 1.0 | 1117 |
| C-146 [PLN 1831] | 5.3 | 1.0 | 1154 | 4.8 | 1.3 | 1405 | 5.1 | 1.5 | 1628 | 5.4 | 1.0 | 1166 |
| B11 R5 T4 | 5.2 | 0.9 | 1061 | 4.4 | 1.3 | 1265 | 5.6 | 1.7 | 2054 | 5.1 | 0.8 | 906 |
| B21 R2 T21 | 5.4 | 0.8 | 964 | 4.2 | 1.1 | 1036 | 5.6 | 1.5 | 1838 | 5.3 | 1.3 | 1442 |
| C-22 [PLN 1828] | 4.6 | 0.3 | 310 | 4.6 | 1.1 | 1056 | 5.3 | 2.3 | 2619 | 5.6 | 1.0 | 1212 |
| ES-1 | 5.1 | 0.6 | 623 | 3.9 | 1.3 | 1071 | 5.5 | 2.1 | 2471 | 5.2 | 0.9 | 999 |
| B21 R4 T25 | 4.7 | 0.9 | 919 | 4.7 | 1.5 | 1565 | 5.2 | 1.7 | 1921 | 5.0 | 0.7 | 713 |
| SO+50-7 | 5.3 | 0.9 | 1051 | 3.8 | 1.1 | 924 | 5.5 | 1.6 | 1901 | 4.9 | 0.8 | 907 |
| B11 R5 T62 | 4.7 | 0.7 | 703 | 3.5 | 1.3 | 950 | 4.7 | 2.5 | 2583 | 4.6 | 0.5 | 506 |
| ES-3 | 5.7 | 1.1 | 1362 | 5.0 | 1.3 | 1438 | 5.9 | 1.3 | 1617 | 5.6 | 0.3 | 303 |
| SRXSH99-18 | 4.9 | 0.7 | 736 | 4.1 | 1.0 | 893 | 5.6 | 1.8 | 2138 | 5.1 | 0.6 | 642 |
| C-57 [PLN 1830] | 5.0 | 0.5 | 585 | 3.9 | 1.1 | 900 | 5.2 | 1.4 | 1644 | 5.3 | 0.8 | 870 |