UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Vegetable Views

Stanislaus County

Winter 2025

2025 Grafted Watermelon Trial Updates

Watermelon research and extension programs in 2025 included three on-farm experiments to continue the assessment of watermelon rootstock-scion combinations and the differences between grafted and non-grafted watermelon plants. While two of the three trials were repeated from the previous year, we implemented a new experiment in 2025 to evaluate grafting of mini watermelons.

I. Mini Watermelon Grafting Trial

As grafting has been extensively applied to full-size watermelons, we need to know its potential applicability for mini watermelons, which is currently becoming more popular. Different from full-size varieties, cultivars of mini watermelon typically lack soil-borne fungal disease resistance. Moreover, grading criteria, such as fruit size, follow a different process from full size watermelons. Therefore, in this trial, we tested multiple citron rootstocks (*Citrullus amarus*) and a commonly used hybrid squash rootstock (*Cucurbita maxima x Cucurbita moschata*) grafting with the grower's field mini-watermelon variety. These rootstocks/treatments were labeled and coded from RS1 to RS7 (Table 1).

Table 1. List of rootstocks used in the 2025 mini watermelon trial.

Rootstock	Type
RS1	Citron rootstock
RS2	Citron rootstock
RS3	Citron rootstock
RS4	Citron rootstock
RS5	Citron rootstock
RS6	Citron rootstock
RS7	Hybrid squash

- *Trial set up.* The trial was implemented within a commercial watermelon field in Escalon, CA. Each rootstock was grafted with the field variety (Ocelot). The pollenizer, "Wild Card Plus", was also grafted to prevent collapse and ensure pollen production. The trial was set up as a randomized complete block design with four replications. Each treatment plot was 70 feet long and contained 28 grafted seedlings and 7 pollenizers. All seedlings were transplanted on April 14, 2025.

- *In-season field management.* After transplanting, our team began manually separating vines multiple times until close to the first harvest in order to ease data collection and maintain accurate harvest data. Watermelon plants typically enter a rapid growth stage about a month after transplanting. If the plants are left to grow naturally, vines will spread and grow onto neighboring rows, which can cause problems in identifying fruit at harvest (Figures 1a and 1b). Although this is not commonly seen in commercial production, it is a routine practice for on-farm watermelon research.

- *Data Collection*:
  - *Fruit harvest.* For fruit harvest, we picked three times with the help of a farm crew on July 14, July 22, and September 22. The two-month period between the second and third harvests allowed for the regrowth of watermelon vines and fruit. Marketable fruit from each treatment row was counted, weighed, and transformed into yield per acre. Measurements included fruit number per acre (no/acre), tons per acre (tons/acre), and average fruit weight (lb.).
  - *Fruit quality.* Fruit quality measurements were performed following the same protocol as previous trials. Marketable fruit from the first harvest were used to measure fruit dimension (length and width), rind thickness at blossom and stem ends, fruit firmness, and soluble solid (^{0}Brix).
  - *Canopy coverage.* Canopy coverage (NDVI - Normalized Difference Vegetation Index) was collected a couple of times using a handheld crop canopy sensor, beginning from two weeks after transplanting and continuing until the end of the season.

- *Results.* For canopy development, differences of canopy coverage were not observed among treatments except for those of Ocelot grafted with RS2 and RS6 on May 12 (Table 2). Vines of each grafted combination grew to the maximum coverage by July 8 and then declined rapidly by August 4 followed by slight increases in late August and early September (Table 2). Yield from the second pick was the biggest for all treatments followed by the third and the first harvests (Table 3). Average fruit weight did not decrease until the last harvest. For total yield, Ocelot grafted with RS6 stood out from other combinations (Table 3). For fruit quality, no apparent changes in fruit size were observed, whereas rind became thicker for fruit grafted with citron rootstocks (RS1-RS6) than fruit with hybrid squash rootstock (RS7). Fruit grafted with RS7 rootstock gave the lowest sugar content and highest fruit firmness (Table 4).

Table 2. Percent canopy coverage for all rootstock treatments taken from April 30 to September 3 for the 2025 mini watermelon trial.

Treatment	April 30	May 12	May 23	June 3	June 17	July 8	August 4	August 22	September 3
RS1	10.5	31.8	69.5	83.3	87	92.5	68.3	79	79.3
RS2	10.8	39.3*	72.3	83.5	88.3	91.8	68.8	80	80.5
RS3	10.5	29.5	68.5	83	89.5	92.8	67.5	80	79.8
RS4	11.8	30	70	82.8	88.8	92.3	68	80.8	81
RS5	11.8	35.8	68.5	83.5	90.3	92	68.3	81	80.8
RS6	11.8	40.5*	71.3	82.5	88.3	92.3	63	78.3	78
RS7	12	28.5	64.5	80.3	87.8	91.3	63.3	78	78

*Indicates significantly greater percent canopy coverage than other treatments at $P<0.05$.

Table 3. Fruit yield from each harvest and total yield for the 2025 mini watermelon trial.

	First Harvest (July 14, 2025)			Second Harvest (July 22, 2025)			Third Harvest (September 22, 2025)			Total	
Rootstock	No/Acre	Tons/Acre	Avg. Weight (lb.)	No/Acre	Tons/Acre	Avg. Weight (lb.)	No/Acre	Tons/Acre	Avg. Weight (lb.)	No/Acre	Tons/acre
RS1	2313	8	7.2	9813	33.5	6.8	5537	13.2	4.7	17664	54.7
RS2	2944	10.5	6.9	8411	27.8	6.5	4136	8.2	3.9	15491	46.4
RS3	2313	8.1	7.1	7687	24.2	6.3	4346	10.2	4.6	14346	42.5
RS4	2617	8	6.3	8645	30.8	7.1	4790	9.4	3.9	16051	48.3
RS5	2360	8.3	7.1	8879	31.5	7.2	4252	9.2	4.5	15491	49
RS6	3271	10.7	6.6	9252	34	7.3	8715	19.8	4.5	21238*	64.5*
RS7	2150	7	6.5	9089	31.9	7	6449	13.7	4.2	17687	52.6

Table 4. Fruit quality for all rootstock treatments taken from the first harvest (July 14, 2025).

Treatment	Length (in.)	Width (in.)	Blossom rind (mm)	Stem rind (mm)	^{0}Brix	Firmness (kg/cm^2)
RS1	7.38	6.98	9.2	12.38	11.95	5.43
RS2	7.3	6.7	9.12	12.94	11.88	5.55
RS3	7.43	7	12.8	14.22	11.35	5.54
RS4	7.33	6.55	9.8	13.45	11.8	5.7
RS5	7.48	6.88	10.39	13.2	12.43	4.38
RS6	7.5	6.75	10.6	13.62	11.1	5.78
RS7	7.23	6.8	8.87	11.48	10.68	6.55

Figures 1a and 1b. The difference of vine growth between manually separated vines (left) compared to natural, untouched watermelon vines (right) (Photos taken in the 2024 grafting trial on June 13, 2024).

II. Scion Variety Trial

The 2025 scion variety trial was transplanted on May 15 in a commercial field in Stockton, CA. It was a repeat from last year with only two of the six scions replaced (Table 6). Experimental design, rootstocks (Table 5), pollenizer, in-season field management, and protocols of fruit harvest and quality measurement were identical to the 2024 trial. Use the link (https://ucanr.edu/county/stanislaus-county/article/vegetable-views-summer-2025) to check information of the 2024 trial. Similar to the 2024 trial, vines were separated throughout the season. NDVI was taken to compare canopy growth among combinations. We made two harvests on August 13 and 21. Fruits were processed the same as previous trials.

Table 5. List of rootstocks in the 2025 scion variety trial.

Rootstock	Type
Camelforce (CAM)	Interspecific hybrid squash
Cobalt (COB)	Interspecific hybrid squash
Carolina Strongback (CSB)	Citron rootstock

Table 6. List of scions used in the 2025 watermelon scion variety trial.

Scion	Rind Type	Description
SC1	Dark Crimson Stripe*	Oval/blocky shaped
SC2	Crimson Sweet	Blocky shaped fruit
SC3	Crimson Sweet	Round/oval shaped
SC4	Crimson Sweet	Uniform, large oval-shaped fruit
SC5	Crimson Sweet*	Medium green fruit with dark stripes
SC6	Mottle Stripe	Round/blocky shaped

*These scions were different from the 2024 trial.

Table 7. Fruit yield from each harvest and total yield for the 2025 watermelon scion variety trial.

Scion	Rootstock	First Harvest (August 13, 2025)			Second Harvest (August 21, 2025)			Total	
		No/Acre	Tons/Acre	Avg. Weight (lb.)	No/Acre	Tons/Acre	Avg. Weight (lb.)	No/Acre	Tons/acre
SC1	CAM	4322	39.6	18.4	1971	13.1	12.6	6293	52.7
	COB	5636	54.7	19.4	1107	8.4	13.2	6743	63.2
	CSB	4011	35.4	17.4	1141	8	11.7	5152	43.4
SC2	CAM	3769	35.7	19.3	3077	26.8	18.2	6846	62.5
	COB	4461	42.6	19.3	2697	21.2	14.7	7158	63.8
	CSB	4910	44.5	18.3	1176	7.1	12.4	6086	51.6
SC3	CAM	5533	37.4	13.6	2697	17.4	12.3	8230	54.9
	COB	5913	47.5	16.1	1833	9.1	10.1	7746	56.7
	CSB	4149	26.9	13	1902	11	11.7	6051	37.9
SC4	CAM	4046	38.3	19.1	2697	20.8	15.6	6743	59.1
	COB	4288	36.2	16.9	2455	18.3	14.9	6743	54.5
	CSB	4841	39.9	16.6	795	4.9	12.6	5636	44.9
SC5	CAM	4633	45	19.5	1833	14.3	16.8	6466	59.3
	COB	4806	43	17.9	553	4.1	14.6	5360	47.1
	CSB	4322	36.2	16.7	761	5.8	14.8	5083	42
SC6	CAM	4426	38.8	17.8	1556	10.9	13	5982	49.7
	COB	6743	64.2	18.8	1141	5.9	11.1	7884	70.1
	CSB	3976	35.6	18	1003	6	13	4979	41.7

Table 8. Fruit quality for all combinations taken from the first harvest (August 13, 2025).

Scion	Rootstock	Length (in.)	Width (in.)	Blossom rind (mm)	Stem rind (mm)	^{0}Brix	Firmness (kg/cm^{2})
SC1	CAM	11.4	8.8	8.7	17.2	11.2	4.5
	COB	11.3	9	12.1	14.9	11.9	4.5
	CSB	11.2	9.2	9.8	15.4	13.3	3.7
SC2	CAM	11.2	8.6	9.1	17.3	12.1	5.4
	COB	10.8	9.2	11.6	15.8	11.8	5.5
	CSB	10.1	8.6	9.4	17.3	11.6	4.9
SC3	CAM	9.2	8.6	8.6	14.4	11.3	5
	COB	10	8.8	9.1	15.2	11.4	5.6
	CSB	9.4	8.2	10.9	11.6	11.9	3.2
SC4	CAM	11.4	9.2	11.1	20.6	12	5.4
	COB	10.7	8.8	10.2	17.7	11.1	5.5
	CSB	10.6	8.6	9.2	14.4	12.3	4.1
SC5	CAM	11.8	8.9	12.2	19.4	11.1	4.7
	COB	11.4	9	10.2	16.2	11.2	4.2
	CSB	10.2	8.1	13.3	18.5	11.7	4.2
SC6	CAM	10.1	8.9	8.6	17.1	12.2	4.8
	COB	10.6	9.4	10.6	14.1	11.7	3.6
	CSB	10.9	9.1	8.5	14.7	13.2	3.5

- *Results.* Overall, fruit yield had a similar trend to the 2024 trial. Plots harvested from plants grafted with Carolina Strongback (CSB) yielded the lowest among all combinations regardless of scion (Table 7). Five out of six scions produced the fruit with the lowest average weight after grafting onto CSB. For fruit quality, CSB-grafted fruit had the highest sugar content except for SC2. Fruit flesh was also the softest for all CSB-grafted treatments (Table 8).

III. Rootstock Variety Trial

The 2025 rootstock variety trial has entered its seventh year since 2019. A seven-year review article summarizing the development of our watermelon rootstock research program was recently published (https://progressivecrop.com/2025/11/13/seven-year-review-of-watermelon-grafting-research-programs-to-advance-long-term-sustainability-of-watermelon-production-in-california/). Again, the 2025 rootstock variety trial continued to evaluate top-performing rootstock-scion combinations that can outperform non-grafted plants. We used the same rootstocks, scion, and pollenizer that were included in the last three repeated trials. Trial information can be found in Table 9.

Table 9. Information of the 2025 rootstock variety trial.

Rootstocks	Scion	Location/Planting Information	Data Collection
Carnivor (CAR) Camelforce (CAM) Cobalt (COB) Carolina Strongback (CSB) Non-grafted (NG)	Warrior	•Site location: Stockton, CA •Transplanted on April 21, 2025. •Vines were separated as usual.	•NDVI •Fruit yield (Three harvests: July 21, July 23, August 6) •Fruit quality: dimension, thickness, sugar, firmness

Table 10. Fruit yield from each harvest and total yield for the 2025 watermelon rootstock variety trial.

Rootstock	First Harvest (July 21, 2025)			Second Harvest (July 30, 2025)			Third Harvest (August 6, 2025)			Total	
	Avg. Weight (lb.)	No/acre	Ton/acre	Avg. Weight (lb.)	No/acre	Ton/acre	Avg. Weight (lb.)	No/acre	Ton/acre	No/acre	Ton/acre
CAR	17.5	2316	20.2	19.7	3566	35.7	15.4	3730	28.6	9611	84.6
CAM	19.5	2336	22.9	18.7	3709	35.3	15.2	3217	24.4	9262	82.7
COB	17.6	2234	19.7	18.5	3484	32.4	15.9	3873	30.9	9590	83
CSB	15.6	2664	20.7	15.7	2623	21.1	15.7	2541	19.7	7828	61.6
NG	15.0	2725	20.7	12.4	943	6.2	10.9	676	4.7	4344	31.6

Table 11. Fruit quality for all treatments using fruit from the first harvest.						
Rootstock	**Length (in)**	**Width (in)**	**Blossomrind (mm)**	**Stemrind (mm)**	**Brix**	**Firmness (kg/cm^2)**
CAR	11.0	8.8	11.6	15.5	11.8	4.5
CAM	11.3	9.0	11.0	15.4	11.8	3.8
COB	10.8	8.7	11.4	16.1	11.1	5.4
CSB	10.8	8.4	8.9	14.6	11.8	3.5
NG	10.9	8.3	11.9	16.7	11.5	3.7

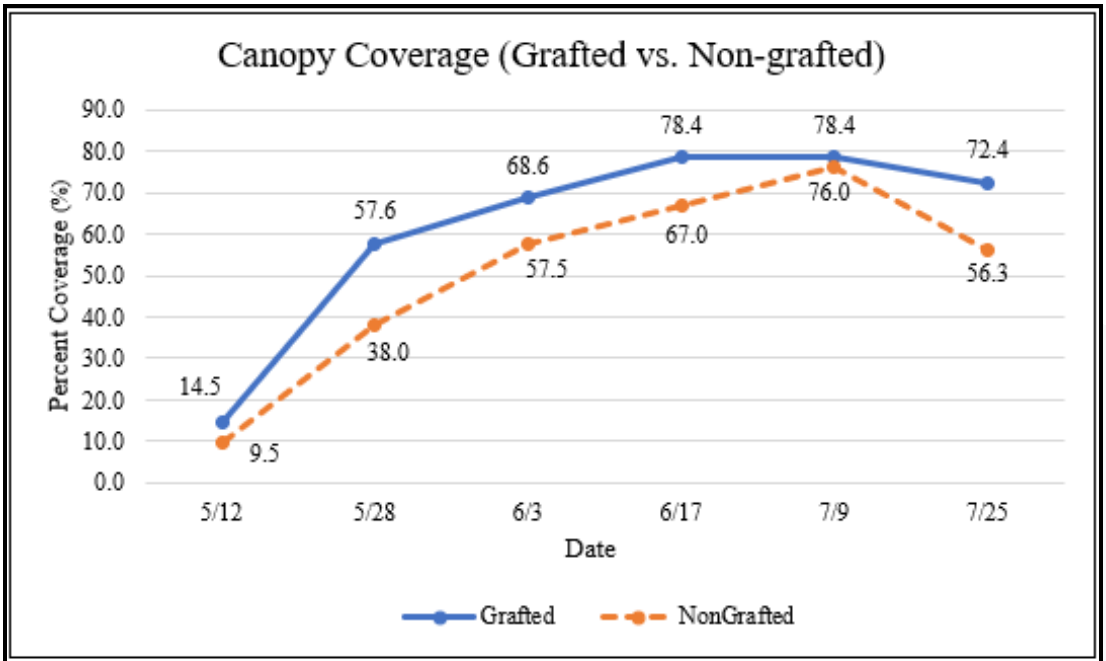

Figure 2. Percent canopy coverage between grafted and non-grafted treatments.

- *Results.* Non-grafted plots yielded comparably to most of the grafted treatments in the first harvest but had a dramatic decrease of yield in the last two harvests compared to grafted treatments (Table 10). For total yield, grafted plots had over 2.5x total fruit weight compared to the non-grafted control (e.g., 84.6 vs. 31.6 tons/acre). Lower fruit yield for the non-grafted treatment was also reflected for an earlier vine decline after July 9 than grafted plots in general (Figure 2). For fruit quality, fruit did not get firmer after grafting with CAM and CSB compared to the non-grafted control (Table 11).

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