

2025-Clemson University Final Progress Report

Project title: Filling the gaps for informed and economical adoption of Carolina Strongback grafted nursery to combat *fusarium* wilt.

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Introduction

A field research experiment was conducted at Edisto Research and Education Center (EREC), Clemson University. The watermelon nursery in experiment was transplanted as per the dates proposed. The following treatments were tested in the proposed experiments.

Table 1: Proposed treatments for first experiment (total 12 treatments: 3 main plot treatments, 4 sub-plot treatments; Split plot design).

Main plot treatments (Transplanting time)	Subplot treatments (Planting density)
April 1	1800 plants/acre + regular nursery (24 sq feet per plant; Business as usual)
April 10	1800 plants/acre + SB grafted nursery (24 sq feet per plant)
April 20	1550 plants + SB grafted nursery (28 sq feet per plant)
	1300 plants + SB grafted nursery (32 sq feet per plant)

The 4–6-week-old watermelon nursery of cultivar fascination [grafted (on SB rootstock) and non-grafted] were purchased from the Tri-Hoshtil Ag group. A special pollinizer variety of watermelon (SP-6) was planted in the nursery at EREC, as per the watermelon nursery planting guidelines of Clemson University. The 4–6-week-old nursery was transplanted as per treatment. The watermelon nursery was transplanted on the raised beds with plastic mulch (30 inches bed width) at a row spacing of 8 ft * 3 ft for 1800 plants/acre, 8 ft*3.5 ft in 1550 plants/acre, and 8 ft*4.2 ft in 1300 plants/acre treatments. Experiment was executed in a split plot design with 3 main plot treatments (transplanting time) and 4 sub-plot treatments (transplanting density), each replicated 4 times on a plot size of 16 ft × 21 ft (2 row with 14, 12, and 10 plants in 1800, 1550 and 1300 plants/acre). A pollinizer watermelon variety (SP-6) seedling was transplanted after every 3 seedlings of seedless watermelon plants in the row for adequate pollination. Starter N, P, and K fertilizer was applied as per soil testing recommendations (by Agricultural Services Laboratory, Clemson University). A drip irrigation and fertigation system were installed, and a soluble fertilizer program was initiated after transplanting as recommended in South-Eastern US vegetable handbook.

Results

Periodic plant vigor rating: The periodic plant vigor rating was measured on May 30, June 7, June 14, June 20 and June 26. On the May 30, June 7, June 14 and June 20, Transplanting time and density had significant effect on the plant vigor rating (Fig. 1A) where highest plant vigor rating was observed on April 1 planting (Fig. 1B). On June 26, Transplanting time did not have any effect on the plant vigor rating (Fig. 1B). Grafted plants transplanted at 1800 plants per acre had significantly higher plant vigor rating than 1300 and regular nursery (@1800 plants) at May 30, June 6 and June 14 (Fig. 1C). The transplanting density of 1300 plants had significantly higher vigor rating than regular nursery at all time points. On May 30, June 6 and 14, April 1 transplanting time had higher vigor rating than April 20, but there was no difference observed for plant vigor rating among the transplanting time on June 26 (Fig. 1B). The SB grafted plants transplanted at 1800, 1550 and 1300 plants per acre had higher plant vigor rating than regular plants (@1800/acre) at all sampling dates (Fig. 1C).

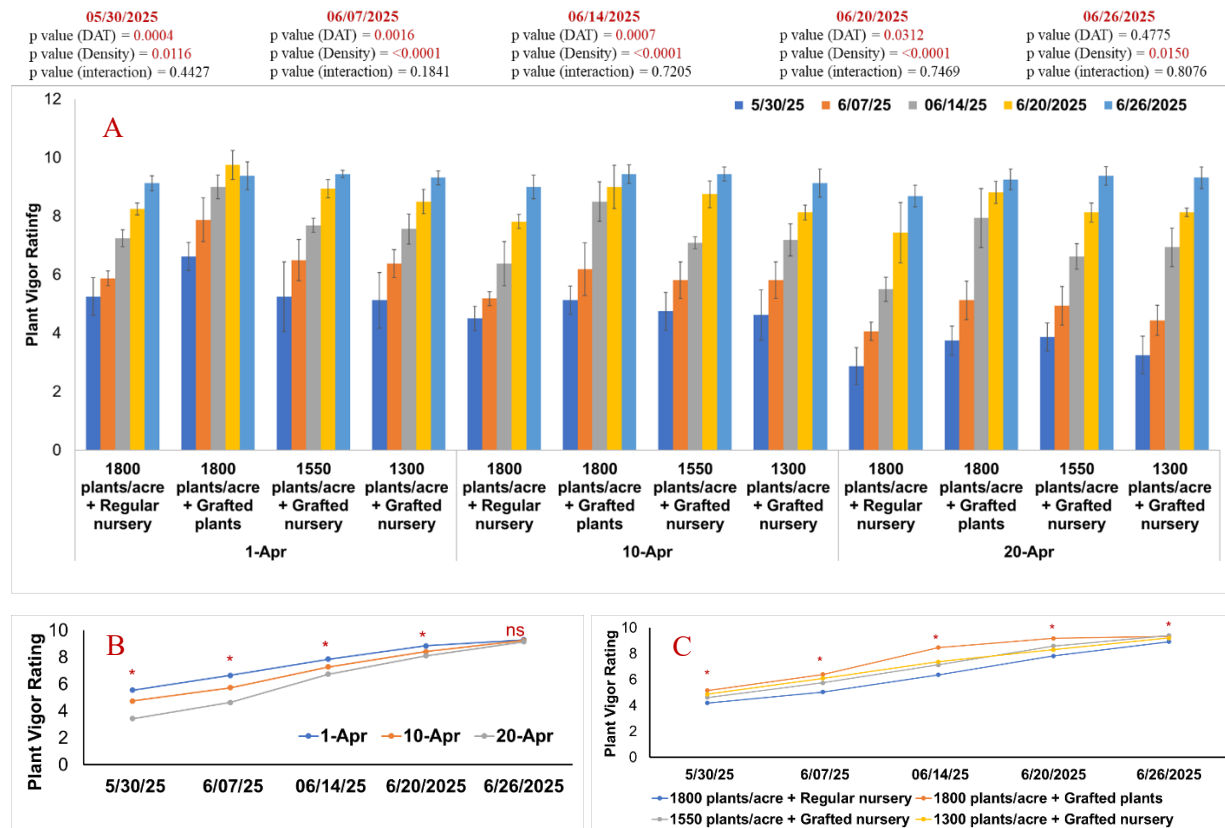


Figure 1: Periodic plant vigor rating at 5 different time points. **A:** Interaction plot for Transplanting date and density; **B:** Main plot for transplanting date; **C:** Main plot for transplanting density.

Periodic marketable fruit yield: Marketable fruit yield was statistically similar for all treatments at second, and fourth pick (Figure 2A). At first pick, lower marketable fruit yield was observed in April 10 and April 20 transplanting dates than April 1 transplanting date (Figure 2A & 2B). At third pick, lower marketable fruit yield was observed in April 1 transplanting date than April 10 and April 20 transplanting dates (Figure 2A & 2B). Transplanting density for SB grafted plants at

1300 plants/acre had similar fruit yield at first, second, third and fourth harvest to that of transplanting at 1550, 1800 SB grafted plants/acre and to normal nursery at 1800 plants/acre (Figure 2A).

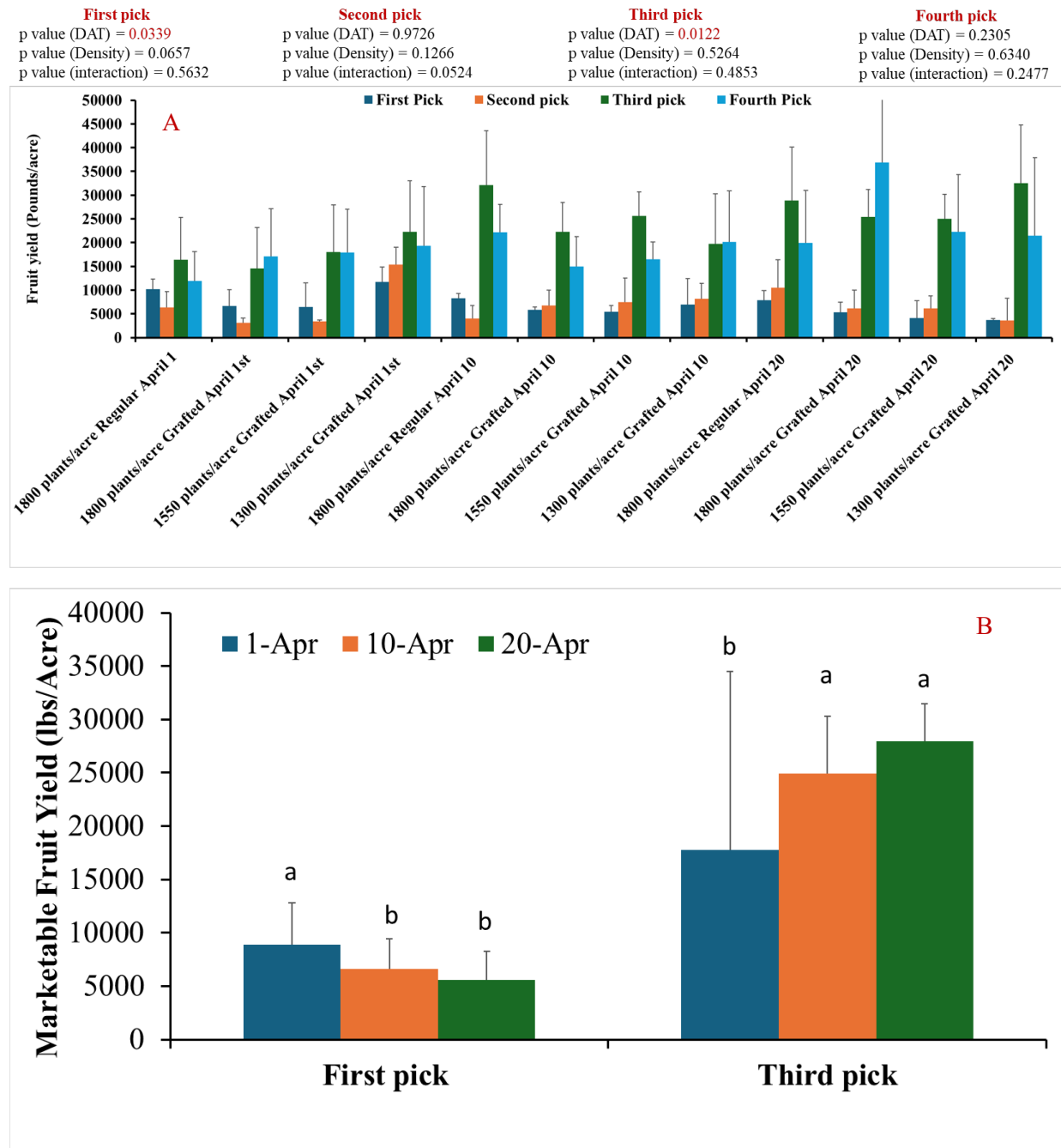


Figure 2: A: The periodic marketable fruit yield at different time points (different picks) as impacted by transplanting time and density. **B:** Main effect of transplanting time on marketable fruit yield at first and third pick.

Total marketable fruit yield: Total marketable fruit yield was calculated by adding the fruit yield from first, second, third and fourth fruit harvest. Statistically similar total marketable fruit yield was observed in all treatments (Figure 3). Grafted plants transplanted at 1300 plants/acre recorded the similar fruit yield to than of grafted plants transplanted at 1800 and 1550 plants/acre and non-grafted nursery transplanted at 1800 plants/acre (Figure 3). This indicates that, since SB grafted plants have higher plant vigor than regular nursery plants, grafted plants need more spacing per plant (~33 sq feet per plant than recommended 24 sq feet/plant; at optimum growing conditions) to make use of higher plant vigor and produce similar yield. At higher transplanting density (1800 plants/acre) even though SB grafted plants produced similar yield to that of regular nursery, but it cost around ~\$700 *per acre* more to put extra 500 extra grafted plants per acre when similar fruit yield can be harvested with 1300 SB grafted plants per acre.

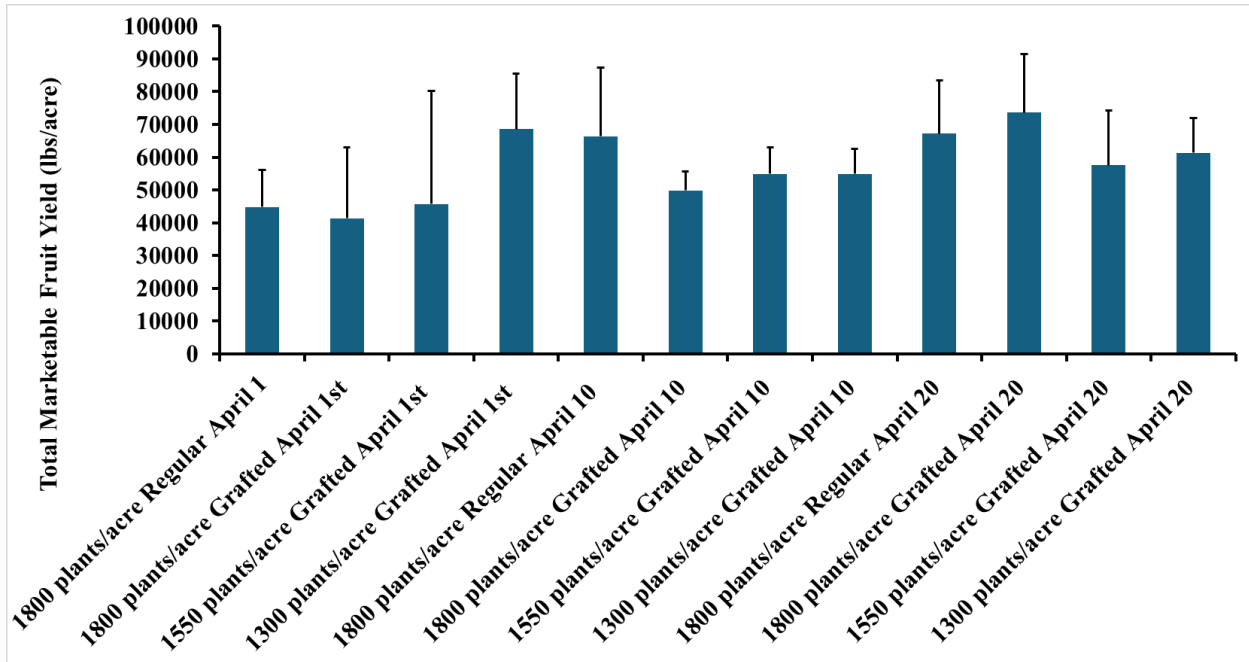


Figure 3: The total marketable fruit yield as impacted by transplanting time and density.

Fruit brix value: Brix value was measured from five different fruits in each plot at each harvest. The mean of brix value for all fruits is shown in figure 4. We did not observe any effect of different treatments on fruit brix value (Figure 4).

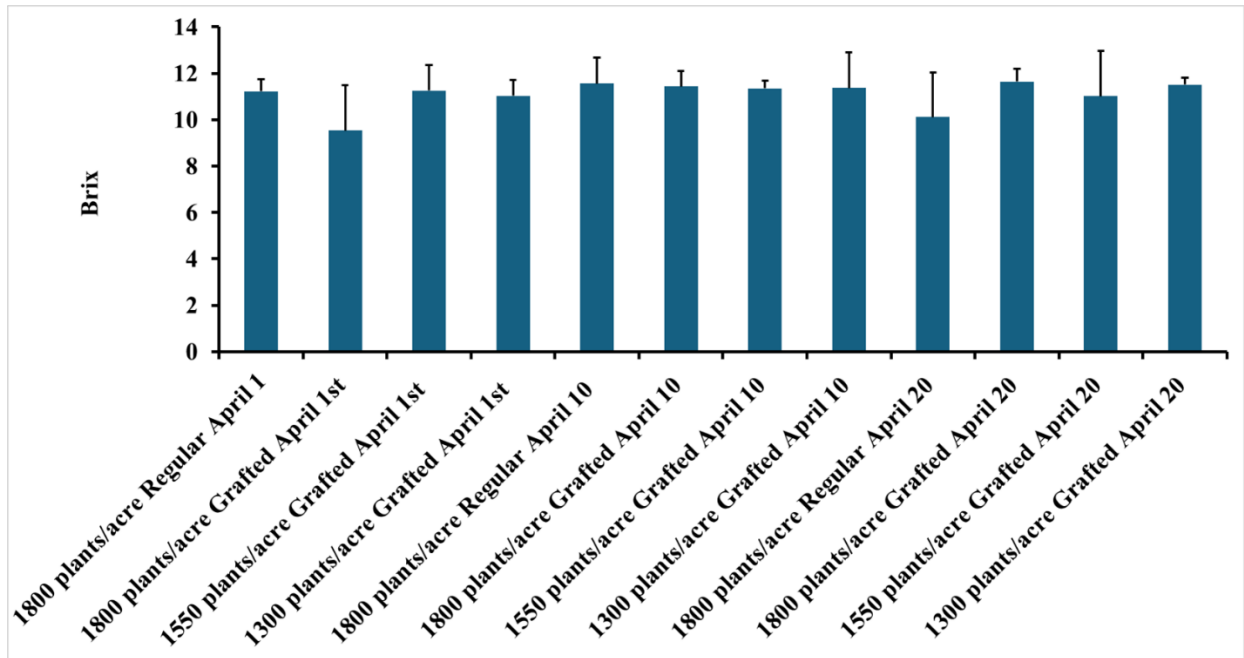


Figure 4: The fruit brix value as impacted by interaction effect of different transplanting dates and transplanting density.

SPAD and NDVI index: The SPAD index measures the plant greenness (chlorophyll) and normalized difference vegetative index (NDVI) determine the canopy health and light interception. The different treatments had no effect on the SPAD index and NDVI index (Figure 5). The similar NDVI index for different treatments indicates that even transplanting density of 1300 plants had similar canopy cover and healthy canopy as compared to transplanting density at 1800 plants per acre.

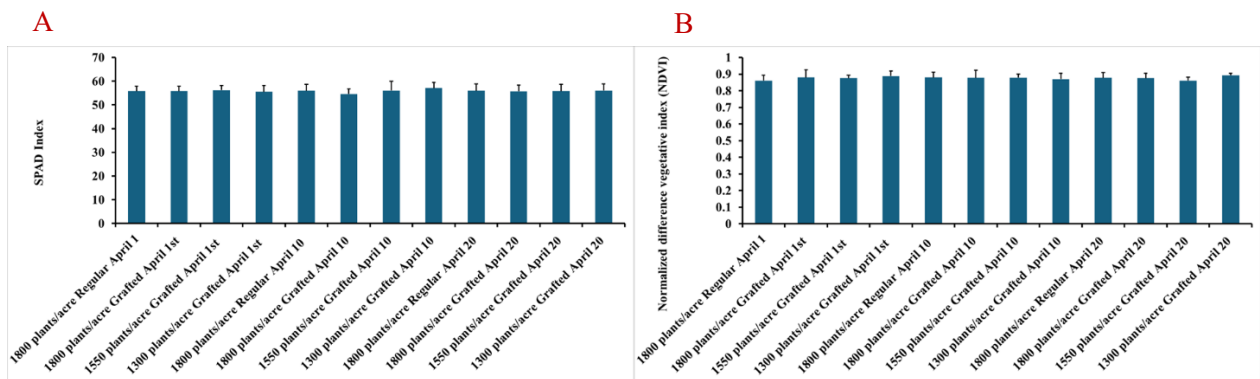


Figure 5: The SPAD (A) and normalized difference vegetative index (NDVI; B) as impacted by interaction effect of different transplanting dates and transplanting density.

Gross returns (\$): The gross returns were calculated using periodic yield and market price of the watermelon at each harvest. The grafted nursery transplanted at 1800 plants/acre on April 20 had the highest gross returns (\$14480) followed by 1800 non-grafted plants transplanted on April 10 and April 20 (Figure 6). The lowest gross returns were observed in grafted nursery planted at

1800 plants/acre on April 1 (Figure 6). Among transplanting densities, 1300 grafted plants/acre recorded the highest gross return with transplanted date of April 1, which was significantly higher than grafted and non-grafted nursery transplanted at 1800 plants/acre on April 1 (Figure 6).

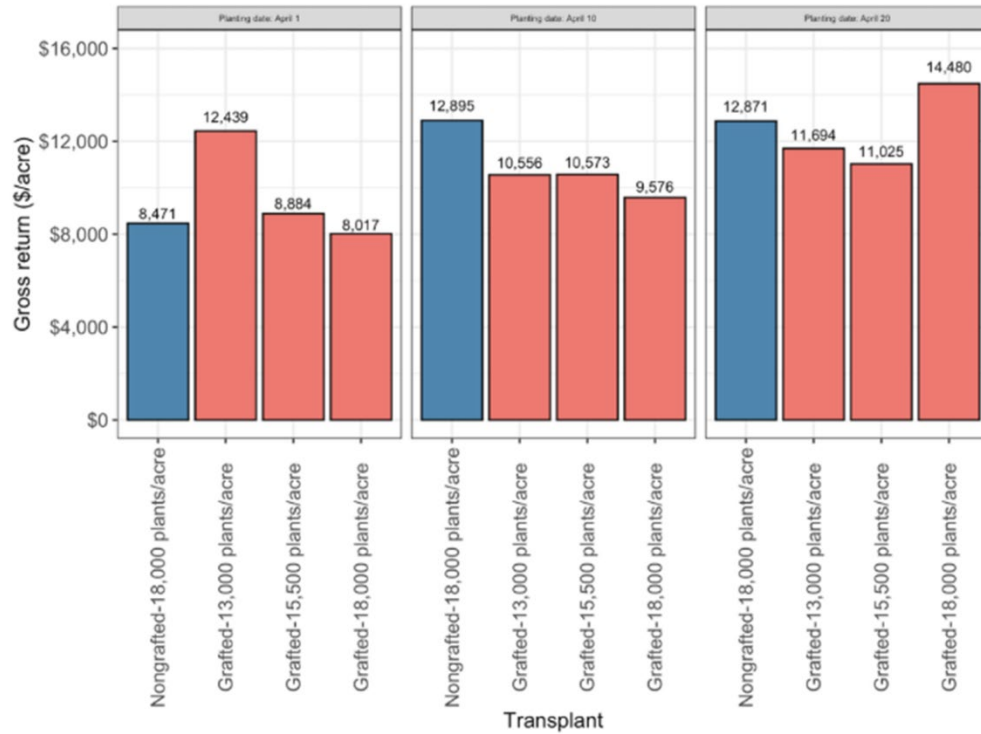


Figure 6: The gross returns from watermelon production as impacted by different treatments.

Net returns (\$): The net returns were calculated by subtracting the cost of production from gross returns. Similar to gross returns, grafted nursery plants transplanted at 1300 plants/acre on April 1 recorded the highest net returns as compared to grafted plants transplanted at 1550 and 1800 plants /acre and non-grafted plants at 1800 plants/acre transplanted on April 1 (Figure 7). The lowest net returns were observed grafted nursery transplanted at 1800 plants/acre on April 1 (Figure 7).

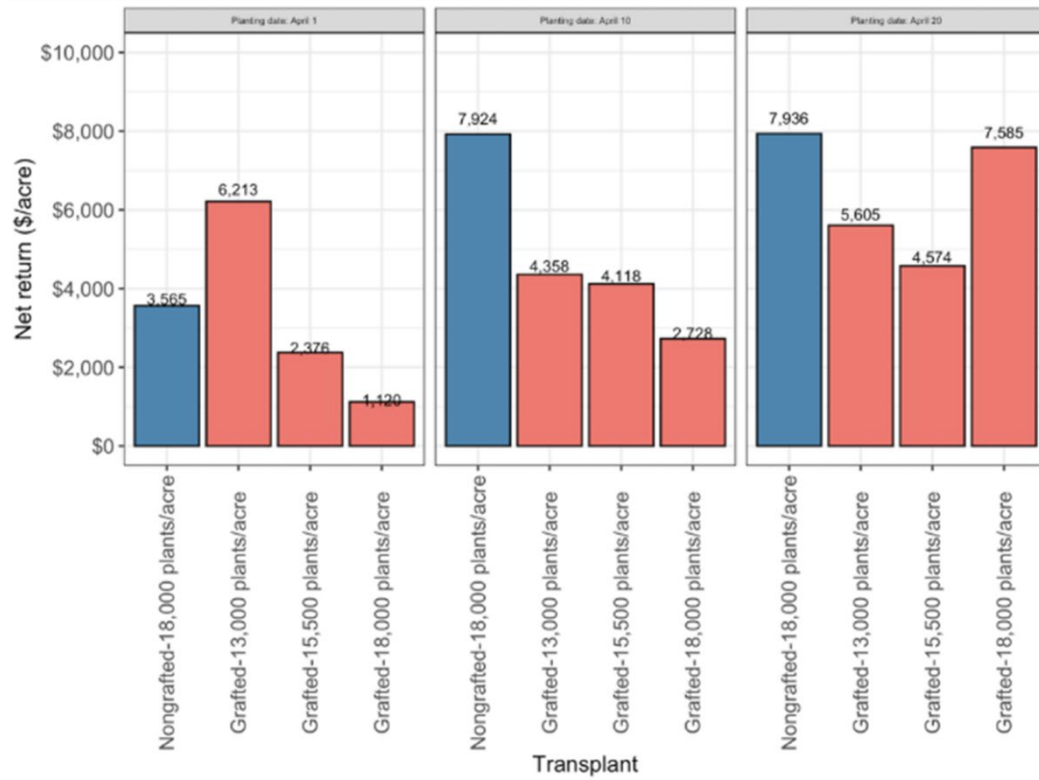


Figure 7: The net returns from watermelon production as impacted by different treatments.

Outcomes:

1. Jatana, B.S. (2025) Field demonstration at watermelon field day, July 10, 2025



Figure: Demonstration/ presentation of the National Watermelon Association funded experiment at the 2025- Watermelon field day at Edisto REC, Clemson University (July 10, 2025).

2. Jatana, B.S., Nian Y (2025). *Optimizing the transplanting date and density for Carolina strongback grafted watermelon nursery*. ASHS conference, New Orleans
3. A manuscript is current being written (by combining the 2024 and 2025 experimental results) for publication in a reputed research journal.



Regular Nursery: 1800 plants

SB Grafted Nursery: 1800 plants



SB Grafted Nursery: 1550 plants

SB Grafted Nursery: 1350 plants