Preliminary evaluation of NC strawberry cultivars for susceptibility to Neopestalotiopsis Leaf and Fruit Rot

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Summary

NC State conducted a strawberry *Neopestalotiopsis* (Neo-P) trial at the Horticultural Crops Research Station in Castle Hayne, NC. The main objective of the trial was to evaluate disease susceptibility and yield performance in strawberry cultivars inoculated with mixed strains of *Neopestalotiopsis* spp. The trial was established in October 2024 using annual plasticulture practices and comprised of 13 cultivars. Mixed Neo-P inoculum was applied to the plants three times throughout spring 2025. Cultivars with the highest marketable yield were Fronteras, Camarosa, and Miss Jo with 379, 332, and 327 g respectively. Cultivars with the lowest marketable yield were 921 (unreleased, Rutgers) and 122x08 (Lassen Canyon Nursery (LCN)) with 38 and 124 g. Cultivars exhibiting the highest average disease severity were 122x08, Ruby June, and Miss Jo while the lowest average disease severity cultivars were 921, Scarlet, and Rocco. In addition, a demonstration plot featuring 15 public and private breeding program cultivars were grown and evaluated alongside the larger research trial. This study will be repeated in spring 2026 to further research cultivar susceptibility and management strategies for Neo-P.

Introduction

Neopestalotiopsis (Neo-P) leaf spot, crown rot, and fruit rot is an emerging fungal disease of strawberry. While *Pestalotia*-like fungi have been previously reported as minor pathogens, a large outbreak caused by *Neopestalotiopsis* spp. in Florida in 2018 and its continued reports in other states have since led to significant crop loss in the Southeastern US. While detected sporadically before, in 2024-25, North Carolina experienced the first outbreak of Neo-P in multiple fruiting fields, with transplants and/or surrounding fields being infection sources. The continued rapid spread and devastating impact of this pathogen has made it one of the main priorities for strawberry disease management on the east coast.

Neo-P infects the leaves, fruit, and crowns of strawberry plants (Figure 1). Leaf spots are tan to brown and of various sizes. They often coalesce into larger, irregular shaped lesions. Fruit rot symptoms appear as shriveled, dry, light-tan lesions. Neo-P leaf spot and fruit rot symptoms can resemble those caused by other pathogens (such as Anthracnose) but can be distinguished by the presence of black spore masses near the lesion's center. Crown infections are the most common symptom in NC and cause wilting, stunting, and eventual death. Lower leaf reddening is characteristic of a Neo-P infection, but not diagnostic.

Figure 1. Typical symptoms of *Neopestalotiopsis* spp. infection on different plant parts.

In NC, Neo-P infections often begin in the crown and can remain symptomless until well after planting. As the infection progresses, these crown rot infected plants can become a source for secondary infections on leaves and fruits. With crown rot infections able to remain latent, Neo-P often begins at the nursery and travels on transplants to farms. Thus, the most effective control method for preventing disease progression is using disease free planting material. This is possible through nursery selection and to some extent by culling visibly infected transplants before planting. If a farm has a history of Neo-P infection it is important to bury old strawberry crowns, rotate fields if possible, and fumigate beds prior to planting. If infection is present during the season – removing symptomatic plants, working in infected fields least, and using sanitization practices are key to prevent further spread. Fungicides can be effective for preventing the fruit rot and leaf spot stage, but more research is needed for NC specific recommendations.

The goal of this project is to evaluate strawberry cultivar tolerance against a mixed inoculum of *Neopestalotiopsis* spp. (Neo-P) from NC isolates. Our hypothesis was that different strawberry cultivars will have varying susceptibility to Neo-P infection. There are currently a lot of unknowns with Neo-P, and this trial aims to shed light on some of those questions and share results back to growers.

Methods

This experiment featured three individual trials: Trial 1: 13 commonly grown strawberry cultivars in a replicated trial; Trial 2: 10 cultivars from the public breeding programs at NC State and UC Davis; Trial 3: 5 cultivars donated from a private breeding program.

Trial 1: The cultivars in this trial were Albion, Ashley Jay, Camarosa, Chandler, Fronteras, Liz, Miss Jo, Monterey, Rocco, Ruby June, Scarlet,122x08, and 921 (unreleased, Rutgers). Plants for the trial were sourced from tissue culture and propagated indoors at NC State University.

Trial 2: The non-replicated public breeding program trial had 20-plant plots. It contained UC Davis cultivars Monarch, Eclipse, Surfline, Golden Gate, Finn, and Mojo. It also included NC State early selections of NC22-005, NC22-008, NC22-003, and the released cultivar Rocco.

Trial 3: The non-replicated private breeding trial had 20-plant plots of cultivars 15-305R, 15-105R, Jayulita, Red Sayra, and 118.129-105.

The experiment was planted in October 2024 and was grown under standard annual plasticulture methods. In late March 2025, three to five plants per plot were randomly selected to be inoculated with a mixture of *Neopestalotiopsis* spp. strains collected from NC strawberries. Inoculations were done by spraying a spore suspension on whole plants using a hand pump sprayer. Due to weather conditions not being conducive for fungal infection after the initial inoculation, the same plants were inoculated two more times throughout the season. This helped to maintain high disease pressure and allowed for more obvious differences in severity between cultivars.

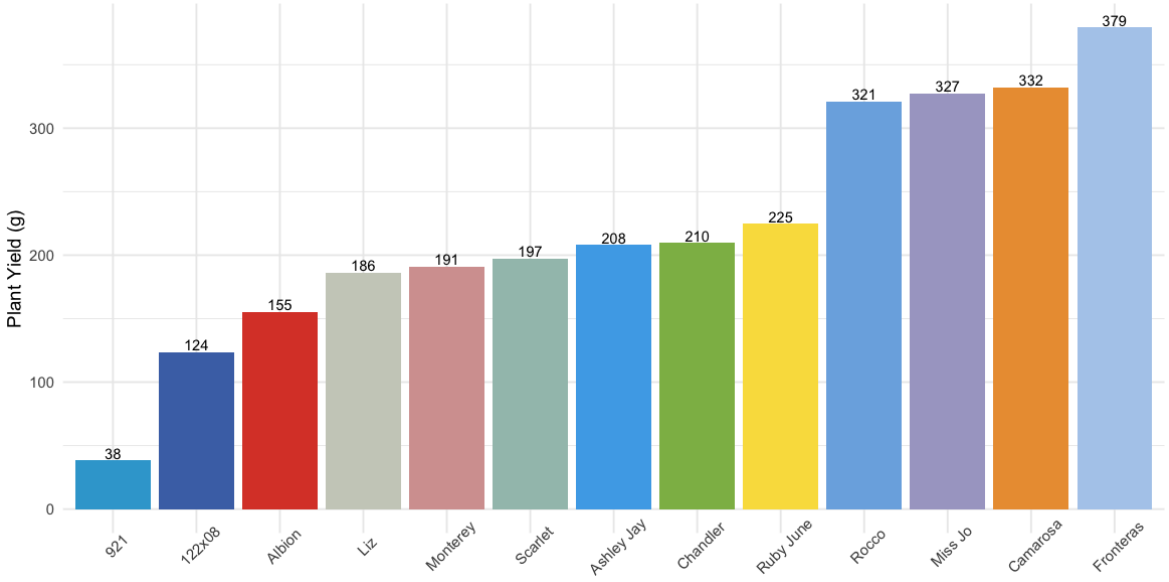
Plants were evaluated by two metrics, marketable fruit yield and disease severity. Fruit was harvested from April 8 until May 30, spanning an 8-week period. Fruit was sorted as marketable or unmarketable based on fruit size, shape and presence of disease. The disease severity on inoculated plants was rated based on the area of the leaves with spots, amount of leaf death, and plant size when compared to uninoculated plants. Trial plots were evaluated for disease severity from May 21 until June 12. Final ratings were taken after the typical season end but are representative of disease severity after an extended period of infection and under plant stress conditions.

Results

Marketable Yield

Trial 1: These plots were harvested twice a week from April 8 to May 30, totaling 15 harvests. The highest average marketable yield was 379 g produced by Fronteras (Figure 2). Other top performers include Camarosa at 332 g, Miss Jo at 327 g, and Rocco at 321 g. At the low end of performance was 921 with 38 g and 122x08 with 124 g. Cultivars that produced early in the season were Rocco, Fronteras, and Camarosa.

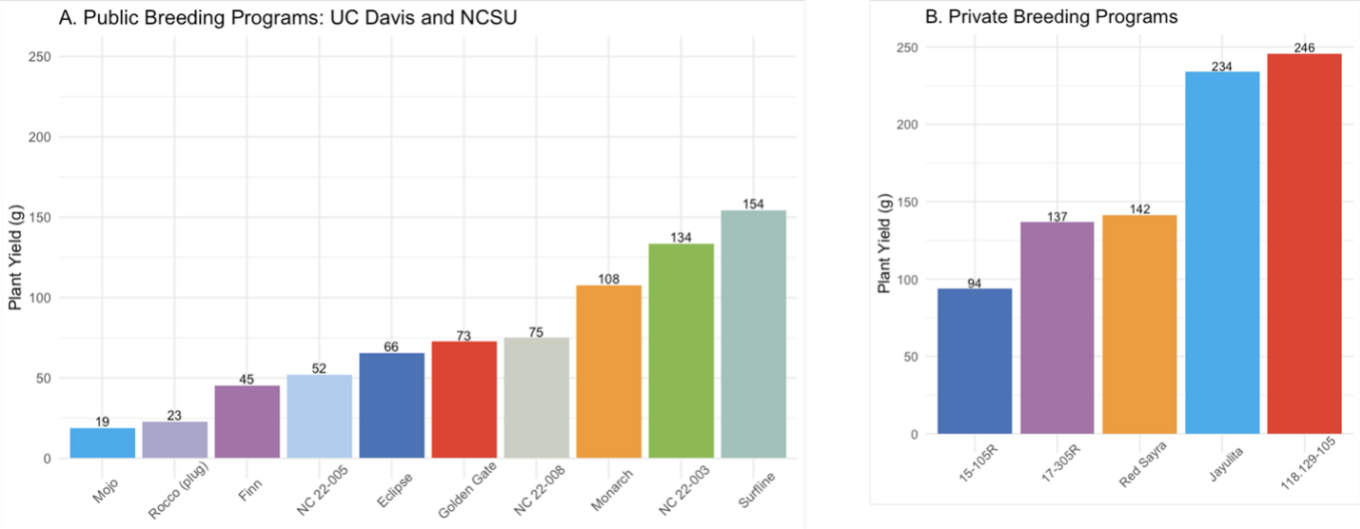
Figure 2. Cumulative Marketable yield per Plant (in g) of the replicated cultivar trial of Common Cultivars grown in NC.



Trial 2: These plots were harvested once a week from April 18 to May 30, totaling 7 harvests. The cultivars with the highest marketable yield were Surfline and NC 22-003 with yields of 154 and 134 g (Figure 3). Cultivars with the lowest marketable yield were Mojo and Rocco. Plant material for these plots was sourced through nursery propagation with some plants showing symptoms of Neo-P crown infections. Plants were smaller, had less yield, and died throughout the season compared to the replicated trial plots.

Trial 3: These plants were harvested April 8 to May 30, totaling 8 harvests. The cultivar with the highest marketable yield was 118.129-105 with 246 g and the cultivar with the lowest marketable yield was 15-105R with 94 g (Figure 3).

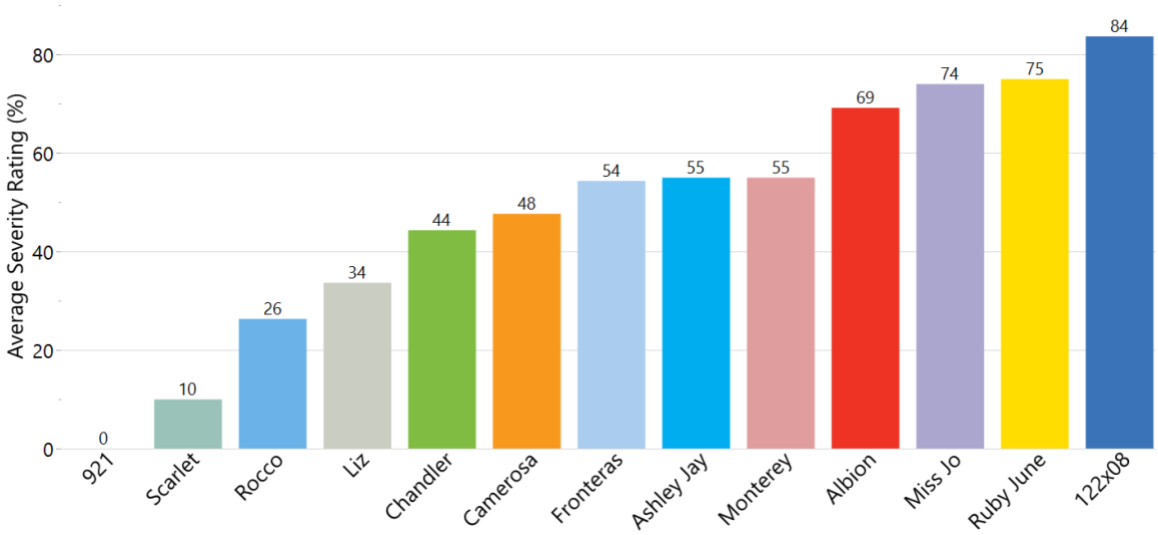
Figure 3. A. Cumulative Marketable Yield per plant (in g) for public varieties from UC Davis and selections from NCSU (non-replicated); B. Cumulative marketable yield per plant (in g) for private selections and cultivars (non-replicated)



Disease Ratings

Trial 1: Disease severity differed by cultivar and severity levels increased for all cultivars over time. At the final rating (6/12/25), the cultivar with the highest average severity of 84% was 122x08; followed by Ruby June at 75%, Miss Jo at 74%, and Albion at 69% (Figure 4). The only cultivar to show no signs of Neo-P infection was 921. However, these plants stayed small all season and showed the lowest yield. Scarlet, Rocco and Liz also showed low disease severity with average ratings of 10%, 26%, and 34%, respectively. The common NC plasticulture cultivars Chandler and Camarosa showed middling disease severity ratings but still yielded well.

Figure 4. Trial 1: Average disease severity rating from Neopestalotiopsis spp. infection among common NC cultivars on 6/12/25.



Trial 2: The highest average severity rating among the public breeding program cultivars were Eclipse at 87%, Finn at 79%, and Mojo at 69% (Figure 5), all from UC Davis. The lowest among them were NC 22-005 at 17.5%, NC 22-008 at 20%, both NCSU selections, and Surfline (UC Davis) at 21.67%. As some of the plants in this trial had suspected Neo-P crown rot infection, whole plant loss was observed at an earlier stage than in the replicated trail plots.

Trial 3: Among the private breeding program cultivars, 118.129-105 had the highest average severity rating of 75% while the cultivar 15-105R had the lowest rating of 15% (Figure 6).

Figure 5. Trial 2: Average disease severity rating from *Neopestalotiopsis* spp. infection among public breeding program cultivars (non-replicated).

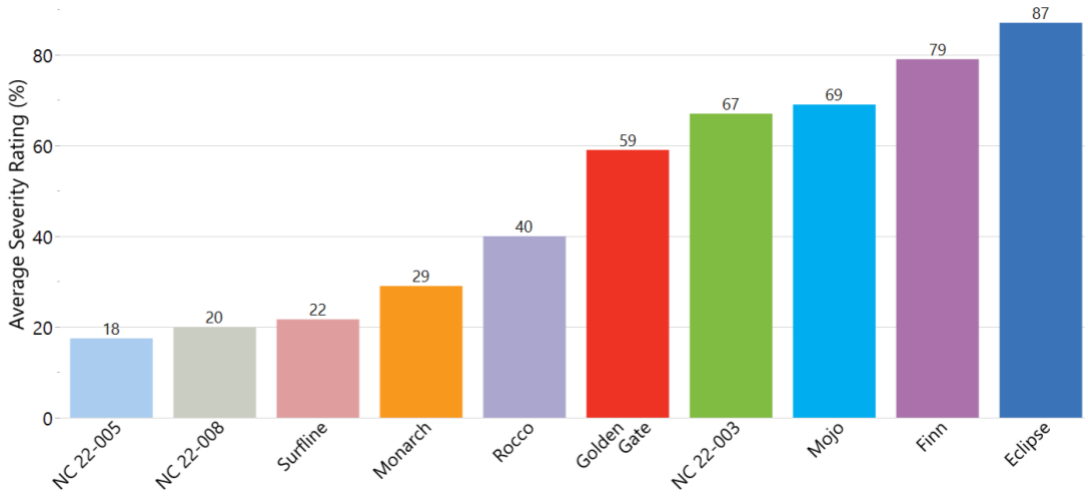
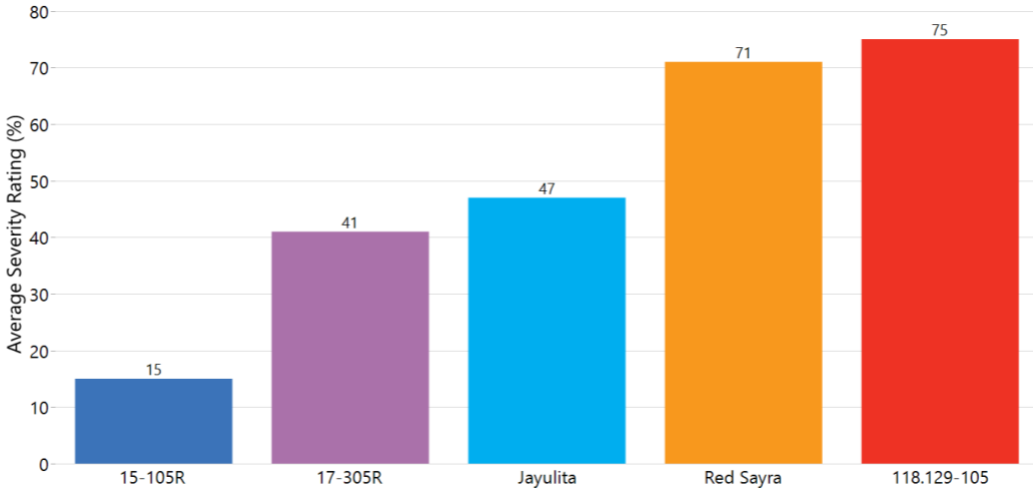


Figure 6. Trial 3: Average disease severity rating from Neopestalotiopsis spp. infection among private breeding program cultivars (non-replicated).



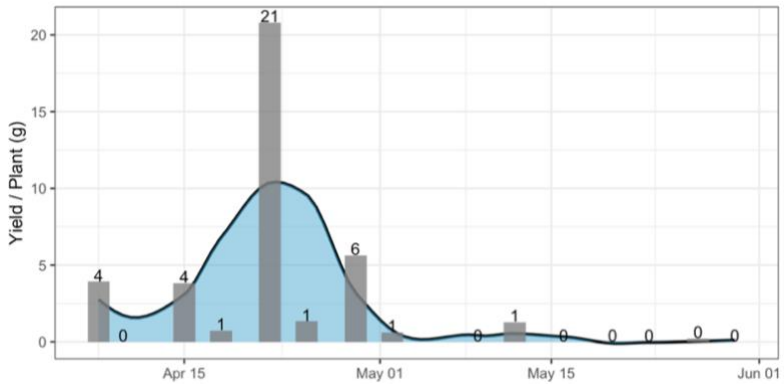
Cultivar Review

We wanted to provide results by cultivar based on the observations in Trial 1. This section will provide wholistic cultivar results for growers who want to understand how specific cultivars performed in this trial.

921-Unreleased, Rutgers

Plot pictures throughout season

Marketable Plant Yield Over Time



Final Disease Severity Rating

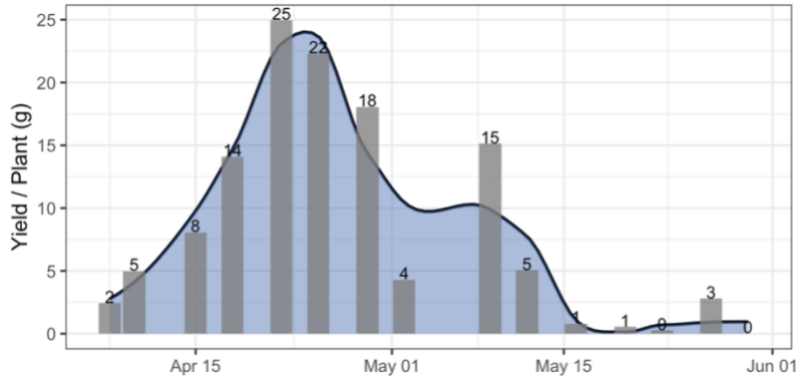
Key Take Aways

- Yield: lowest average plant yield at 38 g
- Disease: lowest disease severity among cultivars trialed with a rating of 0%
- Even though 921 had the lowest disease severity, it also had the lowest yield, making it a poor performer in this trial. Plants remained small and did not yield in the second half of the season.

122x08 – LCN

Plot pictures throughout season

Marketable Plant Yield Over Time



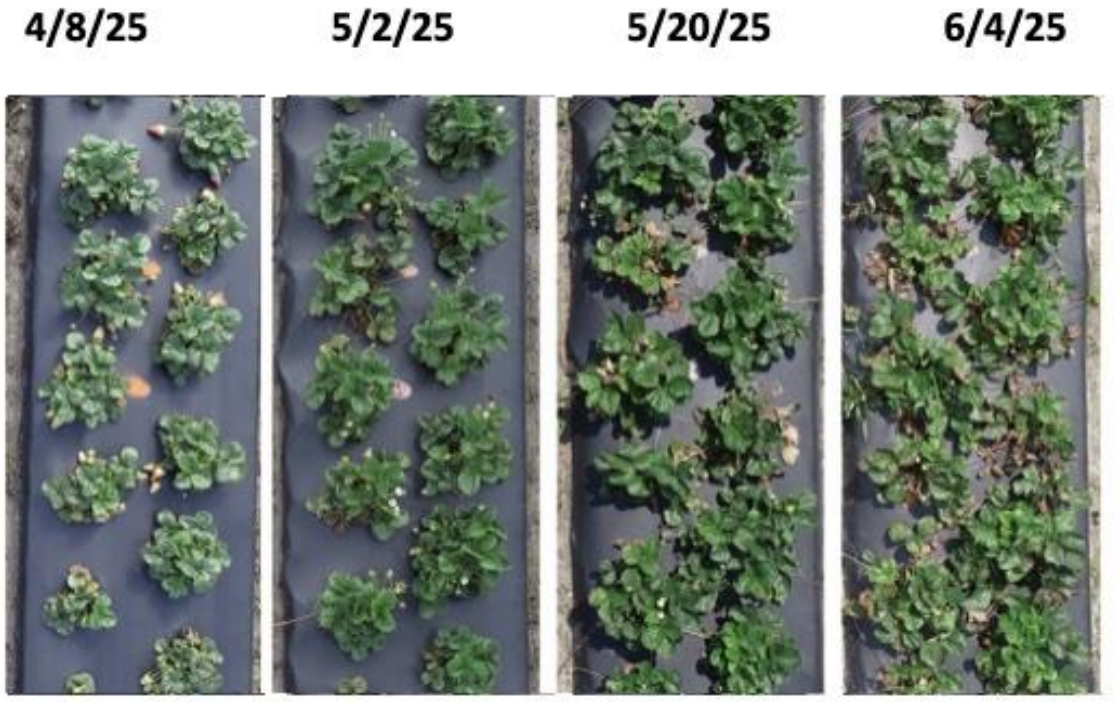
Final Disease Severity Rating

Key Take Aways

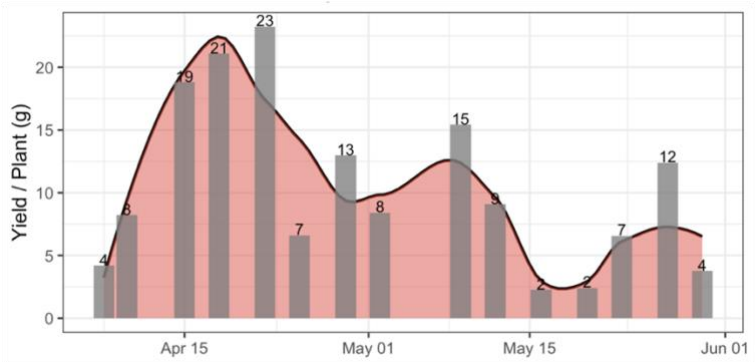
- Yield: second lowest yield with average plant yield of 124g
- Disease: highest disease severity with a rating of 84%
- 122x08 had a low yield and the highest disease severity rating, making it one of the weakest performers in this trial.

Albion – UC Davis

Plot pictures throughout season



Marketable Plant Yield Over Time



Final Disease Severity Rating

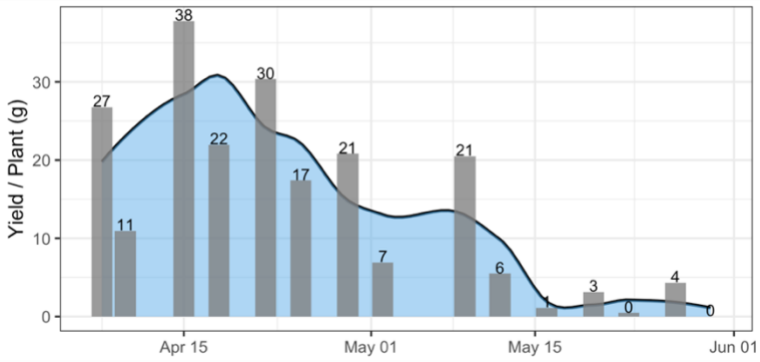
Key Take Aways

- Yield: lower average plant yield of 155 g
- Disease: high disease severity with a rating of 69%
- Albion was in the lower third for yield and upper third for disease severity, showing that it does not yield well when infected with Neo-P.

Ashley Jay – LCN

Plot pictures throughout season

Marketable Plant Yield Over Time



Final Disease Severity Rating

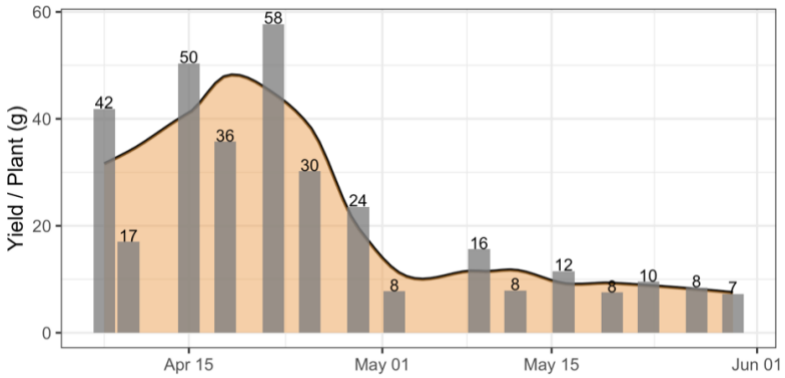
Key Take Aways

- Yield: average plant yield of 208 g, the median yield of trial
- Disease: moderate disease severity of 55%
- Ashley Jay was in the middle of the pack for both yield and disease severity.

Camarosa – UC Davis

Plot pictures throughout season

Marketable Plant Yield Over Time



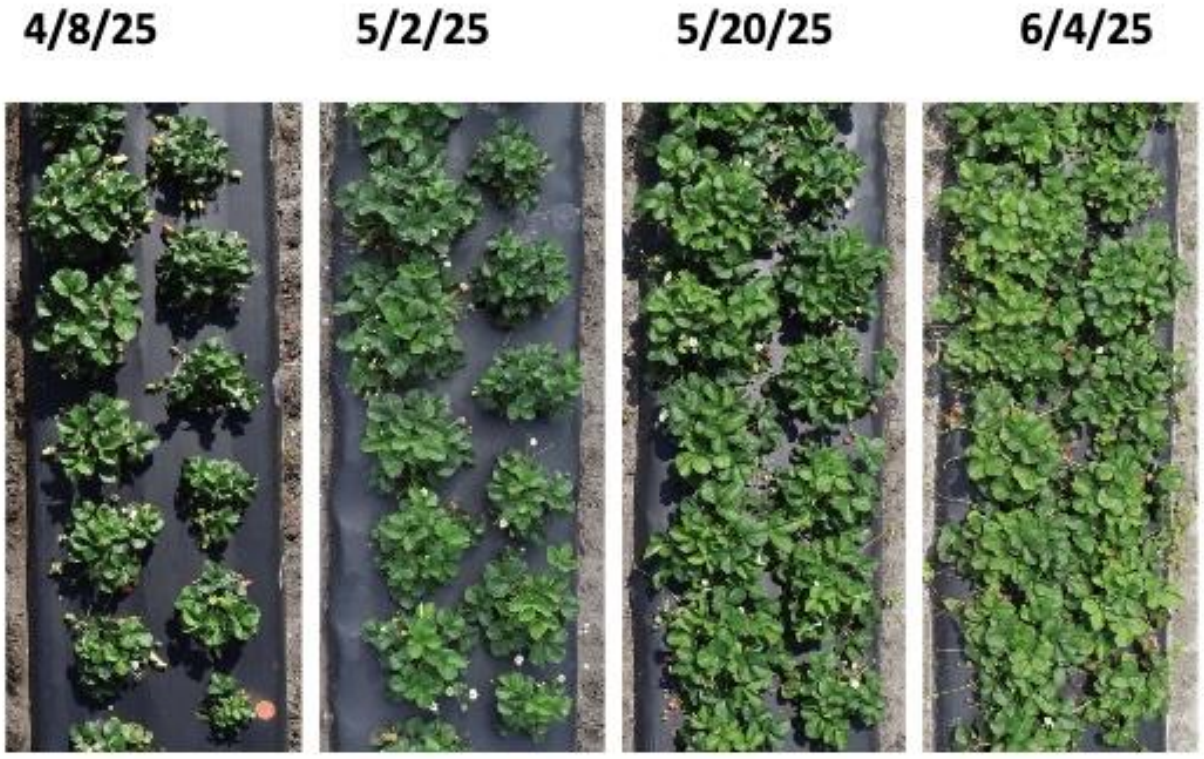
Final Disease Severity Rating

Key Take Aways

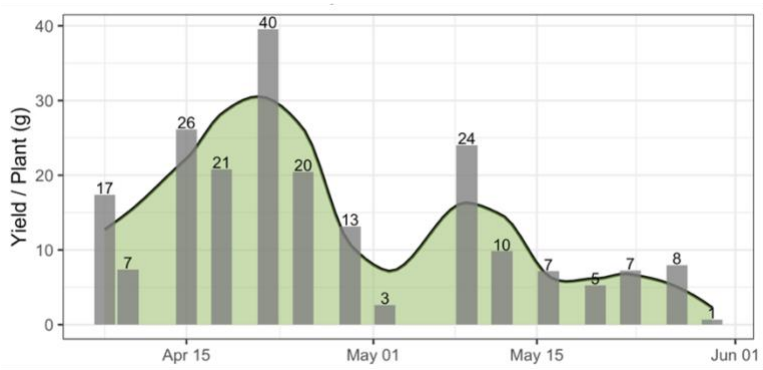
- Yield: second highest producer with an average 332 g plant yield
- Disease: moderate disease severity with a rating of 48%
- Camarosa performed well in this trial; it produced a lot of fruit despite showing disease symptoms.

Chandler – UC Davis

Plot pictures throughout season



Marketable Plant Yield Over Time



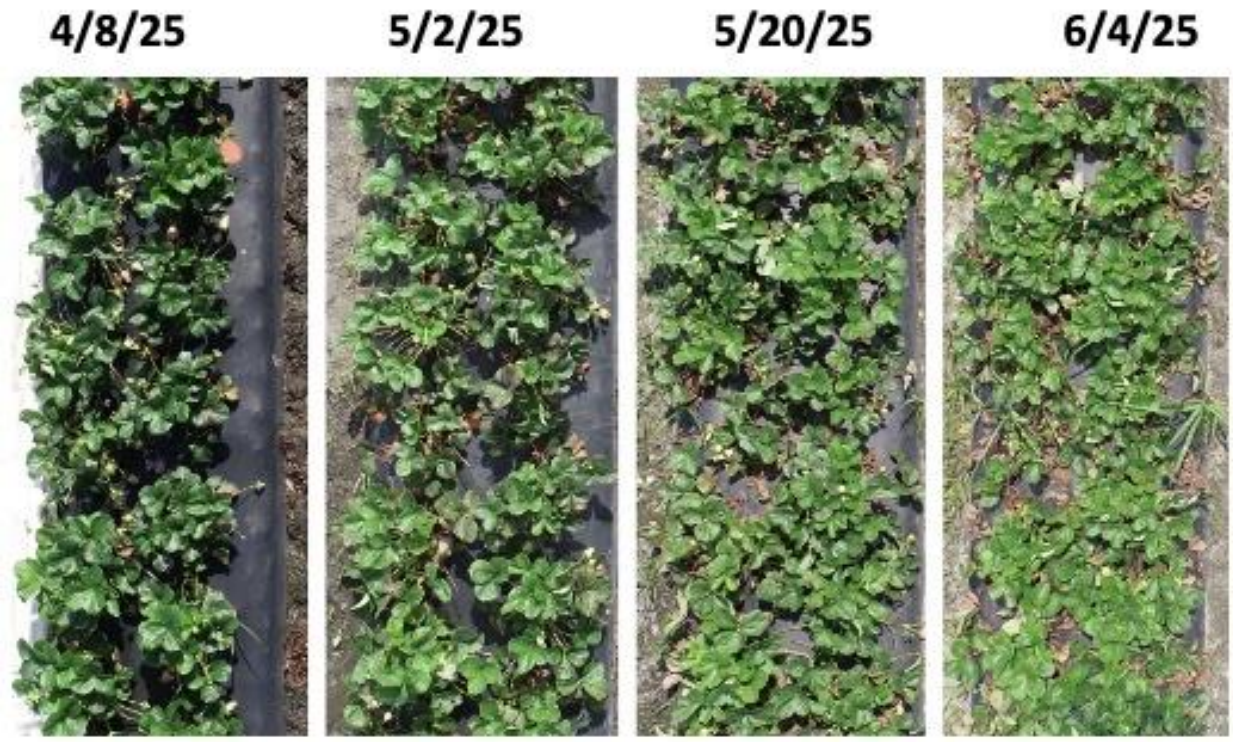
Final Disease Severity Rating

Key Take Aways

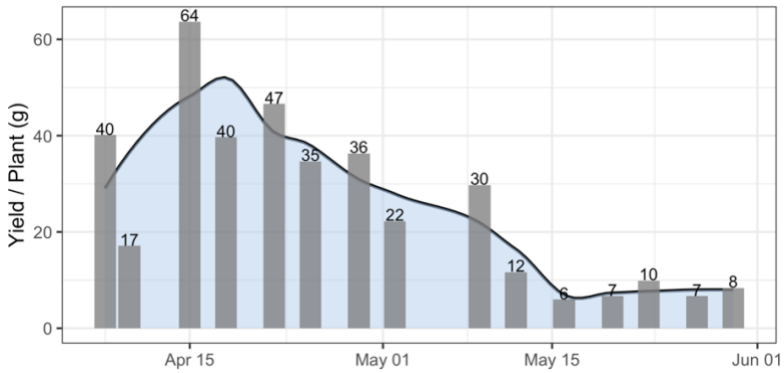
- Yield: average plant yield was 210 g
- Disease: moderate severity with a rating of 44%
- Chandler was in the middle of the pack for both yield and disease severity.

Fronteras – UC Davis

Plot pictures throughout season



Marketable Plant Yield Over Time



Final Disease Severity Rating

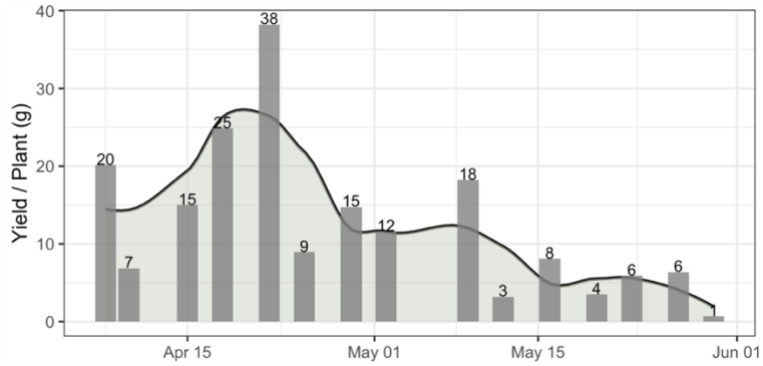
Key Take Aways

- Yield: highest producer with an average plant yield of 380g
- Disease: moderate disease severity with a rating of 54%
- Fronteras was the highest producer and only had moderate disease ratings, making it a promising option from this trial.

Liz – NC State

Plot pictures throughout season

Marketable Plant Yield Over Time



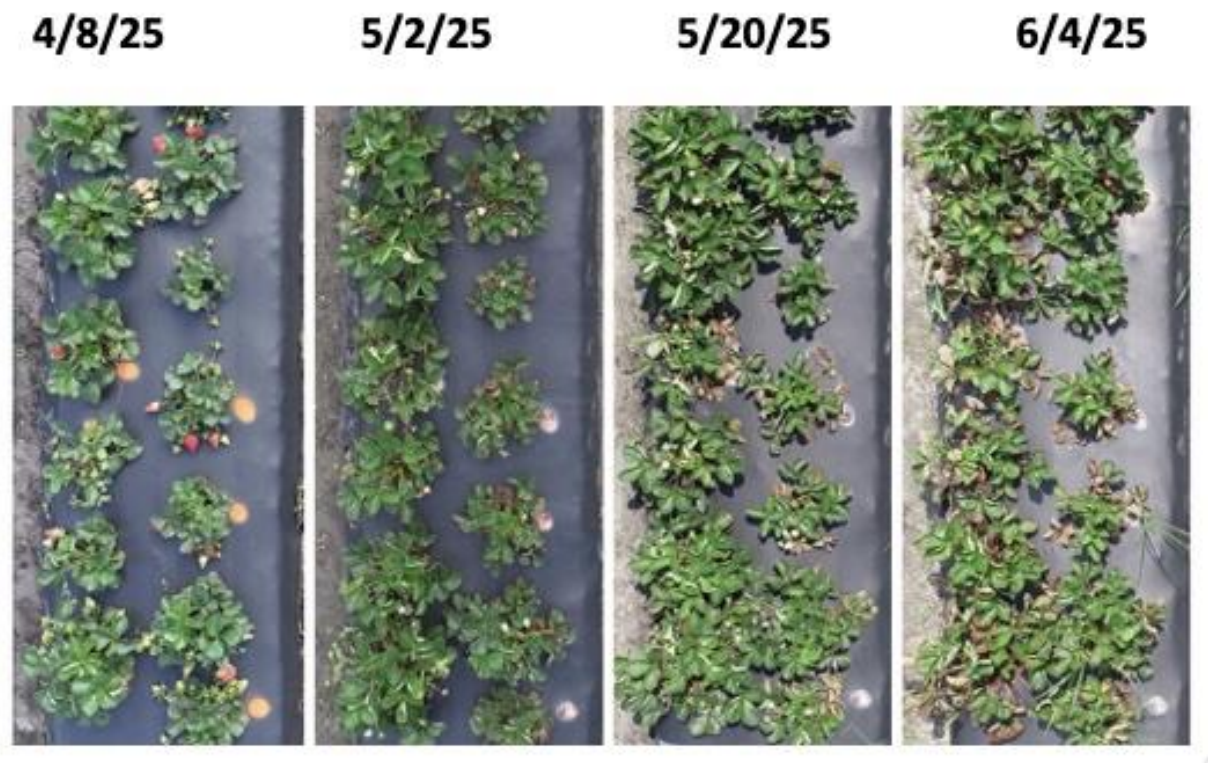
Final Disease Severity Rating

Key Take Aways

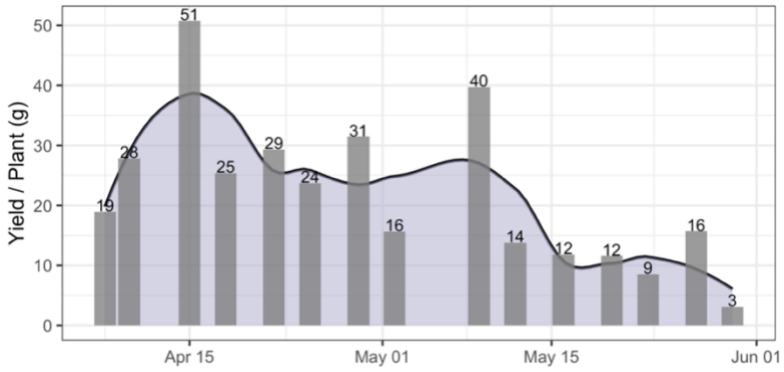
- Yield: low average plant yield of 186 g
- Disease: low disease severity with a rating of 34%
- Liz had low disease severity but also had low yield, therefore this cultivar did not perform well in this trial.

Miss Jo – LCN

Plot pictures throughout season



Marketable Plant Yield Over Time



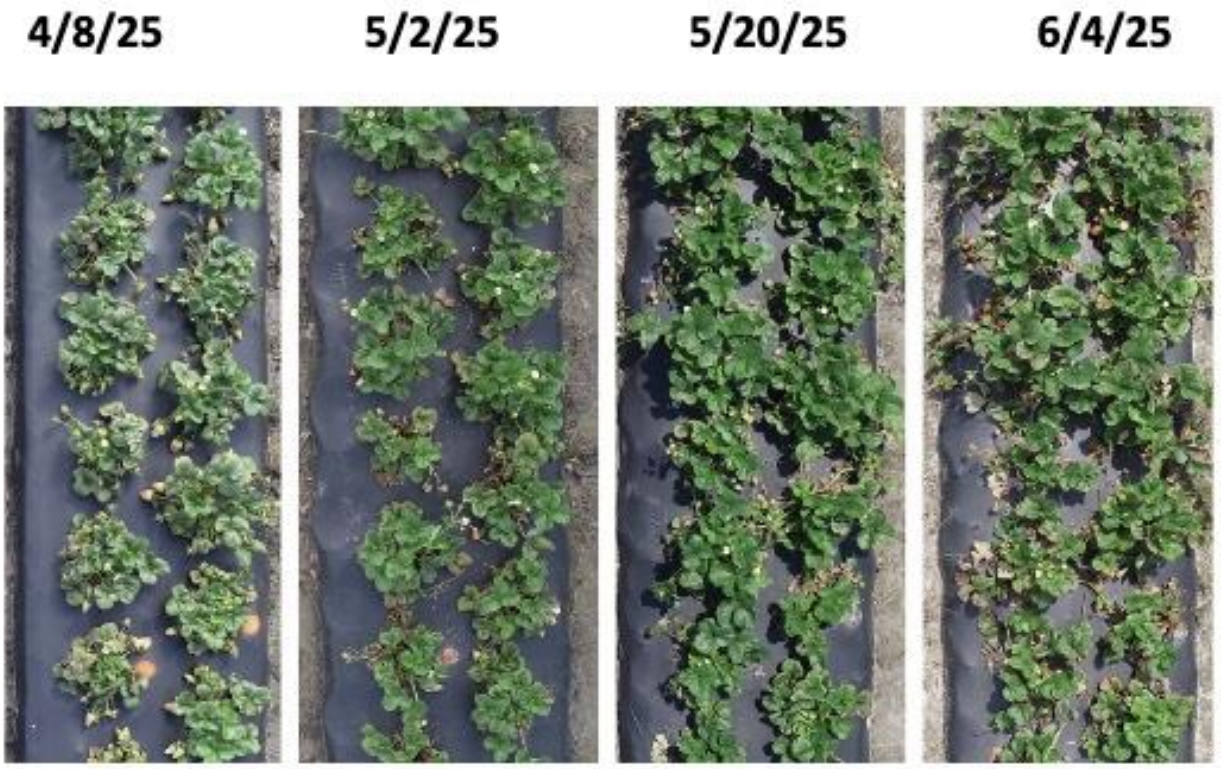
Final Disease Severity Rating

Key Take Aways

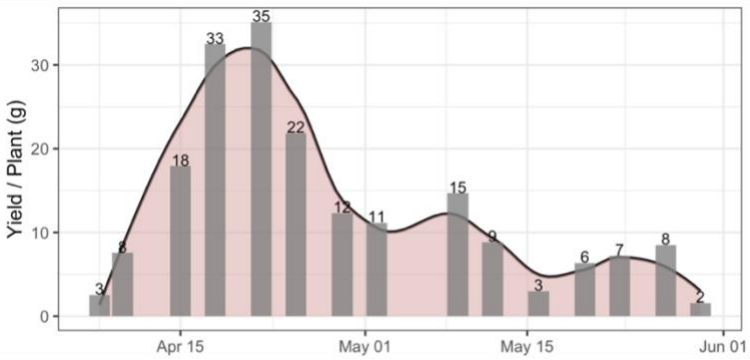
- Yield: high performer with average plant yield of 327 g
- Disease: high disease severity with a rating of 74%
- Miss Jo was able to produce a high yield despite having high disease severity.

Monterey – UC Davis

Plot pictures throughout season



Marketable Plant Yield Over Time



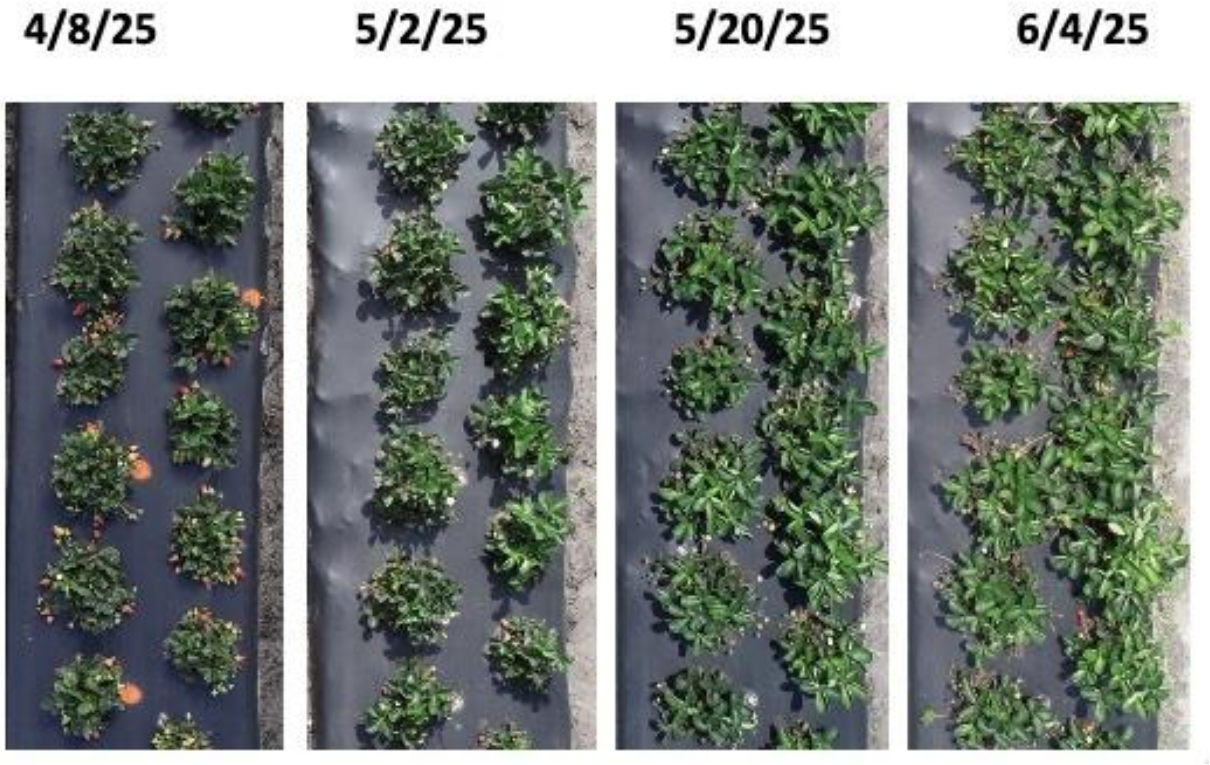
Final Disease Severity Rating

Key Take Aways

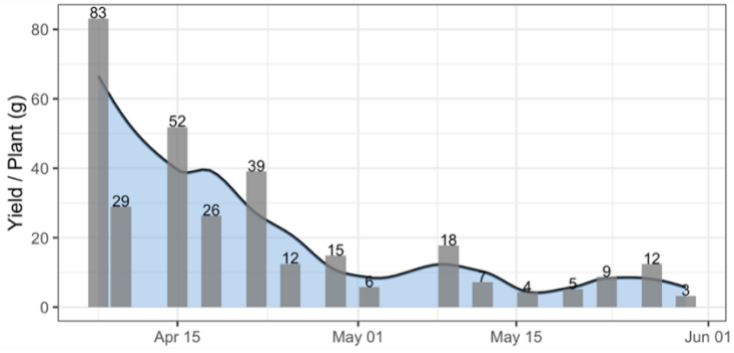
- Yield: had a lower average plant yield with 191 g
- Disease: moderate disease severity at a rating of 55%
- Monterey had high severity and low yield, making it a poor performer in this trial.

Rocco – NC State

Plot pictures throughout season



Marketable Plant Yield Over Time

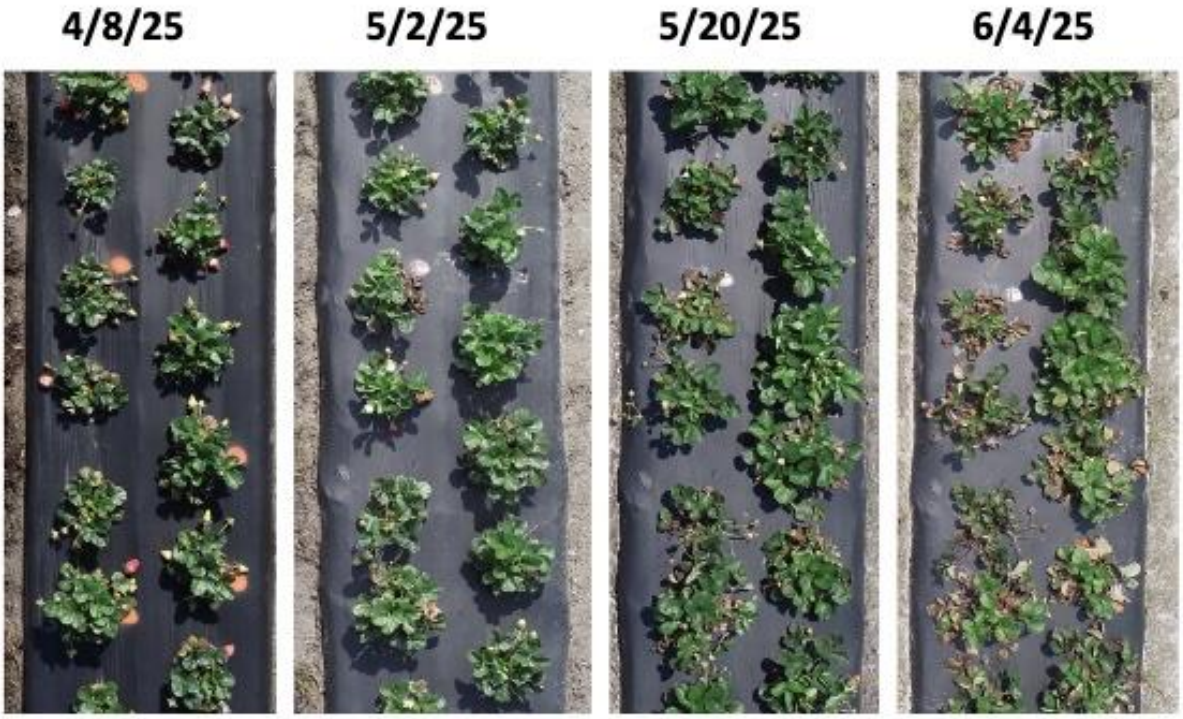


Final Disease Severity Rating

Key Take Aways

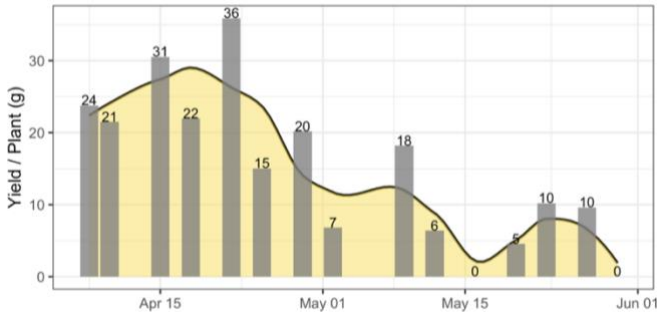
- Yield: high yield with an average plant yield of 321 g
- Disease: low disease severity with a rating of 26%
- Rocco performed well in this trial with a high yield and low disease severity.

Ruby June - LCN



Plot pictures throughout season

Marketable Plant Yield Over Time



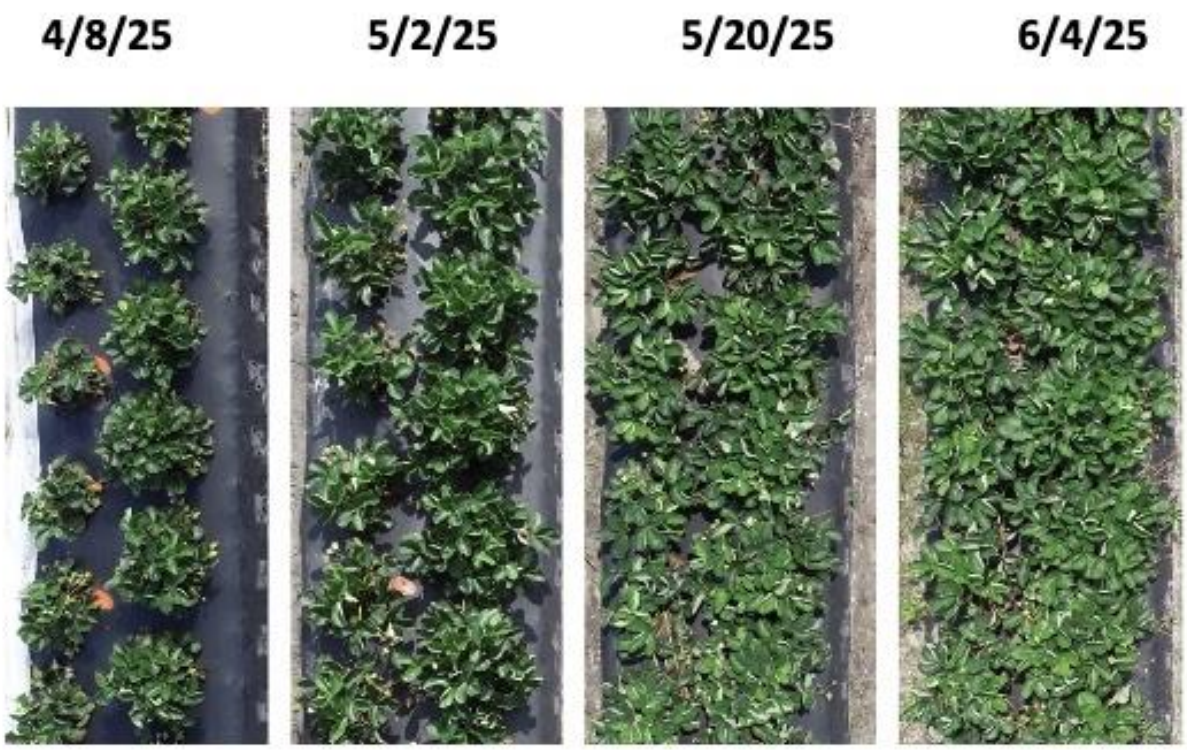
Final Disease Severity Rating

Key Take Aways

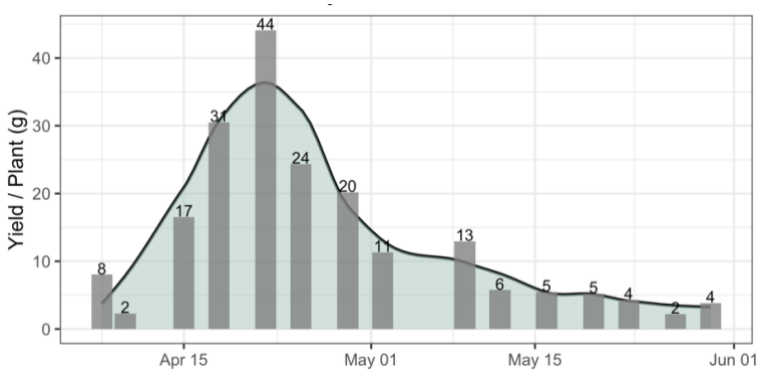
- Yield: had a moderate yield of 225g for average plant yield
- Disease: second highest disease severity at 75%
- Ruby June did not thrive in the trial; it had a high disease severity and only moderate yield.

Scarlet - Rutgers

Plot pictures throughout season



Marketable Plant Yield Over Time



Final Disease Severity Rating

Key Take Aways

- Yield: moderate average plant yield at 197 g
- Disease: second lowest disease severity with a rating of 10%
- Even though it had a low disease severity, Scarlet had low yield, showing that it did not perform well in this trial.

Discussion

For the overall performance of a cultivar, both the disease ratings and yield should be considered together. For example, 921 had the lowest disease rating but it also had the lowest yield out of all 13 cultivars, rendering this cultivar a poor choice for NC coastal region growers. Based on disease ratings and yield results, the cultivars that performed the best in this trial were Rocco, Chandler, Fronteras, and Camarosa. These cultivars were top performers in yield and had moderate disease severity.

Importance of Clean Plant Material

In NC, Neo-P infections most often begin in the crown and lead to whole plant death and potential leaf spot and fruit rot infections. Results from this trial reinforce the concept that clean plant material can lead to a successful season, even with Neo-P leaf and fruit infections that begin after establishment. This means using clean plant material when establishing fields is critical when considering how to prevent and manage Neo-P. This was illustrated by the cultivar Rocco which was grown in both the replicated trial and the public breeding program trial. The Rocco plants in the replicated trial were sourced from the indoor strawberry propagation facility at the Plant Science Building on the NCSU campus. These plants were propagated directly from Tissue Culture in a soil-less hanging gutter system in a greenhouse. TC plants were confirmed to not contain any fungal pathogens (confirmed using High Throughput Sequencing). We considered the plants deriving from this facility “Neo-P Free”.

Those plants maintained the original stand count and low susceptibility to Neo-P. The Rocco plants in the private breeding program trial were not sourced from the indoor strawberry propagation facility at NCSU but was propagated under outdoor conditions. We consider those plants as “Neo-P infected”. These plants only had a 60% stand count at the end of season and showed high disease severity (Figure 7).

However, these statements need to be taken with a grain of salt: it needs to be considered that outdoor propagated material was not replicated, while the indoor propagated material in Trial 1 was replicated three times. Further, the experiment and the trials were not designed to directly compare indoor and outdoor propagated material. Additionally, the location of the experiment experienced a relatively dry picking season, and disease progress could be different under wetter conditions.

Figure 7A Plots of ‘Rocco’ strawberries showing the impact of clean plant material. The top plot (A) was sourced from the NC State Micropropagation Unit and propagated under indoor conditions at the NCSU indoor strawberry propagation facility.

Figure 7B. Plots of ‘Rocco’ strawberries showing the impact of clean plant material. The bottom plot (B) had plant material sourced from an outdoor propagation facility.

G x E x M

The results of this year’s trial should be understood in the larger context of managing a strawberry field in North Carolina. The rule ‘Genetics (G)’ x ‘Environment (E)’ x ‘Management (M)’ applies. In practice this means that for the commonly grown cultivar Ruby June, which has shown high susceptibility, management of the disease becomes more important. It is absolutely possible to manage Neo-P in an infested Ruby June field, but the frequency of sprays, rotation of fungicide modes of action, spray volume, and sprayer design (coverage) will become much more important.

‘Ruby June’ and ‘122x08’ showed high susceptibility, while ‘Camarosa’ ‘Chandler’ and ‘Fronteras’ showed moderate susceptibility. ‘Liz’, ‘Rocco’ and ‘Scarlet’ showed low susceptibility to Neo-P. This is unfortunate news for many NC growers, who rely on ‘Ruby June’, ‘Fronteras’, ‘Chandler’ or ‘Camarosa’. While ‘Rocco’ is picking up with growers across the state, most growers have one or more of the abovementioned cultivars in their arsenal.

Based on our current knowledge of Neo-P infections in strawberries - the more susceptible your cultivar is, the more important it becomes to practice proper spray rotation, including disease management in fall (early season disease management). Fungicides such as Thiram, Captan and Switch have shown to be practical solutions to control Neo-P in fruiting fields. ***Especially if a grower plants a more susceptible cultivar, fall preventative sprays (after planting until dormancy), using broad-spectrum protectant fungicides (Thiram & Captan) become extremely important***. It is now crucial to have those fungicides in stock. Equally crucial is the maintenance of spray equipment. High pressure spray equipment that can reach under the foliage is an essential management tool, especially in years with high disease pressure and susceptible cultivars.

Conclusion

While these initial results teach us more about Neo-P's effect on different cultivars in coastal NC, there is still more to learn about the pathogen and its habits across the state. From the first year of data, Rocco, Chandler, Fronteras, Scarlet, and Camarosa had the highest marketable yield while holding moderate disease severity. Conversely 921, Ruby June and 122x08 did not perform well as expected, due to small vegetative growth (921) or severe disease pressure (Ruby June, 122x08). This trial will be repeated in the 2025-2026 season.