Rapid Cycle Breeding for Pestalotia Resistance

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Summary

The UF Strawberry Breeding Program continues to prioritize resistance to Neopestalotiopsis sp. The release of Ember™ 'FL 20.80-4' was a small step in the right direction. In the last year we applied new rapid cycling approaches to increase resistance throughout the program at a greater pace.

Introduction

A new strain of Pestalotia caused by a species of Neopestalotiopsis has become a primary focus of the UF Strawberry Breeding Program. Current UF varieties do not have the resistance or tolerance needed to prevent plant and yield losses when plants come infected from nurseries. We need to quickly increase resistance in the entire breeding population.

The progress that any breeding program makes is dependent on time. How long does it take to complete a breeding cycle, from cross to cross? In crops like citrus this may take a decade. In UF strawberry the cycle time or "generation interval" has historically been about 4 years. What if we could choose parents for the next cycle of breeding without ever testing them in the field, dramatically increasing the number of breeding cycles that could be achieved in a given amount of time?

Methods

Increasing the speed of breeding in this way requires very specific, predictive genomics tools. Thankfully we have already developed a tool for this purpose and continue to refine its efficacy. Specifically we have developed a proprietary ThermoFisher DNA marker assay of 1,672 loci across the 28 chromosomes of cultivated strawberry.

The table below outlines the possibilities that can be achieved by implementing this technology at various levels of aggressiveness.

UF Breeding Scheme		Cycle Length	Selection Accuracy	No. Traits	Breeding Gain
Traditional	Moderate	4-8 Yrs	100%	8-10	100%
	Aggressive	2-5 Yrs	100%	8-10	150%
Genomics Enabled	Moderate	1-3 Yrs	90%	20	270%
	Aggressive	0.5 - 2 Yrs	80%	20	384%

Table 1. Decreasing cycle length increases breeding gains over time by up to 384% of the traditional method, if we are able to move from one cycle every 4 years to one or two cycles each year.

Results

Inoculation of selections in the field over the last three years showed that an increasing number of selections have better resistance than current commercial varieties. Most importantly, when looking at the performance of each year of selections as a whole, we are able to see the progress we are making to move the whole breeding population in the direction of resistance. Please see Figure 1 on the next page.

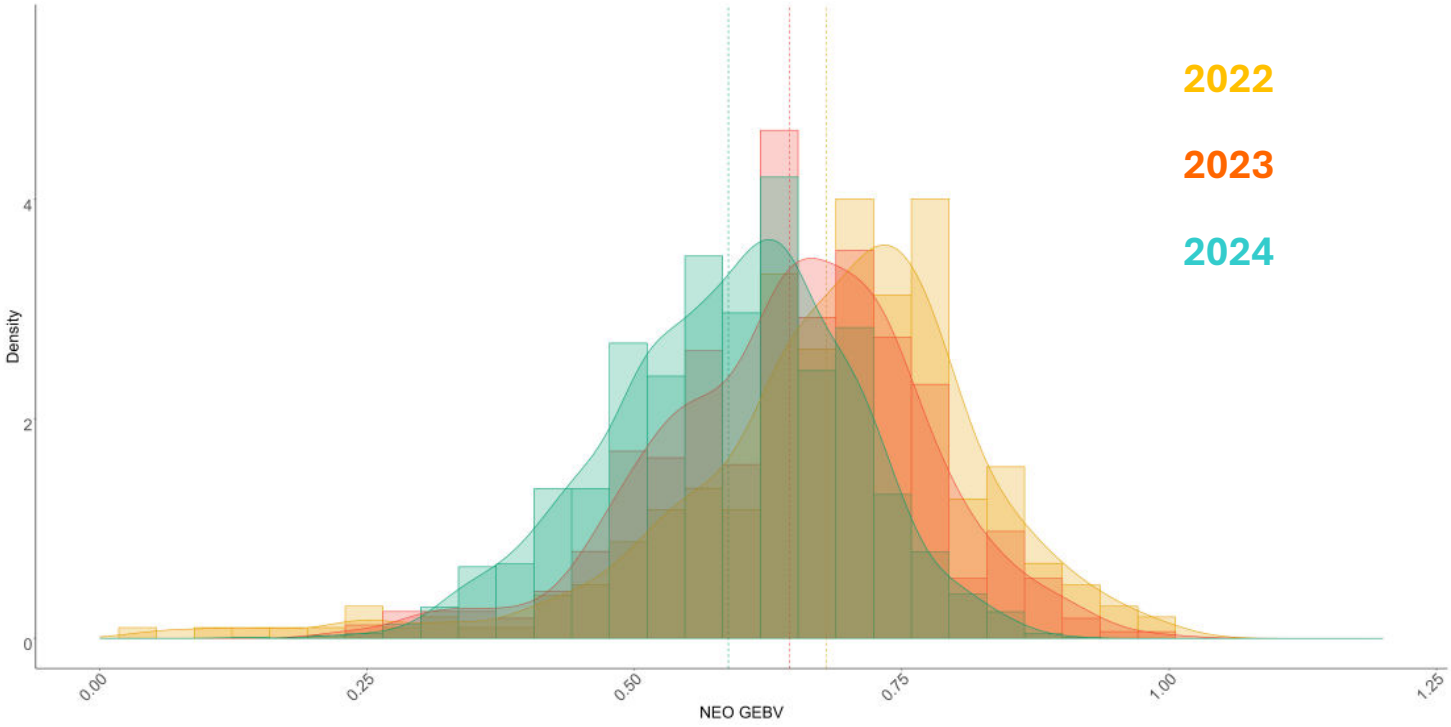

Figure 1. The distribution of resistance in advanced selections from the UF breeding program by their year of selection as seedlings. With each year, the distribution of resistance is shifted more to the left (lower disease).

Takeaways

The use of rapid cycling breeding methods has resulted in breeding progress for resistance to Neopestalotiopsis sp., especially in 2024. These methods have even greater potential to improve resistance in future cycles as we increase the application of these methods.

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