Southern Forest Nursery Management Cooperative™

RESEARCH REPORT 25-02

EVALUATING POSTIVA® and MIRAVIS® NEO for FUSIFORM RUST CONTROL in BAREROOT LOBLOLLY and SLASH PINE SEEDLINGS

by
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INTRODUCTION

Fusiform rust (*Conartium quercuum* f. sp. *fusiforme*) is the most damaging and economically important stem disease that managers of southern pine (*Pinus* spp.) nurseries must address. While all southern pine species are susceptible to fusiform rust, the disease is especially damaging to loblolly pine (*P. taeda*) and slash pine (*P. elliottii*). In the southern U.S., fusiform rust incidence is highest in a 150-mile zone extending from South Carolina to Texas, where environmental conditions are favorable for spore production and susceptible host species (*Pinus* spp. and *Quercus* spp.) occur together (Enebak and Starkey 2012).

While the use of cultural practices and rust-resistant stock can decrease fusiform rust incidence in southern pine nurseries, chemical control is the most effective means of managing the disease. Since 1980, the development of more efficacious fungicides has significantly reduced seedling loss due to fusiform rust and the number of applications needed each growing season (Starkey et al. 2015). Currently, seedling infection in the nursery is usually controlled by treating seeds with Proline® prior to sowing, followed by three to four foliar sprays every two to three weeks from seedling emergence through mid-June (Enebak and Starkey 2012). Because Proline® is a broad-spectrum fungicide, it is routinely used in nurseries to also control damping-off pathogens such as *Fusarium circinatum* and *Rhizoctonia* spp.

Since the removal of Bayleton® from the market in 2012, Proline® has been the only fungicide labeled to control fusiform rust in forest tree seedling nurseries. For this reason, the Southern Forest Nursery Management Cooperative (SFNMC) annually tests new fungicides in hopes of identifying a cost-effective alternative to Proline®. Efficacy of these new fungicides is initially evaluated in greenhouse trials by artificially inoculating seedlings with basidiospores of the pathogen. Fungicides that reduce gall formation are subsequently tested under operational nursery conditions to assess their effectiveness under natural inoculum pressures.

In 2022, a greenhouse screening conducted by SFNMC staff showed that Miravis®Neo and Postiva® were comparable to Proline® in controlling fusiform rust in loblolly and slash pine seedlings. A subsequent *in vitro* study showed that Miravis®Neo and Postiva® effectively controlled or completely inhibited mycelial growth of *F. circinatum* and *Rhizoctonia* spp., respectively, when treated at minimal fungicide concentrations (i.e., three orders of magnitude lower than the maximum field rate) (Newell et al. 2023). Therefore, the primary objective of this study was to test the efficacy of Miravis®Neo and Postiva® in loblolly and slash pine seedlings under operational nursery conditions.

METHODOLOGY

On April 3, 2024, loblolly and slash pine seeds were treated with Proline® and sown under operational conditions at the ArborGen nursery in Shellman, Georgia. At 21 days after sowing, labeled rates of Proline®, Postiva®, and Miravis®Neo were applied to six 40-ft. plots in a randomized complete block design (Table 1, Figure 1). Untreated control plots were also established for comparison. After the initial application, four subsequent applications of each fungicide were made every 14 days from May 8 to June 20, 2024. SFNMC staff applied the fungicides with a CO_2 hand sprayer calibrated to broadcast a spray volume of 22 gallons of water per acre. Fungicide applications began 21 days after sowing to ensure that Proline® activity was no longer in effect.

Seedling samples from each treatment plot were collected from the nursery on October 29, 2024. A 3-ft^2 counting frame was placed in each plot and all seedlings within the counting frame were lifted by hand with the inside and outside rows' seedlings separated and labeled accordingly. Seedlings were transported to the SFNMC Laboratory at Auburn University, where they were later examined for stem galls and evaluated for seedling quality. From November 1, 2024 to January 30, 2025, measurements of root collar diameter (RCD), shoot height, shoot dry weight, root dry weight, and root weight ratio (RWR) were made on 592 interior loblolly pine seedlings and 521 interior slash pine seedlings for a total of 1,113 seedlings evaluated in the study. From each plot's samples, the total number of seedlings from inside and outside rows were counted to measure seedling density. Percent gall formation within each treatment was arcsine transformed before being analyzed as a linear model using R Statistical Software (v4.5.0; R Core Tem 2025). Significant differences between means of each measured parameter were examined, and a significance level of $p < 0.05$ was used.

RESULTS and DISCUSSION

Loblolly pine: There was no significant difference between gall formation on treated versus untreated loblolly pine seedlings ($p = 0.246$) (Figure 2). On average, loblolly pine seedlings presented <1% gall formation across all treatments. Control seedlings had the highest rate of stem galls at 2.2%. No galls were present on seedlings treated with Miravis®Neo. No significant differences in loblolly pine seedling quality were observed across all treatments (Table 2).

Slash pine: There was no significant difference in gall formation between treated and untreated slash pine seedlings ($p = 0.851$) (Figure 3). Compared to loblolly pine, slash pine presented a slightly higher incidence of fusiform rust with 7% gall formation across all treatments. Slash pine seedlings treated with Miravis®Neo and Proline® had the lowest fusiform rust incidence (Figure 3), but these results cannot be attributed to fungicidal efficacy. Seedling quality was not significantly different between treatments (Table 3).

MANAGEMENT IMPLICATIONS

Because fusiform incidence was low, we are unfortunately unable to establish the efficacy of Miravis®Neo and Postiva® in controlling fusiform rust in field settings. Replicating this study in multiple nurseries where environmental conditions are favorable for disease incidence may increase seedling exposure to natural inoculum pressures. Results from this study indicate that neither Miravis®Neo nor Postiva® appear to adversely affect seedling quality. This information, along with their potential for broad-spectrum disease control, warrants further testing of these chemistries under operational nursery conditions.

ACKNOWLEDGEMENTS

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Table 1. Fungicides and application rates evaluated in loblolly and slash pine seedling beds at the ArborGen Nursery in Shellman, Georgia during the 2024 growing season.

Treatment #	Description	Application Rate
1	Control	No fungicide
2	Miravis®Neo	13.7 fl. oz/ac
3	Postiva®	10.0 fl. oz/ac
4	Proline®	5.0 fl. oz/ac

Table 2. Seedling quality attributes of one year-old loblolly pine seedlings grown under operational conditions at the ArborGen Shellman, Georgia nursery and treated with fungicides compared to an untreated control.

Treatment	Density (seedlings/ft²)	RCD (mm)	Height (cm)	Shoot Dry Weight (g)	Root Dry Weight (g)	RWR[a] (%)
Control	12	5.04 ± 0.11	30.67 ± 0.24	4.00 ± 0.05	0.82 ± 0.01	17.35
Miravis® Neo	13	5.00 ± 0.07	31.07 ± 0.30	3.77 ± 0.04	0.84 ± 0.01	18.14
Postiva®	13	4.92 ± 0.07	30.50 ± 0.28	3.83 ± 0.05	0.83 ± 0.01	17.58
Proline®	12	5.15 ± 0.07	30.33 ± 0.25	3.88 ± 0.04	0.79 ± 0.02	16.73
p-value	*0.975*	*0.715*	*0.706*	*0.897*	*0.967*	*0.793*

[a] Root Weight Ratio is calculated by (root dry weight/total dry weight) X 100.

Table 3. Seedling quality attributes of one year-old slash pine seedlings grown under operational conditions at the ArborGen Shellman, Georgia nursery and treated with fungicides compared to an untreated control.

Treatment	Density (seedlings/ft²)	RCD (mm)	Height (cm)	Shoot Dry Weight (g)	Root Dry Weight (g)	RWR[a] (%)
Control	10	7.36 ± 0.11	32.50 ± 0.41	5.95 ± 0.10	1.21 ± 0.02	17.03
Miravis® Neo	10	7.02 ± 0.11	31.00 ± 0.44	6.07 ± 0.08	1.06 ± 0.02	14.85
Postiva®	10	7.06 ± 0.11	33.50 ± 0.40	6.33 ± 0.07	1.14 ± 0.01	15.28
Proline®	11	6.98 ± 0.10	32.33 ± 0.39	6.79 ± 0.06	1.22 ± 0.01	15.20
p-value	*0.660*	*0.636*	*0.463*	*0.380*	*0.363*	*0.139*

[a] Root Weight Ratio is calculated by (root dry weight/total dry weight) X 100.

	Loblolly Pine				Slash Pine			
20’		20 ft. from end	20 ft. from end			20 ft. from end	20 ft. from end	
10’	REP 4	Control			REP 4	Postiva		
10’		Postiva				Proline		
10’		Miravis Neo	Postiva	REP 6		Control		
10’		Proline	Miravis Neo			Miravis Neo		
10’	REP 3	Miravis Neo	Control		REP 3	Postiva		
10’		Proline	Proline			Miravis Neo		
10’		Postiva	Miravis Neo	REP 5		Proline		
10’		Control	Proline			Control		
10’	REP 2	Miravis Neo	Control		REP 2	Control	Postiva	REP 6
10’		Proline	Postiva			Miravis Neo	Proline	
10’		Control				Postiva	Control	
10’		Postiva				Proline	Miravis Neo	
10’	REP 1	Proline			REP 1	Postiva	Control	REP 5
10’		Control				Control	Proline	
10’		Postiva				Miravis Neo	Miravis Neo	
10’		Miravis Neo				Proline	Postiva	
20’		start in 20 feet	start at 3rd pipe			start in 20 feet	start in 20 feet	

Figure 1. Trial layout of the fusiform rust study installed at the ArborGen Nursery in Shellman, Georgia on April 24, 2024. Each treatment was replicated six times in a randomized complete block design in one loblolly pine and one slash pine seedlot.

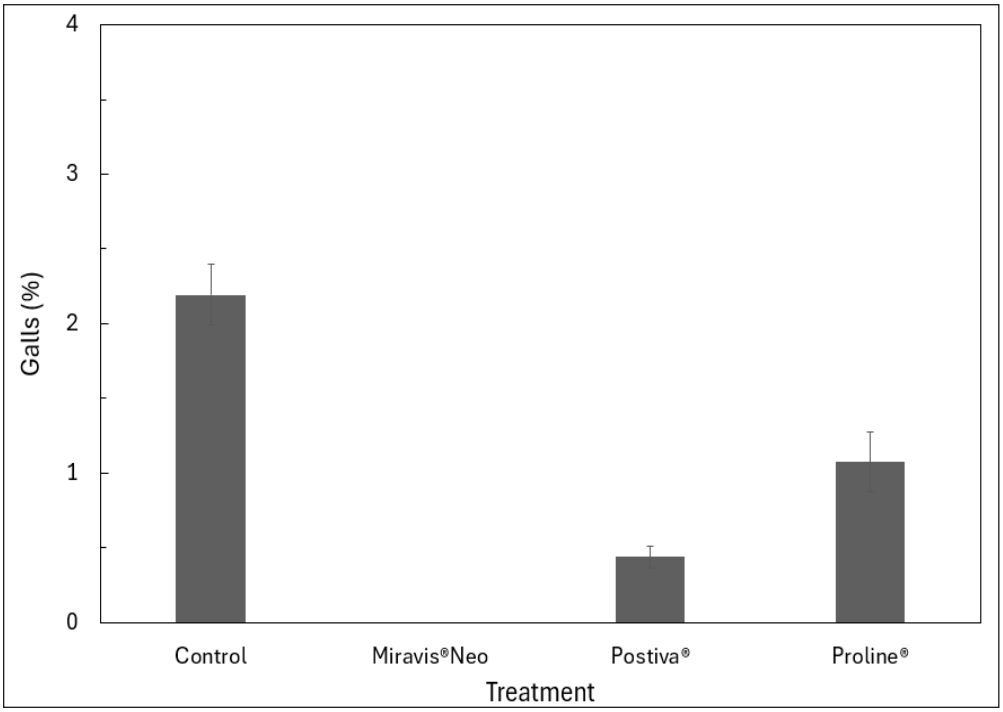

Figure 2. Incidence of fusiform rust galls on one year-old loblolly pine seedlings left untreated or treated with fungicides during the 2024 growing season ($p = 0.246$).

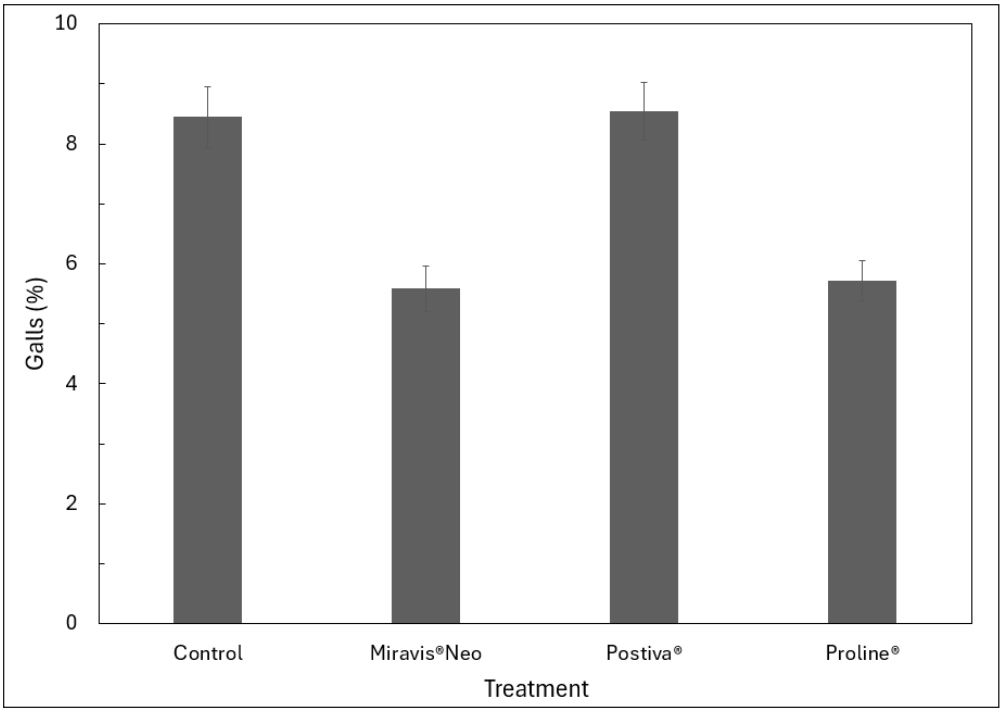

Figure 3. Incidence of fusiform rust galls on one year-old slash pine seedlings left untreated or treated with fungicides during the 2024 growing season (p = 0.851).