Southern Forest
Nursery Management Cooperative

RESEARCH REPORT 20-05

RESULTS FROM THE 2020 FUSIFORM RUST GREENHOUSE TRIAL,
TESTING THE EFFICACY OF TWO POTENTIAL NEW SYNTHETIC FUNGICIDES

by
Ryan Nadel

INTRODUCTION

Cronartium quercuum f.sp. *fusiforme*, the causal agent of Fusiform rust, is still of major concern to many Loblolly (*Pinus taeda*) and Slash (*Pinus elliottii*) seedling growers. Although both genetic and cultural control options are available to reduce the risk of infection after outplanting, the most effective control in nursery production is the use of fungicides. Seedling infections can be significantly reduced by applying registered fungicides either as a seed treatment before sowing or as a foliar spray following germination (Carey 2004, Starkey and Enebak 2008, 2010).

One of the major accomplishments of the Southern Forest Nursery Management Cooperative was in 1980 with the registration of Triadimefon (Bayleton®) for fusiform rust control (Carey and Kelley 1993). At that time, it was estimated that the incidence of rust fell from 2.5% to 0.01% of all seedlings due to this chemistry. In addition, fungicide usage fell from 4 lbs ai /ac/yr to less than 1 lb ai /ac/yr due to the reduced number of applications required per season. The Southern Forest Nursery Management Cooperative continued to look for alternative chemistries to assist with the control of Fusiform rust and was instrumental in obtaining a registration for the active ingredient prothioconazole (Proline®) in 2011 as both a foliar spray and seed treatment (Starkey and Enebak 2010).

The identification of prothioconazole as a backup for Bayleton was fortuitous because, in 2012, the Environmental Protection Agency (EPA), along with the registrant, voluntarily removed Bayleton® from the market, thus reducing the availability of fungicides that are effective in controlling fusiform rust to only that of Proline® (Starkey and Enebak 2011). To ensure that alternative chemistries continue to be available for fusiform rust control, the Southern Forest Nursery Management Cooperative continues to annually test the effectiveness of viable chemistries in controlling this disease. In 2020, in conjunction with the US Forest Service Rust Testing Laboratory in Asheville, NC, the Nursery Cooperative continued to conduct seedling treatment studies on both loblolly and slash pine to test the potential of two new active ingredients for the control of fusiform rust.

MATERIALS AND METHODS

Seedling treatment

For this study, two chemistries (Protect® DF & Hurricane® WDG) were tested at the recommended

rate along with Proline® (Table 1) to loblolly and slash pine seedlings 2-weeks post germination in the greenhouse in Auburn, AL. After treatment, seedlings were brought to the Rust Laboratory in Asheville, NC and challenged with 30,000 basidiospores.ml^{-1} of *Cronartium quercuum* f.sp. *fusiforme* 8 weeks post germination. After inoculation, the seedlings were maintained at the US Forest Service greenhouse and evaluated for gall formation at both 4 and 8 months after being challenged with Fusiform rust. Percent gall formation between treatments were ArcSine transformed before being analyzed as a generalized linear model (GLM) with complete block design, using SAS ver. 9.4 (SAS institute Inc.) statistical software. The mean differences between treatments were determined using a Duncan's multiple range test.

RESULTS AND DISCUSSION

Poor seedling survival in the loblolly pine treatments (due to greenhouse care) resulted in too few seedlings to allow comparisons between treatments to be made.

However, Protect® DF (mancozeb) was found to be effective for slash pine when compared to the fusiform resistant pine families (Figure 1). There was a significant difference in fusiform galling incidence compared to that of the non-treated (Control) or susceptible slash pine (C223) seedlings (Figure 1). Proline®, which is currently used and registered for seedling protection against fusiform rust, resulted in galling incidence equivalent to resistant slash pine families K13 that were significantly less than that of the untreated control (Figure 1). The active ingredient mancozeb provides sufficient protection against fusiform rust when used as a slash pine seedling treatment in this study.

Significantly more rust galls were found to occur on seedlings treated the active ingredient Fludioxonil + Mefenoxam when compared to that of the positive control. Therefore, infection and gall incidence at rates observed for this product are not considered effective in controlling fusiform rust.

Results from this study further indicated that the active ingredient mancozeb gave significantly better results in reducing the incidence of rust galls compared to that of the untreated controls and Proline. Mancozeb appears to be effective in reducing the incidence of infection on slash pine. Like all SFNMC studies, an additional greenhouse study as well as field trials are required for testing this active ingredient on loblolly pine seedlings.

MANAGEMENT IMPLICATIONS

- Results from this greenhouse study indicate that the active ingredient Mancozeb, to be effective in reducing the incidence of rust galls when compared to that of control of untreated slash pine seedlings.
- Additional greenhouse studies are required to determine the effectiveness of the active ingredient on loblolly pine seedlings as well as determine the repeatability in reducing the incidence of fusiform gall for slash pine seedlings treated with this active ingredient.

REFERENCES

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Table 1. Active ingredients tested when Loblolly and Slash seedlings were challenged with basidiospores of *Cronartium quercuum* f.sp. *fusiforme*

Fungicide	Manufacturer	Active Ingredient	Rate tested
Protect® DF	Nufarm	Mancozeb - 75%	4 oz. per 1000 ft^2
Hurricane®	Syngenta	Fludioxonil - 32% Mefenoxam - 16%	3/4 oz. in 100 gallons of water
Proline®	Bayer Cropscience	Prothioconazole – 41%	5 fl oz. per acre

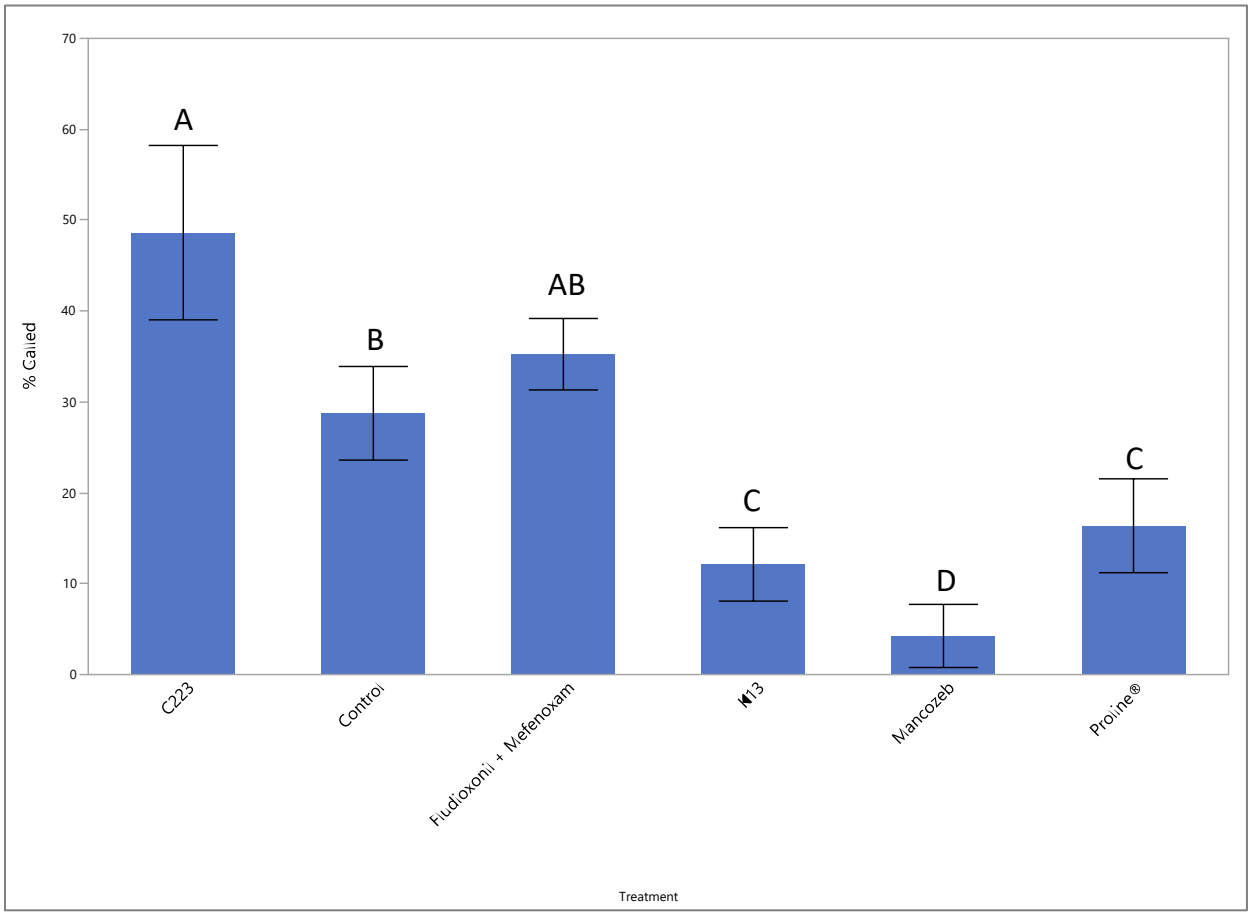

Figure 1. Slash pine seedlings treated with new chemistries compared to standard controls. (Different letters on bars indicate significant differences at $p<0.05$)