Exploring a Biological Alternative for *Tomato spotted wilt virus* Control in Tobacco

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INTRODUCTION

The leading tobacco disease in Georgia is spotted wilt caused by *Tomato spotted wilt virus* (TSWV). TSWV is transmitted by multiple species of thrips, mainly tobacco thrips (*Frankiella fusca)* in tobacco. TSWV can lead to leaf necrosis and yield losses. Actigard® and imidacloprid have been used as pre-transplant seedling treatments in the majority of Georgia tobacco since 2006, resulting in 50% average reduction of spotted wilt.

SP2700 (Ninja) has been utilized for viral control in tobacco and other plant species outside the United States. It is a naturally-occurring biochemical product of soil bacterial fermentation. Its use is being explored to provide additional TSWV control in tobacco when used alone or in tandem with Actigard® and imidacloprid.

MATERIALS & METHODS

Treatments were combinations of Actigard®, imidacloprid, and Ninja at fixed days pre-translplant (7 or 3d) and post-transplant (7, 28, and 49d). Rates were as indicated (Figure 1). Pre-transplant Actigard® and Ninja were applied as foliar spray, pre-transplant imidacloprid was applied as tray drench, and all post-transplant applications were applied as foliar spray (Figure 2 & 3).

Plants were transplanted at two locations on April 15, 2021. Locations consisted of six treatments with four replications. Location 1 had 210 plants per treatment and Location 2 had 110 plants per treatment. Treatment rows were bordered by at least one row of non-treated plants. Incidence of spotted wilt was visually evaluated on plants at two-week intervals, beginning two weeks after transplant and ending 12 weeks after transplant (Figure 4). Vigor was evaluated on a scale of 1 to 5 (low vigor to high vigor) at 21 days post-transplant. Data were analyzed using one-way ANOVA. Means were compared using Tukey's HSD at $p = 0.05$.

Figure 1. Application rates and timing relative to transplanting for Treatments 1 through 6.

Treatment	Products	Timing	Rate
1	*Non-treated check*	-	-
2 (Act + Imid GH)	Actigard	7d pre t	1 oz/100,000 cells
	Imidacloprid	3d pre t	0.8 fl oz/100,000 cells
3 (Imid + Ninja GH)/ Ninja/Ninja/Ninja	Imidacloprid + Ninja	3d pre t	0.8 fl oz/100,000 cells + 0.75 oz/100,000 cells
	Ninja	7d post t	4.5 oz/100 gal, applied @ 10 gal/A
	Ninja	28d post t	9 oz/100 gal, applied @ 10 gal/A
	Ninja	49d post t	9 oz/100 gal, applied @ 10 gal/A
4 (Ninja + Imid GH)/ Ninja/Ninja/Ninja	Ninja	7d pre t	0.75 oz/100,000 cells
	Imidacloprid	3d pret t	0.8 fl oz/100,000 cells
	Ninja	7d post t	4.5 oz/100 gal, applied @ 10 gal/A
	Ninja	14d post t	9 oz/100 gal, applied @ 10 gal/A
	Ninja	21d post t	9 oz/100 gal, applied @ 10 gal/A
5 (Ninja GH)/ Ninja/(Ninja + Imid)	Ninja	7d pre t	0.75 oz/100,000 cells
	Ninja	7d post t	4.5 oz/100 gal, applied @ 10 gal/A
	Ninja + imidacloprid	28d post t	9 oz/100 gal + 7 oz/acre, applied @ 10 gal/A
6 (Act + Imid GH)/ Ninja/Ninja	Actigard	7d pre t	1 oz/100,000 cells
	Imidacloprid	3d pre t	0.8 fl oz/100,000 cells
	Ninja	28d post t	9 oz/100 gal, applied @ 10 gal/A
	Ninja	49d post t	9 oz/100 gal, applied @ 10 gal/A

Figure 2. Foliar application of Ninja at 7 days pre-transplant.

Figure 3. Foliar application of Ninja at 49 days post-transplant.

RESULTS

TSWV was significantly reduced by treatments with either Actigard® and imidacloprid or imidacloprid and Ninja in the greenhouse prior to transplant. Late application of imidacloprid following multiple applications of Ninja in the greenhouse and field did not significantly improve TSWV control compared to non-treated check.

Final mean percent of spotted wilt incidence was highest in Treatment 1 (Check) at 7.8%, followed by Treatment 5 (Ninja GH)/Ninja/(Ninja + Imid) at 6.9%, Treatment 4 (Ninja + Imid GH)/Ninja/Ninja/Ninja at 5.4%, Treatment 2 (Act + Imid GH) at 3.2%, Treatment 6 (Act + Imid GH)/Ninja/Ninja at 2.6%, and Treatment 3 (Imid + Ninja GH)/Ninja/Ninja/Ninja at 2.3% (Figure 5). Spotted wilt was significantly higher in Treatments 1 and 5.

Vigor scores were lower for treatments receiving Actigard® and imidacloprid, or imidacloprid and Ninja prior to transplanting compared to the non-treated check. Mean vigor score at 21 days post-transplant was highest in Treatment 4 (Ninja + Imid GH)/Ninja/Ninja/Ninja and Treatment 5 (Ninja GH)/Ninja/(Ninja + Imid), scoring 4.4 out of 5 across both sites (Figure 6).

Figure 4. Leaf necrosis symptoms associated with spotted wilt.

References:

Csinos, A.S., Pappu, H.R., McPherson, R.M., & Stephenson, M.G. (2001). Management of *Tomato spotted wilt virus* in flue-cured tobacco with acibenzolar-S-methyl and imidacloprid. *Plant Disease, 85*(3), 292-296.

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CONCLUSIONS

- Overall TSWV pressure was relatively low in comparison to other growing seasons. This may have limited the ability to observe trends in spotted wilt control between treatments.
- Although Treatment 3 and Treatment 6 showed numerically lower TSWV compared to Treatment 2, these differences were not statistically significant.
- With regards to vigor, plants treated with Ninja but not Actigard® did initially appear greener with more plant mass. These effects were no longer apparent as plants grew and were deemed unrelated to Ninja.
- Poor vigor or slowed growth in the field with Actigard® and/or imidacloprid treated plants is a common observation. Years with much higher TSWV incidence have convinced growers it is economically advantageous to accept slower early growth in exchange for increased TSWV control. For example, 10% TSWV symptoms in the field will result in ~5% yield loss. For a 2,000 lbs/acre yield at $1.90/lbs, this would be a $190 loss per acre.
- Based on the data collected, we cannot make conclusive generalizations about the performance of Ninja on spotted wilt control. The trial should be repeated to gather additional data.

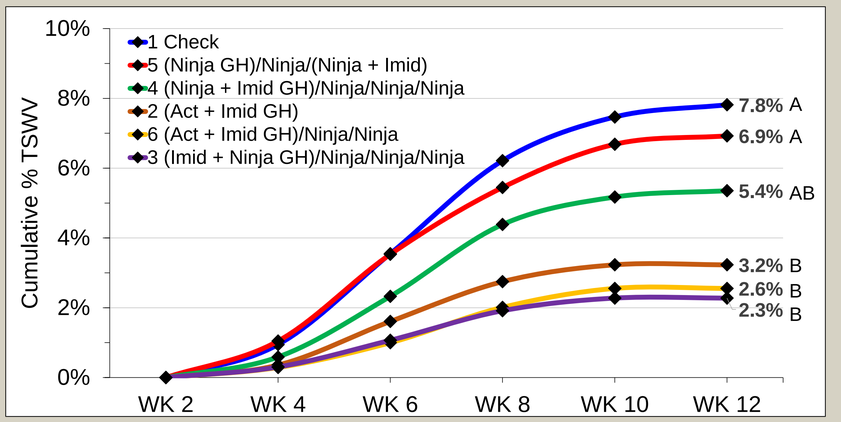

Figure 5. Mean cumulative percent spotted wilt across both locations in each treatment at two-week intervals post-transplant. "GH" indicates greenhouse application. Means followed by the same letter do not differ significantly.

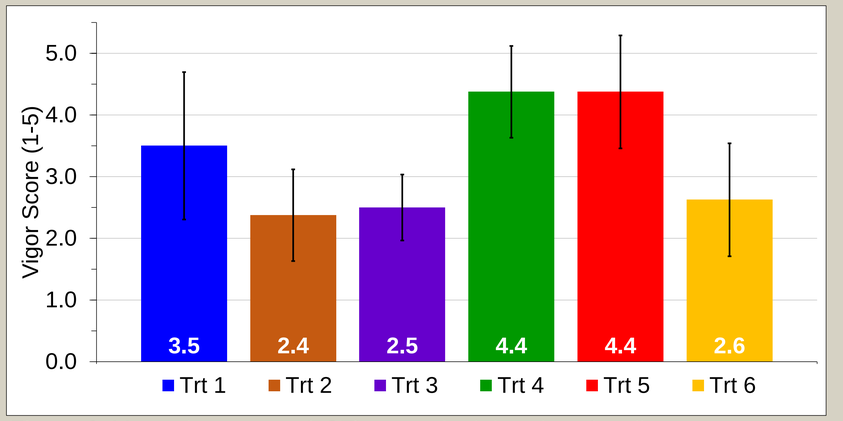

Figure 6. Mean vigor scores (±SE) across both locations for all treatments as evaluated at 21 days post-transplant. Vigor scores were 1 to 5 (scale adjusted to show standard error bars).

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