Evaluation of Actigard and other new fungicides for managing Phytophthora fruit rot of watermelon

NWA grant Recap for 2009

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Phytophthora fruit rot of watermelon

Introduction

Phytophthora fruit rot of watermelons caused by *Phytophthora capsici* was first reported in 1940 (Wiant, 1940), and now is an emerging disease in many watermelon growing regions of the US. Optimal conditions for development of Phytophthora fruit rot and seedling blight are prevalent during the growing season in the Southeast (FL, GA, SC and NC), where over 50% of the watermelon is grown. Identifying solutions to manage Phytophthora fruit rot is considered as a high priority by the National Watermelon Association (Morrissey, 2006). Furthermore at the 2008 National Watermelon Associations Annual meeting held in Alabama, several watermelon growers indicated that research to find solutions to manage *P. capsici* on watermelons is sorely needed.

We have evaluated various new and old fungicides to manage Phytophthora fruit rot for the past three years (2006-2008). Based on these trials we identified several fungicides (such as Revus, Presidio, Ranman, Sipcam, and Captan) that were effective in managing this severe problem (Kousik and Hassell, 2007a; Kousik et al., 2008). However of these fungicides only Revus, Presidio and Ranman are labeled for use on cucurbits. The prevalence of resistance to chemicals such as Ridomil has been well documented for *P. capsici* (Parra and Ristaino, 2001; Hausbeck and Lamour, 2004; French-Monar et al., 2005). Last year we also identified strains of Phytophthora that were resistant to Ranman (Kousik and Keinath, 2008). Therefore it is necessary, that we continue to identify and develop strategies to manage Phytophthora fruit rot.

Phytophthora fruit rot experiments conducted in 2009

The experiment was conducted at the US Vegetable Laboratory farm in Charleston, SC. The soil was Yonges loamy fine sand. The field has been infested with *Phytophthora capsici* for the past two years. The field was sprayed with Roundup Pro (1 pt/A) and Strategy (2 pt/A) after bedding but prior to planting for weed management. The experimental design was a randomized complete block design with replications being the block and fungicide treatments randomized within the blocks. There were a total of four replications. Four-week-old seedlings of a susceptible watermelon cultivar Mickey Lee grown in 50-cell jiffy trays were transplanted on 30 Jun 2009 onto raised beds with 40-in centers. Beds were spaced 21-ft apart. Beds were covered with white plastic mulch. Each fungicide treatment plot was a single row of 12 plants spaced 18-in. apart with 15-ft spacing between plots. Plants were fertilized and irrigated as needed using

drip irrigation. Fruit formation was poor during the months of July, and all the fruits were removed from the plots and discarded. Plants were fertilized and allowed to set fruits again during the month of August. The first fungicide treatments were applied on August 19th when most of the watermelon fruit in the plots were about 6-7 inches in diameter. Subsequent applications of fungicide treatments were made weekly on August 26th, September 2nd and September 9th for a total of four applications. Fungicide treatments were applied using a CO_2 backpack sprayer equipped with 3-nozzles (flat fan, Teejet 8002VS) spaced 19-in apart on a hand held boom.

Mefenoxam sensitive and insensitive isolates of *P. capsici* were grown separately on rice grains soaked in V8 juice in mason jars. Plots were inoculated with a mixture of isolates by scattering equal amounts of infested rice grains in the plots on 26 Aug. However, we did not observe any development of Phytophthora fruit rot in the field plots in 2009 as we have seen in previous years. Therefore the fruits were harvested on September 14th from all the plots. The harvested fruits were inoculated with a 7-mm mycelial plug of one *P. capsici* isolate (RCZ-11) growing on V8 juice agar. One mycelial plug was placed in the center of each fruit and the fruits were maintained under high humidity for 4 days after inoculation (**Figure 1**). Data on the fruit length and width, length and width of the lesion caused by *P. capsici*, the amount of sporulation and the length of sporulation within each lesion was recorded on September 18th 2009. All the data were analyzed using the PROC ANOVA procedure of SAS and means were separated using the Fisher's protected Least Significant Difference (P=0.05).

Results

The technique we used to inoculate the fruits in this experiment can be considered very aggressive, and can mask some of the minor differences among the fungicide treatments that might be observed when fruit rot occurs in the field. Furthermore, the fruits were harvested and inoculated 5 days after the last spray treatments on September 9th. This could have led to some of the residues being diluted or washed away and led to lowering of the effectiveness of the various treatments. However, regardless of these conditions, there were highly significant differences among the various fungicide treatments with respect to lesion length (P<0.0015), sporulation length (P<0.0012) and amount of sporulation (P<0.0023).

Phytophthora fruit rot lesion, sporulation length and sporulation amount were the lowest for fruits treated with Revus 250SC (**Table 1**). Similarly, the fruits treated with Presidio and Forum had significantly smaller lesions and less sporulation compared to the untreated check and the Ridomil Gold treatments. The Presidio and Forum treatments were not significantly different from the Revus treatment and were significantly different from the untreated check or the Ridomil Gold treatment.

The Actigard treatments (0.25 or 0.5 oz/A) were not significantly different from the untreated check or the Ridomil Gold treatment. The Actigard plus either Revus or Presidio treatments were not effective either. However, this may be because these treatments were applied only two times during the season. Furthermore the interval from the last spray to the time of inoculation was 12 days. In our previous study conducted in 2008, Actigard at 1 oz/A treatment significantly reduced lesion caused by *P. capsici*. We will evaluate Actigard at 1 oz/A

rate in trials in 2010. It is not clear why the Forum alternated with Presidio treatment was not very effective in this study, when both Forum and Presidio by themselves were very effective.

Conclusions

Overall the 2009 trial confirmed our previous findings that Revus and Presidio are effective fungicides for managing Phytophthora fruit rot of watermelon. In addition we identified that Forum may also be effective for managing Phytophthora fruit rot. Further studies to determine rotation schedules for these fungicides will be needed.

References

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Table 1. Evaluation of Actigard and other fungicides for management of Phytophthora fruit rot, Charleston, SC, 2009.

Trt No	Treatment and rate of product per A	Lesion length (cm)[z]	Fruit area coverd by lesion (%)[y]	Sporulation length (cm)[x]	Sporulation amount (0-5)[w]
1	Untreated Check	4.23 ab[u]	34.4 abc	2.89 a	2.31 abc
2	Actigard 0.25 oz/A	4.24 ab	41.1 a	2.99 a	2.57 ab
3	Actigard 0.5 oz/A	3.76 abc	32.5 abc	2.18 abc	2.28 abc
4	Actigard 0.25 +Presidio 4 fl oz (2 sp)[t]	4.45 a	40.2 ab	3.08 a	2.59 a
5	Actigard 0.25 + Revus 8 fl oz (2 sp)	2.82 bcde	26.7 bcd	1.97 abc	1.59 bcd
6	Presidio 4 fl oz	2.69 cde	23.5 cd	1.42 c	1.47 cd
7	Revus 8 fl oz	1.59 e	13.3 d	1.05 c	0.92 d
8	Forum 6 oz	2.20 de	20.9 cd	1.52 cd	1.37 cd
9	Forum 6 oz alt/w Presidio 4 fl oz	3.59 abcd	32.9 abc	2.46 ab	2.24 abc
10	Ridomil Gold 1 pt	4.40 a	40.0 ab	3.05 a	2.78 a

[z]Each lesion on a fruit was measured in two directions perpendicular to each other and the mean of the two lengths was calculated and used in the analysis.
[y]Similarly the length and the width of the fruit was measured. The mean lesion length/mean fruit length was calculated and used in the analysis.
[x]The sporulation length was measured as in the same way as the lesion length.
[w]Sporulation amount was a visul rating on a 0-5 scale where 0=no sporulation and 5= very heavy and dense sporulation coving the entire sporulation length.
[w]Means followed by the same letter within columns are not significantly different (P=0.05).
[t]Treatments 4 and 5 were only applied on August 19th and September 2nd. Treatment 9 was Forum alternated with Presidio.

Figure 1. Phytophthora lesion formed on Crimson Sweet watermelon fruit inoculated with a 7-mm *Phytophthora capsici* mycelial plug (center). The *Phytophthora capsici* isolate (RCZ-11) was grown on V8-juice agar plates and mycelia plugs were cut out of the edges of the plates.