Progress Report

Field evaluation of *Fusarium* wilt race 1 resistance in commercially available triploid watermelon varieties

Principal Investigators:

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Justification

Fusarium wilt race 1 (FON1) caused by the soil-borne fungus, *Fusarium oxysporum* f.sp. *niveum*, results in significant annual losses for growers in major watermelon producing states. In years when spring temperatures are particularly cool this pathogen can be devastating for early-planted fields. Although resistance to FON1 is reasonably common in newly-released seedless watermelon varieties, a significant portion of what is currently grown and marketed does not have FON1 resistance. Results from Bruton et al., 2007 indicated that resistance to FON 1 was highly quantitative in the greenhouse, meaning that it could vary widely amongst cultivars. There have been no previous trials documenting resistance and yield at the field level to FON 1 in commercially available FON 1-resistant cultivars. We set out to determine in two infection scenarios (natural and artificially inoculated) the level of resistance in commercially available varieties.

Methods

In the spring of 2014 there were two complimentary trials conducted. One trial was located at the Vidalia Onion and Vegetable Research Center (natural infection) and another conducted at the University of Georgia Blackshank Research Farm in Tifton, GA (inoculated). Approximately 6-week old seedlings were planted on 2-4 April 2014 into black plastic mulch flat beds (36-inch plastic) with drip irrigation tubing. Inoculated plots received 50-ml of inoculum (10^3 conidia per ml) in the transplant hole immediately prior to transplanting. Rows were spaced on 6-foot centers with 36-inch within row spacing. Plots consisted of 5 plants of each variety with 7 replications. The variety 'Sp6' was used as a pollinizer with 2 pollenizers per plot. Because 'Sp6' has been marketed with resistance to both FON 1,2 we felt it would ensure that pollination was adequate regardless of disease level. Four control plots consisting of Charleston Grey, Calhoun Grey, and PI296341, which display no resistance to FON, resistance to FON 1, and resistance to FON 1,2 respectively were planted in each location. Preplant fertility consisted of 1000 lb/acre 10-10-10

banded in rows prior to laying plastic mulch. Plants received supplemental fertility (liquid 7-0-7) fertilizer at a rate of 10 lb/N every two weeks for a season total of 150 lb/N. Plants were sprayed with foliar fungicides according to University of Georgia recommendations for commercial watermelon production. No soil-based fungicides were used. Insecticide applications consisted of imidicloprid (Admire Pro) at planting. No additional insecticide sprays were necessary. Initial harvests took place on 12 and 16 June and terminated on 30 June (Tifton) and 3 July (Reidsville).

There were 16 commercial and precommercial seedless varieties planted at the Reidsville location (natural infection) and 14 selections planted in the Tifton location that have been marketed with at least some level of FON 1 resistance. Due to space limitations two varieties were omitted from the Tifton location. Varieties are listed in table 1.

Table 1. Varieties entered in this trial with FON 1 resistance.

Hollar	Nunhems (Bayer)	Syngenta	Seminis	Seedway
Tiger Eye	5234 plus	Distinction	SV0241	Seedway 4502
Ruby	acx 6177	Exclamation	SV8298	(noted as intermediate only)
(Riedsville location only)	nun 01009	Fascination	SV2757	
	Revolution		SV7018	

Results

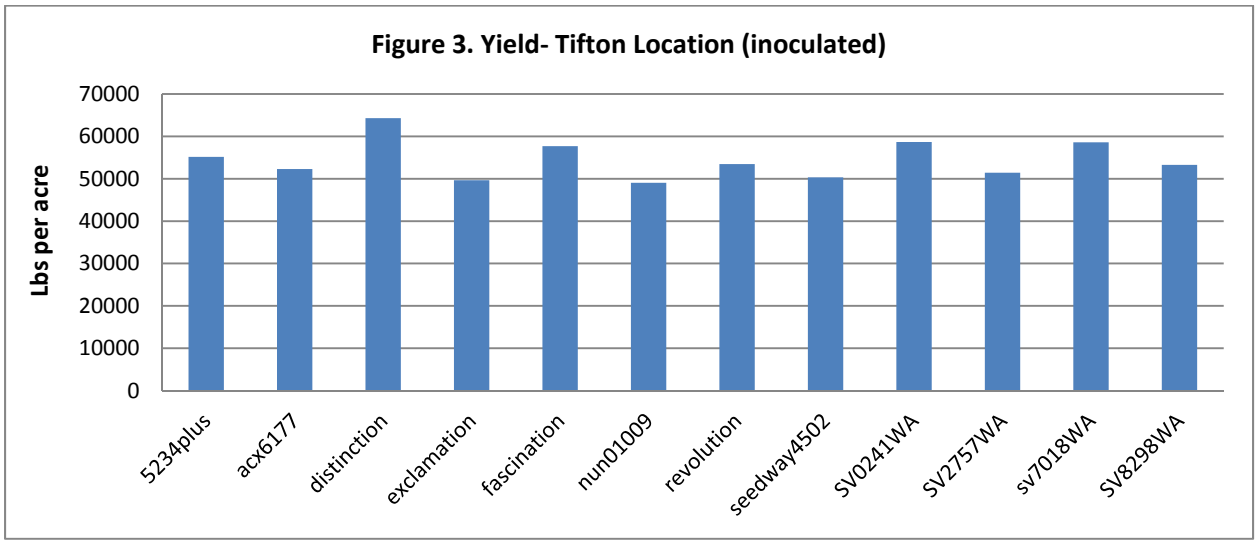
All varieties which were entered in the trial, which were marketed as having FON 1 resistance proved resistant to FON in both trial locations. Vigor and disease ratings taken during growth showed differences in vigor between varieties but no visible symptoms of *Fusarium* wilt were observed except in control plots (Figures 1 and 2.)

Figure 1. Photo of control plot showing Charleston Grey (left) wilted and dead with Calhoun Grey (right) producing fruit and healthy. Calhoun Grey has resistance to FON 1, while Charleston Grey has no resistance to FON. (Tifton location, inoculated)

Figure 2. Evidence of wild *Citron sp.* melons in a plot which are wilting due to FON, while resistant plants continue to grow. *(Reidsville location, natural infection*). Photo credit: F. Hunt Sanders, 6 May 2014.

Since all varieties proved to be resistant to FON 1 there is no area under the disease progress curve (AUDPC) data to present. Yield and vigor data were collected on all melons. In general melons were smaller and of less vigor in both plots compared to nearby variety trials. This suggest that while no evidence of disease was present in infected plots that perhaps there was an effect on yield or vigor of the plants compared to a non-infected field. Although total per acre yields in our plots were comparable to nearby commercial fields, average fruit weight was slightly lower. Nonetheless it is was interesting observation. Because no information was available regarding field-level resistance of FON-resistant plants when this project was proposed our objective in 2014 was to determine presence and level of resistance in commercially available varieties of seedless melon. An ongoing trial in year 2 (2015) is comparing non-inoculated and inoculated plants in the same field side by side to determine if there is an impact of FON inoculum on vigor, despite not observing disease.

There were no significant differences between varieties with regard to yield in either location (Figure 3). However, yields at the Tifton location were greater than the Riedsville location. This could be due to disease level (natural vs. inoculated) or simply differences in management and environment between the two locations.



Conclusions Year 1

We have sought a no-cost extension to conduct another trial year comparing inoculated plants side-by-side in the same field with non-inoculated plants to determine if there is an impact of FON 1 on vigor of resistant plants. The 2014 trial was successful in determining that although resistance to FON 1 is a quantitative trait, all commercially available varieties marketed with FON 1 resistance appear to have a high level of resistance to FON 1 in both inoculated and natural infection scenarios. No symptoms of FON wilt were observed in any resistant plants. Although greenhouse trials have been used to screen germplasm previously this trial is the first time this has been documented with a relatively complete sample of commercially available varieties in the field. As long as FON 1 is the only race of FON present, using a resistant variety is the preferred option for management of the disease.

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