Evaluation of organic fungicides for control of fruit rot diseases in Michigan blueberries

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Introduction

Michigan ranks as the number one blueberry producing state in the U.S. Certified organic blueberry acreage is increasing at a modest rate in Michigan. However, organic growers are limited by a lack of research tailored towards organic production. In a 2007 survey, growers indicated that organic disease management in blueberries was a major barrier to conversion to organic practices. To this end, we initiated several trails in 2008 and 2009 to evaluate OMRI (Organic Materials Review Institute)-listed fungicides and selective pruning for control of mummy berry and anthracnose in blueberries. Mummy berry, caused by *Monilinia vaccinii-corymbosi*, causes blighting of young shoots and mummification of fruit (Fig. 1). Anthracnose fruit rot, caused by *Colletotrichum acutatum* contributes to pre-and post-harvest losses (Fig. 1).

Figure 1. Healthy (left), anthracnose-infected (center), and mummy berry-infected (right) blueberry fruit.

Methods and materials

Experiments were conducted in mature commercial blueberry plantings in western Michigan. Treatments were applied to 4-bush plots with an R&D Research CO_2 cart boom sprayer and were replicated four times in a randomized complete block design. Dormant treatments were applied on or around April 15. Season-long sprays were applied at 7-14 day intervals and 40-gpa spray volume. In the mummy berry trials, we counted the number of fallen mummified fruit below the canopy of the two center bushes of each plot. In the anthracnose trials, we hand-harvested two pints of healthy-looking berries into plastic clamshells from the two center bushes of each plot. Fifty randomly-chosen berries were incubated for 14 days at room temperature and 100% relative humidity to provide optimal conditions for growth of fruit rot. Following storage, berries were rated for incidence of anthracnose and other fruit rot diseases. Data were analyzed using ANOVA and mean separation in SAS 9.2 and StatGraphics.

Table 1. Product name and active ingredient of treatments evaluated.

Product	Active ingredient	Product	Active ingredient
Basic Copper 53	Copper sulfate	Oxidate	Hydrogen dioxide
Tetrasul *(dormant spray)*	Lime Sulfur	Sporan	Rosemary, clove, thyme oil
Nordox *(dormant Spray)*	Copper (I) oxide	Fungastop	Citric acid and mint oil
Serenade Max	*Bacillus subtillus* strain QST 713	Regalia	*Reynoutria sachalinensis* (giant knotweed) extract
Actinovate	*Streptomyces lydicus* WYEC 108	SP-1 compost tea	Aerobic, plant-derived compost extract
PlantShield	*Trichoderma harzianum* strain KRL-AG2	Organic Gem	Fish hydrosylate
Pruning (dormant)	Inoculum reduction and increased air movement	GantecGreen*	Neem extract
Synthetic program *(Indar, Captec, Pristine)*		Fenbuconazole, Captan, and Pyraclostrobin + Boscalid	

*not yet labelled for blueberries

Figure 2. Products tested include inorganic materials (Tetrasul, Oxidate), biological controls (Serenade, PlantShield), botanical concentrates (Sporan, Regalia), and organic waste products (Organic Gem, SP-1 compost tea).

Results

Mummy berry

The treatments varied in control of mummy berry. In trial A, organic fungicides reduced the number of mummies by greater than 90%, similar to the control attained with the recommended synthetic fungicide program. In Trial B, we observed a wider range of performance; Sporan, Serenade Max, and Oxidate reduced mummy berry incidence by more than 50% but no organic treatment achieved the control of synthetic fungicides (Fig. 3).

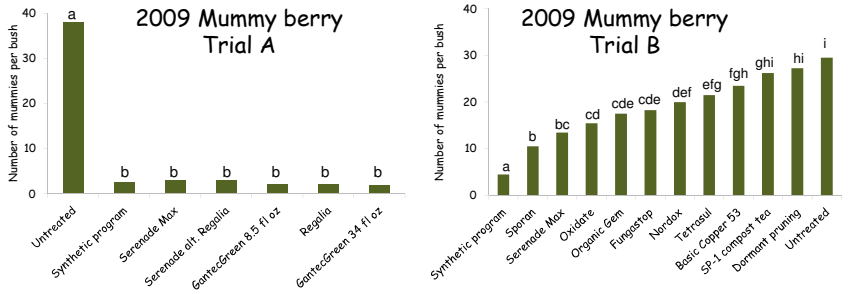

Figure 3. Mummy berry infection in 2009 organic fungicide trials. Different letters denote significant mean treatment differences ($p < 0.05$, Tukey-Kramer test).

Anthracnose

In both years, the synthetic fungicide program provided superior control, while 14-day interval applications of Sporan controlled anthracnose nearly as well as a conventional fungicide program. Serenade Max performed more variably: no better than the untreated control in 2008, but statistically similar to the best organic fungicides in 2009. Organic Gem, Sporan, and Fungastop reduced anthracnose incidence by 50% relative to the untreated control in 2009 and warrant further evaluation for disease management in blueberries (Fig. 4).

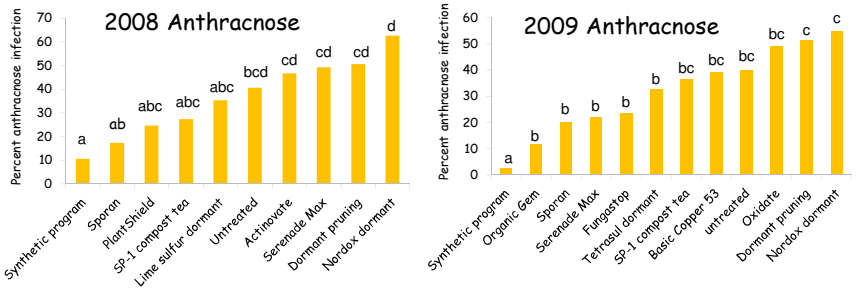

Figure 4. Anthracnose infection in 2008 and 2009 organic fungicide trials. Different letters denote significant mean treatment differences ($p < 0.05$, Tukey-Kramer test).

Conclusions

While many OMRI-listed products are labeled for use in blueberries, they vary in efficacy of control of the two most important blueberry diseases in Michigan. GantecGreen, Serenade Max, and Regalia demonstrated impressive efficacy against mummy berry. However, more trials are needed to confirm the apparent effectiveness of these relatively new products. Sporan shows considerable efficacy against both anthracnose and mummy berry, but these results also need to be confirmed in additional trials. Dormant sprays and pruning show modest efficacy, but should be evaluated in combination with seasonal sprays. Overall, Michigan blueberry growers have new, promising options for fruit disease management.

Acknowledgements

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