Controlling Gummy Stem Blight on Grafted Watermelon Seedlings with Fungicides

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Watermelon seedlings grown as transplants are susceptible to gummy stem blight, caused by the fungus *Didymella bryoniae*, during greenhouse production. Cucurbits used as rootstocks to graft watermelon—bottle gourd (*Lagenaria*) and hybrid squash (*Cucurbita*)—also are susceptible. Gummy stem blight can be particularly serious on grafted watermelon seedlings. After grafting, plants must be misted or held at high relative humidity for one week while the vascular bundles of rootstocks and scions connect. These long, continuous periods of leaf wetness are favorable for severe disease outbreaks. The objective of this project was to test fungicides that control gummy stem blight in the field for efficacy on grafted watermelon seedlings in the greenhouse.

Materials and Methods

Experiments were designed as randomized complete blocks with three replications for phytotoxicity trials and four replications for efficacy trials. All experiments were done twice. Only fungicides that are approved for use in greenhouses were tested. Fungicides were applied to 10-day-old seedlings at labeled rates per 50 gal/A water (see Table 1). Grafting controls included non-grafted seedless watermelon 'SS 7187HQ' and self-grafted watermelon (watermelon used as the rootstock and scion).

For phytotoxicity experiments, three plants per 4-in.-diam. pot were used. Plants were sprayed twice at weekly intervals and held in a greenhouse. Ratings were severity of phytotoxicity (percent of cotyledons or leaves with injury) after two applications.

For efficacy experiments, six plants in a two-by-three-cell section of a 72-cell tray were used. The following schedule was followed:

Day 1: Watermelon and rootstock seedlings were treated with fungicides.
Day 2: Scions and rootstocks treated with the same fungicide were grafted together and placed in a humidity chamber at 100% relative humidity to begin the healing process.
Day 3: Grafted seedlings were sprayed with spores of the gummy stem blight fungus, returned to the humidity chamber, and held for 6 days.
Day 9: Gummy stem blight was rated visually on each seedling.

RESULTS AND CONCLUSIONS

Susceptibility

- ✓ All five rootstocks, bottle gourd (*Lagenaria*) 'Macis,' 'Emphasis,' and 'WMXP 3945' and hybrid squash (*Cucurbita*) 'Strong Tosa' and 'Shintosa Camel,' were equally susceptible to gummy stem blight. They did not differ from seedless watermelon A & C 7187. The pattern

was the same for both the number of plants that developed symptoms and the area of the cotyledons covered with gummy stem blight.

Phytotoxicity (see Table 1)

- ✓ Several fungicides registered on cucurbits were phytotoxic on bottle gourd, hybrid squash, or watermelon seedlings. Inspire Super at the field rate, Luna Experience at the field rate, and Kocide caused injury to cotyledons of all three cucurbits. Inspire Super and Luna Experience still caused injury to the rootstocks at one-half the field rate but not to watermelon. It was not clear why difenoconazole (Inspire) and cyprodinil (Vangard) were not phytotoxic when used alone, but they were phytotoxic when combined (Inspire Super).
- ✓ Tebuconazole in Monsoon and Luna Experience stunted seedlings of hybrid squash, bottle gourd, and watermelon. Reducing the concentration by one-half did not reduce the stunting.

Efficacy (see Table 2)

- ✓ Vangard and Inspire provided the best control of gummy stem blight on grafted seedless watermelon seedlings, even when held in a humidity chamber for healing. Although Vangard is in Switch and Inspire is in Inspire Super, neither Vangard nor Inspire is registered for use on cucurbits. Thus, these fungicides are not options at this point.
- ✓ Manzate and Switch reduced the number of plants with gummy stem blight (disease incidence) compared to the nonsprayed control but not to an acceptable level. However, Manzate and Switch reduced disease severity on both rootstocks. It was not clear why Switch was generally less effective than Vangard, as both fungicides contain the same amount of cyprodinil.
- ✓ Topsin M was not effective because of widespread insensitivity in D. bryoniae.
- ✓ The grafting process had no effect on gummy stem blight; the self-grafted control had as much disease as non-grafted seedlings.

Fungicide Resistance

- ✓ If multiple fungicide applications are required on seedlings before or after grafting, it is crucial to use different products for each application to reduce the risk of fungicide resistance. The risk of resistance to Inspire, Vangard, and Luna is medium to high.
- ✓ Remember that strobilurin products (Quadris and Cabrio) and Pristine cannot be used in greenhouses. Resistance to these fungicides is widespread and has been found in greenhouses.
- ✓ Mancozeb was relatively effective and has no risk of resistance. It should be the first choice for a greenhouse fungicide and should be used in rotation with Switch. Inspire Super and Luna Experience can be used on watermelon seedlings only—but not on rootstocks—at the field rate dissolved in 100 gallons of water.

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Table 1. Fungicide Phytotoxicity Experiment

Treatment	Active Ingredient	Product (rate/A in 50 gpa)	Stunting[a]	Phyto (%) on *Lagenaria*[b]	Phyto (%) on *Cucurbita*[b]	Phyto (%) on Watermelon[b]
Water	(none)	(none)	--	0.0	0.0	0.0
Inspire Super 2.82SC	cyprodinil 24.1% + difenoconazole 8.4%	20 fl oz	--	24.3*	15.0*	1.9*
Inspire Super 2.82SC	cyprodinil 24.1% + difenoconazole 8.4%	10 fl oz	--	11.9*	not done	0.0
Luna Experience 400SC	fluopyram 18% + tebuconazole 18%	17 fl oz	S	24.3*	7.2*	7.4*
Luna Experience 400SC	fluopyram 18%+ tebuconazole 18%	8.5 fl oz	S	8.4*	not done	0.0
Monsoon 3.6L	tebuconazole 38.7%	8 fl oz	S	2.3	1.7	1.8*
Kocide 3000	copper hydroxide 46.1%	1.25 lb	--	2.7*	5.0*	1.4
Switch 62.5WG	cyprodinil 37.5% + fludioxinil 25%	14 oz	--	0.9	0.0	0.0
Topsin M 70WP	thiophanate methyl 45%	0.5 lb	--	0.2	0.0	0.2
Manzate Prostik 75DG	mancozeb 75%	3 lb	--	0.0	0.0	0.2
Inspire 2.08SC	difenoconazole 23.2%	7 fl oz	--	0.0	0.0	0.0
Vangard 75WG	cyprodinil 75%	7 oz	--	0.0	0.0	0.6

[a] "S" means greater than 50% stunted compared to the water control. "--" means no stunting.

[b] Ratings are severity (%) of phytotoxicity after 2 applications.

*Significantly different from the water control, $P<0.05$.

Table 2. Fungicide Efficacy Experiment

Treatment	Fungicide active ingredient	Hybrid Squash 'Strong Tosa' Incidence (%) [a]	Bottle Gourd 'Emphasis' Incidence (%)	Both Rootstocks Mean Severity (%)[b]
Self-grafted control	Water applied	93.4 a[*]	100.0 a[*]	17.1 a[*]
Non-grafted control	Water applied	93.4 a	99.5 a	12.0 b
Grafted control	Water applied	97.7 a	100.0 a	9.2 b
Topsin M	thiophanate methyl 50%	91.2 a	75.0 b	5.1 c
Switch	cyprodinil 37.5% + fludioxinil 25%	24.3 bc	40.7 c	0.8 d
Manzate Prostik	mancozeb 75%	47.6 b	13.3 d	0.5 de
Vangard	cyprodinil 75%	6.1 cd	8.7 d	0.2 de
Inspire	difenoconazole 23.2%	2.3 cd	2.0 de	0.01 e
Non-inoculated grafted control	Water applied	0.0 d	0.0 e	0.00 e

[a] Percentage of plants with symptoms of gummy stem blight.
[b] Percent area of the cotyledons covered with gummy stem blight.
[*] Mean separation by Waller-Duncan k-ratio t tests, k=500 ($P \leq 0.01$).