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Organic Practices for the Production of Muskmelon

Abstract
Cucurbit crops, especially muskmelon and cucumber, attract cucumber beetles, which vector bacterial wilt, Erwinia tracheiphila, causing significant crop losses. High beetle densities are associated with high bacterial wilt incidence, which usually occurs during the first stages of plant establishment. Growers of organic muskmelon need effective ways to manage the cucumber beetle/bacterial wilt complex.

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Organic Practices for the Production of Muskmelon

RFR-A1029

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Introduction

Cucurbit crops, especially muskmelon and cucumber, attract cucumber beetles, which vector bacterial wilt, *Erwinia tracheiphila*, causing significant crop losses. High beetle densities are associated with high bacterial wilt incidence, which usually occurs during the first stages of plant establishment. Growers of organic muskmelon need effective ways to manage the cucumber beetle/bacterial wilt complex.

Row covers are usually deployed from transplant until anthesis (start of flowering), then removed to allow insect pollination. Several studies at ISU and elsewhere have suggested that a 10-day delay in row cover removal can shield muskmelon crops from the first emergence of wilt-vectoring cucumber beetles, resulting in much less bacterial wilt, and correspondingly better yield, than either removing the cover at anthesis or not using row covers at all. Opening the ends of the row covers has been tried in order to allow for pollination.

Plant growth promoting rhizobacteria (PGPR) can enhance plant growth and yield while suppressing soilborne pathogens. A commercialized product, Kodiak® (*Bacillus subtilis* GB03 strain) is OMRI-approved and was tested to determine its efficacy in reducing beetle feeding and increasing yield.

Nutrient management can be challenging on organic farms, in part because organic N must undergo mineralization to become plant available. Preliminary evidence exists that integrating PGPRs with row covers and organic nutrient sources such as compost could improve plant nutrition.

This report focuses on first-year results of a 3-year multi-state effort, with University of Kentucky and Penn State University, to optimize organic growing practices that effectively manage insect and diseases, enhance pollination, and reduce fertilizer inputs for muskmelon production.

Materials and Methods

Transitioning organic land was used for the experimental plot at the ISU Horticulture Research Station, Ames, IA. On May 27, 2010, 2-week-old organic transplants of Strike muskmelon were planted 2 ft apart in black plastic mulch with drip irrigation and 8-ft row centers. Spunbond polypropylene row covers (Agribon® AG-30) were installed on wire hoops immediately after transplanting.

A split plot, randomized complete block experimental design was used to examine impacts of organic fertilizer treatments, use of PGPR, and differential timing of row cover removal. Main plots of fertilizer treatment (30 × 72 ft) were replicated three times. Fertilizer treatments for each plot were based on spring soil analysis and were disc incorporated into the soil: 1) organic bagged fertilizer—Fertrell® 5-1-1 (33 lb) and Fertrell® 3-4-7 (55 lb); 2) dairy-based compost assuming a 10 percent mineralization rate (1.5 cubic yards); and 3) dairy-based compost assuming a 30 percent mineralization rate (0.5 cubic yards).

Subplot treatments were randomly assigned within main plots. Pre-plant seed treatments with Kodiak® were randomly assigned to each of eight rows.

Three row cover treatments (Figure 1) were compared as follows: 1) row covers applied at transplanting and removed at anthesis (start of bloom); 2) row covers applied at transplanting, with the ends opened at anthesis and row covers removed 10 days later; and 3) no row covers (control).

OMRI-registered insecticides and fungicides were applied on a rescue basis only, triggered by results of weekly monitoring. Pyganic® was applied to control picnic beetle damage on ripening fruit on the evening of August 7. Champ 50WG® (copper hydroxide) was used to control cucurbit anthracnose, which is caused by the fungus *Colletotrichum orbiculare*. Weed management was achieved with 6 in. of chopped corn stalk mulch between rows (Figure 1) and composted bark was placed around the opening in the plastic around each seedling before row cover placement.

Populations of striped and spotted cucumber beetle adults were monitored weekly from transplant through the beginning of harvest using yellow sticky cards and weekly visual counts on five randomly chosen plants. Disease incidence was monitored weekly. Melons were harvested twice weekly for three weeks beginning August 3. The number and weight of marketable and cull melons harvested from each subplot was recorded. As an index of fruit quality, Brix readings (percent sugar) were taken from two marketable fruit per subplot at each harvest.

Results and Discussion

Severe weather had a large impact on the growing season. Despite high winds of up to 70 mph in mid-July, row covers remained intact. Exposed plants suffered tattered leaves. Despite record rainfall, culminating in the flooding of the field during the week of harvest, marketable fruit were harvested. Persistence of fruit in a marketable condition may have been due to the corn stalk mulch, which promoted drainage around each fruit, thus preventing fruit rots.

The most serious disease was anthracnose, which was first observed in mid-June. The disease was effectively controlled by weekly sprays of copper hydroxide. Three more Champ WG applications were applied to the no-row-cover treatments than in the row-cover-removed-at-anthesis treatment (Table 1). Reduced rain splash under the row covers may have slowed spread of anthracnose, thereby reducing the need for fungicide sprays.

Bacterial wilt was not detected in our trials in 2010. Absence of bacterial wilt from the Hort Station muskmelon trials for the past two years may be linked to the exceptionally low winter temperatures (-30°F) in central Iowa during January 2009. These extreme temperatures may have led to die-off of overwintering cucumber beetle adults, which spend the winter in litter at the soil surface or in the top inch of topsoil. Cucumber beetle counts were less than five/plant on all dates except July 22, when 50 beetles/plant were observed. This spike was not detected using yellow sticky cards, however. In the absence of bacterial wilt, the trials were used to assess the effect of row cover treatments on fungal diseases, fruit quality, and yield.

Analysis of variance showed no interaction of fertilizer treatment, PGPR seed treatment, or row cover treatment. Therefore each treatment effect was analyzed separately. Average number of fruit per subplot and marketable weight was lower in the no cover treatment (Table 1). Sugar content was also higher from subplots with row covers. The number of culls due to small size (possibly associated with poor pollination) did not differ between the row cover removal at anthesis versus the row cover removal ten days after anthesis

(Table 1). This suggests that pollination was not adversely affected by row cover removal time. Earliness (which often increases the market value of melons) was also enhanced in the subplots with row covers (Figure 2).

The total number of fruit was the highest for the Fertrell fertilizer treatment (Table 2). However, the higher rate of dairy compost did not differ significantly in marketable fruit number or total weight from the Fertrell treatment. Percent sugar in melons was significantly higher in the 10 percent mineralization compost rate than the other fertilizer treatments. Subplots from the lowest rate of compost (30 percent mineralization rate) had 10 and 20 lb less marketable fruit than the higher compost rate and Fertrell treatment, respectively. No yield or sugar content differences were observed in the Kodiak treatments (Table 3).

In conclusion, even in the absence of bacterial wilt, row cover treatments reduced the need for fungicide sprays, increased yield, and enhanced earliness of muskmelon. Opening the row cover ends seems to have allowed for timely pollination.

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Figure 1. Organic practices muskmelon plot at anthesis. Note that ends of row cover are opened.

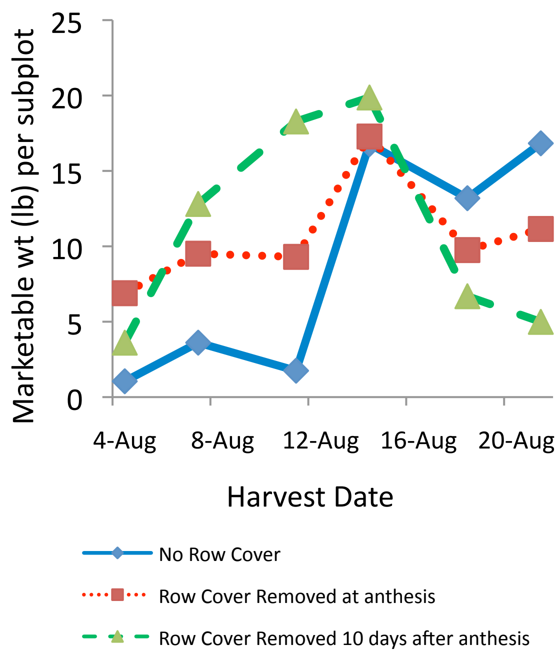

Figure 2. Earliness of muskmelon harvest for three row cover treatments.

Table 1. Effect of row cover treatment (per 15-plant subplot).

	Fruit number		Weight (lb)		Quality		No. of sprays
Treatment	Total	Mktbl.	Total	Mktbl.	Brix	Undersize culls #	Champ WG
No row cover	22.0b*	12.5 b	80.1 b	53.2 b	8.8 b	0.5 b	8
Row cover removed at anthesis	27.1 a	15.2 a	97.1 a	63.9 a	9.2 a	1.7 a	6
Row cover removed 10 days after anthesis	27.1 a	15.6 a	99.4 a	66.6 a	9.3 a	2.0 a	5
LSD	3.1	2.27	12.4	10.4	0.3	1.0	

Table 2. Effect of fertilizer treatment (per 15-plant subplot).

	Fruit number		Weight (lb)		Quality	
Treatment	Total	Mktbl.	Total	Mktbl.	Brix	Undersize culls (no.)
Fertrell	30.0 a*	16.6 a	110.0 a	71.7 a	9.0 b	0.6 a
10% min. rate (1.5 yds^3)	24.0 b	14.3 ab	87.5 a	60.9 b	9.4 a	0.9 a
30% min. rate (0.5 yds^3)	22.3 b	12.3 b	79.1 b	51.0 b	9.0 b	0.6 a
LSD	3.1	2.3	12.4	10.4	0.3	0.5

Table 3. Effect of Kodiak seed treatment on total yield (per 15-plant subplot).

	Fruit number		Weight (lb)		Quality	
Treatment	Total	Mktbl.	Total	Mktbl.	Other	Undersize culls (no.)
Kodiak +	24.3 a*	13.9 a	87.6 a	58.5 a	9.2 a	1.3 a
Kodiak -	26.6 a	14.9 a	96.7 a	63.9 a	9.0 a	1.6 a
LSD	2.6	1.9	10.1	8.5	0.2	0.9

*Means followed by the same letter are not significantly different within row ($P \leq 0.05$).