Strip-tillage and Row Cover Use in Organically and Conventionally Grown Muskmelon

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Introduction

Growing muskmelon in a more sustainable way involves multiple management practices. "Rolling" cover crops after they mature, and then tilling strips into which the crops are planted, can help manage weeds and moisture while improving soil health. This "strip-tillage" technique provides a biodegradable mat that does not need to be removed at the season's end, as plastic mulch does. Row covers are placed over newly planted seedlings to provide a better microclimate and a physical barrier to pests. Extending the time of row cover removal by 10 days after the onset of female flowers has been shown to provide season-long prevention of bacterial wilt, which is spread by cucumber beetles. This may reduce the need for chemical sprays.

This report focuses on the second-year results of a two-year, multi-state effort to determine the effects of strip-tillage and row covers on muskmelon production.

Materials and Methods

A split-plot, randomized complete block experimental design was used in both an organically and conventionally managed system. In each of those systems, main plots comprised of tillage (strip-tillage or conventional tillage with black plastic mulch) and subplots were row covers (row cover or no-row cover). Treatments were replicated four times for a total of 16 subplots in each of the management systems (2 tillage methods × 2 row cover treatments × 4 replications = 16 subplots).

Fields were planted with 110 lb/acre of cereal rye in October 2013. Strip-till plots were established by using a Hiniker strip-tiller in April 2014, rolling the mature rye with an I&J roller-crimper in May, then strip-tilling once more. Conventional till plots were established by incorporating the rye in May, then using a plastic layer to form raised beds and lay black plastic mulch. On June 10, 29-day-old Athena muskmelon plants were transplanted into 30-ft rows, Spunbond polypropylene row covers (Agribon-30) were applied to row cover treatments, and treatments without row covers received a 50 ml drench of Admire (imidacloprid) insecticide for conventionally managed plots or a band of Entrust SC (spinosad) combined with CidetrackD (a cucumber beetle feeding stimulant) for organically managed plots. The ends of row covers were opened when 50 percent of plants had female flowers, and were left open for 10 days before being removed on July 17.

Organic plots were managed using organic fertilizer and sprays, conventional plots were managed with conventional fertilizer and sprays. All plots were scouted weekly for pests and disease. Insecticides for conventionally managed plots included imidacloprid and permethrin. For organic plots, a residue of Surround (kaolin clay) was maintained on the leaves as a deterrent for cucumber beetles; however, a mixture of Pyganic and Trilogy was applied when cucumber beetle thresholds were exceeded. Threshold numbers for cucumber beetles

varied according to melon plant size: pre-flowering = 0.5/plant, during fruit pollination = 1.0/plant, at vine touch = 3.0/plant.

Melons were harvested two times per week from August 14 to August 29, 2014, then assessed for marketability.

Results and Discussion

Plant Biomass. Plant biomass was higher in conventionally tilled plots with black plastic mulch than in strip-till plots in conventional ($P < 0.001$) and organic ($P < 0.0001$) treatments (Table 1). Row covers did not have an effect on plant biomass. Black plastic and thorough tillage increased soil temperature, which enhances plant growth.

Yield. Conventionally tilled plots with black plastic mulch produced significantly ($P \leq 0.0001$) more melons by weight than strip-tillage treatments in conventional and organic plots (Table 1). Row covers increased ($P < 0.05$) marketable melons in organic plots but had no effect ($P = 0.68$) in conventional plots.

Bacterial wilt in conventionally and organically managed plots differed between row cover treatments ($P = 0.012$ and $P = 0.0004$, respectively). Bacterial wilt was not affected by tillage methods ($P = 0.40$ and $P = 0.64$, respectively) and there was no interaction of row cover and tillage ($P = 0.70$ and $P = 0.25$) (Table 1).

Percentage insect culls in conventionally managed plots was higher ($P < 0.01$) in strip tillage treatments than plastic mulch, but row cover treatment did not influence ($P = 0.16$) late season fruit feeding. However, in organically managed treatments, neither tillage nor row cover treatments affected percentage insect culls ($P = 0.18$ and 0.15, respectively). The sudden increase in beetle feeding in late season is difficult to detect with weekly field scouting. Daily scouting may be necessary to manage this problem.

Row covers reduced the number of insecticide applications compared with plots without row covers from six to three for organically managed plots, and from five to four in conventionally managed plots. Organically and conventionally managed plots received two fungicide sprays for control of anthracnose (Champ WP and Bravo, respectively).

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Table 1. Marketable and total yield (weight of melons per plant (lb)) and plant biomass (lb).[1]

Management	Tillage	Row cover	Plant biomass	Marketable yield	Total yield	Insect cull (%)	Bacterial wilt (%)
Organic	Plastic	NRC	0.18 a	2.5 a	5.1 b	32.8 ab	20.0 a
		RC	0.21 a	2.8 a	7.3 a	50.7 a	1.7 b
	Strip	NRC	0.07 b	0.4 c	1.2 d	27.1 b	26.7 a
		RC	0.09 b	1.5 b	3.1 c	33.9 ab	0.0 b
Conventional	Plastic	NRC	0.14 AB	3.2 A	6.1 B	33.7 A	15.0 A
		RC	0.17 A	3.1 A	7.5 A	45.5 AB	3.3 AB
	Strip	NRC	0.10 BC	0.9 B	3.9 C	67.5 BC	10.0 AB
		RC	0.09 C	0.7 B	4.6 C	85.9 C	1.7 B

[1]Organic and conventional plots were analyzed separately. Differing letters in each column significantly ($P < 0.05$) differ based on protected least significant difference critical values.
[2]NRC = no row cover; RC = row cover.