Strip-tillage and Row Cover Use in Organically and Conventionally Grown Summer Squash

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Introduction

Sustainable production of summer squash involves multiple management practices. Some cover crops can be "rolled" when mature to produce a ground-covering mat. The cash crop is then planted in tilled strips made in the residue. This "strip-tillage" technique provides a weed-controlling, moisture-retaining mat that is biodegradable, unlike plastic mulches. The reduction in tillage can improve soil health. Row covers provide a favorable microclimate and act as a physical barrier to pests when placed over young transplants. This can help plants grow more rapidly and reduce diseases spread by insects early in the season, such as yellow vine decline and bacterial wilt.

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 squash production.

Materials and Methods

A split-plot, randomized complete block experimental design was used in both an organically and conventionally managed system. In each system, 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 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. On June 5, 22-day-old Lioness summer squash plants were transplanted into 30-ft rows, Spunbond polypropylene row covers (Agribon-30) were applied to row cover treatments. Seedlings in plots 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. Row covers were removed at female flower onset on June 26.

Weekly scouting reports determined additional sprays with either organic or conventional products. Plots were sprayed for squash vine borer when a pheromone trap placed ~1,000 ft from the field collected adult moths. The threshold for squash bugs was one egg mass/plant. Squash were harvested twice weekly from July 7 to August 15 and assessed for marketability.

Results and Discussion

Plant Biomass. Squash plant biomass was higher in conventionally tilled plots with black plastic mulch than in strip-tillage plots in both organic ($P < 0.0001$) and conventional ($P < 0.01$) systems (Table 1). Black plastic mulch and thorough tillage increased soil temperature, which enhanced plant growth.

Yield. Tillage had no significant effect on marketable yield of squash in conventional treatments (P = 0.14). Conventional tillage with black plastic mulch produced more squash in organic (P < 0.05) treatments compared with strip-tillage treatments (Table 1). Row covers increased squash yield in organic treatments, but did not affect yield in conventional treatments (Table 1). Row covers increase air temperature and limit insect and disease damage; however, they reduce light transmission and can interfere with pollination and fruit set.

Pest management. Row covers eliminated the need for insecticide applications against squash vine borer (Table 2). No differences in insects or diseases were observed among management, tillage, or row cover treatments. Fungicide applications were not needed.

Conclusions

In conventional plots, squash yields for strip tillage treatments were equivalent to plastic mulch treatment, regardless of row covers. In organic plots, row covers enhanced marketable yield in strip tillage treatment enough that these were comparable to the yield from plastic mulch treatments. Row covers reduced the need for some insecticides.

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Table 1. Marketable and total yield (number of squash/plant) and plant biomass (lb).[1]

Management	Tillage	Row cover[2]	Marketable yield	Total yield	Plant biomass
Organic	Plastic	NRC	5.9 a	7.7 b	0.08 a
		RC	6.2 a	8.5 a	0.09 a
	Strip	NRC	3.9 b	5.1 d	0.05 b
		RC	5.3 a	6.6 c	0.06 b
Conventional	Plastic	NRC	6.6 A	9.4 AB	0.05 A
		RC	6.9 A	10.3 A	0.07 A
	Strip	NRC	5.7 A	8.0 B	0.04 BC
		RC	5.8 A	8.4 B	0.04 C

[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.

Table 2. Insecticide applications used in 2014 based on pest or disease presence in squash.[1]

Management	Organic				Conventional			
Tillage	Strip		Plastic		Strip		Plastic	
Row cover	Row cover	No row cover	Row cover	No row cover	Row cover	No row cover	Row cover	No row cover
Transplant insecticide		Entrust Cidetrack		Entrust Cidetrack		Admire		Admire
Squash Vine Borer		Entrust Pyganic 2x		Entrust Pyganic 2x		Asana 2x		Asana 2x
Squash bugs	Entrust Pyganic Trilogy 2x	Entrust Pyganic Trilogy 2x	Entrust Pyganic Trilogy 2x	Entrust Pyganic Trilogy 2x	Asana 2x	Asana 2x	Asana 2x	Asana 2x
Applications	2	5	2	5	1	4	1	4

[1]In each of the four columns, left is row cover (RC) treatment, right is no row cover. 2x signifies spray was applied twice.