Optimizing Organic Weed Control in Acorn Squash Under Mesotunnel Systems

RFR-A2018

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Introduction

Cucumber beetles (*Acalymma vittatum* and *Diabrotica undecimpunctata*) and squash bug (*Anasa tristis*) are important squash and other cucurbits pests. They spread the pathogenic bacteria *Erwinia tracheiphila* (causal agent of bacterial wilt) and *Serratia marcescens* (causal agent of cucurbit yellow vine disease), respectively. The lack of effective insecticides challenges pest control in organic systems, so the use of physical barriers is promising. Mesotunnels (3.5-ft-tall tunnels with a nylon mesh row cover) are more breathable than low tunnels, so these can be used for most or all of the growing season. Some ISU studies also have shown that using mesotunnels can increase yield. However, weed management in the soil strips between plastic-mulched crop rows is an issue that needs to be solved. One option is using living mulches such as teff (*Eragrostis tef).* The research objective is to optimize weed control inside mesotunnels, using teff as the living mulch.

Materials and Methods

Acorn squash (cv. Table Ace) seedlings were transplanted into three parallel 30-ft-long rows/subplot. Rows were spaced 6 ft apart with 2 ft between plants in each row. Each row was drip irrigated and covered with a black plastic mulch. Each subplot had a bumblebee hive (Koppert Biological Systems) in the middle of the center row. A randomized complete block design included four treatments: 1) landscape fabric; 2) teff seeded at 4 lb/acre; 3) teff seeded at 8 lb/acre; and 4) bare ground. Treatments 1, 2, and 3 were established in the alleys between plastic-mulched strips one week before squash transplanting. At harvest, number and weight of fruit were determined in the center row of each subplot. Weeds were sampled from arbitrarily placed 2 ft x 3 ft quadrats in each subplot. Dry biomass of weeds was determined after drying at 140°F for four days.

Results and Discussion

The landscape fabric treatment had the highest marketable yield, followed by teff at 4 lb/acre, teff at 8 lb/acre, and bare ground (Table 1). Significant ($P < 0.05$) differences were observed between landscape fabric and teff at 8 lb/acre, as well as between landscape fabric and bare ground. Weed biomass was absent in the landscape-fabric treatment, and minimal in the teff treatments compared with the bare-ground control (Table 2). Although teff can provide some soil and weed control benefits, its growth likely suppressed squash yield. Therefore, its growth may need to be managed, for example, by midseason mowing between crop rows before the vines cover the soil strips. This strategy will be tried in 2021 trials.

Acknowledgements

Thanks to USDA-NIFA’s Organic Research and Extension Initiative for funding this project, the Gleason Lab hourly workers, and the Horticulture Research Station staff for technical and research assistance.

Table 1. Effect of weed control on marketable yield of organic acorn squash under mesotunnels, lb/A.

Weed control treatments[1]	Marketable yield[2]	Non-marketable yield[2]
Landscape fabric	22,560 A	2,018 A
Teff 4 lb/A	17,416 AB	1,138 A
Teff 8 lb/A	15,918 B	1,229 A
Bare ground	13,043 B	923 A

[1]Landscape fabric was established in the alleys between plastic-mulched strips one week before squash transplanting; teff was seeded in the alleys between plastic-mulched strips with Gandy seeder (Gandy Lawn Drop Spreader, 42 in. wide) one week before squash transplanting; bare ground = no weed control applied.
[2]Fruit weight in lb/A. Means followed by the same letter are not statistically different ($P < 0.05$); means were separated using Tukey LSD.

Table 2. Effect of weed control on weed biomass in organic acorn squash production under mesotunnels.

Weed control treatments[1]	Grass biomass/ subplot[2]	Broadleaf biomass/ subplot[2]	Total weed biomass/subplot[2]
Landscape fabric	0.0 B	0.00 B	0.0 B
Teff 4 lb/A	1.2 AB	0.02 AB	1.3 AB
Teff 8 lb/A	0.5 AB	0.01 AB	0.5 AB
Bare ground	3.6 A	2.08 A	5.7 A

[1]Landscape fabric was established in the alleys between plastic-mulched strips one week before squash transplanting; teff was seeded in the alleys between plastic-mulched strips with Gandy seeder (Gandy Lawn Drop Spreader, 42 in wide) one week before squash transplanting; bare ground = no weed control applied.
[2]Weed biomass (lb/6 ft^2 quadrat) after drying for 4 days at 140°F. Means followed by the same letter are not statistically different ($P < 0.05$); means were separated using Tukey LSD.