Optimizing Weed Control in Organic Mesotunnel Systems

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Kephas Mphande, graduate research assistant
Mark Gleason, professor
Plant Pathology and Microbiology

Introduction

Organic growers of cucurbit crops such as muskmelon are losing millions of dollars every year due to bacterial wilt, which is caused by *Erwinia tracheiphila*. Bacterial wilt is vectored by spotted and striped cucumber beetles. There are no reliable organic insecticides, and no resistant muskmelon varieties are available. A new production system called mesotunnels has shown promising results from previous studies. They are more durable, breathable, and spacious than low tunnels, and can provide protection during most or all of the growing season. A major challenge in mesotunnel systems is how to manage weeds with full-season row covers. Weeds compete with crops for sunlight, water, and nutrients, and their growth must be limited to obtain a reasonable yield. Under mesotunnels, weeds might shade out young crop plants as well as rob the soil of nutrients and water. Living mulches are considered to be a viable option for weed control in mesotunnels, because they are inexpensive and enhance soil health. The objective of this study is to optimize weed control and enhance soil health under mesotunnel systems in organic production. This is the first year of a 4-yr study.

Materials and Methods

Muskmelon (cv. Athena) seedlings were transplanted into 30-ft-long, 3-row subplots spaced at 6 ft on black plastic mulched 2-ft centers with drip tape irrigation system. Under full-season mesotunnels, one bumble bee box was placed during bloom in each subplot for pollination, in a randomized complete block design. There were five mulch treatments: 1) red clover living mulch; 2) red clover and ryegrass combination; 3) shredded *Miscanthus* grass residue; 4) landscape fabric, and 5) bare ground (control) applied between rows. Yield data were taken on the center row of each 3-row subplot. Number and weight of marketable fruit were recorded at harvest. Above-ground weed biomass was taken just before crop harvest. Reactive carbon was measured from the soil by using permanganate oxidizable carbon (POxC) method. Disease incidence and severity were scored from the center row of each subplot and recorded weekly.

Results and Discussion

Mulch treatments did not differ significantly in marketable yield (Table 1). There were significant differences among treatments in above-ground weed biomass: 1) landscape fabric having the least; 2) shredded *Miscanthus* with no significant difference between the two; 3) two living mulches (red clover only and red clover + ryegrass combination); and 4) bare ground having no mulch (Table 2). Reactive carbon from the soil still is being analyzed. The results show under the conditions and treatments tested, the living mulches were not very effective at suppressing the weeds, but weed pressure did not suppress yield significantly.

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Table 1. Effects of different mulches on marketable yield of muskmelons under mesotunnels.

Treatment	Marketable yield[1]	Non-marketable yield[1]	Total yield[1]
Bare ground[3]	11.0[2]	0.5	11.5
Clover[4]	11.2	0.4	11.6
Crop residue[5]	10.4	1.3	11.7
Ryegrass + clover[6]	10.5	0.3	10.7
Weed fabric[7]	13.1	1.6	14.7
LSD (0.05)[8]	0.06	0.17	0.04

[1]Fruit weight in lb/plant.
[2]Pounds of fresh fruits at harvest/individual plant.
[3]No mulch was applied, this was a control treatment.
[4]Red clover was planted between rows just before transplant at 20 lb/acre.
[5]*Miscanthus* grass residues were applied in between rows just before transplant.
[6]Ryegrass plus red clover combination was planted in between rows just before transplant at 15 lb/acre each.
[7]Weed fabric was laid between rows just before transplant.
[8]Means were separated using Tukey LSD.

Table 2. Effects of different mulches on weeds in muskmelon production under mesotunnels.

Treatment	Broadleaf weed biomass[1]	Grass weed biomass[1]	Total biomass[1]
Bare ground[3]	98.5[2]	93.5	192.0
Clover only[4]	65.2	116.5	181.7
Ryegrass + red clover[5]	63.4	76.3	139.7
Crop residue[6]	5.6	7.4	13.0
Weed fabric[7]	0.0	0.0	0.0
LSD (0.05)[8]	1.8	7.4	10.3

[1]Weed biomass in grams/subplot weighed after 5 days oven drying at 68°C.
[2]Grams of dry weed biomass/subplot.
[3]No mulch was applied, this was a control treatment.
[4]Red clover was planted between rows just before transplant at 20 lb/acre.
[5]Ryegrass plus red clover combination was planted in between rows just before transplant at 15 lb/acre each.
[6]*Miscanthus* grass residues were applied in between rows just before transplant.
[7]Weed fabric was laid between rows just before transplant.
[8]Means were separated using Tukey LSD.