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Comparing Between-Row Mulchesin Organic Muskmelon and Squash—Year 1

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Introduction

Organic farmers must plan carefully to manage weeds and soil health. Mulching not only aids weed management, but also can improve soil quality. Organic-matter mulches compete with weeds for sunlight, moisture, nutrients, and growing space. They also improve soil health by reducing soil erosion and increasing soil organic matter. Organic matter contributes greatly to soil structure and microbial activity, both of which are essential to plant health.

The goal of this trial was to compare the effectiveness of two mulch treatments to suppress weeds, improve soil organic matter, and increase yields of organic muskmelon and acorn squash.

Materials and Methods

Experimental design was a split plot randomized complete block with acorn squash (cv. Table Ace) and muskmelon (cv. Athena) as the split plots. Mulch treatments included live mulch (annual ryegrass and medium red clover), crop residue mulch (chopped corn stover), and a bare ground control without mulch. Treatment subplots were three rows wide and 30 ft long, with four replications of three treatments.

Fields were tilled three weeks prior to transplanting. One week later, organic compost was applied according to compost test results, and fields were tilled again at a shallower depth. Commercial organic fertilizer was applied by hand along rows according to soil test results, and then drip tape and black plastic mulch were laid. One week prior to transplanting, soil between rows was cultivated, and a 6-in.-thick layer of corn stover was applied to subplots assigned to the crop residue mulch treatment.

On June 2, 2-wk-old muskmelon and squash seedlings were transplanted 2 ft apart on 6-ft row centers using a water wheel transplanter. Soil in live mulch and bare ground subplots was cultivated, and rye and red clover seed was applied by hand to subplots assigned to the live mulch treatment. Rye and red clover were seeded at rates of 48 and 12 lb/acre, respectively. Insufficient rainfall required the live mulch treatments in squash and muskmelon be reseeded and watered in on June 24, after row covers were removed to allow for pollination. All subplots were weeded at that time. Rye and red clover germinated after re-seeding, but did not become well established before end-of-season weed sampling.

The row cover system in all treatments consisted of conduit hoops and a nylon mesh row cover material (ProtekNet®). The hoops were placed every 7.5 ft and stood 3 ft tall. ProtekNet was draped over the hoops, and the edges were secured with nylon-mesh bags filled with rocks. Row covers were removed at the start of female flowering and replaced two weeks later to allow for pollination.

Conduit hoops were bent in advance from 1-in.-diameter galvanized electrical conduit pipe using a QuickHoops™ 4 ft x 4 ft Low Tunnel Bender (Johnny's Selected Seeds).

Weed sampling occurred in all subplots immediately prior to harvesting. A 2 ft x 3 ft PVC quadrat was randomly placed in both alleys of each subplot. Counts of grass and broadleaf weeds within the quadrats were recorded, and the weeds were collected with roots intact. Soil was shaken from the roots before placing weeds in paper bags. Weeds were dried and weighed (Table 1).

Soil samples were collected in all subplots after harvest and tested for reactive carbon (Table 1). Compared with other forms of soil carbon, reactive carbon changes rapidly as a result of soil management practices. It is the best measure to determine the carbon contributed by each mulch type within one season. Eight 6-in.-deep, 1-in.-diameter soil cores were collected from both alleys of subplots and thoroughly mixed. A sample from each subplot was submitted to the Iowa State University Soil and Plant Analysis Laboratory for testing.

Yield data were taken on the center row of each subplot. Number and weight of marketable fruit, insect culls, disease culls, and total culls were recorded (Table 2).

During the two weeks when row covers were removed, scouting for cucumber beetles, squash bugs, and squash vine borers occurred weekly. When scouting thresholds were reached for cucumber beetles or squash bugs, a tank mix of Surround® WP, neem oil, and pyrethrins was applied to muskmelon and squash fields. Bt was sprayed on the bases of squash plants if a single squash vine borer moth was found.

Results and Discussion

Muskmelon. Compared with bare ground, corn stover had significantly fewer weeds and less weed biomass, and nearly doubled the number and weight of marketable fruit. Although live mulch did not significantly reduce the number of weeds compared with bare ground, it significantly reduced weed biomass. However, live mulch had no significant impact on yield compared with bare ground.

Reactive carbon in soil was significantly greater for corn stover than for live mulch, but not significantly greater than for bare ground. Live mulch had the lowest amount of reactive carbon in soil, probably due to the failure of the live mulch treatment to establish itself early in the season. High weed biomass in the bare ground treatment, combined with poor establishment of rye and red clover, probably led to bare ground having a slightly higher amount of reactive soil carbon than live mulch.

Acorn squash. Treatments had no effect on number of weeds, weight of weeds, or yield. However, despite an absence of statistically significant yield differences, numerically the average number and weight of marketable squash in corn stover subplots was nearly double from the bare ground treatment (Table 1). Corn stover subplots had significantly more reactive carbon than bare ground. Reactive carbon in live mulch subplots did not differ significantly from bare ground or corn stover subplots.

These results show that mulch type was more important in muskmelon than in acorn squash. In muskmelon, corn stover provided the best weed control and led to the highest yield and reactive carbon in soil. Although effects on squash yield were minimal, corn stover resulted in the highest amount of reactive carbon in soil.

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Table 1. Weed pressure and soil reactive carbon in three mulch treatments of muskmelon (cv. Athena) and acorn squash (cv. Table Ace) in 2016 at the Iowa State University Horticulture Research Station, Ames, IA.

Field	Treatment[1]	Broadleaf and grass weeds[2] Mean number		Mean dry weight		Reactive carbon in soil[3]	
Muskmelon	Bare ground	56.5	b	175.5	b	703.8	ab
	Corn stover	1.3	a	35.7	a	808.3	b
	Live mulch	15.9	ab	26.5	a	653.3	a
Acorn squash	Bare ground	0.0	a	0.0	a	766.8	a
	Corn stover	0.2	a	2.8	a	864.0	b
	Live mulch	2.2	a	0.6	a	783.0	ab

[1]The live mulch treatment consisted of rye and red clover seeded at rates of 48 lb/acre and 12 lb/acre, respectively. Treatments were arranged in a split plot, randomized complete block design with four subplots/treatment. ProtekNet row cover was applied to all subplots at transplant, removed at the start of female flowering, and then replaced after two weeks. Muskmelon and acorn squash data were analyzed separately.
[2]Values are treatment averages of number or weight of weeds/square meter (m^2). Weight is expressed in grams. Means in a column followed by the same letter do not differ significantly ($P < .05$) based on Tukey's honestly significant difference critical values.
[3]Reactive carbon (milligrams of permanganate oxidizable carbon per kilogram of soil).

Table 2. Yield data in three mulch treatments of muskmelon (cv. Athena) and acorn squash (cv. Table Ace) in 2016 at Iowa State University Horticulture Research Station, Ames, IA.

		Marketable yield[2]				Insect culls[3]				Disease culls[4]		Total culls[5]	
Field	Treatment[1]	Mean number		Mean weight		Mean number		Mean weight		Mean number		Mean number	
Muskmelon	Bare ground	69.8	a	329.0	a	37.5	a	167.4	a	2.3	a	67.5	a
	Corn stover	116.3	b	506.3	a	16.5	a	71.4	a	3.0	a	69.8	a
	Live mulch	84.0	ab	400.1	a	38.3	a	186.5	a	0.0	a	82.5	a
Acorn squash	Bare ground	53.3	a	108.8	a	0.0	a	0.0	a	0.8	a	96.0	a
	Corn stover	104.3	a	213.8	a	1.5	a	2.8	a	0.0	a	141.0	a
	Live mulch	70.5	a	129.9	a	0.8	a	1.5	a	0.0	a	113.3	a

[1]The live mulch treatment consisted of rye and red clover seeded at rates of 48 lb/acre and 12 lb/acre, respectively. Treatments were arranged in a split plot, randomized complete block design with four subplots/treatment. ProtekNet row cover was applied to all subplots at transplant, removed at the start of female flowering, and then replaced after two weeks. Muskmelon and acorn squash data were analyzed separately.
[2,3]Values are treatment averages of number or weight per 90 row-ft. Weight is expressed in pounds. Means in a column followed by the same letter do not differ significantly ($P < .05$) based on Tukey's honestly significant difference critical values.
[4,5]Values are treatment averages of number of culls per 90 row-ft. Total culls includes all fruit culled due to improper size or ripeness, rot, sun scald, or damage caused by rodents, insects, and disease.