Comparing Between-Row Mulches in Organic Muskmelon and Squash – Year 2

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Introduction

Organic matter mulches are an important multi-purpose tool in organic agriculture. Mulches suppress weeds by competing for sunlight, moisture, and nutrients. Mulches also improve soil health by reducing erosion and increasing soil organic matter. For crops such as muskmelon and squash, mulches protect fruit from moist soil that contributes to fruit rot.

The goals of this trial were to compare the abilities of two mulch treatments to suppress weeds, to increase soil organic matter, and increase marketable yield in organic muskmelon and acorn squash.

Materials and Methods

The experiment was designed as an incomplete latin rectangle and tested on both muskmelon (cv. Athena) and acorn squash (cv. Table Ace). Treatments included living mulch (annual rye and medium red clover), crop-residue mulch (chopped corn stover), and bare soil. Mulch treatments were applied to soil alleys between plant rows. Subplots were three rows wide and 30 ft long, with four replications of each treatment.

Muskmelon and squash fields were tilled April 11, 2017. On May 9, compost was applied and tilled in. On the same date, fertilizer was broadcast in rows, and drip tape and black plastic mulch were laid with 6-ft row centers. Annual rye (48 lb/acre) and red clover (12 lb/acre) seed were hand broadcasted and buried after cultivating May 12. To ensure germination, the rye and red clover were watered daily until four days after seeding. On May 23, corn stover subplots were cultivated and stover was applied to a 6-in. depth.

On May 30, 3-wk-old muskmelon and acorn squash seedlings were hand-transplanted with 2-ft spacing. All subplots were immediately covered with nylon mesh row covers (ProtekNet) to prevent damage from pests and disease. Row covers were supported by tall (3.5 ft) metal hoops and the edges were secured with nylon mesh rock bags. Hoops were made by bending 10-ft lengths of 1-in. conduit pipe with a QuickHoops™ 4 ft x 4 ft Low Tunnel Bender (Johnny's Selected Seeds). For pollination, row covers were removed when female flowers appeared in order to allow for pollination. Row covers were replaced after two weeks and remained in place until harvest began.

Scouting for cucumber beetles, squash bugs, and squash vine borers was done once weekly when plants were uncovered. Insecticides were sprayed if economic threshold was reached. Three plants from the center rows of subplots were scouted for cucumber beetles and squash bugs. The threshold was one beetle or one squash bug egg mass, nymph, or adult per plant. A tank mix of pyrethrins, kaolin clay, and neem oil was applied to a treatment if threshold was reached. To detect squash vine borers, a pheromone trap was placed at plant height and checked for the presence of squash vine borer moths. Bacillus thuringiensis was applied to the bases of squash plants if a single squash vine borer moth was found in the field or in the pheromone trap.

Weeds were sampled in all subplots after harvesting. In each between-row alley of each subplot, grass and broadleaf weeds were counted and collected from a randomly selected 2 ft by 3 ft area. If weeds could not be easily pulled with roots intact, they were cut at the soil line. Samples were dried and weighed (Table 1).

After harvest, a composite soil sample was collected from each subplot by mixing four 6-in.-deep soil cores from both alleys. Samples were submitted to the Iowa State University Soil and Plant Analysis Laboratory to quantify levels of reactive carbon (Table 1). Reactive carbon (POXC) is the form of carbon that is most rapidly broken down in a soil. It is the best measure to determine short-term changes in soil carbon caused by soil management practices such as mulching.

Yield data were recorded from all 15 plants in the center row of each subplot. All marketable and non-marketable fruits were counted and weighed (Table 2).

Results and Discussion

Muskmelon. There was no treatment effect on the mean number or weight of weeds, or for the amount of reactive carbon in soil (Table 1). Corn-stover plots had a significantly higher mean number and mean weight of marketable fruit than the living-mulch plots. There was no difference among treatments in the mean number or mean weight of non-marketable fruit.

Acorn squash. In squash, both corn stover and live mulch plots had a lower mean number of weeds than bare ground. Only corn stover had a significantly lower mean weight of weeds than bare ground. There was no treatment effect on the amount of reactive carbon in soil. The mean number of marketable squash was greater in live mulch than in bare ground. There was no significant treatment effect on mean weight of marketable fruit, or on mean number or weight of non-marketable fruit.

These results show that corn stover is superior to living mulch in muskmelon. However, a difference between these mulch types was less evident in squash.

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Table 1. Weed pressure and soil reactive carbon in three mulch treatments in muskmelon (cv. Athena) and acorn squash (cv. Table Ace) in 2017 at Iowa State University Horticultural Research Station, Ames, IA.

Field	Treatment[a]	Broadleaf and grass weeds[b] Mean number		Mean dry weight		Reactive carbon in soil[c]	
Muskmelon	Bare ground	32.7	a	300.3	a	316.8	a
	Corn stover	15.2	a	292.8	a	385.2	a
	Live mulch	40.8	a	264.6	a	365.4	a
Acorn squash	Bare ground	48.7	b	397.8	b	462.6	a
	Corn stover	15.0	a	176.7	a	439.2	a
	Live mulch	26.2	a	251.6	ab	442.8	a

[a]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 an incomplete latin rectangle design with four replications/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.

[b]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.

[c]Reactive carbon (milligrams of permanganate oxidizable carbon per kilogram of soil).

Table 2. Yield data in three mulch treatments in muskmelon (cv. Athena) and acorn squash (cv. Table Ace) in 2017 at Iowa State University Horticultural Research Station, Ames, IA.

Field	Treatment[a]	Marketable yield[b] Mean number		Mean weight		Total non-marketable[c] Mean number		Mean weight	
Muskmelon	Bare ground	35.3	ab	157.7	ab	150.8	a	580.3	a
	Corn stover	41.3	b	200.3	b	110.3	a	438.1	a
	Live mulch	18.0	a	85.7	a	88.5	a	342.3	a
Acorn squash	Bare ground	39.8	a	63.2	a	93.0	a	127.2	a
	Corn stover	51.8	ab	82.4	a	76.5	a	85.6	a
	Live mulch	59.3	b	98.6	a	63.0	a	82.1	a

[a]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 an incomplete latin rectangle design with four replications/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.

[b,c]Values are treatment averages of number or weight per 90 row-ft. Weight is expressed in pounds. Total non-marketable includes all fruit culled due to improper size or ripeness, rot, sun scald, or damage caused by rodents, insects, and disease. Means in a column followed by the same letter do not differ significantly ($P < .05$) based on Tukey's honestly significant difference critical values.