Strip-tillage and Row Cover Use in Organically and Conventionally Grown Muskmelon

RFR-A1329

Jennifer Tillman, graduate student
Ajay Nair, assistant professor
Department of Horticulture
Jean Batzer, assistant scientist
Mark Gleason, professor/extension
Department of Plant Pathology and Microbiology

Introduction

Growing muskmelon in a more sustainable way involves multiple management practices.

Cover crops often are incorporated into the soil before planting the cash crop. However, they also can be "rolled" and used as a ground cover throughout the growing season. The cash crop is planted in small, tilled strips within the residue. This "strip-tillage" technique provides a weed-controlling, moisture-retaining mat that does not need to be removed at the season's end, as plastic mulch does. The reduction in tillage can improve soil structure and health.

Row covers are placed over newly planted seedlings to provide a better microclimate and a physical barrier to pests. Extending the time of row cover removal by 10 days after the onset of female flowers has been shown to provide season-long prevention of bacterial wilt, which is spread by cucumber beetles. This may reduce the need for chemical sprays.

This report focuses on the first-year results of a two-year, multi-state effort with University of Kentucky, Pennsylvania State University, and Ohio State University. The goal was to determine the effects of strip-tillage and row covers on muskmelon production in terms of plant biomass, yield, weed pressure, and pest management.

Materials and Methods

A double split-plot, randomized block experimental design was used. Main plots of management method (organic vs. conventional) and tillage (strip-tillage in rolled rye vs. conventional till with plastic mulch) were replicated once each and row cover treatment (row cover vs. no row cover) was replicated four times within each of these variables for a total of 32 subplots (2 management methods × 2 tillage methods × 2 row cover treatments × 4 replications).

Fields were planted with 50 lb/acre of cereal rye in October 2012. In May 2013 (at rye anthesis), the rye in the conventional till with black plastic plots was mowed with a rotary mower and incorporated into the soil. In the strip-tillage plots, the rye was rolled using an I & J chevron-patterned back-mounted roller crimper. On June 3, 2013, a Hiniker strip-tiller was used to establish strips in the strip-tillage plots. A plastic mulch layer established raised beds and laid black plastic in the conventional till plots. The wet spring prevented earlier access into the field. On June 4, 26-day-old Athena muskmelon plants were transplanted. Conventional and organic no row cover treatments received imidichloprid drenches or sprays with Entrust and Cidetrack-D, respectively. Spunbond polypropylene row covers (Agribon-30) were applied to the row cover treatments within 24 hours of transplant. The ends of row covers over the muskmelons were opened when melons reached anthesis and left open for 10 days before being removed on July 21.

Organic plots were managed using organic fertilizer and sprays, and conventional plots were managed with conventional fertilizer and sprays. All plots were scouted weekly for pests and disease. Since the one cucumber beetle per plant threshold was not reached, plots were not sprayed with insecticides after row cover removal. Labeled pesticides were applied with backpack sprayers.

Melons were harvested from August 1 to August 31, 2013, three times per week, then assessed for marketability.

Results and Discussion

*Plant biomass***.** Plant biomass was greater (P<0.0001) from black plastic conventionally tilled plots than in strip-tillage plots, and greater (P<0.0001) from row cover treatments than no row cover treatments (Figure 1). Black plastic and tillage increase soil temperature and row covers can increase air temperature, which enhances plant growth.

Weed biomass. Weed biomass tended to be greater in black plastic conventionally tilled treatments than in strip-tillage treatments (Figure 2). This reflects weed growth in pathways between the plastic strips and the weed-suppressive nature of rolled rye.

Marketable yield. After accounting for management, black plastic conventionally tilled plots produced significantly more melons by weight than strip-tillage treatments (P=0.002) (Figures 3, 4). Row cover usage did not affect melon yield weight per plot (P=0.55).

Pest management. Although row covers enhanced biomass (Figure 1) and total fruit yield, marketable yield did not increase (Figures 3, 4). Row covers reduced (P<0.0001) bacterial wilt by about 50 percent compared with no row cover treatments (Figure 5). However, a higher (P<0.0001) percentage of melons were culled as a result of insect damage in plots with row covers, 21 percent, as opposed to 3 percent culled in no row cover plots (Figure 6). An interaction of row cover treatment and management method suggests that plots with conventional management practices were subject to higher pest pressures than plots with organic practices.

Conclusions

The black plastic no row cover treatments performed the best. Soil health, an expected benefit of strip-tillage, has not yet been assessed. The transplant delay required for strip-tillage plots negated the benefits of the row covers to protect plants from early inclement weather. Also, the overwintering cucumber beetles emerged before planting, so row covers were not needed to protect plants from early season bacterial wilt. The delayed removal of row covers resulted in late-season harvest that coincided with high beetle pressure. More aggressive insect control was needed late season.

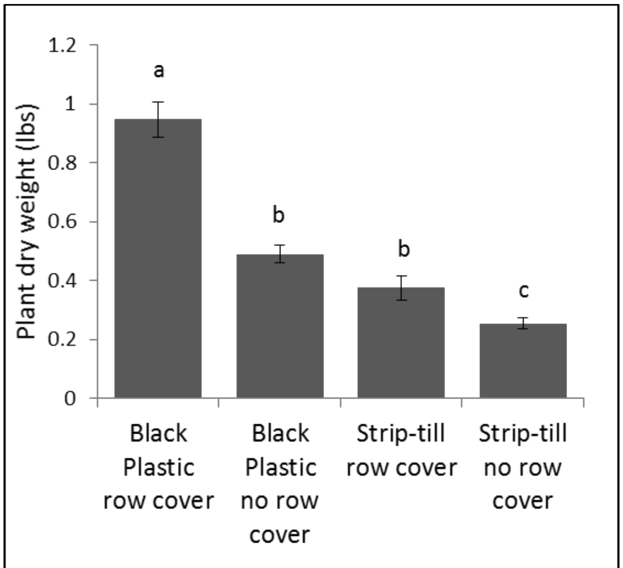

Fig 1: Melon plant biomass samples taken July 29, 2013. Three plants taken from each plot (including roots, excluding fruit) and oven dried. Conventional and organic combined. Mean separation at *P*≤0.05.

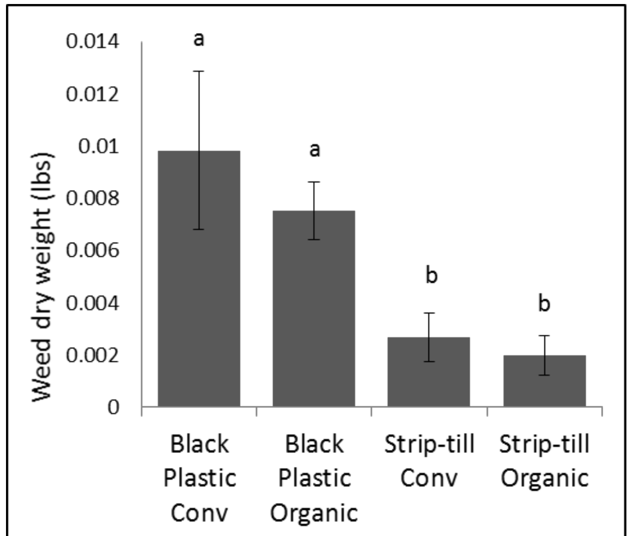

Fig 2: Melon weed biomass samples taken July 8, 2013. Average shoot and root dry weight from 0.25m^2, two samples per plot between rows. Row cover and no row cover combined. Mean separation at *P*≤0.05.

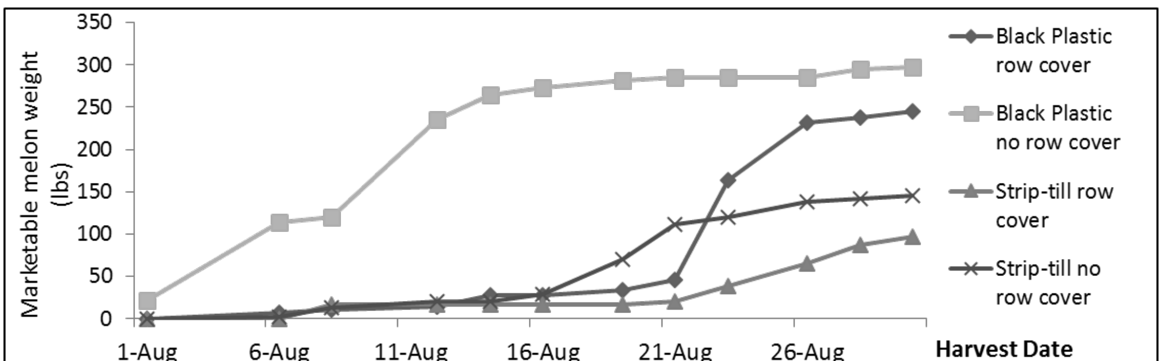

Fig 3: Convention melon. Cumulative marketable melon harvest weights per plot. Marketable melon were at least 2 lbs and without major defects.

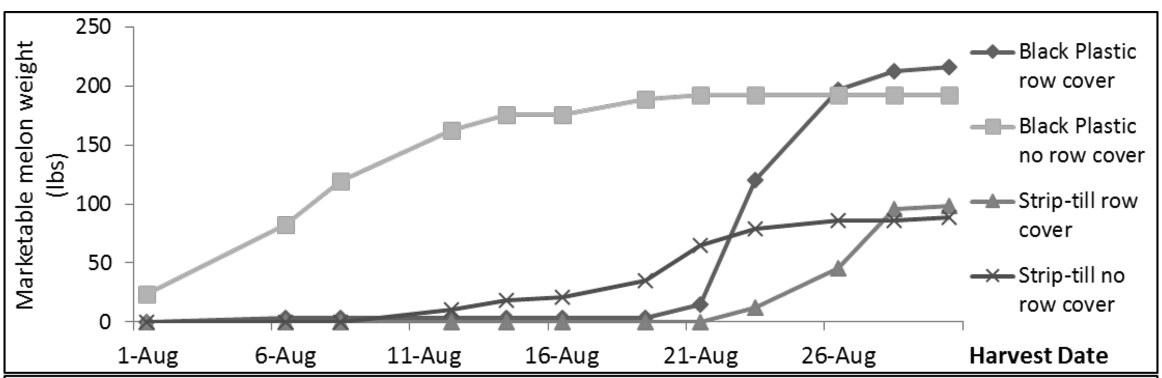

Fig 4: Organic melon. Cumulative marketable melon harvest weights per plot. Marketable melon were at least 2 lbs and without major defects.

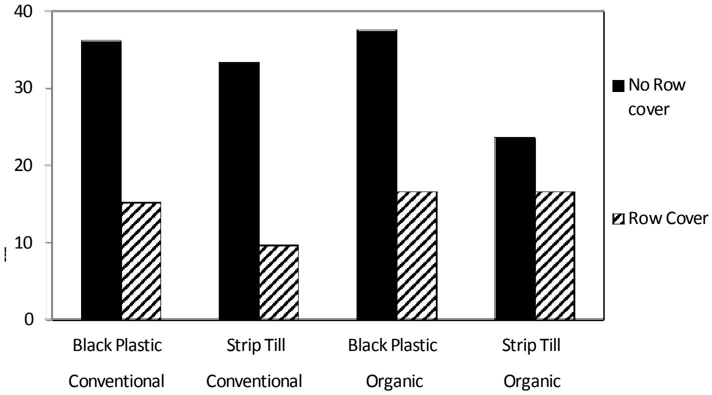

Figure 5. Percentage of bacterial wilt with and without row covers at first harvest. Differing letters show significant differences (P<0.05) within each set of tillage and management practices.

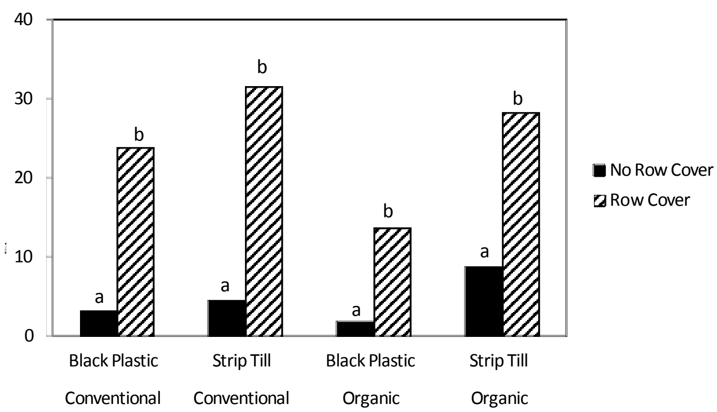

Figure 6. Insect culls as percentage of total fruit weight from plots with and without row covers . Differing letters show significant differences (P<0.05) within each set of tillage and management practices.