



Strip-tillage and Row Cover Use in Organic and Conventional Cucurbit Crops

Jennifer Tillman and Ajay Nair
Department of Horticulture, Iowa State University



Introduction

This project focuses on the impact of tillage and row cover use on soil health, crop yield, and plant growth in cucurbit cropping systems.

Cover crops are often incorporated into the soil before planting the cash crop. However, they can be "rolled" and used as a ground cover. The cash crop is then planted in small, tilled strips within the residue. This "strip-tillage" system provides a porous, weed-controlling, moisture-retaining, biodegradable mat.

Row covers can be used over young plants to provide a suitable microclimate and a physical barrier against pests. By excluding cucumber beetles, row covers can help prevent the spread of bacterial wilt, a disease caused by the bacterium *Erwinia tracheiphila*.

Research Questions

- How do tillage and plastic mulch affect soil temperature?
- What is the effect of row covers on ambient air temperature?
- Does strip-tillage positively impact soil microbial biomass?
- How do tillage and row covers affect plant size and crop yield?
- Do organically and conventionally managed cucurbits differ in their response to tillage or row cover usage?

Materials and Methods

Site: Muscatine Island Research Farm, Fruitland, IA (2013)

Soil type: Fruitfield course sand

Treatments

- Cropping systems:** organic or conventional
- Crops:** muskmelon 'Athena' or summer squash 'Lioness'
- Tillage:** conventional tillage with black microbial mulch or strip-tillage into rolled rye
- Row covers:** row cover (Agribon® 30) or no row cover



Split-split plot randomized complete block design, four replications
Squash and melon had 0.56m in-row spacing in 9.1m long rows

Conventional Tillage



Mower



Tiller



Plastic mulch layer

Strip-tillage



I&J Cover Crop Roller



Hiniker strip-tiller



Hiniker strip-tiller

Results

Soil Temperature

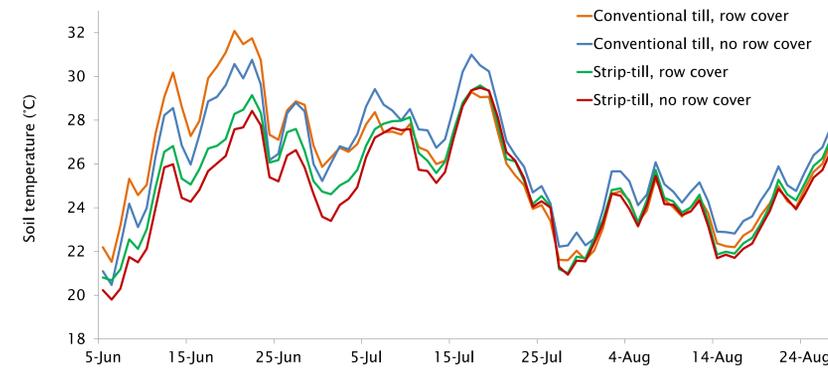


Figure 1: Soil temperature collected using Onset Hobo® data loggers mounted 15 cm below ground in conventionally managed melon plots. Readings every 60 minutes, 24 hour averages shown above.

Air Temperature

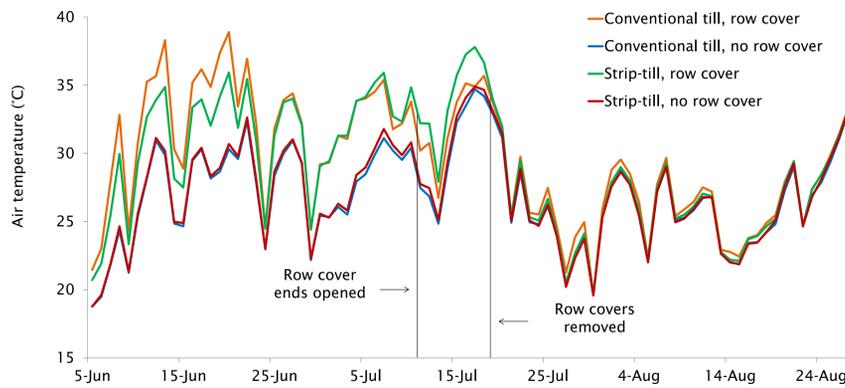


Figure 2: Air temperature collected using Onset Hobo® data loggers mounted 15 cm above ground in conventionally managed melon plots. Readings every 30 minutes, 24 hour averages shown above.

Soil Microbial Biomass

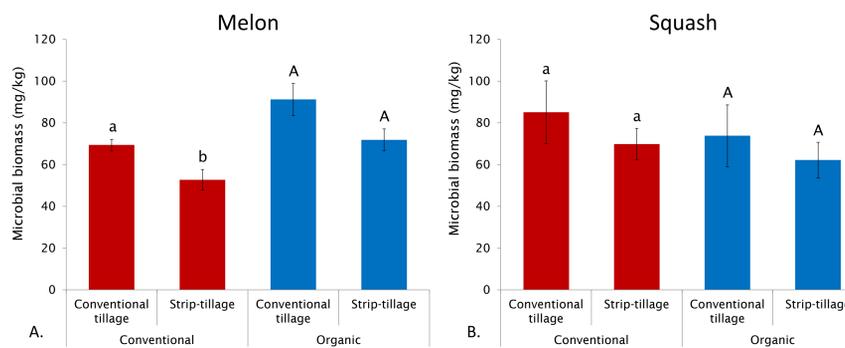


Figure 3: Soil microbial biomass estimated using chloroform fumigation-extraction method. Soils sampled August 29, 2013; 15-cm long, 3.8cm diameter core. (P<0.05)

Plant Biomass

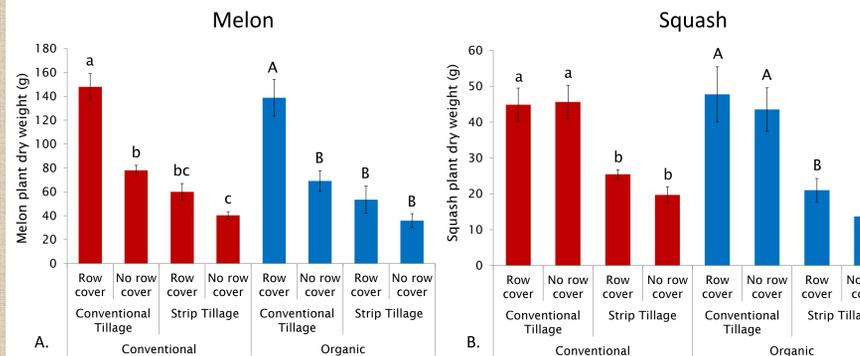


Figure 4: Dry weight of above- and belowground plant biomass, without fruit or blossoms. Melon plants sampled July 29, 2013. Squash plants sampled July 2, 2013. (P<0.05)

Results (continued)

Melon Cumulative Marketable Yield

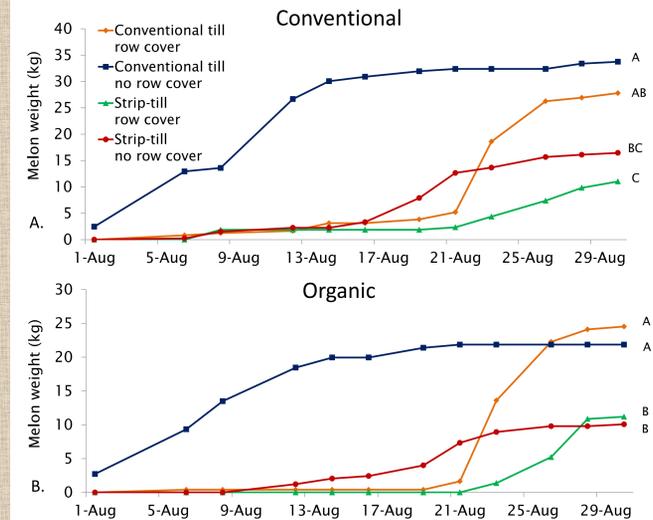


Figure 5: Cumulative marketable yield of conventional (A) and organic (B) melon. Marketable melon were at least 0.9 kg, without major defects. (P<0.05)

Squash Cumulative Marketable Yield

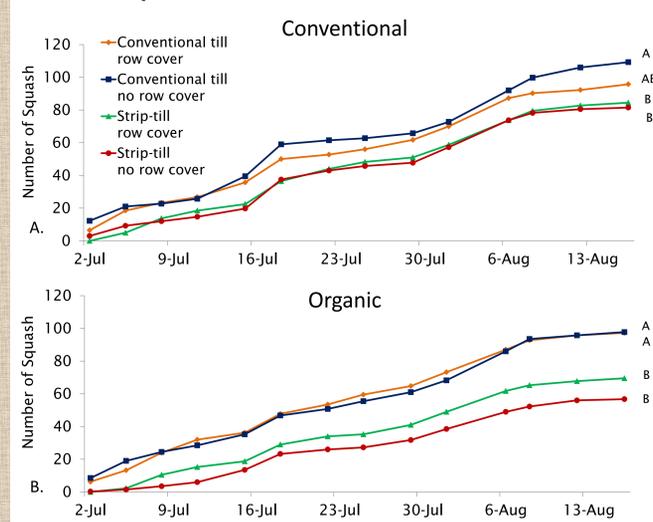
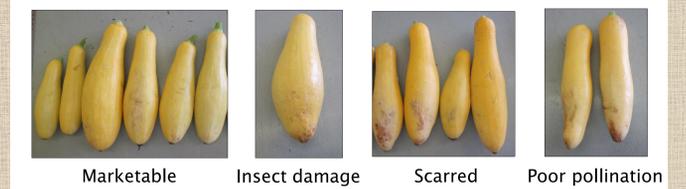


Figure 6: Cumulative marketable yield of conventional (A) and organic (B) squash. Marketable squash were 15-23 cm long, without major defects. (P<0.05)



Summary

Air and Soil Temperature

- Early season, conventional tillage with plastic mulch warmed soil ~2°C compared to strip-tillage
- Row covers warmed air ~5°C compared to plots without covers

Soil Microbial Biomass

- Trended higher in conventional tillage compared to strip-tillage in melon; no effect of tillage in squash treatments

Plant Biomass and Yield

- Biomass tended to be higher in conventional till treatments; row covers only increased plant biomass in conventionally tilled melon
- Row covers did not increase yield in melon or squash, potentially due to delayed pollination
- Melon: conventional- conventional till treatments yielded 17kg more per row than strip-till treatments; organic- conventional till treatments yielded 12.5kg more than strip-till treatments
- Squash: conventional- conventional till treatments yielded 20 more squash per row than strip-till treatments; organic- conventional till treatments yielded 34 more squash per row than strip-till treatments

Conventional/Organic

- Organically managed cucurbits showed a greater difference in yield between conventional tillage and strip-tillage than conventionally managed cucurbits