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Controlling Bacterial Wilt in Muskmelon with Perimeter Trap Cropping

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Abstract
Perimeter trap cropping (PTC) involves planting one or more rows of a cucurbit crop that is highly attractive to cucumber beetles around the border of a main cucurbit cash crop that is less attractive to the beetles. Cucumber beetles attempting to migrate into the field are concentrated in the relatively more attractive border crop, where they can be controlled by insecticides.

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Controlling Bacterial Wilt in Muskmelon with Perimeter Trap Cropping

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Introduction

Perimeter trap cropping (PTC) involves planting one or more rows of a cucurbit crop that is highly attractive to cucumber beetles around the border of a main cucurbit cash crop that is less attractive to the beetles. Cucumber beetles attempting to migrate into the field are concentrated in the relatively more attractive border crop, where they can be controlled by insecticides.

Reduction of insecticides resulting from PTC benefits growers by mitigating chemical contamination of honey bee hives, thereby safeguarding crop pollination, cutting insecticide costs, and reducing the risk of developing insecticide resistance in pest insects.

Successful perimeter trap cropping requires that the trap crop be up and growing well before the main crop emerges or is transplanted, in order to intercept cucumber beetles at the critical early-season stage. The trap crop needs to be considerably more beetle-attractive than the main crop, so that beetles will not continue migrating into the main crop. The trap crop needs to be durable. If it dies early from bacterial wilt, the cucumber beetles are likely to move into the main crop. The trap crop rows and main crop need to be scouted for cucumber beetles, and insecticide needs to be sprayed when thresholds are reached in order to sharply curtail cucumber beetle populations. The trap crop itself should be marketable in the growers' region. We are trying buttercup squash because it is attractive to cucumber beetles and has a high acceptance by consumers.

This report focuses on the second year results of a multi-state effort with Ohio State University to optimize conventional growing practices that effectively manage insect and diseases.

Materials and Methods

Four replications of two subplots (PTC vs. No PTC) were isolated from each other at the central, north, east, and west parts of the ISU Horticultural Research Station to avoid interplot interference. Paired sub-plots were 50 ft apart and were separated by soybeans (Figure 1). Main-crop subplots (50 × 50 ft) each consisted of 360 melon plants. Three-week-old transplants of muskmelon cv. Strike were planted 2 ft apart in black plastic mulch with drip irrigation and 6-ft row centers on June 5.

Three weeks before planting the main-crop of muskmelon, semi-bush Buttercup cv. Space Station seedlings (10 days old) were planted as the perimeter trap crop on May 10. The perimeter trap crop consisted of two border rows surrounding the perimeter trap cropping subplots as well as two plants at each end of the muskmelon rows (164 squash plants/subplot). After transplanting, a 25-ml drench of Admire-Pro 4.6F was applied to each individual plant at a rate of 0.086 ml of imidacloprid/plant. In the 'No PTC' subplots, 12-ft border strips of annual rye grass (the same dimensions as the perimeter trap crop strips in the treatment plots) were seeded June 10.

Populations of cucumber beetles were monitored weekly in both border rows and main-crop rows along three transects within each plot. Insecticides–a synthetic pyrethroid (Asana XL) alternated with a neonicotinoid (Assail)–were sprayed on the squash border rows or main crop muskmelons when a threshold number of an average of one beetle/plant was reached. Bacterial wilt incidence was recorded within one week before harvest. Harvest yields (fruit number and weight) were assessed for each subplot.

Results and Discussion

Bacterial wilt occurred in all four melon main crops in the 'No PTC' and averaged 18.5 percent incidence. In contrast, melons surrounded by a PTC had an average bacterial wilt incidence of 2.8 percent. However, bacterial wilt occurred late in the season and did not appear to affect yield.

No significant differences (P = 0.05) in melon yield were detected between 'PTC' and 'No PTC' plots. Perimeter plots yielded a mean of 1,454 lb of buttercup squash that weighed an average of 3.6 lb each.

Insecticide sprays in the main melon crop '+ PTC' treatment were fewer on average than required by the 'No PTC' control (1.5 vs. 2 sprays, respectively; Table 1). The buttercup perimeter crop received an average of 2.25 foliar sprays for cucumber beetle control, and two early-season insecticide sprays were made to the base of the plants for squash vine borer control.

Conclusions

Use of a perimeter trap crop saved less than one insecticide spray to the melons, in contrast to a savings of 3 to 5 sprays last year. In three plots it was apparent that there were far less cucumber beetles in the control melons than on the nearby perimeter trap crop, leading to the supposition that the cucumber beetles were attracted away from the control melons to the perimeter crop. This apparent interplot interference may have resulted in fewer sprays to the control melon plots, in comparison to last year when corn (a taller interplot barrier than soybeans, the 2012 barrier) was grown between the plot pairs. Future studies will increase the distance between the treatments to 1,000 ft to avoid this interference problem.

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Table 1. Summary of disease development and yield in muskmelon using perimeter trap cropping (PTC). Values are means of four replicated plots.

Treatment	No PTC	+PTC	
	Muskmelon main crop	**Muskmelon main crop**	**Buttercup perimeter**
Date			
Transplanting dates	June 6	June 6	May 10
Imidacloprid drench			May 17
Harvest date(s)	Aug 1 to Aug 27	Aug 1 to Aug 27	Sept 4-5
No. of insecticide sprays to control			
Squash vine borer	0	0	2
Cucumber beetles[a]	2	1.5	2.25
Percent bacterial wilt[b]	18.5%	2.8%	0
Yield[c]			
Weight (lb)	2,050	2,297	1,454
Number	422	421	419

[a]Sprays were based on threshold of one cucumber beetle/plant.
[b]Melon bacterial wilt on the "no PTC' > '+PTC' (P = 0.05).
[c]No significant differences between treatments in muskmelon weight or number (P = 0.5380 and P = 0.9868, respectively).

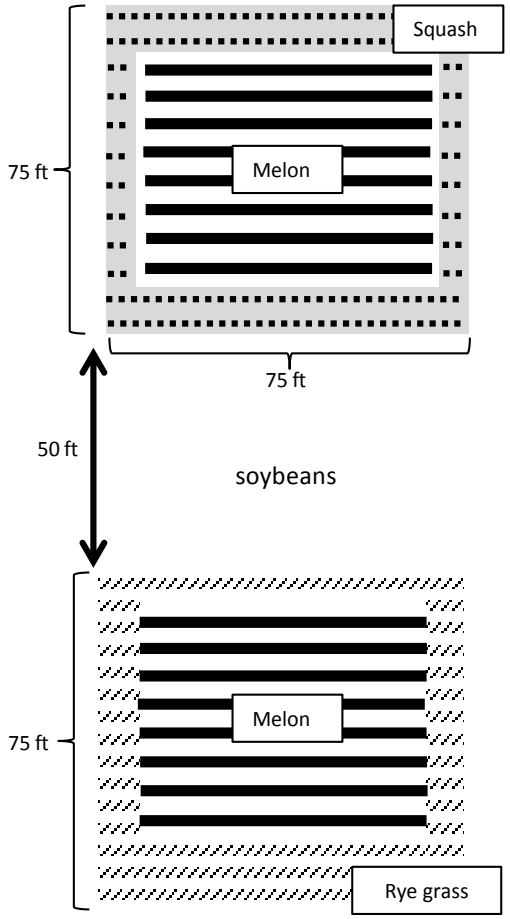

Figure 1. Paired subplots of melon main crop with perimeters of squash or rye grass separated by 50 ft of field soybeans.