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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.

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 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 insecticides need 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 higher acceptance by consumers.

This study is part of an on going multi-state effort with Ohio State University to optimize conventional growing practices that effectively manage insects and diseases. Our previous work in 2011 saved 3 to 5 sprays per field and in 2012 reduced bacterial wilt in the melon crop planted with a squash perimeter.

This study aims to avoid the use of imidachloprid insecticides and test the method in a large-scale setting.

Materials and Methods

Four replications of two subplots (PTC vs. no PTC) were separated by at least 500 ft to avoid interplot interference. Main-crop subplots (200 × 42 ft) each consisted of 672 melon plants. Three-week-old transplants of muskmelon cv. Athena were planted 2 ft apart in black plastic mulch with drip irrigation and 6-ft row centers on June 12.

Three weeks before planting the main-crop of muskmelon, semi-bush Buttercup squash cv. Space Station seedlings (10 days old) were planted as the perimeter trap crop on May 23. 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. 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 16.

Populations of cucumber beetles were monitored weekly in both border rows and main-crop rows along four transects within each plot. Synthetic pyrethroid insecticides (Asana XL or Pounce) were sprayed on the squash border rows or main crop muskmelons when threshold numbers were reached. Threshold numbers for cucumber beetles varied according to melon plant size as follows: pre-flowering = 0.5/plant, during fruit pollination = 1.0/plant, at vine touch = 3.0/plant.

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 incidence was less (P < 0.0001) in plots with squash perimeters (Table 1).
- Melon plots with a perimeter squash crop received about the same number of sprays as melon plots with grass perimeters (Table 1).
- The early squash plantings may have attracted cucumber beetles to those plots, however, the beetles in those plots were apparently controlled with the insecticidal sprays and less disease was spread into the fields with the perimeter of squash.
- Pounce (a day PHI permethrin) applied within 48 hours of first harvest effectively reduced insect damage to fruit to < 2 percent.
- Cucumber beetle vectoring of bacterial wilt and damage to ripening fruit was effectively controlled without the use of imidachloprid insecticides.
- Harvested melon plots with squash and grass perimeter treatments did not differ in mean marketable number (727.5 and 713.8, respectively) and mean marketable weight (2815.4 and 3013.14 lb, respectively) (P = 0.95 and P = 0.84, respectively). Additionally, no differences in melon culls caused by insect, size-shape appearance, animal, rot, or green, were detected between treatments (P < 0.05).
- Buttercup squash growth was greatly reduced by wet, cold conditions during the 2014 growing season in central Iowa. Harvested buttercup squash averaged 2.36 lb/fruit. Mean fruit numbers/plot were 462.75 and ranged from 205 to 762.

Acknowledgements

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Table 1. Cucumber beetles per plant, number of sprays, and bacterial wilt for muskmelons with perimeters of squash or grass.

	Treatment	PTC[b]								Grass[c]			
	field[a]	West		North		East		Central		East	North	West	South
		Melon	Squash	Melon	Squash	Melon	Squash	Melon	Squash	Melon			
Beetle threshold[d]	Date	Beetles/plant								Beetles/plant			
0.5	6/12	0.0[e]	1.1*	0.0	0.5*	3.3*	0.5*	0.1	2.2*	0.0	0.0	0.0	0.0
0.5	6/18	0.0	1.3*	0.0	2.4*	0.3	1.6*	0.3	2.5*	0.0	0.0	0.0	0.0
0.5	6/25	0.6*	1.8*	0.2	0.6*	2.0*	2.3*	2.0*	2.5*	0.0	0.0	0.3	0.0
1	7/7	2.3*	1.0*	0.9*	3.6*	0.0	0.0	0.2	0.9*	0.9*	2.3*	3.9*	1.7*
1	7/14	0.2	0.3	0.0	0.3	0.1	0.0	0.8	0.1	0.1	1.2	0.5	0.2
1	7/21	0.1	0.2	0.2	0.3	0.0	0.3	0.0	0.1	0.8	0.0	0.1	0.3
3	7/28	0.2	0.6	0.7	1.2	0.3	0.6	0.6	0.9	0.8	0.2	1.1	0.6
3	8/4	0.2	2.2	0.5	1.1	0.4	3.3*	0.1	0.8	1.5	2.7	3.4*	1.8
3	8/12	0.8	2.6	0.8	2.6	0.4	1.6	0.7	2.1	1.2	3.3*	0.3	4.2*
3	8/18	1.2	3.6*	0.5	0.9	0.6	1.4	1.3	2.4	1.5	1.3	2.6	1.6
3	8/25	>10*	>10*	>10*	>10*	>10*	>10*			>10*	>10*	>10*	>10*
Number of sprays		3	6	2	5	3	5	1	4	2	2	3	3
% plants with bacterial wilt[f]		8.3		10.3		6.5		11.2		25.7	23.5	21.0	20.2

[a]Fields located at the ISU Horticultural Research Station were separated by at least 500 ft.
[b]PTC = perimeter trap crop. Athena melons planted in black plastic with 6 ft centers and 2 ft apart in 200 × 42 ft plots. Two rows of Space Station buttercup squash were planted around the perimeter 2 weeks before the melons were planted.
[c]A grass perimeter served as the control.
[d]Synthetic pyrethroid sprays were based on cucumber beetle thresholds as follows: pre-flowering = 0.5/plant, during fruit pollination = 1.0/plant, at vine touch = 3.0/plant.
[e]Cucumber beetle counts taken weekly from four transects across each field.
[f]Incidence of bacterial wilt was assessed for melons in each plot within two days of harvest.
*Denotes the application of an insecticidal spray because the threshold was met.