Towards an Integrated Management Plan for Cucumber Beetles

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Cucurbits are grown on a high percentage of vegetable farms in PA. Demand for pumpkins alone has more than doubled since the 1980s and PA is one of the top six producing states. The striped cucumber beetle (SCB) ranks among the most important pests. Adult feeding can cause stand reduction and damage flowers, foliage, and fruit rind, larval feeding on roots can impact early growth and render the plant more susceptible to soil-borne disease, and the SCB is the primary vector and overwintering host of *Erwinia tracheiphila* that causes bacterial wilt. Control with synthetic insecticides is problematic due to neonicotinoid residues in pollen and nectar and their impact on bee health. Recently, we are hearing multiple farmers claiming less control – or reduced duration of control - of SCB with neonicotinoids, suggesting resistance. This proposal focuses on cultural control that target immigrating adults and F1 adults.

Methods. We tested the efficacy of reducing striped cucumber, spotted cucumber and western corn rootworm populations in melon fields by using a perimeter trap crop and commercial lures placed around the field. At Rock Springs, PA, two 200 x 110 ft 'Aphrodite' muskmelon (*Cucumis melo*) fields, spaced 400 ft apart were planted on June 3, 2019 using 3-week-old transplants planted at 3 ft in-row spacing into raised beds with black plastic mulch and drip irrigation. We transplanted muskmelons into all 14 rows in one field and in the center 12 rows of the second field. We transplanted four-week-old blue hubbard (BH) squash (*Cucurbita maxima*) at 3 ft in-row spacing into the top and bottom rows as well as the ends of the center 12 rows of the second field on May 30, 2019 to form a perimeter around the muskmelons and applied Admire Pro at a rate of 7.0 fl oz./A. We sprayed the BH squash with Lambda-T at a rate of 3.84 fl. oz./A on June 14 and 21, 2019 and discontinued all insecticide applications once the squash began flowering. We placed three types of traps on May 31, 2019 around the perimeter of the second field: Ghost traps, Milk Jugs and Unitraps. Ghost traps consisted of a 2 x 3 ft deltamethrin impregnated net staked vertically over a white sheet on the ground with a floral scented lure (AgBio 5-compound lure P313-B5, AgBio Inc., Westminster, CO) attached to the net, and we placed ten of them around the perimeter of the field. We painted 18 milk jugs yellow, hole punched two rows of entrance holes into all 4 sides of the jug and tied them to 4-ft high wooden stakes. We tied the floral scented lure to the inside of each milk jug and placed a Vaportape II Insecticidal Strip (Hercon Environmental, 2019) inside the trap as a killing agent. For the Unitraps (Great Lakes IPM, Vestaburg, MI), we placed the floral scented lure in the trap's cage and placed a Vaportape II Insecticidal Strip inside the bucket. We replaced the floral scented lures on June 28 and July 18, 2019 and the Vaportape II Insecticidal Strips on July 2 and August 5, 2019. We recorded the number of alive and dead SCBs, spotted cucumber beetles, and western corn rootworm in the traps, and bacterial wilt infection per 1 row meter, throughout the growing season in both the melons and BH squash perimeter. We also recorded the number of dead SCBs, spotted cucumber beetles, western corn rootworm and pollinator species found in each trap type. A replicate was conducted at the Southeast Research and Extension Center in Landisville, PA, using the same plant material and a similar field layout, and the yellow-painted milk-jug traps with the AgBio lures. At Rock Springs, in addition to the beetle counts, we harvested two 25 ft sections of each blue hubbard and melon row and weighed the sample on August 12 and 19, 2019.

Results. The AgBio lure was effective in attracting beetles, but not overwintered beetles (Fig. 1). Only second generation (or later) adults were attracted to the traps. The UniTrap was much more effective in capturing adults. Unfortunately, the AgBio lure in the UniTrap also captured bumble bees (Fig 2). We used the yellow/white/green UniTrap. It is possible that the all green UniTrap would have a lower bumble bee bycatch. Also, it may be possible to install a sieve that would prevent bumble bees from entering the UniTrap. In the Milk Jug trap, the smaller hole size (1/4 inch or 6 mm) was aimed at preventing bumble bees from entering.

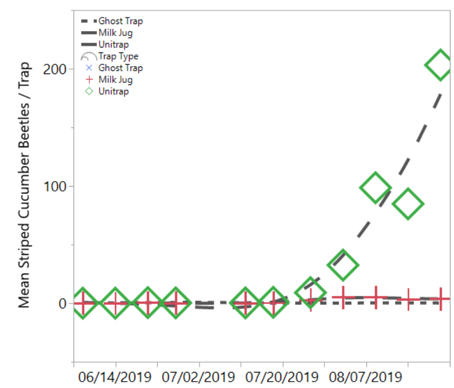

Fig. 1. Catch per week in 3 types of traps, each baited with the AgBio lure

The BH squash consistently attracted more SCBs than the 'Aphrodite' melons planted in the interior of the field at both locations (Fig. 3; Fig. 4) (Table 1). This continued until the BH squash had stopped flowering. However, the number of SCBs found on the melons planted in the interior of the PTC did not differ from the number of beetles found on interior melons planted without a PTC. There was also no difference in yield between melons in the interior portion of fields grown with and without a PTC (Table 2).

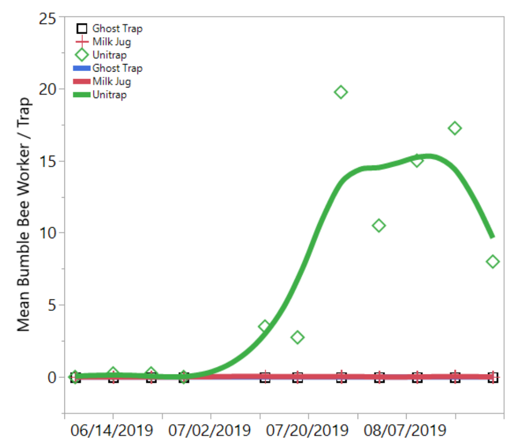

Fig. 2. By catch of bumble bees in traps baited for cucumber beetles. There were also 2 queens captured in the UniTrap on June 6, 2019. One was *Bombus fervidus*.

Utility to Growers. We were able to show that both the AgBio lure and the BH squash resulted in SCB aggregation, and thus could be developed to help control beetles. But we did not reduce SCB numbers in melon fields or affect melon yield given the scale of our planting and the insect pressure in these trials.

To develop the utility of the lures and traps, work should continue with green UniTraps, with screening, to exclude bees. These could be placed within fields to trap F1 and later generations. However, other methods or lures are needed to trap out the immigrating overwintered adults. The BH trap plants are effective in concentrating both overwintered and F1 adults, and at larger field scales or under less pressure may have worked to increase yield. We used large (~5-week old) BH plants, deployed almost a week prior to transplanting melons. Further work should consider combining green UniTraps with screening with insecticide-treated BH trap plants at larger field scales (e.g., on-farm trials), and with varying spatial patterns, and altering the lures to attract the overwintered adults.

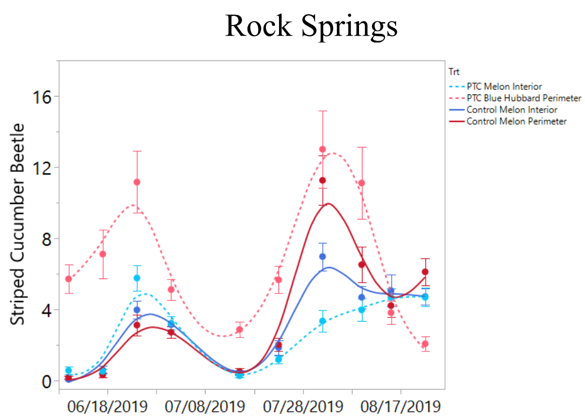

Fig. 3. Dead + live SCB per row meter at Rock Springs on Control (solid lines) interior (blue) and perimeter (red) melons compared to PTC (dashed lines) interior (light blue) melons and perimeter (light red) BH squash.

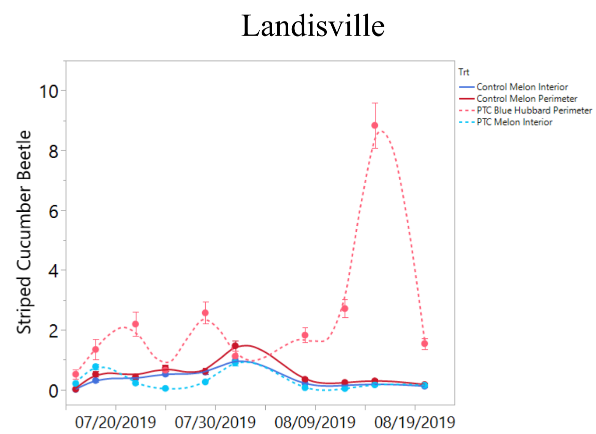

Fig. 4. SCB per plant at Landisville on Control (solid lines) interior (blue) and perimeter (red) melons compared to PTC (dashed lines) interior (light blue) melons and perimeter (light red) BH squash.

Table 1. Mean number of SCB per row meter/plant in PTC BH Perimeter, Control Melon Perimeter, PTC Melon Interior, and Control Melon Interior.

Field	Crop and Location	Rock Springs	Landisville
PTC	BH Perimeter	6.75 A	2.25 A
Control	Melon Perimeter	3.68 B	0.49 B
PTC	Melon Interior	3.13 B	0.35 BC
Control	Melon Interior	2.80 B	0.28 C

Table 2. Melon and squash yield in the perimeter and interior of a field with or without a perimeter trap crop (PTC) of BH squash that also had lures for SCB

Field	Crop and Location	Weight (kg) / 25 feet
PTC	BH Perimeter	42.5 A
PTC	Melon Interior	28.8 B
Control	Melon Perimeter	22.9 B
Control	Melon Interior	25.2 B