

Trap cropping: A simple, effective, and inexpensive IPM approach to manage cucumber beetles and squash bugs in cucurbit crops



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ABSTRACT The relative attractiveness of Blue Hubbard, Red Kuri Hubbard, and Buttercup squash plants (trap crop plants) to adult spotted cucumber beetle (*Diabrotica undecimpunctata howardii*), striped cucumber beetle (*Acalymma vittatum*), and squash bug (*Anasa tristis*) were evaluated using a comparative behavioral approach. In addition, the ability of trap crop plants to prevent pest numbers from exceeding economic thresholds in the cash crop was measured. Results indicate that all three squash varieties suppressed squash bugs from cash crops, but for spotted and striped cucumber beetles Red Kuri squash and Blue Hubbard squash performed best throughout the growing season. Therefore Red Kuri Hubbard and Blue Hubbard squash represent excellent trap crop plants to manage key insect pests of cucurbits.

INTRODUCTION Trap cropping has been recommended as a strategy to manage insect pests in cucurbits for decades. Blue Hubbard squash (BH) has often been the trap crop of choice because it is highly attractive to cucumber beetles and fairly resistant to bacterial wilt disease. BH has proven itself as a perimeter trap crop for striped cucumber beetle, in summer squash, cantaloupe, and butternut squash. Perimeter trap cropping, however, needs to be improved and adapted to the current size and conditions of organic farms, and tested against multiple pest species. This study aimed at assessing the attractiveness of Blue Hubbard, Red Kuri Hubbard, and Buttercup squash to adult spotted and striped cucumber beetles and squash bug, as well as the plant's ability to suppress pest numbers in various cash crops in multiple farms over several years.

METHODS

Studies were conducted at the Lincoln University (LU) George Washington Carver (2011-2014) and Alan Busby (2012-2014) certified-organic research farm, in Jefferson City, as well as several commercial farmer collaborator sites. Reported here are the approaches followed for the years 2012 and 2013 on the LU farms.

Transplants were used for trap crop plants and cash crops were direct seeded. Plastic mulch and drip irrigation were used in all plots.

2012 research was done in 16 plots. Each plot was randomly assigned one of the following treatments: (1) Red Kuri Hubbard squash, (2) Blue Hubbard squash, (3) Buttercup squash, and (4) control (no trap crop).

Two trap crop plants of the assigned variety were planted in the outermost rows (1 and 6) of each sub-plot. The four inner rows contained the cash crop, zucchini, for a total of 16 cash crop plants per replicated sub-plot (Fig. 2A).



Figure 1. Cucumber beetles and the squash bug are key insect pests of cucurbit crops.



METHODS (cont'd.)

- 2013:** Four seedlings of the appropriate treatment (Blue Hubbard = BH, Red Kuri Hubbard = RK, or Buttercup = BC) were planted at each end of every row (Fig. 2B). The cash crop, Zephyr summer squash, was direct seeded at the same time at 18 inch intervals which resulted in about 65 plants per row. The resulting cash crop to trap crop ratio was ca. 8:1.
- For all studies, data were collected 3 times per week for 6-8 weeks. The number of insect pests (by species) was counted for all trap crops and randomly selected cash crop plants per row. All insects and egg masses were removed by hand from the field as they were counted.

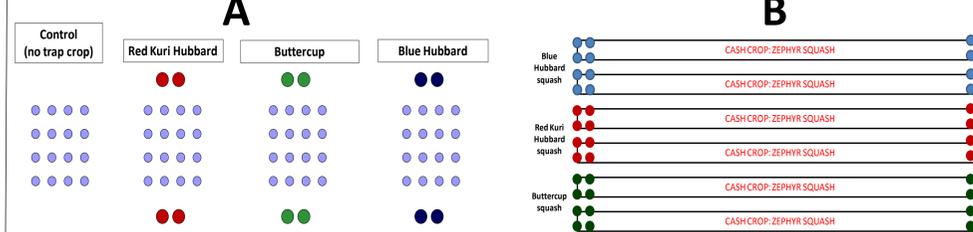


Fig. 2: Layout of the experimental plots used in the (A) 2012, and (B) 2013 field evaluations at two Lincoln University (LU) research farms in Jefferson City, Missouri.

RESULTS

- Overall, the best trap crop for striped cucumber beetles was RK, but for spotted cucumber beetles both RK and BH were equivalent (Figs. 3 and 4).
- At both farms, all trap crops (see blue, red, and green bars in Figs. 3, 4, and 5) were equally effective at suppressing all three pests from cash crops.

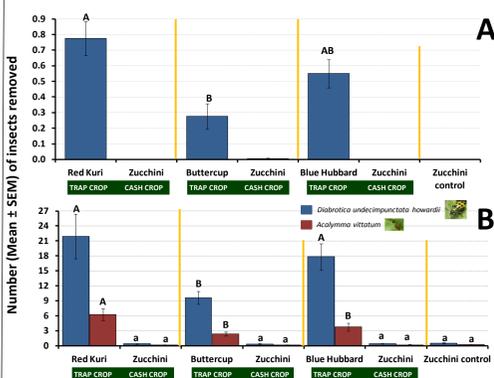


Fig. 3: Number of cucumber beetles in experimental plots at the LU Carver farm on (A) week 1, and (B) weeks 2-3 after transplanting during 2012.

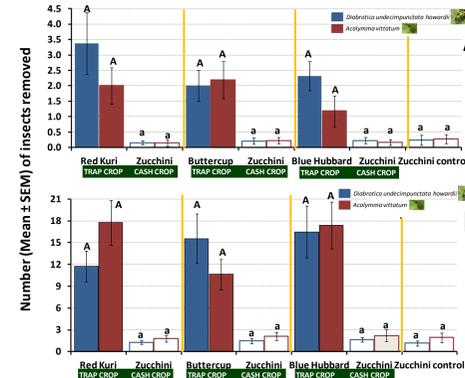


Fig. 4: Number of cucumber beetles in experimental plots at the LU organic Busby farm on (A) week 1, and (B) weeks 2-3 after transplanting during 2012.

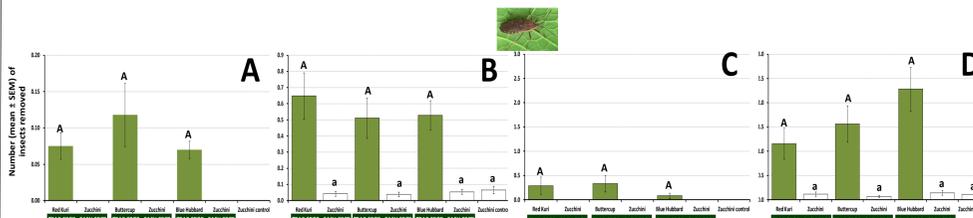


Fig. 5: Number of squash bugs in experimental plots at (A) LU Carver farm, weeks 1-3, (B) LU Carver farm, weeks 4-6, (C) LU organic Busby farm, weeks 1-2, and (D) LU organic Busby farm, weeks 3-4. Bars with same uppercase letters are statistically similar according to a statistical analysis at the odds 19:1. Letters in lower case denote comparisons made across cash crops.

- In 2013 (and also in other years, data not shown), RK was a very attractive trap crop to spotted cucumber beetles and striped cucumber beetles.
- BH also prevented spotted beetles and striped beetles from penetrating into the cash crop (Figs. 4 and 5).

RESULTS (cont'd.)

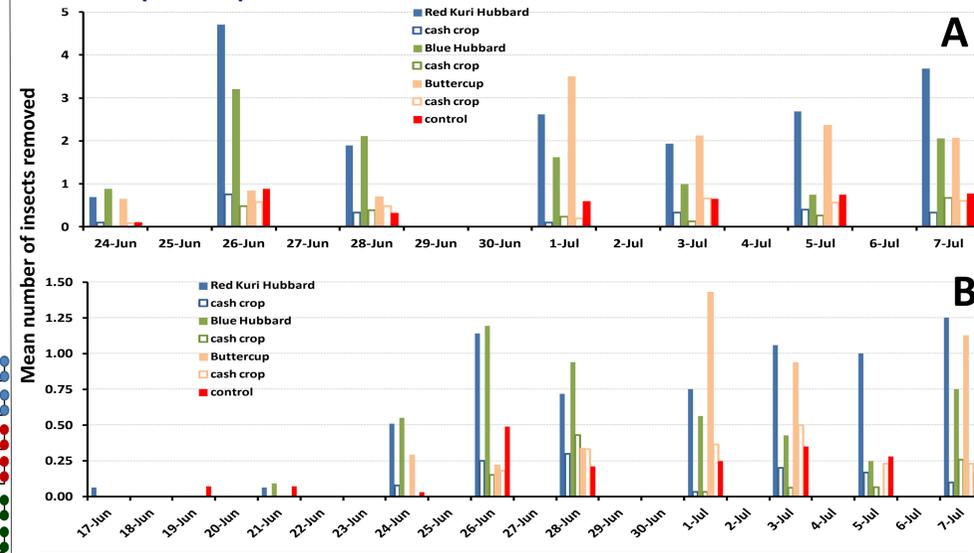


Fig. 6: Number of cucumber (spotted = A, striped = B) beetles on trap crop and cash crop plants in experimental plots at the LU Carver farm.

ON-FARM RESEARCH

- At least 6 farmer cooperators have adopted the trap cropping approach in their vegetable farms. Four of these farms are certified organic. AZERA™ insecticide (pyrethrins + azadirachtin) has been their method of choice for killing the insects on trap crop plants.
- Fig. 7 illustrates the level of pest suppression achieved at the EarthDance farm by planting BH squash in one perimeter row. White bars are pest numbers on trap crops, green bars (almost not visible due to very low pest numbers) are insect pests in cash crops.

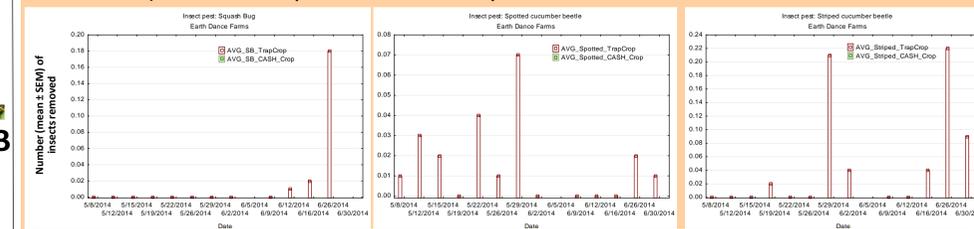


Fig. 7: Season-long evaluation of Blue Hubbard squash as trap crop to suppress key insect pests from the cash crops at EarthDance Farms (Ferguson, MO). Website: <http://www.earthdancefarms.org>.

- For one conventional farmer that now practices IPM, use of trap cropping has saved him about \$ 400 per acre in labor, pesticide, and fuel, per growing season. He reduced insecticide spray by 95% in 2011, has not sprayed his cash crops since 2012.



CONCLUSIONS

- Trap cropping is an effective IPM tool for organic cucurbit growers.
- BH, RK, and BC are all adequate trap crop varieties for cucurbit pests.
- Cucurbit trap cropping is effective at suppressing pests in the cash crop with as few as 11 % of the total plants being trap crops.
- Trap cropping can be adapted to work in various farm sizes and with various growing strategies.

ACKNOWLEDGMENTS We thank G. Ndunguru, K. Kliethermes, J. Miller, E. Ovwielefuoma, A. Dudenhoeffer, T. Hussain, A. Hemwall, D. Newman, L. Hunter, and D. Panday for assisting with data collection. Funding for this study was provided by USDA-NIFA Capacity Building Grant program and the Ceres Trust: An Organic Initiative. A special thanks to our grower collaborators at Pierpont, Share Life, Earth Dance, Happy Hollow, Rocky Creek Valley and Fonseca farms.