Perimeter Trap Cropping for Summer Squash and Cucumbers

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Definition & function

Webster's Dictionary (Guralnik 1980) defines "perimeter" as the outer boundary of a figure or area and as "a boundary strip where defenses are set up". Perimeter trap cropping (PTC) involves planting a more attractive trap crop so that it completely encircles and protects the main cash crop like fortress walls. The effectiveness of this trap crop system can usually be improved by adding other perimeter defenses, such as border sprays or with biological, mechanical and cultural controls. PTC functions by intercepting pest migration, regardless of the direction of attack. It then concentrates the pest population(s) in the border area, where they can be retained or killed, thus preserving natural enemies and reducing disease spread in the main crop.

Introduction

Over the past 2-3 years we have been investigating the efficacy of summer squash PTC both in small-plot trials at the University of Connecticut Plant Science Research Farm and on commercial fields (1/4- to 8-acre fields) around the state. In 2003, we initiated similar studies for cucumbers. Results of trap crop variety trials and efficacy studies have been very informative and promising. Thus far, implementation on commercial farms has exceeded our expectations and those of the growers who have tried this novel pest management system.

Identifying the "best" trap crop

In variety trials, we have compared many potential trap crops to see which might be the best at protecting the main crop. The cucurbit varieties tested were listed in the literature or suggested by growers. We quickly learned that although "Turk's Turban" was the most attractive to the beetles, there were other important considerations, as 93% of the plants of this variety perished before harvest from bacterial wilt infection. It is extremely important that the variety chosen as the trap crop in a PTC system not be a disease reservoir, or you may win the battle against the insects only to lose the war to disease. In other words, any beetle that made it through the perimeter to feed on the main crop would be a disease vector, and you may dramatically lower the number of beetles on the main crop, but suffer reduced yields due to bacterial wilt. We chose "Blue Hubbard" as the trap crop for the cucurbit PTC systems, as it was highly attractive to beetles, but had a much lower incidence of wilt than other varieties tested.

Small-plot results on summer squash

In our first year of small-plot trails, we attempted to stop cucumber beetles, bacterial wilt and other pests with a perimeter trap crop and different combinations of supplemental controls in the border area (i.e. trap crop on yellow plastic mulch). Over 94% of the cucumber beetles in the

experiment were on plants in the perimeter of the plots. However, because 4 of our 5 treatments had "Blue Hubbard" in the perimeter, we "sucked" almost all the beetles out of the control plots and ended up with no significant differences for beetle numbers on the summer squash in the center of the various treatments. Despite the low beetle numbers in the plot centers, we still found that trap crop plots supplemented with border sprays or yellow mulch both had significantly reduced summer squash defoliation levels compared to control plots. We also found that spraying the perimeter trap crop reduced squash vine borer infestation on the unsprayed summer squash within by 88%. The SVB moth probably lands on the perimeter trap crop first, picks up a toxic level of insecticide, and never gets to lay eggs on the main crop in the center.

In 2002, center sub-plots with a sprayed trap crop around them had significantly lower beetle numbers and bacterial wilt mortality, and higher yields, than the centers of control plots consisting of all summer squash plants. Beetle numbers in the sprayed trap crop plots were reduced by 93% when compared with control plots. All treatments plots supplemented with border sprays showed reduced levels of defoliation in the centers.

In 2003, we evaluated a single trap crop row of Blue Hubbard, a border-row insecticide application, and a combination of the two strategies for protecting centrally-located unsprayed summer squash (or cucumbers) from cucumber beetles and bacterial wilt. Summer squash results were not yet analyzed at the time this proceedings article was prepared.

Small-plot results on cucumbers 2003

Although a delay in planting time due to wet conditions and cloudy weather during beetle counts, prevented us from finding significant differences in beetle numbers in 2003, the other cucumber results were very impressive. When the trap crop was sprayed it dramatically reduced defoliation on cucumber seedlings in the center and completely eliminated plant death due to direct feeding damage. Nine percent of the plants were lost directly to beetle feeding in the center of control plots. The sprayed trap crop barrier also dramatically reduced losses from bacterial wilt compared with the control plots. Total plant death (directly from defoliation and from bacterial wilt) dropped from 30% in the center of control plots to 14% for the cucumbers in the sprayed trap crop plots by final harvest. The sprayed PTC treatment increased yields by 33% or 148 boxes per acre.

Field implementation on commercial farms

Six CT growers using the technique on their summer squash and cucumbers, compared the PTC system to their former conventional management system, that relied on multiple full-field sprays to control cucumber beetles, and were quite impressed. In every case, the PTC system provided superior pest control compared to multiple full-field sprays and reduced insecticide use substantially. Growers estimated they saved almost 20% of their summer squash crop and a third of their cucumber crop by switching to PTC.

On most farms, insecticide sprays for cucumber beetles were limited to applications on the "Blue Hubbard" trap crop in the perimeter of the fields only. One of the growers stated on a post-

season survey that: *It blew my mind to see the beetles flock to the perimeter rows*!

On one farm with extreme cucumber beetle populations, the grower applied an average of 1.5 perimeter sprays prior to bloom and 1.5 full-field sprays during harvest to his cucumber fields to regain control of this pest. The sprays at harvest were necessary to prevent cosmetic damage, where the beetles feed on the fruit rind and render the crop unmarketable. In past years, he normally applied 4 full-field sprays per field and still failed to harvest or market any cucumbers. He harvested and marketed a great crop of cucumbers in 2003 using PTC. When asked in a post-program survey to comment about the PTC system, this grower stated that: *I can not even get a crop of cucumbers on my farm without PTC*! This same grower was asked to plant a control field (without a trap crop) as part of the study. He made 4 full-field insecticide applications in the first 3 weeks and 60% of the plants showed signs of bacterial wilt before the plants even started to run. The crop was lost.

All but one grower said that they also saved time and money using PTC and found the new system simpler to use than multiple full-field sprays. All the program participants gave the PTC system high marks for reducing: pesticide use, spray time/expense, possible chemical residues at harvest, possible secondary pest outbreaks, risk of crop damage, and impacts on environment/land/water. They also gave the system high marks for improving farm profitability, for easier/faster pest detection (improved monitoring) and for easier picking/harvesting schedules (reduced REI/dh restrictions).

OK I get it, so how do I do it?

Growers wishing to try PTC should remember a few simple rules: 1) **Plant the trap crop on good ground**, so that it remains healthy and completely encircles the main crop, without large gaps in the perimeter. 2) Multiple rows (1-3) of trap crop **may** be needed if extreme pest pressure is expected, or along treelines where the heaviest pressure usually occurs as beetles colonize the field from overwintering sites. 3) **Spray the perimeter as soon as the beetles appear and begin to feed on the trap crop**. Do not wait for beetles to colonize the main crop or for a threshold level to be exceeded on the trap crop. 4) **Monitor the field continuously until bloom or harvest** and be prepared to make 1-2 additional perimeter sprays or, if necessary, full-field applications. Repeat perimeter applications are necessary if rain washes the insecticide from the plants prematurely or if more live beetles are found on the trap crop prior to bloom. Full-field sprays should be applied when pest pressure is excessive on a particular farm, causing a breach in the perimeter and substantial main crop infestation (>2 beetles/plant for summer squash and >2 beetle/plant for cucumbers). 5) **If the trap crop planting is incomplete** or has large gaps in it, for any reason, **treat the field as if it were a conventional planting** (i.e. spray the whole field as often as needed). You do not have an effective perimeter if you fail to plant along one side or wet conditions prevent emergence of most trap crop plants.

That's it! Its cheap, it's easy and almost anyone can do it! Go forth and conquer. May the force be with you!

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