VEGETABLE RESEARCH PROJECTS

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Perimeter Trap Cropping

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Trap crops are used to protect the main cash crop from a pest or complex of pests. The trap crop can be a different plant species, variety, or just a different growth stage of the same species as the main crop, as long as it is more attractive to the pests when they are present. Trap cropping is most worthwhile for pests that are abundant and destructive in most years. It tends to work best for insects of intermediate mobility rather than those, like aphids, that are passively dispersed by air currents or those strong fliers that descend on a crop from high elevations. Trap crops are more economical to use if the system is easily planted and maintained, if they have some other use (e.g. support beneficial insects or can also be marketed) and if they require a small amount of space relative to the main crop. The required trap crop planting size depends upon the intensity and direction of the pest attack expected, as well as the mobility of the target insect(s). Understanding how the pest uses and moves in its environment is crucial in developing or deploying a successful trap crop system.

Perimeter Trap Cropping (PTC) involves planting the attractive plant species so that it completely encircles the main crop like fortress walls. A trap crop barrier on all sides is useful when it is necessary to protect the crop from a pest attack that may come from several or unknown directions. This technique works best against pests that tend to damage the crop along the edge of the field (at least initially) rather than those that tend to have a random distribution throughout the crop. Wider trap plantings may be necessary along field edges that border known sources of infestation, such as insect overwintering sites, non-crop breeding sites or alternative food sources. For some pests, Perimeter Trap Cropping may work in very small (garden-size) plots but, for others, larger plantings may be required.

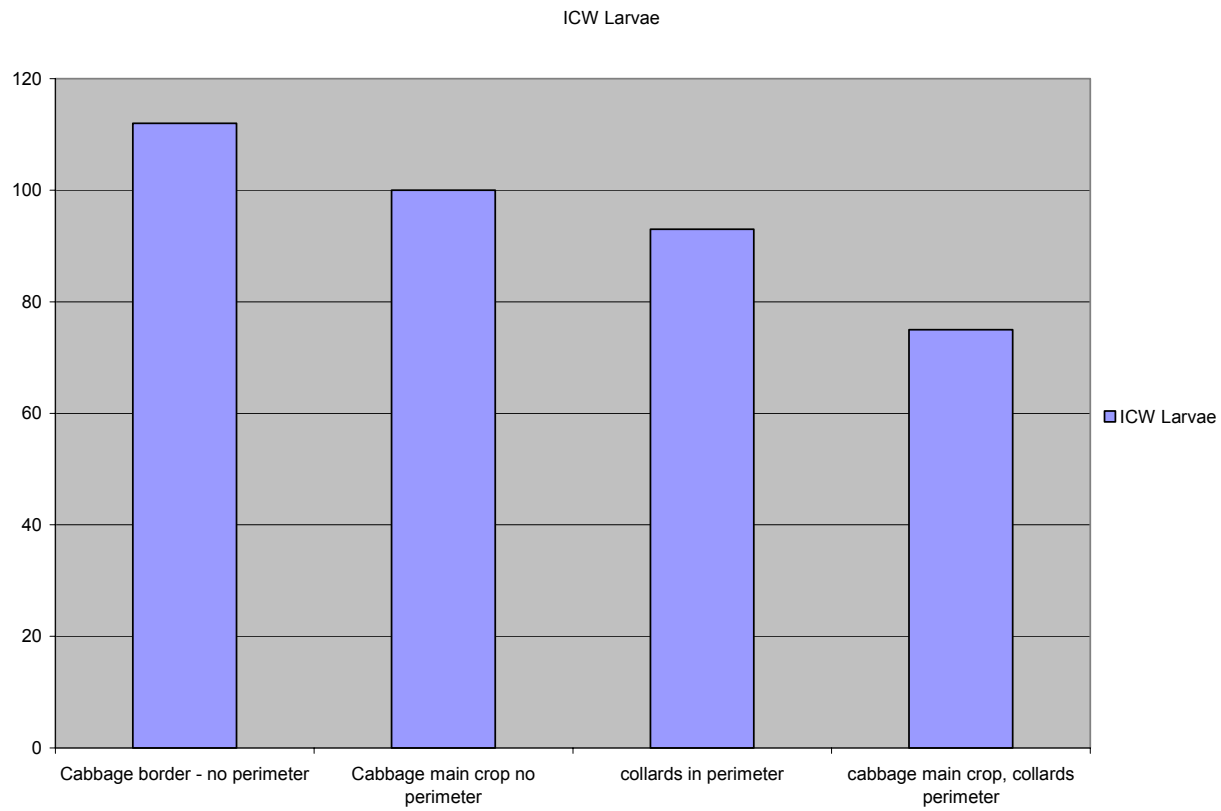
Perimeter Trap Cropping functions by concentrating and/or killing the pest in the border area, while reducing pest numbers and disease spread on the unsprayed cash crop in the center and by preserving natural enemies. The effectiveness of this trap crop technique can often be improved by adding other perimeter defenses like biological, mechanical,

cultural or chemical control tactics (i.e. border sprays), or with pest attractants and repellants. The perimeter orientation of the trap crop and defenses improves efficacy because the barrier intercepts the pest migration regardless of the direction of attack, rather than trying to get the pest to move to where you want it to go. The technique may not always eliminate the pest completely, but it can substantially reduce their populations on the main crop. In recent years, Perimeter Trap Cropping has dramatically increased the efficacy of trap cropping on a variety of crops.

The following PTC systems are currently being evaluated at the UMass Research Farm:

Collards around cabbage. The diamondback moth (DBM) is one the three key caterpillar pests of brassicas. It becomes resistant to insecticides quickly and can therefore be difficult to control. Researchers in Florida were able to keep the DBM from reaching economic action thresholds in nine commercial cabbage fields by surrounded them with two rows of collards. Sixty percent of the nearby control fields without collards exceeded thresholds. The DBM population on the collard plants around the cabbage exceeded threshold in 89% of the fields, but a naturally occurring parasitic wasp, *Diadegma insulare*, helped control the population and keep it from spilling over into the cabbage. Perimeter trap crop fields used 56% fewer insecticide sprays (there were sprays for loopers) for a net savings of $117 - $156/hectare in chemical costs.

We are evaluating this system in small (20X20 foot) plots. The pest complex that must be managed includes three caterpillar species (diamondback moths, imported cabbageworms, and cabbage looper) as well as crucifer flea beetle. Border sprays and border plantings are being tested in a 2X2 factorial experiment. In addition to the perimeter of collards, plots with borders were surrounded with second border of komatsuna (*Brassica rapa*), which is more attractive to flea beetles than cabbage. Insect counts have been made weekly, and damage will be assessed at harvest. Flea beetles, DBM, ICW and *Diadegma insulare* were all present in significant numbers, while cabbage looper numbers were low. The main crop was sprayed with a selective insecticide (Dipel DF or Spintor 2SC) when larval infestation exceeded the economic threshold. Initial review of the data suggests that imported cabbageworms may also prefer collards to cabbage. We found a 25% reduction in ICW larvae in the main crop of the plots with a perimeter of collards vs the unbordered plots.



Blue hubbard around winter squash. In this case we are looking at using blue hubbard squash as a perimeter trap crop around butternut squash, because is it highly preferred by the striped cucumber beetle, compared to butternut. As with the cabbage, there are four treatments, each replicated four times:
Butternut/no border/no spray
Butternut/no border/border spray
Butternut/Blue Hubbard Border/no spray
Butternut/Blue Hubbard Border/border spray

In addition to the small plot work at the South Deerfield farm, we have been working with a six farmers who were interested in experimenting with this perimeter trap crop system. These growers planted a blue hubbard border around their commercial butternut fields, which ranged in size from 1 to 5 acres. Borders were sprayed as soon as striped cucumber beetles were found. These fields are being compared to conventional butternut fields without a border planting. The data from these fields seems to strongly indicate that striped cucumber beetle preference for blue hubbard in the squash will cause beetles to build up in the border, compared to the main crop. For example, during the height of the beetle season one field had roughly twenty beetles per plant in the border, compared with less than three per plant in the main crop. That's almost seven times as many beetles in the border. The other fields showed similar results.

The beetle pressure was high enough in most of the fields that the borders were eventually overrun, and in some cases entirely devoured. This necessitated a spray in the main crop for many of the fields that probably would not have been necessary had the border held or the beetle pressure been somewhat lower. As one grower said, due to the crazy spring weather we got a month's worth of beetles in two weeks. At one point we counted over a hundred beetles on one plant in the border. Fortunately, the border had recently been sprayed and most of them were dead.

In 2004 we will explore how to make the system more effective in preventing beetles from reaching the main crop. This will include using a double border, especially in edges near overwintering sites such as woods, and treating blue hubbard borders with a systemic insecticide treatment to help keep the borders intact enough to protect the main crop even in times of extremely high beetle pressure.

Cherry peppers around bells. Researchers in Connecticut attempted to stop pepper maggots from infesting bell peppers by trying border sprays, a perimeter trap crop of hot cherry peppers and a combination of the two methods. Bell peppers surrounded by the trap crop produced at least 98% pest-free fruit at harvest compared with all-bell plots which had 15% of the fruit infested. Commercial farmers using Perimeter Trap Cropping harvested 99.99% clean fruit, experienced the best pest control in the history of the farms, and better pest control than farms that had used well-timed full-field sprays. They reduced their insecticide use on peppers by up to 89%. Growers said the system simplified pest control and saved them money. Economic analysis confirmed an overall improvement in crop profitability ($13 - $378/hectare).

UMass researchers are working with a farmer in Rehobeth, MA to evaluate the cherry pepper border. The southeastern region of the state experiences high pepper maggot pressure.

Blue Hubbard around yellow summer squash. Connecticut researchers attempted to stop cucumber beetles and squash vine borers damage on summer squash with perimeter trap crops and different combinations of supplemental controls in the border area. In 2002, over 94% of the cucumber beetles in the experiment were on plants in the perimeter. Beetle populations on the unsprayed main crop in the center were reduced by up to 95%. Spraying the perimeter trap crop reduced squash vine borer infestation on the unsprayed summer squash within by 88%. Six commercial cucurbit growers successfully employed the technique in 2002. All the growers improved their pest control and reduced crop damage using Perimeter Trap Cropping, and all said they would continue to use trap crops in the future. This system is being evaluated further in 2003.

Pumpkin around Pumpkin. We worked with one grower this season who tried using PTC methods to control striped cucumber beetles in his pumpkins. He planted a border of Prizewinner pumpkins around a mixed planting of other varieties. The results were very encouraging – we found more than three times the number of beetles in the border than in the main crop, and good control was achieved with border sprays alone.

What can Perimeter Trap Cropping do for you?

- Perimeter Trap Cropping often eliminates the use of broad-spectrum pesticides on the cash crop, which helps preserve natural enemies and helps prevent resurgence of the primary pest population, secondary pest outbreaks and additional spraying to solve these "man-made" problems.
- Perimeter Trap Cropping often results in improved crop quality and dramatic pesticide savings.
- Less spraying usually translates into lower costs.
- Less spraying simplifies harvesting and marketing, by eliminating re-entry (REI) and pre-harvest restrictions (dh).
- Less spraying reduces the possibility of chemical residues at harvest.
- Less spraying leads to fewer environmental and safety concerns.
- Less spraying may help improve personnel/management relations. This is especially true for migrant labor crews, who may be distrustful of management and of pesticide applications.
- Less spraying delays the development of pesticide resistance.
- Perimeter Trap Cropping will complement your current pest management program.
- This technique may also improve the efficacy of full-field sprays for tough pests by restricting most of the damage to the perimeter area.