2011 NS ACORN Conference
Holiday Inn Halifax Harbourview

Workshop Title: Trap Cropping and Companion Planting for Pest Control – A Panel Discussion

Speaker(s) & their title(s): Cindy Rubinfine, Pleasant Hill Farm; Andy Hammermeister, OACC

Summary: *The speakers discuss the need for a multi-pronged, systems-approaches to dealing with pests. It is best, for example, to have a system that integrates habitat for beneficials and natural enemies of crop pests, with a trap crop. Cindy Rubinfine discusses intercropping and trap crop theory before giving examples of the trials at Pleasant Hill Farm, and encourages farmers to do their own trials. Andy Hammermeister focuses on the organic management of the wireworm.*

Cindy Rubinfine

Some farm philosophy: whether a farmer is conventional or organic is not as relevant perhaps as whether one is an inputs farmer or a systems farmer.
1) Inputs farmer: uses fertilizer for nutrition and pesticides for insect control
2) Systems farmer: works toward goal of designing a balanced ecosystem using farmscaping for beneficials and cover crops and rotations for soil improvement

Intercropping (IC) can be part of this ecological approach.

IC goals: improving soil, preventing erosion, providing habitat for beneficial insects and spiders, reducing pest damage, while increasing yields and reducing input expenses

IC must be managed so they don't compete with main crop for light, moisture and nutrients.

Theories on how IC helps:
Taller intercrops create barrier for pest access; pests may find it more difficult to find host plant visually or because of masking odours. Many pests use smell over longer distances and vision at closer range to locate hosts plants.

RE: Janine Gibson's article in last COG magazine about the landing theory highlights Stan Finch's research in UK: pest insects need to land repeatedly on host plants before laying eggs. Intercrops can visually confuse insect, disrupting cycle of repeated landings, causing pests to move on without laying eggs. Odour masking: the idea that a strong smelling IC can disguise main crop, making it less likely that the pest will discover it.

An extension of this idea is that aromatic plants can actively repel or attract pests. A plant that attracts pests away from another plant is called a trap crop. Combining a repellent crop with an attractive crop is known as the push/pull strategy.

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Research on corn in Kenya: using a trap crop of Napier grass surrounding corn, and an intercrop of the legume desmodium, repelled the insect pests and suppressed a parasitic weed. But also improved the soil and provided excellent forage for cattle, and increased yields for corn from 39% to 129%.

Companion crops that provide nectar, pollen, and shelter for beneficials can reduce pest problems in crops dramatically by increasing both predation and parasitism. At Pleasant Hill, they do a lot of farm-scaping for beneficials and support healthy populations of syrphid flies, ladybugs, and various egg parasitoids and see very few aphids in field vegetables. Some plants provide as much benefit to pests as to their natural enemies. For example: phacelia tancetifolia is a favoured flower for tarnished plant bugs during their reproductive phase.

Fields: Good practice: Vegetables laid out in permanent beds with grass strips between them for erosion control, and this way tractor tires never compact the growing beds. Use a spading machine for tillage. As tillage destroys habitat for many kinds of generalist predators, such as spiders and ground beetles, a permanent bed system with grassed strips surrounding beds helps offset this by providing some permanent habitat for beneficials.

One system tried at the farm: intercropping winter squash and corn. After spading in compost and seaweed, they broadcast crimson clover seed in beds and incorporated it by shallow tillage with spader. The winter squash and corn are transplanted, and also direct seeded some of the corn. Drip irrigation was laid next to the vegetables, without watering or feeding the clover. AG-19 row cover was applied for 25 days for protection from chilling, and cuke beetles, while preventing crow-damage to corn.

Another 2 beds were planted with squash transplants, with drip and row covers. One bed was mulched with hay on the day of planting, the other was on bare soil. Despite living in an area with lots of racoons, never had a problem with them eating the corn. One theory: racoons have sensitive paws and don't like walking on squash leaves.

Insect control results: fewer cuke beetles in IC beds, no squash bugs; in non-IC beds, heavy cuke beetle pressure, especially in beds with hay mulch, and fair number of squash bugs – lost plants in the end. IC beds had great yields of corn and squash, minus the direct seeded corn.

Carrots: He experimented for 3 years with a tall barrier crop of trellised tomato beds around beds of carrots, and had control beds with no tall barrier crop. Carrot beds with tomatoes as barrier have had consistently far less rust fly damage than control beds. Rust flies may be low and weak flyers, so tomatoes act as physically barrier.

Have also tried cilantro, purported to be a great companion, on the outside and ends of

carrot beds. Close to 70% rust fly damage in these carrots was observed but no damage in cilantro-free beds.

Would like to try: a technique developed in Holland: undersowing carrots with subterranean clover (low-growing annual clover, not as competitive as most legumes). These are broadcasted at same time or within a week of carrot-seeding, and overhead irrigation provided to both. Greatly reduced rust fly damage and higher percentage of marketable carrots in IC beds compared with controls. The researchers theorize that the clover interfered with fly's ability to lay eggs around the crowns of carrot plants.

We should think about substituting the functions of ecosystem services – like erosion prevention, moisture conservation, providing habitat for natural enemies of crop pests, and enhancing beneficial soil organisms – for the applications of fertilizers and pesticides, even those allowable by organic standards.

Andy Hammermeister

Additional goals of IC are to reduce colonization, damage, and to eliminate egg-laying. "Distraction" plants are what we are trying to grow, but depends on the pest – some are very specific on what they want to eat.

A trap crop on the other hand is meant to attract pest away from cash crop; it has to be more desirable. Strategies: use sprays on trap crop to enhance its affect. In your trials try to have a way of applying a control (an organic pesticide). Can be effective around the edge of a field to catch critters as they move in.

Colorado Potato Beetle: when beetles are out of food, they tend to move into hedgerows, and dig in for shelter. Have tried using culled potatoes as traps, and found that beetles will pile up on them, at which point they can be taken care of.

Deer: love pumpkins, and knowing when and where they're coming in is key – try growing pumpkins as a field edge trap crop.

Wireworms (European agriotes – 4 species in Nova Scotia)
Larvae of a family of beetles commonly called 'click beetles' or skipjacks.
Unusually hard-shelled worms, commonly confused with millipedes.

They eat any crop, and come out of sod, leaving strips of damage. Plants are wilted, dead, or if pest caught in the act, shaking. They feed entirely underground, attacking germinating stems (esp in spring) and the roots, underground stems, and tubers of growing plants (fall). Potatoes, beets, beans, cabbage, carrots, corn, lettuce, onions, turnips all subject to damage.

Life cycle: It can take several years to complete the cycle from egg to adult. Eggs are

laid in June or July and hatch into worms that may persist for multiple (5-7) growing seasons (both adults and worms can overwinter dormant) before entering their pupal cells in August. Beetles emerge the following year, April to June.

Larvae Stage: observed vertical migrations in soil: hang out deep in soil in winter; come up in the spring to damage seeds and stems; go further down in the summer; come back up in the fall to feed on roots and tubers.

Adult Stage - crop preference: might prefer barley and mustard as habitat, but this is not all that conclusive. They need shelter to lay eggs – if the ground is bare, will not lay eggs. But if there are crops, they will. Cultivation of the soil at regular intervals makes conditions unfavourable to egg-laying adults.

Lab Trials, baiting experiments:
A choice experiment was set up to test pest preferences between corn and carrot, dandelion and carrot, wheat and carrot, and potato and carrot. Plexi-glass chambers were filled with crops and covered with loamy sand soil, with wireworms released in the middle of each crop-pairing chamber. There was not much difference in the corn pairing, but both the dandelion and wheat drew more worms than the carrot. The carrot was favoured over the potato.

Wheat was also trialed as a trap crop: planted in narrow strips at the end of August beside beds of carrots. This worked, somewhat, and drew wireworms away. As compared to the control bed, slightly less damage overall in beds beside wheat, and the bulk of the damage less severe. These benefits are small for now, but might be more significant over time.

Crop Rotation Trials:
Best to target spring and fall where the worms are most active. Clover is a good choice, but hay mixtures including timothy may support a pest population.

Barley (which is seldom seriously damaged by wireworms) and clover mix was trialed, wireworms liked it, encouraged wireworms in rotation
Flax beds had least wireworm, but there was no clear effect
Brown mustard, Alfalfa, and Buckwheat also trialed

Bait-strip Trial:
In 2010, bait strips of grass were planted beside each a fallow, barley, and mustard bed/strip. The idea was that bare soil, which has no food for the worm, would encourage the pest to move into the bait strip. In 2011, potatoes were planted in all beds between grass strips and then sampled for damage. The strips did not show a big impact. There was slightly less damage in the bed that stayed fallow the previous year. A multi-year trial is needed to better gauge benefits.

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