

SESSION 3

Strategies and Tactics Currently Used by Organic Farmers

Strategies and Tactics That Work in Maine

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There are four major strategies used by Maine organic farmers to manage insects: crop rotation, barriers, microbial insecticides, and botanical insecticides. Other practices that are used to a lesser extent are insect repellents, insect traps, timed plantings, predators, and parasites.

Crop rotation: When deciding whether crop rotation will be successful in managing an insect, the grower must assess three characteristics of the pest:

1. how long it can persist in the field without any host,
2. how capable it is of invading from other areas, and
3. how well it survives on other hosts when the crop is not present.

Most insect pests can survive only over the winter without a host, and if they emerge in the spring and there is no food source, they die or move on. On the other hand, many insects are good fliers and can migrate from far away into an area where there is food present. And many insects have a wide variety of species that they feed on, so, in the years you do not produce a particular crop, they can sur-

vive on another crop or a weed. Understanding the life of the pest is important when deciding whether or not crop rotation should be planned around avoiding a pest.

Barriers have become much more common with the wide use of floating row covers. Collars around seedlings are another example of a barrier.

Microbial insecticides are still in their infant stage of development. *Bacillus thuringiensis* (Bt) is the most common, but there are many other new products on the market or in the works. Microbial insecticides are very specific and thus are harmless to most nontarget insects and environmentally safe.

Botanical insecticides are toxins derived from plants. The botanicals have been used in agriculture long before synthetic chemicals were made available. They are acceptable to organic growers, because they are natural and they degrade quickly in sunlight. However, botanicals are toxic and should be used with care. Furthermore, they are general insecticides that kill beneficial insects as well as the target pest. The most commonly used botanicals are rotenone and pyrethrum. Most certifiers only permit botanicals as a last resort in conjunction with other methods of pest control.

Some examples of how Maine organic growers control pests are shown in table 1 (page 24).

Table 1. Examples of practices used by Maine organic growers to control pests

Pest	Practice
Carrot rust fly	Floating row cover barrier
Colorado potato beetle	<i>Bt</i> , crop rotation, barrier ditch
Corn earworm	<i>Bt</i> and oil
Cutworms	Barriers, <i>Bt</i>
European corn borer	<i>Bt</i> , crop rotation
Flea beetle	Floating row cover barrier
Imported cabbageworm	<i>Bt</i>
Squash bug	Sanitation, crop rotation, pyrethrum
Tarnished plant bug	No effective control yet

Bt = *Bacillus thuringiensis*

Insect Control Strategies Used by Organic Farmers in New Jersey

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New Jersey organic vegetable farmers rely on a variety of generally preventative tactics to protect crops from insect damage, with relatively little reliance on botanical or other approved spray materials. Certified organic vegetable farmers enrolled in our program are generally producing crops on 5–10 acres, with a few vegetable growers farming larger acreage (20–40 acres). A good soil fertility program with ample water supply is seen as the first prerequisite for avoiding insect problems. Crop timing is often used to avoid certain pest groups. Crop rotation by family groups, resistant varieties, and floating row covers is used at some times.

Common problem insects include flea beetles and cabbage worms on brassicas, cucumber beetles on

cucurbits, tomato fruitworm on peppers and eggplant, stink bugs on tomatoes, Colorado potato beetle on tomatoes and eggplant, thrips on onions, and corn earworm and European corn borer on sweet corn.

Brassicas

- Flea beetles are often a problem on arugula: controlled by timing — very early spring planting, fall planting, or grown only in greenhouse or under row covers. CSA farmers often have customers that are tolerant of a moderate amount of leaf damage. Broccoli and cauliflower transplants are also susceptible to flea beetles, so many New Jersey growers will only plant broccoli in the fall. One or two rotenone sprays may be used if needed.
- Cabbage worms are generally easily controlled with *Bt*, generally Dipel® plus an adjuvant, and usually two sprays are required.

Tomatoes, Peppers, Eggplants, Potatoes

- Stink bugs cause stippling of fruit and are a problem for larger growers. They commonly will use a weekly rotenone plus copper spray for disease control, based on weather conditions.
- Tomato fruitworm is a serious problem on larger plantings of peppers and on some varieties of peppers. These are a problem also because the damage is hard to see from the outside, botanicals seem to have limited impact, and regular spraying is required.
- Colorado potato beetle is an occasional problem on tomatoes and potatoes. Growers are using *Bt* formulations, including Novodor®, at larval stages. Most are practicing at least a three-year rotation (some up to seven years), which is helpful. We do not have any large acreage of potatoes.

Cucurbits

- Summer squash and melons are often planted, treated with one spray of rotenone, then grown

under row covers both for earlier production and to exclude cucumber beetles and squash vine borer. Row covers come off at bloom. Winter squash and pumpkins are usually not treated.

Spray equipment is an important consideration. Most smaller farmers are limited to backpack or small tractor-mounted units. One farmer uses a larger Ag Tec® model, which has good internal agitation and a low-pressure feed to larger diameter nozzles with a mist fan to produce small droplet size, and it works well with coarse botanicals like rotenone and sabadilla. Liquid Pyrellin® formulation has been recently prohibited by OMRI (Organic Materials Research Institute) due to unacceptable inert ingredients, and this will make the choice of materials more difficult for organic vegetable growers.

Best Bug-Outs from West Virginia

*Myra Bonhage-Hale
La Paix Farm
Alum Bridge, West Virginia*

(Summarized by Kim Stoner)

Myra went to ten organic farmers in West Virginia and to a talk by a farmer from North Carolina at an herb conference and compiled their techniques and home remedies for various pests. As has been emphasized by other speakers, good soil is important to building resistance to insects, and crop rotation can help, particularly with the Colorado potato beetle. Row covers are used against a variety of insects, including cucumber beetles and flea beetles. *Bacillus thuringiensis* (Bt) is used against many different species of caterpillars. Diatomaceous earth is used against various soft-bodied insects. Soap sprays are used against aphids, thrips, and spider mites.

Some growers used biological controls, either by collecting local populations of generalist predators (praying mantid egg cases, multicolored Asian lady beetles) and releasing them where needed, or by purchasing parasitoids of specific pests (*Encarsia formosa* against greenhouse whitefly, *Pediobius* wasps against the Mexican bean beetle — discussed

in more depth in a later session, *Trichogramma* wasps against the eggs of various caterpillars — also discussed later). They also encouraged birds as insect predators by providing tomato cages as perches.

Since Myra is particularly interested in herbs and their uses, she collected many recommendations for using solutions of herbs as repellents or for companion planting herbs with crop plants. One farmer used a water extract of rhubarb as a general bug spray (but warns that the oxalic acid crystallizes out, so the produce should be washed thoroughly). Several used a garlic and hot pepper spray to deter insects (leafhoppers, flea beetles) or deer. A pennyroyal spray was also used against eggplant flea beetles (but Myra cautions that pennyroyal should be handled carefully because it is injurious to pregnant women). Myra has experimented with using essential oils to repel insects, such as a mixture of sage and thyme essential oils, diluted in water, against aphids and Japanese beetles. She suggests that testing various combinations of essential oils as insect repellents could make an interesting research project. She also cautions that essential oils must be handled with caution because in their pure state they can burn the skin.

Among the companion plants suggested were: radishes and nasturtiums to deter squash pests (possibly also planting with beans and corn), garlic and other onion family plants to deter pests of the cabbage family, marigolds planted in rotation to deter plant-feeding nematodes, and pokeweed leaves used as a surface mulch to deter slugs.

Discussion: Session 3

There were questions about what methods are used against specific pests:

- Nematodes against cucumber beetle: Some growers are experimenting with them, efficacy is uncertain at this point.
- What is used against leafhoppers? Growers in Maine have had success with Pyrenone®, which is a pyrethrin mixed with PBO (piperonyl butoxide), and which is not accepted as organic by certifiers in most other states.

Audience: Do you find that farmers are buying and using beneficial insects?

Eric Sideman currently recommends the commercially available beneficial insects only for use in the greenhouse. He believes that they are too expensive for field use in most situations.

A grower purchases lady beetles for use in the greenhouse and finds them effective, but a high percentage die off rapidly.

Steve Mong uses the parasitic wasp *Trichogramma pretiosum* for control of European corn borer at a cost of about \$15 for 100,000 wasps (about enough to treat 1 acre). He does three to four releases over 4–5 acres. He has done this for about six years. His observation is that in years when he did not do the releases, he lost more peppers to the corn borer.

Some strawberry growers have successfully used predatory mites for control of two-spotted spider mites. Eric Sideman has not found spider mites to be a problem in organically grown strawberries.

Cass Peterson, who uses the predatory midge *Aphidoletes aphidimyza* for control of aphids in the greenhouse, finds that even though *A. aphidimyza* occurs naturally in the field, it becomes established earlier in the field when it has been used in nearby greenhouses.

Growers in some regions use the parasitic wasp *Pediobius foveolatus* against Mexican bean beetles. *P. foveolatus* does not overwinter, which is a disadvantage to the grower, since it must be purchased and released each year. But the fact that it does not overwinter also eases the concerns of people who worry about releasing foreign insects that may establish themselves permanently and alter the ecosystem.

Elizabeth Henderson commended Myra Bonhage-Hale for her interest in using plants that the farmers can collect or grow themselves as a source of pest-deterrent materials. This is another opportunity to fill a need with resources available on the farm, instead of purchasing materials from outside. As new commercial materials become available, they should be reviewed carefully, taking as much time as is needed.

Emily Rosen: As information about the inert materials in commercial botanical insecticides comes under review, many of them will probably be found to be unacceptable to organic certifiers.

There was a discussion of organic sweet corn and why more growers are not producing it organically. There are problems beyond the insect pests — corn requires more land for the amount of monetary return than some other vegetables and weeds can be hard to control organically. One grower suggested that early sweet corn (harvested late July to mid-August in Massachusetts) avoids the corn earworm (in most years) and the second generation of European corn borer.

Audience: One of the most successful techniques on our farm is timing planting to avoid disease and insect pests. With the recent drastic changes in the weather, it is becoming more difficult to do. What systems are used to track the progression of the season?

Eric Sideman: Extension offices keep track of degree-days and the current stage of development of common insect pests.

Steve Gilman: I have friends who are correlating degree-days with when flowers bloom from year to year. Seems to hold well from one year to the next within an area.

Jake Guest keeps a journal of many phenomena around the farm from one year to the next — the return of the barn swallows and killdeer, size of leaves on his lilac bush, etc., along with what he did on the farm. He finds more consistency among these phenomena than he thought, although many different things are happening earlier in the season. Various people cautioned that some things are light-sensitive (photoperiod), others respond to soil temperature, and others respond to air temperature (which is usually used in degree-day measurements).

Emily Rosen: There is a lot of hard data on development rates around, but it is not available in forms that are easy for farmers to use.