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ORGANIC GARDENING: PEST CONTROL

by
Michael Ivie
and
Walter Knausenberger

Organic pest control is as old as agriculture itself. Recently (since World War II) it has been replaced in the developed countries by pest control based on man-made pesticides. Today, many people in the Virgin Islands and elsewhere are returning to the organic gardening strategy, rejecting or restricting the use of man-made pesticides. Some are totally opposed to the use of these pesticides, some only oppose their use on food crops and many simply aim to minimize their use as much as possible.

There are many excellent reasons to utilize the organic gardening strategy. An important one is that insect pests are "left alone" genetically, because there is no pressure placed upon them by pesticides, so they are not continually selected to become resistant "super bugs". Organic methods are generally less polluting and blend into the surrounding ecosystem rather than disrupting it. Also, because many pesticides are petrochemical derivatives, their costs are increasing, making alternatives more attractive. Whatever the reason, philosophical, ecological, or economic, the organic gardener must be ready to work to make up for the loss of those weapons he chooses not to use.

Organic gardeners have a variety of effective non-chemical weapons against garden pests. They fall into several broad groups:

1. Varietal Selection
2. Cultural Control
3. Physical Control
4. Plant-Derived or Natural Poisons
5. Biological Control
6. Home Remedies

VARIETAL SELECTION is often the easiest way to avoid pest problems. It is the only effective way to deal with plant diseases, without pesticides. Plant breeders are continually producing higher yielding varieties that are more resistant to diseases, insects and nematodes. When reading the seed packages or catalogs, look for mention of resistance to pests or diseases. Information on the most up-to-date varieties can be obtained through your local Extension Agent.

CULTURAL CONTROLS simply involve changing your

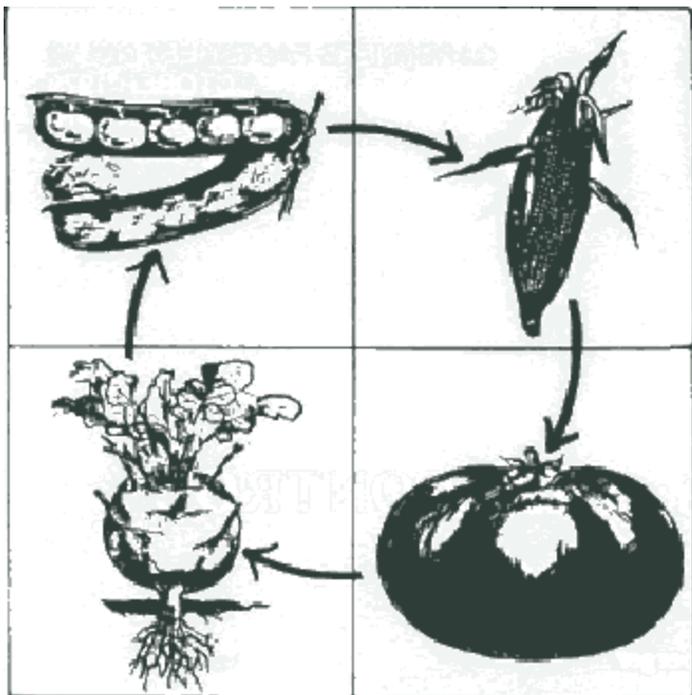


gardening practices to reduce the hospitality your garden offers pests. Removing or burning diseased plant material (sources of infection), such as corn smuts, and destroying weeds and plant debris that serve as hiding places for insects, such as the corm borer in rotting banana stumps, can do a lot towards minimizing pest problems in the next crop.

Staking to keep fruits off the ground (see Gardeners Factsheet 7), pruning off diseased limbs, removing sickly plants, proper soil building (see Factsheets #6 & 18), planting on raised beds in the rainy season and in furrows in the dry, are all cultural practices that help control diseases and pests.

Rotating crops from one location to another in the garden can control problems of nematodes, soil insects and disease build-up. An easy way to do this is divide your garden up into blocks — rows or squares — and number them. Then group the crops you grow into botanical families (see table below). At successive planting times, change the families to different blocks.

Crop rotation requires planning and forethought, as well as some record-keeping, to be effective. However, to the organic gardener few things can be as effective as a good rotation plan.



An example of crop rotation plan for a small garden with four crops.

Certain rotations work best. For example, don't plant tomatoes after cucumbers. Cucumbers give off a toxin that discourages some other plants from growing around them. This property can be used to advantage in companion planting, but tomatoes are sensitive to the toxin and don't get started well after "cukes".

Plant a member of the bean family after high nitrogen users such as corn or sugar cane. Organic gardens are often short of nitrogen. Beans, peas, and other legumes are able to "fix" their own nitrogen from the air, therefore they are not as sensitive to nitrogen-depleted soils. They can, in fact, even add some nitrogen just by having been planted there.

Don't plant two root crops consecutively in the same bloc . Some insects and nematodes will feed on many different types of fleshy roots. Remember, vigorous plants are better able to withstand insect attacks. Deficiency symptoms of malnourished plants should not be mistaken for pest damage.

TABLE 1

SOME COMMON GARDEN CROP FAMILIES

<p>NIGHTSHADE FAMILY — <i>Solanaceae</i></p> <ul style="list-style-type: none"> Tomato Peppers Eggplant Tobacco White Potato Wild Nightshade 	<p>HIBISCUS FAMILY — <i>Malvaceae</i></p> <ul style="list-style-type: none"> Hibiscus Okra Sorrel Cotton 	<p>SQUASH FAMILY — <i>Cucurbitaceae</i></p> <ul style="list-style-type: none"> Melon Cucumber Pumpkin Squash Ghourds Chayote
<p>LEGUME (BEAN) FAMILY — <i>Leguminosae</i></p> <ul style="list-style-type: none"> Green Beans Dry Beans Peas Pigeon Peas Tantan 	<p>LILY FAMILY — <i>Liliaceae</i></p> <ul style="list-style-type: none"> Onions Garlic Shallots Chives Leek 	<p>GRASS FAMILY — <i>Gramineae</i></p> <ul style="list-style-type: none"> Corn Sugar Cane Sorghum Guinea Grass Bamboo
<p>COLE FAMILY— <i>Cruciferae</i></p> <ul style="list-style-type: none"> Cabbage Kale Broccoli Collard Greens Kohirabi Radish Cauliflower Beets 	<p>CARROT FAMILY— <i>Umbelliferae</i></p> <ul style="list-style-type: none"> Carrot Parsley Dill Anise Fennel Parsnips Celery 	<p>ROOT CROPS—Various Families</p> <ul style="list-style-type: none"> Carrot Tannia Dasheen Cassava Sweet Potato Yam Radish Ginger

PHYSICAL CONTROL involves exclusion or removal of pest individuals by various means. Many people find physical control repulsive, but for many pests in small plots it is very effective. Commonly it involves simply looking over your plants carefully, picking off pests, and destroying them physically (usually under a well-placed shoe). For fruitworm, stinkbug, frangipani worm, horn-worm, snails, and any other large “bugs” it is easy, safe, visibly effective, and vengeful! Placing net or screen enclosures over plants, and washing plants off are other physical controls that can be used effectively. Additional options include the use of fire, sticky barriers, and light traps.

THE PLANT DERIVED OR “NATURAL” POISONS are used by organic gardeners under the theory that “if it’s natural, it’s safe”. Many of our most deadly poisons are plant-derived or have natural analogs. Natural pesticides should be used with every bit as much caution as synthetic pesticides. Often their toxicity is as high as, or higher than, the synthetics. Compare the LD₅₀'s* of commonly-used organic pesticides with some common synthetic pesticides in Table 2 (the smaller the number the more toxic).

Among the widely-used natural pesticides that are relatively non-toxic are light oils, such as Volck Supreme oil. These are very good tools for the organic garden, as they control mites, aphids, mealybugs, scales and other small sucking insects better than most other organic means.

*LD₅₀ is a term meaning lethal dose per individual needed to kill 50% of a given population, determined by feeding to test animals.

BIOLOGICAL CONTROL is a method much talked about but little understood. It is the use of predators and parasites of pests to keep pest populations down. Some people think that by leaving your garden alone it will achieve its “natural balance” through biological or natural control. There are several problems with this idea. Man has transported plants and pests around the world from their native homes. Often he has not taken the pests* natural enemies with him.

The native home of the pest may be hard to find since bio-control keeps it rare there, and it and its enemies are often overlooked. Natural enemies that are found, often cannot be introduced because they might attack a related beneficial insect, or be otherwise harmful. Even when natural controls are holding down the pest population, the pest's natural population levels may be too high for us to tolerate on food crops.

However, with these limitations in mind, biocontrol can be a valuable tool for the organic gardener. Choosing control techniques to maximize predator and parasite populations is a must for the organic gardener. These often tiny helpers run around and perform free physical control of pests and as such are valuable allies.

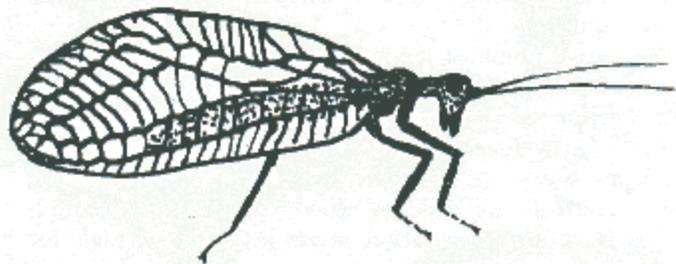
Buying ladybird beetles (“ladybugs”) is usually a waste of money due to the habits of the beetles. Many companies sell *Hippodamia convergens*, a common species, because annual congregations make collecting easy. These beetles are then kept in cold storage until sold. The problem is that it is a behavior trait of this species to fly a good distance before laying eggs, so that you get few to stay in your garden. Other species are available at considerably higher costs that are more effective, but even with these, it is doubtful that the average Virgin Island gardener buying mail-order ladybirds will be rewarded with an economic control.

TABLE 2 PESTICIDE TOXICITY

PESTICIDE	LD ₅₀ (mg/kg)	TOXICITY TO			PERSISTENCE (days)	
		Mammals	Birds	Fish	Plants	Soil
PLANT-DERIVED						
Nicotine	55	High	Slight	High	1	1
Pyrethrum	200	Moderate	Slight	High	1	1
Rotenone	200	Moderate	Slight	High	1	1
Ryania	1200	Slight	High	N.A.	1-3	1-7
SYNTHETIC						
Cygon	225	Moderate	Slight	High	7-21	21-28
Diazinon	300	Moderate	High	High	7	10
Carbaryl (Sevin)	500	Slight	Slight	Slight	2-10	21
Malathion	1375	Slight	High	High	1-3	1

Information taken from: Agricultural Chemicals, Book 1, Thomson, 1977; Agriculture Handbook #554 USDA, 1979; Northeastern Regional Pesticide Coordinators, Pesticide Information Manual, 1972

Green lacewing eggs have a better payoff, though problems here too are common. These eggs must be placed in small groups on* the leaves of the affected plants (the larvae are cannibalistic). Often the eggs are dead upon reaching the Virgin Islands, or have already hatched and eaten each other.



The green lacewing. Larvae of this insect are voracious aphid hunters.

Praying mantises are the worst investment. They are cannibalistic, may wander off, and may eat as many beneficial insects as harmful ones. Also the mongoose and toads seem to find them tasty, and few survive very long.

It's important also to be aware that many of our familiar fellow creatures are out there doing us a favor by seeking insect pests as food. Very significant to us in the V.I. are the many lizards and toads, both expert insect predators. Not to be overlooked are the benefits provided by insectivorous birds, bats, and spiders.

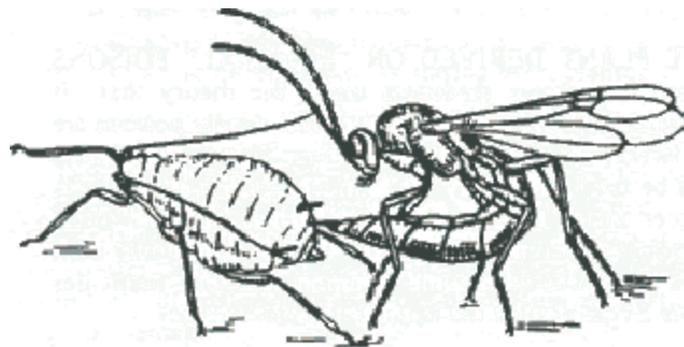
The best news in centuries for organic gardeners is the development of the microbial pesticides. Increasing public concern about pesticide poisoning and environmental impact has led to strengthened pesticide laws. This has spurred the search for control methods that combine the assured, easy control advantage of the synthetic pesticides with the safe, environmentally clean organic school. Microbial pesticides are naturally-occurring bacteria and viruses that attack only certain insects (and can affect practically nothing else). They are as specific to each type of insect as a key is to a lock. This allows one to utilize these already existing systems to tip the natural balance in our favor without resorting to synthetic chemicals. These organisms are already associated with our gardens, so all we will be doing is to multiply and use them.

As an example, *Bacillus thuringiensis*, called BT, is a bacterium that harms only moth and butterfly larvae (caterpillars) with an alkaline stomach, such as hornworms. Live spores of these bacteria are grown and packaged to be sprayed on the plant like an insecticide. The caterpillars eat the spores which multiply inside and kill them. BT is so harmless that predacious insects can eat the dead or dying caterpillars without harm.

Some organic gardeners shy away from these control agents because their packages, consistency and application methods remind them of synthetic chemicals and they equate the two. However, as proof of the "naturalness", you can apply the bacteria to a hornworm-infected plant, and

later pick off the dead and dying caterpillars. Then, put them in a blender with water, strain the resulting mess and spray the liquid on more hornworms. They too will die. Why? The bacteria are eaten by the caterpillar and multiply inside by the millions. Each caterpillar then can cause the death of other caterpillars, organically.

Your best method is to learn to know your "bugs". Know the harmful ones, but also learn about those which are beneficial and accidental. Don't destroy the "good guys" and parasitized "bad guys". Your local Extension Agent can help you learn to identify them.



A parasitic wasp laying an egg in an aphid.

Under HOME REMEDIES are classed all those recipes and imaginative techniques suggested in the popular organic gardening literature. Some, such as neem seeds, black pepper sprays (both insect feeding repellents) and beer baits (snail trap) have already moved into the scientifically proven side. Others such as companion planting and moon-coordinated planting are currently being tested. However, some methods are simply wishful thinking or pure hocus.

But how do you know which is which? First, does the method have any objective experiments to back it up? Second, if based on only casual observations, were they made in a way that makes their conclusions logical, or could the conclusions have resulted from totally unrelated factors? Third, is the method safe? For instance, pouring salt on snails kills them, but it can also kill plants whose roots absorb the salt later.

The organic gardener should have a pest control plan for his specific garden location, crops and pests. A good plan always involves regular inspection of the garden to enable one to spot pest problems early. Make it a habit, and you will have taken an important first step toward successful organic pest management. In conclusion, organic pest control is effective with certain qualifications. The practitioner must be willing to work hard, learn about garden pests — their appearance, life cycles, enemies, and habits — judiciously-read organic gardening literature for methods that might work, and accept some pest damage. The rewards of healthful food, monetary savings, and a sense of accomplishment make these challenges well worth the effort to many thousands of organic gardeners here in the Virgin Islands and the world over.

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