



Canadian Organic Growers

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Canadian Organic Growers Inc is Canada's national membership-based education and networking organization representing farmers, gardeners and consumers in all provinces.

COG Reference Series **#14, Insect and Disease Management** **in the Vegetable Garden**

For the organic Gardener there are many factors to be considered in order to achieve the best possible management of insect problems.

- healthy, vigorously growing plants are less susceptible to insect injury and if it would occur, they will make better regrowth than weak ones.
- Create good soil conditions with plenty of compost. Add builders sand to heavy clay to improve texture and organic fertilizers as needed
- the acidity should be within the range of ph 6.5 to 7. Have soil test done if in doubt
- select a garden site within good drainage Land with plenty of sunlight
- consider invading tree roots, avoid black walnut
- practice crop rotation between various plant groups, such as cole crops, root crops cucurbits and leafy vegetables
- attract birds with feeders, a bird bath and shelter for nesting and weather
- if watering is necessary, do so once in several days but thoroughly , do not be alarmed by a dry soil surface
- the presence of moles may be a nuisance but they are beneficial by eating large quantities of harmful insects
- experiment with companion planting
- use traps and other protection devices

Companion planting

There is some misconception on this subject. Certain plant associations can be beneficial in the way they share nutrients and water by either deep or shallow rooting or the way they share the available light. As far as insects are concerned the aromatic fragrance of certain plants can either attract or repel insects, but not all insects as is often the assumption.

The repelling scent from the companion plant must be produced at the same time as the harmful insects attack the crop.

How strong this scent is at given time may depend on weather conditions.

Rodale's Encyclopedia of organic Gardening mentions that the repelling scent of one plant may be overpowered by the attracting scent of the other plant. Furthermore what is reported as working in one Garden may not work in yours too. You may hit on a beneficial pairing not yet reported.

The main thing is not to plant in strict monocropped rows. Diversity of plants is the easiest and most effective pesticide and fertilizer the garden has , so use it liberally.

The following List is taken from "The Bio dynamic Source: Companion plants and how to use them"., by *Helen Philbrick and Richard Gregg*:

Cabbage worms (not to be confused with the cabbage looper) is the larvae of the white cabbage butterfly which is repelled by tomato, sage, rosemary, hyssop, thyme and wormwood.

Carrot rust fly is repelled by onions and leeks, rosemary, wormwood and sage

Onion fly is repelled by carrot

Mexican bean beetles are repelled by the french marigold and the planting of bush beans and potatoes in alternate rows

Nematodes are suppressed by french marigold. Nematodes are microscopic worms and more of a problem in warmer climates. To eliminate Nematodes for 2-3 Years french marigold has to be seeded solidly.

Flea beetles are repelled by lettuce

Colorado Potato beetle and the potato leave lopper are repelled by interplanting bush beans with potatoes

Squash bugs are repelled by Nasturtium

Other strongly scented plants mentioned in the literature which may be considered are: basil, catnip, celery, chives, dill, flax, garlic, geranium, horseradish, parsley, peppermint and tansy.

Patrick Lima, author of "The Kitchen Garden", plants a group of mixed scented herbs at the end of vegetable beds or throughout the garden which simplifies the procedure but does not allow to observe any specific repellency.

Beneficial Insects

Entomologists have estimated that in an average garden only 5% of the entire insect population causes injury to plants. The vast majority is beneficial as either they devour the harmful insects being predators or they are parasites laying their eggs on or in another insect.

The larvae emerging from this eggs kill their host insect. This is one of the principles on which the balance of nature is based. We have to realize that if we would eliminate all harmful insects, the beneficial ones would disappear for lack of food or sites for reproduction. So the organic gardener must tolerate some insect damage in order to benefit from their assistance. Examples are lacewings, syrphid flies, assassin bugs, dragon flies, damsel flies, ground beetles, soldier bugs, lady bugs, trichogramma wasps and many other.

Most of these prey on their favorite insect but the praying mantis eats any insect, good or bad ones. Beneficial insects can be purchased but in a small garden they soon fly away.

Identification of Insects

It is difficult to identify the beneficial insects, many of them being very small, It is very helpful however to be able to recognize the harmful insects and at which time of the season, on which crops they do their devastating work.

"The Gardeners Handbook" written primarily for Ontario but applicable to most of eastern Canada with descriptions and illustrations is very helpful for this purpose.

We should distinguish between those insects which can be seen with the naked eye like caterpillars, aphids, leafhoppers, also many beetles and those which are hidden in the soil like the various root maggots and cutworms.

This latter group cannot be controlled after the damage has been noticed and therefore it has to be prevented. The unseen insects create the most difficult problems.

Harmful Insects

Cabbage root maggot

This insect attacks all brassicas, namely cabbage, cauliflower, broccoli, brussels sprouts, Chinese cabbage, kale, radish, turnips and rutabaga.

The adult is a fly, resembling a housefly, which lays its eggs on the soil near one of these plants.

These longish white eggs can easily be noticed. In southern Ontario there are three generations of the fly emerging in May, early July and August. These are only two Generations starting somewhat later in Quebec, the Atlantic Provinces and the Prairies, five Generations in coastal B.C.. starting much earlier. The first Generation is by far the most destructive. After hatching, the maggots enter the soil and feed on the rootlets of the stem brassicas (cabbage, etc.). Young plants become stunted and die. To prevent this, place a collar made of Tarpaper, with a hole in the middle and a slit, around the stem flat on the soil, so the fly cannot lay its eggs there.

Do this on the same day as transplanting. Instead of collars you can protect rows of plants by covering with Reemay cloth, which allows the passing of water, light and air.

If you grow your own transplants, do the seeding in a frame covered with mosquito screen or Reemay cloth and do the same for radish. Later generations do not kill established plants in mid summer. Winter turnips or rutabagas are riddled by the maggots but only superficially at the bottom of the root which can be trimmed off at harvest.

By delaying the seeding until early to mid June this damage can be kept to a minimum.

This insect is very common in the northern areas around the world and if present in your neighborhood it will be an annual problem.

Carrot rust fly

The life cycle of this insect is similar to the one of the cabbage root maggot. The adult fly lays its eggs near young carrot plants during May. After hatching the maggots invade the roots. A second generation occurs in mid July in southern Ontario, somewhat later elsewhere in eastern Canada and the Prairies.

The injury shows up as brown tunnels and blackish scars on the surface of the root.

The insect seems to be less widespread than the cabbage root maggot and is not a problem in many areas. So be guided by previous experience or that of neighbors.

By delaying the seeding of the main crop until July the second generation is reduced. Early carrot, should be protected by covering the beds with Reemay cloth.

The adult fly avoids windy locations so these give less trouble.

Seed corn maggot

This one cm long maggot enters the seed of corn, beans, peas and sometimes squash, cucumber and beets so that it will not germinate. In the case of beans it kills the germ leaving the two emerged lobes without further growth. The adult fly lays its eggs in May. Sow peas as early as possible but delay seeding of beans and corn and other affected crops until June in southern Ontario. Early seeding can be done in a protected bed or indoors for transplanting at any time as this insect does not attack emerged seedlings.

In some areas this insect is not a problem so be guided by previous experience.

Onion maggot

This maggot can be a serious problem in some areas but not in others, here again let experience be your guide.

The first generation flies lay the eggs near young onion plants in May. The maggot invades the young plants killing many of them. Yellow leaves are an easy symptom. The second generation maggot appearing in early August does less damage. The last generation hatches in mid September and overwinters in bulbs left in the garden. Where this insect is a problem use onion sets which have been kept dormant and plant them in after June. Never leave infested bulbs in

the garden, if early seeding is preferred do so in a protected frame.

Cutworms

are fat grey caterpillars which lie in a curled up position just below the soil surface by day and feed by night cutting off the stems of tomatoes, cabbage and other plants mostly in may and June.

If this is noticed it can usually be found by scratching the soil surface around the freshly cut off plant. By inserting an empty can (bottom removed) over the plant and pressing it slightly in to the soil the insect cannot cause any damage. A different cut worm species appearing later in the summer climbs up the plants to feed.

White grubs and wire worms live in grass sod, hence they are mainly a lawn problem. If a grass area has to be converted into a vegetable garden, dig it before May and keep the soil bare until the next spring. This will also allow the sod to decompose.

The insects which is readily visible need an entirely different approach. Most of them, such as caterpillars and beetles can be removed by hand picking before they become numerous. Have a small container with soapy water standing ready. Regular observations are needed in order to take early action.

Colorado potato beetle

They can be controlled by this method. This insect cause not much damage until later in the summer. By selecting an early or medium early variety and by pre-sprouting the seed in an open tray indoors in full light, the crop can be harvested early before Colorado potato beetle and the potato leafhopper seriously injure the plants. The damage by the latter insect resembles a leaf disease and is called hopper burn. In northern Ontario the blister beetle requires the same control method.

Beet leaf miner

attacks chard and spinach as well. It can be controlled by removing and discarding damaged foliage, but not on the compost pile where the insect would survive the winter.

Corn earworm

This big striped caterpillar infesting the ears of corn in August, so early corn is not affected.

The European corn borer

lays its eggs in clusters on the underside of the leaves. Larvae feed on leaves, bore into the stalk, causing breakage , then move to the cobs. Neither of this two corn insects withstands control if it is acceptable that the damaged tips are removed before cooking. Resistant varieties are available.

Flea Beetles

They eat small lobes in the leaves of potato, tomato, pepper, eggplant and all cole crops, causing delayed growth. They are very active and fly when disturbed. If they are a problem in the early season, cover the plants with Reemay cloth.

Earwigs

can be trapped by providing hiding places for the night such as wet burlap, rolled pieces of newspaper, short pieces of hose and check them each morning.

Aphids

should be controlled with insecticidal soaps. They are a great attraction for beneficial insects.

Squash wine borer

If the ends of squash vines suddenly wilt, this insect has made a tunnel inside the vine. Slitting the vine and removing the borer prevents further damage. By covering that part of the vine with soil new growth is promoted. The insect overwinters in the soil and once it is in a garden, the problem reoccurs every year. Butternut squash is resistant to the squash vine borer.

Slugs and Snails

They can be trapped in yoghurt or margarine containers sunk up to the rim into the soil and filled with a half and half mixture of molasses and water plus a little brewers yeast and some bran which is much cheaper than using beer for this purpose.

Add dead slugs and snails to the compost pile. It has been reported that crushed egg shells scattered around plants deters slugs. Diatomaceous earth is recommended for slug control. It is a natural dusty material with sharp particles which damage the slimy skin of slugs.

Toads, frogs and snakes are unfortunately rare as they are great insect eaters. Hence they should be protected. It is generally believed that sow bugs and millipedes are causing damage but they are actually beneficial by decomposing organic matter. Many insects, particular aphids and beetles can be washed off foliage with a forceful stream of water from a garden hose.

Insecticides

There are several insecticides which the gardener may safely use to produce organically grown vegetables.

- **B.T.** (bacillus thuringiensis) kills only caterpillars and has no effect on any other insects, hence it is safe on beneficial ones. It is sold as safer's organic B.T., CIL Organic Insect Killer, Dipel and other trade names.
- **Insecticidal Soap** kills only aphids, earwigs and white flies. Do not use household soap as it may cause plant injury and lacks label directions.
- **Rotenone**, which was formerly known as derris. It has a wide spectrum of control killing Colorado potato beetles, flea beetles, asparagus and cucumber beetles, squash vine borer and squash bug. As it kills also many beneficial insects it must be directed as much as possible only on the target insects. It is toxic to honey bees and fish too.
- **Pyrethrin** is made from the extract of chrysanthemum flowers, hence it is fully organic it should not be confused with pyrethroid which is a synthetic chemical and may not be used on organically grown crops. Pyrethrin kills potato leafhoppers, aphids, flea beetles, beetles on asparagus and beans as well as many beneficial insects. Hence it should be used if absolutely necessary and as a spot spray on harmful insects only. It is toxic to honey bees and fish. It is sold as Safer's Trounce as well as other trade marks.

Always read the label directions of any insecticides.

Diseases

Practically all plant diseases are caused by fungi and only a few are the result of an infection by viruses or bacteria. As these fungi have no chlorophyll they must grow as parasites on host plants. Fungi spread by air borne spores which are only viable if they fall on their specific host plant or members of the same plant family. Spores need a wet leaf surface and favorable temperature in order to germinate and let their growth penetrate the leaf tissue causing the various types of leaf spots or mildew by which we recognize the disease.

On these leaf spots an abundance of new spores are formed causing disease to spread very fast if cool and wet weather prevails. Only powdery mildew thrives in dry, hot and humid weather. The only actions an organic gardener can take are sanitation by removing all diseased plant parts,

also rotation, using disease free seed and selecting resistant varieties. Avoid watering in late afternoon and evenings so foliage can dry before the night. Air circulation can be improved by not planting too closely.

As far as fungicides are concerned sulphur is the only non synthetic one, hence it is organically acceptable, but it is harmful to beneficial insects and should be used only if as last resort. This implies that regular observations are necessary in order to prevent any disease to become a severe problem.

The following vegetable diseases may occur. The cultural methods to control them are listed.

- **Bean Rust** can cause great damage and will reoccur if not controlled. Select resistant varieties and practice rotation. In a small garden it may be necessary to skip growing beans for at least one year. Discard all crop refuse.
- **Bean white mould** develops under wet conditions. Immediately destroy affected plants as the disease spreads to all vegetables, except corn, and overwinters in plant refuse, compost pile or soil.
- **Bacterial black rot** affects all brassica crops (cabbage, turnips, tec.). Practise severe sanitation as it overwinters in crop refuse.
- **Bacterial soft rot** can attack many vegetables. The bacteria enters through wounds. The wet rot has an offensive odour.
- **carrot leaf spot and blight** usually starts in late July. Avoid afternoon and evening watering. Thin carrots to create air circulation. Celery may be affected. Buy seeds from a reliable source.
- **Downy mildew** occurs in spring and fall when the weather is cool and wet. Spanish, Egyptian and multiplier onions and those grown from sets are more vulnerable than yellow onions grown from seed. This fungus also affects cabbage and lettuce.
- **Powdery mildew** is a mid summer disease when it is hot, dry and humid weather with cool nights. It may occur on corn, cucumber, melon, pumpkin, squash and zucchini. Use seed of resistant varieties.
- **Damping off fungus** attacks stems of seedlings in cold frame or green house. Use sterilized soil, containers and tools. Do not over water.
- **Potato scab** is caused by a soil borne fungus and occurs every year except in acid soil with a ph below 5.2. Do not apply lime or wood ashes. Plant resistant varieties such as superior, Ontario or Netted Gem.
- **Potato and tomato early blight** affects only the foliage (on tomato starting on lower leaves) but not the tubers or fruit. No control is needed but carefully destroy all plant refuse after harvest as the fungus overwinters in it or on the compost pile.
- **Potato and tomato late blight** seldom occurs in Ontario as the fungus needs wet but cool weather in late summer or fall. It can be a severe problem in eastern Quebec and the Maritimes. It spreads extremely fast. As soon as blackened foliage is noticed cut and remove all vines and tops which can safely be composted but delay harvesting potatoes for two weeks at least. The fungus overwinters in tubers remaining in the soil, which grow "volunteer" plants or in tubers discarded from a root cellar.
- **Potato hollow hearts** are caused by over fertilizing.
- **Tomato leaf roll** showing up in dark green healthy looking plants. It is not a disease and needs no control.
- **Tomato blossom end rot** shows up as a black hard area on the bottom of the fruit, mainly in the early season. It is not a disease but is caused by calcium deficiency when hot dry weather alternates with periods of heavy rainfall. Use only a small amount of nitrogen fertilizer and keep soil moist.

- **Clubroots of brassicas** is a very serious disease affecting the entire cabbage family including turnips, rutabaga, radish and kohlrabi. It is caused by a soil-borne fungus which remains in the soil clinging to tools, rototillers etc..
- Roots show swelling and are deformed. If found dig up plants with roots and discard in garbage. Eliminate related weeds such as mustards and shepherd's purse. Incorporate agricultural lime to raise pH to about 7.2 or the faster acting hydrated lime from a building supplier (1 kg per 6 sq m). Do this 3 weeks before planting. Test soil for pH and rotate crops.
- **Wilt diseases** affect tomato, potato, cucurbits, eggplant and pepper, also raspberries and strawberries. The fungus remains in the soil for several years, even if any of these crops are not grown in that soil.
- Use resistant varieties. Suspected soil can be tested for presence of the fungus at the pest diagnostic clinic (see services).
- **Black walnut injury** The root of this tree causes toxicity in the soil making it unsuitable for growing many vegetables. Only beans, beets, onions and sweet corn are tolerant to this toxic substance. Even after cutting down this tree the soil remains toxic for many years.

Reference Literature

- **The Gardeners Handbook, an Integrated Approach to Insect and Disease Control** with descriptions and illustrations. This government publication is written for the general public and gives equal coverage of organic and non organic methods for Ontario conditions. Available from the Ontario Ministry of Agriculture, Food and Rural Affairs 1-888-466-2372 from within the province or 519-826-3700 from outside Ontario.
- *Patrick Lima, The Kitchen Garden*, written for organic gardeners in Ontario, Key Porter books limited. 70 The Esplanade, Toronto, Ontario, M5E1R2
- *Helen Philbrick and Richard Gregg, Companion Plants and how to use them*. Out of print but available from the COG Library.
- *Louise Riotte, Carrots Love Tomatoes, Secret of Companion Planting*. Storey communications Inc. Pownal V.T. Available from COG Library.
- **Encyclopedia of Organic Gardening**, Rodale Press, Emmaus PA
- *Miranda Smith and Anna Carl, Rodale's Garden Insect, Disease and Weed Identification Guide*, Rodale Press Emmaus PA
- *Olkowski W.S. and H., Common Sense Pest Control*, Taunton Press Newton CT
- *Barbara Ellis and F.M. Bradley, The Organic Gardener's Handbook of Natural Insect and Disease Control*, Rodale Press Emmaus PA

Sources of Supply

- **NIC- Natural Insect Control**, 905-382-2904, e-mail: nic@niagara.com, sells Reemay row covers, beneficial insects, various traps, organic insecticides and sulphur, with much information.
- **Plant Products Co. Ltd.**, 905-793-7000, sells beneficial insects, insecticides and sulphur.
- **Safer Ltd.**, 416-291-8150, sells beneficial insects, insecticides, sulphur and slug bait.

Problem Diagnosis and Soil Testing Services

- **The Pest Diagnostic Advisory Clinic**, University of Guelph, 519-767-6256 for diagnosis and nematodes.
- **A&L Canada Laboratories**, London ON, 519-457-2575
- **Accutest Laboratories**, Napean, ON, 613-727-5691

- **Agri Food Laboratories**, Guelph, ON, 519-837-1600
- **Analytical Services, Land Resource Science**, Guelph ON, 519-824-4120 ext. 2494
- **Stratford Agri Analysis Inc.**, Stratford ON, 519-273-4411

Sample Kits, directions, forms and fee schedules for these services are available from the Ontario Ministry of Agriculture, food and Rural Affairs, Guelph ON and its field Offices. Consult the Government listings in the telephone directory.

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