Integrated Pest Management:

Definition

Integrated Pest Management (IPM) can be defined as an approach that starts with promoting the health of plants and applying a combination of techniques and strategies that monitor pest populations and, where necessary, acts to limit these populations, minimising potential harmful effects on human health and the environment. Pests can include insects, mites and disease organisms.

Obviously, pests and diseases in the garden can adversely affect the health of plants if their numbers and spread are significant; but healthy plants will also be more resistant to pests and diseases. IPM it is a strategy for managing pest populations by taking advantage of all available control measures which include physical, cultural, biological, controls as well as chemical methods where organically acceptable and when other measures are inadequate.

IPM it works with and protects the ecology of the garden and its environment recognising that in most cases pests are part of the eco-system supporting populations of predatory insects and other wildlife.

IPM aims to manage pest populations to a low level to minimise their impact on plants rather than eradicate these pests.

Basic Requirements

In organic gardening, successful application of IPM requires that gardeners:

- have a good knowledge of the pests which affect our gardens and their natural enemies. They should be able to identify these pests and beneficial insects and know their life cycle, likely hosts and habits.
- regularly monitor plants for signs of pests and disease, especially at critical times in the plant's lifecycle. This can be done visually or by using a sampling method such as a sticky trap.
- be aware of all the possible control methods including;
    - biological controls, such as natural occurring insects (eg wasps and lacewings) and introduced enemies (eg Bt *Bacillus thuringiensis*),
    - Cultural controls including organic gardening techniques that promote plant health and resistance to pests and diseases such as composting, weed management, companion planting, crop rotation and plants that provide a habitat for biological controls (ie plants that attract beneficial insects).
    - physical controls, such as squashing, and the removal of overwintering habitat for pests,
    - selecting plants suitable for the climate and soil conditions and using pest resistant varieties and root stocks.
    - chemical controls and their acceptability in organic gardening and food production and associated restrictions and hazards as well as their mode of action to avoid problems with pest and disease resistance and their effects on other (non-target) organisms.
        - Most commonly available pesticides (including registered organic products) have a broad spectrum impact which means they kill both pests and their natural enemies (as well as pollinators).

IPM strategies may need to be adjusted based on experience in the garden; that is, taking into account what worked and what didn't and any changes in environmental and growing conditions, insect populations and plant health generally.

> *"We need to develop a biologically orientated thinking that sees our agricultural efforts as participatory rather than antagonistic vis-à-vis the natural world. It isn't a question of whether pesticides are undesirable or not. The fact is that they are totally superfluous. They were devised to prop up an agro-industrial framework which was misconceived from the start. When you abandon that framework, you can abandon its superficial thinking pattern. Don't start with industrial theory and try to "naturalise" it. Start on another plane entirely. Study the established balances of the natural world in order to learn how to nurture and enhance those balances for agricultural production. Pay attention to the existing framework of pest-plant relationships and learn how food production can be achieved through biological diplomacy rather than chemical warfare. The potential of such a new understanding is as yet undreamed of."*
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> *Eliot Coleman in The New Organic Grower*

Case example: An IPM procedure for Green Vegetable Bug on Tomatoes

Normally an IPM program for tomatoes or any other specific crop would address all the pests and diseases to which that crop is susceptible in a particular area as well as a monitoring and control regime for each pest and disease. However, this example addresses just the green vegetable bug (GVB -*Nezara viridula*) - sometimes called 'green shield bug' or 'stink bug' - which can be a serious pest in tomatoes.

Problems/Symptoms

- Causes wilting on plants and mottled scarring and dimpling on the fruit where the bug has been sucking making the fruit less attractive to eat. Bugs can also be present on the stems of plants.

Identification

- The adults are green, shield-shaped bugs, approximately 15mm long by 8mm wide, with three small spots in a line between the wing insertions. They feed by inserting their sharp, tubular mouthparts into soft plant tissues and sucking the sap.
- They prefer sunny positions. If mildly disturbed they will hide, but if the disturbance persists they will drop to the ground or fly away.
- In common with many other bugs, when provoked they can exude a brownish, foul-smelling fluid which will stain fingers or clothes and leave a persistent odour. Because of this defence mechanism they are not favoured as food by most predators.

Pest Cycle

- Mating takes place on vegetation during spring and summer.
- Approximately 60-80 eggs are laid in a raft shaped formation. Each egg is 0.75mm in diameter and is yellow when first laid. As the embryo develops a reddish-orange Y-shaped mark becomes noticeable.
- Incubation time varies with temperature – 5 days in summer to 2 to 3 weeks in early spring.
- Egg rafts may contain eggs of varying colour: yellow or orange eggs are normal; black eggs have been parasitised, and will produce a small parasitic insect; and there may be whitish empty eggs from which either a nymph or a parasite has emerged.
- The nymphs are orange when they emerge, but soon change to a shining black.

- In later stages the hind wings gradually develop and the green colour becomes more dominant.
- At the final moult the colour changes completely to green, or rarely, to orange.
- Life cycle is approximately 65-70 days with up to four generations a year.
- Over-winters as an adult in tree bark, litter or anywhere it can obtain protection.

Control

- **Cultural Methods**

  Apply best organic gardening practices to promote optimum health of plants. Stressed plants seem more likely to be attacked.

  Choose varieties well suited to growing conditions. Smaller fruit varieties and yellow varieties seem less susceptible but will still be damaged if the pest is present.

  Remove any weeds from around the crop and nearby. Mow grass adjacent to garden beds. Keep an adequate buffer separation from other host plants (eg soybeans and sunflowers) to avoid cross-contamination.

- **Monitoring**

  From November to May: Weekly check of each plant for bugs and eggs. If more than one bug per plant found, squash any GVB and egg rafts where fewer than one third the eggs are parasitised.

  From June to October: Monthly check for overwintering adult bugs on any perennial host plants and on any sheltered surface where they may seek protection. Squash or drown bugs in mild soapy water.

- **Physical controls**

  Remove any bugs found ideally in the early morning when they tend to be sluggish and easier to catch. Physically squash any eggs found if fewer than one third are parasitised.

- **Biological controls**

  A naturally occurring parasitoid wasp *Trissolcus* spp parasitises GVB eggs. Ants are also known to be predators of GVB. There are no biological controls available commercially.

  - CSIRO has successfully established a South American parasitoid (*Trichopoda giacomelli)* in northern NSW and southern QLD which attacks GVB but it has not been established in ACT or southern NSW.

- **Chemical Controls**

  Under an organic gardening regime, there are no chemical insecticides suitable for use on green vegetable bugs. While pyrethrum is registered and may be used in food production under the Australian Certified Organic standard in certain circumstances, its broad spectrum effect on insects make it unsuitable in control of GVB on tomatoes.