

## IPM PACKAGE: COLE CROPS (CAULIFLOWER/CABBAGE)

The IPM Innovation lab (IPM IL) has developed and tested practical IPM packages in vegetables. The IPM packages are holistic suites of IPM recommendations and practices from planting to market chain with an aim to enhance profitability from vegetable farming. These packages are economically and environmentally viable.



Cauliflowers ready for marketing



Nursery using plastic tray with coco peat



Seedlings grown under nylon-net



Seedlings of cauliflower produced by using plastic tray

### SITE SELECTION:

Cole crops use large amounts of nutrients and water. They do well on light, sandy soils which warm up quickly in the spring. However, they need frequent irrigation and supplemental nitrogen during the summer. The ideal location for mid-to-late-season planting is on heavier soils which have a better water-holding capacity and require less frequent irrigation. Avoid planting cole crops in the same site each year to prevent the build-up of soil pathogens. Soil pH should be 6.0-6.8. Similarly, if the field has a history of severe damping-off and club root diseases, consider a new site.

### VARIETY SELECTION:

Most of the cultivars available today are hybrids. Disease resistance is an important consideration when selective cultivar. Cultivars resistance to black rot, and downy mildew are desirable.

### SEEDLINGS PREPARATION:

If seedlings are raised in nursery beds, use raised seed bed and solarized soil. Fertilizers are combined with *Trichoderma spp*, *Pseudomonas spp* and neem cake, which reduces the incidence of seedling diseases, weeds and nematodes. If plastic trays are used, sterilize empty trays in a 10% bleach solution before using. Its important to keep seedbed/media moist but not wet, which can result in several root diseases.

### SEED TREATMENT:

Shortly before planning, treat seeds in a hot water to kill the seed-borne bacteria and fungi that can delineate young plants. Furthermore, treating seeds with fungus *Trichoderma viride* and the bacteria *Pseudomonas fluorescens* protects seedlings from fungal, and bacterial attacks.

### SEEDLINGS IN NURSERY:

Using screens or nets against aphid vector can prevent or delay early virus infection. Drench nursery beds with 5 gm of *Trichoderma* formulation per liter of water. Or, Apply 10 - 25 g of *Trichoderma* powder per 100 m<sup>2</sup> of nursery bed. This will help prevent seedlings from root diseases like damping off. Application of neem cake and FYM before treatment increases the efficacy. Mulching of seed beds with straw or polythene or gunny bags would help to retain moisture, prevent growth of weeds and avoid washing away of seed with water.

### ROUGING:

Monitoring and removing any disease or virus infected plants during early stage will prevent disease spread by insect vectors.



Traps used in IPM method



Adult Diamond Back Moth



Larvae of cabbage butterfly



Adult of Tobacco caterpillar



White grub

## FERTILIZATION:

Well decomposed compost inoculated with *Trichoderma spp* and other bio-fertilizers (N, P, K) will reduce the disease incidence along with building-up of beneficial soil microbes.

## INSECT TRAPS:

a) Setting up yellow sticky traps in the field will reduce aphids, whiteflies and thrips population, b) Pheromone traps should be installed in the field for *Spodoptera litura* and *Plutella xylostella* early in the season.

## BIO-CONTROL AGENTS:

Formulations of fungi *Verticillium*, *Paecilomyces*, *Metarhizium*, and *Beauveria* species are found effective against aphids, and thrips.

## MAJOR INSECTS PESTS AND THEIR MANAGEMENT

### 1. DIAMOND BACK MOTH

Crop damage is caused by larval feeding. First instars mine leaf tissue, thereafter feeding occurs on the undersurface of the leaf, resulting in a windowpane from the remnants of the top leaf surface.

- ◆ Intercropping with tomato.
- ◆ Conservation of NE's.
- ◆ Neem based pesticides @3-5 ml per litre.
- ◆ Use the bacterial insecticide, *Bacillus thuringiensis* (Bt) 2g/ltr water on young plants and on mature plants when pest pressure is low.
- ◆ Use of safe chemical pesticides: eg Acetamide, Imidacloprid only as a last resort.

### 2. CABBAGE BUTTERFLY

The larvae make round holes in leaves, usually on the outside leaves. When heads develop, larvae feed on the outer leaves and bore into the center, making the crop unmarketable for fresh market.

- ◆ Hand picking and mechanical destruction of larvae during early stage.
- ◆ Use of repellent crop - mustard.
- ◆ Bt based pesticides @ 2g/Ltr water.
- ◆ Use of contact insecticides (e.g *Chlorocyper*) as a last resort.
- ◆ Do not overuse NPK/Compost.

### 3. TOBACCO CATERPILLAR

Early larval instars and caterpillars feed in clusters skeletonizing the leaves

- ◆ Hand picking and mechanical destruction of larvae.
- ◆ Use of pheromone traps (1/ropani) for monitoring.
- ◆ Using marigold as trap crop.
- ◆ Neem based pesticides such as Margosom @3-5 ml per litre.
- ◆ Contact insecticides (e.g. *Chlorocyper*) as a last resort.

### 4. SOIL INSECTS (WHITE GRUBS, RED ANTS, CUTWORM ETC)

- ◆ Using well decomposed compost.
- ◆ Irrigating crops regularly.
- ◆ Drenching soil with *Metarhizium anisoplae*.
- ◆ Using contact pesticides as last resort.



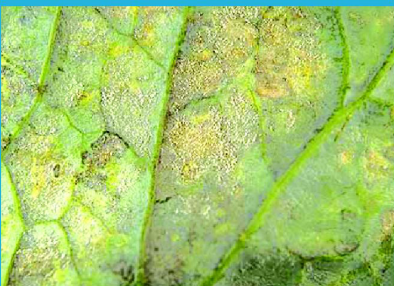
Cabbage Aphids



Damping off in seedling



Club root



Downey mildew



Alternaria leaf spot

## 5. CABBAGE APHID

They are green gray with a white, waxy coating. They commonly occur in dense , often covered with waxy droplets. They prefer to feed on the youngest leaves and flowering parts and are often found deep within the heads of cabbage.

- ◆ Use of insecticidal soap along with Neem or Tobacco (100gm soap+100gm tobacco/neem powder + 20L water).
- ◆ Removing alternate hosts such as mustard and related weeds around.
- ◆ Systemic insecticides: Imidacloprid or contact insecticide.
- ◆ Destroy crop remnants immediately after harvesting.

## DISEASES AND THEIR MANAGEMENT

### 1. DAMPING OFF

This disease mostly attacks seedling stage. In transplanted seedlings, they attacks in ring form in the stem and stem nodes and then the plants rots and fall down to grounds.

- ◆ Nursery should be always established in south facing plot.
- ◆ Make raised nursery bed and regular drenching with Trichoderma solution.
- ◆ Manage irrigation water. Apply required amount and in time. There should be good drainage system.
- ◆ Treat the soil with Trichoderma.
- ◆ In heavy invasion apply Bavistin@2gm per sq. m area.

### 2. CLUB ROOT

- ◆ Use diseases free transplants.
- ◆ Crop rotation with non cruciferous crop.
- ◆ Maintaining soil pH 6.5-7.3.
- ◆ Drenching Trichoderma in seedbed and root dip before transplantation.
- ◆ Uproot and destroy all infected plants after harvest.
- ◆ Never use seedlings from infected area.

### 3. SCLEROTINIA ROT/WHITE MOLD

- ◆ Use well drained soil for plantation.
- ◆ Crop rotation with cereals, onion, corn etc.
- ◆ Avoid contact between soil and plants using mulches.

### 4. DOWNY MILDEW

Causes angular, chlorotic lesions on the foliage. During humid conditions, inspection of the underside of the leaf reveals gray-brown to purplish-black 'down'.

- ◆ Avoid over head irrigation.
- ◆ Promote air circulation and reducing leaf wetness thru increasing plant or row spacing, and pruning older leaves.
- ◆ Spray *Fusarium proliferatum*, F.p. @ 0.6g / liter of water.
- ◆ Use systemic chemicals (*Bavistin*, *Metalaxyl*, *Carbendazim*) as a last resort.

### 5. ALTERNARIA LEAF SPOT

The disease organism is seed and soil borne. The first symptom of the disease is the appearance of small greyish-brown to black specks about 1 to 2 mm in diameter. They usually are most conspicuous on the outer, older leaves. The spots enlarge in storage to sunken and



Black rot disease



Rhizoctonia Root Rot

black areas.

- ◆ Use hot-water-treated seed.
- ◆ Practice long rotations between susceptible crops (turnips, cabbage, rape, other crucifers).
- ◆ Apply fungicides at first sign of disease at 7 to 10 day intervals.

## 6. BLACK ROT

In the field, the disease is easily recognized by the presence of large yellow to yellow-orange "V"-shaped areas extending inward from the margin of a leaf, and by black veins in the infected area.

- ◆ Use disease-free seed. Seed should be treated with hot water (50°C for 25 minutes) to kill any bacteria.
- ◆ Practice plant bed sanitation. Under no circumstances should a site be used if it has a history of the disease. Great care must be practiced in order to avoid introducing the bacteria on tools, cultivating equipment, in run-off water, or by irrigation.
- ◆ Rotate cabbage plantings with crops outside the crucifer family.

## 7. RHIZOCTONIA ROOT ROT

- ◆ Use resistant varieties.
- ◆ Seedling treatment with Trichoderma, and Pseudomonas solution.
- ◆ Remove and destroy affected tissue, plant parts.
- ◆ Using solarized soil for seedbed.
- ◆ Improve soil aeration and drainage.

### Cole crops : Important of Insect Parasitoids:

Insect parasitoids have an immature life stage that develops on or within a single insect host, ultimately killing the host, hence the value of parasitoids as natural enemies is immense. Adult parasitoids are free-living and may be predaceous. Two of the major insect parasitoids of cole crops are described below:

#### Cotesia glomerata:

This wasp parasitizes larvae of the cabbage butterfly. It is most effective at reducing the populations of later generation.

#### Diadegma insulare:

This tiny wasp lays a single egg in a late-instar diamond back moth larva. When the caterpillar pupates, the wasp replaces the host cocoon with its own pupal case.



Cotesia glomerata adult



Cotesia parasitizing cabbage butterfly



Diadegma adult



Contact  
Information

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Funding

The Integrated Pest Management Innovation Lab (IPM IL) is supported by a grant from USAID and managed by Virginia Tech's Office of International Research, Education, and Development (OIRE).