Among various vegetables, tomato and cabbage are most common and extensively grown all over the country. These two vegetables, besides being a rich source of vitamins and minerals, occupy an important place in the food basket of Indian consumers. Tomato occupies an area of 0.47 m ha and cabbage 0.24 m ha, but their productivity remains very low. One of the major constraints identified in their production is the increasing incidence of insect pests, diseases, and nematodes, sometimes resulting in substantial yield losses. Due to their tender and succulent nature and their cultivation under high moisture & input regimes, tomato and cabbage are more prone to pest attack and at a conservative estimate cause about 30-35% losses. Introduction & cultivation of high yielding, short duration, off-season hybrids/varieties have not only brought about changes in their pest scenario but also resulted in availability of continuous and abundant food supply for the build up, perpetuation and multiplication of insect pests, diseases and nematodes.

To mitigate the losses due to these pests, a huge quantity of pesticides is used in tomato and cabbage and it is not unusual for the vegetable growers to give 8-10 sprays in these crops in a season without much increase in the yield. Thus the cabbage & tomato fruits are likely to retain high level of pesticide residues which may not only be hazardous to consumers but may affect the export quality as well. Further, the excessive reliance on chemicals has led to the problem of development of resistance, resurgence, environmental pollution and health hazards to farmers. It has also led to decimation of useful fauna & flora. With a view to minimize all these problems and to create awareness among the farmers, integrated pest management strategies for tomato & cabbage have been developed and validated.

**Key pests**

**Tomato**

**Fruit borer**: Full grown caterpillars are apple green with broken longitudinal stripes. Young larvae scrap and feed on tender foliage while advanced stage larvae bore circular holes and thrust part of their body inside the fruit and eat the contents.

**Mealy bugs**: Crawlers puncture the epidermis and start sucking the cell sap. Nymphs secrete honey dew where sooty mold develops which hinders the photosynthetic activity. Adults also secrete waxy material.

**Leaf Miner**: White long circular mines can be seen in old leaves. Young leaves have small and thin mines in them. The incidence is first noticed at nursery stage itself. The incidence increases with repeated sprayings of insecticides.

**White fly**: Nymphs and adults suck the sap on the ventral surface of leaves. The affected leaves wilt, fall and die. In nursery disease starts in patches and in 2-3 days entire lot of seedlings may collapse. Seedlings when infected appear pale green with brownish water soaked lesions.

**Damping off**: Mostly occurs at nursery stage. Plants suddenly wilt, fall and die. In nursery disease starts in patches and in 2-3 days entire lot of seedlings may collapse. Seedlings when infected appear pale green with brownish water soaked lesions.

**Early blight**: The leaves show small black specks and get enlarged gradually. Yellow halo can be seen around the black spots. When spots increase leaves fall. This disease may occur on all the plant parts.

**Late blight**: Disease may occur at any stage of the crop. Brown, purple or black spots may appear on any part of plant. Persistent moisture in soil increases the disease incidence, even fruit petioles get infected and base of the petiole becomes black.

**Leaf curl**: This is the major disease and is transmitted by whitefly. Leaves curl and flower and fruit set gets reduced due to disease. Plants are stunted due to shortening of internodes. Older curled leaves become leathery & brittle.

**Sun scald**: The sudden exposure of fruits to direct sunlight in hot, dry weather can cause sunscald. This results in white or yellow patches on the side of the tomato exposed to the sun.

**Buck eye rot**: This disease appears on unripe fruits and appears as small black circular concentric rings which get enlarged. There is no rotting of the skin but internal flesh may be discoloured upto the core.

**Red spider mite**: These mites suck the sap from undersurface of leaves and also from twigs. The affected parts become reddish brown and bronzy, wither and dry away. Red spider mites multiply rapidly during summer.

**Root knot nematode**: Microscopic, soil borne, verminiform pests. They feed vigorous on roots and cause galling of roots. Affected plants are weak, stunted with yellow leaves. When the nematode population is high, plants of a susceptible variety may die before reaching maturity.

**Integrated Pest Management Strategies**

**Nursery raising**

- Prepare raised nursery beds about 10 cm above ground level for good drainage to avoid damping off etc.
- Cover the beds with polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing for soil solarisation which will help in reducing the soil borne pests. Sufficient moisture should be present in the soil for solarisation.
- Mix 150 gm of fungal antagonist T. harzianum in 3 kg of FYM and leave for about seven days for enrichment. After 7 days mix in the soil in a bed of 3 sq. m.
- Treat the seeds of popular hybrids with T. viride @ 4 gm/kg.
- Use nylon net of 40 gauge mesh for leaf curl management.

**Cabbage**

**Fruit borer**: Full grown caterpillars are apple green with broken longitudinal stripes. Young larvae scrap and feed on tender foliage while advanced stage larvae bore circular holes and thrust part of their body inside the fruit and eat the contents.

**Mealy bugs**: Crawlers puncture the epidermis and start sucking the cell sap. Nymphs secrete honey dew where sooty mold develops which hinders the photosynthetic activity. Adults also secrete waxy material.

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Main crop

- Before transplanting, dip the roots of seedlings for 15 minutes in 3% mequanolate (0.3 ml/litre) for management of leafcurl.
- Transplant a row of marigold after every 16 rows of tomato as a trap crop.
- Marigold should be 15 days older than tomato plants so that they flower at the same time. Maximum egg laying by borer is observed on marigold flowers.
- First and last row of plots should be marigold and it should be sprayed with HSNPV.
- Adopt wide spacing of 60 x 45 cm (for varieties) and 90 x 60 cm (for hybrids) to reduce the chance of spread of diseases.
- Apply nem cake @ 250 kg/ha at 20 DAP to reduce fruit borer, leaf miner and nematode.
- Bird perches @ 10/acre should be erected for facilitating field visits of predatory birds.
- Spray dimethoate or thionemthoxam at 15 DAP for leaf miner & white fly control. Spray of 5% NSKE at 15 DAP has also been found to be effective against leaf miner.
- Phomorone traps @ 5/ha be installed for monitoring fruit borer activity. Replace the lures with fresh lures every 20-25 day interval. ETL for fruit borer is 8 to 10 moths/day/4trap.
- Monitor top three leaves for Helicoverpa eggs.
- Release of T. pretiosum @ 1.0 lakh/ha 4-5 times from flower initiation stage at weekly intervals for fruit borer.
- Spray HSNPV 250 LE/ha (2 x 10³ POB) 3 times at 28, 35 and 42 DAP to reduce borer damage.
- Regular collection & destruction of damaged fruits i.e. clean cultivation helps in management of borer effectively.
- If the borer incidence crosses ETL (5% damage), apply Ramox or Spinose or endosulfan @ 650 g a.i./ha.
- Rouge out and destroy leaf-curl & wilt affected plants.
- Apply neem cake @ 250 kg/ha at 20 DAP or management of leaf curl.
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