

- As free water is important for distribution and development of the diseases, efforts to reduce soil moisture will help to reduce disease severity.
- Application of *Trichoderma viride* or *Pseudomonas fluorescens* @ 5 kg/ha at the time of land preparation to suppress damping-off fungi.
- Periodically remove and destroy disease affected leaves.

2. Head rot of cabbage : Head rot of cabbage, often referred to as "white mold", is caused by the soil fungus *Sclerotinia sclerotiorum*. The fungus *S. sclerotiorum* causes disease when air temperatures are cool (15 to 25°C) and periods of wet weather associated with rain, high relative humidity and heavy dew occur together. Symptoms often first appear as water soaked spots on lower or upper cabbage leaves. As water soaked spots enlarge, infected tissue becomes soft, and some outer leaves begin to wilt. A white cottony growth becomes evident on the leaves as the disease progresses. Eventually the entire cabbage head is covered with this white cottony growth and the overwintering sclerotia begin to form. Initially sclerotia are white and round and later become black, hard and irregular in shape. The black sclerotia become visible on the outside of the cabbage head, but they also form inside the head.



Management

- Proper management of weeds and insects can reduce the occurrence of *Sclerotinia* head rot.
- Cultural practices such as planting in a well-drained soil away from the edges of a tree line and orienting rows in the direction of prevailing winds will help to reduce production of apothecia and spores by creating drier soil moisture conditions.
- Rotation, minimum of 3-4 years.
- Spray COC @ 2 g/l at weekly interval.

Nursery raising

- Prepare raised nursery beds about 10 cm above ground level for good drainage to avoid damping off. Cover the beds with black polythene sheet of 45 gauge (0.45 mm) thickness for three weeks before sowing for soil solarisation to reduce the soil borne pests. Sufficient moisture should be present in the soil.
- Seed treatment with *Trichoderma viride* @ 4g/kg of seed in nursery to prevent infection of soil borne/seed borne fungal 1 kg of FYM. Mix in 1 sq m. It can be applied even in main field. Spray nursery with *Bacillus thuringiensis* if DBM is noticed.

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ORGANIC MANAGEMENT OF PESTS AND DISEASES OF CABBAGE IN SIKKIM



National Initiative on Climate Resilient Agriculture

NICRA



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Cabbage is the major vegetable crop grown all over Sikkim during *Rabi* season. The crop is rich source of vitamin A, B and C. It has good amount of minerals such as phosphorus, calcium, potassium, iron and sulphur. It also contains high amount of fiber. The flavor in cabbage head is due to the presence of sinigrin (glycosides). Cabbage has medicinal properties and is useful for curing digestion problems. It is used as salad, cooked or processed. However, cabbage is an important cruciferous vegetable grown all over the country. The crop is prone to infestation by a number of insect pests consisting of sucking and defoliating insects at all the stages. Diamond back moth (DBM) (*Plutella xylostella* L.), cabbage aphid (*Brevicoryne brassicae* L.) and red ant (*Solenopsis invicta*) are regular pests of cabbage in Sikkim. Among these pests red ant is one of the serious pests during young stages of cabbage. Besides, damping off is a major disease infecting young seedlings.

INSECTS

1. Red ant : Red ants feed on cabbage roots but may chew through them when creating a nest nearby. However, red ant (*Solenopsis invicta*) feeds on almost all plant material including the roots of cabbage plant resulting the plant begins to wilt and die without a proper root system.



Management : Flooding the entire field for at least two hours minimizes the colonization of ants but due to scarcity of water during *Rabi*, the following measures are recommended.

- Application of neem cake @ 1250 kg/ha at the time of land preparation.
- Spray neem oil @ 15 ml/l of water at the site covering the soil surface thoroughly and surroundings where heavy colonization has appeared twice or thrice at an interval of 3 days followed by 5 ml/l of water at 10 days interval.

2. Diamond back moth : A patch of three diamond shaped yellowish white spots is visible by joining both the forewings, hence the name 'diamond back'. Young larvae feed by scrapping epidermal leaf tissues causing typical whitish patches. Advanced stage larvae bite holes in the leaves.



Management

- Grow mustard as an intercrop at 20:1 ratio to attract Diamond back moths for oviposition.
- Install pheromone traps @ 12 numbers/ha.
- Use light traps for adult DBM @ 3 traps/acre. Hang a bulb over a bucket of water. Within 3-4 days most of the adults get killed.
- Spray *Bacillus thuringiensis* @ 2 g/lit. of water if DBM 1.0/plant is noticed.
- Spray neem oil @ 6 ml/l of water at primordia formation (18-25 DAP- head initiation stage - most critical stage). Repeat if DBM is more than 1 no. per plant at 10-15 days interval. Maximum of 3-4 neem oil sprays in one crop season are required.
- Release parasite *Diadegma semiclausum* @ 50,000/ha, 60 days after planting.

3. Cabbage aphid : Aphids feed by sucking sap from their host plants. They produce a sugary waste product called honeydew, which is fed on by ants. In turn, the ants provide the aphids with protection from natural enemies. Continued feeding by aphids causes yellowing, wilting and stunting of plants. Severely infested plants become covered with a mass of small sticky aphids (due to honeydew secretions), which can eventually lead to leaf death and decay. Colonies of aphids are found on upper and lower leaf surfaces, in leaf folds, along the leafstalk, and near leaf axils.



Management

- Spray neem oil @ 6 ml/l of water at weekly interval.
- Spraying of 5 per cent nettle leaf extract on 45, 60 and 75 days after planting.

DISEASES

1. Damping off : The disease is caused by fungi or fungus-like microorganisms, *Pythium* spp., attack young seedlings of cabbage. These soil borne microorganisms can persist indefinitely in soil or plant debris. If the decay is after emergence, seedlings that fall over or die are said to "damp-off." Cool, cloudy weather, high humidity, wet soils, compacted soil, and overcrowding especially favor development of damping-off.



Damping-off kills seedlings before or soon after they emerge. Seedlings that emerge develop a lesion where the tender stem contacts the soil surface, and the seedling collapses. In some cases, the seedling may continue to grow even though the lesion girdles the stem. The lesion is quite sunken, and the stem resembles a wire, hence the name wirestem. The girdled seedling eventually dies.

Management

- Good seedbed management.
- Practice crop rotation.
- Deeply plough fields.
- Use certified disease-free seeds. If using own seed, hot water treatment can be used. Solarisation of seedbeds should be done where feasible.
- Thin the seedlings in seedbeds to permit good air circulation.
- Avoid excessive watering.
- Adopt wide spacing of 60 cm x 45 cm to reduce the chance of spread of diseases.
- Plant on raised beds to reduce moisture content in the root zone and provide the appropriate drainage in the field to prevent waterlogged conditions.
- Schedule planting times to avoid temperature and moisture conditions that are conducive to the pathogen. It also will reduce disease severity.