

### Introduction:

Kale, a nutritious and popular leafy green is vulnerable to various pests, diseases and environmental stress that reduces its quality as well as quantity, thereby rendering them unmarketable and also affecting the value of the crop for human consumption. So, by focusing on Integrated management approach - from cultural practices to organic and conventional control, we can maximize yield and produce high-quality, undamaged leaves.

**Insect Pests:** Common offenders include cabbage butterfly, cabbage loopers, aphids, flea beetles, and cutworms.

**Diseases:** Fungal and bacterial diseases like *Alternaria* leaf spot, black rot, downy mildew, and damping off can weaken or destroy plants.

**Environmental Stress:** Temperature fluctuations, improper irrigation, and poor soil health can make kale more susceptible to pests and diseases.

### Cultural practices:

- **Sanitation:** Some pests and disease producing organisms can overwinter in old crop debris, so removal of plant debris after harvest can reduce pest populations for the next season.
- **Crop rotation:** Pathogens can survive in the soil for years, rotating kale with non-brassica crops for at least three years helps prevent disease buildup by soil borne pathogens and pests.
- **Water management:** Irrigating the soil directly instead of overhead watering minimizes leaf wetness, thus preventing fungal and bacterial diseases.
- **Weed control:** Some weeds can serve as alternative host for pests and diseases. So weed free area reduces the overall pest population.
- **Fertilization:** Excessive nitrogen fertilizer application is not recommended, as it produces succulent foliage that attracts pests like aphids.

### Physical measures:

- ▶ **Floating row covers:** These fine mesh barriers prevent insects like flea beetles and cabbage moths.
- ▶ **Targeted Removal:** Hand plucking off the affected leaves can be effective in case of minimal disease infestation or insect damage by caterpillars and aphids.
- ▶ **Scouting:** Regular inspection of plants, both upper and undersides of leaves, for early signs of pests or disease.
- ▶ **Hot water treatment:** Hot water seed treatment at 50° for 15–25 minutes followed by 30 minutes dip in 200 ppm streptomycin (2 g/10 lit of water) can eliminate seed-borne bacterial pathogens of black rot.

### Biological control and Organic spray

- ❖ **Natural predators:** Encourage beneficial insects (predators) like lady bugs, lacewings, and parasitic wasps that prey on common kale pests such as aphids and caterpillars and help in controlling infestation naturally.
- ❖ **Bio-fungicides:** Commercial organic seed treatments with beneficial microbes viz., *Trichoderma harzianum* can prevent root rot and other soil-borne diseases.
- ❖ **Bio-pesticides:** Application of *Bacillus thuringiensis* (Bt) at larval stage is effective against caterpillar pests like cabbage loopers and armyworms. Application of *Beauveria bassiana* is effective against aphid and whitefly infestation.
- ❖ **Neem Oil:** Neem oil can be used against aphids, flea beetles and thrips.

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## Crop Protection Practices in Kale



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<p><b>Alternaria leaf blight</b> (<i>Alternaria brassicae</i>)</p>		<p>Small circular to irregular brown or dark grey spots appear on leaves often with concentric rings in the centre, forming yellow halo around the lesions.</p>	<p>Spray hexaconazole 5EC (0.03%) or copper oxychloride 50WP (0.25%) or mancozeb 75 WP (0.3%) twice or thrice at 15 days interval.</p>
<p><b>Black Rot</b> (<i>Xanthomonas campestris</i>)</p>		<p>Initially symptoms appear as irregular, dull yellow blotches at the leaf margin, which later on expands into a characteristic V-shaped lesion, eventually turns brown and necrotic in the center with a yellow halo.</p>	<p>Fortnight spray of streptomycin 2-4 g/10 lit water.</p>
<p><b>Diamond back moth</b> (<i>Plutella xylostella</i>)</p>		<p>The young larvae scrap off the epidermal leaf tissues forming typical whitish patches, internally feeds on it, leading to skeletonized leaves. The older larva feeds externally make holes in the leaves causing leaf defoliation and flower abortion.</p>	<p>Spray dichlorvos 76 EC @ 70 ml in 100 litres of water.</p>
<p><b>Cabbage butterfly</b> (<i>Pieris brassicae</i>)</p>		<p>Caterpillars scrape the leaf surface and eat up leaves from the margins leaving only the main veins causing skeletonization of leaves.</p>	<p>Spray dichlorvos 76 EC @ 70 ml in 100 lit of water or malathion 50 EC @ 140 ml in 100 liters of water.</p>
<p><b>Aphids</b> (<i>Brevicoryne brassicae</i>)</p>		<p>Both nymphs and adults suck the sap from the tender leaves of the plant and the affected leaves crinkle, curl or form cups.</p>	<p>Soil application of carbofuran @ 32.5 kg/ha and spray dimethoate 30 EC @ 100 ml in 100 litres of water.</p>
<p><b>Leaf Miner</b> (<i>Liriomyza brassicae</i>)</p>		<p>Squiggly white or pale irregular winding trails or tunnels just beneath the leaf surface, sometimes form blotchy, discoloured patches and tiny pale spots.</p>	<p>Spray dimethoate 30EC @ 100 ml in 100 litres of water.</p>