

# PLANT DISEASE DETECTION & RECOMMENDATION SYSTEM

(1. Define Scope & 2. Collect Data)

- 1) DEFINE SCOPE
- 2) COLLECT DATA
- 3) PREPROCESS DATA
- 4) CHOOSE MODEL
- 5) MODEL TRAINING
- 6) EVALUATE THE MODEL
- 7) DEPLOYMENT
- 8) FARMER USUABILITY
- 9) GATHER FEEDBACK

## 1. What are the plants and plant disease that leads to high loss in Tamil Nadu?

PLANT	DISEASE	Causal organism
Coconut	Coconut grey blight	Pestalotia palmarum (Cooke) Skey
Groundnut	Early leaf spot	Cercospora arachidicola
	Late leaf spot	Phaeoisariopsis personata
	Rust	Puccinia arachidis
	Collar rot / Seedling blight / Crown rot	Aspergillus niger and A. pulverulentum
	Root rot	Macrophomina phaseolina
	Ring mosaic / Bud necrosis / Bud blight	Groundnut bud necrosis virus
Corn	Maize northern corn leaf blight	(Exserohilum turcicum (Pass.)
Jowar		
Black Gram/ Green Gram	Root rot	Rhizoctonia bataticola
	Powdery mildew	Erysiphe polygoni
	Leaf spot	Cercospora canescens
	Rust	Uromyces phaseoli typical
	Yellow mosaic	Mungbean yellow mosaic virus (MYMV)
	Leaf crinkle	Urdbean leaf crinkle virus (ULCV)
Cotton	Fusarium wilt	Fusarium oxysporum f.sp. vasinfectum
	Verticillium wilt	Verticillium dahlia
	Root rot	Rhizoctonia solani
	Leaf blight	Alternaria macrospora
	Myrothecium leaf spot	Myrothecium roridum
	Areolate mildew	Ramularia areola
	Angular leaf spot / Black arm	Xanthomonas axonopodis pv. Malvacearum
Sugarcane	Red rot	Colletotrichum falcatum

	Sett rot or Pineapple disease	Ceratocystis paradoxa
	Whip smut	Ustilago scitaminea
	Mosaic	Sugarcane mosaic potyvirus
	Grassy shoot Disease (GSD)	Candidatus phytoplasma
	Phanerogamic parasite	Striga spp
Mango	Anthraxnose	Colletotrichum gloeosporioides
	Die back / Fruit Stem end rot	Lasiodiplodia theobromae
	Powdery mildew	Oidium mangiferae
	Grey leaf Blight	Pestalotia mangiferae
	Sooty Mould	Capnodium mangiferae C.ramosum
	Mango malformation	Fusarium moniliforme var. subglutinans
	Bacterial leaf black spot / canker	Xanthomonas campestris pv. mangiferaeindicae
	Red Rust	Cepbaleuros virescens

## 1) Coconut:

### 1. Coconut Grey Blight (Pestalotia palmarum (Cooke) Skey)

#### Symptoms:

- Appears first on **older leaves** (outer whorl).
- Small **yellow spots** with **greyish margins** develop on the leaflets.
- The center of the spots **turns greyish-white** with **dark brown margins** and a **yellow halo**.
- As the disease progresses, the leaf blade **dries out and shrivels**, giving a **blighted (burnt) look**.
- A large number of **black, round or oval acervuli** (fungal structures) appear on the upper surface of the leaves.

#### Pathogen Characteristics:

- The **fungus produces conidia (spores) inside acervuli**.
  - **Acervuli:** Black, cushion-shaped, and break open to release spores.
  - **Conidiophores:** Short, simple, and hyaline (transparent).
  - **Conidia (spores):**
    - **Five-celled** structure.
    - The **middle three cells** are **dark-colored**.
    - The **end cells** are **hyaline (transparent)**.
    - The spore has **3–5 slender, elongated appendages** at its apex.
- (Source: Rahman et al., 2013)

## 2) Groundnut:

### 1. Early Leaf Spot (*Cercospora arachidicola*)

- **Symptoms:**
    - Circular to irregular spots, reddish brown to dark brown.
    - Spots appear on the upper surface with a bright yellow halo.
    - Lesions on the lower surface are light brown.
  - **Key Indicators:**
    - Reddish-brown spots on upper surface.
    - Yellow halo around spots.
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### 2. Late Leaf Spot (*Phaeoisariopsis personata*)

- **Symptoms:**
    - Dark, small, circular spots scattered on leaves.
    - Lower surface lesions turn black.
    - Petioles and stems also have black lesions.
    - Leaves shed prematurely.
  - **Key Indicators:**
    - Dark circular spots.
    - Premature leaf shedding.
    - Black lesions on stems and petioles.
  - **Favorable Conditions:**
    - High humidity for 3 days.
    - Low temperature (20°C).
    - Dew on leaf surface.
    - Heavy nitrogen and phosphorus fertilizers.
    - Magnesium deficiency in soil.
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### 3. Rust (*Puccinia arachidis*)

- **Symptoms:**
    - Small powdery pustules on the lower surface of leaves.
    - Upper surface shows yellow discoloration, later turning brown.
    - Pustules on petioles and stems.
    - Severe infection causes leaf drying and shedding.
  - **Key Indicators:**
    - Powdery pustules on the lower surface.
    - Yellow to brown discoloration.
  - **Favorable Conditions:**
    - High relative humidity (above 85%).
    - Heavy rainfall.
    - Low temperature (20-25°C).
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#### 4. Collar Rot / Seedling Blight / Crown Rot (*Aspergillus niger* and *A. pulverulentum*)

- **Symptoms:**
    - **Post-emergence rot:** Circular brown spots on cotyledons and collar region.
    - **Crown rot:** Large brown lesions on the stem, leading to wilting.
  - **Key Indicators:**
    - Brown circular spots on cotyledons and collar.
    - Drooping leaves and wilting plants.
  - **Key Pathogen:** Fungus growth seen on affected regions.
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#### 5. Root Rot (*Macrophomina phaseolina*)

- **Symptoms:**
    - Reddish-brown discoloration on the stem near soil level.
    - Drooping leaves and branches; plant wilts.
    - White fungal growth on lesions.
    - Shredded bark and sclerotia (fungal growth) on roots.
  - **Key Indicators:**
    - Reddish discoloration near soil level.
    - Shredded bark and fungal growth on roots.
  - **Favorable Conditions:**
    - Prolonged rainy season, especially during the seedling stage.
    - Low-lying areas.
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#### 6. Ring Mosaic / Bud Necrosis / Bud Blight (Groundnut Bud Necrosis Virus)

- **Symptoms:**
    - Mottling and ring spots on leaves.
    - Reduction in leaf size and stunted plants.
    - Malformed, narrow leaves with necrotic lesions.
    - Streaks on stems and necrosis in buds.
  - **Key Indicators:**
    - Mottling and ring spots on leaves.
    - Stunted growth and necrotic lesions.
  - **Transmission:**
    - Spread by thrips (*Frankliniella schultzi* and *Thrips tabaci*).
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### 3) Corn:

#### 1. Maize Northern Corn Leaf Blight (caused by *Exserohilum turcicum*):

##### **Symptoms:**

- **Initial Stage:** Small, narrow, elongated, spindle-shaped spots on the leaves.
- **Progression:** These spots extend along the length of the leaf, becoming larger.
- **Older Plants:** Long, elliptical necrotic lesions that are straw-colored in the center with dark margins.

**Pathogen Characteristics:**

- **Fungal Features:** The mycelium (fungal threads) is brown and intercellular (found between cells).
- **Conidiophores (spore-producing structures):** Emerge through the stomata (pores on leaves), long, olivaceous (olive-colored), septate (with segments), and geniculate (bent).
- **Conidia (spores):** Olivaceous brown, 3-8 septate, and thick-walled.

**Disease Impact:**

- The disease causes **seed rot** and **seedling blight** in sorghum in addition to maize leaf blight.
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4) **Jowar:**

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5) **Black gram & Green gram:**

1. **Root Rot** (*Rhizoctonia bataticola*)

- **Symptoms:** Drooping and drying of leaves and branches, brown basal stem, shredded root bark, presence of spherical to irregular black sclerotia in tissues.
  - **Favorable Conditions:** Day temperature of 30°C, prolonged dry season followed by irrigation.
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2. **Powdery Mildew** (*Erysiphe polygoni*)

- **Symptoms:** White powdery growth on the upper leaf surface, turning grey and causing the leaves to become brown, especially severe during flowering and maturity.
  - **Favorable Conditions:** Warm, humid weather, particularly during late kharif and rabi seasons.
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3. **Leaf Spot** (*Cercospora canescens*)

- **Symptoms:** Small circular to irregular reddish spots on leaves, turning grey at the center, causing defoliation in severe cases, conidiophores and conidia in the center of lesions.
- **Favorable Conditions:** Humid weather and dense plant population.

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4. **Rust** (*Uromyces phaseoli* typical)

- **Symptoms:** Reddish-brown pustules on the lower leaf surface, leaves turning yellow, uredospores (brown, echinulate), and teliospores (elliptical, papillate).
- **Favorable Conditions:** Cloudy, humid weather, temperatures between 21-26 °C, nights with heavy dew.

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5. **Yellow Mosaic** (Mungbean Yellow Mosaic Virus (MYMV))

- **Symptoms:** Small, irregular yellow patches on leaves that enlarge and cover the whole leaf, leading to complete yellowing; pods become yellow, small, and distorted.
- **Favorable Conditions:** Transmitted by whiteflies (*Bemisia tabaci*), prevalent in summer crops, with weed hosts serving as reservoirs for inoculum.

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6. **Leaf Crinkle** (Urdbean Leaf Crinkle Virus (ULCV))

- **Symptoms:** Puckered, curled leaves, stunted plants, bushy appearance, deformed inflorescences, and seldom-open flowers.
  - **Favorable Conditions:** Presence of weed hosts like *Aristolochia bracteata* and *Digera arvensis*, continuous cropping of other legumes, and primary infection via infected seeds. Secondary spread can occur through whiteflies.
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6) **Cotton:**

1. **Fusarium Wilt** (*Fusarium oxysporum f.sp. vasinfectum*)

- **Symptoms:** Wilting of plants starting from the base, yellowing and dropping of leaves, stunted tap root, black streaks on roots and stem, hyphal growth in vascular bundles.
- **Favorable Conditions:** Soil temperature of 20-30 °C, hot and dry periods followed by rains, heavy black soils with an alkaline reaction, excessive nitrogen and phosphorus fertilizers, wounds caused by nematodes and weevil grubs.

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2. **Verticillium Wilt** (*Verticillium dahlia*)

- **Symptoms:** Stunted plants, bronzing of veins, interveinal chlorosis, leaf yellowing and scorched appearance, pinkish discoloration of infected stem and roots.
- **Favorable Conditions:** Low temperatures (15-20 °C), ill-drained, heavy, alkaline soils, high nitrogen fertilizer usage.

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### 3. Root Rot (*Rhizoctonia solani*)

- **Symptoms:** Sudden wilting, root decay, shredded bark on roots and stem, presence of sclerotia on affected tissue.
  - **Favorable Conditions:** Dry weather following heavy rains, high soil temperature (35-39°C), cultivation of favorable hosts (vegetables, oilseeds, legumes), wounds caused by weevil grubs and nematodes.
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### 4. Leaf Blight (*Alternaria macrospora*)

- **Symptoms:** Brown, round or irregular necrotic spots with concentric rings, spots merge into larger patches, infected leaves wither.
  - **Favorable Conditions:** High humidity, intermittent rains, moderate temperature (25-28°C).
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### 5. Myrothecium Leaf Spot (*Myrothecium roridum*)

- **Symptoms:** Circular spots with grey centers and dark brown margins, centers of spots dry out leaving shot holes.
  - **Favorable Conditions:** Generally associated with humid conditions but specific favorable conditions were not provided.
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### 6. Areolate Mildew (*Ramularia areola*)

- **Symptoms:** Irregular to angular lesions on the lower leaf surface, pale white spots bound by veinlets, frosty white fungal growth, chlorosis and yellowing of leaves.
  - **Favorable Conditions:** Wet, humid conditions during winter cotton season, intermittent rains during North-East monsoon, low temperatures (20-30°C), excessive nitrogen fertilizer application, close planting, early or late sowing.
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### 7. Angular Leaf Spot / Black Arm (*Xanthomonas axonopodis* pv. *Malvacearum*)

- **Symptoms:**
  - **Angular Leaf Spot:** Brown to black water-soaked spots on leaves, restricted by veins.
  - **Black Vein:** Blackened veins with bacterial ooze forming encrustations.
  - **Black Arm:** Elongated black lesions on stems and branches, causing branch breakage.
  - **Boll Rot:** Sunken, water-soaked lesions on bolls, premature opening and shedding, yellow lint due to bacterial ooze.
- **Favorable Conditions:** Soil temperature of 28°C, atmospheric temperature of 30-40°C, relative humidity of 85%, early sowing,

delayed thinning, poor tillage, late irrigation, potassium deficiency, rain followed by sunshine.

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## 7) Sugarcane

### 1. Red Rot (*Colletotrichum falcatum*)

- **Symptoms:** Red margin and straw-colored center on the midrib of leaves, acervuli (black dots) in the center, leaf breakage at lesions, red internal tissues in canes, hollow stalks.
  - **Favorable Conditions:** Monoculturing of sugarcane, successive ratoon cropping, waterlogged conditions, insect injuries.
  - **Management:**
    - Use resistant varieties like Co86249, CoSi95071, CoG 93076, CoC 22, CoSi 6, and CoG 5.
    - Treat setts with Carbendazim (Carbendazim 50 WP, 0.05%, or Carbendazim 25 DS, 0.1%) with 1% Urea.
    - Increase irrigation interval to 15 days during tillering and growth phases, and 25 days during maturity.
    - Remove affected clumps early and apply soil drenching with Carbendazim or lime.
    - Rotate with rice for one season and other crops for two seasons.
    - Burn the trash after harvest.
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### 2. Sett Rot or Pineapple Disease (*Ceratocystis paradoxa*)

- **Symptoms:** Central core of affected sett tissue turns black, cavities form, rotting tissues emit a pineapple odor.
  - **Favorable Conditions:** Poorly drained fields, heavy clay soils, temperature of 25-30°C, prolonged rainfall after planting.
  - **Management:** Ensure proper drainage and soil management to avoid waterlogging, and maintain appropriate planting conditions.
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### 3. Whip Smut (*Ustilago scitaminea*)

- **Symptoms:** Stunted plants with a central shoot transformed into a long, curved whip-like sorus, covered by a silvery membrane which ruptures to expose a dark mass of teliospores.
- **Favorable Conditions:** Monoculturing of sugarcane, continuous ratooning, and dry weather during the tillering stage.
- **Management:**
  - Use resistant varieties such as Co86249, CoG 93076, CoC 22, CoSi6, and CoG 5.



- Treat setts with fungicides like Triadimefon (0.1%) or Carbendazim (0.1%) for 10 minutes.
  - Use Aerated Steam Therapy (AST) or hot water treatments at specified temperatures.
  - Remove and burn smut whips and discourage ratooning if infection exceeds 10%.
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#### 4. **Mosaic** (*Sugarcane mosaic potyvirus*)

- **Symptoms:** Chlorotic stripes alternating with dark green areas on young leaves, yellow stripes on leaf sheaths and stalks.
  - **Management:** Manage vector populations like aphids and ensure the use of healthy setts for planting. Avoid planting infected crops to prevent virus transmission.
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#### 5. **Grassy Shoot Disease (GSD)** (*Candidatus phytoplasma*)

- **Symptoms:** Excessive tillering, lanky growth, pale green to white leaves, shortened internodes, bushy appearance.
  - **Management:** Control aphid vectors (e.g., *Melanaphis sacchari* and *Raphalosiphum maidis*) and ensure proper crop management practices to minimize disease spread.
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#### 6. **Phanerogamic Parasite** (*Striga spp*)

- **Symptoms:** Partial root parasite with chlorophyll-bearing leaves, stunted plants due to nutrient and water extraction by the parasite.
  - **Management:**
    - Regular weeding and intercultural operations during the early stages of parasite growth.
    - Spray Fernoxone (sodium salt of 2,4-D) at 450g/500 liters of water.
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### 8) **Mango:**

#### 1. **Anthracnose** (*Colletotrichum gloeosporioides*):

- Affects leaves, panicles, twigs, and fruits.
- Wet and humid conditions favor the disease, especially during flowering.
- Symptoms include brown to black lesions on leaves, black spots on panicles, and premature fruit drop.

- Management includes pruning, proper sanitation, and fungicide sprays with Carbendazim, Mancozeb, and *Pseudomonas fluorescens*.
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**2. Die Back / Fruit Stem End Rot (*Lasiodiplodia theobromae*):**

- Causes drying of twigs, branches, and fruit rotting.
  - High summer temperatures and humidity favor the disease.
  - Symptoms include gum exudation and brown streaking on old branches.
  - Management includes pruning infected plant parts, spraying with Carbendazim and Mancozeb, and harvesting fruits with stalks to avoid infection.
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**3. Powdery Mildew (*Oidium mangiferae*):**

- Affects leaves, panicles, and young fruits.
  - Cool, dry conditions favor disease development.
  - Symptoms include white powdery growth on leaves and panicles, causing premature leaf drop and fruit distortion.
  - Management involves pruning, fungicide sprays with Wettable Sulphur, Dinocap, and Tridemorph.
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**4. Grey Leaf Blight (*Pestalotia mangiferae*):**

- Causes brown spots on leaves that coalesce and lead to defoliation.
  - Heavy infection occurs during monsoon conditions with moderate temperatures.
  - Management includes removing infected plant parts and spraying with Copper oxychloride or Mancozeb.
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**5. Sooty Mould (*Capnodium mangiferae*):**

- Associated with insect activity like mealy bugs and hoppers, which secrete honeydew.
  - Black mould forms on leaves, reducing photosynthetic activity.
  - Management includes pruning affected branches, controlling insects, and spraying starch solution to remove mould.
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**6. Mango Malformation (*Fusarium moniliforme*):**

- Causes abnormal growth like bunchy tops and floral malformation.
  - Disease spreads through infected propagation material and is prevalent in cooler temperatures.
  - Management includes destroying diseased plants, pruning, and spraying Carbendazim or Captafol.
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**7. Bacterial Leaf Black Spot / Canker (*Xanthomonas campestris* pv. *mangiferae-indicae*):**

- Affects all above-ground parts, leading to fruit drop and yield loss.
  - Humid, wet conditions and mechanical injuries facilitate the spread of bacteria.
  - Management includes field sanitation, spraying Streptocycline or Agrimycin, and copper oxychloride for bacterial control.
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**8. Red Rust (*Cephaleuros virescens*):**

- Caused by algae, leading to reduced photosynthetic activity.
  - High humidity and closed plantations favor disease development.
  - Management includes nutrient supply, spraying Bordeaux mixture, and pruning.
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**Integrated Disease Management (IDM):**

- Proper sanitation, pruning, and strategic spraying with fungicides like Carbendazim, Mancozeb, and copper compounds are key management strategies.
- Regular application of beneficial bacteria like *Pseudomonas fluorescens* helps reduce anthracnose incidence.
- Reducing post-harvest fungal infections involves dipping fruits in hot water or a hot water-Carbendazim mix.

These strategies aim to reduce the impact of diseases on mango orchards, improving fruit quality and yield through proactive care, environmental management, and appropriate chemical treatments.

**Reference:**

- [Knowledge Based Information on Coconut: Planting Seasons & Climate](#)

**2. Collect at least 2 datasets for all disease for all the plants mentioned below: Coconut, Groundnut, Corn, Jowar, Black gram, green gram, Cotton, Sugarcane, and Mango. Also learn about the features and nature of the dataset.**

**Dataset Citations:**

- [Research Data - Mendeley Data](#)
- [A novel groundnut leaf dataset for detection and classification of groundnut leaf diseases - ScienceDirect](#)
- [Dataset of groundnut plant leaf images for classification and detection - Mendeley Data](#)
- [Mango Leaf Disease Dataset - Mendeley Data](#)
- [Mango Leaf Diseases Dataset](#)

- [MangoLeafBD Dataset - Mendeley Data](#)
- [MLD24: An image dataset for mango leaf disease detection - Mendeley Data](#)
- [Cotton Leaf Disease Dataset with Severity Levels - Mendeley Data](#)
- [CoSEV: A cotton disease dataset for detection and classification of severity stages and multiple disease occurrence - Mendeley Data](#)
- [Cotton leaves Dataset for diseases classification using EfficientNet Model - Mendeley Data](#)
- [Cotton - Pest and Disease](#)
- [Construction of a Dataset for Knowledge Atlas of Cotton Diseases and Pests](#)
- [Image Dataset for Disease Detection in Black Gram \(Vigna mungo\) Leaves: A Resource for Machine Learning Research - Mendeley Data](#)
- [Corn southern leaf blight dataset](#)
- [southern corn rust dataset](#)
- [Corn rust dataset](#)
- [Corn northern leaf blight dataset](#)
- [Coconut Tree Disease Dataset - Mendeley Data](#)
- [Coconut Diseases and Pest Infestations](#)