DISEASES OF FIELD CASH CROPS AND THEIR MANAGEMENT
DISEASES OF SOYBEAN (Glycine max)

- **Brown Spot** - *Septoria glycines* (*Mycosphaerella uspenskajae*)
- **Pod rot** -
- **Bacterial Pustule** - *Xanthomonas axonopodis pv. glycines*
- **Target leaf spot** - *Corynespora cassiicola*
Brown Spot of Soybean

DISEASE: Brown Spot
PATHOGEN: Septoria glycines
HOSTS: Soybean
Symptoms and Signs

Small dark brown spots bearing pin head pycnidia develop on both surfaces of leaves. These spots may coalesce together to create irregular brown blotches on the leaves. Infection begins on the lower leaves and progresses upward. Infected leaves turn brown and yellow and may drop prematurely.
Pycnidia with conidia
Pre-disposing factors

- Wet-warm weather,
- Monoculture of soybeans and
- Minimum tillage.
*Septoria glycines* overwinters on infected plant debris as *pin head pycnidia* and occasionally on seed. The pathogen spreads in the form of conidia released from the soil (pycnidia) to lower soybean leaves by splashing rain. Epidemics can occur in seasons with frequent rainfall. The spread of the fungus stops during hot and dry weather.
Management strategy

• Use disease free seed.
• Removal and destruction of infected plant debris.
• Deep tillage.
• Crop rotation.
Bacterial Pustule of Soybean

DISEASE: Bacterial Pustule
PATHOGEN: Xanthomonas axonopodis pv. glycines
HOSTS: Soybean
Symptoms and Signs

Bacterial pustules form in shape of angular lesions on the leaves with yellow halos. A small raised pustule usually develops at the centre of the lesion especially on the lower leaf surface. A magnification device (hand lens, microscope, etc.) is needed for diagnosis.
Magnification of bacterial pustules on a soybean leaflet.
Pre disposing factors

• Warm-humid weather conditions and
• Frequent showers prevail during growing season.
The bacterium survives in crop residue and seed. The primary infection starts mainly from the seed-borne bacterium. The secondary spread of the bacteria may be through wind, wind blown rain splash, irrigation water, insects and other implements. The bacterium enters through natural openings or insect caused wounds. Rain splashes play an important role in the development and spread of the disease.
Management strategy

• Use certified disease free seed.
• Removal and destruction of infected plant debris.
• Crop rotation with grain crop is recommended.
• Two sprays at 45 and 55 DAS with a mixture of Blitox @ 0.2% + Streptocycline @ 250ppm effectively control the disease.
Target leaf Spot of Soybean

DISEASE: Target leaf Spot or Root and Stem Rot

PATHOGEN: Corynespora cassiicola

HOSTS: Soybean
Symptoms and Signs

The disease affects the leaves, stems, pods, seeds, hypocotyls and roots. The reddish brown leaf lesions are round to irregular varying from specks to mature spots. A dull green or yellowish green halo commonly surrounds the lesions, which often become concentrically ringed at maturity–hence the name target spot. Severely infected leaves fall prematurely.
Dark brown spindle shaped lesions form on petiole and stem. Small blackish brown round lesions are formed on pods. Dark reddish brown round to oval lesions form on the hypocotyls and roots sometimes girdling the lateral roots. The lesions turn a dark violet brown when the fungus sporulates, producing masses of conidiophores and conidia.
Pre-disposing factors

- Cool-humid weather conditions and
- Frequent showers prevail during growing season.
- Leaf wetness
- Soil temperatures of 15° to 18° C are optimal for infection and disease development.
The *Corynespora* fungus perpetuates in infected soybean debris and seeds and can survive in fallow soil for more than two years. In cool-humid weather, the fungus sporulates abundantly on the cotyledons, stems, and leaves as violet brown lesions producing masses of conidiophores and conidia. The microscopic spores are wind-borne and rain-splashed to other leaves and stems where secondary infections occur. The fungus can colonize a wide range of plant residues in soil as well as the cysts of the soybean cyst nematode (*Heterodera glycines*).
Management strategy

- Grow disease-resistant cultivars.
- Use certified disease free seed.
- Removal and destruction of infected plant debris.
- Crop rotation with corn, sorghum, small grains, alfalfa, or forage grasses.
- Two sprays of Propiconazole-Tilt 25 EC @ 0.1% at 15 days interval.
Pod rot of Soybean

DISEASE: Pod rot

PATHOGEN: Diaporthe phaseolorum var. sojae and Phomopsis longicolla

HOSTS: Soybean
Symptoms and Signs

Phomopsis pod and stem blight are readily apparent after the plants reach physiological maturity. Dead petioles, stems, and pods may be covered with small black specks, which are the fruiting bodies of the fungus (pycnidia). The pycnidia are usually arranged in parallel rows along the stem. During less favorable weather conditions, pycnidia may be confined to small areas of the stem near the soil surface or around the lower nodes of the stem. Pycnidia are found scattered on discolored and poorly developed pods.
Pre disposing factors

- Warm-wet weather.
- Prolonged wet periods after flowering and pod set favor the infection and development of pod and stem blight.
- Higher soil temperature.
Phomoposiosis - Diaporthe fungi overwinter as pycnidia on soybean residues that were infected the previous season. In the spring, spores ooze from the pycnidia and are splashed by rain onto the plants where they infect stems and developing pods. When infected seeds are planted, poor emergence and stands result from seedling death. Higher soil temperature favors the development of seed rot and seedling blight phase.
Management strategy

- Grow disease-resistant cultivars.
- Use certified disease free seed.
- Removal and destruction of infected plant debris.
- Crop rotation with wheat or corn.
- Spray Propiconazole-Tilt 25 EC @ 0.1% at midflowering to late pod stage at 15 days interval.
DISEASES OF BLACK GRAM (*Vigna mungo*)- MASH and GREEN GRAM (*Vigna radiata*)- MOONG
ANTHRACNOSE of BLACK GRAM (*Vigna mungo*)- MASH and GREEN GRAM (*Vigna radiata*)-MOONG

DISEASE: Anthracnose
PATHOGEN: *Colletotrichum lindemuthianum*
HOSTS: Black gram (*Vigna mungo*)- MASH and Green gram (*Vigna radiata*)-MOONG
The fungus attacks all aerial plant parts at any stage of plant growth. Characteristic symptoms are circular, black, sunken spots with dark center and bright red orange margins on leaves and pods. In severe infections, the affected parts wither off. Seedlings get blighted due to infection soon after seed germination.
Pre disposing factors

• Cool-wet weather.
• The temperature range for infection is 13-26º C
• High relative humidity (>90%).
Colletotrichum lindemuthianum overwinters in crop debris or seed as acervuli and hence, soil and seed borne. Conidia spread through wind and rain. The temperature range for infection is 55-80°F and high relative humidity (>90%) is also required.
Management strategy

- Grow disease-resistant cultivars.
- Use certified disease free seed.
- Crop rotation with wheat or corn.
- Seed treatment-Hot water (52°C for 11 minutes) or Carbendazim or Thiram @ 2 g/kg of seed 24 hours.
- Spray mancozeb or carbendazim @ 0.25% at 10 and 15 days intervals.
Macrophomina Blight of **BLACK GRAM** (*Vigna mungo*)- MASH and **GREEN GRAM** (*Vigna radiata*)- MOONG

**DISEASE:** Macrophomina Blight  
**PATHOGEN:** *Macrophomina phaseolina*  
**HOSTS:** Black gram (*Vigna mungo*)- MASH and Green gram (*Vigna radiata*)- MOONG
Symptoms and Signs

• In pre-emergence stage, the fungus causes seed rot and also rotting of germinating seedlings.

• In post-emergence stage, seedlings get blighted due to soil or seed borne infection.

• Decay of secondary roots and shredding of the cortex region of the tap root are symptoms.

• Small, circular, brown spots appear on the cotyledons or on young leaves.

• At pod formation stage, some of the veins in the leaf develop coppery colour.

• As the severity increases, drooping of leaves occurs due to weakening and breakage of the veins. Such leaves droop, dry and shed.
Sclerotial development of *Macrophomina phaseolina*

**A**. Proliferation of a single hypha; **B**. aggregation of several hyphae; and **C**. mature sclerotum. (Reprinted, by permission, from Jackson and Bell, 1966)

- **Pycnidia**
- **Conidia**
- **Ruptured Pycnidium**
Sclerotial development of *Macrophomina phaseolina*
Pre disposing factors

- Warm -humid conditions
- High crop densities impact disease severity.
## Disease cycle

The pathogen can survive in seed, soil, diseased plant parts and collateral host plants. Fungus survives in upper layers of the soil and enters plant through stem. The severity of the disease increases with the increase in temperature.
Management Strategy

Host resistance
• Grow Resistant varieties.

Biological control
• *Trichoderma* bioformulations-through seed dressing and soil application

Cultural control.
• Deep ploughing.
• Clean cultivation.
• Crop rotation with a non pulse crop.

Chemical control:
• Seed treatment with carbendazim + Thiram in the ratio of 1:2.
BLIGHT of BLACK GRAM (Vigna mungo)-MASH and GREEN GRAM (Vigna radiata)-MOONG

DISEASE: Blight
PATHOGEN: Rhizoctonia solani
HOSTS: Black gram (Vigna mungo)-MASH and Green gram (Vigna radiata)-MOONG
Symptoms and Signs

- The pathogens cause seed decay, root rot, damping-off, seedling blight, stem canker and leaf blight.
- The disease occurs commonly at podding stage.
- In the initial stages, the fungus causes seed rot, seedling blight and root rot symptoms.
• The affected leaves turn yellow in colour and brown irregular lesions appear on leaves.
• On coalescence of such lesions, big blotches are formed and the affected leaves start drying prematurely.
• Roots and basal portion of the stem become black in colour and the bark peels off easily.
• The affected plants dry up gradually.
• When the tap root of the affected plant is split open, reddening of internal tissues is visible.
Pre disposing factors

- Warm -humid conditions
- Water logged conditions.
- High crop densities impact disease severity.
Rhizoctonia solani survives in the soil and on infected crop debris as sclerotia or mycelium. Sclerotia are known to survive for several years in the soil. The fungi spread by water (flooding), irrigation, movement of contaminated soil, and plant debris. At the onset of the growing season, in response to favorable humidity and temperatures (15 to 35°C), fungal growth is attracted to freshly planted host crops by chemical stimulants released by growing plant cells. The fungi infect plants, leading to characteristic symptoms on the stem, sheaths, leaves and ears. The fungi overwinter as sclerotia or in
Host resistance
• Grow Resistant varieties.

Biological control
• *Trichoderma* bioformulations-through seed dressing and soil application

Cultural control
• Composting of hardwood.
• Fields should be well drained prior to planting.
DISEASE: Wilt
PATHOGEN: *Fusarium oxysporum*
HOSTS: Black gram (*Vigna mungo*) - MASH and Green gram (*Vigna radiata*) - MOONG
Withering (Drying up) of plant occurs at two stages of crop growth- seedling and flowering or adult stage. Vascular discoloration is observed on longitudinal splitting of stem. Partial wilt also happens when only a few branches are affected.
Pre disposing factors

• High soil temperature
• High soil moisture
• Monoculture and
• Presence of weed hosts
The fungus may be **seed-borne** and survives in infected plant debris in **soil** in the form of **chlamydospores** or **macro** and **micro-conidia**. The primary infection is through chlamydospores in soil, which remain viable up to next crop season. The weed hosts also serve as a source of inoculum. The secondary spread is through irrigation water, cultural operations and implements.
Management Strategy

- Grow resistant varieties.
- Treat the seeds with Carbendazim or Thiram at 2 g/kg seeds or with Trichoderma harzianum at 4 g/kg of seed.
- Apply heavy doses of organic manure or green manure.
- Crop rotation with non-host crops.
POWDERY MILDEW of BLACK GRAM (*Vigna mungo*)- MASH and GREEN GRAM (*Vigna radiata*)-MOONG

DISEASE: Powdery mildew

PATHOGEN: *Erysiphe polygoni*

HOSTS: Black gram (*Vigna mungo*)-MASH and Green gram (*Vigna radiata*)-MOONG
Symptoms and Signs

Small, irregular powdery spots appear on the upper surface of the leaves. When the infection is severe, both surfaces of the leaf are completely covered by whitish powdery growth and foliage becomes yellow causing premature defoliation. The white powdery spots completely cover the petioles, stem and even the pods. The plant assumes greyish white appearance at later stage.
Pre disposing factors

• Warm-less weather.
• The disease is severe generally during late *kharif* and *rabi* seasons.
The fungus is an obligate parasite and survives as **cleistothecia** in the infected plant debris. Primary infection is usually from **ascospores** released from **perennating cleistothecia**. The secondary spread is carried out by the **air-borne conidia**. **Rain splash** also helps in the spread of the disease.
Management Strategy

- Remove and destroy infected plant debris.
- Spray twice with Carbendazim or Thiophanate methyl or Tridemorph @0.1%, one immediately after disease appearance and the second after 15 days.
- Grow tolerant black gram cultivar like Krishnayya and green gram cultivars like JGUM 1, TARM 1, Pusa 9072, WGG 48 and WGG 62.
Cercospora leaf spot of BLACK GRAM (Vigna mungo)- MASH and GREEN GRAM (Vigna radiata)-MOONG

DISEASE: Cercospora leaf spot
PATHOGEN: Cercospora canescens
HOSTS: Black gram (Vigna mungo)- MASH and Green gram (Vigna radiata)-MOONG
Symptoms and Signs

Small, circular spots develop on the leaves with grey centre and reddish brown margins. The several spots coalesce to form brown irregular lesions. Under favourable environmental conditions, severe leaf spotting and defoliation occurs at the time of flowering and pod formation. The brown lesions may be seen on petioles, branches and pods in severe cases.
Pre disposing factors

• Cool-Humid weather
• Dense plant population.
The fungus survives on diseased plant debris in soil and on seeds. The secondary spread is by airborne conidia.
Management Strategy

• Remove and burn infected plant debris.
• Spray **Mancozeb@0.25%** or **Carbendazim@0.1%**
• Grow tolerant black gram varieties like UG 135, TPU 4, TPU 5, TPU 11, TPU 12, AKU 4 and SP 21
Yellow mosaic of Black Gram (Vigna mungo)- MASH and Green Gram (Vigna radiata)-MOONG

DISEASE: Yellow mosaic
PATHOGEN: Mungbean yellow mosaic virus
HOSTS: Black gram (Vigna mungo)- MASH and Green gram (Vigna radiata)-MOONG
Initially irregular yellow and green patches alternating with each other. The yellow discoloration slowly increases and newly formed leaves may completely turn yellow. Infected leaves also show necrotic symptoms and infected plants normally mature late and bear a very few flowers and pods. The pods are small and distorted.
Pre disposing factors

- Summer sown crops are highly susceptible.
- The presence of weed hosts viz., *Croton sparsiflorus*, *Eclipta alba* and *Cosmos pinnatus* and legume hosts.
The virus survives in the weed hosts and other legume crops. The disease spreads through white fly, *Bemisia tabaci*.
Management Strategy

- Remove the weed hosts periodically.
- Increase the seed rate (25 kg/ha).
- Grow resistant black gram varieties like Teja, and Pant-30
- Grow resistant green gram varieties like LGG 407 and ML 267.
- Treat seeds with Imidacloprid 70 WS @ 5ml/kg to control vector.
- Give one foliar spray of systemic insecticide (Dimethoate @ 750 ml/ha) on 30 days after sowing.
Leaf crinkle of **BLACK GRAM** *(Vigna mungo)*- MASH and **GREEN GRAM** *(Vigna radiata)*-MOONG

**DISEASE:** Leaf crinkle

**PATHOGEN:** *Leaf crinkle virus*

**HOSTS:** Black gram *(Vigna mungo)*- MASH and Green gram *(Vigna radiata)*-MOONG
The symptom appears initially in young leaves. The enlargement of 4th or 5th leaf is seen four or five weeks after sowing. Later crinkling and curling of the tips of leaflets are seen. The petioles as well as internodes are shortened. The infected plant gives a stunted and bushy appearance. Inflorescence, if formed, is malformed and turns with small size flower buds and fails to open.
Pre disposing factors

• The presence of weed hosts like *Aristolochia bracteata* and *Digera arvensis*.

• Kharif season crop is highly susceptible.

• Continuous cropping of other legumes which also harbour the virus.
The virus is seed-borne and primary infection occurs through infected seeds. **White fly, Bemisia tabaci,** helps in the secondary spread. The virus is also transmissible through aphids and **Epilachna** beetles.
Management Strategy

- Use increased seed rate (25 kg/ha).
- Hot water treatment of the seed at 550°C for 30 minutes.
- Cultivate seed crop during rabi season.
- Remove weed hosts periodically.
- Spray Monocrotophos or Methyl demeton on 30 and 40 days after sowing at 500 ml/ha.
Leaf crinkle of **BLACK GRAM**
(*Vigna mungo*) - MASH and **GREEN GRAM**
(*Vigna radiata*) - MOONG

**DISEASE:** Leaf crinkle

**PATHOGEN:** *Leaf crinkle virus*

**HOSTS:** Black gram
(*Vigna mungo*) - MASH and Green gram
(*Vigna radiata*) - MOONG