MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Sc (Hons) Agriculture

Semester	:	V (New)	Academic Year	:	2019-20	
Course No.	:	PATH-354	Title	:	Diseases of Field and Horticultural crops & their Management - I	
Credits	:	3(2+1)				
Day & Date	:		Time			Total Marks: 80

1. Solve ANY EIGHT questions from SECTION "A".
4. All questions from SECTION "B" are compulsory.
5. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

Model Answer Paper
SECTION "A"

Q.1 **Write symptoms and management of following diseases (Any two).**
1. Foot rot of papaya 2. Panama wilt of banana 3. Phomopsis blight of brinjal

1. Foot rot of papaya :

Symptoms : **(2 Marks)**

1. Water soaked patches develop on the stem at the ground level.
2. Patches enlarge and diseased tissues turn brown and rot.
3. Because of rotting the basal portion of stem is girdled affecting the upward flow of water and nutrients and weakening the plant.
4. Internal tissues of bark appear dry and give **honey comb appearance.**
5. Infection spreads to roots and causes decay.
6. Terminal leaves turn yellow, wither and droop.
7. Fruits shrivel and drop off.
8. Entire plant topples over and dies.

Management : **(2 Marks)**

1. Avoid flood irrigation, destruction of affected plants from the orchard.
2. Seed treatment with Thiram or Captan 4 g/kg.
3. Drenching with Copper oxychloride 0.25 % or Bordeaux mixture 1% or Metalaxyl 0.1%.

2. Panama wilt of banana :

Symptoms : **(2 Marks)**

1. Leaves :
   - Symptoms initially seen in **older plants** as faint yellow streaks on the petiole of oldest, lower most leaves.
   - **Affected leaves show progressive yellowing, break at the petiole and hang down along the pseudostem.**
   - Young leaves may not dry up but remain erect and they also get affected under severe cases **(Heart leaf alone remains upright).**
2. Pseudostem :
3. Varying degrees of **longitudinal splitting** along pseudostem, light yellow to dark brown **vascular discolouration.** The fungus grows and blocks the vascular system resulting in **wilting** of the plant.
4. Affected plants give characteristic ***odour of rotten fish.***
5. Fruits : Affected plants do not produce bunches. Even if produced, **fruits are malformed and ripen prematurely or irregularly.** However, the pathogen does not infect the fruits.
6. Roots : Roots of diseased rhizomes are frequently blackened and decayed.

Management : (2 Marks)

1. Use of disease free suckers for planting.
2. Avoid ill drained soils, and prefer slightly alkaline soils (7-7.5 pH) for cultivation.
3. Flood fallowing for 2 to 6 months or crop rotation with rice.
4. Application of lime (1-2 kg/pit) to the infected pits after chopping of the plants parts.
5. Dipping of suckers in Carbendazim (0.1%) solution before planting.
6. Soil drench with 0.1 % Carbendazim or Vapam @ 850 g / 100 lit of water.
7. Growing resistant Cavendish varieties, *viz.*, **Basrai** (Vamanakeli), **Poovan** (Karpura chakkarakeli), **Moongil, Peyladen.**

3. Phomopsis leaf blight of brinjal :

Symptoms : (2 Marks)

1. The plants are attacked at all stages of growth, producing **damping-off** symptoms in nurseries and **collar rot** on young plants.
2. On leaves, circular to irregular, clearly defined grayish brown spots having light centers appear. The diseased leaves become yellowish in colour and may drop off.
3. **Several black pycnidia** can be seen on older spots.
4. The lesions on stem are dark brown, round to oval and have grayish centers where pycnidia develop.
5. At the base of the stem, the fungus causes characteristic constrictions leading to canker development and toppling of plants.
6. On fruits, small pale sunken spots appear which on enlargement cover entire fruit surface. These spots become watery leading to **soft rot phase** of the disease.
7. The infection of fruit through calyx leads to development of dry rot and fruits appear **black and mummified.**

Management : (2 Marks)

1. Removal and destruction of diseased crop debris, crop rotation and summer ploughing, use of disease free seed.
2. Hot water treatment of seed at 50 ^{0}C for 30 minutes.
3. Seed treatment with Thiophanate methyl at 1 g/kg seed.
4. Spraying with Difolaton 0.2% or Captan 0.2% in the nursery at 7 – 10 days interval.
5. Spray twice with Thiophanate methyl or Carbendazim 0.1 % at 20 days interval.

Q.2 **Describe the symptoms of following diseases.** (2 Marks each)

1. Yellow vein mosaic of okra
2. Bunchy top of banana
3. Leaf curl of papaya
4. Mosaic of Tomato

1. Yellow vein mosaic of okra :

1. In a field, most of the plants may be diseased and the infection may start at any stage of plant growth.
2. Yellowing of the entire network of veins in the leaf blade (**vein clearing**) is the characteristic symptom.
3. In severe infections the younger leaves turn yellow, become reduced in size and the plant is highly stunted.
4. Infection restricts flowering and fruits are not formed. If formed, turns smaller, harder and rough.

2. Bunchy top of banana :

1. Prominent dark green streaks on the petioles and midrib along the leaf veins (**Morse code**) and dark green streaks with **'J hook'** shape near the midrib.
2. Marginal chlorosis and curling of leaves.
3. Petioles fail to elongate.

4. Leaves are reduced in size, chlorotic, stand upright and become brittle and are crowded at the top (Bunchy top).
5. Flowers display mottled and streaked discolouration.
6. Plants show marked stunting.

3. Leaf curl of papaya :

1. Severe curling, crinkling and distortion of leaves accompanied by **vein clearing** and **reduction of leaf lamina.**
2. Leaf margins rolled downward and inward in the form of **inverted cup.**
3. Curled leaves have **thickened veins.**
4. Leaves become leathery, brittle and petioles are twisted.
5. Diseased plants fail to flower or bear any fruits.
6. In advanced stage, defoliation takes place and growth is arrested.

4. Mosaic of tomato :

1. The virus causes a light and dark green mosaic mottle with raised dark green area and distorted crinkled younger leaves.
2. The plants are stunted and leaves may be distorted to a **fan leaf or tendril like.**
3. The symptoms vary depending on the strain of the virus. Some strains cause yellowing or leaf mottling which may also affect the fruit.
4. Some other strains produce **streak symptoms** consisting of longitudinal necrotic streaks on stem or petioles. Such diseased plants are killed.
5. **Necrotic sunken lesions also appear on fruits** and sometimes internal necrosis or browning of mature fruit occurs.

Q.3 **Enlist causal organism, symptoms, survival and spread and management of bacterial blight of pomegranate.**

CO : *Xanthomonas axonopodis* pv. *punicae* **(1 Mark)**

Symptoms : **(3 Marks)**

1. Small irregular water soaked spots appear on the leaves.
2. Small, deep red spots of 2-5 mm dia. with indefinite margins on leaf blade.
3. Leaves distorted and malformed. Severely infected young leaves shed.
4. The bacterium attacks stem, branches and fruits also.
5. On the stem, the disease starts as brown to black spots around the nodes.
6. **Girdling and cracking of nodes** leading to breaking of branches.
7. Brown to black spots on the pericarp of fruit with **L or Y shaped cracks.**
8. Spots on fruits are raised with dark brown lesions of indefinite margins on the surface.

Survival and spread : **(1 Mark)**

Primary: Bacterial cells in infected cuttings and plant debris.
Secondary: Rain splashed bacterial cells.

Management : **(3 Marks)**

1. Clean cultivation and strict sanitation in orchard; infected leaves, twigs and fruits should be collected and burnt.
2. Use disease free planting material from certified nurseries for planting.
3. The regions where disease is more severe during *kharif* season, it is advisable to discontinue *kharif* crop and encourage *rabi* crop.
4. Rest period of orchard should be 3-4 months, particularly June to September would drastically reduce the buildup of inoculum.
5. Infected twigs should be removed and immediately after pruning plant be sprayed with recommended fungicide and antibiotic solution.

6. Prophylactic spray – BM @1 % or COC @ 0.25 % should be applied immediately at the time of disease appearance or flower initiation and sprays further continued for 4-5 times at 20 days interval with Carbendazim @ 0.15 % + Streptocycline @ 0.05 %.
7. Under blight favourable weather conditions, sprays should be applied at 8 – 10 days interval.

Q. 4 **Enlist causal organisms, major symptoms, perpetuation and management of the following diseases (Any two).**

1. Anthracnose of beans 2. Rust of coffee 3. Early blight of tomato

1. Anthracnose of beans : *Colletotrichum lindemuthianum* **(1 Mark)**

Symptoms : **(1 Mark)**

1. All the above ground parts are affected at any stage of crop growth.
2. On cotyledons spots are sunken dark brown or black with pink spore mass.
3. Spots on leaves appear on lower side and are black. Later these may also appear on upper surface.
4. The centre of these spots later turns grey or pink due to sporulation of the pathogen. The border of these spots appear raised.
5. Seedling infection results in collapse of seedling.
6. When the infection is severe, the affected plants wither off.
7. **Black, sunken, circular spots of varying sizes appear on pods with bright red, yellow or orange margins.**

Perpetuation: **(1 Mark)**

P.I: Through seed and collateral hosts.
S. I: Conidia by splashing rain water or air borne conidia.
Host range: All vegetable beans and cowpea, mungbean, blackgram etc.

Management : **(1 Mark)**

1. Use healthy seed for planting.
2. Seed treatment with Carbendazim @ 2g/kg seed.
3. Protect the crop by spraying 0.2 % Benlate or Bavistin or Zineb or Maneb @ 2 Kg/ha at 7-10 days interval.

2. Rust of coffee : *Hemileia vastatrix*

Symptoms : **(1 Mark)** **(1 Mark)**

1. The fungus confines itself to the leaf blade, rarely occurs on the berries.
2. Small, pale yellow spots on the upper surfaces of the leaves usually around the margins. Later masses of orange uredospores appear on the under surfaces.
3. The fungus sporulates through the stomata rather than breaking through the epidermis, so it does not form the pustules typical of many rusts.
4. The powdery lesions on the undersides of the leaves can be orange-yellow to red-orange in color.
5. The infected leaves drop prematurely, leaving long expanses of twigs devoid of leaves.

Perpetuation: **(1 Mark)**

P.I.: Survive as mycelium or uredospores in infected leaves.
S.I.: Uredospores dispersed by wind and water.
Pycnial and aecial stages are not known.

Management : (1 Mark)

1. Spray the bushes once with BM @ 0.5% or COC @ 0.25% and subsequently 2-3 times during monsoon.
2. Spray Triadimefon @ 0.05%.
3. Collect diseased leaves and destroy.

3. Early blight of tomato : *Alternaria solani* (1 Mark)

Symptoms : (1 Mark)

1. Small, isolated, scattered pale brown spots on the leaf.
2. Fully developed spots are irregular, brown to dark brown in colour, and with concentric rings inside the spot.
3. Spots coalesce to form large patches resulting in the leaf blight.
4. Lowest leaves are attacked first and the disease progresses upwards.
5. In severe attacks the entire plant may be defoliated.
6. Zonate lesions may also develop on stems and petioles, which break at the point of infection.
7. Brown spots are also seen on **calyx.**
8. Slightly dark, sunken, round to irregular lesions on fruit at the calyx end.

(1 Mark)

Perpetuation:

P.I. : Mycelium or conidia in infected plant debris.

S.I.: Conidia dispersed by wind, water or rain splashes (1 Mark)

Management :

1. Maintain proper vigour of the plant.
2. Use of disease free seed.
3. Removal and burning of diseased crop debris.
4. Mancozeb @ 0.25% or Chlorothalonil @ 0.2% or Zineb @ 0.25% spray at weekly intervals.

Q.5 **Enlist different smuts of sorghum with their causal organisms. Write about grain mould of sorghum in terms of causal fungi, symptoms and management.** (2 Marks)

Smuts :

Grain smut – *Sporisorium sorghi* (*Sphacelotheca sorghi*);
Loose smut – *Sporisorium cruentanum* (*Sphacelotheca cruenta*);
Head smut – *Sporisorium relianum* (*Spheceloiheca reliana*);
Long smut – *Tolyposporium eherenbergii*

Grain Mould : (2 Marks)

Causal fungi :

Curvularia lunata, Fusarium moniliforme, F. semitectum, Alternaria spp., *Helminthosporium* spp., *Chaetomium* spp., *Phoma* spp. *etc.*

Symptoms : (2 Marks)

1. If rains occur during the flowering and grain filling stages, severe grain moulding can occur. Symptom varies depending upon the organism involved and the degree of infection.
2. *Fusarium semitectum* and *F. moniliforme* develop a fluffy white or pinkish colouration.
3. *C. lunata* colours the grain black.
4. Moldy grains contain toxic mycotoxins and are unfit for human consumption and cattle feed.

(2 Marks)

Management :

1. Adjust the sowing time.
2. Grow resistant varieties like GMRP 4, GMRP 9, GMRP 13 and tolerant varieties like CSV 15.
3. Spray any one of the following fungicides in case of intermittent rainfall during earhead emergence, a week later and during milky stage. Mancozeb 1 kg/ha or Captan 1 kg + Aureofungin-sol 100 g/ha.

Q. 6 **Explain symptoms and transmission of the following diseases in detail.**

1. Tobacco mosaic
2. Pigeonpea sterility mosaic
3. Rice Tungro disease
4. Yellow mosaic of black gram

1. Tobacco mosaic : (2 Marks)

Symptoms :

1. The first symptom is yellowing of veins in young leaves. Leaves are distinctly blotched and mottled. Young leaves sometimes distorted.
2. Mottling consisting of bright green - yellow white patches and blistering of leaf lamina.
3. Under severity, development of leaves is entirely suppressed, so that leaf is little more than twisted midrib. Irregular, twisted, narrow leaf blade.
4. Leaves become unfit for curing.

Transmission : The virus is **not seed transmitted in tobacco** but tomato seeds transmit the virus. In the field, the virus is transmitted by contact. The farm workers engaged in topping and clipping operations transmit it through their dresses, chewing tobacco and snuff to the standing crop. The implements used in the field also transmit the virus.

2. Pigeonpea sterility mosaic : (2 Marks)

Symptoms :

1. The disease attack can be seen in all stages of crop growth.
2. In the field, the diseased plants appear as **bushy, pale green without flowers or pods.** Leaves of these plants are small and show typical light and dark green mosaic pattern.
3. Symptoms initially appear as vein-clearing on young leaves. In severe cases, leaves become smaller and **cluster** near tip because of shortened internodes and stimulation of auxillary buds.
4. The plants are generally stunted and **do not produce pod.** Plants infected at early stages (up to 45 days) of crop growth show near complete sterility and yield loss up to 95 per cent. As plants become older (after 45 days), their susceptibility to the disease decreases and such plants show partial sterility.
5. If pods develop, the seeds may be small, shrivelled and immature.

Transmission : Eriophyid mite - ***Aceria cajani.***

3. Rice Tungro disease : (2 Marks)

Symptoms :

1. Infection occurs both in the nursery and in the main field.
2. Plants are markedly **stunted.** Stunting is more severe in susceptible varieties and slight in resistant varieties.
3. Leaves show **yellow to orange discoloration** and interveinal chlorosis. Yellowing starts from the tip of the leaf and may extend to the lower part of the leaf blade.
4. Young leaves are often mottled with pale green to whitish interveinal stripes and the old leaves may have rusty streaks of various sizes.
5. The plants may be killed if infected early. **Tillering is reduced** with poor root system. The infected plants have few spikelets and panicles are small with discoloured grains.

Transmission : The **leafhoppers** (*viz*, *Nephotettix virescens, N. nigropictus, N. parvus, N. malayanus* and *Recilia dorsalis*)

4. Yellow mosaic of black gram : **(2 Marks)**

Symptoms :

1. Initially small yellow patches or spots appear on young leaves.
2. The next trifoliate leaves emerging from the growing apex show irregular yellow and green patches alternating with each other.
3. Newly formed leaves may completely turn yellow.
4. Infected leaves also show necrotic symptoms,
5. The infected plants normally mature late and bear a very few flowers and pods. **The pods are small and distorted.**
6. The early infection causes death of the plant before seed set.

Transmission : White fly (*Bemisia tabaci*).

Q.7 **Describe symptoms of following diseases.** **(2 Marks each)**

1. Downy mildew of maize
2. Downy mildew of Bajra
3. Late leaf spot of groundnut
4. Blast of paddy

1. Downy mildew of maize :

1. The most characteristic symptom - **chlorotic streaks** on the leaves, stunted and bushy appearance due to the shortening of the internodes.
2. White **downy growth on** - lower surface of leaf, the chlorotic streaks, bracts of green unopened male flowers in the tassel.
3. Affected leaves often tear linearly causing **leaf shredding.**
4. Partial or complete **malformation of the tassel** into a mass of narrow, twisted leafy structures. Proliferation of axillary buds on the stalk of tassel as well as the cobs is very common **(Crazy top).**

2. Downy mildew of Bajra :

1. The first symptoms can appear in seedlings at three to four leaf stage.
2. On leaves light green to light yellow patches, corresponding lower surface bears white **downy growth** of the fungus.
3. The **yellow discolouration** often turns to streaks along veins.
4. Stunting and excessive tillering.
5. **Leaves shred at the tips only.** But shredding is not as prominent as in Jowar.
6. In affected plants, ears fail to form or if formed, they are completely or partially malformed into twisted green leafy structures; hence the name **green ear** disease.
7. The infection converts the various floral parts, including glumes, palea, stamens and pistil into green linear leafy structures of variable length. As the disease advances, the green leafy structures become brown and dry bearing masses of oospores.

3. Late leaf spot of groundnut :

1. The spots on leaves are circular with bright yellow halo around mature spots, usually **darker** than early leaf spots.
2. On the under surface of the leaves the halo is not seen.
3. The spots are deep black in colour with clusters of conidiophores bearing conidia, arranged in concentric manner.
4. Generally lower leaves are first attacked but later on the disease spreads to other leaves also. Fungus produce lesions also on petiole, stem and pegs. Loss of photosynthetic tissue. leads to reduction in yield and quality of nuts.
5. Severely diseased leaves dry up and results in heavy defoliation.

4. Blast of paddy :

The fungus attacks the crop at all stages of crop.

1. **Leaf blast:** On the leaves, the lesions start as small water soaked bluish green specks, soon enlarge and form characteristic **spindle shaped** spots with grey centre and dark brown margin. The spots join together as the disease progresses and large areas of the leaves dry up and wither. Similar spots are also formed on the sheath. Severely infected nursery and field show a **burnt** appearance.
2. **Node blast:** In infected nodes, irregular black areas that encircle the nodes can be noticed. The affected nodes may break up and all the plant parts above the infected nodes may die.
3. **Neck blast:** At the flower emergence, the fungus attacks the peduncle which is engirdled, and the lesion turns to brownish-black. This stage of infection is commonly referred to as rotten neck/neck rot/neck blast/panicle blast. In early neck infection, grain filling does not occur and the panicle remains erect like a dead heart caused by a stem borer. In the late infection, partial grain filling occurs. Small brown to black spots also may be observed on glumes of the heavily infected panicles.

Q.8 **Comment on causal organism, symptoms and etiology of following diseases.**

1. Ergot of Bajra 2. Anthracnose of sorghum

1. Ergot of Bajra :

CO : *Claviceps sorghi* or *Sphacelia sorghi* **(1 Mark)**

Symptoms : **(1.5 Marks)**

1. At flowering, small droplets of pinkish or light honey coloured dew-like substance exudes from infected spikelets known as "Honey dew" stage.
2. Under favourable conditions, grain is replaced by long (1-2cm), straight or curved, cream to light brown, hard sclerotia can be seen projecting from between the glumes.
3. These sclerotia replace the ovary or grain and are hard and woody.
4. **"Ergotoxin"** or "Ergotin".
5. At the base of the affected plants white spots can be seen on the soil surface, denoting the drops of honey dew which had fallen on the soil.

Etiology : **(1.5 Marks)**

The fungus produces septate mycelium. The honey dew is a concentrated suspension of conidia, which are single celled, hyaline, elliptic or oblong in shape and slightly constricted in the middle. The **sclerotial bodies** produced by the fungus are 10-12 mm long and 2 mm thick, hard and tough.

2. Anthracnose of sorghum :

CO : *Colletotrichum graminicola* **(1 Mark)**

Symptoms : **(1.5 Marks)**

1. The fungus causes both leaf spot (anthracnose) and stalk rot (red rot) in sorghum.
2. The disease appears as small red coloured spots on both surfaces of the leaf.
3. The centre of the spot is white in colour encircled by red, purple or brown margin.
4. Numerous small black dots are seen on the white surface of the lesions which are the fruiting bodies (acervuli) of the fungus.
5. Many lesions coalesce and kill large leaf portions.
6. In midrib region, elongate elliptical, red or purple regions with black acervuli are formed.
7. Stalk and inflorescence infection can be characterized externally by the development of circular cankers.
8. Infected stem when split open shows discoloration, which may be continuous over a large

area or more generally discontinuous giving the stem a marbled appearance. The stem lesion also shows acervuli.

Etiology : **(1.5 Marks)**

The mycelium of the fungus is localized in the spot. **Acervuli** with long dark setae arise through epidermis. The conidiophores are short, single celled and colourless. Conidia are short, hyaline, **single celled**, vacuolate and **falcate** in shape.

Q.9 **Write short notes (Any two).**

1. Pigeonpea wilt 2. Coconut bud rot 3. Gunva wilt

1. Pigeonpea wilt :

CO : *Fusarium udum*

Symptoms :

1. The diseases may appear from early to late stages of plant growth.
2. Patches of dead plants in the field during flowering or pod filling stage.
3. The most characteristic symptom is a **purple band** extending upwards from the base of the main stem. **Vascular tissues exhibit brown discolouration.**
4. Partial wilting of the plant may seen.
5. Foliar symptoms include loss of turgidity, interveinal clearing and chlorosis.

Mode of Survival and Spread: The disease is seed and soil borne. The fungus survives in the infected stubbles in the field for about 3 years. The primary spread is by soil-borne chlamydospores and also by seed contaminant. The secondary spread in the field is through irrigation water and implements.

Monocropping and ratooning pre-disposes the plant to wilt. Disease incidence is more severe in Vertisols than in Alfisols.

Management :

1. Follow long crop rotation with tobacco, sorghum or castor. Avoid monoculture of redgram, adopt mixed cropping of sorghum in the field, soil solarization in summer to reduce the inoculum of pathogen, collect and destroy the diseased stubbles.
2. Grow resistant / tolerant varieties like Asha (ICPL 87119), Maruti (ICP 8863), Lakshmi (ICPL 85063), Durga (ICPL 84031), PRG 100, PRG 158, Muktha, Prabhat and Sharada.
3. Seed treatment with Thiram @ 0.3% or Carbendazim @ 0.2%. or treat the seeds with *Trichoderma viride* at 4 g/kg..

2. Coconut bud rot :

CO : *Phytophthora palmivora*

Symptoms :

1. Severe on young palms.
2. **Yellowish green discoloration of the heart leaf or crown leaf.**
3. The basal tissues of the leaf rot quickly and can be easily separated from the crown.
4. Spindle withers and droop down. Older leaves develop irregular, water soaked spots which are sunken in nature. The leaves and sheath in the central spindle fall off leaving an outer whorl of green leaves.
5. **The withered central shoot can be pulled out very easily** from the crown. The central crown may rot and in few months the tree may wilt.
6. Young nuts fail to mature and fall.

Mode of survival and spread :

P.I: Through dormant mycelium, oospores or chlamydospores carried over summer months on the host debris. With the onset of monsoon rains, the fungus becomes active producing cottony mycelium that infects tender host tissue.

S.I: Through sporangia with numerous zoospores which spread rapidly in the rain water or sporangia spread through wind and insects also.

Management :

1. Cutting and burning of badly infected palms.
2. If the disease is detected early remove the infected portions and protect with Bordeaux paste (Tree surgery).
3. Spray copper fungicides (B.M@1% or COC@0.3%) after onset of monsoon to prevent infection. Keep a mixture of CuSO4 + NaCl (1: 3-5) parts in a cloth bag in the crown or above bud.

3. Guava wilt :

CO : *Fusaium oxysporum f.sp. psidii, F. solani, Macrophomina phaseolina. Cephalosporium sp., Gliocladium roseum and Verticillium alboarum.*

Symptoms :

1. Yellowing and slight curling of leaves at terminal branches, becoming reddish at the later stage and subsequently premature shedding of leaves. **Twigs become bare** and fail to generate new leaves or flowers and eventually dry up.
2. Fruits remain underdeveloped, become **hard, black and stony**.
3. A few plants also show partial wilting, which is very common symptom of wilt in guava. Entire plant may die.
4. Black streaks on tertiary roots, root rotting. Discolouration of cortical regions of the stem and roots. Light brown **discoloration in vascular bundles**. Bark splitting can be seen in wilted plants in later stages.

Mode of Survival and spread:

Through movement of plants containing sick soil in virgin areas.
Short distance spread is by water.
Root injury predisposes wilt disease.

Soil pH 6.0 is optimum for disease development. Disease is more in clay loam and sandy loam compared to heavy soil. Higher disease incidence in monsoon. Presence of nematode, ***Helicotylenchus dihystera.***

Management :

1. Proper sanitation of orchard, wilted plants should be uprooted, burnt and a trench of 1.0-1.5 m should be dug around the tree tunk.
2. Treat the pits with **formalin** and cover the pit for three days and then transplant the seedlings after two weeks, while transplanting avoid damage to seedling roots.
3. Maintain proper tree vigour. Intercropping with turmeric or marigld.
4. **Soil solariztion** with transparent polythene sheet during summer months.
5. Application of oil cakes like neem cake, mahua cake, kusum cake supplemented with urea. Apply 6kg neem cake + 2kg gypsum per plant. Judicous ammendments of N and Zn. Drench soil with 0.2% Benomyl.
6. Resistant variety: **Apple guava**
7. Application of *Trichoderma viride.*

Q.10		Explain in detail about black rot of cabbage.

CO : *Xanthomonas campestris* pv. *campestris*

Symptoms :

1. Ist appear near the leaf margins as chlorotic or yellow (angular) areas.
2. The yellow area extends to veins & mid rib forming characteristic **'v' shaped chlorotic spots.**
3. Veins and veinlets turn brown and finally black.
4. The vascular blackening extend beyond affected veins to midrib, petiole and stem.
5. In advanced stages, infection may reach the roots system and blackening of vascular bundles occur.
6. Bacterial ooze can also be seen on affected parts.
7. If the infection is early, the plants wilt and die.
8. If the infection is late, plant succumb to soft rot &die.

Disease cycle : Bacterium is **internally seed and soil borne.** It also survives on plant debris and collateral host: ***Centella asiatica.*** Bacteria enter through stomata of cotyledons, hydathodes on leaf margin and also through wounds. Bacterium spread through irrigation water or wind splashed rain and also by mechanical means causes secondary infection.

Management :

1. Seed treatment with HgCl2 solution for 30 min or Agrimycin or Aureomycin 0.01%.
2. Hot water treatment at 50 0c for 30min, for killing seed borne inoculum followed by a 30min dip in Streptocycline 100 ppm.
3. Spray Agrimycin-100 or Streptocycline-50 ppm at transplanting, curd formation and pod formation.
4. Crop rotation for 2-3 yrs with non cruciferous crop.
5. Drenching seed bed with 5% formalin or any antibiotic solution in nursery beds.
6. Resistant varieties : Cabbage: Cabaret, Defender, Gladiator, Pusa Muktha.
   Cauliflower: Pusa ice, Pusa snow ball-K-1-F, Sel-12

		SECTION "B"
Q.11		State true or false.
	1.	Brown spot disease of paddy is not soil borne. (True)
	2.	Dwarf Cavendish bananas are generally resistant to panama wilt. (True)
	3.	Summer sown black gram is highly susceptible to yellow mosaic disease. (True)
	4.	Taichung Native 1 variety of paddy is highly susceptible to bacterial blight. (True)
	5.	Long smut of jowar is air borne disease. (True)
	6.	Secondary spread of false smut of paddy is accomplished through chlamydospores. (True)
	7.	Pycnial and aecial stages of coffee rust are not known. (True)
	8.	*Exobasidium vexans* causes blister blight in tea plantations. (True)
Q.12		**Do as directed.**
	1.	Name the sexual spore which initiate primary infection in damping off of tomato - **Oospore**
	2.	Akiochi symptom of paddy is result of deficiency of potash nutrient in the soil.
	3.	State causal organism of *Phytophthora* blight of castor – ***Phytophthora parasitica***
	4.	***Fusarium oxysporum f.sp. cubense*** is soil borne and mainly survive in the form of **Chlamydospores.**
	5.	Name any one phytotoxin produced by the fungus causing brown spot of paddy – **Ophiobolin A (Cochliobolin A), Ophiobolin B (Cochliobolin B), Ophiobolin I**
	6.	Paddy bacterial blight resistant gene *Xa21* is isolated from ***Oryza longistaminata.***
	7.	Enlist name of the virus causing mosaic disease in soybean – **Soybean mosaic virus**
	8.	Bunchy top of banana is transmitted by Banana aphid (***Pentalonia nigronervosa***)

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