

Pradhan Mantri Fasal Bima Yojana Brief Guidelines and FAQ's

What is the objective of implementation of PMFBY scheme?

PMFBY is a risk mitigation tools aims at providing financial support and stabilizing the income of farmers to ensure their continuance in farming. It covers the perils to the crops arising out of unforeseen events at all stages, i.e. from sowing to post harvest,. It also encourages the farmers to adopt the modern and innovative agriculture practices in order to have a stabilize income and sustainable production in agriculture sector.

Who are eligibly covered under this scheme?

All Farmer having insurable interest can be covered under these scheme including sharecroppers and tenant farmers. Further, Covered farmer are divided under 2 components:-

- a. **Compulsory Components:** - Those farmers who are availing Seasonal Agricultural Operations Loan from the Financial Institutions would be covered compulsorily i.e. Loanees Farmers.
- b. **Voluntarily Components:** - All those farmers who have not availed the SOA loans and having the insurable interest are covered under these optional components i.e. Non Loanees Farmers.

Scheme also aims a covering maximum farmers under SC/ ST/ and Women Farmers under both these components.

Which crop can be covered under this scheme?

- a. Food Crops (Cereals, Millets and Pulses)
- b. Oilseeds
- c. Annual Commercial /Annual Horticulture Crops

What are the stages of crops and risk covered under this scheme?

Prevented Sowing/ Planting Risk: Prevented Sowing is a failure to sowing/ planting the insured crops due to deficit rainfall or adverse weather conditions. Any losses raises out of such conditions under prevented sowing are covered and payouts will be eligible only if more than 75% of area sown for notified crops remained unsown in that notified insurance unit.

Insurance Company liability would be limited to 25% of the sum insured and claim settlement within 30 days (Subject to receipt of Govt. share of premium subsidy) of state notification on having suffered prevented sowing losses with approx % of Area.

- a. **Standing Crops (Sowing to Harvesting):** The comprehensive risk from Sowing of the plant to reaping the crops from the field. This scheme covers the yield losses that arises due to disasters alike conditions. Viz. Drought, Flood, Inundation, Pest and diseases, Hailstorm, Natural Fire Etc. All notified insurance units would be eligible for "On-Account" payment only if expected yield is likely to be less than 50% of threshold yield.

Joint committee of State Govt. will issue an order defining eligibility of On-Account payment with details of damaged insurance units based on proxy indicators within 15 days from such occurrences. Maximum On-Account payable would be 25% of likely claims.

Insurance company to settle On-account payment within one month of State notification and subject to receipt of loss report from State Govt. and on receipt of Govt. share of premium subsidy.

- b. **Post Harvest Losses:** Post harvest is a stage of crop production immediately following harvest or cutting of the crops from its fields which are then kept in “cut and spread” conditions to dry in the ground field. Under these schemes the risk is covered up to a maximum period of 2 weeks from harvesting against specific perils of cyclone, cyclonic rains and unseasonal rainfall.
Intimation within 48 hours by farmer directly to insurance company toll free number or either concerned bank or local agriculture department.
 - a. Appointment of surveyors within 48 hours of intimation and the final survey report to be submitted within next 10 days.
 - b. Duly filled claim form along with relevant land record document to be submitted to insurance company by farmer/ bank within 7 days of such occurrence.
 - c. If the percentage of loss in the affected area under notified crop is more than 25 % of total insured area in a notified insurance unit, then all eligible farmers in the notified insurance units will be deemed for payment.
 - d. If claim based on CCE is more than the claim of post harvest loss, difference in claim will be payable to farmers. If post harvest claim is higher, no recovery will be applicable from farmers.
 - e. Insurance company to disburse the claim (Subject to receipt of Govt. share of premium subsidy) within 30 days of receipt of loss survey report.
- c. **Localized Calamities:** Scheme also covers losses which arise due to localized risk such as hailstorm, landslide, Inundation in the notified area.
 - a. Intimation within 48 hours by farmer directly to insurance company toll free number or either concerned bank or local agriculture department.
 - b. Appointment of surveyors within 48 hours of intimation and the final survey report to be submitted within next 10 days.
 - c. Duly filled claim form along with relevant land record document to be submitted to insurance company by farmer/ bank within 7 days of such occurrence.
 - d. If the percentage of loss in the affected area under notified crop is more than 25 % of total insured area in a notified insurance unit, then all eligible farmers in the notified insurance units will be deemed for payment.
 - e. If claim based on CCE is more than the claim of post harvest loss, difference in claim will be payable to farmers. If post harvest claim is higher, no recovery will be applicable from farmers.

- f. Insurance company to disburse the claim (Subject to receipt of Govt. share of premium subsidy) within 30 days of receipt of loss survey report.

What are the Preconditions for implementation of this scheme?

- a. State/ UT to conduct requisite number of Crop Cutting Experiments (CCEs) at notified insurance unit area on a sliding scale basis.
- b. State/ UT to submit CCE based yield data to insurance companies within the prescribed time limits i.e. within one month from the date of final harvest.
- c. State/ UT should facilitate strengthening of automatic weather station network for the purpose of on account payment settlement.
- d. State/ UT to adopt modern technology for conduct of CCEs.

What are the Premium Rates charged under this scheme?

Actuarial premium rates to be charged under PMFBY scheme are as follow:-

- a. For Kharif Crops, the maximum premium rates payable by the farmers is 2 % of Sum Insured or Actuarial premium rate whichever is less.
- b. For Rabi Crops, the maximum premium rates payable by the farmers is 1.5 % of Sum Insured or Actuarial premium rate whichever is less.
- c. For Kharif and Rabi Crops, the maximum premium rates payable by the farmers is 5 % of Sum Insured or Actuarial premium rate whichever is less.

What would be the Normal Premium subsidy ratio?

- a. Difference between actuarial premium rate and farmer payable premium rate shall be treated as Normal premium subsidy rate, which shall be shared equally by Central and State Govt.\
- b. However, the State/ UT Governments are free to extend additional subsidy over and above the stipulated subsidy from its budget

What is Sum Insured Limit for individual farmer?

Sum Insured for individual farmer is equal to scale of finance per hectare multiplied by area of notified crop by the farmers for insurance.

What are the indemnity levels under this scheme?

The level of indemnity under PMFBY scheme is defined at 3 levels: - 70% corresponding to High Risk, 80% to Moderate Risk and 90% to Low Risk. SLCCI in consultation with Insurance Company approves the above indemnity level for notified crop and area.

What is the Seasonality Cut-off dates disciplines?

- a. Post issuance of administrative instruction from Govt. Of India for implementation of PMFBY scheme. SLCCI would conduct the meeting to finalize various terms and conditions on Notification of crops, Notified area, Scale of finance, Indemnity level etc., along with issuance of bid notice.
- b. SLCCI to issue notification and its circulation to all concern implementing agencies of their respective states at least one month in advance of the commencement of crop seasons i.e. For Kharif is March and Rabi is September.
- c. Uploading of all requisite information of notification on the Crop Insurance portal (www.agri-insurance.gov.in) in co-ordination with State Govt. and selected implementing agency should be made available within one week from issuance of notification.
- d. For Bankers, Loaning Period for covering of loanee farmers under compulsory components would be, for Kharif – April to July and Rabi – October to December.
- e. For Bankers, Cut-off dates for receipt of proposal form/ debit of premium from farmers account for both Loanees and Non loanee farmers would be, for Kharif – 31st July and Rabi – 31st December.
- f. For Insurance Companies, Cut-off dates for receipt of consolidated declaration/ proposal from Nodal bank/ Bank branches would be within 15 days for Loanees and 7 days for Non loanee farmers from cut-off date of debit of premium from farmers account for Kharif and Rabi season respectively.
- g. For Insurance companies, Cut-off dates for receipt of Proposal from designated Insurance Agent's would be within 7 days of receipt of declaration/ premium respectively.
- h. For Banker and intermediaries, Cut-off dates for uploading of soft copy of individual insured farmers in crop insurance portal would be, within 15 days after cut-off date of collection of premium.
- i. For State Govt. / UT, Cut-off dates for receipt of Yield data by Insurance Companies from State Govt./ UT would be, within one month from the date of final harvest.
- j. For Insurance Companies, Cut-off dates for payment of final claims based on yield data would be, within three weeks from the receipt of yield data from the State Govt.
- k. It may be noted that neither DAC & FW nor any State/ UT Government will be authorized to extend the cut-off dates of seasonality under any circumstance once it is fixed and notified.

What are the basic requirements of Insurers for pricing or to derive the premium rate?

- a. The scheme shall operate on the principle of Area Approach in the selected define area called Insurance Unit (IU). State Govt. should notify the Insurance Unit to Village Panchayat or other equivalent units for Major Crops and unit size above the level of Village/ Village Panchayat for Minor Crops.

- b. SLCCCI to provide at least past 10 years historical yield data based on insurance unit for Major and Minor Crops in a standard format within stipulated time.
- c. Also furnish Insurance Unit wise Area sown of insured crops within two month from sowing period to insurance company.
- d. Calamity years if any, declared in respect of any district/ area for that year to be provided to insurance company for calculation of premium rates.
- e. Sum Insured per hectare for both loanee and non-loanee farmers will be same and equal to the Scale of Finance as decided by the District Level Technical Committee, and SLCCCI to pre declare and notify the same to Insurance companies.

What is the collection process of proposal and premium from farmers?

a. Loanees Farmer under Compulsory component – Financial institutions

Based on seasonality of Crops, banks should separately calculate the eligibility of loan amount for both Kharif and Rabi seasons based on the scale of Finance and declared acreage of individual loanees farmer under notified crops and shall be taken into consideration for compulsory coverage.

Crop loan under Kisan Credit Cards (KCC) are also covered under compulsory coverage through banks and shall maintain all records relating to compliance with these scheme.

Nodal Bank system currently operating for NAIS/ NCIP will continue for PMFBY for collection of proposal and premium from loanees farmer.

Individual bank branches for Commercial Banks/ RRBs shall act as Nodal branch. Necessary guidelines to concerned bank branches will be governed by concerned Lead bank and Regional offices/ Administrative offices of commercial banks/ RRBs.

Declaration submitted by Nodal banks/ Branches shall contain details about Insurance Unit, sum insured per unit, premium per unit, total area insured, and category of farmers covered (small and marginal or other) and number of farmers under other categories (SC/ ST/ others) / Women along with their bank account details etc. (bank / their branches) as per the format envisaged / provided in the crop insurance portal.

The bank branches of commercial banks/ RRBs will directly submit the consolidated proposals along with details of insured farmers in the format envisaged in the crop insurance portal within the stipulated time.

Nodal Banks/ Intermediaries to collect the list of individual farmers with requisite details like Farmer name, Bank A/c No, Village, Category of farmers, Acreages, Crop, Sum Insured, Premium Collected, Govt. Subsidy etc., from concerned branches in soft copy and send the same to insurance company along with declaration within 15 days of final cut-off dates.

b. Non Loanees Farmer under Optional component - Channel partner/ Intermediaries

All those farmers who have not availed the SOA loans and having the insurable interest can be covered simply by visiting to nearest commercial bank or Regional Rural Bank (RRB) or PACS (DCCB) branch. Bank official will assist and guide the farmers related to filling of the proposal

form, relevant documents, Sum insured and applicable premium Etc. Operating a bank account is essential for such cases. Bank branch will submit the details to their Nodal bank which in turn submit the prescribed declaration format along with premium remittance details to insurance company.

All those farmers who have not availed the SOA loans and having the insurable interest can also be covered simply by filling the proposal form and relevant documents with requisite premium amount and can submit the same to approved and designated by IRDA, Intermediaries.

Designated intermediaries to verify the insurable interest and relevant document pertaining to Land Record, 7/ 12 Extract or Record of Land Rights, Sowing Certificate, ID Proof, Bank Passbook, Cancelled Cheque – Only if required Photo id not available in bank passbook and applicable contract/ agreement in case of sharecroppers or tenants. Intermediaries to collect and submit the requisite premium and remit individual/ consolidated premium to insurance company, accompanied by individual proposal forms and summary details in Declarations/ Listing sheet (MIS), provide soft copy to IA and details of each insured farmer and will also upload the data directly to the crop insurance portal.

c. Non Loanee Farmer under Optional component – Directly to Insurance Companies

Non loanee farmers having insurable interest can send the proposal form through Post to insurance companies Or can also avail insurance through insurance companies Online portal or through Crop Insurance portal with requisite premium and relevant document i.e. Land record or applicable Agreement/ Contract in case of sharecroppers or tenants.

Insurance companies retain the right to accept or reject the insurance proposal. Premium will be refunded by insurance companies within 1 month of receipt of proposal, if any proposals are rejected.

d. Option for Changes in Crop

For any reason if a farmer changes the crop planned earlier, the farmer need to intimate to insurance company at least 30 days before the final cut-off date for buying the insurance, either through financial institution/ Channel partner/ intermediary/ directly, along with sowing certificate and difference in premium payable, if any.

How the assessment of claim is done?

- a. If the Actual yield per hectare of insured crops for the insurance unit (calculated on the basis of requisite no. of CCEs) in insured season falls short of specified Threshold yield, all insured farmer in that defined area and crop are deemed to have suffered shortfall in yield.

'Claim' shall be calculated as per the following formula:

(Threshold Yield - Actual Yield)

----- X Sum Insured

Threshold Yield

Where,

- b. Threshold yield is the average yield of past seven years (excluding a maximum of two calamity year(s) as notified by State Government/ UT) multiplied by applicable indemnity level for that crop.
- c. Settlement of claim to the farmers would commence once premium subsidy from Central and State/ UT Govt. have been received for the season by insurance company.
- d. After receiving the claim amount from concerned insurance companies, the financial institution/ banks should remit the claim amount to beneficiaries farmer account within 1 week and should display the complete details of beneficiaries at branch offices within 7 days and send the report to insurance companies along with utilization certificate for verification and audit.
- e. In case of farmers covered through voluntary basis i.e. Intermediaries, payable claim will be directly credited into individual farmer accounts with an intimation of claim details by insurance company.
- f. At least 5% of beneficiaries to be audited by Regional/ Local Offices of insurance companies and feedback will be shared to concerned DLMC offices and SLCCCI offices.
- g. At least 10% of beneficiaries audited by insurance companies may be cross verified by concerned DLMC authorities and send the report to State Govt.
- h. At least 1 to 2% of beneficiaries may be verified by Head offices of insurance company/ Independent agencies appointed by Central Govt. / NLNC and send the report to Central Government

What are the Commission and Bank charges?

Bank and other financial institutions etc. shall be paid service charges @ 4% of the premium collected from farmers. Rural agents engaged in providing insurance related services to farmers may be paid appropriate commission as decided by the insurance company, subject to cap prescribed under IRDA regulations.

Is service tax applicable under this scheme?

PMFBY is a replacement scheme of NAIS/MNAIS, and hence exempted from Service Tax.

PRADHAN MANTRI FASAL BIMA YOJANA (PMFBY)

I. Objective of the Scheme

Pradhan Mantri Fasal Bima Yojana (PMFBY) aims for supporting sustainable production in agriculture sector by way of a) to provide compensation to farmers suffering crop loss/damage arising out of unforeseen events b) to stabilize the income of farmers to ensure their continuance in farming c) to encourage farmers to adopt innovative and modern agricultural practices d) to ensure flow of credit to the agriculture sector; which will attribute to food security, crop diversification and enhancing growth and competitiveness of agriculture sector besides protecting farmers from production risks.

II. Coverage of Farmers

1. All farmers including sharecroppers and tenant farmers growing the notified crops in the notified areas are eligible for coverage. However, farmers should have insurable interest on the insured crops. The non-loanee farmers are required to submit necessary documentary evidence of land records prevailing in the State (Records of Right (RoR), Land possession Certificate (LPC) etc.)and/or applicable contract/agreement details (in case of sharecroppers/tenant farmers).

2. Compulsory Component

All farmers availing Seasonal Agricultural Operations (SAO) loans from Financial Institutions (i.e. loanee farmers)for the crop(s) notified would be covered compulsorily.

3. Voluntary Component

The Scheme would be optional for the non-loanee farmers.

4. Both PMFBY and other notified scheme can be implemented for non-loanee farmers in the area(s) notified for PMFBY. Non-loanee farmers can choose between PMFBY and other notified scheme, and also insurance companies-, where State Govt. has notified such a provision.
5. Special efforts shall be made to ensure the maximum coverage of SC/ST/Women farmers under the scheme. Budget allocation and utilization under these segments of farmers should be in proportion to SC/ST/General along with gender (Male/Women) land holding in the respective state/cluster. Panchayat Raj Institutions (PRIs) may be involved at various stages of implementation of crop insurance schemes particularly in the identification of the crops & beneficiaries, extension & awareness creation amongst farmers, obtaining feed-back of the farmers while assessing the

payment on account of prevented sowing/ planting risk, localized perils, post-harvest losses and advance payment of claims etc.

III. Coverage of Crops

- 1) Food crops (Cereals, Millets & Pulses),
- 2) Oilseeds
- 3) Annual Commercial / Horticultural crops

IV. Coverage of Risks & Exclusions

1. Following stages of the crop and risks leading to crop loss are covered under the scheme.
 - a) **Prevented Sowing/Planting Risk:** Insured area is prevented from sowing/ planting due to deficit rainfall or adverse seasonal conditions
 - b) **Standing Crop (Sowing to Harvesting):** Comprehensive risk insurance is provided to cover yield losses due to non-preventable risk, viz.: Drought, Dry spells, Flood, Inundation, Pests & Diseases, Landslides, Natural Fire & Lightening, Storm, Hailstorm, Cyclone, Typhoon, Tempest, Hurricane, Tornado etc.
 - c) **Post-Harvest Losses:** coverage is available only up to a maximum period of two weeks from harvesting for those crops which are allowed to dry in cut & spread condition in the field after harvesting against specific perils of cyclone & cyclonic rains and unseasonal rains.
 - d) **Localized Calamities:** Loss / damage resulting from occurrence of identified localized risks of hailstorm, landslide, and Inundation affecting isolated farms in the notified area.
2. General Exclusions: Losses arising out of war & nuclear risks, malicious damage and other preventable risks shall be excluded.

V. Scheme Acceptance by the State/UT Governments

1. Issuance of Notification by State Government / UT for implementation of the scheme (PMFBY) will imply their acceptance on all provisions, modalities and guidelines of the Scheme. The main conditions relating to PMFBY which are binding on States/UTs, are as follows:
 - a) State has to conduct requisite number of Crop Cutting Experiments (CCEs) at the level of notified insurance unit area;
 - b) CCE based yield data will be submitted to insurance company within the prescribed time limit;

- c) State/UT will make necessary budgetary provision in State/UT budget, to release premium subsidy based on fair estimates, at the beginning of the crop season;
 - d) State/UT should be willing to facilitate strengthening of weather station network.
2. Department of State Government already looking after implementation of National Agriculture Insurance Scheme(NAIS)/ National Crop Insurance Programme (NCIP) may be designated as Nodal Department for implementation of PMFBY. The SLCCCI presently overseeing implementation of NAIS & NCIP may be authorized to oversee implementation of PMFBY. The States/UTs which have not implemented the NAIS / NCIP shall constitute SLCCCI for implementation of PMFBY on the lines similar to that of NAIS/NCIP. The present composition of SLCCCI may be strengthened by including representatives from State Horticulture Dept., State Remote Sensing Application Centre, India Meteorological Department (IMD), Farmers' Representatives and Empanelled Insurance Companies for implementing PMFBY. Chairman of SLCCCI shall co-opt representatives from other departments / agencies, if considered necessary.

VI. Notification

1. Prior to the commencement of crop year, preferably in the beginning of February, meeting of SLCCCI should be convened for finalising various terms & conditions and calling of bid, issuance of the notification to select insurance companies and carry out implementation of the scheme during the bid period. State Government /UT should ensure the issuance of the notification and its circulation to all concerned agencies/departments/institutions at least one month in advance of the commencement of the crop season incorporating all the essential details about insured crops, areas, Scale of Finance, Available Sum Insured for notified crops, Premium rate for farmers, subsidy along with seasonality disciplines/ cutoff date for each activities etc..

Notification of crops, areas& Implementing Agency (IA)

2. The Scheme shall operate on the principle of "Area Approach" in the selected Defined Areas called Insurance Unit (IU). State Government /UT will notify Crops and Defined Areas covered during the season in accordance with decision taken in the meeting of SLCCCI. State/UT Government should notify as an insurance unit, Village/Village Panchayat or any other equivalent unit for major crops. For other crops it may be a unit of size above the level of Village / village Panchayat.

3. SLCCCI will, for the purpose of notification, consider factors such as availability of past yield data based on CCEs for adequate number of years, cropped acreage and ability to conduct requisite number of CCEs for estimating yield during proposed season, etc.
4. State Government/UT should provide 10 years historical yield data to Insurance Companies for calculations of indemnity limits, threshold yield, calculation of premium rates etc. at insurance unit area and in absence of above, data at next higher unit / nearest neighboring unit / weighted average of contiguous units as decided by the SLCCCI shall be used. The level and name of notified areas of insurance unit will be part of notification and should be provided at the time of bidding itself.
5. In case it is proposed to notify irrigated & un-irrigated areas separately under a crop, State Government / UT shall ensure that minimum CCEs are planned & conducted for irrigated & un-irrigated crops, separately in such areas. In addition, past yield data for adequate number of years will have to be made available separately.
6. States implementing PMFBY at Village/Village Panchayat level shall be entitled for 50% reimbursement of incremental expenses of CCEs and cost of smart phones/improved technology from GOI. A cap will be put on such expenses for reimbursement from GOI to States which will be fixed based on the annual budget for the purpose.

Notification of indemnity level, Average Yield, Threshold Yield, Sum Insured(SI) & Premium Rates

7. Three levels of Indemnity, viz., 70%, 80% and 90% corresponding to high, moderate and low risk level of the areas shall be available for all crops. SLCCCI based on inputs of Insurance Companies shall approve indemnity levels for notified crops and areas at sub-district or district level.

The Average Yield of a notified crop in insurance unit (IU) will be moving average yield of last seven years excluding upto two declared calamities years). The Threshold yield of the notified crops is equal to Average Yield multiply by Indemnity level..SI and Premium Rates will be notified according to the envisaged criteria.

Notification of calamity year(s), if any for calculation of threshold yield

8. If the State Government/UT declares calamity year(s), if any, in respect of any district/area based on decision/notification made for that year by concerned Government/competent authority, such calamity year(s) will be excluded while calculating threshold yield at insurance unit level, and also 'Notional Threshold Yield' at sub-district / district level for purpose of

computation of sum insured (value of threshold yield). Not more than two such years shall be excluded from calculation of threshold yield and sum insured, even in instances where calamity years are more than two during the preceding seven years. The yield in declared calamity year is not supposed to be reported higher than the normal years. However if it is so, then that year shall not be considered as a calamity year for calculation of Threshold Yield for the season. Further, Threshold Yield once notified in the Notification issued by the State should not be changed at later stage under any circumstances. However, based on actual yield, Threshold Yield and Sum Insured for the later years may be recalculated and notified accordingly at the beginning of each crop season.

Seasonality discipline

9. State Government /UT shall also notify seasonality discipline for various activities under the scheme viz. submission of insurance proposals, consolidated declarations by banks, yield data, claim assessment of losses for (i) area approach, (ii) localized calamities, (iii) prevented sowing, (iv) post harvest loss, (v) payment slabs for total loss during the season (vi) on-account payment for major calamities, etc as per the provisions of the scheme.

Notification of Automatic Weather Stations (AWS)

10. For the purpose of on account payment of claims and claims for prevented sowing etc., State Government shall notify concerned weather data provider / expert agency whose report/methodology to be used in assessing the extent of losses and payment.

VII. Sum Insured /Coverage Limit

1. Sum Insured per hectare for both loanee & non-loanee farmer will be same and equal to scale of finance decided by the District Level Technical Committee, and is pre-declared by SLCCCI and notified. Sum Insured for individual farmer is equal to the Sum Insured multiple by acreage of the notified crop. 'Area under cultivation' shall always be expressed in 'hectare'.
2. Sum insured for irrigated & un-irrigated areas will be separate.

VIII. Premium Rates &Premium Subsidy

1. The Actuarial Premium Rate (APR) would be charged under PMFBY by

implementing agency (IA). The rate of Insurance Charges payable by the farmer will be as per the following table:

S.No	Season	Crops	Maximum Insurance charges payable by farmer (% of Sum Insured)
1	Kharif	All foodgrain & Oilseeds crops,(all Cereals,Millets, Pulses, & Oilseeds crops)	2.0% of SI or Actuarial rate, whichever is less
2	Rabi	All food grain & Oilseeds crops, (all Cereals Millets, Pulses, & Oilseeds crops)	1.5% of SI or Actuarial rate, whichever is less
3	Kharif & Rabi	Annual Commercial / Annual Horticultural crops	5% of SI or Actuarial rate, whichever is less

2. AIC shall calculate **Loss Cost** (LC) i.e. Claims as % of Sum Insured (SI) observed in case of the notified crop(s) in notified unit area of insurance during the **preceding 10 similar crop seasons** (Kharif / Rabi) (till an Independent agency/TSU takes over) based on the latest available yield data in month of February for Kharif crops and August for Rabi crops as per requirement of the States and shall provide to DAC&FW/Concerned States before invitation for premium bidding. This calculation to be done by AIC on behalf of Ministry is for internal purposes to have information on the approximate cost to the IA for covering the risks so as to evaluate the bids in proper perspective.
3. Payment of Government Subsidy:
 - a) The difference between actuarial premium rate and the rate of Insurance charges payable by farmers shall be treated as Rate of Normal premium Subsidy, which shall be shared equally by the Centre and State. **However, the State government / UT are free to extend additional subsidy over & above the stipulated subsidy from its budget. In other words, additional subsidy, if any shall be entirely borne by the State government / UT. Subsidy in premium is allowed only to the extent of Sum Insured.**
 - b) Government premium subsidy to the Private empanelled Insurance Companies may be routed through Agricultural Insurance Company (AIC) of India Limited strictly as per the guidelines/order of the Government.

- Accordingly, AIC is empowered to call/collect all requisite information related to implementation of Scheme and utilization of Government funds.
- c) Government (both Central & States) may release 50% estimated premium subsidy to empanelled insurance companies at the beginning of crop season on the basis of the business projection to be submitted by each insurance companies subject to fulfillment of General Financial Rule/guidelines in the matter.
 - 4. **Claim Liabilities:** Insurance company shall take all necessary steps to take appropriate reinsurance cover for their portfolio in order to safeguard insured's interest. In case premium to claims ratio exceeds 1:3.5 or percentage of claims to Sum Insured exceeds 35% whichever is higher at the National Level, then DAC&FW will provide protection to IAs. The losses exceeding the above mentioned level in the crop season would be met by equal contribution of the Central Government and the concerned State Governments.

IX. Seasonality Discipline

1. The cut-off date is uniform for both loanee and non-loanee cultivators. The State-wise cut off dates for different crops shall be based on Crop Calendar of major crops published from time to time by the Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Government of India. However, besides prevailing agro-climatic conditions, rainfall distribution/irrigation water availabilities, sowing pattern etc. the SLCCCI, in consultation with the insurance company shall fix seasonality discipline of the coverage and other activities in such a way that it doesn't encourage adverse selection or moral hazards. The broad seasonality discipline is given in the chart below:

Sl. No.	Activity	Kharif	Rabi
1	Issuance of Administrative Instructions by Government of India	February	August
2	Conduct of SLCCCI meeting to decide for notification of Crops and Notified areas, limits of Sum Insured, and adoption of Level of Indemnity etc.	March	September

3	Issuance of Notification by SLCCCI of State / UT	March	September
4	Loaning period (loan sanctioned/renewed) for Loanees farmers covered on Compulsory basis.	April to July	October to December
5	Cut-off date for receipt of Proposals of farmers/debit of premium from farmers account (loanees & non-loanees).	31 th July	31 st December
6	Cut-off date for receipt of Declarations/proposal of Loanees farmers covered on compulsory basis & non-loanees farmers covered on Voluntary basis from Bank branches to respective Nodal Banks/offices.	Within 15 working days for loanees farmers and 7 working days for non-loanees farmers after cut-off date	
7	Cut-off date for receipt of Declarations of farmers covered on Voluntary basis from designated insurance Agent(s) to Insurance Companies	Within 2 working days after receive declaration/ premium.	
8	Cut-off date for receipt of Proposal of Loanees farmers covered on compulsory basis & non-loanees farmers covered on Voluntary basis from respective Nodal Banks offices to Insurance Company	Within 7 working days from receipt of Declarations by the respective Nodal bank offices	
9	Cut-off date for receipt of yield data	Within a month from final harvest	
10	Processing, Approval and Payment of Final Claims based on yield data	Three weeks from receipt of yield data	

2. Further, in case of three crop / season pattern, a modified discipline keeping in mind the overall seasonality discipline prescribed above, shall be adopted by State Level Co-ordination Committee on Crop Insurance (SLCCCI).

3. Keeping in mind the specialty and catastrophic nature of crop insurance, SLCCCI shall fix seasonality in such a way that it doesn't encourage adverse selection or moral hazards and also ensure early payment of claims to eligible insured farmers. No relaxation for extension in the above seasonality/cut off dates shall be considered / granted by this department however, pre-ponementin cut off dates shall be considered on case to case basis. If any state/UT extends the above seasonality / cut off dates on their-own then central share of premium subsidy shall not be available for the concerned notified crops / areas.
4. It may be noted that neither DAC&FW nor any State/UT Govt. will be authorized to extend the cut-off dates of seasonality under any circumstance. However, States/UTs in agreement with IA may do so, if felt necessary, but in such cases, no central premium subsidy will be provided for the areas / farmers / crops which are covered / insured in the extended period. However, Insurance Company has to inform such agreement to DAC & FW and submit the details of coverage during such extended period separately.

X. Collection of Proposals & Premium from Farmers

1. The present Nodal Banks system under NAIS/NCIP will continue for PMFBY as well, for Cooperatives Bank only, wherein the implementing insurance company is not required to deal with all the loan disbursing points (PACs) and instead, deals only with designated Nodal banks. However, individual bank branches for Commercial Banks/RRBs shall act as Nodal branch for this purpose. Besides, insurance company may also use the IRDA approved insurance agents/ insurance intermediaries for the purpose.
2. Declaration formats to be submitted by Nodal banks/Branches shall contain details about Insurance Unit, sum insured per unit, premium per unit, total area insured of the farmers, no. and category of farmers covered (small & marginal or other) and no. of farmers under other categories (SC/ST/others) /gender (male/female) along with their bank account details.

Loanee farmers (Compulsory coverage)

3. For loanee farmers, modalities for coverage will be same as in NAIS/NCIP. Whenever banks sanction loan for a notified crop in a notified area, the crop loan amount only to the extent of **Scale of Finance for notified crops** and acreage of individual notified crops of loanee farmers shall be taken into consideration for deciding the limit of loan and the same will only be eligible for compulsory coverage, as per seasonality discipline. Based on seasonality of Crops, banks should separately calculate the eligibility of loan amount for both Kharif & Rabi seasons based on the scale of Finance & declared acreage under notified crops. Disbursing bank branch / Primary

Agriculture Cooperative Society (PACS) will prepare monthly statement of crop-wise and insurance unit-wise details of crop insurance with premium as per the seasonality discipline. Loan disbursing bank branch/PACS will finance the additional loan towards premium amount payable by farmer for insurance.

4. For crop loans through Kisan Credit Cards (KCC) are covered under compulsory coverage and banks shall maintain all back up records and registers relating to compliance with PMFBY and its seasonality discipline, cut-off-date for submitting Declarations as in case of normal crop loans. Bank branch will apportion coverage among insurable crops, based on acreage mentioned in loan application or on the basis of actual area sown as declared by the farmer subsequently.
5. Crop loans advanced against hypothecation of gold / ornaments are also eligible for compulsory coverage, subject to insurability of crop and seasonality discipline within the prescribed Sum insured limit.
6. Bank branches/Nodal Bank Branch, shall consolidate insurance proposals / statements from bank branches & PACS under its jurisdiction, respectively and forward the same to insurance company along with details of remittance /RTGS towards insurance premium, in accordance with cut off dates, as specified by SLCCI for that particular crop and season.

Non-loanee farmers (Optional coverage) through Channel partners

7. Farmers desirous of availing insurance shall fill up Proposal Form of Scheme and submit same to nearest bank branch or authorized channel partners or insurance intermediaries of insurance company.
8. In case channel partner is a Bank, farmers will submit duly filled up proposal form in the village branch of a Commercial Bank (CB) or Regional Rural Bank (RRB), or PACS (DCCB) with requisite insurance premium amount. Operating a bank account is essential for such cases. Branch/PACS officials will assist the farmers in completing insurance proposal form and provide necessary guidance. While accepting the proposal and premium, Branch / PACS will be responsible for verification of eligible sum insured , applicable premium rate, etc. Bank Branch / PACS will thereafter consolidate these particulars and send them to respective Nodal Bank and Nodal Banks will, in turn, submit crop-wise and insurance unit-wise Crop Insurance Declarations in the prescribed format, along with the premium, within the stipulated time, to insurance company.
9. Non-loanee cultivators could also be serviced directly by any designated agencies, other authorized channel partner or insurance intermediaries, approved by the IRDA for the purpose and will act as guide and facilitator, advise of benefits and desirability of Scheme, guide farmers through procedures; collect requisite premium and remit individual / consolidated premium to insurance company, accompanied by individual proposal forms

and summary details in Declarations / Listing sheet (MIS) provide soft copy to IA and also upload directly to the crop insurance portal.

10. While accepting the Proposal and the premium from aforesaid, designated agents, other authorized channel partner or insurance intermediaries, approved by the IRDA, **it shall be the responsibility of Insurance Company or its designated agents to verify insurable interest and collect the land records, particulars of acreage, sum insured, crop sown etc. and applicable contract/agreement details in case of share croppers/tenant farmers.** The designated intermediaries shall remit the premium with consolidated proposals within 3 days. However, it's mandatory that the Non-loanee cultivators serviced by the designated intermediaries should hold a bank account in order to facilitate remittance of the claim, if payable.

Non-loanee Farmers (Optional coverage) - directly to Insurance companies

11. Non-Loanee farmer may submit insurance proposals personally / through post to insurance company with requisite premium. Non-loanee farmer can also avail insurance through 'on-line portal' of insurance company. However, it's mandatory that Non-Loanee farmers, personally submitting proposals to insurance company, should have insurable interest and submit necessary documentary evidence as proof, as decided by SLCCI. The insured farmer forfeits the premium and the right to claim (if any) if the material facts furnished in the proposal form are wrong or incorrect.
12. Insurance companies retain the right to accept or reject insurance proposal(s) in case proposal is incomplete, not accompanied by necessary documentary proof or insurance premiumordinarily, within one month after receipt of proposal by Insurance Companies. It is also mandatory to hold Bank account in designated bank branch/any branch, to receive crop insurance claims, if any.

Option for change of crop name

13. Farmers covered, on voluntary basis, can buy insurance before actual sowing / planting, based on advance crop planning. However, for any reason if a farmer changes the crop planned earlier, he should intimate the change to insurance company, at least before 30 days from cut-off-date for buying insurance or sowing, through financial institution / channel partner / insurance intermediary / direct; as the case may be, along with difference in premium payable, if any, accompanied by sowing certificate issued by concerned village / sub-district level official of the State. In case the premium paid was higher, insurance company will refund excess premium.
14. Declarations/proposals received from the Banks/PACS after the cut-off date shall be summarily rejected and the liability, if any, for such declarations

shall rest with the concerned bank. Therefore, the Banks/PACS must not receive any proposal after the cut-off date of coverage. The Banks/PACS must also ensure that the consolidated statement alongwith the premium amount is remitted to the insurance company within the stipulated time, failing which they shall be responsible for payment of claims, if any to the farmers. However, any dispute in the matter may be referred to Department by the concerned State/Agency.

15. The Nodal Banks may also collect the list of individual insured farmers (both loanee & non-loanee) with requisite details like name, fathers' name, Bank Account number, village, categories – S&M/SC/ST/Women, insured acreage, details of insured land, insured crop(s), sum insured, premium collected, Govt. subsidy etc. from concerned branch in soft copy also for further reconciliation and send the same to the concerned insurance company within 15 days after final cut-off date for submission of Proposal / Declaration to insurance company and also upload the same on the crop insurance portal.
16. Insurance companies may also collect the requisite information in respect of non-loanee farmers from the channel partner in same formats. It is responsibility of the concerned insurance companies to collect/obtain the details of the insured farmers (both loanee & non-loanee) from the bank/financial institutions/ intermediaries/agents and facilitate the banks to upload the same on crop insurance portal.
17. Insurance Companies should also verify and be satisfied themselves about the coverage of farmers/crops and up-load the same in their websites within a month preferably before the approaching the Government to release the final installment of subsidy under the scheme.

XI. Assessment of Loss / Shortfall in Yield

Wide Spread Calamities (based on season-end yield)

1. The Scheme operates on the basis of 'Area Approach' i.e., Defined Areas for each notified crop for widespread calamities and insurance unit is Village/Village Panchayat or any other equivalent unit for major crops and for other crops it may be a unit of size higher than Village/ Village Panchayat level, to be decided by the State/UT Government. State Government Department overseeing conduct of CCEs will submit yield data as per cut-off date decided by SLCCCI, along with results of individual CCEs. Yield data will be furnished to Insurance company by State Government / UT, in accordance with the cut-off dates fixed, and crops and areas notified, based on total number of CCEs (but not less than prescribed minimum CCEs) being conducted.

2. CCEs shall be undertaken per unit area of insurance per crop, on a sliding scale, as indicated below:

Sl. No.	Level of Insurance Unit	Minimum sample size of CCEs
1	District	24
2	Taluka / Tehsil / Block	16
3	Mandal / Phirka / Revenue Circle / Hobli or any other equivalent unit	10
4	Village / Village Panchayat	4 for major crops & 8 for other crops

3. In order to maintain the sanctity and credibility of CCEs as an objective method of yield estimation, the modalities mentioned below will be followed:

- State shall strengthen audit process of CCE conduct, with necessary checks and balances. Digitizing CCE process including geo-coding and date / time-stamping is must for all CCEs conducted where Village / Village Panchayat is the Insurance Unit (IU).
- Wherever external agencies are used for conducting CCEs or CCEs out-sourced, it can only be given to 'professional' agencies with adequate experience in agriculture field activities/ yield estimation. It's mandatory for these agencies to follow the digital protocol as mentioned in the previous paragraph.
- States shall maintain 'single series' of CCEs, i.e. the same set of CCEs and Yield estimates are used both for Crop Production estimates and Crop Insurance.
- In instances where required number of CCEs could not be conducted due to non-availability of adequate cropped area, the yield estimate for such IUs can be generated by using methods as (i) clubbing with neighboring / contagious units or (ii) adopting yield estimate of next higher unit, or (iii) adopting the yield of neighboring IU with maximum correlation. Priority of their applicability of aforesaid three methods should be notified by the concerned States well in advance. If the such areas where CCEs in requisite numbers were not conducted for any notified crops, is more than 5% total area under the crop in district, permission for applicability of aforesaid methodology may be sought from DAC & FW alongwith detailed cause/reasons etc.

- The yield estimates at IU level shall be submitted by the state government within the cut-off date, along with results of individual CCEs.
- Insurance company has complete access to co-witness the CCEs, as also the digital images of the CCEs.
- Wherever the yield estimates reported at IU level are abnormally low or high vis-à-vis the general crop condition, the insurance company can make use of satellite imagery or other technologies to confirm the yield estimates. In case of significant differences between these two yield estimates, the matter is referred to TAC and its decision is final.

4. Use of Innovative Technologies to target CCEs

With development of number of satellites with high resolution images orbiting the Earth, there have been great improvements in satellite imagery products. It has been reasonably proven the satellite imagery can help in demarcating the cropped areas into clusters on the basis of crop health. This feature can be successfully used to target the CCEs within the Insurance Unit (IU). In other words, satellite imagery can help in '**smart sampling**' of CCEs. While an IU with heterogeneous crop health may need standard sample of CCEs, say 4 CCEs per Village / Village Panchayat, the more homogenous IU may need a fewer sample size, say 2 CCEs. This is expected to minimize the total CCEs needed by about 30-40%. States can adopt this technique in generating yield estimates while following digital protocol outlined in the preceding paragraphs.

5. Use of Technology to remove area discrepancy in coverage

It is noticed that in some States/districts area insured is much more than area sown figures resulting in reduction of sum insured and consequently reduction in claims of farmers. Use of RST/satellite imagery, digitization of land records may be promoted to minimize the area discrepancy.

6. Use of Innovative Technologies for Direct Yield Estimation

ii. For addressing the problems reliability of CCEs, accuracy and speed, innovative technology such as RST, drone, online transmission of data etc. will be utilized to ensure timely payment of claims to farmers. The World Bank based on some pilots in this regard recommended that image video capture of crop growth at various stages and transmission thereof with CCEs data on a close real time basis utilizing mobile communication technology with GPS time stamping, can improve data quality, / timeliness and support timely claim processing and payments. Thus, States and insurance companies may start use of this available technology for the purpose. This Department has also been piloting in this regards and assessment of crop loss at lower unit level.

iii. After adequate number of pilots & proven through the strong correlation between RST / Satellite Imageries results and yield estimates through CCEs, States and insurance companies may use the technologies in estimating the crop yields at IU level, subject to the satisfaction of both States and insurance companies with the accuracy of the yield estimates to service the claims.

7. Use of Mobile Phone Technology to improve Yield-data Quality & Timeliness

It has also been felt that CCEs process currently being conducted by the State's primary employees for estimating yield is lacking in reliability, accuracy and speed which affecting the claims settlement. There is a need to have good quality, timely and reliable yield-data. To increase the reliability, accuracy and speed of CCE data use of smart phones for capturing images and for online transmission of data on centralised server would be done for compilation of data and use for claim settlement. RST and Drones etc. may also be used for the purpose.

8. The cost of using technology etc. for conduct of CCEs process will be shared between Central Government and State/U.T. Governments on 50:50 basis, wherever necessary, subject to a cap on total funds to be made available by Central Government for this purpose based on approximate cost of procuring hand held devices/Smart phones and other related costs.
9. The existing Technical Advisory Committee (TAC) comprising representatives from Indian Agricultural Statistical Research Institute (IASRI), National Sample Survey Organization (NSSO), Central Statistical Organization (CSO), DAC&FW and insurance company may review sample size of CCEs from time to time. TAC shall also review any other technical matters related to conduct of CCEs and timely submission of yield data.

Assessment of Claims (Wide Spread Calamities)

10. If ‘Actual Yield’ (AY) per hectare of insured crop for insurance unit (calculated on basis of requisite number of CCEs) in insured season, falls short of specified ‘Threshold Yield’ (TY), all insured farmers growing that crop in defined area are deemed to have suffered shortfall in yield of similar magnitude. PMFBY seeks to provide coverage against such contingency.

‘Claim’ shall be calculated as per the following formula:

$$\frac{(\text{Threshold Yield} - \text{Actual Yield}) \times \text{Sum Insured}}{\text{Threshold Yield}}$$

Where,

Threshold yield for a crop in a notified insurance unit is the average yield of past seven years (excluding calamity year(s) as notified by State Government/UT) multiplied by applicable indemnity level for that crop.

11. Illustration

In table below, assumed yield of wheat for the last 7 years is given for insurance unit area of “X”. Calculation of TY for Rabi 2012-13 season is as under:

Year	200	200	200	200	200	20	20
Yield (kg/ha)	450	3750	2000	4250	1800	4300	1750

The years of 2007-08, 2009-10 and 2011-12 were declared natural calamity years.

Total of yields of seven years is 22350 kg/ha and that of two worst calamity years is 3550 kg/ha i.e. (1800+1750). Therefore according to provision, average of past seven years excluding maximum two calamity years is $(22350-3550=18800/5)$ i.e. 3760 kg/ha. Hence, threshold yield at 90%, 80% and 70% of indemnity levels will be 3384 kg/ha, 3008 kg/ha and 2632 kg/ha respectively.

XII. On Account Payment of Claims due to Mid-Season Adversity

1. It is proposed to provide immediate relief to insured farmers in case of adverse seasonal conditions during the crop season viz. floods, prolonged dry spells, severe drought etc., wherein expected yield during the season is likely to be less than 50% of Normal average yield.

Eligibility Criteria:

- i. Notified Insurance Unit would be eligible for “ON ACCOUNT” payment only if the expected Yield of the affected crop during the season is less than 50% of Normal average yield.
- ii. The provision is invoked by the state government through damage notification based on the proxy Indicators.
- iii. The provision could be invoked for a specific crop or group of crops in Notified Insurance Unit, depending on compliance with the criteria and crop loss survey to be carried based on notified insurance unit only.
- iv. Insurance company may decide the quantum of likely losses and the amount of ‘on-account’ payment based on the joint survey of Insurance Company and state government officials.
- v. Only those farmers would be eligible for compensation under this cover who have paid the premium / the premium has been debited from their account before the damage notification by the state government invoking this provision for compensation.
- vi. Maximum amount payable would 25% of the likely claims, subject to adjustment against final claims.
- vii. If adversity occurs within 15 days of normal harvest time this provision will not be invoked.

Proxy-Indicators: Indicators for damage intimation order could be rainfall data, other weather data, satellite imagery and crop condition reports by district level state govt. official, supported by media reports.

Loss assessment procedure:

- i. Joint committee for claim assessment of crop damage to be formed and notified before start of the crop season by the SLCCI for each districts.
- ii. The joint committee of State Govt., Insurer shall decide the eligibility for on-account payment based on the weather data (available AWS notified by the Govt.) /long term average rainfall data/satellite imagery supported by estimated yield losses at notified Insurance unit level. Damage intimation order to be issued within 7 days from the adverse seasonal event.
- iii. Based on the above report, a joint inspection of the affected area may be done by Insurance Company for ground truthing with State government officials and arrive at extent of loss.

- iv. Information/Services of Mahalanobis National Crop Forecast Centre (MNCFC) may also be utilized for determination of on-Account payout.
- v. If the expected loss of the affected crop is more than 50% of the Normal average Yield (TY) for the Notified Insurance Unit on-account payment would be payable.
- vi. On-account payment would be calculated as per following formula:

(Threshold Yield - Estimated Yield) × Sum Insured × 25%

Threshold Yield

Time frame for loss assessment and submission of report:

- a. Eligibility of on-account payment order with details of damaged Insurance Units to be issued by the state government within 7 days from the occurrence of adverse seasonal event.
- b. Loss assessment report at affected insurance unit level to be completed by the committee within 15 days from occurrence of adverse seasonal event.

Conditions:

- i. Mere disbursement/ sanction of loan without receipt/ debit of premium before the notification of calamity won't make a farmer eligible for claim.
- ii. The On-account payment would be disbursed by the insurance company only after the receipt of Government share of premium subsidy.
- iii. On- account payment would be paid to all eligible insured farmers within one month of notification invoking this provision by the State Government and subject to receipt of loss report from state government.
- iv. These claims would be adjustable from end season area approach yield based claims.

2. Illustration

District 'A' has been affected by floods having 100 insurance units under Crop 'X'. Out of which 50 insurance units were severely affected and as per the weather indicators / agro-met data, it has been assessed that 30 insurance units could have yield loss of more than 50% (compared to the normal average threshold yield). Out of these 30 insurance units, estimated yield loss for 5 units is 80% (Category-I), for another 10 units, it is 70% (Category-II) and remaining 15 units, it is 60% (Category-III) of normal average yield. As per declarations received, if sum insured for notified areas in Category-I,

Category-II and Category-III is Rs. 1 crore, Rs. 2 crore, and Rs 3 crore, respectively, then likely total claims will be Rs. 80 lakh, 140 lakh and 180 lakh, respectively. Hence on-account claims upto 25% shall be Rs. 20 lakh, 35 lakh and 45 lakh, which will be released during the season subject to receipt of premium subsidy.

XIII. Prevented / Failed Sowing / Planting / Germination Claims

1. It is proposed to provide insurance cover to farmers in case of widespread incidence affecting crops in more than 75% of normal area sown in a notified unit at early stage leading to total loss of crop or the farmers are not be in a position to either sow or transplant crop due to non-receipt of sufficient rainfall or excess rainfall or other weather.

The precondition for this cover is issuance of notification before commencement of normal sowing process and details of insurance coverage from banks should be advised to Insurance company..

Eligibility Criteria:

- i. The state govt. would provide Notified Insurance Unit and crop wise normal area sown at the beginning of the season within 15 days.
- ii. Notified Insurance Units will be eligible for “Prevented Sowing/Planting” payout only if more than 75% of Normal Crop Sown Area for notified crop remained unsown due to occurrence of any of the above perils.
- iii. The provision is invoked by the state government through notification based on the proxy Indicators.
- iv. Only those farmers would be eligible for compensation under this cover who have paid the premium / the premium has been debited from their account before the notification by the state government invoking this provision for compensation.
- v. The state govt. would notify crop wise and agro-climatic zone or district wise cut off dates by which, this provision could be invoked.

Proxy-Indicators: Indicators like rainfall data, other weather data, satellite imagery and crop condition reports by district level State Govt. official, media reports, area sown data released by State Govt.

Loss assessment procedure:

- i. State Govt. would declare a Notified Insurance Unit as having suffered Prevented or Failed Sowing/Planting conditions with approximate areas in percentage of the unit.
- ii. The Lump sum payout under this cover would be limited to 25% of the sum insured and the insurance cover will be terminated.

Conditions:

- i. The cover will be available for major crops only.
- ii. Mere disbursement/ sanction of loan without receipt/ debit of premium before the notification of calamity won't make a farmer eligible for claim.
- iii. The insurance company would disburse the claim within 30 days of the notification invoking the event subject to receipt of estimated area sown data from State Government.
- iv. The pay-out under the cover would be disbursed by the insurance company only after the receipt of Government share of premium subsidy.
- v. Insurance Cover would terminate for the affected crop in a Notified Insurance Unit once a claim under this section is invoked and the Affected Insurance Unit/Crop would not be eligible for area yield based claim calculated at the end of the season.
- vi. This provision would be needed to be invoked within the cut-off date as notified by the state government, beyond which if invoked, no claim would be payable.
- vii. Once this provision is invoked, no fresh enrolment of farmers for the affected notified crops & areas would be done.
- viii. Once exigency is invoked it applies to all the insured farmers in the Notified Insurance Unit for a given crop, including for those whose crop survived.

2. Illustration

District 'B' with 100 insurance units has been affected by dry-spell at the beginning of crop season, consequently about 80% of the area could not be sown in about 50 insurance units for groundnut crop, where per hectare sum insured is Rs. 20,000. As per provision of payment for prevented sowing, the benefit payable is sum insured X 25%, which on a sum insured of Rs. 20,000 works out to Rs. 5000.

XIV. Post-Harvest Losses

1. It is proposed to provide for assessment of yield loss on individual plots basis in case of occurrence of cyclone, cyclonic rains and unseasonal rains throughout the country resulting in damage to harvested crop lying in the field in 'cut & spread' condition up to maximum period of two weeks (14 days) from harvesting for sole purpose of drying.

Eligibility criteria:

- i. Available to all insured farmers, at farm unit level, affected by above mentioned perils in a Notified Insurance Unit growing notified crops for which insurance have been availed.
- ii. Available to all crops damaged by specified perils, which are left in the field after harvesting in “cut & spread condition” for drying up to a period of 14 days from harvest.

Proxy-Indicators: Report in the local media or reports of the agriculture/revenue department supported by media reports and other evidences.

Loss assessment procedure:

Time and method of reporting the loss/claims

- I. Immediate intimation (within 48 hours) by the insured farmer to any one as detailed in below.
- II. Intimation must contain details of survey number-wise insured crop and acreage affected.
- III. Premium payment verification to be reported in next 48 hours by the farmer/Bank.

Whom to be reported i.e. Channel of reporting:

- a. **Post-Harvest losses:** Intimation may be given within 48 hours by farmer either directly to the insurance company, concerned bank, local agriculture department government/district officials or through toll free number (*Centralised dedicated Toll Free Number for claim intimation, intimations can be redirected to respective Insurance Companies through backend*) to insurance company. First mode of intimation will be centralised Toll Free Number, in absence of such facility, the report can be given to banks or govt. officials, the same would be forwarded/intimated to the insurance company immediately on receipt of such information. The banks would verify the insured details like crop insured, sum insured, premium debited and date of debit before sending the same to insurance company.

- i. **Documentary evidence required for claim assessment,**

- a. **Post-Harvest losses:**

- Duly filled Claim form along with all relevant documents are requisite for payment of claims. However, if information on all the columns is not readily available, semi-filled form may be sent to the insurance company and later within 7 days of the loss, filled form may be submitted.
- Local Newspaper cutting and any other available evidence to substantiate occurrence of loss event and severity of the loss, if any.

ii. Appointment of Loss Assessors by the Insurance Company:

The loss assessors would be appointed by the insurance company for assessment of losses due to the operations of Post-harvest losses (Yield Insurance). The loss assessors appointed should possess following experience and qualification:

- a. Any Graduate (preferably Agriculture i.e. B. Sc. (Ag.)) with minimum 2 years' relevant experience.
- b. Retired Government officials of Agriculture/Horticulture/Extension Department having B. Sc. (Ag.) degree.
- c. Retired Bank officials with experience of crop loaning or KCC For compliance under the above provisions the insurance companies would empanel the suitable loss assessors for using their services as and when required.

The loss would be jointly assessed by a team of loss assessor appointed by the insurer, block level agriculture officer and the concerned farmer.

Time frame for loss assessment and submission of report

- a. Appointment of loss assessor within 48 hours from receipt of information
- b. Loss assessment to be completed within next 10 days
- c. Claim settlement/payment to the farmers to be completed in next 15 days (subject to receipt of premium) from loss assessment report.
- iii. If the affected area under a notified crop is more than 25% of the total cropped area in a Notified Insurance Unit, all the insured farmers in the Notified Insurance Unit deemed to have suffered post harvest loss and would be eligible for compensation. Percentage of loss would be arrived at by requisite percentage of sample survey (as decided the Joint Committee) of affected area by the insurance company.
- iv. Maximum liability would be limited to proportionate Sum Insured of damaged cropped area compared with area insured. If the claims on area approach (based on CCEs) is more than the claims of the Post Harvest losses, the difference claims will be payable to affected farmers. If claims for Post Harvest is higher, no recovery will be applicable from affected farmers.

Example:

- i. Sum Insured for a crop = Rs. 50,000
- ii. Affected area of the insured field = 80% (eligible for sample survey)
- iii. Assessed loss in the affected area/fields due to operation of insured peril = 50%
- iii. Claims Payable under Post Harvest loss = $Rs. 50,000 \times 50\% = Rs 25,000$
- iv. End of season reported shortfall in yield = 60%

- v. Claim estimated based on 'area approach' at IU level = Rs. $50,000 \times 60\% =$ Rs. 30,000
- vi. Balance payable at end of season = Rs. 30,000 - Rs. 25,000 = Rs. 5,000

Conditions:

- i. Mere disbursement/sanction of loan without receipt/debit of premium before the occurrence of insured peril won't make a farmer eligible for claim.
- ii. When affected areas are limited up 25% of total crop sown areas in the notified areas, the losses of only those farmers would be assessed who have intimated the loss and have paid premium prior to occurrence of insurance peril.
- iii. The pay-out under the cover would be disbursed by the insurance company only after the receipt of Government share of premium subsidy.
- iv. The insurance company would disburse the claim, if payable within 30 days of receipt of loss survey.
- v. If end of season based on the yield data claim is more than the claim under this cover, the balance would be paid at the end of the season under widespread claims.
- vi. Farmers getting enrolled or whose premium is debited after occurrence of insurance peril would not be eligible for compensation under this cover.

XV. Localized Risks

- 1. It is intended to provide insurance cover at individual farm level to crop losses due to occurrence of localized perils/calamities viz. Landslide, Hailstorm and inundation affecting part of a notified unit or a plot.

Eligibility Criteria:

- i. Available to all insured farmers, at farm unit level, affected by above mentioned perils in a Notified Insurance Unit growing notified crops for which insurance have been availed.
- ii. Maximum liability is limited to proportionate Sum Insured of damaged crop's area. This would be based on the proportion of cost of inputs incurred during sowing period to the sum insured.
- iii. Only those farmers would be eligible for compensation under this cover who have paid the premium/the premium has been debited from their account before occurrence of the insured peril.
- iv. Maximum pay-out under this provision would be in proportion to cost of inputs, incurred up to the occurrence of insured peril, subject to the sum insured. If the payout under area approach (based on CCEs data) is more

than localized losses, the higher claims of two will be payable to insured farmers.

Proxy-Indicators: Report in the local media or reports of the agriculture/revenue department.

Loss assessment procedure:

Time and method of reporting the loss/claims

- i. Immediate intimation (within 48 hours) by the insured farmer to any one as detailed in (ii) below.
- ii. Intimation must contain details of survey number-wise insured crop and acreage affected.
- iii. Premium payment verification to be reported in next 48 hours by the farmer/Bank.
- iv. Mobile application may be used for reporting incidents of localized risks for intimation of events including long./lat. details and pictures using NRSC Mobile App.

Whom to be reported i.e. Channel of reporting:

- a. **Localised risks:** Intimation may be given within 48 hours by farmer either directly to the insurance company, concerned bank, local agriculture department government/district officials or through toll free number (*Centralised dedicated Toll Free Number for claim intimation, intimations can be redirected to respective Insurance Companies through backend*) to insurance company. First mode of intimation will be centralized Toll Free Number, in absence of such facility, the report can be given to banks or govt. officials, the same would be forwarded/intimated to the insurance company immediately on receipt of such information. The banks would verify the insured details like crop insured, sum insured, premium debited and date of debit before sending the same to insurance company.

v. Documentary evidence required for claim assessment,

a. Localised risks:

- Duly filled Claim form along with all relevant documents are requisite for payment of claims . However, if information on all the columns is not readily available, semi-filled form may be sent to the insurance company and later within 7 days of the loss, filled form may be submitted.
- Evidence of crop loss through capturing pictures using mobile application, if any.
- Local Newspaper cutting to substantiate occurrence of loss event and severity of the loss, if any.

vi. Appointment of Loss Assessors by the Insurance Company:

The loss assessors would be appointed by the insurance company for assessment of losses due to the operations of Localized Risks (Yield Insurance)/Add-on cover (Weather Insurance). The loss assessors appointed by the insurance companies should be in accordance with the IRDAI provisions. The loss assessors appointed should possess following experience and qualification:

- i. Any Graduate (preferably Agriculture i.e. B. Sc. (Ag.)) with minimum 2 years' experience of crop insurance.
 - ii. Retired Government officials of Agriculture/Horticulture/Extension Department having B. Sc. (Ag.) degree.
 - iii. Retired Bank officials with experience of crop loaning or KCC For compliance under the above provisions the insurance companies would empanel the suitable loss assessors for using their services as and when required.
- The loss would be jointly assessed by a team of loss assessor appointed by the insurer, block level agriculture officer and the concerned farmer.
- iv. Time frame for loss assessment and submission of report

- Appointment of loss assessor within 48 hours
- Loss assessment to completed within next 10 days
- Claim settlement to be completed in next 15 days (subject to receipt of premium)
 - v. Maximum liability would be limited to proportionate Sum Insured of damaged cropped area.

Example:

- i. Sum Insured for a crop = Rs. 30,000
- ii. Assessed loss in the affected area due to operation of insured peril = 40%
- iii. Claims Payable under this cover = $Rs. 30,000 \times 40\% = Rs 12,000$
- iv. End of season reported shortfall in yield = 60%
- v. Claim estimated based on 'area approach' at IU level = $Rs. 30,000 \times 60\% = Rs. 18,000$
- vi. Balance payable at end of season = $Rs. 18,000 - Rs. 12,000 = Rs. 6,000$

Conditions:

- i. Mere disbursement/sanction of loan without receipt/debit of premium before the occurrence of insured peril won't make a farmer eligible for claim.

- ii. The losses of only those farmers would be assessed who have intimated the loss and have paid premium prior to occurrence of insurance peril.
- iii. The pay-out under the cover would be disbursed by the insurance company only after the receipt of Government share of premium subsidy.
- iv. The insurance company would disburse the claim, if payable within 30 days of survey of loss.
- v. If end of season based on the yield data claim is more than the claim under this cover, the balance would be paid at the end of the season under widespread claims.
- vi. Farmers getting enrolled or whose premium is debited after occurrence of insurance peril would not be eligible for compensation under this cover.
- vii. Bank would remit farmers premium with farmers list within 7 days of intimation of loss under this section, if not send earlier.

XVI. Procedure for Settlement of Claims to the farmers

- 1. Upfront premium subsidy from Government of India and concerned State /UT, should have been received for the season, by insurance company to enable them to settle the claim.
- 2. In case of widespread calamity (end of season claims), once yield data is received from State Government as per the cut-off-dates decided, claims will be worked out as per Declarations/proposals received from banks / channel partners / insurance intermediaries for each notified area & crops and claims will be approved by Competent Authority of Insurance company i.e. Implementing Agency (IA).
- 3. In case of farmers covered through Financial Institution, claims shall be released only through electronic transfer, followed by hard copy containing claim particulars, to individual bank branches/nodal banks; and banks branches /PACs at grass root level, will credit into accounts of individual farmers within a week of receipt of funds from the Insurance companies and shall provide a certificate to the insurance companies along with list of farmers benefited. Bank Branch should also display particulars of beneficiaries on notice board and also upload the same on crop insurance portal..
- 4. In case of farmers covered on voluntary basis through intermediaries, payable claims will directly credited to the concerned bank accounts of insured farmers and details of the claims may also intimated to them. The list of beneficiaries may also be uploaded on the crop insurance portal immediately..

5. In case of claims under prevented/failed sowing, localized calamities, post-harvest losses; insurance company will get claims approved by their competent authority after assessment and shall release the claims as per procedure given in above.
6. Insurance companies resolve all the grievances of the insured farmers and other stakeholders in the shortest possible time.
7. Disputed claims / sub-standard claims, if any will be referred through SLCCCI/State Government to DAC&FW for consideration by insurance company; and decision of DAC&FW in case of any interpretation of provisions of scheme or disputes will be binding on State Govt. / Insurance Company / Banks and the farmers.

XVII. Important Conditions /Clauses Applicable for Coverage of Risks

1. Insurance companies should have received the premium for coverage either from bank, channel partner, insurance intermediary or directly. Any loss in transit due to negligence by these agencies or non remittance of premium by these agencies, the concerned bank / intermediaries liable for payment of claims.
2. In case of any substantial misreporting by nodal bank /branch in case of compulsory farmers coverage, the concerned bank only shall be liable for such mis-reporting.
3. Mere sanctioning / disbursement of crop loans and submission of proposals/ declarations and remittance of premium by farmer / bank, without explicit intent to raise the crop, does not constitute acceptance of risk by insurance company.
4. Insurance company, if deemed necessary, will investigate coverage on its own or by an agency appointed for the purpose and may utilize technologies, including satellite imagery for identification of anomalies in crop insurance coverage vis-à-vis actual field conditions.
5. Acreage discrepancy

Some areas in the past reported excess insurance coverage vis-à-vis planted acreage, leading to 'over' insurance. Ideally the discrepancy should be handled at farm level to protect the interest of farmers with genuine insurance coverage. All suitable measures should be taken by concerned stakeholders for de duplication with the help of land records, banks records, revenue records and proposal/loan application of insured farmers. However, in the absence of digitized farm records on a GIS platform, it would be cumbersome to physically verify each farm when the reported discrepancies are comparatively large (more than 150 % of insured area of the sown areas

due to shifting of acreage, promotion of particular crops, change in economic value/market etc at micro level.). For the time-being, it is to be addressed as follows:

- Wherever the ‘acreage discrepancy’ likely, the acreage insured at district level shall be compared with 150% of the average planted acreage of past three years, and the difference is treated as ‘excess’ insurance coverage.
- Sum insured is scaled down in the proportionate ratio the average of three years’ actual planted acreage bears to the insured acreage for the given crop.
- Claims shall be calculated on the scaled down sum insured
- Premium (farmer share & govt. Subsidy) shall be refunded back to Government of India for the portion of sum insured scaled down and the amount may be utilised for improvement of technology/research/Impact assessment etc..

Once the individual farms (plots / survey numbers) are digitized and available on a GIS platform, it’s quite possible to overlay the crop cover as derived using satellite imagery on the GIS platform to identify the crop and estimate the cropped area on each farm. This should lead to identifying the acreage discrepancy at individual farm level.

XVIII. Publicity and Awareness

1. Adequate publicity needs to be given in all the villages of the notified districts/ areas. All possible means of electronic and print media, farmer’s fair, exhibitions including SMS messages, short films, and documentaries shall be utilized to create and disseminate awareness, benefits and limitations of the Scheme among the cultivators and the agencies involved in implementing the Scheme. Agriculture/Cooperation Departments of the State in consultation with Insurance Companies shall work out appropriate Plan for adequate awareness and publicity three months prior to the start of coverage period. All the published material information should necessarily be uploaded on the crop insurance portal along with coverage/frequency /duration date etc
2. The State Government/ UT in collaboration with Insurance Companies shall also chalk out plan for capacity building of the associated agents, banks etc

for effective implementation of the scheme and organize training workshops/sensitization programme for them in association with participating insurance companies.

XIX. Commission & Bank Charges

1. Bank shall be paid service charges @ 4% of the premium collected from farmers. Rural agents engaged in providing insurance related services to farmers may be paid appropriate commission as decided by the insurance company, subject to cap prescribed under IRDA regulations.

XX. Service Tax

PMFBY is a replacement scheme of NAIS/MNAIS, and hence exempted from Service Tax.

XXI. Review of the Scheme

1. State Governments / UT may ensure that products provide comprehensive insurance coverage to the farmers on sound insurance principles and provide the best value for the premium. State Government may also review the progress of scheme periodically and undertake impact assessment after the completion of each season and send their suggestion/recommendations to this Department for making further improvements in the scheme.

XXII. Monitoring of the Scheme and Social Audit

1. State Level Coordination Committee on Crop Insurance (SLCCCI) of the concerned State will be responsible for monitoring of the schemes/programme in their states. However, a National Level Monitoring Committee (NLMC) under the chairmanship of Joint Secretary (Credit), DAC&FW will monitor the scheme at national level.
2. It is proposed to take following monitoring measures for effective implementation during each crop season to ensure maximum benefits to the farmers:
 - a) The Nodal Bank(s)/intermediaries may collect the list of individual insured farmers (both loanee & non-loanee) with requisite details like name, fathers' name, Bank Account number, village, categories – S&M/SC/ST/Women, insured acreage, insured crop(s), sum insured, premium collected, Govt. subsidy etc from concerned branch in soft copy for further reconciliation and send the same to the concerned insurance company along with declarations of farmers within 15 days after final cut-off date. Yield data based on CCEs shall be made

available to the concerned insurance company by the state government within a month from the date of final harvest.

- b) After receiving the claims amount from the concerned Insurance Companies, the financial institutions/banks should remit/transfer the claim amount to the account of beneficiaries farmers within a week and also display the list of the beneficiaries (both loanee & non-loanee) on the notice board of the branch within seven days with details of beneficiaries like Name of farmers/beneficiaries, crops insured, sum insured, amount of claims received etc. and send a copy to concerned insurance companies with utilization certificates within 15 days for further verification and audit.
- c) The list of the beneficiaries (Bank-wise & insured area-wise) may also be uploaded/placed on the crop insurance Portal &website of the concerned insurance companies with proper provisions & mechanisms of public grievance redressal /feed-back etc.
- d) The Insurance Companies should also send a copy of the list of beneficiaries received from financial banks along with the list of beneficiaries covered through other intermediaries to concerned Gram Panchayat within one month of disbursement of claims for displaying the same in the notice board for social audit etc.
- e) About 5% of the beneficiaries may be verified by the Regional Offices/local level Offices of Insurance Companies and send the feed back to concerned District Level Monitoring Committee (DLMC) & State Government/State Level Coordination Committee on Crop Insurance (SLCCCI).
- f) At least 10% of the beneficiaries verified by the insurance company may be cross verified by the concerned District Level Monitoring Committee (DLMC) and send the feed back to State Government.
- g) 1 to 2% of the beneficiaries may be verified by the Head Offices of the insurance company/Independent Agencies appointed by the Central Government/National Level Monitoring Committee and send the necessary feed back to Central Government.

XXIII. Participation of Insurance Companies in Implementation of the Scheme

Empanelment Criteria

1. The public sector and private sector General Insurance Companies empanelled by the Department of Agriculture, Cooperation& Farmers'

Welfare (DAC&FW), Ministry of Agriculture & Farmers' Welfare (MOA&FW), Government of India (GOI) and selected by concerned State Government / Union Territory (UT) implement PMFBY. The Insurance Companies mainly engaged in agriculture/rural insurance business and having adequate experience, infrastructure, financial strength and operational capabilities are empanelled by DAC&FW. However, selection of insurance company from amongst the empanelled insurance companies will be done by the concerned State Government for implementation of PMFBY in their State.

Selection Criteria of Insurance Companies as Implementing Agency (IA)

2. The selection of insurance company from amongst the empanelled insurance companies to act as IA shall be done by the concerned State Government for implementation of the scheme in their State. Such selection of IA shall be done from amongst the designated / empanelled companies .The final selection of IA from amongst the bidders shall be done based on the lowest weighted premium quoted by the company for all notified crops within the cluster of districts .
3. Selection of Implementing Agency (IA) may be made by adopting the cluster approach. In case of smaller States, the whole State may be assigned to one IA.

Clustering/Clubbing of districts for bidding by the state:

In order to diversify/spread the risk and cover high risk/low risk districts/area equally, the State Government would group the districts in such a way that each group contains mix of districts with different risk profiles. Prior to inviting financial bid (premium rates) the State Government would divide the state in to multiple clusters. While clustering/clubbing following criteria would be followed:

- i. States may form the clusters of districts based on similar estimated Sum Insured and mixed agro-climatic zones.
- ii. Prior to the bid invitation, details on the clusters formation would be made available to the insurance companies.

Clustering/Clubbing of districts may be based on one or more of the following:

- i. Cluster formation shall be applicable for 1 year to 3 years and clusters may be formed having 5-10 districts.

- ii. Cluster may have defined based on similar estimated Sum Insured and mixed agro-climatic zones so as to increase the diversification of risk within a cluster and enable risk spreading for insurer.
- iii. Cluster may contain districts with mixed agro-climatic zones so as to increase the diversification of risk within a cluster.
- iv. Crop wise associated risk may also be diversified among the clusters and not concentrated within the cluster.

Example:<to be given>

Applicable conditions for Clustering/Clubbing of districts:

- i. Within the cluster insurance companies would be required to quote premium rates for all district-crop combination for their bids to be evaluated.
 - ii. Company not quoting for even a single district-crop combination would be disqualified for the bidding period.
 - iii. There would be no further negotiations with the L1 bidder to accept L1 rates of other bidder for any district crop combination i.e. the rates quoted by the L1 bidder for different district-crop combination would be applicable within the cluster.
 - iv. If any company declines after being declared L1, the company may be barred for the coming season and the L2 may be given the cluster for implementing the crop insurance scheme at L1 district-crop combination rates and so on to L3, L4 bidder as per the consent of insurance company.
 - v. All the insurers who have participated in the bidding process, if not disqualified/debarred, would be allowed to cover Non-loanee farmers at L1 district crop combination rates to encourage competition.
4. State Govt. would invite all the empanelled insurance companies to submit the district-wise premium rates for the notified crops, Indemnity Level, Threshold Yields, Sum Insured etc. which will be same for all insurance companies for the season. Allocation of notified crops / areas may be made to companies strictly on the basis of merit. The lowest weighted premium quoted by a company for all crops within the cluster of districts i.e. Sum of all crops (premium x sum insured x area sown) may be the guiding factor for arriving to L1. The designated / empanelled companies participating in bidding have to bid the premium rates for all the crops notified / to be notified by the State Govt. and non-compliance will lead to rejection of company's bid.

Sample calculation to find L1:

Table-1: calculation to arrive company's weighted average premium in a district of the cluster

District: D1 Company -X

Crops Notified in a District of the Cluster	Expected Area to be insured (in ha)	Notified SI per ha (Rs.)	Total SI (Rs. Lakh)	Premium Quoted by company X (% of SI)	Premium Amount (Rs. Lakh)
Paddy	10000	30000	3000	5	150
Maize	6000	20000	1200	10	120
Cotton	8000	35000	2800	12	336
Arhar	9000	50000	4500	15	675
Groundnut	5000	40000	2000	13	260
Above all crops	38000		13500		1541

District: D1 Company -Y

Crops Notified in a District of the Cluster	Expected Area to be insured (in ha)	Notified SI per ha (Rs.)	Total SI (Rs. Lakh)	Premium Quoted by company Y (% of SI)	Premium Amount (Rs. Lakh)
Paddy	10000	30000	3000	6	180
Maize	6000	20000	1200	8	96
Cotton	8000	35000	2800	10	280
Arhar	9000	50000	4500	14	630
Groundnut	5000	40000	2000	13	260
Above all crops	38000		13500		1446

District: D1 Company -Z

Crops Notified in a District of the Cluster	Expected Area to be insured (in ha)	Notified SI per ha (Rs.)	Total SI (Rs. Lakh)	Premium Quoted by company Z (% of SI)	Premium Amount (Rs. Lakh)
Paddy	10000	30000	3000	7	210

Maize	6000	20000	1200	9	108
Cotton	8000	35000	2800	11	308
Arhar	9000	50000	4500	15	675
Groundnut	5000	40000	2000	14	280
Above all crops	38000		13500		1581

and like-wise for other districts (D2, D3, D4, D5) and companies.

Table-2: calculation to arrive company's weighted average premium in a cluster of districts

For Company: X

Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company X (% of SI)
District D1	38000	13500	1541	
District D2	40000	14000	1600	
District D3	35000	13000	1400	
District D4	45000	15000	1650	
District D5	30000	12750	1350	
Above all Districts	188000	68250	7541	11.05

For Company: Y

Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company Y (% of SI)
District D1	38000	13500	1446	
District D2	40000	14000	1500	
District D3	35000	13000	1425	
District D4	45000	15000	1675	
District D5	30000	12750	1400	

Above all Districts	188000	68250	7446	10.91
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For Company: Z

Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company Z (% of SI)
District D1	38000	13500	1581	
District D2	40000	14000	1550	
District D3	35000	13000	1475	
District D4	45000	15000	1600	
District D5	30000	12750	1275	
Above all Districts	188000	68250	7481	10.96

The company of the lowest weighted average premium in the cluster will be selected as L1. Hence, company Y qualifies for L1 in the cluster of 5 districts.

And like-wise for other clusters and companies.

5. State Government may ensure that only one insurance company operates in each district or notified area for loanee farmers. However, more than one insurance company can be permitted to implement the scheme in a district for non-loanee farmers.
 6. Selection of IA may be made for one year to three years however, the State government / UT and the concerned insurance company are free to renegotiate the terms if relevant. This will facilitate the insurance company to establish the credibility among the farmers through investment out of the premium savings in various welfare activities for socio-economic development of the farmers like creation of the facilities of drinking water/health care/education, farm leveling, no claim bonus, Weather Forecasts, common Service Centres etc. It is also anticipated that long term continuity gives an opportunity to Insurers, Bankers, State Govt. and other stakeholders for a supportive and collaborative interaction and business relationship and service effectiveness.
7. The insurance coverage in terms of number of farmers & hectare-age should be at least at the previous season's level.

Assessment of Performance & De-empanelment of Insurance Companies

8. The performance of the empanelled insurance companies shall be closely monitored by DAC&FW on 3 years interval through ascertaining the company's skills & efficiencies for providing cost effective better insurance services to farmers. For the purpose, 5 indicators basing the company's risk-underwriting ability, coverage enhancement, fiscal skills & strength, payouts, promptness in claim settlement have been evolved. The indicators are (i) Percentage of number of successful biddings to total number of biddings participated (with 30% weight age), alternatively percentage of districts / area allocated (existence) to total districts / area (ii) Percentage of actual area insured to total cropped area in the allocated districts / areas (with 30% weight age) (iii) Percentage of own-retention of risk insured (SI) to total risk insured weight age 20%)(iv)Percentage of claims paid to total premium collected (weight age 10%).(v) Percentage of claims paid to total admissible claims (weight age 10%). If the total points of performance so arrived are found below 40, the said insurance company is liable to be de-empanelled.

XXIV. Role & Responsibilities of Various Agencies

For successful implementation and administration of Scheme, roles of various Agencies/Institutions/Government Departments/Committees are spelt out herein.

1. Central Government

- a) Support & Coordination with the State/UT Governments for implementation of PMFBY including its awareness and publicity and issue necessary instructions/ guidelines from time to time for smooth and effective implementation.
- b) Issue directives to Banks through "Reserve Bank of India (RBI)" and "National Bank for Agriculture and Rural Development (NABARD)", for complying with the terms and conditions of PMFBY and its operational modalities.
- c) Facilitate for providing the weather data through India Meteorological Department (IMD) on near real-time basis to insurance company.
- d) Release 50% premium subsidy towards DAC&FW committed liability under the scheme to insurance companies at the beginning of crop season on the basis of business projections (premium collection) to be submitted by insurance companies. The balance of premium subsidy, if any for the season shall be released based on submission of final / actual business achieved during crop season by insurance companies to enable them to release claims to beneficiary farmers.

- e) Review & monitor the implementation of PMFBY including premium rates, product-benchmarking and other matter/directives to insurance companies. Review of performance of participating insurance companies and suggests modifications/improvements wherever required.
- f) Organize Capacity building training/workshops for the State Government officials and other stakeholders.
- g) Interpretation of any provisions of the scheme and decision on any dispute in settlement of claims.

2. State / UT Governments

- a) The composition of SLCCCI may be strengthened suitably from time to time to give representation to all the concerned participants including farmers in the implementation of the scheme. To set up the review and monitoring committee at both, State and District levels under the chairmanship of Principal Secretary (Agriculture/Cooperation) and District Collector, respectively for periodical review (preferably monthly) of implementation of scheme and also verify the coverage etc. on random basis to ensure proper coverage under the scheme. DLMC also provide fortnightly crop condition reports and periodical reports on seasonal weather conditions, loans disbursed extent of area cultivated, etc. to concerned insurance company. DLMC shall also monitor conduct of CCEs in districts.
- b) Issuance of Notification for implementation of the scheme least one month in advance of season and circulate it to all concerned before every crop season. Selection of the Implementing Agencies (insurance company) following a transparent bidding process as described in preceding paragraphs. Issue Notification at. **Timely issuance of notification is a must for giving wide publicity and coverage of non-loanee farmers. There should be a gap of at least one month between the notification issuance and risk inception date.** Notification of the State Government may essentially contain following information:
 - a. Crops and insurance units notified in various districts.
 - b. Premium rates, and subsidy, as applicable for various crops.
 - c. Seasonality discipline for various activities.
 - d. Calamity year, if any to be excluded for calculation of threshold yield, etc.(up to maximum two years out of last seven years)
- c) Issue necessary directives to all agencies / institutions / government departments/ committees involved in implementation of Scheme.

- d) Notify insurance unit area to Village Panchayat or other equivalent units for major crops and for other crops, unit size may be above the level of Village / Village Panchayat.
- e) Furnish in advance insurance unit-wise (or of higher unit, if unit level data not available) yield data of immediate past 10 years of all notified crops under PMFBY to insurance companies.
- f) Issuance of necessary instructions to Regional Meteorological Centres of IMD and other government / quasi government agencies for supplying weather data on real-time basis to insurance company.
- g) To release its 50% share of Premium Subsidy to insurance companies, in the beginning of every crop season, based on fair estimates submitted by them, and settle balance of actual premium subsidy for season as soon as final figures are submitted by insurance company. In order to ensure timely release of premium subsidy by the states, release of GOI subsidy shall be made to those states only which have cleared their liability of premium subsidy excluding the immediate previous crop season.
- h) To undertake extensive awareness and publicity campaigns of Scheme amongst farming community through agriculture and extension Departments to maximize coverage of the farmers specially non-loanee farmers.
- i) Submission of yield data for all notified crops and insurance units to insurance companies in standard format within stipulated date.
- j) To furnish to the insurance companies the insurance unit wise area sown of insured crops within two months from the sowing period.
- k) Assist insurance companies for assessment of crop loss of individual insured farmers caused by localized perils and also assist in post harvest losses.
- l) To undertake requisite no. of CCE in the notified area following single series, and provide the yield data to the insurance company within the prescribed cut-off date, along with results of individual CCEs.
- m) Allow insurance companies to co-observe and witness CCEs, and permit them to access various records at grass root / district / state level. State shall strengthen audit process of conducting CCE with

necessary checks and balances. Audio/Video-recording of CCEs shall be implemented besides other process to ensure accuracy of CCE.

3. Insurance Companies (IA)

- a) Insurance companies to liaise with State Governments and agencies / institutions / committees involved in implementation of PMFBY.
- b) Furnish the necessary details to SLCCCI as may be required as per the notification.
- c) Underwriting – responsibilities of processing and acceptance of risk.
- d) Claim processing / finalization on receipt of yield data from States/UTs and payment within the prescribed timelines.
- e) Obtain Re-insurance arrangements if felt necessary.
- f) Database – develop crop-yield and weather databases, also related agri-insurance databases.
- g) Review of implementation of PMFBY and provide regular feedback for its effective implementation/improvements to DAC&FW.
- h) Disclose designated Agents in writing before the underwriting of insurance for the season.
- i) Ensuring payment of commission / service charges to banks / other agents for implementing the scheme.
- j) Awareness and publicity – extensive efforts to create awareness and generate publicity for PMFBY at grass-roots level including bank branches. Also coordinate with the States and other agencies for awareness and publicity of the scheme.
- k) Providing monthly progress returns / statistics / information demanded by the Governments, both Central and State Government.
- l) Obtain the list of insured farmers & beneficiaries with all requisite details from Nodal Banks and agents and upload the same in their website well in time.
- m) Redressal of all Public Grievances within the time fixed by IRDA.
- n) The coverage of loanee farmers should be carried out by insurance companies themselves, use of agents / brokers are not allowed.

4. Financial Institutions/Banks

- a) For purpose of PMFBY, scheduled banking institutions engaged in disbursing Seasonal Agricultural Operations (SAO) loans as per relevant guidelines of NABARD / RBI shall be reckoned as Banks.
- b) The existing system of Nodal Banks under NAIS/NCIP would continue to service the PMFBY. The Banks in States which have not implemented NAIS/NCIP would create the Nodal Bank system. Each Scheduled Commercial Bank/Cooperative Banks/Regional Rural Bank shall fix Nodal

Points which would deal with insurance companies on behalf of its branches in the District/Region/State. However,

- i) Commercial Banks will consider designating Nodal Bank-Banches at District level. Preferably, controlling branch in that area may be designated as Nodal Bank.
- ii) Cooperative Banks may designate District Central Cooperative Banks (DCCB) as Nodal Bank.
- iii) Regional Rural Banks (RRB) may designate their Head Office as Nodal Bank.
- iv) Nodal Bank shall be responsible for discharging their assigned roles under the Scheme on behalf of its branches, in its designated jurisdictional area.
- c) Notification, as well as other directives, guidelines, etc., shall flow as insurance company ▶ Nodal Bank ▶ Service (subordinate) Bank Branch / PACS. While compensation remittance to and from insurance companies shall follow same route, the remittance of premium shall follow the reverse route.

Nodal Banks

- a) Communicate Notification, as well as other directives, guidelines, etc. to all service (subordinate) bank branches / PACS within their jurisdictional area.
- b) Ensure that lending branches / PACS within their jurisdictional area sanction additional loan component to loanee farmers towards premium payable by them.
- c) Ensure that all service (subordinate) bank branches within their jurisdictional area serve all non-loanee farmers desiring and eligible to take insurance cover under PMFBY. Such service will include opening bank account of non-loanee farmers, guiding them to fill up proposal forms, accepting premium from them and maintaining records etc.
- d) Ensure that, for both loanee and non-loanee farmers separately, premium and related data is remitted to nodal bank within prescribed time.
- e) Nodal Banks should ensure that all the eligible crop loans/seasonal operational loans taken for notified crop(s) are fully insured and the conditions stated in the declarations submitted have been complied with. No farmer should be deprived from insurance cover. Nodal banks therefore, should make all out efforts and pursue their branches for enrolling all eligible loanee farmers & interested non-loanee farmers under crop insurance. **In case, claims have arisen during crop season then respective nodal bank & its branches would be responsible to make payment of the admissible claims to loanee farmers who were deprived from insurance cover to their crops.**

- f) Nodal Bank should ensure submission to insurance companies within stipulated time the notified crop-wise, insurance unit-wise Declarations in prescribed format, along with consolidated Premium payable separately for both loanee farmers and non-loanee farmers. **If Nodal banks keep the amount of premium collected beyond the defined timelines then they will be liable to pay interest (@prevailing rate of saving account) for the delay period to the insurance company.**
- g) Nodal bank will also arrange for onward transmission to service (subordinate) bank branches / PACS, compensation amounts as received from insurance companies with all details, to be credited to beneficiary accounts.
- h) The Nodal Banks may also collect the list of individual insured farmers with requisite details like name, fathers' name, Bank Account number, village, categories – S&M/SC/ST/Women, insured acreage, insured crop(s), sum insured, premium collected, Govt. subsidy etc from concerned branch in soft copy for further reconciliation and send the same to the concerned insurance company within 15 days after final cut-off date for submission of proposal to insurance company.
- i) The insurance company shall acknowledge all the declarations submitted by the banks mentioning the details of crop, area, sum insured etc. The banks should cross check with their records and aberrations, if any, should be brought to the notice of the insurance company immediately. If no response is received from banks within 15 days, the details given in the acknowledgement shall be considered final and no changes would be accepted later on.
- j) To credit the claim proceeds of PMFBY received from insurance company to respective beneficiary bank account within seven days. **If Nodal banks keep the claims amount beyond the defined timelines then they will be liable to pay interest (@prevailing rate of saving account) for the delay period to the eligible farmers.** The list of beneficiary cultivators with claim amount shall be displayed by the Branch / Primary Agricultural Cooperative Society (PACS) and a copy shall also be provided to the Chairman/ Sarpanch / Pradhan of the village Panchayat. The Banks shall issue a certificate to the insurer that entire money received for settlement of claims has already been credited into the account of beneficiaries.
- k) Soft copy of the beneficiaries' farmers may also be provided by bank branch/PACS through Nodal Bank to concerned Insurance companies for uploading the same in their web-site.
- l) To permit insurance company with access to all relevant records / ledgers at the Nodal Bank / Branch / PACS at all times for the purpose of implementation of the scheme.
- m) Banks should ensure that cultivator may not be deprived of any benefit under the Scheme due to errors / omissions / commissions of the Nodal

Bank/Branch/PACS, and in case of such errors, the concerned institutions shall only make good all such losses.

Lending Banks / RFIs

- a) To educate the cultivators on the Scheme features.
- b) To guide the cultivators for filing up the insurance proposal in the prescribed forms and collecting the required documents, particularly in case of Non-Loanee cultivators.
- c) To prepare the consolidated statements for Loanee and Non-Loanee cultivators and forward the same to the insurance company along with the premium amount and other details of the insured farmers.
- d) Maintaining the records of proposal forms, the other relevant documents and statements for the purpose of scrutiny / verification by insurance company or its authorized representatives and DLMC.
- e) Allow insurance company access to all relevant records and registers at offices of Nodal Bank and service (subordinate) bank branches within their jurisdictional area.

Under administrative mechanism, banks are designated as terminal service points for farmers. Hence, it is their duty to ensure compulsory coverage of all eligible loanee farmers and all interested non-loanee farmers. In case of any misreporting by Nodal Bank / branch / PACS in case of farmers coverage, concerned bank only will be liable for such mis-reporting and its consequences.

5. Designated Insurance agents

- a) To educate the cultivators on the Scheme features.
- b) To guide the cultivators for filing up the insurance proposal in the prescribed forms and collecting the required documents from Non-Loanee cultivators.
- c) Underwrite & collect the premium on behalf of Insurance company, strictly as per the provisions of the scheme.
- d) To prepare the consolidated statements of Non-Loanee cultivators and forwarding the same to the insurance company along with the premium amount well within the stipulated time.
- e) The designated Insurance agents shall also prepare the list of individual insured farmers with requisite details like name, fathers' name, Bank Account number, village, categories – S&M/SC/ST/Women, insured acreage, insured crop(s), sum insured, premium collected, Govt. subsidy etc in soft copy and send the same to the concerned insurance company within five days after final cut-off date.
- f) The designated Insurance agents should ensure that insured farmers may not be deprived of any benefit under the Scheme due to errors /

omissions / commissions of them, and if any, the concerned agents / insurance company shall only make good all such losses. Necessary administrative and legal action may also be taken for lapses in service/malpractices, if any, reported.

6. Loanee farmers

- a) As the Scheme is compulsory for all loanee cultivators availing SAO loans for notified crops, it is mandatory for all loanee cultivators to insist on insurance coverage as per provisions of the Scheme.
- b) Any change in crop plan should be brought to the notice of the bank within one week of sowing.
- c) Insurance Proposals are accepted only upto a stipulated cut-off date, which will be decided by the SLCCCI.
- d) Give information of any post harvest loss due to specified perils of cyclone in coastal areas resulting in damage to harvested crop lying in field in “cut & spread” condition to concerned bank branch / financial institution / channel partner / insurer within 48 hours.

7. Non-Loanee cultivators

- a) Non-Loanee cultivators desirous of availing insurance under PMFBY for any notified crop in any notified insurance unit may approach nearest bank branch / PACS / authorized channel partner / insurance intermediary of insurance company within cut-off date, fill-up proposal form completely in prescribed format, submit form and deposit requisite premium to bank branch / Insurance Intermediary along with necessary documentary evidence regarding his insurable interest in cultivating land / crop (e.g. ownership / tenancy / cultivation rights) proposed for insurance.
- b) The farmer desiring for coverage should open/operate an account in the branch of the designated bank, and the details should be provided in the proposal form.
- c) The farmers should mention their land identification number in the proposal.
- d) The farmer must provide documentary evidence with regard to possession of cultivable land.
- e) The cultivator must furnish area sown confirmation certificate.
- f) The farmer should ensure that he gets insurance coverage for a notified crop(s) cultivated/proposed to be cultivated, in a piece of land from a single source. In other word, Double insurance is not allowed. The insurance company shall reserve the right to repudiate all such claims and not refund the premium as well in such cases. Company may also take legal action against such farmers.

DRAFT V1.1



OPERATIONAL GUIDELINES

**Pradhan Mantri Fasal Bima Yojana
(PMFBY)**

(Revised)

**Department of Agriculture, Cooperation and Farmers Welfare
Ministry of Agriculture & Farmers Welfare
Krishi Bhawan, New Delhi-110001**

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Abbreviations

AIC	Agricultural Insurance Company of India Ltd
ACF	Area Correction Factor
APR	Actuarial Premium Rate
ARG	Automatic Rain Gauge
AWS	Automatic Weather Stations
AY	Actual Yield
CB	Commercial Banks
CBS	Core Banking Solution
CCAFS	Research program on Climate Change, Agriculture and Food Security
CCEs	Crop Cutting Experiments
CPMU	Central Program Management Unit
CSC	Common Service Center
CSO	Central Statistical Office
CV	Co-efficient of Variance
DAC&FW	Department of Agriculture, Cooperation and Farmers Welfare
DBT	Direct Benefit Transfer
DCCBs	District Central Cooperative Banks
DLMC	District Level Monitoring Committee
DLTC	District Level Technical Committee
ESI	Expected Sum Insured
FASAL	Forecasting Agricultural output using Space, Agro meteorological and Land based observations
FI	Financial Institutions
GIC Re	General Insurance Corporation of India
GFR	General Financial Rule
GIS	Geographic Information System
GPS	Global Positioning System
IA	Implementing Agency
IC	Insurance Company
IASRI	Indian Agricultural Statistical Research Institute
IFPRI	International Food Policy Research Institute
IMD	Indian Meteorological Department
IRRI	International Rice Research Institute
IRDAI	Insurance Regulatory and Development Authority of India
ISRO	Indian Space Research Organisation
ISS	Interest Subvention Scheme
IT	Information Technology
IU	Insurance Unit
KCC	Kisan Credit Cards
LC	Loss Cost
LPA	Long period Average
LPC	Land Possession Certificate
MIS	Management Information System
MNCFC	Mahalanobis National Crop Forecast Centre
MOA&FW	Ministry of Agriculture and Farmers Welfare

NABARD	National Bank for Agriculture and Rural Development
NAIS	National Agricultural Insurance Scheme
NCIP	National Crop Insurance Portal
NCIP*	National Crop Insurance Programme
NEFT	National Electronic fund Transfer
NFA	Notified Area
NLMC	National Level Monitoring Committee
NOAACPC	National Oceanic and Atmospheric Administration Climate Prediction Center
NRSC	National Remote Sensing Centre, ISRO
NSSO	National Sample Survey Organization
NTSU	National Technical Support unit
PACS	Primary Agricultural Credit Society
PMFS	Public Finance Management System
PMU	Project Management Unit
PRIs	Panchayati Raj Institutions
RBI	Reserve Bank of India
RoR	Records of Right
RRBs	Regional Rural Banks
RST	Remote Sensing Technology
RTGS	Real Time Gross Settlement
SAO	Seasonal Agricultural Operations
SAC	Space Applications Centre, ISRO
SI	Sum Insured
SLA	Service level agreement
SLCC	State Level Coordination Committee
SLCCI	State Level Coordination Committee on Crop Insurance
SLTC	State Level Technical Committee
SOF	Scale of Finance
SOP	Standard Operating Procedures
SRSC	State Remote Sensing Centres
STAC	State level Technical Advisory Committee
STSU	State Technical Support Unit
TAC	Technical Advisory Committee
TSU	Technical Support Unit
TY	Threshold Yield
UIDAI	Unique Identification Authority of India
USSD	Unstructured Supplementary Service Data
UT	Union Territory
UTR	Unique Transaction Reference
VLE	Village Level Entrepreneur
UAV	Unmanned Aerial Vehicle
WMO	World Meteorological Organisation
XML	eXtensible Markup Language

1. Objective of the Scheme

Pradhan Mantri Fasal Bima Yojana (PMFBY) aims at supporting sustainable production in agriculture sector by way of

- Providing financial support to farmers suffering crop loss/damage arising out of unforeseen events
- Stabilizing the income of farmers to ensure their continuance in farming
- Encouraging farmers to adopt innovative and modern agricultural practices
- Ensuring flow of credit to the agriculture sector which will contribute to food security, crop diversification and enhancing growth and competitiveness of agriculture sector besides protecting farmers from production risks.

2. Adoption of Technology for Scheme Administration:

- 2.1 In an endeavour to integrate Technology in implementation and execution of the Scheme, the Govt. of India has designed and developed a National Crop Insurance Portal (NCIP) (www.pmfby.gov.in). This will bring in better administration and coordination amongst stakeholders viz. Farmers, States, Insurers and Banks as well as real time dissemination of information and transparency.
- 2.2 The successful running of the Portal calls for responsible participation by different stakeholders who will have the responsibility for census coding and updating revenue/administrative units, AWS code mapping and updating requisite information/details as per login credential module.
- 2.3 Implementing States and Insurance Companies during each crop season are required to digitize and upload on the web Portal in the relevant module, basic information like notified areas, crops, sum insured, Govt. subsidy, and premium to be paid by farmers and name of the implementing Insurance Companies in the particular insurance unit etc., well within the prescribed time. This will facilitate farmers and other stakeholders to get the relevant information on Internet and through SMS. State Govt. and concerned Insurance Company will be responsible for any incorrect entry/ errors/ omissions etc.
- 2.4 Digitization of basic information/notification should compulsorily be done before floating tender documents which will be followed by entry of bidden Premium rates and name of selected Insurance Company immediately after finalization of bids and issue of work order.
- 2.5 Since the National Crop Insurance Portal has been conceptualised for auto administration and seamless flow of data/information/reports on real time basis, State Govt. would not be allowed to create/use separate Portal/website for Crop Insurance purposes.
- 2.6 All Stakeholders have defined roles and responsibilities and accessibility to related modules on the Portal for administration of the Scheme. Details of operationalization of modules for each stakeholder are available on the Portal for ready reference.

- 2.7 Secured credential/login, preferably linked with Aadhaar Number and mobile OTP based, for all Stakeholders viz, Central Government, State Governments, Banks, empanelled Insurance Companies and their designated field functionaries will be provided on the Portal to enable them to enter/upload/download the requisite information.
- 2.8 Insurance Companies shall not distribute/collect/allow any other proforma/utility/web Portal etc for collecting details of insured farmers separately. However they may provide all requisite support to facilitate Bank Branches/PACS for uploading the farmer's details on the Portal well within the prescribed cut-off dates.
- 2.9 Only farmers whose data is uploaded on the National Crop Insurance Portal shall be eligible for Insurance coverage and the premium subsidy from State and Central Govt. will be released accordingly.
- 2.10 All data pertaining to crop-wise, area-wise historical yield data, weather data, sown area, coverage and claims data, calamity years and actual yield shall be made available on the National Crop Insurance Portal for the purpose of premium rating, claim calculation etc.
- 2.11 Banks/Financial Institutions/other intermediaries need to compulsorily transfer the individual farmer's data electronically to the National Crop Insurance Portal. Accordingly Banks/FIs **may endeavour to undertake CBS integration** in a time bound manner for real time transfer of information/data.
- 2.12 It is also proposed to develop an integrated platform/portal for both PMFBY and Interest Subvention Scheme. The data/information of both the Schemes shall be auto synchronized to enable real time sharing of information and better program monitoring.
- 2.13 Insurance Companies shall compulsorily use technology/mobile applications for monitoring of crop health/Crop Cutting Experiments (CCEs) in coordination with concerned States. States shall also facilitate Insurance Companies with Satellite Imagery/Usage of Drones by way of prior approval of agency from which such data can be sourced. This is required for better monitoring and ground-truthing. ICs can be active partners in facilitating use of technology.
- 2.14 States shall adopt technology, such as satellite and UAV remote sensing, for various applications such as crop area estimation and yield disputes and also promote the use of remote sensing and other related technology for CCE planning, yield estimation, loss assessment, assessment of prevented sowing and clustering of districts.

3. Coverage of Farmers

3.1 All farmers including sharecroppers and tenant farmers growing the notified crops in the notified areas are eligible for coverage. However, farmers should have insurable interest for the notified/insured crops. The non-loanee farmers are required to submit necessary documentary evidence of land records prevailing in the State (Records of Right (RoR), Land possession Certificate (LPC) etc.) and/or applicable contract/ agreement details/ other documents notified/ permitted by concerned State Govt. in case of sharecroppers/tenant farmers and the same should be defined by the respective States in the notification itself.

3.1.1 Compulsory Component

3.1.1.1 All farmers who have been sanctioned Seasonal Agricultural Operations (SAO) loans from Financial Institutions (FIs) (i.e. loanee farmers) for the notified crop(s) season would be covered compulsorily. This provision shall override any decision taken by FIs including PACS exempting farmers from compulsory coverage of loanee farmers.

3.1.1.2 However non-standard KCC /crop loans as defined and as per prevailing practices of the concerned Banks/Govt. regulator shall not be covered compulsorily. However bank branches may facilitate such farmers for enrolment as non-loanee farmers .

3.1.1.3 Merely, sanctioning of crop loan against other collateral securities including fixed deposits, gold/jewel loans, mortgage loans etc. without having insurable interest of the farmer on the insurable land and notified crops shall not be covered under the Scheme.

3.1.2 Voluntary Component

- The Scheme is optional for non-loanee farmers.
- The insurance coverage will strictly be equivalent to sum insured/hectare, as defined in the Govt. notification or /and on National Crop Insurance Portal multiplied by sown area for notified crop.

3.1.3 Special efforts shall be made to ensure maximum coverage of SC/ ST/ Women farmers under the Scheme. Further Panchayat Raj Institutions (PRIs) may be involved in extension and awareness creation amongst farmers and obtaining feed-back of farmers about the implementation of the Scheme

3.1.4 The implementing Insurance Company selected as L1 will be responsible for taking necessary measures to ensure at least 10% incremental increase in coverage of non-loanee farmers. However other empanelled Insurance Companies which have participated in the bidding and are keen for enrolment of non loanee farmers in the cluster may also be allowed to enrol non-loanee farmers at L1 premium rate. The interested companies have to inform their willingness in writing within seven days of finalisation of tender/issuance of work order to L1. It will however be the responsibility of all the Insurance Companies engaged in this process to ensure that duplicate enrolment does not happen in the given cluster/district. Engaging companies other than L1 for enrolling non loanee farmers will be taken up on a pilot basis in Districts notified by State Govt. They shall enrol non loanee farmers as per

conditions laid down in Para 17.5.

- 3.1.5 These Insurance Company will maintain separate data of such non loanee farmers covered by them and enter the said data on the portal as per seasonality discipline detailed in Para 16.2. They shall be liable for payment of claims to such farmers.
- 3.1.6 The exchange of information, co-witnessing of CCEs and sharing of yield data etc for the cluster by Government/NCIP will be limited to L1 Company only and it will be binding on other companies to accept it. However, the requisition for payment of Government subsidy in respect of non-loanee enrolled by them will be submitted directly to the Govt designated agency.

4. Coverage of Crops

- I. Food crops (Cereals ,Millets and Pulses),
- II. Oilseeds
- III. Annual Commercial / Annual Horticultural crops.

In addition for perennial crops, pilots for coverage can be taken for those perennial horticultural crops for which standard methodology for yield estimation is available.

5. Coverage of Risks and Exclusions

- 5.1 Following stages of the crop risks leading to crop loss are covered under the Scheme. Addition of new risks by the State Govt other than the one mentioned below, by the State Govt. is not permitted.
- 5.1.1 **Prevented Sowing/Planting/Germination Risk:** Insured area is prevented from sowing/planting/germination due to deficit rainfall or adverse seasonal/weather conditions.
- 5.1.2 **Standing Crop (Sowing to Harvesting):** Comprehensive risk insurance is provided to cover yield losses due to non-preventable risks, viz. Drought, Dry spell, Flood, Inundation, widespread Pests and Disease attack, Landslides, Fire due to natural causes ,Lightening, Storm, Hailstorm and Cyclone.
- 5.1.3 **Post-Harvest Losses:** Coverage is available only upto a maximum period of two weeks from harvesting, for those crops which are required to be dried in cut and spread / small bundled condition in the field after harvesting against specific perils of Hailstorm, Cyclone,Cyclonic rains and Unseasonal rains.
- 5.1.4 **Localized Calamities:** Loss/damage to notified insured crops resulting from occurrence of identified localized risks of Hailstorm, Landslide, Inundation, Cloud burst and Natural fire due to lightening affecting isolated farms in the notified area.
- 5.1.5 **Add-on coverage for crop loss due to attack by wild animals:** The States may consider providing add-on coverage for crop loss due to attack by wild animals wherever the risk is perceived to be substantial and is identifiable. Detailed protocol and procedure for evaluation of bids will be issued separately by GOI in consultation with Ministry of Environment and Forest and GIC Re. The add-on coverage will be optional for the farmers and applicable notional premium will be borne by the

farmer, however the State Govts may consider providing additional subsidy on this coverage, wherever notified. The actuarial premium rates for add-on coverage should be sought in the bid itself from the Insurance Companies, however the add-on actuarial premium rate will be considered separately and shall not form part of evaluation of L1.

- 5.1.6 **General Exclusions:** Losses arising out of war and nuclear risks, malicious damage and other preventable risks shall be excluded.
- 5.1.7 State Govts./UTs ,in consultation with SLCCCI, can exclude any of the aforesaid perils listed above which is not prevailing in their State/UT
- 5.1.8 Yield loss damage for localised calamities and post harvest losses will be assessed on the basis of individual insured farm level and hence lodging of loss information by farmer/designated agencies is essential. For remaining risks losses are due to widespread calamities. Hence lodging of information for claims by insured farmers / designated agencies for such wise spread calamities is not essential. Claims will be calculated based on the loss assessment report/average yield submitted by concerned State Govt.

6. Preconditions for implementation of the Scheme

- 6.1 **States:**

Issuance of Notification by State Govt. / UT for implementation of the Scheme (PMFBY) will imply their acceptance of all provisions, modalities and guidelines of the Scheme. The main conditions relating to PMFBY which are binding on States/UTs are as follows:

 - 6.1.1 Adoption of innovative technology especially Smart phones/ hand held devices for capturing conduct of CCEs through CCE-Agri App and use of NCIP platform for flow of information and auto administration of the scheme
 - 6.1.2 State has to conduct requisite number of Crop Cutting Experiments (CCEs) at the level of notified insurance unit area;
 - 6.1.3 CCE based yield data will be uploaded on the National Crop Insurance Portal/submitted to Insurance Company within the notified cut off date ;
 - 6.1.4 State/ UT will make necessary budgetary provision for premium subsidy based on fair estimates, at the beginning of the crop season;
 - 6.1.5 To carry out pilot studies for improved yield estimations using technology.
 - 6.1.6 Department of State Govt. which was earlier looking after implementation of erstwhile National Agriculture Insurance Scheme (NAIS)/ National Crop Insurance Programme (NCIP*) may be designated as Nodal Department for implementation of PMFBY. The State Level Coordination Committee on Crop Insurance (SLCCCI) which was overseeing implementation of NAIS and NCIP* may be authorized to oversee implementation of PMFBY. The States/UTs which had not implemented the NAIS / NCIP* shall

constitute SLCCI for implementation of PMFBY on the lines similar to that of NAIS/NCIP*. The present composition of SLCCI may be strengthened by including representatives from State Horticulture Dept., State Remote Sensing Application Centre, India Meteorological Department (IMD), Farmers' Representatives and empanelled Insurance Companies for implementing PMFBY. Chairman of SLCCI may co-opt representatives from other departments/agencies, if considered necessary.

6.2

Insurance Company:

Empanelment of Insurance Companies and their participation for implementation of the Scheme (PMFBY) will imply their acceptance of all provisions, modalities and guidelines of the Scheme. The empanelled Insurance Companies have to deploy requisite infrastructure and resources for implementation of PMFBY particularly for following identified major activities:

6.2.1

To carry out Pilot study for leveraging new technology for effective implementation of Scheme in a transparent manner,

6.2.2

Deployment of requisite infrastructure to increase the outreach to rural farmers at their doorstep,

6.2.3

Commitment for at least 10 % incremental increase in Non loanee coverage,

6.2.4

Deployment of sufficient manpower to co-observe CCEs and allied activities and compulsory use of CCE Co-observation app,

6.2.5

Allocation of requisite resources and commitment for advertisements, awareness generation and capacity building of stakeholders about the Scheme. The detailed planning for the same should be submitted to Central and State Govt. in advance, before the start of each season.

6.3

Submission of UID (AADHAAR) by farmer:

6.3.1

Aadhaar has been made mandatory for availing Crop insurance from Kharif 2017 season onwards. Therefore, all banks are advised to mandatorily obtain Aadhaar number of their farmers and the same applies for non-loanee farmers enrolled through banks/Insurance companies/insurance intermediaries.

6.3.2

Farmers not having Aadhaar ID may also enrol under PMFBY subject to their enrolment for Aadhaar and submission of proof of such enrolment as per notification No. 334.dated 8th February, 2017 issued by GOI under Section 7 of Aadhaar Act 2016(Targeted Delivery of Financial and other Subsidies, Benefits and Services). Copy of the notification may be perused on www.pmfby.gov.in. This may be subject to further directions issued by Govt. from time to time.

6.3.3 All banks have to compulsorily take Aadhaar/Aadhaar enrolment number as per notification under Aadhaar Act before sanction of crop loan/KCC under Interest Subvention Scheme. Hence the coverage of loanee farmers without Aadhaar does not arise and such accounts need to be reviewed by the concerned bank branch regularly.

7. Notification

- 7.1 **Procedure for Issuance of Notification by the States/UTs:**
- 7.1.1 Prior to the commencement of the Kharif season, preferably in the beginning of November of previous year, meeting of SLCCCI should be convened for finalising various terms and conditions and calling of bids/issuance of the bid notice to all empanelled Insurance Companies for selection to implement the Scheme during the bid/ risk period. State / UT Govt. should ensure the issuance of the notification and its circulation to all concerned agencies/ departments/ institutions at least one month in advance of the commencement of the crop season incorporating all the essential details about insured crops, areas, Scale of Finance, Sum Insured, Threshold Yield at insurance unit (IU) level for notified crops, period of contract, bidder's evaluation and selection methodology, premium rate for farmers, Govt. subsidy along with seasonality discipline/ cut off date for each activity etc. **Notification should be issued for at least one year to facilitate banks for deduction of premium for a year**
- 7.1.2 In order to have transparency and system driven approach for crop insurance implementation, all the details as mentioned in para 7.1.1 above need to be part of the Tender Document and State Notification and no modification in the terms and condition enumerated in the tender document shall be allowed post tendering.
- 7.1.3 Bidding annexures may be generated through Portal. Procedure and template are available on National Crop Insurance Portal. Before floating the Tender, last 10 years yield data at notified/available level and TY at notified unit should be uploaded on the Portal in the given template and should be made part of the Tender.
- 7.1.4 Calculation of lowest weighted premium of district shall be based on the insured areas of notified crops in each district during last year/season. However, in absence of insured area of last year/season for all proposed crops or any crop, net sown area of that crop(s) will be considered for calculation of weighted premium of district. This data will be used for calculation of L1 only.
- 7.1.5 Bidding **shall be done through e-tendering** and work order may be released within 2 weeks of the opening of the Tender.
- 7.1.6 Depending on the risk profile, historical loss cost and cost benefit analysis for the proposed crop(s) in district(s) of any cluster, if the State Government feels that the premium rate likely to be offered by bidding Insurance Companies would be abnormally high, then the State Govt. can fix a ceiling on premium rates for such crop(s) proposed to be included in the bidding evaluation for the bidding period. However, recourse to this ceiling provision may be done only in well justified cases and not as a general practice. The ceiling premium rate may be derived based on statistical evaluation/actuarial premium analysis, loss cost, historical payout etc and name of such crop should be disclosed by State Govt. compulsorily in the tender document.
- 7.1.7 In such cases where a ceiling has been indicated, State government must call financial bids in two step bidding or in two separate envelopes. First bid/envelop is for disclosing the premium rate offered by each participating Insurance Company for such ceiling crops and must be categorised under "Ceiling

Premium Rate" and 2nd bid envelop is for bidding of crop wise premium rate for all crops included in tender. Time interval for opening of both bid/envelop should be compulsorily mentioned in the bidding documents and should preferably be on the same day. All participating Insurance Companies have to submit the bid offer as per the procedure mentioned above.

- 7.1.8 State Govt. shall first evaluate first envelop of the bid keeping in view the premium offered by each individual participating Insurance company and if the risk propensity and weather susceptibility of the crop and/or historical claim/loss data doesn't support the actuarial rates offered by the participating Insurance Companies, such crop(s) may be dropped from the list of proposed crops for notification by the State Government and evaluation for L1 bidder should be done strictly based on the rates offered for left out/remaining crops. The second envelope shall be opened by the State Govt. only after decision on dropping the proposed crops/or accepting the premium rates offered by participating Insurance companies has been taken by the State Govt. If State Govt decides not to drop all proposed crop(s)/ few crops for which premium rate obtained in separate envelop of "Ceiling Premium Rate" from the bidding process, then L1 will be calculated by inclusion of premium offered for all crops/remaining crops.
- 7.1.9 States should avoid doing re-tendering as a general practice. Re-tendering may be held only in exceptional circumstances and only with the prior approval of GOI after submission of a request with detailed reasons. GOI on its part will give its decision within 5 working days of the receipt of the request.
- 7.1.10 States are required to compulsorily upload Meeting Notices, Tender Documents, Addendums, requisite data and other relevant information on the National Crop Insurance Portal for faster communication and response. Accordingly the subsequent notifications, circulars, directives shall also be uploaded on the Portal as and when issued for wider reach and circulation.
- 7.1.11 All conditions proposed to be stipulated by State Govt. should be incorporated in bid document itself and no new condition should be included in the notification. In case ICs have any objection to any Tender condition which is in conflict with guidelines, they can make a reference to State govt. with a copy to GOI within 3 days of issuance of Tender
- 7.1.12 L1 bidder will not be allowed to withdraw their bid after opening of bids/allotment of work. If L1 bidder withdraws then financial loss, if any, to the State Govt. due to retendering /assignment of work to others, due to increase in actuarial premium rate from previously declared L1 rate, shall be recovered from the withdrawing L1 bidder.

7.2 Notification of Crops, Areas and Implementing Agency (IA)

- 7.2.1 The Scheme shall operate on the principle of "Area Approach" in the selected defined areas called Insurance Unit (IU). State Govt. /UT will notify crops and defined areas covered during the season in accordance with decision taken in the meeting of SLCCI. State/UT Govt. should notify Village/Village Panchayat or any other equivalent unit as an insurance unit for **major crops defined at District / Taluka or equivalent level**. For **other crops** it may be a unit of size above the level of Village/village Panchayat. **For defining a crop as a major crop for deciding the Insurance Unit level, the sown area of**

that crop should be at least 25% of Gross Cropped Area in a District/ Taluka or equivalent level

- 7.2.2 For the claims arising out of crop damage due to post-harvest losses and localized risks, assessment of damage will be made on individual farm basis as outlined in (Section 21, para 21.4 and 21.5 respectively).
- 7.2.3 SLCCCI will, for the purpose of notification, consider factors such as availability of past yield data based on CCEs for adequate number of years (at least 7 years for calculation of threshold yield), cropped acreage and capacity for estimating yield during proposed season, etc. State govt. should endeavour to cover all the major crops grown in all the districts of the State. States should ensure that a standard methodology of yield estimation exists for all the crops proposed to be notified
- 7.2.4 **State Govt./ UT should provide 10 years' historical yield data in soft format(in Excel) in English to Insurance Companies for calculation of threshold yield , premium rates etc. at insurance unit area** and in its absence, data at next higher unit/nearest neighbouring unit/weighted average of contiguous units, as decided by the SLCCCI shall be used. The level and name of notified area of insurance unit must be part of notification and should be provided at the time of bidding itself.
- 7.2.5 In case State Govts/UT proposes to notify irrigated and un-irrigated areas under a crop separately, they shall ensure that minimum CCEs are planned and conducted for irrigated and un-irrigated crops separately in such areas. In addition, past yield data for requisite number of years will have to be made available separately for both
- 7.2.6 While notifying the crop(s) where a specific conversion factor is being used for reporting of yield such as in the case of rice/paddy etc, due care should be taken by the State Nodal Department to use the relevant specific nomenclature for disclosure of Average Yield, Threshold Yield and Actual Yield while releasing the Tender Document and submission of Yield data and CCE data for calculation of admissible claims. Insurance Companies will also be responsible for prior scrutiny of Tender document. Information/data provided in Tender document will be treated as final and in case of any error/misreporting/disparity, State Govt. and Insurance Company will be equally liable for payment of additional claims arising on account of it, if any.
- 7.2.7 For the current season or subsequent seasons (in a multi-year contract), the States, if required, can notify additional IUs or de-notify certain IUs subject to maximum deviation of 10% of already notified IUs for the crop within a district at the same premium rate, before the cut-off date for debit of premium. If the deviation is >10% or in case of addition of new crop, actuarial premium rate may be worked out either by calculation of weighted average premium rate as prevalent in contiguous districts or by applying appropriate loading on the existing premium rate. The rates for such crops will be determined /verified by TSU and its decision will be binding on both States and ICs.
- 7.2.8 **States implementing PMFBY at Village/ Village Panchayat level for major crops shall be entitled for 50% reimbursement of incremental expenses of CCEs and cost of smart phones/ improved technology from GOI.** Only eligible items will be considered for reimbursement. The data source for calculation of admissibility of incremental CCEs will be the National Crop Insurance Portal.

7.3 Notification of Indemnity Level, Average Yield and Threshold Yield

7.3.1 Three levels of Indemnity, viz., 70%, 80% and 90%. SLCCI in consultation with Insurance Companies shall approve indemnity levels for notified crops at district level. Threshold Yield (TY) shall be notified in the Tender for the current season and the same will be used for claim calculation for that season. The Average Yield of a notified crop in Insurance Unit (IU) will be average yield of best five years out of last seven years. The Threshold yield of the notified crop is equal to Average Yield multiplied by Indemnity level. The Threshold Yield for any crop and IU shall compulsorily be part of the notification for the season and shall not change at any point during that season.

7.3.2 **Calculation and Notification of Threshold Yield:** For calculation of Threshold Yield, historical average yield of best five out of last seven years shall be considered. Further Threshold Yield should be defined only at notified area level and once notified in the Notification issued by the State should not be changed at later stage under any circumstances. In case of multi-year contract, the Threshold Yield for the subsequent years shall be revised by adding/considering the yields of immediate previous corresponding season. The revised TY and Sum Insured (if revised) should be notified accordingly at the beginning of each crop season in case of multi-year tender.

7.4 Notification of Seasonality discipline:

7.4.1 State Govt./ UT in accordance with the broad seasonality defined/prescribed in the Operational Guidelines shall also notify seasonality discipline for various activities under the Scheme viz. submission of insurance proposals/application, consolidated declarations by banks, remittance of premium to Insurance Companies, uploading of individual covered farmer's data on National Crop Insurance Portal, submission of yield data, claim assessment of losses for(i) standing crop(ii) localized calamities,(iii) prevented sowing, iv) post harvest losses, (v) On-Account payment for major calamities, etc as per the provisions of the Scheme.

*In exceptional cases, where last corresponding season yield data is not available at the time of Bidding/Notification, yield data is to be provided before the harvesting of the current season. However the yield data upto last to last corresponding season should be provided at the time of bidding itself. However, in such cases admissible claims will be anyway calculated on the basis of yield data of last 7 years only.

7.5 Notification of Automatic Weather Stations (AWS)

7.5.1 Only those AWS/ARGs of IMD/State Govt. /private agencies should be considered and notified which are as per standards defined by IMD/WMO and are certified and approved by IMD/any agency to be notified by the State/Central govt. These must be optimally operational and be able to provide real time weather data. AWS/ARG of private agencies should only be considered in absence of properly functioning AWS/ARGs of IMD/ State Govt. AWS /ARG data sourced for crop insurance should be transferred on real time basis to National Portal. The detailed guidelines for sharing of weather data on the Portal will be circulated separately.

7.5.2 **State govt can explore the possibility to create dense AWS/ARG network on PPP Mode for which GOI will provide 50% of the viability gap funding.**

- 7.5.3 The following data sources may be used for validation of on account claims and claims for prevented sowing:
- Satellite/UAV Remote Sensing Data
 - AWS/ARG Data
 - MNCFc Report/Study on drought assessment
- 7.5.4 State Govt. shall notify concerned weather data provider/ expert agency whose report/ methodology would be used in assessing the extent of losses and computation of claims. Cost of such weather data shall be borne by the concerned Insurance Companies. The notified AWS and ARG should fulfil/ meet the standards/ norms/ criteria specified by the concerned authorities from time to time.

8. Engagement of Common Service Centres (CSCs) and Intermediaries for coverage of Non-Loanee Farmers:

- 8.1 CSCs under Ministry of Electronics and Information Technology (MeITY) have been engaged to enrol non-loanee farmers. The Insurance Companies are required to enter into a separate agreement with CSC and pay service charges as fixed by DAC&FW, GOI per farmer per village per season. No other agreement or payment is required to be made for this purpose. Nodal agency for engagement with Ministry of Agriculture and Farmers Welfare and Insurance Companies will be CSC-SPV, a company established under MeITY for carrying out e-governance initiatives of GoI.
- 8.2 No charges/fee shall be borne or paid by the farmers being enrolled through CSCs i.e. CSC-SPV and CSC-VLE
- 8.3 As per IRDA circular, no separate qualification/certification will be required for the VLEs of CSCs to facilitate enrolment of non-loanee farmers.
- 8.4 All empanelled Insurance Companies will compulsorily be required to enter into an agreement with CSC for enrolment of non-loanee farmers and for provision of other defined services to farmers.
- 8.5 Other designated intermediaries may be linked with the Portal in due course.
- 8.6 Empanelled Insurance Companies have to necessarily register on the portal and submit list and details of agents/intermediaries engaged for enrolment of non-loanee farmers in the beginning of each season within 10 days of award of work in the State. Further all agents/intermediaries have to work strictly as per the provisions of the Scheme and IRDA regulations

9. Electronic Remittance of Funds

- 9.1 Govt. of India and State Govt. will endeavour to utilize Public Financial Management System (PFMS)/PFMS linked systems to remit the funds to State Govt/agencies
- 9.2 Banks, CSC and Insurance Agents are required to remit the premium payment to respective Insurance

Company mandatorily through Payment gateway (Pay-Gov) of National Crop Insurance Portal or through RTGS/NEFT followed by mandatory uploading of payment details on National Crop Insurance Portal within stipulated date. Bank details of Insurance Companies shall be made available on National Crop Insurance Portal itself. Accordingly, all Stakeholders including Insurance Companies, Bank branches, CSC and Insurance Agents must compulsorily maintain dedicated bank accounts for this purpose. **No remittance/financial transaction in the form of Banker's cheque/Demand Draft will be allowed.**

- 9.3 Insurance companies will be provided login access to the essential crop notification data/information along with farmer level coverage data including banking details of individual farmers on the National Crop Insurance Portal to reconcile, verify, validate and calculate payable claims and remit the same directly into pre-declared bank accounts linked to the National Crop Insurance Portal.

10. Census Code Mapping of Entities;

- 10.1 All States shall map census codes of their villages with the higher administrative/revenue units like Gram Panchayat, Firkas, Patwar Circles, Revenue Circles, Hoblis, Mandals, Blocks, Tehsils, Talukas, Districts and Automatic Weather Stations/Backup Weather Stations. This will create a standard mechanism of mapping and identification across the country.
- 10.2 Further, for purposes of obtaining accurate location, State Govts. must also provide geo coded (latitude. & longitude) village maps on digital format for integration with other Apps like CCEs Agri App, Loss reporting/Assessment App etc.

11. Digitization of Land Records

- 11.1 State Govts. are advised to digitize their revenue records using village Census codes so that the individual land records of farmers can be accessed through the National Crop Insurance Portal for crop insurance. This will help the Govt. to reach and identify individual beneficiaries and bring utmost transparency and authenticity in benefit transfer.

12. Sum Insured /Coverage Limit

- 12.1 Sum Insured per hectare for both loanee and non-loanee farmers will be same and equal to the Scale of Finance as decided by the DLTC/SLTC, and would be pre-declared by SLCCI and notified. No other calculation of Scale of Finance will be applicable. Sum Insured for individual farmer is equal to the SOF per hectare multiplied by area of the notified crop proposed by the farmer for insurance. Area under cultivation shall always be expressed in hectare'.
- 12.2 In cases where crops are separately notified under irrigated, un-irrigated category by State Govts. Sum insured for irrigated and un-irrigated areas should be separately indicated.

13. Premium Rates and Premium Subsidy

- 13.1 The Actuarial Premium Rate (APR) would be charged under PMFBY by implementing Insurance Company. The rate of premium payable by the farmer will be as per the following Table 1:

Season	Crops	Maximum Premium payable by farmer (% of Sum Insured)*
Kharif	All food grain and Oilseeds crops (all Cereals, Millets, Pulses and Oilseeds crops)	2.0% of SI or Actuarial rate, whichever is less
Rabi	All food grain and Oilseeds crops (all Cereals, Millets, Pulses and oilseeds)	1.5% of SI or Actuarial rate, whichever is less
Kharif and Rabi	Annual Commercial/ Annual Horticultural crops	5% of SI or Actuarial rate, whichever is less
	Perennial horticultural crops (pilot basis)	5% of SI or Actuarial rate, whichever is less

* Premium paid by non loanee farmers should be rounded off in Rupee terms

13.2 Payment of Govt. Subsidy:

- 13.2.1 The difference between Actuarial Premium Rate and the rate of Insurance premium payable by farmers shall be treated as Rate of Normal Premium Subsidy, which shall be shared equally by the Centre and State Govts. However, the State/ UT Govts. are free to extend additional subsidy over and above the normal subsidy from its budget. In other words, additional subsidy, if any shall be borne entirely by the State/ UT Govt. Subsidy in premium is allowed only to the extent of Sum Insured.
- 13.2.2 Govt. premium subsidy to the Private empanelled Insurance Companies may be routed through Agricultural Insurance Company (AIC) or any agency designated by GOI strictly as per the guidelines/order of the Govt. This may be reviewed later by Central Govt. and changed accordingly if necessary. Accordingly, AIC/ other designated agency is empowered to call/ collect all requisite information related to implementation of the Scheme and utilization of Govt. funds and to share the same with the Govt for better planning, implementation and monitoring of the Scheme. **The premium subsidy will be routed through PFMS/PFMS linked systems strictly based on the MIS generated through National Crop Insurance Portal.**
- 13.2.3 Govt, both Centre and State, will release their share of advance subsidy (First Instalment) equivalent to 50% of 80% of their respective share of subsidy in corresponding previous season subject to fulfilment of General Financial Rule(GFR)/guidelines in the matter without waiting for coverage details for the ongoing season.
- 13.2.4 To facilitate settlement of prevented risk/ mid season adversity/localized claims: ICs should release the admissible claim amount to the beneficiary immediately after receipt of farmers premium and advance subsidy (1st Instalment) and without waiting for release of final subsidy (Second Instalment) from Govt. The premium in respect of affected IUs including subsidy to enable settlement of claims arising due to above events in respect of all such beneficiaries shall be adjusted from the fund already available with ICs as advance upfront subsidy (First Instalment) to facilitate compliance of Section 64 B of Insurance Act/Regulation of IRDAI

- 13.2.5 All admissible claims based on Yield data/Post harvest losses will be settled on receipt of second installment of Govt. subsidy to be paid on the basis of tentative business statistics generated on the portal after 15 days of period specified for auto approval of applications on the Portal. The remaining Govt. subsidy, if any will be paid after reconciliation of all business statistics for the season on portal.
- 13.2.6 All empanelled insurance companies including private insurance companies shall provide free access to the Central/State level agencies including CAG authorized to verify the accounts and audit in respect of Crop Insurance.
- 13.2.7 In case, the State Govt. subsidizes full farmers' share of premium, in that case a token amount of at least Re. 1 should compulsorily be charged from the farmer to facilitate electronic tracking.
- 13.2.8 State Govt. has to release the State share of premium subsidy within 3 months from premium requisition by concerned Insurance Company failing which 1% interest per month shall be levied as penalty on the State govt.

13.3 Payment of Claim Liabilities:

- 13.3.1 Insurance company shall take all necessary steps to take appropriate reinsurance cover for their portfolio in order to safeguard insured's interest. In case premium to claims ratio exceeds 1:3.5 or percentage of claims to Sum Insured exceeds 35%, whichever is higher, at the National Level in a crop season, then Govt. will provide protection to Insurance Companies. The losses exceeding the above mentioned level in the crop season would be met from equal contribution of the Central Govt. and the concerned State/UT Govts. In case losses are below the above mentioned condition, insurers shall be responsible to settle the admissible claims.

14. Budget for Administrative Expenses

- 14.1 At least 2% of the total budget for PMFBY shall be earmarked by State/UTs for administrative expenses, publicity, yield/loss assessment expenses, purchase of smart phones, adoption of new technology, setting up of State Technical Support Unit (STSU), travelling and contingency fund.
- 14.2 Govt. of India has already made provisions for separate allocations under sub heads like Salaries, Domestic Travel Expenses, Technology interventions, Office Expenses, other Administrative Expenses and Professional Services etc. for Crop Insurance program under PMFBY/RWBCIS. States should make provisions and budgetary allocation on similar lines including subhead for incremental cost of CCEs.

15.

Technical Support Unit (TSU)/ CPMU

- 15.1 National Technical Support Unit (NTSU) or Central Program Management Unit (CPMU) will be created at the Central level at the earliest to provide support and advise on risk classification & rating, development of new products, methodology for loss assessment, legal works, workshop/training & capacity building, alongwith use of technology including innovation/ replication, digitisation of administration of Schemes through Crop Insurance Portal etc.
- 15.2 NTSU shall calculate Loss Cost (LC) i.e. Claims as percentage (%) of Sum Insured (SI) observed in case of notified crop(s) in notified unit area of insurance during the preceding 10 similar crop seasons (Kharif/ Rabi) along with approximate actuarial premium rate of the crops proposed to be notified for the season. This loss cost/premium rate shall be based on the latest available yield data in month of **January** for Kharif crops and **July** for Rabi crops and shall be provided to DAC & FW/ Concerned States on request before invitation for premium bidding. This calculation to be done by NTSU on behalf of DAC & FW is only for official purposes to have information on the approximate cost to the IA for covering the risks so as to evaluate the bids in proper perspective.
- 15.3 National Technical Support Unit (NTSU) may also develop a suitable methodology for risk classification/premium rating by using historical yield data, weather data, use and level of inputs/irrigation/technology in crop cultivation, remote sensing data/information etc. for standardization of methodology for risk perception and premium rating for crop insurance in the country.
- 15.4 In addition to National Technical Support Unit (NTSU) / Central Programme Management Unit (CPMU) at Central level, all States/UTs implementing Schemes should also create a separate TSU/PMU at State HQ level with sufficient technical experts/staff to ensure proper implementation of the Scheme. State TSU (STSU) may also opt for members on contractual/temporary basis or take services of other organizations/research institutes etc as deemed fit. However, **States shall have to allocate a separate budget for running the STSU.**

16. Seasonality Discipline

16.1 The cut-off date is uniform for both loanee and non-loanee cultivators. The State-wise cut-off dates for different crops shall be based on Crop Calendar of major crops published from time to time by the Directorate of Economics and Statistics, DAC&FW, GOI. The latest copy of the Crop Calendar (District Wise, Crop Wise) is available on www.pmfby.gov.in. The SLCCI, shall besides considering the prevailing agro-climatic conditions, rainfall distribution/ availability of water for irrigation, sowing pattern etc. in consultation with the Insurance Company fix seasonality discipline of the coverage and other activities in such a way that it does not encourage adverse selection or moral hazards. If this is violated by SLCCI, GOI may decide not to provide premium subsidy.

16.2 The **broad indicative seasonality discipline** is given in the Table 2 below:

S.No	Activity	Kharif	Rabi	Action to be taken by
1	Conduct of SLCCI meeting to take decision for notification of Crops and areas, , adoption of Level of Indemnity and to inform crop wise Scale of Finance etc for drafting of Tender documents	15 th November	1 st June	Nodal Department of States/UTs
2	Uploading of requisite information/data on crop insurance Portal and Issuing of tender documents	30 th November	15 th June	Nodal Department of States/UTs
3	Finalization of Tender and award of work by States/UTs	31 st December	15 th July	States/UT
4	Digitization of notification and downloading/ issuance of notification from crop insurance Portal for circulation amongst stakeholders	31 st January	31 st July	By State/UTs and concerned Insurance Companies
5	Awareness/ sensitization/training programmes by State Govt. and ICs/IAs	From 15 th March	15 th September	By State/UTs and concerned Insurance Companies
6	Start of enrolment of farmers for the season(as per crop calendar)	From 1 st April	From 1 st October	All Stakeholders
7	Cut-off date for intimation of change of insured crop by the loanee farmer	2 working days prior to cut-off date for debit/collection of premium from farmers	2 working days prior to cut-off date for debit/collection of premium from farmers	Farmers/Bank

8	Cut-off date for receipt of Applications of farmers/debit of premium from farmers account (loanee and non- loanee) by all stakeholders including banks/PACS/CSC/ insurance agent/online enrolment by farmers etc. Note: *This is indicative only and district wise crop calendar will be the final basis to arrive at cut off date	Upto last date of enrolment of farmers as notified by States for notified crop(s) or up to 15 th July* for Kharif season	Upto last date of enrolment of farmers as notified by States for notified crop(s) or up to 15 th December* for Rabi season	Banks/PACS/CSC/ insurance agent/online enrolment by farmers etc.
9	Declaration of Prevented sowing	Strictly within 15 days from cut off date for enrolment of farmers i.e 31 st July for Kharif and 31 st Dec for Rabi		State Govt./ IC
10	Cut-off date for electronic remittance of premium along with consolidated Declarations to respective Insurance Company and uploading of details of individual covered farmers on crop insurance Portal by Bank branches (CBs/ RRBs/DCCBs/PACs), followed by SMS to all insured farmers from Portal	Within 15 days of cut-off date for enrolment of farmers/debit of premium for both loanee and non- loanee farmers i.e. 31 st July for Kharif and 31 st Dec for Rabi		Banks/Portal
11	Cut-off date for electronic remittance of farmer premium to Insurance Companies for farmers covered on Voluntary basis by designated insurance Agent(s) and uploading of details of individual covered farmers on crop insurance Portal.	Within 48 Hours of receipt of application & premium.		Insurance companies and their agents
12	Cut-off date for Insurer to accept or reject the farmer's data on Portal	Within 15 days from the cut-off date for uploading of data/information by Banks/PACS/CSC/Agent respectively, for loanee and within 30 days for non loanee i.e. 15th Aug for Kharif and 15th Jan for Rabi for loanee and 31st Aug for Kharif and 31st Jan for Rabi for Non Loanee		Insurance Companies
13	Cut-off date for CSCs/Banks/Intermediary to correct/update the paid application intimated by ICs on Crop Insurance Portal	Within 7 days from the date of intimation by ICs		CSCs/Banks/ Intermediary
14	Cut-off date for Insurer to accept the corrected/updated applications	Within 7 days from the date of submission of correction/updation by the Bank/CSC		Insurance Companies
15	Cut-off date for Banks/ICs to hand over insurance acknowledgement receipt along with folio to the insured farmer	Within 7 days from acceptance of proposal by concerned Insurance Company on Portal		Banks/ICs for enrolment through their intermediaries

16	Cut off date for processing of applications by ICs and auto approval of application of insured farmers on crop insurance Portal	60 days from the cut off date for enrolment/debit of premium from farmers i.e. 15 th September for Kharif and 15 th February for Rabi seasons	Insurance companies/crop insurance Portal	
17	Cut off date for raising bills/requisitions with supporting documents for releasing of advance premium subsidy based on 50% of 80% of respective share of Centre/State in corresponding previous season	Before cut off date of enrolment of farmers	Insurance Companies/GOI /State	
18	Release of advance upfront premium subsidy (First Instalment)i.e. 50% of 80% of respective share of Centre/State in corresponding previous season	Within 15days of cut off date of enrolment of farmers i.e. 31st July for Kharif	Within 15days of cut off date of enrolment of farmers i.e 31 st December for Rabi	Goi & State Govts./UTs
19	Training and registration of field level workers assigned for conduct of CCEs and reporting of the same on crop insurance Portal through smart phones/CCE Agri App	Upto 15 th August* *state may fix earlier dates for early Kharif crops	Upto 15 th January* *state may fix earlier dates for early Rabi crops	Designated Ground Level field Functionaries/ State/District Level Nodal Officer
20	Registration of mobile number of representative of ICs for co-witnessing of CCEs	Upto31 st August* *state may fix earlier dates for early Kharif crops	Upto30 th January* *state may fix earlier dates for early Rabi crops	Insurance Companies
21	a) Uploading of tentative schedule/date for conducting CCEs (crop-wise/IU wise) followed by SMS on one day notice through CCEs app. ICs are equally responsible to liaise with district authorities/field workers to ascertain the schedule.	At least 7 days before tentative date for conducting CCEs	Concerned Department of States to incorporate the same in Notification	
	b) Confirmation of the CCEs schedule	Via SMS on one day notice through Portal		
22	Timeline for lodging online complaint about defaulting CCEs data	Within 2 hours of conduct of CCEs through CCE Co-observation app.	Insurance Companies	
23	Crop wise, Block/Tehsil wise sown area for major crops to be provided by/through MNCFC for which they release data presently on NCIP for Area Correction/Reduction Factor(ACF/ARF)	Before harvesting period	MNCFC	
24	Approval of district wise crop wise Actual yield data and uploading on Portal	Within one month of completion of CCEs from district wise crop wise specific cut off dates notified by States for a notified crop	Nodal Department of States/UTs	
25	Cut-off date for intimation/ reconciliation/ clarification of any deficiency in Actual Yield data	Within 7 days from the date of uploading CCE Data from State Department, if any.	Insurance Companies/ flagged on Portal	

26	Cut off date for resolution by State Govt. on clarification sought by ICs/ flagged on Portal	Within 7 days of clarification sought by ICs/ flagged on Portal	Within 7 days of clarification sought by ICs/ flagged on Portal	State Govt.
27	Cut off date for raising bills/requisitions with supporting documents for releasing of 2nd Instalment of premium subsidy based on business statistics finalized on Portal/auto approval.	Within 15 days of auto approval of business statistics finalized on portal.	Within 15 days of auto approval of business statistics finalized on portal.	Insurance Company
28	Release of 2nd instalment of Govt. subsidy	Within 15 days of receiving requisition from ICs based on business statistics finalized on portal.	Within 15 days of receiving requisition from ICs based on business statistics finalized on portal.	GOI/States
29	Auto approval of yield data	Within one week from receipt of yield data /reply to clarification sought by ICs by State Govt.		Goi/ Portal
30	Sharing of detailed information of claims with bank branches & other Stakeholders from crop insurance Portal	Within 7 days of approval of claims by ICS		Portal/ Insurance Companies
31	Timelines for Payment of claims	Within 2 weeks from calculation/auto approval of claims irrespective of whether ICs have raised the bill of 2 nd Instalment of premium subsidy or not		Insurance Companies
32	Payment of final government subsidy	On finalisation of business statistics on portal after completion of approval/reconciliation for the season on portal		GOI/States
33	Reconciliation of claim amount by concerned bank branches for loanee farmers disbursed either through Banks or directly to beneficiary accounts/ DBT In case of Non Loanee, reconciliation of claims , if required, to be done by enrolling agencies in consultation with concerned bank/State Govt.	Within a week after receipt of claims		Banks/Farmers/State Govt.

- 16.3 In case the cut-off date falls on a public holiday or is declared as public holiday by the Govt. or there is disruption of services due to strikes/shut-down etc., the next working day will be treated as the cut-off date. Concerned States have to take decision in this regard suo moto. For this State Govts should send a formal intimation to GoI.
- 16.4 In case of disruption of services due to natural events beyond human control or technical/software/network issues with the National Crop Insurance Portal the subsequent dates

(other than the cut-off dates for Enrolment/Premium Debit/Collection) may be extended by the competent authority on the basis of specific written inputs from Portal Development and Maintenance Agency. However due care has to be taken that such extension does not lead to moral hazard and misuse of the Scheme and suitable measures should be put forth for the same accordingly.

- 16.5 Further, in case of three crops / season pattern, a modified seasonality discipline keeping in view the overall seasonality discipline prescribed above, shall be adopted by SLCCI.
- 16.6 **Keeping in view the specific nature of crop and scope for catastrophic crop damage, SLCCI shall fix seasonality in such a way that it does not encourage adverse selection or moral hazards and also ensure early payment of claims to eligible insured farmers. Scheme also has provisions for claims due to prevented sowing and option to change the insured crop. Hence, State Govt. will take all necessary steps to ensure enrolment of farmers well within the stipulated time under the Scheme. No request/relaxation for extension in the above seasonality/cut-off dates shall be considered/granted by GoI once it is fixed and notified for the crop season.** However, preponement in cut off dates shall be considered on case to case basis. If any State/ UT extends the above seasonality/ cut off dates on their-own, then Central share of premium subsidy shall not be provided for the concerned notified crops /areas.
- 16.7 **It may be noted that, under no circumstance, will DAC&FW or any State/UT Govt. extend the cut-off dates for enrolment of farmers.** However, in case the States/UT decide to do so, it may be done only in agreement with implementing Insurance Company. In such cases, however **no central premium subsidy will be provided for the areas/farmers/crops which are covered/ insured in the extended period and the concerned State has to bear the entire subsidy liability for the coverage in the extended period.**
- 16.8 In a situation where total claims have been approved/auto approved, the company shall be liable to pay claims within 2 weeks of calculation/auto approval of claims irrespective of whether Insurance Companies have raised the bill for 2nd Instalment of premium subsidy or not. Hence, it is binding on the Insurance Company to seek the 2nd Instalment of premium subsidy within the timelines.
- 16.9 All admissible claims shall mandatorily be paid within the stipulated cutoff date failing which penal interest @ 12% per annum shall be payable on admissible pending claims beyond 30 days of uploading AY on portal/provided in soft copy by State Govt. subject to release of applicable subsidy by State Govt.

17.

Collection of Proposals and Premium from Farmers

- 17.1 The Nodal Bank system adopted under NAIS/ NCIP* wherein the implementing Insurance Company is not required to deal with all the loan disbursing points and instead deals only with designated Nodal banks, will continue under PMFBY only for Cooperative Banks , However, for Commercial Banks/RRBs, the individual bank branches shall act as Nodal branch for this purpose. The concerned Lead bank and Regional offices/ Administrative offices of Commercial banks/RRBs will provide necessary guidelines to concerned bank branches and coordinate with them to ensure that all concerned branches compulsorily remit the farmers premium electronically through NEFT/RTGS to be routed through NCIP to concerned Insurance Companies and submit the consolidated proposals/information in prescribed format well within the stipulated cut-off dates and also upload the details of individual covered/insured farmers on National Crop Insurance Portal. Besides, for the coverage of non-loanee farmers only, Insurance Company may also use IRDAI approved micro insurance agents/ insurance intermediaries. However, details of such agents should compulsorily be submitted to State Govt. and Govt. of India well before the start of the season for creating their credentials and subsequent uploading of details of individual insured/covered farmers on Portal within stipulated timelines.
- 17.2 Consolidated declaration/ proposal formats to be submitted physically/ electronically by Nodal banks/Branches shall contain details about Insurance Unit, sum insured per unit, premium per unit, total area insured of the farmers, number and category of farmers covered (small and marginal or other)and number of farmers under other categories(SC/ST/others)/Women along with their bank account details etc.(bank/their branches) as per the application form provided on the National Crop Insurance Portal. Banks are required to upload the insured farmers' data mandatorily on the National Crop Insurance Portal. No other platform shall be used for uploading/submission of farmers' data. Those farmers whose data is uploaded on the National Crop Insurance Portal shall only be eligible for Insurance coverage and accordingly the premium subsidy will also be released. In cases where farmers are denied crop insurance due to incorrect/ partial/non-uploading of their details on Portal, concerned Banks/Intermediaries shall be responsible for payment of claims to them
- 17.3 In order to facilitate timely release of Govt. subsidy and remittance of claims to the farmers. entry of detailed information of all insured farmers on NCIP is essential for all bank branches/PACS/ CSCs/Intermediaries/designated insurance agents and Insurance Companies
- 17.4 **Loanee farmers (Compulsory coverage)**
- 17.4.1 **Whenever banks sanction loan for a notified crop in a notified area, the crop loan amount to the extent of notified Sum Insured (equivalent to DLTC/SLTC approved Scale of Finance) for notified crop and acreage of individual notified crop of loanee farmer shall be taken into consideration for compulsory coverage, as per seasonality discipline. Based on seasonality of crop, banks should separately calculate the eligibility of loan amount for both Kharif and Rabi seasons based on the Scale of Finance and declared acreage under notified crops. Disbursing bank branch/ PACS will prepare statement of crop-wise and insurance unit-wise details of crop insurance with premium as per the seasonality discipline. Loan disbursing bank branch/ PACS shall finance additional loan equal to the premium amount payable by farmer for crop insurance.**

- 17.4.2 For insurance coverage of a farmer, SI amount for a notified crop will be equivalent to Scale of Finance defined in the Govt. notification and uploaded on the National Crop Insurance Portal for the concerned notified crop and season. The total Sum Insured of loanee farmer for the season shall be calculated accordingly. The compulsory coverage shall solely be based on the sanctioned / renewal of credit limit for notified crop for the season only and will be independent of disbursed amount/withdrawals. Farmers availing/renewing the KCC loans for Kharif & Rabi crops after cut-off date (renew/sanction period) for the season will be eligible for cover under crop insurance for the next/following crop season subject to the loan being standard loan and cut-off-date of premium debit for the season. In order to eliminate excess insurance and subsequent application of Area Correction Factor(ACF), care should be taken by the banks to ensure that only correct acreage under each declared crop in loan application is considered for compulsory coverage of notified crop and not the actual total acreage,. Banks will be liable for audit and inspection on account of excess Insurance/ACF.
- 17.4.3 Benefit of add on products viz., prevented sowing/ on account payment for Mid season adversity/ localized calamity will be available to only those farmers who have paid the premium / the premium has been debited from their account before the damage notification by the State Govt. for invoking this provision for compensation. Hence, Banks must ensure that they debit farmers premium within 15 days from sanction/renewal of KCC/crop loan, failing which banks will be liable to meet the claim liabilities of uncovered eligible famers. Banks are therefore advised to debit loanee farmers premium at least one month before cut-off date for enrolment to avoid this situation and in case sanction happens within one month of cut-off date, banks may daily debit premium for such accounts.
- 17.4.4 Detailed example for Calculation of crop-wise Sum Insured for the season for compulsory coverage is given in Table 3 below:

	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6			
8									
Total Land Ownership (Ha)	Kharif				Rabi				
Name of Crop	Paddy	Maize	Cotton	Wheat	Potato	Gram			
Actual Sown Area (Ha) under the crop	5	2	1	6	1	1			
Area (Ha) declared in KCC application	2	1	1	2	1	1			
Crop Season	Kharif			Rabi					
Scale of Finance (Rs./Ha)	50,000	40,000	60,000	50,000	70,000	30,000			
Total Sanctioned Sub limit for crop cultivation	1,00,000	40,000	60000	1,00,000	70,000	30,000			
Season-wise sub limit for crop cultivation	2,00,000			2,00,000					
Additional loan amount for consumption and maintenance of machinery etc (max. Upto 30%)	1,20,000								
Total sanctioned loan for an year	5,20,000								
Whether Crops notified by State	Yes	Yes	No	Yes	No	No			
Crop wise SI (Rs./Ha)	-	-							
SI to be considered for Insurance/Ha	50,000	40,000		50,000					
Total SI to be considered for Insurance	1,00,000	40,000		1,00,000					
SI for Compulsory Insurance	1,00,000	40,000	-	1,00,000					
Farmer's Share of Premium	0.02	0.02	-	0.015	-	-			

(% of SI)					
Premium to be debited from KCC	2,000	800		1,500	
Total Farmer's Premium (Loanee)	2,800			1,500	
Insured Area through compulsory coverage	2	1		2	
Balance Un-covered area (Ha)*	3	1		4	
Additional premium (as non-loanee)*	3,000	800	-	3,000	
Total Farmer's Premium (as non-loanee)	3,800			3,000	
Total Premium of Farmers (both as loanee and non-loanee)	6,600			4,500	

* The Area which has been left out of compulsory coverage for the notified crop can be insured by the farmer as a non-loanee farmer by depositing additional applicable premium along with required relevant documents.

- 17.4.5 Crop loans sanctioned through Kisan Credit Cards (KCC) are covered under compulsory coverage and banks shall maintain all back up records and registers relating to compliance with PMFBY and its seasonality discipline and cut-off-date for remittance of premium/ submitting of coverage details as in the case of normal crop loans. Bank branch will apportion coverage among insurable crops, based on acreage mentioned in loan application or on the basis of actual area sown as declared by the farmer subsequently.
- 17.4.6 Bank branches of Commercial banks and RRBs/ Nodal Bank in case of PACS under its jurisdiction shall submit individual insured farmer's details along with NEFT/RTGS/UTR details of premium online through National Crop Insurance Portal. Additionally, consolidated insurance proposals/ statements/declarations from the bank branch/ Nodal Bank in case of PACS under its jurisdiction, shall be forwarded to the concerned Insurance Company along with details of remittance/ RTGS towards insurance premium, in accordance with cut off dates, as specified by SLCCI for a particular crop and season. It shall be the responsibility of ICs to collect the consolidated statement from the concerned bank branches/ PACS.
- 17.4.7 Different options are available for bank branches to provide details of beneficiaries in a more transparent and authentic mechanism. Bank branch can upload the details of insured farmers through online application mode. Banks are required to upload/enter the information continuously without waiting for last day for premium debit and data entry.
- 17.4.8 As an alternative, direct integration of Core Banking Solution (CBS) with National Crop Insurance Portal has also been successfully initiated and the same may be used by Scheduled Commercial Banks/RRBs/DCCBs available on CBS for pushing the farmers' details in bulk directly without filling the individual farmer's details on web-portal or off-line utility.

17.5 Non-loanee farmers (Optional coverage) through other channel partners

- 17.5.1 Farmers desirous of availing insurance shall fill up Application Form of the Scheme and submit the same to nearest bank branch/CSCs or authorized channel partner or insurance intermediaries of insurance company.

- 17.5.2 In case of submission through Bank Branches, farmers will submit duly filled proposal form in the nearest branch of a Commercial Bank (CB) or Regional Rural Bank (RRB), or PACS (DCCB) with applicable insurance premium amount and other documents. Bank Branch may, after completing verification of documents, accept or reject the application. Premium is accepted by the bank branch preferably from the farmer's operational account in the same bank branch itself and the same would be sent to the concerned Insurance Company within the stipulated time for the purpose. **It is the responsibility of bank branch to complete the application of farmer. In case the farmers is unable to fill the application, bank branch is responsible for filling the application on farmer's behalf**, so that not a single farmer who desires to take crop insurance coverage is left out from the purview of crop insurance Scheme
- 17.5.3 In case submitted through CSCs, farmer will be required to authenticate herself/himself using Aadhaar for filling up online application form. Having a bank account is essential for such cases. CSC will upload all requisite/desired supporting documents on Portal while filling up the application form on behalf of the farmer. Applications without requisite documents would not be considered for insurance coverage and CSC-VLE is responsible for proper filling of application form.
- 17.5.4 CSC/Branch/ PACS officials will assist the farmers in completing the insurance proposal form and provide necessary guidance. While accepting the applications and premium, CSC/Branch/ PACS will be responsible for verification of required documents, eligible sum insured, applicable premium rate, etc. In case of coverage through PACS, they will consolidate these particulars and send them directly/ to respective Nodal Bank Branches which will, in turn, submit application details online on National Crop Insurance Portal and submit crop-wise and insurance unit-wise declarations electronically in the prescribed format, along with the e-remittance of premium using payment gateway/ RTGS/NEFT mode, within the stipulated time, to insurance company. Besides CSCs, other Govt./ semi-Govt. institutions/organizations including Post offices are also proposed to be utilized for insurance of non-loanee farmers after their integration with the National Crop Insurance Portal after obtaining approval of competent authorities.
- 17.5.5 Non-loanee cultivators could also be serviced directly by any designated agencies, other authorized channel partners or insurance intermediaries, approved by the IRDA for the purpose and they will act as a guide and facilitator wherein they will advise such non loanee cultivators about the benefits and desirability of the Scheme and guide the farmers about procedures; collect requisite premium and remit individual/ consolidated premium electronically to insurance company, accompanied by individual proposal forms and summary details in declaration form and upload details of each insured farmer compulsorily within stipulated timelines on the NCIP.
- 17.5.6 While accepting the Proposal and the premium from aforesaid designated agents, other authorized channel partner or insurance intermediaries approved by IRDA, it shall be the responsibility of Insurance Company or its designated agents to verify insurable interest and collect the land records, Aadhaar Number., particulars of acreage, sum insured, crop sown etc. and applicable contract/ agreement details in case of share croppers/ tenant farmers. The designated intermediaries shall enter the data of farmers on web-portal, remit the premium with consolidated proposals within 2 days. However, it is mandatory that the non-loanee cultivators serviced by the designated intermediaries should hold a bank account and Aadhaar No. or Aadhaar enrolment No. in order to get insured and the

- designated intermediaries will also facilitate remittance of the claim, if payable.
- 17.5.7 For farmers buying crop insurance through CSCs or online, OTP/Aadhaar enabled verification shall be construed as signature by the applicant for coverage under crop insurance
- 17.6 **Non-loanee Farmers (Optional coverage) - directly to Insurance Companies/Web Portal**
- 17.6.1 Non-Loanee farmer may submit insurance proposals personally - to Insurance Company with requisite/desired supporting documents and applicable premium has to be remitted electronically to concerned Insurance Company and details of UTR/remittance slips should compulsorily be attached with application. .
- 17.6.2 Non-loanee farmers can also submit application forms for getting insurance coverage through web-Portal. For this, farmer can fill up the online application form available on crop insurance Portal (www.pmfby.gov.in) and pay the requisite premium through payment gateway. As soon as the application is submitted through the system, an acknowledgement receipt will be generated along with a unique identification number. Additionally, intimation will also be sent through SMS on registered mobile number of the farmer.
- 17.6.3 However, it is mandatory that Non-Loanee farmers, personally submitting proposals to Insurance Company or through National Crop Insurance Portal, should have insurable interest and submit necessary documentary evidence as proof as decided by SLCCI along with Aadhaar no. or Aadhaar enrolment No. . The insured farmer loses the premium and the right to claim (if any) if the material facts furnished in the proposal form are found to be wrong or incorrect at any subsequent point in time.
- 17.6.4 Insurance companies retain the right to accept or reject insurance proposal(s) within 15 days/one month of receipt of proposal for Loanees/Non loanee respectively, in case proposal is incomplete, not accompanied by necessary documentary proof, Aadhaar no. or Aadhaar enrolment No./Slip or insurance premium ordinarily,. If the proposal is rejected, the Insurance Company will fully refund the collected premium.
- 17.7 **Option for change of crop name**
- 17.7.1 Farmers covered, on voluntary basis, can buy insurance before actual sowing/ planting, based on advance crop planning. However, for any reason if a farmer changes the crop planned earlier, he should intimate the change to insurance company, up to 2 working days before the cut-off-date for enrolment/buying insurance, through financial institution/channel partner/ insurance intermediary/directly as the case may be, along with difference in premium payable, if any, accompanied with sowing certificate issued by concerned village/ sub-district level official of the State. In case the premium paid was higher, Insurance Company will refund the excess premium.
- 17.7.2 Similarly, **loanee farmers** can also change the name of insured crop from the original crop indicated in the loan application but such change should be submitted in writing to the concerned bank branch up to 2 working days before cut-off date for enrolment and accordingly their newly proposed crop should be insured. However change of non-notified crop to notified crops without submitting the sowing certificate is not permissible. Bank will ensure that all standard loans (as defined by concerned financial institutions) sanctioned/renewed for notified crops within stipulated cut-off date should compulsorily be covered.

- 17.8 **Declarations/ proposals and debited premium received by Insurance Companies from the Banks/ PACS after the cut-off date shall be summarily rejected and the liability, if any, for such declarations shall rest with the concerned bank.** Accordingly the data/proposal entry on the National Crop Insurance Portal will also be stopped after the applicable cut off date. However, any dispute in the matter may be resolved as per the Grievance redressal mechanism detailed in Section 30.
- 17.9 The concerned branches of banks and Nodal Banks/ DCCBs in case of PACS will upload the details of individual insured farmers (both loanee and non-loanee) like farmer's name, father's name, Bank Account number, Aadhaar Number, village, categories – Small and Marginal/SC/ST/Women, insured acreage, details of insured land, insured crop(s) etc as prescribed in online application form available on National Crop Insurance Portal or CBS integration module and submit the same within stipulated cut-off date as per the seasonality discipline/ The Banks/ PACS must also ensure the premium amount is remitted to the concerned Insurance Company electronically within the stipulated time, failing which they shall be responsible for payment of claims, if any to the farmers. However, any dispute in the matter may be referred to the State Govt. by the concerned Agency/Bank for taking appropriate action within the prescribed cut off date for reconciliation of premium by banks with all details.
- 17.10 Insurance companies shall upload requisite information including necessary documentation in respect of non-loanee farmers enrolled through channel partner other than CSCs on the National Crop Insurance Portal within the stipulated date of coverage of non loanee farmers .All intermediaries shall ensure that the documentation is complete in all respect before accepting the premium. It is the responsibility of the concerned Insurance Companies to collect/obtain any documentation of the insured farmers (both loanee and non-loanee) from the bank/financial institutions/ intermediaries/ agents if necessary for verification/acceptance of risk and also to facilitate the banks/ financial institutions/ intermediaries/ agents to submit/ upload all requisite documents/information on the National Crop Insurance Portal within timelines.
- 17.11 Insurance Companies should also reconcile the details of individual insured farmers uploaded on the Portal with the premium/consolidated declaration received from each branch/nodal bank within the stipulated date and any deficiency/ mismatch may be reported to concerned bank branch/nodal bank. The Bank Branch/Nodal Bank should further send/upload the requisite information in respect of such farmers for whom clarification has been sought, immediately within 7 days. If such rectification is not done/completed by bank branch /nodal bank within the stipulated period, Insurance Companies may recommend to take necessary action to State Govt. under intimation to Central Govt. State Govt. in consultation with SLBC may recommend suitable administrative action against such defaulting branch/bank. However, claims (if any) in such cases of such farmers shall be borne by the concerned bank only.
- 17.12 Insurance Companies should verify and satisfy themselves about the coverage of farmers/ crops and give acceptance to the applications submitted by banks electronically through National Crop Insurance Portal. The insured farmer's personal details like AADHAAR numbers, Banking Details, Address, mobile nos. and all such details prohibited under RBI, IRDA or UIDAI Act. shall not be displayed/disclosed publicly. Insurance Companies will reconcile the details along with farmer's share of premium receipt before approaching the Govt. to release the final instalment of subsidy (third Instalment) under the Scheme.

- 17.13 All Insurance Companies will compulsorily verify and take necessary action including approval/rejection of proposal or policy of any farmer through National Crop Insurance Portal within stipulated date. After stipulated period for reconciliation & obtaining further clarification from stakeholders, **all pending proposals/information of insured/covered farmers uploaded on Crop Insurance Portal will be treated as approved and Insurance Companies will cease their right for any further verification.** However, any losses to the Govt. including excess payment of premium subsidy due to delayed/non- verification of data/information of individual covered/insured farmers on crop insurance Portal will be recovered from concerned Insurance Companies only.
- 17.14 Banks will ensure distribution of Acknowledgement Receipt along with Folio to each insured farmer within 7 days from the acceptance of applications by the concerned insurance company. The Acknowledgement Receipt will be generated through National Crop Insurance Portal itself.



18.

Assessment of Loss / Shortfall in Yield

18.1 **Wide Spread Calamities (based on season-end yield):** The Scheme operates on the basis of 'Area Approach' i.e., Defined Areas for each notified crop for widespread calamities and insurance unit is Village/Village Panchayat or any other equivalent unit for major crops and for other crops it may be the same unit or a unit of size higher than Village/ Village Panchayat level, to be decided by the State/ UT Govt.. State Govt. Department overseeing conduct of CCEs will submit yield data as per cut-off date decided by SLCCCI, along with results of individual CCEs (conducted through smart phone using CCE Agri App) on National Crop Insurance Portal. Yield data so arrived at will be approved/ uploaded by the concerned authority/State nodal department and made available to Insurance Company.

18.2 CCEs shall be undertaken per crop per unit area of insurance for notified crops*, on a sliding scale, as indicated in Table 4 below:

Sl. No.	Level	Minimum sample size
1	District	24
2	Taluka/Tehsil/Block	16
3	Mandal/Firka/Revenue Circle/Hobli or any other equivalent unit	10
4	Village/Village Panchayat	4

* Minor crops may be notified at higher than Village/Village Panchayat level.

18.3 In order to maintain the sanctity and credibility of CCEs as an objective method of yield estimation, the modalities mentioned below will be followed:

18.3.1 To bring better transparency and confidence in the data, States shall mandatorily ensure 100% CCEs through a mobile application specially designed by Govt. of India for this purpose. No other application shall be used for conducting CCEs. CCE plots for conducting CCEs shall be chosen through random selection or preferably using RST and **secrecy of the selected plot should be maintained until the CCE is actually conducted in order to rule out moral hazards.**

18.3.2 In order to provide proper benefits to the farmers and to compensate them as per near actual loss experience, crop should be notified at lowest level i.e. Village/Village Panchayat

18.3.3 State shall strengthen audit process of conduct of CCEs, with necessary checks and balances. Digitizing the CCE process including geo-coding (providing the latitude and longitude of the CCE location), date/time- stamping and taking photographs (of the CCE plot and CCE activity), is a must for all CCEs(para 20.4)

18.3.4 Wherever external agencies are proposed to be used by the State Govts. for conduct of CCEs (i.e. CCEs are out-sourced), it should be given only to the registered 'professional/accredited' agencies with adequate experience in agricultural field activities/yield estimation. It is mandatory for these agencies to follow the digital protocol as mentioned in the previous paragraph. Services of such agencies may also be utilized for assessment of Post-harvest loss and losses due to localized risks.

18.3.5 States shall maintain same procedure and methodology for conducting CCEs as adopted by NSSO or

State Manual for Crop Production estimation

- 18.3.6 District level Steering Committee: State Govt shall compulsorily constitute a Steering committee in each district to plan, conduct and supervise the CCEs for yield assessment and to provide reports of yield data to the State Nodal department. The Steering committee should be headed by District level Head of Department/Organisation responsible for conducting CCEs. District Agriculture/Cooperative officers, representatives of SSO and Insurance Companies shall be members. The Steering committee will compulsorily associate the representatives of Insurance Companies so that they shall be well informed about each and every activity and obtain the requisite information about CCE planning, schedule for conducting CCEs, selection of CCEs plot, sharing of requisite form 2, form 8 etc. and individual CCE result etc. Head of Steering Committee wil be responsible for uploading of all requisite information on National Crop Insurance Portal i.e. CCE schedule, individual CCE report etc. and imparting training to field functionaries responsible for conducting CCEs. Steering Committee will compulsorily send all their proceedings / minutes etc to DLMC and Nodal officer of the State. Concerned Insurance Companies shall compulsorily deploy one well conversant official at the office of head of Steering Committee for at least 3 months of the harvesting period for better coordination and obtaining the information of CCEs etc. District Administration will provide requisite space and logistics at the office for the insurance company official.
- 18.3.7 In instances where required number of CCEs could not be conducted due to non-availability of adequate cropped area, adverse weather conditions/inadequate infrastructure etc. the yield estimate for such IUs can be generated by using methods such as (i) adopting yield estimate of next higher unit, or (ii) adopting the yield of a neighbouring IU with maximum correlation. Priority of applicability of aforesaid two methods should be notified by the concerned States in the notification itself, failing which option of yield estimate of next higher unit only would be considered. However, this clause shall only be applicable in unavoidable situations and shall be limited to only minimal number of IU units and cannot be made a general rule to avoid CCEs. Special efforts should be made by the State to conduct adequate no. CCEs in all notified units in order to provide appropriate benefits to farmers.
- 18.3.8 In case of multi-picking crops e.g. Cotton, Chilly, Tobacco, Tomato, Pea, Fruits (Mango & Apples) & other crops of similar nature, following procedure shall be followed.
- 18.3.8.1 State needs to, in the beginning; specify the number of required picking for each crop both for irrigated and un-irrigated conditions. Ideally it should be as per NSSO/IASRI defined guidelines, if it is not available, State in consultation with local Agriculture Universities and concerned ICAR center may identify the required number of pickings. However number of actual picking depends on climatic conditions etc. Hence possibility of further pickings of each picking should compulsorily be recorded in CCE app and no. of actual picking will be final in such cases.
- 18.3.8.2 If the required number of CCEs have been done and the required number of picking have not being done, then for those experiments, factors need to be used to extrapolate yield to the final yield.
- 18.3.8.3 The factors (proportion of picking wise yield) need to be computed from well conducted CCEs (with the required number of pickings) from the same Taluka separately from Irrigated and Un-irrigated condition. At least data of 5 well conducted CCE should be used for computing the factors.

An Example for Yield Calculation for multi-picking crop is mentioned in Table 5 below:

Crop	Experiment no.	Picking 1 Yield (Kg)	Picking 2 Yield (Kg)	Picking 3 Yield (Kg)	Picking 4 Yield (Kg)	Total Yield Kg)
		P1	P2	P3	P4	$\Sigma P1, P2, P3, P4$
Well Conducted CCEs in the Taluka with 4 pickings						
Cotton	E1	1	1.95	2.1	1.25	6.3
Cotton	E2	1	2	1.75	1.4	6.15
Cotton	E3	0.75	1.75	1.5	1.5	5.5
Cotton	E4	0.8	1.43	2.15	1.4	5.78
Cotton	E5	0.95	1.85	1.4	0.75	4.95
	Average	0.9	1.8	1.78	1.26	5.74
	Factor (Total yield/ Picking Yield)	6.373	2.128	1.282		
		(1 st)	(1 st + 2 nd)	(1 st + 2 nd +3 rd)		
CCEs with Less Pickings in any IU within that Taluka						
Cotton	E6 (only 1 st Picking)	1				6.373*
Cotton	E7 (1 st and 2 nd Picking)	1.2	1.75			6.278*
Cotton	E8 (1 st , 2 nd & 3 rd Picking)	1.1	1.85	1.57		5.795*

* Total yield has been calculated as the sum of the available picking yields multiplied by the corresponding factor

18.3.8.4

In cases there is dispute regarding the large deviation in picking dates the average picking dates should be computed from well conducted CCEs in Taluka level. Accordingly the picking dates and number will be adjusted. For example, if the average picking date for second picking in a particular Taluka is in December and one experiment has shown first picking in December it will be considered as second picking.

18.3.8.5

If there is no proper CCE (with required number of pickings) in the Taluka level even, it should be considered as no CCE being available and the procedure defined in yield dispute SOP (Standard Operating Procedure) should be followed, i.e. yield should be estimated using remote sensing and weather based models. In case the crop has withered and there is no further possibility of having further pickings the same shall be recorded compulsorily in the mobile application/ CCE-Agri App while conducting the current picking experiment. In such cases, no multiplication factor may be used for calculation of AY.

The Actual Yield Data at Crop-IU level shall be automatically synchronised with the Portal through online CCE mobile application. Once the Actual Yield data is available on the Portal, the same shall be verified and approved by the concerned District/State authorities. For those experiments which were conducted offline/without mobile application, the Actual Yield data, along with the location information shall be uploaded by the concerned District administration or State nodal department on the Portal itself. This shall be an exception to be exercised in rare cases and CCEs should not exceed 5% of total CCEs. Actual Yield data through any other mode other than through National Crop

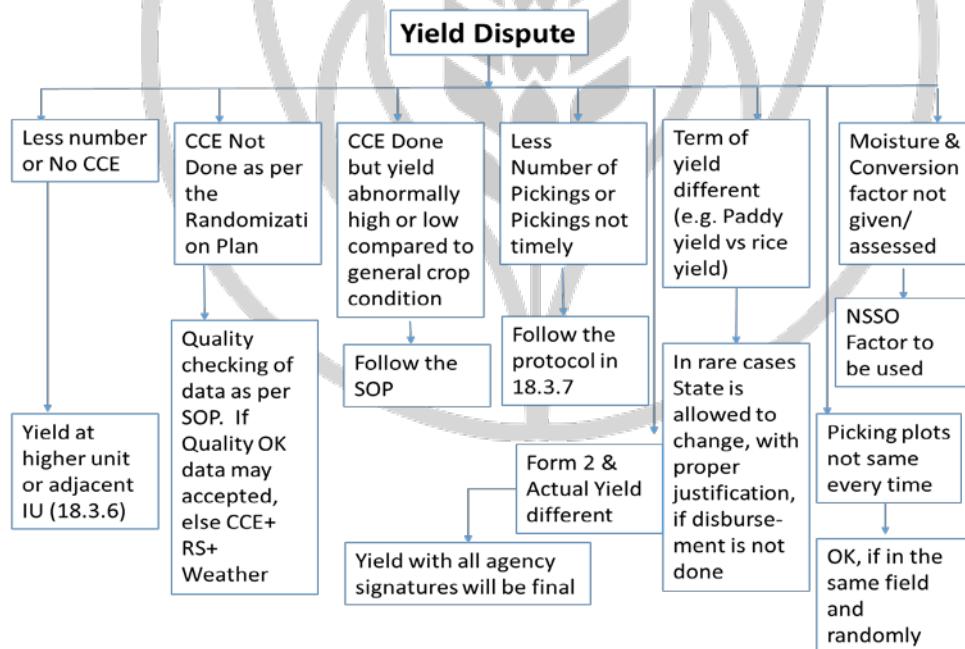
Insurance Portal shall not be accepted. If yield data is not uploaded/ synchronised /approved within pre-defined cut-off date by the concerned authority/department, the concerned Insurance Company, may inform State Govt. /Central Govt. well in time for taking appropriate action.

- 18.3.8.6 Insurance Company should be given complete access to co-witness the CCEs, the digital images of the CCEs and relevant data in the requisite format (electronic/physical) by the State Govt. on real time basis (Para 35.2.11). A schedule should be formally given/ shared with Insurance Companies sufficiently in advance without fail to help them to coordinate with field functionaries and mobilize their manpower accordingly. For this purpose, Insurance Company shall permanently station one representative at the concerned dist office of the dept/ agency mandated to conduct CCEs for proper day to day liaison (Para 18.3.6). State shall provide necessary space in the concerned office & facilitate sharing of information.

19. Dispute resolution regarding Yield Data/Crop loss

- 19.1 It has been seen, during first two years of implementation of PMFBY, there are various types of yield disputes, which unnecessarily delays the claim settlement. Following figure shows the procedures to be adopted in various cases.

Figure. Procedures to be followed in different yield dispute cases



- 19.2 Wherever the yield estimates reported at IU level are abnormally low or high vis-à-vis the general crop condition the Insurance Company in consultation with State Govt. can make use of various products (e.g. Satellite based Vegetation Index, Weather parameters, etc.) or other technologies (including statistical test, crop models etc.) to confirm yield estimates. If Insurance Company witnesses any anomaly/deficiency in the actual yield data(partial /consolidated) received from the State Govt., the

same shall be brought into the notice of concerned State department within 7 days from date of receipt of yield data with specific observations/remarks under intimation to Govt. of India and anomaly, if any, may be resolved in next 7 days by the State Level Coordination Committee (SLCC) headed by Additional Chief Secretary/Principal Secretary/Secretary of the concerned department. This committee shall be authorized to decide all such cases and the decision in such cases shall be final. The SLCC may refer the case to State Level Technical Advisory Committee (STAC) for dispute resolution (Constitution of STAC is defined in Para 19.5). In case the matter stands unresolved even after examination by STAC, it may be escalated to TAC along with all relevant documents including minutes of meetings/records of discussion and report of the STAC and SLCC. Reference to TAC can be made thereafter only in conditions specified in Para 19.7.1 However, data with anomalies which is not reported within 7 days will be treated as accepted to insurance company. The protocol of timelines defined above shall also be applicable to the actual Yield data being provided by the concerned State department in batches, i.e. Crop-wise-District-wise lots of data and timelines for each batch of data shall be counted separately/batch wise. Unnecessary delay in finalization of yield data will attract penal interest on due claim amount payable to the farmers as decided by the SLCC in the matter.

- 19.3 The existing Technical Advisory Committee (TAC) comprising of representatives from Directorate of Economics and Statistics, DAC&FW, MNCFc, NSSO, IASRI, will be further augmented and constituted under the chairmanship of **Additional Secretary, DAC&FW** and additional members depending on case to case basis will be drawn from various organizations namely, relevant institution under Indian Council of Agriculture Research (ICAR), Indian Agriculture Research Institute (IARI), National Remote Sensing Centre (NRSC), Space Applications Centre (SAC), Central Statistical Organization(CSO), Insurance Regulatory and Development Authority of India (IRDAI), Reserve Bank of India (RBI), National Bank for Agriculture & Rural Development (NABARD), India Meteorological Department (IMD) or any other such organisation.
- 19.4 The role of TAC shall be to review the technical matters related to execution of the Scheme. In case, the matter requires further focused deliberations, the TAC will refer the issue to Technical Agency (as defined in the SOP for yield dispute). Technical Agency (TA) will compulsorily take input/reports/relevant information from concerned State Department and Insurance Company and may also opt for representatives of other organizations/experts (if required) with permission of chairman of TAC and follow the procedure as defined in the SOP.
- 19.5 State shall also constitute the State Level Technical Advisory Committee (STAC) on similar pattern to resolve disputes. The STAC may be chaired by the Principal Secretary/Secretary of the concerned department with members from State Agricultural University, State Remote Sensing Centre, IMD (state centre), DES, any ICAR centre in the state, NSSO, etc.). However, in case of disagreement between the concerned parties, the case may be referred to TAC along with recommendations and findings for further deliberation/examination and decision.

- 19.6 TAC/TA/STAC shall deliberate and examine the subject matter and indicate their views /decisions based on statistical/technological inputs and other related scientific and technical parameters as detailed in the SOP.
- 19.7 The SOP to deal with yield dispute cases is as under:
- 19.7.1 **When to use this SOP:** This SOP will be followed only when there is a dispute about the crop yield values between the State Government and the Insurance Company and this has not been resolved at SLCC level and STAC (Para 19.2) and the matter has been referred to the Central Government Technical Advisory Committee (TAC), which in turn decides that the matter needs to be referred to a Technical Agency (TA). The dispute can be brought to TAC, only in the case, where all of the following conditions are satisfied. All conditions not falling in these criteria shall be decided by SLCC and their decision shall be final and binding on all concerned.
- There is more than 25% difference between the yield estimated by the State government and the insurance company.
 - There is sufficient documentary evidence that the CCEs have not been conducted in required number and following the standard protocol, in at least 20% area of the IUs for the particular crop in the Cluster.
 - The matter has been considered by the SLCC and STAC but could not be resolved at State level.
 - The Insurance Company has already carried out technical analysis of data in consultation of State Govt. or in collaboration with Central/State agencies and has used satellite/model/weather data to support its claim.
- 19.7.2 **The Organizations to which TAC can refer the case to:** The organizations can be Central Govt. or autonomous organizations, which have requisite capacity to carry out such analyses, such as: MNCFc (DAC&FW), SAC (ISRO), NRSC (ISRO) and other similar government/non-government organizations (e.g. CCAFS-BISA-CGIAR), as decided by TAC. Hereafter, these organizations will be referred to as Technical Agencies.
- 19.7.3 **Data to be provided by State Government:**
- All CCEs data of the contested area, in digital format, (preferably Excel), along with photographs and other collateral data, as collected during CCE. The CCE data should be ideally geo referenced.
 - Village level crop area estimates.
 - Long term (at least 10 years) data of crop yield at GP level (if not available, at least at Taluka/block level) in digital format, (preferably Excel)
 - Long term (at least 10 years) data of weather parameters (daily or weekly) at GP level (if not available, at least at Taluka /block level). The weather parameters should cover at least, rainfall, rainy days and temperature, in digital format, (preferably Excel)
 - Any information about pest/disease attack, hailstorm, cyclones, inundations, heavy rainfall or any other natural/ manmade disasters in that area
 - Report of any analysis carried out by the States to support its claim

19.7.4

Data to be provided by Insurance Company:

- Data of the co-observed CCEs collected by Insurance Companies in digital format, (preferably Excel), along with photographs and other collateral data, as collected during CCE
- Data of weather observatories*, if maintained or sourced by Insurance Companies, in the contested area
- Report of the technical studies* carried out by the Insurance Company to support its claim.
- Detailed reasons for the yield data being perceived as contested.
- Any UAV data/output collected from the contested area

(*This data shall only be considered where prior approval for such agency has been taken from State Govt. as outlined in para 2.13)

19.7.5

Analysis to be carried out by the Technical Agency:

Among the steps given below, any 3 steps should be followed from a to d and any one step should be followed from e to f. The steps in g and h are compulsory.

- **Statistical analysis of the CCE yield data:** Basic Statistical Parameters (Mean, Variance, CV, Range, Standard Error, etc.) Scatter plots, Test of Normality (Shapiro-Wilk test, Quartile- Quartile plot, Whiskers box plot, Skewness and Kurtosis, etc.). It also needs to be checked whether CCEs were done using the proper sampling design. Village level crop area may also be checked to identify reasons for lower number of CCE.
- **Analysis of Weather Data:** Weekly Rainfall Deviations (at least at block level) or at grid level using gridded or satellite based data, Dry-spell Occurrence, Temperature Anomaly, Soil Moisture Analysis (either from satellite or model data) and any other available weather parameters (related to crop condition), either from ground or satellite data. Another rainfall based index, which can also be studied, is Standardized Precipitation Index (SPI). SPI can be developed using IMD gridded rainfall data or NOAA CPC rainfall data. However, while using gridded data (either from satellite or ground stations), appropriate resolution should be used at appropriate level. For example, 0.25 degree data should be used only at district level and not at block/village level. High resolution weather data can also be sourced from weather companies.
- **Analysis of Long-term Yield Data:** Previous 10 years' yield data (at GP or Taluka level) analysis should be carried out to assess the ups and downs. The analysis would include yield ranges, mean yield, standard deviation, and CV.
- **Analysis of Other collateral data:** Other data or reports, which should be considered, include Crop Weather Watch Report, NSSO Supervised CCE data, FASAL programme crop reports, drought assessment reports prepared by MNCFC, Market arrivals and prices data for 2-3 years (<http://agmarknet.gov.in/>), crop condition data available on VEDAS platform (<https://vedas.sac.gov.in/vedas/>), Disaster maps available on Bhuvan platform, IMD weather bulletins, weather information/forecasts available on MOSDAC (<https://www.mosdac.gov.in/>), etc.
- **Analysis of Vegetation Index from Satellite Data:** The vegetation index, which can be used for this purpose are Normalized Difference Vegetation Index (NDVI), Normalized Difference Wetness Index

(NDWI), Vegetation Condition Index (VCI), Temperature Condition index (TCI), Vegetation Health Index (VHI), Enhance Vegetation Index (EVI), etc. To derive these indices, satellite data of appropriate resolution should be used (Table 6).

Table 6 : Types of resolution to be used for vegetation index derivation for different levels of analysis

Level of Analysis	Spatial Resolution to be used	Examples of Satellite/Sensor
Village level	5-10 m or better	Resourcesat 2/2A: LISS IV (5.8m), Sentinel 2:MSI (10 m); Rapid Eye (6.5 m); SPOT 5 HRG (5,10 m)
Block/Tehsil level	10-30 m	Resourcesat 2/2A: LISS III (23.5 m), Landsat 8: OLI (30 m); Sentinel 2:MSI (10 m)
District level	50-100 m	Resourcesat 2/2A: AWIFS (56 m); Proba V (100 m)

However, wherever long-term satellite data is needed MODIS (250 m) data can be used, but it should not be used for village level for information. Ideally for deriving crop specific vegetation indices, crop maps should be overlaid on the data. Generally for few major crops, crop maps are prepared under FASAL project of DAC&FW. Crop maps can be generated using either optical or microwave remote sensing (SAR) data of appropriate resolution. Wherever, crop maps are not available, at least agricultural area map should be used. For assessing NDVI or NDWI deviation percentage, data of latest 2-3 years should be used or at least data of a normal crop year should be used.

- **Crop Growth Modelling:** Yield loss estimates can be made using crop simulation models such as DSSAT/ InfoCrop, etc. Remote sensing based semi-physical modelling approach can also be used for crop growth analysis. However, care should be taken to use well calibrated and validated models and also models should be run in spatial at higher resolution, at least 5 km.
- **Identification of Outliers:** All these above analyses can be used to check whether there was any reason for yield deviation as presented in the CCE data. Then a yield proxy map may be prepared. The Yield proxy map can be derived from remote sensing vegetation indices (single or combination of indices), crop simulation model output, or an integration of various parameters, which are related to crop yield, such as soil, weather (gridded), satellite based products, etc. Whatever, yield proxies to be used, it is the responsibility of the organization to record documentary evidence (from their or other's published work) that the yield proxy is related to the particular crop's yield. Then the IU level yields need to be overlaid on the yield proxy map. Both yield proxy and CCE yield can be divided into 4-5 categories (e.g. Very good, Good, Medium, Poor, Very poor). Wherever there is large mismatch between yield proxy and the CCE yield (more than 2 levels), the CCE yield for that IU can be considered, as outliers.
- **Computing Yield for the Outliers:** For the IUs, where the yield was considered as outlier, the yield may be estimated by developing empirical models (statistically significant) between long-term yield data (at IU level or, if not available, higher administrative level) and weather and remote sensing based index data. Using these models, yield for the concerned year should be estimated.

The final yield can be estimated as a combination of CCE Yield and model estimated. The weightage to be given to each estimate will depend upon the quality of each estimate (CCE or Model). Low weightage should be given to CCE not conducted properly (without photograph, geo location, proper sampling plan etc.). Similarly lower weightage to be given model estimates, if model is statistically not highly significant. Wherever, if the model was not statistically significant the average of estimated yields of adjacent blocks should be used (Note: Each and every case may have specific and special cause related to a problem and may not be considered as a reference for any other case.) Each time, the stage of the crop should be given prior importance e.g. 10 mm rainfall at vegetative stage and at harvest or post-harvest stage has different impacts; a small amount rainfall having devastating wind-speed have different impact than high amount of rainfall having calm or no-wind. The Technical Agency needs to take into account all these factors to consider each of the cases as an individual and special case.

19.7.6 **Time required for the analysis:** The analysis needs to be completed by the concerned technical agency, within one month of receipt of all mentioned data from the Insurance Company and the State Government.

19.7.7 **Funds needed for the analysis:** All the analysis will be carried out by the Technical Agency, with its existing resources. However, if there is any need of procurement of priced data or services, this may be funded by the concerned Insurance Agency or the State Government, whichever organization has brought the dispute issue up to TAC.

19.7.8 **General Suggestions:** Though this SOP identifies the procedure for yield dispute resolutions, in a long run, it will benefit the scheme and the farmers, if there is no Dispute. Following suggestions are made to avoid dispute.

- The States should conduct the CCEs following the standard procedure (proper sampling plan) and collect the data using Smartphone based Android App
- States need to pro-actively use technology for more accurate crop yield estimation
- States should develop mechanism to resolve disputes at State level by technical support from State level organizations, such as Agricultural Universities, State Remote Sensing Centres, ICAR Centres located in the State, local IMD office, etc.
- The Insurance Companies should proactively, get involved with the States for supervision of CCEs.
- The Insurance Companies should more and more invest in use of technology to support the loss assessment.
- There should be better coordination between the State and the Insurance Companies.

20. Use of Innovative Technologies

- 20.1 **To Rationalize CCEs:** With availability of a number of satellites with high resolution imaging capability orbiting the Earth, there is a great improvement in satellite remote sensing based products. It has been reasonably proven that satellite based vegetation indices (such as, Normalized Difference Vegetation Index, NDVI and Normalized Difference Wetness Index, NDWI) can help in demarcating the cropped areas into clusters on the basis of crop health. This feature can be successfully used to target the CCEs within the Insurance Unit (IU). In other words, satellite imagery can help in '**smart sampling**' (**stratified sampling**) of CCEs. This will help in optimizing the number of CCEs, to make them representative of different crop conditions. This is expected to reduce the total need of CCEs by about 30-40% while maintaining similar accuracy. It will also give a more representative yield of the IU, as it will consider all crop pixels (fields) within the IU and not just location of 4 CCEs. States can adopt this technique (of using satellite based remote sensing data for planning of Crop Cutting Experiments) in generating yield estimates while following digital protocol outlined in the preceding paragraphs. For using satellite data for smart sampling, there is a need to generate specific crop map. MNCFC under the FASAL project of the DAC&FW prepares crop maps for various crops, as mentioned in Section 25, para 25.4. These crop maps can be used for CCE planning. Vegetation Indices (NDVI and NWDI) need to be computed for the cropped area. On the basis of Vegetation Index, the crop area can be categorized into poor, medium, good and very good crop health strata. Within each stratum, CCE points should be selected randomly. Additionally, ground truthing within these IUs can be done in order to develop crop yield model to ascertain yield estimation of the crop and simultaneously can act as a reconciliation/verification tool of actual CCEs conducted on the field. This can be done in consultation with MNCFC, NRSC (ISRO), SAC (ISRO), SRSC and IASRI. This Department has also been piloting such studies, in this regard, for optimization/reduction of crop cutting experiments using technology.
- 20.2 **To remove Area Discrepancy in coverage:** It is noticed that in some instances in States/districts, area insured is much more than area sown figures hence, compulsory use of RST/ satellite imagery, digitization of land records needs to be done to minimize the area discrepancy. For this detailed procedure has been laid down in section 25
- 20.3 **For Direct Yield Estimation**
- 20.3.1 For addressing the issue of reliability of CCEs in terms of their accuracy, representativeness and timeliness, innovative technologies such as satellite remote sensing, drone, modeling, AWS/ARG, real time transmission of data etc. should be utilized. This will ensure accurate assessment of yield and timely payment of claims to farmers. Various studies carried out by national and international organizations, including MNCFC, NRSC, SAC, CCAFS, IRRI, IFPRI, World Bank, etc. have shown that the use of satellite, weather, soil and crop data, along with images/video capture of crop growth at various stages and accurate sample CCE data collection can improve the yield data quality/ timeliness and support timely claim processing and payments.
- 20.3.2 States, with the support of national centres as mentioned above, SRSC and SAUs, need to carry out adequate number of pilot studies for improved yield estimation using technology, as mentioned

above, and small number of good quality CCEs. When a significant correlation is observed between remote sensing and weather estimated yield and yield estimated through CCEs, States and Insurance Companies can use these technologies in estimating the crop yields at IU level, subject to the satisfaction of both States and Insurance Companies about the accuracy of the yield estimates, to service the claims.

20.4 **To improve Yield-data Quality and Timeliness**

- 20.4.1 It has been observed that the normal CCE process being followed by the State for estimating yield is lacking in reliability, accuracy and speed, which affects claim settlement. There is a need for real time, good quality and reliable actual yield-data for which mandatory use of smart phones / hand held devices has to be done for capturing images, location of the CCE and for online transmission of data on National Crop Insurance Portal through CCEs Agri-app. RST using satellite and drones, weather data, model etc. may also be used for the purpose of increasing accuracy and speed of yield estimation through CCEs.
- 20.4.2 The cost of using technology etc. for conduct of CCE process specially purchase of smart phones/ hand held devices and use of technology (RST, Drone etc.) will be shared between Central Govt. and State Govts/ U.Ts on 50:50 basis, wherever necessary, subject to a cap on total funds to be made available by Central Govt. for this purpose based on approximate cost of procuring handheld devices/smart phones and other related costs (RST, Drone, etc).
- 20.5 Technology Fund: A technology fund will be created by GOI wherein resources shall be allocated for meeting 5% of GOI share/100% grant in various technological interventions undertaken by State Govt. funds as admissible. The fund shall be augmented with excess farmers share of premium surrendered by Insurance Company due to application of ACF and penalties imposed on Insurance Companies on account of poor performance by Insurance Companies as per the parameters outlined in Annexure 2

21. **Assessment of Claims**

21.1 **Wide Spread Calamities**

- 21.1.1 If 'Actual Yield' (AY) per hectare of insured crop for the insurance unit (calculated on basis of requisite number of CCEs) in insured season, falls short of specified 'Threshold Yield' (TY), all insured farmers growing that crop in the defined area are deemed to have suffered shortfall of similar magnitude in yield. PMFBY seeks to provide coverage against such contingency.

'Claim' shall be calculated at IU level as per the following formula:

$$\frac{(\text{Threshold Yield} - \text{Actual Yield})}{\text{Threshold Yield}} \times \text{Sum Insured}$$

Where Threshold Yield (TY) for a crop in a notified insurance unit is the average yield of best 5 years from past seven years of that season multiplied by applicable Indemnity Level for that crop

21.1.2

Illustration

In table below, assumed yield of wheat for the last 7 years is given for insurance unit area of "X". Calculation of TY for Rabi 2014-15 season is given in Table 7 below:

Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Yield(kg/ha)	4500	3750	2000	4250	1800	4300	1750

The years of 2012-13 and 2014-15 have the lowest yields.

Total of yields of seven years is 22350 kg/ha and that of two lowest yield years is 3550kg/ha i.e.(1800+1750). Therefore according to the provision, average of best five years excluding two lowest yield years will be $(22350 - 3550 = 18800/5)$ i.e. 3760 kg/ha. Hence, threshold yield at 90%, 80% and 70% of indemnity levels will be 3384kg/ha, 3008kg/ha and 2632 kg/ha respectively.

21.2

On Account Payment of Claims due to Mid-Season Adversity

21.2.1

Insurance cover will be provided to the farmers to provide immediate relief in case of adverse seasonal conditions during the crop season viz. floods, prolonged dry spells, severe drought etc., wherein expected yield during the season is likely to be less than 50% of Normal Yield.

21.2.2

Eligibility Criteria:

21.2.2.1

All notified IUs would be eligible for "ON ACCOUNT" payment only if the expected Yield of the affected crop during the season is less than 50% of Normal Yield.

21.2.2.2

The provision could be invoked for a specific crop or group of crops in notified IU, by the State Govt. through damage notification based on the proxy indicators and depending on fulfilment of laid down conditions

21.2.2.3

The quantum of likely losses and the amount of 'on-account' payment shall be decided based on the joint survey by Insurance Company and State Govt. officials.

21.2.2.4

Only those farmers would be eligible for financial support under this cover who have paid the premium / the premium has been debited from their account before the damage notification by the State Govt. for invoking this provision for compensation. Banks must ensure to debit farmers premium within 15 days from sanction/renewal of KCC/crop loan to provide benefit of this add on products , failing which banks will be liable to meet the claim liabilities of uncovered eligible famers.

21.2.2.5

Amount payable would be 25% of the likely claims, subject to adjustment against final claims.

21.2.2.6

If adversity occurs within 15 days before the normal harvest time, this provision will not be invoked.
Then the losses will not qualify under this provision.

21.2.3

Proxy-Indicators: Indicators to be used for loss intimation could be rainfall data, other weather data, satellite imagery, drought assessment reports of MNCFC and crop condition reports by district level/ State Govt. officials, supported by media report and field photographs. The State's notification should also spell out all the necessary details in this regard.

- 21.2.4 Loss assessment procedure:**
- 21.2.4.1 Joint Committee of State Govt. and the Insurer for assessment of crop damage have to be formed and notified before start of the crop season by the SLCCCI for each district.
- 21.2.4.2 This Joint Committee shall decide the eligibility for On-Account payment based on the weather data (available AWS notified by the Govt.)/long term average rainfall data/satellite imagery supported by estimated yield losses at notified IU level. Loss intimation order has to be issued within 7days from the adverse seasonal event.
- 21.2.4.3 Based on the above report, a joint inspection of the affected area maybe done by Insurance Company along with State Govt officials for ground truthing using mobile phone App and arrive at the extent of loss.
- 21.2.4.4 Information/ Services of MNCFC, ISRO or SRSC may also be utilized for determination of extent of loss, using satellite data, for On Account payout.
- 21.2.4.5 If the expected loss of the affected crop is more than 50% of the normal yield for the Notified Insurance Unit, On-Account payment would be payable.
- 21.2.4.6 On-Account payment would be calculated as per following formula:
- $$\frac{(\text{Threshold Yield}-\text{Estimated Yield})}{\text{Threshold Yield}} \times \text{Sum Insured} \times 25\%$$
- 21.2.5 Timeframe for loss assessment and submission of report:**
- 21.2.5.1 An order will be issued by Nodal Dept. of State Govt. defining eligibility of On Account payment with details of affected IUs within 7 days from the occurrence of adverse seasonal event.
- 21.2.5.2 Loss assessment report at the affected insurance unit level has to be completed by the Joint Committee within 15 days from occurrence of the adverse seasonal event.
- 21.2.6 Conditions:**
- 21.2.6.1 Mere disbursement/ sanction of loan without receipt/ debit of premium before the notification of calamity would not make a farmer eligible for the claim.
- 21.2.6.2 The On-Account payment would be disbursed by the Insurance Company without waiting for the receipt of final share of Govt. subsidy (Second Instalment)
- 21.2.6.3 On Account payment would be paid to all eligible insured farmers within one month of the notification invoking this provision by the State Govt. and subject to receipt of loss assessment report from State Govt..
- 21.2.6.4 These claims would be adjusted against the end season area approach yield based claims.
- 21.2.6.5 Bank would remit farmers' premium to Insurance Company, with farmers list, within 7 days of

intimation of loss under this section, if not uploaded earlier on Portal. However, this option must be exercised as a last recourse with proper justification.

21.2.7 Illustration

- 21.2.7.1 District 'A' has been affected by floods having 100 insurance units under Crop 'X'. Out of which 50 insurance units were severely affected and as per the weather indicators / agro-met data, it has been assessed that 30 IUs could have yield loss of more than 50% of the normal yield. Out of these 30 insurance units, estimated yield loss for 5 units is 80% (Category-I), for another 10 units, it is 70% (Category-II) and remaining 15units, it is 60% (Category-III) of normal average yield. As per declarations received, if sum insured for notified areas in Category-I, Category-II and Category-III is Rs. 1 crore, Rs. 2 crore, and Rs 3 crore, respectively, then likely total claims will be Rs. 80 lakh, 140 lakh and 180 lakh, respectively. Hence on-account claims upto 25% shall be Rs.20 lakh, 35 lakh and 45 lakh, which will be released during the season subject to receipt of premium subsidy.
- 21.2.7.2 Detailed Procedure and Timelines On Account Payment of Claims due to Mid-Season Adversity is mentioned in Table 8 below:

Sl No.	Actions required to be taken	Actions to be taken by	Schedule for taking action
1	Formation of District Level Joint Committee (DLJC) under Chairpersonship of DC/DM with the following members for loss assessment survey <ul style="list-style-type: none"> • District Agriculture / Horticulture / Revenue Officer – <u>as Convener</u>, • Concerned Insurance Company , • Representative of IMD from nearest Observatory, if available • Representative of KVK / Agriculture University • 3 representatives from district farmers nominated by Agriculture Department • District collector may co-opt experts , 	State/ UT (SLCCCI)	It should be a part of main Notification to be issued by State/ UT for implementation of PMFBY. The composition of Committee should be notified in the PMFBY notification by the State/UT & first meeting should be held within a week after notification to familiarize the members with the procedure to be followed.
	Details of Govt.'s AWS/ARG in Notification to be issued by State/ UT for implementation of PMFBY for weather data supply including rainfall to DLJC.		To be included in the main notification of State Govt. itself
	In case Govt. AWS/ARG not available, Pvt. AWS/ARG can be notified		
	Tentative dates of crop-wise & district-wise sowing & harvesting		-do-
	Details of month-wise district-wise IMD's Long Period Average LPA of rainfall.		-do-

2	<p>After 1 month from normal sowing and before 15 days from the normal harvest time, fulfilment of eligibility of On-Account payment (i.e. 50% yield loss in standing crops to be compared with average yield as explained in Para 7.3 of PMFBY in notified insurance unit area) is to be decided based on occurrence of any one of the proxy Indicators occurring along with other proxy indicators of:-</p> <ul style="list-style-type: none"> • Severe Drought Condition, as defined in the Drought Manual, 2016 • Dry spells and drought declared by State/ UT • Abnormally Low / High temperature in comparison to LPA • Widespread incidences of Insect, Pest & Diseases • Any other defined natural event including flooding which may lead to widespread losses <p>Supported by Satellite Image based outputs to be provided by ISRO, MNCFC or any other Govt. approved agency, Govt. crop condition reports, and Media reports.</p>	DL JC	
3	<p>Keeping watch over breaching of set triggers of proxy indicators as mentioned above.</p> <p>Meeting of DLJC to be convened on breaching of any one of above triggers of excess rainfall, deficit rainfall and dry spells.</p>	District Agriculture / Horticulture / Revenue Officer (i.e. convener of DLJC)	Meeting of DLJC to be convened with relevant data, to be placed before the Committee and decision should be taken within 7 days from the occurrence of adverse seasonal event.
4	Visual loss assessment survey to be carried out for at least 5% of crop sown area at 10 different locations randomly spread over Insurance Unit (IU).	To be done by DLJC	Within 7 days of meeting of DLJC
5	Issue of notification to invoke the provision of on account payment for mid-season adversity.	State/ UT (SLCCI)	Within 7 days from receipt of loss assessment survey report of DLJC
6	Assessment of likely losses & amount of 'on-account' payment based on the joint survey.	Insurance company	Within one month of the notification invoking this provision and receipt loss report by State/ UT subject to receipt of at least 50% govt. subsidy
7	Payment to eligible farmers (25% of likely claims)	Insurance company	

21.3 Prevented / Failed Sowing and Prevented Planting / Germination Claims

21.3.1 Insurance cover will be provided to farmers in case of widespread incidence of eligible risks (Section 5, para 5.1.1) affecting crops in more than 75% of area sown in a notified unit at early stage, but not later than 15 days from cut off date for enrolment, leading to total loss of crop or the farmers are not in a position to either sow or transplant the crop.

21.3.2 Eligibility Criteria:

21.3.2.1 Notified IUs will be eligible for "Prevented Sowing/ Planting" pay-out only if more than 75% of Crop wise normal sown area for notified crop in the IU remained unsown/prevented sowing/germination failure during sowing period due to occurrence of widespread incidence of eligible risks.

- 21.3.2.2 The provision is invoked by the State Govt. through notification based on the proxy Indicators. Insurance Companies may also provide input to the State in this regard with substantial evidence for consideration within the stipulated time so that claim of Insurance Companies may be verified by them. If Insurance Company makes such a case then State Govt. is bound to get it examined within a stipulated time of 7 days and in case State Govt. thinks that Prevented Sowing is not made out then they should inform Insurance Companies giving cogent reasons for the same.
- 21.3.2.3 Only those farmers would be eligible for financial support under this cover who have paid the premium / the premium has been debited from their account before the damage notification by the State Govt. for invoking this provision for compensation. Banks must ensure to debit farmers premium within 15 days from sanction/renewal of KCC/crop loan to provide benefit of this add on products , failing which banks will be liable to meet the claim liabilities of uncovered eligible farmers.
- 21.3.2.4 The State Govt. would notify crop wise and agro-climatic zone or district wise cut-off dates by which, this provision could be invoked but this notification should not be later than 15 days from cut off date for enrolment of farmer.
- 21.3.2.5 Insurance companies may appeal to invoke prevented sowing within prescribed period with proper evidence. In case, this provision is not invoked by the DL JC, Insurance Company may escalate the same in writing to State Govt.
- 21.3.3 **Proxy-Indicators:** Indicators to be used for loss intimations could be rainfall data, other weather data, satellite imagery and crop condition reports by district level / State Govt. official, media reports and area sown data released by State Govt.
- 21.3.4 **Loss assessment procedure:**
- 21.3.4.1 State Govt. would declare a notified IU as having suffered Prevented or Failed Sowing/Planting conditions with approximate areas in percentage of the unit.
- 21.3.4.2 The lump sum payout under this cover would be 25% of the sum insured and the insurance cover will be terminated.
- 21.3.5 **Conditions:**
- 21.3.5.1 The cover will be available for major crops only.
- 21.3.5.2 Mere disbursement/ sanction of loan without receipt/ debit of premium before the notification of calamity won't make a farmer eligible for claim.
- 21.3.5.3 This provision would be needed to be notified within 15 days of the cut-off date of enrolment by the State Govt., beyond which if invoked, no claim would be payable.
- 21.3.5.4 The Insurance Company would disburse the claim within 30 days of the State's order / notification invoking the event of the insured risk, subject to the data on estimated area sown having been received from State Govt.

- 21.3.5.5 The pay-out under the cover would be disbursed by the Insurance Company without waiting for the receipt of final Govt. share of premium subsidy.
- 21.3.5.6 Insurance Cover would terminate for the affected crop in a Notified Insurance Unit once a claim under this section is invoked and the affected Insurance Unit/ Crop would not be eligible for area yield based claim calculated at the end of the season.
- 21.3.5.7 Once this provision is invoked, no fresh enrolment of farmers for the affected notified crops and areas would be done.
- 21.3.5.8 Once exigency is invoked it applies to all the insured farmers in the Notified Insurance Unit for a given crop, including for those whose crop survived.
- 21.3.5.9 Bank would remit farmers' premium to Insurance Company, with loanee farmers list, within 7 days of intimation of loss under this section, if not uploaded earlier on Portal. However, this option must be exercised as last recourse with proper justification.

21.3.6 Illustration

District 'B' with 100 insurance units has been affected by dry-spell at the beginning of crop season, consequently about 80% of the area could not be sown in about 50 insurance units for groundnut crop, where per hectare sum insured is Rs. 20,000. As per provision of payment for prevented sowing, the benefit payable is sum insured X 25%, which on a sum insured of Rs.20,000 works out to Rs.5000 in the 50 insurance units which have morethan75% area which could not be sown.

- 21.3.6.1 Detailed Procedure and Timelines for payment of Prevented / Failed Sowing and Prevented Planting / Germination Claims is mentioned in Table 9 below:

Sl. No.	Actions required to be taken	Action to be taken by	Schedule for taking action
1	Formation of District Level Joint Committee (DL JC) under <u>Chairpersonship</u> of DC/DM with the following members for loss assessment survey <ul style="list-style-type: none"> • District Agriculture / Horticulture / Revenue Officer – as Convener, • Concerned Insurance Company • Representative of IMD from nearest Observatory, • Representative of KVK / Agriculture University • 3 representatives from district farmers nominated by Agriculture Department 	State/ UT (SLCCI)	It should be a part of main Notification to be issued by State/ UT for implementation of PMFBY. The composition of Committee should be notified in the PMFBY notification by the State/UT & first meeting should be held within a week after notification to familiarize the members with the procedure to be followed.
	Details of Govt.'s AWS/ARG (at appropriate level according to availability) in Notification to be issued by State/ UT for implementation of PMFBY for weather data supply including rainfall to DLJC		To be included in the main notification of State Govt. itself
	Major crops should be declared based on criteria defined in the OGs (para____) and they should be mentioned in notification issued by State Govt.		-do-
	District-wise tentative <u>time period and cut off dates</u> for sowing of major crops.		-do-

	*Cut-off date for applicability of prevented sowing provision shall be one month from the cut-off date for sowing subject to this cut off being not later than 15 days from cut off enrolment date.		
	Details of month-wise district-wise as per IMD's Long Period Average (LPA) of rainfall		-do-
2	To make available the details of insurance unit Area-wise normal sown area (Para 25.3) current season's sown area to insurance company	State/ UT	Within one month of normal sowing as mentioned in notification
3	Decision to be taken about fulfilment of eligibility of more than 75% affected area of sown area in the notified insurance unit area <u>within one month</u> of sowing based on occurrence of any one of the proxy Indicators occurring along with other proxy indicators:- <ul style="list-style-type: none"> • Severe Drought Condition, as defined in the Drought Manual, 2016 • Dry spells and drought declared by State/ UT • Abnormally Low temperature recorded at nearest Govt. AWS / Observatory in comparison to LPA for Rabi season • Widespread Flood Supported by Satellite Imageries , soil moisture, hydrological parameters , sowing information , Govt. crop condition reports, Media reports, 	DLJC	Definitions & interpretations regarding proxy indicators would be applied as per IMD's guidelines as below. %age w.r.t. LPA Excess (+) 20 or more Normal (+) 19 to (-) 19 Definitions & interpretations regarding proxy indicators for drought would be applied as per Drought Manual 2016.
4	Keeping watch over the breaching of set triggers of proxy indicators as mentioned above. Meeting of DLJC to be convened on breaching of any one of proxy indicators as mentioned above.	District Agriculture / Horticulture / Revenue Officer (i.e. convener of DLJC) Besides, if Insurance Company notice the occurrence of prevented sowing & failure of sowing / planting / germination, then they can also report and appeal to DLJC for invoking the claims under the provision.	Meeting of DLJC to be convened with relevant data, to be placed before the Committee and decision should be taken within 7 days from the occurrence of adverse seasonal event.
5	Survey of assessment for more than 75% affected sown area in the notified insurance unit area and submission of report to SLCCI.	To be done by DLJC	Within 7 days of meeting of DLJC
6	Issue of notification to invoke the provision of prevented sowing & failure of sowing / planting / germination.	State/ UT (SLCCI)	Within 7 days from receipt of loss assessment survey report of DLJC
7	Supply of the details of farmers & area insured along with total premium (farmers share & Govt. subsidy) debited to Insurance company. This is prerequisite condition for making payment.	Banks (loanee & non-loanee) and Intermediaries (non-loanee)	Within 15 days from the occurrence of adverse seasonal event. This should be processed on parallel basis with survey and issue of notification.
8	Payment to eligible farmers (25% of sum insured) N.B.: no other payouts after payment under this provision will be applicable.	Insurance company	Within one month of the notification invoking this provision without waiting for Govt. subsidy.

- 21.4 **Post-Harvest Losses due to unseasonal rains etc**
- 21.4.1 Provision has been made for assessment of yield loss on individual plot basis in case of occurrence of hailstorm, cyclone, cyclonic rains and unseasonal rains resulting in damage to harvested crop lying in the field in 'cut and spread' / small bundled condition for drying upto maximum period of two weeks(14 days) from harvesting , for sole purpose of drying. For the purpose of indemnification of post harvest crop losses, unseasonal rains shall be triggered when the excess rainfall is more than 20% over long period average over the month for that district subject to confirmation of the damage in the Joint survey to be conducted by concerned State Govt. and Insurance Company.
- 21.4.2 **Eligibility criteria:**
- 21.4.2.1 Available to all insured farmers, at farm unit level, affected by above mentioned perils in a Notified Insurance Unit growing notified crops for which insurance have been availed.
- 21.4.2.2 Available for all crops damaged by specified perils, which are left in the field after harvesting in " cut and spread condition"/small bundled conditions for drying upto a period of 14 days from harvest. State Govt. shall also notify the normal harvesting period of each crop.
- 21.4.2.3 **Proxy-Indicators:** Rainfall data substantiated by media Report in the local media or reports of the Agriculture/ Revenue Department supported by media Report and other evidences.
- 21.4.3 **Loss assessment procedure:**
- 21.4.3.1 **Time and method of reporting the loss/claims**
- Immediate intimation (within 72 hours) by the insured farmer to any one as detailed in para 21.4.3.2 below.
 - Intimation must contain details of survey number-wise insured crop and acreage affected.
 - Premium payment verification to be done from portal and in case of need, may be verified from the bank and bank shall provide the payment verification within next 48 hours of receipt of such request.
- 21.4.3.2 **Channel of reporting, i.e. Whom to be reported:** Intimation may be given within 72 hours by farmer either directly to the insurance company, concerned bank, local agriculture department Govt./district officials or through toll free number (*Centralised dedicated Toll Free Number for claim intimation/intimations can be redirected within 48 hours to respective Insurance Companies through backend*) to the insurance company or on NCIP. First mode of intimation will be centralised Toll Free Number, followed by the order/loss report issued by concerned officials of district administration to Insurance Company for conducting the individual level investigations The concerned bank/intermediary would verify the insured details like crop insured, sum insured, premium debited and date of debit & remittance for conducting investigation/assessment.

- 21.4.4 Documentary evidence required for claim assessment:**
- 21.4.4.1 Duly filled Claim form along with all relevant documents is necessary for payment of claims. ICs shall complete all formalities for payment of such claims like local newspaper cutting and any other available evidence to substantiate occurrence of loss event and severity of the loss, if any.
- 21.4.5 Appointment of Loss Assessors by the Insurance Company:**
- 21.4.5.1 The loss assessors would be appointed by the Insurance Company for assessment of Post-harvest losses (Yield- index Insurance). The loss assessors appointed should possess following experience and qualification:
- Diploma in any subject with minimum 2 years relevant experience /degree in Agri and allied subjects with one year experience).
 - Retired Govt. officials of Agriculture/ Horticulture/ Extension Department
 - Retired Bank officials with experience of crop loaning or KCC.
- 21.4.5.2 For compliance of the above provisions the Insurance Companies would empanel the suitable loss assessors for using their services as and when required.
- 21.4.5.3 The loss would be jointly assessed by a team comprising of loss assessor appointed by the insurer, block level agriculture officer and the concerned farmer.
- 21.4.6 Time frame for loss assessment and submission of report**
- 21.4.6.1 Appointment of loss assessor within 48 hours from receipt of information
- 21.4.6.2 Loss assessment to be completed within next 10 days
- 21.4.6.3 Claim settlement/payment to the farmers to be completed in next 15 days (subject to receipt of premium) from loss assessment report.
- 21.4.6.4 If the affected area under a notified crop is more than 25% of the total cropped area in a notified insurance unit, all the eligible farmers (who have taken insurance for the notified crop, which has been damaged, and informed about occurrence of calamity in the farm within the stipulated time) in the notified insurance unit would be deemed to have suffered post harvest loss and would be eligible for financial support. Percentage of loss would be arrived at by the Insurance Company through requisite percentage of sample survey as decided by the Joint Committee of the affected area.
- 21.4.6.5 If the claim on area approach (based on CCEs) is more than the claims of the Post harvest losses, the difference in the claims will be payable to affected farmers. If claim for Post Harvest is higher, no recovery will be applicable from affected farmers.

21.4.7 **Conditions:**

- 21.4.7.1 Mere disbursement/ sanction of loan without receipt/ debit of premium before the occurrence of insured peril would not make a farmer eligible for claim.
- 21.4.7.2 When affected area is limited up to 25% of total cropped area in the notified insurance unit, the losses of eligible farmers would be assessed individually provided they have paid premium prior to occurrence of insurance peril.
- 21.4.7.3 The pay-out under the cover would be disbursed by the Insurance Company only after the receipt of final Govt. share of premium subsidy (second instalment)
- 21.4.7.4 The Insurance Company would disburse the claim, if payable, within 15 days of receipt of loss survey report.
- 21.4.7.5 If end of season claim based on the yield data is more than the claim under this cover, the balance would be paid at the end of the season under wide spread claims.

21.4.8 **Illustration**

- Sum Insured for a crop=Rs.50,000
- Affected area of the I.U.=80%(eligible for sample survey)
- Assessed loss in the affected area/fields due to operation of insured peril= 50%
- Claims Payable under Post Harvest loss=Rs.50,000×50%=Rs25,000
- End of season reported shortfall in yield=60% in respect of Threshold Yield
- Claim estimated based on 'area approach' at IU level=Rs.50,000×60% = Rs.30,000
- Balance payable at end of season = Rs. 30,000 - Rs. 25,000 = Rs. 5,000

21.4.8.1 Detailed Procedure and Timelines for payment of Post Harvest Loss is mentioned in Table 10 below:

Sl. No.	Actions required to be taken	Action to be taken by	Schedule for taking action
1	Intimation may be given within 72 hours by farmer either directly to the insurance company, concerned bank, local agriculture department Govt./district officials or through toll free number (<i>Centralised dedicated Toll Free Number or NCIP for claim intimation/intimations can be redirected within 48 hours to respective Insurance Companies through backend</i>) to the insurance company. First mode of intimation will be centralised Toll Free Number	Affected farmer(s) through his own mobile or land line phone or any his own media. Farmer should inform his bank account number (loan account for loanee farmer and savings account for non-loanee farmer) or Enrolment number generated from portal.	Within 72 hours from the occurrence of peril
2	Forwarding of information / intimation of the farmer(s) to Insurance Company either using company's web link or on NCIP	Bank/PACS, Local Agriculture Department / District officials	Within 48 hours from receipt of information / intimation from the farmer(s)

3	Appointment of loss assessor as per qualifications & experience laid in OGs of PMFBY	Insurance company	Within 48 hours from receipt of information / intimation
4	Assessment of yield loss	Jointly by loss assessor, block level agriculture officer and affected farmer(s)	Within 10 days of appointment of loss assessor by the company
5	Assessment of affected area in term of % of area insured	Above Joint Committee and Insurance Company	
6	Get verification of details of affected insured farmer(s) from bank using company's web link or on Central Portal	Insurance company	Within 7 days of the loss intimation
7	Claim-payment to affected intimated farmers	Insurance company	Within 15 days from receipt of loss assessment report subject to receipt of full Govt. share of subsidy (2 nd instalment)

21.5

Localized Risks

- 21.5.1 The Scheme provided for insurance cover at individual farm level to crop losses due to occurrence of localized perils/ calamities viz. Hailstorm, Landslide, Inundation, Cloud burst and Natural fire due to lightening affecting part of a notified unit or a plot.
- 21.5.1.1 For the purpose of indemnification of crop losses due to inundation as localised claim, Inundation is a situation where insured field is covered or submerged by water due to rise in water level by rainwater that has fallen naturally from the sky or from an artesian well or flood water locally and where water stays for prolonged period and causes visible damage to the crop.
- 21.5.2 **Eligibility Criteria:**
- 21.5.2.1 Available to all insured farmers, at farm unit level, affected by above mentioned perils in a Notified Insurance Unit growing notified crops for which insurance has been availed.
- 21.5.2.2 Maximum liability is limited to proportionate Sum Insured of damaged crop's area and the pay-out under this provision would be in proportion to cost of inputs, incurred up to the occurrence of insured peril.
- 21.5.2.3 Only those farmers would be eligible for financial support under this cover who have paid the premium/the premium has been debited from their account before occurrence of the insured peril
- 21.5.2.4 If the pay out under area approach (based on CCEs data) is more than localized losses, the higher claims of two will be payable to insured farmers.
- 21.5.2.5 If the affected area under a notified crop is more than 25% of the total insured area in a notified insurance unit, all the eligible farmers (who have taken insurance for the notified crop, which has been

damaged, and informed about occurrence of calamity in the farm within the stipulated time) in the notified insurance unit would be deemed to have suffered localised loss and would be eligible for financial support.

21.5.2.6 Percentage of loss would be arrived at by Insurance Company through requisite percentage of sample survey as decided by the Joint Committee of the affected area.

21.5.3 **Proxy-Indicators:** Report in the local media or reports of the Agriculture/ Revenue Department, weather data, etc.

21.5.4 **Loss assessment procedure:**

21.5.4.1 **Time and method of reporting the loss/claims**

- Immediate intimation (within 72 hours) by the insured farmer to any one as detailed in Para 21.5.4.2 below.
- Intimation must contain details of survey number-wise insured crop and acreage affected.
- Premium payment verification to be done from portal and in case of need, may be verified from the bank and bank shall provide the payment verification within next 48 hours of receipt of such request.
- Mobile application may be used for reporting incidence of localized risks for intimation of events including longitude/latitude details and pictures using Mobile App to be developed by DAC&FW.

21.5.4.2 **Channel of reporting i.e. Whom to be reported:** Intimation may be given within 72 hours by farmer either directly to the insurance company, concerned bank, local agriculture department Govt./district officials or through toll free number (*Centralised dedicated Toll Free Number for claim intimation/intimations can be redirected within 48 hours to respective Insurance Companies through backend*) to the insurance company or on NCIP. First mode of intimation will be Centralised Toll Free Number followed by the order/loss report issued by concerned officials of district administration to Insurance Company for conducting the individual level investigations. In case the concerned farmer's details are not available on National Crop Insurance Portal, the concerned bank/intermediary would verify the insured details like crop insured, sum insured, premium debited and date of debit & remittance for conducting investigation/assessment.

21.5.5 **Documentary evidence required for claim assessment,**

21.5.5.1 Duly filled Claim form along with all relevant documents is necessary for payment of claims. However, if information on all the columns is not readily available, semi-filled form may be sent to the Insurance Company and later within 7days of the loss, filled form may be submitted.

21.5.5.2 Evidence of crop loss through capturing pictures using mobile applications

21.5.5.3 IMD report, Media report, Local Newspaper cutting to substantiate occurrence of loss event and severity of the loss, if any.

- 21.5.6 Appointment of Loss Assessors by the Insurance Company:**
- 21.5.6.1 The loss assessors would be appointed by the Insurance Company for assessment of losses due to incidence of Localized Risks (Yield –index Insurance). The loss assessors appointed by the Insurance Companies should be in accordance with the IRDAI provisions. The loss assessors appointed should possess following experience and qualification:
- Diploma in any subject with minimum 2 years relevant experience /degree in Agri and allied subjects with one year experience).
 - Retired Govt. officials of Agriculture/ Horticulture/ Extension Department having Diploma/B.Sc(Ag.) degree.
 - Retired Bank officials with experience of crop loaning or Kisan Credit Card (KCC).
- 21.5.6.2 For compliance under the above provisions the Insurance Companies would empanel the suitable loss assessors for using their services as and when required.
- 21.5.6.3 The loss would be jointly assessed by a team comprising of loss assessor appointed by the insurer, block level agriculture officer and the concerned farmer.
- 21.5.7 Time frame for loss assessment and submission of report**
- Appointment of loss assessor within 48 hours.
 - Loss assessment to be completed within next 10 days.
 - Claim settlement to be completed in next 15 days (subject to receipt of farmers premium)
 - Maximum liability would be limited to proportionate Sum Insured of damaged cropped area.
- 21.5.8 Conditions:**
- 21.5.8.1 Mere disbursement/sanction of loan without receipt/debit of premium before the occurrence of insured peril would not make a farmer eligible for claim.
- 21.5.8.2 When affected area is limited upto 25% of total insured area in the notified insurance unit, the losses of eligible farmers would be assessed individually provided they have intimated and paid premium prior to occurrence of insurance peril. Intimation is a pre condition to get benefit for localized claim. Intimation at the time of survey would also be considered
- 21.5.8.3 The pay-out under the cover would be disbursed by the Insurance Company only after the receipt of at least advance Govt. share of premium subsidy (1st instalment).
- 21.5.8.4 The Insurance Company would disburse the claim, if payable within 15 days of survey of loss.
- 21.5.8.5 If, at the end of season, based on the yield data, claim is more than the claim under this cover, the balance would be paid at the end of the season under wide spread claims.
- 21.5.8.6 Farmers getting enrolled or whose premium is debited after occurrence of insurance peril would not be eligible for financial support under this cover.

21.5.8.7 Bank would remit farmers' premium to Insurance Company, with farmers list, within 7 days of intimation of loss under this section, if not uploaded earlier on Portal.

21.5.9 Illustration

- Sum Insured for a crop=Rs.30,000
- Assessed loss in the affected area due to operation of insured peril=40%
- Claims Payable under this cover=Rs.30,000×40%=Rs12,000
- End of season reported short fall in yield=60% w.r.t. TY
- Claim estimated based on 'area approach 'at IU level=Rs.30,000×60% = Rs.18,000
- Balance payable at end of season = Rs. 18,000 - Rs. 12,000 = Rs. 6,000

21.5.9.1 Detailed Procedure and Timelines for payment of Localized claims due is mentioned in Table 11 below:

Sl. No.	Actions required to be taken	Action to be taken by	Schedule for taking action
1	Information / intimation to Insurance Company directly Or any one of the concerned- a) Bank/PACS, b) Local Agriculture Department / District officials either through toll free number or mobile app (to be notified in notification by States / UTs) or written report about occurrence of landslide, hailstorm and inundation*before 15 days from the normal harvest time as notified by State/ UTs supported by Information of IMD / Local Media, Reports of Agriculture / Revenue Departments, Media Reports	Affected farmer(s) through his own mobile or land line phone or any his own media. Farmer should inform his bank account number (loan account for loanee farmer and savings account for non-loanee farmer) or Enrolment number generated from portal.	Within 72 hours from the occurrence of peril
2	Forwarding of information / intimation of the farmer(s) to Insurance Company either using company's web link or on NCIP	Bank/PACS, Local Agriculture Department / District officials	Within 48 hours from receipt of information / intimation from the farmer(s)
3	Appointment of loss assessor as per qualifications & experience laid in OGs of PMFBY	Insurance company	Within 48 hours from receipt of information / intimation
4	Loss assessment	Jointly by loss assessor, block level agriculture officer and affected farmer(s)	Within 72 hours of appointment of loss assessor by the company.
5	Assessment of affected area in term of % of area insured**	Jointly by Insurance Company& block level Agriculture Officer	
6	Get verification of details of affected insured farmer(s) from bank using company's web link or on Central Portal	Insurance company	Within 7 days of the loss intimation

7	Claim-payment to affected farmers	Insurance company	Within 15 days from receipt of loss assessment report subject to receipt of at least 50% govt. subsidy
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- *1) Crop damage should have occurred on account of inundation, mere water logging without corresponding crop loss will not be considered
- 2) Inundation peril is not applicable in case of hydrophilic crops like Paddy, Sugarcane Jute & Mesta.
- ** If affected area is more than 25% of insured area of notified crop in notified insurance unit then the losses are not individual but are widespread therefore, all eligible claimant insured farmers would be paid ad-hoc claims for localized losses.

22. Participation of Loss Assessors/Evaluators for Loss Assessment under of the Scheme

22.1 Empanelment Criteria

- 22.1.1 The agencies having relevant field experience, financial and infrastructural strength, sufficient skilled manpower having Diploma in any subject with minimum 2 years relevant experience or degree in Agri and allied subjects with one year relevant experience in crop loss assessment and having desired operational capabilities shall be empanelled by DAC & FW for carrying out the crop loss evaluation/assessment across the country and shall be individually engaged/selected by the concerned Insurance Company for implementation of PMFBY. Agencies having infrastructure/capacity to provide technical services like Drones/RST/mobile/web applications will be given priority.
- 22.1.2 Once loss assessment/evaluation agency has been empanelled by DAC & FW, it is considered as pre-qualified company to participate/engage with concerned Insurance Company to undertake loss evaluation/assessment of losses under the provisions of the Scheme, however concerned Insurance Company will be responsible for maintaining quality of services being delivered by such agencies.
- 22.1.3 Once empanelled, the performance of such agencies will be evaluated after two consecutive seasons against vital parameters defining service and quality standards as described below by the Committee headed by Joint Secretary/Additional Secretary of DAC&FW and non-performing agencies shall be de-empanelled for a period of 2 consecutive seasons.
- 22.1.4 Detailed guidelines on accreditation of loss assessment agencies shall be prepared by the Committee comprising of members from IASRI, NSSO, MNCFC, Economic and Statistical Advisor-DES, empanelled Insurance Company, GIC-Re, representatives from State Nodal Departments etc. These guidelines will enable empanelment/de-empanelment of agencies based on set performance parameters to maintain desired quality and standardization of protocols and processes.

Table 11: Criteria for Performance Evaluation and Ranking of Loss Assessment Agencies

S. No	Service Level Agreements (SLA's)	Source of data	Monitoring method	Periodicity	Points criteria
1	CCE Co-observance	Computed from the CCE upload data in National Crop Insurance Portal.	Co-observance of CCEs	Based on the CCE data made for each season	If 51% to 75% : 3 points If less than 50% : 5 points
2	Mid-term/localized Loss Assessment/Post Harvest Loss Assessment	List of mid-term/Localized loss assessment/post harvest loss assessment reported on the Crop insurance Portal.	Loss Assessment with the timelines prescribed in the OG	Based on the claims made for each season	If partial timelines are met: 3 points If no timelines are met : 5 points
3	Qualified Human resources each at a block/equivalent level	Report from insurance company	Details of the manpower on the letterhead of the Insurance Company to be given to SNA	At least 15 days before enrolment cut-off date	If not appointed till before 15 days : 3 point If not appointed at all : 5 points
4	Organizing of training/capacity building workshops as per the guidelines	Report from insurance company	Report by Insurance Company to State Department within 7 days of workshop	At least 15 days before start of each season	If not conducted 15 days before the enrolment cut-off date : 3 points If not conducted at all : 5 points
5	District office in all districts being served	List of offices with their contact details provided to State Department by insurance company	District offices are established and staffed	Within 30 days from award/bid opening	If not set up within 30 days from award/bid opening : 3 points If partially set-up or not set-up at all : 5 points

22.2

Performance severity of Loss Assessors:

Threshold limit	Severity
5-8 points	1% of total service charges for the concerned agency for the season
9-14 points	2% of total service charges for the concerned agency for the season
15- 22 points	3% of the total service charges for the concerned agency for the season
>= 23 points	5% of total service charges for a season, cancellation of renewal/continuation for next season and de-empanelment
False intimations on any of the above parameters	Investigations to be called against the loss assessment agency & if found false, cancellation of renewal/continuation for next season and loss assessment agency to be de-empanelled

23.

Procedure for Settlement of Claims to the farmers

- 23.1 Tentative final share of Govt. subsidy (2nd instalment), both Central and State, on the basis of business statistics finalized on portal after 30 days of period specified for auto approval of applications on portal should have been received by Insurance Company to enable them to settle the Actual Yield based claims arising out of wide-spread calamity as well as for claims against post harvest losses. However, for settlement of On-Account payment of claims, prevented sowing/planting/germination claims and Localized calamity claims, advance subsidy (1st instalment) of 50% of 80% of respective Central/State Govt. share in corresponding previous season should have been received for the season/area(s)
- 23.2 Threshold Yield for all notified crops at each IU level shall compulsorily be part of the notification for the season and shall not change at any point during that season. Crop-IU wise historical Average Yield, Calamity Years, Indemnity level and Threshold Yield shall be uploaded on the Portal by the concerned State Nodal Department at the time of release of notification only and shall be verified and accepted by the concerned Insurance Company within given timelines. In order to avoid manipulation/misuse of information at field level, **threshold Yield shall not be a part of public information before payment of claims for that season.**
- 23.3 The DLMC will be required to upload/enter the details of crop loss as per the Joint Loss Survey conducted by DLJC for all intermediate loss events viz. prevented sowing/planting/germination failure & Mid-season Adversity on the National Crop Insurance Portal. Similarly, the crop loss details for localized losses and post-harvest loss events shall be entered by the concerned Insurance Company on the Portal. Once the Actual Yield data is available on the Portal, the same shall be verified and approved by the concerned District/State authorities. For those experiments which were conducted offline/without mobile application, the Actual Yield data shall be uploaded by the concerned District administration or State nodal department on the Portal itself.
- 23.4 The loss reports and Actual Yield data shall be approved/reverted (in case of any discrepancy/concern on the authenticity/correctness of report/data) by the Insurance Company based on which the eligible claims shall be calculated through the Portal and accordingly the payment of claims shall be initiated by the concerned Insurance Company and remitted directly into beneficiary account as per pre-defined timelines. The application wise payment details viz. amount, reference number, date etc. shall be entered/ synchronised with the National Crop Insurance Portal for future reference and audit purpose.
- 23.5 In case of widespread calamity (end of season claims), once yield data is received/finalized from State Govt. as per the cut-off-dates decided, claims will be worked out on the National Crop Insurance Portal as per declarations/ approved proposals & covered farmer's data received from banks / channel partners / insurance intermediaries for each notified area and crops and accordingly the claims will be approved by Competent Authority of implementing Insurance Company.
- 23.6 In case of farmers covered through Financial Institution, claims shall be released only through electronic transfer directly into insured farmer's given bank account, followed by details containing claim particulars, to individual bank branches/ nodal banks; Bank Branch should also display particulars

of claim disbursal on notice board to enable spread of awareness and inclination amongst farming community for risk mitigation through crop insurance. Insurance Company is required to compulsorily upload the claim details against each insured farmer on National crop insurance Portal.

- 23.7 In case of farmers covered on voluntary basis through intermediaries, payable claims will directly be credited to the bank accounts of concerned insured farmers and details of the claims may also be intimated to them. The list of beneficiaries shall also be uploaded on National Crop Insurance Portal immediately.
- 23.8 In case of claims under prevented/failed sowing, localized calamities, post- harvest losses; Insurance Company will process the claims after assessment and shall release the claims as per detailed procedure given in the relevant sections above.
- 23.9 The claim settlement intimation shall be sent to each beneficiary farmer through SMS from the Portal itself. State Govts, Banks & Insurance companies shall ensure correctness of data before hand viz. Threshold Yield, Actual Yield, Insured Area, Sum Insured and Indemnity levels etc. Responsibility of any error, omissions and mis-reporting shall lie with the concerned State Nodal Department and insurance Company. State Govt. & Insurance Companies shall resolve all the grievances of the insured farmers and other stakeholders in the shortest possible time.
- 23.10 In any situation, State Govt. can not reopen/ re calculate claims after 30 days of claims settlement for notified crop(s) at notified unit. Disputed claims / sub-standard claims , if any, due to erroneous data may be referred within this time to SLCC/STAC and further to Technical Advisory Committee (TAC), if required, for consideration and decision

24. Important Conditions /Clauses Applicable for Coverage of Risks

- 24.1 Insurance companies should have received the premium for coverage either from bank, channel partner, insurance intermediary or directly. In case of any loss in transit due to negligence by these agencies or non remittance of premium by these agencies, the concerned bank/intermediaries shall be liable for payment of claims.
- 24.2 In case of any substantial misreporting by nodal bank /branch in case of compulsory farmers coverage, the concerned bank only shall be liable for such mis-reporting.
- 24.3 Mere sanctioning/ disbursement of crop loans and submission of proposals/ declarations and remittance of premium by farmer/bank, without explicit intent to raise the crop, does not constitute acceptance of risk by Insurance Company.

25. Acreage discrepancy

- 25.1 Some areas in the past have reported excess insurance coverage vis-à-vis planted acreage, leading to over-insurance. Ideally the discrepancy should be handled at farm level to protect the interest of farmers with genuine insurance coverage. All suitable measures are being taken by concerned stakeholders for de duplication with the help of Aadhaar Number, land records, banks records, revenue records and proposal/loan application of insured farmers. The details of individual insured farmers are being collected on National Crop Insurance Portal for de duplication. However, in the absence of digitized farm records on a GIS platform and its integration with the Portal, it would be cumbersome to physically verify each farm when the reported discrepancies are comparatively large compared to the sown areas. Moreover, the scheme also covers the risk of prevented sowing/germination failure which is not being included in sowing areas furnished by the State Government for arriving of sown area of crop the during the season. State wise List of such major crops will be notified by DAC&FW in consultation with MNCFC from time to time before beginning of every season.
- 25.2 Under the scheme, notified crops are being insured by the Insurance companies on the basis of actuarial premium rate, hence, it is not their prerogative to reduce the Sum Insured and resultant claims on the application of ACF. However, to rationalize the government subsidy, it is the responsibilities of all concerned stakeholders including farmers and financial institutions to insure the crop which farmer actually intend to sow/actually sown. Option to change the insured crop has also been provided under the scheme for reporting of crop(s) actually sown for the insurance. There is also a provision to indemnify the crop losses due to localized perils on the basis of survey of individual plot/field under insured crops. Any wrong reporting of insured crops may lead to forfeiting of claims, if the crop actually sown and insured will be different.
- 25.3 Area Discrepancy will be applied only to those major crops for which Normal area sown data at the Block/Taluka level shall be provided by MNCFC based on the remote sensing data etc after factoring the areas remains unsown and failed germination/plantation due to adverse climatic conditions and shall be made available on National Crop Insurance Portal. No other data from any source including State Govt. will be considered.
- 25.4 However, any mass irregularities/anomalies in insuring of excess area i.e. more than the published cultivable area at Taluka level should compulsorily be brought to the notice of DAC&FW, in writing after cut off date of enrolment but before the period specified for reconciliation with banks along with facts/documents and list of bank branches etc so that the same may be examined by the Government and rectified by concerned bank itself before finalisation of business Statistics for the season on Portal
- 25.5 Decision of GOI in applicability of discrepancy in insured area shall be binding on all.
- 25.6 If the difference between insured area and sown area provided by MNCFC is >30% at Block/Tehsil/ Taluka , all IUs of such Block/Tehsil/ Taluka will fall under acreage discrepancy category and should be treated as having 'excess' insurance coverage.
- 25.7 Data on application of ACF shall be uploaded on National Crop Insurance Portal.

- 25.8 Accordingly excess insured area shall be treated as un-insured and corresponding farmer's premium will be forfeited and the same will be surrendered to Technology Fund of GOI and may be utilized for leveraging technology in PMFBY for improvement of technology/research/Impact assessment etc and towards assistance to States for cost of incremental CCEs
- 25.9 Premium subsidy refunded by ICs due to application of ACF shall be refunded to Central/State Govt. in ration of 50:50

26. Publicity and Awareness

- 26.1 Adequate publicity needs to be given in all the villages of the notified districts/areas. All possible means of electronic and print media, farmer's fair, exhibitions, SMS, short films, and documentaries shall be utilized to create and disseminate awareness about provisions and benefits of the Scheme among the cultivators and the agencies involved in implementing the Scheme. Agriculture/ Cooperation Departments of the State shall work out appropriate plan for awareness generation and publicity on an on-going basis from **three months** prior to the start of coverage period. Similarly, Insurance Companies will conduct Publicity and Awareness immediately on receipt of award of work. All the publicity material/ information should necessarily be uploaded on the National Crop Insurance Portal along with coverage/frequency/ duration date etc.
- 26.2 The State Govt./ UT in collaboration with Insurance Companies shall also chalk out plan for capacity building of the associated agents, banks etc for effective implementation of the Scheme and organize training workshops/ sensitization programme for them in association with participating Insurance Companies.
- 26.3 Insurance company should spend 0.5% of the total gross premium for publicity expenses at the field level and the corresponding details should be submitted to GOI and State govt. at the end of every season. In case of expenditure in this category is less than 0.5% of Total Gross Premium, the IC shall deposit the difference in Technology fund within 3 months of cut off date for enrolment.

27. Service Charges

To Banks

- 27.1.1 Bank and other financial institutions etc. shall be paid service charges @ 4% of the farmer's share of premium by Insurance Company as generated from the Portal and within the 15 days of finalization of business statistics. Rural agents engaged in providing insurance related services to farmers may be paid appropriate commission as decided by Insurance Company, subject to cap prescribed under IRDAI regulations. If there is delay in payment of service charges by Insurance Company beyond 15 days of finalization of business statistics, amount needs to be paid with interest @12% p.a.
- 27.1.2 Even if the farmer's share of premium is contributed/financed by the concerned State Govt. the applicable service charges shall be paid by the concerned Insurance Company only.
- 27.1.3 No service charges will be payable to the concerned bank/branch for the applications for which any

anomaly/deficiency/misrepresentation of details/data is found.

27.2 To CSC & Other Intermediaries:

- 27.2.1 Common Service Centres shall be paid service charges by Insurance Companies, as decided by GOI, per farmer application form successfully submitted by them. This includes charges for submission of electronic data of farmers along with uploading of copy of LPC/Land records/ /contract document or any other document defined by the concerned State Govt. to identify share-cropper/tenant farmer, self declaration of intent to sow the proposed crop or sown crop/sowing certificate as notified by State., Bank Passbook, upto 5 pages and printout of one page of premium acknowledgement receipt.
- 27.2.2 No service charges will be payable to CSC for the applications for which any anomaly/ deficiency/ misrepresentation of details/data is found.

28. Goods & Service Tax (GST)

- 28.1 Collection of premium under the Scheme is exempted from applicability of Goods & Service Tax (GST)

29. Monitoring and Review of the Scheme

- 29.1 State Level Coordination Committee on Crop Insurance (SLCCCI) of the concerned State will be responsible for monitoring of the Schemes/programme in its State. However, a National Level Monitoring Committee (NLMC) under the chairmanship of Secretary, DAC & FW will monitor the Scheme at the national level.
- 29.2 It is proposed to take following monitoring measures for effective implementation during each crop season to ensure maximum benefits to the farmers:
- 29.2.1 The Bank branches/CSCs/ intermediaries may collect the details of individual insured farmers (both loanee and non-loanee) like name, fathers' name, Bank Account number, Aadhaar number village, categories – small and marginal/SC/ST/women, insured acreage, insured crop(s), sum insured, premium collected, Govt. subsidy etc and submit electronically using web form or CBS Integration module along with electronic submission of crop wise consolidated declarations on or before final cut-off date.. Yield data based on CCEs shall be made available online on National Crop Insurance Portal to the concerned Insurance Company by the State Govt. within a month from the date of final harvest of individual crop.
- 29.2.2 Calculation of ACF if any shall be made immediately after receipt of insured acreage and sown area data but not later than the onset of CCEs similarly any anomaly in the actual yield data shall immediately be brought into the notice of concerned State Govt. and not later than 15 days from final receipt of actual yield data as detailed in section 25.
- 29.2.3 Insurance Companies shall calculate crop-wise, IU wise payable claims based on the actual yield data and threshold yield given at the time of tendering. Accordingly the payable claims subject to payment

- of full premium share by the Central and State Govt for the season shall be remitted by the Insurance Companies directly into benefitted farmer's accounts electronically, payment details for which shall be updated on the National Crop Insurance Portal on daily basis.
- 29.2.4 After receiving the claims amount from the concerned Insurance Companies, the financial institutions/banks should display the list of the beneficiaries/details of claims (both loanee and non-loanee) on the notice board of the branch within seven days with details of beneficiaries like Name of farmers/beneficiaries, crops insured, sum insured, amount of claims received etc.
- 29.2.5 The list of beneficiaries (Bank-wise and insured area-wise) shall also be uploaded/ placed on the website of the concerned Insurance Companies with proper provisions and mechanisms of public grievance redressal/feed-back etc. State Govts./UT should ensure that crop insurance products provide comprehensive insurance coverage to the farmers on sound insurance principles and provide the best value for the premium. State Govt. may also review the progress of Scheme periodically and undertake impact assessment after the completion of each season and send their suggestion/recommendations to this Department for making further improvements in the Scheme.
- 29.2.6 About 5% of the beneficiaries may be verified by Regional Offices/Local level Offices of ICs who will send the feedback to concerned DLMC and State Govt./SLCCI on Crop Insurance.
- 29.2.7 At least 10% of the beneficiaries verified by the IC may be cross verified by the concerned DLMC and they should send the feed back to State Govt.
- 29.2.8 1 to 2% of the beneficiaries may be verified by the Head Office of the IC/Independent Agencies appointed by the Central Govt./NLMC and they should send the necessary feed back to Central Government.
- ## 30. Grievance Redressal Mechanism-
- 30.1 At the initial level, for grievance redressal, each district shall designate district level grievance redressal officer preferably **District Agri Officer** to respond to the grievances of Farmers, Banks, ICs etc. within 7 days of receipt of grievance. In case of dissatisfaction the matter may be brought before **District Level Grievance Redressal Committee (DGRC)**
- 30.2 **District Level Grievance Redressal Committee (DGRC):** a district level monitoring Committee shall act as a grievance redressal Committee for redressal of grievances of Farmers, Banks, Insurance Company, District Authority/Department. This Committee will be headed by District Magistrate/Collector and representatives of Farmers, LDM/Banks, DDM NABARD, Insurance Company and concerned District Authority/Department shall be appointed as members. This Committee may also invite subject specialists/experts from University/IMD/commodity Boards/Research Institutions, SRSC etc. if deemed necessary. The Committee will dispose the matter within 15 days. The decision of the Committee shall be accepted by all the parties and in case of disagreement with the decision; the same shall be represented to the State Level Grievance Redressal Committee (SGRC) within 15 days from the decision of DGRC. In case the DGRC doesn't take the matter for discussion within 7 days from

submission of grievance or the grievance has wider scope of effect impacting more number of districts or there is a breach of guidelines by any of the stakeholder or the grievance matter exceeds Rs. 25 Lakh in monetary terms, the matter may be directly raised at State Level Grievance Redressal Committee.

- 30.3 **State Level Grievance Redressal Committee (SGRC):** a State level monitoring Committee shall act as a grievance redressal Committee for redressal of grievance of Farmers, Banks, Insurance Company, District Authority/Department which does not get settled at DGRC. This Committee will be headed by Principal Secretary/Secretary of Nodal Department , SLBC/Banks, CGM NABARD, Insurance Company and concerned State Authority/Department shall be appointed as members. This Committee may also invite subject specialists/experts from University/IMD/research institutions/commodity Boards/, State Remote Sensing Agency, STSU, STAC etc. if deemed necessary. The Committee will dispose the grievance within 15 days time of receipt of grievance. The decision of the Committee shall be accepted by all the parties.

31. Empanelment and Selection of Insurance Companies

31.1 Empanelment Criteria

- 31.1.1 The Public Sector (AIC& others) and Private Sector General Insurance Companies empanelled by DAC & FW and selected by concerned State Govt. / Union Territory (UT) shall implement the PMFBY. The Insurance Companies mainly engaged in agriculture/rural insurance business and having adequate experience, infrastructure, financial strength and operational capabilities are empanelled by DAC&FW. **Once Insurance Company has been empanelled by DAC &FW, it is considered as pre-qualified company to bid for the selection of Implementing Agency (IA) to undertake implementation of the Scheme/Programme of DAC&FW.**

- 31.1.2 L1 bidder shall not be permitted to surrender partial clusters/districts. If any Insurance Company declines after being declared L1, it will be de-empanelled/ de-barred to implement crop insurance Scheme for the coming/next season(s) in the concerned State and L2 may be given the cluster for implementing the crop insurance Scheme at L1 district-crop combination rates and so on to L3, L4 bidder with their consent. All Such bidders will be required to simultaneously furnish appropriate reasons for withdrawal/surrender/non acceptance in writing to State Govt. with copy to DAC&FW to enable further corrective measures and appropriate administrative & legal action accordingly. Financial losses, if any, to the State Govt., in retendering due to withdrawal of selected bidders, will be recovered from withdrawing L1 bidder.

- 31.1.3 Tender should be preferably for 3 years and in no case less than 1 year

- 31.1.4 Each Insurance Company should compulsorily bid for any 3 NER/Hilly States and 2 UTs

31.2 Selection Criteria of Insurance Companies as Implementing Agency (IA)

- 31.2.1 The selection of Insurance Company from the empanelled Insurance Companies to act as Implementing Agency (IA) shall be done by the concerned State/UT Govt. for implementation of the Scheme in their State. Selection of IA will be made by adopting the cluster approach. In case of smaller States, the whole State may be assigned to one IA.
- 31.2.2 Before the commencement of the crop season, State **Govt. would invite the pre-qualified companies as mentioned in the preceding para through open tender for submission of district-wise and crop-wise actuarial premium rates in percentage of Sum Insured (financial bid)**. Indemnity Level, Threshold Yields, Sum Insured etc. will be same for all Insurance Companies for the season. The empanelled companies participating in bidding have to bid the premium rates for all the crops notified / to be notified in the cluster by the State Govt. and non-compliance will lead to rejection of the bid.
- 31.2.3 Based on the district-wise and crop-wise actuarial premium rates quoted by the pre-qualified companies, the total premium amount and weighted average premium rates for cluster of districts will be worked out to arrive at L1. L1 Bidder will be selected to act as Implementing Agency in the concerned cluster.
- 31.2.4 Selection of IA may be made for at least 1 year or up to three years as mentioned above Such long term continuity will facilitate the Insurance Company to establish the credibility among the farmers through investment out of the premium savings in various welfare activities for socio-economic development of the farmers like creation of the facilities of drinking water/ healthcare/education, farm levelling, Weather Forecasts, CSCs etc. It is also anticipated that long term continuity gives an opportunity to Insurers, Bankers, State Govt. and other stakeholders for a supportive and collaborative interaction and business relationship and service effectiveness.
- 31.2.5 The insurance coverage in terms of number of farmers and acreage should be at least at the level of corresponding previous season. In case of fall in coverage, GOI may get the facts examined and necessary action including penal action against negative points in ranking for ICs and State Govt., if found at fault may be taken by GOI.
- 31.2.6 State Govt. may provide requisite data about past yield data of last 10 consecutive years or more, threshold yield, crop-wise sum insured, indemnity level, insurance unit levels, names of notified units, calamity years etc. in digital form by uploading the same on National Crop Insurance Portal itself before floating the formal tender notice.

32. Clustering /clubbing of districts for bidding by the State

In order to diversify/ spread the risk and cover high risk/ low risk districts/ area equally, the State Government are required to group the districts/ area in such a way that each group contains mix of districts/ area with different risk profiles. Prior to inviting the bid, the State Government specially large State have to divide the State in to multiple clusters of districts depending upon volume of risk associated in the crops and district/areas proposed to be notified under the Scheme. The purpose of clustering is to divide the States into different groups of districts, so that expected sum insured (ESI) becomes low and risk is shared and diversified. States may form the clusters of districts based on

mixed agro-climatic zones. i) Districts of high risk and low risk areas, ii) districts of different agro-climatic zones, and iii) ESI of each cluster should be of similar order.

Prior to the bid invitation, details on the clusters formation may also be made available to the Insurance Companies.

The object of Clustering/ Clubbing of districts should be done to achieve the following objectives:

- Cluster formation may be applicable for upto 3 years.
- Different Clusters may be defined based on risk profile of the district so as to increase the diversification of risk within a cluster and enable risk spreading for insurer.
- Cluster may contain districts with mixed agro-climatic zones so as to increase the diversification of risk within a cluster.
- Crop wise associated risk may also be diversified among the clusters and shall be factored in cluster formation.

1. Hence, one of the major requirements of clustering is risk analysis of different districts. As per 2016 Guidelines of PMFBY, for the purpose of clustering/clubbing of districts and determination of L1 bidder, the risk is analyzed based on long term data of yield by (a) computing average burn cost (percent difference between actual yield and threshold yield) and b) computing the level of variability in long term yield. Since, availability of high quality long term yield data is difficult, especially at lower administrative level, other methods (including use of satellite data) can be tried for risk assessment.
2. Satellite data, of moderate resolution (e.g. Resourcesat AWIFS, Terra/Aqua MODIS) are available, for long term, i.e. at least around 15 years. The long term Vegetation Indices, which are indicators of crop health, derived from these satellites can be used to assess the year to year variations and thereby understanding the risk potential of an area. It can be combined with many other satellite derived products, such as flood maps, drought assessments and vulnerability and long term weather data to carry out the risk analysis. States are advised to take the support of concerned national or State level research organizations (e.g. ISRO- NRSC/SAC, MNCFC, SRSC, SAUs, etc.), to use the above mentioned technology for carrying out risk analysis of the Districts/ Talukas/ Blocks towards improvement in clustering.
3. These are only for guidance of States and States are free to follow either of these or any other method devised by them with intimation to DAC&FW.
4. The detail illustration for classification of risks, clubbing/clustering of risks and districts and determination of L1 bidder are at [Annexure 1](#).

33. Assessment of Performance and De-empanelment of Insurance Companies

- 33.1 The performance of the empanelled Insurance Companies shall be closely monitored by DAC & FW on 2 years interval through ascertaining the company's skills and efficiencies for providing cost effective better insurance services to farmers. For the purpose, a detailed performance evaluation matrix containing key performance indicators with assigned weightage has been worked out and is as given at Annexure 2.

34. Evaluation of Efficiency of Nodal Department of the State

- 34.1 The efficiency evaluation of the State Nodal Department shall also be closely monitored by DAC & FW on every 1 year interval through ascertaining the State's efficiency and execution / implementation of the Scheme. For the purpose, a detailed performance evaluation matrix containing key performance indicators with assigned weightage has been worked out and is as given at Annexure 3.

35. Role and Responsibilities of Various Agencies

For successful implementation and administration of Scheme, roles of various Agencies/Institutions/Govt. Departments/Committees are spelt out herein.

- 35.1 **Central Govt.**
- 35.1.1 Support and Coordination with the State/UT Govts for implementation of PMFBY including its awareness and publicity and issue of necessary instructions/ guidelines from time to time for smooth and effective implementation.
- 35.1.2 Issue of directives to RBI, NABARD, Commercial Banks, RRBs and Cooperatives for compliance with the terms and conditions of PMFBY and its operational modalities.
- 35.1.3 Maintain NCIP
- 35.1.4 Setting of TSU/CPMU with adequate infrastructure and expertise as defined in section 15.
- 35.1.5 Constitution/Revamping of TAC as defined in para 19.3
- 35.1.6 GOI will facilitate States in strengthening of AWS/ARG network on PPP Mode by providing 50% fund for the same.
- 35.1.7 Release advance premium subsidy equivalent to 50% of 80% of Central share of premium subsidy of corresponding previous season under the Scheme to Insurance Companies within 15 days of enrolment cut off date for allocated clusters.
- 35.1.8 The balance of premium subsidy, for the season shall be released within 15 days of finalization of

district wise business statistics by Insurance Companies on National Crop Insurance Portal

- 35.1.9 Review and monitor the implementation of PMFBY including premium rates, product-benchmarking and other matters/ and issue necessary directives to Insurance Companies. Review of performance of participating Insurance Companies and suggest modifications/ improvements wherever required.
- 35.1.10 Organize Capacity building training/workshops for the State Govt. officials and other stakeholders.
- 35.1.11 Interpretation of any provisions of the Scheme and decision on any aspects of acceptance of risk/any dispute in settlement of claims.
- 35.1.12 Provide necessary assistance, guidance and resources for adoption of new technology for transparency, better administration of Scheme and timely payment of claims to insured farmers.

35.2 State/UT Govts.

- 35.2.1 The composition of SLCCI may be strengthened suitably from time to time to give representation to all the concerned participants including farmers in the implementation of the Scheme. To set up the Review and Monitoring Committee at both, State and District levels under the chairmanship of Principal Secretary (Agriculture/ Cooperation) and District Collector respectively for periodical review (preferably monthly) of implementation of Scheme and also verify the coverage etc. on random basis to ensure proper coverage under the Scheme. District Level Monitoring Committee (DLMC)to also provide fortnightly crop condition reports and periodical reports on seasonal weather conditions, loans disbursed ,extent of area cultivated, etc. to concerned Insurance Company. DLMC shall also monitor conduct of CCEs in districts.
- 35.2.2 SLCCI meeting to be held well in advance to finalize clusters, issue bid notice, selection of Implementing Agency and issuance of Notification. Timely issuance of notification/digitization is a must for giving wide publicity and coverage of the farmers. There should be a gap of at least two month between the notification issuance/digitization and commencement of the crop season. Notification of the State Govt. shall contain all information as outlined in Section 7.
- 35.2.3 Take suitable action for adoption of new technology for early loss assessment and better administration of Scheme
- 35.2.4 Issue necessary directives to all agencies/institutions/Govt. departments/Committees involved in implementation of Scheme.
- 35.2.5 Notify insurance unit area at Village/Village Panchayat or other equivalent units for major crops and for other crops, unit size may be above the level of Village/Village Panchayat.
- 35.2.6 Furnish in advance insurance unit-wise (or of higher unit, if unit level data not available) yield data of immediate past 10 years of all crops notified under PMFBY, previous 10 years season-wise, crop-wise & IU-wise loss cost data, Past 5 years season-wise, crop-wise, IU-wise coverage and claim data in soft copy format in English to Insurance Companies.
- 35.2.7 Issuance of necessary instructions to Regional Meteorological Centres of IMD and other Govt./ quasi Govt. agencies for supplying weather data on near/real-time basis to Insurance Company.

- 35.2.8 Shall work out appropriate plan and conduct awareness and publicity on an on-going basis from three months prior to the start of coverage period, to maximize coverage of the farmers specially non-loanee farmers. State Govt. may also earmark separate annual budget for the same.
- 35.2.9 Release advance premium subsidy equivalent to 50% of 80% of Central share of premium subsidy of corresponding previous season under the Scheme to Insurance Companies within 15 days of enrolment cut off date for allocated clusters.
- 35.2.10 The balance of premium subsidy, for the season shall be released within 15 days of finalization of district wise business statistics by Insurance Companies on National Crop Insurance Portal
- 35.2.11 Notify District wise crop wise cut off date for end of harvesting
- 35.2.12 Submission of yield data for all notified crops and insurance units to Insurance Companies in standard format in electronic form (editable format) preferably on portal within stipulated timelines. In case of delay in submission of AY data, State should intimate GoI with justification for delayed submission and take approval from GoI for onward submission.
- 35.2.13 Assist Insurance Companies for assessment of crop loss of individual insured farmers caused by localized perils and also assist in assessment of post harvest losses.
- 35.2.14 To undertake requisite number of CCE in the notified area following GCES/State manual provide the yield data to the Insurance Company within the prescribed cut-off date, along with results of individual CCEs.
- 35.2.15 Allow Insurance Companies to co-observe and witness CCEs with timely prior formal intimation and permit them to access various records including Form-1/Table-1, Form-2 / Table 2-and Form-3/Table-3 at grass root / district / State level used for recording data of CCEs by States. State shall strengthen audit process of conducting CCE with necessary checks and balances. Audio/Video- recording of CCEs shall be taken besides other processes to ensure accuracy and transparency of CCE.
- 35.2.16 To notify district-wise and crop-wise normal sowing and harvesting calendar
- 35.2.17 To provide crop-wise, IU wise data of normal area sown and notify cut-off dates for invoking provisions of prevented/failed sowing/transplantation/germination clause.
- 35.2.18 Compulsorily use Mobile Application/ other technology like RST for improvement of quality of CCEs and upload CCE-wise yield on National Crop Insurance Portal.
- 35.2.19 To issue notification for On Account payment, if need arise.
- 35.2.20 States should also de-notify the IUs where for 3 continuous years CCEs could not be conducted due to insufficient sown area.
- 35.2.21 Not to extend pre-defined cut-off dates during mid-season without concurrence of concerned IA. If extended, the entire premium subsidy will be borne by the State Govt. for extended period.
- 35.2.22 Facilitate provision of weather data through IMD on near/ real-time basis to insurance company. State govt can explore the possibility to create dense AWS/ARG network on PPP Mode. GOI will provide 50%

- fund for the same.
- 35.2.23 Setting up of STSU with adequate infrastructure and expertise
- 35.2.24 Constitution of STAC , SLAC , SGRC and DGRC in each district.
- 35.3 **National Technical Support Unit/State Technical Support Unit**
- 35.3.1 Monitoring of implementation of Crop Insurance Schemes.
- 35.3.2 Calculation of Scheme-wise/season-wise/ crop-wise Loss Cost.
- 35.3.3 Design & development of weather based crop insurance products for the crop / areas based on the local weather conditions.
- 35.3.4 Appraisal / benchmarking and standardization of crop insurance products (weather based) for various participating Insurance Companies.
- 35.3.5 Undertake the evaluation / impact / co-relation studies.
- 35.3.6 Capacity building and training of personnel involved in crop insurance.
- 35.3.7 To provide technical input to Govt. & Insurance Companies regarding crop insurance products.
- 35.3.8 To develop methodology for assessment of yield including assessment through remote sensing, suggest improvements in the method for yield assessment through CCEs & other alternatives etc,
- 35.3.9 Development of integrated database for crop insurance
- 35.3.10 Internet / Web enabled Evaluation & Management Information System (E&MIS),
- 35.3.11 Other related works entrusted by the Central/State/ UT Govt.
- 35.4 **Insurance Companies(IA)**
- 35.4.1 Insurance companies to liaise with State Govts. and Agencies/ Institutions/Committees involved in implementation of PMFBY.
- 35.4.2 Furnish the necessary details to SLCCI as may be required as per the notification.
- 35.4.3 Underwriting—responsibilities for processing and acceptance of risk.
- 35.4.4 Claim processing / finalization on receipt of yield data from States/UTs and payment within the prescribed timelines. The claim remittance shall be made directly into farmer's loan account for loanee farmers and into saving Bank A/c for non-loanee farmers.
- 35.4.5 Obtain Re-insurance arrangements, if necessary.
- 35.4.6 IA reserves the right to reduce/repudiate claims, if during verification of bank records/land records and assessment of claims for loanee/non-loanee farmers, it is discovered that:
- Loan was covered/premium was paid outside seasonality discipline
 - Actual sown area was less than the actual insured area under a crop in a notified area(refer Section 25)

- Different crop other than the declared/insured was sown in the land survey no. insured
 - Survey number insured was not actual crop growing survey no.
 - Area insured is more than the total land holding of the farmer.
 - Multiple insurance for same crops grown on same land with multiple insurers or through multiple banks/intermediaries.
 - Sum insured was more than the Scale of Finance for the insured crop
 - To verify the bank/land records when claims are reported due to clerical errors/omissions. This can be done only before approval of claims.
- 35.4.7 Develop crop-yield and weather data bases, along with related agri-insurance data bases.
- 35.4.8 Review of implementation of PMFBY and provide regular feedback for its effective implementation/improvements to DAC&FW.
- 35.4.9 Disclose designated Agents in writing before the inception of non-loanee enrolment of farmers for the season.
- 35.4.10 Ensure timely payment of commission/ service charges to banks/other agents for implementing the Scheme.
- 35.4.11 Awareness and publicity – extensive efforts to create awareness and generate publicity for PMFBY at grass-roots level including bank branches. Also coordinate with the States and other agencies for awareness and publicity of the Scheme.
- 35.4.12 Provide monthly progress returns/statistics/information demanded by the Govts., both Central and State
- 35.4.13 Facilitate the bank branches/ intermediaries/ agents to upload the details of insured farmers and beneficiaries with all requisite details on National Crop Insurance Portal well in time.
- 35.4.14 Redressal of all Public Grievances within the time fixed by IRDAI. There shall be a centralized farmer's help line number maintained, which will be used for receiving the grievances of farmers and will work on the docket system and forwarding to respective Insurance Companies for resolution.
- 35.4.15 The coverage of loanee farmers should be carried out by Insurance Companies themselves through banks/FIs. Coverage through agents/ brokers is not allowed.
- 35.4.16 Establish a functional office at Tehsil level in each District and at least one agent should be deployed at the Block level in the allocated Districts. Insurance Company shall deploy one agri graduate in each district. Details of the offices including contact number of the person should compulsorily be uploaded on National Crop Insurance Portal.
- 35.4.17 Deployment of sufficient manpower to co-observe CCEs and allied activities and compulsory use of CCE Co-observation app,

- 35.5 Financial Institutions/Banks**
- 35.5.1 For purpose of PMFBY, scheduled banking institutions engaged in disbursing Seasonal Agricultural Operations (SAO) loans/KCC loan as per relevant guidelines of NABARD/RBI shall be reckoned as Banks.
- 35.5.2 Notification, as well as other directives, guidelines, etc., shall flow as Insurance Company→ District Lead Bank/Administrative offices of Commercial banks/RRBs/DCCBs →Service /Individual Bank Branch /PACS.
- 35.5.2.1 Lead Bank/Administrative office of Commercial bank, DCCBs, RRBs**
- 35.5.2.2 Communicate Notification, as well as other directives, guidelines, etc. to all agencies within their jurisdictional area.
- 35.5.2.3 Ensure that all agencies within their jurisdictional area sanction additional loan component to loanee farmers towards premium payable by them.
- 35.5.2.4 Ensure that all service (subordinate) bank branches within their jurisdictional area serve all non-loanee farmers desiring and eligible to take insurance cover under PMFBY. Such service will include opening bank account of non-loanee farmers, guiding them to fill up proposal forms, accepting premium from them and maintaining records etc.
- 35.5.2.5 Ensure that the premium for both loanee and non-loanee farmers shall be remitted to concerned Insurance Companies and the related data uploaded on National Crop Insurance Portal within the prescribed time.
- 35.5.2.6 Lead bank/Administrative Offices of Banks should ensure that all farmers sanctioned crop loans/seasonal operational loans/KCC loan for notified crop(s) are compulsorily insured and the conditions stated in the Operational Guidelines of the Scheme have been complied with. No farmer should be deprived of insurance cover. Lead banks/ Administrative Offices of Banks therefore, should make all efforts and pursue their branches for enrolling all eligible loanee farmers and interested non-loanee farmers under crop insurance. In case, claims have arisen during crop season then respective bank and its branches would be made responsible to make payment of the admissible claims to loanee farmers who were deprived from insurance cover to their crops.
- 35.5.2.7 Concerned Bank and its branches should ensure upload/submission of notified crop-wise, insurance unit-wise Declarations in prescribed format on National Crop Insurance Portal along with details of remittance of premium within stipulated time. A copy/print out of declaration uploaded on Portal may also be submitted to concerned Insurance Companies, if so desired by them. The consolidated premium of farmers' share will be remitted electronically either through payment gateway of National Crop Insurance Portal or RTGS/NEFT to Insurance Companies followed by compulsory entry of payment details on Portal for proper and timely reconciliation by ICs. If Concerned Bank and its branches are not able to remit the amount of premium collected to Insurance Companies or submit declaration in prescribed format by the defined timelines then they will be liable to pay admissible claims to farmers who are deprived from insurance cover to their crops.

- 35.5.2.8 The Nodal Banks/Administrative offices/Bank Branches shall also upload the details of each individual insured farmer on National Crop Insurance Portal through web-form or CBS on or before final cut-off date.
- 35.5.2.9 The Insurance Company shall acknowledge the receipt of farmers premium and declarations submitted by the banks and any clarification/rectification sought by Insurance Companies should compulsorily be replied/addressed by the bank within 7 days. The banks should cross check with their records and aberrations, if any, should be brought to the notice of the Insurance Company immediately. If no response is received from banks within cut off time/reconciliation period, the details submitted on the Portal shall be considered final and no changes would be accepted later on. Insurance Companies will thereafter act as deemed fit as per applicable provisions .
- 35.5.2.10 While it is intended that Insurance Companies in consultation with concerned State Govts. will transfer claims directly into bank accounts of eligible farmers, however in case that is not feasible for loanee farmers, the Insurance Companies may transfer claims through bank branches which will credit the claims amount to respective beneficiary loan account positively within seven days. **If Bank Branches/ Nodal banks are not able to do so within this time period then they will be liable to pay interest (at prevailing rate of interest for saving account) for the delayed period to the eligible farmers.** The Banks shall issue a certificate within 30 days to the insurer that entire money received for settlement of claims has already been credited in to the account of beneficiaries.
- 35.5.2.11 The list of beneficiary cultivators with claim amount shall be displayed by the Bank Branch/PACS and a copy shall also be provided to the Chairman/ Sarpanch/ Pradhan of the village Panchayat.
- 35.5.2.12 To permit Insurance Company access to all relevant records / ledgers at the Nodal Bank/ Branch/ PACS for the purpose of scrutiny, if desired by them.
- 35.5.2.13 Banks should ensure that cultivator are not be deprived of any benefit under the Scheme due to errors/omissions/commissions of the concerned branch/ PACS, and in case of such errors, the concerned agencies shall have to make good all such losses.
- 35.5.3 Lending Banks Branches / RFIs**
- 35.5.3.1 To educate the cultivators on the Scheme features.
- 35.5.3.2 To guide the cultivators on filling up the insurance proposal in the prescribed forms and collecting the required documents, particularly in case of non-loanee cultivators.
- 35.5.3.3 To collect Aadhaar Number and Mobile number of all eligible farmers well before the start of enrolment/debit of premium.
- 35.5.3.4 To organize and help in preparation of the consolidated data for loanee and non- loanee cultivators and uploading on the National Crop Insurance Portal, along with the electronic remittance of premium amount to the Insurance Company through payment gateway of Portal or through NEFT/RTGS within 15 days after cut-off date for enrolment/premium debit.
- 35.5.3.5 Maintaining the records of proposal/declaration forms and other relevant documents and statements

- for the purpose of scrutiny/ verification by Insurance Company or its authorized representatives and DLMC, if necessary.
- 35.5.3.6 Allow Insurance Company access to all relevant records and registers at offices of Nodal Bank and service (subordinate) bank branches within their jurisdictional area.
- 35.5.3.7 To capture all relevant data including land and crop details of all loanee farmers covered compulsorily as well as non loanee farmers availing crop insurance through them.
- 35.5.3.8 To reconcile, validate and provide clarification, if necessary, on the coverage details to the Insurance Company within next 15 days from cut-off date for data uploading on Portal and within 7 days of receipt of such request from Insurance Company
- 35.5.3.9 To provide the list of insured farmers for whom the premium has been debited but data entry on Portal has not been completed for the IUs/area where preventive-sowing/germination failure or mid-term calamity/localized calamity is reported.
- 35.5.3.10 Debit /collect the applicable premium from the farmer's account on or before cut-off-date and remit it entirely to the concerned Insurance Company electronically.
- 35.5.3.11 To credit the payable claim amount to the farmer's account with 7 days from date of receipt of such claims from Insurance Company. To refund the undistributed claims amount to Insurance Company with reasons and details within 10 working days from receipt of such claims amount under intimation to GOI and the concerned State Govt.
- 35.5.3.12 Not to re-enrol the farmers under crop insurance for the same crop if the State/District has notified prevented/failed sowing/germination.
- 35.5.3.13 Under administrative mechanism, bank branches are designated as terminal service points for farmers. Hence, it is their duty to ensure compulsory coverage of all eligible loanee farmers and all interested non-loanee farmers. In case of any misreporting by Banks/Bank branches/PACS with respect of farmers' coverage, concerned Bank/ Bank branches/PACS will be liable for such mis-reporting.
- 35.6 Common Service Centre-Special Purpose Vehicle (CSC-SPV):**
- 35.6.1 To ensure enrolment of non loanee farmers through its SPV/VLE
- 35.6.2 To educate and train the VLEs on selling of crop insurance through the Portal and /or through concerned Insurance Companies at District level.
- 35.6.3 To electronically remit the premium collected from the CSCs to concerned Insurance Companies in batches but not later than 3 days of receipt of premium from farmers.
- 35.6.4 To send the daily MIS of premium remitted along with the summary of insured farmers to respective insurance company.
- 35.6.5 To reconcile the data uploaded on National Crop Insurance Portal and premium remittance to concerned Insurance Companies within 7 days after cut off date for enrolment of farmers.

- 35.6.6 To raise an invoice for pre-agreed service charges per farmer per crop season application to the respective Insurance Company on or before 10th of following month.
- 35.6.7 To ensure post sales services and facilitate grievance redressal of the insured farmers.
- 35.6.8 Will be responsible for accuracy of details and document of individual farmers uploaded on National Crop Insurance Portal and liable for claim payment due to errors and omissions committed by SPV/VLE.
- 35.7 **Common Service Centres (VLEs):**
- 35.7.1 To educate the cultivators especially non-loanee farmers on the Scheme features.
- 35.7.2 To display the advertisement, publicity material, banner, poster, leaflets in its premises for the use of farmers provided by Insurance Companies/State Govt.
- 35.7.3 To fill up the online insurance proposal in the prescribed format and collect the required documents from non- loanee cultivators only.
- 35.7.4 Collect the premium on behalf of implementing Insurance Company, strictly as per the provisions of the Scheme.
- 35.7.5 To fill up the correct details of non-loanee cultivators and upload the requisite documents alongwith their mobile number on National Crop Insurance Portal and remit the premium amount through CSC Portal well within the stipulated time. Due care should be taken in filling up the details in the application form of each insured non- loanee farmer and it should be matched with documents attached with the application.
- 35.7.6 The VLE should ensure that insured farmers are not deprived of any benefit under the Scheme due to errors/ omissions/ commissions by them, and in case of benefits being impacted, necessary administrative and legal action will also be taken for lapses in service/malpractices, if any, reported.
- 35.7.7 To facilitate post sales services, claim intimation and grievance redressal of the insured farmers
- 35.8 **Designated Insurance Agents:**
- 35.8.1 To educate the cultivators on the Scheme features.
- 35.8.2 To guide the cultivators for filing up the insurance proposal/application in the prescribed format and collecting the required documents alongwith Aadhaar number and Mobile number from non- loanee cultivators.
- 35.8.3 Collect the premium on behalf of Insurance Company, strictly as per the provisions of the Scheme and issue acknowledgement receipt of proposal to the farmer.
- 35.8.4 To enter details along with requisite documents of individually insured farmer on National Crop Insurance Portal and transfer the consolidated premium to concerned Insurance Company electronically and the payment details should compulsorily be uploaded on National Crop Insurance Portal within the respective cut off dates. Insurance coverage will only be valid in respect of only those insured/covered farmers by them for which farmers premium is remitted electronically to Insurance

- Companies and remittance details are entered/ uploaded on National Crop Insurance Portal within the respective cut off dates.
- 35.8.5 The designated Insurance agents should ensure that insured farmers are not deprived of any benefit under the Scheme due to errors/ omissions/ commissions by them, and if any, the Insurance Company shall make good all such losses. Necessary administrative and legal action may also be taken for lapses in service/malpractices, if any, reported.
- 35.9 **Loanee farmers**
- 35.9.1 As the Scheme is compulsory for all loanee cultivators availing SAO loans/KCC loans for notified crops, it is mandatory for all loanee cultivators to insist on insurance coverage as per provisions of the Scheme.
- 35.9.2 Any change in crop plan should be brought to the notice of the KCC/ agri-loan sanctioning bank branch immediately but not later than 2 days prior to cut off date for debit of premium. This should be accompanied with sowing certificate
- 35.9.3 All loanee farmers are compulsorily required to submit Aadhaar number/copy of Aadhaar card or authenticate themselves through Aadhaar enabled e-KYC alongwith mobile number for enrolment under crop insurance before prescribed cut-off date. All banks have to compulsorily take Aadhaar/Aadhaar enrolment number as per notification under Aadhaar Act before sanction of crop loan/KCC under Interest Subvention Scheme hence the coverage of loanee farmers without Aadhaar doesn't arise and such accounts needs to be reviewed by the concerned bank branch regularly
- 35.9.4 Insurance Proposals are accepted only upto a stipulated cut-off date, which will be decided by the SLCCI. Hence, loanee farmers may ensure themselves from the concerned bank branches that applicable premium should be debited and remitted to Insurance Companies within cut off date and details uploaded on Portal.
- 35.9.5 Give information of any loss due to localized risk or post harvest loss due to specified perils of cyclone, cyclonic rains and unseasonal rains resulting in damage to harvested crop lying in field in "cut and spread"/small bundled condition to concerned bank branch/ financial institution/ channel partner/insurer within 72 hours.
- 35.9.6 Loanee farmer should not avail KCC/Agriculture Loan from multiple banks on the same land or insure the same land through more than one bank or insure the same land more than once as a non-loanee farmer. If any such cases are reported/ identified, the insurance cover will be terminated and the premium shall be forfeited and necessary administrative and legal action may also be taken for such malpractice.
- 35.10 **Non-Loanee cultivators**
- 35.10.1 Non-loanee cultivators desirous of availing insurance under PMFBY for any notified crop in any notified insurance unit may approach nearest bank branch/PACS/authorized channel partner/ CSC/insurance intermediary of Insurance Company or themselves fill-up online application form on the National Crop Insurance Portal within cut-off date and simultaneously upload/ submit the requisite documents and

applicable premium to concerned agency.

- 35.10.2 Applicants must sign/authorize electronically (along with copy of Aadhaar Card/Aadhaar enrolment ID (if Aadhaar seeding/eKYC has not been completed) along with copy of LPC/Land Records/contract document or any other document defined by the concerned State Govt. to identify share-cropper/tenant farmer, sowing certificate or self declaration of intent to sow the proposed crop and copy of Pass Book to the Bank/Intermediary.
- 35.10.3 All non-loanee farmers willing to enrol through CSCs are compulsorily required to submit mobile phone number and Aadhaar number and authenticate themselves through Aadhaar enabled e-KYC for enrolment under crop insurance before prescribed cut-off date along with copy of LPC/Land Records/contract document or any other document defined by the concerned State Govt. to identify share-cropper/tenant farmer, sowing certificate or self declaration of intent to sow the proposed crop, and Copy of Pass Book.
- 35.10.4 The farmer desiring coverage under crop insurance should open/operate an account in the branch of the designated bank, and the details should be provided in the proposal/application form.
- 35.10.5 The farmer should mention his land identification number in the proposal/application.
- 35.10.6 The farmer must provide documentary evidence with regard to possession of cultivable land.
- 35.10.7 To notify implementing Insurance Company in the event of change of crop or sown area being different than the declared in the proposal form or to CSC or other channel.
- 35.10.8 The cultivator must furnish area sown confirmation certificate/self declaration of intent to sow the proposed notified crop(s).
- 35.10.9 Non-loanee farmers being covered through other than online channels of CSC, NCIP etc. shall submit the duly filled proposal/application form along with copy of Aadhaar Card, Bank Passbook, Land Ownership proof /contract document or any other document defined by the concerned State Govt. to identify share-cropper/tenant farmer, sowing certificate or self declaration of intent to sow the proposed crop.
- 35.10.10 Non-Loanee farmer should ensure that the crop on the same land is not insured from two different agencies. If any such cases are reported/ identified, the insurance cover will be terminated and the premium shall be forfeited and necessary administrative and legal action may also be taken for lapses in service/malpractices.
- 35.10.11 Give information of any loss due to localized risk or post harvest loss due to specified perils of cyclone, cyclonic rains and unseasonal rains resulting in damage to harvested crop lying in field in “cut and spread”/small bundled condition to concerned bank branch/ financial institution/ channel partner/insurer within 72 hours.

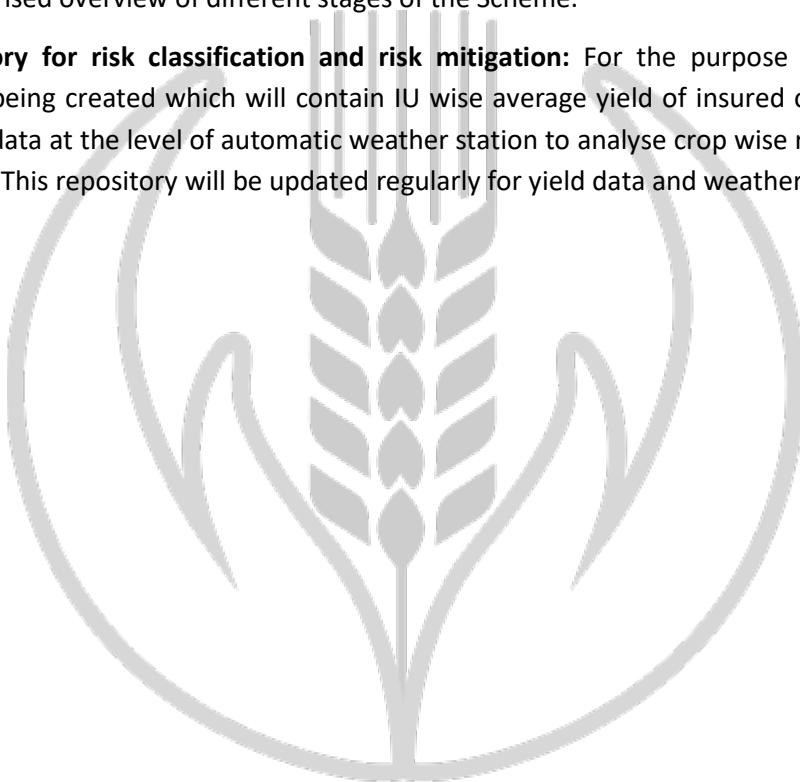
36. National Crop Insurance Portal for administration of Crop Insurance Program (www.pmfby.gov.in)

- 36.1 The Govt. is endeavouring to integrate all stakeholders' viz. farmers, Insurance Companies, financial institutions and Govt. agencies on single IT platform to ensure better administration, coordination and transparency for getting real time information and monitoring in a phased manner.
- 36.2 **The idea behind developing a web-based, integrated IT solution is to speed up service delivery, unify fragmented databases, achieve a single view of data, eliminate manual processes and thus provide faster insurance services to farmers.** DAC&FW has designed a web Portal for crop insurance (www.pmfby.gov.in) and is doing further enhancements to provide a single IT enabled platform for digitization of processes and information data bank and dissemination mechanism, automation of administrative procedures, premium and claim calculation and remittance etc. This IT driven system is envisaged to address the issues which affect the current system of programme administration and thereby reduce its efficacy and lead to denial/ delay in benefit transfer to farmers viz. selective/layered information access, manual interventions, multi-step procedures, documentary evidence/proofs, delayed/defective information sharing. Hence, integration of IT platforms of banks, Insurance Companies, State Govts. and yield/weather data providers with National Crop Insurance Portal directly or through interface for fetching in information is felt essential to avoid errors for timely transmission of requisite information amongst major stakeholders, early settlement of claims, proper monitoring and transparent administration of the Schemes. Once the entire linking of IT platforms of all stakeholders with the Web Portal is established, it would also lead to faster processing of claims due to electronic flow of information. Currently, this Portal is available in two languages – Hindi and English and it will be converted into all regional languages.
- 36.3 The aforesaid Portal will provide an integrated ecosystem to streamline the process and to automate administrative functions. A web-based, integrated IT solution has been developed which has opened a window of opportunity to remote and economically-weak farmers to benefit from crop insurance services.
- 36.4 The conceptualisation and development of web-portal has already been completed and launched however development and integration of futuristic technologies and enhancements as defined below are envisaged to be initiated in coming months.
- 36.4.1 **Payment of Premium and Remittance of Claims through Payment Gateway:** All premium remittance from Farmers/Banks/Intermediaries and claim remittance from Insurance Companies will be routed through the Portal using payment gateway Pay-Gov. The facility is envisaged to address reconciliation of funds and bring swiftness and transparency in claim settlement.
- 36.4.2 **Integration of National Crop Insurance Portal with IT infrastructure of Insurance Company:** For seamless and real-time data flow of following stages to the Insurance Companies, direct integration of National Crop Insurance Portal with the IT system of respective Insurance Companies will be established. The information/data will be shared in encrypted form over secure data exchange platform.

- Farmer's enrolment and premium remittance,
 - Information and reports regarding mid-term/preventive sowing/individual/localized claims and
 - AY/TY data for final claim calculation and remittance of claims into farmer's bank account.
- 36.4.3 **Integration of Digital Land Records:** Various State Govts. are working on digitization of land records and providing facility to land owners to identify and take records of land parcels owned by them. The same digitized land records will be mapped with the codes used in National Crop Insurance Portal followed by online integration of the individual land records with the crop insurance application. This facility will address the issue of excess insurance/double insurance and application of ACF which is prevalent currently.
- 36.4.4 **Integration of Weather Data with the Portal:** Weather Data procured from a network of Automatic Weather Stations and Automatic Rain Gauges across the country will be procured from IMD and integrated with the National Crop Insurance Portal. This will enable real-time monitoring of weather parameters, agro-climatic inputs, crop health monitoring, triggers for preventive sowing/mid-term adversities etc. This integration will also facilitate faster, transparent transmission of yield/weather data to concerned Insurance Companies and automated claim calculation and remittance to beneficiaries. This feature will ensure availability of real-time information about crop loss and payable claims vis-a-vis necessary triggers/inputs to Govt. agencies/Implementing agencies so that policy decisions/administrative corrective measures can be taken.
- 36.4.5 **Integration of Public Grievance Redressal Module:** For bringing efficiency in addressing the grievances of farmers and other stakeholders, a system for registration of complaints and grievances, escalations and resolution will be integrated with the Portal.
- 36.4.6 **Launch of National Help Line and Integration with Web-Portal:** A quick response system is very crucial for creating trust and bringing behavioural changes and efficiency amongst the stakeholders. Keeping the same in view, an integrated help line of Kisan Call Center will be launched for benefit of all the stakeholders for query resolution, technical handholding and specific information dissemination.
- 36.4.7 **Development of Mobile-App for Localized/Individual, Preventive/Mid-Term Loss Assessment and reporting:** For bringing in swiftness and accuracy in the information sharing and reporting of Localized/Individual, Preventive/Mid-Term Losses, a mobile application will be launched for use of loss assessors/DLMC members. **This data collected through app will be immediately sent to National Crop Insurance Portal which will be accessed by all the stakeholders.** This will help in monitoring and faster analysis and claim settlement.
- 36.4.8 **Integration of Interest Subvention Scheme with Crop Insurance:** A web-portal for Interest Subvention Scheme is also being developed for monitoring and implementation of ISS. This Portal will be inter-linked with the National Crop Insurance Portal for automatic enrolment of eligible farmers and deduction of applicable premium. This will also enable de-duplication of KCC/seasonal Crop Loans and provisioning of services
- 36.4.9 **Integration of RST/Satellite Data for handling Data Discrepancy/dispute resolution:** New Age Technologies like Remote Sensing Technology is a promising step in bringing in procedures and

systems of approach which is more reliable, accurate and fast in resolving errors/concerns of stakeholders and provide a progressive and scientific solution which the traditional/existing procedures and practices are unable to provide. This will help in reduction in time required for collection and collation of different data sets and reports pertaining to crop health, productivity, sowing and harvesting activities.

- 36.4.10 **MNCFC data Integration on Portal:** To streamline the flow of information amongst stakeholders, the portal will also be integrated with the system/data being developed by MNCFC on aforesaid aspects.
- 36.4.11 **Evaluation & Management Information System (E &MIS) for all stakeholders with secured credential:** For monitoring progress of the Scheme, a stakeholder specific customized MIS is also being developed, which will help in monitoring, application creation, notification status, CCE status etc. to give a summarised overview of different stages of the Scheme.
- 36.4.12 **Data repository for risk classification and risk mitigation:** For the purpose of risk estimation, a repository is being created which will contain IU wise average yield of insured crops for past decade and weather data at the level of automatic weather station to analyse crop wise risk calculation before season starts. This repository will be updated regularly for yield data and weather data.



ANNEXURE- 1

Illustration for classification of risks, clubbing/clustering of risks and districts and determination of L1 bidder

Method 1

Define Risk Level

- Calculate Loss Cost for each district as per illustration given for District1, Notified Area 1 (NFA1) and Crop1, on the basis of immediate past ten years of yield data:**

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average	TY (Kg/ha)
Yield	2877	2558	1800	2097	2503	1500	2855	2734	1200	2987	2311	2041
LC (%)	0%	0%	12%	0%	0%	27%	0%	0%	41%	0%	8.00%	

District Name	NFA Name	Crop	Estimated Area Insured (In Ha)	Sum Insured (Rs./ha)	Weight (ESI) in Rs.	Average Loss Cost	Weighted Average Loss Cost
A	B	C	D	E	F=D*E	E	F= D*E
District 1	NFA1	Crop1	400	10000	4000000	8%	320000
District 1	NFA1	Crop2	300	4000	1200000	10%	120000
District 1	NFA2	Crop1	200	10000	2000000	6%	120000
District 1	NFA2	Crop2	150	4000	600000	5%	30000
District 1	NFA3	Crop1	125	10000	1250000	10%	125000
District 1	NFA3	Crop2	250	4000	1000000	7%	70000
Total					10050000		785000

$$\text{Loss Cost (\%)} \text{ of District 1} = 785000 / 10050000 = 7.80\%$$

- List the districts with their loss cost (%)**

Sl. No.	District Name	District Loss Cost
1	District 1	7.80%
2	District 2	8.60%
3	District 3	5.40%
4	District 4	3.20%
5	District 5	4.60%

Low	District Loss Cost < 1/3 percentile value
Medium	District Loss Cost >= 1/3 and < 2/3 percentile values
High	District Loss Cost >= 2/3 percentile value

1/3 percentile value	4.87%	= PERCENTILE(district Loss Cost,1/3)
2/3 percentile value	7.01%	= PERCENTILE(district Loss Cost,2/3)

iii. Define Coverage Level

- a) **Estimation of the Area Insured (in ha):** The area insured for the ensuing season would be estimated on the basis of previous years the districts within State based on the fair judgment. The State Government would project area insured for the ensuing season for each district-crop combination.

Illustration: for District 1 with two crops would be estimated

District Name	Crop	Latest available Area Sown (ha)	Area Insured in Normal Previous Year (in ha)	Existing Penetration (%)	Targeted Penetration (%) *	Estimated Area Insured (ha)
A	B	C	D	E = D / C	F	G = C * F
District 1	Crop1	2900	300	10%	25%	725
District 1	Crop2	1400	490	35%	50%	700

* Targeted penetration percentage (%) can be decided according to the associated potentiality of the district and other relevant parameters.

- b) **Estimated area insured for current season-year** will be multiplied with sum insured (Rs. /ha) to arrive the Expected Sum Insured (in Rs.) for each and every district-crop combination. The district level Expected Sum insured (ESI) will be the total of each district-crop combination within the districts.

Example given for District 1:

District Name	Crop	Estimated Area Insured (in Ha)	Sum Insured (Rs./ha)	Expected Sum Insured (in Rs.)
A	B	C	D	E = C * D
District 1	Crop1	725	10000	7250000
District 1	Crop2	700	4000	2800000
District 1 Expected Sum Insured (in Rs.)				10050000

- c) In the similar manner calculate Expected Sum Insured (ESI) in Rs. for all the districts.
d) Calculate 1/3 and 2/3 Percentile values of Expected Sum Insured (ESI) for entire district within State. Define Coverage Level as per following percentile values:

Coverage Level	Percentile
Low	District ESI < 1/3 percentile value
Medium	District ESI >= 1/3 and < 2/3 percentile values
High	District ESI >= 2/3 percentile value

1/3 percentile value	$3500000 = \text{PERCENTILE}(\text{DistrictESI},1/3)$
2/3 percentile value	$8833333 = \text{PERCENTILE}(\text{DistrictESI},2/3)$

1/3 percentile value	$3500000 = \text{PERCENTILE}(\text{DistrictESI},1/3)$
2/3 percentile value	$8833333 = \text{PERCENTILE}(\text{DistrictESI},2/3)$

District Name	Expected Sum Insured (inRs.)	Coverage Level
District 1	10050000	High
District 2	9000000	High
District 3	8500000	Medium
District 4	1000000	Low
District 5	700000	Low

Risk Level	Coverage Level	Code
High Risk	High Coverage	1
Medium Risk	High Coverage	2
Low Risk	High Coverage	3
High Risk	Medium Coverage	4
Medium Risk	Medium Coverage	5
Medium Risk	Low Coverage	8
Low Risk	Low Coverage	9

e) Allocation of codes to different districts:

- Arrange the districts in any order.
- Write risk level and coverage level corresponding to each district.
- On the basis on above code table allot codes to each district.
- Arrange the districts in ascending order of allotted codes.
- Write ESI against each district in next column and arrange ESI in descending order of the district within the same code.

Illustration:

District Name	Expected Sum insured (in Rs.)	Risk Level	Coverage Level	Code
District 1	10050000	High Risk	High	1
District 2	9000000	High Risk	High	1
District 3	8500000	Medium Risk	Medium	5
District 4	1000000	Low Risk	Low	9

Cluster1		Cluster2		Cluster3	
District Name	ESI (in Rs.)	District Name	ESI (in Rs.)	District Name	ESI (in Rs.)
District 1	10050000	District 2	9000000	District 3	8500000
		District 5	700000	District 4	1000000
	10050000		9700000		9500000

For other codes, the distribution may be done to achieve balancing of ESI.

- f) Make suitable minor changes in the distribution of districts to clusters for achieving the objective of clustering.

Applicable conditions for Clustering/ Clubbing of districts:

- i. Within the cluster Insurance Companies would be required to quote premium rates for all district-crop combination for their bids to be evaluated.
- ii. Company not quoting even for one of the total district-crop combinations within the cluster would be disqualified for the bidding period.
- iii. There would be no further negotiations with the L1 bidder to accept L1 rates of other bidder for any district crop combination i.e. the rates quoted by the L1 bidder for different district-crop combination would be applicable within the cluster. Bidding and negotiation conditions will be as per CVC guidelines vide its circular nos. No.005/CRD/012 dated 03rd March 2007 & No.005/CRD/012 dated 20th Jan 2010.
- iv. L1 bidder shall not be permitted to surrender partial clusters/districts. If any company declines after being declared L1, the company may be barred to implement crop insurance scheme for the coming 1 season in the concerned State and the L2 may be given the cluster for implementing the crop insurance scheme at L1 district-crop combination rates and so on to L3, L4 bidders as per the consent of insurance company. Such bidders will be required to furnish appropriate reasons for withdrawal/surrender in writing to Ministry of Agriculture & Farmer's Welfare, Govt. of India within 10 days from opening of the bids to enable further corrective measures and appropriate administrative & legal action against defaulting bidders.

Selection of Implementing Agency:

Illustration:

Weighted Premium Rate (%) for companies		
X	Y	Z
0.044289	0.046435	0.044221
4.43%	4.64%	4.42%

L1 in Cluster1 is company (Z). Similar process would be followed other clusters.

Method 2

Agriculture output in the area/ district is influenced by the agro-climatic conditions of that area/district. On the basis of the variation in agriculture output (crops) in each district during the last 10 years, districts may be divided in to three categories of low, moderate and high risks to agriculture. If variation in agriculture output in the district during the last 10 years worked out to be plus minus <15% then district may be categorized as low risk. Similarly, districts of variation ranging plus minus 16-30% may be categorized of moderate risks and variation of plus minus >30% as high risks districts to agriculture operations. Accordingly all districts of the State would be identified as low/moderate/high risk. Number of clusters to be formed shall be decided according to total no. of districts in the State. Total no. of each category of low, moderate and high risks districts shall be divided by no. of clusters to be formed in the State. Then, equal no. of low risk districts shall be selected randomly for each cluster of districts. Similarly, moderate and high risks districts would be selected.

Example:

State— UP, No. of districts – 75

Based on the last 10 years variation in output, category-wise No. of districts identified:

Low risks 40, Moderate risks 20, High risks 15,

No. of clusters (of preferably 15-20 districts each) to be formed: $75/19 = 3.95$ say 4

Then, no. of low risks districts in each cluster: $40/4 = 10$

Similarly, moderate risks districts: $20/4 = 5$ and high risks districts: $15/4 = 3.75$ say 4 As such,

Sample calculation to find L1:

Table-1: Calculation to arrive company's weighted average premium in a district of the cluster

Cluster	Formation of clusters				
	No. of low risks districts	No. of moderate risks districts	No. of high risks districts	Total districts in cluster	
C 1	10	5	4	19	
C 2	10	5	4	19	
C 3	10	5	4	19	
C 4	10	5	3	18	

District: D1 Company –Y

Crops Notified in a District of the Cluster	Expected Area to be insured (in ha)	Notified SI per ha (Rs.)	Total SI (Rs. Lakh)	Premium Quoted by company	Premium Amount (Rs. Lakh) X(% of SI)
Paddy	10000	30000	3000	5	150
Maize	6000	20000	1200	10	120
Cotton	8000	35000	2800	12	336
Arhar	9000	50000	4500	15	675
Groundnut	5000	40000	2000	13	260
Above all crops	38000		13500		1541

District: D1 Company –Z

Crops Notified in a District of the Cluster	Expected Area to be insured (in ha)	Notified SI per ha (Rs.)	Total SI (Rs.Lakh)	Premium Quoted by company Z(% of SI)	Premium Amount (Rs. Lakh)
Paddy	10000	30000	3000	7	210
Maize	6000	20000	1200	9	108
Cotton	8000	35000	2800	11	308
Arhar	9000	50000	4500	15	675
Groundnut	5000	40000	2000	14	280
Above all crops	38000		13500		1581

Table-2: Calculation to arrive at company's weighted average premium in a cluster of districts

For Company: X

Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company X(% of SI)
District D1	38000	13500	1541	
District D2	40000	14000	1600	
District D3	35000	13000	1400	
District D4	45000	15000	1650	
District D5	30000	12750	1350	
Above all Districts	188000	68250	7541	11.05

For Company: Y

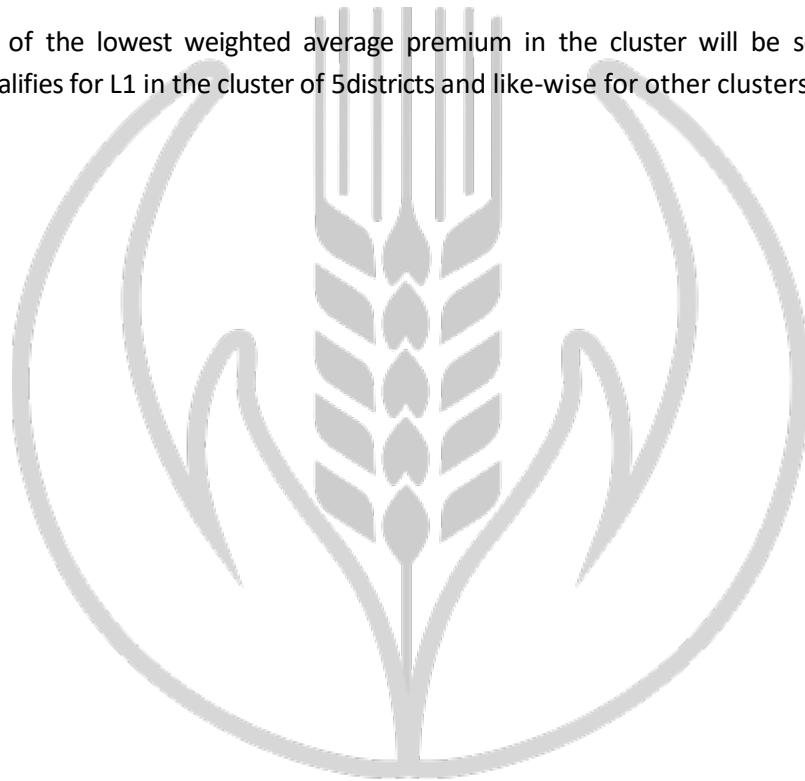
Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company Y(% of SI)
District D1	38000	13500	1446	
District D2	40000	14000	1500	
District D3	35000	13000	1425	
District D4	45000	15000	1675	
District D5	30000	12750	1400	
Above all Districts	188000	68250	7446	10.91

For Company: Z

Districts of the Cluster	Expected Area to be insured (in ha)	Total SI (Rs. Lakh)	Premium Amount (Rs. Lakh)	Weighted average Premium of company Z(% of SI)
District D1	38000	13500	1581	
District D2	40000	14000	1550	
District D3	35000	13000	1475	
District D4	45000	15000	1600	
District D5	30000	12750	1275	
Above all Districts	188000	68250	7481	10.96

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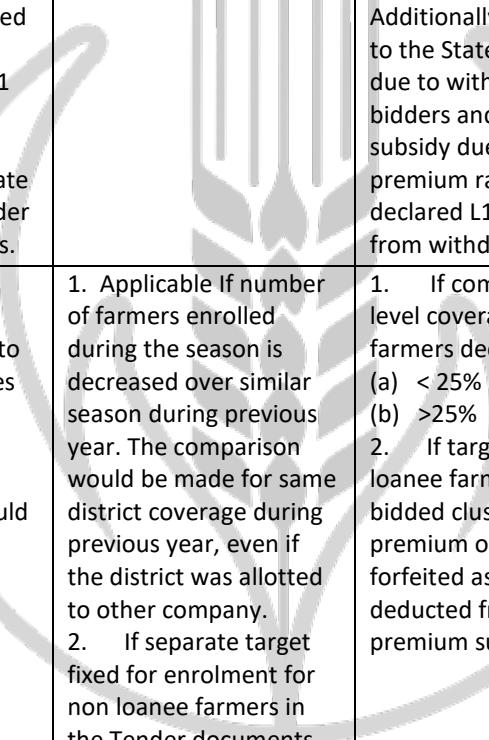
The company of the lowest weighted average premium in the cluster will be selected as L1. Hence, company Y qualifies for L1 in the cluster of 5 districts and like-wise for other clusters and companies.



Annexure 2

Penalty and performance Monitoring/evaluation of Empanelled Insurance Companies

(More points indicate more penalty/negative rating)

S. No.	Topic	Pre-condition/ Remarks	Remarks on Monitoring method	Remarks on Points criteria	Rationale
Key Penalty/Performance Indicators					
1	Withdrawal of Bids after being L1	<p>State follows the OGs for calling for bids and selection of Insurance Company. Post tendering, no additional terms/clauses allowed</p> <p>Announcement of L1 bidder within 3 working days of schedule opening date of bids and work order given within 3 weeks.</p>	<p>Selected L1 bidder withdraws its bid after the announcement of L1 bidder is made and/or work order is released</p> 	<p>If bids are withdrawn by the Insurance Company:</p> <ul style="list-style-type: none"> a) 1 cluster/state : 5 Points b) > 1 cluster/State : 15 Points <p>Additionally, financial losses, if any, to the State Govt., in retendering due to withdrawal of selected bidders and additional premium subsidy due to increase in actuarial premium rates from previously declared L1 rates, will be recovered from withdrawing L1 bidder.</p>	<p>With a view to ensure well worked out rational rating practice and professional handling of bids</p>
2	Enrolment of loanee and non-loanee farmers	<p>1) At least 30 days marketing window should be available to Insurance Companies post notification.</p> <p>2) Post tendering, separate target should not be entrusted by the State Govt.</p>	<p>1. Applicable If number of farmers enrolled during the season is decreased over similar season during previous year. The comparison would be made for same district coverage during previous year, even if the district was allotted to other company.</p> <p>2. If separate target fixed for enrolment for non loanee farmers in the Tender documents could not achieved by any Insurance Companies.</p>	<p>1. If company-wise at all India level coverage of Non-Loanee farmers decreases by:</p> <ul style="list-style-type: none"> (a) < 25% : 5 Points (b) >25% : 10 Points <p>2. If target of enrolment of non loanee farmers not achieved in the bidden cluster(s), -1% of Gross premium of such clusters would be forfeited as penalty and shall be deducted from final instalment of premium subsidy.</p>	<p>To increase coverage under the Scheme</p>

3	Settlement of Claims within 21 Days	This clause would be applicable for location-crop combination where yield data is undisputed and received within 'notified and specific cut off date'	All eligible undisputed claims should be released within 21 days from the date of AY uploaded on the GOI Portal subject to receipt of applicable premium subsidy on the business finalised on National Crop Insurance Portal.	% of the undisputed claims remain unpaid at the end of 21 days <ul style="list-style-type: none"> • between 5% -10 % : 1 Point • between 25 % - 50 % : 5 Points • > 50 % : 10 Points • > 75 % : 15 Points Penal interest @ 12% per annum will be recovered on admissible pending claims amount, if Insurance Companies keep claims pending beyond 30 days after uploading of AY on Portal and releasing all admissible subsidy for the crop(s) of district, without any genuine reason(s) acceptable to the Government.	
4	District Office and Human resources	1) Applicable only If the district is allotted for at least one year including Kharif and Rabi. 2) If the district is allotted for duration less than one year, the Insurance Company must have a district level representative residing in the district.	a) To be appointed within 1 month in case of functional district office and 15 days in case of district level representative from the date of notification. b) Opening of Taluka level offices with requisite infrastructure and manpower. The details of offices and human resources deployed at each Taluka and district should be uploaded with three week of award of work or at least two months before the cut off date of enrolment, whichever is later.	1) District Office <ul style="list-style-type: none"> a) If functional district office not set up within 30 days : 5 Points b) If functional district office not set up at all : 15 Points 2) District Representative <ul style="list-style-type: none"> a) If district representative not placed within 15 days : 5 Points b) If district representative not placed at all : 10 Points 3) Taluka level office <ul style="list-style-type: none"> a) Taluka level office not setup : 15 points b) Taluka level offices setup after timelines : 5 points 	It will encourage State Govts. to go for long-term tenders

Other Performance Indicators:

1	Bidding participation	It should not be mandatory for companies to participate in all clusters within a	Non-serious participation if : a) Deviation of rate	1) Non-Participation State Level a) If participated in <50% of States : 2 Points	Non serious participation has been defined with a view to ensure participation in
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	State.	quoted from the weighted L1 rates quoted by companies is <table border="1"> <thead> <tr> <th>Average Rate</th><th>Deviation</th></tr> </thead> <tbody> <tr> <td><5%</td><td>>75%</td></tr> <tr> <td>>=5% to 10%</td><td>> 75%</td></tr> <tr> <td>> 10%</td><td>> 50%</td></tr> </tbody> </table>	Average Rate	Deviation	<5%	>75%	>=5% to 10%	> 75%	> 10%	> 50%	b) If participated in <25% of States : 5 Points District Level a) If participated in <50% of clusters : 2 Points b) If participated in <25% of clusters: 5 Points 2) Non-serious participation a) If non-serious in >25 % clusters and upto 50% of clusters : 10 Points b) If non-serious participation in >50 % of clusters : 20 Points	maximum number of States and clusters by the companies.
Average Rate	Deviation											
<5%	>75%											
>=5% to 10%	> 75%											
> 10%	> 50%											
2	Preparation of brochures, etc.	1) If the notification is delayed and cut-off date is less than 7 days from the date of notification, then this clause will not be applicable	Brochures/Pamphlets/Leaflets, etc. pertaining to crop insurance schemes not be less than half of the number of farmers covered during the previous similar (Kharif/Rabi) season in the district. Payment to vendor would be the deciding criteria	If printing is less than: a) 50% : 2 Points b) 25% : 5 Points								
3	Training, workshop, etc	If the notification is delayed and cut-off date is less than 15 days from the date of notification, then this clause will not be applicable	Organization of at least one banker's sensitization programme and not less than 5 farmers awareness Block level/Panchayat level programmes in each district during the season	a) If banker's sensitization programme not conducted : 10 Points b) farmers awareness programme: < 2 : 5 Points <5 : 2 Points								
4	CCE Co-observance	This clause would be applicable only if State Govt provides CCE schedules timely	co-observance of CCEs scheduled by the concerned department in the district	Between 20 % to 30 % : 10 Points Less than 20% : 15 Points								
5	Localized loss / Post-Harvest claims	This clause would be applicable only if State Govt provides the required support during surveying	As per time-line for claim disbursement under this cover as per OG.	> 50 % and up to 75 % :2 Points < 50% : 3 points < 25% : 5 points								

Performance severity of Insurance Company:

Threshold limit	Severity
<10 Points	Insurance Company nominated for Annual National Award
Up to 20 points	Insurance Company nominated for Technical/RST Pilot Project through Technology Fund
>21 points	Deduction of 1% of total Premium amount for the concerned Insurance Company for the season
>31 points	Deduction of 2% of total Premium amount for the concerned Insurance Company for the season
>41 points	Deduction of 3% of total Premium amount for the concerned Insurance Company for the season
> 51 points	Deduction of 5% of total Premium amount for the concerned Insurance Company for the season
>61 points	Deduction of 7% of total premium for a season - cancellation of renewal/continuation for next season
>71 points	Deduction of 10% of total premium for a season - cancellation of renewal/continuation for next season and de-empanelment of Insurance Company for 1 year
False intimations on any of the above parameters	Investigations to be called against the insurance company and if it is found that company has falsified data - cancellation of renewal/continuation for next season and de-empanelment of Insurance Company for 2 years.

*All fund collection due to imposition of penalty would go to Technology Fund except penalty due to delay in release of claim by ICs which shall be passed on to the concerned beneficiary farmers. The penalty amount shall be deposited by the concerned ICs within one month of publication of Ranking by GOI.

Annexure 3

Illustrative Evaluation of Efficiency of Nodal Department of the State

S.No	Service Level Agreement's (SLA's)	Source of data	Monitoring method	Periodicity	Points criteria
Key Performance Indicators					
1	Release of Tender at least 3 months before the commencement of the season Tender results should be displayed and uploaded on national Portal.	The available information on the National Crop Insurance Portal	Date of Tender Document release and the onset of respective crop season	For each season and scheme separately	Tender result on Portal within stipulated timelines: 5 points
2	Release of Physical Notification/GO by the State at least 2 months before the commencement of the season	The available information on the National Crop Insurance Portal	Date of Notification release and the onset of respective crop season	For each season and scheme separately	<ol style="list-style-type: none"> 1. Release of Notification/GO as per timelines : 5 points 2. Release of Notification/GO after timelines but before commencement of season : 3 points 3. Release of Notification/GO after commencement of season : 0 point 4. Release of Notification/GO after commencement of the season but within 60 days of enrolment cut off date : (-2) points 5. Release of Notification/GO after commencement of the season but within 15 days of enrolment cut off date : (-5) points
3	Digital notification on the National Crop Insurance Portal at least 30 days from the commencement of season.	The available information on the National Crop Insurance Portal	Date of complete Digitization of Notification	For each season and scheme separately	<ol style="list-style-type: none"> 1. Release of digital notification within timelines : 10 points 2. Release of digital notification before commencement of season : 5 points 3. Release of digital notification after commencement of season: (-2) points for each fortnightly delay
4	Level of Notification (Village/GP/Mandal/District)	The available information on the National Crop Insurance Portal	Level	Each season	<ol style="list-style-type: none"> 1. If >75% Insurance Unit in a state notified at village/GP level : 5 points 2. If < 75% Insurance Unit in a state notified at village/GP level : 0 point
5	Notification of Maximum Gross Cropped Area	The available information on the National Crop Insurance Portal	Total hectares insured	Both seasons together	<ol style="list-style-type: none"> 1. Notified GCA >40% : 15 Points 2. Notified GCA between 30 to 40% : 10 Points 3. Notified GCA <20% : (-5) Points

6	Payment of State share of Premium Subsidy to Insurance Company (As prescribed in Operational guidelines)	Computed from the data available on the National Crop Insurance Portal/to State Govt. Premium Requisition (PR) raised by the concerned Insurance Company on National Crop Insurance Portal/to State Govt.	The premium requisition made on the Portal and the payment actually made by the State.	Based on the requests made for each season and scheme	<ol style="list-style-type: none"> 1. Release of premium within timelines : 10 points 2. Release of premium after timelines : 0 point
7	Initiatives and monitoring taken for increasing enrolment of loanee farmers	List of insured farmers on the crop insurance Portal	Increase in number of enrolled loanee farmers over same season of the previous year.	Based on the enrolments made for each season	<ol style="list-style-type: none"> 1. > 10% Increase in overall enrolment : 5 points 2. 5-10% Increase in overall enrolment : 2 points 3. <5% or no Increase in overall enrolments : 0 point 4. decrease in overall enrolments : (-5) points
8	Initiatives taken for increasing enrolment of non-loanee farmers	List of non-loanee insured farmers on the crop insurance Portal	a) Share of non loanee famers in total enrolment	Each season	<ol style="list-style-type: none"> 1. If % NL farmers insured w.r.t total farmers insured is >25% : 10 points 2. If % NL farmers insured w.r.t total farmers insured is between 10-25% : 5 points 3. If % NL farmers insured w.r.t total farmers insured is < 10% : 0 point
			b) Increase in number of enrolled non-loanee farmers over same season of previous year.		<ol style="list-style-type: none"> 1. % Increase over previous season >10% : 5 points 2. % Increase over previous season between 5-10% : 2.5 points 3. % decrease over previous season : (-5) points
9	Reporting of CCEs through mobile/ CCE App	The available information on the National Crop Insurance Portal	Total CCEs reported through Mobile/CCE App out of gross no of CCEs planned	For each season	<ol style="list-style-type: none"> 1. Reporting of > 90% CCEs through Mobile App : 15 points 2. Reporting of between 75% to 90% CCEs through Mobile App : 10 points 3. Reporting of between 50% to 74% CCEs through Mobile App : 5 points 4. Reporting of <25% CCEs through Mobile App : (-10) points 5. No reporting of CCEs through Mobile App: (-15) points
10	Uploading of TY, AY, Historical Yield data, on Portal	The available information on the National Crop Insurance Portal		For each season	<ol style="list-style-type: none"> 1. Uploading of > 90% of data within timelines : 15 Points 2. Uploading of between 50% to 90% of data within timelines: 10 Points 3. Uploading of between 25% to 49% of data within timelines : 5 Points 4. No data uploaded on Portal within timelines : 0 Point

Other Parameters					
11	Setting up of State Technical Support Unit	Report from the State Govt.	Within 12 months from release of Operational Guidelines		<ol style="list-style-type: none"> Setting up of STSU within timelines : 5 points Non-setting up of STSU or after the timelines : 0 points
12	Setting up of DGRC and SGRC for settlement of Grievances	Notification issued regarding formation of DGRC and SGRC	Within 60 days after publishing of Operational Guidelines	Based on the details of DGRC/SGRC constituted and uploaded on the Portal	<ol style="list-style-type: none"> Setting of DGRC & SGRC as per timelines : 5 points Setting of DGRC & SGRC after the timelines : 0 points
13	Preparation of brochures/pamphlets /posters/banners/to be used for publicity. 30 days before the commencement of enrolment	Printed brochures/pamphlets /posters with a report from State Govt.	Pamphlets/ leaflets to be distributed through all channels.	Each season separately Based on information furnished/uploaded on Portal by State Govt	<ol style="list-style-type: none"> Awareness and extension activities as per timelines : 5 point No Awareness and extension activities or after the timelines : 0 points
14	Folio Distribution by the Banks to Farmers	Report from the National Crop Insurance Portal and from State Govt./SLBC	Report by State Department to MoA&FW uploaded on Portal	Within 60 days after premium cut-off date for each season	<ol style="list-style-type: none"> Folio distribution to > 90% farmers : 5 points Folio distribution to between 75% to 90% farmers : 3 points Folio distribution to between < 75% : 0 point No distribution of Folios : (-5) points
15	Organizing State level training/capacity building workshops as per the guidelines for Districts Officials for <ul style="list-style-type: none"> • Banks, CSCs and Departmental workers • For Crop Cutting Experiments 	Report from State Department	Report by State Department to MoA&FW within 7 days of workshop and information upload on Portal	At least 60 days from premium cut-off date and Harvesting period each season	<ol style="list-style-type: none"> Organizing Workshops as per timelines : 10 points Organizing Workshops after the timelines : 5 points N workshop organized : 0 point
16	Setting up of District Level Monitoring Committees in each notified District and fortnightly review	The available information of committees on the National Crop Insurance Portal	Date of formation of DLMC and data of review meetings shared on Portal	upon commencement of each season	<ol style="list-style-type: none"> Setting up of DLMC as per timelines : 10 point Setting up of DLMC after the timelines: 5 point Not Setting up of DLMC as per timelines: 0 points
17	Constituting Joint Loss Assessment Committee in each notified District	The available information of committees on the National Crop Insurance Portal	Date of formation of committee shared on Portal	upon commencement of each season	<ol style="list-style-type: none"> Setting up of JLAC as per timelines- : 10 point Setting up of JLAC after the timelines : 5 point Not Setting up of JLAC: 0 point

18	Sharing of CCE Schedule with Insurance Company	The available information on the National Crop Insurance Portal	Sharing of information as per the timelines as prescribed in OGs	For each season	<ol style="list-style-type: none"> Sharing of CCE schedule for > 85% Notified IU Level as per timelines : 5 point Sharing of CCE schedule after timelines : 0 point
19	Timely approval and sharing of CCE data with stakeholders	The available information on the National Crop Insurance Portal	Within 30 days from final harvest	For each season	<ol style="list-style-type: none"> Approval and sharing of CCE data within prescribed timelines : 5 point Approval and sharing of CCE data after timelines : 0 point Approval and sharing of CCE data after 2 months of prescribed timelines : (-5 points)
20	Mapping of villages and upper Revenue/Administrative hierarchy with Census Codes and mapping of AWS/Back up AWS with village census codes	The available information on the National Crop Insurance Portal	Total villages/AWS/Backup AWS actually mapped against gross no of villages	Before commencement of the season	<ol style="list-style-type: none"> Completion of 100% mapping before digitization of Notification within timelines : 5 point Request for any change/updation after digitization of Notification : 0 point
21	Use of new technology, RST, NDVI and smart sampling for crop health monitoring, loss assessment and dispute/ grievance redressal at State Level.	The available information on the National Crop Insurance Portal and report by the State Govt.	Use of Technology vs conventional modes employed	For each season	<ol style="list-style-type: none"> Use of Technology : 10 points

Performance Severity of States

Threshold limit	Severity
Non-Payment of State Share of Premium subsidy	1% additional Interest per month after 3 months from date of premium requisition by Insurance Company
>300 points	Nomination for National Award on PMFBY Implementation
>200-300 points	No central financial assistance for technology upgradation to States
<100-200 points	States categorised as non-serious States (Non performers).
<100 points	No Central subsidy assistance to States on Premium

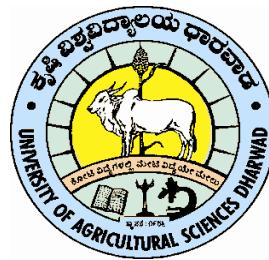
* Provisional ranking of State shall be released on seasonal basis. However, final ranking will be release on yearly basis and incentives/disincentives shall be applied on the basis of final ranking

* The total score for both seasons and the score obtained in annual criteria shall be considered for determining the performance as per the table above.



Department of Agriculture, Cooperation and Farmers Welfare
Ministry of Agriculture & Farmers Welfare
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UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD



Lecture Notes for Diseases of Crops and Their Management – I PAT 302 (2+1)

COURSE TEACHERS

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DEPARTMENT OF PLANT PATHOLOGY

UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD
PAT 302: Diseases of Crops and Their Management – I (2+1)
Course Out line

Weeks	Lecture Schedule (Theory)
1	Rice: Blast, Brown leaf spot, Bacterial blight.
2	Rice: Sheath blight, False smut, Tungro and Khaira.
3	Sorghum: Downy mildew, Rust, Smuts, Charcoal rot, Anthracnose, Grain molds.
4	Bajara (Pearl millet): Downy mildew, Ergot, Blast, Rust.
5	Maize: Downy mildews, Turcicum leaf blight, Rusts, Stalk rots. Finger millet: Blast
6	Groundnut: Early and late leaf spot, stem and pod rots, Rust, Bud necrosis.
7	Soybean: Purple seed stain, Rust, Bacterial pustule, Anthracnose.
8	Soybean: Yellow Mosaic (Target leaf spot, Cercospora leaf spot). Castor: Phytophthora blight, wilt
9	Pigeon pea: Phytophthora blight, Fusarium wilt. Sterility mosaic.
10	Greengram and Blackgram: Cercospora leaf spot, Anthracnose, Powdery mildew and Yellow mosaic.
11	Tobacco: Damping off, Blackshank, Frog eye leaf spot, TMV, Leaf curl. Root knots
12	Ginger: Rhizome rot Cabbage and Cauliflower: Alternaria leaf spot, Black rot.
13	Brinjal: Phomopsis blight and fruit rot, Foot rot (Sclerotium wilt)
14	Tomato: Damping off in nursery beds, Early and late blight, buck eye rot, leaf curl.
15	Okra: Yellow vein mosaic and powdery mildew Beans: Anthracnose, Rust, Bacterial blight.
16	Banana: Panama wilt, Bacterial wilt, Sigatoka ,Bunchy top, Toppling, Tip over
17	Papaya: Foot rot,Anthracnose, PRSV,Leaf curl Pomegranate: Bacterial blight,Wilt, Anthracnose
18	Guava: Wilt,Anthracnose, Coconut: wilt and bud rot
19	Tea : Blister blight Coffee: Rust, Anthracnose Colocasia: Phytophthora blight

Selected References:

1. Singh R.S, Plant Diseases, Tenth Edition, Oxford & IBH publishers
2. Rangaswamy G and Mahadevan, 4th Edition, Diseases of Crop Plants in India
3. Agrios, G.N., Plant Pathology, 5th Edition, Elsevier Academic Press

DISEASES OF CROPS AND THEIR MANAGEMENT-I PAT 302 (2+1)

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Diseases of Rice

Fungal Diseases

Blast - *Pyricularia oryzae* (Syn: *P. grisea*) (Sexual stage: *Magnaporthe grisea*)

Symptoms

The fungus attacks the crop at all stages of crop growth. Symptoms appear on leaves, nodes, rachis, and glumes. On the leaves, the lesions appear as small bluish green flecks, which enlarge under moist weather to form the characteristic spindle shaped spots with grey centre and dark brown margin (**Leaf blast**).

The spots coalesce as the disease progresses and large areas of the leaves dry up and wither. Spots also appear on sheath. Severely infected nursery and field appear as burnt. Black lesions appear on nodes girdling them. The affected nodes may break up and all the plant parts above the infected nodes may die (**nodal blast**).

During flower emergence, the fungus attacks the peduncle and the lesion turns to brownish-black which is referred to as rotten neck / neck rot / panicle blast (**neck blast**).

In early neck infection, grain filling does not occur while in late infection, partial grain filling occurs. Small brown to black spots may also be observed on glumes of the heavily infected panicles. The pathogen causes yield losses ranging from 30-61 per cent depending upon the stages of infection.



Pathogen

The mycelium is hyaline to olivaceous and septate. Conidia are produced in clusters on long septate, olivaceous conidiophores. Conidia are pyriform to ellipsoid, attached at the broader

base by a hilum. Conidia are hyaline to pale olive green, usually 3 celled. The perfect state of the fungus is *M. grisea* producing perithecia. The ascospores are hyaline, fusiform, 4 celled and slightly curved.



Conidia and Conidiophore of *P. grisea*

Favourable Conditions

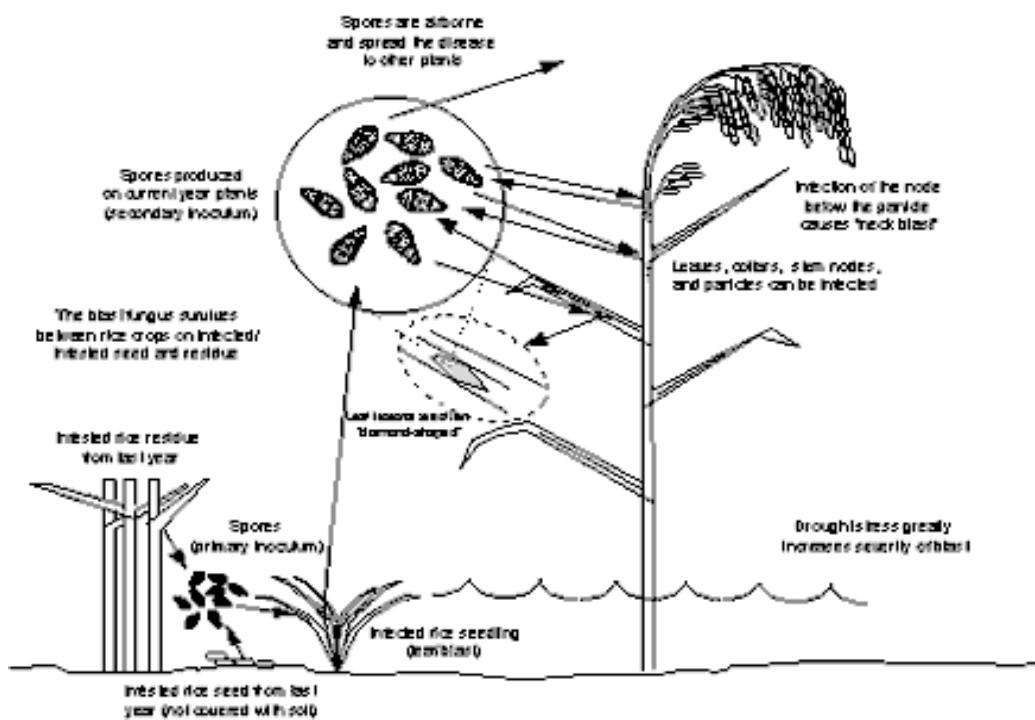
- Intermittent drizzles, cloudy weather, more of rainy days, longer duration of dew high relative humidity (93-99 per cent).
- Low night temperature (between 15-20°C or less than 26°C).
- Availability of collateral hosts and excess dose of nitrogen.

Forecast for rice blast can be made on the basis of minimum night temperature range of 20-26°C in association with a high relative humidity of 90 per cent and above lasting for a period of a week or more during any of the three susceptible phases of crop growth, viz., seedling stage, post transplanting tillering stage and neck emergence stage. In Japan, the first leaf blast forecasting model was developed named as BLAST. Later several other models have also been developed namely, PYRICULARIA, PYRIVIEW, BLASTAM, EPIBLA and PBLAST.

Disease Cycle

The disease spreads primarily through airborne conidia since spores of the fungus present throughout the year. Mycelium and conidia in the infected straw and seeds are major sources of inoculum. Irrigation water may carry the conidia to different fields. The fungus also survives on collateral hosts viz., *Panicum repens*, *Digitaria marginata*, *Brachiaria mutica*, *Leersia hexandra* and *Echinochloa crusgalli*.

Spores land on leaves, germinate, penetrate the leaf, and cause a lesion 4 days later; more spores are produced in as little as 6 days. Infections from spores arriving from a distance are termed primary infections.



Primary infections generally result in a few widely scattered spots on leaves. Spores arising from the primary infections are capable of causing many more infections. This cycling is called secondary spread. Secondary spread is responsible for the severe epidemics of blast in fields and localized areas.

Management

- Grow resistant to moderately resistant varieties CO47, IR 20, ADT36, ADT39, ASD 18 and IR64. Avoid cultivation of highly susceptible varieties viz., IR50 and TGM6 in disease favourable season.
- Remove and destroy the weed hosts in the field bunds and channels.
- Treat the seeds with Captan or Thiram or Carbendazim or Tricyclazole at 2 g/kg. or *Pseudomonas fluorescens* @ 10g/kg of seed. Spray the nursery with carbendazim 500mg/L or tricyclazole 300mg/L.
- Spray the main field with Edifenphos 500 ml or Carbendazim 500 g or Tricyclazole 500 g or Iprobenphos (IBP) 500 ml /ha.

Brown Spot - *Helminthosporium oryzae* (Syn: *Drechslera oryzae*; *Bipolaris oryzae*)
(Sexual stage: *Cochliobolus miyabeanus*)

Symptoms

The fungus attacks the crop from seedling to milky stage in main field. Symptoms appear as minute spots on the coleoptile, leaf blade, leaf sheath, and glume, being most prominent on the

leaf blade and glumes.

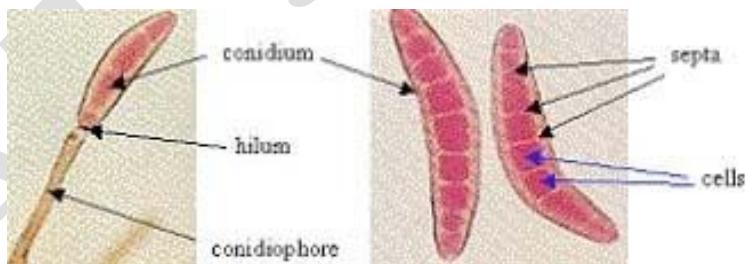
Brown Spot- *Bipolaris oryzae*



The spots become cylindrical or oval, dark brown with yellow halo later becoming circular. Several spots coalesce and the leaf dries up. The seedlings die and affected nurseries can be often recognised from a distance by scorched appearance. Dark brown or black spots also appear on glumes leading to grain discolouration. It causes failure of seed germination, seedling mortality and reduces the grain quality and weight.

Pathogen

Bipolaris oryzae produces brown septate mycelium. Conidiophores arise singly or in small groups. They are geniculate, brown in colour. Conidia are usually curved with a bulged center and tapered ends. They are pale to golden brown in colour and are 6-14 septate. The perfect stage of the fungus is *C. miyabeanus*.



It produces perithecia with ascospores containing 6-15 septate, filamentous or long cylindrical, hyaline to pale olive green ascospores. The fungus produces terpenoid phytotoxins called ophiobolin A (or Cochliobolin A), ophiobolin B (or cochliobolin B) and ophiobolin I. Ophiobolin A is most toxic. These breakdown the protein fragment of cell wall resulting in partial disruption of integrity of cell.



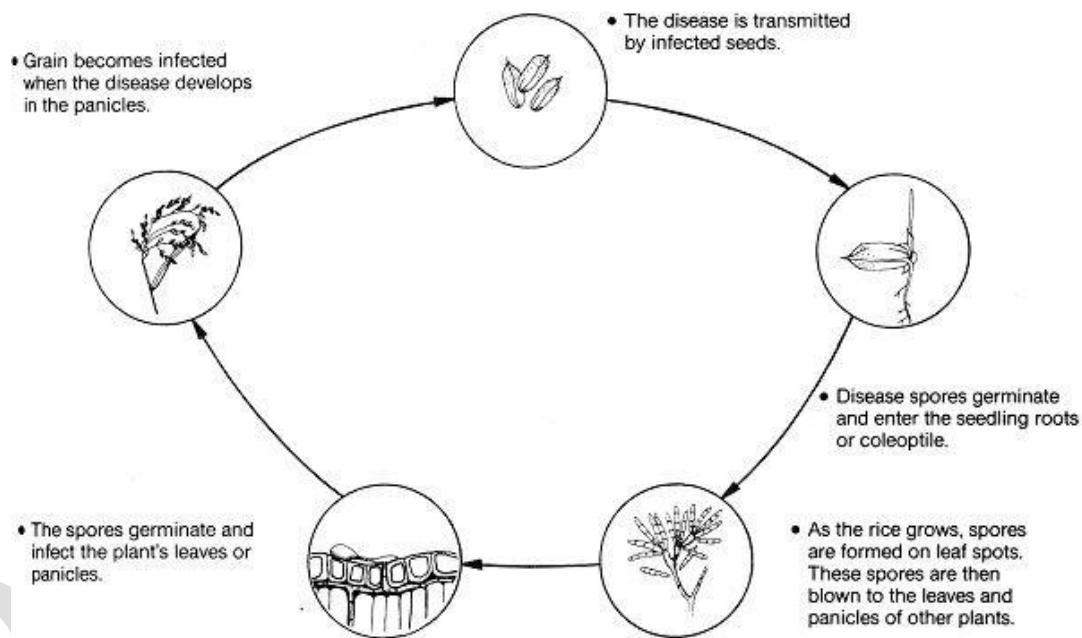
Conidia and Conidiophore

Favourable Conditions

- Temperature of 25-30°C with relative humidity above 80 per cent are highly favourable.
- Excess of nitrogen aggravates the disease severity.

Disease Cycle

Infected seeds and stubbles are the most common source of primary infection. The conidia present on infected grain and mycelium in the infected tissue are viable for 2 to 3 years. Airborne conidia infect the plants both in nursery and in main field.



The fungus also survives on collateral hosts like *Leersia hexandra* and *Echinochloa colonum*. The brown spot fungus is normally present in areas with a long history of rice culture. Airborne spores that are capable of causing infection are produced in infested debris and older lesions.

Management

- Field sanitation-removal of collateral hosts and infected debris from the field.
- Use of slow release nitrogenous fertilizers is advisable.
- Grow tolerant varieties viz., Co44 and Bhavani.
- Use disease free seeds.
- Treat the seeds with Thiram or Captan at 4 g/kg. Spray the nursery with Edifenphos 40 ml or Mancozeb 80 g for 20 cent nursery.
- Spray the crop in the main field with Edifenphos 500 ml or Mancozeb 2 kg/ha when grade reaches 3. If needed repeat after 15 days.

Narrow brown leaf spot - *Cercospora janseana* (Sexual stage: *Sphaerulina oryzina*)

Symptoms

The fungus produces short, linear brown spots mostly on leaves and also on sheaths, pedicels and glumes. The spots appear in large numbers during later stages of crop growth.



Pathogen

Conidiophores are produced in groups and brown in colour. Conidia are hyaline or subhyaline, cylindrical and 3-5 septate.

Management

Spray Carbendazim 500 g or Mancozeb 2 kg/ha.

Sheath rot - *Sarocladium oryzae* (Syn: *Acrocylindrium oryzae*)

Symptoms

Initial symptoms are noticed only on the upper most leaf sheath enclosing young panicles. The flag leaf sheath show oblong or irregular greyish brown spots. They enlarge and develop grey centre and brown margins covering major portions of the leaf sheath.

The young panicles remain within the sheath or emerge partially. The panicles rot and abundant whitish powdery fungal growth is seen inside the leaf sheath.



Pathogen

The fungus produces whitish, sparsely branched, septate mycelium. Conidia are hyaline, smooth, single celled and cylindrical in shape.

Favourable Conditions

- Closer planting
- High doses of nitrogen
- High humidity and temperature around 25-30°C
- Injuries made by leaf folder, brown plant hopper and mites increase infection

Disease Cycle

The disease spreads mainly through air-borne conidia and also seed-borne. Primary source of inoculum is by means of infected plant debris. Secondary spread is by means of air borne conidia produced on the leaf sheath.

Management

- Spray Carbendazim 500g or Edifenphos 1L or Mancozeb 2 kg/ha at boot leaf stage and 15 days later.
- Soil application of gypsum (500 kg/ha) in two splits.
- Application of Neem Seed Kernel Extract (NSKE) 5% or neem oil 3 % or Ipomoea or Prosopis leaf powder extract 25 Kg/ha. First spray at boot leaf stage and second 15 days later.

Sheath blight - *Rhizoctonia solani* (Sexual stage: *Thanetophorus cucumeris*)

Symptoms

The fungus affects the crop from tillering to heading stage. Initial symptoms are noticed on leaf sheaths near water level. On the leaf sheath oval or elliptical or irregular greenish grey spots are formed. As the spots enlarge, the centre becomes greyish white with an irregular blackish brown or purple brown border.

Lesions on the upper parts of plants extend rapidly coalescing with each other to cover entire tillers from the water line to the flag leaf. The presence of several large lesions on a leaf

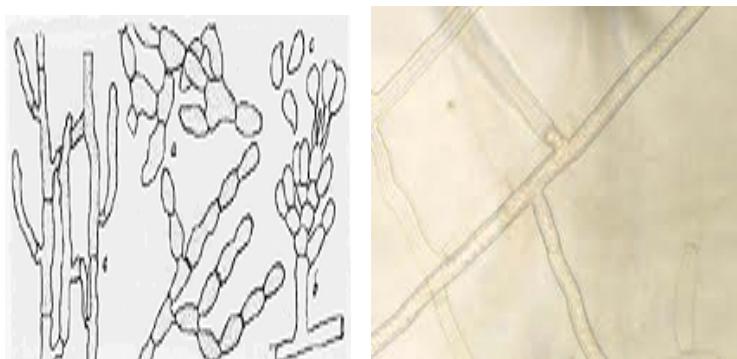
sheath usually causes death of the whole leaf, and in severe cases all the leaves of a plant may be blighted.



The infection extends to the inner sheaths resulting in death of the entire plant. Older plants are highly susceptible. Plants heavily infected in the early heading and grain filling growth stages produce poorly filled grain, especially in the lower part of the panicle.

Pathogen

The fungus produces septate mycelium which are hyaline when young, yellowish brown when old. It produces large number of spherical brown sclerotia.

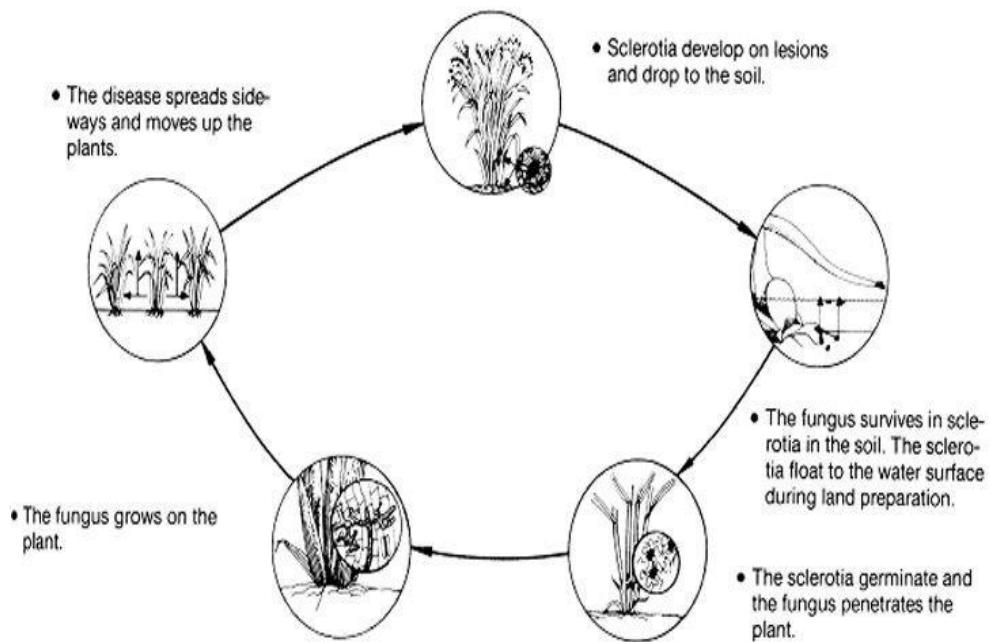


Favourable Conditions

- High relative humidity (96-97 per cent), high temperature (30-32°C).
- Closer planting.
- Heavy doses of nitrogenous fertilizers.

Disease cycle

The pathogen can survive as sclerotia or mycelium in dry soil for about 20 months but for 5-8 months in moist soil. Sclerotia spread through irrigation water. The fungus has a wide host range.



Management

- Grow resistant varieties like Mansarovar, Swarau Dhan, Pankaj etc.
- Apply organic amendments viz., neem cake @ 150Kg/ha or FYM 12.5 tons/ha. Avoid flow of irrigation water from infected fields to healthy fields.
- Deep ploughing in summer and burning of stubbles.
- Spray Carbendazim 500 g/ha

- Soil application of *P. fluorescens* @ of 2.5 kg/ha after 30 days of transplanting (product should be mixed with 50 kg of FYM/Sand and applied).
- Foliar spray *P. fluorescens* at 0.2% at boot leaf stage and 10 days later

False smut - *Ustilaginoidea virens* (Syn: *Claviceps oryzae - sativa*)

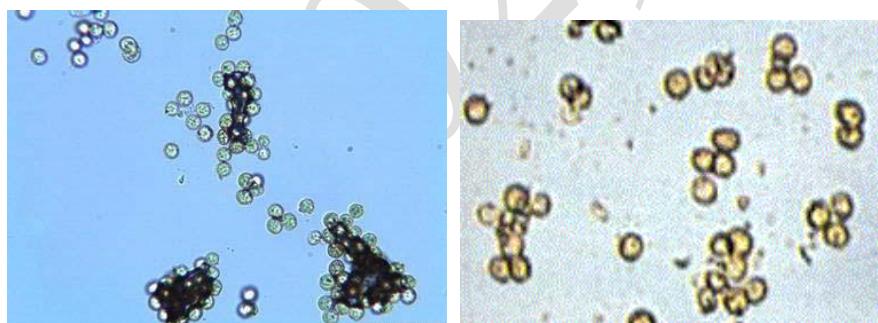
Symptoms

The fungus transforms individual ovaries / grains into greenish spore balls of velvetty appearance. Only a few spikelets in a panicle are affected.



Pathogen

Chlamydospores are formed as spore balls which are spherical to elliptical, warty and olivaceous.



Disease Cycle

Grasses and wild rice species are alternate hosts. The main source of inoculum is air-borne spores. Ascospores produced from sclerotia act as primary source of infection while chalmydospores are secondary source of infection. Chlamydospores are air - borne, abundant at heading stage.

Favorable conditions

- Rainfall and cloudy weather during flowering and maturity.

Udbatta disease - *Ephelis oryzae* (Sexual stage: *Balansia oryzae-sativa*)

Symptoms

Symptoms appear at the time of panicle emergence. The entire ear head is converted into a straight compact cylindrical black spike like structure since the infected panicle is matted together by the fungal mycelium. The spikelets are cemented to the central rachis and the size is remarkably reduced. The entire spike is covered by greyish stroma with convex pycnidia immersed inside.



Pathogen

Pycnidiospores are hyaline, needle shaped and 4-5 celled.

Management

- The pathogen is internally seed borne. Hot water seed treatment at 45°C for 10 min. effectively controls the disease.
- Removal of collateral hosts *Isachne elegans*, *Eragrostis tenuifolia* and *Cynodon dactylon*.

Stackburn disease - *Trichoconis padwickii* (Syn: *Alternaria padwickii*)

Symptoms

Leaves and ripening grains are affected. On leaves circular to oval spots with dark brown margins are formed. The center of the spot turns light brown or white with numerous minute dots. On the glumes reddish brown spots appear. The kernels may shrivel and become brittle.



Symptoms

Pathogen

Conidia are elongated with a long beak at the tip, 3 to 5 septate, thick walled and constricted at the septa.

Management

- Treat the seeds with Thiram or Captan or Mancozeb at 2g/kg.
- Hot water treatment at 54° C for 15 minutes is also effective.
- Burn the stubbles and straw in the field.

Bunt or Kernel Smut or black smut - *Tilletia barclayana*

Minute black pustules or streaks are formed on the grains which burst open at the time of ripening. The grains may be partially or entirely replaced by the fungal spores. The sorus pushes the glumes apart exposing the black mass of spores. Only a few flowers are infected in an inflorescence. The fungus survives as chlamydospores for one or more years under normal condition and 3 years in stored grains.

Stem rot – *Sclerotium oryzae*

Symptoms

Small black lesions are formed on the outer leaf sheath and they enlarge and reach the inner leaf sheath also. The affected tissues rot and abundant small black sclerotia are seen in the rotting tissues. The culm collapses and plants lodge. The sclerotia are carried in stubbles after harvest.



Pathogen

White to greyish hyphae, spherical black and shiny sclerotia, visible to naked eyes as black masses.

Favourable Conditions

- Infestation of leaf hoppers and stem borer.
- High doses of nitrogenous fertilizers.

Disease Cycle

The sclerotia survive in stubbles and straw those are carried through irrigation water. The fungus over winters and survives for long periods as sclerotia in the upper layers (2-3 inches) of the soil profile. The half-life of sclerotia in the field is about 2 years. Viable sclerotia have been found in fields for up to 6 years after a rice crop. The sclerotia are buoyant and float to the surface of floodwater where they contact, germinate, and infect rice tillers near the water line.

Management

- Deep ploughing in summer and burning stubbles to eliminate sclerotia.

- Use of balanced application of fertilizer.
- Avoid flow of irrigation water from infected to healthy fields.
- Draining irrigation water and letting soil to dry.

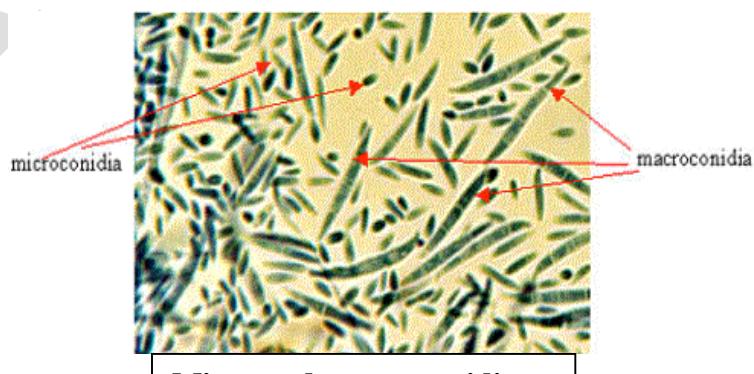
Foot rot or Bakanae disease - *Fusarium moniliforme* (Sexual stage: *Gibberella fujikuroi*) Symptoms

Infected seedlings in nursery are lean and lanky, much taller and die after some time. In the main field, the affected plants have tall lanky tillers with longer internodes and aerial adventitious roots from the nodes above ground level. The root system is fibrous and bushy. The plants are killed before earhead formation or they produce only sterile spikelets. When the culm is split open white mycelial growth can be seen.



Pathogen

Fungus produces both macroconidia and microconidia. Microconidia are hyaline, single celled and oval. Macroconidia are slightly sickle shaped, and two to five celled. The fungus produces the phytotoxin , fusaric acid, which is non-host specific.



Micro and macro conidia

Management

- The fungus is externally seed-borne.
- Treat the seeds with Thiram or Captan or Carbendazim at 2 g/kg.

Grain discolouration - *Drechslera oryzae*, *D. rostratum*, *D.tetramera*, *Curvularia lunata*, *Trichocomis padwickii*, *Sarocladium oryzae*, *Alternaria tenuis*, *Fusarium moniliforme*, *Cladosporium herbarum*, *Epicoccum purpurascens*, *Cephalosporium* sp., *Phoma* sp., *Nigrospora* sp.

Symptoms

The grains may be infected by various organisms before or after harvesting causing discoloration, the extent of which varies according to season and locality. The infection may be external or internal causing discolouration of the glumes or kernels or both. Dark brown or black spots appear on the grains.

The discolouration may be red, yellow, orange, pink or black, depending upon the organism involved and the degree of infection. This disease is responsible for quantitative and qualitative losses of grains.



Favourable Conditions

- High humidity and cloudy weather during heading stage

Disease cycle

The disease spreads mainly through air-borne conidia and the fungus survives as parasite and saprophyte in the infected grains, plant debris and also on other crop debris.

Management

- Pre and post-harvest measures should be taken into account for prevention of grain discolouration.

- Spray the crop at boot leaf stage and at 50% flowering with Carbendazim + Mancozeb (1:1) @ 0.2%.
- Store the grains with 13.5-14% moisture content.

Bacterial Diseases

Bacterial leaf blight - *Xanthomonas oryzae* pv. *oryzae*

Symptoms

The disease is usually noticed at the time of heading but it can occur earlier also. Seedlings in the nursery show circular, yellow spots in the margin, that enlarge, coalesce leading to drying of foliage. “Kresek” symptom is seen in seedlings, 1-2 weeks after transplanting. The bacteria enter through the cut wounds in the leaf tips, become systemic and cause death of entire seedling.



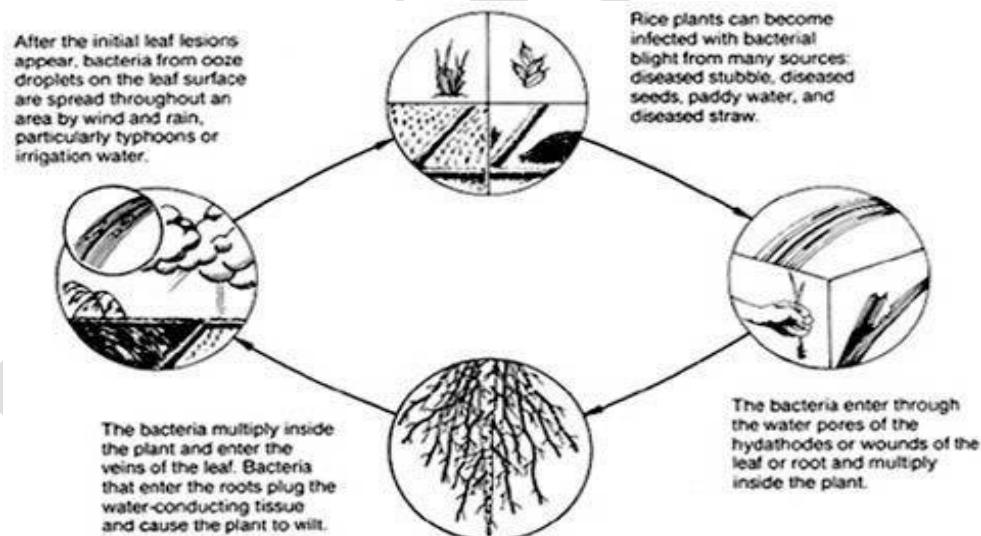
In grown up plants water soaked, translucent lesions appear near the leaf margin. The lesions enlarge both in length and width with a wavy margin and turn straw yellow within a few days, covering the entire leaf. As the disease advances, the lesions cover the entire lamina which turns white or straw coloured. Milky or opaque dew drops containing bacterial masses are formed on young lesions in the early morning. They dry up on the surface leaving a white encrustation. The affected grains have discoloured spots. If the cut end of leaf is dipped in water, it becomes turbid because of bacterial ooze.

Pathogen

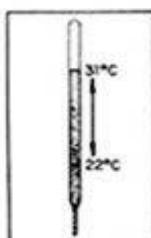
The bacterium is aerobic, gram negative, non spore forming, rod with size ranging from $1-2 \times 0.8-1.0\mu\text{m}$ with monotrichous polar flagellum. Bacterial colonies are circular, convex with entire margins, whitish yellow to straw yellow colored and opaque.



Bacterium



High temperature and humidity during crop growth increase the incidence of bacterial blight.



Favorable Conditions

- Clipping of tip of the seedling at the time of transplanting.
- Heavy rain, heavy dew, flooding, deep irrigation water
- Severe wind and temperature of 25-30 C
- Application of excessive nitrogen, especially late top dressing

Disease Cycle

The infected seeds as a source of inoculum may not be important since the bacteria decrease rapidly and die in the course of seed soaking. The pathogen survives in soil and in the infected stubbles and on collateral hosts *Leersia* spp., *Plantago major*, *Paspalum dictum*, and *Cyanodon dactylon*. The pathogen spreads through irrigation water and also through rain storms.

Management

- Burn the stubbles.
- Use optimum dose of fertilizers.
- Avoid clipping of tip of seedling at the time of transplanting.
- Avoid flooded conditions. Remove weed hosts.
- Grow resistant cultivars IR 20 and TKM 6.
- Spray Streptomycin sulphate and tetracycline combination 300g + Copper oxychloride 1.25 Kg/ha.

Bacterial leaf streak - *Xanthomonas oryzae* pv. *oryzicola*

Symptoms

Fine translucent streaks are formed on the veins and the lesions enlarge lengthwise and infect larger veins and turn brown. On the surface of the lesions, bacterial ooze out and form small yellow band-like exudates under humid conditions. In severe cases the leaves dry up.



Management

- Burn the stubbles.
- Use optimum dose of fertilizers.
- Avoid clipping of tip of seedling at the time of transplanting.
- Avoid flooded conditions.
- Remove weed hosts. Grow resistant cultivars IR 20 and TKM 6.
- Spray Streptomycin sulphate and tetracycline combination 300g + Copper oxychloride 1.25 Kg/ha.

Viral Diseases

Rice Tungro Disease (RTD) - *Rice tungro bacilliform virus (RTBV)* and *Rice tungro spherical virus (RTSV)*

Symptoms

Infection occurs both in the nursery and main field. Plants are markedly stunted. Leaves show yellow to orange discoloration and interveinal chlorosis. Young leaves are sometimes mottled while rusty spots appear on older leaves. Tillering is reduced with poor root system. Panicles not formed in very early infection, if formed, remain small with few, deformed and chaffy grains.



Pathogen

Two morphologically unrelated viruses present in phloem cells. Rice tungro bacilliform virus (RTBV) bacilliform capsid, circular ds DNA genome and Rice tungro spherical virus (RTSV) isometric capsid ss RNA genome.

Disease Cycle

Transmission mainly by the leaf hopper vector *Nephrotettix virescens*. Males, females and nymphs of the insect can transmit the disease. Both the particles are transmitted semi-persistently, in the vector the particles are noncirculative and nonpropagative. Plants infected with RTSV alone may be symptomless or exhibit only mild stunting. RTBV enhances the symptoms caused by RTSV. RTSV can be acquired from the infected plant independently of RTBV, but acquisition of RTBV is dependent on RTSV which acts as a helper virus. Both the viruses thrive in rice and several weed hosts which serve as source of inoculum for the next. Ratoon from infected rice stubble serve as reservoirs of the virus. Disease incidence depends on rice cultivars, time of planting, time of infection and presence of vectors and favorable weather conditions.

Management

- Field sanitation, removal of weed hosts of the virus and vectors.
- Grow disease tolerant cultivars like Pankhari203, BM66, BM68, Latisail, Ambemohar102, Kamod253, IR50 and Co45.

- Control the vectors in the nursery by application of Carbofuran 170 g/cent 10 days after sowing to control hoppers.
- Spray Phosphomidan 500 ml or Monocrotophos 1lit/ha (2 ml/litre) or Neem oil 3% or NSKE 5% to control the vector in the main field 15 and 30 days after transplanting.
- Set up light traps to monitor the vector population.

Rice Grassy stunt disease - *Rice grassy stunt tenuivirus*

Symptoms

Plants are markedly stunted with excessive tillering and an erect growth habit. Leaves become narrow, pale green with small rusty spots. May produce a few small panicles which bear dark brown unfilled grains.



Pathogen

Rice grassy stunt tenuivirus, flexuous, filamentous 950-1350nm long x 6nm wide, ssRNA genome

Disease Cycle

Disease spreads by the brown plant hopper, *Nilaparvata lugens*, in a persistent manner having a latent period of 5 to 28 days in the vector. Ratoon crop and presence of vector perpetuate the disease from one crop to other.

Rice dwarf – *Rice dwarf virus*

Symptoms

Infected plants show stunted growth, reduced tillering and root system. Leaves show chlorotic specks turning to streaks along the veins. In early stage of infection no ear heads formed.

Pathogen

- The virus is spherical, 70nm diameter with an envelope, dsRNA genome.

Disease Cycle

Spreads by leafhopper feeding by *Nephrotettix cincticeps*, *Recllia dorsalis* and *N. nigropictus* in a persistent manner. The transmission is transovarial through eggs. Gramineous

weeds *Echinochloa crusgalli* and *Panicum miliaceum* serve as source of inoculum.

Management

- Destroy weed host that serve as source of inoculum
- Spray Phosphamidon or Fenthion 500 ml or Monocrotophos 1 lit/ha.

Rice ragged stunt disease – *Rice ragged stunt virus*

Symptoms

- Formation of ragged leaves with irregular margins, vein swelling, enations on leaf veins may be formed.
- Stunting of plants, delayed flowering, production of nodal branches and incomplete emergence of panicles.



Pathogen

- Spherical virus (Figivirus), 65 nm diameter, dsRNA genome

Disease Cycle

Spreads through brown planthopper, *Nilaparvata lugens* transmitted in a persistent manner. Multiplies in the vector, latent period of 3 to 35 days, but not transmitted congenitally

Rice yellow dwarf disease – *Rice yellow dwarf virus*

Symptoms

Prominent stunting of plants and excessive tillering are the characteristic symptoms of the disease. Leaves yellowish green to whitish green, become soft and droop. Plants usually remain sterile but sometimes may produce small panicles with unfilled grains.



Pathogen

- Caused by a phytoplasma (rice yellow dwarf phytoplasma designated as a novel taxon,

'*Candidatus Phytoplasma oryzae*')

Disease Cycle

The disease is transmitted by leafhopper vectors *Nephrotettix sp.* *Nephrotettix* with a latent period of 25-30 days in the vector. The pathogen survives on several grass weeds.

Management

- Deep ploughing during summer months and burning of stubbles.
- Rice varieties IR62 and IR64 are moderately resistant to the disease.
- The management practices followed for Rice Tungro disease holds good for this disease also.

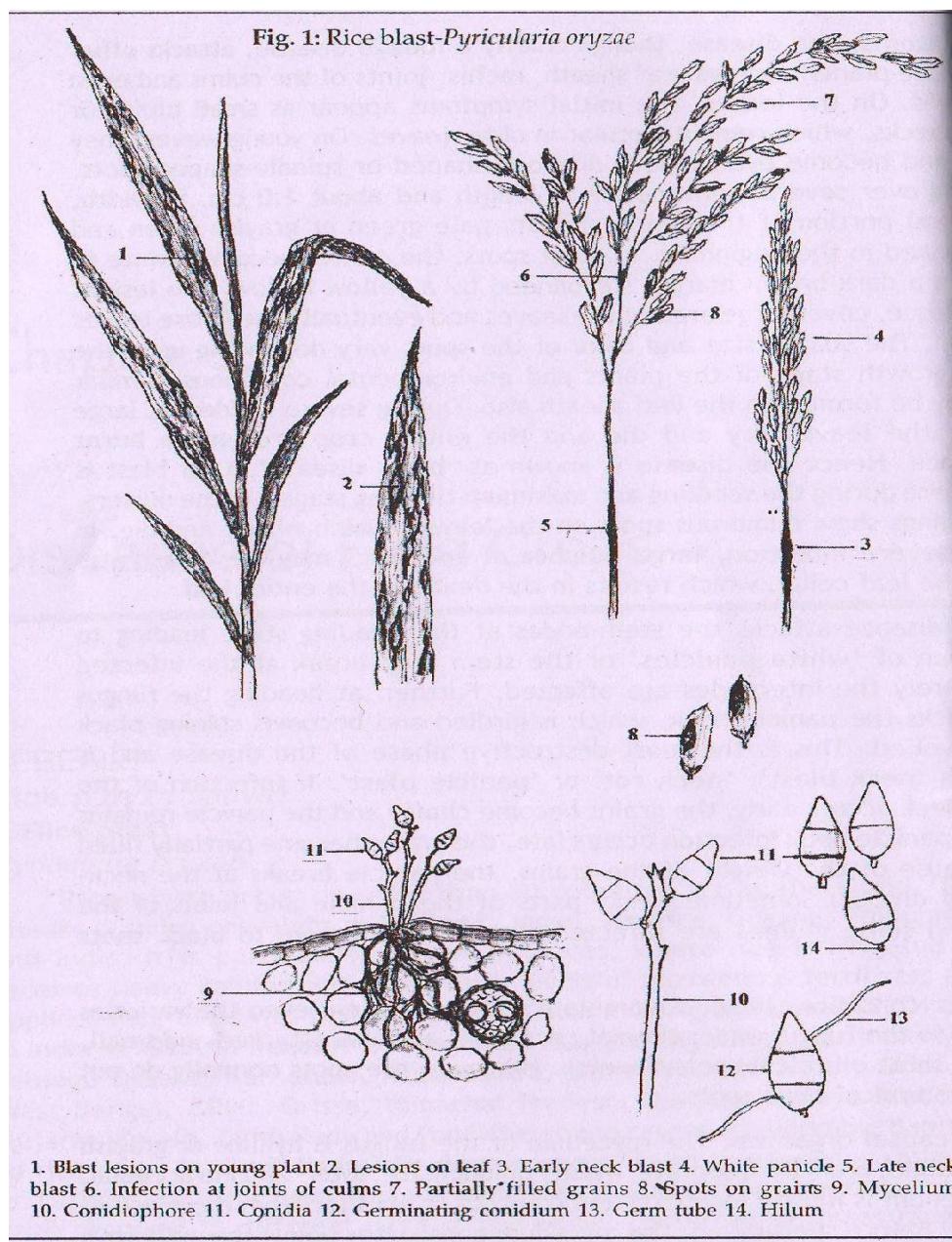
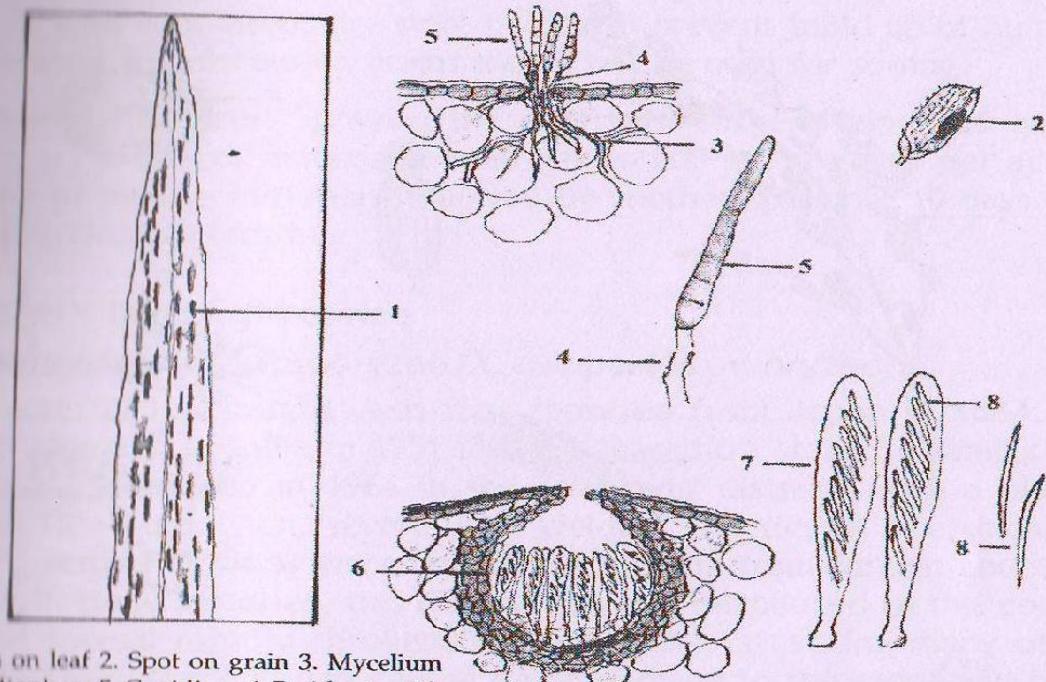
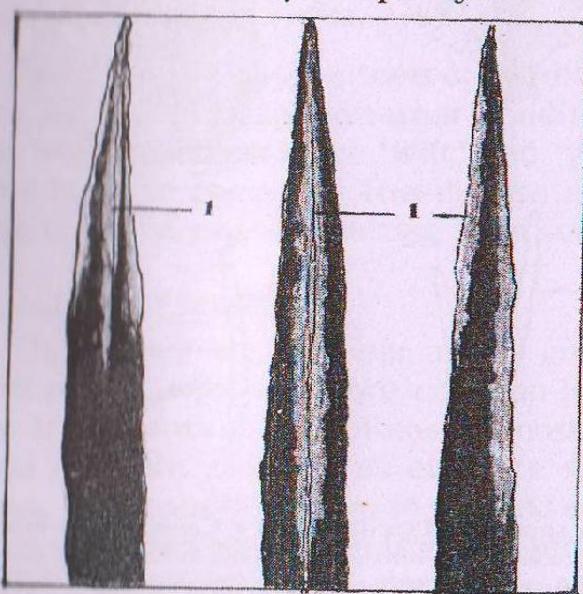


Fig. 6: Narrow brown leaf spot of rice-*Cercospora oryzae*



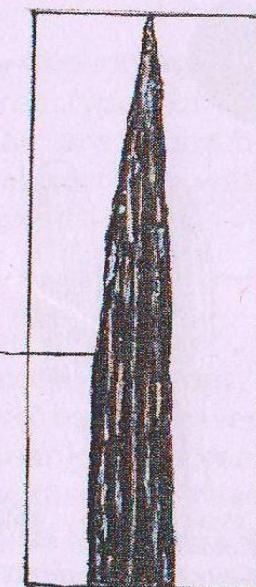
1. Spots on leaf 2. Spot on grain 3. Mycelium
4. Conidiophore 5. Conidium 6. Perithecia with
asci 7. Ascus 8. Ascospore

**Fig. 7: Bacterial leaf blight of rice
Xanthomonas campestris pv. *oryzae***



1. Blighted area on leaf

**Fig. 8: Bacterial leaf streak of rice
Xanthomonas translucens f.sp. *oryzicola***



1. Streaks on leaf

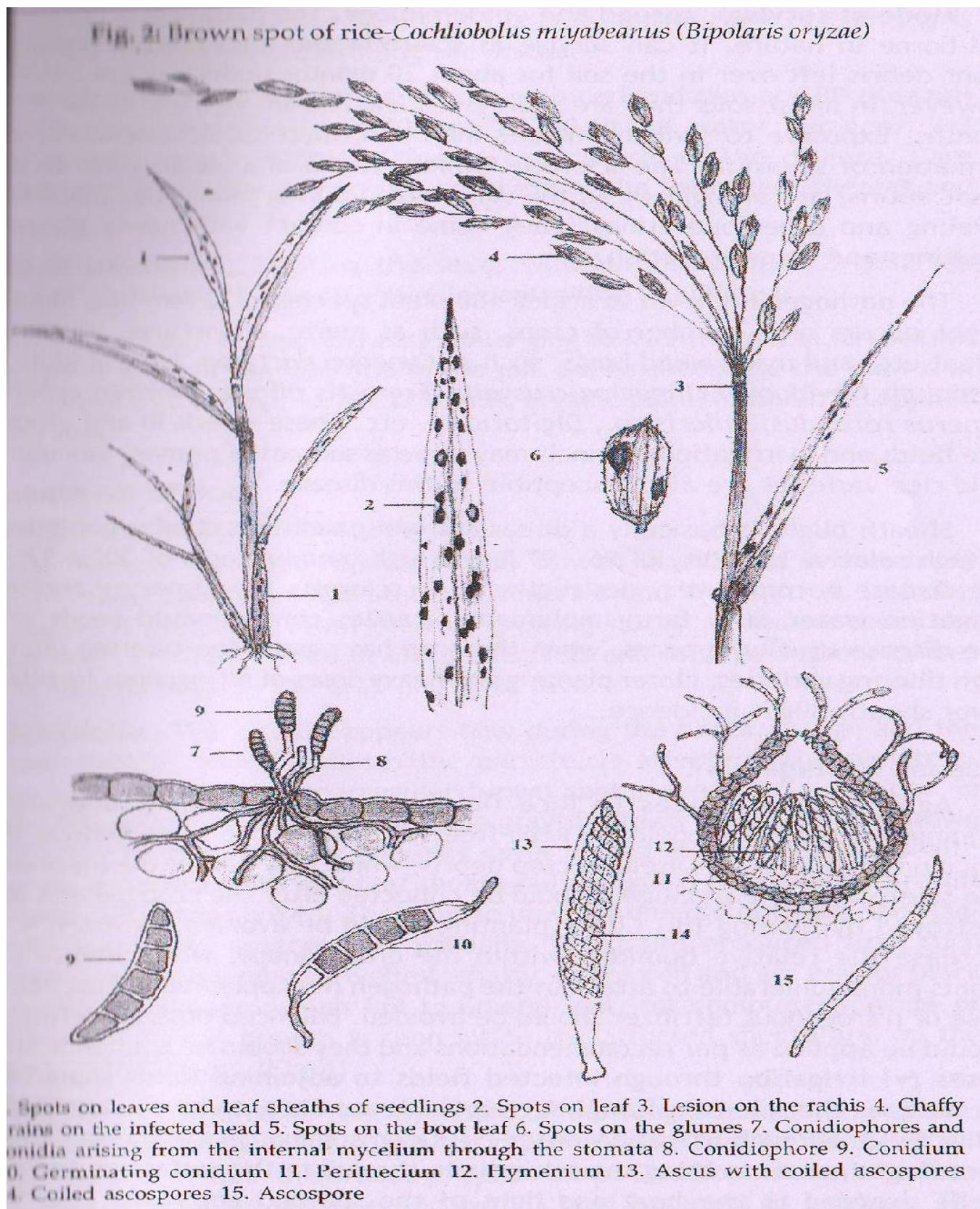
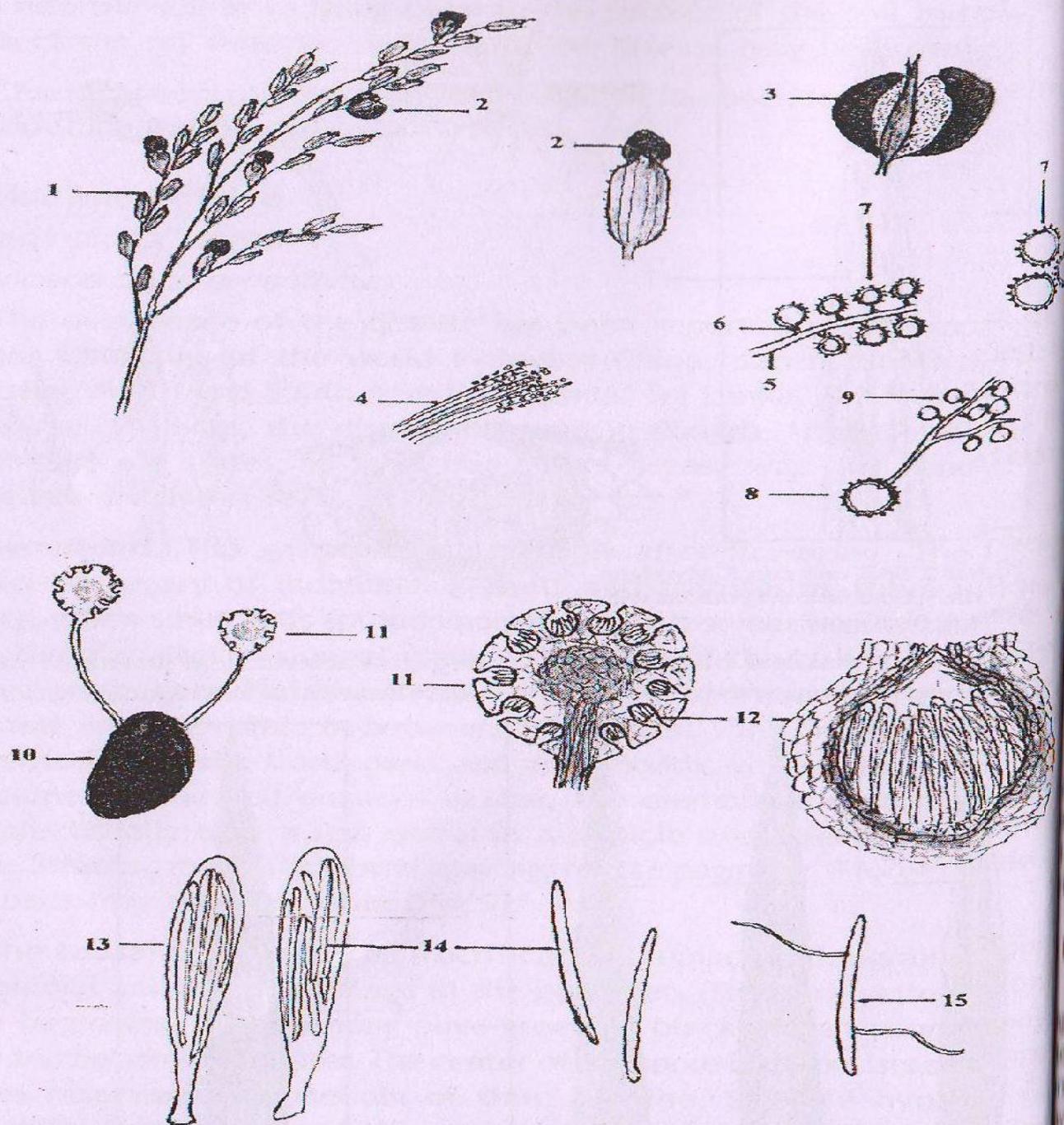


Fig. 9: False smut of rice-*Ustilaginoidea virens*



1. Infected panicle 2. Smut balls 3. Mature smut ball (Pseudomorph) 4. Conidiophore bearing conidia 5. Conidiophore 6. Sterigmata 7. Conidia 8. Germinating conidium 9. Secondary conidia 10. Germinating sclerotium 11. Perithecial head 12. Perithecium 13. Asci with ascospores 14. Ascospores 15. Germinating ascospore.

Fig. 3: Sheath blight of rice-*Rhizocionia solani*

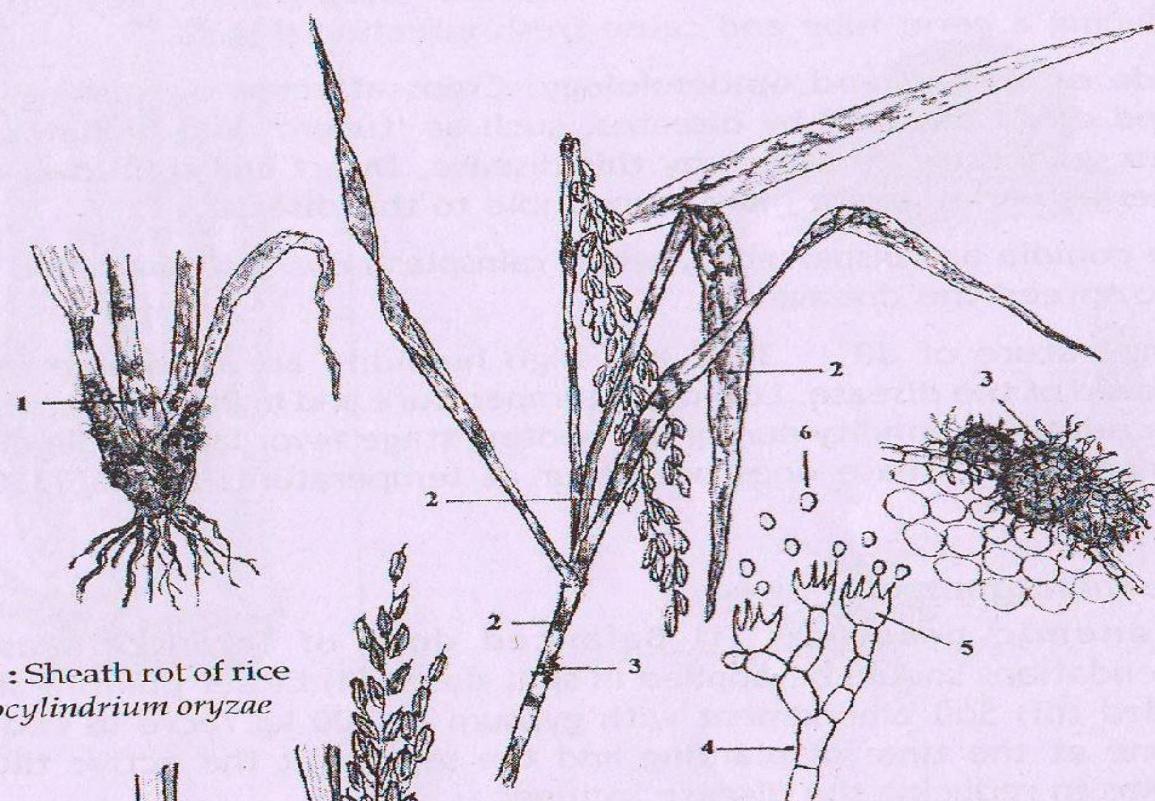


Fig. 4 : Sheath rot of rice
Acrocylindrium oryzae

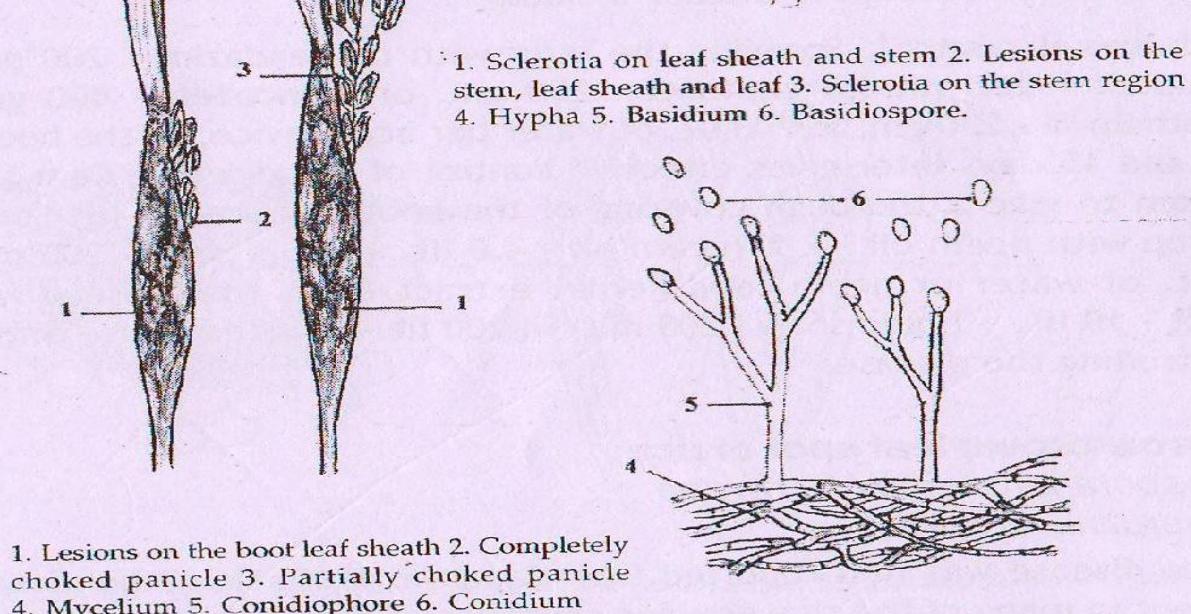
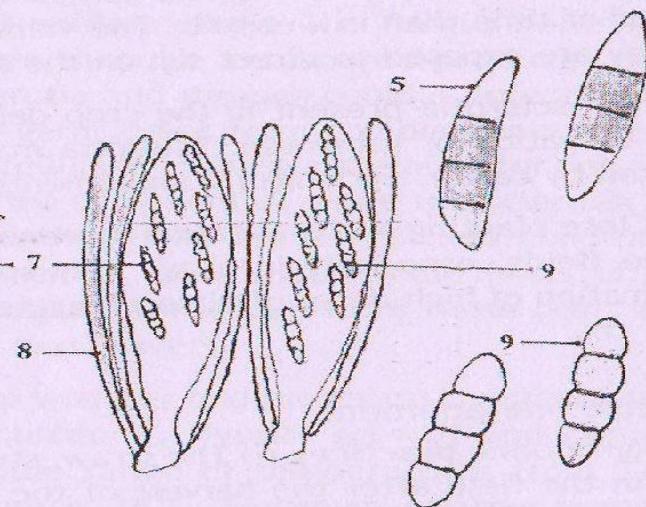
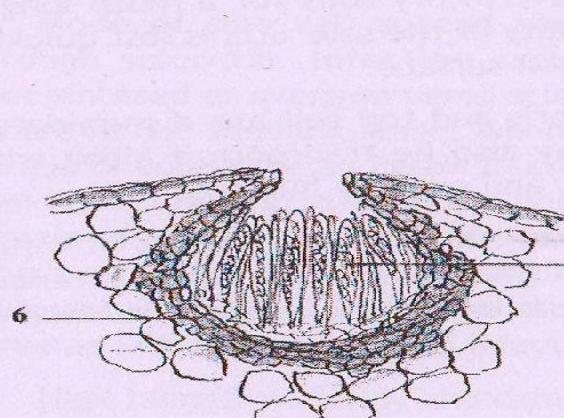
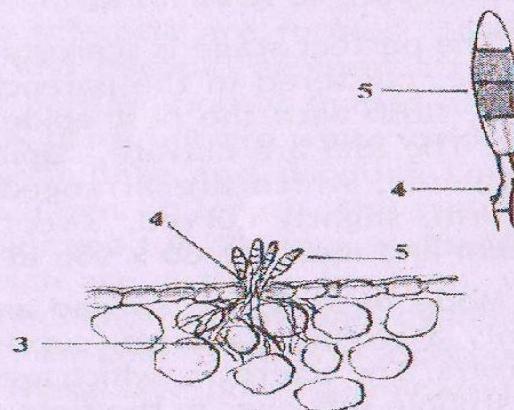
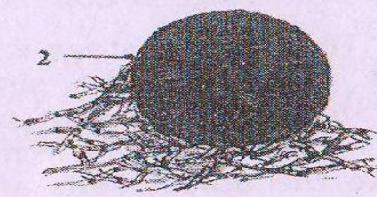
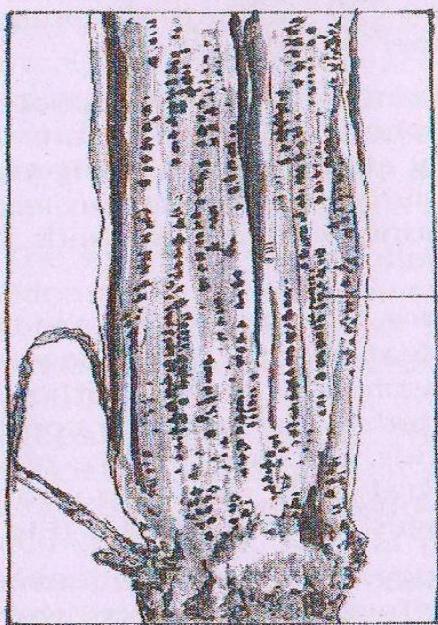


Fig. 5: Stem rot of rice-*Sclerotium oryzae*



1. Sclerotia inside the stem 2. Selerotium 3. Mycelium 4. Conidiophore 5. Conidium 6. Perithecioid
7. Ascii 8. Paraphysis 9. Ascospores

Diseases of Sorghum

Downy Mildew - *Peronosclerospora sorghi*

Symptoms

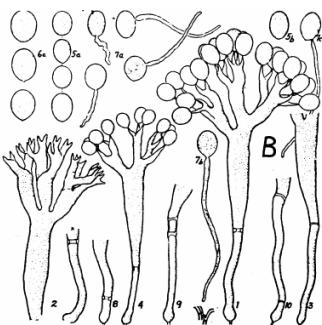
The fungus causes systemic downy mildew of sorghum. It invades the growing points of young plants, either through oospore or conidial infection. As the leaves unfold they exhibit green or yellow colouration. Abundant downy white growth is produced on the lower surface of the leaves, which consists of sporangiophores and sporangia.



Normally three or four leaves develop the chlorotic downy growth. Subsequent leaves show progressively more of a complete bleaching of the leaf tissue in streaks or stripes. As the infected bleached leaves mature they become necrotic and the interveinal tissues disintegrate, releasing the resting spores (oospores) and leaving the vascular bundles loosely connected to give the typical shredded leaf symptom.

Pathogen

P. sorghi is an obligate parasite systemic in young plant. The mycelium is intercellular, non-septate. Sporangiophores emerge through the stomata in single or in clusters which are stout and dichotomously branched. Spores are single celled, hyaline, globose and thin walled. Oospores are spherical, thick walled and deep brown in colour.



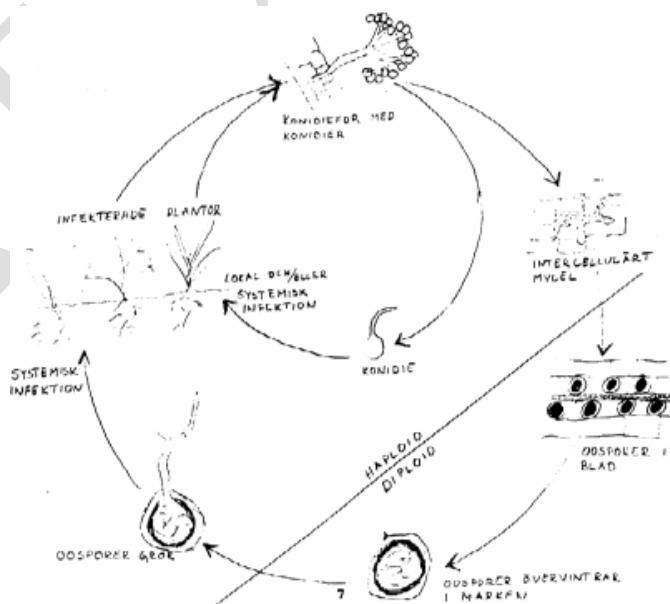
Sporangia and sporangiophores

Favourable Conditions

- Maximum sporulation takes place at 100 per cent relative humidity.
- Optimum temperature for sporulation is 21-23°C during night.
- Light drizzling accompanied by cool weather is highly favourable.

Disease Cycle

The primary infection is by means of oospores present in the soil which germinate and initiate the systemic infection. Oospores persist in the soil for several years. Secondary spread is by air-borne sporangia. Presence of mycelium of the fungus in the seeds of systemically infected plants is also a source of infection. The disease has been known to occur through a collateral host, *Heteropogen centortus* on which the fungus perpetuates of the host. The breakdown of tissue causes shredding. The oospores either fall to the soil or are wind blown, often within host tissue. They can remain viable in the soil for 5-10 years. Conidia are formed at night in large numbers. The optimum temperature for production is 20-23°C.



Management

- Crop rotation with other crops viz., pulses and oilseeds.
- Avoid the secondary spread of the disease by roguing out the infected plants since the wind plays a major role in the secondary spread of the disease.
- Grow moderately resistant varieties like Co25 and Co26.
- Seed treatment with Metalaxyl at 6 g/kg of seed.
- Spray Metalaxyl 500 g or Mancozeb 2 kg or Ziram 1 kg or Zineb 1kg/ha.

Leaf blight - *Exerohilum turcicum* (Syn: *Helminthosporium turcicum*)

Symptoms

The pathogen also causes seed rot and seedling blight of sorghum. The disease appears as small narrow elongated spots in the initial stage and in due course they extend along the length of the leaf. On older plants, the typical symptoms are long elliptical necrotic lesions, straw coloured in the centre with dark margins.



The straw coloured centre becomes darker during sporulation. The lesions can be several centimeters long and wide. Many lesions may develop and coalesce on the leaves, destroying large areas of leaf tissue, giving the crop a burnt appearance.

Pathogen

The mycelium is localised in the infected lesion. Conidiophores emerge through stomata and are simple, olivaceous, septate and geniculate. Conidia are olivaceous brown, 3-8 septate and thick walled.

Favourable Conditions

- Cool moist weather.
- High humidity (90 per cent)
- High rainfall.

Disease cycle

The pathogen is found to persist in the infected plant debris. Seed borne conidia are responsible for seedling infection. Secondary spread is through wind-borne conidia.

Management

- Use disease free seeds.
- Treat the seeds with Captan or Thiram at 4 g/kg.
- Spray Mancozeb 1.25 kg or Captafol 1 kg/ha.

Rectangular Leaf spot - *Cercospora sorghi*

Symptoms

The symptoms appear as small leaf spots which enlarge to become rectangular lesions (which can be 5-15 mm long by 2 to 5 mm wide) on the leaf and leaf sheath. Usually the lower leaves are first attacked. The lesions are typical dark red to purplish with lighter centers. The lesions are mostly isolated and limited by veins. The colour of the spots varies from red, purple, brown or dark depending upon the variety.

Pathogen

Mycelium of the fungus is hyaline and septate. Conidiophores emerge in clusters through stomata, which are brown and simple, rarely branched. Conidia are hyaline, thin walled, 2-13 celled and long obclavate.

Favourable Conditions

- Cool moist weather.
- High humidity (90 per cent)
- High rainfall.

Disease cycle

The conidia survive up to 5 months. The disease spreads through air-borne and seed-borne conidia.

Management

- Use disease free seeds.
- Treat the seed with Captan or Thiram at 4 g/kg.
- Spray Mancozeb 2 kg /ha.

Anthracnose and red rot - *Colletotrichum graminicolum*

Symptoms

The fungus causes both leaf spot (anthracnose) and stalk rot (red rot). The disease appears as small red coloured spots on both surfaces of the leaf. The centre of the spot is white in colour encircled by red, purple or brown margin.





Numerous small black dots like acervuli are seen on the white surface of the lesions. Red rot can be characterized externally by the development of circular cankers, particularly in the inflorescence. Infected stem when split open shows discoloration, which may be continuous over a large area or more generally discontinuous giving the stem a marbeled appearance.

Pathogen

The mycelium of the fungus is localised in the spot. Acervuli with setae arise through epidermis. Conidia are hyaline, single celled, vacuolate and falcate in shape.



Favourable Conditions

- Continuous rain.
- Temperature of 28-30°C.
- High humidity.

Disease cycle

The disease spread by means of seed-borne and air-borne conidia and also through the infected plant debris.

Management

- Treat the seeds with Captan or Thiram at 4 g/kg.
- Spray the crop with Mancozeb 2 kg/ha.

Rust - *Puccinia purpurea*

Symptoms

The fungus affects the crop at all stages of growth. The first symptoms are small flecks on the lower leaves (purple, tan or red depending upon the cultivar). Pustules (uredosori) appear

on both surfaces of leaf as purplish spots which rupture to release reddish powdery masses of uredospores. Teliopores develop later sometimes in the old uredosori or in telisori, which are darker and longer than the uredosori. The pustules may also occur on the leaf sheaths and on the stalks of inflorescence.



Pathogen

The uredospores are pedicellate, elliptical or oval, thin walled, echinulated and darkbrown in colour. The teliospores are reddish or brown in colour and two celled, rounded at the apex with one germ pore in each cell. The teliospores germinate and produce promycelium and basidiospores. Basidiospores infect *Oxalis corniculata* (alternate host) where pycnial and aecial stages arise.

Favourable Conditions

- Low temperature of 10 to 12°C favours teliospore germination.
- A spell of rainy weather favours the onset of the disease.

Disease cycle

The uredospores survive for a short time in soil and infected debris. Presence of alternate host helps in perpetuation of the fungus.

Management

- Remove the alternate host *Oxalis corniculata*.
- Spray the crop with Mancozeb at 2 kg/ha.

Grain smut/Kernel smut / Covered smut / Short smut - *Sphacelotheca sorghi*

Symptoms

The individual grains are replaced by smut sori. The sori are oval or cylindrical and are covered with a tough creamy skin (peridium) which often persists unbroken up to thrashing. Ratoon crops exhibit higher incidence of disease.



Loose smut/ kernel smut - *Sphacelotheca cruenta*

Symptoms

The affected plants can be detected before the ears come out. They are shorter than the healthy plants with thinner stalks and marked tillering. The ears come out much earlier than the healthy. The glumes are hypertrophied and the earhead gives a loose appearance than healthy. The sorus is covered by a thin membrane which ruptures very early, exposing the spores even as the head emerges from the sheath.



Long smut - *Tolyposporium ehrenbergii*

Symptoms

This disease is normally restricted to a relatively small proportion of the florets which are scattered on a head. The sori are long, more or less cylindrical, elongated, slightly curved with a relatively thick creamy-brown covering membrane (peridium). The peridium splits at the apex to release black mass of spores (spore in groups of balls) among which are found several dark brown filaments which represent the vascular bundles of the infected ovary.



Head smut - *Sphacelotheca reiliana*

Symptoms

The entire head is replaced by large **sori**. The sorus is covered by a whitish grey membrane of fungal tissue, which ruptures, before the head emerges from the boot leaf to expose a mass of brown smut spores. Spores are embedded in long, thin, dark colored filaments which are the vascular bundles of the infected head.



Symptoms

Management for all smuts

- Treat the seed with Captan or Thiram at 4 g/kg.
- Use disease free seeds.
- Follow crop rotation.
- Collect the smutted ear heads in cloth bags and bury in soil.

Ergot or Sugary disease - *Sphacelia sorghi*

Symptoms

The disease is confined to individual spikelets. The first symptom is the secretion of honey dew from infected florets. Under favourable conditions, long, straight or curved, cream to light brown, hard sclerotia develop. Often the honey dew is colonised by *Crerebella sorghivulgaris* which gives the head a blackened appearance.



Pathogen

The fungus produces septate mycelium. The honey dew is a concentrated suspension of conidia, which are single celled, hyaline, elliptic or oblong.

Favourable Conditions

- A period of high rainfall and high humidity during flowering season.
- Cool night temperature and cloudy weather aggravate the disease.

Disease Cycle

The primary source of infection is through the germination of sclerotia which release ascospores that infect the ovary. The secondary spread takes place through air and insect-borne conidia. Rain splashes also help in spreading the disease.

Management

- Adjust the date of sowing so that the crop does not flower during September- October when high rainfall and high humidity favor the disease.
- Spray any one of the following fungicides viz., Mancozeb 2 kg/ha (or) Carbendazim at 500 g/ha at emergence of ear head (5-10 per cent flowering stage) followed by a spray at

50 per cent flowering and repeat the spray after a week, if necessary.

Head mould/Grain mould/Head blight

More than thirty two genera of fungi were found to occur on the grains of sorghum.

Symptoms

If rains occur during the flowering and grain filling stages, severe grain moulding occurs.

The most frequently occurring genera are *Fusarium*, *Curvularia*, *Alternaria*, *Aspergillus* and *Phoma*. *Fusarium semitectum* and *F.moniliforme* develop a fluffy white or pinkish coloration. *C. lunata* colours the grain black. Symptom varies depending upon the organism involved and the degree of infection.



Favourable Conditions

- Wet weather following the flowering favors grain mould development.
- The longer the wet period the greater the mould development.
- Compact ear heads are highly susceptible.

Disease cycle

The fungi mainly spread through air-borne conidia. The fungi survive as parasites as well as saprophytes in the infected plant debris.

Management

- Adjust the sowing time.
- 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.

Phanerogamic parasite - *Striga asiatica* and *Striga densiflora*

It is a partial root parasite and occurs mainly in the rainfed sorghum. It is a small plant with bright green leaves, grows up to a height of 15-30 cm. The plants occur in clusters of 10-20/host plant. *S. asiatica* produces red to pink flowers while. *S. densiflora* produces white

flowers. Each fruit contains minute seeds in abundance which survives in the soil for several years.

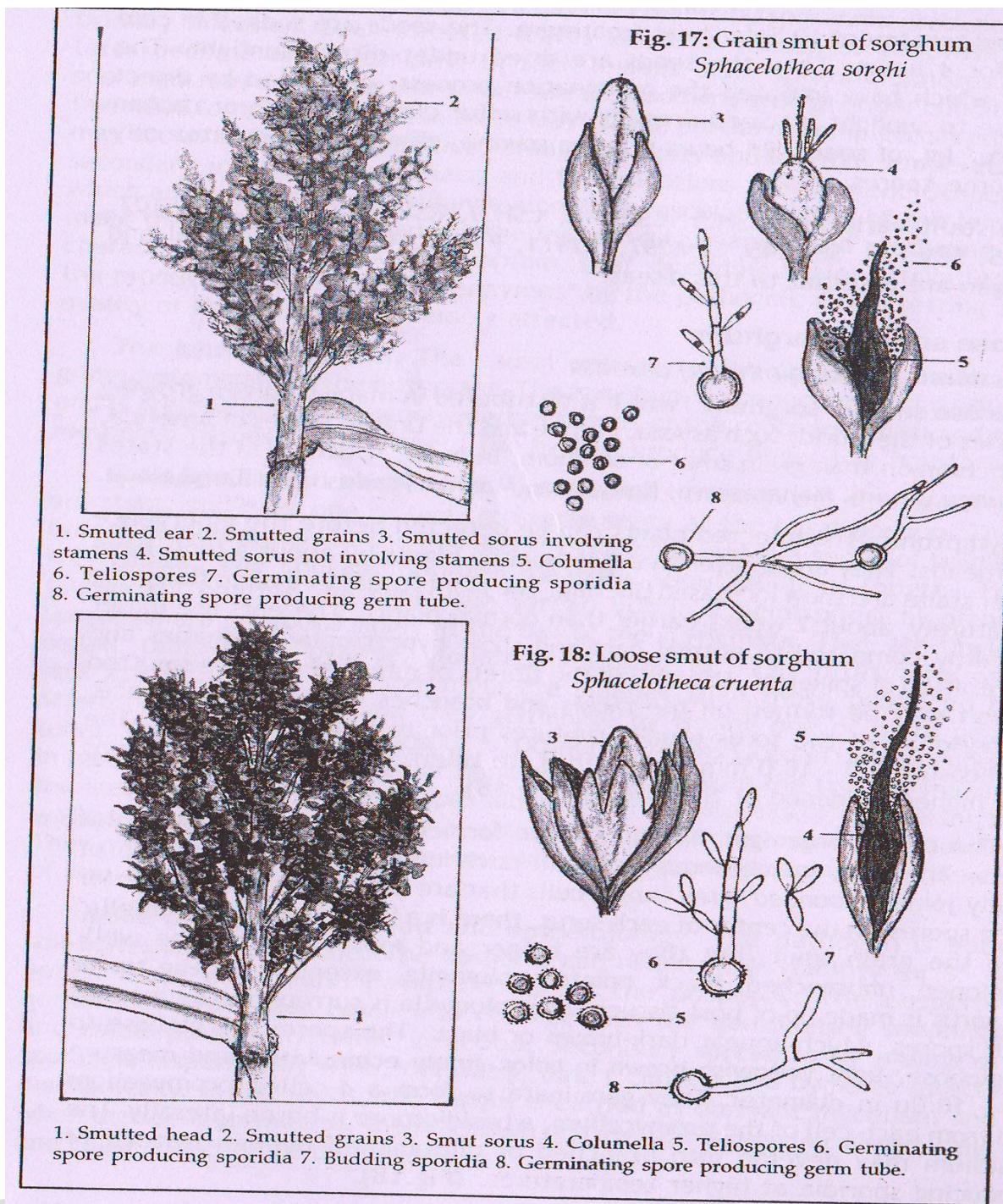
The root exudates of sorghum stimulate the seeds of the parasite to germinate. The parasite then slowly attaches to the root of the host by haustoria and grows below the soil surface producing underground stems and roots for about 1-2 months. The parasite grows faster and appears at the base of the plant. Severe infestation causes yellowing and wilting of the host leaves. The infected plants are stunted in growth and may die prior to seed setting.

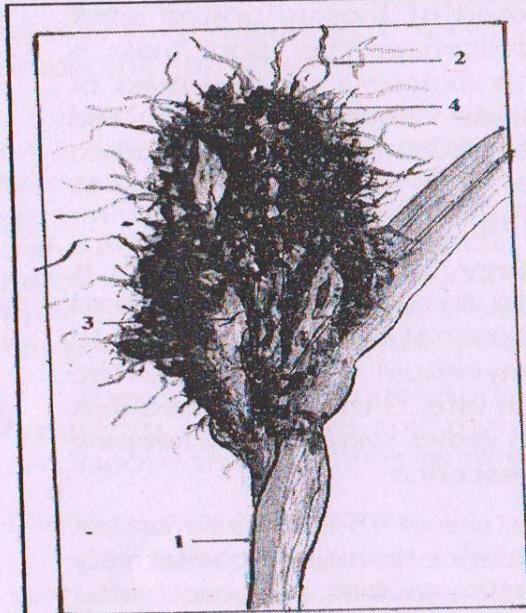
Management

- Regular weeding and intercultural operation during early stages of parasite growth.
- Spray Fernozone (sodium salt of 2, 4-D) at 450g /500 litre of water.

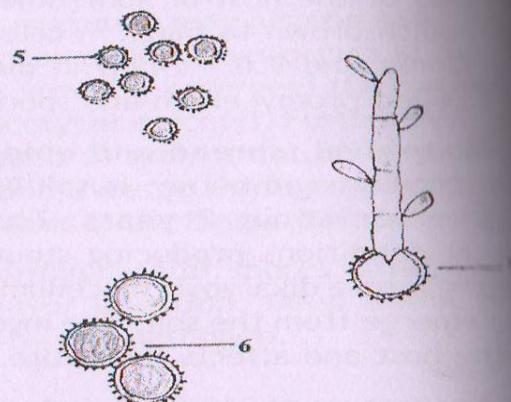
Different between different smuts of sorghum

Characters	Grain smut	Loose smut	Head smut	Long smut
Pathogen	<i>Sphacelotheca sorghi</i>	<i>Sphacelotheca cruenta</i>	<i>Sphacelotheca reiliana</i>	<i>Tolysporium ehrenbergii</i>
Host	Stunted Heading premature	Not stunted Heading normal	Not stunted Heading premature	Not stunted Heading normal
Ear infection	All or most grains smutted	All or most grains smutted	The entire inflorescence is converted into a big sorus	Very few grains are infected
Site	Ovary	Ovary	inflorescence	Ovary
Sori	Small	Small	Very large	Long
Membrane	Rather tough and persists	Ruptures easily	Ruptures easily	Relatively thick membrane
Columella	Short columella present	Long columella present	Columella absent, but network of vascular tissues present	Columella absent, but 8-10 vascular strands present
Spores	6-7µm, spore surface apparently smooth	7-8µm, minutely echinulate	10-15µm spore balls, free surface papillate	9-14µm, spore conspicuously echinulate
Viability of spores	More than 10 years	4 years	2 years	2 years
Spread	Externally seed borne	Externally seed borne	Air -borne	Soil and seed borne

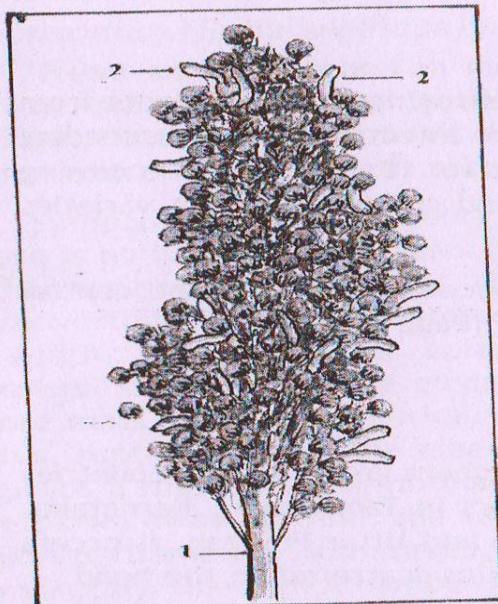




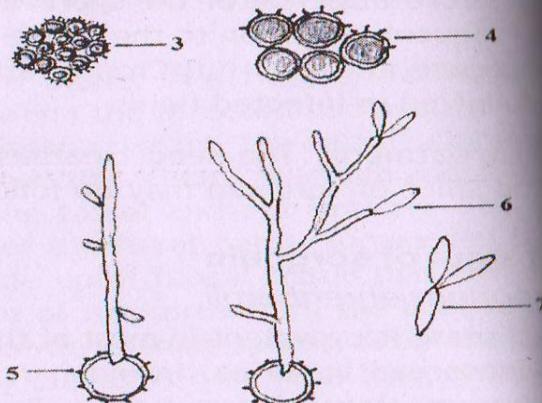
**Fig. 19: Head smut of sorghum
*Sphacelotheca reiliana***



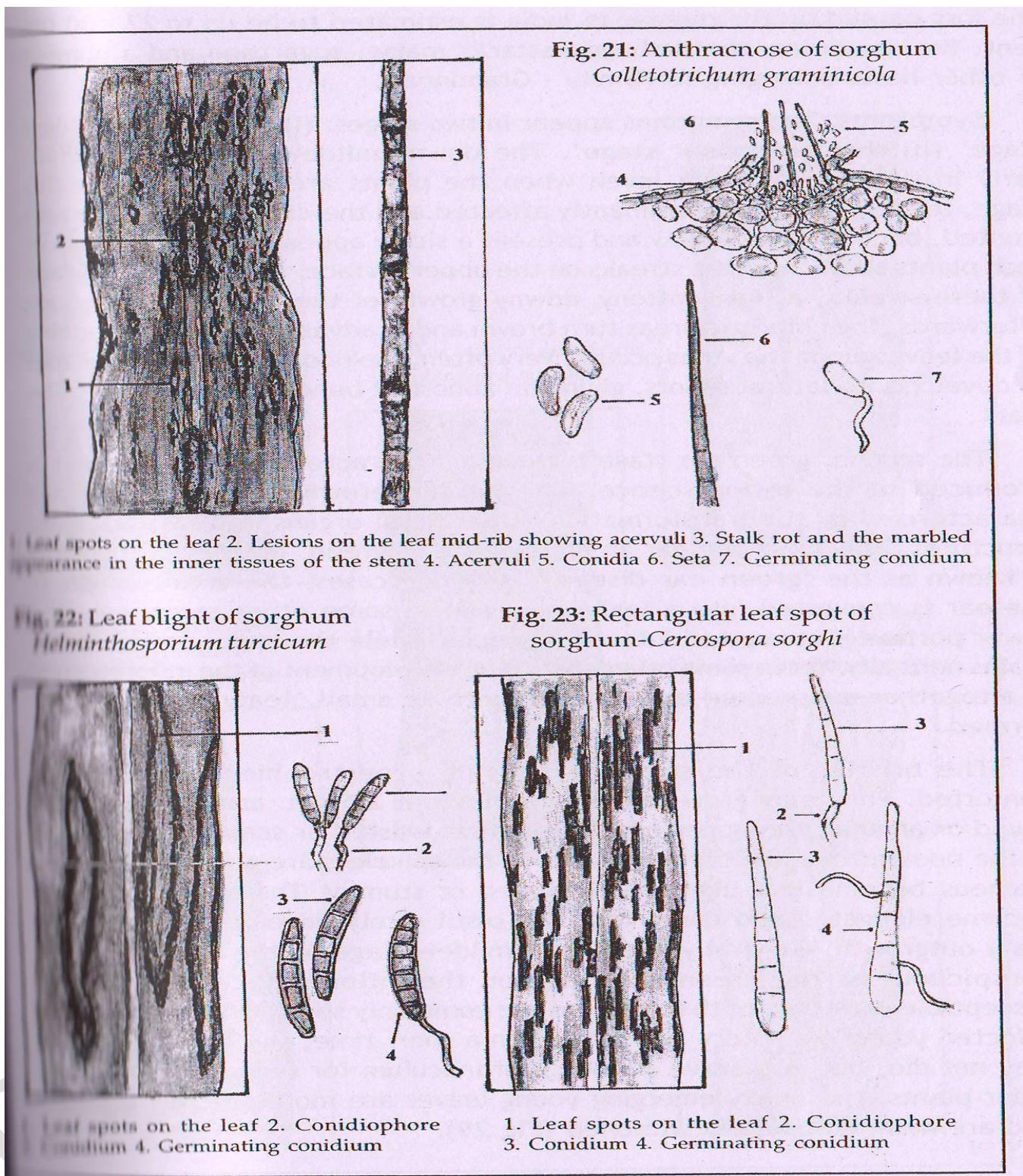
1. Smuttied head
2. Vascular strands of the inflorescence
3. Pieces of the ruptured peridium
4. Spore masses
5. Spores
6. Spores showing fine echinulations
7. Germinating spore producing sporidia.

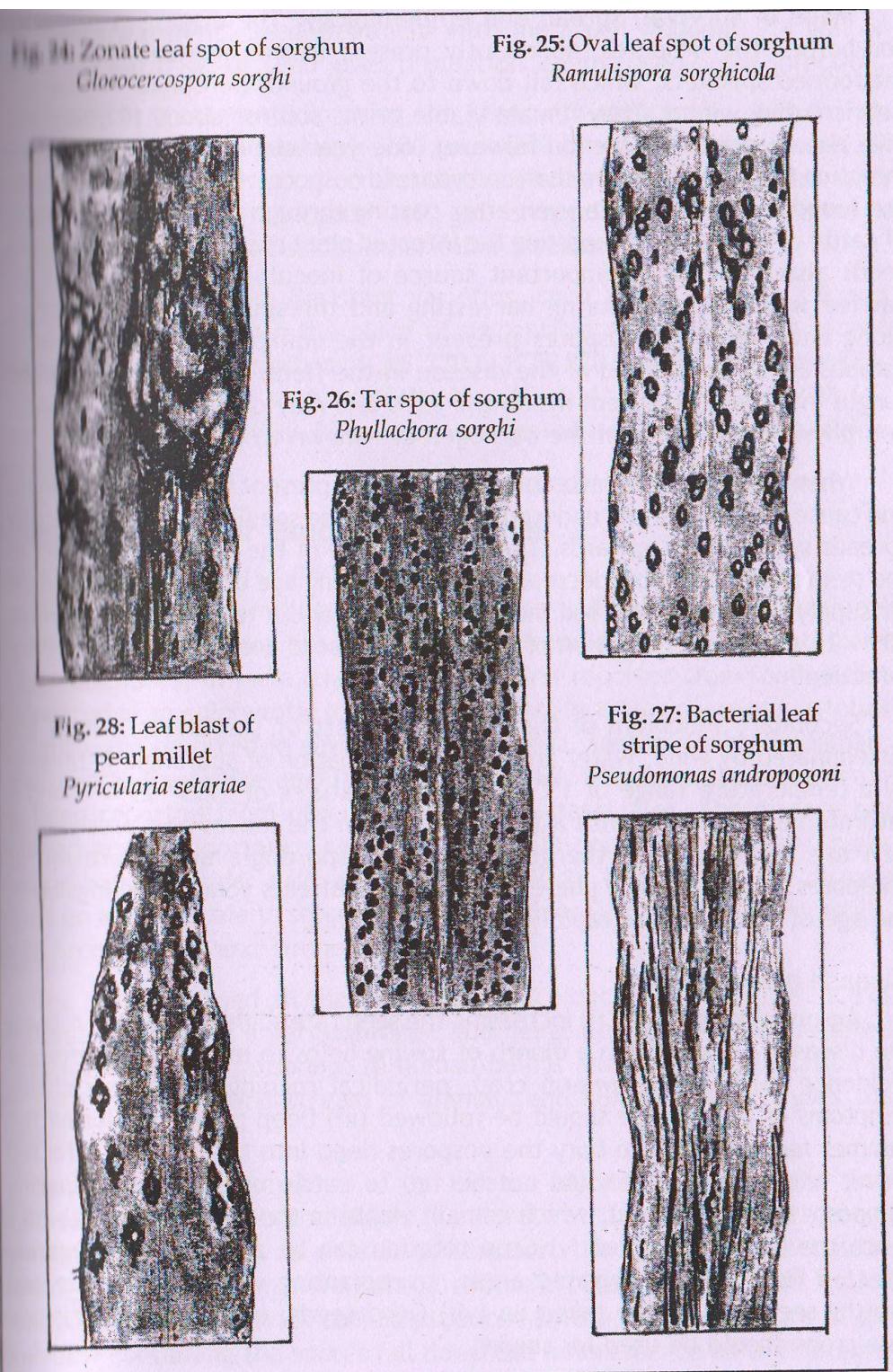


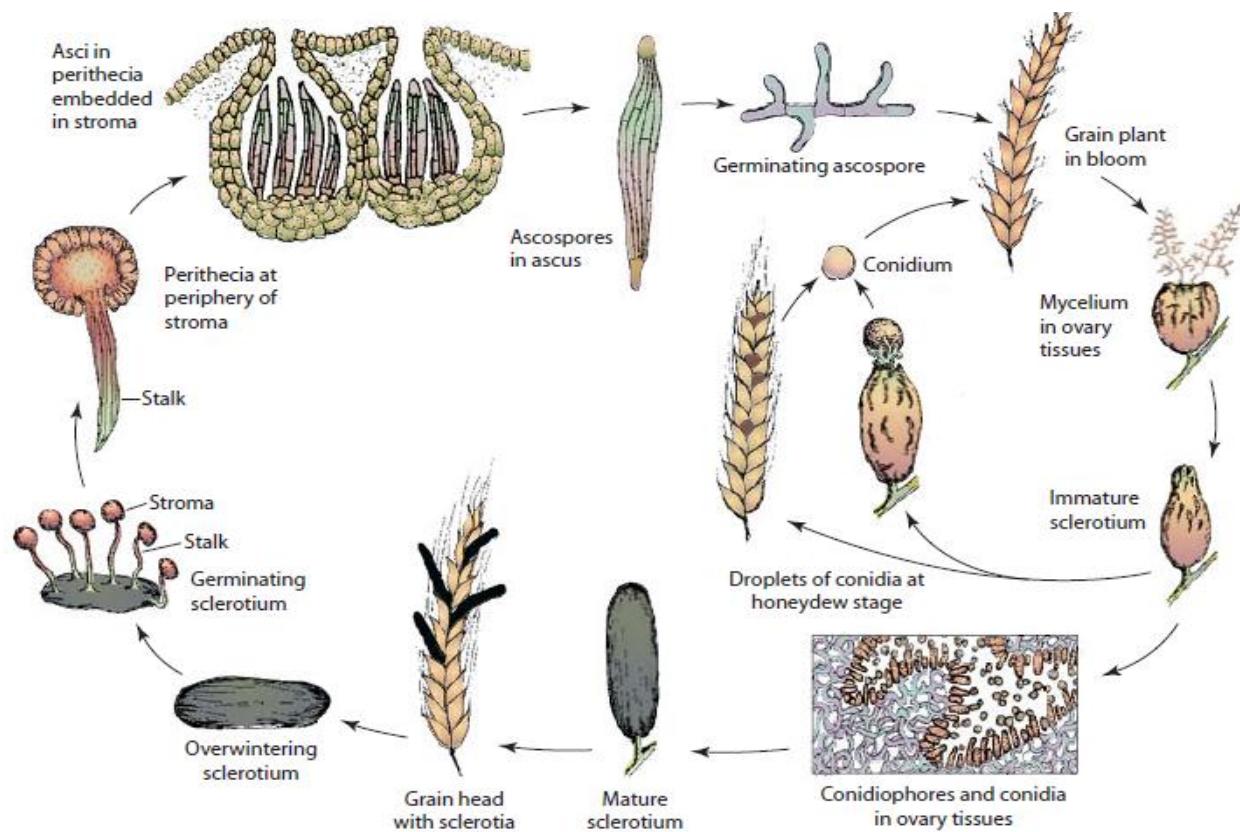
**Fig. 20: Long smut of sorghum
*Tolyposporium chrenbergii***



1. Smuttied ear
2. Smuttied grains
3. Spore ball
4. Spores on the surface of the spore ball showing echinulations
5. Germinating spore
6. Germinating spore producing sporidia
7. Budding sporidia







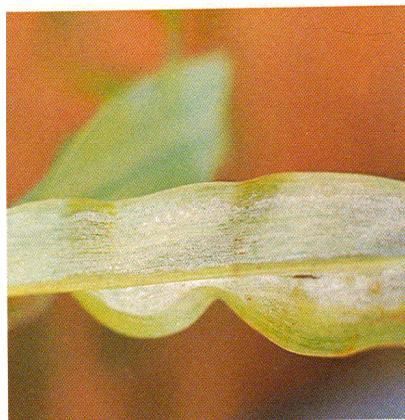
Disease cycle of ergot of grains caused by *Claviceps purpurea*

Diseases of Pearl millet

Downy mildew - *Sclerospora graminicola*

Symptoms

Infection is mainly systemic and symptoms appear on leaves and inflorescence. The initial symptoms appear in seedlings at three to four leaf stages. The affected leaves show patches of light green to light yellow colour on the upper surface and the corresponding lower surface bears white downy growth of the fungus consisting of sporangiophores and sporangia. The yellow discolouration often turns to streaks along veins. As a result of infection young plants dry and die ultimately. Symptoms may appear first on the upper leaves of the main shoot or the main shoot may be symptom free and symptoms appear on tillers or on the lateral shoots.



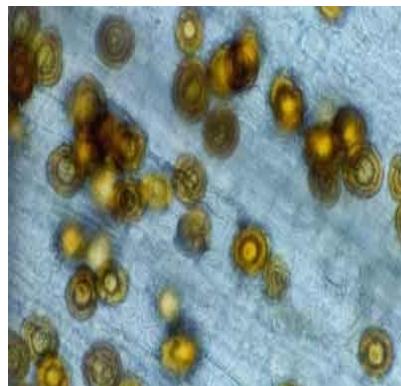
The inflorescence of infected plants gets completely or partially malformed with florets converted into leafy structures, giving the typical symptom of **green ear**.

Infected leaves and inflorescences produce sporangia over a considerable period of time under humid conditions and necrosis begins. The dry necrotic tissues contain masses of oospores.



Pathogen

The mycelium is systemic, non septae and intercellular. Short, stout, hyaline sporangiophores arise through stomata and branch irregularly, with stalks bearing sporangia. Sporangia are hyaline, thin walled, elliptical and bear prominent papilla. Oospores are round in shape, surrounded by a smooth, thick and yellowish brown wall.



Oospores

Favourable Conditions

- Very high humidity (90%).
- Presence of water on the leaves
- Low temperature of 15-25°C favor the formation of sporangiophore and sporangia.

Disease cycle

The oospores remain viable in soil for 5 years or longer giving rise to the primary infection on seedlings. Secondary spread is through sporangia produced during rainy season. The dormant mycelium of the fungus is present in embryo of infected seeds.

Management

- Deep ploughing to bury the oospores.
- Roguing out infected plants.
- Adopt crop rotation.
- Grow resistant varieties WCC-75, Co7 and Co (Cu)9.
- Treat the seeds with Metalaxyl at 6g/kg.
- Spray Mancozeb 2 kg or Metalaxyl + Mancozeb at 1 kg/ha on 20th day after sowing in the field.

Smut - *Tolyposporium penicillariae*

Symptoms



The pathogen infects few florets and transforms them into plump sori containing smut spores. The sori are larger than normal healthy grains and when the sori mature they become dark brown releasing millions of black smut spore balls.

Pathogen

The fungus is mostly confined to the sorus. The sori contain spores in groups and are not easy to separate. Each spore is angular or round and light brown.

Favourable Conditions

- High relative humidity.
- Successive cropping with pearl millet.

Disease cycle

- The pathogen survives as spore balls in the soil and serves as primary source of inoculum. Secondary spread is by air-borne conidia.

Management

- The damage caused by the fungus is negligible.
- Removal and destruction of affected ear head will help in controlling the disease.

Rust - *Puccinia pennisetii*

Symptoms

Symptoms first appear mostly on the distal half of the lamina. The leaf soon becomes covered by uredosori which appear more on the upper surface. The pustules may be formed on leaf sheath, stem and on peduncles. Later, telial formation takes place on leaf blade, leaf sheath and stem. While brownish uredia are exposed at maturity, the black telia remain covered by the epidermis for a longer duration.



Pathogen

Uredospores are oval, elliptic, sparsely echinulated and pedicellate. Teliospores are dark brown in colour, two celled, cylindrical to club shaped, apex flattened, broad at top and tapering towards base. The fungus is macrocyclic producing uredial and telial stages on pearl millet and aecial and pycnial stages on brinjal.

Favourable Conditions

- Closer spacing.
- Presence of abundant brinjal plants and other species of *Solanum* viz., *S.torvum*, *S.xanthocarpum* and *S.pubescens*.

Disease cycle

Air-borne uredospores are the primary sources. The uredial stages also occur on several species of *Pennisetum*, which helps in secondary spread of the pathogen.

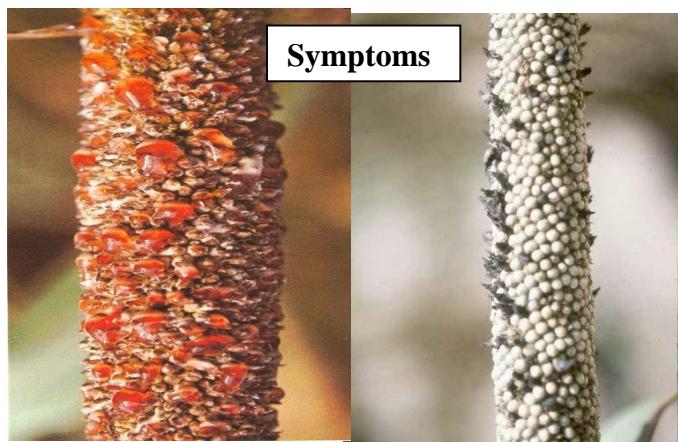
Management

Spray with Wettable Sulphur 3 kg or Mancozeb 2 kg/ha.

Ergot or Sugary disease - *Claviceps fusiformis*

Symptoms

The symptom is seen by exudation of small droplets of light pinkish or brownish honey dew from the infected spikelets. Under severe infection many such spikelets exude plenty of honey dew which trickles along the earhead. This attracts several insects. In the later stages, the infected ovary turns into small dark brown sclerotium which projects out of the spikelet.



Pathogen

The pathogen produces septate mycelium which produces conidiophores and is closely arranged. Conidia are hyaline and one celled. The sclerotia are small (3-8mm x 0.3-15mm) and dark grey but white inside.

Disease cycle

Sclerotia are viable in soil for 6-8 months. The primary infection takes place by germinating sclerotia present in the soil. Secondary spread is by insects or airborne conidia. The role of collateral hosts like *Cenchrus ciliaris* and *C. setigerus* in perpetuation of fungus is significant. The fungus also infects other species of *Pennisetum*.

Management

- Adjust the sowing date so that the crop does not flower during September when high rainfall and high relative humidity favour the disease spread.

- Immerse the seeds in 10 per cent common salt solution and remove the floating sclerotia.
- Remove collateral hosts.
- Spray with Carbendazim 500g or Mancozeb 2 kg or Ziram 1kg/ha when 5-10 per cent flowers have opened and again at 50 per cent flowering stage.

Minor diseases

Grain mould - Fungal complex

Grains covered with white, pink or black moulds.

Blast - *Pyricularia setariae*

Diamond shaped to circular lesions with dark brown margins and chlorotic haloes.

Zonate leaf spot - *Gloeocercospora* sp.

Rough circular lesions with alternating concentric bands of straw and brown colour, often coalescing over the leaf surface.

Banded leaf spot - *Rhizoctonia* spp.

Patch of light and dark, discoloured areas and often bearing fluffy to light brown fungal mats.

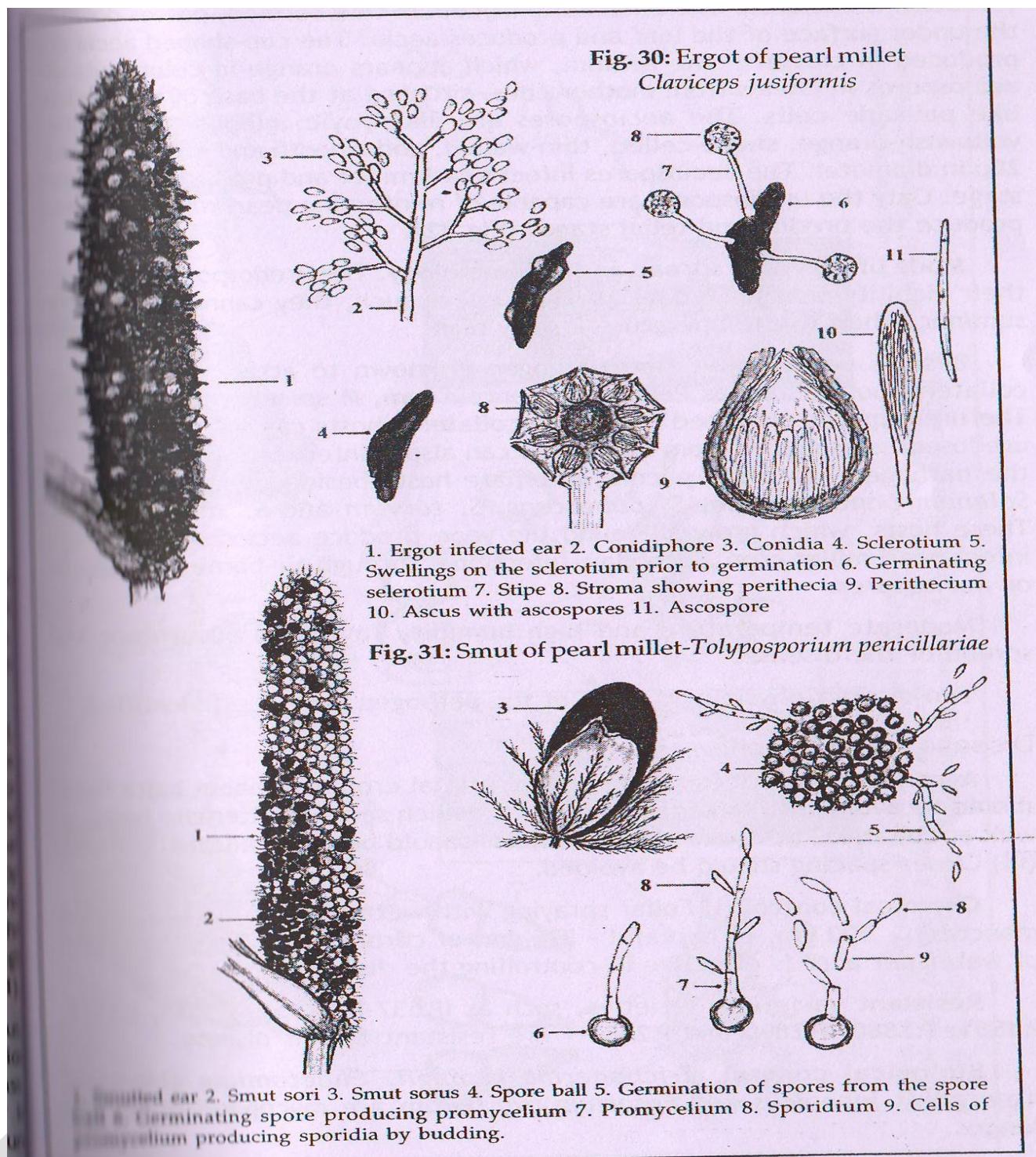
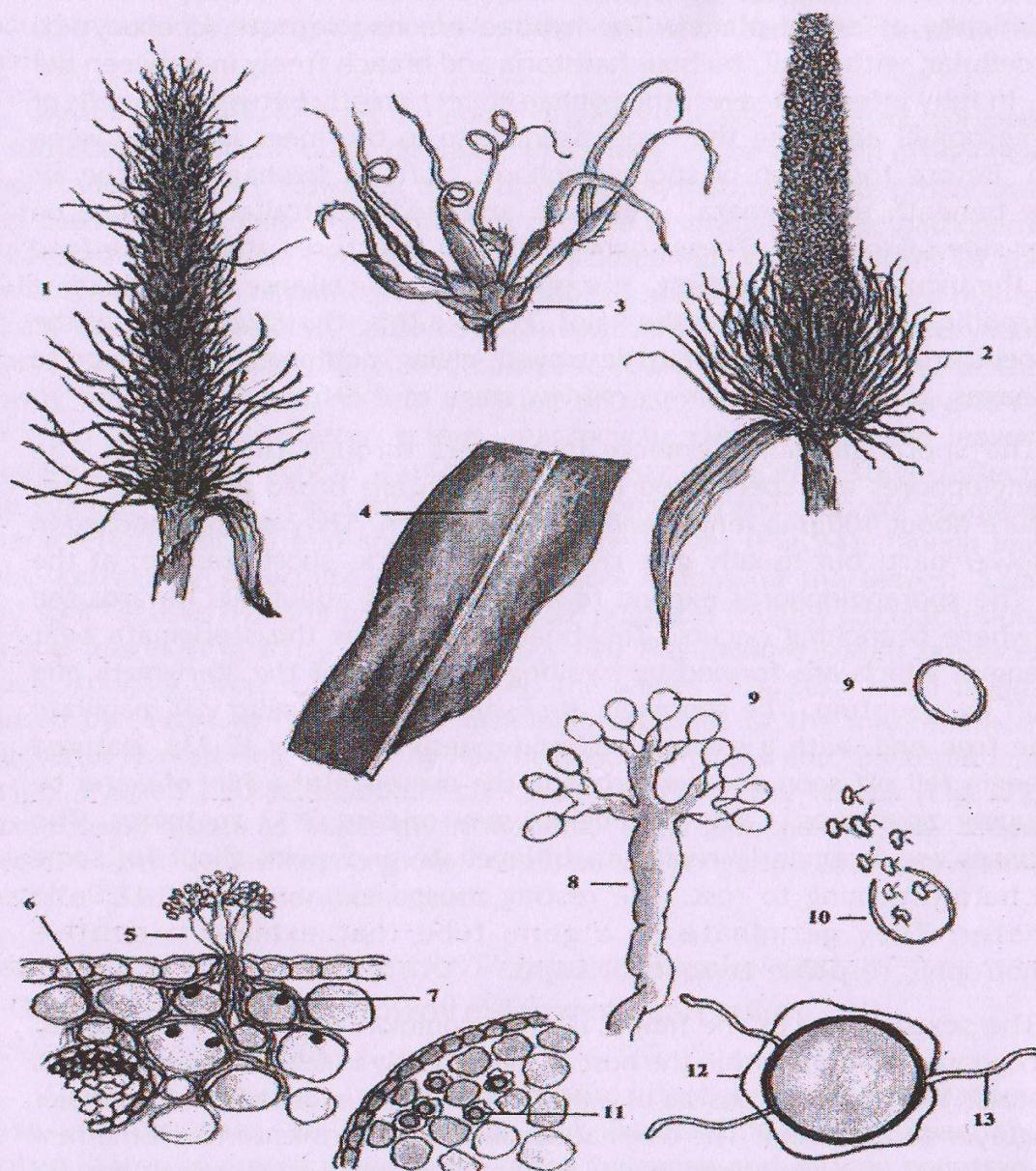
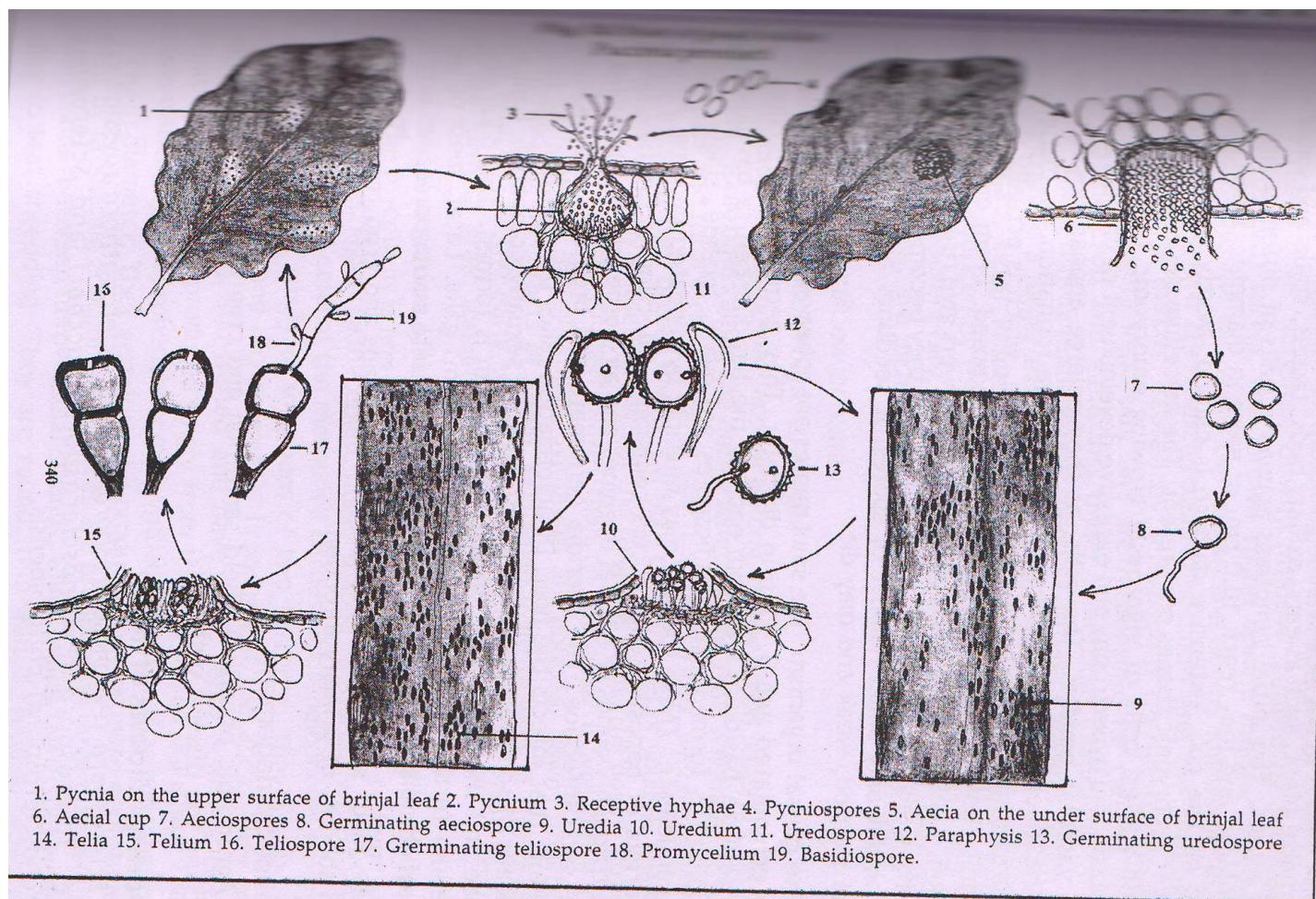


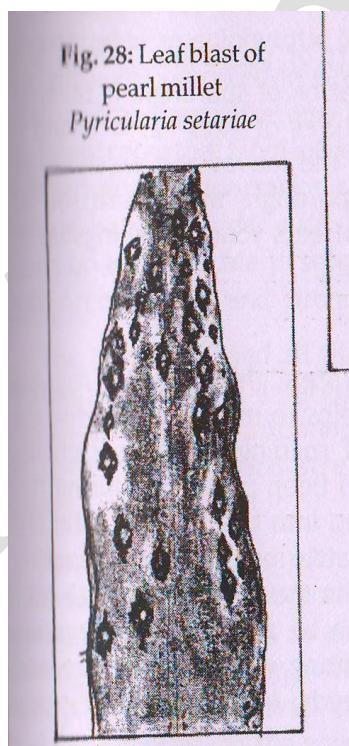
Fig. 29: Green ear disease of pearl millet-*Scierospora graminicola*



1. Entire ear converted into a leafy mass 2. Lower part of the ear alone converted into a leafy mass
3. Hypertrophied floret 4. Downy growth of the fungus on the under surface of leaf 5. Sporangiophores emerging through the stomata 6. Intercellular mycelium 7. Haustoria 8. Sporangiophore with sporangia 9. Sporangium 10. Germinating sporangium releasing zoospores 11. Oospores inside the malformed part of floret 12. Germinating oospore 13. Germ tube.



1. Pycnia on the upper surface of brinjal leaf 2. Pycnium 3. Receptive hyphae 4. Pycniospores 5. Aecia on the under surface of brinjal leaf
6. Aecial cup 7. Aeciospores 8. Germinating aeciospore 9. Uredia 10. Uredospore 11. Uredospore 12. Paraphysis 13. Germinating uredospore
14. Telia 15. Telium 16. Teliospore 17. Germinating teliospore 18. Promycelium 19. Basidiospore.



Diseases of Ragi / Finger millet (*Eleusine coracana*)

Blast

Pyricularia grisea

Economic importance

It is the most important disease on ragi. It causes heavy damage to the crop under favourable environmental conditions. In **Chittoor** district of A.P, it is more or less endemic. Yield loss may range from 50 to 90%.

Symptoms

Infection may occur at all stages of plant growth. Young seedlings may be blasted or blighted in the nursery bed as well as developing young plants in the main field. There are three stages in disease development.

Leaf blast: It is more severe in tillering phase. The disease is characterized by spindle shaped spots on the leaves with gray centres surrounded by reddish brown margins.

Node blast: Infection on stem causes blackening of the nodal region and the nodes break at the point of infection. All the parts above the infected node die.

Neck blast: At flowering stage, the neck just below the earhead is affected and turns sooty black in colour and usually breaks at this point. In early neck infections, the entire earhead becomes chaffy and there is no rain set at all. If grain setting occurs, they are shrivelled and reduced in size.



Pathogen

Young hyphae are hyaline and septate and turns to brown when become old. Numerous conidiophores and conidia are formed in the middle portion of the lesions. Conidiophores are slender, thin walled, emerging singly or in groups, unbranched, and pale brown in colour.

Conidia are thin walled, sub-pyriform, hyaline 1-2 septate, mostly 3 celled with a prominent hilum.

Disease cycle

The fungus is seed-borne and the primary infection takes place through the seed-borne conidia and also through diseased plants, stubbles and weeds. The secondary spread is through air-borne conidia.

Favourable Conditions

Application of high doses of nitrogenous fertilizers, low night (20^0C) and day (30^0C) temperatures with high relative humidity (92-95%) and rain or continuous drizzles favour the disease development. Presence of collateral hosts like bajra, wheat, barley and oats.

Management

- Destruction of collateral hosts and infected plant debris
- Treat the seeds with Captan or Thiram@3g/kg or Carbendazim at 2 g/kg.
- Grow resistant varieties like Ratnagiri, Padmavati, Gowtami and Godavari
- Spray with Carbendazim@0.2% or Iprobenphos (IBP)@0.1% or Edifenphos@0.1%, first spray immediately after symptom appearance and second spray at flowering stage.

Smut

Melanopsichium eleusinii

Economic importance

The disease is of minor importance being found only in certain places of Karnataka and Maharashtra.

Symptoms

Disease appears mostly during kharif at grain setting stage. Only few scattered grains in a head are attacked and transformed into globose galls of 5-15 mm diameter, greenish at first and turning black at maturity. The sorus ruptures releasing black mass of spores.



Pathogen

The fungus is mostly confined to the spikelets, being present in the form of hyphae with thickened cells or **chlamydospores**. The spores are globose with a rough, spiny or pitted spore wall. They measure 7-11 μ in diameter and readily germinate in water producing **sporidia** on septate promycelium.

Disease cycle

The disease is mainly air borne, infecting only few spikelets in the panicle. The spores are released from the sac while on the panicle or they may reach the soil subsequent to harvest. During the following season the spores germinate to produce masses of sporidia which become air borne and infect spikelets.

Management

- Crop rotation
- Rouging and destruction of affected earheads reduces smut incidence.
- Grow resistant varieties

Diseases of Maize

Downy mildew/Crazy top

Sorghum downy mildew:	<i>Peronosclerospora sorghi</i>
Crazy top downy mildew:	<i>Sclerophthora macrospora</i>
Brown stripe downy mildew:	<i>Sclerophthora rayssiae</i> var. <i>zeae</i>
Green ear disease:	<i>Sclerospora graminicola</i>
Java downy mildew:	<i>Peronosclerospora maydis</i>
Philippine downy mildew:	<i>Peronosclerospora philippinensis</i>
Sugarcane downy mildew:	<i>Peronosclerospora sacchari</i>

Symptoms

The most characteristic symptom is the development of chlorotic streaks on the leaves. Plants exhibit a stunted and bushy appearance due to shortening of the internodes. White downy growth is seen on the lower surface of leaf. Downy growth also occurs on bracts of green unopened male flowers in the tassel. Small to large leaves are noticed in the tassel. Proliferation of auxillary buds on the stalk of tassel and the cobs is common (**Crazy top**).

Downy mildews



Pathogen

The fungus grows as white downy growth on both surface of the leaves, consisting of sporangiophores and sporangia. Sporangiophores are quite short and stout, branch profusely into series of pointed sterigmata which bear hyaline, oblong or ovoid sporangia (conidia). Sporangia germinate directly and infect the plants. In advanced stages, oospores are formed which are spherical, thick walled and deep brown.

Favourable Conditions

- Low temperature (21-33°C)
- High relative humidity (90 per cent) and drizzling.
- Young plants are highly susceptible.

Disease cycle

The primary source of infection is through oospores in soil and also dormant mycelium present in the infected maize seeds. Secondary spread is through airborne conidia. Depending on

the pathogen species, the initial source of disease inoculum can be oospores that over winter in the soil or conidia produced in infected, over wintering crop debris and infected neighboring plants. Some species that cause downy mildew can also be seed borne, although this is largely restricted to seed that is fresh and has high moisture content.

At the onset of the growing season, at soil temperatures above 20°C, oospores in the soil germinate in response to root exudates from susceptible maize seedlings. The germ tube infects the underground sections of maize plants leading to characteristic symptoms of systemic infection including extensive chlorosis and stunted growth. If the pathogen is seed borne, whole plants show symptoms. Oospores are reported to survive in nature for up to 10 years.

Once the fungus has colonised host tissue, sporangiophores (conidiophores) emerge from stomata and produce sporangia (conidia) which are wind and rain splash disseminated and initiate secondary infections. Sporangia are always produced in the night. They are fragile and can not be disseminated more than a few hundred meters and do not remain viable for more than a few hours.

Germination of sporangia is dependent on the availability of free water on the leaf surface. Initial symptoms of disease (chlorotic specks and streaks that elongate parallel to veins) occur in 3 days. Conidia are produced profusely during the growing season. As the crop approaches senescence, oospores are produced in large numbers.

Management

- Deep ploughing.
- Crop rotation with pulses.
- Rogue out infected plants.
- Treat the seeds with metalaxyl at 6g/kg.
- Spray the crop with Metalaxyl + Mancozeb @ 1kg on 20th day after sowing.
- Grow resistant varieties and hybrids viz. CO1, COH1and COH2.

Leaf blight - *Helminthosporium maydis* (Syn: *H. turcicum*)

Symptoms

The fungus affects the crop at young stage. Small yellowish round to oval spots are seen on the leaves. The spots gradually increase in area into bigger elliptical spots and are straw to grayish brown in the centre with dark brown margins. The spots coalesce giving blighted appearance. The surface is covered with olive green velvety masses of conidia and conidiophores.



Conidia

Pathogen

Conidiophores are in group, geniculate, mid dark brown, pale near the apex and smooth. Conidia are distinctly curved, fusiform, pale to mid dark golden brown with 5-11 septa.

Favourable Conditions

- Optimum temperature for the germination of conidia is 8 to 27°C provided with freewater on the leaf.
- Infection takes place early in the wet season.

Disease cycle

It is a seed-borne fungus. It also infects sorghum, wheat, barely, oats, sugarcane and spores of the fungus are also found to associate with seeds of green gram, black gram, cowpea, varagu, Sudan grass, Johnson grass and Teosinte.

Management

- Treat the seeds with Captan or Thiram at 4 g/kg.
- Spray Mancozeb 2 kg or captan 1 kg/ha.

Rust - *Puccinia sorghi*

Symptoms

Circular to oval, elongated cinnamon-brown powdery pustules are scattered over both surface of the leaves. As the plant matures, the pustules become brown to black owing to the replacement of red uredospores by black teliospores.



Pathogen

Uredospores are globose or elliptical finely echinulate, yellowish brown with 4 germpores. Teliospores are brownish black, or dark brown, oblong to ellipsoidal, rounded to flattened at the apex. They are two celled and slightly constricted at the septum and the spore wall is thickened at the apex.



Uredospores and teliospores

Favourable Conditions

- Cool temperature and high relative humidity.

Disease cycle

Primary source of inoculum is uredospores surviving on alternate hosts viz., *Oxalis corniculata* and *Euchlaena mexicana*.

Management

- Remove the alternate hosts.
- Spray Mancozeb at 2 kg/ha.

Head smut - *Sphacelotheca reiliana*

Symptoms

Symptoms are usually noticed on the cob and tassel. Large smut sori replace the tassel and the ear. Sometimes the tassel is partially or wholly converted into smut sorus. The smutted

plants are stunted produce little yield and remain greener than that of the rest of the plants.



Pathogen

Smut spores are produced in large numbers which are reddish brown to black, thick walled, finely spined, spherical.

Favourable Conditions

- Low temperature favours more infection and this fungus also infects the sorghum

Disease cycle

The smut spores retain its viability for two years. The fungus is externally seedborne and soil-borne. The major source of infection is through soil-borne chlamydospores.

Management

- Field sanitation.
- Crop rotation with pulses.
- Treat the seeds with Captan or Thiram at 4 g/kg.

Common smut

Ustilago maydis



Charcoal rot - *Macrophomina phaseolina* (*Rhizoctonia bataticola*)

Symptoms

The affected plants exhibit wilting symptoms. The stalk of the infected plants can be recognized by grayish streak. The pith becomes shredded and grayish black minute sclerotia

develop on the vascular bundles. Shredding of the interior of the stalk often causes stalks to break in the region of the crown. The crown region of the infected plant becomes dark in colour. Shredding of root bark and disintegration of root system are the common features.



Pathogen

The fungus produces large number of sclerotia which are round and black in colour. Sometimes, it produces pycnidia on the stems or stalks.

Favourable Conditions

- High temperature and low soil moisture (drought)

Disease cycle

The fungus has a wide host range, attacking sorghum, pearl millet, finger millet and pulses. It survives for more than 16 years in the infected plant debris. The primary source of infection is through soil-borne sclerotia. The pathogen also attacks many other hosts, which helps in its perpetuation. Since the fungus is a facultative parasite it is capable of living saprophytically on dead organic tissues, particularly many of its natural hosts producing sclerotial bodies. The fungus over winters as a sclerotia in the soil and infects the host at susceptible crop stage through roots and proceeds towards stem.

Management

- Long crop rotation with crops that are not natural host of the fungus.
- Irrigate the crops at the time of earhead emergence to maturity.
- Treat the seeds with Carbendazim or Captan at 2 g/kg.
- Grow disease tolerant varieties viz., SN-65, SWS-8029, Diva and Zenit.

Minor diseases

Bacterial Stalk rot - *Erwinia dissolvens*

Symptoms

Bacterial stalk rot

Erwinia chrysanthemi pv. *zeae*, syn. *Erwinia carotovora*
f. sp. *zeae*



The basal internodes develop soft rot and give a water soaked appearance. A mild sweet fermenting odour accompanies such rotting. Leaves some time show signs of wilting and affected plants topple down in few days. Ears and shank may also show rot. They fail to develop further and the ears hang down simply from the plant

Disease cycle

Borer insects play a significant role in initiation of the disease. The organism is soil borne and makes its entry through wounds and injuries on the host surface. The organism survives saprophytically on debris of infected materials and serves primary inoculum in the next season.

Mosaic - *Maize mosaic potyvirus*

Symptoms

Symptoms appear as chlorotic spots, which gradually turn into stripes covering entire leaf blade. Chlorotic stripes and spots can also develop on leaf sheaths, stalks and husks. Moderate to severe rosetting of new growth is observed. Size of stalk, leaf blades and tassel tend to be normal in late infection.

Pathogen

It is caused by *Maize mosaic potyvirus*. Virions are flexuous, 750-900nm long, ssRNA genome.

Disease cycle

It is transmitted in nature by leaf hopper vector, *Perigrinus maidis*.

Brown spot - *Physoderma maydis*

Water soaked lesions, which are oval, later turn into light green and finally brown.

Brown spot

Physoderma maydis



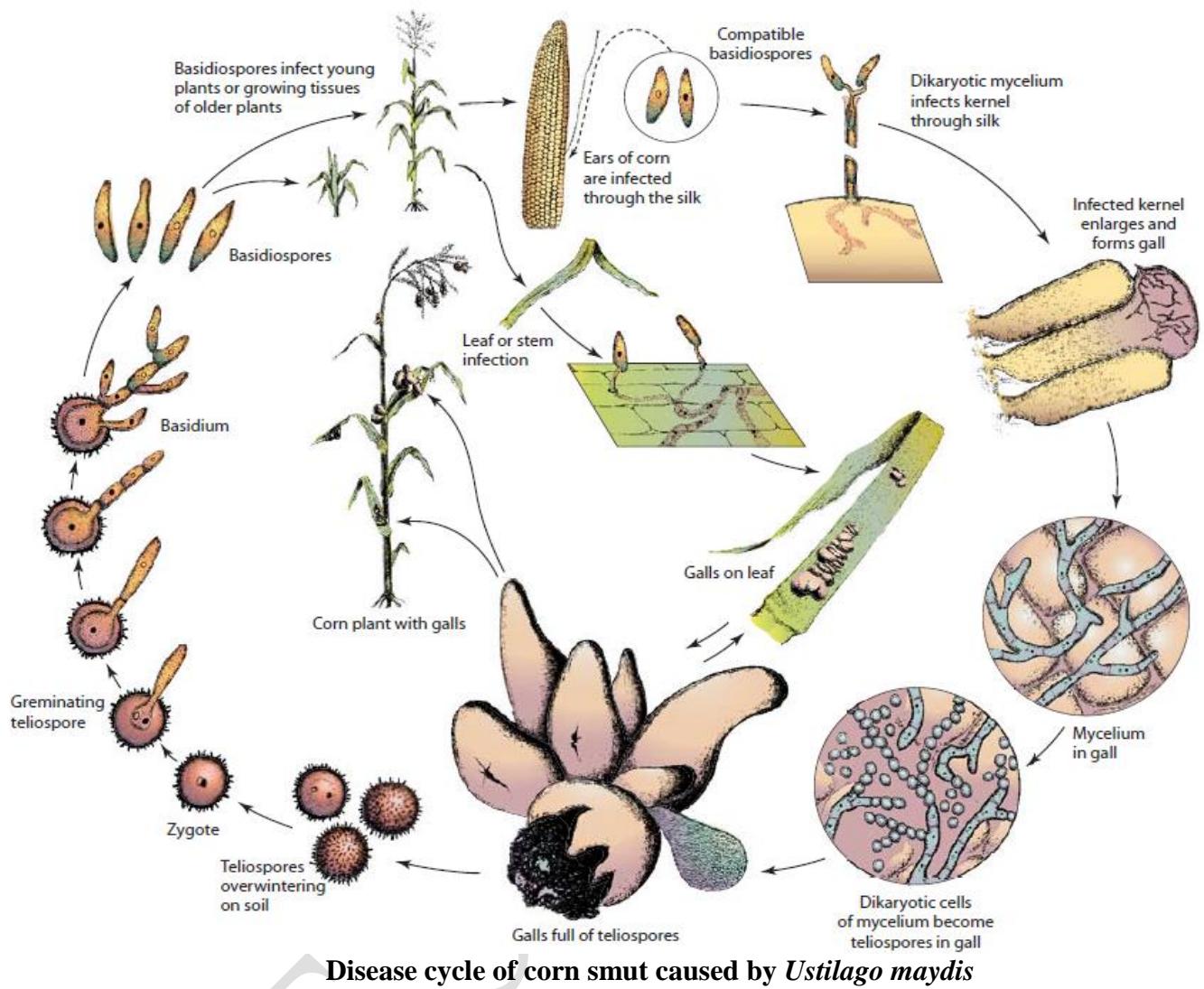
Stewart's wilt

Erwinia stewartii, syn. *Pantoea stewartii*



Maize streak virus (MSV)





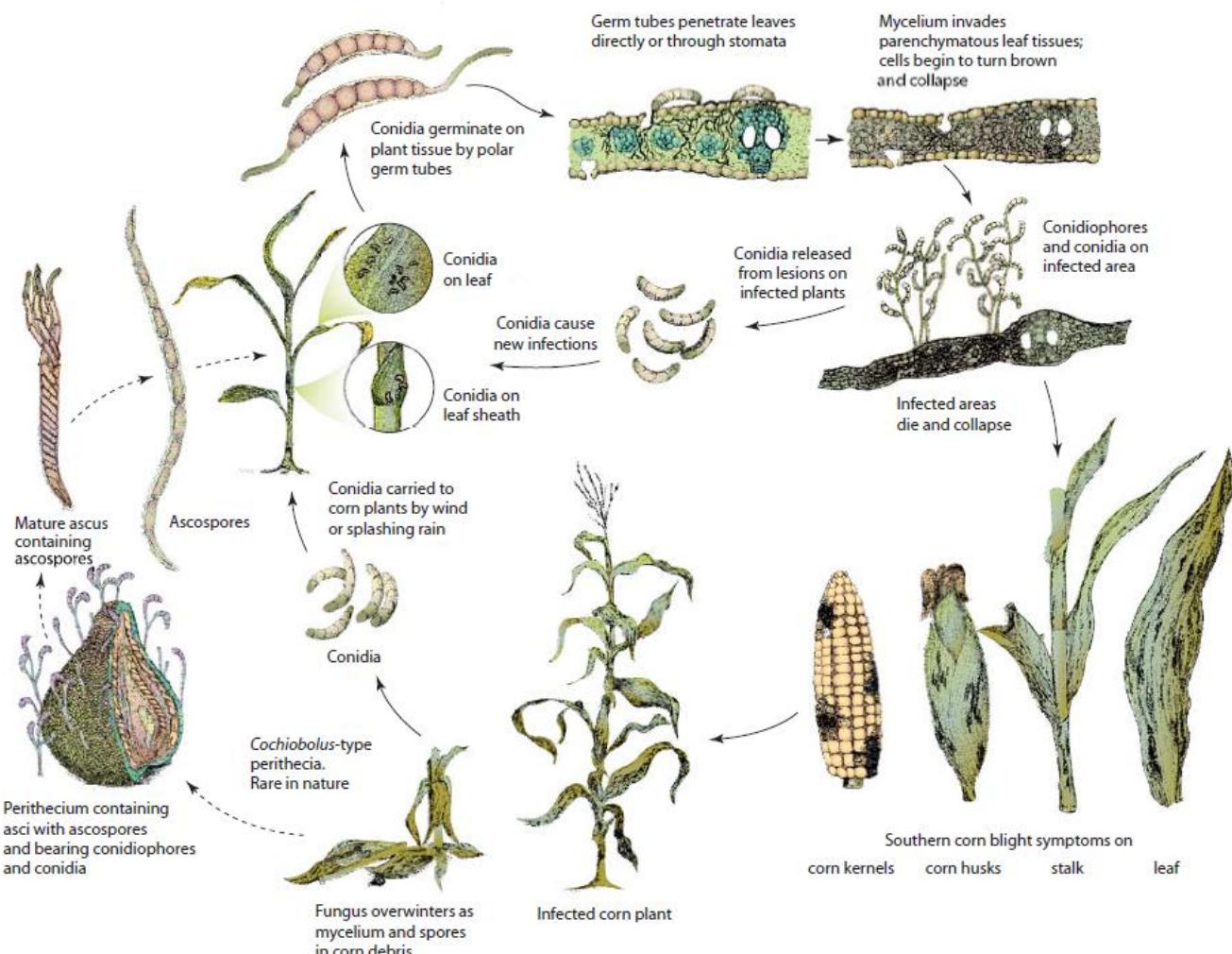


FIGURE 11-63 Disease cycle of southern corn leaf blight caused by *Cochliobolus heterostrophus* race T.

Disease cycle of corn leaf blight caused by *Cochliobolus heterostrophus* race T

Diseases of Tobacco

Damping off - *Pythium aphanidermatum*

Symptoms

The pathogen attacks the seedlings at any stage in the nursery. Sprouting seedlings are infected and wither before emergence from the soil (Pre emergence damping off). Water soaked minute lesions appear on the stems near the soil surface, soon girdling the stem, spreading up and down in the stems and with in one or two days stem may rot leading to toppling over of the seedlings (Post-emergence damping off).



The young seedlings in the nursery are killed in patches and infection spreads quickly. Under the favorable conditions, the entire seedlings in the nursery are killed within 3 to 4 days. A thick weft of mycelium may be seen on the surface of the soil.

Pathogen

The fungus produces thick, hyaline, thin walled, non-septate mycelium. It produces irregularly lobed sporangia which germinate to produce vesicle containing zoospores. The zoospores are kidney shaped and biflagellate. Oospores spherical, light to deep yellow or yellowish brown coloured, measuring 17-19 μm in diameter.

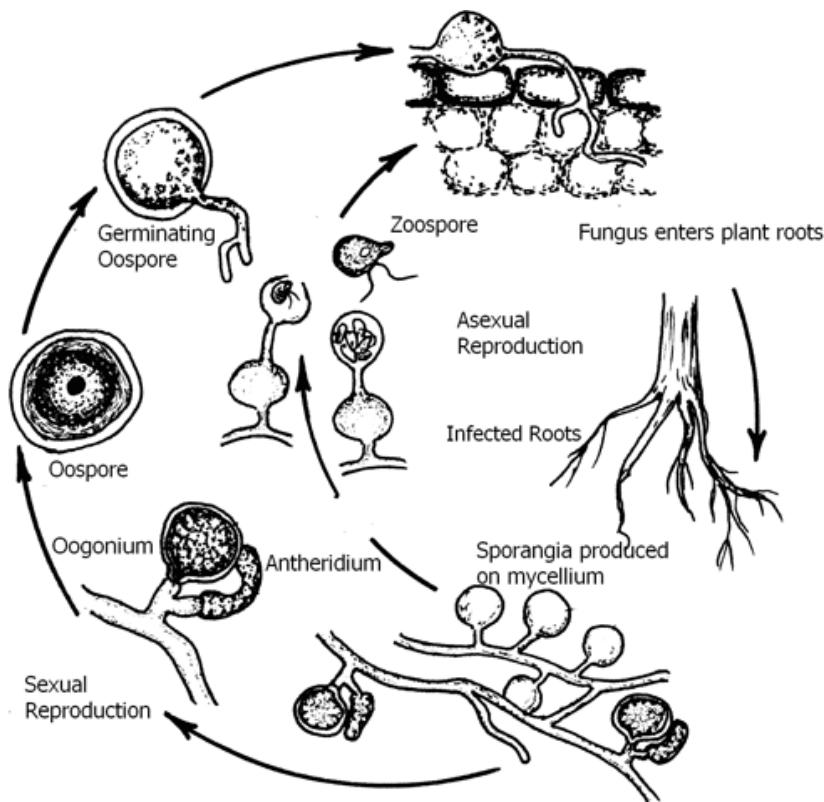
Favourable Conditions

- Over crowding of seedling.
- Ill drained nursery beds
- Heavy shade in nursery
- High atmospheric humidity (90-100 per cent)
- High soil moisture
- Low temperature (below 24 C) and low soil temperature of about 20°C.

Disease cycle

The pathogen survives in the soil as oospores and chlamydospores. The primary infection

is from the soil-borne fungal spores and secondary spread through sporangia and zoospores transmitted by wind and irrigation water.



Management

- Prepare raised seed beds with adequate drainage facility.
- Burn the seed beds with paddy husk before sowing.
- Drench the seed bed with 1 per cent Bordeaux mixture or 0.2 per cent Copper oxychloride, two days before sowing.
- Avoid over crowding of seedlings by using recommended seed rate (1 to 1.5g/2.5m²).
- Avoid excess watering of the seedlings.
- Spray the nursery beds two weeks after sowing with 1 per cent Bordeaux mixture or 0.2 per cent Copper oxychloride or 0.2 per cent Mancozeb and repeat subsequently at 4 days interval under dry weather and at 2 days interval under wet cloudy weather or spray 0.2 per cent Metalaxyl at 10 days interval commencing from 20 days after germination.

Black shank - *Phytophthora parasitica* var. *nicotianae*

Symptoms

The pathogen may affect the crop at any stage of its growth. Even though all parts are affected, the disease infects chiefly the roots and base of the stem. Seedlings in the nursery show black discolor of the stem near the soil level and blackening of roots, leading the wet rot in humid condition and seedling blight in dry weather with withering and drying of tips. The

pathogen also spreads to the leaves and causes blighting and drying of the bottom leaves. In the transplanted crop, the disease appears as minute black spot on the stem, spreads along the stem to produce irregular black patches and often girdling occurs.

The upward movement leads to development of necrotic patches on the stems. The infected tissues shrink, leaving a depression and in advanced condition the stem shrivels and plant wilts. When the affected stem is split open, the pith region is found to be dried up in disc-like plates showing black discolouration. On the leaves large brown concentrically zonate patches appear during humid weather, leading to blackening and rotting of the leaves.

Black shank-*Phytophthora parasitica* var. *nicotianae*



Pathogen

The fungus produces hyaline and non-septate mycelium. The sporangia, which are hyaline, thin walled, ovate or pyriform with papillae, develop on the sporangiophores in a sympodial fashion. Sporangia germinate to release zoospores which are usually kidney shaped, biciliate and measure $11-13 \times 8-9\mu\text{m}$. The fungus also produces globose and thick walled chlamydospores, measuring $27-42\mu\text{m}$ in diameter. Oospores are thick walled, globose, smooth and light yellow coloured, measuring $15-20\mu\text{m}$ in diameter.



Sporangia

Favourable Conditions

- Frequent rainfall and high soil moisture.
- High population of rootknot nematodes *Meloidogyne incognita* var. *acrita*.

Disease cycle

The fungus lives as a saprophyte on organic wastes and infected crop residues in soil. The fungus is also present in the soil as dormant mycelium, oospores and chlamydospores for more than 2 years. The primary infection is by means of oospores and chlamydospores in the soil. Secondary spread is by wind-borne sporangia. The pathogen in the soil spreads through irrigation water, transport of soil, farm implements and animals.

Management

- Cover the seed beds with paddy husk or groundnut shell at 15-20 cm thick layer and burn.
- Provide adequate drainage in the nursery. Drench the nursery beds with 1 per cent Bordeaux mixture or 0.2 per cent Copper oxychloride, two days before sowing.
- Spray the beds two weeks after sowing with 0.2 per cent Metalaxyl or 0.2 per cent Captafol or 0.2 per cent Copper oxychloride or 1 per cent Boreaux mixture and repeat after 10 days.
- Select healthy, disease free seedlings for transplanting.
- Remove and destroy the affected plants in the field.
- Spray Mancozeb 2 kg or Copper oxychloride 1 kg or Ziram 1 lit/ha. Spot drench with 0.4 per cent Bordeaux mixture or 0.2 per cent Copper oxychloride.

Frog eye spot - *Cercospora nicotianae*

Symptoms

The disease appears mostly on mature, lower leaves as small ashy grey spots with brown border. The typical spots have a white centre, surrounded in succession by grey, brown portions with a dark brown to black margin, resembling the eyes of a frog. Under favorable conditions, several spots coalesce to form large necrotic areas, causing the leaf to dry up from the margin and wither prematurely. Both yield and quality are reduced greatly. The disease may occur in the seedlings also, leading to withering of leaves and death of the seedlings.



Pathogen

The mycelium is intercellular and collects beneath the epidermis and clusters of conidiophores emerge through stomata. The conidiophores are septate, dark brown at the base and lighter towards the top bearing 2-3 conidia. The conidia are hyaline, slender, slightly curved, thinwalled and 2-12 septate.

Favorable Conditions

- Temperature of 20-30°C.
- High humidity (80-90 per cent).
- Close spacing, frequent irrigation and excess application of nitrogenous fertilizers.

Disease cycle

The pathogen is seed-borne and also persists on crop residues in the soil. The primary infection is from the seed and soil-borne inoculum. The secondary spread is through wind-borne conidia.

Management

- Remove and burn plant debris in the soil.
- Avoid excess nitrogenous fertilization.
- Adopt optimum spacing.
- Regulate irrigation frequency.
- Spray the crop with 0.4 per cent Bordeaux mixture or Thiophanate Methyl 750g/ha or Carbendazim 750 g/ha and repeat after 15 days.

Powdery mildew - *Erysiphe cichoracearum* var. *nicotianae*

Symptoms

Initially the disease appears as small, white isolated patches on the upper surface of the leaves. Later, it spreads fast and covers the entire lamina. The disease initially appears on the lower leaves and as disease advances, the rest of the leaves are also infected and sometimes powdery growth can be seen on the stem also. The affected leaves turn to brown and wither and show scorched appearance. The severe infection leads to defoliation and reduction in quantity and quality of the curable leaves.

Pathogen

The fungus is ecotrophic and produces hyaline, septate and highly branched mycelium. Short, stout and hyaline conidiophores arise from the mycelium and bear conidia in chains. The conidia are barrel shaped or cylindrical, hyaline and thin walled. Cleistothecia are black, spherical with no ostiole, with numerous densely-woven septate, brown-coloured appendages. They contain 10-15 ascii which are ovate with a short stalk. Each ascus contains two ascospores which are oval to elliptical, thinwalled, hyaline and single celled.

**Powdery mildew- *Erysiphe cichoracearum/*
*Golovinomyces cichoracearum***



Favourable Conditions

- Humid cloudy weather.
- Low temperature (16-23°C).
- Close planting and excess doses of nitrogenous fertilizers.

Disease cycle

The fungus remains dormant as mycelium and cleistothecia in the infected plant debris in soil. The primary infection is mainly from soil-borne inoculum. The secondary spread is aided by wind blown conidia.

Management

- Apply balanced fertilizers.
- Avoid overcrowding of plants.
- Remove and destroy the affected leaves.
- Plant early in the season so that crop escapes the cool temperature at maturity phase.
- Spray dinocap at 375 ml or Carbendazim at 500g/ha.

Brown spot - *Alternaria longipes*

Symptoms

Brown spot in contrast to frog-eye spot is not normally observed in the nursery but is very much prevalent in the field. Initially it appears on lower and older leaves as small brown, circular lesions, which spread, to upper leaves, petioles, stalks and capsules even. In warm weather (30 °C) under high humidity, the leaf spots enlarge, 1-3 cm in diameter, centres are necroses and turn brown with characteristic marking giving target board appearance with a definite outline. In severe infection spots enlarge, coalesce and damage large areas making leaf dark-brown, ragged and worthless. On leaves nearing maturity, leaf spots are surrounded by bright yellow halo, due to production of toxin 'alternin' by the fungus.



Disease cycle

The fungus over summers in the soil as mycelium in the diseased plant debris such as stems of tobacco, weeds and other hosts. Under favourable weather in the next season conidial production starts which infect the lowermost leaves. As the season progresses, repeated infection cycles of the fungus attack healthy tissues of all aerial parts of tobacco of any age under high humidity. There is enormous spore density in the air near the end of the harvesting. Fungus persists as a mycelium in dead tissue for several months.

Management

- Removal and destruction of diseased plant debris can check the primary infection promptly.
- Continuous growing of tobacco after tobacco must be avoided in the heavily infected fields.
- Weekly, spraying of fungicides such as Maneb or Zineb @ 2g/ha or Benomyl or Thiophanate methyl at 1kg/ha.

Anthracnose -*Colletotrichum tabacum*

Symptoms

Initially, infection starts on lower leaves as pale-brown circular spots of 0.5 mm diameter with papery depressed centres outlined by slightly raised brown margin. The leaf-spots may remain small with white areas in the centre or coalesce to form large necrotic lesions. Under continuous humid weather, dark brown or black, elongated, sunken necrotic lesions appear on midrib, petiole and stem resulting in petiole and stem rot. Such seedlings do not establish in the field if planted. Primary infection starts from affected bits of aerial parts left in the soil in the previous season. The pathogen is not seed-borne but persists in the soil on dried plant debris.

Management

- Raised seed beds and rabbing with farm wastes help in reducing the initial infection.
- Removal and destruction of all diseased debris minimises the pathogen in the soil.
- Rogueing diseased seedlings especially with necrotic lesions on stem
- Protective spraying with Bordeaux mixture at 1.0% (2-2-500) or Zineb @ 2 kg/ha

Wild fire - *Pseudomonas tabaci*

Symptoms

The leaf spots may occur at any stage of plant growth including the nursery seedlings. Dark brown to black spots with a yellow halo spreads quickly causing withering and drying of leaves. In advanced cases, lesions develop on the young stem tissues leading to withering and drying of the seedlings. In the fields, initially numerous water soaked black spots appear and latter become angular when restricted by the veins and veinlets.



Several spots may coalesce to cause necrotic patches on the leaves. In advanced conditions, the entire leaf is fully covered with enlarged spots with yellow haloes. The leaves slowly wither and dry. Under humid weather condition, the disease spreads very fast and covers all the leaves and the entire plant gives a blighted appearance.

Pathogen

The bacterium is a rod, motile with a single polar flagellum, non-capsulated, non spore forming and Gram negative.

Favourable Conditions

- Close planting.
- Humid wet weather.
- Strong winds.

Disease cycle

The bacterium survives in the infected crop residues in the soil, which is the primary source of infection. The secondary spread of the pathogen in the field is through wind splashed rain water and implements.

Management

- Remove and burn the infected crop residues in the soil.
- Avoid very close planting.

Tobacco mosaic - *Tobacco mosaic virus (TMV)*

Symptoms

The disease begins as light discoloration along the veins of the youngest leaves. Soon the leaves develop a characteristic light and dark green pattern, the dark green areas associated more with the veins, turning into irregular blisters.

The early infected plants in the season are usually stunted with small, chlorotic, mottled and curled leaves. In severe infections, the leaves are narrowed, puckered, thin and malformed beyond recognition. Later, dark brown necrotic spots develop under hot weather and this symptom is called “Mosaic burn” or “Mosaic scorching”.

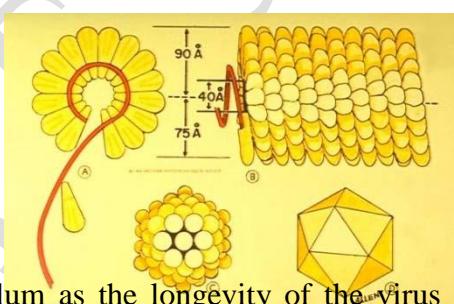


Pathogen

The disease is caused by *Tobacco mosaic tobamovirus*. It is a rigid rod measuring 300 X 150-180 nm with a central hollow tube of about 4nm diameter with ssRNA as its genome.

Disease cycle

The virus wounds, sap and virus remains the source of inoculum as the longevity of the virus is very high. It is capable of remaining infective when stored dry for over 50 years. The virus has a wide host range, affecting nearly 50 plant species belonging to nine different families. The virus is not seed-transmitted in tobacco but tomato seeds transmit the virus. No insect vector known to transmit the virus.



spreads most rapidly by contact farm implements and operators. The viable in the plant debris in the soil as

Management

- Remove and destroy infected plants.
- Keep the field free of weeds which harbour the virus.
- Wash hands with soap and running water before or after handling the plants or after

weeding.

- Prohibit smoking, chewing and snuffing during field operations.
- Spray the nursery and main field with botanical leaf extracts of *Bougainvillea* or *Basella alba* at 1 litre of extract in 150 litres of water, two to three times at weekly intervals.
- Adopt crop rotation by growing non-host plants for two seasons.
- Grow resistant varieties like TMV RR2, TMV RR 2a and TMV RR3.

Leaf curl - *Tobacco leaf curl virus* (TLCV)

Symptoms

The infections may occur at any stage, when young plants are infected the entire plant remains very much dwarfed. Curling of leaves with clearing and thickening of veins; twisting of petioles; puckering of leaves; rugose and brittle and development of enations are the important symptoms of tobacco leaf curl disease. Three forms of leaf curl expression are observed. First the leaf margins curl downward towards the dorsal side and show thickening of veins with enation on the lower surface. Second crinkle form shows curling of whole leaf edge towards dorsal side with enation on the veins and the lamina arching towards the ventral side between the veinlets. Third the transparent symptom shows the curling of leaves towards the ventral side with clearing of the veins and enations are absent.



Pathogen

It is caused by Tobacco leaf curl geminivirus. Virions are geminate, non- enveloped, 18 nm diameter circular ssDNA genome. The virus is a white fly transmitted Geminivirus with ssDNA as genome.

Disease cycle

The virus has a narrow host range in eight plant families. The virus is not transmissible through sap or seed. The whitefly, *Bemisia tabaci* is the vector. Due to wide host range of the virus many other plants are acting as source of inoculums.

Management

- Remove and destroy the infected plants.

- Rogue out the reservoir weed hosts which harbour the virus and whiteflies. Planting tobacco crop during the crop periods when the vector population is low.
- Spray Methyl demeton at 0.1 to 0.2 per cent to control the vectors.

Phanerogamic parasite

Broom rape - *Orobanche cernua* var. *desertorum*

Symptoms

The affected tobacco plants are stunted and show withering and drooping of leaves to wilting. These indicate underground parasitism of the tobacco roots by the parasite. The young shoot of the parasite emerges from the soil at the base of the plants 5-6 weeks after transplanting. Normally, it appears on clusters of 50-100 shoots around the base of a single tobacco plant. The plants which are attacked very late exhibit no external symptoms but the quality and yield of leaves are reduced.



Parasite

It is a total root parasite. It is an annual, fleshy flowering plant with a short, stout stem, 10-15 inches long. The stem is pale yellow or brownish red in colour and covered by small, thin, brown scaly leaves and the base of the stem is thickened. White-coloured flowers appear in the leaf axils. The floral parts are well developed with a lobed calyx, tubular corolla, superior ovary, numerous ovules and a large four-lobed stigma. The fruits are capsules containing small, black, reticulate and ovoid seeds.

Disease cycle

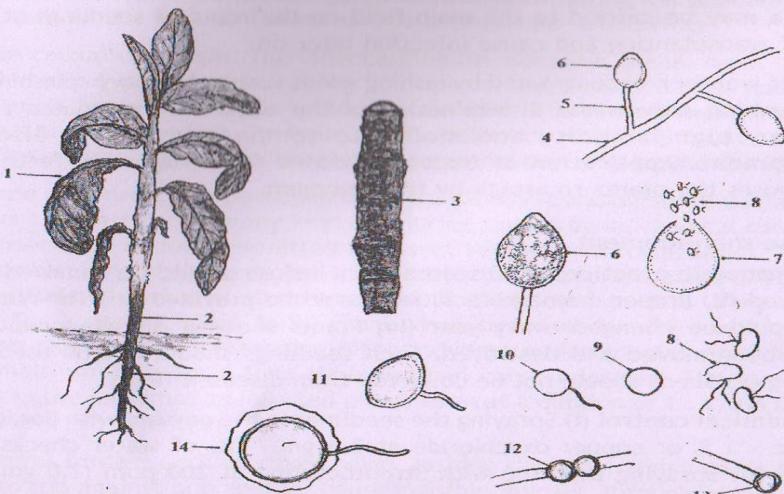
The seeds of the parasite remain dormant in the soil for several years. Primary infection occurs from the seeds in the soil. The seeds spread from field to field by irrigation water, animals, human beings and implements. The dormant seeds are stimulated to germinate by the

root exudates of tobacco and attach itself, to the roots by forming haustoria. Later, it grows rapidly to produce shoot and flowers. *Orobanche* also attacks other crops like brinjal, tomato, cauliflower, turnip and other cruciferous crops.

Management

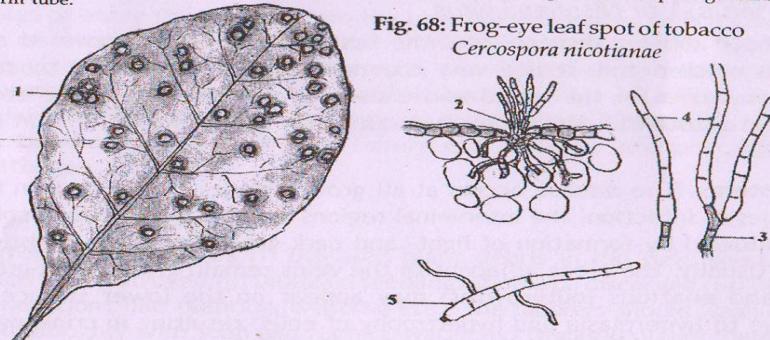
- Rogue out the tender shoots of the parasite before flowering and seed set.
- Spray the soil with 25 per cent copper sulphate.
- Spray 0.1 per cent Allyl alcohol.
- Apply few drops of kerosene directly on the shoot.
- Grow decoy or trap crops like chilli, moth bean, sorghum or cowpea to stimulate seed germination and kill the parasite.

Fig. 67: Black shank of tobacco-*Phytophthora parasitica* var. *nicotianae*

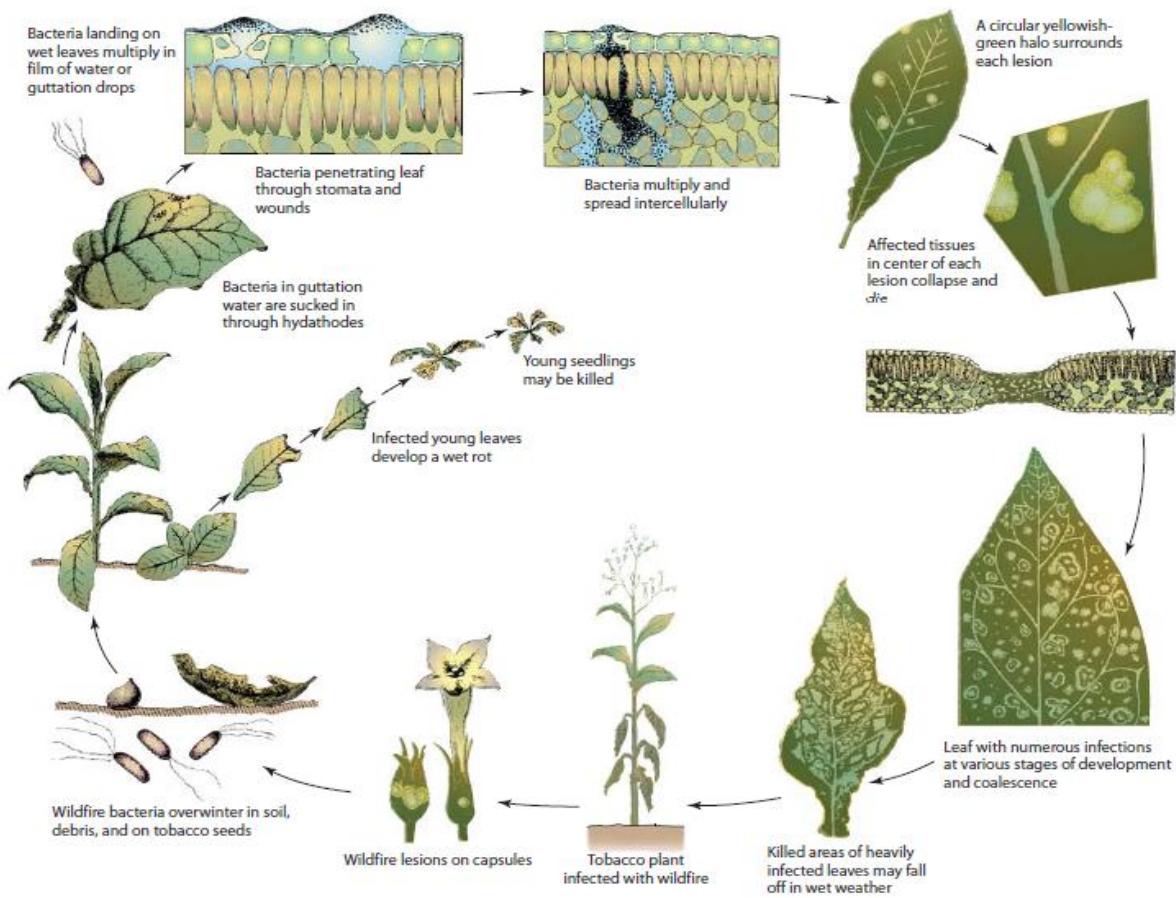


1. Infected plant 2. Rotten stem region and roots 3. Split stem showing transverse disc-like plates of the pith 4. Hypha 5. Sporangiophore 6. Sporangium 7. Sporangium germinating by zoospores 8. Zoospores 9. Encysted zoospore 10. Germinating encysted zoospore 11. Sporangium germinating by germ tube 12. Intercalary chlamydospore 13. Terminal chlamydospore 14. Oospore germinating by germ tube.

Fig. 68: Frog-eye leaf spot of tobacco
Cercospora nicotianae



1. Spots on the leaf 2. Conidiophores emerging through the stoma 3. Conidiophore 4. Conidia 5. Conidium germinating by germ tubes.



Disease cycle of bacterial leaf blight/ wild fire of tobacco caused by *Pseudomonas syringae* pv. *tabaci*

Diseases of Groundnut

Tikka leaf spots

Early leaf spot: *Cercopora arachidicola* (Sexual Stage: *Mycosphaerella arachidis*)

Late leaf spot: *Phaeoisariopsis personata* (Syn : *Cercospora personata*)
(Sexual stage : *Mycosphaerella berkeleyii*)

Symptoms

The disease occurs on all above ground parts of the plant, more severely on the leaves. The leaf symptoms produced by the two pathogens can be easily distinguished by appearance, spot colour and shapes. Both the fungi produce lesions also on petiole, stem and pegs. The lesions caused by both species coalesce as infection develops and severely spotted leaves shed prematurely. The quality and yield of nuts are drastically reduced in severe infections.



Pathogen

C. arachidicola (Sexual Stage: *M. arachidis*)

The pathogen is intercellular and do not produce haustoria and become intracellular when host cells die. The fungus produces abundant sporulation on the upper surface of the leaves. Conidiophores are olivaceous brown or yellowish brown in colour, short, 1 or 2 septate, unbranched and geniculate and arise in clusters.

Conidia are sub hyaline or pale yellow, obclavate, often curved 3-12 septate, 35- 110 x 2.5 - 5.4 μm in size with rounded to distinctly truncate base and sub-acute tip. The perfect stage of the fungus produces perithecia as ascostromata. They are globose with papillate ostiole. Asci are cylindrical to clavate and contain 8 ascospores. Ascospores are hyaline, slightly curved and two celled, apical cell larger than the lower cell.

***P. personata* (*C. personata*) (Sexual stage: *M. berkeleyii*)**

The fungus produces internal and intercellular mycelium with the production of haustoria. The conidiphores are long, continuous, 1-2 septate, geniculate, arise in clusters and olive brown in colour. The conidia are cylindrical or obclavate, short, measure

18-60 x 6-10 μ m, hyaline to olive brown, usually straight or curved slightly with 1-9 septa, not constricted but mostly 3-4 septate. The fungus in its perfect stage produces perithecia as ascostromata which are globose or broadly ovate with papillate ostiole. Ascii are cylindrical to ovate, contain 8 ascospores. Ascospores are 2 celled and constricted at septum and hyaline.

Favourable Conditions

- Prolonged high relative humidity for 3 days.
- Low temperature (20 C) with dew on leaf surface.
- Heavy doses of nitrogen and phosphorus fertilizers
- Deficiency of magnesium in soil.

Disease cycle

The pathogen survives for a long period in the infected plant debris through conidia, dormant mycelium and perithecia in soil. The volunteer groundnut plants also harbour the pathogen. The primary infection is by ascospores or conidia from infected plant debris or infected seeds. The secondary spread is by wind blown conidia. Rain splash also helps in the spread of conidia.

Management

- Remove and destroy the infected plant debris.
- Eradicate the volunteer groundnut plants.
- Keep weeds under control.
- Treat the seeds with Carbendazim or Thiram at 2g/kg.
- Spray Carbendazim 500g or mancozeb 2 kg or Chlorothalonil 2 kg/ha and if necessary, repeat after 15 days.
- Grow moderately resistant varieties like ALR 1.

Rust - *Puccinia arachidis*

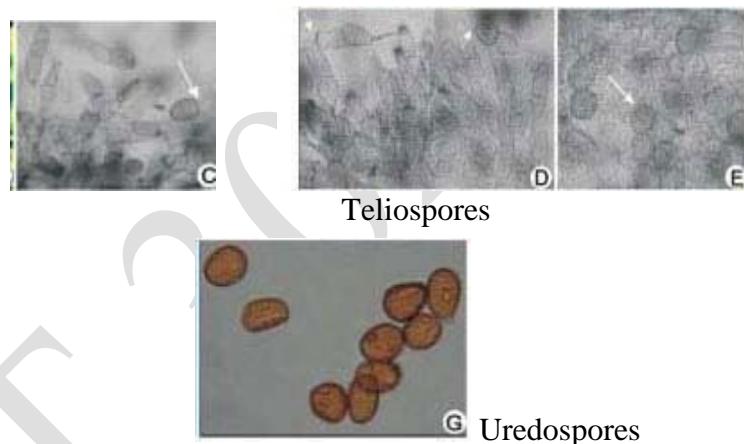
Symptoms

The disease attacks all aerial parts of the plant. The disease is usually found when the plants are about 6 weeks old. Small brown to chestnut dusty pustules (uredosori) appear on the lower surface of leaves. The epidermis ruptures and exposes a powdery mass of uredospores. Corresponding to the sori, small, necrotic, brown spots appear on the upper surface of leaves. The rust pustules may be seen on petioles and stem. Late in the season, brown teliosori, as dark pustules, appear among the necrotic patches. In severe infection lower leaves dry and drop prematurely. The severe infection leads to production of small and shriveled seeds.



Pathogen

The pathogen produces both uredial and telial stages. Uredial stages are produced abundant in groundnut and production of telia is limited. Uredospores are pedicellate, unicellular, yellow, oval or round and echinulated with 2 or 3 germpores. Teliospores are dark brown with two cells. Pycnial and aecial stages have not been recorded and there is no information available about the role of alternate host.



Favourable Conditions

- High relative humidity (above 85 per cent).
- Heavy rainfall.
- Low temperature (20-25°C).

Disease cycle

The pathogen survives as uredospores on volunteer groundnut plants. The fungus also survives in infected plant debris in soil. The spread is mainly through wind borne inoculum of uredospores. The uredospores also spread as contamination of seeds and pods. Rainsplash and implements also help in dissemination. The fungus also survives on the collateral hosts like *Arachis marginata*, *A. nambyquarae* and *A. prostrata*.

Management

- Avoid monoculturing of groundnut.

- Remove volunteer groundnut plants and reservoir hosts.
- Spray mancozeb 2 kg or Wetttable Sulphur 3 kg or Tridemorph 500ml or Chlorothalonil 2 kg/ha.
- Grow moderatelyresistant varieties like ALR 1.

Collar rot or seedling blight or crown rot - *Aspergillus niger* and *A. pulverulentum*

Symptoms

The disease usually appears in three phases.

i. Pre-emergence rot

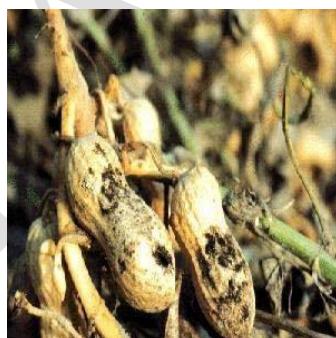
Seeds are attacked by soil-borne conidia and caused rotting of seeds. The seeds are covered with black masses of spores and internal tissues of seed become soft and watery.

ii. Post-emergence rot

The pathogen attacks the emerging young seedling and cause circular brown spots on the cotyledons. The symptom spreads later to the hypocotyl and stem. Brown discolored spots appear on collar region. The affected portion become soft and rotten, resulting in the collapse of the seedling. The collar region is covered by profuse growth of fungus and conidia and affected stem also show shredding symptom.

iii. Crown rot

The infection when occurs in adult plants show crown rot symptoms. Large lesions develop on the stem below the soil and spread upwards along the branches causing drooping of leaves and wilting of plant.



Pathogen

The mycelium of the fungus is hyaline to sub-hyaline. Conidiophores arise directly from the substrate and are septate, thick walled, hyaline or olive brown in colour. The vesicles are mostly globose and have two rows of hyaline phialides viz., primary and secondary phialides. The conidial head are dark brown to black. The conidia are globose, dark brown in colour and produce in long chains.

Favourable Conditions

- Deep sowing of seeds.
- High soil temperature (30-35° C).
- Low soil moisture.

Disease cycle

The pathogen survive in plant debris in the soil, not necessarily from a groundnut crop. Soil-borne conidia cause disease carry over from season to season. The other primary source is the infested seeds. The pathogen is also seedborne in nature.

Management

- Crop rotation.
- Destruction of plant debris.
- Remove and destroy previous season's infested crop debris in the field
- Seed treatment with *Trichoderma viride* / *T.harzianum* @ 4 g/kg of seeds and soil application of *Trichoderma viride* / *T.harzianum* at 2.5kg/ha, preferably with organic amendments such as castor cake or neem cake or mustard cake @ 500 kg/ ha.

Root rot - *Macrophomina phaseolina*

Symptoms

In the early stages of infection, reddish brown lesion appears on the stem just above the soil level. The leaves and branches show drooping, leading to death of the whole plant. The decaying stems are covered with whitish mycelial growth. The death of the plant results in shredding of bark. The rotten tissues contain large number of black or dark brown, thick walled sclerotia. When infection spreads to underground roots, the sclerotia are formed externally as well as internally in the rotten tissue. Pod infection leads to blackening of the shells and sclerotia can be seen inside the shells.

Pathogen

The fungus produces hyaline to dull brown mycelium. The sclerotia are thick walled and dark brown in colour.

Favourable Conditions

- Prolonged rainy season at seedling stage and low lying areas.

Disease cycle

The fungus remains dormant as sclerotia for a long period in the soil and in infected plant

debris. The primary infection is through soil-borne and seed-borne sclerotia. The secondary spread of sclerotia is aided by irrigation water, human agency, implements and cattle etc.

Management

- Treat the seeds with thiram or carbendazim 2g/kg or *Trichoderma viride* at 4g/kg.
- Spot drench with Carbendazim at 0.5 g/lit.

Rosette - *Groundnut rosette assistor virus (GRAV)*, *Groundnut rosette virus* and *Groundnut rosette satellites*

Symptoms

The affected plants are characterized by the appearance of dense clump or dwarf shoots with tuft of small leaves forming in a rosette fashion. The plant exhibits chlorosis and mosaic mottling. The infected plants remain stunted and produce flowers, but only a few of the pegs may develop further to nuts but no seed formation.



Pathogen

The disease is caused by a complex mixture of viruses viz., *Groundnut rosette assistor virus (GRAV)*, *Ground nut rosette virus* and *Groundnut rosette satellites* is an isometric, not enveloped and 28nm diameter (reported from India) and it gives no overt symptom in groundnut. *Groundnut rosette virus* is with ssRNA genome, which becomes packaged in GRAV virus and thus depends on it for aphid transmission, but produces no overt symptoms in groundnut. The groundnut rosette satellites are satellite RNAs that control the symptoms and cause the different types of rosette (chlorotic, green and mosaic).

Disease Cycle

The primary source of spread by aphid vector, *Aphis craccivora* and *A. gossypii* in a persistent manner, retained by vector but not transmitted congenitally. The virus is not transmitted by any other means like mechanical or seed or pollen. The virus can survive on the volunteer plants of groundnut and other weed hosts.

Management

- Practice clean cultivation.
- Use heavy seed rate and rogue out the infected plants periodically.
- Spray Monocrotophos or Methyl demeton at 500 ml/ha.

Groundnut bud necrosis disease - *Groundnut bud necrosis virus* (GBNV- Tospo virus)

Symptoms

First symptoms are visible 2-6 weeks after infection as ring spots on leaves. The newly emerging leaves are small, rounded or pinched inwards and rugose with varying patterns of mottling and minute ring spots. Necrotic spots and irregularly shaped lesions develop on leaves and petioles. Stem also exhibits necrotic streaks.



Plant becomes stunted with short internodes and short auxillary shoots. Leaflets show reduction in size, distortion of the lamina, mosaic mottling and general chlorosis. In advanced conditions, the necrosis of buds occurs. Top bud is killed and necrosis spreads downwards. Drastic reduction in flowering and seeds produced are abnormally small and wrinkled with the dark black lesions on the testa.

Pathogen

It is caused by *Groundnut bud necrosis virus* (GBNV). The virus particles are spherical, 30 nm in diameter, enveloped, ssRNA with multipartite genome.

Disease cycle

The virus perpetuates in the weed hosts viz., *Bidens pilosa*, *Eriogon bonariensis*, *Tagetes minuta* and *Trifolium subterraneum*. The virus is transmitted by thrips viz., *Thrips palmi*, *T. tabaci* and *Frankliniella* sp.

Management

- Adopt plant spacing of 15x15 cm.
- Remove and destroy infected plants up to 6 weeks after sowing.
- Application of Monocrotophos 500 ml/ha, 30 days after sowing either alone or in combination with AVP (Anti Viral Principle) extracted from sorghum or coconut leaves. Spray the crop with 10 per cent AVP at 500 lit/ha, ten and twenty days after sowing.

Minor diseases

Stem rot - *Sclerotium rolfsii*

Symptoms

The first symptom is the sudden drying of a branch which is completely or partially in contact with the soil. The leaves turn brown and dry but remain attached to the plant. Near soil on stems white growth of fungus mycelium is appeared. As the disease advances white mycelium web spreads over the soil and the basal canopy of the plant. The sclerotia, the size and colour of mustard seeds, appear on the infected areas as the disease develops and spreads. The entire plant may be killed or only two or three branches may be affected. Lesions on the developing pegs can retard pod development. Infected pods are usually rotted.



Management

- Cultural practices such as deep' covering or burial of organic matter before planting, non-dirting cultivation by avoiding movement of soil up around the base of plants and preventing accumulation of organic debris are extremely useful in reducing the disease.
- Crop rotation with wheat, corn and soyabean may minimize the incidence of stem rot.
- Seed treatment with Carbendazim / Thiram / Captan @ 2-3 g/kg seed.
- Seed treatment with *Trichoderma viride* formulation (4g/kg) followed by application of 2.5kg *Trichoderma viride* formulation mixed with 50kg farm yard manure before sowing.

Wilt - *Fusarium oxysporum* and *F. solani*

Symptoms

Germinating seeds are attacked by the pathogens shortly before emergence. There is general tissue disintegration and the surface of the seedling is covered with sporulating mycelium. Damping off symptoms characterized by brown to dark brown Water soaked sunken lesions on the hypocotyl which later encircle the stem and extend above the soil level. Roots are also attacked, especially the apical portions. The affected seedlings become yellow and wilted. The leaves turn greyish green and the plants dry up and die. The roots and stems show internal vascular browning and discolouration. These fungi are also commonly associated with pod rot.

Management

- Seed treatment with systemic fungicides like Carbendazim at 2g/kg seed.

Anthracnose - *Colletotrichum dematium* and *C. capsici*

Symptoms

Small water-soaked yellowish spots appear on the lower leaves which later turn into circular brown lesions with yellow margin 1 to 3 mm in diameter. In some cases lesions enlarge rapidly become irregular and cover the entire leaflet, and extend to the stipules and stems. Brownish grey lesions occur on both the surfaces of leaflets. Infection spreads to stipules, petioles and branches.



Disease cycle

The pathogen is seed, soil and air-borne.

Management

- Deep summer ploughing.
- Use healthy certified seeds.
- Removal of plant debris.
- Seed treatment with copper oxychloride at 3g/kg seed or carbendazim at 2g/kg seed.

Yellow mould - *Aspergillus flavus*

Symptoms

Seed and un-emerged seedlings attacked by the pathogen are rapidly shriveled and dried. Brown or black mass covered by yellow or greenish spores may be seen. Decay is most rapid when infected seeds are planted. After seedling emergence cotyledons already infected with the pathogen, show necrotic lesions with reddish brown margins. This necrosis terminates at or near the cotyledonary axis. Under field conditions the diseased plants are stunted, and are often

chlorotic. The leaflets are reduced in size with pointed tips, widely varied in shape and sometimes with veinal clearing.

Management

- Since the fungus is a weak parasite, agronomic practices which favour rapid germination and vigorous growth of seedling will reduce the chance of *A. flavus* infection.
- Seed treatment with carbendazim or captan or thiram at 2g/kg seed.

Grey mould - *Botrytis cinerea*

Infection is seen on leaves, stem and underground parts of the groundnut. Initially infection occurs at ground level by a light grey fungal rot which causes death of the plants.

Bacterial wilt - *Pseudomonas solanacearum*

Infected plants appear unhealthy, chlorotic and wilt under water stress. Dark brown discolouration of xylem is seen. Grey slimy liquid ooze out of the vascular bundles.

Leaf spot - *Alternaria arachidis* and *A. tenuissima*

Symptoms

Lesions produced by *A. arachidis* are brown in colour and irregular in shape surrounded by yellowish halos. Symptoms produced by *A. tenuissima* are characterized by blighting of apical portions of leaflets which turn light to dark brown colour. Lesions produced by *A. alternata* are small, chlorotic, water soaked, that spread over the surface of the leaf. The lesions become necrotic and brown and are round to irregular in shape. Veins and veinlets adjacent to the lesions become necrotic. Lesions increase in area and their central portions become pale, rapidly dry out, and disintegrate. Affected leaves show chlorosis and in severe attacks become prematurely senescent. Lesions can coalesce, give the leaf a ragged and blighted appearance.



Management

- Foliar application of Mancozeb (2kg/ha) or Copper oxychloride (2kg/ha) or Carbendazim (500g/ha).

Indian Peanut Clump Disease - *Peanut Clump virus*

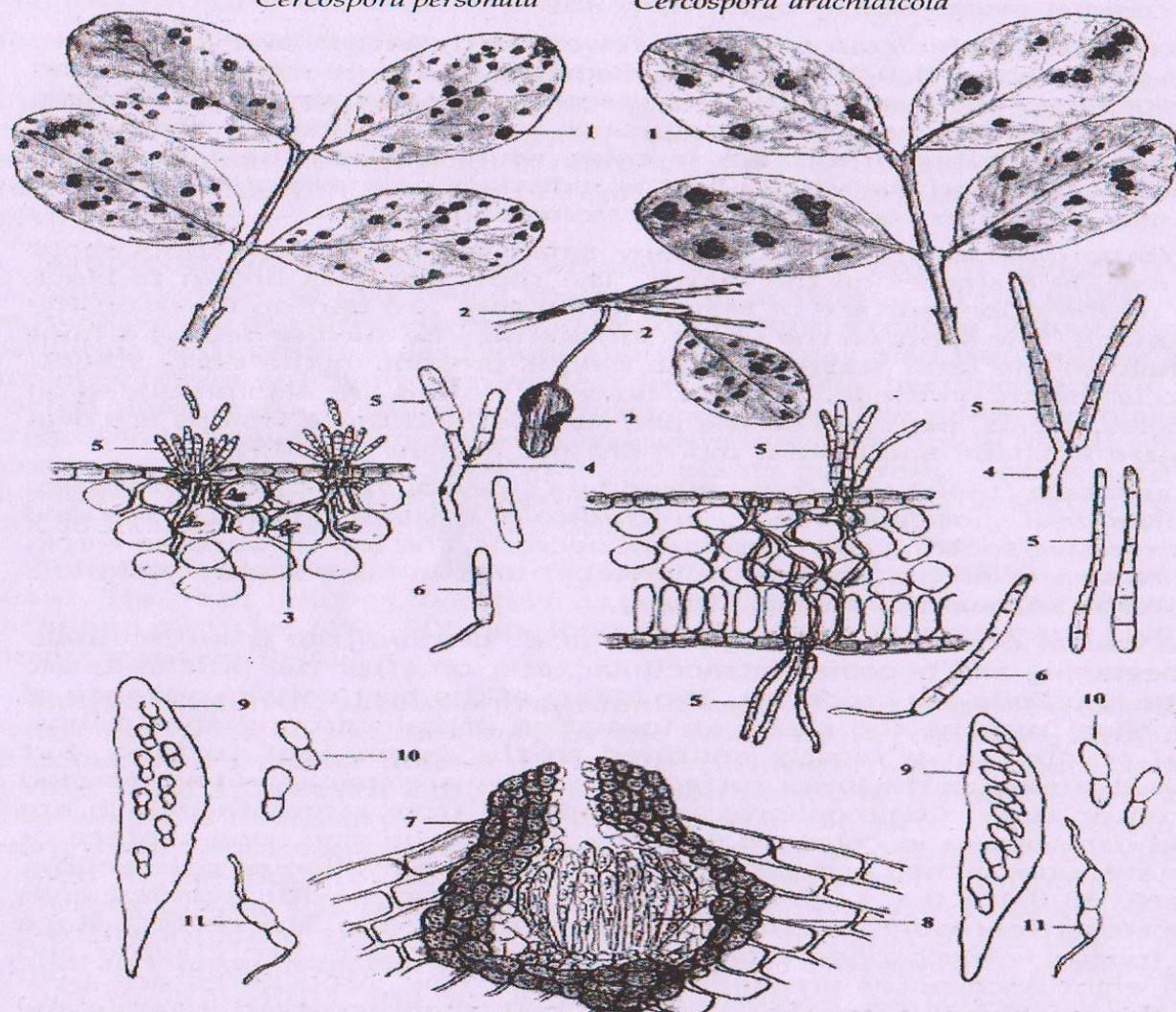
Earlier this disease was confused with groundnut rossste. Now it is recognized as a distinct virus causing clump disease. The leaves turn very dark and plants become severely stunted. The disease is soil borne and transmitted by a fungus, *Polymyxa graminis*. The pH of the soil affects transmission. It is also transmitted by seed. The virus is rod shaped, 190-245nm long x 21nm wide, not enveloped, ssRNA genome.

Other virus diseases of minor importance occurring on groundnut are:

Peanut chlorotic streak (caused by Caulimovirus, occurs only in India), Peanut green mosaic and mottle (caused by a Potyvirus), peanut stunt (caused by Cucumovirus), groundnut chlorotic spot (caused by a Potexvirus), groundnut eye spot (caused by Potyvirus) and groundnut ringspot.

Fig. 45: Brown leaf spot or 'Tikka' leaf spot of groundnut

(i) Late 'Tikka' leaf spot
Cercospora personata (ii) Early 'Tikka' leaf spot
Cercospora arachidicola



1. Leafspots on the leaves 2. Lesions on the stem, peg and shell of pod 3. Haustorium 4. Conidiophore 5. Conidia 6. Germinating conidium 7. Ascocarp 8. Ascus 9. Ascus with ascospores 10. Ascospores 11. Germinating ascospore 12. Germ tube.

Fig. 46: Rust disease of groundnut-*Puccinia arachidis*

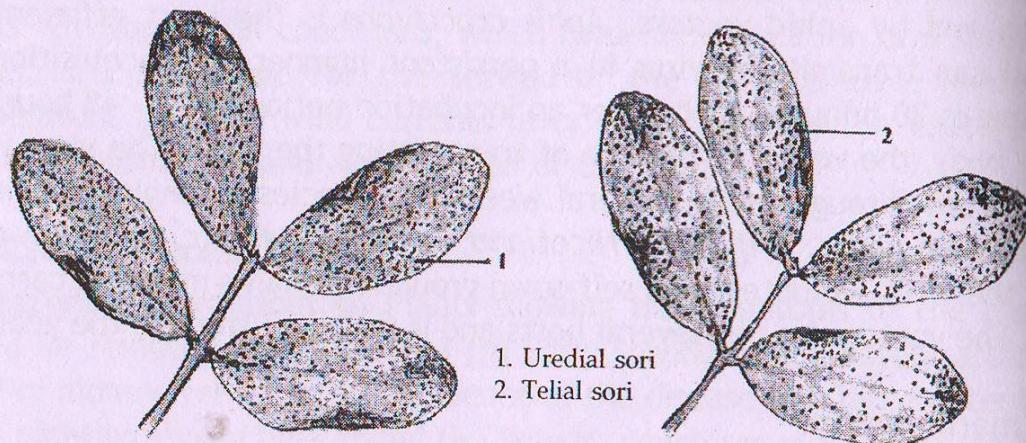
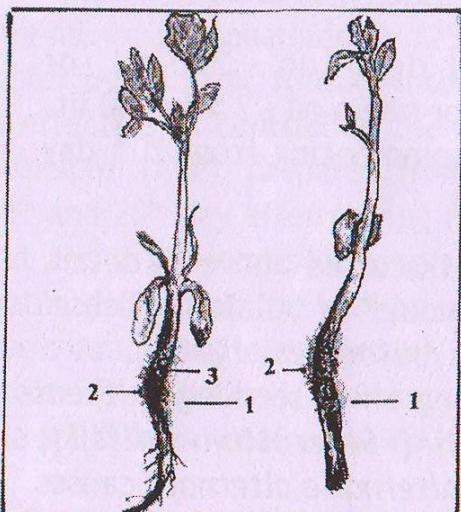
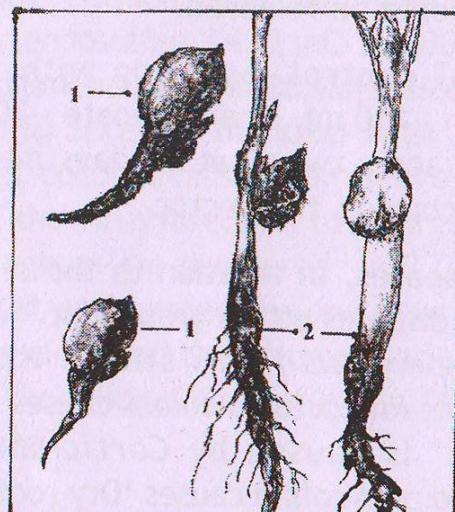


Fig. 47: Root rot of groundnut
Rhizoctonia bataticola



1. Lesions on the collar region
2. Mycelium 3. Sclerotia

Fig. 48: Seed rot of groundnut
Aspergillus niger



1. Pre-emergence rotting
2. Post-emergence rotting

Diseases of Castor

Seedling blight - *Phytophthora parasitica*

Symptoms

The disease appears circular, dull green patch on both the surface of the cotyledon leaves. It later spreads and causes rotting. The infection moves to stem and causes withering and death of seedling. In mature plants, the infection initially appears on the young leaves and spreads to petiole and stem causing black discoloration and severe defoliation.



Dead seedling



Spot on older leaf



Leaf blight symptom

Pathogen

The pathogen produces non-septate and hyaline mycelium. Sporangia emerge through the stomata on the lower surface singly or in groups. They are unbranched and bear single celled, hyaline, round or oval sporangia at the tip singly. The sporangia germinate to produce abundant zoospores. The fungus also produces oospores and chlamydospores in adverse seasons.

Favourable Conditions

- Continuous rainy weather.
- Low temperature (20-25°C).
- Low lying and ill drained soils.

Disease cycle

The pathogen remains in the soil as chlamydospores and oospores which act as primary source of infection. The fungus also survives on other hosts like potato, tomato, brinjal, sesamum etc. The secondary spread takes place through wind borne sporangia.

Management

- Remove and destroy infected plant residues.
- Avoid low-lying and ill drained fields for sowing.
- Treat the seeds with thiram or captan at 4g/kg.

Rust – *Melampsora ricini*

Symptoms

Minute, orange-yellow coloured, raised pustules appear with powdery masses on the lower surface of the leaves and the corresponding areas on the upper surface of the leaves are yellow. Often the pustules are grouped in concentric rings and coalesce together to form drying of leaves.



Pustules on lower leaf surface

Pathogen

The pathogen produces only uredosori in castor plants and other stages of the life cycle are unknown. Uredospores are two kinds, one is thick walled and other is thin walled. They are elliptical to round, orange-yellow coloured and finely warty.

Disease cycle

The fungus survives in the self sown castor crops in the off season. It can also survive on other species of *Ricinus*. The fungus also attacks *Euphorbia obtusifolia*, *E.geniculata* and *E.marginata*. The infection spreads through airborne uredospores.

Management

- Rogue out the self-sown castor crops and other weed hosts.
- Spray Mancozeb at 2kg/ha or Propiconazole 1l/ha.

Leaf blight- *Alternaria ricini*

Symptoms

All the aerial parts of plants viz., leaves, stem, inflorescences and capsules are liable to be attacked by the pathogen. Irregular brown spots with concentric rings form initially on the leaves

and covered with fungal growth. When the spots coalesce to form big patches, premature defoliation occurs. The stems, inflorescences and capsules are also show dark brown lesions with concentric rings. On the capsules, initially brown sunken spots appear, enlarge rapidly and cover the whole pod. The capsules crack and seeds are also get infected.



Alterneria leaf spot with concentric rings

Pathogen

The pathogen produces erect or slightly curved, light grey to brown conidiophores, which are occasionally in groups. Conidia are produced in long chains. Conidia are obclavate, light olive in colour with 5-16 cells having transverse and longitudinal septa with a beak at the tip.

Favourable Conditions

- High atmospheric humidity (85-90 %).
- Low temperature (16-20°C)

Disease cycle

The pathogen survives on hosts like *Jatropha pandurifolia* and *Bridelia hamiltoniana*. The pathogen is externally and internally seed-borne and causes primary infection. The secondary infection is through air-borne conidia.

Management

- Treat the seeds with captan or thiram at 2g/kg.
- Remove the reservoir hosts periodically.
- Spray mancozeb at 2kg/ha.

Brown leaf spot - *Cercospora ricinella*

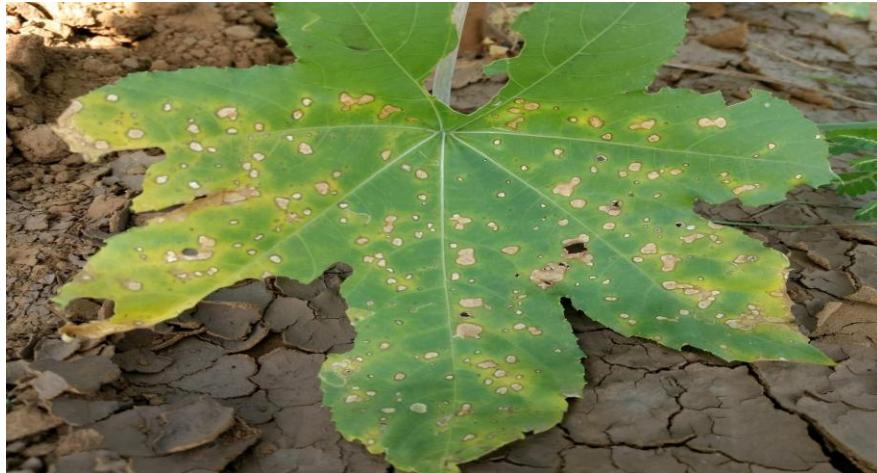
Symptoms

The disease appears as minute brown specks surrounded by a pale green halo. The spots enlarge to greyish white centre portion with deep brown margin. The spots may be 2-4 mm in diameter and when several spots coalesce, large brown patches appear but restricted by veins. Infected tissues often drop off leaving shot-hole symptoms. In severe infections, the older leaves

may be blighted and withered.

Pathogen

The pathogen hyphae collect beneath the epidermis and form a hymenial layer. Clusters of conidiophores emerge through stomata or epidermis. They are septate and un branched with deep brown base and light brown tip. The conidia are elongated, colourless, straight or slightly curved, truncate at the base and narrow at the tip with 2-7 septa.



Disease cycle

The pathogen remains as dormant mycelium in the plant debris. The disease mainly spreads through wind borne conidia.

Management

- Spraying with 1% Bordeaux mixture or Copper oxy chloride @ 0.2% may help to bring the disease under check; but where the cultures of Eri-silk worm are maintained on castor plants, spraying would not be desirable.
- Use of resistant varieties would be the most effective method for combating the disease.
- Spraying twice with Mancozeb 2g/lit or Carbendazim 500g/ha at 10-15 day interval reduces the disease incidence.
- Treat the seed with thiram or Captan 2gm/kg seed.

Powdery mildew - *Leveillula taurica*

Symptoms

It is characterized by typical mildew growth which is generally confined to the under-surface of the leaf. When the infection is severe the upper-surface is also covered by the whitish growth of the fungus. Light green patches, corresponding to the diseased areas on the under surface, are visible on the upper side especially when the leaves are held against light.



Powdery mass covering entire leaf

Management

- When weather is comparatively dry spray twice with wettable Sulphur 2g/lit at 15 days interval, starting from 3 months after sowing.
- Spray 1ml hexaconazole or 2ml dinocap / litre of water at fortnight intervals. The variety Jwala is resistant to this disease.

Stem rot - *Macrophomina phaseolina*

Symptoms

Small brown depressed lesions on and around nodes. Increase in size on both directions causing 2 to 20 cm necrotic area. Lesions often coalesce and girdle the stem causing leaf drop. Drying and death starts from apex and progress. Infected capsules discoloured and drop easily. Sudden wilting of plants in patches under high moisture stress coupled with high soil temperature. Plant exhibit symptoms of drought and drooping of leaves. At ground level black lesions are formed on the stem. Young leaves curl inwards with black margins and drop off later, such branches Die-back. Entire branch and top of the plant withers.



Affected plant showing drooping of leaves

Management

- Grow tolerant and resistant varieties like Jyothi, Jwala, GCH-4, DCH-30 and SHB-145.
- Avoid water logging.
- Destruction of crop debris.
- Selection of healthy seed.
- Providing irrigation at critical stages of the crop.
- Treat the seed with thiram @ 2g/kg or carbendazim at 2g/ kg seed.
- Seed treatment with *Trichoderma viride* formulation at 4g/kg of seed.
- Soil drenching with Carbendazim (1g/1 litre of water) 2-3 times at 15 days interval.

Bacterial leaf spot - *Xanthomonas campestris* pv. *ricinicola*

Symptoms

The pathogen attacks cotyledons, leaves and veins and produces few to numerous small round, water-soaked spots which later become angular and dark brown to jet black in color. The spots are generally aggregated towards the tip. At a later stage the spots become irregular in shape particularly when they coalesce and areas around such spots turn pale-brown and brittle. Bacterial ooze is observed on both the sides of the leaf which is in the form of small shining beads or fine scales.

Management

- Field sanitation help in minimizing the yield loss as pathogen survives on seed and plant debris.
- Hot water treatment of seed at 58°C to 60°C for ten minutes.
- Grow tolerant varieties.
- Spray Copper oxychloride 2kg/ha or Streptocycline 100g/ha or Paushamycin 250g/ha.

Wilt - *Fusarium oxysporum*

Symptoms

When seedlings are attacked cotyledonary leaves turn to dull green colour, wither and die subsequently. Leaves are droop and drop off leaving behind only top leaves. Diseased plants are sickly in appearance. Wilting of plants, root degeneration, collar rot, drooping of leaves and necrosis of affected tissue and finally leading to death of plants. Necrosis of leaves starts from margins spreading to interveinal areas and finally to the whole leaf. Spilt open stem shows brownish discolouration and white cottony growth of mycelia much prominently in the pith of the stem.



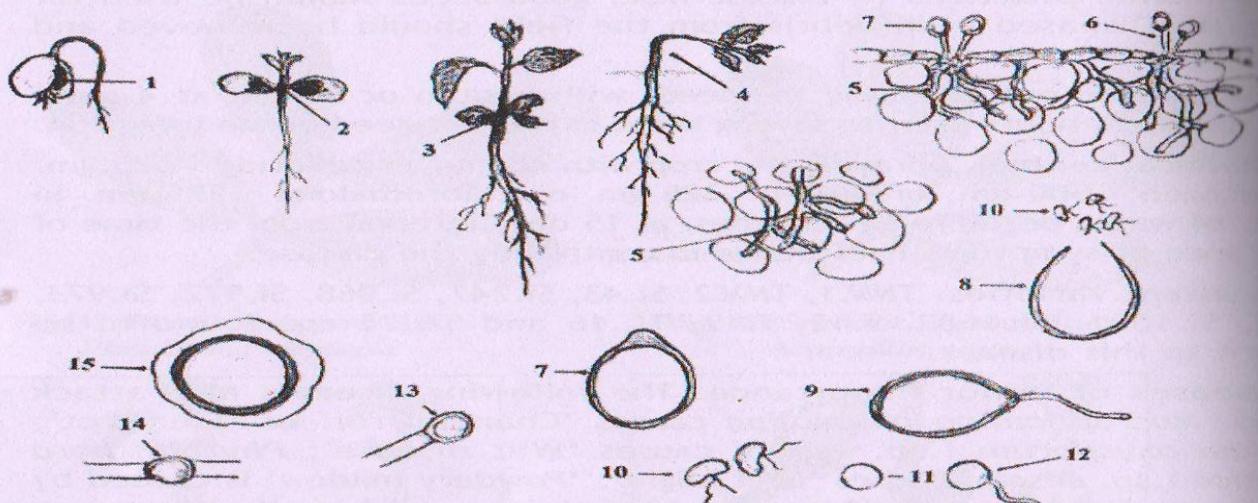
Castor wilt
Symptoms

Management

- Selection of disease free seeds.
- Grow tolerant and resistant varieties like Jyothi, Jwala, GCH-4 DCH-30 and SHB 145.
- Avoid water logging
- Burning of crop debris

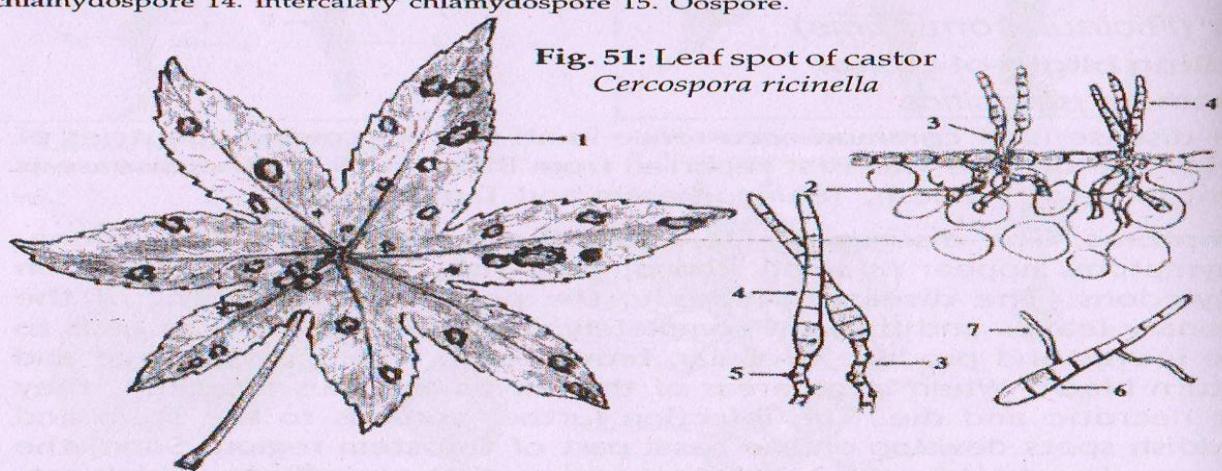
- Green manuring and intercropping with red gram
- Treat the seeds with thiram @ 2g/ kg or carbendiazim @ 2g/ kg seed.
- Seed treatment with 4g of *Trichoderma viride* talc formulation.
- Multiplication of 2kg of *T.viride* formulation by mixing in 50kg farm yard manure
- Sprinkling water and covering with polythene sheet for 15days and then applying between rows of the crops is helpful in reducing the incidence.

Fig. 50: Seedling blight of castor-*Phytophthora parasitica*



1. Lesion on cotyledon 2. Lesion extending to the stem from the cotyledon 3. Infection on the stem
4. Toppled diseased seedling 5. Inter and intracellular mycelium 6. Sporangioaphore 7. Sporangium
8. Germination of sporangium by zoospores 9. Germination of sporangium by germ tube
10. Zoospores 11. Encysted zoospore 12. Germination of encysted zoospore 13. Terminal chlamydospore 14. Intercalary chlamydospore 15. Oospore.

**Fig. 51: Leaf spot of castor
*Cercospora ricinella***



1. Spots on leaf 2. Inter and intracellular mycelium 3. Conidiophore 4. Conidium 5. Scar on the conidiophore 6. Germination of conidium 7. Germ tube.

Diseases of Red Gram

Wilt - *Fusarium udum*

Symptoms

The disease may appear from early stages of plant growth (4-6 week old plant) up to flowering and podding. The disease appears as gradual withering and drying of plants. Yellowing of leaves and blackening of stem starting from collar to branches which gradually result in drooping and premature drying of leaves, stems, branches and finally death of plant. Vascular tissues exhibit brown discoloration. Often only one side of the stem and root system is affected resulting in partial wilting.



Pathogen

The fungus produces hyaline, septate mycelium. Microconidia are hyaline, small, elliptical or curved, single celled or two celled. Macroconidia are also hyaline, thin walled, linear, curved or fusoid, pointed at both ends with 3-4 septa. The fungus also produce thick walled, spherical or oval, terminal or intercalary chlamydospores singly or in chains of 2 to 3.

Favourable conditions

- Soil temperature of 17-25°C.
- Continuous cultivation of redgram in the same field.

Disease cycle

The fungus survives in the infected stubbles in the field. The primary spread is by soil-borne chlamydospores and also by infected seed. Chlamydospores remain viable in soil for 8-20 years. The secondary spread in the field is through irrigation water and implements.

Management

- Treat the seeds with *Trichoderma viride* at 4 g/kg (10^6 cfu/g).
- Avoid successive cultivation of red gram in the same field.
- Crop rotation with tobacco.
- Mixed cropping with sorghum in the field.
- Grow resistant cultivars like Sharad, Jawahar, Maruthi, Malviya Arhar-2, C-11, Pusa-9, Narendra Arhar-1 and Birsa Arhar-1

Dry root rot - *Macrophomina phaseolina* (Sclerotial stage: *Rhizoctonia bataticola*)

Symptoms

The disease occurs both in young seedlings and grown up plants. Infected seedlings can show reddish brown discoloration at collar region. The lower leaves show yellowing, drooping and premature defoliation. The discolored area later turns to black and sudden death of the plants occurs in patches.

The bark near the collar region shows shredding. The plant can be easily pulled off leaving dark rotten root in the ground. Minute dark sclerotia are seen in the shredded bark and root tissues. Large number of brown dots seen on the stem portion represents the pycnidial stage of the fungus.



Pathogen

The fungus produces dark, brown, filamentous hyphae and constrictions are seen in hyphal branches at the junction with main hyphae. Sclerotia are jet black, smooth, hard, minute, globose and 110-130 μ m in diameter. The pycnidia are dark brown and ostiolated. Conidiophores (phialides) are hyaline, short, obpyriform to cylindrical, develop from the inner walls of the pycnidium. The conidia (Pycnidiospores) are hyaline, single celled and ellipsoid to ovoid.

Favourable Conditions

- Prolonged drought followed by irrigation.
- High temperature of 28-35°C.

Disease cycle

The primary spread of the disease is by seed and soil. Secondary spread is by air-borne conidia. The pathogen survives as sclerotia in the soil as facultative parasite and in dead host debris.

Management

- Treat the seeds with carbendazim or thiram at 2g/kg or pellet the seeds with *Trichoderma viride* at 4 g/kg (10^6 cfu/g).
- Apply heavy doses of farm yard manure or green leaf manure like *Gliricidia maculata* at 10 t/ha or apply Neemcake at 150 kg/ha.

Powdery mildew - *Leveillula taurica*

Symptoms

White powdery growth of the fungus can be seen on the lower surface of leaves. The corresponding areas in upper surface show pale yellow discoloration. The white powdery mass consists of conidiophores and conidia of the fungus. In severe cases, the white growth can be seen on the upper surface also. The severe infection of the fungus leads to premature shedding of leaves and plant remains barren.



Pathogen

The fungus is intercellular and absorbs nutrition through haustoria. The conidiophores, which arise through stomata, are hyaline, long, non septate, slender and rarely branched and bear single conidium at the tip. The conidia are hyaline, single celled and elliptical or clavate. The fungus also produces black, globose cleistothecia with simple myceloid appendages. They

contain 9-20 cylindrical asci. Each ascus contains 3-5 ascospores which are also hyaline and unicellular.



Conidia and conidiophores

Favourable Conditions

- Dry humid weather following rainfall.

Disease Cycle

The fungus survives in the soil through cleistothecia and ascospores from asci infect the first lower most leaves near the soil level. Secondary spread is by air-borne conidia.

Management

Spray Carbendazim 500g/ha or Wettable sulphur 2 kg/ha at the initiation of the disease and repeat after 15 days.

Stem blight - *Phytophthora drechsleri* fsp. *cajani*

Symptoms

Initially purple to dark brown necrotic lesions girdle the basal portion of the stem and later may occur on aerial parts. Initially lesions are small and smooth, later enlarging and slightly depressed. Infected tissues become soft and whole plant dies. In grown up plants, infection is mostly confined to basal portions of the stem. The infected bark becomes brown and the tissue softens causing the plant to collapse. In leaf, localized yellowing starts from the tip and margin and gradually extends towards the mid-rib. The centre of the spots later turn brown and hard. The spots increase in size and cover a major portion of the lamina, leading to drying.



Pathogen

Fungus produces hyaline, coenocytic mycelium. The sporangiophores are hyaline bearing ovate or pyriform, non-papillate sporangia. Each sporangium produces 8-20 zoospores. Oospores are globose, light brown, smooth and thick walled.

Favourable Conditions

- Soils with poor drainage,
- Low lying areas,
- Heavy rain during the months of July- September
- High temperature (28-30°C).

Disease Cycle

The fungus survives in the soil and plant debris in the form of oospores. Primary infection is from oospores and secondary spread of the disease by zoospores from sporangia. Rain splash and irrigation water help for the movement of zoospores.

Management

- Treat the seeds with Metalaxyl at 6 g/kg.
- Spray Metalaxyl at 500 g/ha.
- Adjust the sowing time so that crop growth should not coincide with heavy rainfall.

Leaf spot - *Cercospora indica*

Symptoms

Small, light brown coloured spots appear on leaves. The spots later become dark brown and the infected portions drop off leaving shot hole symptoms. When several spots join together, irregular necrotic blotches develop and premature defoliation occurs. In severe cases, black lesions develop on petioles and stem.



Pathogen

The fungus produces large number of whip-like, hyaline, 7-9 septate conidia in groups on

the conidiophores which are light to dark brown in colour.

Disease cycle

The fungus survives in the infected plant tissues. The disease is spread by airborne conidia.

Management

- Remove the infected plant debris and destroy.
- Spray Mancozeb 2 kg or Carbendazim 500 g/ha soon after the appearance of symptom and repeat after a fortnight.

Sterility Mosaic Disease (SMD) - *Pigeonpea sterility mosaic virus* (PPSMV)

Symptoms

The Symptoms are characterized by bushy and pale green appearance of plants. The excessive vegetative growth, stunting, prominent mosaic on leaves and reduction in leaf size. Complete or partial cessation of flowering leads to sterility. Depending on genotype three types of symptoms are recognized. They are

- a. Severe mosaic and sterility
- b. Mild mosaic and partial sterility
- c. Chlorotic ringspot without any noticeable sterility.



Light and dark green mosaic pattern on leaves

Pathogen

It is caused by *Pigeonpea sterility mosaic virus* (PPSMV). The virions are slender highly flexuous filamentous virus like particles (VLPS) of 3-10 nm diameter, a major virus specific proteins of 32kDa and 5-7 major RNA species of 0.8-6.8kb.

Disease cycle

It is not transmitted by infectious sap. It is transmitted by an eriophyid mite, *Aceria cajani* in a semi persistant manner, mites retaining the virus 12-13 hours, eggs of mites do not transmit. The self grown redgram plants and perennial species act as source of virus inoculums.

Management

- Rogue out infected plants up to 40 days after sowing.
- Spray Monocrotophos at 500 ml/ha soon after appearance of the disease and if necessary, repeat after 15 days.
- Grow resistant genotypes/cultivars like ICP 7035, VR3, Purple 1, DA11, DA32, ICP 6997, Bahar, BSMR 235, ICP 7198, PR 5149, ICP 8861 and Bhavanisagar 1.

Minor diseases

Seedling blight - *Sclerotium rolfsii*

Small brown water soaked dots appear near collar region, expands to irregular necrotic spots leading to girdling of stem and death of seedling.



Brown blotch - *Colletotrichum capsici*

Purple brown discolouration occurs mainly on pods but also on petioles, leaf veins, stems and peduncles. Pods become distorted and have black fruiting bodies.

Anthracnose - *Colletotrichum lindemuthianum* (*Glomerella cingulata*)

Black lesions develop on stem which spreads to leaf petiole and leaves. Black sunken lesions also develop on pod.

Stem rot - *Pythium aphanidermatum*

Seedlings of 2-3 weeks old are severely attacked at collar region and death occurs immediately. Greyish green water soaked lesions develop on adult plants, leading to girdling of stem.

Leaf spot - *Alternaria alternata*

Water soaked, circular to irregular spots occur. The centre of the spot is straw coloured with raised reddish brown margins.

Halo blight - *Pseudomonas phaseolicola*

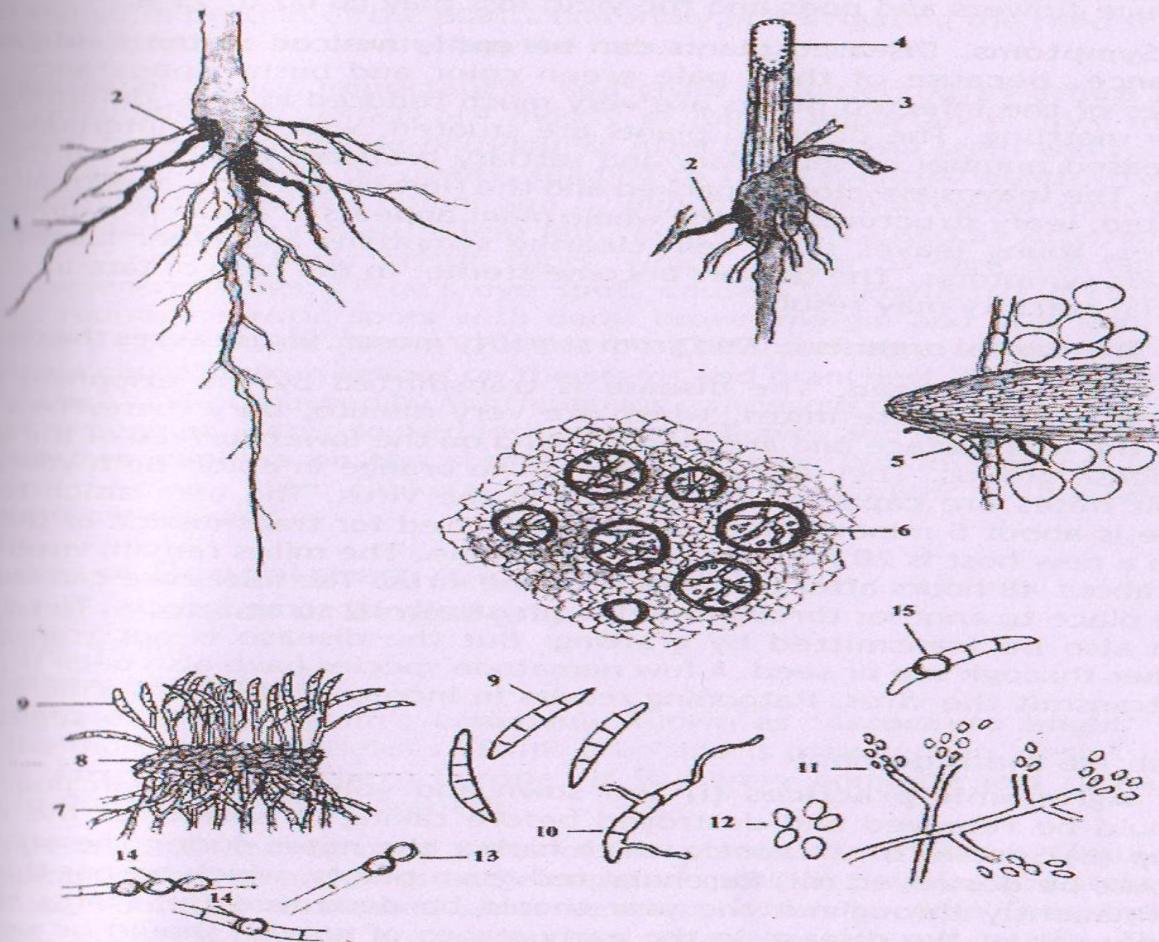
Small brown spots appear on leaves and develop a chlorotic halo. The spots extend and

form dried brown zone. Brown elongated streaks appear on petioles, stem and pods.

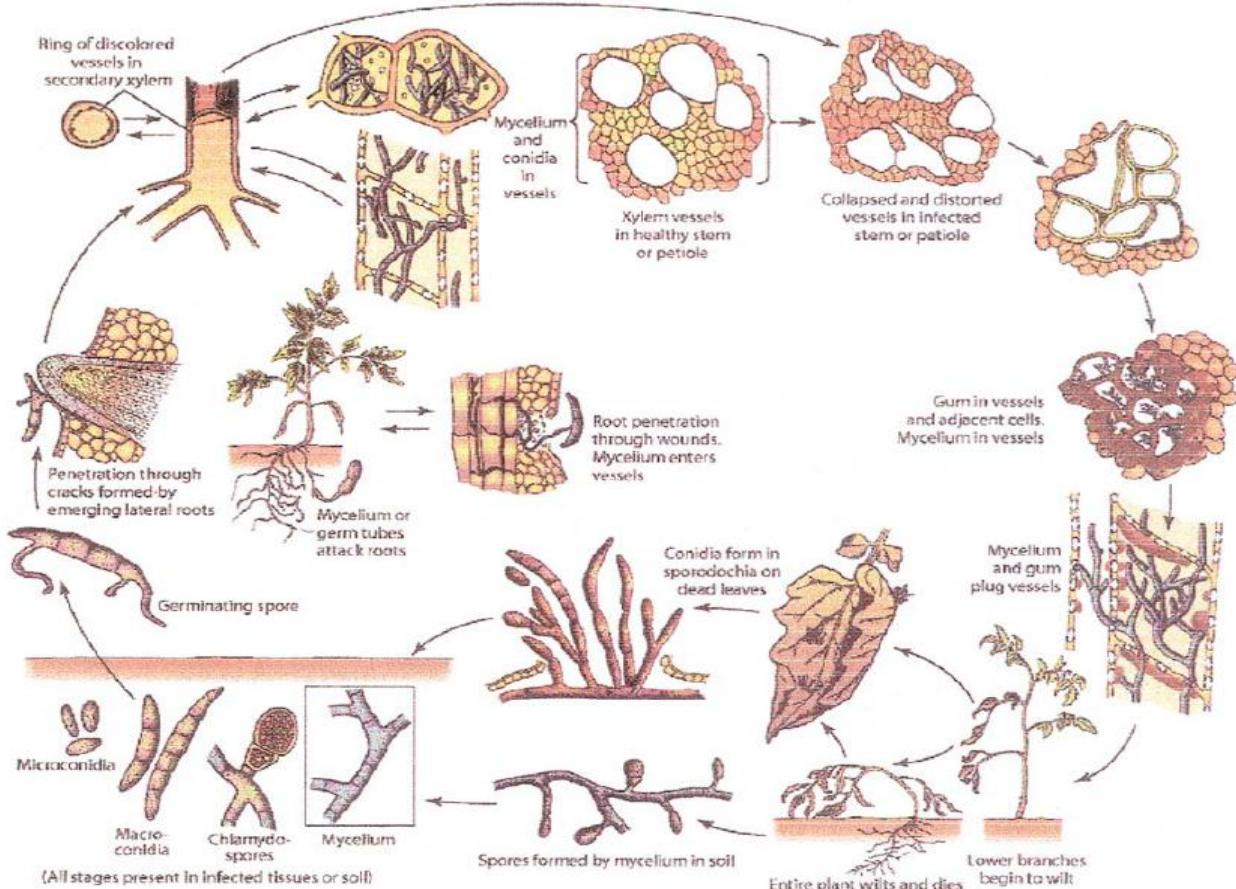
There are two other virus diseases reported on pigeonpea, mosaic and yellow mosaic transmitted by aphids and whiteflies which are of sporadic occurrence only.



Fig. 33: Wilt of red gram-*Fusarium udum*



1. Infected lateral root becoming dark 2. Infection spreading to the stem 3. Streaks beneath the rind of the stem 4. Ring of discolored xylem vessels 5. Penetration through cracks formed by emerging lateral root 6. Mycelium, microconidia and chlamydospores inside the larger xylem vessels 7. Mycelium 8. Stroma 9. Macroconidia 10. Germinating macroconidium 11. Microconidia from hyphal tips 12. Microconidia 13. Terminal chlamydospores 14. Intercalary chlamydospores 15. Chlamydospores from macroconidium.



Disease cycle of Fusarium wilt

Diseases of Green gram and Black gram

Powdery mildew - *Erysiphe polygoni*

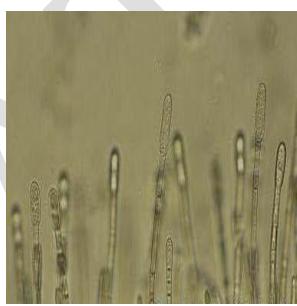
Symptoms

Small, irregular powdery spots appear on the upper surface of the leaves, sometimes on both the surfaces. The disease becomes severe during flowering and pod development stage. The white powdery spots completely cover the leaves, petioles, stem and even the pods. The plant assumes greyish white appearance; leaves turn yellow and finally shed. Often pods are malformed and small with few ill-filled seeds.

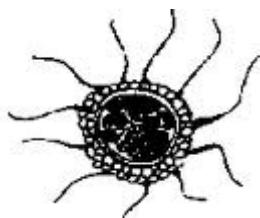


Pathogen

The fungus is ectophytic, spreading on the surface of the leaf, sending haustoria into the epidermal cells. Conidiophores arise vertically from the leaf surface, bearing conidia in short chains. Conidia are hyaline, thin walled, elliptical or barrel shaped or cylindrical and single celled. Later in the season, cleistothecia appear as minute, black, globose structures with myceloid appendages. Each cleistothecium contains 4-8 asci and each ascus contains 3-8 ascospores which are elliptical, hyaline and single celled.



Conidia and conidiophores



Cleistothecium

Favourable Conditions

- Warm humid weather.
- The disease is severe generally during late kharif and rabi seasons.

Disease cycle

The Pathogen is an obligate parasite and survives as cleistothecia in the infected plant debris. Primary infection is usually from ascospores 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

- Remove and destroy infected plant debris.
- Spray Carbendazim 500g or Wettable sulphur 2kg or Tridemorph 500 ml/ha at the initiation of disease and repeat 15 days later.

Anthracnose - *Colletotrichum lindemuthianum* (Sexual stage: *Glomerella lindemuthianum*)

Symptoms

The symptom can be observed in all aerial parts of the plants and at any stage of crop growth. The fungus produces dark brown to black sunken lesions on the hypocotyl area and cause death of the seedlings. Small angular brown lesions appear on leaves, mostly adjacent to veins, which later become greyish white centre with dark brown or reddish margin.

The lesions may be seen on the petioles and stem. The prominent symptom is seen on the pods. Minute water soaked lesion appears on the pods initially and becomes brown and enlarges to form circular, depressed spot with dark centre with bright red or yellow margin. Several spots join to cause necrotic areas with acervuli. The infected pods have discolored seeds.



Pathogen

The fungus mycelium is septate, hyaline and branched. Conidia are produced in acervuli, arise from the stroma beneath the epidermis and later rupture to become erumpent. A few dark coloured, septate setae are seen in the acervulus. The conidiophores are hyaline and short and bear oblong or cylindrical, hyaline, thinwalled, single celled conidia with oil globules. The

perfect stage of the fungus produces perithecia with limited number of ascii, which contain typically 8 ascospores which are one or two celled with a central oil globule.

Favourable Conditions

- High relative humidity (Above 90 per cent),
- Low temperature (15-20° C)
- Cool rainy days.

Disease cycle

The fungus is seed-borne and cause primary infection. It also lives in the infected plant tissues in soil. The secondary spread by air borne conidia produced on infected plant parts. Rain splash also helps in dissemination.

Management

- Remove and destroy infected plant debris in soil.
- Treat the seeds with Carbendazim at 2 g/kg.
- Spray Carbendazim 500g or Mancozeb 2kg/ha soon after the appearance of disease and repeat after 15 days.

Leaf spot - *Cercospora canescens*

Symptoms

Small, circular spots develop on the leaves with grey centre and brown margin. Several spots coalesce to form brown irregular lesions. In severe cases defoliation occurs. The brown lesions may be seen on petioles and stem in severe cases. Powdery growth of the fungus may be seen on the centre of the spots.



Pathogen

The fungus produces clusters of dark brown septate conidiophores. The conidia are linear, hyaline, thin walled and 5-6 septate.

Favourable Conditions

- Humid weather and dense plant population.

Disease cycle

The fungus survives on diseased plant debris and on seeds. The secondary spread is by

air-borne conidia.

Management

- Remove and burn infected plant debris.
- Spray Mancozeb at 2 kg/ha or Carbendazim at 500 g/ha.

Rust - *Uromyces phaseoli typica* (Syn: *U. appendiculatus*)

Symptoms

The disease is mostly seen on leaves, rarely on petioles, stem and pods. The fungus produces small, round, reddish brown uredosori mostly on lower surface. They may appear in groups and several sori coalesce to cover a large area of the lamina. In the late season, teliosori appear on the leaves which are linear and dark brown in colour. Intense pustule formation causes drying and shedding of leaves.



Pathogen

It is autoecious, long cycle rust and all the spore stages occur on the same host. The uredospores are unicellular, globose or ellipsoid, yellowish brown with echinulations. The teliospores are globose or elliptical, unicellular, pedicellate, chestnut brown in colour with warty papillae at the top. Yellow coloured pycnia appear on the upper surface of leaves. Orange coloured cupulate aecia develop later on the lower surface of leaves. The aeciospores are unicellular and elliptical.

Favourable Conditions

- Cloudy humid weather, temperature of 21-26° C
- Nights with heavy dews

Mode of Spread and Survival

The pathogen survives in the soil through teliospores and as uredospores in crop debris. Primary infection is by the sporidia developed from teliospores. Secondary spread is by wind-

borne uredospores. The fungus also survives on other legume hosts.

Management

- Remove the infected plant debris and destroy.
- Spray Mancozeb 2 kg or Carbendazim 500 g or Propiconazole 1L/ha, immediately on the set of disease and repeat after 15 days.

Web blight/ Rhizoctonia blight/ Dry root rot- *Rhizoctonia bataticola* (Pycnidial stage: *Macrophomina phaseolina*) Symptoms

The disease symptom starts initially with yellowing and drooping of the leaves. The leaves later fall off and the plant dies within a week. Dark brown lesions are seen on the stem at ground level and bark shows shredding symptom. The affected plants can be easily pulled out leaving dried, rotten root portions in the ground. The rotten tissues of stem and root contain a large number of black minute sclerotia.



Pathogen

The fungus produces dark brown, septate mycelium with constrictions at hyphal branches. Minute, dark, round sclerotia in abundance. The fungus also produces dark brown, globose ostiolated pycnidia on the host tissues. The pycnidiospores are thin walled, hyaline, single celled and elliptical.

Favourable conditions

- Day temperature of 30°C.
- Prolonged dry season followed by irrigation.

Disease cycle

The fungus survives in the infected debris and also as facultative parasite in soil. The primary spread is through seed-borne and soil-borne sclerotia. The secondary spread is through pycnidiospores which are air-borne.

Management

- Treat the seeds with carbendazim + thiram at 2 g/kg (1:1 ratio) or pellet the seeds with *Trichoderma viride* at 4 g/kg (10^6 cfu/g) or *Pseudomonas fluorescens* @ (10^6 cfu/g) of seed.
- Apply farm yard manure or green leaf manure (*Gliricidia maculata*) at 10 t/ha or neemcake at 150 kg/ha.

Mungbean Yellow mosaic disease - *Mungbean yellow mosaic virus* (MYMV)

Symptoms

Initially small yellow patches or spots appear on green lamina of young leaves. Soon it develops into a characteristic bright yellow mosaic or golden yellow mosaic symptom. Yellow discoloration slowly increases and leaves turn completely yellow. Infected plants mature later and bear few flowers and pods. The pods are small and distorted. Early infection causes death of the plant before seed set.



Pathogen

It is caused by *Mungbean yellow mosaic India virus* (MYMIV) in Northern and Central region and *Mungbean yellow mosaic virus* (MYMV) in western and southern regions. It is a Begomovirus belonging to the family geminiviridae. Geminivirus particles, ssDNA, bipartite genome with two genomic components DNA-A and DNA-B.

Disease cycle

Transmitted by whitefly, *Bemisia tabaci* under favourable conditions. Disease spreads by feeding of plants by viruliferous whiteflies. Summer sown crops are highly susceptible. Weed hosts viz., *Croton sparsiflorus*, *Acalypha indica*, *Eclipta alba* and other legume hosts serve as reservoir for inoculum.

Management

- Rogue out the diseased plants up to 40 days after sowing.
- Remove the weed hosts periodically.
- Increase the seed rate (25 kg/ha).
- Grow resistant black gram variety like VBN-1, PDU 10, IC12/2 and PLU 322. Cultivate the crop during rabi season.
- Follow mixed cropping by growing two rows of maize (60 x 30 cm) or sorghum (45 x 15 cm) or cumbu (45 x 15 cm) for every 15 rows of black gram or green gram.
- Treat the seeds with Thiometoxam-70WS or Imidacloprid-70WS @4g/kg
- Spray Thiometoxam-25WG @ 100g or Imidacloprid 17.8% SL @ 100 ml in 500 lit of water.

Leaf crinkle disease - *Urdbean leaf crinkle virus (ULCV)*

Symptoms

Crinkling and curling of the tips of leaflets and increase in leaf area. Crinkling and rugosity in older leaves becomes severe and leaves thickened. Petioles as well as internodes are shortened. Infected plant gives a stunted and bushy appearance. Flowering is delayed, if inflorescence is formed, is malformed with small size flower buds and fails to open.



Pathogen

Casual organism of the disease is not yet ascertained.

Disease cycle

Presence of weed hosts like *Aristolochia bracteata* and *Digera arvensis*. Kharif season crop and continuous cropping of other legumes serve as source of inoculum. The virus is seed-borne and primary infection occurs through infected seeds. Perhaps white fly, *Bemisia tabaci* helps in the secondary spread. The virus is also sap transmissible.

Management

- Use increased seed rate (25 kg/ha).
- Rogue out the diseased plants at weekly interval up to 45 days after sowing. Cultivate seed crop during rabi season.

- Remove weed hosts periodically.
- Spray methyl demeton on 30 and 40 days after sowing at 500 ml/ha.

Minor diseases

Ascochyta leaf spot - *Ascochyta phaseolorum*

Small irregular spot with grey to brown centre and yellow border. They rapidly enlarge to produce very large brown lesions with concentric markings.

Bacterial blight - *Xanthomonas phaseoli*

Circular, reddish brown spots appear on leaves, enlarge to form irregular brown lesions.

Water soaked, sunken spots with red border occur on pods.

Diseases of Soybean

Dry root rot - *Macrophomina phaseolina*

Symptoms

The disease symptom starts initially with yellowing and drooping of the leaves. The leaves later fall off and the plant dies within a week. Dark brown lesions are seen on the stem at ground level and bark shows shredding symptom. The affected plants can be easily pulled out leaving dried, rotten root portions in the ground. The rotten tissues of stem and root contain a large number of black minute sclerotia.



Pathogen

The fungus produces dark brown, septate mycelium with constrictions at hyphal branches. Minute, dark, round sclerotia in abundance. The fungus also produces dark brown, globose ostiolated pycnidia on the host tissues. The pycnidiospores are thin walled, hyaline, single celled and elliptical.

Favourable conditions

- Day temperature of 30°C
- Prolonged dry season followed by irrigation.

Disease cycle

The fungus survives in the infected debris and also as facultative parasite in soil. The primary spread is through seed-borne and soil-borne sclerotia. The secondary spread is through seed-borne and soil-borne sclerotia. The secondary spread is through pycnidiospores which are air-borne.

Management

- Treat the seeds with Carbendazim or Thiram at 2 g/kg or pellet the seeds with *Trichoderma viride* at 4 g/kg or *Pseudomonas fluorescens* @ 10g/kg of seed.
- Apply farm yard manure or green leaf manure (*Gliricidia maculata*) at 10 t/ha or neem cake at 150 kg/ha.

Wilt - *Fusarium oxysporum* f. sp. *tracheiphilum*

Symptoms

Symptoms do not appear until the plants are about six weeks old. Initially a few plants are noticed with pale green flaccid leaves which soon turn yellow. Growth is stunted, chlorosis, drooping, premature shedding or withering of leaves with veinal necrosis often occurs and finally plant dies within 5 days. Brownish, purple discoloration of the cortical area is seen, often extends throughout the plant.



Pathogen

The fungus produces falcate shaped macroconidia which are 4-5 septate, thin walled and hyaline. The microconidia are single celled hyaline and oblong or oval. The chlamydospores are also produced in abundance.

Favourable conditions

Temperature of 20-25°C and moist humid weather.

Disease cycle

The fungus survives in the infected stubbles in the field. The primary spread is through soilborne chlamydospores and infected seeds. The secondary spread is through conidia by irrigation water.

Management

- Treat the seeds with Carbendazim or Thiram at 2 g/kg or treat the seeds with *Trichoderma viride* at 4 g/kg.
- Spot drenching with Carbendazim at 0.5 g/litre.

Leaf spot - *Cercospora sojina*

Symptoms

Light to dark gray or brown areas varying from specks to large blotches appear on seeds. The disease primarily affects foliage, but, stems, pods and seeds may also be infected. Leaf lesions are circular or angular, at first brown then light brown to ash grey with dark margins. The leaf spot may coalesce to form larger spots. When lesions are numerous the leaves wither and drop prematurely. Lesions on pods are circular to elongate, light sunken and reddish brown.



Favourable conditions

- Fungus survives in infected seeds and in debris.
- Warm, humid weather favor disease incidence

Management

- Use resistant varieties.
- Use healthy or certified seeds.
- Rotate soybean with cereals.
- Completely remove plant residue by clean ploughing the field soon after harvest.
- Destroy last years infected stubble.
- Seed treatment with Thiram + Carbendazium (1:1) @ 2g/kg seed.
- Spray Mancozeb @ 2g/L or Carbenzadum (500 mg/L).

Mosaic - Soybean mosaic virus (SMV) Symptoms

Diseased plants are usually stunted with distorted (puckered, crinkled, ruffled, narrow) leaves. Pods become fewer and smaller seeds. Infected seeds get mottled and deformed. Infected seeds fail to germinate or they produce diseased seedlings.



Pathogen

It is caused by *Soybean mosaic virus* - a potyvirus. Flexuous particles 750 - 900nm long, ss RNA genome.

Disease cycle

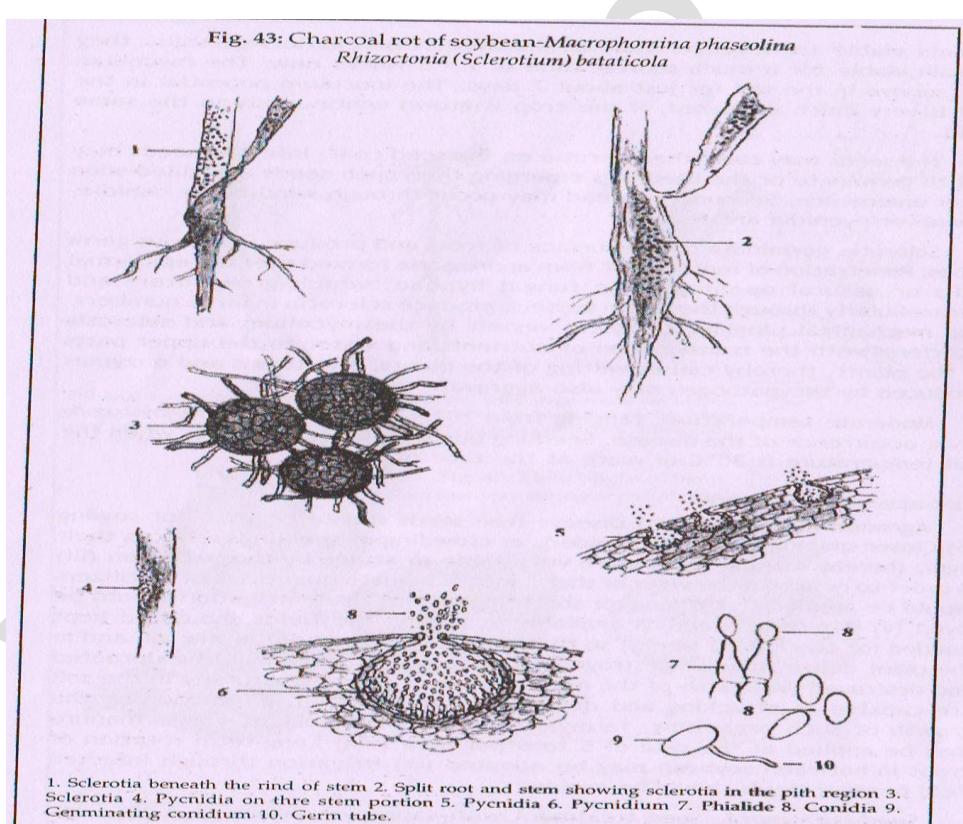
Soybean mosaic virus is seed borne. The SMV can be transmitted through sap, 32 aphid species are involved in transmission.

Favorable conditions

- Temperature around 18° C
- Humid weather.

Management

- Deep summer ploughing.
- Use resistant or tolerant varieties.
- Use healthy/certified seeds.
- Keep the field free from weeds.
- Rogue out infected plants and burn them
- Pre-sowing soil application of Phorate @ 10 kg/ha.
- Two foliar sprays of Thiamethoxam 25 WG @ 100 g/ha or Methyl demeton 800 ml/ha at 30 and 45 days after sowing.



1. Sclerotia beneath the rind of stem 2. Split root and stem showing sclerotia in the pith region 3. Sclerotia 4. Pycnidia on the stem portion 5. Pycnidia 6. Pycnidium 7. Phialide 8. Conidia 9. Germinating conidium 10. Germ tube.

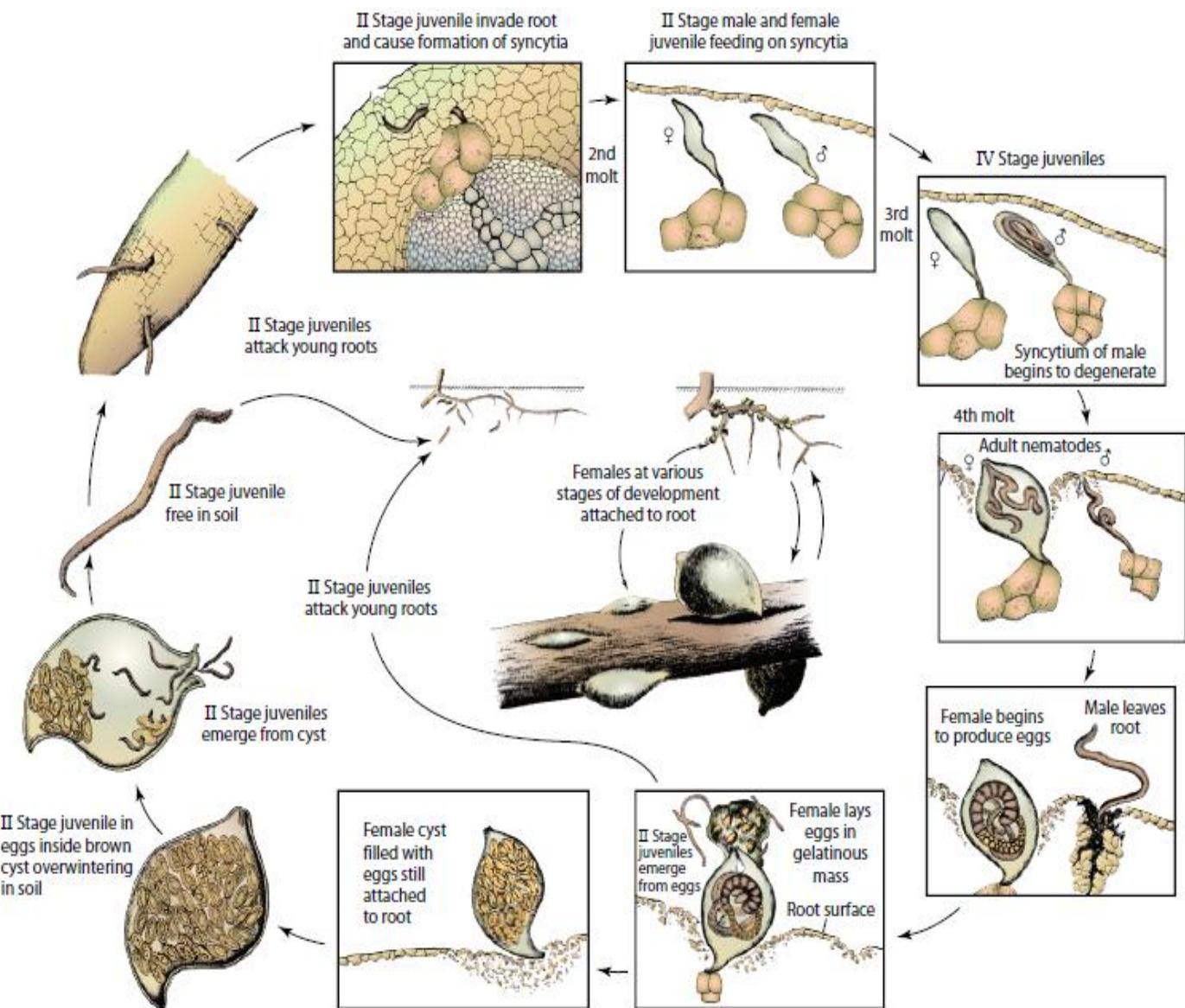


FIGURE 15-13 Disease cycle of the soybean cyst nematode *Heterodera glycines*.

Disease cycle of the soybean cyst nematode *Heterodera glycines*

Diseases of Banana

Panama disease: *Fusarium oxysporum* f. sp. *cubense*

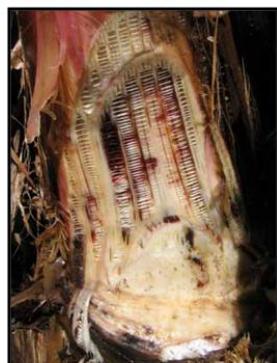
Economic Importance

The first major disease which attacked banana was called Panama disease from the area where it first became serious. Banana wilt is a soil-borne fungal disease and gets entry in the plant body through roots and wounds caused by nematodes. It is most serious in poorly drained soil. Disease spreads through infected suckers.

Fusarium wilt- *Fusarium oxysporum* f. sp. *cubense*



Early symptoms of *Fusarium* wilt



Reddish-brown to maroon discoloration of vessels in the pseudo-stem



Pseudostem pitting



Complete wilting of plants



Yellowing of the lower most leaves starting from margin to midrib of the leaves.

Yellowing extends upwards and finally heart leaf alone remains green for some time and it is also affected. The leaves break near the base and hang down around pseudostem. Longitudinal splitting of pseudostem. Discolouration of vascular vessels as red or brown streaks. The fungus spreads through use of infected rhizomes. Continuous cultivation results in build up of inoculum.

Pathogen

Mycelium is septate, hyaline and branched. Fungus produces micro, macro conidia and also chlamydospores. Micro conidia - Single celled or rarely one septate hyaline elliptical or oval. Macro conidia - Sickle shaped hyaline, 3-5 septate and tapering at both ends.

Chlamydospores - Thick walled, spherical to oval, hyaline to slightly yellowish in colour.

Mode of spread and survival

The pathogen is soil borne. It survives in soil as chlamydospores for longer periods. The primary spread of the disease is through infected rhizomes and secondary spread is through irrigation water. Continuous cultivation results in build up of inoculum.

Management

Avoid growing of susceptible cultivars viz., Rasthali, Monthan, Red banana and Virupakshi. Grow resistant cultivar Poovan. Since nematode predispose the disease pairing and prolinage wit Carbofuran granules. Corm injection of 3 ml of 2% Carbendezim injected in the corm by making a hole to a depth of 10cm with 45° angle on 5 th and 7 th month as mentioned earlier.

Moko disease: *Ralstonia solanacearum / Pseudomonas solanacearum / Burkholderia solanacearum*

Symptoms

Leaves become yellow and progress upwards. The petiole breaks and leaves hang. When it is cut open discolouration in vascular region with pale yellow to dark brown colour. The discolouration is in the central portion of the corm. Internal rot of fruits with dark brown discoloration. When the pseudostem is cut transversely bacterial ooze can be seen.



Pathogen

It is rod shaped, gram negative bacterium with one polar flagellum.

Mode of spread and survival

The pathogen is soil borne, it survives in susceptible hosts like banana and Heliconia spp.

Management

Eradicate infected plant. Expose soil to direct sunlight. Use of clean planting material. Fallowing and crop rotation is advisable. Disinfection of pruning of tools. Providing good

drainage.

Tip over or Heart rot: *Erwinia carotovora* subsp. *carotovora*

Symptoms

The base of the pseudostem and upper portion of the corm are affected and leads to rotting. Young 1-3 month old plantation susceptible during summer months.

Management

Plant disease free suckers. Remove infected plants and destroy. Drench with Methoxy ethyl mercuric chloride (Emisan-6) 0.1 / or Sodium hypohlorite 10% or Bleaching powder 20g /litre/tree.

Sigatoka disease : *Mycosphaerella musicola* (*Cercospora musae*)

Symptoms

On leaves small light yellow or brownish green narrow streaks appear. They enlarge in size becomes linear, oblong, brown to black spots with dark brown brand and yellow halo. Black specks of fungal fruitification appear in the affected leaves. Rapid drying and defoliation of the leaves.

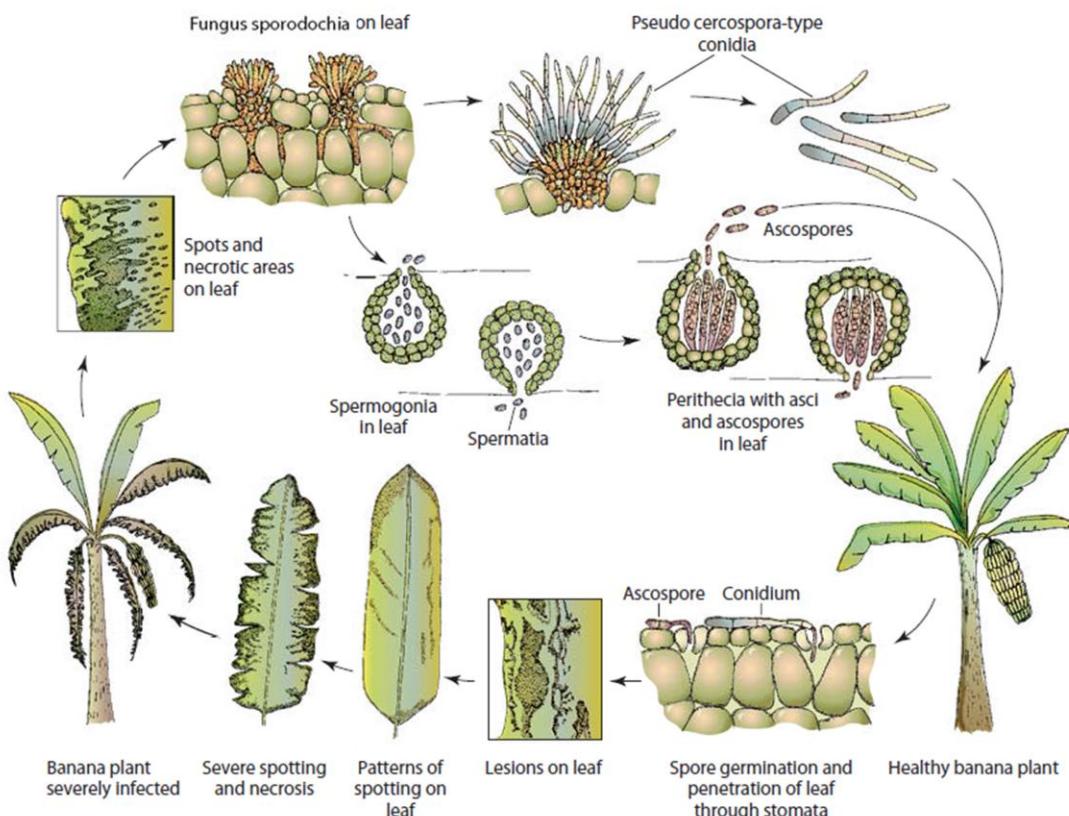


Pathogen

Conidia are elongated, narrow and multi septate and measure 20 – 80 x 2-6micron meter.

Perithecia are dark brown to black and ascii are oblong, clavate and measure 28.8- 36.8x8.0-10.8 micron meter. Ascospores are one septate, hyaline, obtuse with upper cell slightly broader.

Disease Cycle



Development of Sigatoka disease of banana caused by *Mycosphaerella musicola* or *M. fijiensis*

Management

Removal and destruction of the affected leaves. Spray Propiconazole + Carbendazim 0.1% or Chlorothalonil 0.25%. Add wetting agent such as teepol or sandovit added at the rate of 1ml/lit of water.

Cigar end Rot (*Verticillium theobromae*, *Trachysphaera fructigena* and *Gloeosporium musarum*)



A black necrosis spread from the perianth into the tip of immature fingers. The rotted

portion of the banana finger is dry and tends to adhere to fruits (appears similar to the ash of a cigar).

Pathogen

Conidiophores are usually solitary or in small groups. Conidia are hyaline, oblong to cylindrical. They are borne at the end of tapering phialides, aggregated into rounded, mucilaginous translucent heads.

Control:

Removal of pistil and perianth by hand 8-10 days after bunch formation and spraying the bunch with Dithane M -45 (0.1%) or Topsin M (0.1%) controls the disease effectively. Minimising bruising; prompt cooling to 14°C; proper sanitation of handling facilities reduce the incidence in the cold storage.

Anthracnose: *Gloeosporium gloeosporioides*

Symptoms:



The skin at the distal ends of the fingers turn black shrivels. The fungus produces masses of conidia which form a pinkish coat. The entire fruit and bunch is affected in severe cases. Sometimes main stalk of bunch diseased. The bunch becomes black and rotten. Acervuli produces cylindrical conidiophores, hyaline, septate, branched. Conidia hyaline, non-septate, oval to elliptical.

Pathogen

Acervuli are usually rounded or sometimes elongated, erumpent. Conidiophores are cylindrical, tapered towards the apex, hyaline and septate. Conidia are hyaline, aseptate, oval to ellipitical in shape.

Mode of spread and survival

The spread of the disease is by air borne conidia and numerous insects which frequently visit banana flowers also spread the disease.

Management

Post harvest dipping of fruits in Carbendazim 400 ppm, or Benomyl 1000 ppm, or Aureofunginsol 100 ppm.

Freckle or Black Spot: *Phyllostictina musarum*

Symptoms



Minute raised dark brown spots appear with black dots in the centre on leaves and fruits. On the fruits the pathogen is confined to the skin. The fungus produces pycnidium which are dark. conidiophores simple, short, elongate. Conidia are byline, single celled ovoid. Fungus survives in infected plant debris. Conidia spread by rain water and wind.

Pathogen

The fungus produces pycnidia and pycnidiospores. Pycnidiospores are needle shape, hyaline and multi septate.

Management

Spray Copper oxychloride 0.25%. Add wetting agent such as teepol or sandovit added at the rate of 1ml/lit of water.

Banana bunchy top: *Banana bunchy top virus*

Economic Importance

The disease is covered by domestic quarantine regulations. Losses were estimated to be Rs.4 crores every year and 100% loss occurs if infected suckers are planted.

Symptoms



Subsequent leaving show the same symptoms and are dwarfed. Dark broken bands of green tissues on the veins, leaves and petioles. Plants are extremely stunted. Leaves are reduced in size marginal chlorosis and curling. Leaves upright and become brittle. Many leaves are crowded at the top. Branches size will very small. If infected earlier no bunch will be produced. The disease is transmitted primarily by infected suckers.

Mode of spread

Secondary spread is through the aphid vector *Pentalonia nigronervosa*

Management

Select suckers from disease free areas. Control vector by spraying methyl demeton 1 ml/l.or Monocrotophos, 2 ml/l.or Phosphomidon 1 ml / lit. or Injection of Monocrotophos 1 ml / plant (1 ml diluted in 4 ml). Infected plants are destroyed using 4ml of 2, 4, D (50g in 400 ml of water).

Infectious chlorosis: *Cucumber mosaic virus*

Economic Importance

Infectious chlorosis or heart rot of banana is caused by Cucumber Mosaic Virus (CMV) has recently become serious, the disease has been recorded from 20 to 80 per cent in Poovan cultivar.



Symptoms

Chlorotic or yellow linear discontinuous streaks on leaves, upward curling of leaves, twisting and bunching of leaves at the crown, erectness of newly emerged leaves. Sometimes heart rot symptom also appear. Diseased plants are dwarf, do not produce bunches. The virus spreads through infected suckers and aphid vectors -*Aphis gossypii*

Management

Destroy infected plants. Use disease free suckers. Control vector by spraying systemic insecticide 0.1%.

Toppling over/ Banana burrowing nematode: *Radopholus similis*

Symptoms

Show yellowing of leaves and root discoloration, forms tunnels on suckers, followed by root decay and finally complete plant collapse.

Etiology

Migratory endoparasite and obligate in nature.

Mode of spread and survival

Primary source of inoculum: infected soil and suckers.

Secondary source of inoculum: soil borne, water borne nematodes (2 stages).

Epidemiology

High soil moisture and neutral pH, sandy loam soils and presence of susceptible host.

Life cycle

- The burrowing nematode has a migratory endoparasitic habit.
- Although the stages remain vermiform, sexual dimorphism is apparent with adult males being somewhat degenerated and probably non parasitic.
- Eggs are normally laid on infested tissues within 7-8 days at the rate of about 4 eggs/day.
- The life cycle from egg to egg stage takes 20-25 days at 24°C -25°C for its completion with eggs taking

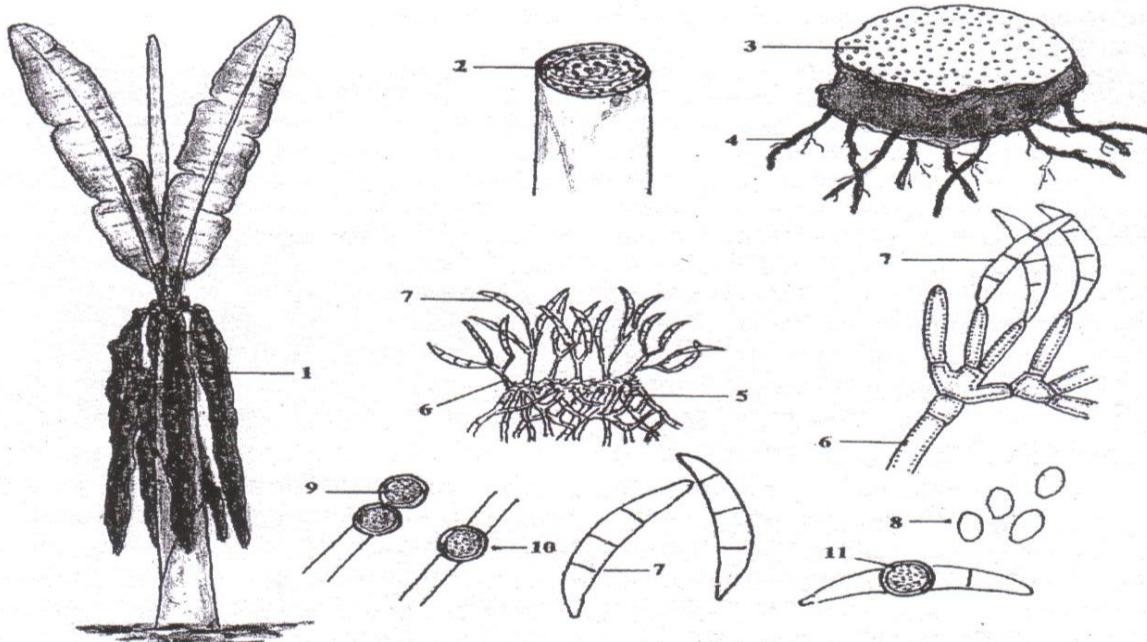
8-10 days to hatch and larvae 10-13 days to mature.

- All the larval stages and female, except male are infective. They invade at any part of the root, causing more root damage and are capable of spending their entire life in the root.

Management

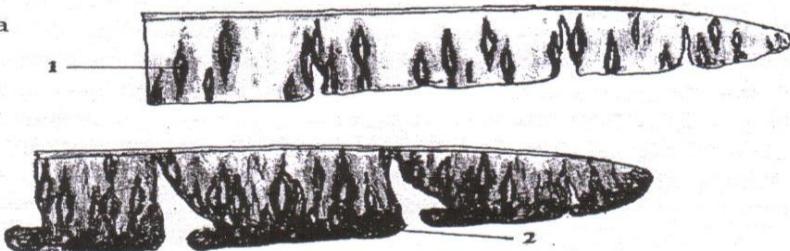
- Use disease free suckers collected from disease free area for plantation.
- Initially infected plants should be pulled out and burnt.
- Use disease resistant cultivars.
- Avoid excess nitrogen application in the soil
- Give proper dose of potassium after testing the soil
- Apply 5-10 kg of FYM at the root zone per plant.
- Application of carbofuran @ 10 -15 gm/plant with FYM and the application of neem cake @ 5kg/plant has also been found effective
- Paring pralinage treatment should be followed (Shaving the discoloured parts on rhizome and treating them with mud having Carbofuran granules).

Fig. 71: 'Panama disease' or *Fusarium* wilt of banana-*Fusarium oxysporum* f.sp. *cubense*

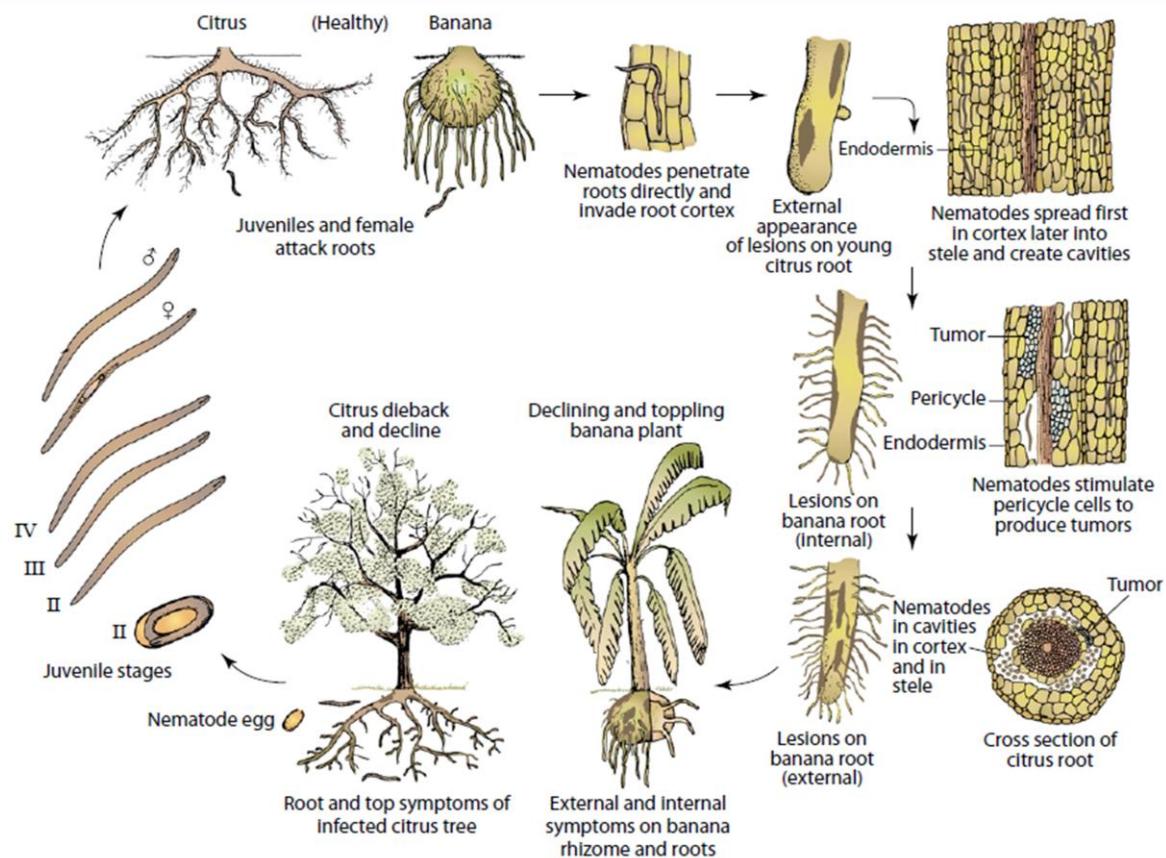


1. Infected plant showing collapsed peripheral leaves 2. Cut stem and 3. Cut corm showing vascular discoloration as dots 4. Blackened and rotten roots 5. Sporodochium 6. Conidiophore 7. Macroconidium 8. Microconidium 9. Terminal and 10. Intercalary chlamydospore 11. Chlamydospore from conidial cell.

Fig. 72: 'Sigatoka disease' of banana
Mycosphaerella musicola
 (= *Cercospora musae*)



1. Leafspots on leaf in the early stages 2. Spots coalesce forming larger patches and drying of leaf from the margin toward.



Disease cycle of the burrowing nematode *Radopholus* sp. in banana and citrus

Diseases of Pomegranate

Cercospora fruit Spot: *Cercospora punicae*

Symptoms

The affected fruits showed small irregular black spots, which later on coalesce, into big spots.



Management

The diseased fruits should be collected and destroyed. Two to three spray at 15 days interval with Mancozeb 0.25%.

Leaf Spot or Blight: *Colletotrichum gloesporioides*; *Pseudocercospora punicae*; *Curvularia lunata* and *Cercospora punicae*)

Symptoms

The disease is characterized by appearance of small, irregular and water-soaked spots on leaves. Affected leaves fall off.



Pathogen

Conidiophores are olivaceous brown, short, fasciculate, sparingly septate. Conidia are hyaline to pale olivalceous cylindric and septate.

Mode of spread and survival

The pathogen spread through wind borne conidia.

Management

Spraying Mancozeb 0.25 % at 15 days interval gives good control of the disease.

Alternaria fruit spot: *Alternaria alternata*

Symptoms

Small reddish brown circular spots appear on the fruits. As the disease advances these spots, coalesce to form larger patches and the fruits start rotting. The arils get affected which become pale and become unfit for consumption.



Management

All the affected fruits should be collected and destroyed. Spraying Mancozeb 0.25 % effectively controls the disease.

POMEGRANATE WILT COMPLEX

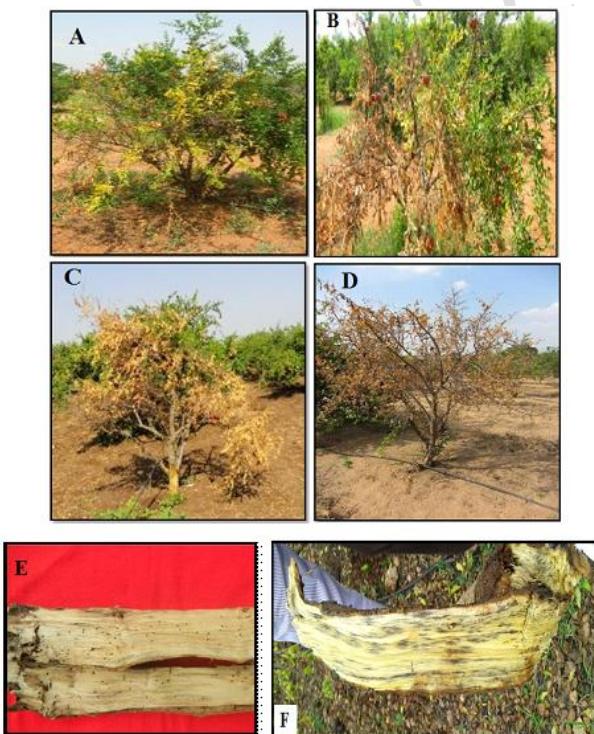
Co: *Ceratocystis fimbriata*, *M. incognita* and scolytid beetle (*Xyleborus fornicatus*)

History

In 1990, pomegranate wilt was first noticed in two areas of Vijayapura district of Karnataka. This disease has rapidly spread in the entire Vijayapura district around 1993. Until 1995, the cause of the disease couldnot be recognized but in 1996, from the discolored stem, root and branch tissues of the wilted plant, the fungus *Ceratocystis fimbriata* was isolated.

Symptomatology

The initial symptoms of disease was characterized as yellowing and wilting of leaves on few to several branches leading to death of affected plants within few weeks. Upon cross-section of the diseased plant, brown discolouration extending from outer xylem from roots to the main trunk was observed (Somasekhara and Wali, 1999).



A. Initial wilting B. Progressive yellowing C. Partial wilting D. Complete wilting
E. Shot holes F. Grayish streaks in vascular and cortex tissues in infected stem

Morphology of pathogen

Somasekhara and Wali (1999), on the basis of the morphological studies, indicated that *C. fimbriata* was belonging to Latin American group. Perithecia were black with a globose base (130 to 300 µm). Ascospores exuded from the apex of the perithecium neck in a long coil and were small, hyaline and hat – shaped (3.8 to 5.0 µm long X 2.3 to 4.0 µm wide). Conidiophores were septate and hyaline to dark greenish brown. Hyaline conidia, 8 to 17 µm long x 6 to 15 µm wide, were usually produced in chains of 10 or more. Thick-walled endoconidia were globose to oval, olive brown, and 8 mm to 20mm in diameter.

Transmission of pathogen

Somasekhara *et al.* (2009) reported that above five year plant were infested with scolytid beetle (*Xyleborus fornicatus*) in the collar region (0.41 %). *C. fimbriata* was also isolated from the scolytid beetles and it may act as a vector of this pathogen. Infected in seedlings, irrigation water, root contact, implements, rain water, budding knife, secateurs and wind are the major sources for the spread of disease and pathogen enters through wounds.

Management

Provide proper spacing 4.5 X 3.0m

Maintain Proper drainage

Sandy loam soils are good for planting

Use healthy planting material

Drip irrigation is good

Infected plant should be drenched with Carbendazim 50 WP (2g/l) or **Propiconazole 25 EC (2ml/l) + Chloropyriphos 20EC (4ml/l)** treat to healthy surrounding plants of infected

Phorate 35g/tree.

Application of **neem cake @ 500 g/plant** twice a year.

Fruit Rot (*Aspergillus foetidus*):



The symptoms are in the form of round black spots on the fruit and petiole. The disease starts from calyx end and gradually the entire fruit shows black spots. The fruit further rots emitting a foul odour.

Management

The disease can be controlled by spraying of Bavistin (0.5%), Dithane M-45 (0.25%) or Dithane Z-78 (0.25%) at an interval of 10-15 days from the onset of flowering.

Bacterial blight

- **Causal organism:** *Xanthomas axonopodis* pv. *punicae*

Symptoms

Small, irregular, water soaked spots appear on the leaves.

- Spots vary from two to five mm in diameter with necrotic centre of pin-head size.
- Spots are translucent which turn light brown to dark brown after sometime and are surrounded by prominent water-soaked margins. Spots coalesce to form large patches.
- Severely infected leaves defoliated.
- The bacterium attacks stems, branches and fruits also.
- On stem, the disease starts as brown to black spots around the nodes .It further causes girdling and cracking of nodes. Finally the branches get broken.
- Brown to black spots formed on fruits which are raised and oily in appearance.



Etiology

- It is a Gram-negative rod, motile with single polar flagellum. It is non acid fast and aerobic.
- Mode of spread and survival
- The bacterium survives on the tree.
- The pathogen survives for 120 days on fallen leaves during the season.
- The primary infection occurs through infected cuttings.The disease spreads through wind and splashed rains.

Epidemiology

- High temperature and low humidity favour the disease. Temperature of 30 - 34° C and relative humidity (80 to 85%) is favourable for multiplication of the pathogen.

Management of

- **Use disease free seedlings**
- **Orchard Sanitation:** affected leaves, stem, fruits should be remove and burnt.
- **Provide proper spacing 4.5 X 3.0m**

- Planting of **Wind breaks**
- Enrich soil with organics and bio agent apply *Trichoderma harzianum*, *Pseudomonas fluroscens*, *Bacillus subtilis*
- First year bearing flower should be removed
- **One crop per year Hasta bahar** (september – october) or Ambe (January- February) is good
- Before pruning – Spray **1% Bordeaux mixture** to reduce leaf infection. Then use **2.5 ml ethrel/l** for defoliation.
- Collect the defoliated leaves and burn it.
- Apply **Bleaching powder (20-25 kg/ha)** at base of plant in early morning (100 g/plant)
- **Pruning Knife, secateurs** should be **disinfect** after every cutting by dipping in **sodium hypochlorite for @ 25 ml/ liter solution.**
- After pruning paste the stem with **streptocycline 0.5g/l or Bromopal (Bacterinashak) + Copper oxychloride 2.0 g/l + red oxide or red soil 200g**
- spray **streptocycline / Bromopal @ 0.5 g + Copper oxychloride 2.0 g/l** 5-6 sprays at interval of 10 days.
- Application of **bio agents** (*pseudomonas fluroscens*, *Bacillus subtilis* 10g/l)
- **Application of micronutrients** (Zn, B, Ca, Mg) immediately after antibiotic spray.
- If the disease pressure is high then **Hasta bahar** is effective to reduce the disease.
- **September-October pruning is good.**
- If June –July pruning - give rest to plants from December to May.
- Avoid unnecessary spraying of insecticides, fungicides, growth regulator and micro nutrients.



Diseases of Papaya

Stem rot / Foot rot – *Pythium aphanidermatum*

Symptoms

Water soaked spot in the stem at the ground level which enlarge and girdle the stem. The diseased area turns brown or black and rot. Terminal leaves turn yellow droop off. The entire plant topples over and dies. Forward by rain. *R. solani* is favoured by dry and hot weather. Common in 2-3 year old trees.



Pathogen

Mycelium is septate, brown and much branched. The sclerotia are black, spherical to irregular shape and produced in abundance.

Management

Seed treatment with Thiram or Captan 4 g/kg or Chlorothalonil.

Drenching with Copper oxychloride 0.25 % or Bordeaux mixture 1% or Metalaxyl 0.1%.

Powdery mildew – *Oidium caricae*



Symptoms

While mycelia growth appear on the upper surface of the leaf, flower stalks and fruit.

Seven attak causes yellowing and defiation of leaves.

Pathogen

It is an obligate parasite. The mycelium is hyaline, septate and haustoria develop in epidermal cells. Conidia are hyaline.

Mode of spread and survival

The pathogen spread through wind borne conidia.

Management

Spray Wettable Sulphur 0.25% or Dinocap 0.05% or Chinomethionate 0.1% or Tridemorph 0.1%.

Papaya ring spot – Papaya ring spot virus

Symptoms

Vein clearing, puckering and chlorophyll leaf tissues lobbing in. Margin and distal parts of leaves roll downward and inwards, mosaic mottling, dark green blisters, leaf distortion which result in shoe string system and stunting of plants. On fruits circular concentric rings are produced. If affected earlier no fruit formation.



Pathogen

The virus particles are rod shaped and thermal inactivation point of the virus lies between 54 and 60°C.

Mode of spread

Vectored by aphids *Aphis gossypii*, *A. craccivora* and also spreads to cucurbits not through seeds.

Management

Raise papaya seedlings under insect-proof conditions. Plant disease free seedlings. Raise

sorghum / maize as barrier crop before planting papaya. Rogue out affected plants immediately on noticing symptoms. Do not raise cucurbits around the field.

Leaf curl – *Papaya leaf curl virus*

Symptoms



Curling, crinkling and distortion of leaves, reduction of leaf lamina, rolling of leaf margins inward and downward, thickening of veins. Leaves become leathery, brittle and distorted. Plants stunted. Affected plants does not produce flowers and fruits.

Mode of spread

Spread by whitefly *Bemisia tabaci*.

Management

Uproot affected plants. Avoid growing tomato, tobacco near papaya. Spraying with systemic insecticides to control the vector.

Anthracnose – *Colletotrichum gloeosporioides*

Symptoms



If affect leaf and stem on erotic spots are produced. On fruit initially brown superficial

discoloration of the skin develops which are circular and slightly sunken. Then they coalesce in which sparse mycelial growth appear on the margins of a spot. Under humid condition salmon pink spores are released. Fruits mummified and deformed.

Mode of spread

Infection is caused by fruit from field. Secondary spread by conidia by rain splashes

Management

Spray with Carbendazim 0.1% (or) Chlorothalonil 0.2% or Mancozeb 0.2%.

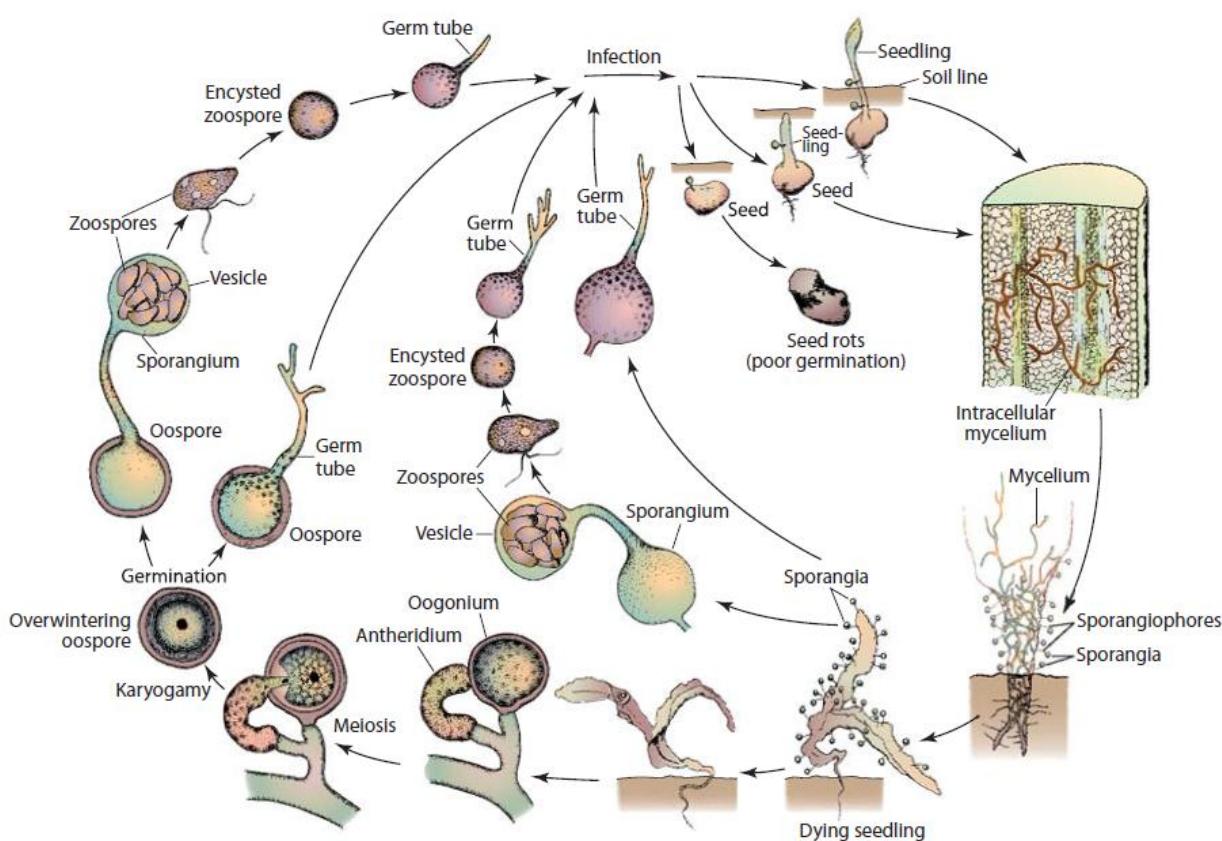


FIGURE 11-18 Disease cycle of damping-off and seed decay caused by *Pythium* sp.

Disease of Guava

Anthracnose: *Colletotrichum gloeosporioides*

Symptoms

Symptoms of this disease are observed on mature fruits on the tree. The characteristic symptoms consist of sunken, dark colored, necrotic lesions. Under humid conditions, the necrotic lesions become covered with pinkish spore masses. As the disease progresses, the small sunken lesions coalesce to form large necrotic patches affecting the flesh of the fruit.



Pathogen

Conidia are hyaline, aseptate, oval to elliptical conidiophore is cylindrical.

Acervulli are dark brown to black.

Mode of Spread and Survival

The conidia are spread by wind or rain.

Management

Spray Mancozeb 0.25%.

Guava rust: *Puccinia psidii*

Symptoms

The pathogen can affect foliage, young shoots, inflorescences and fruit of guava. Typical symptoms associated with this disease include distortion, defoliation, reduced growth and if severe, mortality. On fully expanded leaves, dark bordered, roughly circular brown lesions with yellow halos develop.



Management

Control of guava rust is based on the use of fungicides. Scouting fields for onset of disease or during the times of year when environmental conditions are favorable for pathogen infection are recommended so that proper and timely fungicide applications can control the disease.

Wilt – *Fusarium oxysporum f.sp. psidii, F. solani, Macrophomina phaseolina, Cephalosporium sp., Gliocladium roseum and Verticillium alboarum.*

Economic importance: It was first reported in 1935 from Allahabad. Jhoty et al., in 1984 reported that seven thousand acres of land in A.P under guava cultivation was reduced to half the land value by the presence of the disease.

Symptoms

- The affected plants show yellow colouration with slight leaf curling at the terminal branches, becoming reddish at the later stage and subsequently premature shedding of leaves takes place.
- Twigs become bare and fail to bring forth new leaves or flowers and eventually dry up. Fruits of all the affected branches remain underdeveloped, become hard, black and stony.
- The entire plant becomes defoliated and dies. A few plants also show partial wilting, which is very common symptom of wilt in guava.
- The finer roots show black streaks which become prominent on removing the bark. The roots also show rotting at the basal region and the bark is easily detachable from the cortex.
- The cortical regions of the stem and root show distinct discolouration and damage. Light brown discoloration is noticed in vascular bundles. Bark splitting can be seen in wilted plants in later stages.
- The disease can be categorized into slow wilt and sudden wilt. In slow wilt, plant takes several months or even a year, to wilt after the appearance of initial symptoms and in sudden wilt, infected plant wilts in 15 days to one month.

Favourable conditions:

- **pH 6.0** is optimum for disease development. Both pH 4.0 and 8.0 reduces the disease.
- Disease is more in clay loam and sandy loam compared to heavy soil.
- Higher disease incidence in monsoon period.
- Disease appears from August and increases sharply during September-October.
- The presence of nematode, *Helicotylenchus dihystera*

Management

Cultural:

- Proper sanitation of orchard.
- Wilted plants should be uprooted, burnt and a trench of 1.0-1.5m should be dug around the tree trunk. Treat the pits with formalin and cover the pit for three days and then transplant the seedlings after two weeks.
- While transplanting seedlings avoid damage to the roots.
- Maintain proper tree vigour by timely and adequate manuring, inter-culture and irrigation.

- Intercropping with turmeric or marigold.
- Soil solarization with transparent polythene sheet during summer months.
- Application of oil cakes like neem cake, mahua cake, kusum cake supplemented with urea. Apply 6kg neem cake + 2kg gypsum per plant.
- Judicious amendments of N and Zn.

Host Plant Resistance:

- Resistant variety: **Apple guava**
- Guava species, *Psidium cattleianum* var. *lucidum* and *Syzygium cumini* (Jamun) are resistant to wilt.
- *Psidium cattleianum* (*P. molle*), *P. quianense*, Chinese guava (*P. friedreichianum*) and Phillipine guava are recommended as resistant root stocks

Biological:

- *Aspergillus niger* strain AN 17, *Trichoderma viride*, *Trichoderma harzianum* and *Penicillium citrinum* can be used as biocontrol agents

Chemical:

- Stem injection with 0.1% water soluble 8-Quinolinol sulphate
- Drench with 0.2% Benomyl or Carbendazim, four times in a year and spray twice with Measystox and Zinc sulphate.
- Disinfestation of soil with Metam-sodium at 252 ml/10m² area to control nematodes.



Lecture 09 - Diseases of Brinjal

Bacterial Wilt: *Ralstonia solanacearum*

Symptoms



Bacterial wlt symptoms on leaf surface Wilting, stunting, yellowing of the foliage and finally collapse of the entire plant are the characteristic symptoms of the disease. Lower leaves may droop first before wilting occurs. The vascular system becomes brown. Bacterial ooze comes out from the affected parts. Plant show wilting symptoms at noontime will recover at nights, but die soon.

Pathogen

The bacterium is non acid fast, non spore forming, non capsulated and motile by a polar flagellum. The bacterium produces acid but no gas in dextrose, sucrose, lactose and glycerol. Starch hydrolyzed with slight liquefaction of gelatin.

Mode of spread and survival

The bacterium infects banana, chillies, fennel, ginger, potato, radish, tomato etc., the bacterium though a non spore former is found to be alive and viable for more than 16 months under laboratory conditions. The pathogen is found to be alive in the infected plant debris for about 10 months. Presence of root knot nematode, *Meloidogyne javanica* increases the wilt incidence.

Management

Use resistant variety .Crop rotation with cruciferous vegetables such as cauliflower help in reducing the disease incidence. Fields should be kept clean and effected parts are to be collected and burnt. Spray Copper fungicides to control the disease (2% Bordeaux mixture.). The

disease is more prevalent in the presence of root knot Nematodes, so control of these nematodes will suppress the disease spread.

Cercospora Leaf Spot :*Cercospora solani -melongenae, C. solani*

Symptoms



The leaf spots are characterized by chlorotic lesions, angular to irregular in shape, later turn grayish-brown with profuse sporulation at the centre of the spot. Severely infected leaves drop off prematurely, resulting in reduced fruit yield.

Pathogen

The fungus produces stromata which are globular. Conidiophores in mass are medium dark and slightly olivaceous brown in colour and paler towards the tip. Conidia are sub hyaline to pale olivaceous.

Mode of spread and survival

The disease is spread by air borne conidia.

Management

Pant Samrat variety is resistant to both the leaf spots. Diseases can be managed by growing resistant varieties. Spraying 1 per cent Bordeaux mixture or 2 g Copper oxychloride or 2.5 g Zineb per litre of water effectively controls leaf spots.

Alternaria leaf Spot :*Alternaria melongenae, A. solani*

Symptoms



Cracks appearing in leaf spot. The two species of *Alternaria* occur commonly, causing the characteristic leaf spots with concentric rings. The spots are mostly irregular, 4-8 mm in diameter and may coalesce to cover large areas of the leaf blade. Severely affected leaves may drop off. *A. melongenae* also infects the fruits causing large deep-seated spots. The infected fruits turn yellow and drop off prematurely.

Pathogen

Mycelium is septate, branched, light brown to dark brown. It is inter and intra cellular. Conidiophores emerge through stomata and dark colored. Conidia are single celled, muriform, beaked and produced in chains. The conidia are with 5-10 transverse septa and a few longitudinal or oblique septa.

Mode of spread and survival

The disease is spread by wind borne conidia.

Management

Spraying 1 per cent Bordeaux mixture or 2 g Copper oxychloride or 2.5 g Zineb per litre of water effectively controls leaf spots.

Little Leaf of Brinjal

Economic importance

This disease of brinjal was reported from India in 1938 and as far as known it occurs only in India and Sri Lanka. In almost all the states of the country it has become a serious problem facing brinjal cultivation. The yield loss is hundred per cent in the diseased plants.

Symptom



The characteristic symptom is the smallness of the leaves. The petioles are so short and the leaves appear to be sticking to the stem. Such leaves are narrow, soft, smooth and yellow. Newly formed leaves are much more shorter. The internodes of the stem are also shortened.

Axillary buds get enlarged but their petioles and leaves remain shortened. This gives the plant a bushy appearance. Mostly, there is no flowering but if flowers are formed they remain green. Fruiting is rare.

Pathogen

Little leaf was first considered a disease caused by a virus. In 1969 it was attributed to a mycoplasma-like organism, closely related to aster-yellows and curly top.

It is a sap transmissible disease. The organism has been transmitted to *Datura*, tomato and tobacco. It occurs in nature on *Datura fastuosa* and *Vinca rosea*. Natural transmission is through a vector, *Cestius phycytis* (*Eutettix phycytis*) while *Emoasca devastans* is a less effective vector. Perennation of the organism is through its weed hosts.

Mode of spread and survival

The disease is transmitted by leaf hoppers, *Hishimonas phycitis* and *Emoasca devastans* and grafting. *E. devastans* is less effective vector. Perennation of virus is through weed host. This disease has a very wide host range.

Management

The severity of the disease can be reduced by destruction of affected plants and spraying of insecticides. New crop should be planted only when diseased plants in the field and its neighbourhood have been removed.

Methyldemeton 25 EC	2 ml / litre
Dimethoate 30 EC	2 ml/ litre
Malathion 50 EC	2 ml/litre

has been recommended for vector control.

Although mycoplasmas are reported to be suppressed by tetracyclines field application of this method has not yet been recommended. Varietal resistance has not been systematically studied. Cultivars such as Pusa Purple Cluster, Arka Sheel, Aushy, Manjari Gota and Banaras Giant show moderate resistance to resistance in the field. Other cultivars found tolerant to the disease are Black Beauty, Brinjal Round and Surati.

Damping off: *Pythium aphanidermatum*, *Pythium indicum*, , *Phytophthora parasitica*, *Rhizoctonia solani* and *Sclerotium rolfsii*.

Symptom

Sudden collapsing of the seedlings occur in the seed bed. The seedlings are attacked at the collar region and the attacked seedlings are toppled down. The disease spreads through fungi present in the soil. The disease spreads through fungi present in the soil.

Management

The disease can be controlled by seed treatment with agrosan or ceresin @2gm/kg of seed.

Collar rot :*Sclerotium rolfsii*

Symptoms

The disease occasionally occurs in serious form. The lower portion of the stem is affected from the soil borne inoculum (sclerotia). Decortications is the main symptom. Exposure and necrosis of underlying tissues may lead to collapse of the plant. Near the ground surface on the stem may be seen the mycelia and sclerotia. Lack of plant vigour, accumulation of water around the stem, and mechanical injuries help in development of this disease.

Management

Seed treatment with 4 g of *Trichoderma viride* formulation per kg seed will help in reducing the disease. Spraying with Mancozeb @ 2g/Litre of water. Collection and destruction of diseased parts and portions of the plant.

Fruit rot :*Phomopsis vexans*

Symptoms

Affects all above the ground plant parts. Spots generally appear first on seedling stems or leaves. Girdle seedling stems and kill the seedlings. Leaf spots are clearly defined, circular, up to about 1 inch in diameter, and brown to gray with a narrow dark brown margin. Fruit spots are much larger, affected fruit are first soft and watery but later may become black and mummified. Center of the spot becomes gray, and black pycnidia develop.



Pathogen

Pycnidia with or without beak are found in the affected tissue. They are globose or irregular. Conidiophores in the pycnidium are hyaline, simple or branched. Conidia are hyaline, one celled and sub cylindrical. Ascospores are hyaline, narrowly ellipsoid to bluntly fusoid with one septum.

Mode of spread and survival

The fungus survives in the infected plant debris in the soil. It is seed borne. The spores are spread by rain splashes. The fungus spreads through implements and insects.

Management

Seeds should be dipped in hot water at 50°C for 30 min. spraying with difoliation 0.2% or captan 0.2% in the nursery and field at 7 – 10 days interval controls the disease. Deep summer ploughing, three year crop rotation and collection and destruction of diseased plant debris are some of the other control methods. Spraying the crop in the field with zineb 0.2% or Bordeaux mixture 0.8% is effective in controlling Phomopsis blight.

Diseases of Bhendi

Cercospora Leaf Spots: *Cercospora malayensis*, *C. abelmoschi*

Symptoms



In India, two species of *Cercospora* produce leaf spots in bhendi. *C. Malayensis* causes brown, irregular spots and *C. abelmoschi* causes sooty black, angular spots. Both the leaf spots cause severe defoliation and are common during humid seasons.

Pathogen

Conidiophores are pale to medium olivaceous brown, multiseptate, sometimes branched, geniculate and irregular. Conidia are obclavate to cylindric, olivaceous brown and straight to curved.

Mode of spread and survival

The fungus survives in the diseased crop material.

Management

Spraying Mancozeb 0.25 % control the disease.

Fusarium wilt: *Fusarium oxysporum* f.sp. *vasinfectum*

Symptoms

The conspicuous symptom is a typical wilt, beginning with a yellowing and stunting of the plant, followed by wilting and rolling of the leaves as if the roots were unable to supply sufficient water. Finally, the plant dies. If a diseased stem is split lengthwise, the vascular bundles appear as dark streaks. When severely infected, nearly the whole stem is blackened.

Pathogen

Macroconidia are 3- 5 septate formed on sporodochia and pionnotes. In mass conidia appear buff or salmon orange in color. Macroconidia are fusiform and curved inward at both ends. The base is pedicellate. Microconidia are septate. Terminal and intercalary chlamydospores are broadly ovate.

Mode of spread and survival

The fungus is soil borne.

Management

Treat the seeds with Mancozeb @ 3g/kg seed. Drench the field with Copper oxy chloride @ 0.25%.

Powdery mildew: *Erysiphe cichoracearum*

Symptoms



Powdery mildew is very severe on bhendi. Greyish powdery growth occurs on the under as well as on the upper surface of the leaf causing severe reduction in fruit yield.

Pathogen

Conidia are single celled, hyaline, barrel shaped and in long chains. Cleistothecia are globose and dark brown myceloid appendages. The ascii are pedicellate, ovate or ellipsoid. The number of ascospores is usually 2 rarely 3 per ascus. The ascospores are single celled, hyaline and oval to sub cylindrical

Management

Spary inorganic sulphur 0.25% or Dinocap 0.1% 3 or 4 times at 15 days interval.

Vein-Clearing/Yellow Vein Mosaic: *Bhendi yellow vein mosaic virus*

Symptoms



Yellowing of the entire network of veins in the leaf blade is the characteristic symptom. In severe infections the younger leaves turn yellow, become reduced in size and the plant is highly stunted. The veins of the leaves will be cleared by the virus and intervenal area becomes completely yellow or white. In a field, most of the plants may be diseased and the infection may start at any stage of plant growth. Infection restricts flowering and fruits, if formed, may be smaller and harder. The affected plants produce fruits with yellow or white colour and they are not fit for marketing.

Pathogen

The virus particles are 16 – 18nm in diameter.

Mode of spread

The virus is spread by whitefly.

Management

By selecting varieties resistant to yellow vein mosaic like Parbhani Kranti, Arka Abhay, Arka Anamika, and Varsha Uphar, the incidence of the disease can be minimised. The virus is transmitted by the whitley (*Bemisia tabaci*). Parbhani Kranti, Janardhan, Haritha, Arka Anamika and Arka Abhay can tolerate yellow vein mosaic. For sowing during the summer season, when the whitefly activity is high, the susceptible varieties should be avoided. Spraying monocrotophos 1.5 ml/litre of water can restrict the disease spread. Synthetic pyrethroids should not be used because it will aggravate the situation. It can be controlled by application of Chlorpyriphos 2.5 ml + neem oil 2 ml lit of water.

Diseases of Crucifers

Alternaria Blight: *Alternaria raphani*

Symptoms



The pathogen affects leaves, stem, pods and seeds. Symptoms of the disease first appear on the leaves of seed stem in the form of small, yellowish, slightly raised lesions. Lesions appear later on the stems and seed pods. Infection spreads rapidly during rainy weather, and the entire pod may be so infected that the style end becomes black and shriveled. The fungus penetrates in pod tissues, ultimately infecting the seeds. The infected seed fails to germinate.

Pathogen

A. raphani conidia are 70 – 115 x 14 – 18 micron in size.

Mode of spread and survival

It is seed borne. The fungi subsistas mycelium in the infected plant refuse. They also survive in susceptible weeds or perennial crops. The conidia are borne abundantly in moist atmosphere and are disseminated readily by air currents.

Management

Spraying with Mancozeb 0.25 %

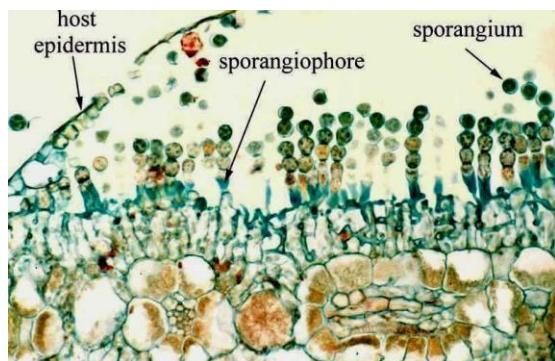
White Rust: *Albugo candida*

Symptoms

Disease attacks the leaves and flowering shoots. Affected flowering shoots get deformed and bear only malformed flowers. White powdery substance in patches is observed on the under surface of the leaves.



Pathogen



Here, Pathogen is an obligate parasite; Mycelium is intercellular producing knob shaped haustoria in the host cells. Each sporangium has 4 to 8 zoospores.

Mode of Spread and Survival

Over wintering may be through oospores in plant debris in the soil and mixed with seeds and perennial mycelium in weed hosts are primary source of inoculum.

Management

Regular spraying with Mancozeb 0.25 % effectively controls the disease.

Wire stem: *Rhizoctonia solani*

Symptoms:



Wire stem can be a seed problem where cauliflower or other cruciferous transplants are grown crowded together in unsterilized soil or seedling beds. This disease makes the seedlings unsuitable for transplanting since many of the affected plants will die or grow poorly.

Pathogen

The fungus shows branching at right angles near the distal septum in young hyphae. Sclerotia are irregular, brown to black and 5mm in dia. The fungus produces both terminal and intercalary, barrel shaped chlamydospores. In the perfect stage basidia are produced on the host. They are barrel shaped, clavate and have four sterigmata. Basidiophores are hyaline and ellipsoid.

Management

Sterilized soil and seedbed drenches with Copper oxychloride 0.25% will give good disease control

Downy mildew: *Peronospora parasitica*

Symptoms



It may attack young plants and also at the seed production stage as being commonly observed in northern India in recent years, when high humidity prevails during seed production

stage. The fungus when attacks the young seedlings, discoloration occurs and in severe cases the whole plant perishes. Purplish leaf spots or yellow brown spots on the upper surface of the leaf appear, while fluffy downy fungus growth is found on the lower surface.

Pathogen

It is an obligate parasite. It has large, finger shaped or clavate and branched haustoria. Conidiophores are erect and dichotomously branched. Sterigmata are long, slender and pointed. A single conidium is borne at the tip of each branch. Conidia are broadly oval, ellipsoidal and hyaline. Oogonium is spherical and hyaline. Oospores are globose and yellow in color.

Mode of Spread and Survival

The fungus attacks broccoli, cabbage, cauliflower, radish and turnip. The fungus perennates in the soil through oospores in roots or in old diseased plant parts and as contaminant with seeds. It also persists in perennial hosts. Secondary spread of the disease is through water and wind borne conidia.

Management

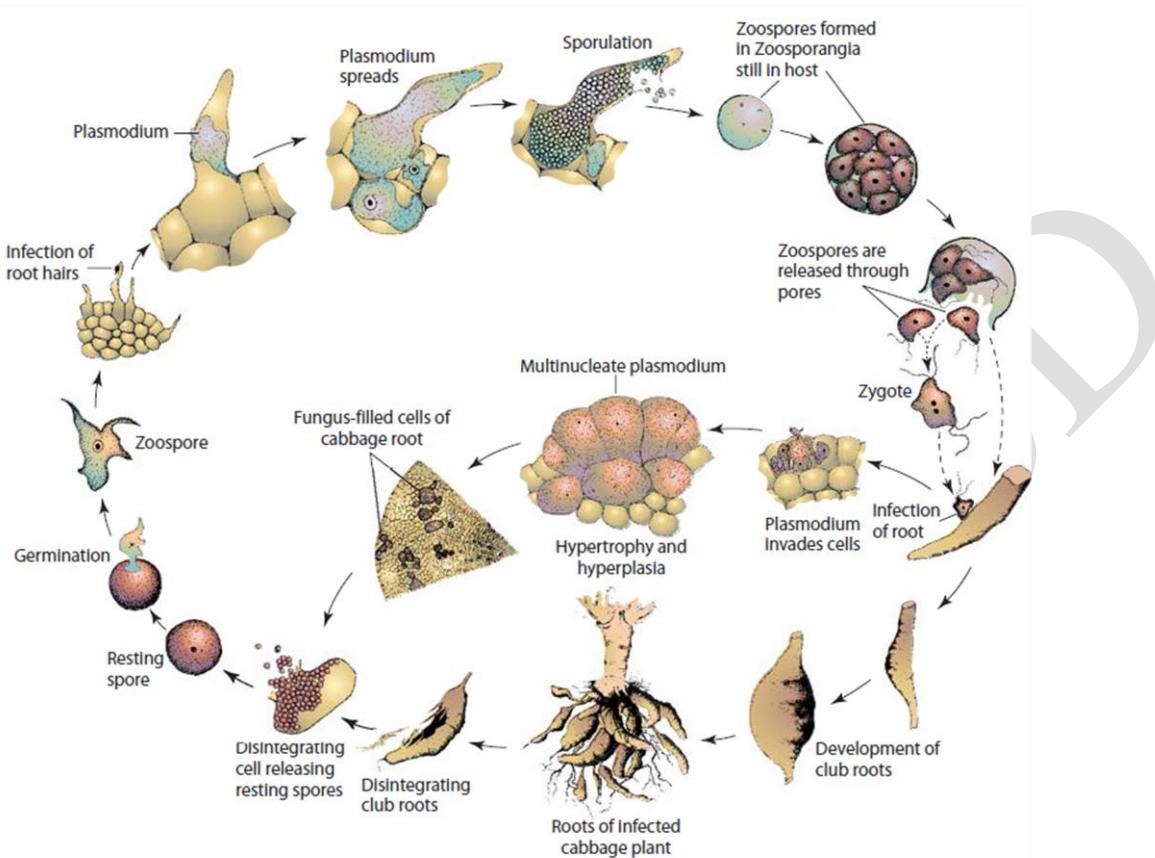
Seed treatment with Metalaxyl (Apron 6g/kg of seed). Foliar spraying with Metalaxyl (Ridomil) 0.4%.

Club root: *Plasmodiophora brassicae*

Symptoms



Stunting and yellowing of plants. Leaves become yellowish and wilt on hot days. Club like swelling of root and root lets. Club root is particularly prevalent on soils with a pH below 7, whereas it has been observed that the disease is often less serious on heavy soils and on soils containing little organic matter.



Disease cycle of club root of crucifers caused by *Plasmodiophora brassicae*

Pathogen

Primary zoospores are anteriorly by flagellate which is of whiplash type. Secondary zoospores are smaller than primary zoospores.

Mode of Spread and Survival

Fungus is soil borne and survival in the crop refuses in the form of minute resting spores for at least 10 years. Contaminated soil can be caused by wheel of implements, carts, tools and on the feet of human being.

Disease Cycle

P. brassicae is capable of surviving in the soil for 7-10 years or longer as resting spores. The resting spores of the fungus can be spread from field to field by infested soil, contaminated water supplies, infected transplants, infested soil on farm machinery, and even by roving animals such as cattle. When soil conditions dictate, the resting spores of the pathogen germinate to produce zoospores, which are able to "swim" by means of flagella to infect susceptible plant root hairs. The germination of resting spores requires moist, acid soil and can occur over a wide temperature range of 12-27°C. Disease development is favored by high soil moisture and soil temperatures between 18-25°C. Although clubroot has been found in soils exhibiting a wide pH

range from 4.5-8.1, the disease is primarily associated with acid soils. Within the infected plant roots, the organism develops rapidly, causing an increase in the number and size of cells, which results in "clubbing." During the development of the organism in the plant, new zoospores are produced; these are capable of infecting the same plant or adjacent plants and, thus, repeating the cycle. Eventually, resting spores are formed within the diseased plant tissue, and these are released into the soil when the plant roots disintegrate.

Management

Soil fumigation with Methyl bromide 1kg/10m² followed by covering with plastic film. Seed treatment with Captan/Thiram 4g/kg, followed by *T. viride* 4g/kg. Application of lime 2.5 t/ha. Soil drenching with Copper oxychloride 0.25%.

Black rot: *Xanthomonas campestris* pv. *campestris*

Symptoms



The infection of the foliage results in yellow 'V' shaped spots arising along the margin which extend in the direction of the midrib. These spots are associated with a typical black discoloration of the veins. The infection extends through the xylem to the stalk and the vascular bundles turn black. In severe infection, the whole leaf shows discoloration and eventually falls off.

Pathogen

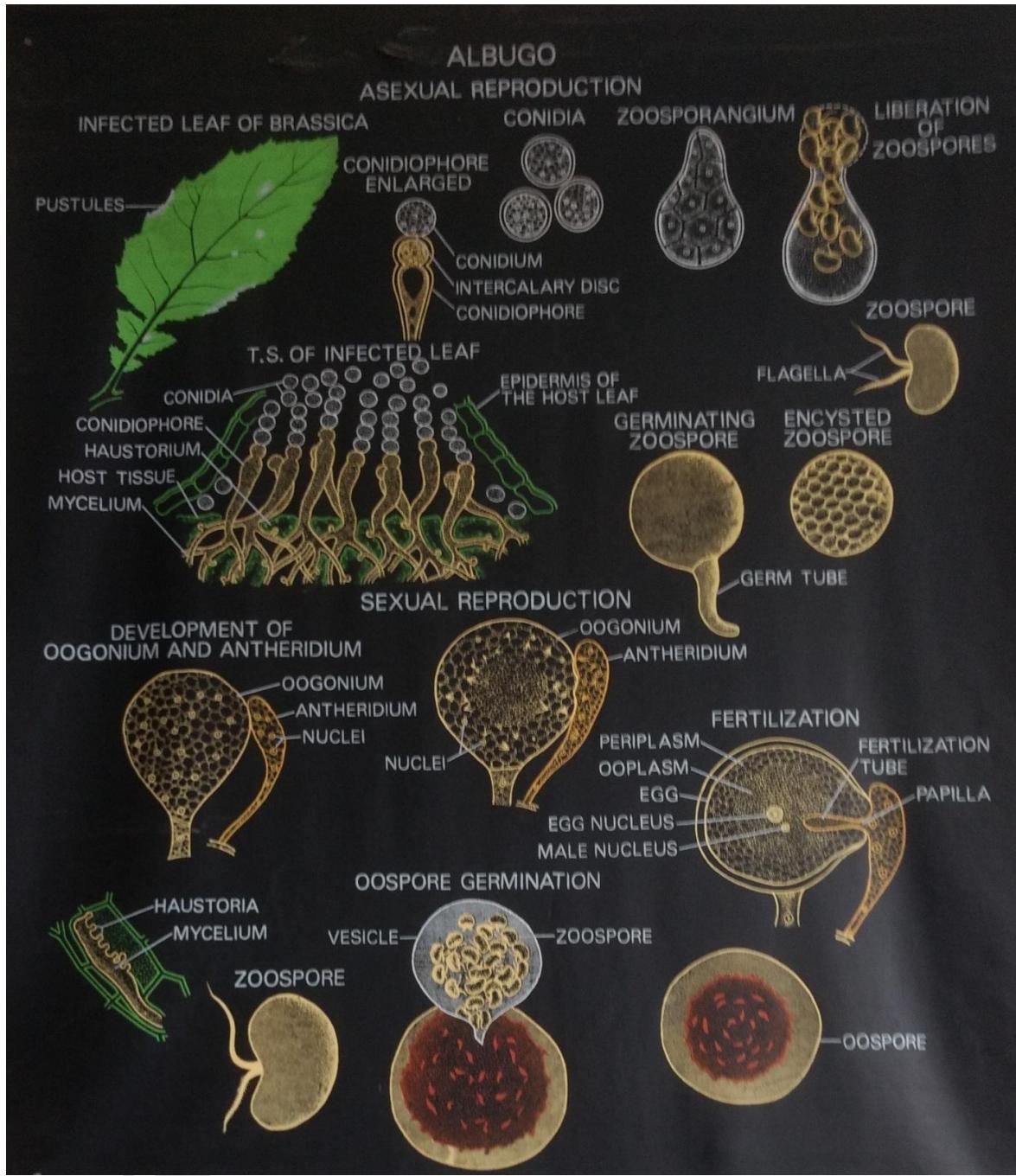
It is gram negative, short rod with rounded ends and non capsulated. It occurs singly, rarely in pairs and motile with single polar flagellum.

Mode of Spread and Survival

Black rot is spread rapidly during warm, humid weather, with an optimal temperature range of 27- 30°C at 80- 100% humidity. Once in the soil, the bacteria are spread by splashing rain and wind. Bacteria enter plants through wounds or natural openings at the leaf margins called hydathodes

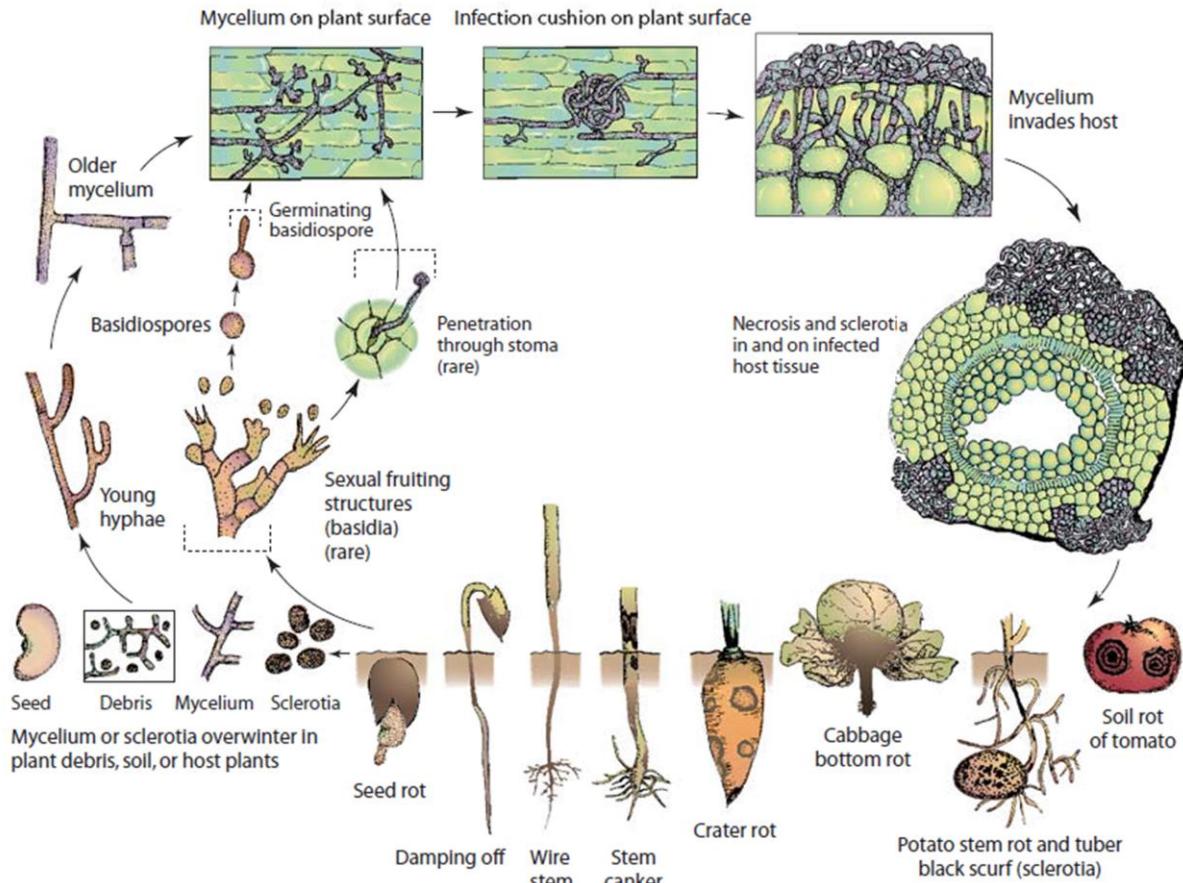
Management

Seed treatment with Aureomycin 1000ppm for 30 min is effective in killing both the internally and externally seed-borne pathogen. Drenching the nursery soil with formaldehyde 0.5% helps in checking the disease. Application of bleaching powder at 10.0 to 12.5 kg/ha controls the disease.



Whiptail of cauliflower





Disease cycle of *Rhizoctonia solani* (*Thanatephorus cucumeris*)

Diseases of Tomato

Damping off: *Pythium aphanidermatum*

Symptoms



Damping off of tomato occurs in two stages, i.e. the pre-emergence and the post-emergence phase. In the pre-emergence phase the seedlings are killed just before they reach the soil surface. The young radical and the plumule are killed and there is complete rotting of the seedlings. The post-emergence phase is characterized by the infection of the young, juvenile tissues of the collar at the ground level. The infected tissues become soft and water soaked. The seedlings topple over or collapse.

Mode of spread and survival

All the causal organisms are soil inhabitants and they build up in soil with the available hosts. Generally these pathogens have wide host range.

Management

Used raised seed bed. Provide light, but frequent irrigation for better drainage. Drench with Copper oxychloride 0.2% or Bordeaux mixture 1%. Seed treatment with fungal culture *Trichoderma viride* (4 g/kg of seed) or Thiram (3 g/kg of seed) is the only preventive measure to control the pre-emergence damping off. Spray 0.2% Metalaxyl when there is cloudy weather

Fusarium Wilt: *Fusarium oxysporum f. sp. lycopersici*

Symptoms



The first symptom of the disease is clearing of the veinlets and chlorosis of the leaves. The younger leaves may die in succession and the entire may wilt and die in a course of few days. Soon the petiole and the leaves droop and wilt. In young plants, symptom consists of clearing of vein let and dropping of petioles. In field, yellowing of the lower leaves first and affected leaflets wilt and die. The symptoms continue in subsequent leaves. At later stage, browning of vascular system occurs. Plants become stunted and die.

Pathogen

Mycelium is septate and hyaline. They produce macro and micro conidia. Micro conidia are one celled, hyaline, ovoid to ellipsoid. Two races of pathogen have been identified.

Mode of spread and survival

The fungus is seed borne and soil borne. The fungus survives in the soil as chlamydospores or as saprophytically growing mycelium in infected crop debris for more than 10 years. One of the chief methods of its distribution is by seedlings raised in infected soil. Wind borne spores, surface drainage water and agricultural implements also help in distribution of the pathogen from field to field.

Management

The affected plants should be removed and destroyed. Spot drench with Carbendazim (0.1%). Crop rotation with a non-host crop such as cereals.

Early Blight: *Alternaria solani*

Symptoms



This is a common disease of tomato occurring on the foliage at any stage of the growth. The fungus attacks the foliage causing characteristic leaf spots and blight. Early blight is first observed on the plants as small, black lesions mostly on the older foliage. Spots enlarge, and by

the time they are one-fourth inch in diameter or larger, concentric rings in a bull's eye pattern can be seen in the center of the diseased area. Tissue surrounding the spots may turn yellow.

If high temperature and humidity occur at this time, much of the foliage is killed. Lesions on the stems are similar to those on leaves, sometimes girdling the plant if they occur near the soil line. Transplants showing infection by the late blight fungus often die when set in the field. The fungus also infects the fruit, generally through the calyx or stem attachment. Lesions attain considerable size, usually involving nearly the entire fruit; concentric rings are also present on the fruit.

Pathogen

Mycelium is septate, branched, light brown which become darker with age. Conidiophores are dark colored. Conidia are beaked, muriform, dark colored and borne singly.

Mode of spread and survival

The pathogen is spread by wind and rain splashes. Under dry conditions it survives in infected plant debris in the soil for upto three years and is also seed borne.

Management

Removal and destruction of crop debris. Practicing crop rotation helps to minimize the disease incidence. Spray the crop with Mancozeb 0.2 % for effective disease control.

Late Blight

Symptoms:

- The symptoms of the disease appear on leaves, stem and fruits.
- Initially small water-soaked lesions develop near the tips and margins of the leaves which rapidly grow into large, brown to purplish black, necrotic lesions under favourable weather conditions.
- During morning hours, whitish downy growth of the pathogen consisting of sporangiophores and sporangia can be seen on the edges of the lesions mostly on the underside of the leaves.
- Light brown to dark brown lesion appear on stem and petioles which may elongate later and girdle the affected parts.
- Since the disease is polycyclic in nature, the entire crop in the field may be killed in one or two weeks and field give blighted appearance.
- The fruits may get infected by rain washed sporangia from the diseased foliage.
- The infected fruits show irregular, small to large, slightly depressed areas of brown to purplish skin.



Pathogen:

- The disease is caused by *Phytophthora infestans* (Mont.) de Bary.
- The mycelium is coenocytic, endophytic, hyaline, branched and intercellular.
- Sporangiophores arise from the internal mycelium through stomata and are slender, hyaline, sympodially branched, indeterminate, relatively thick walled, septate having side branches with swollen base.
- Sporangia develop on the tip of the sporangiophores and are hyaline, thin walled, lemon shaped, distinctly papillate.
- Antheridia and oogonia are produced after A 1 and A 2 mating types come in close contact. Antheridia are amphigynous while oogonia are spherical.
- Oospores are thick walled and develop after fertilization.

Disease cycle and epidemiology:

- The fungus perpetuates as dormant mycelium in the infected debris left in the field at temperatures $<30^{\circ}\text{C}$.
- Oospores even if formed rarely, also serve as source of primary inoculum.
- Relative humidity >90 per cent coupled with suitable temperature ($12\text{-}24^{\circ}\text{C}$) is most important for disease development.
- The sporangia germinate at temperature ranging from $2\text{-}30^{\circ}\text{C}$.
- Temperature around $16\text{-}18^{\circ}\text{C}$ are optimum for mycelial growth while $9\text{-}16^{\circ}\text{C}$ are optimum for sporulation.
- At a temp. $12\text{-}13^{\circ}\text{C}$, the sporangia germinates by producing zoospores while direct germination of sporangia takes place around 24°C .
- Initial low temperatures thus, can help in assuming the high disease severity in the crop.

Management:

- High ridges and proper earthing up prevents infection.
- Restrict irrigation during cloudy days.
- Give timely application of fungicides like mancozeb/ chlorothalonil/ propineb (0.25%) as prophylactic sprays and repeat at weekly intervals.
- Repeat sprays promptly after rain. Use metalaxyl + mancozeb or cymoxanil + mancozeb (0.25%) only when disease risk is likely to be severe and favourable weather conditions persist.
- Avoid the use of formulations containing metalaxyl alone.

Septoria Leaf Spot: *Septoria lycopersici*

Symptoms



The plant may be attacked at any stage of its growth. The disease is characterized by numerous, small, grey, circular leaf spots having dark border.

Pathogen

Mycelium is septate, branched, hyaline when young and darkens with age. Pycnidia are erumpent. Pycnidiospores are filiform, hyaline and septate.

Mode of spread and survival

The pathogen is spread by wind and rain splashes, insects and on the hands and clothings of tomato pickers. It survives from one season to the next on infested crop debris and also on solanaceous weeds. The fungus also survives on or in the seed. Seed stocks contaminated with spores produce infected seedlings.

Management

Removal and destruction of the affected plant parts. Seed treatment with Thiram or Dithane M-45 (2 g/kg seed) is useful in checking seed borne infection. In the field spraying with Mancozeb 0.2 % effectively controls the disease.

Buckeye rot

- **Symptoms:**
- Immature fruits (green colour) irrespective of their development stages are susceptible.
- Water soaked light brown discoloured spots appear which increase readily showing concentric dark brown rings slightly resembling the markings as a buckeye.
- The lesions rapidly enlarge and within 3-4 days, whole of the fruit surface turns dark brown and feels soft to touch.
- In warm and humid weather, white flocculent superficial growth of the fungus consisting of sporangia and sporangiophores also develops on the diseased fruits.
- Later, these fruits may drop off from the plant.

Tomato buckeye rot



Pathogen:

- The disease is caused by *Phytophthora nicotianae* Breda de Hann. var. *parasitica* (Dastur) Waterhouse.
- The mycelium of the pathogen is hyaline and coenocytic with branching typically at right angles. The sporangiophores arise from hyphal threads and produce sporangia.
- The sporangia are broadly ovoid to globose in shape having one hemispherical papilla at the tip. Chlamydospores are smooth, globose, and slightly yellowish with thick brown walls, produced abundantly in culture and germinate by producing zoospores or germ tubes.
- Antheridia are amphigynous, spherical or oval and oogonia are rough, thick walled and yellowish brown in colour.
- Oospores are aplerotic, 18 to 20 μm in diameter with 2 μm thick wall.

Disease cycle and epidemiology

- The fungus overwinters in the soil in the form of oospores or chlamydospores and can remain active in soil for at least one year without the support of a susceptible host (Fig.1.).

- With the onset of monsoon rains, in the presence of high soil moisture and moderate temperatures (20-25°C), the chlamydospores and oospores start germinating by producing mycelium and sporangia.
- The sporangia in turn produce biflagellate zoospores, which are splashed by rain to the fruits.
- The symptoms develop on fruits after 3-4 day of infection.
- Infected fruit become mummified and fall down on the ground.
- The sporangia produced on infected fruits, liberate zoospores which are again splashed by rain and cause secondary infection.
- Maximum fruit infection under field conditions occurs at a temperature range of 20-25°C, RH > 80 per cent and high rainfall conditions.
- Higher doses of N resulted in higher fruit rot while higher levels of P resulted in more yield of healthy fruits and less fruit rot.

Management

- Stake the plants erect and remove foliage and fruit up to a height of 15-20 cm to avoid moist and stagnant air conditions.
- Collect and destroy the affected fruits regularly.
- Apply pine needle/grass mulch on the field floor to create a barrier between the host and soil borne inoculum.
 - With the onset of monsoon rains, spray the crop with metalaxyl + mancozeb (0.25%) followed by sprays of either mancozeb (0.25%) or copper oxychloride (0.3%) or Bordeaux mixture (4:4:50) and repeat at 7-10 days interval.

Bacterial wilt: *Ralstonia solanacearum*

Symptoms

This is one of the most serious diseases of tomato crop. Relatively high soil moisture and soil temperature favour disease development. Characteristic symptoms of bacterial wilt are the rapid and complete wilting of normal grown up plants. Lower leaves may drop before wilting. Pathogen is mostly confined to vascular region; in advantage cases, it may invade the cortex and pith and cause yellow brown discolouration of tissues. Infected plant parts when cut and immersed in clear water, a white streak of bacterial ooze is seen coming out from cut ends.



Pathogen

The bacterium is gram negative, rod shaped often occurs in pairs, motile with 1 – 4 flagella. The optimum temperature for growth is 30 - 37°C.

Mode of spread and survival

The bacterium survives in soil and they spread through irrigation water and by transplanting of infected seedlings. The bacterium survives for 3 years in fallow and for a unlimited period in cultivated land. Chilli, egg plant, ground nut, potato and tobacco are alternative hosts which help it to survive between tomato crops.

Management

Avoid damage to seedling while transplanting. Apply bleaching powder @ 10kg/ha. Crop rotations, viz., cowpea-maize-cabbage, okra-cowpea-maize, maize- cowpea-maize and finger millet-egg plant are reported effective in reducing bacterial wilt of tomato.

Bacterial Leaf Spot: *Xanthomonas campestris* pv. *vesicatoria*

Symptoms



Moist weather and splattering rains are conducive to disease development. Most outbreaks of

the disease can be traced back to heavy rainstorms that occur in the area. Infected leaves show small, brown, water soaked, circular spots surrounded with yellowish halo. On older plants the leaflet infection is mostly on older leaves and may cause serious defoliation.

The most striking symptoms are on the green fruit. Small, water-soaked spots first appear which later become raised and enlarge until they are one-eighth to one-fourth inch in diameter. Centers of these lesions become irregular, light brown and slightly sunken with a rough, scabby surface. Ripe fruits are not susceptible to the disease. Surface of the seed becomes contaminated with the bacteria, remaining on the seed surface for some time. The organism survives in alternate hosts, on volunteer tomato plants and on infected plant debris.

Pathogen

The bacterium is gram negative, short rod shaped and has a single, polar flagellum.

Capsules are formed.

Mode of spread and survival

The pathogen survives in the diseased plant debris, volunteer plants. It is seed borne. The bacterium enters through stomata or injuries and lenticels. Secondary spread through rain splashes. Disease spreads to new areas through infected seeds and diseased transplants.

Management

Disease-free seed and seedlings should always be used and the crop should be rotated with non-host crops so as to avoid last years crop residue. Seed treatment with mercuric chloride (1:1000) is also recommended for control of disease. Spraying with a combination of copper and organic fungicides in a regular preventative spray program at 5 to 10 day intervals or Spraying with Agrimycin-100 (100 ppm) thrice at 10 days intervals effectively controls the disease.

Mosaic: Tomato mosaic virus (TMV)

Symptoms



The disease is characterized by light and day green mottling on the leaves often accompanied by wilting of young leaves in sunny days when plants first become infected. The leaflets of affected leaves are usually distorted, puckered and smaller than normal. Sometimes the leaflets become indented resulting in "fern leaf" symptoms. The affected plant appears stunted, pale green and spindly. The virus is spread by contact with clothes, hand of working labour, touching of infected plants with healthy ones, plant debris and implements.

Pathogen

Virus paricles are rod shaped, not enveloped, usually straight and thermal inactivation point is 85 - 90°C.

Mode of spread and survival

The virus is seed borne and upto 94% of seeds may contain the virus. The virus infection occurs during transplanting It is readily transmissible. Many solanaceous plants are susceptible to tomato mosaic virus. The virus is spread easily by man and implements in cultural operations or by animals and by leaf contact.

Management

Seeds from disease free healthy plants should be selected for sowing. Soaking of the seeds in a solution of Trisodium Phosphate (90 g/litre of water) a day before sowing helps to reduce the disease incidence. The seeds should be thoroughly rinsed and dried in shade. In the nursery all the infected plants should be removed carefully and destroyed. Seedlings with infected with the viral disease should not be used for transplanting. Crop rotation with crops other than tobacco, potato, chilli, capsicum, brinjal, etc. should be undertaken.

Leaf curl: Tomato leaf curl virus (ToLCV)

Symptoms



Leaf curl disease is characterized by severe stunting of the plants with downward rolling and crinkling of the leaves. The newly emerging leaves exhibit slight yellow colouration and later they also show curling symptoms. Older leaves become leathery and brittle. The nodes and internodes are significantly reduced in size. The infected plants look pale and produce more lateral branches giving a bushy appearance. The infected plants remain stunted.

Pathogen

The virus particles are 80nm in diameter.

Mode of spread and survival

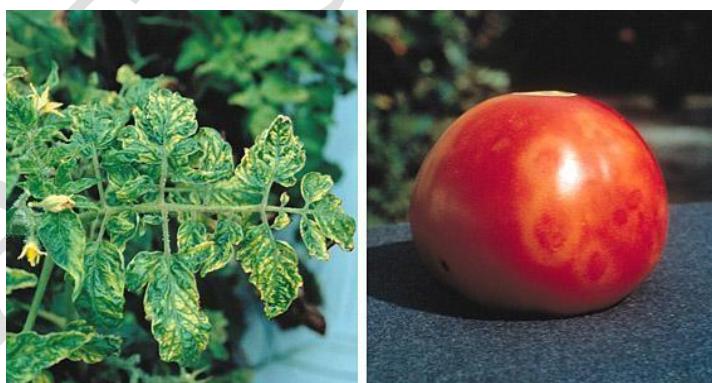
It is neither seed nor sap transmissible. But seeds from fresh fruits having infection may have the virus on the seed coat. The virus is transmitted by white fly, *Bemisia tabaci* and grafting. Even a single viruliferous insect is able to transmit the virus.

Management

Keep yellow sticky traps @ 12/ha to monitor the white fly. Raise barrier crops-cereals around the field. Removal of weed host. Protected nursery in net house or green house. Spray Imidachloprid 0.05 % or Dimethoate 0.05% @ 15, 25, 45 days after transplanting to control vector.

Spotted wilt: Tomato spotted wilt disease (TSWV), Groundnut bud necrosis virus

Symptoms



It causes streaking of the leaves, stems and fruits. Numerous small, dark, circular spots appear on younger leaves. Leaves may have a bronzed appearance and later turn dark brown and wither. Fruits show numerous spots about one-half inch in diameter with concentric, circular markings. On ripe fruit, these markings are alternate bands of red and yellow.

Pathogen

It is isometric particles of 70 – 90nm diameter. Thermal inactivation point is 40°C.

Mode of spread and survival

The spotted wilt virus is transmitted through thrips (*Thrips tabaci*, *Frankliniella schultzi* and *F. occidentalis*).

Management

The affected plants should be removed and destroyed. Alternate or collateral hosts harboring the virus have to be removed. Raise barrier crops – Sorghum, Maize, Bajra 5-6 rows around the field before planting tomato. Spray Imidachloprid 0.05% or any systemic insecticide to control the vector.

Gray Mould: *Botrytis cinerea*

Symptoms

Lesion - a watery area with a light brown or tan-colored central region. Converted into a soft, watery mass within a few days. Skin is broken, the grayish mycelium and spore clusters develop within a few hours. Halo forms around the point of entry -small whitish rings approximately - develop on young green fruit. "Ghost spots" are usually single rings but may be solid white spots; the center of which contain dark-brown specks.

Pathogen

Mycelium is septate and branched, hyaline but become dark in color upon age. Conidiophores are branched and bear conidia at the apex. Conidia are continuous or one septate, oblong and dark.

Mode of spread and survival

High relative humidities are necessary for prolific spore production. Optimum temperatures for infection are between 65° and 75° F (18° and 24° C), and infection can occur within 5 hours.

High temperatures, above 82° F (28° C), suppress growth and spore production.

Management

Spraying with Bordeaux mixture 1.0 % or mancozeb 0.2% is helpful in reducing the disease. Resistant varieties like Vetomold may be grown in area's where disease appears in an endemic form. Eurocross varieties like Antincold, LMRI and Sapsford's No.1 are resistant.

Bacterial Soft Rot and Hollow Stem: *Erwinia carotovora* pv. *carotovora*

Symptoms

Fruit -soft watery decay of fruit, starting at one or more points, as very small spots. Enlarge-very rapidly until the entire fruit -soft watery mass. Pathogen liquefies fruit tissue by breaking down the pectate "glue" that holds plant cells together Leakage-internal collapse resembling a shriveled water balloon. Bacteria -single-celled - rapidly multiply and spread-in water. During wet weather and High humidity, Heavy rain fall or irrigation. Warm temperatures in the 73 - 95 F. range

Phoma Rot: *Phoma destructive*

Symptoms



Distinguished from other rots by the black color of this spot .Small, black, pimple-like eruptions. Specks are the pycnidia or fruiting bodies of the fungus. Moderate temperature and high humidity.

Pathogen

The ascospores are irregularly arranged in two series. They are ellipsoid with obtuse ends, hyaline and guttulate. Pycnidia are solitary to gregarious and dark brown. Conidia typically biguttulate, straight and irregular.

Mode of spread

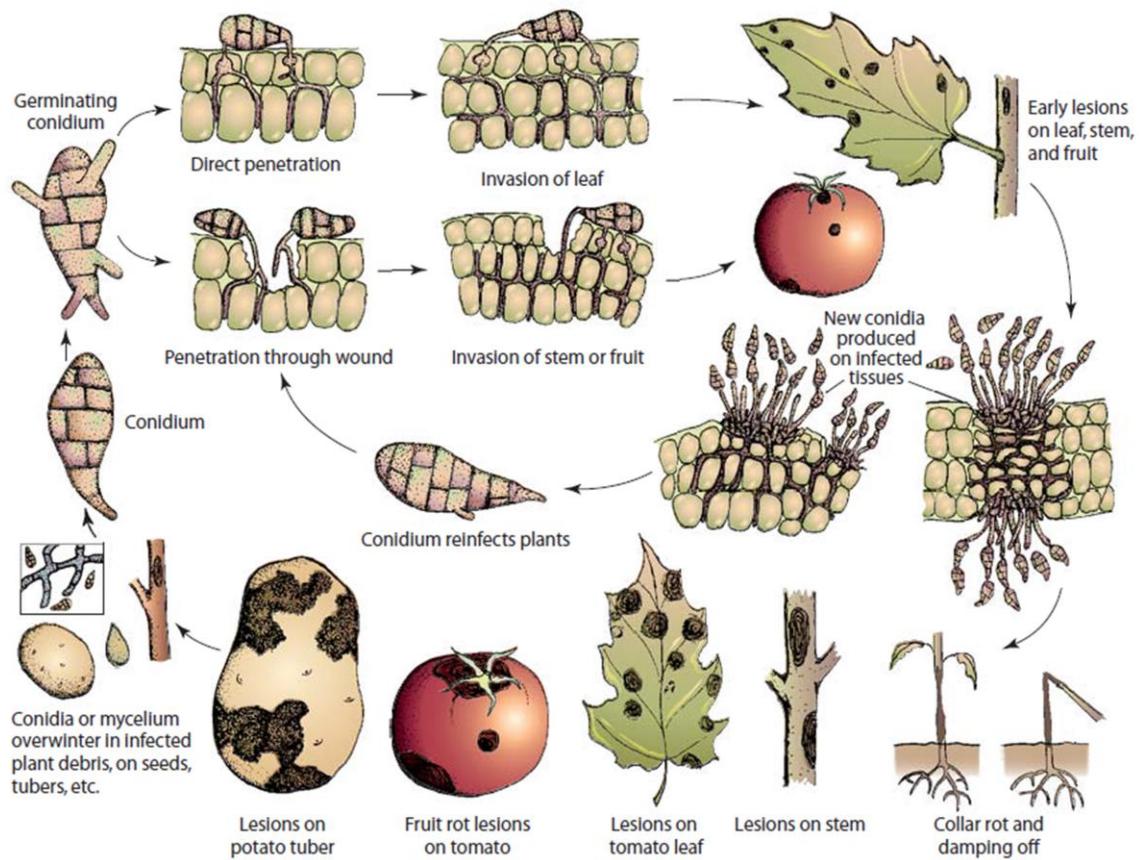
The pathogen is seed borne.

Management

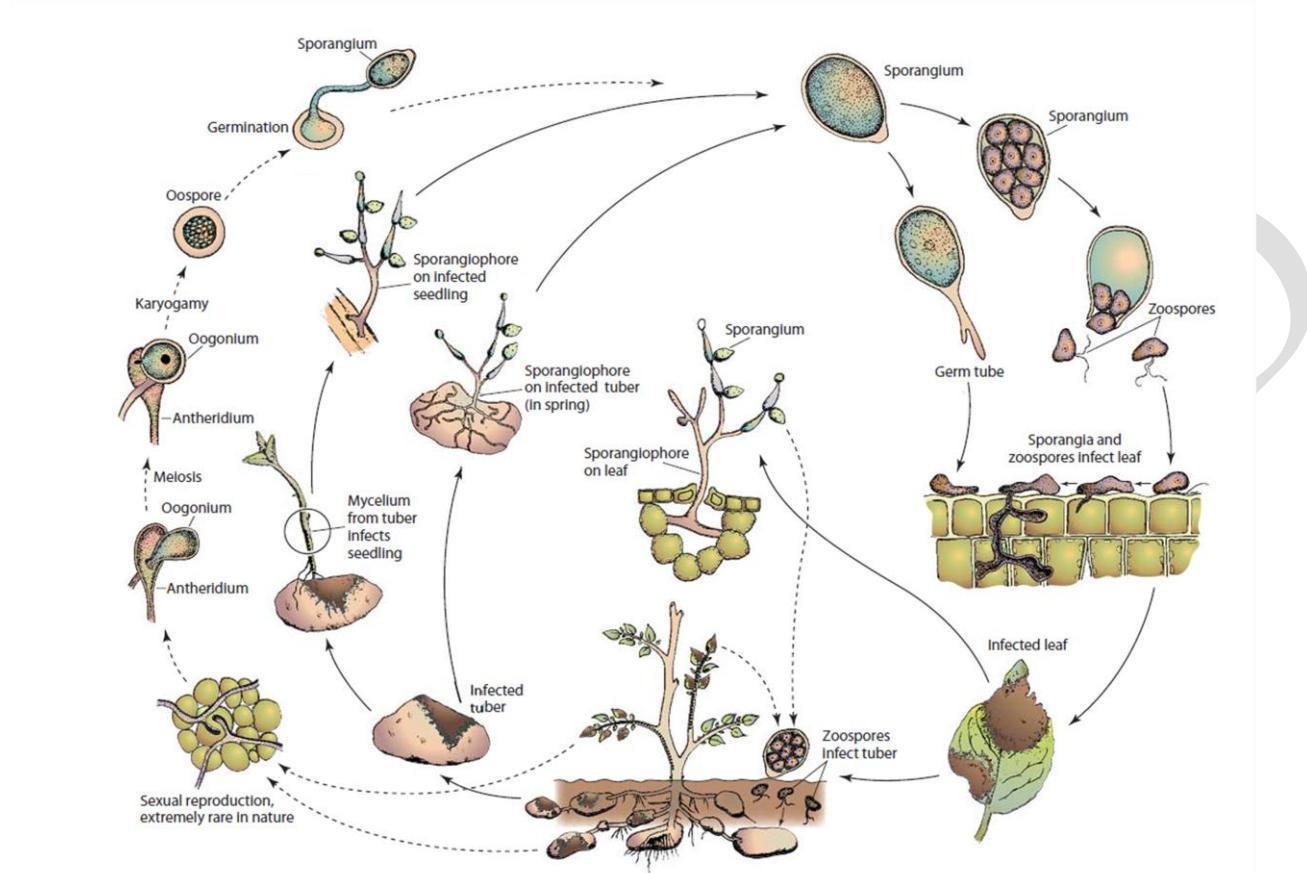
Seed treatment with organomercurial and spraying the crop with zineb 0.2% gives adequate protection against the disease.



Blossom end rot of tomato



Development and symptoms of diseases caused by *Alternaria*



Disease cycle of late blight of potato and tomato caused by *Phytophthora infestans*

Diseases of Beans

Anthracnose: *Colletotrichum lindemuthianum*

Symptoms



Bean pods with black, sunken lesions or reddish-brown blotches most likely have anthracnose, a fungal disease caused by *Colletotrichum lindemuthianum*. Black, sunken lesions about $\frac{1}{2}$ inch in diameter develop on stems, pods and seedling leaves (cotyledons) but are most prominent on pods. A salmon colored ooze on lesions and the veins on lower leaf surfaces turns black. On lima beans, symptoms are sooty- appearing spots on leaves and pods. Anthracnose develops primarily during the spring and fall when the weather is cool and wet, and not during our hot, dry summers. Lima beans are particularly susceptible.

Pathogen

Mycelium is branched, septate , hyaline at first and dark colored with age. Acervuli develop beneath the cuticle. Conidia are borne on short conidiophores. Setae are few, brown and septate. Conidia are one celled, hyaline and cylindrical with rounded ends or with one end slightly pointed.

Mode of spread and survival

The fungus is seed borne and can survive from one season to another in debris from infected plant as well as in diseased seed. The fungus can remain alive in seeds even after the seeds are dead.

Disease Cycle

The fungus survives the winter primarily in bean seed. Survival in soil or in plant residue varies greatly, depending on environmental conditions. Moisture is required for development, spread, and germination of the spores as well as for infection of the plant. A prolonged wet period is necessary for the fungus to establish its infection. The time from infection to visible symptoms ranges from 4 to 9 days, depending on the temperature, bean variety, and age of the

tissues. The fungal spores are easily carried to healthy plants in wind-blown rain and by people and machinery moving through contaminated fields when the plants are wet. Frequent rainy weather increases disease occurrence and severity.

Management

Prevent this disease by using certified disease-free seed for planting and removing all plant debris after harvest. Anthracnose can survive in the soil for two years on plant debris or be brought to the garden on infected seeds. Do not plant bean seeds in an area that had disease for two to three years. Avoid overhead watering and avoid splashing soil onto the plants when watering. Fungicide sprays of fixed copper are the only recommended chemical that can be used on lima beans for anthracnose control.

Bean Root Rots: *Rhizoctonia solani*, *Pythium*, *Fusarium solani*

Symptoms



Many fungi, including *Rhizoctonia solani*, *Pythium* species and *Fusarium solani*, form species *phaseoli*, live in the soil and will infect young seedlings or the seeds of bean plants. Seedlings fail to emerge after planting when the seeds rot in the soil or young seedlings may be stunted. Plants are usually affected slightly above or below the soil line with a watery soft rot. Roots of the plant usually die and leaves turn yellow.

Management

Do not plant beans in low, poorly drained areas. Plant on raised beds. Plant after the soil has warmed to 69° F at a 4 inch depth. Reduce disease buildup in the soil by rotating locations in the garden where you plant bean or pea with other vegetables. Try to avoid injury to the root system, which often occurs during planting, through cultivation or due to a large population of nematodes in the soil. Remove crop debris immediately after harvest. Plant seeds previously

treated with captan. Apply chemicals according to directions on the label.

Rust: *Uromyces appendiculatus*

Symptoms



Bean rust is mainly a disease of bean leaves that causes rust-colored spots to form on the lower leaf surfaces. Severely infected leaves turn yellow, wilt, and then drop off of the plant. Stems and pods may also be infected. This disease is caused by the fungus *Uromyces appendiculatus*. It affects most types of beans under humid conditions.

Pathogen

The fungus is autoecious, thus living its entire life on bean and long cycled rust. Uredia are brown and powdery. Uredospores are globose or ellipsoid. Spore wall is golden brown. Telia are formed on uredia and are dark brown or black. Teliospores are globose or broadly ellipsoid, pedicellate and one celled. Pycnia appear on the yellowish spots on the upper surface of the leaves.

Mode of spread and survival

The rust fungus is not seed borne, but can be disseminated locally by farm tools, insects, animals or other moving bodies. However wind is the principal agent for long distance spore dissemination.

Management

The fungus survives the winter in the soil, on plant debris and even on poles used the previous year. In gardens where rust has been severe, crop rotation is important. As plants begin to bloom, sulfur or chlorothalonil can be sprayed weekly on snap and green beans only. Do not apply chlorothalonil to lima (butter) beans. Wait seven days between spraying and harvest when using chlorothalonil on beans, and 14 days on Southern peas. Apply chemicals according to directions on the label.

Bacterial Blight: *Xanthomonas campestris* pv. *phaseoli*

Symptoms



There are two widespread bacterial blights that affect most types of beans, common blight (*Xanthomonas campestris* pv *phaseoli*) and halo blight (*Pseudomonas syringae* pathovar *phaseolicola*). The stems, leaves and fruits of bean plants can be infected by either disease. Rain and damp weather favor disease development. Halo blight occurs primarily when temperatures are cool. Light greenish-yellow circles that look like halos form around a brown spot or lesion on the plant. With age, the lesions may join together as the leaf turns yellow and slowly dies. Stem lesions appear as long, reddish spots. Leaves infected with common blight turn brown and drop quickly from the plant. Common blight infected pods do not have the greenish-yellow halo around the infected spot or lesion. Common blight occurs mostly during warm weather.

Pathogen

The bacteria is gram negative rod, non capsulated and motile with single polar flagellum.

Mode of spread and survival

The pathogen is seed borne and the disease spread through wind splashed rains from diseased to healthy plants. In new area disease spreads through infected seeds.

Management

Both of these diseases come from infected seeds. The diseases spread readily when moisture is present. Avoid overhead watering and do not touch plants when the foliage is wet. The bacteria can live in the soil for two years on plant debris. Do not plant beans in the same location more frequently than every third year. Buy new seeds each year. Fixed copper can be applied at ten day intervals. Wait one day between spraying and harvest.

Powdery Mildew: *Erysiphe polygonii*

Symptoms

Leaves are covered with patches of a whitish to grayish powdery growth. This disease is caused by the fungus *Erysiphe polygonii*. New growth appears contorted, curled or dwarfed and may turn yellow and drop. Pods are dwarfed and distorted. This is mostly a problem on fall beans. Powdery mildew is spread by wind and rain.

Pathogen

The mildew pathogen develops mycelial threads between a few cells near the epidermis and grows root like structures, haustoria that slowly withdraw food from the living plant tissue. After the fungus covers the upper and sometimes the lower leaf surface with fungus threads, the threads can produce many short multicellular fungus stalks, each of which bears a few spores resembling beads in a chain.

Mode of spread and survival

The fungus is capable of attacking different leguminous hosts and survives in conidial or perithecial form. The conidia are easily carried by wind, rain and insects. The spores are short lived and usually die in about 2 days if they do not reach a suitable host. When humidity is high and the leaf surface is dry, the spores germinate readily in few hours and the germ tubes enter the plant. Some strains produce sexual perithecia with asci which can remain alive from one season to the next.

Management

Avoid crowding plants by allowing adequate space between rows. On Southern peas, sulfur can be used. When the disease is first noticed, sprays or dusts of sulfur are recommended for use on snap and green beans only. Do not use sulfur on young plants. Apply chemicals according to directions on the label.

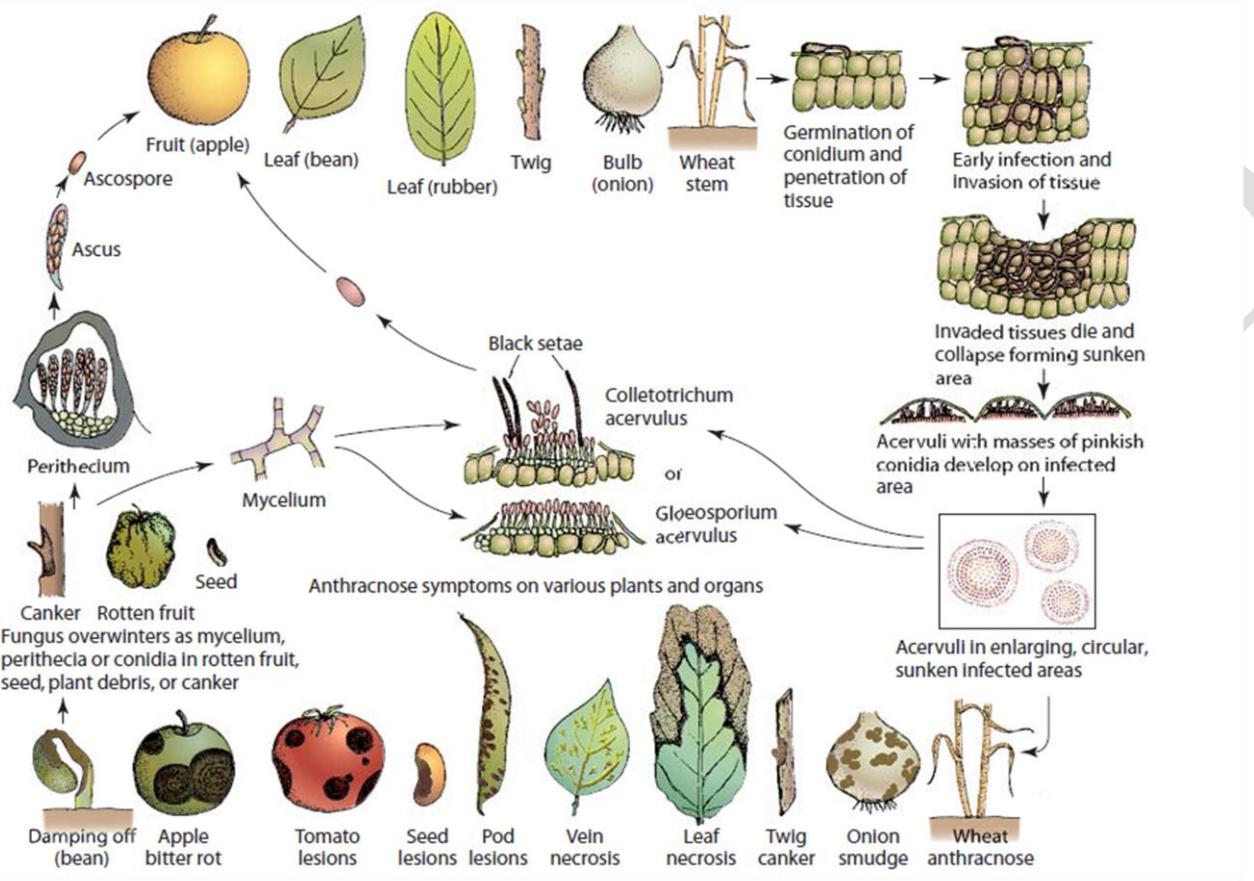
Cercospora Leaf Spot: *Cercospora* sp.

Symptoms

This fungal disease, caused by *Cercospora* species, occurs primarily on the lower leaves of plants as irregular, tan spots. Severe infection causes excessive leaf drop and stunting of the plant. Infection is worse during periods of extended rainfall, high humidity and temperatures between 75 to 85° F.

Management

Use disease-free seed for planting. Remove all debris in the garden after harvest. Do not plant beans in the same area for two to three years. There are no resistant varieties or recommended chemicals for this disease in the home garden.



Disease cycle of anthracnose diseases caused by *Glomerella cingulata* and *Colletotrichum* or *Gloeosporium* sp.

Diseases of Coconut

Bud rot *Phytophthora palmivora*

Symptoms



Palms of all ages are susceptible to the disease, but it is more severe in young palms of 5- 20 years. The first indication of the diseases is seen on the central shoot of the tree (spindle). The heart leaf shows discolouration which becomes brown instead of yellowish brown. This is followed by drooping and breading off the heart leaf. With the progress of diseases, more number of leaves get affected with loss of lusture and turn pale yellow. The entire base of the crown may be rotten emitting a foul smell. The central shoot comes off easily on slight pulling.

The leaves fall in succession starting from the top of the crown. The leaf falling and bunch shedding continue until a few outer leaves are left unaffected. But within few months the infection leads to complete shedding of leaves, within subsequent wilt and death of the tree.

Pathogen

The fungus produces intercellular, non septate, hyaline mycelium. Sporangiophores are hyaline and simple or branched occasionally. The sporangiophores are hyaline, thin walled, pear shaped with a prominent papillae. Sporangia releases reniform, biflagellate zoospores upon germination. The fungus also produces thick walled, spherical oospores. In addition, thick walled, yellowish brown chlamydospores are also produced.

Favorable Conditions

High rainfall, high atmospheric humidity (above 90 per cent), low temperature (18-20°C) and wounds caused by tapper and Rhinoceros beetles.

Mode of Spread and Survival

The fungus remains as dormant mycelium in the infected tissues and also survives as chamydospores and oospores in crop residues in the soil. The diseases spread is mainly through air-borne sporangia and zoospores. Rainfall also helps in spreading the diseases. Insects and tappers also help in the spread of the inoculum from diseased trees.

Mangement

Remove and burn badly affected trees which are beyond recovery. If disease is detected in early stage, remove the infected tissue thoroughly by cutting the infected spindle along with two leaves surrounding it and protect the cut portion with Bordeaux paste. Give prophylactic spray with 1% Bordeaux mixture to all the healthy palms in the vicinity of diseases one and also before onset of monsoon rains.

Basal Stem Rot (Thanjavur wilt / Bole rot) *Ganoderma lucidum*

Symptoms



The trees in the age group of 10-30 years are easily attacked by the pathogen. The fungus is soil-borne and infects the roots. The most usual symptoms are yellowing, withering and drooping of the outer fronds which remain hanging around the trunk for several months before shedding. The younger leaves remain green for sometime and later turn yellowish brown. The new fronds produced become successively smaller and yellowish in colour which do not unfold properly. Soft rot occurs in the bud with a bad newly formed leaves wither away. More often the spindle is blown off leaving the decapitated stem.

The wilting plants also show bleeding patches near the base of the trunk. A brown gummy liquid oozes out from the cracks in the tree which slowly result in the death of outer tissues. As the infection advances, fresh bleeding patches appear above the old once, up to 3-5 meters height. The decay of the basal portion occurs slowly and tree succumbs to the diseases in 2-3 years. In the advanced stages of infection, the fungus produces fruiting body (Bracket) along the side of the basal trunk. The roots of wilting trees show discoloration and severe rotting.

Pathogen

The fungus produces a semi circular basidiocarp (bracket), which is attached to the tree with a stalk. The bracket is very big about 10-12 cm diameter and woody. The upper surface is

tough, shining, light to dark brown or almost black with concentric furrows. The lower surface is white and soft with numerous minute pores. These pores represent the opening of the hymenial tubes, which are lined with basidia and basidio-spores. Basidiospores are oval, brown and thick walled.

Favourable Conditions

Trees grown in sandy loam and sandy soils, water logging during severe rains, low soil moisture content during summer months and damages caused by weevils and beetles.

Mode of Spread and Survival

The fungus is soil-borne and survives in the soil for long time. The primary infection is through basidiospores in the soil, which attack roots. The irrigation water and rain water also help in the spread of the fungus.

Management

Remove and burn severely infected trees which are beyond recovery. Isolate the diseased trees by digging a trench all around to check further spread. Irrigate the palms at least once in a fortnight during summer months. Apply heavy doses of farm yard manure or compost for green manure at 50 Kg/tree/year along with 5 kg of neem cake. Drench the soil near the tree with 40 litres of 1 per cent Bordeaux mixture at quarterly interval for thrice a year and repeat after 2-3 years. Apply Aureofunginsol 2g+Copper sulphate 1g in 100 ml of water or Tridemorph 2ml/100 ml of water through stem injection or root feeding at quarterly intervals for one year.

Stem bleeding *Theilaviopsis paradoxa Ceratocystis paradoxa*)

Symptoms

Stem bleeding



The characteristic symptom is the exudation of reddish brown fluid from the cracks in the stem. The fluid trickles down to several feet on the stem and the exudates dries up forming a black crust. The tissues below the cracks turn yellow and decay. As the disease progresses, more area underneath the bark gets decayed and the bleeding patch extends further up. The vigour of the tree is affected and nut yield is reduced. The tree is not killed out right but become

uneconomical to maintain. In extreme cases, the trees may become barren and die.

Pathogen

The fungus produces two type of conidia. Macroconidia are produced on conidiophores singly or in chains. They are spherical and dark green in colour. Microcondinia are produced endogenously inside the long cells ruptures when mature and release the microcondia in long chain. Microconidia (endoconidia) are thinwalled, hyaline and cylindrical in form. *C. paradoxa* also produces hyaline perithecia with a long neck base is ornamented with knobbed appendages and ostiole is covered by numerous pale-brown, erect, tapering hyphae. Ascii are clavate and ascospores are hyaline ad ellipsoid.

Favourable Conditions

Copious irrigation or rainfall followed by drought, shallow loamy soils or laterite soil with clay or rock layer beneath the soil, poor maintenance of gardens and damages by *Diocalandra* and *Xyleborus* beetles.

Mode of Spread and Survival

The fungus survives in the infected plant debris and soil as perithecia and conidia.

The spread is mainly through wind-borne conidia. The irrigation and rain water also help in the disease spread. The beetles which feed on the diseased plants also help in transmission.

Management

Maintain the gardens properly with adequate fertilization. Scoop out the diseased tissue with a portion of healthy tissues, burn the exposed tissue and apply molten coal tar followed by swabbing Bordeaux paste. When stem bleeding is observed in association with *Ganoderma*, follow root feeding or stem injection technique. Irrigate during the summer months.

Grey leaf blight *Pestalotia palmarum*

Symptoms

Initially symptoms develop only on the outer whorl of leaves, especially in older leaves. Minute yellow spots surrounded by a greyish margin appear on the leaflets. Gradually, the centre of the spots turns to greyish white with dark brown margins with a yellow halo. Many spots coalesce into irregular grey necrotic patches. Complete drying and shrivelling of the leaf blade occur giving a blighted or burnt appearance. Large number of globose or ovoid black acervuli appear on the upper surface of leaves.



Pathogen

The fungus produces conidia inside the acervuli. The acervuli are black in colour, cushion shaped and sub epidermal and break open to expose conidia and black sterile structures, setae. The conidiophores are hyaline, short and simple, bear conidia at the tip singly. The conidia are five celled, the middle three cells are dark coloured, while the end cells are hyaline with 3-5 slender, elongated appendages at the apex of the spore.

Favourable conditions

Ill drained soils, soils with potash deficiency, continuous rainy weather for 4-5 days and strong winds.

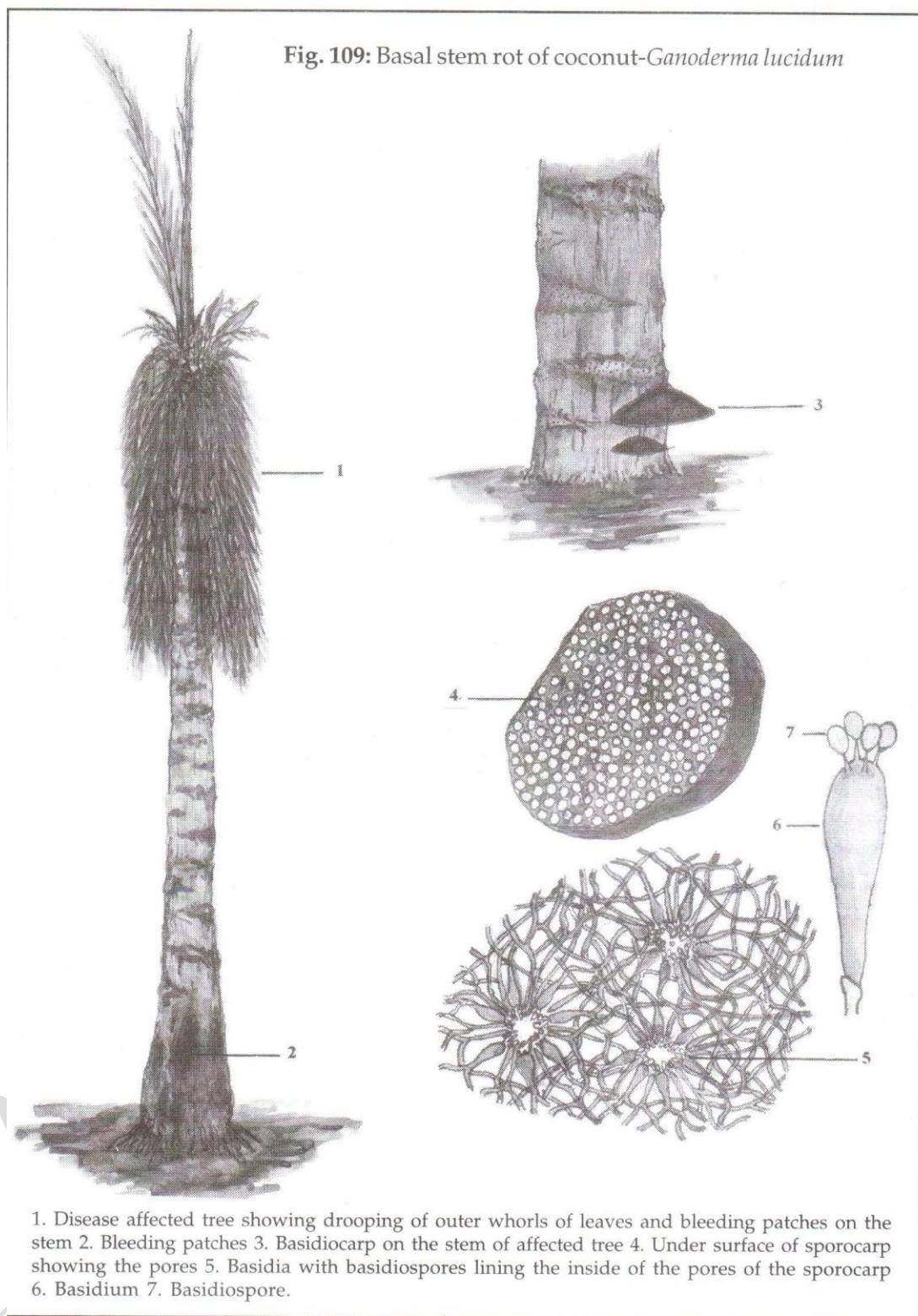
Mode of Spread and Survival

The fungus remains in the infected plant debris in soil. The disease is spread through wind-borne conidia

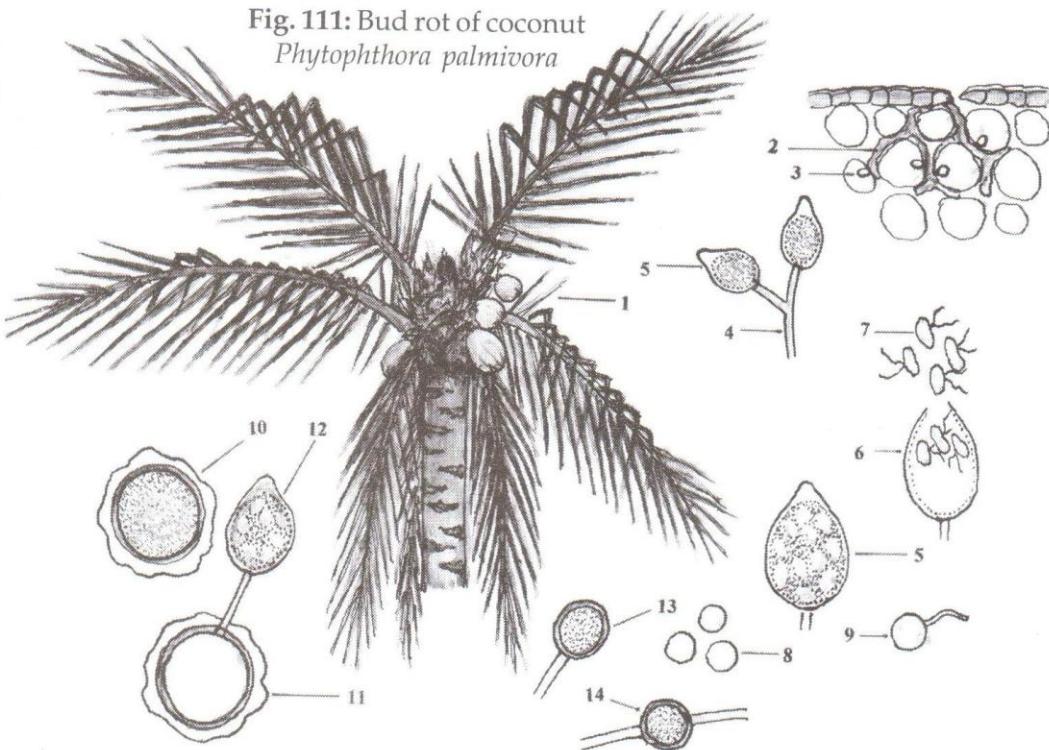
Management

Remove and burn the infected, fallen leaves periodically. Apply heavy doses of potash. Improve the drainage conditions of the soil. Spray the crown with 0.25 per cent copper oxychloride or 1 per cent Bordeaux mixture before the onset of rains.

Fig. 109: Basal stem rot of coconut-*Ganoderma lucidum*

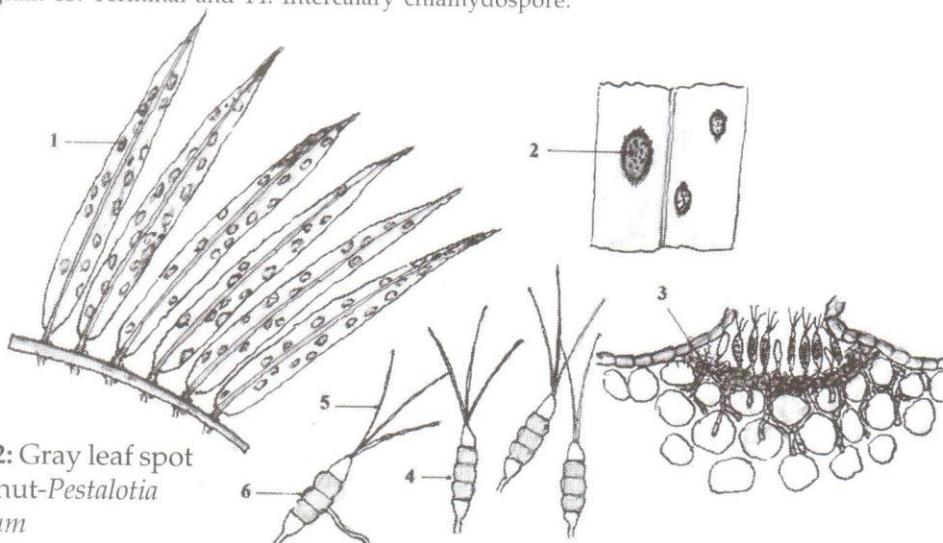


**Fig. 111: Bud rot of coconut
*Phytophthora palmivora***



1. Infected tree with only a few outer leaves
2. Intercellular mycelium
3. Haustorium
4. Sporangiophore
5. Sporangium
6. Zoospores emerging from sporangium
7. Zoospore
8. Encysted zoospore
9. Germination of encysted zoospore
10. Oospore
11. Germinating oospore
12. Secondary sporangium
13. Terminal and
14. Intercalary chlamydospore.

**Fig. 112: Gray leaf spot
of coconut-*Pestalotia pilmarum***



1. Spots on the leaflets
2. Acervuli on the spots on the surface of leaflet
3. Acervulus
4. Conidia
5. Appendages
6. Germinating conidium.

Diseases of Coffee

Coffee leaf rust - *Hemileia vastatrix*

Symptoms

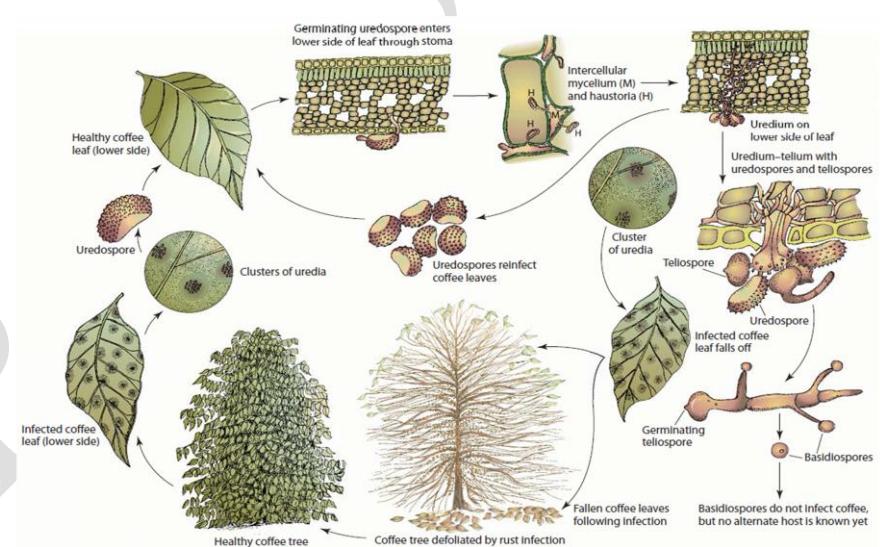


Small pale-yellow spots on the lower surface of infected leaves, orange-yellow spore mass appears, defoliation and die-back. Results in serious crop loss and causes fluctuations in production.

Pathogen

The mycelium is intercellular and sends haustoria into the cells. The mycelium sends out erumpent stalks through stomata which bear the uredospores. The uredospores are reniform or orange segment like in shape. The convex side of the spores are echinulated and the lower side is smooth and measure 26 – 40 x 20 – 30 micron meter. The telial stage succeeds the uredial stage in the later stage.

Disease Cycle



Disease cycle of coffee rust caused by *Hemileia vastatrix*

Mode of spread and survival

One lesion produces 1.5 lakhs uredospores which are spread by rain splash and wind. Many animals (insects, birds etc.,) can also carry spores over long distances. Infection requires the presence of water for uredospores germination and only occurs through stomata, which are on the underside of the leaf.

Management

Three applications of 0.5% Bordeaux mixture for susceptible varieties.

Black rot (*koleroga roxia*)

Economic Importance

In India it occurs in Karnataka and Tamil Nadu. In south India the disease is severe only in those areas growing with *C. arabica*. It is influenced by south west monsoon period from June– Sep.

Symptoms

Blackening and rotting of affected leaves, young twigs and berries. Affected leaves get detached and hang down by means of slimy fungal strands. Defoliation and berry drop occur.

Pathogen

The hyphae are hyaline when young and turn light brown with age. Fructifications arise with numerous basidia and basidiospores. Basidia are simple, oval rounded or pyriform. Basidiospores are hyaline, elongated, rounded at one end, slightly concave on one side. At a later stage the fungus forms sclerotia or hyphal clumps by repeated branching of short cells.

Mode of spread and survival

The pathogen penetrates the leaves through the stomata on the lower side and the hyphae invade intercellularly in the palisade tissue. The fungus mostly spreads by contact from leaf to leaf through the vegetative mycelium. The pathogen spread through infected plant debris. Mycelium lies in twigs throughout year.

Management

Remove and burn affected parts. Apply 1% Bordeaux mixture close to the south westerly monsoon if needed. Centre the coffee bushes, regulate the overhead canopy.

Berry blotch

Symptoms

Necrotic spots on the exposed surface of green berries enlarge and cover the major portion. Fruit skin shrivels and sticks fast.

Cercospora leaf spot (Brown eye spot, Berry blotch) -

Cercospora coffeicola



Pathogen

Cercospora coffeicola conidiophores are short, fasciculate and olivaceous. Conidia are subcylindrical, hyaline, 2-3 septate and 40-60x 3.5 micron meter in size.

Mode of spread and Survival

The pathogen is seed borne and conidia are spread by wind.

Management

Spray 1% Bordeaux mixture during june and late august, maintain medium shade overhead.

Damping off / Collar rot – *Rhizoctonia solani*

Symptoms

It caused pre emergence damping off and post emergence damping off. In post emergence damping off collar region near soil level is infected leading the rotting of tissue and death of seedlings.



Mode of spread and survival

The disease is soil borne

Management

Soil drenching with Copper oxychloride 0.25%.

Die back or Anthranose – *Collectorichum coffeatum*

Symptoms

On leaves circular to grayish spots of 2-3 m in dia. On berries small dark coloured sunken spots are formed. Beans become brown. Die back also occurs.

Coffee berry disease –*Colletotrichum coffeatum* var. *virulans*



Mode of spread and survival

The fungus occurs as a saprophyte on dead tissue on the outer layer of the bark, which provides the major source of inoculum. It releases large numbers of water borne conidia during the wet season. Conidia are spread by rain water percolating through the canopy and rain splash can disperse conidia between trees. Long distance dispersal occurs primarily by the carriage of conidia on passive vectors such as birds, machinery etc.

Management

Spraying Mancozeb 0.25%

Diseases of Tea

Blister blight – *Exobasidium vexans*

Symptoms

Small pale or pinkish circular spots appear on leaves and attain a size of 2.5 cm diameter. The spots in the upper surface of the leaf becomes light brown in color and depressed while in under surface of leaf it bulges forming a blister like swelling. Lower budget portion is covered with a white powdery growth of fungus. When many spots courses, curling of leaves will occur. When it spreads to young succulent stems affected portion are withered. The leaf yield is reduced vigor of the tea bush is affected.



Pathogen

The mycelium is confined to the blistered areas on the leaves. They are septae and collect in bundles below the lower epidermis. Later by rupturing the epidermis continuous layer of vertical hyphae are projected on the surface of spot. The fungus produces two kind of spores viz., the conidia and basidiospores. The conidia are most abundant, borne singly at the tip of long stalks. Basidia are formed on the surface in large number but never form a continuous hymenium.

Mode of spread and survival

The fungus completes its life cycle in 11-28 days and several generations of spores are produced in a season. It produces conidia and basidiospores in the same blister. Spores are air borne. The perpetuation of the fungus appears to be from the pre existing infected bushes.

Management

Removal and destruction of the affected portion. Spraying with Copper oxychloride 0.25 % is effective. Spray with 210 g of COC + 210 g nickel chloride/ha at 5 days interval from June – September and 11 days interval in October – November gives economic control. Spraying

with systemic insecticides like Atemi 50 SL at 400 ml/ha (or) Baycor (300 EC) at 340 ml/ha a weekly interval is also effective. Chlorotalonil, Bayleton, tridemorph is also effective. Tridemorph at 340 and 60 ml/ha is sat in factory under mild and moderate rainfall condition.

Black rot

Symptoms

Small dark brown irregular spots appear on leaf. They coalesce to produce a dark brown patch which eventually covers the whole leaf and drop off. Before the leaf turns black the lower surface assumes a white powdery appearance.

Pathogen

Corticium invisum and *C. theae*

Mode of spread and Survival

Basidiospores carried by workers. The disease develops rapidly when temperature is high and air is humid. At the beginning of rainfall they germinate and produce hyphae which start fresh infection.

Epidemiology

Occur in nursery shaded with *Crotalaria*. Basidiospores germinate only in wet weather or when leaves are covered with dew.

Management

Prune in December end, remove the prunings immediately, burn after drying. Collect all dead and dried leaves. Spray a copper fungicide in third week of April.

Red rust: *Cephaleurus mycoidea*

Symptoms

Orange yellow, circular patches appear on upper surface of leaves. The spots become brown and dry up. When it affects the given stem it hardens prematurely.

Pathogen

Cephaleurus mycoidea also attacks *Tephrosia* sp. and *Desmodium gyroides* grown as green manure and shade.

Epidemiology

Rainy season is best suited for propagation of algae.

Management

Removal of infected portion and spraying with Copper oxychloride 0.25 %

DISEASES OF GINGER

Rhizome rot/soft rot – *Pythium sp.*

Symptoms

- Rhizome rot of zinger is common in all zinger growing areas. When infection takes place through contaminated seed, sprouts fail to grow resulting in pre-emergence damping off.
- If the disease strikes after sprouting it manifests itself on the leaves, which turn pale green in colour.
- Yellowing is noticed on the top leaves, gradually spreading downwards of the leaf blade and leaf sheath along the margin.
- Yellowing is followed by withering and drying of the dead area gradually extending to leaf sheath. Dead leaves ultimately drop off and hang down along the stem till the entire shoot becomes dry.
- On stem, a translucent brown lesion develop at collar region and later becomes water soaked and soft, extends to whole shoots and can be easily pulled out from this point.
- Soft rot extends from the collar region to rhizomes which first become discoloured and gradually decompose, forming a watery mass of putrifying tissues enclosed by tough ring of rhizome.
- The fibrovascular strands are rarely affected. Roots arising from affected rhizome undergo rotting and softening. Rotting is also noticed in rhizomes collected from infected crop during storage.



Disease cycle

- P.I: Survive in soil and infected rhizomes as oospores
- S.I: Spreads through irrigation water as zoospores

Favourable conditions

- Mimegralla flies play a role in the spread of the pathogen

Management

- Crop rotation for 3-5 years with non-host crops
- Avoid water stagnation
- Collect the seed from disease free plots
- Rhizome treatment with Metalaxyl@0.2%
- Drench the field with COC@0.3% or Metalaxyl@0.2%
- Control the Mimegralla insects by 0.05% methyl parathion

Phyllosticta leaf spot -*Phyllosticta zingiberi*

Symptoms:

- On leaves, small oval to elongated spots appear which later on develop white papery centre and dark brown margins with a yellow halo.



- The affected leaves suffer from extensive desiccation and are shredded and disfigured.

Pathogen:

- The disease is caused by *Phyllosticta zingiberi* T.S. Ramakr.
- The fungus forms amphigenous, subglobose, dark brown, ostiolate pycnidia on the host. Pycnidiospores are hyaline, unicellular, oblong and biguttulate.

Disease cycle and epidemiology:

- The fungus overwinters in infected plant debris and seed rhizomes.
- The disease begins to appear towards the end of June when temperature varies from 23.4 to 29.6 and RH is in between 83.3 to 90.2 per cent.
- Later, in July when rainy days and total rainfall increases, the disease aggravates and spread fast.

- Higher intensity of rain, accompanied by wind, exert greater impact on target leaves and fungus is splashed to a greater distance resulting in increased disease incidence.

Management:

- Collect and destroy the infected plant debris by burning.
- Use healthy seed rhizomes and by steeping them in the mixture of mancozeb (0.25%) and carbendazim (0.1%) for 60 minutes before sowing and dry in shade for 48 h. Spray the crop with mancozeb (0.25%) or carbendazim (0.1%) or combination of mancozeb (0.25%) and carbendazim (0.05%) and repeat at 10 to 14 days interval.
- Few cultivars like Narasapatom, Tura, Nadia, Tetraploid and Thingpani are moderately resistant to the pathogen.

Bacterial wilt

Symptoms:

- Water-soaked patches or streaks appear on collar region which slowly enlarge.
- Bronze colouration on leaf margins is also observed and the leaves slowly become flaccid with intense yellowish bronze colour and ultimately droop down exhibiting typical wilt symptoms.
- At advanced stages, pseudo stem appears slimy and if infected rhizomes are pressed, a milky bacterial exudates oozes out in clear water.



Pathogen:

- The disease is caused by bacterium *Ralstonia solanacearum* (Smith) Yabuuchi et al.
- The bacterium is described in detail under tomato lecture.

Disease cycle and epidemiology:

- The bacterium perpetuates through infected rhizomes and soil. Biotype III of the bacterium is known to cause this disease in India.
- The bacterium has wider host range including both cultivated and weeds.

- The presence of nematodes has a positive and significant effect on the development of bacterial wilt.

Management:

- Use healthy seed rhizomes for planting.
- Eradicate weed hosts and adopt effective crop rotation for at least three years.
- Treat seed rhizomes with Streptocycline (100 ppm) for 30 minutes before planting and spray the crop with Streptocycline (100 ppm) starting from 1 month after transplanting and repeat at fortnightly interval.

Root-knot

Nematodes can attack ginger and turmeric such as root-knot nematode (*Meloidogyne incognita*). This nematode has a very wide-host range and heavy infections may render drastic reduction of ginger yield.

Symptoms:

The symptoms are similar to root gall as on tomatoes, cucurbits, lettuce, and other vegetable crops. Root knot infected ginger may have stunted growth with partial yellowing of plants.

On roots irregular round galls and spindle-shaped enlargements appear on the tap and side roots.

The nematode larvae feed on roots causing the swellings or knots that are characteristic of root-knot infection.

Roots are often stunted and deformed.

Pathogen:

- Root-knot nematode is caused by the plant parasitic nematode, *Meloidogyne incognita*.
- Root knot nematodes are sedentary, endoparasitic and gall producing nematodes.
- The infective stage is the second stage juveniles, which have lightly sclerotized cephalic framework.
 - The stylet in juveniles and adult female is weak.
 - Third and fourth stage juveniles lack stylet and body is saccate.
 - Adult females are swollen, pyriform, saccate with short neck, vulva is terminal, perineal cuticular pattern of striae is present, tail is absent, didelphic, prodelphic ovaries are coiled, excretory pore is present near stylet base, large rectal glands produce gelatinous matrix expelled through the anus.
 - Males are vermiform with single or paired testis, tail end is twisted and rounded, bursa is absent, reproduction is parthenogenic.

Disease cycle and epidemiology:

- The second stage juveniles in the soil after searching a suitable site, normally behind the root cap, start feeding on epidermal cells and penetrate in cortical layers of root.
- They reach upto the stellar region, where they form giant cells for feeding.
- Second stage juveniles initiate gall formation and feed for 7-15 days, undergo three moults to become adult.
- The total time taken for completing one life cycle under optimum conditions is 3-4 weeks.
- Moderate temperature (29-30°C) and higher relative humidity (79-80%) favour *M. incognita* reproduction and spread.

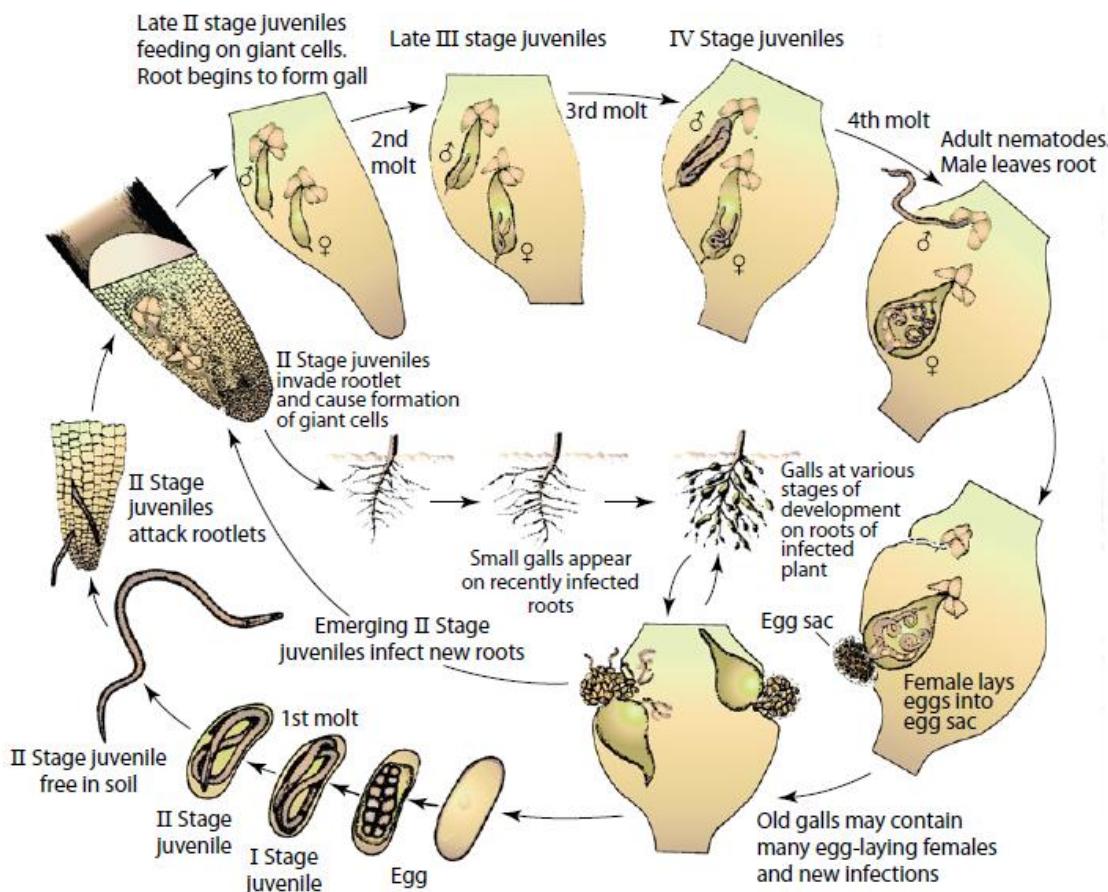


FIGURE 15-11 Disease cycle of root knot caused by nematodes of the genus *Meloidogyne*.

Management:

- Crop rotation with non-hosts, graminaceous poor hosts and a few antagonistic crops for one or two years have been reported to be effective in reducing the population of root knot nematode.
- Groundnut-mustard rotation was found most effective in reducing the population of *M. incognita*.

- Soil amendments (dry or green crop residues, oil cakes, meals, sawdust, FYM etc.) are allowed to decompose in the nematode infested field, which in turn helps in alteration of physical, chemical and biotic conditions of the soil.
- At the time of field preparation, nematicides like Thimet or Phorate (12-15 kg/ha) should be applied and immediately apply light irrigation. After 15-20 days again cultivate the field and sow the crop.
- Efficacy of various biocontrol agents like *Paecilomyces lilacinus*, *Pasteuria penetrans* and *Pseudomonas fluorescens* in managing *M. incognita* has also been reported.

Diseases of colocasia

PHYTOPHTHORA BLIGHT

Symptoms

- *Phytophthora colocasiae* is primarily a foliar pathogen, but it also affects the petioles and corms of its hosts.
- The first symptoms on taro (*Colocasia esculenta*) are small, dark brown flecks or light brown spots on the upper leaf surface.
- These early spots often occur at the tips and margins of leaves where water accumulates.
- The spots enlarge rapidly, becoming circular, zonate, and purplish brown to brown in color.
- On the lower leaf surface, spots have a water-soaked or dry gray appearance and hard globules of plant exudate are sometimes present.
- As spots increase in size they coalesce and quickly destroy the leaf.
- In dry weather or on some resistant cultivars, the centers of lesions become papery and fall out, producing a “shot-hole” appearance.
- Dead leaves often hang on their long petioles like flags.
- Bright orange or reddish brown plant exudate oozing from infection sites is another symptom of leaf blight disease in taro .
- The presence of yellow tissue around lesions.
- Infected corm tissue is brown, firm, and develops rapidly after harvest.
- After harvest, grey-brown to dark-blue lesions occur on undamaged corms. These lesions enlarge rapidly and coalesce. The boundary between the healthy and diseased tissues is usually indistinct and soft. Affected corms are almost completely decayed at 8 days after harvest in wet conditions.

Phytophthora leaf blight *Phytophthora colocasiae*



Transmission

Oospores occur infrequently in nature, and taro leaf blight is thus spread almost exclusively by sporangia from the anamorph. Dissemination via rain splash is the most common dispersal mechanism. Spread of the fungus within a taro planting occurs when sporangia and zoospores are splashed from infected to healthy leaves. The infection of new planting occurs by spores blown in wind-driven rain from adjacent diseased fields or from infected wild taro. Also the fungus has been distributed by means of vegetatively propagated material and probably by soil.

Epidemiology

P. colocasiae occurs under conditions of high temperature and humidity, in wet areas and densely planted fields. Epidemics occur frequently between July and September in Hainan, China. Primary leaf infection has been observed following tropical storms.

Control

- Use of disease-free plant material,
- Roguing infected leaves, and
- Avoiding excessive levels of moisture.
- Metalaxyl, Pyrachlostrobin + Metiram, Tebuconazole, Cymoxanil, Copper oxychloride, Mancozeb, Zineb applied as foliar sprays.
- Seed treatment and soil application of *Trichoderma viride*

PAT 302, UASD