

PLANT PATHOLOGY

Course Code: BSAL 2213

Credit Units: 4 CU

Contact Hours: 60 Hours

Course Instructor

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Course Description

Plant Pathology provides a comprehensive, competency-based understanding of plant diseases, their causes, diagnosis, epidemiology, and management. Plant diseases significantly reduce crop productivity, threaten food security, and undermine farmer incomes in Sub-Saharan Africa. Effective disease management requires scientific knowledge of pathogen biology, host-pathogen interactions, disease cycles, and integrated management approaches. This course integrates theory, laboratory diagnosis, field-based disease identification, epidemiological analysis, and integrated disease management strategies. Students develop professional competence in diagnosing plant diseases, recommending evidence-based control strategies, and promoting sustainable, climate-resilient crop protection systems. The course prepares graduates for roles in agricultural extension, research, regulatory services, crop protection enterprises, and sustainable farming systems.

Course Objectives

1. Develop integrated competence in plant disease diagnosis and management.
2. Build practical skills in laboratory and field identification of plant pathogens.
3. Strengthen analytical capacity in disease epidemiology and risk assessment.
4. Promote environmentally sound and sustainable disease management approaches.
5. Foster professional ethics and responsible pesticide stewardship.

Learning Outcomes

By the end of the course, students should be able to:

1. Diagnose plant diseases using field symptoms, laboratory techniques, and pathogen identification tools.

2. Differentiate among major plant pathogens (fungi, bacteria, viruses, nematodes, phytoplasmas, parasitic plants).
3. Analyze disease cycles and epidemiological factors influencing outbreaks.
4. Design and implement integrated disease management (IDM) strategies.
5. Evaluate chemical, biological, cultural, and host resistance approaches for disease control.
6. Apply safe pesticide handling and regulatory compliance principles.

Rationale

Crop losses due to plant diseases remain a major constraint to agricultural productivity in Uganda and Sub-Saharan Africa. Misdiagnosis and inappropriate pesticide use often exacerbate losses, increase production costs, and pose environmental and health risks. A CBET approach ensures graduates acquire practical diagnostic, analytical, and management competencies rather than purely theoretical knowledge. This course bridges plant pathology science with real-world crop protection practice, strengthening national capacity in food security, safe production systems, and sustainable agricultural transformation.

Competences / Skills

General Competence

Learners will apply scientific diagnostic methods, epidemiological principles, and integrated disease management strategies to protect crops and enhance sustainable agricultural productivity.

Specific Competences

i. Knowledge & Understanding

Learners will be able to:

- Explain the nature and causes of plant diseases.
- Describe major pathogen groups and their characteristics.
- Explain host-pathogen interactions and disease development processes.
- Interpret epidemiological principles and disease forecasting models.
- Understand regulatory frameworks governing plant protection and pesticide use.

ii. Practical / Technical Skills

Learners will be able to:

- Identify disease symptoms and signs in the field.
- Isolate and identify fungal and bacterial pathogens in the laboratory.
- Perform microscopy and basic pathogen culturing techniques.
- Diagnose viral and nematode infections using appropriate methods.
- Develop integrated disease management plans.
- Calibrate and safely apply plant protection chemicals.

iii. Problem-Solving & Analytical Skills

Learners will be able to:

- Diagnose causes of crop disease outbreaks.
- Analyze disease cycles to identify intervention points.
- Evaluate control options based on economic, environmental, and social factors.
- Recommend sustainable and climate-smart disease management strategies.

iv. Attitudes & Values

Learners will demonstrate:

- Professional integrity in diagnosis and reporting.
- Responsible pesticide stewardship.
- Environmental consciousness and sustainability ethics.
- Commitment to farmer-centered crop protection solutions.

Pre-requisite Course(s)

- Annual and perennial crop agronomy
- Microbiology
- Principles of Crop Production Systems

Mode of Delivery

Blended learning with strong emphasis on laboratory diagnostics, field practical sessions, and case-based learning.

Teaching Approaches

- Interactive lectures
- Laboratory practical sessions
- Field disease scouting
- Case-based outbreak analysis
- Group discussions
- Diagnostic simulations

Instructional Materials

Microscopes, culture media, Petri dishes, incubators, disease specimens, herbarium samples, hand lenses, diagnostic manuals, pesticide labels, field sampling tools, digital projection tools.

Course Outline

Learning Outcome	Content	Learning Activities	Values & Attitudes	CH
Explain principles of plant pathology	Definition and importance of plant pathology; history of plant diseases; disease triangle; types of plant diseases; economic importance	Interactive lectures	Critical thinking	4 LH
Differentiate plant pathogens	Fungi (Ascomycetes, Basidiomycetes, Oomycetes); Bacteria; Viruses; Nematodes; Phytoplasmas; Parasitic plants; symptomatology vs signs	Lectures; specimen observation	Analytical reasoning	6 LH, 4 PH
Diagnose plant diseases	Field symptom identification; sampling techniques; Koch's postulates; pathogen isolation; culturing; microscopy; viral diagnosis basics; nematode extraction methods	Laboratory practicals; field scouting	Accuracy; professional integrity	6 LH, 8 PH
Analyze host-pathogen interactions	Infection processes; disease cycles (monocyclic vs polycyclic); plant defense mechanisms; resistance vs susceptibility; environmental influences	Case studies; diagrams; outbreak analysis	Systems thinking	6 LH
Apply epidemiology and forecasting	Disease epidemiology; inoculum sources; dispersal mechanisms; disease progress curves; forecasting models; climate influence on epidemics	Data interpretation; group exercises	Evidence-based reasoning	6 LH, 2 PH
Design integrated disease management (IDM) strategies	Cultural control; biological control; host resistance; chemical control; integrated approaches; crop rotation; sanitation; quarantine	Case-based learning; group design exercises	Sustainability; stewardship	4 LH
Diseases of major plants and management	Banana, coffee, cocoa, tea, macadamia, beans, pea nuts, tomatoes, onions, cow pea, soy bean, oil palms, cashew nuts, sugarcane, cabbage, green pepper	Field scouting	Evidence-based reasoning	2 LH 4PH
Evaluate chemical disease management	Fungicide classification (contact vs systemic); modes of action; resistance	Demonstrations; calibration practical	Safety; ethical compliance	3 LH, 2 PH

	management; pesticide calibration; safe handling; PPE; regulatory compliance			
Assess emerging and climate-driven diseases	Climate change and disease dynamics; emerging pathogens; biosecurity; surveillance systems; food safety implications	Group discussions; case analysis	Innovation; resilience	4 LH
Student diagnostic presentations	Case-based disease diagnosis and management plans	Presentations	Communication; teamwork	4 PH

Total Contact Hours = 60 Hours

- Lecture Hours (LH)
- Practical Hours (PH)

Mode of Assessment

Assessment	Competence Assessed	Assessment Mode	Weight (%)
Coursework (40%)	Practical diagnostic competence	Lab reports; field reports	20%
	Communication & teamwork	Presentations	10%
	Professional conduct	Practical evaluation & participation	10%
Final Examination (60%)	Conceptual understanding	Short-answer questions	20%
	Epidemiological analysis	Long-answer questions	20%
	Application & synthesis	Case-based disease management questions	20%
Total			100%

Reading materials

Agrios, G. N. (2005). *Plant pathology* (5th ed.). Elsevier Academic Press. <https://www.elsevier.com/books/plant-pathology/agrios/9780120445653>

Agrios, G. N. (2018). *Plant pathology* (6th ed.). Elsevier. <https://www.elsevier.com/books/plant-pathology/agrios/9780120445653>

Schumann, G. L., & D'Arcy, C. J. (2010). *Essential plant pathology* (2nd ed.). APS Press. <https://www.apsnet.org/apsstore/shopapspress/Pages/EssentialPlantPathology.aspx>

Annual Review of Phytopathology Editorial Committee. (2024). *Annual review of phytopathology* (Vol. 62). Annual Reviews. <https://www.annualreviews.org/journal/phyto>

Tohge, T., Yan, J., & Fernie, A. R. (Eds.). (2024). *Plant pathogen resistance biotechnology*. Springer. <https://doi.org/10.1007/978-3-031-25432-1>

