

**DAV UNIVERSITY, JALANDHAR**



FACULTY OF AGRICULTURAL SCIENCES

COURSE CURRICULUM

FOR

M. Sc. Ag. (Plant Pathology)

(2 Years Course)

1<sup>st</sup> to 4<sup>th</sup> SEMESTER

Examinations 2017–2018 session

Syllabi applicable for admissions in 2017

1. Mode of Admission: DAVU may follow entrance examination or merit at B. Sc. (Hons.) Agriculture (min. CGPA 5.5 or above).
2. Reservation of seats: Reservation of seats is governed by the rules of State government.
3. Semester Duration: The minimum duration of 110 working days, consisting of 95 instructional days and 15 examination days.
4. Credit Definition: One credit is defined as one-hour lecture / 2 hours lab / 2 hours field work/week.
5. Attendance required: 75 percent
6. Maximum and minimum credits per semester  
Max. 18 credits per semester & Min. 9 credits per semester
7. Course curriculum and minimum credits requirement:  
Major discipline: 21 credit hours (including one seminar of one credit hour)  
Minor discipline + supporting course(s): 14 credit hours (One minor discipline)  
Research work: 20 credit hours
8. Compulsory courses for M.Sc. Agriculture: It is required that a student must enrol himself/herself for some (listed subsequently in course scheme) for the award of M.Sc. Ag. (All disciplines).
9. Comprehensive Examinations: After having successful completion of 75% of approved course work in major field and 100% in minor field(s) with a CGPA of not less than 6.60/10.00, every postgraduate student shall have to pass two comprehensive examinations one in major field and one in minor field.

Qualifying marks: 60%

Grading: S (Satisfactory) or U (Unsatisfactory)

## Course Scheme for M. Sc. Ag. (Plant Pathology)

<b>Semester I</b>													
Sr. No	Course Code	Course name	Course type	L	T	P	Cr	A	B	C	D	E	F
1	AGR 650	MYCOLOGY	Core	2	0	2	3	15	20	30	7	28	75
2	AGR 651	PLANT BACTERIOLOGY	Core	2	0	2	3	15	20	30	7	28	75
3	AGR 652	PRINCIPLES OF PLANT PATHOLOGY	Core	3	0	0	3	15	20	30	7	28	75
4	DEPARTMENTAL ELECTIVE I (OPTIONAL)			2	0	2	3	15	20	30	7	28	75
5.	OPEN ELECTIVE I (INTERDISCIPLINARY ELECTIVE I)			2	0	2	3	15	20	30	7	28	75
6.	CSA	COMPUTER FUNDAMENTALS AND PROGRAMMING	Compulsory Foundation	2	0	2	3	15	20	30	7	28	75
Total							18						450

A: Continuous Assessment Theory: Based on Objective Type  
 B: Mid-Semester Exam Theory: Based on both Objective & Subjective Type  
 C: End-Term Exam Theory: Based on both Objective & Subjective Type  
 D: Continuous Assessment Practical: Based on Continuous Assessment (Practicals)  
 E: End-Term Exam Practical: Based on Continuous Assessment, viva-voce test and Exam  
 F: Total Weightage

L: Lectures T: Tutorial P: Practical Cr: Credits

Departmental ElectiveI (Choose any one course)

Sr. No	Course Code	Course name	Course type	L	T	P	Cr	A	B	C	D	E	F
1	AGR 653	MUSHROOM PRODUCTION TECHNOLOGY	Elective	2	0	2	3	15	20	30	7	28	75
2	AGR 654	POST HARVEST DISEASES	Elective	2	0	2	3	15	20	30	7	28	75
3	AGR 655	DISEASES OF FRUITS, PLANTATION AND ORNAMENTAL CROPS	Elective	2	0	2	3	15	20	30	7	28	75
4	AGR 656	DISEASES OF VEGETABLE AND SPICES CROPS	Elective	2	0	2	3	15	20	30	7	28	75
5	AGR 657	DISEASES OF FIELD AND MEDICINAL CROPS	Elective	2	0	2	3	15	20	30	7	28	75
6	AGR 658	PLANT QUARANTINE	Elective	2	0	0	2	20	30	50	-	-	75
7	AGR 659	BIOLOGICAL CONTROL OF PLANT DISEASES	Elective	2	0	2	3	15	20	30	7	28	75

A: Continuous Assessment Theory:

Based on Objective Type

B: Mid-Semester Exam Theory:

Based on both Objective & Subjective Type

C: End-Term Exam Theory:

Based on both Objective & Subjective Type

D: Continuous Assessment Practical:

Based on Continuous Assessment (Practicals)

E: End-Term Exam Practical:

Based on Continuous Assessment, viva-voce test and Exam

F: Total Weightage

L: Lectures T: Tutorial P: Practical Cr: Credits

## Course Scheme for M. Sc. Ag. (Plant Pathology)

<b>Semester II</b>													
Sr. No	Course Code	Course name	Course type	L	T	P	Cr	A	B	C	D	E	F
1	AGR 660	PRINCIPLES OF PLANT DISEASE MANAGEMENT	Core	2	0	2	3	15	20	30	7	28	75
2	AGR 661	PLANT VIROLOGY	Core	2	0	2	3	15	20	30	7	28	75
3	AGR 662	DETECTION AND DIAGNOSIS OF PLANT DISEASES	Core	0	0	4	2	-	-	-	20	80	50
4	DEPARTMENTAL ELECTIVE II (OPTIONAL)			2	0	2	3	15	20	30	7	28	75
5	OPEN ELECTIVE II (INTERDISCIPLINARY ELECTIVE II)			2	0	2	3	15	20	30	7	28	75
6	ENG	TECHNICAL WRITING AND COMMUNICATION SKILLS	Compulsory Foundation	0	1	1	1	-	-	-	20	80	25
7	AGR 503	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	Compulsory Foundation	1	0	0	1	20	30	50	-	-	25
8	AGR 500	MASTERS RESEARCH	Core	0	1	4	2	-	-	-	-	-	S/U S*
Total							16						400

A: Continuous Assessment Theory:

Based on Objective Type

B: Mid-Semester Exam Theory:

Based on both Objective & Subjective Type

C: End-Term Exam Theory:

Based on both Objective & Subjective Type

D: Continuous Assessment Practical:

Based on Continuous Assessment (Practicals)

E: End-Term Exam Practical:

Based on Continuous Assessment, viva-voce test and Exam

F: Total Weightage

\*S- Satisfactory

\*US- Unsatisfactory

L: Lectures T: Tutorial P: Practical Cr: Credits

Departmental Elective II (Choose any one course)

Sr. No	Course Code	Course name	Course type	L	T	P	Cr	A	B	C	D	E	F
1	AGR 663	SEED HEALTH TECHNOLOGY	Elective	2	0	2	3	15	20	30	7	28	75
2	AGR 664	PHYTO NEMATOLOGY	Elective	1	0	2	2	10	15	25	10	40	50
3	AGR 665	INSECT VECTORS OF PLANT VIRUSES AND OTHER PATHOGENS	Elective	1	0	2	2	10	15	25	10	40	50
4	AGR 666	CHEMICALS IN PLANT DISEASE MANAGEMENT	Elective	2	0	2	3	15	20	30	7	28	75
5	AGR 667	ECOLOGY OF SOIL-BORNE PLANT PATHOGENS	Elective	2	0	2	3	15	20	30	7	28	75
6	AGR 668	DISEASE RESISTANCE IN PLANTS	Elective	2	0	0	2	20	30	50	0	0	50
7	AGR 669	EPIDEMIOLOGY AND FORECASTING OF PLANT DISEASES	Elective	2	0	2	3	15	20	30	7	28	75

A: Continuous Assessment Theory:

B: Mid-Semester Exam Theory:

C: End-Term Exam Theory:

D: Continuous Assessment Practical:

E: End-Term Exam Practical:

F: Total Weightage

Based on Objective Type

Based on both Objective & Subjective Type

Based on both Objective & Subjective Type

Based on Continuous Assessment (Practicals)

Based on Continuous Assessment, viva-voce test and Exam

L: Lectures T: Tutorial P: Practical Cr: Credits

## Course Scheme for M. Sc. Ag. (Plant Pathology)

<b>Semester III</b>													
Sr. No	Course Code	Course name	Course type	L	T	P	Cr	A	B	C	D	E	F
1	MTH	STATISTICS METHODS FOR APPLIED SCIENCES	Compulsory Foundation	3	0	2	4	15	20	40	5	25	<b>100</b>
2	LIB	LIBRARY AND INFORMATION SERVICES	Compulsory Foundation	0	1	2	1	-	-	-	20	80	<b>25</b>
3	AGR 504	BASIC CONCEPTS OF LABORATORY TECHNIQUES	Compulsory Foundation	0	1	2	1	-	-	-	20	80	<b>25</b>
4	AGR 505	AGRICULTURAL RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMS	Compulsory Foundation	1	0	0	1	20	30	50	-	-	<b>25</b>
5	AGR 670	INTEGRATED DISEASE MANAGEMENT	Core	2	0	2	3	15	20	30	7	28	<b>75</b>
6	EVS 658	DISASTER MANAGEMENT	Compulsory Foundation	1	0	0	1	20	30	50	-	-	<b>25</b>
8	AGR500	MASTERS RESEARCH	Core	0	1	10	5	-	-	-	-	-	<b>S/US*</b>
<b>Total</b>							<b>16</b>						<b>250</b>

A: Continuous Assessment Theory:

Based on Objective Type

B: Mid-Semester Exam Theory:

Based on both Objective & Subjective Type

C: End-Term Exam Theory:

Based on both Objective & Subjective Type

D: Continuous Assessment Practical:

Based on Continuous Assessment (Practicals)

E: End-Term Exam Practical:

Based on Continuous Assessment, viva-voce test and Exam

F: Total Weightage

\*S- Satisfactory

\*US- Unsatisfactory

L: Lectures T: Tutorial P: Practical Cr: Credits

## Course Scheme for M. Sc. Ag. (Plant Pathology)

<b>Semester IV</b>													
<b>Sr. No.</b>	<b>Course Code</b>	<b>Course name</b>	<b>Course type</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>1</b>	AGR700	MASTER'S SEMINAR	Core	1	0	0	1	-	-	-	20	80	<b>25</b>
<b>2</b>	AGR500	MASTER'S RESEARCH	Core	0	1	30	15	-	-	-	-	-	<b>S/US*</b>
<b>Total</b>							16						

A: Continuous Assessment Theory:

Based on Objective Type

B: Mid-Semester Exam Theory:

Based on both Objective & Subjective Type

C: End-Term Exam Theory:

Based on both Objective & Subjective Type

D: Continuous Assessment Practical:

Based on Continuous Assessment (Practicals)

E: End-Term Exam Practical:

Based on Continuous Assessment, viva-voce test and Exam

F: Total Weightage

\*S- Satisfactory

\*US- Unsatisfactory

L: Lectures T: Tutorial P: Practical Cr: Credits



# Syllabus

**AGR650**

**MYCOLOGY**

**2+1**

## Theory

### SECTION A

Introduction, definition of different terms, basic concepts.

### SECTION B

Importance of mycology in agriculture, Importance of fungi to man, history of mycology.

### SECTION C

Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.

### SECTION D

The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens, variability in fungi.

**Practical:** Detailed comparative study of different groups of fungi; collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

### Suggested Readings

Ainsworth GC, Sparrow FK & Susman HS. 1973. *The Fungi – An Advanced Treatise*. Vol. IV (A & B). Academic Press, New York.

Alexopoulos CJ, Mims CW & Blackwell M. 2000. *Introductory Mycology*. 5th Ed. John Wiley & Sons, New York.

Mehrotra RS & Arneja KR. 1990. *An Introductory Mycology*. Wiley Eastern, New Delhi.

Sarbhoy AK. 2000. *Text book of Mycology*. ICAR, New Delhi.

Singh RS. 1982. *Plant Pathogens – The Fungi*. Oxford & IBH, New Delhi. Webster J. 1980. *Introduction to Fungi*. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

**AGR651**

**PLANT VIROLOGY**

**2+1**

## Theory

### SECTION A

History of plant viruses, composition and structure of viruses. Symptomatology of important plant viral diseases, transmission, chemical and physical properties, virus-host interaction, virus-vector relationship.

### SECTION B

Virus nomenclature and classification, genome organization, replication and movement of viruses. Virus isolation and purification, electron microscopy, protein and nucleic acid based diagnostics.

### SECTION C

Mycoviruses, phytoplasma, arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions. Principles of the working of electron-microscope and ultra-microtome.

### SECTION D

Virus origin and evolution, mechanism of resistance, genetic engineering, ecology, and management of plant viruses.

**Practical:** Study of symptoms caused by viruses, transmission, assay of viruses, physical properties, purification, method of raising antisera, serological tests, electron microscopy and ultratome, PCR.

#### Suggested Readings

Bos L. 1964. *Symptoms of Virus Diseases in Plants*. Oxford & IBH., New Delhi.

Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ & Watson L. 1995. *Virus of Plants: Descriptions and Lists from VIDE Database*. CABI, Wallington.

Gibbs A & Harrison B. 1976. *Plant Virology - The Principles*. Edward Arnold, London. Hull R. 2002. *Mathew's Plant Virology*. 4th Ed. Academic Press, New York.

Noordam D. 1973. *Identification of Plant Viruses, Methods and Experiments*. Oxford & IBH, New Delhi.

**AGR652**

**PLANT BACTERIOLOGY**

**2+1**

#### Theory

### SECTION A

History and introduction to phytopathogenic procarya, viz., bacteria, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic procarya and important diseases caused by them.

### SECTION B

Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya.

### SECTION C

General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria.

### SECTION D

Survival and dissemination of phytopathogenic bacteria.

**Practical:** Isolation, purification, identification and host inoculation of phytopathogenic bacteria, staining methods, biochemical and serological characterization, isolation of plasmid and use of antibacterial chemicals/antibiotics.

### **Suggested Readings**

Goto M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York.

Jayaraman J & Verma JP. 2002. *Fundamentals of Plant Bacteriology*. Kalyani Publ., Ludhiana.

Mount MS & Lacy GH. 1982. *Phytopathogenic Prokaryotes*. Vols. I, II. Academic Press, New York.

Verma JP, Varma A & Kumar D. (Eds). 1995. *Detection of Plant Pathogens and their Management*. Angkor Publ., New Delhi.

Verma JP. 1998. *The Bacteria*. Malhotra Publ. House, New Delhi.

AGR653

## **PRINCIPLES OF PLANT PATHOLOGY 3+0**

### **Theory**

#### **SECTION A**

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes and classification of plant diseases.

#### **SECTION B**

Pathogenesis- survival, growth, reproduction, and dispersal of important plant pathogens, role of environment and host nutrition on disease development.

#### **SECTION C**

Host parasite interaction, recognition concept and infection, symptomatology, mechanism of infection- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

#### **SECTION D**

Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance. Disease management strategies.

### **Suggested Readings**

Agrios GN. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York.

Heitefuss R & Williams PH. 1976. *Physiological Plant Pathology*. Springer Verlag, Berlin, New York.

Mehrotra RS & Aggarwal A. 2003. *Plant Pathology*. 2nd Ed. Oxford & IBH, New Delhi.

Singh RS. 2002. *Introduction to Principles of Plant Pathology*. Oxford & IBH, New Delhi.

Singh DP & Singh A. 2007. *Disease and Insect Resistance in Plants*. Oxford & IBH, New Delhi.

Upadhyay RK & Mukherjee KG. 1997. *Toxins in Plant Disease Development and Evolving Biotechnology*. Oxford & IBH, New Delhi.

**Practical****SECTION A**

Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.

**SECTION B**

Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.

**SECTION C**

Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens.

**SECTION D**

Evaluation of fungicides, bactericides etc., field experiments, data collection and preparation of references.

**Suggested Readings**

Baudoin ABAM, Hooper GR, Mathre DE & Carroll RB. 1990. *Laboratory Exercises in Plant Pathology: An Instructional Kit*. Scientific Publ., Jodhpur.

Dhingra OD & Sinclair JB. 1986. *Basic Plant Pathology Methods*. CRC Press, London, Tokyo.

Fox RTV. 1993. *Principles of Diagnostic Techniques in Plant Pathology*. CABI Wallington.

Mathews REF. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press, Boca Raton, Tokyo.

Forster D & Taylor SC. 1998. *Plant Virology Protocols: From Virus Isolation to Transgenic Resistance. Methods in Molecular Biology*. Humana Press, Totowa, New Jersey.

Matthews REF. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press, Florida.

Trigiano RN, Windham MT & Windham AS. 2004. *Plant Pathology- Concepts and Laboratory Exercises*. CRC Press, Florida.

Chakravarti BP. 2005. *Methods of Bacterial Plant Pathology*. Agrotech, Udaipur.

**Theory****SECTION A**

Principles of plant disease management through cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures (IDM- module) of plant diseases. Disease resistance and molecular approach for disease management.

#### **SECTION B**

Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures.

#### **SECTION C**

History of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy

#### **SECTION D**

Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

**Practical:** *In vitro* and *in vivo* evaluation of chemicals against plant pathogens; ED and MIC values, study of structural details of sprayers and dusters.

#### **Suggested Readings**

Fry WE. 1982. *Principles of Plant Disease Management*. Academic Press, New York.

Hewitt HG. 1998. *Fungicides in Crop Protection*. CABI, Wallington.

Marsh RW. 1972. *Systemic Fungicides*. Longman, New York.

Nene YL & Thapliyal PN. 1993. *Fungicides in Plant Disease Control*. Oxford & IBH, New Delhi.

Palti J. 1981. *Cultural Practices and Infectious Crop Diseases*. Springer- Verlag, New York.

**AGR656**

**DISEASES OF FIELD AND MEDICINAL CROPS**

**2+1**

#### **Theory**

#### **SECTION A**

Diseases of Cereal and Pulse crops- wheat, barley, rice, pearl millet, sorghum, maize, gram, common bean, urdbean, mungbean, lentil, pigeonpea and soybean.

#### **SECTION B**

Diseases of Oilseed and Cash crops- rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor, cotton and sugarcane.

#### **SECTION C**

Diseases of Fodder legume crops- berseem, oats, guar, lucerne, cowpea.

## SECTION D

Medicinal crops- plantago, liquorice, mulathi,, sacred basil, mentha, ashwagandha, *Aloe vera*.

**Practical:** Detailed study of symptoms and host-parasite relationship of important diseases of above mentioned crops. Collection and dry preservation of diseased specimens of important crops.

### Suggested Readings

Joshi LM, Singh DV & Srivastava KD. 1984. *Problems and Progress of Wheat Pathology in South Asia*. Malhotra Publ. House, New Delhi.

Rangaswami G. 1999. *Diseases of Crop Plants in India*. 4th Ed.. Prentice Hall of India, New Delhi.

Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. *Diseases of Sugarcane, Major Diseases*. Academic Press, New York.

Singh RS. 1998. *Plant Diseases*. 7th Ed. Oxford & IBH, New Delhi.

Singh US, Mukhopadhyay AN, Kumar J & Chaube HS. 1992. *Plant Diseases of Internatiobnal Importance*. Vol. I. *Diseases of Cereals and Pulses*. Prentice Hall, Englewood Cliffs, New Jersey.

AGR657

## DISEASES OF FRUITS, PLANTATION AND ORNAMENTAL CROPS 2+1

### Theory

#### SECTION A

Introduction, symptoms, etiology, epidemiology and management of different diseases of fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus and mango

#### SECTION B

Introduction, symptoms, etiology, epidemiology and management of different diseases of fruits like grapes, guava, *ber*, banana, pineapple, papaya, fig, pomegranate, date palm

#### SECTION C

Introduction, symptoms, etiology, epidemiology and management of different diseases of plantation crops such as tea, coffee, rubber and coconut;

#### SECTION D

Introduction, symptoms, etiology, epidemiology and management of different diseases of ornamental plants such as roses, gladiolus, tulip, carnation, orchids, marigold, chrysanthemum.

**Practical:** Detailed study of symptoms and host parasite relationship of representative diseases of plantation crops. Collection and dry preservation of diseased specimens of important crops.

### Suggested Readings

Gupta VK & Sharma SK. 2000. *Diseases of Fruit Crops*. Kalyani Publ., New Delhi.

Pathak VN. 1980. *Diseases of Fruit Crops*. Oxford & IBH, New Delhi.

Singh RS. 2000. *Diseases of Fruit Crops*. Oxford & IBH, New Delhi.

Walker JC. 2004. *Diseases of Vegetable Crops*. TTPP, India.

AGR658

**DISEASES OF VEGETABLE AND SPICES CROPS** 2+1

**Theory**

**SECTION A**

Nature, prevalence, symptoms, factors affecting disease development and management of bulb crops, leafy vegetables and crucifers

**SECTION B**

Nature, prevalence, symptoms, factors affecting disease development and management of cucurbits and solanaceous vegetables.

**SECTION C**

Nature, prevalence, symptoms, factors affecting disease development and management under protected cultivation.

**SECTION D**

Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger.

**Practical:** Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.

**Suggested Readings**

Chaube HS, Singh US, Mukhopadhyay AN & Kumar J. 1992. *Plant Diseases of International Importance*. Vol. II. *Diseases of Vegetable and Oilseed Crops*. Prentice Hall, Englewood Cliffs, New Jersey.

Gupta VK & Paul YS. 2001. *Diseases of Vegetable Crops*. Kalyani Publ., New Delhi.

Sherf AF & McNab AA. 1986. *Vegetable Diseases and their Control*. Wiley InterScience, Columbia.

Singh RS. 1999. *Diseases of Vegetable Crops*. Oxford & IBH, New Delhi. Gupta SK & Thind TS. 2006. *Disease Problem in Vegetable Production*. Scientific Publ., Jodhpur.

Walker JC. 1952. *Diseases of Vegetable Crops*. McGraw-Hill, New York.

AGR659

**SEED HEALTH TECHNOLOGY** 2+1

**Theory**



## SECTION A

History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.

## SECTION B

Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens.

## SECTION C

Seed certification and tolerance limits, types of losses caused by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection.

## SECTION D

Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.

**Practical:** Conventional and advanced techniques in the detection and identification of seed-borne fungi, bacteria and viruses. Relationship between seed-borne infection and expression of the disease in the field.

### Suggested Readings

Agarwal VK & JB Sinclair. 1993. *Principles of Seed Pathology*. Vols. I & II, CBS Publ., New Delhi.

Hutchins JD & Reeves JE. (Eds.). 1997. *Seed Health Testing: Progress Towards the 21st Century*. CABI, Wallington.

Paul Neergaard. 1988. *Seed Pathology*. MacMillan, London.

Suryanarayana D. 1978. *Seed Pathology*. Vikash Publ., New Delhi.

**AGR660**

**PHYTONEMATOLOGY**

1+1

## SECTION A

History, morphology and anatomy of body wall, digestive, reproductive, excretory and nervous system; body cavity;

## SECTION B

Taxonomic concepts, classification with emphasis on phytonematodes; nematological techniques;

## SECTION C

Nematodes as pests of crops, nematode ecology and disease compels; nematode biology and physiology;

## SECTION D

Different methods of nematode management.

**Practical:** Sampling and extraction techniques for endo and ecto-parasitic nematodes; counting estimation of soil populations; killing; fixing and preserving, preparing mounts; staining nematode in plant tissues; pathogenicity techniques; morphology studies of different body systems, drawing measurement of nematodes; identification of phyto-parasitic nematodes upto genetic level; familiarity with important nematode diseases and their control.

### **Suggested readings**

Barrington EJW. 1967. *Invertebrate Structure and Function*. Nelson, Nairobi.

Blackwelder RE. 1967. *Taxonomy - A Text and Reference Book*. John Wiley & Sons, New York.

Chen ZX, Chen SY & Dickson DW. 2004. *Nematology: Advances and Perspectives. Vol. I. Nematode Morphology, Physiology and Ecology*. CABI, Wallingford.

AGR661                    **CHEMICALS IN PLANT DISEASE MANAGEMENT**    2+1

### **Theory**

#### **SECTION A**

History and development of chemicals; definition of pesticides and related terms; advantages and disadvantages of chemicals. Classification of chemicals used in plant disease control and their characteristics.

#### **SECTION B**

Chemicals in plant disease control, viz., fungicides, bactericides, nematocides, antiviral chemicals and botanicals. Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides.

#### **SECTION C**

Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides.

#### **SECTION D**

General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.

**Practical:** Acquaintance with formulation of different fungicides and plant protection appliances. Formulation of fungicides, bactericides and nematocides; *in vitro* evaluation techniques, preparation of different concentrations of chemicals including botanical pesticides based on active ingredients against pathogens; persistence, compatibility with other agro-chemicals; detection of naturally occurring fungicide resistant mutants of pathogen; methods of application of chemicals.

### **Suggested Readings**

Bindra OS & Singh H. 1977. *Pesticides - An Application Equipment*. Oxford & IBH, New Delhi.

Nene YL & Thapliyal PN. 1993. *Fungicides in Plant Disease Control*. 3<sup>rd</sup> Ed. Oxford & IBH, New Delhi.

Torgeson DC (Ed.). 1969. *Fungicides*. Vol. II. *An Advanced Treatise*. Academic Press, New York.

Vyas SC. 1993. *Handbook of Systemic Fungicides*. Vols. I-III. Tata McGraw Hill, New Delhi.

AGR662

**ECOLOGY OF SOIL-BORNE PLANT PATHOGENS 2+1**

**Theory**

**SECTION A**

Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi.

**SECTION B**

Bio-control agents and their types.

**SECTION C**

Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis.

**SECTION D**

Suppressive soils, biological control- concepts and potentialities for managing soil borne pathogens.

**Practical:** Quantification of rhizosphere and rhizoplanemicroflora with special emphasis on pathogens; pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in natural soils; suppression of test soil-borne pathogens by antagonistic microorganisms. Isolation and identification of different biocontrol agents.

**Suggested Readings**

Baker KF & Snyder WC. 1965. *Ecology of Soil-borne Plant Pathogens*. John Wiley, New York.

Cook RJ & Baker KF. 1983. *The Nature and Practice of Biological Control of Plant Pathogens*. APS, St Paul, Minnesota.

Garret SD. 1970. *Pathogenic Root-infecting Fungi*. Cambridge Univ. Press, Cambridge, New York.

Hillocks RJ & Waller JM. 1997. *Soil-borne Diseases of Tropical Crops*. CABI, Wallington.

Parker CA, Rovira AD, Moore KJ & Wong PTN. (Eds). 1983. *Ecology and Management of Soil-borne Plant Pathogens*. APS, St. Paul, Minnesota.

AGR663

**DISEASE RESISTANCE IN PLANTS 2+0**

**Theory**

**SECTION A**

Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centres as sources of resistance, disease resistance terminology.

### **SECTION B**

Disease escapes, disease tolerance, disease resistance, types of resistance, identification of physiological races of pathogens, disease progression in relation to resistance, stabilizing selection pressure in plant pathogens.

### **SECTION C**

Host defense system, morphological and anatomical resistance, preformed chemicals in host defense, post-infectious chemicals in host defense, phytoalexins, hypersensitivity and its mechanisms.

### **SECTION D**

Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment.

#### **Suggested Readings**

Deverall BJ. 1977. *Defence Mechanisms in Plants*. Cambridge Univ. Press, Cambridge, New York.

Mills Dallice et al. 1996. *Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction*. APS, St Paul, Minnesota.

Parker J. 2008. *Molecular Aspects of Plant Diseases Resistance*. Blackwell Publ.

Robinson RA. 1976. *Plant Pathosystems*. Springer Verlag, New York.

Singh BD. 2005. *Plant Breeding – Principles and Methods*. 7th Ed. Kalyani Publ., Ludhiana

Van der Plank JE. 1975. *Principles of Plant Infection*. Academic Press, New York.

Van der Plank JE. 1984. *Disease Resistance in Plants*. Academic Press, New York.

## **AGR664 INSECT VECTORS OF PLANT VIRUSES AND OTHER PATHOGENS**

**1+1**

### **Theory**

#### **SECTION A**

History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

#### **SECTION B**

Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors. Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.

#### **SECTION C**

Transmission of mycoplasma and bacteria by leafhoppers and planthoppers. Transmission of plant viruses by psyllids, beetles and mites.

## SECTION D

Epidemiology and management of insect transmitted diseases through vector management.

**Practical:** Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; culturing and handling of vectors; demonstration of virus transmission through vectors- aphids, leafhoppers and whiteflies.

### Suggested Readings

Basu AN. 1995. *Bemisia tabaci* (Gennadius) - *Crop Pest and Principal Whitefly Vector of Plant Viruses*. Oxford & IBH, New Delhi.

Harris KF & Maramorosh K. (Eds.).1980. *Vectors of Plant Pathogens*. Academic Press, London.

Maramorosch K & Harris KF. (Eds.). 1979. *Leafhopper Vectors and Plant Disease Agents*. Academic Press, London.

Youdeovei A & Service MW. 1983. *Pest and Vector Management in the Tropics*. English Language Books Series, Longman, London.

**AGR665**

**BIOLOGICAL CONTROL OF PLANT DISEASES**

**2+1**

### Theory

#### SECTION A

Concept of biological control, definitions, importance, principles of plant disease management with bio-agents, history of biological control, merits and demerits of biological control.

#### SECTION B

Types of biological interactions, competition, mycoparasitism, exploitation for hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis, induced resistance, mycorrhizal associations, operational mechanisms and its relevance in biological control.

#### SECTION C

Factors governing biological control, role of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens, pathogens and antagonists and their relationship, biocontrol agents, comparative approaches to biological control of plant pathogens by resident and introduced antagonists, control of soil-borne and foliar diseases. Compatibility of different bioagents.

#### SECTION D

Commercial production of antagonists-mass multiplication and preparation of formulation, their delivery systems, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market. Quality control system of biocontrol agents.

**Practical:** Isolation, characterization and maintenance of antagonists, methods of study of mechanisms of antagonism *in vitro*, application of antagonists against pathogen *in vivo* conditions. Enumeration of antagonists.

### Suggested Readings

Campbell R. 1989. *Biological Control of Microbial Plant Pathogens*. Cambridge Univ. Press, Cambridge.

Cook RJ & Baker KF. 1983. *Nature and Practice of Biological Control of Plant Pathogens*. APS, St. Paul, Minnesota.  
Gnanamanickam SS (Eds). 2002. *Biological Control of Crop Diseases*. CRC Press, Florida.

Heikki MT & Hokkanen James M (Eds.). 1996. *Biological Control - Benefits and Risks*. Cambridge Univ. Press, Cambridge.

Mukerji KG, Tewari JP, Arora DK & Saxena G. 1992. *Recent Developments in Biocontrol of Plant Diseases*. Aditya Books, New Delhi.

**AGR666**                                    **INTEGRATED DISEASE MANAGEMENT**                                    **2+1**

**Theory**

**SECTION A**

Introduction, definition, concept and tools of disease management

**SECTION B**

Components of integrated disease management- their limitations and implications.

**SECTION C**

Development of IDM- basic principles, biological, chemical and cultural disease management.

**SECTION D**

IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard, pearl millet, *kharif* pulses, vegetable crops and fruit crops.

**Practical:** Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM; demonstration of IDM in certain crops as project work.

**Suggested Readings**

Gupta VK & Sharma RC. (Eds). 1995. *Integrated Disease Management and Plant Health*. Scientific Publ., Jodhpur.

Mayee CD, Manoharachary C, Tilak KVBR, Mukadam DS & Deshpande Jayashree (Eds.). 2004. *Biotechnological Approaches for the Integrated Management of Crop Diseases*. Daya Publ. House, New Delhi.

Sharma RC & Sharma JN. (Eds). 1995. *Integrated Plant Disease Management*. Scientific Publ., Jodhpur.

**AGR667**                                    **MUSHROOM PRODUCTION TECHNOLOGY**                                    **2+1**

**Theory**

**SECTION A**

Historical development of mushroom cultivation and present status, taxonomy, classification, uses of mushrooms, edible and poisonous mushrooms. Maintenance of pure culture, preparation of spawn and facilities required for establishing commercial spawn laboratory and strain improvement.

## SECTION B

Preparation of substrate for mushroom cultivation, long, short and indoor composting methods, formulae for different composts and their computation, qualities and testing of compost, uses of spent mushroom compost/substrate, spawning and spawn run, casing preparation and its application.

## SECTION C

Setting up mushroom farm for seasonal and environmentally control cultivation, requirement and maintenance of temperature, relative humidity, CO<sub>2</sub>, ventilation in cropping rooms, cultivation technology of *Agaricusbisporus*, *Pleurotus* sp., *Calocybeindica*, *Lentinusedodes* and *Ganodermalucidum*.

## SECTION D

Insect pests, diseases and abnormalities of cultivated mushroom and their management, post harvest processing and value addition, economics of mushroom cultivation, biotechnology and mushroom cultivation.

**Practical:** Preparation of spawn, compost, spawning, casing, harvesting and postharvest handling of edible mushroom; identification of various pathogens, competitors of various mushrooms.

### Suggested Readings

Chadha KL & Sharma SR. 2001. *Advances in Horticulture (Mushroom)*. Vol. XIII. Malhotra Publ. House, New Delhi.

Chang ST & Hays WA. 1997. *The Biology and Cultivation of Edible Mushrooms*. Academic Press, New York.

Chang ST & Miles PG. 2002. *Edible Mushrooms and their Cultivation*. CRC Press, Florida.

Kapur JN. 1989. *Mushroom Cultivation*. DIPA, ICAR, New Delhi.

Dhar BL. 2005. *Cultivation Technology of High Temperature Tolerant White Button Mushroom*. DIPA, ICAR, New Delhi.

## AGR668      EPIDEMIOLOGY AND FORECASTING OF PLANT DISEASES      2+1

### Theory

#### SECTION A

Epidemic concept and historical development, pathometry and crop growth stages, epidemic growth and analysis.

#### SECTION B

Common and natural logarithms, function fitting area under disease progress curve and correction factors, inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens.

#### SECTION C

Survey, surveillance and vigilance, crop loss assessment and models for prediction of crop losses.

## SECTION D

Principles and pre-requisites of forecasting, systems and factors affecting various components of forecastings, some early forecasting, and procedures based on weather and inoculum potential, modeling disease growth and disease prediction.

**Practical:** Measuring diseases, spore dispersal and trapping, weather recording, survey, multiplication of inoculum, computerized data analysis, function fitting, model preparation and validation.

### Suggested Readings

Campbell CL & Madden LV. 1990. *Introduction to Plant Disease Epidemiology*. John Wiley & Sons. New York

Cowling EB & Horsefall JG. 1978. *Plant Disease*. Vol. II. Academic Press, New York.

Nagarajan S & Murlidharan K. 1995. *Dynamics of Plant Diseases*. Allied Publ., New Delhi.

Thresh JM. 2006. *Plant Virus Epidemiology*. Advances in Virus Research 67, Academic Press, New York.

Van der Plank JE. 1963. *Plant Diseases Epidemics and Control*. Academic Press, New York.

Zadoks JC & Schein RD. 1979. *Epidemiology and Plant Disease Management*. Oxford Univ. Press, London.

**AGR669**

**POST HARVEST DISEASES**

**2+1**

### Theory

## SECTION A

Concept of post harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as preharvest and post-harvest, merits and demerits of biological/phytoextracts in controlling post-harvest diseases.

## SECTION B

Types of post harvest problems both by biotic and abiotic causes, rhizosphere colonization, competitive, saprophytic ability, antibiosis, induced resistance, microbial associations, concept, operational mechanisms and its relevance in control.

## SECTION C

Factors governing post harvest problems both as biotic and abiotic, role of physical environment, agro-ecosystem leading to quiescent infection, operational mechanisms and cultural practices in perpetuation of pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post-harvest diseases, comparative approaches to control plant pathogens by resident and introduced antagonists. Isolation, characterization and maintenance of pathogens, role of different storage.

## SECTION D



Integrated approach in controlling diseases and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentarius for each product and commodity.

**Practical:** Isolation, characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions. Comparative efficacy of different chemicals, fungicides, phytoextracts and bioagents.

**Suggested Readings**

Pathak VN. 1970. *Diseases of Fruit Crops and their Control*. IBH Publ., New Delhi.

Chaddha KL & Pareek OP. 1992. *Advances in Horticulture* Vol. IV, Malhotra Publ. House, New Delhi.

**AGR670**

**PLANT QUARANTINE**

**2+0**

**Theory**

**SECTION A**

Definition of pest, pesticides and transgenics as per Govt. notification; relative importance; quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status.

**SECTION B**

Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control agents.

**SECTION C**

Identification of pest/disease free areas; contamination of food with Toxigens and microorganisms, and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations; VHT and other safer techniques of disinfection/salvaging of infected material.

**SECTION D**

WTO regulations; non-tariff barriers; Pest Risk Analysis (PRA), good practices for pesticide laboratories; pesticide industry; Sanitary and Phytosanitary measures.

**Suggested Readings**

Rajeev K & Mukherjee RC. 1996. *Role of Plant Quarantine in IPM*. Aditya Books.

Rhower GG. 1991. *Regulatory Plant Pest Management*. In: *Handbook of Pest Management in Agriculture*. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.

**AGR 501**

**Library and Information Services**

**0+1**

**SECTION A**

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library;

### **SECTION B**

Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);

### **SECTION C**

Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services;

### **SECTION D**

Use of Internet including search engines and its resources; e-resources access methods.

**EVS 658**

**Disaster Management**

**1+0**

### **SECTION A**

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

### **SECTION B**

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

### **SECTION C**

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs,

### **SECTION D**

Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

### **Suggested Readings:**

Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan. Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge.  
Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

**AGR700**

**MASTER'S SEMINAR**

**1+0**

**AGR500**

**MASTER'S RESEARCH**

**0+20**