

द्वितीय पत्र : प्लान्ट प्रोटेक्सन सम्बन्धी विषय

Section A- 30 Marks

- 1. Plant Protection: 10%**
- 1.1 Introduction:**
- 1.1.1 Importance of Pests to human
 - 1.1.2 Climate change and implication on pests
 - 1.1.3 Plant Protection for disaster hit areas
 - 1.1.4 Plant Protection principle and approaches
- 1.2 Survey and surveillance**
- 1.2.1 Importance of pest survey and surveillance, their institutionalization for forecasting the pest problem and their management in Nepalese Agriculture
- 1.3 Rules, Regulation, Standards and Guidelines**
- 1.3.1 Plant Protection Act, 2029 and Rules, 2031
 - 1.3.2 Pesticide Act, 2048 and Rules, 2050
 - 1.3.3 International Plant Protection Convention (IPPC), Sanitary and Phytosanitary Measures (SPC) and Asia Pacific Plant Protection Commission (APPPC), International Code Of Conduct on the Distribution and Uses of Pesticide
 - 1.3.4 Economic & Social Challenge for Organic Pest Management in Agriculture
 - 1.3.5 Organic Seed Treatment
- 4 Toxicology, Plant Quarantine & and Post harvest 20%**
- 4.1 Toxicology of Pesticide**
- 4.1.1 Type of Pesticide formulation
 - 4.1.2 WHO classification of pesticide by hazard
 - 4.1.3 Lethal Dose₅₀ (LD₅₀) of a pesticide
 - 4.1.4 Pesticide residues in implication: Maximum Residue Limit (MRL), Average Daily Intake (ADI) and Withholding Periods (WP)
 - 4.1.5 Metabolism of Insecticides and Herbicides and types of metabolic reaction and Pesticide Management
 - 4.1.6 Safe use of pesticides
 - 4.1.7 Status of Pesticide use in Nepal
 - 4.1.8 Symptoms and treatment of pesticide poisoning
- 4.2 Integrated Pest Management (IPM)**
- 4.2.1 Concepts, tactics and strategy. Components of IPM
 - 4.2.2 Conventional and bio intensive IPM
 - 4.2.3 Sustainable agriculture and IPM in Nepal
 - 4.2.4 Typical example of IPM to control insect-pests of rice and vegetables
- 4.3 Biological Control of Insect-pests and Diseases**
- 4.3.1 Classical biological control of insect-pests
 - 4.3.2 Important agents of biological control
 - A) Insect origin
 - B) Microbial origin
 - 4.3.1 Techniques in biological control
- 4.4 Plant Quarantine**
- 4.4.1 Importance, issues, challenges and role of plant quarantine in Nepalese agriculture system in agro-forestry trade facilitation in Nepal
 - 4.4.2 Harmonization of Plant Quarantine measures as per International Plant Protection Convention

- 4.5 Post Harvest
4.5.1 Prevention of post harvest food loss in perishable and durable and durable commodities
4.5.2 Economic Importance of rodent causing losses in agricultural commodities
4.5.3 Principles of Storage Management

Section B- 20 Marks

2 Entomology: 20%

2.1 Introduction:

- 2.1.1 Importance of Agricultural Entomology
2.1.2 Role of insects in Agriculture
2.1.3 Classification of insect

2.2 Agricultural Insect Pests of National Importance and Their Management

- 2.2.1 Cereals:
2.2.1.1 Stem borers (*Chilo partellus*; *Chilo suppressalis*; *Sesamia inferens*; *Scirpophaga incertulas*)
2.2.1.2 Green leafhopper (*Nephotettix nigropictus*)
2.2.1.3 Brown planthopper (*Nilaparvata lugen*)
2.2.1.4 Gandhi bug (*Leptocorisa chinensis*)
2.2.1.5 White grubs (*Melolontha sp.*; *Phyllophaga sp.*; *Holotrichia sp.*)
2.2.1.6 Grasshoppers (*Hieroglyphus banian*, *H. nigrorepletus*)
2.2.2 Vegetables:
2.2.2.1 Cutworm (*Agrotis ipsilon*; *A. segetum*)
2.2.2.2 Pumpkin fruitfly (*Bactrocera cucurbitae*)
2.2.2.3 Aphids (*Myzus persicae*; *Aphis fabae*; *A. gossypii*; *A. craccivora*; *Brevicoryne brassicae*)
2.2.2.4 Red ants (*Dorylus orientalis*)
2.2.2.5 Pod borer (*Lampides boeticus*)
2.2.2.6 Shoot and fruit borer (*Leucinodes orbonalis*)
2.2.2.7 Large white butterfly (*Pieris brassicae nepalensis*)
2.2.2.8 Fruit borer (*Helicoverpa armifera*)
2.2.2.9 Tobacco Caterpillar (*Spodoptera litura*)
2.2.2.10 Potato Tuber Moth (*Phthorimaea operculella*)
2.2.2.11 Root-knot Nematodes (*Meloidogyne spp.*)
2.2.2.12 Diamondback Moth (*Plutella xylostella*)
2.2.2.13 White Fly (*Bemisia tabaci*)
2.2.3 Oil Seed Crops:
2.2.3.1 Cabbage Butterflies (*Pieris brassicae*, *P. nepalensis*)
2.2.3.2 Sesamum Gall Midge (*Asphondylia sesami*)
2.2.3.3 groundnut Leaf-miner (*Stomopteryx subsecivella*)
2.2.3.4 Mustard Aphid (*Lipaphis erysimi*)
2.2.4 Cash Crops:
2.2.4.1 Sugarcane White Fly (*Aleuro lobus barodensis*)
2.2.4.2 Early Shoot Borer (*Chilo infuscatellus*)
2.2.4.3 Spotted Bollworms (*Earias vittella*, *E. insulana*)
2.2.4.4 Pink Bollworms (*Pectinophora gossypiella*)
2.2.5 Fruits
Sub- tropical

- 2.2.5.1 Oriental fruitfly (*Bactrocera dorsalis*)
- 2.2.5.2 Leafhopper (*Amritodus atkinsoni*)
- 2.2.5.3 Gall midge (*Apsylla cistellata*)
- 2.2.5.4 Citrus psylla (*Diaphorina citri*)
- 2.2.5.5 Green stink bug (*Rhynchocoris humeralis*)
- 2.2.5.6 Citrus red scale (*Aonidiella aurantii*)
- 2.2.5.7 Banana weevil (*Cosmopolites sordidus*; *Odoiporus longicolis*)
- 2.2.5.8 Pomegranate butterfly (*Deudoryx epijarbas*; *Virachola isocrates*)
- 2.2.6 Tropical
 - 2.2.6.1 Apple wooly aphid (*Eriosoma lanigerum*)
 - 2.2.6.2 San Jose scale (*Quadraspidiotus perniciosus*)

Section C- 20 Marks

3. Pathology:

20%

- 3.1 Introduction
 - 3.1.1 Importance of Plant Diseases
 - 3.1.2 History of Plant Pathology in agriculture in Nepal
- 3.2 Agricultural Crop Diseases of National Importance and Their Management
 - 3.2.1 Cereals (Rice, Wheat, Maize)
 - 3.2.1.1 Rice Blast (*Pyricularia oryzae*)
 - 3.2.1.2 Bacterial blight (*Xanthomonas campestris pv oryzae*)
 - 3.2.1.3 Brown Spot (*Helminthosporium oryzae*)
 - 3.2.1.4 Sheath Blight (*Rhizoctonia solani*)
 - 3.2.1.5 Stalk Rot (*Erwinia carotovora*)
 - 3.2.1.6 Leaf Blights (*Helminthosporium turcicum*)
 - 3.2.1.7 Loose smut (*Ustilago tritici*)
 - 3.2.1.8 Rusts (*Puccinia graminis tritici*, *P. recondita*, *P. striiformis*)
 - 3.2.1.9 Powdery Mildew (*Erysiphe graminis tritici*)
 - 3.2.1.10 Bunt or Stinking Smut (*Tilletia caries*, *Tilletia foetida*)
 - 3.2.1.11 Leaf blight of wheat (*Bipolaris brizae*)
 - 3.3 Vegetables (*Potato, Tomato, Cruciferae*)
 - 3.3.1 Late Blight (*Phytophthora infestans*)
 - 3.3.2 Wart (*Synchytrium endobioticum*)
 - 3.3.3 Bacterial Wilt (*Pseudomonas solanacearum*, *Ralstonia solanacearum*)
 - 3.3.4 Alternaria Leaf spots (*Alternaria brassicicola*, *A. brassicae*)
 - 3.3.5 Damping off of seedlings (*Phuthium spp.*, *Fusarium spp.*)
 - 3.3.6 Club root (*Plasmodiophora brassicae*)
 - 3.3.7 Root knot (*Meloidogyne spp.*)
 - 3.3.8 Anthracnose (*Colletotrichum spp.*)
 - 3.4 Others
 - 3.4.1 Peanut:
 - 3.4.1.1 Tikka disease (*Cercospora arachidicola*)
 - 3.4.1.2 Cottony rot (*Sclerotinia sclerotiorum*)
 - 3.4.2 Mustard:
 - 3.4.2.1 Blight (*Alternaria brassicae* & *A. brassicicola*)
 - 3.4.2.2 White blight (*Sclerotinia sclerotiorum*)
 - 3.4.3 Lentil:
 - 3.4.3.1 Wilt (*Fusarium oxysporum f. sp. lentis*)

लोक सेवा आयोग
नेपाल कृषि सेवा, प्लान्ट प्रोटेक्सन समूह, राजपत्राङ्कित तृतीय श्रेणीका पदहरूको खुला र आन्तरिक प्रतियोगितात्मक
लिखित परीक्षाको पाठ्यक्रम

- 3.4.3.2 Root rot (*Fusarium solani*)
- 3.4.3.3 Collar rot (*Sclerotium rolfsii*)
- 3.4.4 Soybean:
 - 3.4.4.1 Rust (*Phakopsora pachyrhizi*)
 - 3.4.4.2 Anthracnose (*Colletotrichum glycines*)
 - 3.4.4.3 Bacterial pustule (*Pseudomonas syrofsii*)
- 3.4.5 Sugarcane:
 - 3.4.5.1 Red rot (*Colletotrichum falcatum*)
 - 3.4.5.2 Whip smut (*Ustilago scitaminea*)
- 3.4.6 Tobacco:
 - 3.4.6.1 Tobacco mosaic virus (TMV)
 - 3.4.6.2 Leaf spot (*Cercospora nicotianae*)
- 3.5 Fruits (Citrus, Mango, Apple, Pear)
 - 3.5.1 Powdery Mildew (*Acrosporium spp.*)
 - 3.5.2 Foot and Root Rot (*Phytophthora citrophthora, P. nicotianae*)
 - 3.5.3 Citrus Tristeza virus (CTV Mild Virulent Strain)
 - 3.5.4 Gummosis (*Phytophthora parasitica*)
 - 3.5.5 Citrus greening (*Huanglungbin*) – (*Liberibacter asiaticum*)
 - 3.5.6 Anthracnose (*Colletotrichum gloesporioides*)
 - 3.5.7 Malformation (*Gibberella fujikuroi and Fusarium monoliformae*)
 - 3.5.8 Powdery Mildew (*Oidium mangiferae*)
 - 3.5.9 Pink disease (*Pellicularia samoniclor*)
 - 3.5.10 Scab (*Venturia inaequalis*)
 - 3.5.11 Collar Rot (*Phytophthora cactorum*)
 - 3.5.12 Crown gall (*Agrobacterium tumefaciens*)
- 3.6 Mechanism of Infection by Plant Pathogen
- 3.7 Defense Mechanisms of Host Plants
- 3.8 Effects of Plant Pathogens on Host and Host Physiology
 - 3.8.1 Structure, growth and reproduction of the host
 - 3.8.2 Host photosynthesis
 - 3.8.3 Host respiration and
 - 3.8.4 Translocation of water and nutrients in the host plant
- 3.9 Effects of Environment on Plant Disease Development
- 3.10 Genetics and Disease Resistance in Plants
 - 3.10.1 Host-pathogen interfaces
 - 3.10.2 Gene for gene concepts
 - 3.10.3 Nature of resistance, genetics of host resistance, tolerance
- 3.11 Plant Disease Epidemiology and forecasting
 - 3.11.1 Measurement of disease and loss assessment
 - 3.11.2 Plant disease epidemics
 - 3.11.2.1 Pattern and types of epidemics
 - 3.11.2.2 factors affecting development of epidemics
 - 3.11.2.3 forecasting of epidemics based on weather and inoculum
- 3.12 Seed Pathology
 - 3.12.1 Seed-borne diseases and their significance
 - 3.12.2 Seed health-testing techniques
- 3.13 Non-infectious Disease
 - 3.13.1 General characteristics of plant pathogens and non-infectious disease (Morphology, reproduction, nutrition)

- 3.13.2 Classification, taxonomy and nomenclature of fungus, bacteria, and bacteria like organisms, mycoplasma and viruses sand virus like organism and Phyto-nematodes
- 3.14 Storage Fungi and Toxins

Section D- 30 Marks

- 5. Insects and fungi of Industrial use** **20%**
- 5.1 Sericulture
- 5.1.1 Prospect of sericulture and silk industry in Nepal
- 5.1.2 Mulberry cultivation practices & Management in Nepal
- 5.1.3 Silkworm rearing techniques, diseases and their management
- 5.1.4 Plan and Project development in Sericulture in Nepal
- 5.2 Bee-keeping
- 5.2.1 Scope of commercial apiculture in Nepal
- 5.2.1 Biology and reproduction of honeybees in Nepal
- 5.2.3 Bees, crop pollination and bee-forage
- 5.2.4 Seasonal management of honey bee's colonies
- 5.2.5 Honey Extraction and Quality standard Maintenance in Nepal
- 5.3 Mushroom
- 5.3.1 Importance and cultivation technique of mushroom
- 5.3.2 Food Value and scope of Mushroom cultivation in Nepal
- 5.4 Lac culture
- 5.4.1 Lac insect, its importance and scope
- 6. Miscellaneous** **10%**
- 6.1 Weed Science
- 6.1.1 Biology of weeds and weed seeds
- 6.1.2 Importance of weeds in agricultural crops and their management
- 6.1.3 Herbicides and the plant
- 6.2 Statistics in Plant Protection
- 6.2.1 General knowledge of statistical tests including Dhi-square, sampling, designs of experiment layout in field and in laboratory, data transformation, mean separation and analysis
- 6.3 Plant Protection Equipments:
- 6.3.1 Types of Sprayers and Duster and seed treatment Equipments
- 6.3.2 Care and maintenance
- 6.3.3 Use of equipment, calibration, dose calculation
- 6.4 Laboratory Technique:
- 6.4.1 Isolation
- 6.4.2 Culture & preservation
- 6.4.3 Mounting
- 6.4.4 Sterilization
- 6.4.5 Different media used

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लिखित परीक्षाको पाठ्यक्रम

द्वितीय पत्रको एकाईहरूको प्रश्नसंख्या निम्नानुसार हुनेछ

द्वितीय पत्रका खण्ड	A		B	C	D	
द्वितीय पत्रका एकाई	1	4	2	3	5	6
प्रश्न संख्या	1	2	2	2	2	1

विषयगत नमूना प्रश्नहरू (Sample questions)

1. Among the insect pest reported in Nepal, list 120 most serious ones (in descending order) and give enough reason for doing so
2. Evaluate the current plant protection (research and extension) activities in Nepal and comment on their strengths and weakness
3. Brown plant hopper has appeared as a threat to rice crop in Nepal. What activates have been taken up by different organizations to prevent this pest? Are the activities enough? Give your comments
4. Review the current status of pesticide use in Nepal