

## 1. Policy and Strategy

- 1.1 Government Policy on Pesticide Management.
- 1.2 Government Policy and Strategy on Post Harvest Programs.
- 1.3 Government Policy on Sericulture and Apiculture.

## 2. Management

- 2.1 Strategic Planning and Use of Logical frame work (Log frame)
- 2.2. Monitoring and Evaluation- Indicators for plant protection M & E

## 3. Act, Standards and Guidelines

- 3.1 Pesticide Act, 2048
- 3.2 International Code of Conduct on the Distribution and Uses of Pesticides.
- 3.3 Rotterdam Convention on Prior Informed Consent (PIC) and Stockholm Convention on Persistent Organic Pollutants (POPs)
- 3.4 International Standards for Phytosanitary Measures (ISPMs)

## 4. Entomology

- 4.1 Introduction
- 4.2 The insect and the host plant
- 4.3 Insects and chemical environment of plants.
- 4.4 Insects and resistant and resistant host plants

## 5. Insect ecology

### Ecological roles of insect pests

- 5.1 Insect population
- 5.2 Ecosystems and agroecosystems
- 5.3 Ecological roles of insect outbreaks

## 6. National Insect Pests of Agriculture and Their Management

### 6.1 Cereals

- 6.1.1 Stem borers (*Chilo partellus*; *Chilo suppressalis*; *Sesamia inferens*; *Scirpophaga incertulas*)
- 6.1.2 Green leafhopper (*Nephotettix nigropictus*)
- 6.1.3 Brown planthopper (*Nilaparvata lugens*)
- 6.1.4 Gandhi bug (*Leptocorisa chinensis*)
- 6.1.5 White grubs (*Melolontha* sp.; *Phyllophaga* sp.; *Holotrichia* sp.)
- 6.1.6 Hispa (*Dicladispa armigera*)

### 6.2 Vegetables

- 6.2.1 Cutworm (*Agrotis ipsilon*; *A. segetum*)
- 6.2.2 Pumpkin fruitfly (*Bactrocera cucurbitae*), *B. scuteralis*, *B. tau*, *B. zonatus*,; *B. yoshimotoi* )
- 6.2.3 Aphids (*Myzus persicae*; *Aphis fabae*; *A. gossypii*; *A. craccivora*; *Brevicoryne brassicae*)
- 6.2.4 Red ants (*Dorylus orientalis*)
- 6.2.5 Pod borer (*Lampides boeticus*)
- 6.2.6 Shoot and fruit borer (*Leucinodes orbonalis*)
- 6.2.7 Large white butterfly (*Pieris brassicae nepalensis*)
- 6.2.8 Tomato fruit worm (*Helicoverpa armigera*)
- 6.2.9 Okra jassid (*Empoasca devastans*)

### 6.3 Fruits

#### Sub- tropical fruits

- 6.3.1 Oriental fruitfly (*Bactrocera dorsalis*)
- 6.3.2 Leafhopper (*Amritodus atkinsoni*)
- 6.3.3 Gall midge (*Apsylla cistellata*)
- 6.3.4 Citrus psylla (*Diaphorina citri*)
- 6.3.5 Green stink bug (*Rhabdocoris humeralis*)
- 6.3.6 Citrus red scale (*Aonidiella aurantii*)
- 6.3.7 Banana weevil (*Cosmopolites sordidus*; *Odoiporus longicolis*)
- 6.3.8 Pomegranate butterfly (*Deudoryx epijarbas*; *Virachola isocrates*)

#### Temperate fruits

- 6.3.9 Apple wooly aphid (*Eriosoma lanigerum*)
- 6.3.10 San Jose scale (*Quadraspidiotus perniciosus*)

### 6.4 Commercial Crops

- 6.4.1 Red spider mite (*Oligonychus coffeae*)
- 6.4.2 Tea mosquito (*Helopeltis thelvora*),
- 6.4.3 Jute hairy caterpillar (*Diacrisia oblique*)

## 7 Pathology

### 7.1 Importance of Plant Diseases

### 7.2 Causes of plant diseases

- 7.2.1. Biotic- Fungi, Bacteria and Bacteria like organisms, Nematodes, Viruses and Virus like agents.
- 7.2.2. Taxonomy, classification and nomenclature of above pathogens
- 7.2.3. A biotic- Deficiency and environment related diseases
- 7.2.4. General characteristics of infectious and non-infectious diseases

### 7.3 History of Plant Pathology in Nepal.

## 8. Plant Diseases of National Importance and Their Management

### 8.1 Cereals (Rice, wheat, maize, finger millet)

8.1.1 Rice: Blast (*Pyricularia grisea*), Bacterial leaf blight (*Xanthomonas campestris* p.v. *oryzae*), Sheath blight (*Rhizoctonia solani*), Foot rot (*Fusarium moniliforme*), Brown spot (*Helminthosporium oryzae*). False smut (*Ustilaginoides virens*)

8.1.2 Wheat: Rusts ( *Puccinia graminis tritici*, *P. recondite* and *P. striiformis*), Loose smut (*Ustilago tritici*), Foliar blight (*Bipolaris sorokiniana* and *Drechslera tritici-repentis*), Powdery mildew (*Erysiphe graminis tritici*), Bunt (*Tilletia caries* and *T. foetida*)

8.1.3 Maize: Stalk rot (*Erwinia carotovora*), Northern Leaf blights (*Exserohilum turcicum*), Southern leaf blight (*Bipolaris maydis*), Banded leaf and sheath blight (*Rhizoctonia solani*), Ear rot (*Fusarium vertilloides*.)

8.1.4 Finger millet: Blast (*Pyricularia grisea*) and Cercospora leaf spot (*Cercospora eleusine*).

### 8.2 Vegetables (Potato, tomato, cruciferae, cucurbitaceae)

8.2.1 Potato: Blights ( *Pytophthora infestans* and *Alternaria* spp.), Bacterial wilt (*Ralstonia solanacearum*), Rhizoctonia rot (*Rhizoctonia solani*), Wart (*Synchytrium endobioticum*), Viral diseases

8.2.2 Tomato: Wilts ( *Ralstonia solanacearum*), Blight( *Phytophthora infestans* and *Alternaria* spp.), Root knots (*Meloidogyne* spp.), Damping-off (*Pythium* spp., *Fusarium* spp. and others).

- 8.2.3 Cruciferae: Clubroot (*Plasmodiophora brassicae*), Alternaria leaf spot (*Alternaria brassicola* and *A. brassicae*), Camping-off (*Pythium* spp. and others), Stalk rot (*Sclerotinia sclerotiorum*), white rust (*Albugo* spp.)
- 8.2.4. Cucurbitaceae: Powdery mildew (*Erysiphe* spp.), Downey mildew (*Peronospora cubensis*), Viral diseases.
- 8.3 Fruits/Plantation crops (Citrus, mango, apple, pear, banana, papaya, tea)
  - 8.3.1 Citrus: Gummosis, Foot and root rots (*Phytophthora* spp.), Greening /Huanglungbin (*Liberibacter asiaticum*), Powdery mildew (*Oidium* spp.), Tristeza (*Virus*), Pink disease (*Pellicularia salmonicolor*), Anthracnose (*Colletotrichum gloesporioides*), Scab (*Elsinoe fawcetti*), Citrus decline (disease complex)
  - 8.3.2 Apple and temperate fruits: Scab (*Venturia inaequalis*), Pink (*Pellicularia salmonicolor*) and root rot (complex), Powdery mildew (*Oidium* spp.)
  - 8.3.3 Mango: Black tip (S-pollution), Mango malformation, Anthracnose (*Colletotrichum gloesporioides*)
  - 8.3.4 Banana: Wilt (*Fusarium* spp.), Sigatoka or leaf spot (*Mycosphaerella*), Bunchy top (viral)
  - 8.3.5 Papaya: Ring spot (*Virus*), Leaf curl (*Virus*), Collar and root rot (complex).
  - 8.3.6 Tea: Blister blight (*Exobasidium vexans*), Black rot (*Corticium* spp.)
- 8.4. Commercial crops:
  - 8.4.1 Rhizome rots of ginger (complex),
  - 8.4.2 Red rot of sugarcane (*Colletotrichum gloesporioides*)
  - 8.4.3 Charcoal rot of Jute (*Macrophomina* spp.)
  - 8.4.4 Mustard: white rot (*Sclerotinia sclerotiorum*), Alternaria leaf spot (*Alternaria* spp), Witch weed (*Striga* spp.)
  - 8.4.5 Lentil: Grey mould (*Botrytis cinerea.*), Leaf blight (*Stemphyllium sarciniformae.*) and wilt complex (*Fusarium, Rhizoctonia* and others)

## 9. Mechanism of Infection by Plant Pathogen and Stages in the development of diseases

- 9.1 Penetration
- 9.2 Infection
- 9.3 Incubation
- 9.4 Reproduction
- 9.5 Dissemination
- 9.6 Off-season survival of pathogens

## 10. Defense Mechanisms of Host Plants

- 10.1 Structural defense
- 10.2 Biochemical defense

## 11. Effects of Plant Pathogens on Host and Host Physiology

- 11.1 Structure, growth and reproduction of the host.
- 11.2 Host photosynthesis
- 11.3 Host respiration and
- 11.4 Translocation of water and nutrients in the host plant.
- 11.5. Effect on transpiration

## 12. Effects of Environment on Plant Disease Development

- 12.1 Effect of Temperature
- 12.2 Effect of Moisture or humidity
- 12.3 Effect of light
- 12.4 Effects of pH (Soil or substrate/host)

12.5 Effect of host plant nutrition

### **13. Genetics and Disease Resistance in Plants**

13.1 Host-pathogen interfaces

13.2 Gene for gene concepts

13.3 Types of resistance: Horizontal, Vertical, Field, Tolerance, genetics of host resistance, tolerance. Nature of resistance, genetics of host resistance,

### **14. Plant Disease Epidemiology and Forecasting**

14.1 Measurement of disease and loss assessment

14.2 Plant disease epidemics

14.2.1 Pattern and types of epidemics.

14.2.2 Factors affecting development of epidemics

14.3 Forecasting of epidemics based on weather and inoculums

### **15. Plant diseases of special environment**

15.1 Seed-borne diseases, their significance and their management

15.2 Seed health-testing techniques

15.3 Soil-borne diseases and their management

### **16. Biotechnology in Plant Pathogens**

16.1 Wide hybridization for incorporation of alien genes

16.2 Expansion of gene pools through somatic hybridization

16.3 Incorporation of novel genes through genetic engineering

16.4 Isozymes and RFLP markers for tagging resistant genes

16.5 Nuclie acid probes as diagnostic tools for pathogens

16.6 GMO Issues.

### **17. Toxicology**

17.1 Pesticide Hazard and Risk

17.2 Pesticide Classification on the basis of LD<sub>50</sub>

17.3 MRL & ADI

17.4 Selectivity and Resistance

17.5 Pesticide residue in plant products

17.6 Metabolism of insecticides and fungicides

17.7 Developing pesticide resistance insects and their management

17.8 Execution of Pesticide Act and Regulation in the country

### **18. Integrated Pest Management (IPM):**

18.1 Importance of Agro-ecosystem

18.2 Crop damage and Economic Injury level

18.3 Progress of Economic Threshold Level (ETL) in Nepal

18.4 Concept of Pest Management

18.5 Importance of Agro-ecosystem and Economic Injury level

18.6 History and Progress in IPM in Nepal

18.7 Farmer Field School

18.8 Economic-injury level (EIL)

18.9 Economic Threshold (ET)

18.10 Calculation of Economic Decision Levels

### **19. Alternatives to Conventional Pesticides for Insect Pest Management**

19.1 Biological Control

19.2 Bioactive plant parts and herbs

- 19.3 Microbial pesticides
- 19.4 Bioactive inert materials
- 19.5 Genetically Modified Organism

**20. Survey & surveillance of crop insects and diseases**

- 20.1 Importance.
- 20.2 Documentation

**21. Concept and importance of organic farming**

- 21.1 Bio-rational and Bio-intensive Approaches
- 21.2 Bio-technological Approaches
- 21.3 Bio-pesticides
- 21.4 Graft technology with resistant materials
- 21.5 Ecosystem Management and Biodiversity.

**22. Plant Quarantine**

- 22.1 Importance and role of Plant Quarantine in Nepalese Agriculture system in the context of WTO/SPS.
- 22.2 Prohibitions and restrictions regarding the import of plants or plant products into Nepal.

**23. Post Harvest**

- 23.1 Post harvest technology for market oriented vegetable and fruit crops.
- 23.2 Alternatives of Pesticides in Storage.

**24. Insects and Fungi of Industrial Use**

- 24.1 Sericulture:
  - 24.1.1 Potential of sericulture development in Nepal.
  - 24.1.2 Role of private sector and NGOs in sericulture development.
  - 24.1.3 Problems and constraints in sericulture industry.
- 24.2 Apiculture:
  - 24.2.1 Promotion of bee products, marketing and trade in the context of
  - 24.2.2 Major concerns on legal basis and controls, quality and control of pesticides.
  - 24.2.3 Bee poisoning and avoiding honey bee losses when using pesticides
- 24.3 Mushroom:
  - 24.3.1 Importance and cultivation technique of mushroom.
- 24.4 Lac culture:
  - 24.4.1 Lac insect, its importance and scope

**25. Weed Science**

- 25.1 Emerging weeds problem
- 25.2 Herbicide, environmental impact and management practices of weed.

**26. Statistics in Plant Disease**

- 26.1 General knowledge of statistical tests, designs, data transformation, field plot techniques and laboratory experiments, analysis of variance, mean separation, result interpretation, research presentation and useful statistical softwares.

**27. Use of computer for decision making and forecasting disease and insect pest epidemics**

- 27.1 Computer Modeling for Crop loss
- 27.2 GIS for diseases and crop loss