Lecture 12: **PEST MONITORING - PEST SURVEILLANCE AND FORECASTING - OBJECTIVES, SURVEY, SAMPLING, TECHNIQUES AND DECISION MAKING - ETL AND EIL. FACTORS INFLUENCING EIL AND ETL.**

Pest Monitoring

Monitoring phytophagous insects and their natural enemies is a fundamental tool in IPM - for taking management decision

Monitoring - estimation of changes in insect distribution and abundance

- information about insects, life history
- influence of biotic and abiotic factors on pest population

Pest Surveillance

Refers to the constant watch on the population dynamics of pests, its incidence and damage on each crop at fixed intervals to forewarn the farmers to take up timely crop protection measures.

Three basic components of pest surveillance

Determination of

a. the level of incidence of the pest species
b. the loss caused by the incidence
c. the economic benefits, the control will provide

Pest Forecasting

Forecasting of pest incidence or outbreak based on information obtained from pest surveillance.

Uses

- Predicting pest outbreak which needs control measure
- Suitable stage at which control measure gives maximum protection

Two types of pest forecasting

a. Short term forecasting - Based on 1 or 2 seasons
b. Long term forecasting - Based on affect of weather parameters on pest

Objectives of Pest Surveillance

to know existing and new pest species
to assess pest population and damage at different growth stage of crop
to study the influence of weather parameters on pest
to study changing pest status (Minor to major)
to assess natural enemies and their influence on pests
effect of new cropping pattern and varieties on pest

Survey

Conducted to study the abundance of a pest species

Two types of survey - Roving survey and fixed plot survey

Roving survey

- Assessment of pest population/damage from randomly selected spots representing larger area
- Large area surveyed in short period
- Provides information on pest level over large area

Fixed plot survey

Assessment of pest population/damage from a fixed plot selected in a field. The data on pest population/damage recorded periodic from sowing till harvest. e.g. 1 sq.m. plots randomly selected from 5 spots in one acre of crop area in case of rice. From each plot 10 plant selected at random. Total tillers and tillers affected by stem borer in these 10 plants counted. Total leaves and number affected by leaf folder observed. Damage expressed as per cent damaged tillers or leaves. Population of BPH from all tillers in 10 plants observed and expressed as number/tiller.

Qualitative survey - Useful for detection of pest
Quantitative survey - Useful for enumeration of pest

Sampling Techniques

Absolute sampling - To count all the pests occurring in a plot
Relative sampling - To measure pest in terms of some values which can be compared over time and space e.g. Light trap catch, Pheromone trap

Methods of sampling

a. *In situ* counts - Visual observation on number of insects on plant canopy (either entire plot or randomly selected plot)
b. Knock down (Sudden trap) - Collecting insects from an area by removing from crop and counting (Jarring)
c. Netting - Use of sweep net for hoppers, odonates, grasshopper
d. Norcotised collection - Quick moving insects anaesthesised and counter
e. Trapping - Light trap - Phototropic insects
Pheromone trap - Species specific
Sticky trap - Sucking insects
Bait trap - Sorghum shootfly - Fishmeal trap
Emergence trap - For soil insects

f. Crop samples

Plant parts removed and pest counted e.g. Bollworms

Stage of Sampling

- Usually most injurious stage counted
- Sometimes egg masses counted - Practical considerations
- Hoppers - Nymphs and adult counted

Sample Size

- Differs with nature of pest and crop
- Parger sample size gives accurate results

Decision Making

- Population or damage assessed from the crop
- Compared with ETL and EIL
- When pest level crosses ETL, control measure has to be taken to prevent pest from reducing EIL.

Economic Injury Level

- Defined as the lowest population density that will cause economic damage (Stern *et al*., 1959)
- Also defined as a critical density where the loss caused by the pest equals the cost of control measure

EIL can be calculated using following formula

$$EIL = \frac{C}{V \times I \times D \times K} \text{ (or) } \frac{C}{VIDK}$$

where,

EIL = Economic injury level in insects/production (or) insects/ha

C = Cost of management activity per unit of production (Rs./ha)

V = Market value per unit of yield or product (Rs./tonne)

I = Crop injury per insect (Per cent defoliation/insect)

D = Damage or yield loss per unit of injury (Tonne loss/% defoliation)

K = Proportionate reduction in injury from pesticide use

Worked examples of EIL

Calculate EIL in terms of pest population/ha with following figures

C = Management cost per unit area = Rs.3,000/- per ha

V = Market value in Rs./unit product = Rs.1,000/tonne

I = Crop injury/pest density = 1% defoliation/100 insects

D = Loss caused by unit injury = 0.05 tonne loss/1% defoliation

K = Proportionate reduction in injury by pesticide application = 0.8 (80% control)

$$EIL = \frac{C}{VIDK} = \frac{3000}{1000 \times 0.01 \times 0.05 \times 0.8}$$

EIL = 7500 insects/ha

Economic threshold level (ETL) or Action threshold

- ETL is defined as the pest density at which control measures should be applied to prevent an increasing pest population from reaching Economic Injury Level (EIL)
- ETL represents pest density lower than EIL to allow time for initiation of control measure

Factors Influencing ETL and EIL

a. Market value of crop } Primary factors
b. Management costs
c. Degree of injury per insect } Secondary factors
d. Crop susceptibility to injury

a. Market value of crop

When crop value increases, EIL decreases and vice-versa

b. Management of injury per insect

When management costs increase, EIL also increases

c. Degree of injury per insect

- Insects damaging leaves or reproductive parts have different EIL (Lower EIL for Rep. part damages)
- If insects are vectors of disease EIL is very low even 1 or 2 insects if found - management to be taken
- If insects found on fruits - Marketability reduced - EIL very low e.

Crop susceptibility to injury

- If crop can tolerate the injury and give good yield. EIL can be fixed at a higher value
- When crop is older, it can withstand high pest population - EIL can be high

Tertiary factors

Weather, soil factors, biotic factors and human social environment

These tertiary factors cause change in secondary factors thereby affect the ETL and EIL.