

INTEGRATED PEST MANAGEMENT (IPM)

- **Integrated control** -Stern et al., (1959) as applied pest control which combines the biological and chemical control
- Managing pest population was proposed by Geier and Clark 1961 who called their concept as protective management which later was shortened as **pest management**
- Later **Smith and Van Den Borsch in 1967** mentioned that the determination of the insect numbers is broadly under the influence of total agro ecosystem and the role of the principle element is essential for integrated pest management
- In **1972 the term IPM was accepted by CEQ** (Council of Environmental Quality)

I - Integration that is **harmonious use of multiple methods** to control the impact of single pest as well as multiple pests

P - Pest- any organism that is **detrimental** to humans including vertebrates and invertebrate or weed or pathogens

M - Management refers to a **set of decisions or rules** based on ecological principles, economic and social consideration

The backbone of management of pest in an agricultural ecosystem is the **concept of economic injury level**

Why Pest Management

1) Collapse of control system

After World War during the massive use of pesticides, **Rachel Carson, an American biologist**, warned the people about the side effects of the use of pesticides through her book entitled, **Silent Spring**.

An over-reliance on chemical pesticides led to development of
pesticide resistance development of multiple resistance emergence of secondary pests
resurgence of pests elimination of natural enemies hazards to non- target species
hazards to agricultural workmen deleterious effects on the environment

2) Phases of crop protection

Smith. R.F (1969) has classified World wide patterns of crop protection in cotton agro ecosystem into the following phases which are also applicable to other crop ecosystems

A) Subsistence phase

- No Irrigation and Low yields
- Barter system marketing
- Natural pest control like natural enemies and Host plant resistance and rare usage of Chemicals

B) Exploitation phase

- Pest control solely depend on chemical pesticides
- Chemical control measures were exploited to the maximum extent
- intensive use of pesticides resulted in higher yields

C) Crisis phase

- More frequent and higher doses applications of pesticides
- Excessive use of insecticides over a number of years led to serious problems like
 - i) Pest resurgence ii) Pest Resistance iii) pest status change iv) Increase of production costs

D) Disaster phase

- Cost of cultivation got increased
- Crops were not grown profitably
- Frequent encounters of crop failures
- Rejection of the produce due to residues
- Finally collapse of the existing pest control system

E) Integrated control phase

- Control measures are to the optimum and not to the maximum
- Pest management concept is followed to avoid crisis and disaster phases by
 - a) Combination of the resources
 - b) Analysis of eco- factors
 - c) Optimization of techniques
 - d) Recognizing or restoring the pest at manageable level

3) Environmental contamination

Presence of residues in foods, feed and organisms caused widespread concern about contamination of Environment

Concepts of IPM

Seeks to minimize the disadvantages of pesticide usage and maximizing socio, economic and ecological advantages

1. Understanding the agricultural ecosystem

- **Lesser diversity** than natural ecosystem like forests
- Only **1-4 major crop** species and **6-10 major pest** species
- Intensively **manipulated** by man
- Subjected to **sudden alterations** (ploughing , inter cultivation Pesticide treatment)
- more **susceptible to pest damage** and catastrophic outbreaks
- These practices are critical in pest management as pest populations are greatly influenced

2. Planning of agricultural ecosystem

- **Anticipating pest problem**
- Alternatives to the **ways of control**
- **Integration of crop protection with crop production** system

Ex: Growing of susceptible varieties should be avoided and related crops shouldn't be grown
Ground nut followed by soybean increases incidence of the leaf miner

3. Cost benefit ratio

- By **predicting the pest problem** and **defining economic threshold level**
- **Crop life table** provide information analysis of pest damage as well as cost benefit ratio
- **Benefit risk analysis** includes impact of Pesticide usage on society as well as environment relevant to its benefits

4. Tolerance of pest damage

- Castor crop can tolerate upto **25 per cent** defoliation
- Exceptions occur in case of plant **disease transmission** by vectors
- The relationship between **density of pest population and profitability of control measures** is expressed through threshold values

A) Economic Injury Level (EIL):

- **Lowest population** at which the pest **will cause economic damage** or the pest level at which the damage can no longer be tolerated
- The level at or before which the control measures are initiated
- EIL is usually expressed as the **number of insects per unit area**

b) Economic Threshold Level (ETL):

- Index for making pest management decisions
- Population density **at which control measures should be applied** to prevent increasing pest population **from reaching the EIL**
- When **no action is taken at ETL the population reaches or exceeds EIL**

E.g.:- ETL value for BPH in rice is 25 insects/hill

Rice stem borer -5% dead hearts

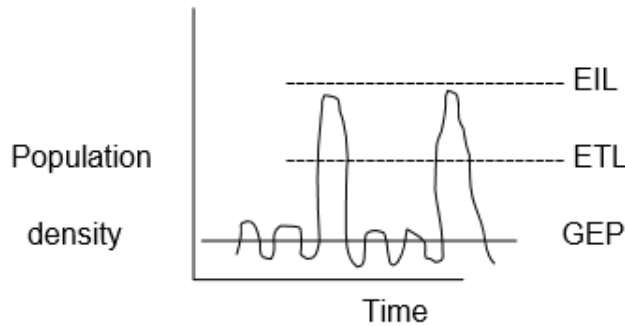
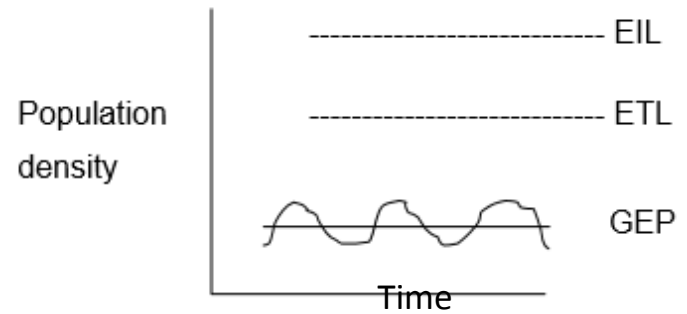
Gall midge of rice-5% silver shoots

c) General equilibrium position(GEP) Average population density of insect over a long period of time unaffected by temporary interventions of pest control

- The EIL may be at any level from well below to well above the GEP

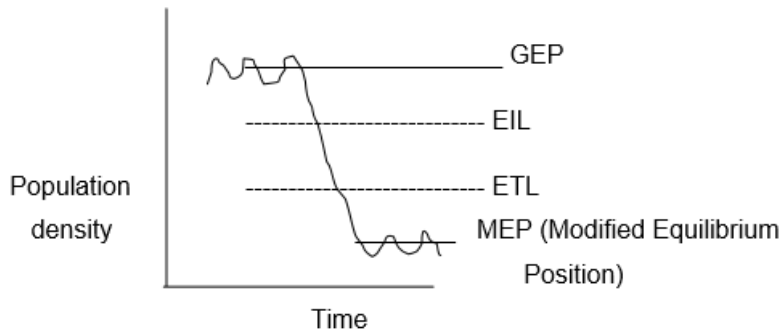
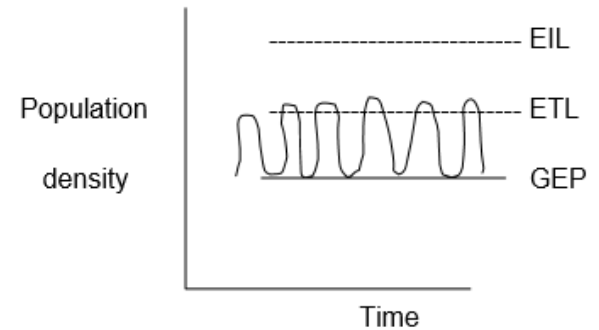
Based on this insects can be grouped into 4 categories

a) **Negligible pest:** Pop density never increases high enough to cause economic injury



b) **Occasional pest:** Occasionally their density reaches EIL due to unusual weather conditions or the injudicious use of insecticides
 •At their peak population density, some sort of intervention usually an insecticide is required to reduce their numbers

c) **Perennial pest:** EIL's are slightly above the GEP
 Intervention is necessary at nearly every upward population fluctuation.



d) **Severe pest:** They have EIL below the GEP
 Regular and constant interventions with insecticides are required to produce marketable crops

5. Leaving a pest residue

- **Absence of their respective insect hosts and indiscriminate use of broad spectrum insecticides** eliminate natural enemies
- Leave a permanent **pest residue below ETL**, so that natural enemies will survive

6. Timing of treatments

- Pesticide spray should be **need based**
- **Timely scheduled minimum number of sprays + Improved techniques of pest monitoring**
E.g.: Use of **pheromone traps** for monitoring of pest population

7. Public understanding and acceptance

- Simple and effective communication to the people for better understanding and acceptance
- Should be economical and sustainable

Limitations of IPM

- Higher degree of management
- Labour intensive
- Accurate field scouting
- Weather dependant