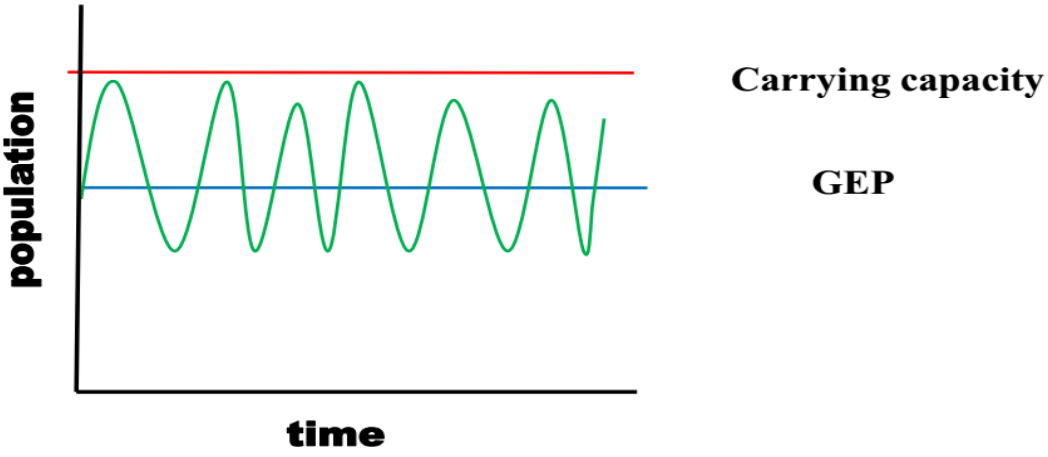
When an insect is called a pest ?

General equilibrium positions (GEP): It is the average of a population over a period of time, around which the insect population tends to oscillate due to biotic abiotic factors.



- Biotic factor: fecundity, food availability, natural enemies etc.
- Abiotic factors: Temperature, Rainfall, Humidity, wind etc.

- **Damage boundary (DB):** It is the lowest level of damage which can be measured.
- **Economic Injury level (EIL):** It is defined as the lowest population density of insect that will cause economic damage. **OR**
- The critical density of insect population where the loss caused by the pest equals the cost of control measures.

HOW TO CALCULATE ECONOMIC INJURY LEVEL

EIL can be calculated by using the following formula

$$EIL = P' = \frac{C}{V \times I \times D \times K}$$

- ✓ P' = Economic Injury level in insects / Production or insects / ha
- ✓ C= cost of management activity per unit production (Rs/ha)
- ✓ V= Market value per unit yield (Rs/tonne)
- ✓ I = Crop injury per insect (percent defoliation or percent fruit damage)
- ✓ D= Damage or yield less per unit injury(Tonne less or % defoliation)
- ✓ K= proportional reduction in injury from pesticide use.

Worked Example:

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

C= management cost per unit area = Rs. 3000/ha

V= market value (in Rs/ unit product) =Rs 1000/tonne

I= crop injury / Pest density = 1% defoliation /100 insect

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=C/VIDK

= 3000/1000x0.01x0.05x0.8 =**7500 insects/ ha.**

Is EIL of a pest constant at all time?.....

NO.....

EIL is influenced by

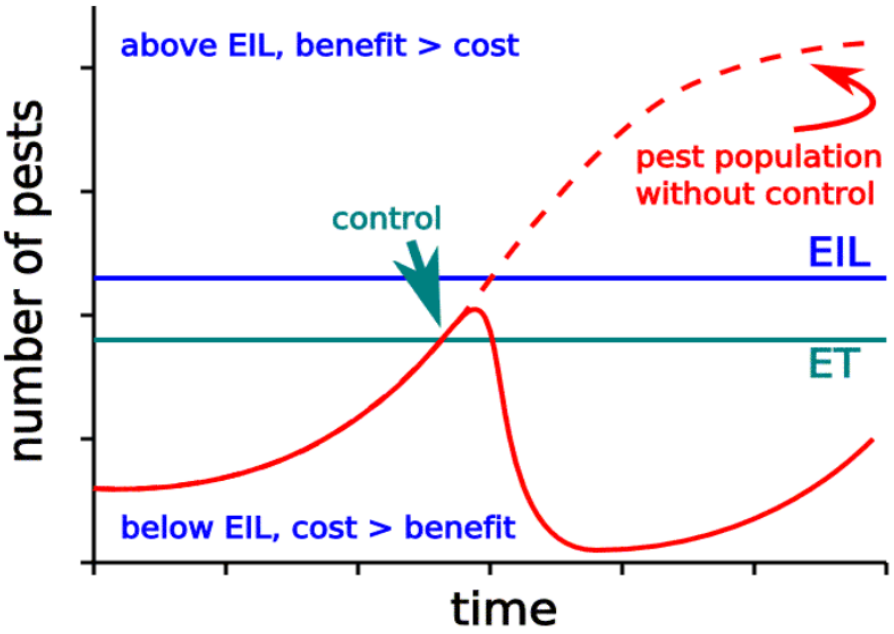
1. **Market value of the crop (Primary factor):** When crop value increases, EIL decreases and vice versa
2. **Management of injury by insect (Primary factor):** When management cost increases, EIL also increases
3. **Degree of injury per insect (Secondary factor):** Insect damaging leaves or reproductive parts will have different EILs

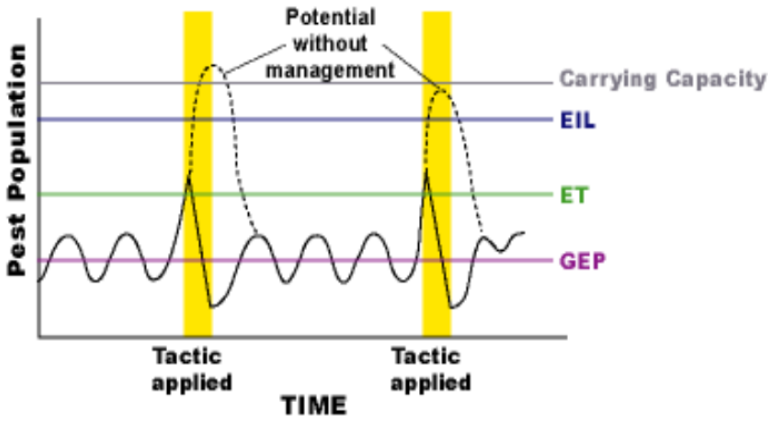
   For instance, defoliators will have higher EIL

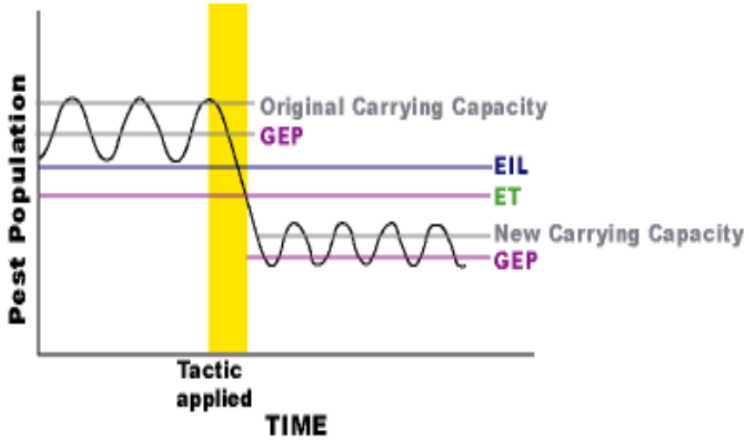
   If insects are found on fruits – EIL low.

   If insects are vectors of diseases EIL is very low.
4. **Crop susceptibility to injury(Secondary factor):** If the crop can tolerate the injury and gives good yield, EIL can be fixed at higher volume. When the crop is older, it can withstand high population- EIL can be high.

Economic Threshold Level (ETL) or Action threshold : It is defined as the pest density at which control measures should be applied to prevent an increasing pest population from reaching EIL.







CATEGORIES OF PESTS

Based on occurrence, following are pest categories……..

1. Regular pest: Frequently occurs on crop - Close association
e.g. Rice stem borer, Brinjal (egg plant) fruit borer

2. Occasional pest: Infrequently occurs, no close association
e.g. Caseworm on rice, Mango stem borer


Rice stem borer


Brinjal (egg plant) fruit borer


Caseworm on rice

3. Seasonal pest: Occurs during a particular season every year

e.g. Red hairy caterpillar on groundnut, Mango hoppers

4. Persistent pests: Occurs on the crop throughout the year and is difficult to control

e.g. Chilli thrips, mealy bug on guava

5. Sporadic pests: Pest occurs in isolated localities during some period.

e.g. Coconut slug caterpillar

Based on level of infestation

1. **Epidemic Pest** : Sudden outbreak of a pest in a severe form in a region at a particular time

   e.g. Whitefly outbreak in Punjab, Sugarcane wooly aphid in Karnataka

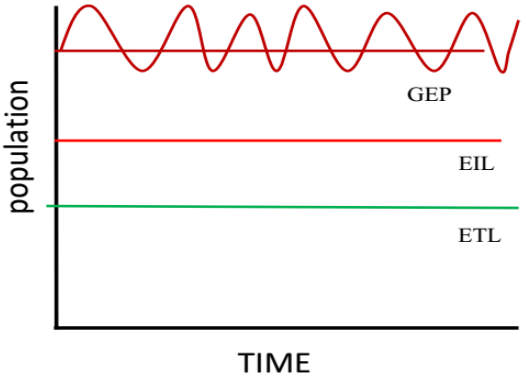
2. **Endemic pest:** Occurrence of the pest in a low level in few pockets, regularly and confined to particular area

   e.g. Rice gall midge infestation in coastal Karnataka, Red headed hairy caterpillar on groundnut (peanut) in Karnataka

PEST CATEGORIES ACCORDING TO EIL, GEP & DB

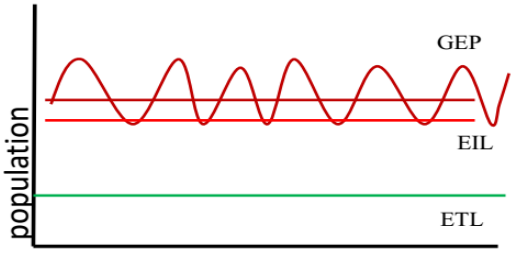
(i) Key pest

- Most severe and damaging pests
- GEP lies above EIL always
- Spray temporarily bring population below EIL
- These are persistent pests
- The environment must be changed to bring GEP below EIL e.g. Diamond back moth



(ii) Major pest

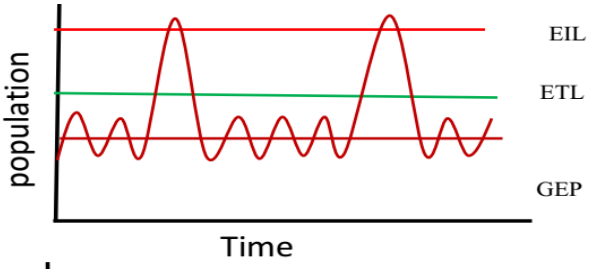
- GEP lies very close to EIL or coincides with EIL
- Economic damage can be prevented by timely and repeated sprays e.g. Cotton jassid, Rice stem borer



(iii) Minor pest/Occasional pest

- GEP is below the EIL usually
- Rarely they cross EIL
- Can be controlled

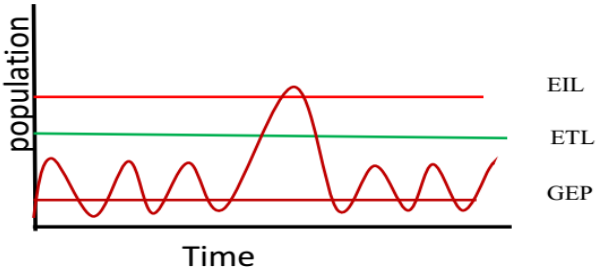
e.g. Cotton stainers, Rice hispa, Ash weevils



(iv) Sporadic pests

- GEP generally below EIL
- Sometimes it crosses EIL and cause severe loss in some places/periods

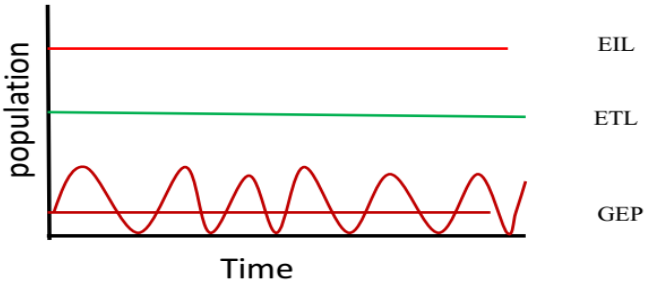
e.g. Sugarcane pyrilla, White grub, Hairy caterpillar



(v) Potential pests

- They are not pests at present
- GEP always less than EIL
- If environment changed may cause economic loss

e.g. *H. armigera* is potentia pest on alfalfa



Methods of Insect Control

1. NATURAL CONTROL

2. APPLIED CONTROL

1. NATURAL PEST CONTROL

A. Climatic factors: Temperature humidity photoperiod directly influence the population of pest as well as their host plants. The seasonal development of their host plant is closely related and the seasonal development of phytophagous insects.

B. Natural barriers: The natural topographic barriers like mountain range and large water bodies and deserts prevent pest migration. Apart from checking insect pest migration they affect climate itself and the ability of pest to live in changed weather conditions.

C. Natural enemies: there is not a single group of vertebrate starting from first up to mammal which do not feed on insects. They keep the insect population under check to a greater extent. Along the insect themselves are a large number of entomophagous species that where capture or devour other insect species(i.e., predators) or may the eggs on or in the body of other insects



D. Diseases: Entomophagous pathogen which produce fatal diseases in insect and keep a check on insect population.


Objectives of pest management

1. To reduce pest status below economic injury level.

   Complete elimination of pest is not the objective……

2. To manage insects by not only killing them but by preventing feeding, multiplication and dispersal.

3. To use eco-friendly methods, which will maintain quality of environment (air, water, wild life and plant life)

4. To make maximum use of natural mortality factors, apply control measures only when needed.

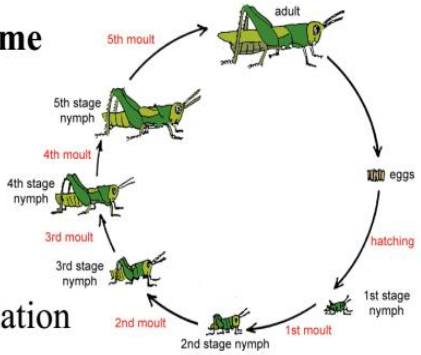
5. To use component in sustainable crop production.

Requirements for successful pest management programme

1. Correct identification of insect pests

2. Understanding the life history and behavior of the pest

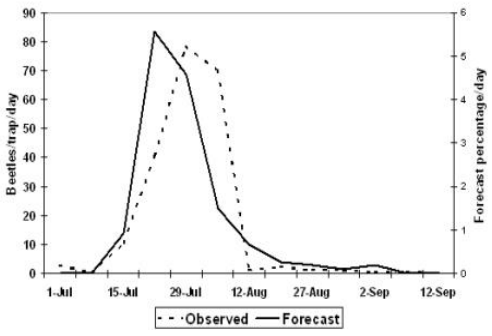
3. Natural enemies and weather factors affecting pest population

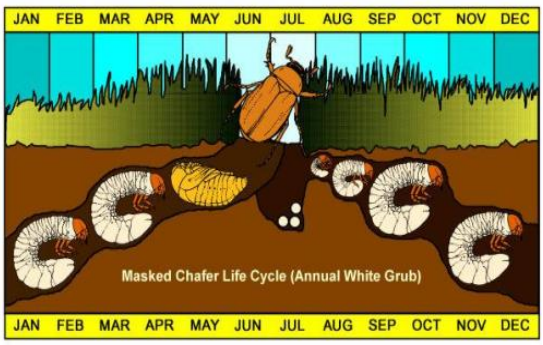


4. Pest surveillance will provide above data

5. Pest forecasting and predicting pest outbreak

6. Finding out ETL for each pest in a crop





7. Need and timing of control measure – Decision making

8. Selection of suitable methods of control

9. Analysis of cost/benefit and benefit/risk of each control measure

10. Farmer's awareness and participation

11. Government support

12. Consumer awareness on use of pesticides free products