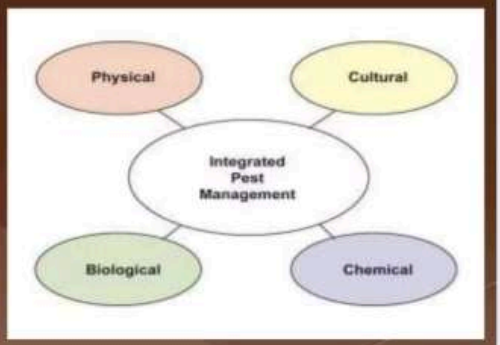
IPM(Integrated Pest Management)

What is IPM?

Ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

"Integrated Pest Management (IPM) is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks."



- 3 principle approaches incudes-
  - Direct action against pest.
  - Genetic modification of the host.
  - Modification of environment to make it unfavourable for the host.

HISTORY OF I.P.M.

- Shortly after World War II, when synthetic insecticides became widely available, entomologists in California developed the concept of "supervised insect control.
- Michelbacher and Bacon (1952) coined the term "integrated control"
- Stern *et al*. (1959) defined integrated control as "applied pest control which combines and integrates biological and chemical control"
- Geier (1966) coined the term "pest management"
- Council on Environmental Quality (CEQ, 1967) gave the term "Integrated Pest Management"
- In 1967 the **term** IPM was introduced by R.F. Smith and R. van den Bosch.

- Food and Agricultural Organization (FAO, 1967) defined IPM as "a pest management system, that, in the context of associated environment and population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains pest populations at levels below those causing economic injury"
- In **1972** the **term** IPM was accepted by **CEQ (Council of Environmental Quality)** and the report Integrated Pest Management prepared by the **CEQ** was published. In creating the synthesis between integrated control and pest management.

Requirements for I.P.M.

- Chemical pesticides can impact the human health and ecosystems. Example:- DDT, a pesticide, can accumulate in the fatty tissue of animals and affect bird reproduction.
- Insects can become resistant to chemical pesticides. Approximately 500 species of insects are resistant to one or more pesticides.
- Due to exclusions it leads to transmit a large number of plant diseases worldwide.For eg.- Leaf rust of coffee, Late blight of potato etc.

-Impact of overuse of chemical pesticides leading to endangered species of birds.

Basic principles of IPM :-

1. Consideration of Ecosystem : Control of insect pest population is a function of the ecosystem itself by means of natural enemies and other factors. The study of individuals is of prime importance, their biology behaviour response to other members of the same species and to other organisms and to biotic factors in the environment. The most effective system for controlling pests can be derived only after understanding the principles responsible for the population fluctuation in the ecosystem.

2. Pest Surveillance : Surveillance or monitoring means constant observation of a subject i.e., a crop or pest, and recording the factors observed, compilation of information obtained and prediction of future events about pest population. Hence pest surveillance comprises of three basic components.

- Determination of the level of incidence of the pest species.
- Determination of what loss the incidence will cause.
- Determination of economic benefits or other benefits the control will provide.

3. Utilization of Economic Threshold Levels (ETL) The level of pest population is very important consideration for taking up control measures. Pest population must be maintained at levels below those causing economic injury. The economic threshold is the pest density at which control measures should be determined to prevent an increasing pest population from reaching economic injury level. The determination of these thresholds is a pre-requisite to the development of any pest management strategy.

4. Application of minimum selective hazards : The application of chemical measures to pest population has to be in such a manner that target pest populations are just kept below economic injury thresholds. By observation of this principle the development of resistant populations of pest is avoided or delayed, the possibility of resurgence of treated population is decreased, adverse effect on non-target organism and amount of environmental contamination are reduced, and the cost of control is also lowered.

Strategies of IPM

- **Monitoring insect pests and natural enemies**:- Pest surveillance and forecasting are essential tools in IPM which help in making management decision.
- **Concepts of injury levels**:- ETL (Economic threshold level) and EIL (Economic injury level) concepts are followed to reduce the use of insecticide and their impact on environment.
- **Integration of pest control tactics**:- Proper choice of compatible tactics and blending them so that each component complements the other.

The strategy of applying pest management tactics is similar to that of human medicine.

- i.e. Preventive practice
- Curative practice

BASIC COMPONENTS OF I.P.M.

An American I.P.M. system designed around 6 basic components and these are as follows-

Acceptable pest levels.

Preventive cultural practices.

Monitoring.

Mechanical controls.

Biological controls.

Responsible pesticides use.

Tools Or Components of IPM

- **i. Cultural method or use of agronomic practices**
  1. Crop rotation
  2. Crop refuse destruction
  3. Tillage of soil
  4. Variation in time of planting or harvesting
  5. Pruning or thinning
  6. Fertilizer management
  7. Water management
  8. Intercropping
  9. Trap crop
- **ii. Host plant resistance - Antixenosis, antibiosis, tolerance**
- **iii. Mechanical methods of pest control**
  1. Hand destruction
  2. Exclusion by screens, barriers
  3. Trapping, suction devices, collecting machine
  4. Crushing and grinding
- **iv. Physical methods**
  1. Heat
  2. Cold
  3. Energy - light trap, irradiation, light regulation, Sound
- **v. Biological methods**
  1. Protection and encouragement of NE
  2. Introduction, artificial increase and colonizing specific parasitoids and predators
  3. Pathogens on insects like virus, bacteria, fungi and protozoa
  4. Use of botanicals like neem, pongam, etc.
- **vi. Chemical methods**
  1. Attractants
  2. Repellents
  3. Insecticides - carbamates, pyrethroids, etc.
  4. Insect growth inhibitors
  5. Chemosterilants
- **vii.Behavioural methods**
  1. Pheromones
  2. Allelochemics
- **viii. Genetic/biotechnology method**
  - Release of genetically incompatible/sterile pests
  - Transgenic plant
- **ix. Regulatory/legal method**
  - Plant/animal quarantine
  - Eradication and suppression programme

Advantages of IPM

- **1. Fits better in National Economy**. Pest control activities at present are mainly based on the application of chemical pesticides, quite a large proportion of which has to be imported. The expenditure envisaged for plant protection runs into crores of rupees even when only one or at the most two pesticide application are envisaged per crop. High yielding varieties show that many more pesticide applications are called for many crops if pest control has to depend only on the use of pesticide. Thus a time has come where Integrated Pest Management is not only advisable but also inevitable.
- **2. More efficient and cheaper method.** In IPM schedule efforts are made to utilize various methods of control including use of pesticides but some times and in some cases it is feasible to nip the trouble in the bud itself even by a mechanical campaign like destruction of egg masses of some pests or collecting the caterpillar stages. In such cases it envisages a lot of saving in the use of pesticides, this means saving of money and saving of foreign exchange and also the destruction of the pest before it has been able to inflict damage.

- **3. Avoid upsetting the balance of nature**. Chemical control has often been reported to upset the balance of nature at times leading to upsurge of new type of pest problem which did not exist before. The seriousness of mites in many parts of the world has occurred by the use of DDT. It is confidently expected that such adverse side effects will be much less as a result of integrated pest management schedule.
- **4. Minimises residue hazards of pesticides** : It is obvious that in an IPM schedule the use of pesticides will be considerably reduced, hence the pesticide residue hazards will also get automatically minimised.

Disadvantages of IPM

- Integrated Pest Management systems are extremely complex and require a higher level of understanding to utilize.
- An IPM system of pest control involves a lot more time and is sometimes more costly than the traditional method of spraying pesticides to eliminate pests.
- In order for an IPM to work effectively, it needs constant monitoring.
- Also, the natural enemies of pests used in some IPMs can later become pests themselves.