UNIT-5-INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is that method of pest control, which utilizes all suitable techniques of pest control to reduce pest populations and maintain them below economic injury level.

IPM is also defined as a stable system of crop protection, which based on the ecological relations within the crop and the environment, combines several methods of pest control in such a way that the pest is prevented from causing economic injury.

Or

Integrated Pest Management (IPM) is a program that should be based on prevention, monitoring, and control which offers the opportunity to eliminate or drastically reduce the use of pesticides, and to minimize the toxicity of and exposure to any products which are used. IPM does this by utilizing a variety of methods and techniques, including cultural, biological and structural strategies to control a multitude of pest problems. IPM is the answer or an amicable alternative to chemical pesticides. As per United Nation's **Food' and Agriculture Organization (FAO), IPM is defined as: "The careful consideration of all available pest control technique's and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. 1PM emphasizes the growth of a healthy crop with the' least possible disruption to agro-ecosystems and encourages natural pest control mechanism"**

The idea of integrated control emerged independently in California and in Netherlands, where it was first known as harmonic control. The term pest management arose in Canada and Australia. It is also called protective management and was originally coined to define the blending of biological control agents with chemical control because these techniques used independently, either failed to produce satisfactory results or caused environmental problems. Therefore, need arose to consolidate these two methods and also other possible means into a unified programme to manage pest population so that economic injury is avoided.

Components of Integrated Pest Management

Various components and techniques that can be utilized in Integrated Pest Management programmes are as follows:

1. Cultural control: Use of resistant varieties of crops is a promising technique in IPM. Moderately to low level of resistance is best integrated with chemical and biocontrol agents. Crop rotation and sanitation are also used to reduce the pest population to lower levels.

2. Mechanical control: Use of screens or barriers or handpicking in nursery stage of the crops and use of light traps to kill egg-laying adults can bring down the population for the other methods to be effective.

3. Biological control: Natural enemies are commonly utilized in IPM programmes. Emphasis is given to protection and augmentation of indigenous natural enemies and recolonisation of those that have been wiped out due to indiscriminate use of insecticides.

4. Chemical control: Minimal use of insecticides is recommended in IPM. Rule of the thumb is not to use insecticides unless absolutely necessary. Application methods that do not bring insecticides in contact with natural enemies are favoured in IPM programmes

5. Regulatory methods: Plant and animal quarantines by the government and collective eradication and suppression in large areas help in providing long-lasting management. International efforts to suppress noxious pests like locusts have proved fruitful.

6. Acceptable pest levels: It aims on controlling and not eradicating pests: Allowing a pest population to survive at a reasonable threshold reduces selection pressure. This lowers the rate at which a pest develops resistance to a control and maintains homeostasis by maintaining the normal food web around the pest.

7. **Genetic Control:** It involves traditional selective breeding and newer biotechnology to produce robust varieties. Pests are virtually never eradicated. Thus record-keeping system is essential to establish trends and patterns in pest outbreaks. Further a regular evaluation program is essential to determine the success of the pest management strategies. National Centre for Integrated Pest Management (NCIPM) of Indian Council of Agricultural Research. (ICAR), India develop and promote IPM technologies for major crops so as to sustain higher crop yields with minimum ecological implications and develop information base on all aspects of pest management and to advise on related national priorities and pest management policies.

In most of the cases, chemical, biological and varietal resistances are combined to manage the population of pest species.

Role of biological control in IPM

Being safe, permanent and economical, biocontrol should be of primary consideration in any IPM programme and should not be taken up only when other methods fail. In IPM biological control need not achieve complete success, since other methods combined also contribute in achieving the goal.

There are three major ways to integrate biological control in IPM programmes: **1.** conservation and augmentation of natural enemies already available, **2.** Importation and colonization of exotic natural enemies and **3.** Mass culture and release of indigenous as well as exotic natural enemies.

Conservation is done by using selective insecticides to which natural enemies are resistant or use of soil application methods or habitat management like planting of nectar producing flowering plants in the vicinity of the crop. Cultural practices which maintain diversity of crops in the area are usually beneficial for the natural enemies. Intercropping of selected crops is known to augment parasitic activity. Integration of moderately resistant crop varieties with natural enemies is currently a popular component of pest management.

Role of insecticides in IPM

When pest populations reach above tolerable levels, insecticides provide immediate control. But great majority of insecticides are broadly toxic and therefore ecologically disruptive. Great need for IPM is to develop selective or even specific insecticides which will have negligible effect on non-target species. Modification of dosage, times of application, formulations and placement of material can be utilized to increase selectivity of chemicals. Successful use of pesticides of mites illustrates bright future for selectivity. Use of pheromones, hormones, repellents, antifeedants and sterilants are selelective in their action and hence must be encouraged.

An elementary integration is the application of insecticides and pheromone traps to reduce male population of the pest before undertaking control through sterile male technique, since the latter is more successful at lower pest densities. An example is the control of Mediterranean fruit fly *(Ceratitis capitata)* on Procida Island in Italy.

Role of varietal resistance in IPM

Use of resistant varieties is a less utilized concept. A low plant resistance is better since it does not impose too much stress on the pest species to change its behavior and develop biotypes. It also harbors natural enemies at low pest densities. A highly resistant crop, on the other hand, wipes out not only the pest species but also the specific natural enemy fauna from the area.

An interesting integration of resistance, cultural practice and chemical control is the planting of trap crop of a susceptible variety or attractive crop on the borders and main crop in the middle, and then spraying only on the susceptible variety where the pest would naturally congregate.

An integration of resistance and biocontrol was shown in California by planting moderately resistant variety of barley and sorghum which complemented the activity of the parasite *Lysiphlebus testaceipes* in reducing green bug (*Schizaphis graminum)* population. Advantages of varietal resistance in IPM programmes include: its specificity, easy compatibility with other methods, cumulative effect is carried through generations over a long period and non-disturbance of ecosystem.

Examples of Integrated Pest Management

1. Cotton pest control in Peru: Developed by Wille (1951) in Canete Valley which is a self-contained ecosystem surrounded by arid areas. Due to extensive use of organic insecticides and subsequent resistance developed by the cotton pests, the valley was led to the brink of disaster. The following steps were taken to save the crops:

- Prohibition of ratooning.
- Prohibition of synthetic organic insecticides and return to the old calcium and lead arsenates and nicotine sulphates.
- Repopulation of the area with; natural enemies introduced from the surrounding regions.
- Establishment of deadlines for planting, ploughing, irrigation, pruning and harvesting.
- Employment of cultural practices, which led to the establishment of healthy, uniform stands.

As a result of this IPM programme, the pest problem was solved and the whole agro-ecosystem twined into a self-balanced system.

2. Integrated Pest Management in Paddy: FAO developed an intercountry programme for IPM in South and Southeast Asia by integrating biological, chemical and cultural control methods.

3. Integrated Pest Management in Sugarcane: Chemical control is not successful in sugarcane fields because of technical and mechanical problems of insecticide applications and also insecticide contamination eventually reaching humans. Integration of biological contraol, particularly the egg parasite, *Trichogramma* species and modification of cultural practices has been found to keep the pest densities below economic injury levels.

4. Integrated control of locusts: FAO undertakes constant surveillance throughout the breeding areas and follows the following IPM programme: Eggs are destroyed by ploughing or flooding (mechanical control). Nymphs are controlled either by direct spraying by aircrafts or by barrier spraying, baiting, trenching or burning by flame-throwers. Repellents like neem-oil are sprayed on crop at the time of swarming. Swarms are either sprayed while resting on ground or by aircrafts while migrating. Some biological control is achieved by conserving predators in the breeding grounds.