

## **Methods of pest control**

**Physical control:** elimination of pests through physical means

- a. Collection and destruction of pests
- b. Use of traps
- c. Burning
- d. Use of inert dusts
- e. Flooding
- f. Manipulation of temperature and humidity
- g. Gamma radiation

**Cultural control:** oldest traditional method of control

- a. Selection of good site: empirical observation will reveal that certain areas of field are constantly at risk
- b. Use of clean plant materials: planting of insect-free materials would prevent insect development
- c. Deep sowing: Sowing of certain seeds deep into the soil can reduce insect infestation
- d. Deep ploughing: Ploughing exposes the various stages of insect to sunlight and natural enemies
- e. Manipulation of planting time: Peak population of pests may be avoided by planting early or late depending on the biology or ecology of the pests involved
- f. Manipulation of harvesting time: Prompt harvesting may prevent insect pests from infesting crops
- g. Crop sanitation: this includes destruction of diseased or badly damaged plant, removal and destruction of old crop residues, fallen leaves, branches, dead trunks, weeds, etc, removal or destruction of fallen fruits, destruction of crop residues.
- h. Crop rotation: Susceptible crops must not follow another one in a row.
- i. Plant density and spacing: closely planted crops may provide shade for certain insect pests.
- j. Intercropping: non-host crops should be mixed with hosts
- k. Use of trap crops
- l. Use of mulches

m. Close season

### **Biological Control**

-Purposeful manipulation of the natural enemy to suppress, decimate the population of a pest.

#### **Agents of biological control**

- a. Parasite: are microorganisms that inhibit pests in certain ways thus reducing the efficiency of the pest.
- b. Pathogen: are also microscopic in nature but are different from parasites in that they cause a disease condition before the host is killed
- c. Parasitoids: parasites that have destructive biology. They lay eggs on or close to the host, and when the eggs hatch, they obtain water and nutrients from the host thereby killing the hosts.
- d. Predator: They are natural enemies that seize their preys and kill them.
- e. Competitor: competitively displace pest species

#### **Methods of Biological control:**

- a. Conservation
- b. Augmentation
- c. Introduction

#### **Considerations for biological control**

- a. Economic consideration: Economic threshold must be established for the crops involved.  
It must also increase crop production
- b. Ecological consideration: Annual agro ecosystem is not ideal for biological control.

Ecological considerations include the following:

Nature of pests (whether they are sedentary, aggregate, relatively exposed, pests of perennial crops)

Nature of infestation: single or multiple infestations

Characteristics of a good natural enemy:

Aggressiveness, good searching ability, must be discriminatory enough, specificity, high reproductive ability.

### **Host plant Resistance**

It is the relative amount of heritable qualities possessed by a plant which influence the ultimate degree of damage done by insects in the field.

Types of resistance/mechanism of resistance

- a. True and false resistance
  1. antixenosis
  2. antibiosis
  3. tolerance
- b. False resistance
  1. Host evasion
  2. Host escape
  3. Induced resistance

### **Legislative control**

It is the enactment of legislation to prevent the introduction and /or further spread of pest organism in an area. Sometimes, drastic preventive measures are necessary to checkmate incidence of a pest from gaining entry into a country.

- a. Legislation to prevent introduction of foreign pests
- b. Legislation to prevent spread of pest after entry
- c. Legislation to enforce the application of effective control measures
- d. Legislation to prevent to set up surveillance system
- e. Legislation to license pesticide
- f. Legislation to prevent adulteration or mis-branding of pesticides
- g. Legislation to regulate the act of men engaged in pest activity

Procedure for legislative control at the port

- Inspection
- Detection
- Quarantine
- Sorting
- Interception
- Eradication

- Prohibition
- Treatment or remedy

**Chemical control:** is the use of chemical pesticides to kill, destroy, attract, repel or outright decimation of a pest population. The old concept of chemical control was outright killing of pests, but now there are pesticides that do not necessarily kill their targets, but attract, repel or prevent their feeding; all these are also called pesticides.

### **Advantages of Pesticides**

- a. they are active
- b. readily available
- c. cheap

### **Disadvantages**

- a. Development of resistance: After exposures to pesticides, many pests are able to adapt to pesticides so that higher doses or combinations would be required to control them
- b. Outbreak of secondary pests: Natural enemies of minor pests are killed along with target key pests. The minor or potential pests may develop to key status in the absence of their natural enemies.
- c. Resurgence of sprayed pests: Natural enemies are more susceptible to pesticides than the target pests themselves. Sprayed pests could re-build their population after their natural enemies have been killed.
- d. Toxic residues: Pesticides leave toxic residues in foods
- e. Health hazards: Pesticides use pose direct risk to field operators, domestic users and non-users
- f. Loss of soil fertility: When pesticides get into the soil, they kill beneficial soil organisms thereby causing loss of soil fertility

### **Types of pesticides**

Pesticides can be categorized based on several criteria such as: route of entry, formulation, origin, selectivity, point of contact, time of application etc.

Classification based on parent chemical (inorganic and organic)

- a. inorganic: These group lack carbon atoms in their molecules. They are toxic by ingestion; mode of action is stomach. They are toxic man, they have persistent residues e.g. arsenates, elemental sulphur.
- b. Organic compounds: Have carbon atoms in their molecules.
  - i. Botanicals: derived from plants
  - ii. hydrocarbon oils
  - iii. synthetic organic insecticides

Synthetic organic insecticide could be classified into (a). organochlorines (b). organophosphates (c) carbamates (d) botanical analogues (e) hormone derivatives

### **STERILE INSECT TECHNIQUE**

This is the employment of genetically impaired pest species to control or destroy its own kind or bring about self destruction of its own species. It is also called 'autocidal control' (self-killing) or genetic control. In SIT, a large population of laboratory bred and artificially sterilised male is released into an environment to outnumber the local males. When they mate with the local females, the offspring produced will not be viable.

Conditions necessary for the application of SIT

- a. it must be against isolated pests
- b. can be used against isolated pests when reach low point in their density cycle
- c. against newly introduced pests

Conditions necessary for success of SIT

- area-wide programme must be imposed
- insect rearing facility
- there must be ecological barrier such as mountains, oceans etc
- sterilization of the insect must be done without affecting vigour and mating competitiveness
- sterilization must not alter the morphology of exposed insects

Advantages and disadvantages of SIT

**Integrated pest management** (IPM) is an integrated approach of crop management to solve ecological problems when applied in agriculture.

These methods are performed in three stages: *prevention*, *observation*, and *intervention*. It is an ecological approach with a main goal of significantly reducing or eliminating the use of pesticides while at the same time managing pest populations at an acceptable level.

An IPM system is designed around six basic components:

**Acceptable pest levels:** The emphasis is on *control*, not *eradication*. IPM holds that wiping out an entire pest population is often impossible, and the attempt can be economically expensive, environmentally unsafe, and frequently unachievable. IPM programmes first work to establish acceptable pest levels, called action thresholds, and apply controls if those thresholds are crossed. These thresholds are pest and site specific, meaning that it may be acceptable at one site to have a weed such as white clover, but at another site it may not be acceptable. By allowing a pest population to survive at a reasonable threshold, selection pressure is reduced. This stops the pest gaining resistance to chemicals produced by the plant or applied to the crops. If many of the pests are killed then any that have resistance to the chemical will form the genetic basis of the future, more resistant, population. By not killing all the pests there are some un-resistant pests left that will dilute any resistant genes that appear.

- 1. Preventive cultural practices:** Selecting varieties best for local growing conditions, and maintaining healthy crops, is the first line of defense, together with plant quarantine and 'cultural techniques' such as crop sanitation (*e.g.* removal of diseased plants to prevent spread of infection).
- 2. Monitoring:** Regular observation is the cornerstone of IPM. Observation is broken into two steps, first; inspection and second; identification. Visual inspection, insect and spore traps, and other measurement methods and monitoring tools are used to monitor pest levels. Accurate pest identification is critical to a successful IPM program. Record-keeping is essential, as is a thorough knowledge of the behavior and reproductive cycles of target pests. Since insects are cold-blooded, their physical development is dependent on the temperature of their environment. Many insects have had their development cycles modeled in terms of degree days. Monitor the degree days of an environment to determine when is the optimal time for a specific insect's outbreak.
- 3. Mechanical controls:** Should a pest reach an unacceptable level, mechanical methods are the first options to consider. They include simple hand-picking, erecting insect barriers, using traps, vacuuming, and tillage to disrupt breeding.

4. **Biological controls:** Natural biological processes and materials can provide control, with minimal environmental impact, and often at low cost. The main focus here is on promoting beneficial insects that eat target pests. Biological insecticides, derived from naturally occurring microorganisms (*e.g.*: *Bt*, entomopathogenic fungi and entomopathogenic nematodes), also fit in this category.
5. **Responsible Pesticide Use:** Synthetic pesticides are generally only used as required and often only at specific times in a pest's life cycle. Many of the newer pesticide groups are derived from plants or naturally occurring substances (*e.g.*: nicotine, pyrethrum and insect juvenile hormone analogues), but the toxophore or active component may be altered to provide increased biological activity or stability. Further 'biology-based' or 'ecological' techniques are under evaluation.