

**Can you tell?**

- Names of the some insects familiar to you.
- The body parts of insects.
- The examples of harmful and useful insects.

11.1 Meaning and types of pest and diseases**11.1.1 Meaning of pest**

Pest means any living organism that multiplies in large number and cause damage or disease to human, animals, plants or property. Pest indicates the harmful insect or this includes insects, mites, fungi, bacteria, viruses, rats, birds, animals nematodes, weeds, etc. The terms pest is derived from Latin word *pestis* which means damage.

The insects are dominant in ecosystem as insects have external skeleton, small size, prolific reproduction, efficient body system, adoptability to new environment, remain dormant in adverse condition.

**Can you recall?**

- Names of human diseases
- Name the organisms responsible for diseases.

**Do you know ?****When plant is said healthy?**

Plant growth and development is good and it is capable of reproduction.

When plant physiological processes [Cell division and growth, absorption of water and minerals from soil, photosynthesis, respiration, food storage, etc.] are performing smoothly.

**Try this**

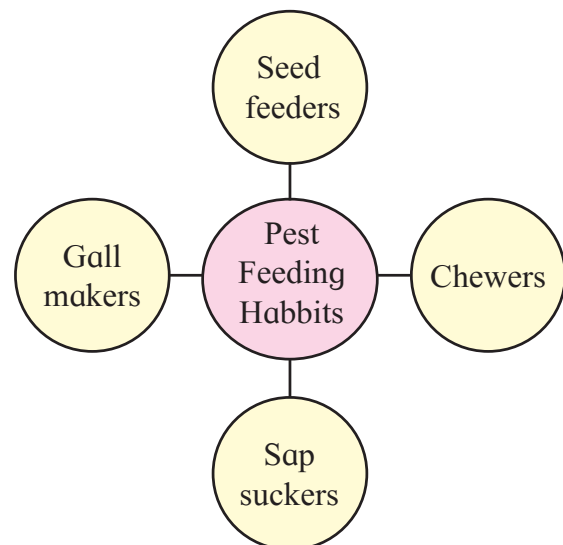
Take some disease affected seed and observe.

**Always remember**

The economic threshold level is the pest density at which control measures should be determined to prevent an increasing pest population from reaching economic damage level.

11.1.2 Meaning of diseases

Disease is defined as physiological or structural deformity that is harmful to plant or any of its parts or produces that reduces their economic value. Diseases of plant are responsible for plant damage and their produce. Damage due to diseases in India is estimated approximately 500 crores per year. Disease may be caused by living organism which are affected by factors as temperature, moisture, aeration, deficiency or excess of plant nutrients, soil pH (acidity or alkalinity), etc.





Always remember

Plant diseases make changes in plant. Destroy plant cells or tissue due to toxic or growth retarding substances secreted by causal organism.

Due to continuous feeding of organism on plant food material plants become weaker as well as absorption of minerals and water is disturbed.

Reduction in the yield of plant.

11.1.3 Types of pest and disease

[A] Types of pest on basis of incidence

1. **Regular pest:** The regular pest occur most frequently on the crop and such pest have close association with a particular crop. These pest are expected to occur on the crop sometime before harvest e.g. Thrips on chilli, Jassids on paddy, Aphids on mustard, Fruit borers on brinjal .
2. **Sporadic pest:** The sporadic pest occur in a few isolated localities occasionally in certain years e.g. rice stink bug on rice, slug caterpillar on castor.
3. **Occasional pest:** Many pest occur rather infrequently and close association with particular crop is absent e.g. case worm of rice, the mango stem borer.
4. **Seasonal pest:** Those pest which occur mostly during a particular part of the year. The incidence of these pests are governed by environmental factors in a locality. e.g. red hairy caterpillar on groundnut during April-May in certain localities of the south India, rice grass hopper during August – September in U.P.
5. **Persistent pest:** Pest that occur on a crop throughout the year are known as persistent pest e.g. mealy bugs on sugarcane.

6. **Potential pest:** These pest normally cause little loss but may become highly destructive resulting from some disturbance in the environment and the consequent increase in their number e.g. brown plant hopper on paddy.

[B] Types of pest on the basis of damaging organism

1. **Insect:** These are important and major pests. Insect have three pairs of legs, two pairs of wings, segmented body and characteristic compound eyes and antennae. The damaging stages of different insects pests are larvae, nymphs and adults.
2. **Mites:** These are creatures similar to insect having four pairs of legs. They suck the sap from the plant and attack the crops in huge number.
3. **Rodents:** The rats eat away large amount of human food and also damage the crops on large scale. They are also responsible for heavy loss to stored grains on farms, in warehouses and houses.
4. **Animals:** Large animals like boar, deer, elephants, wild buffalo, monkeys, squirrels cause direct damage to crop plants. They eat away the plants and waste huge amount of crops.
5. **Birds:** Birds attack the crop plants and eat grains. Crow, parrots and sparrows are major birds that attack the crops.

[C] On the basis of feeding habits the insect pest

1. **Chewers:** Chewing is the most common way by which insects feed plant materials (leaves, stems, flowers, pollens, seeds, roots) larvae and adult have chewing mouth parts e.g. beetles
2. **Sap suckers:** Some insects with the help of their highly modified mouth parts pierce the plant epidermis and suck the cell sap. They do not physically damage the plant e.g. aphids, thrips.

3. **Miners and borers:** Leaf miners are chewing insect feed within plant tissues layers between the intact upper and lower epidermis of leaves. Due to feeding a tunnel is made that is often characteristics of the species. Boring insects live in the woody tissue of plants or fruits. Larvae of sugarcane top borer and stem borer feed the content of the stem. Most of the fruit borers (brinjal, okra) and stem borers (jowar, paddy) are injurious to crop.
4. **Gall makers:** Some insects induce the galls (the production of abnormal growth) in the tissues of their host plants, flowers or roots. The gall is entirely product of plant developed in response to a chemical stimulus from the secretions of the insect e.g. Paddy gall
5. **Seed feeders:** Seed feeders and seedling feeders are the only true predators among insects because they kill plants by consuming them e.g. seed beetles
6. **Soil insects:** Insects that are found in the soil live by feeding on the roots of plants by chewing or boring or sucking the sap or forming galls. Many soil insect are host specific as in cutworms, flea beetles.
7. **Store grain pest:** The stored products are attacked by insects in three ways,
 - (i) It may be a continuation of field attack as in potato tuber moth.
 - (ii) The eggs may be laid in the field itself and damage occur in storage as in red gram infested by bruchid beetle.
 - (iii) The attack may from the material stored earlier and be carried over to fresh material stored in the same storage house as in the grain weevil.

[D] Classification on the basis of economic damage

1. **Major pest:** The pest causing 10% or more damage to crop is called as major pest e.g. sucking insect of cotton.

2. **Minor pest:** The pest causing only 5-10% damage (loss) to crop is called as minor pest. e.g. mealy bug of sugarcane.
3. **Negligible pest:** The pest causing loss of crop production less than 5% is called as negligible pest e.g. gray cotton bug.

[E] Classes of pest on the basis of feeding on crop.

1. **Monophagous pest:** Pest in this class gets food from specific single crop hence called monophagous pest, e.g. hoppers of mango.
2. **Polyphagous pest:** Pest feed on many crops is known as polyphagous pest. e.g. gram pod borer.
3. **Oligophagous pest:** Pest feeds only on special crops is called oligophagous e.g. spotted bollworm of cotton.

[F] On the basis of outbreak of the pest

1. **Epidemic pest:** Irregular large scale infestation of insect at specific time in a particular area e.g. grass hoppers on jowar.
2. **Endemic pest:** When insect infestation is regular in large scale but at particular place then that pest is called endemic pest. e.g. white grub on sugarcane at riverside of kumbhi.
3. **Economically important pest:** The insect population is always above economic threshold level and require repeated control management for that pest. In spite of regular control measures insect population crosses economic threshold level. e.g. gram pod borer.

Type of diseases: On the basis of various criteria disease are classified as below.

(A) On the basis of symptoms of disease.

1. **Mosaic:** Due to uneven development of chlorophyll when colour variation and alternate light green patches develop on plant that disease is called as mosaic.

2. **Blast** : When the entire leaf blade, bud or other plant parts are involved resulting in quick death of the parts or whole plant that disease is called blast. e.g. blast in rice.
3. **Rot**: In such disease affected tissues get disintegrate. e.g. root rot, stem rot, collar rot, etc.
4. **Smut**: In this disease there is development of sori which are filled with masses of spore that gives them deep brown or black colour. The malformation affects floral structures, buds and leaves. e.g. jowar smut.
5. **Cankers**: Corky growth often develop in affected parts. It causes localized death of the tissue but in several infection they may girdle the stem and kill the plant. e.g. cotrus canker.
6. **Rust**: Infection begin when a spore lands on plant surface. Infection is limited to plant parts as leaves, petioles and tender shoots. It may display signs of infection such as rust fruiting bodies e.g. Wheat rust.

(B) On the basis of affected plant parts.

1. Root disease : e.g. Root rot
2. Stem disease: e.g. Tumours
3. Flower disease : e.g. Smuts
4. Fruits disease : e.g. Scab
5. Leaf disease : e.g. Leaf spot

(C) On the basis of spread and intensity

1. Endemic: When a disease occur more or less constantly prevalent from year to year in moderate to severe form in a particular area. e.g. Wart disease of potato is endemic to Darjeeling.
2. Epidemic or epiphytotic: A disease occurring periodically but in a server or involving major area of the crop. It may be constantly present in locality but occur severe occasionally. e.g. Rust.
3. Sporadic: Disease that occur at very irregular interval and location in a moderate to severe form e.g. Wilt.

4. Pandemic: Disease occurring throughout the continent or sub -continent resulting in mass mortality. e.g. late blight of potato.

(D) On the basis of cause (pathogen).

1. Infectious : Causal organisms may be fungi, bacteria, viruses, nematodes, higher parasitic plants.
2. Non infectious : Disease caused by nutritional deficiencies e.g. Khaira disease of rice due to Zn deficiency.

(E) On the basis of host plants

1. Disease of Cereal
2. Disease of Vegetable
3. Disease of Legume crop
4. Disease of Flower crop



Use your brain power

Infectious

- | | |
|--------------|-------------|
| 1. Fungal | 2. Bacteria |
| 3. Viral | 4. Nematode |
| 5. Parasitic | |



Try this

- Prepare a glass slide from disease plant part and observe under microscope.
- Visit the field and record following observations
 - (a) Difference between healthy and infected plant
 - (b) Symptoms of disease
 - (c) Changes in next few days

11.2 Principles and methods of pest and disease control

Principles of pest control may have two approaches viz. control planning against a pest or disease and control planning for crop.

Control planning against a pest and disease is directed against a specific pest without taking in to account of other pest of the same crop.

Control planning for crop involves a plan in which all insect pest, diseases are taken in consideration. The second approach is of more practical value for farmers because they are interested in increasing productivity of the crop hence prefer a plan that can provide safeguard against all possible pest occurring on the crop. This control planning is based on the following principles.

1. Prevention of pest and pathogen.
2. Avoid entry of pest and pathogen.
3. Removal and destruction of pest or diseases.
4. Chemical control of pest and diseases.
5. Development or production of pest or disease resistant plants.

In accordance with the above stated approaches to the pest and disease control the methods of the pest control are as follows.

11.2.1 Methods pest control

1. Cultural control methods
2. Mechanical methods
3. Physical methods
4. Legal methods
5. Biological methods
6. Chemical methods

1. Cultural control methods :

These tactics may include

- (a) Selection of seeds
- (b) Clean cultivation
- (c) Provision of alternate hosts
- (d) Crop rotation
- (e) Tillage operation
- (f) Timing of planting and harvesting
- (g) Cultivation of trap crops
- (h) Nutrient management
- (i) Plant density

Handpicking of infested plant parts along with pests is effective in controlling the pests e.g. the easily detectable egg masses of rice stem borer can be handpicked and killed.

Trenching is very good method for controlling locusts at nymphal stages.

Selection of seeds and cultivars: Seed damaged by insects or other pest, if sown may cause poor germination or poor health of seedling. Seed of resistant crop varieties should be used for crop production.

Clean cultivation: Disposal or destruction of crop residues removes residual pest population e.g. pink bollworm larvae.

2. Mechanical control

- (i) Hand picking of infested plants and destruction
- (ii) Netting, Bagging and dislodging of insect pest
- (iii) Trenching
- (iv) Burnings
- (v) Hitting and crushing
- (vi) Insect barriers or mechanical excluders
- (vii) Insect traps
- (viii) Provisions of bird perching objects

3. Physical method :

Use of certain physical forces for eradication of insects e.g. kaolinite clay mixed with stored grains. It also includes use of heat, moisture, light, etc.

4. Legal methods :

Legislation to prevent introduction of new pest, prevention of already established pest, regulate the activities of men engaged in pest control operation.

5. Biological methods :

Control of a pest by means of another living organism that is encouraged and spread by man is called as biological control. The natural enemies of insects, parasites and predators, diseases causing viruses, bacteria, fungi, parasitic nematodes, etc. are used to control pest.

6. Chemical methods :

Various common pesticides are used for controlling the insects. The natural or synthetic chemicals that directly cause the death, repulsion or attraction of the insects are used in this method.

The pesticide is chemical or a mixture of chemicals employed to a kill pest. The term pesticide encompasses insecticide, herbicide, rodenticide, fungicide and other substance.

Protection: Preventing infection by creating a chemi-toxic barriers between the plant surface and pathogen

- Chemical treatment
- Chemical control of insect vector
- Modification of environment

Resistant varieties

Preventing infection or reducing effect of infection by managing the host through improvement of resistance in it by genetic manipulation or by chemotherapy

- Selection and hybridization
- Mutation

The following formula is used for preparation of spray solution to find out the quantity of insecticide required for treating an area at a required.

$$N_1 V_1 = N_2 V_2$$

Or

Quantity of insecticide required =

$$\frac{\text{Total quantity of spray solution} \times \text{Strength in percentage of spray solution desired}}{\text{Strength of the chemical available}}$$

Example : Find out the quantity of Chlorpyrifos 20 % EC required for treating an area which required 1000 liters of spray fluid at 0.02 % strength.

Solution : Formula

$$N_1 V_1 = N_2 V_2$$

Where

N_1 – Strength of the chemical

V_1 – Quantity of insecticide

N_2 – Strength of spray solution desired in percentage

V_2 – Total quantity of spray solution required

Quantity of Chlorpyrifos required

$$V_1 = \frac{N_2 \times V_2}{N_1}$$

$$V_1 = \frac{0.02 \times 1000}{20} \\ = 1 \text{ litre}$$

Precautions and care to be taken during application of pesticides

- (1) Select only proper insecticide / fungicide.
- (2) Keep pesticides in their original containers with label.
- (3) Read carefully information about precautions and first aid.
- (4) Store the pesticides beyond the reach of children, away from food and food materials.
- (5) Wear protective appliances while application.
- (6) Do not drink, eat or smoke while handling pesticides.
- (7) Do not use defective equipment.
- (8) Spray along with wind direction.
- (9) Wash all equipments after handling pesticide.
- (10) Take care for avoiding contamination of tanks, ponds, wells and other sources of water
- (11) Use pesticide in appropriate concentration against particular pest.

Storage and handling of pesticides

Pesticides are toxic to human being and animals. They should be handled with at most

care. The following precautions should be taken while storing and handling of pesticides.

- (1) The pesticides should always be stored in their original containers.
- (2) They should be stored away from food, fodder and medicines. They should be kept out of reach of children and domestic animals.
- (3) Containers of pesticides should be cut open with separate knife and the empty containers should be destroyed properly.
- (4) The instructions found on the labels should be strictly followed.
- (5) Avoid contact of pesticides with skin or clothing.
- (6) Avoid smoking, chewing, eating or drinking while mixing or applying the chemicals.
- (7) Make the spraying or dusting in cool and calm weather and in the wind directions.
- (8) Sprayer nozzles should not be blown by mouth if gets blocked while spraying.
- (9) Washing of equipments in or near wells or street should be avoided.
- (10) Contaminated parts should be buried.

11.2.2 Disease control / management

What is meant by control measure of disease?

Can you tell approaches regarding plant disease control. Measures taken to prevent incidence of a disease, spread of diseases and minimize the loss caused by the disease is called as control measure. The aim of disease control is to check the loss of economic gain from the crop. If the control measure fails to increase economic gain even if disease incidence is reduced, farmer will not accept the recommendations for plant disease management.

The principle of plant disease management have two approaches viz. management of a single disease of crop and planning for overall health of crop. Management planning for

disease is against a specific disease that causes heavy loss without taking in to consideration other diseases of the same crop. Management of crop health involves plan in which all diseases of crop are taken in to consideration, although major stress may be against the severe disease. The second approach is difficult for farmer but have more practical value.

General principles

1. Avoidance : It involves avoiding disease by planting at time when, or in areas where inoculums are absent or ineffective due to environmental conditions.

Main practice:

- (1) Selection of planting material
- (2) Modification of cultural practices.
- (3) Escaping varieties
- (4) Choice of geographical area
- (5) Selection of the field
- (6) Sowings / planting time

2. Exclusion: It restricts the movement of diseased plant materials to the area free from the disease concerned.
3. Eradication: It involves eliminating the pathogen from infested areas.
4. Protection: These are measures used to prevent the onset of a disease on a crop to protect the host from attack by the pathogen.
5. Host resistance: It utilizes in build mechanism to resist various activities of pathogen. The infection or subsequent damage by pathogen can be rendered ineffective through genetic manipulation or by chemotherapy.
6. Therapy : It is the treatment of infected host plant

The first five principles are mainly preventive (prophylactic) and these are applied to the population of plants before infection takes place. Therapy is curative procedure and is applied to individual after infection has taken place.

Method of disease control

1. Exclusion of the pathogen

- (i) Quarantine (Lejal method)
- (ii) Inspection and certification
- (iii) Seed treatment
- (iv) Eradication of insect vectors.

2. Avoidance of the pathogen

- (i) Choice of geographical area
- (ii) Selection of field
- (iii) Choice of time of planting
- (iv) Disease escaping varieties
- (v) Selection of seed and planting material

3. Eradication of pathogen

- (i) **Heat treatment** : Seed/stock
Tools and implement
Soil

4. **Biological** : Antagonists
Hyper parasite
Mycorrhizae
Cross protection
Control of weeds and pests

5. Cultural practices -
Crop rotation
Fertilizer application
Storage disinfection
Sanitation
Removal and destruction of diseased plant.

6. Chemical control :

Information on Important method

Cultural methods

In this methods pest or pathogen population is either eliminated or reduced by farm practices

- (i) Crop rotation: Growing of crops which are hosts of pest in a successive manner results in increase of population of that pest. When crop rotation with non- host crop is done, population of pest is reduced because the insect is excluded from its food supply. Lady's finger followed by cotton crop suffers from increased pest infection.

Most of diseases are caused by soil born pathogens and can be significantly reduced by crop rotation. The success of crop rotation for disease control depends on proper selection of crops in the sequence.

- (ii) Mixed cropping: Mixed cropping is intended for getting some return from an area if one crop is attacked the other escapes. Mixed cropping of pigeon pea and sorghum give significant reduction in the incidence of wilt of the pigeon pea.
- (iii) Sanitation – Destruction of crop debris by burning the field decreases parasites. Sanitation is very important when diseased crop residue is left on the field.



Always remember

Basic requirement for plant disease control

1. Clean and healthy seeds
2. Clean field, pathogen free soil.
3. Prevent entry of pathogen in standing crop.
4. Precautions during harvesting and storage.

Chemical control

In this method protective toxic layer on host surface is formed so that when it comes in contact it is killed or prevented from growth.

Spraying and dusting with fungicides protect plant from infection of disease. The chemical act externally to destroy the organism on the plant surface or act from within a systemic manner to eliminate a pathogen already established in the host.

Fungicide is a chemical which is capable of killing fungi.

Fungicide based on their mode of action can be grouped as follows.

1. Protectant : Fungicides which is effective only if applied prior to fungal infection is called Protectant e.g. Sulphur
2. Therapeutant: Fungicides having capacity

to eradicate fungi after it has caused infection e.g. carboxin.

3. Eradicant: Eradicant are those chemicals which remove pathogenic fungi from infection court e.g. organic mercurial.
4. Systemic fungicides: Any compound capable of being freely translocated after penetrating plant is called systemic. This type of fungicides could eradicate established infection and protect the new parts of the plant. e.g. Carboxin, Benlate.
5. Antibiotics: Antibiotic is defined as a chemical substance produced by microorganism which in low concentration can inhibit or kill other microorganism.

Biological control

Biological control is nothing but control of plant disease using living micro organism

The bio control agent parasitizes the pathogen by coiling around the hype e.g. *Trichoderma viride*. Various bacteria and fungi secrete enzymes which degrade the cell wall of pathogen e.g. *Bacillus sp.*

11.2.3 Integrated Pest Management (IPM)

Integrated pest management is a system that utilizes all suitable techniques in compatible manner to reduced and maintain pest populations at levels below those causing economic damage.

Principles of integrated pest management

1. Identify pests, their hosts and beneficial organisms before taking action.
2. Establish monitoring guidelines for each pest species.
3. Establish an action threshold for the pest.
4. Evaluate and implement control tactics.

IPM comprises strategies aimed at minimizing pest damage through the careful integration of available pest control technologies.

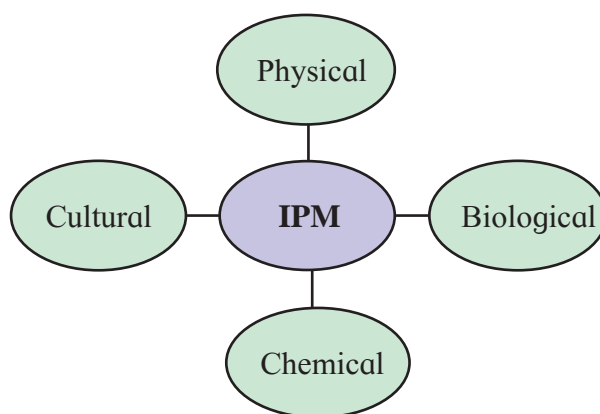
Objective of IPM

1. To reduce pest status below economic damage level.
2. To manage insects by not only killing them but by preventing feeding, multiplication and spread.
3. To use ecofriendly methods.
4. To make maximum use of natural mortality factors and apply control measures only when needed.
5. To use components in suitable crop production

Requirements for successful pest management

1. Correct identification of insect pest
2. Life history and behavior of the pest
3. Natural enemies and weather parameters affecting pest population
4. Pest forecasting and predicting pest outbreak
5. Need and timing of control measure
6. Selection of suitable method of control.

Integrated pest management



11.2.4 Integrated Disease Management (IDM)

Definition

Integrated plant disease management can be defined as a process involving co-ordinated use of multiple methods of optimizing the control of pathogen or it is a disease control methods that uses all types of management techniques to keep disease pressure below the economic threshold level.



Use your brain power

1. Can single control methods is effective for pest or disease control?
2. Is it possible to use control methods simultaneously?
3. What is your opinion regarding biological control methods?

Technique use in IDM

1. Maintaining plant population
2. Balanced fertilizers application
3. Avoid alternative host during off season
4. Avoid coincidence of susceptible stages with disease favorable conditions,

Advantages

1. It does not allow the development of disease resistance in the plant.
2. It is ecofriendly and does not harm the nature.
3. It is economical and efficient method for disease control.
4. Plant disease of crop are managed by minimum number of operations and repetition for each separate disease.

Introduction to scientist

Tarakad Vaidyanatha Ramakishana Ayyar was an Indian entomologist who was born at Tarakad in Palghat. In 1908, he took charge of entomology education at college of Agriculture, Coimbatore. He was a founder of the entomological society of India. Hand book of economic entomology for south India was written by him.



11.3 Important pests

Sr. no	Name of pests	Nature of Damages	Control Measures
Sugarcane			
1	Top shoot borer	Larva feeds on the leaves and later bore in to the shoot	Remove and destroy infected shoots, spray the crop with quinalphos.
2	Sugarcane stem borer	Larva bore hole in to the stem and feeds on inner matter. The affected plant dries up.	Remove dry plant parts, spray the crop with monochrotophos
3	Mealy bugs	Nymph suck the cell sap. In severe infestation canes shriveled and remain stunted.	Sets treatment with 1% fish oil, rasin soap solution before planting
4	Wooly aphids	Infestation starts beneath the leaves along the midrib and later on spread to entire lower surface. Huge insect population suck cell sap.	Clip and destroy affected leaves of initial stage, spray the crop with mixture of malathion and dimethoate.
5	White grub	The fleshy grubs are highly destructive to the roots and underground stalks of cane . The damage to sugarcane by grubs is noticeable during July to September	Collection and destruction of adults and grubs. Application of phorate granules @ 25 kg / ha
Cotton Pest affecting before flowering			
1	Aphids, Jassids, Thrips Whiteflies	Pest of this group suck the sap from leaves and tender parts causing their yellowing and curling.	Spray insecticide belonging to organo phosphorus group (e.g. chlorphyriphos)
Pest affecting after flowering			
2	Spotted boll worm, Pink boll worm, American boll worm	Larva bore hole on bolls and feeds on it, boll rotting takes place that result in shedding of bolls	All boll worms can be controlled by spraying of insecticides like acephate, chlorpyriphos
Paddy			
1	Stem borer	Larva enters the leaf sheath feeds on it and bore in to stem near to the nodal region.	Collection and destruction of egg masses, spray phosphomidon
2	Gall fly	Maggot infestation is seen on growing points of the plants and produces long tubular structure which is covered by silvery shoots.	Remove and destroy affected plant parts

Soybean			
1	Stem borer	Larva causes damage by tunneling the stem and side branches plants dry and affect yield.	Spraying of chloropyriphos on crop controls the pest.
2	Pod borer	Larva bores hole in pod and feed on developing seeds	Pod borer can be controlled by spraying monocrotophos
3	Hairy caterpillar	Pest cause damage by feeding on young leaves	Spray monocrotophos insecticide, plough land immediately after harvesting
Onion			
1	Thrips	Nymph and adult suck the sap from the leaves. Bulb yield is affected	Spray dimethoite at 15 days interval.
2	Jassids	Jassids also suck the sap from leaves and make spot on it	Spray monocrotophos.
Potato			
1	Tuber moth	The caterpillar feed on the leaves and attack the exposed tubers. It makes a tunnel in the tubers and feed on inner matter.	Earthing up to plants and spraying of carbaryl
2	Cut worm	The larva remains hidden in soil, larva cut the young potato plant at the ground level and feed on tender leaves.	Collect and destroy the larva. Application of carbaryl
Mango			
1	Mango – hopper	Adult and nymphs suck sap from tender shoots and flower panicles, secretion of honey dew like substance on leaves results in the sooty mold growth on affected portion	Spraying of malathion or monocrotophos at panicle emergence and peak fruit setting stage.
2	Fruit fly	The maggots feed on flesh and affected fruits become unfit for consumption. The fruit fly lays eggs in the clusters under the skin of fruit just before ripening. The affected fruits begin to rot and drop.	Collection and destruction of damaged fruits Spraying of malathion. Use fruit fly trap
Pomegranate			
1	Fruit borer	The caterpillar bores into the fruit and feeds on the internal contents. The affected fruits fall and rot	The fruit screened with polythene paper bags may escape infestation, spray the crop with carbaryl

2	Bark eating caterpillar	The caterpillar bores into the bark and feeds inside. Tree becomes weak and collapse in severe cases.	Clean the hole and put the cotton dipped in petrol in it.
3	Fruit sucking moth	Adult moth suck the juice from ripened fruits with the help of spines by making puncture after sunset during the rainy season. Pin hole spot appears on fruits	Keep poison bait malathion + molasses+ water) spray tree with carbaryl
Citrus			
1	Citrus butterfly	The adult feed on the leaves from the margin towards the mid-rib and defoliate branches	Hand picking of larva spraying of malathion is effective against pest.
2	White fly	Adult and maggots suck the cell sap from tender shoot and leaves, yellow patches are formed on surface of leaf	Spray tree with monocrotophos
Coconut			
1	Rhinoceros beetle	Caterpillar burrows and cut across the leaf in its folded conditions. Death of growing points.	Hook out beetles from affected palms. Fill the leaf axils with chlordane dust.
2	Red palm weevil	Adult feeds on soft tissue inside trunk	Inject carbaryl in the trunk of infested tree.
3	Mites	Mites feeding on young and developing nuts causes superficial bands with necrotic tissue about the circumference of the nuts	Root feeding with carbosulfan, spray fenpyroximate.

11.4 Major diseases of crop

Sr. no	Name of Disease	Symptoms	Control Measure
Sugarcane			
1	Whip tail (smut)	This is fungal disease, long whip like structure comes out from the growing point. This is covered with black powder.	Use healthy sets for planting, treat sets with fungicide like cerasan.
2	Red rot	In this fungal disease on splitting red strips are observed. In severe cases rotting and alcoholic smell come out.	Treat the sets with fungicide like Agalol.
3	Grassy shoot	In affected plots to many lateral tillers arises with light green to dark green in colour.	Treat the sets with hot water at 50° C for two hours.

4	Rust	Numerous small but long yellow coloured spots appear on both the surfaces of leaves. These spot later on turn dark brown to black.	Grow resistant variety.
Paddy			
1	Blast	The fungus attack all aerial parts at all stages of growth. Spindle shaped spots whitish gray with brown margin are originated on leaf, neck of panicle, nodes, glumes, etc.	Use of disease free seeds, spray copper fungicides, systemic fungicides are very effective in controlling blast.
2	Bacterial blight	Initially dull greenish water soaked or yellowish spots on leaf margins are observed, these spots extend into lesions to form blighted portions. On drying these form minute crusts.	Hot water treatment for 10 minutes at 52-54 ^o C. Sock seed in Agrimycin for eight hours. Spraying of streptomycine.
3	Stem rot	Affected plants remain stunted, they produce tillers, root become reddish stem, root rot, grain get shriveled	Avoid extra standing water in the field. Apply fungicides like cerasan at the ease of plants.
Cotton			
1	Wilt	It is fungal disease. Gradual drying and dropping of the plant is observed. The wiltings and dropping starts from top to bottom.	Grow resistant varieties, seed treatment with fungicides like cerasan.
2	Anthraco nose	In this disease fungal infection starts in seedling stage. In seedling stage red circular spots are found on leaves. Affected bolls show brown circular spots. These do not open properly to from kawadi. Shedding of bolls take place.	Seed treatment with fungicides, spray 1% Bordeaux mixture.
3	Dahiya (powdery mildew)	The affected leaves show whitish growth on underside of older leaves, defoliation of leaves take place.	Grow American cotton varieties, spraying of sulphur
4	Root rot	Rotting of roots and sudden wilting of plants.	Seed treatment with carbandazim
5	Black arm	This is bacterial disease, bacteria attack on aerial plants parts, angular water soaked spots appear on leaves, it also causes rotting of bolls	Seed treatment with streptomycin check the disease.

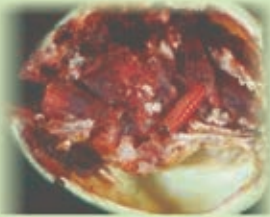
Soybean			
1	Bacterial blight	Reddish – brown spots having yellow margin appear on the leaves and pod .	Grow resistant varieties, seed treatment with fungicides like cerasan
2	leaf spot	Brown spots appears on upper surface of the leaves and other plant parts.	Seed treatment with thirum spray the crop with thirum or with Dithane M-45
3	Downy mildew	On leaves upper surface small yellow spots appear which turn to brown in later stages, under side of leaves show whitish downy growth.	Seed treatment with thirum. Grow resistant varieties.
Onion			
1	Seedling blight	Disease infection starts in early stage on leaves, yellowish or brownish patches are developed.	Spraying of 1% Bordeaux mixture.
2	Smut	It is fungal diseases. The fungus attack on young seeding, dark thickened areas on small leaves occur, leaves are swollen and dry to bent.	Treat the seed with thiram, grow disease resistant variety, apply fungicides in furrow.
Potato			
1	Early blight	Disease infection starts in early stage, with brown spots on leaves. In severe cases leaves shriveled and fall down	Spraying of Bordeaux mixture
2	Late blight	In later stage of crop growth it is serious disease, brown spots develop on leaves and rapidly spread on stem and tubers.	Use of disease free sets for planting. Spray Dithane Z-78
3	Ring rot (bacterial wilt)	It is bacterial disease, leaves turn yellow plants get dry, brown spot are observed when tubers are cut.	Use disease free tubers. Follow proper crop rotation.
Mango			
1.	Powdery mildew	It is fungal disease, grey white powdery patches appears on the blossom and fruit, affected panicles gets dry and turn back.	Application of wet table sulphur Spray Benlate 0.1 %
Pomegranate			
1	Bacterial leaf Spot (Telya)	Disease is characterized by the appearance of many dark coloured, irregular spots the leaves they drop off prematurely. The bacterial infection of fruits cause dark brown spots with an oily appearance.	Spray Dithane M 45

2	Fruit rot	The small irregular spots surrounded by greyish yellow border are observed on the fruit rind. Arils become brownish in colour.	Spray tree with dithane m-45 at the time of fruit development at interval of 15 days.
Citrus			
1	Citrus canker	It is bacterial disease of citrus. The lesion appear first as minute water soaked roundish spot which turn brown. Due to severe infection of leaves there may be defoliation. The lesion on fruit reduces market value of fruits.	Periodically spray streptomycin sulphate or Bordeaux
2	Gummosis	Fungal infection starts with forming water soaked large patches on stem. These patches soon turn brown and bark may spilt, through which a gum like liquid ooze exudes.	Scrapping off the infected portion Apply Bordeaux paste on the stem up to 60 cm from bottom.
3	Citrus decline (die – back)	Drying and die back of small branches and twigs begins with infection of this disease. In severe cases chlorosis and mottling is observed reduction in leaf size and wilting is observed. Roots become dead, the bark of larger roots is distorted and brittle.	Good drainage is beneficial for checking of disease, periodical spray against insect vector.
Coconut			
1	Bud rot	Fungal infection starts with yellowing of young leaves surrounding the spindle, the tender leaf base and soft tissues of crown rot in to slimy mass.	Application of Bordeaux paste.
2	Root wilt	Yellowing and marginal necrosis of the leaflets. Nuts are smaller, kernel is thin.	Application of fertilizer along with $MgSO_4$ Grow hybrid varieties

Pest of crop plants



Red cotton bug



Pink boll worm in cotton



Lemon butterfly larva



Lemon butterfly



Paddy hopper



Mealy bug



Woolly Aphid



Fruit sucking moth of pomegranate



Whitefly



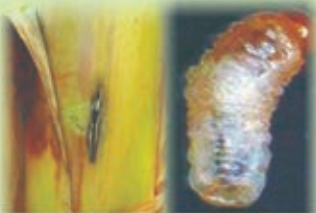
Aphids



Mango stone weevil



Damage by Mango stone weevil



Damage by Banana pseudostem grub



Mango Fruit fly



Sugarcane stem borer



Adult of Leaf roller in grape



Damage by Leaf roller in grape



Citrus black fly



Citrus fruit sucking moth

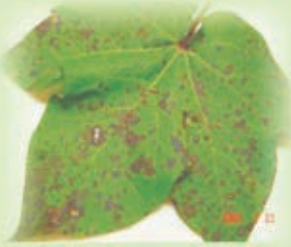


Jassid

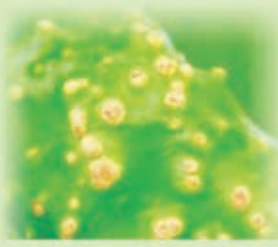


Damage by Sugarcane stem borer

Diseases of crop plants



Leafspot of Cotton



Citrus scab



Whip smut of sugarcane



Citrus canker



Yellow vein mosaic of papaya



Black rust of wheat



Loose smut of wheat



Red rot of sugarcane



Fruit rot of papaya



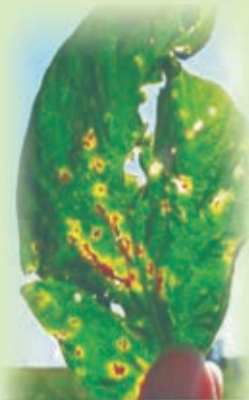
Soybean harvesting



Downy mildew of jowar



Tikka or leaf spot of groundnut



Bacterial blight in soybean



Anthracnose of Cotton



Wilt of cotton

Exercise

Q. 1 A. Fill in the blanks.

1. Physiological or structural deformity that is harmful to plant or reduce its economic value is called as
2. Pyrilla is serious pest of crop.
3. Use of insecticide to control pest is method of pest control.
4. Root rot disease infection normally observed in growth stage of plant growth.
5. Infestation of bollworm in cotton is difficult to identify.

B. Make the pairs.

'A' Group

1. Soil insect
2. Sap suckers
3. Store grain pest
4. Chewing insect

'B' Group

- a. Aphid
- b. Grain weevil
- c. White grub
- d. Housefly
- e. Boll worms
- f. Cutworm

C. State true or false.

1. Paddy gall fly is important disease of paddy crop.
2. Citrus dieback is serious disease of sweet orange crop.
3. Biological control method is hazardous due to residual effect on human health.
4. Sugarcane red rot disease can be control by hot water treatment.
5. Plants protection focus only on mineral management.

Q. 2 Answer in brief.

1. Write note on pest control
2. Give examples of regular pest.
3. Write down nature of damage by white grub to sugarcane crop.
4. Give types of pest on the basis of damage.

Q. 3 Answer the following questions

1. Describe the biological method for insect pest control.
2. Classify plant diseases on the basis of symptoms.
3. State advantage of integrated disease management.
4. Write the nature of damage and control measure for citrus pest.

Q. 4 Answer in detail.

1. Describe integrated disease management
2. List out the control methods for pest and diseases and explain cultural methods.
3. State principles of disease control.
4. Explain sugarcane pest management in detail.
5. Complete the following table

No.	Name of pest	Nature of damage/symptom	Control measure
1	Citrus butterfly	-	-
2	Mango hopper	-	-
3	-	Bore holes in to bolls and after entry block it on splitting	-
4	Red rot	Red strip and rotting observed	-
5	-	-	Hot water treatment of sets.

Activity :

Practice different methods of pest and disease control whichever possible at your locality