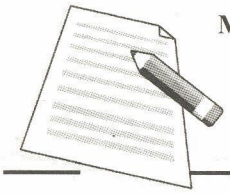


Module-2

Notes

INTEXT QUESTIONS 4.2

1) Match the followings:

A	B
1. Mango	a) Thompson seedless
2. Banana	b) Ganesh
3. Papaya	c) Co - 1
4. Pomegranate	d) Dwarf Cavendish
5. Grape	e) Alphonso

4.5 STUDY OF VEGETABLE CROPS

More than 50 vegetable crops from different families are grown in India. India is the second largest producer of vegetables. India ranks first in production of Cauliflower, ranks second in Onion and third in Cabbage. West Bengal, Orissa, U.P., Bihar and Maharashtra are the major vegetable growing states.

Vegetables are important protective food stuff. They provide vitamins and minerals to our body and are very cheap source of digestive fibre. As the majority of Indian population is vegetarian, the demand for vegetables in domestic markets is very high. As the per capita consumption of vegetables is low in India, there is great scope for improving production and productivity of vegetable crops.

Information about some important vegetable crops is given below in tabular form:

Name of the crop Particulars	Tomato	Cabbage	Brinjal	Cauliflower	Potato
Botanical Name	***Lycopersicon esculentum***	***Brassica oleraceae Var.capitata***	***Solanum melongena***	***Brassica oleraceae Var. botrytis***	***Solanum tuberosum***
Soil	Clay, black, red soils	Clay loam, Silt pH 5.5-6.5	Fertile sandy loam	Sandy loam to clay loam	Well drained sandy loam
Climate and season	Warm and mild	Cool season crop, rabi	Frost free long warm, summer	Temperate crop, rabi	Cool mild
Varieties	Arka vikas, Pusa. Sheetal, Ratna, Rupali,	Pusa drum head, Pride of India, Golden acre	Arka keshar, pusa kranti, PPR, PPL, Pragati	Pusa dipali, Pusa katki, Pusa shubhra, Snoball-16, K-1	Kufri sinduri, Kufri lawkar, Kufri badshah
Preparation of land	Ploughing , prepare ridges	Ploughing , harrowing, prepare flat beds	Ploughing , ridges opened at 60-75 cm	Ploughing , mixing of organic manure	Ploughing , prepare beds or ridges

Method of Planting	Transplanting of seedling	Transplanting of seedling	Transplanting of seedling	Transplanting of seedling	Cut section of tubers
Seed rate and spacing	300 – 500 g. 45-90 cm.	500-750 g. 60-75 cm X 45-60 cm.	200-400g, 60-75 cm^2	300-500 g, 60-45 cm.	25 q 60-25 cm
Fertilizer	110:80:80 kg NPK per hectare	150:80:75 kg NPK per hectare	100:75:50 kg NPK per hectare	150:80:120 kg NPK per hectare	150:50:100 kg NPK per hectare
Irrigation	6-10 days interval	Regular	Timely light and frequent	5 to 8 days interval	12-15 days interval
Interculture	Weeding, thinning	Earthing up, Weeding	Weeding, earthing up	Hoeing, weeding	Weeding, earthing up
Harvesting and Yield	200-400 q. per hectare	Full size firm heads are harvested, 70-80 tonnes per hectare	Harvest Immature tender fruits , 250-300 q per hectare	Compact white heads are harvested, 250-300 q per hectare	Digging of tubers, 20 tonnes per hectare

Name of the crop Particulars	**Carrot**	**Radish**	**Palak**	**Fenugreek**	**Drum stick**
Botanical Name	Dacus carota	Raphanus sativus	Beta vulgaris	Trigonela foenum graecum	Moringa oleifera
Soil	Well drained light		Well fertile sandy loam	Sandy light, well drained	Sandy red
Climate and season	Cool season	Cool season	Cool, mild climate	Cool climate	Tropical climate
Preparation of land	Ploughing, harrowing, ridges	Ploughing, harrowing, ridges	Ploughing, harrowing, raised beds	Ploughing, harrowing, raised beds	Ploughing, harrowing, Pits are dug
Method of Planting	Direct sowing	Direct sowing	Direct sowing	Direct sowing	Direct sowing, Stumps
Seed rate and spacing	5-6 kg 15 cm	10-15 kg Broadcasting	25 kg Broadcasting	15-20 kg Broadcasting	500 gm. 2.5mX2.5m.
Fertilizer	80:60:50 kg NPK per hectare	65:50:50 kg NPK per hectare	80:50:50 kg NPK per hectare	30:30:30 kg NPK per hectare	45:16:30 kg NPK per hectare
Irrigation	8 to 10 days interval	10-12 days interval	12-15 irrigations	12-15 irrigations	As required
Intercultural	Weeding, earthing up	Weeding, hoeing	Weeding, hoeing	Weeding, hoeing	Weeding, twice in a month
Harvesting and Yield	200 q. per hectare	150-200 q. per hectare	80-100 q per hectare	80-100 q per hectare	500 q per hectare per year

Name of the crop Particulars	Cluster bean	Ridge gourd	Bitter gourd	Water melon	Musk melon
Botanical Name	*Cymopsis tetragonolobus*	*Luffa acutagula*	*Momordica chrancia*	*Citrallus lanatus*	*Cucumis melo*
Soil	Light red Sandy soil	Sandy loam, rich in organic matter	Well drained loamy, pH 6.5-7	Sandy loam, pH 6.5-7	Sandy loam, pH 6.5-7
Climate and season	Hot and Dry	Warm and hot	Along warm summer or rainy	Hot and dry	Hot and dry
Varieties	Pusa Navbahar, Pusa Sadabahar	Pusa Nasdar, Satputia	Arka harit, CO-1, Priya, Pusa vishesh	Arka Manik, Sugar baby, Asahi yamato	Arka Madhu,
Preparation of land	Ploughing, harrowing, ridges and furrows	Ploughing, harrowing, ridges and furrows	Ploughing, harrowing, ridges and furrows	Ploughing, harrowing, ridges and furrows	Ploughing, harrowing, ridges and furrows
Method of Planting	Direct sowing	Direct sowing	Direct sowing	Direct sowing	Direct sowing
Seed rate and spacing	10 to 12 kg / ha. 30 X 30 cm	3.5 kg / ha. 2.5 X 1.0 m	4 to 5 kg/ha. 1.5-2mX1.0m	3to 3. 5 kg/ha 1.5-2mX1.0m	2.5 to 3 kg/ha 1.5m-2mX1.0m
Fertilizer	25:60:30 kg NPK per hectare	25:40:30 kg NPK per hectare	40:30:30 kg NPK per hectare	150:80:80 kg NPK per hectare	150:80:80 kg NPK per hectare
Irrigation	Drought resistant crop only few irrigations	Irrigations as and when required	5 to 6 days interval	3 to 6 days interval in summer	5 to 6 days interval in summer
Interculture	Weeding, hoeing	Weeding, Training	Weeding, provision of support	Weeding, training	Weeding, training
Harvesting and Yield	Harvest tender pods 10 q per hectare	160-180 q per hectare	Harvest tender fruit after 60 – 70 days 100 - 150 q per hectare	300 q per hectare	250 q per hectare
Interculture	Weeding, hoeing	Weeding, Training	Weeding, provision of support	Weeding, training	Weeding, training
Harvesting and Yield	Harvest tender pods 10 q per hectare	160-180 q per hectare	Harvest tender fruit after 60 – 70 days 100 - 150 q per hectare	300 q per hectare	250 q per hectare

INTEXT QUESTIONS 4.3

1) Match the followings:

A	B
1. Tomato	a) Provision of support
2. Bitter gourd	b) Root vegetable
3. Pea	c) Arka anamika
4. Okra	d) Pusa sheetal
5. Carrot	e) Cool season

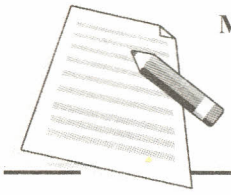
4.6 STUDY OF FLORICULTURAL AND ORNAMENTAL CROPS

Flowers have socio-cultural and religious importance. The cultivation or growing of flowers is practiced in India since ancient time. But in recent years the view of flower production is changed. The potential of this sector in generating income and employment is very high. Further it enhances involvement of women and youth . This sector also provides greater scope for export. Traditionally we are growing flowers such as Jasmin, Marigold, Chrysanthemum, Tube rose, Aster, Crossansra. Now a days commercial cultivation of flowers like Rose, Gladiolus, Carnation, Anthurium, Gerbera, Orchids has become popular. The area under flower crops and the export of flowers has increased significantly in recent years, especially under protected form of cultivation.

1. Ornamental plants : These are the showy plants grown for their attractive foliage and flowers. They have important place in gardens and in pot culture e.g. Croton, Aglonema.
2. Cut flowers: The flowers with out long stalk used for keeping in vases, single offering and for preparing bouquets. e.g. Rose.
3. Loose flowers: The flowers with stalk used for making garlands, festrons, hair decoration. e.g. Jasmine, Crossandra.
4. Fragrant flowers: The flowers with scented essential oil and are used for extraction of essential oil which used in perfumery industry. e.g. Jasmine.

Information about some important flower crops is given below in tabular form.

Name of the crop Particulars	Carnation	Marigold	Chrysanthemum	Gladiolus	Zinia
Botanical Name	*Dianthus caryophyllus*	*Tagetus erecta Tagetus patulla*	*Chrysanthemum maurifolium*	*Gladiolus species*	*Zinnia elegance Zinnia laniaries*
Soil	Rich sandy pH 6-7	Light medium pH 6.5-7.5	Well drained sandy loam	Well drained fertile	Well drained light medium
Climate and season	Cool season, long day plant	Hot & Dry, Hot & humid	Cool & dry, Short days for flowering	Open sunny situation	Hot mild
Propagation	Tissue culture	Seed	Seed, Cuttings	Corms	Seed
Varieties	Arthur sim, Candy, Master, Rivera, Aristotal	Yellow supreme, Hawai, Spray, Flash	Indira, Vasantika, Birbal sahani, Apsara, Himangi	Friendship, Sancere, Suchitra, Blue sky	Scarlet, Golden ball, Dream, White baby
Preparation of land	Soil mixture is prepared and is sterilized with chemicals	Ploughing preparation of flat beds or ridges	Ploughing preparation of flat beds or ridges	Ploughing preparation of flat beds or ridges	Ploughing preparation of flat beds or ridges
Method of Planting	Grown in poly houses, Beds are prepared and seedlings are planted	Transplanting of seedlings	Seedlings are transplanted in pots or beds	Corms are planted	Seedlings are transplanted
spacing	40 X15X 15 cm	60 x 30 cm	30 x 30 cm	30 x 20 cm	30 x 30 cm



Fertilizer	30 : 20 : 20 g NPK per sq m	100 : 50 : 50 kg NPK per ha	400 : 200 : 200 kg NPK per ha	15:10:10 kg NPK per 500 sq m	100 : 50 : 50 kg NPK ha
Irrigation	Drip irrigation	8 – 10 days interval in winter 6 – 7 days interval in summer	Drip irrigation	7– 10 days interval in winter	8 – 10 days interval in winter 6 – 7 days interval in summer
Interculture	Weeding, Loosening of soil	Weeding, mulching, Pinching	Weeding, mulching Disbudding	Weeding, earthing up	Weeding, Punching mulching
Harvesting and Yield	Firm and full grown buds are harvested 1.2 lakh per 5000 m2	Just open flowers are harvested 10-15 tones per ha	Full grown just unfurling flowers are harvested 1.5-2 t / ha	Spikes are cut when one or two flowers are opened	Loose flowers or flowers with stalk are harvested.

Name of the crop Particulars	**Rose**	**Tuberose**	**Aster**	**Gaillardia**	**Gerbera**
Botanical Name	*Rosa species*	*Polyanthus tuberose*	*Callistephus chinensis*	*Gaillardia pulchella*	*Gerbera gemsonii*
Soil	Will drained medium loamy	Well drained, light pH 6.5 -7	Well drained medium	Light red	Fertile, loamy
Climate and season	Cool hilly climate	Tropical, Hot	Mild cool climate	Hot dry or hot humid climate	Mild cool
Varieties	Gladiator, Super star, Double delight	Single, Double, variegated, Rajatrekha, Swarnarekha	Rose pink. White, New boy, Super gaint	Dazzler, Indian chief, Burgundy	Scarlet, Golden ball, Dream, White baby
Propagation Preparation of land	Budding Trenches or pits are prepared	Bulbs Sloughing and harrowing, Preparation of beds	Seeds Ploughing Preparation of flat beds or ridges	Seeds Ploughing Preparation of flat beds or ridges	Seeds, tissue culture Soil mixture is prepared and is sterilized with chemicals
Method of Planting	Budded plants are planted or in situ budding is practicaed	50 gm bulds are treated with fungicide and planted	Transplanting of seedlings	Transplanting of seedlings	Grown in poly houses beds are prepared and Tissue cultured seedlings are planted
spacing	1.5 m X60 cm	40 x 30 cm	45 - 20 cm	45 - 30 cm	30 x 30 cm
Fertilizer	(1 Urea + 3 SSP + 2 k Sulphate) 40 gm per bush	250 : 300 : 300 kg NPK per ha	50 : 50 : 25 kg NPK per ha	50 : 50 : 25 kg kg NPK per	30 : 20 : 20 g NPK PER sq m
Irrigation	Drip 10 days interval	3 to 4 days interval	5 to 6 days accordingly	5 to 6 days accordingly	Drip irrigation
Interculture	Weeding, mulching, Desuckering, Pinching, Disbidding	Weeding, Loosening of soil	Weeding, Loosening of soil	Weeding, Loosening of soil	Weeding, Loosening of soil

Harvesting and Yield	Hirvest along with stalk, 55to 60 thousand per 500 sq ft.	Flowers along Long stalk, loose flower singly [1000-1200 kg m^2 1000	Harvest flowers singly 1000-1200 kg per 500 m^2	Harvested along with 10 -15 cm stalk, Bunch of 4 – 6 flowers	Harvested along with stalk 90,000 – 120,000 per 5000 sq ft.

INTEXT QUESTIONS 4.4

1) Match the followings:

A	B
1. Marigold	a) Desuckering
2. Rose	b) Tissue culture
3. Gerbera	c) Corm
4. Tuberose	d) Bulb
5. Gladiolus	e) Punching

4.7 WHAT YOU HAVE LEARNT

There are four branches of Horticulture viz Olericulture, Floriculture and ornamental gardening, Pomology and Post harvest technology and preservation. Different horticultural crops are grown in India. These crops are very much important for the farmers as they are profitable, nutritious and environmentally beneficial.

Important fruit crops like Mango, Banana, Apple, Coconut, Sapota, and Grape along with other many fruit crops are grown on large scale. Vegetables are the staple food and different vegetables like Tomato, Potato, Cabbage, Brinjal, Root vegetables, leafy vegetables and pod vegetables are grown on large scale.

4.8 TERMINAL QUESTIONS

Q1 Write in detail about cultivation of mango.

Q2 Write in detail about cultivation of banana.

Q3 Write in detail about cultivation of rose.

Q4 Write in detail about cultivation of aster.

Q5 Write in detail about cultivation of tomato.

Module-2

Notes

Q6 Write in detail about cultivation of potato.

Q7 State importance of horticultural crops.

Q8 State and explain the branches of Horticulture.

4.9 ANSWER TO INTEXT QUESTIONS

4.1

A. Fill in the blanks:

1. Hortus and Culture.
2. Vegetable
3. Pomology
4. Aesthetic

4.2

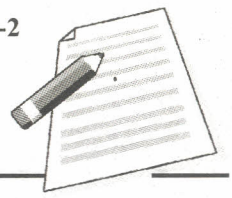
1) Match the followings:

A	B
1. Mango	a) Alphonso
2. Banana	b) Dwarf Cavendish
3. Papaya	c) Co - 1
4. Pomegranate	d) Ganesh
5. Grape	e) Thompson seedless

4.3

1) Match the followings:

A	B
1. Tomato	a) Pusa sheetal
2. Bitter gourd	b) Provision of support
3. Pea	c) Cool season
4. Okra	d) Arka anamika
5. Carrot	e) Root vegetable



4.4

1) Match the followings:

A	B
1. Marigold	a) Punching
2. Rose	b) Desuckering
3. Gerbera	c) Tissue culture
4. Tuberose	d) Bulb
5. Gladiolus	e) Corm

SUGGESTED ACTIVITIES

1. Visit the nearest fruit orchard, cultivating different fruit crops in various stages of growth and study different fruit crops.
2. Visit any vegetable farm for studying different vegetables at different stages.
3. Visit commercial floriculture farm and study different practices of cultivation.

5

STUDY OF DIFFERENT DISEASES OF CROP PLANTS

5.1 INTRODUCTION

Diseases cause huge loss of crop plants. In human being we found diseases like Malaria, typhoid, cholera etc. Likewise plants also get affected by number of disease causing reasons. Plant pathogen or micro-organisms cause various diseases in plants resulting in diseased growth of plants. Various diseases are difficult to cure in case of crop plants as they already caused damage to plant systems before using control measures. Hence, identifying the diseases in early stages and immediate control against them is very much necessary. Early prevention is better controlling the diseases after its spread.

5.2 OBJECTIVES

After reading this lesson, you will be able to understand:

- Importance and causes of plant diseases.
- Classification and modes of spreading plant diseases.
- General symptoms and management of plant diseases.
- Diseases of different crop plants and their control measures.

5.3 PLANT DISEASES

The importance of plant diseases

The study of plant diseases are important as they cause loss to the produce. The various types of losses occur in the field, in storage or any time between sowing and consumption of produce.

The diseases are responsible for direct monitory loss and material loss. Further, these diseases are harmful for the society as they cause stomach disorders, paralysis and liver diseases.

Hence, the diseases are required to be prevented and controlled to avoid loss of valuable food.

The pathogen infects the soil and cause devaluation of land also.

Causes of diseases

A pathogen is always associated with disease. When the plant is suffering its functioning and development is disturbed, we call that as a diseased plant. The pathogen may not be living thing also. Thus the causes of diseases are grouped as follows:-

(A) Abiotic Factors:-

These are the resultants of deficiencies or excess of nutrients, light, moisture, aeration, adverse soil conditions or atmospheric condition etc. These are generally referred as disorders.

(B) Mesobiotic Factors:-

The causal agent is neither living thing nor a non living thing. The diseases caused by viroids and viruses are of this category.

(C) Biotic Factors:-

This category includes diseases caused by living or cellular organization.

1) Eukaryotes: - Fungi, Protozoa, Algae, Nematodes, Parasites.
2) Prokaryotes : Mycoplasma, Rickettsia, Bacteria

Classification of Plant diseases:

1) Endemic diseases: - Endemic means prevalent in and confined to a particular locality. These diseases are more or less constantly present in a particular area.
2) Epidemic diseases: - These diseases occur incidentally and occasionally in a particular locality. The word epiphytotic is used particularly for plant diseases instead of epidemic.
3) Sporadic diseases: These occur at very irregular intervals and locations.

Modes of spreading of diseases:

1) Soil borne diseases: - Inoculums of the diseases causing pathogen remains in soil and penetrate the plant resulting in diseased condition e.g. Root rot, wilt.
2) Seed borne diseases: - The micro organisms are carried along with seeds and cause diseases when congenial condition occurs. E.g. Damping off.
3) Air borne diseases: - The micro-organisms are spread through air and attack the plants causing diseases. E.g. Blight, rust, powdery mildew.
4) Diseases spread by insects: The viral diseases are spread by insects. The insets which carry the viruses are known as vectors.

General Symptoms and diagnosis of plant diseases

Evidence of disease shown by plant is called symptom. Symptoms are seen on the plant either due to character and appearance of the visible pathogen or its structure or organs or due to some effect upon or change in the host plant.

A) Symptoms due to visible pathogen

The pathogen is visible when they are in larger size or in sufficient mass, such symptoms are as follows:

i) Mildew: - Pathogen is seen as a growth on the surface of the host. Downy mildew and powdery mildew.

ii) Rust: - Rusty symptoms are seen on the host epidermis Red, Green, yellow and black rust.

iii) Smuts: - Sooty or charcoal like powder appears on floral organs, smut symptoms also found on stem, leaves and roots.

iv) White blisters : Numerous white blister, like pustules are seen.

v) Scab: Crust like lesion on the diseased organs.

vi) Sclerotia: A compact, often hard, mass of dormant fungus mycelium.

vii) Blotch: Superficial growth giving the fruit a blotched appearance.

viii) Fruiting bodies: Relatively large spore bearing structures which are either fleshy or woody.

ix) Exudations: mass of bacteria oozes out to the surface of affected organ.

x) Tar spots: Raised, black coated fungus bodies with the appearance of a flattened out drop of tar on leaves.

B) Symptoms due to some effect on host plant

1) Colour changes, Discoloration, Chromosis, and Chlorosis.

2) Overgrowth

Galls, Curl, bladder, witches broom, hairy root,

3) Dwarfing stunted growth

4) Necrosis

Spots, strips, blight, damping off, scald, scorch, rot.

5) Anthracnose: ulcer like lesions on stems, leaves, pods.

6) Dieback: Drying of plant organ from the tip backwards.

7) Wilts : Drying or wilting of entire plant

8) Miscellaneous symptoms.

Change in habit, dropping of leaves, flowers, fruits, destruction of organs etc.

Management of plant diseases:-

For control and prevention of plant diseases various methods are followed. According to the pathogen involved, symptoms and crop affected the method is selected. Prevention is always better but timely control also helps in reducing the losses.

1) Use of resistant varieties: This is very useful easy and low cost method for preventing the diseases. Growing resistant varieties to particular disease is important.

2) Use of cultural methods: Proper ploughing, harrowing, timely sowing, balance fertilization and irrigation, crop rotation, mix cropping, proper drainage are the cultural method for protecting crops from diseases.

3) Chemical Control: Use of fungicides as a seed treatment and for spraying is a method of controlling various diseases. Spraying insecticides to control disease spreading insects is also essential to protect the crops from viral diseases.

Fungicide - Any chemical used to kill or inhibit growth of fungi that cause economic damage to crop or ornamental plants (including rust in cereals, blight in potatoes, mildew in fruits)

Most are applied as sprays or dust; seed fungicides are applied as a protective coating to seeds before germination. Copper compounds, especially copper sulfate mixed with lime and water (Bordeaux mixture), and sulfur have long been used for this purpose, but now synthetic organic compounds are commonly used. Many antifungal substances occur naturally in plant tissues.

4) Biological methods: Use of natural extracts and micro-organisms to protect the crops from diseases is safest method from environmental point of view.

5) Legislative control: To control spread of diseases from other countries each country has its own legislation.

Terminologies:

Disease or disorder: These two terms are synonymous. The malfunctioning of plant body is known as disease or disorder. The term disease includes all types of harmful physiological changes in the plant while non infectious changes due to abiotic factors are termed as disorders.

Pathogen: The agent responsible for suffering plant body.

Parasite: The organisms which derive the food material from the host plant.

Infections: Establishment of parasitic relationship between the pathogen and the host following the entry or penetration.

Symptom: Any evidence of disease or disorder shown by plant is called symptom.

Syndrome: A set of symptoms characterizing a disease is collectively called as syndromes.

Fungus: It is a eukaryotic protests, chlorophyll less nucleated, unicellular or multicellular filamentous micro-organism.

Virus : Microscopic, simple infectious agent that can multiply only in living cells of animals, plant, or bacteria.

Bacteria : Group of microscopic, single-celled organisms that inhabit virtually all environments, including soil, water, organic matter, and the bodies of multicellular animals.

Viroid : Infectious particle that is smaller than any of the known viruses

INTEXT QUESTIONS 5.1

1. Match the followings:

A	B
1. Mildew	a. Prevalent in a particular locality

Module-2

Notes

2. Scab	b. Irregular occurrence in a locality
3. Endemic diseases	c. Pathogen is seen on the surface of the host
4. Sporadic diseases	d. Sooty or Charcoal like powder
5. Smuts	e. Crust like lesion on diseased organ

5.4 DISEASES – VEGETABLE CROPS

Sl. No.	Name of diseases	Crops affected	Symptoms	Control measure
1	Anthracnose	Bean, Radish, Chilli	Dark brown cankers throughout the plant	Spray COC (1g/l) at 10 days interval
2	Black rot	Cabbage, Cauliflower, radish, turnip	Chlorosis of leaves vascular blackening soft rot of head	Use resistant variety and crop rotation
3	Blight	Brinjal, Beans	Leaves get discoloured	Use resistant varieties
4	Damping off	Brinjal, Chilli, Tomato, Cabbage	Affected seedling become pale green and collapse	Drenching soil with Bordeaux mixture. Seed treatment COC (1g/ 1kg)
5	Downy Mildew	Cabbage, Cucurbits, Pea	Grey tinged space mass / Dark blotches / purplish brown spots	Spray COC use resistant variety
6	Foot rot	Drumsticks, Chilli, Cucurbits, tomato	Necrotic spots, stem and root get rotted	Soil drenching COC (4g/ 1 lit) seed treatment
7	Leaf blotch/ spots	Beet root, Carrot, Tapioca, Chilli, Brinjal	Circular yellow spots later turn grey	Spray Bordeaux mixture (1%)
8	Little leaf	Brinjal	Extreme reduction in leaf size	Destroy affected plants
9	Mosaic	Cucurbits, tomato, bean, okra	Discolouration along the veins	Use virus free seeds/ resistant variety
10	Powdery Mildew	Cucurbits, beans, okra, pea	White powdery spots on both leaf surfaces	Spray carbendazim (1g/1) or decofol (2.5 ml li)
11	Root Knot	Brinjal, Chilli, Okra, Radish, Tomato	Stunted plant, sickly, galls on roots	Carbofuran (1 %) soil application
12	Rust	Bean, pea	Reddish brown rust pustules on lower side of leaves	Spray carbendazim weekly, intervals
13	Smut	Onion	Lesions appear as blisters, severely affected plants die	Seed treatment with Arasan or Tersan
14	Wilt	Brinjal, cucurbits, pea, tomato	Complete wilting of plant, chlorosis dropping leaves	Use resistance varieties, soil drenching Captan (1g / 1 lit)

* COC – Copper oxy chloride

INTEXT QUESTIONS 5.2

1 Match the followings:

A	B
1. Anthracnose	a. White powdery spots
2. Blight	b. Chlorosis
3. Powdery Mildew	c. Dark brown cankers
4. Rust	d. Leaves get discoloured
5. Wilt	e. Reddish brown pustules

5.3 DISEASES OF FRUIT CROPS

Sr. No.	Name of diseases	Name of Crops	Symptoms	Control measures
1	Anthracnose	Grape, Guava, Mango	Small roundish, grayish black spots surrounded by yellow border on all parts	Spray carbendazim1g/l at 10-15 days interval.
2	Bud rot	Coconut	Discoloured spots on leaves	Spray COC (4g/l)
3	Bunchy Top	Banana	Leaves bunched together and crispy in nature	Use disease free planting material, control Banana aphid
		Papaya	Deformation of leaves, stunted growth	Spray Tetracycline 500 ppm
4	Cankar	Citrus	Cankers on leaves, twigs & fruits	Spray Phytomycin
5	Downy mildew	Grape	Pale translucent spots appear on the upper surface of leaves	Spray COC (4g/l) weekly
6	Foot rot	Guava, Papaya	Dark circular patches on the fruits	Spray Captafol 80w (1g/l)
7	Fruit Canker	Guava	Infected fruits remain under developed	Spray COC (4g/l)
8	Fruit rot	Citrus	Severe fruit fall, rotting fruits, emit foul smell	Spray COC (4g/l)
9	Greening	Citrus	General yellowing of leaves with green patches	Tetracycline spray, use certified stock
10	Gummosis	Citrus	Exudation of brownish gummy substance	Soil disinfection with Bordeaux mixture
11	Leaf Curl	Papaya	Crinkling and curling of leaves	Remove diseased plants of destroy them
12	Malformation	Mango	Deformation of young shoots, floral malformation	Spray Benomyl @ 2 to 3 weeks interval, spray NAA
13	Mosaic	Banana, Papaya	Chlorotic mosaic and blister like patches on leaves	Use virus free planting material, remove diseased plants.
14	Panama wilt	Banana	Yellowing of leaves collapse of petiole leads to sudden	Soil drencing with carbendazim (1g/li) ground noot zone.
15	Powdery mildew	Citrus, grape, mango	Profuse whitish powdery growth on leaves, shoots and inflorescences	Spray wetable sulphur at weekly interval
16	Root knot	Citrus papaya	Stunted plant growth, galls on root	Soil application carbofuran (3%)

17	Root rot	Citrus	Attack on root, spread upward cause wilting of plants	Soil drenching with Bordeaux mixture
18	Scab	Citrus, Guava	Corky spots on leaves, twigs and fruits	Spray Bordeaux mixture
19	Slow decline	Citrus	Stunted growth, die back	Soil application carbofuran (3%)
20	Sooty mould	Mango, sapota	Growth of Black fungus on sticky excretion of sucking insects,	Spray carbaryl / and wetable sulphur
21	Stem canker	Guava	Infected branches develop cracks and tissues get killed	Destroy affected branches.
22	Stem rot	Papaya	Rotting of tissues of stem	Soil drenching with Bordeaux mixture
23	Tristeza	Citrus	Clearing of veins, stem pitting	Control insects spreading this disease. Use resistant stock
24	Wilt	Guava	Browning of leaves, discolouration of the stem,	Use resistant stock soil treatment with lime and gypsum

INTEXT QUESTIONS 5.3

1 Match the followings:

A	B
1. Bunchy top	a. Mango
2. Tristeza	b. Grape
3. Sooty mould	c. Citrus
4. Downy mildew	d. Sapota
5.Malformation	e. Banana

5.6 DIFFERENT DISEASES ON FIELD CROPS

Name of Disease	Symptoms	Control measures
I. Rice		
1) Blast	All aerial parts are attacked at all stages of growth; leaves, neck of panicle infected, full developed spot is spindle shaped with brown margin and grey centre. Neck region is blackened and shrivelled and grain settling in these ears is either partially or completely prohibited.	Field sanitation, foliar spray with Blasticidin at 20 ppm, Rabicide 20% soln @ 1.5 kg/ha Grow resistant varieties.
2) Blight	Wilting or leaf blight symptoms. Wilting occur 3-4 weeks after transplanting and results in death of plant or few leaves.	Seed treatment seed soaking for 8 hours in Agrimycin and vitavax followed by hot water treatment for 30 min. at 52^0 -54 ^{0} C
3) Brown spot	Seedling stage – blight, in grown up plants, brown, round to oval spots on leaves, leaf sheaths sometimes on grams and glumes ear never breaks.	Seed treatment with Bavistin 2.5 g/ kg seed. Spraying copper fungicides. Grow resistant varieties.

4) Foot rot	In nursery stage – affected seedlings are chlorotic, less health and wilt from tip downward and ultimately die. In main field appearance of stray, tall, lanky tillers showing symptoms of fungal infection in collar region, die in 2 to 6 weeks	Seed treatment with Bavistin @ 2 g/kg. seed. Steeping seeds in 1% CuSO4 solution, or 2% formalin.
II. Wheat		
1. Rusts		
i) Black stem rusts	Oblong, reddish brown pustules on leaves and later in the season linear, oblong dark brown to black sori appear on same parts of plant.	Growing resistant varieties seed treatment with plantvax protects till 7 weeks and then 2 sprays with carboxin 1%.
ii) Leaf / brown orange rust	Round, orange sori irregularly distributed on leaves	Growing resistant varieties seed treatment with plantvax protects till 7 weeks and then 2 sprays with carboxin 1%.
iii) Yellow/ stripe rust	Bright yellow, elongated sori arranged in linear rows between the veins on leaves	Growing resistant varieties seed treatment with plantvax protects till 7 weeks and then 2 sprays with carboxin 1%.
2. Smut	All spike lets in a plant are affected transformed into a mass of black powdery spores.	Hot water treatment (soak seeds in cold water for 4 hrs followed by dipping in hot water 54-56 ^{0}C for 10 minutes and drying.
3. Bunt disease	Plants ripen earlier than healthy ones and ears are dark green.	Seed treatment with Benate 0.3 percent.
4. Powdery Mildew	Greyish white powdery growth on leaves in later stages becomes greyish and finally black.	Foliar spray with 1% sodium thio sulphats.
III. Sorghum		
1. Smuts		
i) Covered/ grain/ short smut	Disease appearance only at time of grain formation. Most of the grains replaced by sori in infected ear.	Seed treatment with sulphur (4 g /kg seed) Bavistin (2 g / kg seed) Thiram (2 g / kg seed).
ii) Loose smut	Affected plants stunted, more tillers, early flowering than healthy plants Affected ears appears like leafy and leathery structure.	Seed treatment with sulphur (4 g /kg seed) Bavistin (2 g / kg seed) Thiram (2 g / kg seed).
iii) Head smut	Disease appears at flowering time when a sorus fully covered with greyish white membrane from leaf in place of normal inflorescence.	No satisfactory control measures.
2. Rust	Rust pustules on both surfaces of lower leaves being more on upper surface.	Use of disease resistant varieties.
3. Downy mildew	Downy whitish growth on lower surface of leaves with upper surface appearing yellowish.	Grow resistant varieties. Collection & destruction of infected plants.
4. Leaf spot	Circular spots on leaves	Foliar spray of Dithane M-45 at 20 days interval.
IV. Bajra		
1. Downy mildew/ Green ear	Infected plants tiller excessively remain dwarf, foliage becomes pale and chlorotic, ears either fail to emerge or if formed they are malformed to structures and hence the name green ear.	Seed treatment with Bavistin 0.25% is recommended. Difficult to control.

2. Smut	Disease becomes apparent at the time of grain setting when few grains sporadically distributed on the ear may be replaced by oval sori which are 2-3 times larger than normal grains.	No effective control known.
3. Ergot	Appears at flowering stage when small droplets of light honey coloured dew like substances exudes from infected spike lets, which darken with age and change to small, dark brown or greyish sclerotia which are hard and woody and replace grains.	Spray of fungicides like Ziram etc. Floating of seed in 10% salt soln prior to sowing removes sclerotial bodies.
V. Maize		
1) Smuts		
a) Common smut	Galls on buds, stalks and rarely on leaves	Crop rotation, field sanitation, Resistant variety.
b) Head smut	Floral parts covered with black powdery mass of smut spores	Crop rotation, field sanitation, Resistant variety.
2) Brown spot	Light green water soaked lesions on leaves later turning brown/ dark brown on lower side of leaf blades.	Crop rotation, field sanitation, Resistant variety.
3) Maize mosaic	Chlorotic leaves and stunted plants	Control of insect vector by spraying insecticide.
VI. Cotton		
i) Cotton wilt	Gradual dropping and withering of either the whole plant or only a particular branch.	Seed treatment with mercurial compound and growing resistant varieties.
ii) Anthracnose	Infected bolls shrink and resemble kawdi and do not open properly bolls sheds.	Seed treatment with 1 percent organo-mercurial compound at 7 gm/kg of seed.
iii) Dahiya	Older leaves show whitish growth on the underside, shed prematurely.	Dusting the crop with sulphur or growing American varieties.
iv) Black arm	All above ground parts of plants are affected lesions on leaves are angular and water soaked, which turn dark brown having reddish of purplish margin when old.	Disinfecting the seed with 1 percent organo mercurial fungicide compounds.
VII. Sugarcane		
1) Red rot	Discolouration and withering of leaves cane shrinks infected cane when split emits alcoholic smell and shows red tissue with white cross bands.	Select planting sets from healthy plants, sanitary practices. Grow resistant varieties Dip sets in systemic fungicide soln.
2) Smut	The growing shoot turns into a long whip-like black growth, covered by a powdery mass of black spores.	Avoid planting sets from infected canes, avoid ratoon crop, pull the whips and destroy them. Grow resistant variety.
3) Wilt	Canes show gradual withering, leaves become yellow and dry stem becomes light and hollow.	Seed treatment with Thiram/ Bavistin before. Planting.Plant healthy setts
4) Sett rot	Setts are primarily affected which not after planting before germination or shoots may die afterwards	Plant healthy sets sett treatment with Thiam/ Bavistin before planting.

5) Grassy shoot	Excessive tillering, poor cane formation in ratoon crop. Leaves are pale yellow to chlorotic.	Hot water treatment 50^0 C for 1 hour, spraying insecticides
VIII) Turmeric		
1) Leaf blotch	Spots on both surfaces of leaf covering a large area of leaf blade infected leaves reddish brown.	Spraying 3-4 times at 15 days with any copper fungicides after 1 month planting.
2) Anthracnose / leaf spot	Oblong brown spots with black concentric rings with grey centres severely infected leaves dry.	------- "-------
IX) Groundnut		
1) Tikka / leaf spot	Distinct dark brown leaf spots which are small to large, premature leaf shedding.	Preventive spray with organic or copper fungicides 2-3 times at 2 weeks interval, Resistant varieties.
2) Wilt, stem rot, root rot	Basal portion of stem and root is attacked causing sudden withering.	No effective control. Sanitation, Removal of infected plants.
3) Rust	Small brown dusty pustules on underside of leaves	Preventive dusting with sulphur dust spray with Dithane M-45
X) Soyabean		
1) Bacterial leaf blight	Lesions common on leaves as yellow pustules later turn brown small reddish brown spots also on pods.	Seeds should be collected from healthy plants, seed treatment with bactericide.
2) Downy mildew	Small chlorotic spots on upper surface of leaves later turn greyish dark brown, downy growth on leaf under-surface.	Prophylatic spray regularly with copper or any other suitable fungicides.
3) Dry root rot	Small round or irregular black sclerotia on affected stem and roots.	Soil drenching with copper fungicides, Thiram.
4) Leaf spot	Numerous typical zonate grey spots with purplish margin on leaves and other aerial parts of plants.	Preventive spray with 0.2% Dithane M-45
5) Mosaic	Mosaic mottling of leaves, reduction in size, plants stunted and few seeds are formed.	Use virus free seed use insecticides to control insect vectors
XI) Mustard		
1. Blight	Light brown & dark brown concentric rings on leaves.	Use healthy seed.
2. Downy mildew	Thin greyish white downy growth appears on lower surface of leaves upper surface marked by white spots.	Foliar spray with 0.2% copper or organic fungicides
3. White rust	All plant parts except root are attacked white pustules of various size and shapes are formed mainly on lower surface.	Foliar spray with 0.2% copper or organic fungicidesw
XII) Sunflower		
i) Leaf spot	Brown spot on leaves, may appear on stems, sepals or petals, lesions dark brown with pale margin.	3 foliar spray with 0.2% Dithane M-45
ii) Rust	Small reddish brown spots covered with rusty coloured dust appear first on lower leaves.	Sanitation, use of resistant varieties. Foliar spray with copper or organic fungicides.

XIII) Red gram		
1) Wilt	Leaves of affected plants turn brown prematurely, foliage droops and plants wilt.	Crop rotation for 3-4 yrs. Grow resistant variety.
XIV) Bengal Gram		
1) Blight	Circular spots on leaves, elongated on petioles and stalks with brown / red margin.	Hot water treatment of seeds. Spray Zineb for secondary infection.
2) Wilt	Leaves turn yellow and drop off prematurely.	Use resistant variety.
3) Rust	Small oval brown powdery lesions on both surfaces of leaves.	Foliar spray with Dithane M-45
XV) Peas		
1) Rust	Uredo sori are small, oval to round in shape, appear on both surfaces of leaf and infected leaves fall off prematurely.	Spray Dithane M-45
2) Downy mildew	Appears early on young plants in the form of downy growth on the undersurface of leaves.	Field sanitation & crop rotation sulphur dust 25-30 kg/ha 2 to 3 times in a season.
3) Powdery mildew	Disease appears on leaves and other green parts of plant as white powdery patches, premature leaf fall and poor pod formation and yield.	Field sanitation

INTEXT QUESTIONS 5.4

Match the followings:

A	B
i) Grassy shoot of sugarcane	a) 10% salt soln.
ii) Green Ear	b) lesion on leaves are angular and water soaked
iii) Ergot	c) Seed treatment with Bavistin
iv) Black arm	d) Hot water treatment.

5.7 WHAT YOU HAVE LEARNT

Diseases cause huge loss of crop plants. There are endemic, epidemic and sporadic diseases. Diseases spread through soil, air, seed and water. Diseases are also spread by insects. Evidence of disease shown by plant is called symptoms. Mildew, rusts, smuts, blisters, scab, blotch are the different symptoms shown by the crop plants. For control and prevention of plant diseases various methods are followed. Prevention is always better but timely control helps in reducing crop plant losses.

5.8 TERMINAL QUESTIONS

1) Write different causes of diseases.
2) Write different modes of spreading of diseases.
3) What are the general symptoms of plant diseases?
4) Write short note on management of plant diseases.
5) Write any four diseases of Vegetable crops with their symptoms and control measures.
6) Write any four diseases of flower crops with their symptoms and control measures.
7) Write any four diseases of field crops with their symptoms and control measures.
8) Write any four diseases of fruit crops with their symptoms and control measures.

5.9 ANSWER TO INTEXT QUESTIONS

5.1

1. Match the following
   a. Pathogen is seen on the surface of the host
   b. Crust like lesion on diseased organ
   c. Prevalent in a particular locality
   d. Irregular occurrence in a locality
   e. Sooty or Charcoal like powder

5.2

1 Match the following
   a. Dark brown cankers
   b. Leaves get discoloured
   c. White powdery spots
   d. Reddish brown pustules
   e. Chlorosis

5.3

1 Match the following
   a. Banana
   b. Citrus
   c. Sapota
   d. Grape

Notes

e. Mango

5.4

Match following

a) Hot water treatment

b) Seed treatment with Bavistin

c) 10% salt soln.

d) Lesions on leaves are angular and water soaked

SUGGESTED ACTIVITIES

a. Prepare an album of various diseases occurring on vegetable crops.

b. Prepare an album of various diseases occurring on fruit crops.

C. Prepare an album of various diseases occurring on field crops

6

STUDY OF PESTS OF CROPS PLANTS

6.1 INTRODUCTION

Different crops are attacked by different pest causing reduction in the yield and quality of the crop plants. The major contribution of the cost of production is the expenses towards plant protection. Variety of pests cause damage to the crop plants in different ways.

6.2 OBJECTIVES

After reading this lesson, you will be able to understand:

- About different types of pests that attack the crop plants.
- About the different methods of pest control.
- Various pests of crop plants and their control.

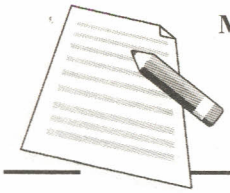
6.3 TYPES OF PEST

In this lesson we are learning mainly about the pests belonging to animal kingdom. The others are already learnt in previous lesson as disease causing organisms.

Pest: It is an organism that causes any type of damage to the crop plants.

Types of pests

1) Insect: These are important and major pests. Insects have three pairs of legs, two pairs of wings, segmented body and characteristic compound eyes and antennae. Insects are tricky and cause damage in different ways viz. sucking sap from plants, biting plant parts, boring in to fruits, twigs and leaves, attacking roots, barks and blossoms etc. The damaging stages of different insect pests are larvae, adults and nymphs.



Module-2

Notes

2) Mites: These are creatures like insect but have soft body and four pairs of legs. These tiny creatures have red or pale yellow colour. They suck the sap from the plant and attack the crops in huge number.

3) Rodents - This group of pest 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: Animals like Wild Boar, Deer, Elephants, Wild Buffalo, Jackals, Monkeys, Squirrels cause direct damage to crop plants. They eat away the plants and by and large they waste huge amount of crops.

5) Birds: Birds attack the crop plants and eat grains. Crow, Parrots and Sparrows are major among birds that attack the crops.

Methods of pest control

Pest causes lot of reduction in the yield and quality of crops. Broadly the measures of pest control are of two types, preventive and protective. Preventive measures are used before the attack of the pest and protective measures are used to control the pest after their attack.

The methods of controlling pest are as follows.

A) Mechanical methods:

1) Picking of pests, larvae by hand and destroying them.
2) Remove the part or whole plant that is infested.
3) Use of traps.
4) Catch them with the help of net.

B) Physical methods:

1) By heat: High temperature kills the pest.
2) Low temperature.
3) X-rays and gamma ray.

C) Cultural methods:

1) Crop rotation.
2) Deep ploughing.
3) Clean cultivation.
4) Proper use of fertilizers and water.
5) Growing pest resistant Varieties.
6) Timely or late sowing.
7) Proper harvesting

D) Chemical methods

This method is used on large scale for direct control of pests. In these methods, chemicals that kill the pest are used. These chemicals are called as pesticides/ Insecticides. The chemical method is effective and faster as compared to other methods but it is hazardous to environment. Improper use of these chemical leads

to development of resistance among the pests causing heavy out break which leads to increase in cost of cultivation and heavy loss. Dusts, Wettable powders, Seed dressers, Emulsions and granules are the insecticides formulations.

E) Biological methods

Use of biological agents to control pests is called Bio-control. Ninety eight per-cent pests are controlled by nature. There are certain predators, parasites, birds, animals, micro-organisms that can be used for control of pests.

Certain biological factors used to control the pests are :

Tricogama, Crysopa, HNPV, LLNPV, Chilonus, Copidosoma, Bacillus thuringenesis.

F) Plant Quarantine measures

Control of distribution and spread of pest by laws, (Indian Quarantine Act 1925)

6.3.3 Integrated Pest Management

Owing to uncontrolled use a pesticides, the control of pest has not remained as effective as earlier. This raises resistance of pests against chemicals; increases cost of cultivation, increase residues in the produce, etc. The environmental imbalance is another effect of such methods so it is the necessity of the time to use IPM.

IPM- Use of cultural, physical, mechanical, biological, environmental and legal methods collectively to control pest is called as IPM. It also uses biological extracts, traps, repellents etc. for pest control.

INTEXT QUESTIONS 6.1

Fill in the blanks

1) Insects have _____ type of body.

2) Mites have _____ legs.

3) _____ is an organism that causes any type of damage to the crop plants.

4) The chemicals used to kill the insect pest are called as _____ .

5) Tricogama is used to control insect pests in _____ method.

6.4 DIFFERENT PESTS ON FIELD CROPS

Name of Pests	Nature of damage	Control Measures
I) Paddy		
1) Stem borer	Caterpillar bore into stem	3% Carbofuran @ 15 kg/ha.
2) Swarming caterpillar	Caterpillars appear in big swarms and eat young plants	Dust 10% Folidol powder 10kg/ha
3) Rice bug	Bugs suck the milky sap of tender grains	Spray in nursery & field Endrin 20 p.c.

Module-2

Notes

4) Rice grass hopper	Nymphs and adults feed on tender leaves and tender grains	Demercon – 100 or 500 ml.
5) Rice hispa	Small blue – black beetle, grubs make winding tunnels in leaves	Endosulfan or 2 kg Zineb/ ha.
6) Jassids & Delphasids	Suck juice from plant parts	Spray Malathion 0.05 p.c.
7) Paddy gall fly	Maggots attack base of growing points and produce silver shoot	10 kg 10 p.c. Thimet granules
8) Rice leaf hopper	Small green insect causes damage by sucking sap from tender shoots	Spray 1.5 litre 50 p.c. Malathion.
9) Rats	Damage by eating plant parts both in nurseries and fields	Kill by poison baiting. Zinc phosphides or selphos tablets.
10) Crab	Damage by eating plant parts both in nurseries and fields	Mix 40 ml 20 p.c. Endrin in 1 kg cooked ricked and put small pellets in the to holes.
II) Wheat		
1) Termite/ white ants	Damage almost anything containing cellulose	At time of sowing mix 10% granules of Chlorpyriphos, neem cake in the soil.
2) Cutworms	Caterpillars damage the crops after emergence from eggs and feed on them during night hours.	Spray 0.07% Endosulfan setting fire in the nights for killing moths.
3) Rats	Damage by eating plant parts	Poison baits.
III) Jowar		
1) Stem borer	Larvae bore into the stem causing dead heart	Spray 0.1% Carbaryl / 15 day interval.
2) Cutworms	Larvae cut the seedlings at soil level	Spray 0.07% Endosulfan
3) Army worms	Larvae feeds on the leaves leaving the midrib	Dusting the crop with 5 p.c. aldrin or 3 p.c. Heptachlor @ 25 kg/ha.
4) Hairy caterpillars	Larvae cause severe defoliation.	Spray 4% Endosulfan.
5) Sorghum shoot or stem fly.	Maggots bore into the stem of young plants generally up to 4 weeks	Treat the seed with Carbofuran (20:1) or apply 3% Carbofuran.
III) Maize.		
Army worms	Larvae feeds on leaves during night hours and take shelter in the whorl during day time	Dusting the crop with 5 p.c. Aldrin or 3 p.c. Heptachlor @ 25 kg/ha.
Deccan wingless grasshoppers	Eat leaves and leave only the veins on the plants	10% BHC /Folidol 20 to 25kg/ha
Stem borer. Others minor are shoot fly, aphids, thrips, mites	Larvae punctures the top most leaves of the whorl and feed on the stem	Spray 0.1% Carbaryl / 15 day interval.
IV Bajara		
Blister beetle	Adult beetles feed on pollen & flower	Dust 10% Folidol or 4% carbaryl
Leaf roller	Larvae fold the leaves and feed inside on green matter	Dust Folidol powder
Shoot fly	Seedling stage – larvae cut the growing point causing	Treat the seed with Carbofuran (20:1) or apply