2.8 TERMINAL QUESTIONS

i) Enlist the nutrients required by plants for growth.

ii) Write the functions of phosphorous, potassium and calcium in plant growth.

iii) Classify the manures and fertilizers with suitable examples.

iv) Write short notes on:

a) Farm Yard Manure

b) Biofertilizers

c) Vermi-Compost

v) Define organic farming and write the principles of organic farmings.

2.9 ANSWER TO INTEXT QUESTIONS

2.1

i) 16

ii) Primary

iii) Secondary

iv) Air

2.2

i) Dark green plants and succulent

ii) Vigour and disease, resistance

iii) Essential for formation of chlorophyll

v) Respiratory activities in plant

vi) Essential for nitrogen fixing organism

2.3

i) Farm Yard Manure

ii) Compost

iii) Green

v) Rhizobium

vi) Vermicompost

2.4

i) ability to supply essential nutrient

ii) yield of crop

iii) Predators

iv) Auxins

Notes

SUGGESTED ACTIVITIES

1) Visit the verrmi compost production unit to study the methodology and practices.
2) Study various biofertilizers available in the market.
3) Prepare a vermi compost bed with locally available material.

3

STUDY OF FIELD CROPS

3.1 INTRODUCTION

India grows variety of crops which meet the requirements of food viz. cereals. pulses, oil crops, sugar crops etc. There is a great demand, of fodder for the cattle which provide milk and motive power for agriculture, of cotton for manufacture of cloth and other raw materials for various industries for growing population. The principal crops are Rice, Wheat, Jowar, Bajra, Groundnut, Sugarcane, Cotton and Spices.

In India 59.2 percent area is devoted to growing cereal crops and 12.6 percent to pulse crops, oil seeds occupy 13.7 percent and the fibre crops 4.7 percent and the remaining area is shared by sugarcane and other crops.

3.2 OBJECTIVES

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

- the cultivation practices of important cereals, pulses, oilseeds, cash, fibre and spice crops.
- Importance of growing pulse and oilseed crops in Indian farming.

3.3 CLASSIFICATION OF FIELD CROPS

Field crops may be classified in more than one way. It may be on the basis of: a) climate b) season in which grown c) life of crop plant d) source of water e) root system f) economic importance g) use h) botanical or morphological similarity.

The important classification of group of field crop is as below:

Notes

Classification on the basis of climate:-

Tropical climate crop – rice, sugarcane

Temperate climate crop – wheat, gram

Classification on the basis of season

Kharif Crops – Crop grown in monsoon season from June to October e.g. Rice, Jowar, Bajra, Groundnut.

Rabi Crops – Crop grown in winter season from October to March e.g. Wheat, gram, safflower etc.

Summer Crops – Crop grown in summer season from March to June e.g. summer groundnut, water melon, cucumber etc.

Botanical classification of field crop –

Field crop belongs to the big division of plant kingdom spermatophyte. In which reproduction is carried out by the seeds. Within this division the common crop plants belong to the sub-division Angiosperms (ovules are enclosed in an ovary wall.) The Angiosperms are further divided into two classes, the monocotyledonous and dicotyledonous. All grasses, cereals like rice, wheat, jowar, sugarcane are monocotyledonous plants. The legumes or pulses viz. Red gram, green gram, beans are dicotyledonous. (Seeds have two cotyledons)

These are further sub-divided into orders, families, genera, species and varieties.

INTEXT QUESTIONS 3.1

Q1) Fill in the blanks:

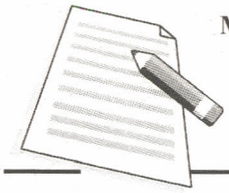
1) Field crops belong to big division of plant kingdom _____.
2) Kharif crop are grown in _____ to _____ months.
3) Wheat is a _____ season crop.
4) Grasses, cereals are _____ plants.
5) Sugarcane is a _____ crop.

3.4 CEREAL CROPS

Rice, Wheat and millets are consumed as important staple food all over the world. Cereals provide essential carbohydrates which are important source of energy for working. Cereals are monocotyledonous plants and are grown on large scale by Indian farmers. The economy of huge number of Indian farmers is largely dependent on cereals.

The cultivation of important cereal crops is given in Table no. 1.

Sr. No.	Common name	Paddy (Rice)	Jowar (Great millet)	Maize (Makka, makki)
1	Botanical name	*Oryza sativa. L*	*Sorghum vulgare*	*Zea mays*
2	Origin	South India	India & Africa	America
3	Climate	Hot & humid climate	Tropical crop, warm climate	Warm & humid
4	Soil	Light to heavy, sandy loam alluvial, lateritic, yellow to heavy black soil	Clay loam, loamy soils, rich in humus, Black cotton soils	Deep, fertile , rich in organic matter, well drained, alluvial soils
5	Preparatry tillage	Ploughing, clod crushing & 2 to 3 harrowing, Bunds	Deep summer ploughing, 2 to 3 harrowings	Ploughing, 2 to 3 harrowings, ridges & furrows
6	Seed & sowing			
	i) Time of sowing	Kharif – June to first week of July Rabi – October (T.N.,A.P., Kerala) Summer – Feb-March	Kharif – June-July Rabi – Sept-Oct Summer – Feb-March	Kharif -June-July Rabi –oct-nov Summer – Jan-feb
	ii) Method of sowing	Broadcasting – 80 to 100kg/ha. Drilling – 15-22.5 cm. 60to 80kg/ha. or 30cm. Row to row **Dibbling early 15X15cm^2.** Mid late – 20X15 cm^2. Late – 20X20 cm^2. No of seeds/hill 5 to 6. Depth of sowing 5cm. (Common 40-50 kg / ha Seed rate)	Broadcasting, drilling & dibbling, spacing Drilling – 45 cm. Dibbing – 45X15 cm^2. Seed rate 10 to 12 kg/ha. No of seeds/hill – 2 to 3. Depth of sowing – 5cm.	Drilling, Dibbing Spacing Medium & full season – 75X25cm^2 Early and very early 60X22cm^2 Fodder 30 cm Seed rate Grain-15 to 20kg/ha Fodder-75 kg/ha
7	Manures & fertilizers	FYM or compost 10 to 15 tons/ha N P K → local var.50 25 25 kg/ha Improved and high. yielding: 100 50 50 kg/ha.	FYM /compost 6 to 15 tons N P K (kg/ha) Rain fed 50 25 - Irrigated 80 40 40 High 120 60 60 Yielding (hybrids)	12 to 15 tons/fym N P K Kg/ha. Rain fed 90 40 40 Irrigated 120 60 40 Fodder 120 30 20
8	After care	Weeding –2, hoeings –3	Thinning & gap filling, 2 hoeings and 1 weeding	Gap filling, Thinning, hoeings, weeding
9	Water manage-ment	Semi-aquatic plant, requires abundant water, optimum water requirement 90 to 130cm.	Rain fed crop, water requirement 40 to 45 ha.cm., 4 to 5 irrigation at 15 days interval	4 to 5 irrigations
10	Harvesting	Ears are ripened and straw is green moisture content of grain is 14 to 16%	100 to 120 days, matures in month of November or December	Sheaths of cobs turn brownish and seeds become hard and dry
11	Yield	Early – 35 to 40 q//ha. Mid late – 55 to 60 q/ha.	Kharif rain fed 8 to 10 q/ha. 12-15 q/ha fodder Kharif irrigated 30 to 35 q/ha. 40-50 q/ha. fodder Hybrids (irrigated) 40 to 50 q/ha 60-80 q/ha. fodder	Rain fed 6.5 to 7.5q/ha. Irrigated 17 to 18q/ha. Hybrid 50 to 70 g/ha. Green fodder irrigated 35 to 50 tons/ha Rain fed 15 to 20 ton/ha.



12	varieties	Short duration-Karjat184, IR-28, Karjat 35-3 Medium duration – Jaya, sona, IR-8, TN-1, Padma, ACK-5 Long duration – Pankaj, Jagannath, Ratnagiri-68, Phalguna	Kharif – CSH 1,2,3,4,5, MSH-33,37 Rabi – CSH-7R, CSH-8R, , CSH-9R Improved Swarna, PV-86, PV-504 (swati) Maldandi – 35-1 (Rabi) Fodder – Nilwa, Dagadi, Hundi, Kalbondi	Hybrid – Ganga hybrid 1,3,5,101 Ganga safed-2, Deccan double hybrid. Composite varieties-Hi-starch, Amber, Jawahar, African tall, Hunis.

Cereal crops (Table No.1) contd

Sr.No	Common name	Bajri (Pearl millet)	Wheat
1	Botanical name	*Pennisetum typhoideum*	*Triticum species*
2	Origin	Africa	South west India & Afghanistan
3	Climate	Tropical, warm & Dry	Cool dry & clear weather
4	Soil	Poor sandy soil to medium soil, alluvial	Desert to heavy soil, loamy textured, fertile. Well drained
5	Preparatory tillage	Ploughing, 2 to 3 harrowings	1 Ploughing, 2 to 3 harrowings
6	Seed & sowing		
	i) Time of sowing	Kharif-June to July	Rabi-Oct. to Nov.
	ii) Method of sowing	Drilling, Broadcasting Seed rate 4 to 5 kg/ha. Spacing 22.5 to 30cm	Drilling, Broadcasting Sowing Direction- North, south Seed rate Normal 100kg/ha HD2189-125kg/ha Spacing Irrigated-22.5cm Rainfed-30cm
7	Manures & fertilizers	8 to 10 tons fym/ha. N P K Kg/ha. Rainfed 12 - - Irrigated 25 25 - Hybrid 50 37 25	N P K Kg/ha Irrigated 120+160+60 Rain fed 50 + 25+25
8	After care	1 to 2 weedings, 2 to 3 hoeings	1 to 2 weeding, 1 hoeing
9	Water management	Rain fed crop. 1 to 3 irrigations	1 presowing, second at 20 to 25 days, late tillering flowering and grain formation in all 5 irrigation
10	Harvesting	80 to 90 days	100 to 130 days
11	Yield	Average .yield 7 to 8q/ha Hybrid 20 to 25q/ha	Rain fed – 8 to 10q/ha Irrigated 25 to 40q/ha
12	varieties	Hybrids –HB-1,3,4. NHB-5, MBJ 110, WCC-75, RH RBH-8209, ICTP-8203 Improved-WCC-75, RHR-1 (Sangam) CMS-7703	Rainfed-N-59, Ajanta,NI-5439, MACS-9 Irrigated – HD 2189, HD4502 (Malvika), Sonalika, Kalyan, sona.

INTEXT QUESTIONS 3.2

1) Match the followings:

A	B
1) Paddy	i) Triticum species
2) Jowar	ii) Zea mays
3) Maize	iii) Sorghum vulgare
4) Wheat	iv) Pennisetum typhoideum
5) Bajri	v) Oryza sativa

3.5 PULSE CROPS

Pulse crops are legumes. The word legume is derived from the Latin word 'legere', with means 'to gather'. Pulses are important in crop rotations and crop mixtures practiced by farmers, as they help in maintaining the soil fertility. Pulses are rich in protein and they meet the major share of the protein requirements of the predominantly vegetarian population of India.

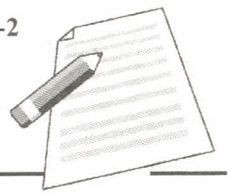
The cultivation of important pulse crops is given below in Table No. 2:

Pulse crop (Table No. 2)

Sr. No.	Common name	Red gram (Pigeon pea,tur)	Bengal Gram (Harbara, Chana)	Kidney bean (Matki)	Green gram(Mung)
1	Botanical name	*Cajanus indicus*	*Cicer arietinum*	*Phaseolus aconitifolus*	*Phaseolus aureus*
2	Origin	Africa	Afghanistan, Iran	India	India
3	Climate	Fairly moist and warm climate	Winter(Rabi)	Warm weather	Warm climate
4	Soil	Well drained, medium to heavy soils	Well drained light to medium	Sandy loam. Light to medium	Fertile, well drained. Black heavy
5	Preparatory tillage	Deep ploughing, clod crushing and 2 to 3 harrowings	1 ploughing, 2 harrowings	1 ploughing, 2 cross harrowings	1 ploughing, 2 harrowings
6	Seed and sowing				
	i) Time of sowing	Later part of June or early July	Rabi season. 2nd week of Oct.	Kharif-June-July	Kharif, summer
	ii) Method of sowing	Drilling Dibbling 2 to 3 seeds/hill	Drilling	Drilling	Drilling
	iii) Spacing	Early var – 45X20cm^2 Midlate var – 60X30cm^2 Late varieties- 75X30cm^2	30cm	30cm or 45X10cm^2	22 to 30cm.
	iv) Seed rate	Mixed – 6 to 9kg/ha. Sole – 15 to 20kg/ha.	40 to60 kg/ha.	Sole 15 to 18 kg/ha. Mix 4 to5kg/ha.	18 to 20 kg/ha.

7	Manure and fertilizer	6 tones/ha FYM 25kg/ha N 50 kg/ha P at the time of sowing	10 tons/ha Fym Kg/ha N P K Irrigated 25 50 0 Rain fed 15 30 0	6 to 10 tons/ha N P K kg/ha 25 50 0 at sowing	3 to 5 tons/ha N-20kh/ha P-20 to 25kg K-0 at sowing
8	After care	2 hoeings & 2 weedings	1 to 2 weedings		1 to 2 hand weeding
9	Water manage-ment	1 to 2 irrigations	2 Irrigation	Kharif No irrigation	Summer at an interval of 15 days
10	Harvest-ing	120 to 125 days, Early var130 to 170 days, Midlate 180 to 190 days Late	100 to 120 days	125 to 135 days	Early 60 to 70 days Late-100 to 110 days
11	Yield	Mixed 2 to 8 q/ha Sole 10 to 12q/ha	Rain fed – 5 to 6q/ha Irrigated- 10 to 12 q/ha	8 to 10 q/ha	5 to 6 Q/ha
12	Varieties	Early-type-21 Prabhat,BS-1 I CPL-67 Mid – BDN-1,2 T.Vishakha, Sharda Late – C-11, P.T.301	Chafa, N-59,N-31 Waragal, Deccan, B-P-N-9-3, Phule G-1,G-5	MBS-27, No.88 Dhule No.3-5	Jalgaon-781, Pusa-vaishakhi, Kopergaon, Tap-7, S-8,T-44

Sr. No	Common name	Black gram (Udid)	Cow pea (Chavli or lobia)	Soyabean	Pea (Watana)
1	Botanical name	*Phaseolus mungo*	*Vigna cataing*	*Glycine max*	*Pisum sativum*
2	Origin	India	Central Africa	Asia	South Europe
3	Climate	Warm season	Warm weather	Temperate crop, grows well in subtropical & tropical region	Cool season, Rabi 13 to 18°C
4	Soil	Light to medium	Well drained loam or slightly heavy	Light or sandy loam	Medium to heavy
5	Preparatory tillage	1 ploughing and 2 harrowings	Clean & smooth seedbed	1 ploughing and 1 harrowing	1 ploughing, 2 harrowings
6	Seed and sowing				
	i) Time of sowing	Kharif, Rabi	Kharif – June-July Summer-March-April	Kharif and Summer	Rabi 15th oct.
	ii) Method of sowing	Drilling	Drilling	Drilling	Dibbling, Drilling



	iii) spacing	30 cm	Grain 45X 8-10cm (F) 30cm	30X10cm or 45X22.5 cm	20 to 30 cm apart
	iv)seed-rate	15 to 20kg/ha	(G) 25 to 30kg/ha (F) 50kg/ha	45 to 60 kg/ha	Drill 25 to 30 kg/ha Dib. – 40 kg/ha
7	Manure and fertilizer	3 to 5 tons/ha N-20kg/ha P-20 to 25 kg K- 0	6 to 10 tons/ha N-25 kg/ha P-50kg/ha K-0 at sowing	8 to 10 tons/ha N-25kg/ha P-50kg/ha K-0 kg/ha	3 to 5 tons/ha FYM N P K kg/ha Rain fed 20 to 25: 25: 50 Irrigated 50 50 50
8	After care	2 hand wedding		2 hoeings 1 weeding	2 hand weedings
9	Water manage-ment		1 to 2 irrigation		
10	Harvest-ing	60 to 90 days	90 to 120 days. F-40 to 45 days	2 irrigation Early var 100 days Late var 165 days	2 to 3 irrigations Early – 100days Late – 120-125 days
11	Yield	4 to 5 q/ha	12 to 15q/ha	(sole) 10 to 15q/ha Mix 3 to 4q/ha	Rain fed – 6to7 q/ha Irrigated – 10 to 15q/ha
12	Varieties	Sindkheda no 1 D-6-7, Udid-55 T-9	C – 152, No 5-19-4-1 No 2-1, V -16,RC-19, K-11 VCM (F) Barsati, Russian giant	Brag, Punjab-1, Clark, Soybean No.4, Monita, P.K.V.1, MACs-13, 57,58,124 PKV-472	Boneville, NP-29,EC-93866, Type-163, Early gaint, Khaper kheda, English wonder

INTEXT QUESTIONS 3.3

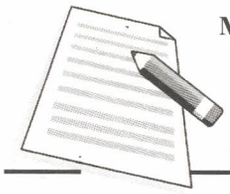
1) Match the followings

A	B
1) Red gram	i) South Europe
2) Bengal gram	ii) Central Africa
3) Kidney bean	iii) Afghanistan
4) Cow pea	iv) India
5) Pea	v) Africa

3.6 OILSEED CROPS

Importance of oilseeds crop in Indian farming:-

- They can be grown on all kinds of soil.
- Important constituent of the crop rotation with millets and pulses.
- Valuable cash crops and bring ready cash to the farmers.



- They are a source of foreign exchange.
- They provide raw material for many industries e.g. paints, varnishes, soaps, lubricating oils etc.
- They contribute vegetable oils and fats to Indian diet.
- The edible oil cakes provide concentrates for the cattle.
- The non-edible oil cakes are used as manures and some oil cakes like castor cake control termites due to their vermicide properties.

The cultivation of important oil seed. Crops in given in table no 3

Oilseed Crops (Table No 3)

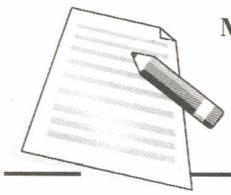
SN	Common name	Ground nut	Sun flower (Suryaful)	Safflower (Kardai, Kusum)	Mustard (Rai, mohari)
1	Botanical name	*Arachis. hypogaea*	*Helianthus anunsus*	*Carthamus tinctorius*	*Brassican juncea*
2	Origin	Brazil (South America)	North America	Abyssinia and Afghanistan	European
3	Soil	Well drained, light, loose, friable, sandy loam well supplied with Ca, and rich in organic matter pH-6.5 to 7.2	Medium to heavy soils pH 6.5 to 8.5	Black cotton soil, loam and light alluvial soil	Well-drained soils
4	Climate	Tropical crop, requires long and warm growing season	Cool climate, warm weather. Warm & sunny days	Cool climate, drought, resistance	Cool climate
5	Preparatory tillage	Ploughing, 2 to 3 harrowings	Ploughing, 2 to 3 harrowings	Ploughing, harrowing	Ploughing, harrowing
6	Seed & sowing				
	i) Time of sowing	Kharif – June-July Rabi- Feb-March	Kharif – June-July Rabi- October Summer – Jan Feb	Rabi season – Oct - November	Rabi season – Sept to Oct
	ii) Method of sowing	Drilling & dibbling	Drilling & dibbing	Mixture with wheat and gram and Jowar	Grown on mixture and also pure crop
	iv) Number of seeds/dib	1 seed/dibble	Heavy soil with tall var 60X22.5-30cm2	Seed rate (mix) 8 to 15 kg/ha Pure – 20 to 25 kg/ha	Broadcas-ting & drilling
	v) Spacing & seed rate Spacing / Seed rate / Plant population	i) Bunch or erect 30X10cm^2 90-100 kg/ha 3.33 lakh/ha ii)Semi sprading 37.5X15cm^2 80-90 kg/ha	Medium soil dwarf 45X15-22.5 cm^2 or 45X30cm^2 Seedrate – 10 to 12kg/ha	Border crop	Mixed– 2 to 2.5 kg/ha Pure cropping- 4 to 6 kg/ha Pure crop 45cmX10 to

		1.80lakh/ha iii) Sprading 45 X15-20cm^2 60-80 kg/ha 1.50 lakh/ha Phule pragati 125kg/ha			15 cm
7	Manures & fertizers	8 to 10 tones of Fym/compost/ha N P K kg/ha Irrigated25 50 - Rain fed 12.5 25- General 20 40- Or 100kg DAP/ha	5 to 6 tons/ha fym or comput N P K Kg/ha Assured rainfall 60 30 30 & irrigation Dry land 50 25-		60 kg N per ha at the time of sowing
8	After care	Gap filling, 1 to 2 weedings		tops of the plants are removed to encourage branching	Thinning, two weedings and two hoeings
9	Irrigation	Rainy season crop , 2 to 3 supplementary irrigation Summer – 8 to 10 irrigations	Medium water requirement. No irrigation for kharif	—	—
10	Harvesting	Growth period Erect 100days, semi spread – 120 days, spreading – 150 days	Maturity in 90 to 100 days	120 to 125 days	Maturity – 75 to 100 days
11	Yield	Erect or Bunch type 15-20 q/ha Semi-spreading 20-25q/ha Spreading (Irrigated) 30q/ha Oil content – 45 to 55 %	Rain fed – 10 to 12g/ha Irrigated – 15 to 20 g/ha Oil – 36 to 42 %	Mixed – 125kg seed/ha Pure – 500 to 800 kg seed/ha For dye purpose 100 to 150 kg of dried petals/ha Oil – 28 to 30%	350 kg/ha Good condition – 1000 to 1200 kg/ha Oil content – 25 to 33 %
12	Varieties	Bunch - Kopergam no 3,SB-11, Faiz pur 1-5 JL-24 (Phule pragati). Sprading – Karad 4.-11, M-13, TNV-1, Jmv-3 Semi- sprading – uf-70-103, Kopergaon no 1, TMV-10, AK-8-11	EC 68414, Morden, S.S.56. Surya, EC 69874 Hybrid – L.D.M, R.s.h.-1, L.D.M.R.S.H.3, M.S.F.H-1,8,17	N-630,N-628,N-300, N-7, NP-30,18,CT-11 and 5-4	Local varieties

INTEXT QUESTIONS 3.4

1) Match the followings:-

A	B
1) Groundnut	i) Local varieties
2) Sunflower	ii) N - 630
3) Safflower	iii) SB – 11
4) Mustard	iv) EC 68414



Module-2

Notes

3.7 CASH, FIBRE AND SPICE CROPS

Sugarcane is the important cash crop grown in India. Sugarcane is cultivated in UP, Bihar, Maharashtra, Karnataka and AP. on large scale. Sugarcane is the most important source of sugar and jaggery. The sugar factories have transformed the total scenario in the sugarcane tracts. Cotton is the most extensively grown commercial crop and the most important of all fibre crops of the world. Likewise turmeric is an important spice crop grown on commercial scale as a source of farm income. It is cultivated in the states of AP, Tamilnadu, Maharashtra, Orissa, Kerala and Assam.

The cultivation of important Cash, fibre & spice crops is given belowin table No. 4

(Table No 4)

Sr. No.	Common names	Sugar cane	Cotton	Turmeric (Haldi)
1	Botanical name	*Saccharum officinarum*	*Gossiypium spp*	*Curcuma longa Linn*
2	Origin	India	Old world – India indo china and Tropical Africa,	Southern Asia
3	Soil	Medium to heavy, well drained pH-6.5 to 7.5	Well drained fertile medium black to deep black	Loamy or alluvial soil, well drained, loose
4	Climate	Tropical crop, Av mean temp. 20° to 26°C	Subtropical crop, Optimum temp. 21° to 27 °C	tropical crop, hot and dry climate
5	Preparatory tillage	Two ploughings, 2 to 3 harrowings	Deep ploughing, 2 to 3 harrowings	Deep ploughing, 2 to 3 harrowings
6	Seed-sowing	Season Time Duration		
	i) Showing season	Suru Jan-feb 12 months Preseasonal Sep-Oct 15 months Adsali July-Aug18 months	Kharif ,sowing time- June to July (Rain fed) March to May (Irrigated) Sowing method – Drilling, Dibbling, Broadcasting	Optimum time. 15th may to first week of June Spacing – Ridges & furrows 60-75X 25-30 cm^2Broad beds and flat beds 30X30 cm^2
	ii) Seed rate iii) Spacing	25,000 sets/ha 120cm in heavy soil furrows 105cm in light soil	Rain fed seed rate spacing kg/ha i) Desi cotton 15 to 20 45X20-25 cm^2 ii) American cotton 10 to 12 60 to 75X30-45 cm^2 ii)Hybrids 5 to 6 60X60 cm^2 Irrigated i) American 7.5 to 8 90X60 cm^2 ii) Hybrids 2.5 to 3 90X60 cm^2	Mother set – 25 to 35 q/ha Finger set – 15 to 20 q/ha Depth of planting – 8 to 10 cm
	iv)Planting method	Flat beds, ridges an furrows, long firrow, contour furrow, Trench, Rayungan		
7	Manures & fertilizers	Crop N P K Ka/ha kg/ha kg/ha Suru 250 125 125 Presea- 350 170 170 sonal Adsali 400 170 170 Rattoon 250 125 125	Manure (T) N P K(Kg) → Rainfed 1)Desi & American 7.5 50 25 25 2)Hybrids 7.5 80 40 40 3)Irrigated vari 15 80 40 40 4)Hybrids 15 100 50 50	20 to 30 tons FYM/ha N P K (kg/ha) 125 37 37

8	After care	3 to 4 hoeings for weed control Earthing up is carried out when crop is 5 to 5.5 months old and 2 to 3 internodes are visible	Gap filling, thinning	5 to 7 hand weeding, Light earthing
9	Irrigation	Total water required 140 to 160 acre inches. The interval between irrigations. Heavy 10 days during summer and 20 days in winter	Sensitive to deficient and excessive moisture. Water required 2.5 mm/day- emergence & square formation 2.5 to 6.25 mm/day square to first bloom. 6.65 to 10 mm/day first bloom to peak bloom	18 to 22 irrigations
10	Harvesting	Yellow color of whole crop, emergence of arrowheads in flowering var, swelling of eye buds, metallic sound of cane, sweet juice, Brix reading 21° to 24°c		8 to 9 months in Jan. to March leaves turn yellow, dry and drop down.
11	Yield	Suru – 100 tons/ha Preseasonal – 125 tons/ha. Adsali-150 tons/ha	Rain fed Desi – 7 to 8 q/ha, American hybrid – 10 to 12 q/ha Irrigated improved – 20 to 25 q/ha (Laxmi, MCU-5,) Hybrid – 25 to 30 q/ha	Raw turmeric – 15 to 18 tons/ha 2 to 3 tons/ha mother sets Raw turmeric – 2.0 tons. Of dry polished turmeric
12	Varieties	Co-290, co-419, co-740, co-775, co-798, co-7219 (Sanjivani) COM-7125 (Sampada) co-86032, co-8011	Desi- AKH-4, AKA-2, AKA-8401, American DHY286, AKH 081 Hybrid – PKV H-2, PKV-HY-3, H-4, H-6, Laxmi Varlaxmi, Savitri	Rajapuri and Karadi (Soni), Lakhandi, Duggiralo, selum, gadhavi, alleppy, Kasturi, Krishna

INTEXT QUESTIONS 3.5

1) Fill in the blanks:

   1. Preseasonal sugarcane crop is sown in the month of _____.
   2. H - 4 is the variety of _____ crop.
   3. Curcuma longa Linn is the botanical name of _____ crop.
   4. The botanical name of sugar cane crop is _____.
   5. Rajapuri is the famous variety of _____ crop.

3.8 WHAT YOU HAVE LEARNT

In this lesson we have studied the cultivation practices of different important field crops viz. cereals, pulses, oilseed fibre, cash and spice crops with respect to preparation of land, sowing, important varieties, intercultural practices, irrigation, fertilizers, harvesting and yield of these crops.

3.9 TERMINAL QUESTIONS

1) Give information on wheat crop with reference to preparation of land and sowing, important varieties, fertilizers, harvesting and yield.

2) Give information on mustard crop with reference to preparation of land and sowing, important varieties, irrigation, harvesting and yield.

3) Give information on ground nut crop with reference to preparation of land and sowing, important varieties, fertilizers, harvesting and yield.

4) Give information on sugarcane or cotton crop with reference to preparation of land and sowing, important varieties, fertilizers, harvesting and yield.

5) Give information on turmeric crop with reference to preparation of land and sowing, important varieties, fertilizers, harvesting and yield.

3.10 ANSWER TO INTEXT QUESTIONS

3.1

1 Spermatophyta

2 June to October

3 Rabi

4 Monocotyledons

3.2

1) Oryza sativa

2) Sorghum vulgare

3) Zea mays

4) Triticum species

5) Pennisetum typhoideum

3.3

1) Africa

2) Afghanistan

3) India

4) Central Africa

5) South Europe

3.4

1) SB – 11

2) EC 68414

3) N – 630

4) Local varieties

3.5

1) September to October
2) Cotton
3) Turmeric
4) Saccharum officinarum
5) Turmeric

SUGGESTED ACTIVITIES

A) Prepare a crop museum of pulses and oil seeds

B) Visit a commercial farm producing different cereals, fibre, spice and cash crops to study the cultivation practices

4

STUDY OF HORTICULTURE CROPS

4.1 INTRODUCTION

Cultivation of different crops is an occupation of large number of people in the world. The farmers grow different crops according to their needs, the agro climatic conditions and demand in the market. Horticultural crops are valuable crops and are grown all over the world with objectives of getting higher profits. Hence, we must study these crops with lot of interest.

4.2 OBJECTIVES

After reading this lesson you will be able to:

- Understand the Horticulture as a science of studying variety of valuable crops.
- Compare different Horticultural crops with field crops.
- Get knowledge of Horticultural crops like Fruit crops, Vegetables and Flower crops.

4.3 INTRODUCTION TO HORTICULTURE

Horticulture is a science of studying garden plants. The world Horticulture is derived from two Latin words viz. *Hortus* means garden and *Culture* means knowledge of growing these crops.

Horticulture is an aesthetic science that deals with the important crops which are grown in the gardens e.g. vegetable crops in vegetable garden, fruit crops in fruit orchards.

Branches of Horticulture

There are four branches of Horticulture, which are as follows:-

1. Olericulture (Vegetable culture): This branch deals with the study of vegetable crops. Vegetables are nutritive food of plant origin which are

normally cooked before consumption or eaten raw as salad. e.g. Cabbage, Tomato, Fenugreek.

2. Pomology (Fruit Culture): This branch of Horticulture deals with study of different fruit crops. Cultivation, management and other aspects of fruit crops are covered under this branch e.g. Mango, Banana, Grapes.
3. Floriculture and Ornamental Gardening: This branch of Horticulture covers flower crops and ornamental plants. Study of different flower crops and ornamental plants with reference to their production and uses. It also includes gardening, landscaping and beautification of surroundings e.g. Roses, asters, lily, Cactus, Ferns, etc.
4. Post Harvest Technology and preservation: Study of post harvest handling, marketing, and processing of Horticultural crops is covered under this branch. Post harvest management of fruits, vegetables, flowers with their storage, marketing and preservation is studied under this branch e.g. Preparation of jam, jelly, ketchup etc.

Importance and scope of Horticulture

Let us see the importance of Horticulture:

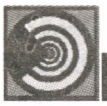
1. As compared to field crops Horticultural crops give more returns per unit area (More yield in terms of weight and money).
2. Horticulture crops are important as their nutritional status is high. Particularly fruits and vegetables provide high amount of vitamins and minerals to us.
3. Horticulture is important as it beautifies the surroundings.
4. Horticulture crops are suitable for small and marginal farmers.
5. The varieties of crops are available in the Horticulture section with wide range of uses.
6. Horticultural plants improve environment by reducing pollution, conserves soil and water and improve socio-economic status of the farmer.

Scope of Horticultural crops

Factors affecting the scope of Horticultural crops in India is as follows:

1. Varied agro climatic conditions in India, allows growing different Horticultural crops in different regions.
2. Increasing irrigation facilities provide more scope for growing Horticultural crops.
3. Availability of technical information regarding production of Horticultural crops will provide congenial condition for growing these crops.
4. Increasing communication and transport facilities provide greater markets to Horticultural crops.
5. There is scope for export of fresh and processed products.
6. Greater demand for Horticultural commodities in local markets.
7. Facilities provided by the government helps farmer to replace their traditional crops with Horticultural crops.
8. Development of financial institutions, co-operatives in rural areas.

9. Improvement of post harvest facilities like storage and processing help in increasing returns from these crops.



INTEXT QUESTIONS 4.1

A. Fill in the blanks:

1. The term Horticulture is derived from _____ and _____ words.
2. Olericulture is a branch of Horticulture that deals with _____ crops.
3. _____ branch of Horticulture deals with fruit crops.
4. Horticulture is an _____ science.

4.4 STUDY OF FRUIT CROPS

More than 50 fruit crops are cultivated on commercial scale in India, starting from Apple to Ziziphus. The tropical and sub-tropical fruit crops (Mango and banana) temperate crops (Apple, Peach, Pear) and arid zone fruit crops (Fig, Ber, Phalsa) are grown in India. India accounts for 10 % of total world's fruit production. India ranks first in production of Mango, Banana, Sapota and lime. India records highest productivity of grapes. The leading fruit growing states are Maharashtra, Karnataka, AP., Bihar and U.P.

Cultivation of fruits contributes to health, happiness and prosperity of the people. It is often said that the standard of living of people can be judged by the production and consumption of fruit per capita. Fruits provide raw material for preservation industry, the wine industry(Grapes), and oil industries(Coconut) .

Economical health of the grower is improved by growing fruits crops alongwith the nutritional health of consumer as they are high yielding and high paying as compared to agronomical crops.

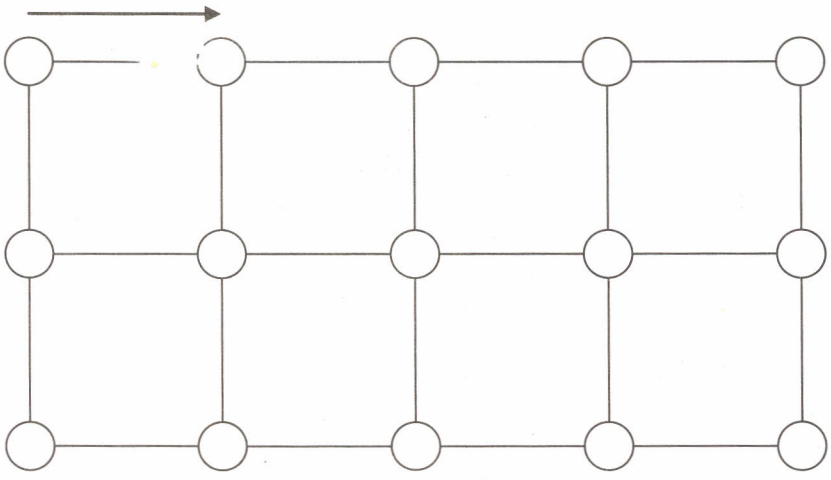
Methods of layout of an orchard :-

The layout of an orchard is a very important operation. Laying out the orchard begins with the making of a base line which is usually taken parallel to half the spacing to be given between the trees. At both ends of the base line right angles are created by following the simple carpenters meter system. After the formation of these three lines. It is easy to fix the boundary of the orchard.

Different methods of planting an orchard:-

1. **Square system: -** In this case a tree is planted on each corner of a square whatever may be the planting distance. This plan is commonly followed as it is easy to layout, inter cropping and cultivation is possible in two directions e.g. Mango (10X10 mt), Banana (1.25X1.25 mt). Each tree gets equal area for growth.

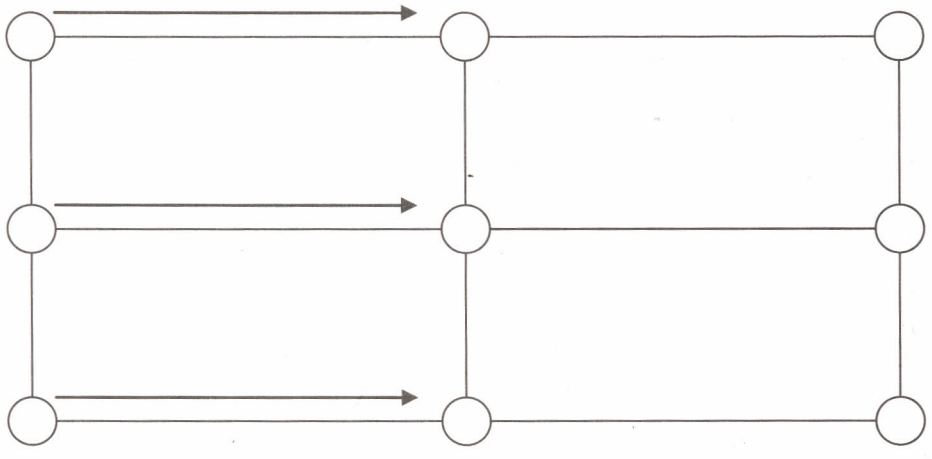
Diagram



Square System

2. **Rectangular System: -** This system is similar to that of the square system in its layout except in this layout row to row and plant to plant spacing is not same. E.g. Grape (3m x 2m mt.) Increased spacing in rows is useful for mechanical cultivation between rows.

Diagram

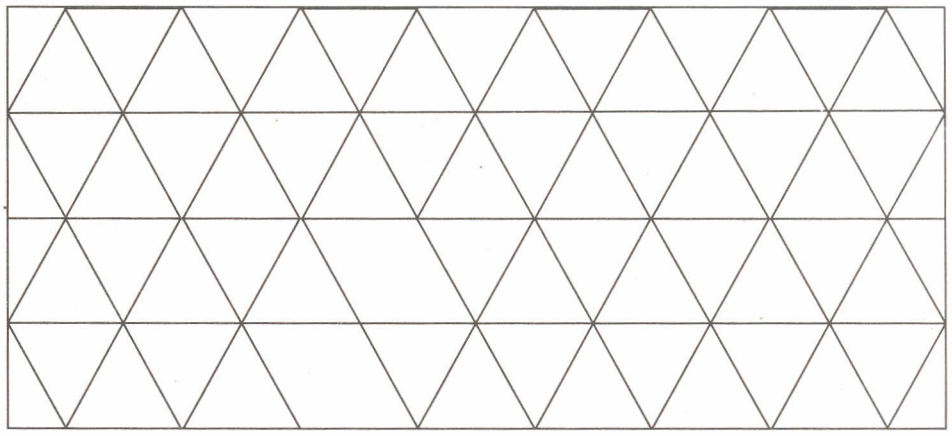


Rectangular System

3. **Hexagonal system: -** In this method the trees are planted at each corner of equilateral triangle. In this way six trees form hexagon with the seventh tree in the centre. This plan can be usually employed where land is expensive and very fertile with good available water supply. The trees are equally spaced from each other. It is difficult to layout. In this layout 15% more

plants are accommodated than the square system. In this system intercultivation is difficult.

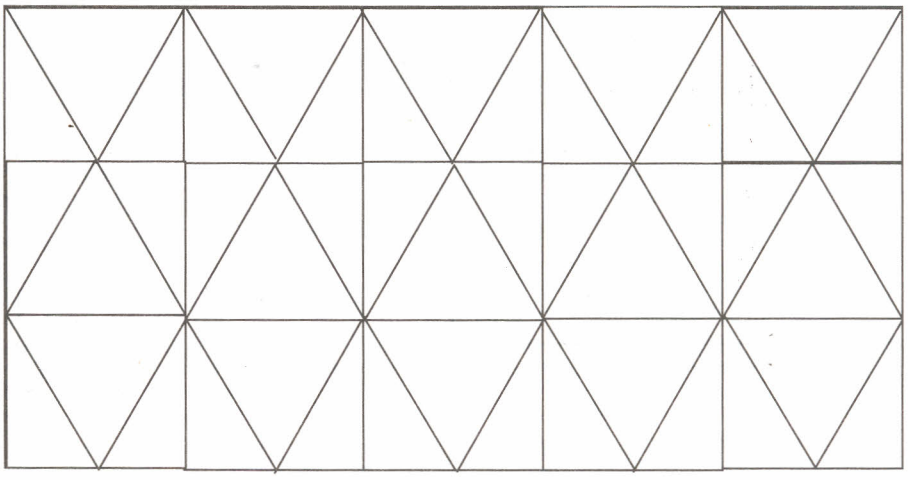
Diagram



Hexagonal system

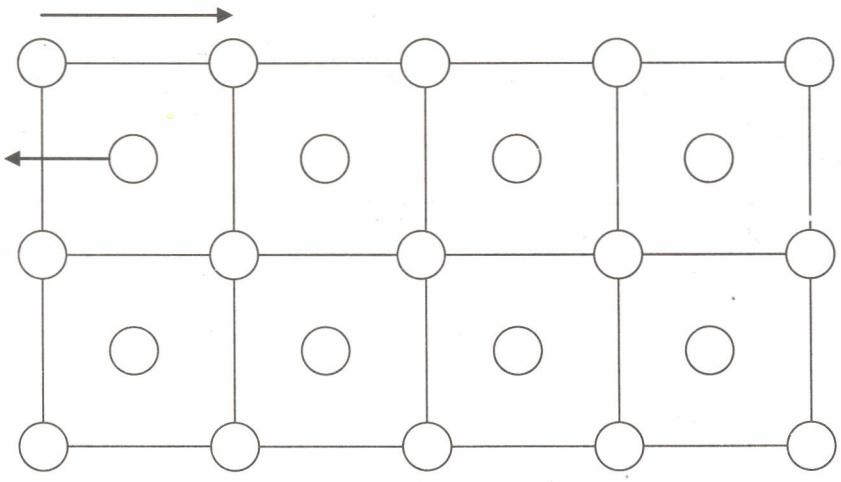
4. **Triangular System:** In this system the trees are planted as in the square system but the plants in the 2nd, 4th, 6th and such other alternate rows are planted mid way between the 1st, 3rd, 5th and other alternate rows. This system has no special advantages over the square system except providing more open space for the trees and for intercrops. It is difficult for labour and cultivation. This system is useful for plantation on hill slopes.

Diagram.



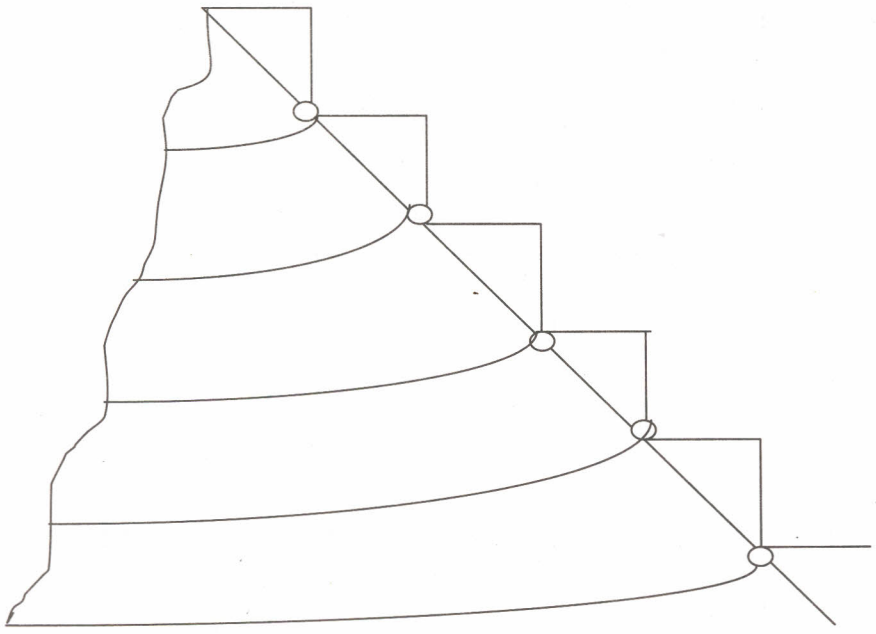
Triangular System

5. **Quincunx system: -** It is differing from square system by planting and additional tree in the centre of each square of permanent trees. The central tree is usually the filler tree which is kept only for a shorter period.



Quincunx system

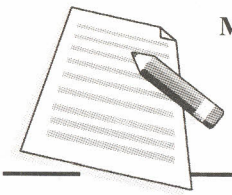
6. **Contour system:** It is only followed on hills with high slopes. In this case the tree rows are planted along a uniform slope and usually at right angle to the slope with the idea of reducing loss of soil due to soil erosion. It is followed just as in case of square system. The marking should be done from the lowest level to the top.



Contour system

Calculation of plant population:

$$\text{No. of Plants} = \frac{\text{Total area in Sq. M.}}{\text{Plant to plant distance (in M.)} \times \text{Row to row distance (in M.)}}$$



Module-2

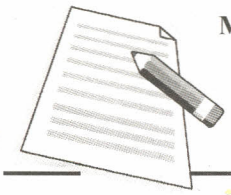
Notes

Information about some important fruit crops is given below in tabular form.Study of fruit crops is given below:

Name of the crop Particulars	Mango	Banana	Grape	Apple	Guava
Botanical Name	*Mangifera indica*	*Musa species*	*Vitis vinifera*	*Mallus pumila*	*Psidium guajava*
Major states	A.P., U.P., Bihar, Karnataka, Maharashtra	A.P., Assam, Bihar, Gujarat, Karnataka, Maharashtra,	Maharashtra, Karnataka, A.P., Tamilnadu	J & Kashmir, Himachal Pradesh, Sikkim, Nagaland, Meghalaya	U.P., Maharashtra
Soil	Light red, Lateritic, medium black	Sandy loam pH 6.5 – 7.5	Alluvial heavy black pH 6.5 – 7.5	Loamy rich soil Well drained pH 5.5 – 6.5	Heavy clay to light sandy pH 4.2 – 8.2
Climate	Hot and humid, Frost free, rain free during flowering	Humid subtropical up to 2000 M. altitude	Hot and dry, Frost free, low rainfall	Temperate crop, need cool season	Hot and dry, low night temperature
Propagation	Epicotyle, Softwood, Inarch grafting	Suckers, Tissue cultured plants	Cutting, In situ grafting on *Dogridge* root stock	Tongue graft, T Budding	Layering
Varieties	Alphanso, Totapuri, Keshar, Dashehari, Neelum, Langra	Dwarf Cavendish, Robusta, Grand Nain, Lal velchi, Safed velchi, Poovan	Thompson seedless, Sharad seedless, Tas a ganesh, Sonaka, Banglore blue	Golden delicious, Red delicious, Red chief, Tap red, Red gold	Lucknow – 49, Allahabad safeda, Chittidar
Preparation of land	Dug pits of 1 m^3. Fill the pits with top soil, leaf mould, rotten FYM, bone meal and insecticide powder	Ploughing, preparation of trenches or pits	Ploughing, preparation of trenches or pits	Dig pits of 1 m^3 Fill them with soil and compost	Ploughing, leveling, preparation of pits 1 m^3 Fill with soil and FYM
Planting distance	10m X 10 m 2.5mX2.5 m for high density	1.2mX1.8 m	3 m to 6 m	6 m to 8m	5 m to 8 m
Time	June to September	February to April, September – October, June - July	January to February, July - August	December - January	July – August

Fertilizer dose	50 kg FYM, 750:180:680 g. NPK / Tree	10 kg FYM, 200:50:300 g. NPK / Tree	500:500:1000 kg NPK / ha in multiple splits	10 kg FYM, 700:350:700 g. NPK / Tree	260:320:260 g NPK / Tree
Irrigation	Rain fed crop Irrigation in initial years	Drip system is useful Furrow method	Light and frequent, Drip system used mainly	No irrigation under rain fed conditions	Grown as rain fed crop Light irrigation in summer if needed
Interculture	Intercropping, removing weeds, shrubs	Cut the suckers, weed regularly	Training/ Pruning clean cultivation	Clean basin management	Training/ Pruning light cultivation
Yield	500 fruits per tree	25 to 40 tones per hectare	20 to 50 tones per hectare	10-20 kg per tree in southern 40-100 kg per tree in northern parts	100 kg fruits per tree

Name of the crop Particulars	**Sapota**	**Pome-granate**	**Orange**	**Coconut**	**Cashew nut**
Botanical Name	*Manilkara achras*	*Punica granatum*	*Citrus reticulata*	*Cocos nucifera*	*Anacardium occidental*
Major states	A.P., Gujarat, Karnataka, Maharashtra	Maharashtra,	W.B.., Karnataka, Maharashtra,	A.p., Kerala, Tamilnadu Karnataka, Maharashtra,	M.P., W.B., Karnataka, Maharash-tra,
Soil	Light well drained	Well drained, sandy, loam	Light loamy well drained pH 6-8	Laterite, sandy, Alluvial sandy pH 4.5- 6.8	Red sandy loam, Laterite
Climate	Warm and humid	Semi-arid, hot and dry	Frost free, dry, 10^0 - 35^0 C	Hot and Humid	Hot, humid
Propagation	Grafting on rayan stock	Air layering	Seed, budding	seed	Softwood grafting
Varieties	Kalipatti, palipatti , cricket ball	Ganesh, Mridula, Arakta, Jyoti	Coorg, Nagpuri, Kinnow	West coast tall, T x D, Pratap,	Vengurla-4 to Vengurla-7
Preparation of land	Pits 1 m^3	30 cm^3 pits	50 cm^3 pits	Pits 1 m^3	50 cm^3 pits
Planting distance	8 to 10 m. 5m x5m for high density	4 to 5 m. 2.5mx4.5m for high density	5m to 6m	7.5m to10m	7.5m to 8 m
Time	June – September	All year round	Feb -March, Sept.- Oct	Oct - Nov	June-September
Fertilizer	400:160:450 g. NPK per tree	10 Kg FYM 600:200:200 g NPK per plant	20 Kg FYM 450:450:900 g NPK per tree	50 Kg FYM 500:320:1200 g NPK per tree	500:125:125 g NPK per tree
Irrigation	15 days interval in summer	Drip irrigation	Light irri-gation 5 to 7 days interval	Regular irri-gation from November	Rain fed crop



Interculture	Intercrop-ping, Pruning, Weeding	Bahar treatment, Pruning	Bahar treatment, Weeding, light cultivation	Weeding, Light cultivation	Weeding, Mulching
Yield	15 – 20 tones per Hectare	60-80 fruits per tree	100-300 fruits per tree	100 fruits per tree	5 to 10 kg. fruits per tree

Name of the crop Particulars	**Fig**	**Papaya**	**Jamun**	**Acid lime**	**Pineapple**
Botanical Name	*Ficus carica*	*Carica papaya*	*Syzygium cuminii*	*Citrus aurantifolia*	*Ananas comosos*
Major states	UP., Gujrat, Karnataka, Maharashtra	U.P., Tamilnadu, Karnataka, Maharashtra	Tamilnadu, Himalyan region, Kumaon hills	Tamilnadu, Karnataka, Maharashtra	Assam, Meghalaya, WB, AP, Maharash-tra
Soil	Medium to heavy, Well drained, deep pH 7–8	Rich, alluvial, Calcareous, stony pH 5- 8	Calcareous, saline, deep welll drained	Sandy loam well drained	Heavy clay, pH 5- 6
Climate	Semiarid, Temp. 45^0 C	$12^0 – 14^0$ C night temp. adverse effect	Dry and hot frost free	Frost free warm	Warm and humid
Propa-gation	Seed, cutting, layers and Grafting	Seed	Seed, Nucellar plants, Graft	Seed, Nucellar seedling	Suckers, Slips
Varieties	Poona, Climyra king, Sanpedro, Stan ford	Pusa delicious, Pusa Majesty, CO-1 to CO-6, Coorg honey dew	Rajamun, Local, Paras	Pramalini, Vikram, Seedless lime	Kew, Giant Kew, Queeen
Preparation of land -	Pit 60 cm^3, fill with soil+ sand+ FYM (1:1:1)	Trenches or furrows or pits	1 m^3 pits	Ploughing 90 cm^3 pits	Ploughing trenches or furrows opened
Planting distance	2.5mX2.5m	1.2m to1.8m	8m to 10 m	4m to 6m	22.5X60 X90 cm
Time	On set of monsoon	Feb – March, June – July, October – November	July - September	June - August	June – July, October – November
Fertilizer	25 kg FYM + 2kg oil cake+ 300:200: 200 g. NPK per tree	250:250:500 g NPK per tree	20 kg FYM 500:600:300 g NPK per tree	50 kg FYM 900:250:500 g NPK per tree	12:4:12 g NPK per tree
Irrigation	At 10 days interval in summer	At 10 days interval from Oct to may	Rain fed crop	Drip irrigation	Rain fed crop Irrigation once in 20 – 25 days

Interculture	Training and regular pruning	Weed control	-	Bahar treatment	Weeding, Mulching
Yield	12 to 15 tones per hectare	60- 75 tones per hectare	50- 100 kg per tree	3000 to 3500 fruits per tree	40 – 50 tones per hectare

Name of the crop Particulars	**Custard apple**	**Ber**	**Jackfruit**	**Aonla**	**Karvand**
Botanical Name	*Annona squamosa*	*Zizyphus mauritiana*	*Artocarpus hetero-phyllus*	*Emblica officinalis*	*Carissa carandas*
Major states	AP., Bihar, Karnataka, Maharash-tra	Haryana., Rajasthan, Gujrat, Karnataka, Maharashtra	Coastal AP., Tamilnadu, Karnataka, Maharashtra	U.P., A.P., Rajasthan, Gujrat, Karnataka, Maharashtra	West Bengal, Tamilnadu, Kamataka, Maharash-tra
Soil	Shallow, Rocky and Gravell	Wide range of soil sandy light saline soil	Light sandy to heavy	Slitightly acidic to saline, pH 6.5 – 9.5	Light saline and sodic also.
Climate	Tropical climate	Hot and dry drought conditions	Warm and humid high rainfall can-not tol-lerate cold and frost	Dry and hot Frost free	Drought tollerent
Propagation	Seed, Grafting	I or T budding	Seed, grafting	Seed, budding, grafting	Seed, cutting, air layering
Varieties	Balangar, Local	Gola, Seb, Umran, Kaithali, Kadaka, Mehrun	Gulabi, Champa, Hazar	Kanchan, N-7, N-10, Banarasi, Chakaiya	Maroon, Local
Preparation of land	Pits 60 cm^3	Dig the pit 60 cm^3	Dig the pit 1 m^3	Pits 90 cm^3	Pits 45 cm^3
Planting distance	5m x 5 m	6m to 8 m	10m to 12 m	7m to 10 m	2m to 4 m
Time	June	January – March, Insitu budding	June - August	June – September	June – July
Fertilizer	250 : 125 : 125g NPK per tree	750 : 250 : 250g NPK per tree	600 : 300 : 240g NPK per tree	10 Kg FYM 100 : 50 : 100g NPK per tree	10 to15 Kg FYM per tree
Irrigation	Rain fed crop	Grown as a rainfed crop	Grown as a rainfed crop	10 to 15 days interval	Grown as a rainfed crop
Interculture	Weeding, Pruning	Intercroping initially with pulses	Intercropping	Mulching, Weeding	
Yield	100 – 150 fruits per plant	80 to 120 kg fruits per tree	40 to 50 tones per hectare	15 to 20 tones per hectare	3 to 5 kg fruits per plant