2. Commercial Crops

Can you recall?

1. Different traditional crops.
2. Difference between traditional farming and commercial agriculture.
3. What is survival farming?
4. Why commercial approach is essential in agriculture sector?
5. Have you observed the Jaggery plant and sugar factory.
6. Which information will you share about banana chips and banana wafers?

2.1 SUGARCANE

Botanical Name : *Saccharum* species

Sugarcane comprises of following species.

i. *Saccharum officinarum*
ii. *Saccharum barberi*
iii. *Saccharum sinensis*
iv. *Saccharum spontaneum*
v. *Saccharum robustum*

Family: *Gramineae*

Origin:

1. *Saccharum officinarum* - Indo-Myanmar China border with New Guinea as the main center of diversity.
2. *Saccharum barberi* - North India
3. *Saccharum sinensis* - China
4. *Saccharum spontaneum* - India

Remember this

The Indian cane is a result of natural hybridization between *saccharum officinarum* and *saccharum spontaneum* (wild species).

2.1.1 Uses :

Sugarcane is mainly grown for the manufacture of sugar. Apart from sugar, other products like jaggery *(gul) and khandsari* are also prepared from this. Green tops of plant are used as forage for cattle. Stubbles are used as fuel in rural areas. Cane trash is used as thatching material for huts and also used for preparing compost. The factory by- products namely bagass, molasses, pressmud cake and wax are obtained. Bagass is used in paper industry, while molasses is useful in distillery for preparing acetic acid, alcohol, etc., and pressmud cake is used as manure. Wax is used for preparing lubricating material. Sugar itself is used as sweetener in food items, ingredient for hair tonics, shoe polishes, explosives, etc. It is also used in tanning leather, silvering mirrors, etc.

Do you know ?

- Globally 60 per cent of sugar comes from sugarcane and 40 per cent from sugarbeet.
- In India, sugar industry is the largest processing industry next to cotton textiles.

Fig. 2.1 Sugarcane Crop

2.1.2 Soil :

Sugarcane can be grown on a wide range of soils. In Maharashtra, it is grown predominantly on medium black soils. It grows best on well drained, fertile medium to heavy soils having 60-120 cm depth. Soils rich in organic matter and levelled are most suitable. The pH of soil should be between 6.5. to 7.5. It is a heavy feeder crop, hence not grown on light soils. Saline, alkaline and acidic, soils are not suitable for this crop.

2.1.3 Climate :

Sugarcane is a tropical crop but can be grown in subtropical region. It requires warm and humid climate for growth, while cool, sunny and dry climate for maturity. The temperature requirement is 30^{o}C to 35^{o}C for 4 to 5 months

and cooler climate 1.5 to 2 months before harvesting. Germination does not take place when temperature goes below 7^{o}C and plant growth is slowed down below 20^{0}C temperature. Both the extremes of temperature are harmful. Severe cold ceases the growth, while attack of stem borer increases in hot weather. It does best with 750 to 1250 mm annual rainfall. Rainfall deficiency produces fibrous cane, where as too heavy rainfall reduces sugar accumulation.

2.1.4 Preparatory tillage :

Sugarcane stands in the field for more than one year, hence land should be prepared by giving two deep ploughing. First ploughing is given immediately after the harvesting of previous crop with iron plough and the land is exposed to sun for one to two months. The clods are crushed with clod crusher or Norwegian harrow. About 35 – 50 tons of FYM/ha is added to soil. Second cross ploughing is given followed by 2 – 3 harrowings. Thus soil brought to clod free tilth. Land is levelled with the help of planker and beds are prepared.

2.1.5 Planting season and time :

Sr. No.	Planting season	Planting time
1	Seasonal/*Suru*	Jan – February
2	Pre-seasonal	October – November
3	*Adsali*	July – August

2.1.6 Lay out of land for planting and irrigation

1. Small bed with ridge and furrow method :

In this method ridges and furrows are prepared in small beds. Distance between ridges is 105-120 cm. This method does not allow inter cultivation by bullock drawn implements. But farmers like it, because more water can be applied at a time. Water flows from all the directions of the furrows as both the ends of ridge are kept open in the bed.

2. Serpentine method :

On slightly sloping lands, this method is followed. The Ridges and furrows are drawn across the slope in a serpentine way. The distance between ridges is 105-120 cm. This method has same advantages and disadvantages as that of small bed method except water is applied slowly and uniformly. One end (alternative) of the ridges is kept open to flow water in surpentine way in one direction only.

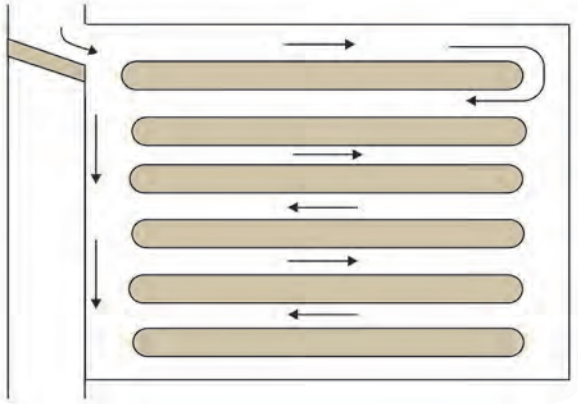


Fig. 2.2 Small bed with ridge and furrow

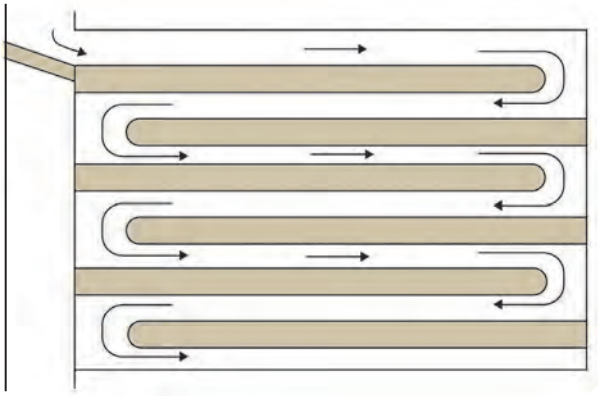


Fig. 2.3 Serpentine method

3. Long Furrow method : In this method distance between two ridges is 120 cm. The ridging is straight. Where land is levelled, this layout is commonly used. It allows inter-cultivation by bullock and tractor drawn implements. The irrigation can be watched at tail ends of furrows.

4. Contour furrow method : In this method furrows are opened along adjusted contour lines and a gradient of 10 to 15 cm per running 33 meters is given depending upon the soil type and topography

- This layout is followed on undulating and sloppy lands.
- It facilitates proper handling of water and reduction in soil erosion.
- Initial cost of this layout is more. By this method more water can be handled at a time.

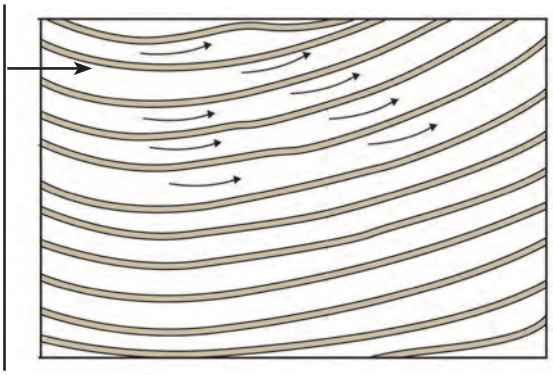


Fig. 2.4 Contour furrow method

5. Paired row (*Patta*) method :

In this method depending on the type of soil two consecutive furrows are opened at 2.5 to 3 feet distance and wide gap (empty space)of 5 to 6 feet is kept before the next set of two consecutive furrows. Cane is planted in consecutive furrows.

Advantages:

- It helps in vigorous crop growth and increased yield due to proper interception of sunlight and air
- Facilitates intercutivation and plant protection measures.
- Helps in saving irrigation water and reducing weed infestation.
- Intercropping is also possible without affecting the growth of sugarcane crop.

2.1.7 Planting methods : There are four methods of planting: 1. Ridges and furrows 2. Flat bed method 3. Rayungan method 4. Trench or Jawa method.

1. Ridges and furrows method : This is the most common method of sugarcane planting followed in Maharashtra. In this method ridges and furrows are prepared in small beds. Ridges and furrows are opened with the help of ridger at 105 cm distance on medium soil and 120 cm distance on light heavy soil. Main and Sub-irrigation channels are opened at appropriate distance. Planting is done by the following methods.

a. **Wet method :** This method is followed in light to medium soil. Irrigation is given to the field before plantation and then sets are planted by pressing them 2.5 to 5 cm deep in furrows with feet. While planting, the sets are placed end to end by facing buds on sides.

b. **Dry method :** This method is followed in heavy soils. Sets are planted into the furrow and covered with soil. After planting, irrigation is given to the field.

2. Flat bed method : This method of planting is followed in U.P., Bihar, etc. Land is ploughed, harrowed, levelled and flat beds are prepared. Cane sets are laid down in the flat bed end to end in rows at distance of 60 to 90 cm. They are pressed into soil with hand or feet to a depth of 2.5 to 5cm. and covered with soil. At the time of planting care should be taken that buds face should be on the sides.

3. Rayungan Method : It is followed in high rainfall areas for *adsali planting*. In Maharashtra this method is followed in river side fields in heavy rainfall areas of Kolhapur district. In these areas usually cane fields get flooded during rainy season. In such cases sets cannot be planted directly in main field. Single bud sets are planted vertically in nurseries in the month of June-July. Nursery should be on high lying area. After six weeks the sprouted sets are transplanted in the main field when the danger of flooding is over.

4. Trench or Jawa method : This method is followed in Jawa and Mauritius Islands. In India, it is practiced in Assam. The land is ploughed and trenches are made about 90 to 120 cm apart and 22 to 30 cm deep. The soil at the bottom is loosened and mixed with manures. The sets are planted in the middle of trenches and covered with soil to a depth of 7.5 cm. to 10 cm. This method produces large clumps of cane which do not lodge when tied together. Thus the damage from wild animals is also less.

2.1.8 Seed rate (Quantity of Sets) :

Sugarcane is propagated by vegetative method i.e. by using stem cuttings called as sets.

Seed rate of sugarcane depends upon type of soil, sources of water, type of varietis and type of planting. Generally 25,000 to 30,000 sets of 3 eye buds per hectare are required.

2.1.9 Selection of seed material (Sets) :

Set should be selected from healthy canes of well manured and cared nursery. Usually cane is cut into three bud sets. Planting with single bud sets is also practiced at some place. Buds on immature tops of cane germinate well and hence priority should be given to top sets. Over mature cane possess dry scaled buds and should not be selected for sets. Thick canes germinate better and produce good number of tillers and should be used for selecting sets than the thin canes. It is desirable for the farmer to raise his own separate seed or nursery crop.

Try this

Practice different methods of planting practically on the field.

2.1.10 Set treatment

- Set treatment with organo mercurial fungicide is necessary for preventing the attack of seed borne diseases.
- Treatment of carbendazim (0.1%) or copperoxichloride is given against leaf spot.

Fig. 2.5 Set selection and Set treatment

- Rotting of sets can be prevented by treating them with agallol or areton (0.5%)
- Hot water treatment at 50^0C temperature for 2 hours or at 52^0C temperature for half an hour is recommended to control grassy shoot and other viral diseases.
- Grassy shoot and leaf scald can be controlled by Moist-Hot Air Treatment at 54^0C and 99% humidity for 2 to 5 hours.
- Attack of Mealy bugs can be prevented by treating the sets with 1% fish oil rosin soap.
- Chloropyriphos or heptachlor @ 1kg/ha can be used for preventing the attack of termites and shoot borer. It is applied on cane sets at the time of planting

2.1.11 Varieties : CO-740, Co-775, Co-798, CO- 419, CO-421, CO-678, CO-475, CO-92005, CO-7125, (Sampada), CO-7219 (Sanjivani), CO- 8011, CO- 7527, CO- 671, CO- 86032, CO- 8014, CO- 85061, Phule - 265, CO - 10001, CO - 8005 etc.

Internet my friend

Collect information regarding sugarcane varieties and their important characteristics.

2.1.12 Manures and fertilizers : Sugarcane is a heavy feeder and long duration crop so, it requires more manures. Requirements of manures and fertilizers also depend on the variety of sugarcane. The recommended dose of organic and inorganic fertilizer for *adsali*, pre seasonal and seasonal sugarcane crop is used. At the time of preparation of land the organic manures i.e. FYM or compost is used for *adsali*, Preseasonal and seasonal cane crop 50, 35 and 25 tonnes per ha, respectively. Inorganic fertilizers for *adsali*, preseasonal and seasonal cane crop are given in table 2.1

Use your brain power

What are the advantages and disadvantages of application of urea to the sugarcane crop at the stage of maturity?

Table 2.1 : Recommended dose of fertilizers and its distribution

Sl. No.	Time of Application	Adsali				Pre-seasonal				Seasonal/Suru			
		FYM tones /ha	N kg/ ha	P kg/ ha	K kg/ ha	FYM tones /ha	N kg/ ha	P kg/ ha	K kg/ ha	FYM tones /ha	N kg/ha	P kg/ ha	K kg/ ha
1	At planting	50	45	85	85	35	35	85	85	25	25	62	62
2	6-8 weeks after planting	--	180	--	--	--	140	--	--	--	100	--	--
3	8-12 weeks after planting	--	45	--	--	--	35	--	--	--	25	--	--
4	At earthing up (22) weeks after planting	--	180	85	85	--	140	85	85	--	100	63	63
	Total	**50**	**450**	**170**	**170**	**35**	**350**	**170**	**170**	**25**	**250**	**125**	**125**

2.1.13 Intercultivation : The intercultural operations followed in sugarcane crop are as follows:

1. Gap filling

It is done after complete emergence of crop to fill up the gaps in the crop stand. It is done about 6-8 weeks after planting. Gap filling should be done using sets having sprouted eye buds from cane field.

2. Weed control

Depending on the intensity of weeds, 2 to 5 hand weedings should be given. It can also be controlled by weedicide with one pre-emergence spraying of atrazine or alachlor and post emergence spraying of prosulfuron, etc.

3. Hoeing

About 2-3 hoeings are given by two tyned hoes worked in the furrow to stir the soil and to remove weeds. This operation is done at one month interval.

4. *Tagarni or Bal bandhani*

Tagarni means a partial hilling up of soil against crop rows. This operation is done when the crop is at 3-4 months old, and starts rapid growth. It is done twice at an interval of one month for loosening the soil and pruning non-functional roots. In small bed this operation is done by manual labour with (pickaxe) and in long furrow, it is done by bullock drawn or tractor drawn implements.

5. Earthing Up

Earthing up means breaking of ridges and converting them into furrows. It is done when the crop is 5 to 5.5 months old and 2-3 internodes are visible. It is done to support the plants with soil and to avoid the direct contact of water to plants.

6. Detrashing

Removal of some of the older leaves from cane crop is known as detrashing. It is done to avoid the attack of insects and pest.

7. Mulching

Large quantities of cane trash are stored along the boundaries of cane field which can be used as mulch in furrows for conserving moisture. This helps in reducing requirement of water and adding organic matter into the soil.

8. Propping or tieing of cane plants

This operation is done to prevent lodging of cane crop. Some canes of two adjacent rows are brought together and tied by sugarcane leaves, rope. It also provides covenience while irrigating the field.

Observe and Discuss

Visit the sugarcane field and discuss with farmers regarding intercultural practices like gap filling, earthing up,detrashing, mulching, propping, etc.

2.1.14 Irrigation :

- Irrigation requirement depends upon type of soil, season, growth stage and duration.
- Shortage of water results in stunted growth, pith formation in cane and low yield.
- First irrigation is given as pre-planting, irrigation. Second light irrigation is given 7 days after planting. Up to germination subsequent 2-3 light irrigations are given at 10 days interval. Other irrigations are given depending on type of soil and season. In case of heavy soil irrigation is given at 10 days in summer and 20 days in winter season.
- In case of light to medium soil, it is given at 7 days in summer and 15 days in winter.
- Tillering, grand growth and earthing up stages are critical for irrigation.

Remember this

1. Now a days drip irrigation method is popular as it increases sugarcane yield by 20 to 25%.
2. Drip irrigation saves 50 to 60% water.
3. It reduces 30 to 40% fertilizer cost.
4. By using drip irrigation there is less chance for weed infestation.

2.1.15 Crop rotation :

- In low rainfall areas, sugarcane is rotated with cotton and in heavy rainfall areas it is rotated with paddy. For long rotation, sugarcane is rotated with banana and turmeric.
- The common rotations are:
  a. Paddy - Sugarcane - Ratoon
  b. Cotton - Sugarcane –Ratoon -Wheat
  c. Paddy - Groundnut - Jowar -Sugarcane
  d. Cotton - Sugarcane - Rabi Jowar
  e. Sugarcane - Green manure.

Try this

Visit the sugarcane field to acquaint the students with the different cultivation pracitices. Try to prepare a schedule of an intergrated pest and disesase management for sugarcane.

2.1.16 Intercropping : Onion, garlic, coriander, potato gram may be taken as intercrops in sugarcane which gives additional income to the farmers.

2.1.17 Plant Protection :

I. Pest

a. Top shoot borer :

Nature of damage :

i. Caterpillar initially feed on the leaves and later on bore into the shoot from the top.

ii. As a result of this, the main shoot stops growing and too many lateral shoots arises from the top internodes.

Fig. 2.6 Top shoot borer

Control measures :

i. Collect and destroy egg masses.

ii. Remove and destroy infected shoots.

b. Sugarcane stem borer :

Nature of damage :

The infected plant dries up as a result of injury caused by larvae to the stem.

Fig. 2.7 Stem borer

Control measures

Remove dead hearts (infected plants)

c. Pyrilla :

Nature of damage

i. It sucks up the sap from the leaves.

ii.The infected leaves become yellow and dry up.

Fig. 2.8 Pyrilla

Control measures :

i. Remove and destroy lower most leaves bearing egg masses.

ii. Spray the crop with Malathion (0.1 %)

d. Mealy bugs :

Nature of damage :

i. These are the small insects which remain adhering to the buds and sheaths of the cane and suck up the sap.

ii. Infected canes are shrivelled and remain stunted.

Fig. 2.9 Mealy bugs

Control measures :

i. Treat the sets with 1% fish oil rosin soap solution.

ii. Spray the crop with 1 % fish oil rosin soap solution or Malathion (0.1%).

e. Termites :

Nature of damage : White ants feed on buds of the planted sets.

Fig. 2.10 Termites

Control measures :

Application of chloropyriphos @ 1 kg/ha. at the time of planting is effective against termites.

f. Mites :

Nature of damage :

i. Mites suck up the sap from the lower surface of leaves.

ii. The infected leaves turn red and dry up.

Fig. 2.11 Mites

Control measures :

i. Give lime-sulphur spray in the proportion of 1:2.

ii. Spray the crop with monocrotophos.

g. Field rats

Nature of damage : A rat nibbles out the cane and reduces the yield.

Control measures :

Poison baiting with Zinc Phosphide and Selphos tablet is effective against rats.

Fig. 2.12 Field rats

h. Wooly aphid :

Nature of damage : Its outbreak occurs in area where rainfall is less and climate is hot and extremely humid. Infestation starts beneath the leaves along the midrib and later on spread to entire lower surface. Aphids suck the cell sap. In a case of severe infestation crop becomes stunted resulting into reduction in yield to greater extent.

Fig. 2.13 Wooly aphid

Control measures :

i. Spray the crop with the mixture of malathion and dimethoate. Repeat the spray after 15 -30 days, if necessary.
ii. Apply balanced nutrients on soil test basis and avoid excess use of nitrogenous fertilizers.
iii. Clipping and disposing of affected leaves when pest problem is rare on limited area.

II. Diseases :

a) Whip smut :

Symptoms : Whip like structure arises from the top of infected cane. It is surrounded by powdery mass of fungal spores. The infected plant may survive but remains stunted.

Control measures :

i. Remove the whip with thick cloth, without allowing the spores to fall on the ground and destroy it.
ii. Use healthy sets for planting.
iii. Use resistant varieties.

Fig. 2.14 Whip smut

b. Rust :

Symptoms : Numerous small but long yellow coloured spots appear on both the surfaces of leaves. These spots later on turn dark brown to black.

Fig. 2.15 Rust

Control measures :

i. Grow resistant varieties and avoid excessive irrigation.
ii. Spray the crop with 0.05 % zyrum.

c. Red rot :

Symptoms : The leaves turn yellow and dry up. Internal portion of cane becomes red and when cane is split up, uneven red stripes with occasional white strips are observed.

Fig. 2.16 Red rot

Control measures

i. Use healthy sets for planting.
ii. Avoid ratooning of affected crop.
iii. Grow resistant varieties.
iv. Treat the sets with aretan or agallol.

d. Grassy shoot :

Symptoms : From the base of affected plant too many lateral tillers arises, which are light to dark green in colour.

Fig. 2.17 Grassy shoot

Control measures :

i. Treat the sets with hot water at 50^0C temperature for two hrs or at 52^0C temperature for half an hour or with moist hot air at 54^0C temperature.
ii. Use resistant varieties.

e. Mosaic disease :

Symptoms : There is mottling of leaves as dark green or light green stripes.

Control measures : i. Remove and destroy infected plants.
ii. Grow resistant varieties.

f. Twisted top :

Symptoms : The top most leaves become abnormal and intermingled into each other forming knot like structure. Locally it is known as *veni* disease.

Control measures

i. Remove and destroy affected plants.
ii. Change the sets for planting

2.1.18 Harvesting : The sugarcane is said to be mature when the sucrose concentration goes above 16 percent and the purity of juice is more than 85 percent. The parameters which are applied for determining the time of sugarcane harvesting are

a. General yellowish appearance of the entire crop.
b. Metallic sound of cane after being tapped by finger nail.
c. Breaking of cane at the node after bending.
d. Cessation of plant growth and emergence of flowering arrows.
e. Swelling of eye buds.
f. Brix–Saccharometer reading (21 to 24 brix).
g. The average crop age of Adsali, Pre-seasonal and Suru crop is 18, 15 and 12 months respectively.

After ascertaining the maturity by above criteria, the crop is harvested by cutting the cane near to the ground level with the help of sharp chopper or knife. The dry leaves and roots are removed from the cane. The immature tops with leaves are also cut off. Cane is then bundled and taken to the factory for crushing.

2.1.19 Yield :

Sugarcane yield varies with the season of planting as stated below:

1. *Adsali*: 150 tons / ha.
2. Pre- seasonal: 125 tons / ha.
3. *Suru* / Seasonal: 100 tons / ha.

2.1.20 Ratooning :

Ratooning is the practice of allowing stubbles of previously harvested crop to sprout and grow to raise a new crop.

A good ratoon crop can also give quiet comparable yield with seasonal/ *suru* crop. Mid late and late high yielding varieties are better ratooners than early maturing varieties.

a. Importance :

Ratooning is very economical as it saves costs on preparatory tillage, purchasing of seed material and planting of sets. Similarly it gets an advantage of residual manure. In all it is estimated that there is 20- 25 % saving of expenditure as compared to planted crop. It also gives good yield, if same care is to be taken as for the planted cane.

b. Ratoon management

The practices to be followed for ratooning are as follows:

1. The planted cane should be harvested at ground level.

2. Dried canes and trash should be removed. Trash mulching may help in moisture conservation and suppressing weed growth.
3. Emerged shoots and protruding stubbles should also cut at ground level to have uniform stand of crop.
4. The hard soil needs to be loosened. Sides of ridges should be broken by plough and middle portion is loosened by iron grubber or shovel tooth cultivator.
5. The irrigation scheduling may be more or less same as for planted cane. First irrigation should be given 3- 4 weeks after harvesting.
6. The nutrient requirements are same to that of suru crop. Nitrogen is applied in two splits at ratoon initiation and 60 days then after. Whole phosphorus and potassium should be applied at ratoon initiation.
7. Earthing up should be done at the age of 3-4 months.
8. One hoeing and 2-3 hand weedings are required.
9. In India only one ratoon or sometimes two are practiced.
10. Late maturing varieties and *Adsali* ratoon gives more yield.

Remember this

Sugarcane ratoon contributes 50 to 55 % of total sugarcane area and 30 to 35 % of total sugarcane production in India.

2.1.21 Preparation of Jaggery (*Gul*) :

It is second important product after sugar. It is prepared by a number of operations as summarized below:

- Iron crusher operated either with bullocks, oil engine or electric motors are used and cane is crushed to obtain juice.
- The juice is then filtered through wire guage and taken to the boiling pan or stored in metal vessels or storage tank.
- The juice should be boiled within a period of 6 hrs. after its extraction.
- Suspended impurities and colloidal matter are removed by first heating for a period of

Fig. 2.19 *Gul* blocks

30 to 35 minutes. The scum is removed by long handled perforated ladle.

- Bagass, trash or cotton stalks etc., are used as fuel for heating.
- The juice in the course of heating is freed of all impurities by bhendi mucilage. An emulsion made up of groundnut and castor seed in water may also be used.
- Chemical clarificants like super phosphate solution is used in second course of heating for removing impurities and for improving colour of jaggery.
- Kagzi lemon suspension is essential for avoiding saltish taste to the juice.
- Lime water solution is used to avoid problems in solidification of jaggery.
- Striking point of liquid jaggery is 105^{0}C to 107^{0}C temperature and for solid jaggery it is 116^{0}C to 118^{0}C.
- Hot liquid jaggery is then transferred to a cooling pan. The juice is then stirred constantly by long handled wooden spade. When juice reaches in semi solid stage, it is poured in moulding pans of varying shapes and sizes.

Fig. 2.20 Jaggery preparation

2.2 MANGO

Botanical Name : *Mangifera indica*

Family: Anacardiaceae

Synonym : *Amba, Amra*

Origin : Indo-Burma region

Fig. 2.21 Mango fruits

2.2.1 Uses:

Mango is the king of tropical fruits and is pride of India. Wonderful changes are observed in case of its taste from immature to matured stage. Mango fruit possesses a very high nutritive value. It is consumed as fresh table fruit. Many preserved / processed products like jam, squash, canned pulp and slices, pickles, chatneys and amchur are also prepared. Fresh fruits as well as processed products are exported. Konkan is one of the main region where quality Alphonso mango fruits are produced. It is good source of Vitamin A, B and C.

Internet my friend

Find other uses of mango fruit, seed and plant parts.

2.2.2 Soil :

Mango can grow in various types of soil from alluvial to laterite. It prefers slightly acidic, well drained, fairly deep (2m), loamy soil which is rich in organic matter. The water table should be below 2.5 m. The range of pH should be between 5.5 to 7.5. The soils in Ratnagiri are rich in Fe and Al and therefore, there is a typical colour and taste to Ratnagiri alphonso.

Internet my friend

Collect information on propagation methods of mango and find the best suitable method for your region.

2.2.3 Climate :

Mango crop can thrive in wide range of climatic conditions. It grows well in tropical and subtropical climate. It favours a temperature range of 24^0 C to 27^0 C. It can tolerate a very high temperature even up to 48^0 C. High temperature favour fruit development and maturity. Very low (freezing) temperatures and commonly occuring frost during the period of flowering are limiting factors for cultivation. Mango flowers only when temperature start rising after winter. It can do well in an area of average rainfall of 250 cm. During flowering, bright sunny days and low humidity are ideal for mango cultivation. Fairly warm, dry, rainless and frostless weather during flowering ensures heavy and healthy crop.

2.2.4 Propagation :

Mango can be propagated by

i. Sexual method i.e. by using seeds

ii. Asexual method i.e. by means of vegetative propagation

Mango when propagated by seed does not come true to type. Being highly cross pollinated and heterozygous in nature, seed propagation even from the seeds of single tree results in enormous variation in seedlings. Most of commercial mango varieties are monoembryonic.

Commercially mango is propagated by asexual method to get true to type and early yielding plants. It is propagated by grafting on mango rootstock seedling. *In situ method* mango stones (seeds) are planted in field directly and then grafted with desirable type. For this soft wood grafting is mostly used.

As compared to techniques like veneer grafting, approach grafting, side grafting recenty, stone grafting is being adopted efficient. Rootstock seedling are prepared from monoembryonic as well as polyembryonic plants. The seed should be sown within one week after its extraction from ripe fruit. The seeds loose viability within 4 to 5 weeks from extraction. Just germinated stock when leaves are pink the seedling is used for stone grafting. The period suited for stone grafting is July-August.

2.2.5 Spacing :

Planting is done at spacing of 7 × 7 m. for dwarf varieties and 10 × 10 m. distances for tall varieties.

2.2.6 Varieties :

Varieties are classified according to use -

1. **Table varieties** : Alphonso, Kesar, Neelam, Totapuri, Dasheri, Langra, Goa Mankur, Ratna, Amrapali, and Mallika, etc. (should have pleasant, sweet subacid taste with delightful flavour. The stone should be small with firm pulp, and should ripen slowly during storage)
2. **Juicy varieties**: Pairi, Dudhpedha, etc. (Should have soft pulp with or without fibre, fruits should be juicy with agreeable flavour)
3. **Pickle and preserve varieties**: The varieties are, Karel from Sawantwadi for pickles and Gawasji Patel and Amini for preserves. (varieties having sour taste, white firm pulp with even terpentine smell can be used for pickles)
4. **Irregular bearing varieties**: Alphonso, Pairi, Dasheri, Langara, Sindhu (seedless variety – evolved by K.K.V., Dapoli, MS).
5. **Regular bearing varieties**: Neelam, Totapuri, Amrapali, Mallika and Ratna.

Let's discuss

1. What is meant by irregular and regular bearing in mango?
2. What is spongy tissue in mango?

2.2.7 Planting method and materials :

After preparation of land for planting the pits of the size 90 × 90 × 90 cm are dug during summer months. The pits are filled with 20 to 25 kg F.Y.M. or compost and top soil. Phorate 10 G be mixed in the upper layer of soil to avoid termite problem.

Planting should be done during rainy season. In Konkan area planting is done after heavy rains. While planting, it should be seen that the earth ball (rooted ball) of graft does not break. The planting is done generally in the evening. The graft union should not be buried in the soil. The plant should be given irrigation immediately after planting.

After care

After planting uniform moisture level should be maintained and water stagnation should be avoided. Use thatch or lacally available materials to protect the seedling from hot and dry sun. In the initial 2-3 years, the plants are protected from summer heat by covering the stem with dry grass or straw.

2.2.8 Manuring :

The crop should be manured regularly. The manures should be given in the month of June- July, September - October, January-February and efforts are made to develop good framework of the plant. Recommended dose of manure and fertilizer for mango crop on the basis of age is as per the following table.

Use your brain power

What type of bahar treatment is necessary to mango plant.

Manuring Programme of Mango trees

Age of the tree	FYM (Kg)/ plant	N (g)/ plant	P (g)/ plant	K (g)/ plant
1 year	10	20	18	50
2 years	15	50	27	75
3-5 years	25	100	36	100
8-10 years	50	400	144	400
10 years on	75	500	360	750

2.2.9 Irrigation :

Irrigation requirement is high in dry areas and less in high rainfall areas and in heavy soils. First irrigation is given just after planting. Irrigation at the interval of 2 to 3 days should be given in summer in the first year and from the next 2-5 years irrigation should be given at the interval of 4-5 days in summer. As rainfed crop where *in situ* planting is done mango does not require regular irrigation. The frequency and amount of water should be adjusted according to soil and climatic conditions.

2.2.10 Intercropping :

During the first 8 to 10 years intercrops should be taken if irrigation facilities are available. Fruit crops like papaya, pineapple or vegetable crops can be grown as intercrops.

2.2.11 Plant protection :

I. Pest

a. Mango hopper :

Nature of damage : It is very destructive pest of mango during flowering season. Adults and nymphs suck sap from tender shoots and panicles causing drying of the panicles. The fruit setting is affected. Honey dew like secretion on leaves and panicles results in the growth of sooty mould on affected portion.

Fig. 2.22 Mango hopper

Control measures :

i. Hoppers are controlled by spraying Malathion 0.15% or monocrotophos 0.02%.

ii. Sray Carbaryl 10% at the time of panicle emergence and peak fruiting stage.

b. Mango mealy bug :

Nature of damage : The nymphs of mealy bug suck sap from young mango shoots, panicles and flowers and fruits. Drying of affected part of the plant and immature fruit drop occurs. The insects can be identified by white milky powder.

Control measures :

i. The damage can be avoided by digging trench around the trunk during hot months.

ii. Stick bands of grease + coatar in the proportion of 1: 2 and resin + castor oil in the proportion of 4:5, 30-45 cm wide strip should be applied around the tree trunk.

iii) Banding stem with polythene sheet of 400 gauge at 45 cm height from ground

iv) Spray monocrotophos 0.02% on the tree.

Fig. 2.23 Mango mealy bug

c. Fruit fly :

Nature of damage The damage includes feeding of maggots on the pulp leading to appearance of off-smelling. Rotting followed by falling of fruits.

Fig. 2.24 Fruit fly

Control measures :

i. Collection and destruction of the affected fruits.

ii. Hanging traps containing methyl eugenol @ 10 in number/ ha.

d. Bark eating caterpillar :

Nature of damage The caterpillars bore into the bark and feed on it. The dark brown excreta appear in the form of ribbons on the affected portion of the bark. Drying of affected branch can also be seen.

Control measures :

i. Control includes cleaning of tunnel with hooked wire and filling the hole using kerosene.

ii. The hole should be plastered using mud.

Activity

Collect information and samples of physiological disorders in mango.

e. Stem borer :

Nature of damage : The pest tunnel through the main trunk or its branches. Coming out of hard ball of excreta from the tunnel portion, drying of branches in case of severe attack are the characteristic damage.

Control measures :

i) Clean the tunnel with hard wire.

ii) Pour kerosene oil inside the hole and plug it using mud.

II. Disceases :

a. Powdery Mildew :

Symptoms : It is a fungal disease and the mango crop can be completely destroyed in case of severe attack. Grey white powdery blocks appear on the blossom and fruitlets. Affected panicles get dry and turn black. It may cause total failure of the crop.

Fig. 2.25 Powdery mildew

Control measures : Application of wettable sulphur 0.2%/karathane 0.1%/Bavistin 0.1% or Benlate 0.1% are recommended for the control.

b. Anthracnose :

Symptoms : It is a fungal disease. Appearance of black necrotic areas on leaves, shoots, inflorescence and fruits are seen. Dropping of young fruits. Rotting of affected fruits in storage also appears.

Fig. 2.26 Anthracnose

Control measures : Spray Blitox 0.3 %.

c. Loranthus

Symptoms : It is a parasite. It grows on the branches of mango tree and it causes retardation of growth and yield of trees. Degradation of fruit quality.

Control measures : Cut parasite affected branches below the point of invasion.

2.2.12 Harvesting :

In Maharashtra mango starts flowering in the month of November and continues till February. Fruits become ready for harvesting in the month of March-June i.e. 4-5 months are required from flowering to harvesting.

Keep in Mind

Maturity indices of mango fruit

1. Slight colour development on the shoulders of the fruits (yellowish or reddish pigmentation is developed).
2. Dark green colour of immature fruits change to pale green on maturity.
3. When one or two ripe fruits fall from the tree, other fruits are supposed to be matured.
4. When the specific gravity of fruits reaches between 1.01 to 1.02 they are considered ready to harvest.

When fruits are ready for harvesting, fruit picker climbs the tree and collect fruits in bags on his shoulder. Recently, Konkan Krishi Vidyapeeth has developed a mango picker. In this picker, a bamboo pole is fitted with a cutting blade at the end under which fruit collecting net is tied.

2.2.13 Yield :

Yield upto 10 years age - 500-800 fruits/ plant. i. e. 8 to 12 tones / ha.

Yield after 15 years - 1000-3000 fruits/ plant. i.e. 12 to 20 tones/ha.

Try this

Why is packing necessary for transporting of mango to long distance market?

2.3 BANANA

Botanical Name: *Musa cavendish*
Musa paradisiaca
Musa sapientum

Family: Musaceae

Synonym: *Keli, kela*

Origin: The mountain regions of Assam, Burma, Thailand and Indo - China.

Fig. 2.27 Banana

Can you recall?

1. Have you visited any banana plantation?
2. Which is the leading district in banana cultivation?

2.3.1 Uses :

In India banana is the second important fruit crop next to mango. Maharashtra stands first in the country for production and area of banana. The fruit is available throughout the year. Out of the total production of banana 85 per cent is used for fresh consumption and about 14% is used for processing. i.e., powder, dried banana, etc. Banana is a rich source of energy. All the parts of this plant are useful to various products like soft drink, beer etc. It also contains vitamins A and B. Banana is a rich source of minerals like phosphorus, calcium and magnesium, etc.

Try this

Spot the region where banana is mostly cultivated in Maharashtra and note the climatic conditions of that area

2.3.2 Soil :

Banana can be grown in various types of soils in India. The soil suitable for banana should have 1m depth, well drained, fertile, free working, moisture retentive, and containing plenty of organic matter. Fertility of soil is very important for successful cultivation as it is heavy feeder crop. The root system of banana goes up to a depth of 1m with a concentration of majority of its roots (30 to 40 cm depth) in upper layer. Though banana is a water loving plant, it cannot tolerate water logging condition. The range of pH should be 6 to 8.

2.3.3 Climate :

Banana is tropical crop and requires a warm, humid and rainy climate, but has wide adaptability from wet tropical to dry sub- tropical regions. It can be grown in a temperature range of 10 to 40^0 C. The yield is more when temperature is above 24^0 C for a considerable period. Heavy storms, frost, low temperature below 10^0 C or extremely high temperature are limiting factors for successful cultivation. It needs good humidity with an abundant water supply. The total water requirement of banana plant is about 900-1200 mm for its entire lifecycle for satisfactory growth. If rains are distributed over a period of 8 months then it can be taken as rainfed crop. It cannot tolerate water stress at any stage of growth. Maharashtra have the most ideal climate for banana cultivation.

2.3.4 Propagation :

Commercially edible bananas are seedless and propagated exclusively by vegetative means eg. Rhizomes, sword suckers and bits. Sword suckers having narrow sword like leaves are selected as they grow vigorously, faster and bear large size bunches. 2-3 months old sword suckers with 30 cm height and 500 g to 1 kg weight is ideal for planting. Broad leaf sucker or water suckers should be discarded. Narrow

leaf sucker becomes broad leaf soon after its detachment from mother rhizome. Suckers of 2 to 4 months age are selected.

Basrai variety in Jalgoan district is propagated through dormant rhizomes. After cutting the parent plant, the rhizomes are removed from soil, stored in a cool, dry place for about 2 months. During the resting period the remaining part of pseudo stem at the bottom falls off, leaving prominent heart bud. Conical rhizomes should be selected. Flat rhizome should be rejected. The weight of rhizome should be 500 to 800 g. Rhizomes should be 3-4 months age at planting very small rhizomes, will give bigger size fruits with late flowering. While bigger size rhizomes fruit flowers early but bear small size bunches.

Banana is also propagated by bits. It is a small cut piece of rhizomes having at least one bud on it. Now tissue culture technique has been made possible to prepare plants true to type.

2.3.5 Varieties : In Maharashtra the following varieties are commercially cultivated.

1. Dwarf varieties

Basrai, Rasthali, Sonkel, etc.

2. Semi tall varieties

Harichal or Bombay Green, Safed Velchi, etc.

3. Tall varieties

Lal velchi or Champa, Poovan, Grand-9, etc.

2.3.6 Preparatory tillage : It is biennial crop, hence before planting, field should be prepared by ploughing followed by harrowing. FYM at the rate of 40 -50 tones/ha. is added.

Remember this

Sword suckers:

1. Sword shape leaves, pointed at the tip
2. Pseudo stem is strong
3. Strong in growth
4. It is used for propagation gives late crop but yield is more

2.3.7 Planting method : There are two methods of planting.

i. Pit method : This method is very laborious and expensive for planting of banana, pits of 45x45x45 cm are dug and the pits are filled with well decomposed FYM.

ii. Furrow method : This is common method in which furrows of 20-25 cm depth are opened by a ridger at a distance of 1.5 m and rhizomes are planted in a furrow.

Generally June to July is the most common time of planting in India. The suckers are planted in such a way that it will be 20 to 30 cm below the surface of soil.

2.3.8 Spacing :

The distance of planting depend upon the variety, climate, yield and quality expected, and practice of ratooning. According to vigour of the variety the distance of planting varies from 1.25 to 3.00 m.

2.3.9 Planting season :

The planting can be done any time during the year if irrigation facilities are available. It has two main season :

i) **Mrigbaug :** Planting should be done at the end of May to end of June for better sprouting of rhizome and vegetative growth.

ii) **Kandebaug :** Planting should be done from the end of September to early October. It facilitates early quick growth of banana due to October heat. February planting is also recommended to overcome the problem of choking of inflorescence due to low temperature.

2.3.10 Irrigation :

The banana plant with its large leaves and succulent Pseudostem requires adequate soil moisture throughout the year for optimum growth. For one banana crop of 18 months 50-70 irrigation turns are required.

After planting it develops one leaf every week. The growth of plant is very fast from beginning itself. Banana is a water loving plant and thus needs frequent irrigation. Immediately after planting the orchard is flooded with water. Under dry condition it has to be irrigated throughout the year. The frequency of irrigation will depend upon season, type of

soil and location. Generally in rainy season no irrigation is given except long monsoon breaks. In summer season irrigation is required more frequently (4 to 7 days interval) than winter season (10 to 15 days interval).

Think about it

1. Whether drip irrigation method is more beneficial to this crop than flooding method.
2. Whether sprinkler method is suitable for irrigatiing banana crop.

Remind

Irrigation schedules –

i. Beginning of monsoon when rains are scanty – irrigation at 10- 15 days interval.
ii. July to August – normally no irrigation is required.
iii. September – irrigation once or twice a month.
iv. October to end of winter – 10-15 days interval between two irrigation.
v. February to end of May – 4-7 days interval between two irrigation.
vi. The quantity of irrigation should be 75 cm/ha. at each time.

2.3.11 Manures and Fertilizers :

Banana is a very heavy feeder and quickly responds to manuring. It requires plenty of organic matter for excellent growth and producing better crop. The fertilizer application is completed before flower initiation which normally occurs within 5-6 months from planting. The organic manures should be applied before planting, and for higher production the banana plant should be fertilized with 100 g N, 40 g P and 100 g K per plant. Out of this P and K should be applied in one single dose along with 50 tonnes FYM/ha. before planting. Nitrogen is applied in three splits as 40 g, 30 g and 30 g respectively after planting at one month interval. One additional dose of 50 g nitrogen is given after fruit set for better development of fruit.

2.3.12 Special cultural practices :

1. Desuckering : Desuckering is the removal of unwanted suckers from mother plant. These suckers are to be removed from mother plant from time to time as they compete with the mother plant for nutrients resulting in yield reduction. Suckers start appearing from the base of plant after about 3 month of planting.

2. Protection against physiological disorder : Dislodging of bunch is a physiological disorder caused mainly due to uneven irrigation, hot dry wind and inadequate supply of potash. To protect the plant give proper irrigation and good supply of potash is required.

3. Protection against low temperature : Banana is very sensitive to low temperature (below 7^0C) due to this leaves turn yellow and also cause scorching of leaf, growth rate as well as fruit maturity is delayed, and inflorences gets chocked. To protect the plant from low temperature, smudging and covering of bunch is followed.

2.3.13 Plant Protection :

I. Pest

a. Stem borer :

Nature of damage : The insects feed and make tunnel inside the corm. Leaves turn yellow followed by withering and drying of plant.

Control measures : Use carbofuran granules @ 3 g /plant.

Fig. 2.28 Stem borer

b. Banana aphid :

Nature of Damage : The aphid is a vector of viral disease bunchy top of banana. The insects suck the sap from young and tender leaves.

Fig. 2.29 Banana aphid

Control measures : Spray 0.05 % phosphomedon.

c. Burrowing nematode :

Nature of damage : Small dark spots appear on the leaves. The plants do not respond to fertilizer.

Control :

i. Use Furadan at 2 kg/ ha just before or after planting suckers.

ii. It can also be control by application of systemic granular insecticide / neem cake, etc. to the soil.

iii. Dipping of rhizomes at the time of planting in 0.2 % Fenamiphos for 10 minutes.

II. Diseases

a. Panama wilt

Symptoms : It is a fungal disease caused by water stagnation or ill drained soil. Yellowing of lower leaves including leaf blades and petioles. Hanging of leaves around pseudostem and withering are the important symptoms. Turning of fruit to bottle shape also occurs.

Fig. 2.30 Panama wilt

Control measures :

i. Growing resistant varieties like Basrai, Poovan, Robusta and Champa.

ii. Avoid continuous cropping of banana in the same field.

iii. Use disease free planting material and apply quicklime near the base of the stem.

b. Leaf spot or sigatoka disease :

Symptoms : It is fungal disease, light yellow oval spots on the leaves. The centre of the spot dies. Turning leaf light gray surrounded by brown ring and killing of large portion of leaves.

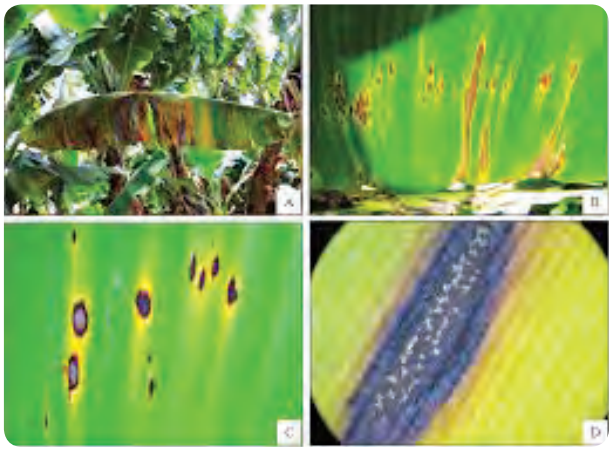


Fig. 2.31 Leaf spot

Control measures : Spray Dithane M- 45 / Captan 0.2%.

c. Bunchy top :

Symptoms : It is viral disease. The leaves develop bunchy like structure.

Fig. 2.32 Bunchy top

Control measures :

i. Application of carbofuran to soil at the time of planting is the effective preventive measure for this disease.

ii. Clean cultivation should be practiced.

2.3.14 Harvesting :

Under favorable conditions banana flowers 230 to 260 days after planting. And fruit mature 100 to 120 days after flowering. Bunches are harvested at 3/4 th maturity for distant markets and for local market they can be harvested at full maturity.

Keep in Mind

Signs of banana maturity

i. Change of fruits colour from dark green to light green.
ii. Tendency of floral end of fruit to fall by slightest touch by hand.
iii. Fruit becomes round shaped and angles are filled in completely.
iv. When tapped, the fruit give metallic sound.

2.3.15 Yield :

The yield varies according to variety. The average yield of banana is 30 tons/ha. The yield of basrai variety is 40 to 45 tons/ ha.

2.4 MANDARIN ORANGE (SANTRA)

Botanical Name : *Citrus reticulata*

Family : Rutaceae

Synonym: *Santri/santra*

Origin: South East Asia (India, China)

Fig. 2.33 *Santra* crop

Can you recall?

1. Which city in Maharashtra is famous for Mandarin orange?
2. State availability time of *santra* fruit in to market?
3. Do you like Mandarin orange fruit? Why?

2.4.1 Uses :

Citrus fruits are commercially important fruits of India. Mandarin orange fruits are rich source of vitamin C. It is the most refreshing and health promoting juicy fruit. It is excellent source of pectin and certain essential oils and also supplies other vitamins, fruit sugars, fruit acids, minerals, and alkaline salts which are needed in diet. Fruits are used as fresh table fruits as well as used for preparing refreshing beverages. The juice of fruit is bottled and canned in large scale. Mostly the juice is advised to patients. The segments of orange are canned and other commercial products are citric acid, pectin, etc.

Remember this

Botanically citrus fruit is classified as modified berry i.e. “Hesperidium” in which the rind is not edible.

2.4.2 Soil :

Mandarin orange trees grow luxuriously in 1.5 m deep well drained soils. Soil which are medium to light loam, deep, well drained, free from excess salts and having adequate content of organic matter are most suitable. Very heavy soils have a problem of drainage. The presence of lime also affects the growth of oranges. Lime should be below 10%. The pH range of soils for orange is 6.5 to 7.5. Soil with water table less than 2 m and soil containing lime nodules should never be selected for Mandarin orange as it is very sensitive to salt accumulation.

2.4.3 Climate:

Mandarin orange require subtropical and tropical climate. However occasional light frost can be tolerated by most of the species. It prefers more humid climate and tropical

summer, warmer winters and more rainfall. Average temperature requirement is from 10^0 to 37^0C. Mandarin orange tolerate extremes of temperatures. In Vidarbha mandarin orange is grown successfully with higher temperature upto 45 to 48^0C. It grows well in areas with annual average rainfall of 875 - 1125 mm.

2.4.4 Varieties :

Nagpur *santra* is grown commercially in Vidarbha region. The important varieties are Coorg Mandarin (Karnataka), Kinnow (hybrid variety) Emperior, Hill orange, Mudkhed seedless, Honey (for kitchen gardening), Satsuma.

2.4.5 Propagation :

Orange commercially propagated by shield or "T" budding by using a rootstock of jamberi or rangpur lime. Rootstock of rangpur lime is suitable for early bearing, more and quality fruits and free from viruses like *tristeza.* Rootstocks are mostly propagated by seed. The seed of rootstock are sown in a bed during October, November and seedlings become ready for budding after a year i.e. during next year in October to December.

2.4.6 Planting method and mateial :

Generally planting is done during rainy season in previously prepared pit at the spacing of 6 × 6 m by square system. The pit of 1 × 1 × 1 m should be dug and filled in with a mixture of good soil and compost. Single super phosphate 1 to 2 kg and phorate 10 G, 75 to 100 g should be mixed in the lower layer of pit. At the time of planting care should be taken to keep the bud joint at 20-25 cm above ground level. After planting of budded plant, irrigation should be given immediately, if there is no rain.

Remind

Sequence of budding operation

Sowing seed for rootstock ==> Transplanting of seedling in poly bag or seed bed ==> Selection of scion bud ==> Budding on seedling rootstock ==> Budded plants ready for Shifting ==> Shifting of plants from seedbed to raised bed for set ==> Shifting of plants from raised bed to nursery bed for sale or planting.

Remember this

In Mandarin orange, Rangpur lime and Jambheri were generally used as root stocks. But now-a-day kinnow is prefered as it improves the quality of fruit.

2.4.7 Irrigation :

After the rainy season is over the orchard is harrowed cross wise and basins are prepared for irrigation purpose. Irrigation is given by ring system with the object to avoid the contact of water with trunk of plant and to avoid gummosis diseases. The size of ring basin should be equal to the canopy or periphery of plant as spreading of root system is more or less equal to the canopy of a tree. Irrigation during winter is given at an interval of 8 -10 days while during summer at 4 days interval. The frequency of irrigation depends on the type of soil, age of the plant and climatic conditions. During rapid growth and flowering stage, the plants are particularly sensitive to water stress. Nowaday, drip irrigation is recommonded for santra plantation which save near about 50% water. Heavy irrigation should be avoided as it may cause accumulation of salt as well as induce collar rot and gummosis.

2.4.8 Manures and fertilizers :

The orchard should be manured twice a year and the main principle is that such application should coinside with growth flushes. Manure should be applied 1-2 month before flowering while fertilizers are applied just before flowering and fruit set. Generally manures and fertilizers are applied during June - July and January - February.

In the month of March and August, trees should be sprayed with micronutrients i.e. 0.2 % Zinc sulphate with the onset of new growth.

Remind

Age of the tree	FYM (kg)/ plant	N (g)/ plant	P (g)/ plant	K (g)/ plant
1 year old	5	120	60	50
2nd year	10	240	120	120
3rd year	15	360	180	180
4th year	20	480	240	240
5th year	25	600	300	300
6th to 9th year	30-40	720	360	360
10th year and onword	40-50	1000-1200	360-400	360-400

0.25 kg and 2 kg of Neem cake can be given to 1 year old crop and 10 years old crop respectively.

2.4.9 Bahar treatment :

The main object of bahar treatment (water stress) is to bring the soil to a temporary wilting stage, thereby reducing nitrogen supply and accumulating carbohydrates content in the branches or twigs resulting in good C : N ratio. Mandarin orange starts commercial bearing from the 6th year onward and produces two main growth flushes or bahars in a year. Bahar treatment should be followed as under :

Bahar	Period of bahar treatment	Period of flowering	Period of harvesting
Ambia bahar	Nov-Dec	Jan-Feb	Oct-Dec
Mrig bahar	April – May	June-July	Feb - Mar

2.4.10 Intercultivation :

- Timely removal of weeds and loosening of soils is regular practice followed in orchard.
- Loosening of basin soil is necessary as it becomes compact.
- Deep ploughing at flowering and fruit stage be avoided.
- Due to heavy weight of fruits there is possibility of bending of branches or splitting of branches. To avoid such possibilities the trees should be supported with bamboo stakes.
- Dried branches, infected plant parts and excessive growth should be timely removed in time.

2.4.11 Plant protection :

I. Pest

a. Lemon butterfly :

Nature of damage : The insects feed on the leaves from the margin toward the mid-rib and defoliate branches. The insect also feeds on fruit stalk resulting in dropping of fruits.

Fig. 2.34 Lemmon butterfly

Control measures : Hand picking of larvae and spraying of Malathion 0.5 % is effective against lemon butterfly.

b. Citrus psylla :

Nature of damage Suck the sap from tender shoots and leaves resulting in curling of leaves. Defoliation and drying of twigs. Secretion of honey dew like crystalline material resulting in growth of sooty mould appears. It also acts as a vector of greening disease and brings citrus decline.

Control measures : Spraying of Nuvacron 0.025% or Monocrotophos 0.02% is recommended.

c. Stem borer :

Nature of damage It is very severe pest of mandarin orange. It bores into the trunk near the tree base and makes tunnel leading to drying of plants.

Fig. 2.35 Citrus psylla

Control measures :

i. Keep the orchard clean.
ii. Treat the soil around the trunk with phorat dust.
iii. Spray the tree with 0.02% methyl parathion
iv. Inject petrol in hole and Plug with cotton balls or mud.

d. White fly and leaf miner :

Nature of damage : It sucks the cell sap from tender shoot and leaves.Yellowish patches are formed on surface of leaf region.

Fig. 2.36 White fly

Control measures : Spraying tree with Nuvacron 0.1% is the effective control measure.

II. Diseases :

a. Foot-rot or collar-rot :

Symptoms : It is a fungal disease. Symptoms consists of appearance of dark brown stain with water soaked lesion on the stem, rotting of rootlets, girdling of tree trunk and defoliation of leaves. Cracking of bark and exuding of gum, yellowing and dying back of limbs above the injured portion of the plants also seen.

Control measures :

i. Scrapping of affected portion.
ii. Application of Bordeaux paste is effective.

b. Citrus canker :

Symptoms : It is bacterial disease. Minute water–soaked lesion appears on leaves, twigs, fruits and mostly occurs in rainy season. Yellow hole appears very distinctly which can be seen by viewing the leaves in light. Brown corking spots appears on fruits.

Fig. 2.37 Citrus canker

Control measures :

i. Pruning of affected portion of plant before monsoon.
ii. Spraying of 1% Bordeaux mixture on newly emerging flush
iii. Spraying Streptomycin sulphate @ 500 ppm or streptocyclin (100 ppm) + copper oxychloride (0.3%)

c. Gummosis :

Symptoms : It is a fungal disease caused by appearance of gum like substance oozing through stem and trunk.

Control measures : Scrapping of oozing portion and application of Bordeaux paste to the affected plant.

d. Kolshi :

Symptoms : White fly is the agent for kolshi. Pest sucks the cell sap from plant and then develops a mould severely on it. It affects the leaves, twigs, as well as the whole plant. Whole foliage appears blackish in colour.

Control measures : Regular spraying of pesticide for controlling white fly and spray Nuvacron + Copper fungicide.

2.4.12 Harvesting :

In mandarin orange all fruits mature at different times therefore, harvesting should be done at proper stage. If harvesting is delayed, there is the possibility of damage of fruits. Mandarin orange starts bearing after 5 to 6 year and time required for flowering to harvesting is 8-9 months. Change in colour of fruits from dark green to pale green is a sign of maturity. The economical life of plant is 25 to 30 years.

2.4.13 Yield :

800 to 1600 fruits/tree or 10 tons / ha.

Internet my friend

Collect information about 'citrus dieback' disease from various links.

Remind

Quality of Mandarin orange fruits

It depends on the type of bahar

Ambia Bahar

1. Fruits are more juicy but less tasty.
2. It may be attacked by fruit sucking moth during rainy season hence there is a possibility of damage by this pest.

Mrig Bahar

1. Fruits develop with good colour, sweet taste and less juicy.
2. Marketed at higher price than the ambia bahar fruits because quality of fruits is better.

Students performing farm activities

Exercise

Q. 1 Answer the following questions.

A) Select the appropriate alternative and complete the following statements.

1. Botanical name of mandarin orange is ----------
   a. *Citrus reticulata* b. *Citrus indica*
   c. *Musa* spp. d. *Saccharum* spp.
2. ---------- is a variety of banana
   a. CO-7219 b. Harichal
   c. Cricket ball d. Ratna
3. Partial hilling up of soil against sugarcane crop row is called as ----------.
   a. Desuckeing b. Harvesting
   c. Tagarni d. ratooning
4. Breaking of ridges and converting them into furrows and furrows into ridges in sugarcane is termed as ----------.
   a. Tagarni b. Earthing up
   c. Topping d. Interculture
5. Banana is grown at a temperature range of ---------- °C.
   a. 5 to 10 °C b. 35 to 55 °C
   c. 10 to 40 °C d. 45 to 55 °C

B. Make the pairs.

Crop	Variety
1. Sugarcane	a) Mandarin
2. Banana	b) Kesar
3. Mandarin orange	c) Co-740
	d) Basrai
	e) Sardar

C. Find the odd one out.

1. Sugarcane, Bannana, Santra, mango
2. Stem borer, Pyrilla, Grub, Redrot
3. Alphanso, Kesar, Harichal, Totapuri
4. Harvesting, Gapfilling, Weeding, Hoeing

D. Write true or false.

1. Mango when propagated by seed is true to type.
2. Banana is a very heavy feeder crop quickly responds to manuing.
3. Removal of some of the older leaves from sugarcane crop is known as detrashing.
4. Pairi is the table variety mango.
5. Pannama wilt is the disease of sugarcane.

Q. 2 Answer in brief.

1. Write the signs of maturty in banana crop.
2. Name any four diseases of sugarcane.
3. Write in brief about gummosis disease of Mandarin orange.
4. Write in brief paired row method of sugarcane layout.
5. Write in brief criteria for judging the proper maturity of mango crop.

Q. 3 Answer the following questions.

1. What are the ceriteria for sets selection for planting of sugarcane.
2. Write in short desuckering in banana.
3. What are the uses of mango fruit.
4. Explain seed rate and seed treatment in sugarcane.
5. Write in short about alternate bearing in mango.
6. Complete the following chart of Mandarin orange crop:

Sr. no.	Bahar	Time of treatment (month)	Time of flowe-ing (month)	Time of harvesting (month)
1	Ambia bahar			
2	Mrug bahar			

Q. 4 Answer the following questions.

1. Describe the intercultivation in sugarcane corp :
2. Give information on following points regarding plantation of Mandarin orange crop on following points:
   a. Propagation
   b. Planting method
   c. Harvesting
   d. Yield
3. Complete the following chart :

Sr. no.	Crop	Family	One pest
1	Sugarcane		
2	Mango		
3	Banana		
4	Mandarin orange		

4. Complete the following chart :

Sr. no.	Crop	Botanical name	Origin
1	Santra		
2	Banana		
3	Sugar cane		
4	Mango		

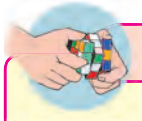
5. What are the characteristics of citrus root stalks?

Q. 5 Answer the following questions in detail.

1. Write the information of mango cultivation on follwing points.
   a. Climate
   b. Planting distance and propogation
   c. Manuring
2. Describe Banana cultivation on following aspects.
   a. Preparatory tillage
   b. Varieties
   c. Harvesting

Q. 6 Answer the following questions in detail.

1. Describe in detail the preparation of jaggery from sugarcane.
2. Describe cultivation practices of *adsali* sugarcane on following points.
   a. Seed rate and spacing
   b. Manuring
   c. Harvesting
   d. Uses



Activity

1. Prepare an album of different seed of crops, grown in your region.
2. Prepare pest and disease album of different crops in syllubus.