

* Special Horticultural Practices For inducing fruiting :- I

Q Answer

VSA

- 1) Pruning
- 2) Root pruning
- 3) Ringing
- 4) Girdling.
- 5) Notching
- 6) Bending
- 7) Smudging

This are the some of the specialized horticultural practices followed for regulation of fruiting.

Ringing & Girdling :-

Ringing consists of removing a ring of bark about 1-2 cm. wide around the trunk or branches, while ~~girdling~~ girdling is a milder treatment to draw a knife around the branch so as to cut through the bark but not the wood.

→ Ringing or girdling will increase the concentration of carbohydrates above the ring.

→ It also reduce the nitrogen supply because subsequent to stopping of food to the roots.

→ No more root growth, no nitrogen supplies

→ The result will be wide C:N ratio & then flowering increase

→ Ringing is a drastic operation when fruits trees fail to set fruits

→ Ringing is done in vigorous mango tree.

i) Notching :-

- It is similar to the ringing except that in notching only soil slip bark about 0.2 - 0.5 cm thick & 1.5-2.5 cm in length is removed just above or close to dormant bud.
- The bud should be selected large, plump & healthy which is produced as a perfect mature wood & has undergone dormancy.
- Generally 3-4 buds in the middle position of the selected shoot are best to operate on responded to notching.
- Season for notching August-September.

ii) Bending :-

- Bending a branch downward, sometimes checks growth & causes accumulation of starch in the branch with greater flowering.
- This tends to increase carbohydrate concentration.
- The bending bring pressure on bark on the translocation of photosynthesis is obstructed due to narrow passage.
- This practice usually operated for local guava variety in the Maharashtra state.

iii) Smudging :-

- Smudging is a practice of smoking the tree by burning brush wood on the ground & allowing smoke to pass through the centre of crown of tree.
- The smoking is discontinued as soon as terminal buds begin to swell.

→ Not commonly followed in India,

iv) Root pruning :-

- Root pruning result is less carbohydrate utilization of top growth though there is a little more utilization of carbohydrate for root function.
- There is an accumulation of carbohydrates due to check of top growth, which result in fruit bud differentiation
- As the effect of root pruning is the check the vegetative growth. Plant become dwarf
- Root pruning is a method of inducing fruitfulness or determining the time of flowering.
- The root pruning is done two months before the bloom requires.

v) Bahar treatment :-

- This practices is followed with ~~the~~ trees like mosambi, santol, grape fruit, guava, pomogranet, ber, lime etc in state of Maharashtra, M.P & Gujarat etc.
- As there is no ~~at~~ distinct winter (very cold winter) these fruits are usually continuous vegetative growth.
- This practice is useful in encouraging flowering as well as regulating the time of flowering.
- Three season of flowering
 - ① Maig Bahar :- flowering in June-July
 - ② Hasta bahar :- Oct-Nov
 - ③ Ambe bahar :- Dec-feb.

Horticulture :-

Derived from Latin word Hortus.
Hortus → meaning enclosure & culture
culture → cultivation.

It is branch of agriculture which deals with the study of all aspects of cultivation, processing & utilization of crops such as fruits, vegetables, ornamentals, plantation crops, spices, medicinal & aromatic plants & mushrooms.

Pomology :- The branch deals with the study of fruit crops.

* Importance of fruits

1) Nutritional importance :-

A man should be 85 g fruit per day as per ICMR but availability of fruits is only 44 g per capita/day. The 308 g, 223 g fruits consumed in Italy.

2) Medicinal importance :-

Some fruits are great medicinal importance. medicinal importance of some fruits are given below:

- 1) Papain (white extract of ~~Apple~~, Papaya)
- 2) Triphala (combination of Amla)
- 3) Vitamin 'C' used in preventing scurvy disease.
- 4) Arjun bark used as cure in heart troubles.

3) Economic importance :-

Fruits are good source of income which is many times greater than the income receive by cereals crops.

4) Industrial importance :-

- A No. of products are prepared by fruits which are generally used in off-season.
- The papain is used in tannery to clarify the leather.
- Sirka which acts as preservative is also prepared from fruits.
- Flour prepared from banana
- Hockey sticks & furniture are used from fruit trees wood.

5) Aesthetic importance :- सौंदर्य प्रसाधन

Trees also purify the environment & beautify cities & villages

6] Religious Importance :- (धार्मिक)

The fruits, flowers & leaves are used in the religious functions.

7] Miscellaneous importance :-

Fruit trees are helpful in making the rain. seedling trees of mango, Jamun, Mahua, & imli are planted as road side avenues.

* Scope of fruits growing :-

- 1) There is vast scope of growing fruits crops in our country because total area under full crops is very small about 5.51 mb.
- 2) Majority of Indian population is vegetarian & production of fruits is far less.
- 3) India provides almost all types of suitable climatic condition for large No. of fruits species which can be grown under tropical, sub-tropical & temperate climatic zones.
- 4) Many fruits crops are well adapted to adverse edaphic & climatic condition where other cereals, vegetables etc.
- 5) Productive life of fruits crops is long & planting them once provide continuous yield for long period.
- 6) The demand of fruits is very high & supply is too low.
- 7) Fruits are have role to play in many medicinal preparation.

8)

Mango :- king of fruit & National fruits of India

B.N \Rightarrow Mangifera indica L.

family \Rightarrow Anacardiaceae

origin \Rightarrow South East Asia, particularly Indoburma

① Soil & climate :-

soil :- 1) It is hardy & woody crop it can be grown in all type of soil.

2) But most suitable is sandy loam & laterite soil.

3) ~~Not~~ well drained soils with rock subsoils are unsuitable.

4) A well drained, fairly deep loamy soil is considered best for mango.

climate :-

1) It grows in all type of climate.

2) for maximum production $24-27^{\circ}\text{C}$ temp

② Propagation :- By softwood grafting & inarch grafting

③ Preparation of land :-

~~Planting~~ :- deep ploughing, cross cross, harrowing.

1m³ :- $10 \times 10 \text{ m}$ in April - May

Added 1-2 kg SSP at each pit

staking & light irrigation given immediately after planting

~~Manures :-~~

~~Manuring to non-bearing trees :-~~
(upto 4 years)

④ Manuring & fertilizers :-

In 1st year

Add 10 kg FYM & 300 gr urea : 300 gr SSP : 100 g MOP

give to each tree.

2. Increases double yearly upto 10 years

RDF \Rightarrow 100 : 1500 : 500 gram
N P K kg/tree

⑤ Irrigation :-

→ In pre-bearing age (upto 3-years)
plants must irrigated more frequently

→ Apply irrigation at 3-4 days in summer season.

→ once in fortnight in winter

⑥ Intercropping :-

Tomato, Radish, carrot, beans, cauliflower,
cabbage & palak are suitable.

~~harvesting~~ ~~field~~ ~~of~~

⑦ Planting :-

By the grafting, seed sowing
monsoon is the suitable period for
grafting or budding.

⑧ Harvesting & Yield :-

Indices of maturity of mango :-

- ① Changing the colour of fruit
- ② Tafka stage (आंवा पाडी येणे)
- ③ Specific gravity 1.002 value is used for Alphonso

P Picking of fruit of mango by the use of instrument ~~rate~~ Nuton Zela

Yield :- ~~for seeded~~

^g
for grafted,

500 - 600 fruits/tree

Mango life : 60-70 ~~years~~ years

⑨ Variety :-

Kokan → Alphonso, Ratna, Kesari,
Pest MH → Wansaj, Langra, Totapuri
Marathwada → Kesari, Nixanjan, Neelum
Vidharbha → Kesari, Dashehari, Amrapali, Neelum.

⑩ Pest & Disease

Pest ⇒ Mango hopper, Mili bug, stem borer, shoot borer

Disease :- Black spot, Bacterial canker, Anthracnose, Dieback.

* Criteria for coconut selection :-

- 1) Crown should be spherical or semi-spherical
- 2) Drooping or erect crown should be avoided.
- 3) Palm should have 30-40 fully open leaves & 12-15 ~~bs~~ bunches with a high setting of female flowers.
- 4) Nut should be a minimum size & having the sound or sphericle.
- 5) Palm should be age grouped of 25-50 years old.
- 6) Palm growing close to houses, cattleshed, compost peet should be avoided.
- 7) The mother's palm selected should be free from pest & diseases.

Banana

B.N \Rightarrow Musa paradisiaca,
Musa cavendish

family \Rightarrow Musaceae

origin \Rightarrow Tropical Asia, Assam, Burma.

Soil & Climate :-

- Soil :-
- 1) well drained soil & lighter soil are better.
 - 2) very deep soils having extremely fine texture are not suitable as they are bad in drainage.
 - 3) pH required 6-8.

climate :-

- 1) Banana is tropical crop & requires warm humid & rainy climate.
- 2) optimum temp - 13-40°C. with relative humidity 90% or above
- 3) Heavy storms, frost, low temperature below 10°C or extremely high temperatures are detrimental to growth as it kills the plant tissues.

Economic Importance :-

- 1) Banana is one of oldest & commonest of Indian fruits that have been cultivated since ancient times.
- 2) It is one of the important fruits occupying an area of 45400 ha.
- 3) In Maharashtra banana crops tops the lists in acreages & occupies an area of 45400 ha which is total 38% of total acreages under fruits crops.
- 4) It is one of important energy producing fruits & is a good source of mineral & vitamins.

Propagation :-

- 1) Commercial edible bananas do not produce viable seeds & hence propagation is exclusively by vegetative means.
- 2) It is propagated by rhizome suckers & bits.
- 3) sword suckers become broad leaf suckers after detachment from the mother rhizome.
- 4) suckers of 2-4 months age should be selected.
- 5) After cutting the parent plant rhizome are removed from soil & stored in cool dry places for about two months.
- 6) Banana is propagated by tissue culture plantlets.

Planting method :-

- ① Pit method :- → The pits $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \text{ m}^3$ are dug
→ This method is laborious & expensive
→ If soil are deep there is no necessity of taking pits
- ② Furrow method :- → This is common method of planting
→ furrow of 15-20 cm depth are opened with the help of ridges at regular distance. & rhizome are planted at furrows

Planting distance & season :-

The distance of planting depends upon ① variety ② Climate ③ Yield & ④ Quality of produce.

According to variety the distance of planting varies from 1.25-3.0 m Tall & vigorous growing varieties.

Variety :-

- ① Basrai, ② Harichal ③ Lal velchi ④ safed velchi ⑤ Aardhapuri
⑥ Shrimanti ⑦ Rajeli ⑧ Grand nine (G-9)

Irrigation :-

- 1) It required frequent irrigation immediately after planting orchard is flooded with water.
2) Basrai under poona condition requires about 40-45 irrigation/years.
3) drip irrigation is more economical for irrigation to fruits crops.

Manuring :-

- supplied plenty of organic matter
→ Add 100-150 cartloads FYM or compost/ha. at the time of preparatory tillage.
→ Add 250 g : 200 g : 250 NPK g/ha of this P_2O_5 & K_2O are apply at the time of planting & N is spilted at 3 doses in 3rd, 4th & 5th month of after planting.

After cares :-

- 1) Desuckering :- During life cycle banana produce No. of suckers & this suckers utilizes the food material for growth from mother plant so. that's why desuckering is done by cutting the pseudostem of sucker. By application.

2) supporting or propping :-

Banana is a shallow rooted crop & its likely falls down by wind or by weight of bunch. If bunches are small no support required but bunches are more then supporting is required.

3) Removal of male bud :-

Male flower bud is allow to grow wastage of food material²
If male bud is removed, the bunches mature about 15 days earlier.

4) Protection against low temperature :-

It is affected by low temp. below 7°C .
Due to low temp. leaves become yellow or get scorched,
To protect from low temp. covering bunch, planting shelter belts, irrigation of field, & changing time of planting.

* Harvesting of Indices of banana :-

Banana starts flowering 9-12 months & fruits mature in about 3-5 month.

1) drying off top leaves

2) changing colour of fruits from green to light green.

3) Tendency of flower ends of fruits to shed with slightest touch by hand

4) Fruits become plumpy & angles are filled in completely.

5) When tapped gives metallic sound.

Yield :-

Average yield of Maharashtra :- 28.7 ton/hq
of Basrai :- 40 ton/hq

Pests :-

1) Banana stem borer

2) Banana aphid

3) Thrips

Disease :-

1) Panama / Banana wilt (Fusarium oxysporum)

2) Leaf spot or Sigatoka disease (Mycosphaerella muscicola)

3) Bunchy top

4) Banana Mosaic or Infectious chlorosis.

Citrus :-

- 1) Sweet orange :- Citrus sinensis
- 2) Mandarin orange :- Citrus reticulata
- 3) Kagzi lime :- Citrus aurantifolia

Family :- Rutaceae

Origin :- North East India & Central China

Economic Importance :-

- 1) Next to mango & banana, citrus fruit represents the largest fruits industry of India, occupying about 6% of the total area.
- 2) They are excellent source of vitamin 'C' & supply also other vitamins.
- 3) Fruits are not only used as fresh, but juice is also used for preparing many refreshing beverages.

Soil :-

- Proper selection of soil determines the success of citrus cultivation.
- High salt accumulation is injurious.
- It grows in wide range of soil, like well drained, medium black, alluvial loams,
- pH \Rightarrow 6-7.5

Climate :-

- Sweet orange & mandarin orange differ from one another to some extent.
- optimum temp: 10-35°C.
- Temperature above or below retard the growth of plant.

Planting :-

1) Type of plant :-

Santora & Mosambi are planted at 6x6 m, whereas kagzi lime is planted at 4.5x4.5 m.

2) Type of propagation :-

Seedling trees grow bigger than grafted tree & hence they are planted at a wider distance than grafted tree & hence they are planted.

3) Type of root stock used :-

Certain root stock gives dwarfing effects to scion.

4) Type of soil :-

If soil are heavy, distance of planting is more,

* Varieties :-

②

Sweet orange \Rightarrow Malta blood red, Malta common, katal gold, Sathgudi, Taffa, Hamlin, Washington, Naval orange etc.

Mandarin \Rightarrow Santa, Dancy, kinnow, satsuma etc.
Nagpur Mandarin (Santa) Dr. PDKV Akola.

Kagzi Lime \Rightarrow 1) Rahuri sharbati (M.P.K.V) Rahuri)
2) Pramalini (M.A.U Parbhani)
3) Vikram (M.A.U. Parbhani)
4)

Irrigation :-

When young it should be required frequent irrigation.

The irrigation is with hold for $1-1\frac{1}{2}$ months before taking buds.

The irrigation should be given only when soil moisture goes below 80% of field capacity.

Manuring :-

Add :- 10 kg FYM.

RDP \Rightarrow 1 kg N : 0.5 kg P_{2O_5} : 0.5 kg K_2O .

Whole FYM, P_{2O_5} & K_2O & $\frac{3}{4}$ th of N is applied in month of June. & remaining N is applied at the time of development of fruit.

Harvesting :-

Fruits mature of sweet orange & mandarins in 8-9 months from flowering.

Change dark green colour to yellowish green colour is the sign of maturity.

Yield :- 13 t/ha or 500-600 fruit/plant. (Sweet orange)
10 t/ha or 800 fruits/plant (Nagpur Santa)
8 t/ha or 1500-2000 fruit/plants (Kagzi lime)

Pests :-

- 1) Citrus leaf miner
- 2) Citrus caterpillar
- 3) Aphids
- 4) Fruits sucking moth

Disease :-

- 1) Dry root rot
- 2) Gummosis
- 3) Tristeza
- 4) Citrus mosaic
- 5) Powdery mildew

Grape :-

B.N \Rightarrow Vitis vinifera

family \Rightarrow Vitaceae

origin \Rightarrow

Economic Importance :-

- 1) Grape is one of the most delicious, refreshing & nourishing fruit. They are easily digestible & rich in energy giving sugars, certain mineral & vitamin.
- 2) Grape juice is a refreshing drink, a stimulant to kidneys & laxative.
- 3) In India grapes are grown over an area of about 40000 ha. In Maharashtra it is grown over 15,000 ha.

Soil :-

- 1) Grape is adapted to a wide range of soil types.
- 2) Well drained fertile soil with 1m depth should be selected.
- 3) Crop grown best even on very poor soils.
- 4) pH should be - 6-8.5.

Climate :-

- 1) Grape is primarily a fruit of semi arid sub-tropical region.
- 2) It requires hot dry summer & cool winters with moderate rainfall.
- 3) Dry cloudless weather during flowering fruitset & its development is prerequisite for a successful cultivation.
- 4) optimum temp. \rightarrow 28-32°C.

Varieties :-

Thompson seedless, Tas-A-Ganesh, Sonaka, Sharad seedless, flame seedless, Manik chaman, Morchaman, Anab-E shahi

Propagation :-

Grapes are propagated by hardwood cuttings. Cutting from matured canes from Oct. pruning are preferred. In Tasgaon method of planting cutting from April pruning are used. cutting of 3-5 buds are prepared.

* Propagation of Land & Planting :-

Land is levelled, green manured to add enough organic matter. Direction of planting should be North-south to full sunshine.

Planting method :-

① Trench planting :-

If heavy soils which contain harmful salts, a trench is good which helps to replace the soil.

A trench 60x70 cm & wide is opened & filled in with good fertile & well drained & compost.

② Pit planting :-

Pits of 60x60x60 cm are dug at desired distance & filled in with good soil & compost.

In trench ~~or~~ pit 50 kg of fym & 1 kg P₂O₅ per vine should be applied.

Time of planting

October - January common season of planting.

In tasgaon time of planting, it is done in April-June.

Planting distance :-

Thompson seedless \Rightarrow 3x1.5m 1.2x1.2m (Tasgaon)

Cheema seedless \Rightarrow 3x3m

Anab-E-shahi \Rightarrow 3x2.4m

Kali sahebi \Rightarrow 4x2.5m

Gulabi \Rightarrow 1.0x1.2m

Bangalore purple \Rightarrow 2.4x1.2m

Training :-

Training primarily concern with the form of & frame work of vine to obtain maximum benefits. Vines are trained to single stem with bamboo support initially by removing side shoots.

Pruning :- Pruning is nothing but an art & science of removing scientifically certain part of plant with a view to divert sap flow towards fruiting area to induce vegetative & fruitful growth.

Manuring & fertilizers.

20 kg FYM + 1 kg P_2O_5 + $\frac{1}{2}$ kg K_2O . per vine is applied before planting.

during Development of, first year 1 kg Ammonium sulphate or $\frac{1}{2}$ kg urea be given in split doses.

Fully grown vine yard of Thompson seedless should be receive about

50 t/ha FYM , 800 kg N, 500 kg P_2O_5 & 700 kg K_2O /ha.

Irrigation :-

After April pruning vine should be irrigated @ 6-7 days intervals upto middle of June.

October pruning to January the interval of should be 7-9 days.

Twisting of canes :-

In grapes due to apical dominance & due to other factors, many buds fail to sprout after October pruning.

Means to improve grape quality :-

Girdling, thinning, Use of GA & Topping & Pinch

Harvesting :-

Nearly 100-125 days after October pruning bunch become ready to harvest. Change in colour & development of TSS : Grapes do not ripe after harvest

Yield :- Yield is according to variety

Areca nut (सुपारी)

S.N. \Rightarrow Areca catechu

Family \Rightarrow Palmae

origin \Rightarrow Islands of Indian ocean,
India, south eastern countries

Economic Importance :-

Botany :-

- 1) It is a tall, slender palm.
- 2) The stem is known as caudex.
- 3) It reaches a height 15-20 m.

Varieties :- Thisthaballi
Sreevardhan
Mehatingar
Kabikuchi

Introduced varieties :- mangala, sumangla, sreamangla.

Soil :-

- 1) Deep well drained soil are suitable
- 2) Laterites & red loams & alluvial soils are preferable.
- 3) Does not stand water stagnation.
- 4) Drainage is more important in high rainfall areas

Climate :-

- 1) A tropical plant.
- 2) It require well distributed rainfall.
- 3) Cultivated mainly from 28° N & S latitudes.
- 4) Require moist climate.
- 5) optimum temp. 15-38°C.

Planting material :-

Propagated through seed.

Elite mother palms should have :-

- 1) Higher productivity
- 2) Higher percent of fruit set
- 3) Precocity
- 4) It should be able to transform 50%

Land preparation :-

- Land is prepared by repeated ploughing
- It is levelled.
- Irrigation & drainage channels are laid out.

Planting :-

- seedling are planted from the beginning of monsoon up to the end of rainy season.
- on well drain soils - planted during May-June
- on clay - planted in June-July.

Irrigation

Guava (फैफ)

B.N \Rightarrow Psidium guajava

family \Rightarrow Myrtaceae

origin \Rightarrow Tropical America.

Economic Importance :-

- 1) This is the 4th largest fruit crop of India.
- 2) U.P has the largest area under guava followed by Bihar, M.P & Maharashtra.
- 3) The plant is very hardy & can be grown with little attention, as compared to other fruit crops.
- 4) It has fresh fruits are very rich in vit C. (100-260 mg/100 g pulp) & minerals like Calcium & Phosphorous.
- 5) It can be processed in jelly & butter.

Soil :-

- 1) It grown on wide range of soil like light sandy loam, clayey, deep, rich alluvial or shallow.
- 2) It thrives even in moist soils.
- 3) However, it does well in medium black, well aerated river soil at least $\frac{1}{2}$ -1 m depth with irrigation & manuring.
- 4) pH 5.5-7.5.

Climate :-

- 1) It is tropical crop but it can grown on wide range of climate conditions.
- 2) The quality of fruits is better where winters are cool.
- 3) It's also tolerates little drought, irrigation facilities are required.
- 4) It can stand summer temperature at 40°C .

Variety :-

1) ~~Sardar~~

1) Sardar (L-49) :-

It is prolific bearer, horizontal growing, medium size plant.

- 2) Kothoud :- Pear shaped & typically red fleshed. Hard & seed.
- 3) Nasik :- Pear shape with narrow neck, white flesh.
- 4) Dharwar :- Small, hard, pear shape fruit, seedy.
- 5) Other varieties :-
Allahabad safeda, chittidar, kerala etc.

Propagation :-

- 1) Both the methods i.e. seed & vegetative are useful.
- 2) seed propagation through very quick & easy, gives lot of variation due to heterozygous in nature.
- 3) commercially guava is propagated by vegetative means i.e. tongue layering or approach grafting.

Planting :-

- 1) Land should be ploughed, levelled & added with 50-60 ct FYM/ha. & mixed well.
- 2) Planting at spacing 6x6 m.
- 3) pits of 1x1x1 m are dug & fill with mixture of good soil & FYM.
- 4) After planting plant should be given support of bamboo.

Irrigation :-

- 1) Immediately after planting, orchard is irrigated, on 1st & 3rd day.
- 2) if there is no rain then irrigates the orchards at short interval for about 2 months.
- 3) Normally not required irrigation in monsoon, winter - 10-15 days & summer - 4-6 days.

Manuring :-

one year old tree \rightarrow 20 kg FYM & 125 g N. should increase with age of tree & after 4 years

4 years tree should \Rightarrow 100 kg FYM, 600g : 300g & 300g NPK receive

whole FYM, P_2O_5 & K_2O & half dose of N is given at bi-annual treatment. & remaining after 1-1.5 months.

Bahar treatment or crop regulation :-

For economic crop of better quality the flowering is required to be regulated by giving bahar treatment. Major bahar is better under Maharashtra conditions for various seasons :-

- 1) Shortage of water during summer months does not a limiting factor.
- 2) Fruits are of better quality & they are escaped from the attack of flies and moths.

Training & Pruning :-

- it needs no pruning.
- Training is required to give shape.

Harvesting :-

It takes nearly five months for maturity of fruits after flowering. The maturity of fruits is observed by the change in colour of fruits from dark green to pale green.

Yield :-

Sardar \Rightarrow 25 t/ha, 1000-1300 fruits/plant
Local \Rightarrow 10-15 t/ha.

Pests :-

- 1) Fruit fly
- 2) Shoot & Bark borer
- 3) Guava scale

Disease :-

- 1) Guava ~~mite~~ wilt
- 2) Anthracnose

Papaya :-

B.N \Rightarrow Carica papaya

Family \Rightarrow Caricaceae

origin \Rightarrow

Economic Importance :-

- 1) Papaya has long been known as wonder fruit of the tropics & is one of the five major fruit crops.
- 2) This fruit crop are mostly grown in almost every part of country.
- 3) It gives one of the highest production of fruits per hectare & an income next to banana.
- 4) Its cultivation is practised as commercial orchard, kitchen garden, home garden or nutrition garden.
- 5) Papaya is a rapidly growing perennial herbaceous plant.
- 6) Short duration fruit' crops with having a useful life 3-4 years.

Soil :-

- 1) It requires a soil of high fertility & good drainage soil due to papaya is evergreen plant.
- 2) Papaya has shallow root system & can even be grown in soil having 45 cm depth.
- 3) Papaya can be grown on wide range of soil.
- 4) pH required range is 6.5-7.0.

Climate :-

- 1) It required warm humid climate & cultivated upto elevation of about 1000-1200 m.
- 2) optimum temperature - 38-44°C.
- 3) Temperature below 10°C retards the process of maturity & ripening of fruits.

Propagation :-

- 1) Papaya is propagated by seed.
- 2) Vegetative propagation is not possible due to hollow & fragile nature of stem.

Nursery raising :-

- 1) The seed should be extracted from selected ripe fruits.
- 2) The seed freely taken from the fruit should be thoroughly washed to remove the gelatinous matter & then dried in shade.
- 3) Sowing seeds soon after extraction gives maximum germination & their seedlings grow faster than the stored seeds.
- 4) Storage of seed at 10°C was effective.
- 5) Best time of raising seedling is the middle of June to end of Oct.
- 6) Seed rate vary according to spacing usually 250 g of seed is required to plant one hectare at spacing 1.8 m.
- 7) Seeds are sown on raised nursery beds at a depth 1 cm in rows spaced 15 cm apart with 2.5 cm spacing in the row.
- 8) Water logging should be avoided as this leads to fungal disease called "Damping off" which kills the seedling.
- 9) Seed start germination with 15-20 days.
- 10) Seedling will be ready for transplanting in main field in 60 days old.
- 11) Attain height 15-22 cm.
- 12) Nursery bed are irrigated few hours before lifting the seedling from the nursery.

Varieties :-

Washington, CO-1 (Coimbatore-1), CO-2 (Coimbatore 2),
Coorg Honey Dew, Pusa Majesty, Pusa Dwarf,
Pusa Giant, Pusa Delicious, Pusa Nandha.

Planting :-

The orchard site for papaya is thoroughly ploughed & harrowed to make soil pulverised.
Pits of $45 \times 45 \times 45$ cm should be prepared at 1.8×1.8 m.
FYM or compost @ 20-25 kg/pit.

Irrigation :-

- Papaya responds well to better water management.
- Adequate irrigation helps to rapid fruit development & also to obtain regular yields.
- It is advisable to irrigate the papaya plants at 5 days interval in summer & at 10-15 days interval in winter months.
- Ring system of irrigation minimizes excessive loss of plants due to basal plotting.

Manures & fertilizers :-

Add 25 kg FYM in split doses 1st, 3rd, 5th & 7th months after planting gave good growth
& NPK 200g : 200g : 200g each

Hoeing & weeding :-

- Weeding should be done regularly to keep the field weed free.
- Light digging is given after every 3-4 irrigation to loosen the soil.
- At initial stages, earthing up of plants is necessary.

Intercropping :-

During pre-bearing stage, short duration vegetable like cabbage, cauliflower, onion, chillies, radish, tomatoes, etc. can be grown for six months.

Seedless papaya :-

Seedless fruits are developed from the pure female flowers which are not fertilized by the pollen of male trees.

Harvesting :-

- Papaya fruits are very delicate they ripen rapidly after maturity & are very perishable when ripe.
- The first crop of fruits is harvested in 12-14 months after transplanting or 4-6 months after fruits set.
- All the fruits showing first a tinge or yellow colour at the apical end should be harvested.
- Picking at this stage allows 5-7 days to full ripeness.
- Papaya fruit is best picked by giving it a carefully twist with hand or may be picked by climbing on a ladder.

Yield :-

Per tree varies from 25 - 75 fruits.
Fruits weight ranges from $\frac{1}{2}$ to 3 kg or even more.
An average 30-45 kg fruits/plant are obtained in one season.

Packaging :-

After harvesting, the fruits to be consumed locally should be stored in single layer of straw until they become yellow. For distant transport should be packed in bamboo basket with rice straw to avoid bruising. The most common fungal disease caused by Collectotrichum gloeosporioides was found to spoil the fruits during storage.

Storage :-

Room temp. (28-32°C) was practically unsuitable for storage of fruits. A temp of about 20°C was optimum both for ripening & satisfactory storage.

Ripening :-

Papaya fruits when exposed to 2000 ppm of Ethephon solution having a few pellets of sodium hydroxide, ripened within 24 hours as against 96-120 hrs required for non treated fruits.

Pests :- The plant is not affected by any serious pest in India. only mites & virus disease which mainly transmitted by insect damage the tree to large extent.

Disease :- Collar rot, Anthraenose, ~~leaf mosaic~~, (fungal) Papaya mosaic, Papaya leaf curl (virus)

Apple :-

B.N \Rightarrow Malus pumila

Family \Rightarrow Rosaceae.

origin \Rightarrow Europe

Economic Importance :-

- 1) Apple is most important temperate fruit.
- 2) It is the premier table fruit of the world.
- 3) It excels the pear in its excellent keeping quality & wide variety of tastes & flavour.

Uses & Composition :-

- 1) 'An apple a day keeps the doctor away'.
- 2) Apple has long been the staple fresh fruit.
- 3) Apple eating is believed to reduce the incidence of dental caries, helps to control obesity & supply extra energy for heavy exercise.
- 4) Contains :- carbohydrates, sugars, dextrins, starch, hemicellulose, cellulose & pectic substance.

Soil & Climate :-

- Soil \Rightarrow
- 1) Apples are cultivated on varied types of soils.
 - 2) They are grown on deep, organic loams.
 - 3) The soil must be well drained, slightly acidic (pH 6.5-6.7) loam soil with good depth (45cm).
 - 4) Heavy clay or compact sub-soil should be avoided for planting apple as in clay soils.

Propagation :-

Apple is generally propagated by budding or grafting on seedlings of crab apple. Grafting is done at the end of winter, while shield budding with buds of current season's growths is done in months of June.

Planting :- Planting distance 7-10 m & depth - 2-5cm

Training & Pruning :-

Training is given desired shape to a tree during early growing years.

Pruning of bearing trees is important to maintain a balance between vegetative growth & fruit production, too much vegetative growth results in poor fruiting. & absence of vegetative growth.

Irrigation :-

Apple trees are sensitive to low moisture supply. water stress during growing season reduces No. & size of fruits & increases June drop.

Weed control :-

Complete elimination of weed competition in the tree row is essential. This results in increased tree vigour & higher crop yields.

Thinning of fruits :-

Blossom thinning in apples is one of the major operations for a successful cropping.

It does not regulate fruit quality.

With too many fruits on the shoots, it initiates alternate bearing.

Growth regulators are widely adopted employed for thinning of fruits

Maturity :-

The maturity of apple fruits cannot be judged by firmness of flesh.

The gustatory qualities of apples are inferior if the fruits are picked too early.

Fruits picked at immature stage are inferior in quality. The days of full bloom to harvest is considered as a fairly good index of maturity.

Harvesting :-

Harvesting period varies with variety, location & climate.

Colour of fruit is the indication of maturity of fruit.

Harvesting in Sept-Octo; except in Nilgiris, where season is from April-July.

Each tree is harvested in three installments.

The bearing generally commences after five years & continues for 50 years.

Yield :- full bearing tree yield from 40-100 kg of fruits

Pests :-

- 1) Wolly Aphid
- 2) Apple Rot Borer
- 3) San Jose scale

Disease :-

- 1) Apple scab (Venturia inaequalis)
- 2) Powdery mildew (Podosphaera leucotricha)

Pineapple :- आम्रस

B.N \Rightarrow Ananas comosus (L.)

Family \Rightarrow Bromeliaceae.

Origin \Rightarrow

This fruits are tropical fruits

It is also called "Golden Queen" due to its beauty.

Composition & Uses :-

- \rightarrow Pineapple fruit is a good source of Vitamin 'A' & 'B' & rich in Vitamin 'C' & calcium.
- \rightarrow Dried waste after juice extraction is a valuable cattle feed.
- \rightarrow The processed products from pineapple are mainly slices, titbits, juice & squash & Jam & mixed jam.
- \rightarrow Fruit core is used for preparing candy.

Soil :-

Sandy loam & loamy soils or lateritic soil on hill tops are best for pineapple. Fruits are larger on heavier soils & flavour is better when grown in lighter soils.

Heavy clay soils & high water table are not suitable. pH ranges 5.5-6.0.

Climate :-

\rightarrow Pineapple essentially a tropical plant but can adapt well in sub-tropical areas also.

It can be grow near between temp. $21-23^{\circ}\text{C}$

\rightarrow Bright sunshine & total shade both are harmful.

\rightarrow Annual rainfall is 150 cm is considered for Pineapple.

Area & Production :-

- Pineapple is about 3.5 million tones in production in ^{world}.
- The greater part of pineapple grown is commercially used in the processing industry.
- In India, area under pineapple is about 25000 ha.

Propagation :-

- Pineapple is easily propagated by vegetative methods.
- It can be propagated by suckers, ground suckers, slips, crowns, stumps, stem-bits & from spitted crowns.

Planting :-

- Pineapple planted in early rains or in early winter & any time of the year with irrigation.
- Before planting, the suckers or slips should be sun cured & dry leaf scales at the base should be removed & basal ends.

Irrigation :-

Pineapple mostly grown as a rain fed crop.
4-6 irrigation in Hot months at 20-25 days interval ensure good crop.

Manuring & fertilizers :-

Add 123 kg P, 83 kg S & 308 kg NPK/ha

Apply in 2 splits doses. once at the onset of monsoon (May-June) & again at the end of rainy season (Sept-Oct) after harvesting slips & suckers are removed.

Earthening :-

Earthening should be done after fertilizer application & after harvesting, otherwise lodging will occur. It also serves the purpose of weeding, particularly between the rows.

Weeding :-

Weeds are serious problems in cultivation of pineapple.

Flowering :-

A pineapple plant produces only one fruit during its life time. Even after 15-18 months of growth only 40-50% plants come to flowering.

Harvesting :-

Pineapple generally flowers from Feb-April & ripenes from June - August under North Bengal.

Harvesting for local markets should be done at full maturity stage and for distant markets at 75-80% maturity stage.

Fruits harvest between 115-130 days after flowering were better suited for canning.

Yield :-

Plant population 35000 - 45000/ha is about 40-55 tonnes

Plant population 43000 - 50000/ha varies about 50-60 tonnes

Packaging & transport :-

For successful marketing, grading of fruits is done on the basis of shape, maturity, freedom from disease, pest & blemishes. Crown should be trimmed to less than 10cm & the stalk end trimmed to 5-7 cm. Packaging is done by wrapping individual fruits with jaddy straw.

Storage :-

The maximum duration of storage with minimum spoilage was obtained by treatment with NAA & GA3 at 500 ppm & 110 ppm, respectively.

Ripening :-

Ethrel enhance uniform ripening in pineapple. The treated fruit however, were acidic & lacked in flavour, although its appearance was good.

Varieties :-

- 1) Giant kew :- 1) late fruiting variety
2) Large size & weight upto 1.5 kg to 4 kg
- 2) Queen :- 1) table variety, not suitable for canning
2) In ripe fruits shell colour is golden yellow.
- 3) Mauritius :-
1) Mid-season variety
2) Yellow types
- 4) Other varieties :-
'Singapore spanish (Ruby), Red spanish, Cayenne & Thaldhup.

Pests :-

- 1) mealy bug wilt

Disease :-

- 1) soft Rot, storage Rot & fruit Rot
- 2) Heart Rot or stem Rot

Disorders :-

- 1) sun scald
- 2) fasciation & multiple crown

Pomegranate :- ~~दालिच~~ (डालिच)

B.N \Rightarrow Punica granatum

Family \Rightarrow Punicaceae.

Origin \Rightarrow

Economic importance :-

- 1) It is tropical crop & table fruit in tropical countries.
- 2) It is grown all over India on small scale but is commercially important, only in Maharashtra.
- 3) The area under this crop is increasing fast.
- 4) It is liked for the cool refreshing juice & also valued for its medicinal properties.
- 5) The juice is useful for patients suffering from leprosy.

Tree characters :-

The tree is deciduous in temperate countries while it is evergreen in tropical & sub-tropical regions. The fruits are borne terminally on short spurs, arising from mature shoots.
Very hardy tree.

Climate :-

Best quality fruits can be grown in areas of cool winters & hot & dry summer where rainfall is low.

This tree requires hot & dry climate during the period of fruit development & ripening. Tree cannot be produced sweet fruits, unless the temperature are high for considerably long period.

The quality of fruit is ~~considerable~~ ~~and~~ adversely affected in humid climate.

Soil :-

It can be grown on soils which are considered unsuitable for most other fruit crops.

pH - 6-7.5.

- Varities :-
- 1) Ganesh :- Evergreen bush with spreading habit, large leaf.
 - 2) Dholka :- Large sized fruits, colour of rind greenish white.
 - 3) Alandi :- Medium sized fruits, flesh deep red & deep pink.
 - 4) P-23 :- (M.P.K.V. Rahuri)
 - 5) P-26 :- ———//———
 - 6) G-137 :- MPKV Rahuri
 - 7) Moudula :- (MPKV Rahuri)
 - 8) Bhagwa :- (MPKV Rahuri) higher yield, attractive colours of fruit & processing (Anars Dana) uses in

Propagation :-

- 1) Propagated by seed as well as by vegetative means.
- 2) Propagation by cutting or air layer is easy as well as quick & gives true to type characters.
- 3) Root suckers are can be also used for propagation.

Planting :-

- Planting is done with onset of monsoon as weather during monsoon period.
- The pits of 60x60x60 cm in size are prepared by 5x5 m. apart, during summer months
- The one-two years old rooted cutting or layer prepared from known tree should be planted.

Irrigation :-

Newly planted orchard requires frequent & regular irrigation. After about 6-months, when the plant establishes it can stand considerable drought may be irrigated at 15-25 day interval, depending upon the climatic condition.

Manuring :-

Initially when plants builds it from work manuring should be done regularly 2-3 times a year. Everytime 5 kg FYM & 20-30g N should given.

Bearing tree at the age of 4-5 years should receive about 50 kg FYM, 625 gm N, 250 g P_2O_5 & 250 g K_2O .

At the age of 10 years the dose should be double.

Training & Pruning :-

Immediately after planting, the plant should be supported with bamboo & allow to grow straight upto 1 m height.

Problems :-

Cracking of fruits :- (Control by regular irrigation during fruit development)

Most serious problem of pomegranate is splitting or cracking of fruits. It is due to hardening of skin of fruits during the period of shortage of water.

Monsoon bahar fruits are more susceptible to cracking due to moisture fluctuations.

Fruit borers :-

Fruit borers reduce market quality of fruits, spraying of carbaryl at flowering helps to control.

Harvesting & Yield :-

- The trees start bearing from 4th year onwards
- give economic crop upto 25-30 years.
- The fruits are harvest about 5-6 months, after blossoming.
- The fruits are harvested when rind attains yellowish brown colour. Ripe fruits keep well.
- The skin of fruit may loose luster but the quality improved.

Yield :- 100-125 fruits/tree . Average yield \Rightarrow 200-250 fruits/tree
OR 10-12 t/ha

Jack fruit

B. N \Rightarrow Artocarpus heterophyllus, Artocarpus integrifolia

family \Rightarrow Moraceae

Economic Importance :-

- 1) The jack fruit is great importance in India which is not generally cultivated in regular plantations.
- 2) It is one of the few fruits, which are indigenous to India.
- 3) It gives, the biggest fruits, which are borne on small leafless stalk arising from trunk & main branches of tree.
- 4) The large fruits can weight upto 40 kg.
- 5) The male & female flowers of jack are borne in separate drooping catkins.
- 6) The fruits is extensively used for cooking but the ripened fruit is also quite tasty.
- 7) It often used as a shade tree, in coffee plantation.

Varieties :-

1) Singapore or Ceylon Jack \Rightarrow

- \rightarrow Remarkable for early bearing in $2\frac{1}{2}$ to 3 years.
- \rightarrow Fruits are medium size, weight 7-10 kg.
- \rightarrow Flesh is sweet, aroma strong.
- \rightarrow It gives fruits from June to December.
- \rightarrow Fruits contain 80 seeds

2) ~~K~~ Mutton Varica (Kerala).

Soil :-

- 1) Soil drainage is greatest importance to the Jack fruit, as sudden rise in water table the tree decline suddenly.
- 2) It required deep, well drained alluvial soil.

Climate :-

- 1) Jack comes up well under humid & warm climate of hill slopes.
- 2) It is also coming if adequate soil moisture is available.
- 3) Jack is sensitive to frost & drought.

Propagation :-

- 1) It is universally grown from seed.
- 2) Germination will take place in 3 to 8 weeks.
- 3) The viability of Jack seed is short.
- 4) The seeds are best sown immediately after extraction from the ripe fruit.
- 5) The germination is improved if the seeds are soaked in water for 24 hours.

Planting :-

- 1) Pits of 1x1x1 m dug at 9-12 m depth, 4 month ~~or~~ two before planting.
- 2) Filled 20-25 kg FYM
- 3) Seedling with ball of earth lifted & planted
- 4) June - September \Rightarrow Planting

Cultural requirements :-

Irrigation is necessary, as Jack is sensitive to drought & frost & no other cultural operation is necessary.

Harvesting :-

In North India the plants flower in winter & the fruits ripen in summer, but in Assam & south India the fruit is available almost throughout the year.

Seedling Jack trees comes to bearing within ~~4-6~~ 9 4-8 years

Yield :- 3700 kg/acre

Insect/Pest & Diseases :-

No insect pest or disease of jack fruit is serious.

Plantation crops

Tea: *Camellia sinensis* L. O. Kuntze.; Camelliaceae

- ① **Varieties:** Pandian, Sundaram, Golconda, Jayaram, Evergreen, Athrey, Brookeland, BSS 1, BSS 2, BSS 3, BSS 4, BSS 5
- ② **Soil and climate:** Tea requires well drained soil with high amount of organic matter and pH 4.5 to 5.5. The performance of tea is excellent at elevations ranging from 1000- 2500 m. Optimum temperature – 20-27 ° C.
- ③ **Nursery:** The nursery soil should be well drained and deep loam in nature with pH of 4.5 to 4.8. The rooting medium should be tested for pH and free from nematode infestation.
- ④ **Pre-treatment of rooting medium:** Treating with Aluminium sulphate can reduce soil pH. For this purpose the nursery soil is formed into beds of one metre width and about 8 cm height and of a convenient length. Then the beds are drenched with 2 % solution of Aluminium sulphate applied at 10 litres per 2.5 m² of area. Over this another layer of soil of 8 cm height is spread and again drenched with equal quantity of water twice. Then the soil is allowed to dry and the pH is checked before use in the nursery.
- ⑤ **Preparation of sleeves:** Polythene bags of 30 – 45 cm length, 10 cm width and 150 or 200 gauge thickness may be used. Drainage holes may be provided. The lower 3/4 of the sleeves should be filled with 1:3 sand and soil mixture and the top 1/4 with 1:1 sand and soil mixture and staked in rows. Overhead shade is provided.
- ⑥ **Selection and preparation of mother bush:** Healthy and vigorously growing high yielding bushes should be selected. For selected bush, application of 0.5 % Al SO₄+ 1 % Mg SO₄ as foliar spray is recommended. One week later, apply 2 % Zn SO₄. After one week apply 1 % Urea. Then 40 g of young tea mixture 60:90 NK mixture per bush may be applied upto 5 years.
- ⑦ **Preparation of cuttings:** Cuttings are taken on April - May and August - September. Semi hard-wood cuttings are prepared with one full leaf and an internode with a slanting cut at the bottom.
- ⑧ **Planting of cuttings:** The sleeves are watered thoroughly and holes are made in the soil. The cuttings are inserted in the hole and the soil around is pressed firmly to avoid airspace followed by watering. Small polythene tents may be provided which maintain high humidity and regulate the temperature inside. Cuttings may take 10 - 12 weeks for rooting. After 90 days - when all the cuttings have rooted, the polythene tent may be removed gradually over a period of 10 – 15 days.
- ⑨ **Manuring of nursery:** After the tent is removed the cuttings are sorted and staked. 30 g of Nursery soluble mixture of the following composition dissolved in 10 litres of water may be applied over an area of 4 sq.m. This should be done fortnightly.

Composition of the fertilizer:

Ammonium phosphate (20:20)
Potassium sulphate

35 parts by Weight
15 parts by Weight

(or) MOP
Magnesium sulphate
Zinc sulphate
Total

12 parts by Weight
15 parts by Weight
3 parts by Weight
80 parts by Weight

- (14) **Hardening of the cuttings:** Hardening of 4 - 6 months old young cuttings should be done by removing shade gradually in stages over a period of 4 - 6 weeks starting from a few hours exposure to sun every day initially and extending the time of exposure gradually.

• **Methods of planting**

Single Hedge System: Planted at the spacing of 1.20 x 0.75 m accommodating 10,800 plants/ha.

Double Hedge System: Planted at the spacing of 1.35 x 0.75 x 0.75 m accommodating 13,200 plants/ha.

Season and planting: May - June or September - October. Sleeves should be opened lengthwise without injuring the roots and planted in the pit and the soil is gently pressed.

Irrigation: Subsoil irrigation may be given for young teas during summer months.

Manuring: Manuring should be done 2 months after planting. Phosphorous should be applied at 80 - 100 kg/ha as Rock phosphate once in a year by placement at 15 - 25 cm depth upto the first pruning and thereafter once in two years. N: K ratio 2: 3 should be adopted for the first 3 years and a ratio 1: 1 thereafter may be followed.

Year of application	kg/ha/year		No. of applications	g/plant/year	
	N	K		Ammonium Sulphate	Urea
I year	180	270	5	13	27
II year	240	360	6	23	15
III year	300	450	6	29	18
IV year onwards	300	300	6	33	19

Application of fertilizers should be done before the onset of monsoon. Fertilizers should be broadcast around the drip circle avoiding contact with the collar.

Aftercultivation: Control perennial grasses (Forbicot weeds) by spraying Glyphosate 1.75 lit + Kaoline 2 lit + 2 kg of wetting agent in 450 lit of water followed by Gramoxone 500 ml in 200 lit of water to control dicot weeds.

Training young tea

Centering: To induce more laterals centering should be done 3 - 5 months after planting. The main leader stem should be cut, leaving 8 - 10 matured leaves.

Tipping: First tipping at a height of 35 cm and second tipping at 60 cm respectively from ground level.

Pruning: To maintain convenient height and vegetative growth and to remove dead and diseased branches, pruning is done.

Area to be pruned every year = $\frac{\text{Total extent of the garden}}{\text{Number of years between prunings}}$

Pruning cycle

Pruning interval = (Elevation in feet / 1000) * 1

Pruning should be done in April - May or August - September respectively to S.W or NE monsoon areas.

Types of pruning

Rejuvenation pruning: The whole bush should be cut near the ground level less than 30 cm with a view to rejuvenate the bushes.

Hard pruning: Formation pruning of young tea at 30 to 45 cm (12" to 18") for proper spread of bushes.

Medium pruning: To check the bush growing to an inconvenient height this type of pruning is done in order to stimulate new wood and to maintain the foliage at lower levels less than 60 cm.

Light pruning: Pruning depends on the previous history of the bush raising the height of medium pruning by an inch or less to manageable heights for plucking (less than 65 cm).

Skiffing: This is the lightest of all pruning methods. Remove the top 5 - 8 cm new growth to obtain a uniform level of pruning surface (more than 65 cm).

Shade regulation: Pollarding of shade trees should be done prior to heavy rains at a height of 8 - 10 m from the ground level.

Annual lopping: Cutting the erect type branches on the laterals in shade trees before monsoon season.

Plant protection - Pests

Scales: Spray carbaryl 50 WP @ 2 g/lit. or phosalone 2 ml/lit or quinalphos 25 EC 2 ml/lit or chlorpyrifos 20 EC 2 ml/lit.

Sahydrassis/Phassus borer: Locate the particle mat covering at the base tea bush and remove.

Insert a thick wire in the bore hole to kill the larvae.

Thrips: Spray any one of the following insecticide

Insecticide	Dose
Azadirachtin 5 % Neem extract concentrate	5.0 ml/10 lit.
Azadirachtin 1.0 % EC (neem based)	2.0 ml/lit.
Ethion 50%EC	5.0 ml/10 lit.
Profenofos 50 % EC	2.0 ml/lit.
Quinalphos 25 % EC	7.5 ml/10 lit.

Aphids: Spray phosalone 35 % EC @ 2.0 ml/lit

Red spider mite, Pinkmite, scarlet mite:

Insecticide	Dose
Azadirachtin 5% Neem extract concentrate	5.0 ml/10 lit
Azadirachtin 1.0% EC (neem based)	2.0 ml/lit
Dicofol 18.5 % SC	2.0 ml/lit
Ethion 50 % EC	5.0 ml/10 lit
Fenazaquin 10 % EC	1.6 ml/lit
Fenpyroximate 5 % EC	1.2 ml/lit
Flumite 20%SC/flufenzine 20%SC	5.0 ml/10 lit
Hexythiazox 5.45% EC	1.2 ml/lit.
Phosalone 35 % EC	1.0 ml/lit.
Profenofos 50 % EC	2.0 ml/lit.
Propargite 57 % EC	2.0 ml/lit.
Spiromesifen 22.9 % SC	1.0 ml/lit.

Tea mosquito bug:

- Monitoring the incidence of tea mosquito bugs at regular intervals.
- Removal of alternate hosts like neem, cashew, guava in the surroundings
- When the infestation is lesser: Spraying of any one of the following:
 - Imidacloprid (0.6 ml/l)
 - Thiamethoxan (0.6 g /l)
 - Profenophos (2 ml/l).

Diseases

Blister blight:

1. Spray Hexaconazole 200 ml + Copper oxychloride 210 g/ha at 5 days interval/ha. (or)
2. Spray 210 g of Copper oxychloride and Nickel chloride per ha at 5 days interval from June – September, 11 days intervals in October and November (or)
3. Copper oxychloride 210 g + 200 ml Propiconazole/ha at 10 days interval.

Crop duration and harvest: Plucking commences when the tea bush is 3 years old. The plucking of extreme tip of the growing branch consists of an unopened bud together with two leaves is popularly known as "Two leaves and a bud" while fine plucking is anything less than this. Plucking continues throughout the year in South at weekly intervals during March – May and at intervals of 10 -14 days during the other months.

Rush period - harvesting of 2 – 3 leaves with a bud at 7 to 10 days interval

Lean period – harvesting of two leaves and a bud at 10 – 15 days interval

Yield: The yield of green leaves is 10 t/ha.

Market information

Growing Districts	Nilgiris, Coimbatore, Dindigul, Theni, Kanyakumari and Tirunelveli districts
Major markets in Tamil Nadu	Coimbatore, Nilgiris
Grade specification	Size of the tea leaves : Whole, large tea – Higher grading Method of production : CTC process (Crush, Tear and Curl) and Orthodox

Coffee: *Coffea arabica* L.; *Coffea canephora* Pierre ex Frechna; Rubiaceae

Varieties

Arabica varieties: Sln 795, Sln 7, Sln 9, Sln 10, Cauvery and its selections HRC (Hawaiian Red Cuturra), Chandragiri and sanRoman

Robusta varieties: Sln 274, Sln 270, Sln 3.

Soil: Soil should be deep, friable, open textured rich in plant nutrients with plenty of humus and of slightly acidic nature (pH – 4.5 to 6.5)

Varieties	Elevation (m)	Rainfall (mm)	Distribution
Robusta	500 – 1000	1000 - 2000	Blossom shower – February - March
Arabica	1000 - 1500	1600 - 2500	Blossom shower – March - April
Backing shower during April – May is required for both the varieties.			

Propagation: by seeds.

Preparation of seeds: Healthy and well developed fully ripe berries are harvested from specially identified plants for use as seed bearers. After discarding the floats, the sound fruits are depulped, sieved and mixed with sieved wood ash and dried in shade. The seed is then graded to remove all cut, triangular and elephant beans. Prior to planting, the seeds are treated with Agrosan or any Organomercurial compound to prevent fungal infection.

Nursery practices: Select light loamy soil of good drainage and high organic matter content with water and shade facilities.

Form raised beds of 15 cm height, 1m width and of convenient length.

Incorporate 30 - 40 kg of well rotten compost, 2 kg of finely sieved agricultural lime and 400 g of rock phosphate to a bed of 1 x 6 m size.

In heavy soils, it is necessary to add coarse sand for drainage and aeration.

Sowing: Pre-sowing seed treatment with *Azospirillum* and *Phosphobacteria* can be done.

Seeds are sown in December - January in the bed 1.5 - 2.5 cm apart with the flat side down wards in regular rows. Then they are covered with a thin layer of fine soil and a layer of paddy straw. Water the beds daily and protect from direct sunlight by an over head pandal. Seeds germinate in about 45 days after which they are transplanted to secondary nursery beds for raising ball or Bag nursery.

Bag nursery: Polythene bags with adequate number of holes in the bottom half are taken and are filled with a prepared mixture containing jungle soil, FYM in the proportion of 6:2:1.

An area of 12 x 8 m can accommodate 5000 seedlings. Seedlings are planted in polythene bags.

Season: June - September.

Preparation of field: Selective felling may be done while retaining a number of desirable shade trees. Terracing should be done in deep slopy areas. After the summer showers, pits of 45 cm³ are dug. The pits are left open for weathering and then filled and heaped for planting. At the time of filling, apply 500 g of rock phosphate per pit along with top soil. Planting is done along the contour in slopy areas.

Spacing

Arabica Coffee: 1.5 to 2.0 m either way.

Dwarf varieties: Sanraman: 1 x 1 m.

Robusta coffee: 2.5 m either way.

Planting shade trees: Dadap is commonly used as a lower canopy shade. Stakes of 2 m length are planted for every two coffee plants. Silver Oak and Dadaps are planted during June when South-West monsoon commences. During summer the stem of young Dadaps are painted with diluted lime or wrapped with polythene sheets in order to prevent them from sun scorch. Regulate shade by cutting criss-cross branches during monsoon season. Silver oak trees are planted at 6x6m for permanent shade.

Irrigation: It is generally grown as a rainfed crop. But irrigation with sprinkler during March - April increases blossoming and results in higher yields.

Manuring:

Species	Pre-blossom March N:P ₂ O ₅ :K ₂ O	Post blossom May N:P ₂ O ₅ :K ₂ O	Mid-monsoon August N:P ₂ O ₅ :K ₂ O	Post-monsoon October N:P ₂ O ₅ :K ₂ O	Total
ARABICA					
Young coffee 1 st year After planting	15:10:15	15:10:15	---	15:10:15	45:30:45
2 nd and 3 rd year	20:10:20	20:10:20	---	20:15:20	60:45:60
4 th year	30:20:30	20:20:20	---	30:20:30	80:60:80
Bearing coffee 5 years and and above for less than one tonne/ha crop	40:30:40	40:30:40		40:30:40	140:90:120
For one tonne/ha and above	40:30:40	40:30:40	40:30:40	40:30:40	160:120:160
ROBUSTA					
For less than one tonne/ ha crop	40:30:40	---	---	40:30:40	80:60:80
For 1 tonne /ha and above	40:30:40	40:30:40	---	40:30:40	120:90:120

Pruning: Centering and desuckering should be carried out for 5-6 years after planting. Done immediately after the harvest (June-July and September - october) and till the onset of monsoon. Unproductive wood between all primaries, secondaries and tertiaries should be removed.

Rejuvenation / collar Pruning: Removal of dead, exhausted, dried and worn out branches. Done immediately after the harvest.

Hard pruning: Plants are cut at 5-20 cm above the ground level and one leader shoot is allowed.

Medium Pruning: Removal of lateral shoots to regulate shade.

Light pruning: Removal of Suckers.

Intercropping: Orange, Pepper, Banana, Pine apple, Avocado, Custard apple.

After cultivation: Weeding and mulching should be done as and when necessary. Digging is done to a depth of 30 cm towards the end of monsoon (October - November). The weeds and vegetative debris are completely turned under and buried in the soil while the stumps are removed. This is known as the cover digging. In slopy areas dig trenches on the contour 45 cm wide and 30 cm deep of any convenient length. Prune water shoots and disease affected shoots.

Plant protection

Pests

White stem borer: Attacks arabica coffee grown under inadequate shade.

- Maintain/create optimum shade
- Borer infested plants should be thoroughly trace, uprooted during March and September, burnt to avoid economic loss during the subsequent years.
- Install pheromone traps @ 25 /ha, if the incidence is high.
- Remove the loose scaly bark on the main stem and thick primaries using coir glove or coconut husk.
- Pad with monocrotophos 36 WSC @ 5 ml by making a window in the stem at 5 cm x 5 cm and fill it with absorbant cotton dipped in insecticide solution and close it.

Berry borer:

- Carry out timely and thorough harvest.
- Avoid gleanings as far as possible.
- Pick up and destroy the gleanings.
- Meticulously remove the leftover berries.
- Remove offseason berries to save main crop.
- Avoid excessive shade.
- Prune plants properly to facilitate better ventilation and illumination.
- Set up traps with ethyl : methyl alcohol (1 : 1) to attract adults.
- While processing at the estate level dry coffee berries to the prescribed moisture level :

Arabica / robusta parchment 10 %, Arabica cherry 10.5 % and robusta cherry 11.0 %.

Shot hole borer beetle:

Attacks branches and suckers of robusta coffee. This pest thrives under heavy shade and can be controlled by pruning the branches

Green scales and mealy bugs:

Release coccinellid predator *Cryptolaemus montrouzieri* @ 300 beetles/acre.

Spray *Verticillium lecanii* @ 6×10^6 spores/ml or spray any one of the following insecticide

Insecticide	Dose
Monocrotophos 36 % SL	1.5 ml/lit.
Oxydemeton –Methyl 25 % EC	2.5 ml/lit.
Quinalphos 25 % EC	2.5 ml/lit.

For the control of leaf miner spray Oxydemeton –Methyl 25 % EC @ 2.5 ml/lit.

Diseases

Rust: Spray 0.5 % Bordeaux mixture in February - March (Pre-bloom) followed by 0.03 % Oxycarboxin in May - June (Pre-monsoon).

Repeat in July - August (mid-monsoon) September - October (Post-monsoon) with any one of the above fungicides or

Spray 0.5 % Bordeaux mixture during the month of June followed by 0.02 % Triadione during September and 0.5 % Bordeaux mixture during the month of December.

Black rot or Koleroga: Centering and handling of the bushes should be done prior to the onset of South-West monsoon.
Remove affected twigs.

Spray 1% of Bordeaux mixture during break in monsoon.

Collar rot: Treat seeds with Carbendazim 1 g/kg or Carboxin 0.7 g/kg.

Maintain filtered shade in nursery.

Drench nursery beds with Mancozeb or Captan 0.5 g/lit before sowing.

Brown eye spot: Spray Captan or Mancozeb or Ferbam 2 g/lit or Carbendazim 0.5 g/lit in September.

Black root rot: Dig out and burn infected bushes.

Dig a trench 30 cm deep around affected spot along with a ring of healthy bushes.

Prune the healthy bushes within and outside the trench to allow sunlight.

Keep the trench free from fallen leaves.

Do not replant for 18 months.

Harvest: Harvest starts during October and extends upto February. Coffee fruits should be harvested as and when they become ripe. Coffee is just ripe when on gently squeezing the fruits the beans inside come out easily.

Fly picking: small scale picking of ripe berries during October to February

Main picking: well formed and ripened berries are harvested during December. Bulk of the yields are obtained from this picking.

Stripping: picking of all the berries left irrespective of ripening.

Cleanings: This is collection of fruits that have been dropped during harvesting.

Unripe fruits should be scrupulously sorted out before using the fruits for pulping. They may be dried separately as cherry.

Yield: Dry parchment 750 - 1000 kg/ha.

Market information

Growing Districts	Dindigul, Nilgiris, Salem and Theni
Major markets in Tamil Nadu	Coonoor, Bodinayakanur, Mettupalayam
Types	Arabica, Robusta
Grade specification	Washed, Unwashed, Monsooned, Instant, Ground, Roasted, Speciality

Cashew: *Anacardium occidentale* L.; Anacardiaceae

Varieties: VRI 1, VRI 2, VRI 3, VRI 4 and VRI (CW) H1

Soil and climate: It grows up well in all soils. Red sandy loam is best suited. Plains as well as hill slopes upto 600 - 700 feet elevation are suitable for cultivation.

Season: June - December.

Propagation: Soft wood grafting, air layer and epicotyl grafting.

Requirement of plants: 200 plants/ha.

Preparation of field: Pits of 45 cm³ size are dug and filled up with a mixture of soil + 10 kg FYM + one kg neem cake and 100 g Methyl parathion 1.3 %.

Spacing: 7 m either way.

High Density Planting: Spacing of 5 x 4 m accommodating 500 plants per hectare is recommended prune the interlocking branches during the July-August to maintain the frame.

Manuring (per tree)

Manures and fertilizers	I year	II year	III year	IV year	V year onwards
FYM or Compost (kg)	10	20	20	30	50
N(g)	70	140	210	280	500
P(g)	40	80	120	160	200
K(g)	60	120	180	240	300

Fertilizer application may be done during October - November in the East Coast areas. Wherever possible the fertilizer can be applied in 2 equal split doses during June-July and October-November periods under eastcoast area, a fertilizer schedule of 1000:125:250 g NPK/tree is recommended tree.

Irrigation: Normally grown as a rainfed crop. Irrigation once in a week from flowering to fruit maturity stage is good to increase the yield.

Intercropping: Plough the interspaces after the receipt of rain and raise either groundnut or black gram till the trees reach bearing age.

Training and pruning: Develop the trunk to a height of 1 m by removing low lying branches. The dried twigs and branches should be removed every year.

Plant protection

Pests

Stem borer –

- Collect and destroy affected shoots.
- Swabbing the bark of exposed roots and shoots with carbaryl 50 WP@ 2 g/lit. Twice a year before the onset of South West Monsoon (March – April) and after cessation of monsoon (November) painting of coal tar + kerosene mixture (1:2) or swabbing with a suspension of carbaryl 50 WP (4 g/lit) upto one metre length in the exposed trunk region

after shaving the bark or swab the tree trunk with neem oil 5% thrice during January-February, May-June, and September-October

- Root feeding with monocrotophos 36 SL @ 10 ml + 10 ml of water kept in a polythene bag on one side of the tree and keep the same amount on the other side of the tree (Total 20 ml/tree) divided into two equal halves will give protection when there is moderate incidence.
- Remove grubs from early stage infested trees and drench the damage portion with Chlorpyrifos 0.2% @ 10 ml/lit or Neem Oil 5%

Tea mosquito bug:

- Spray application of phosalone 35 EC @ 2.0 ml, followed by carbaryl 50WP @ 2g/l and monocrotophos @ 2ml/l at vegetative flush stage, panicle initiation stage and nut formation stage respectively are recommended for the management of tea mosquito bug.
- Spray schedule involving three rounds of spray viz., first spraying with Profenophos (0.05%) at flushing stage, second spraying with Chlorpyrifos (0.05%) at flowering and third spraying with Carbaryl (0.1%) at fruit set stage is most effective.

Apple borer: Spray dichlorvos 76 % EC @ 6.0 ml/10 lit.

Root borer: Pour monocrotophos 10 ml/tree in the bore holes split into two halves (insecticide 5 ml + 5 ml water).

Diseases

Die back or Pink disease:

Prune the affected shoots just below the affected portion and apply Bordeaux paste.

Spray 1 % Bordeaux mixture or copper oxychloride 0.25 % twice in May- June and again in October as a prophylactic measure.

Harvest: The plant starts yielding 3rd year onwards. The peak picking months are March to May. Good nuts are grey green, smooth and well filled. After picking, the nuts are separated from the apple and dried in the sun for two to three days to bring down the moisture content to 10 to 12 %. Properly dried nuts are packed in alkathene bags. This will keep for 6 months.

Yield: 3 - 4 kg/tree/year.

Market information

Growing Districts	Cuddalore, Tirunelveli
Major markets in Tamil Nadu	Jayankondam, Vridhachalam, Panruti
Grade specification	White/ Pieces, splits, butts

Coconut (*Cocos nucifera* L.); Palmae

Varieties:

Hybrids: VHC1, VHC2 and VHC3

Tall: VPM3, ALR 1, ALR 2 and West Coast Tall

Dwarf (tender coconut): COD, CYD, CGD and MYD

Soil and climate: Light sandy soils to heavy soils with a pH - 5.2 to 8.0. Proper drainage, good water-holding capacity, presence of water table within 3 m and absence of rock or any hard substratum within 2 m of the surface.

Altitude: 600 to 900 m

Rainfall: 200 cm per year.

Planting seasons: Jun - Jul and Dec - Jan. The planting can also be taken up in other seasons wherever irrigation and drainage facilities are available.

Spacing: For garden: 25' x 25' (Square system - 7.5 x 7.5 m) - 175 plants/ha.
Field border as a single row - 20' spacing between plants

Planting: Pit size of 3 cubic feet.

Sprinkle methyl parathion Dust to prevent white ant damage. Fill the pit to a height of two feet (60 cm) with FYM, red earth and sand mixed in equal proportions. At the center of the pit, remove the soil mixture and plant the seedling after removing all the roots. Press the soil well around the seedling and provide the seedling with shade by using plaited coconut leaves or palmyrah leaves. Keep the pits free from weeds. Remove soil covering the collar region. As the seedlings grow and form stem, fill up the pits gradually by cutting the sides.

Water management: Summer irrigation – production of female flowers and setting percentage increases. Moisture stress – stunted growth, drooping of leaves, immature nut fall

Months	Normal condition (for best yield)	Moderate water scarcity condition	Severe water scarcity condition
A. Drip irrigation			
March – September	80 lit / day	55 lit / day	27 lit/day
October – February	50 lit / day	35 lit/ day	18 lit /day
B. Basin irrigation			
March – September	410 lit / 5 days		
October – February	410 lit /8 days		

Drip irrigation in coconut: Root zone of coconut for moisture absorption is concentrated in a circular area of 200 cm radius around the base of coconut tree up to a depth of 100 cm. Irrigating coconut trees by a set of four drippers set equidistant in a circle 100 cm away from the base of the tree and discharging water at the rate of 30 l/h for 2.5 h with a irrigation frequency of 8 days can maximize the wetting area of soils in the effective root zone of coconut.

Drought management and soil moisture conservation:**a. Mulching with coconut husks/leaves/coir pith**

Apply coconut husks with convex surface facing upwards (100 Nos.) or dried coconut leaves (15 Nos) or coir pith up to a height of 10 cm in the basin of 1.8 m radius around the palms during summer season

b. Burial of coconut husk or coir pith

Bury husks @ 100 Nos. with concave surface facing upwards or 25 kg of coir pith /palm in circular trenches, dug 30 cm width and 60 cm depth at 1.5 metres radius - preserves the monsoon rains.

Manuring & Fertilizer application

Age(Years)	FYM(kg/tree)	Urea(kg/tree)	Super Phosphate(kg/tree)	Muriate of Potash(kg/tree)
1	10	0.308 (140 g N)	0.500 (80g P ₂ O ₅)	0.480 (300 g K ₂ O)
2	20	0.616 (280 g N)	1.000 (160 g P ₂ O ₅)	0.960 (600 g K ₂ O)
3	30	0.924 (420 g N)	1.500 (240 g P ₂ O ₅)	1.440 (900 g K ₂ O)
4	40	1.23 (560 g N)	2.000 (320g P ₂ O ₅)	1.920 (1200 g K ₂ O)
5 th year onwards	50	1.23 (560 g N)	2.000 (320g P ₂ O ₅)	1.920 (1200 g K ₂ O)

Apply manures and fertilizers in circular basins of 1.8 m from the base of the palm, incorporate and irrigate.

The fertilizers may applied in two split doses, in June – July and in December to January.

TNAU Coconut Tonic Nutrition: For nut bearing coconut, root feed TNAU coconut tonic @ 200 ml/palm once in six months.

Bio-fertilizer recommendation : 50 g of *Azospirillum*, 50 g of *Phosphobacteria* (or) 100 g Azophos and 50 g of VAM. Mix all the contents in sufficient quantity of compost or FYM and apply near feeding roots once in 6 months / palm starting from planting. Don't mix with chemical fertilizers and pesticides

Organic recycling: Any one of the green manure crops like sunhemp, wild indigo, calapagonium or daincha may be sown and ploughed *in situ* at the time of flowering as a substitute of compost to be applied. Sow sunhemp @ 50 g/palm in the basin and incorporate before flowering. Coir pith compost or vermicompost made from coir pith/ coconut leaves/ other wastes from coconut grove can be applied.

Intercropping in coconut

- Below 7 years of age: annual crop
- 7 – 20 years of age: Green manure crops and fodder crops
- Above 20 years of age

Annuaals	Groundnut, bhendi, turmeric, tapioca, sweet potato, sirukizhangu, elephant foot yam, ginger, pineapple
Biennials	Banana varieties viz., Poovan and Monthan are suitable
Perennials	Cocoa, pepper (Panniyur 1 or Panniyur 2 or Panniyur 5 or Karimunda), nutmeg and vanilla

Weed management: The inter-space in the coconut garden has to be ploughed twice in a year in June-July and December - January. Intercultural operation is essential to keep weed population under check, to enhance the utilisation of the applied plant nutrients by the coconut trees, to facilitate proper aeration to the roots of coconut, to induce fresh root growth.

For the broad-leaved weeds, pre-emergence spraying of atrazine @1.0 kg a.i. / ha for the control of grasses and sedges. Post emergence spraying of glyphosate @ 10 ml and 20 g ammonium sulphate/litre of water.

Yield and Earliness:

S.No	Variety	Nut yield (Nos / tree / year)	Earliness (year)
1.	Hybrid	100	3 – 5
2.	Tall	60 – 80	6 – 7
3.	Dwarf (tender coconut)	70 - 90	4 – 5

Pests and diseases

I) Rhinoceros beetle

- Remove and burn all dead coconut trees in the garden (which are likely to serve as good breeding ground) to maintain good sanitation.
- Collect and destroy the various bio-stages of the beetle from the manure pits (breeding ground of the pest) whenever manure is lifted from the pits.
- Incorporate the entomopathogen i.e, fungus (*Metarhizium anisopiae*) in manure pits to check the perpetuation of the pest.
- Apply Methyl parathion dust in the manure pits once in three months to kill the grubs.
- Soak castor cake in small mud pots and keep them in the coconut gardens to attract and kill the adults.
- Treat the longitudinally split tender coconut stem and green petiole of fronds with fresh toddy and keep them in the garden to attract and trap the beetles.
- Examine the crowns of tree at every harvest and hook out and kill the adults.
- Fill the crown and the top most three leaf axils with a mixture of Aldrin 5 D and fine sand (1:1 by volume) once in three months, particularly before and after the monsoon months to check the damage by adults. For seedlings, apply 3 nos. of naphthalene balls/palm weighing 3.5 g each at the base of interspace of leaf sheath in the 3 inner most leaves of the crown once in 45 days.
- Set up light traps following the first rains in summer and monsoon period to attract and kill the adult beetles.
- Field release of Baculovirus inoculated adult rhinoceros beetle reduces the leaf and crown damage caused by this beetle.
- Mixture of either neem seed powder +sand (1:2 @ 150 g per palm or Neem Seed Kernel powder + Sand (1:2) @ 150 g per palm applied in the base of the 3 inner most leaves in the crown effectively controlled rhinoceros beetle damage.

II Black headed caterpillar

- The incidence of the pest is noticed from the month of November to May and from August to November after rainfall. The coconut trees of all ages are attacked. Among the larval parasites, the bethylid *Parasierold nephandidis* is the most effective in controlling the pest. The optimum level of release is 1:8 of host parasite ratio. The parasite should be released under the coconut trees then the pest is in the 2nd or 3rd instar larval stage. Parasite release trap may be used to release the parasite at the site of feeding. Parasites should not be released in the crown region since they will be killed by predators like spiders and reduvils.
- Remove and burn all affected leaves/leaflets.

- iii. Release the larval (Bethyids, Braconid and Ichneumonid) and pupal (Eulophid) parasites and predators periodically from January, to check the build up of the pest during summer.
- iv. Spray Malathion 50 EC 0.05 % to move the undersurface of the leaves thoroughly in case of severe epidemic outbreak of the pest in young palms.
- v. Harvest all mature nuts, and drill a downward slanting hole and inject 5.0 ml of Monocrotophos 36 SL into the stem at about 1.5 m above the ground level and plug with clay mixed with Copper oxychloride. Monocrotophos (5 ml) may also be mixed in water (20 ml) and injected into the stem or a cotton wick soaked in Monocrotophos (after absorption of 5 ml) and inserted into the hole and plugged. Plucking tender coconuts or harvesting the nuts should be avoided strictly for forty days after treatment.
- vi. Root feeding for the control of coconut Black headed caterpillar: Select a fresh and live root, cut sharply at an angle and insert the root in the insecticidal solution containing Monocrotophos 36 SL 10 ml + water 10 ml in a 7x10 cm polythene bag. Secure the bag tightly to the root with a cotton thread. Twenty four hours later, check whether there is absorption. Select another root. These methods should not be resorted to as a routine practice and it is suggested only for cases of severe epidemic outbreak of the pest and when the survival of the tree is threatened.

III. Red palm weevil

- i. Remove and burn all wilting or damaged palms in coconut gardens to prevent further perpetuation of the pest.
- ii. Avoid injuries on stems of palms as the wounds may serve as oviposition sites for the weevil. Fill all holes in the stem with cement.
- iii. Avoid the cutting of green leaves. If needed, they should be cut about 120 cm away from the stem.
- iv. Plug all holes and inject Pyrocone E or Carbaryl at 1% ml or 10 ml of Monocrotophos or 5 ml of Monocrotophos + 5 ml of Dichlorvos into the stem by drilling a hole above the points of attack.
- v. Setting up of attractant traps (mud pots) containing sugarcane molasses 2 ½ kg / toddy 2 ½ litres + acetic acid 5 ml + yeast 5 g + longitudinally split tender coconut stem /logs of green petiole of leaves of 30 numbers in one acre to trap adult red palm weevils in large numbers.

IV. Termites

- i. Locate termite mounds in or near the coconut nursery or garden and destroy.
- ii. Incorporate 120 kg of Heptachlor 3 D per ha into the soil twice a year, i.e, on receipt of summer and monsoon showers (Heptachlor 3 D per tree). Spray Aldrin 0.15 % or HCH 0.25 % or Neem oil 5 % once on the base and upto 2 m height of the trunk for effective control.
- iii. Spray Copper sulphate 1 % or Cashew nut shell oil 80 % followed by Copper sulphate 1 % then neem oil 5 % and copper sulphate 1 %, then NSKE 20 % to preserve planted coconut leaves from the termite attack.

V. Scale insect: Pluck mature nuts and spray Monocrotophos 0.036%. Do not harvest nuts for 1 ½ months after spraying.

VI. Mealy bugs: Remove leaflets harbouring these insects and destroy them and spray Malathion at 0.1 % or Dimethoate 0.03 % or Methyldemeton 0.025 % or Phosphomidon 0.05 %

or Monocrotophos 0.04 % or Methomyl 0.25 %. Application of neem oil 3% was effective in controlling mealy bug.

VII. Leaf caterpillars, nut caterpillar and nut coreid bud: Collect and destroy the immature stages of the insects wherever possible and spray Carbaryl 0.1 %. A combined treatment of root feeding of Monocrotophos at 5 ml + 5 ml water, spraying of 0.01% Monocrotophos followed by the release of Parasitoids at every 15 days interval of time effectively control leaf eating caterpillars.

VIII. Palm civet: Poinson baiting with ripe banana fruit sand wixed with 0.5 g Carbofuran 3 g granules.

IX. Rat: Tree banding with inverted iron cores or Prosopis thorns. Baiting with Bromodialone 0.005% at 10 g/tree at crown region twice at an interval of 12 days.

X. Thanjavur wilt: Aureofungin – sol 2 g+one g Copper sulphate or 2 ml of Tridemorph dissolved in 100 ml water may be applied as root feeding. The active absorbing root of pencil thickness be selected and a slanting cut is made. The solution is taken in a polythene bag or bottle and the cut end of the root is dipped in the solution. Forty litres of 1% Bordeaux mixture should be applied as soil drench around the trucks in a radius of 1.5 metre. Neem cake (5 kg/tree) can be applied along with fertilizers and Azotobactor (200 g/tree).

For early diagnosis of Thanjavur Wilt, and EDTA test utilizing the root samples has been developed and based on the O.D values the disease intensity can be detected.

Disease intensity -	Optical Density value
Mild -	0.18 – 0.22
Moderate -	0.24 – 0.59
Severe -	> 0.59
Healthy palm -	0.02 - 0.10

Intercrop with banana to reduce the severity of Thanjavur Wilt.

XII. Bud rot: The infective tissues from the crown region should be removed and protected with Bordeaux paste. Spray Bordeaux mixture at 1% or Copper oxy chloride 0.25 % on crown region as pre-monsoon spray. Spray Copper oxy chloride 0.25 % after the onset of monsoon.

XIII. Stem bleeding disease: The bark of the trunk should be removed in the bleeding area and Bordeaux paste should be applied in this area.

- a. Preparation of 1% Bordeaux mixture: A quantity of 400 g of copper sulphate should be dissolved in 20 litres of water and 400 g of lime in another 20 litres of water separately. The copper sulphate solution should be added to the lime solution constantly stirring the mixture. Earthen or wooden vessels alone should be used and metallic containers should not be used. To find out whether the mixture is in correct proportion, a polished knife should be dipped in the mixture for one minute and taken out. If there is reddish brown deposit of copper, additional quantity of lime should be added till there is no deposit in the knife.
- b. Preparation of Bordeaux paste: Take 200 g of Copper sulphate and dissolve it in one litre of water and 200 g of lime in one litre of water separately.; both are mixed simultaneously in a third vessel and the resultant mixture can be used as a paste.

XIV. Pencil point disease: Because of micronutrient deficiency, the stem will taper towards its tip with lesser number of leaves. The leaf size will be greatly reduced and the leaves will be pale and yellow in colour. Along with the recommended fertilizer dose, 225 g each of Borax, Zinc sulphate, Manganese sulphate, Ferrous sulphate, Copper sulphate and 10 g of Ammonium molybdate may be dissolved in 10 l of water and poured in the basin of 1.5 m radius.

SPECIAL PROBLEMS IN COCONUT

1. Rejuvenation of existing garden: The low yield in vast majority of gardens is due to following measures are taken.

- i. Thinning of thickly populated gardens: In the farmer's holdings, 41 per cent of the trees give a yield of less than 20 nuts/palm/year. By cutting and removal of these trees the yield could be increased by 1750 nuts/ha. After removal of low yielding trees, the populations should be maintained at 175-200 palms/ha.
- ii. Apply manurial schedule of 50 kg of FYM or green leaf plus NPK at 560, 320, 1200 g/palm and irrigate at 10 days intervals during summer months in addition to manuring.

2. Button shedding: Shedding of buttons and premature nuts may be observed to many reasons: Provide regular irrigation, requested nutrition to reduce the button shedding.

Barren nuts

Apply extra 2 kg of K_2O with 200 g of Borax/palm over and above the usual dosage of fertilizer to correct the barren nuts in coconut.

- a) Regularly survey for pest and diseases
- b) Select seedlings 9 to 12 months after planting. Seedlings, which have germinated earlier, having good girth at collar and early splitting of leaflets, should be selected for planting.

TNAU MN mixture @ 1 kg/tree/year

(* Enriched FYM prepared at 1:10 ratio of the MN mixture and FYM, mixed at friable moisture and incubated for one month in shade).

Market information

Growing Districts	Thiruvapur, Coimbatore, Kanyakumari, Tanjore
Major markets in Tamil Nadu	Coimbatore, Tanjore, Chennai
Preferred varieties	Tall Dwarf, Tall x Dwarf
Grade specification	Colour, Nut Weight

Arecanut: *Areca catechu* L.; Palmae

Varieties: Mangala, Sumangala, Subamangala, Mohitnagar, Srimangala, Samruthi (Andaman), Hirehalli dwarf, VTLAH 1,2 and Thirthahalli dwarf.

Soil and climate:

Arecanut is capable of growing in a variety of soils. It thrives best in well drained soils. Adequate protection from exposure to South-Western sun is essential to avoid sun-scorch. Quick growing shade trees have to be planted on the southern and western sides well in advance of planting seedlings. It is sensitive to moisture deficit and should be grown where adequate water facilities are available.

Grows in a wide range of temperature ranging from minimum of 4°C to a maximum of 40°C. Altitude upto 1000 m above Msl. Rainfall – 750 – 4500 mm.

Season: June - December.

Seeds and sowing: For raising seedlings seed nuts from pre-marked and pre-potent mother palms of outstanding performance are selected

Sown immediately after harvest at a spacing of 5 - 6 cm apart in sand beds under partial shade with their stalk end pointing upwards.

After the sprouts have produced two to three leaves (90 days old), they are transplanted to Secondary nursery beds at a spacing of 30 x 30 cm or polythene bag of 30 x 10 cm filled with forest soil and are allowed to grow for 12 to 18 months under partial shade. Periodical watering should be given.

Planting:

Dwarf and compact seedlings with more number of leaves of 1 – 2 years age should be selected.

Plant in pits of 90 cm³ at a spacing of 2.75 m either way and covered with soil to the collar level and pressed around.

Provide shade during summer months.

Growing Banana or other crops in advance may also provide shade.

Irrigation: Irrigate weekly once during November – February, once in 4 days during March – May. Flood irrigation 175 lit/ tree/ day. In drip irrigation 16 – 20 lit/ tree/ day.

Manuring: Apply to each bearing palm (5 years and above) 10 - 15 kg of FYM or green leaf. 100:40:140 g of NPK/ tree/ year. To palms less than five years old, half of the above dose is recommended. Manures are applied during January - February after the North - East monsoon in a basin of 0.75-1.00 m radius around the tree to a depth of 20 - 30 cm.

Aftercultivation: Weeding is done twice or thrice in a year. Wherever the land is slopy terracing has to be done to prevent soil erosion.

Intercropping:

Cocoa, Black Pepper, Coffee, Cinnamon, Clove and citrus

Plant protection**Pests**

Mites: Spray Dicofol 18.5 EC at 2.5 ml/lit of water.

Spindle bug: Drenching spray with Methyl parathion 1.3 D @ 2.5 g/lit of water or Dimethoate @ 1.5 ml/lit.

Inflorescence caterpillars: Dust Methyl parathion 20 EC 2 ml/lit or WP @ 2.5 g in one litre of water.

Nematode:

Soil application of *P. fluorescens* (Pfbv 22) and *B. subtilis* (Bbv 57) each @ g / vine was found to be effective in reducing the root knot and reniform nematode population in Black pepper.

Diseases**Bud rot or Mahali disease:**

Infected tissues of the bud should be scooped off and treated with 10 % Bordeaux paste.

Destruction and removal of seed palms and bunches

Drenching crowns of surrounding healthy palms with 1 % Bordeaux mixture.

Foot rot or anabe:

Affected palms have to be isolated by digging trenches all round.

The severely affected palms should be cut and destroyed.

The stumps should be pulled out by digging and the drainage improved.

Soil application of neem cake @ 2 kg / palm / year followed by root feeding with 125 ml of 1.5 % (15 ml/litre of water) Tridemorph at 3 months interval or Soil drenching of Bordeaux mixture (1%).

Stem breaking: Wrapping up of the green portion of the stem which are exposed to the South-West sun to protect against sun-scorch.

Yellow Leaf Disease:

Application of balanced nutrients with additional quantity of super phosphate

Apply 1 kg of lime/tree/year.

Apply organic manures @ 12 kg/ tree/year.

Leaf spot: Foliar spray with Bordeaux mixture 1 % or 0.2 % Dithane M 45

Nut crack:

Spray Borax 2 g/lit with proper water management.

Harvest: The bearing starts after 5 years of planting. Nuts are harvested when they are three quarters ripe. The number of harvests will vary from three to five in one year depending upon the season and place of cultivation.

Yield: 1250 kg/ha