CULTIVATION OF GUAVA

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INTRODUCTION

- **Botanical Name**: *Psidium guajava*
- **Family**: Myrtaceae
- **Chromosome number**: 2n= 2X= 22
- **Origin**: Tropical America
- **Inflorescence**: Cyme
- **Fruit Type**: Berry
- **Edible Part**: Pericarp and Plecenta

- It is the fourth most important fruit crop of India after Mango, Banana and Papaya
- It is popularly known as "apple of the tropics" due to its rich nutritive value and availability at reasonable price.
- It is a native of tropical America. It is now widely grown allover the tropics and the subtropics.
- The major guava producing countries in the world are south Asian countries, the Hawaiian islands, Cuba and India
- The important guava producing states of India are Maharastra, Uttar Pradesh, Bihar and Madhya Pradesh.

- The area of guava cultivation in india is 270 thousound hactare with production of 4107 thousound M.T. (2017)
- The area of guava cultivation in Rajasthan is 3850 ha with production 41354 M.T. (2017)
- Guava is an excellent source of vitamin C, (299mg/ 100g of fruit pulp), pectin and minerals such as iron, calcium and phosphorus. It is a very common fruit, popular among both the rich and the poor due to its moderate prices, nourishing value and good taste.
- The importance of guava is also due to the fact that it is very hardy and can be grown in a wide range of soil and climatic conditions.

Climate

- Guava is more resistant to drought than most other fruits and can withstand temperatures as high as 46.0° C.
- The best quality guavas are obtained at low night temperature (10° C)
- The young seedlings are affected by the drought and winter cold. It can grow from sea level to an altitude of about 5000 ft (1500m).
- It grows best with annual rainfall below 40 inches distributed between June to September.
- For good flowering and fruiting it requires a dry atmosphere.

Soil

- ✓ **Guava can be grown on all types of soil from alluvial to laterite.**
- ✓ **However, the best soil suitable for its cultivation is deep, fertile and well-drained loamy soil.**
- ✓ **It is sensitive to water logging. It can be grown with a pH range of 6.5 to 8.2.**
- ✓ **Being hardy in nature, it can be grown even on less fertile soils by providing adequate amount of manures and fertilizers, and good management practices.**

Varieties

- There is a great variation in the types of fruit.
- Apple guavas have a brilliant red blush.
- Some types are pear shaped and some even look like bittergourd (Karela).
- Many varieties have red or pink flesh with distinct flavour.
- A few varieties are seedless but their yield is poor and are of little commercial importance for being irregular in shape, shy bearer and tasteless.
- Some of the promising varieties are described here

Varieties	Specific features
Pant Prabhat	
Harijha	Popular variety of Bihar
Allahabad Safeda	Most popular cultivar of Uttar Pradesh
Allahabad Surkha	Pink fleshed and large fruited variety
Chittidar	**Highest TSS** guava variety
Lucknow-46	Pear pyriform shaped
Lucknow-49	**Highest Vit.-C** variety National Variety
Nagpur Seedless	Seedless variety of guava
Safed Jam	
Kohir Safeda	
Arka Amulya	
Arka Mridula	

Varieties	Specific features
Arka Kiran	Pink fleshed soft seeded variety
CISH-G-1	Red colour and longer shelf life
Lalit	Red colour pulp
Shweta	Colour variety
Hisar Safeda	
Hisar Surkha	Pink fleshed hybrid
TRY (G)-1	Off season, drought, sodicity tolerence
Apple Colour	Tolerant to anthracnose and fruit canker
Hafshi	Red fleshed guava
Behat Coconut	
Pusa Srijan	Tolerant to wilt
Aneuploid-82	Recommended for dwarf rootstock from IARI

Other varieties:

Saharanpur Seedless

Seedless

Baruipur

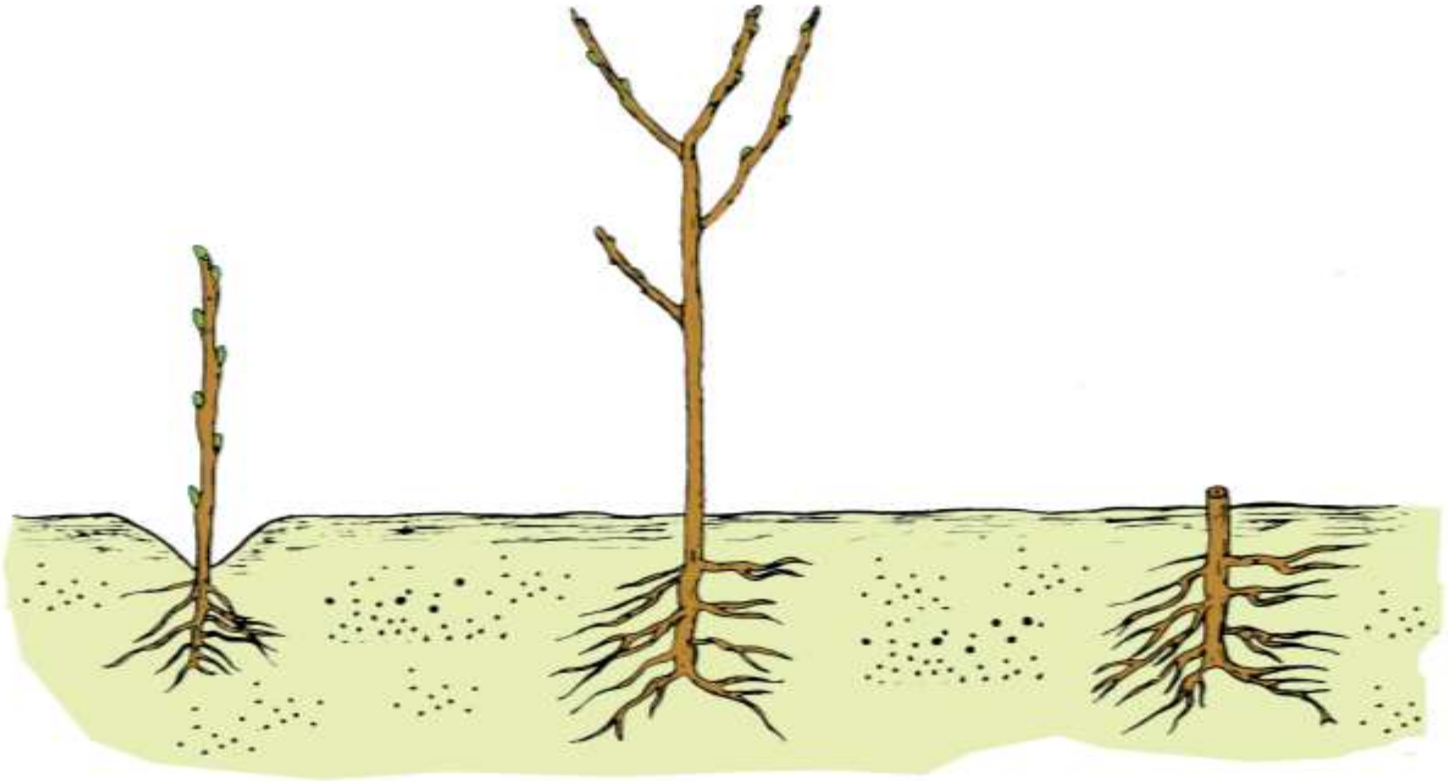
Banarsi

Propagation

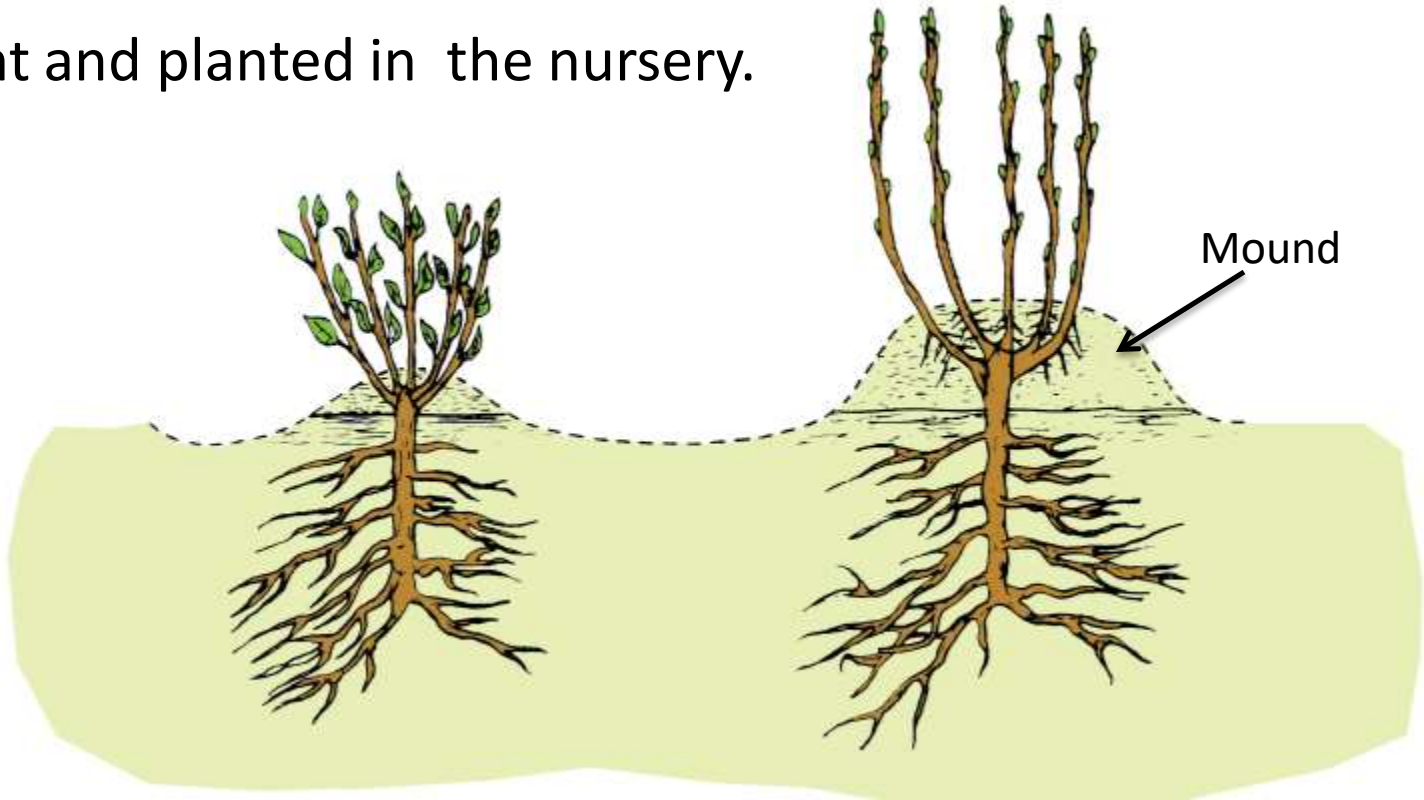
- Easiest and cheapest method of guava propagation is **stooling**.
- Commercial method of propagation is **inarching** grafting.
- **Air layering** also followed for guava propagation.
- Guava is also propagated by seed. HCl treatment improve the seed germination in guava.

STOOLING IN GUAVA

- ✓ Stoolng also known as **mound layering**.
- ✓ Firstly plant is pruned severely at 2.5 cm above ground level before the start of new growth.



- As a result many shoots emerge out from the base of the plant.
- When the shoots become little sturdy, it is girdled at the base, rooting hormone is applied if needed.
- It is covered with soil to a height of about 15-20 cm (Mound).
- After some time roots emerge out and shoots are seperated from mother plant and planted in the nursery.



INARCHING OR APPROACH GRAFTING

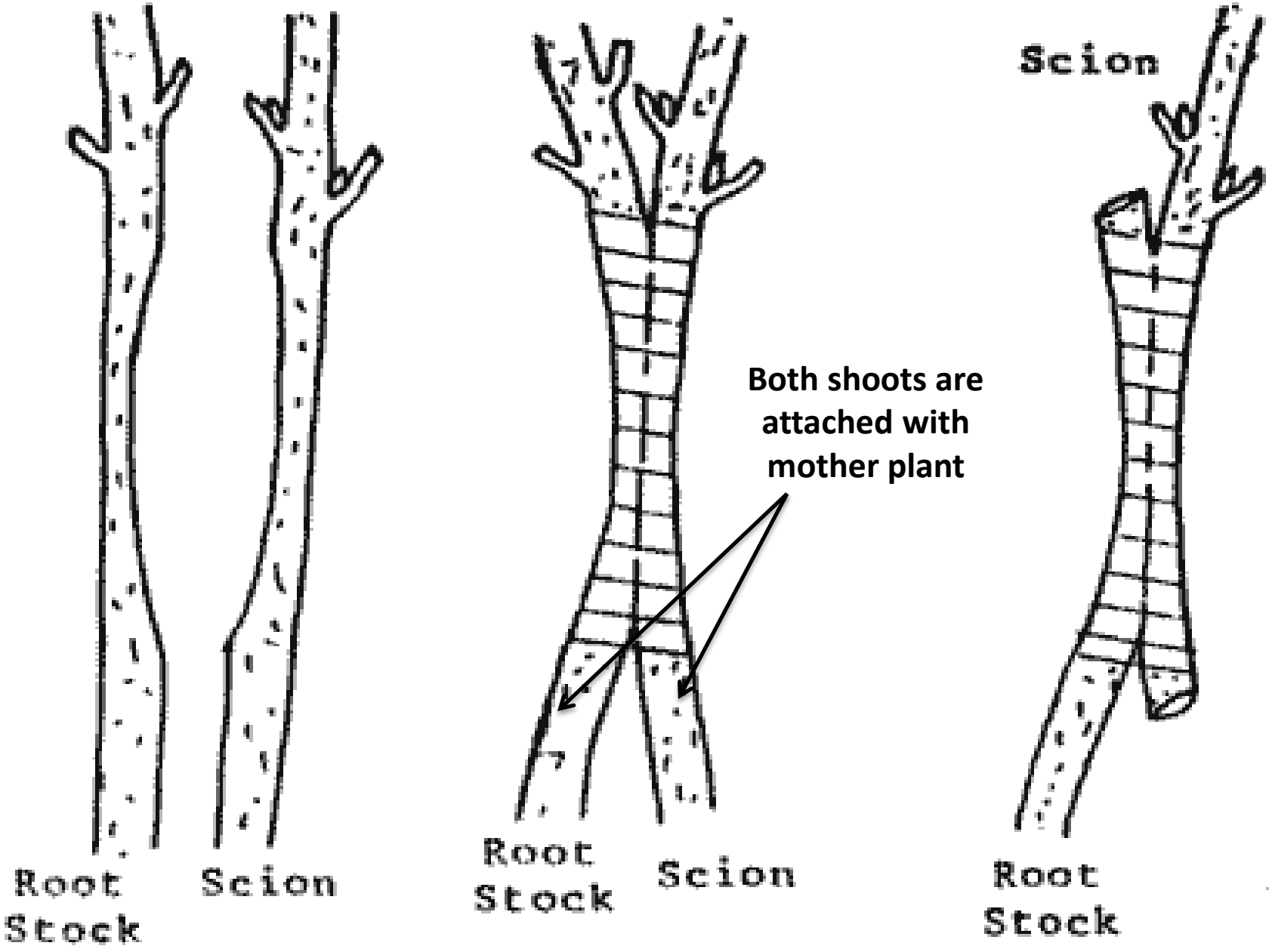
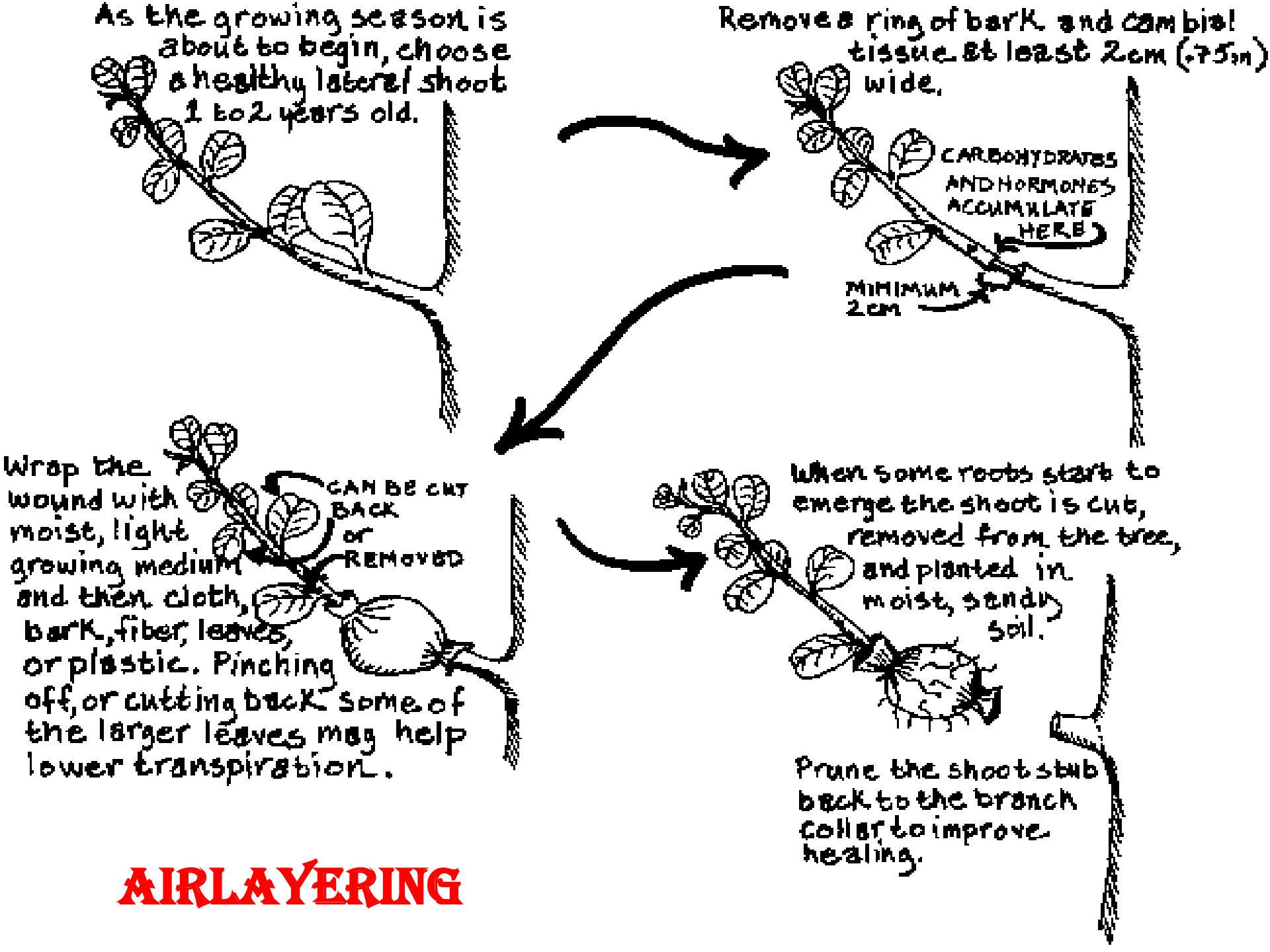
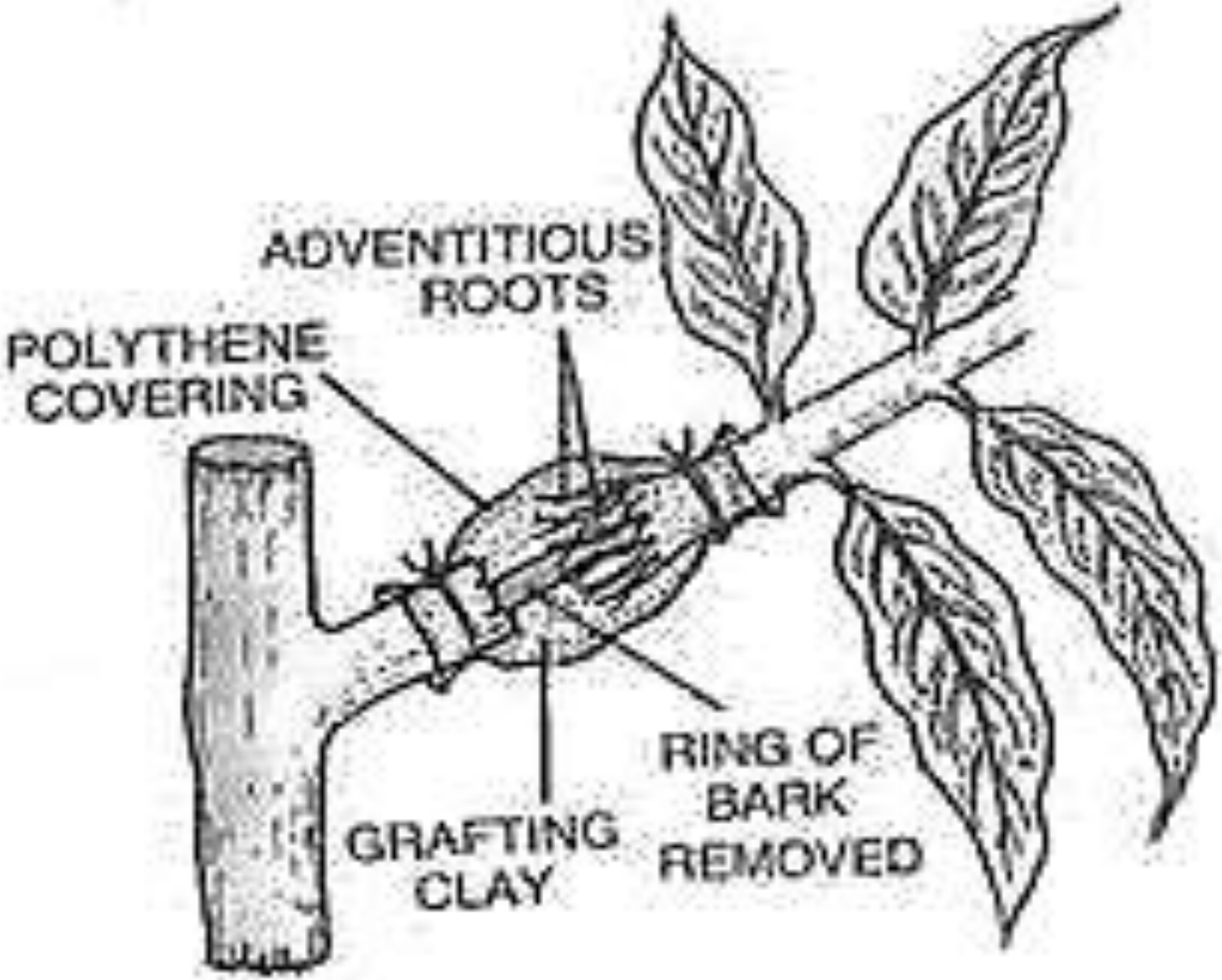


Fig. V Approach Graft

AIRLAYERING IN GUAVA


As the growing season is about to begin, choose a healthy lateral shoot 1 to 2 years old.
Remove a ring of bark and cambial tissue at least 2cm (.75in) wide.
CARBOHYDRATES AND HORMONES ACCUMULATE HERE
MINIMUM 2cm
Wrap the wound with moist, light growing medium and then cloth, bark, fiber, leaves, or plastic. Pinching off, or cutting back some of the larger leaves may help lower transpiration.
CAN BE CUT BACK or REMOVED
When some roots start to emerge the shoot is cut, removed from the tree, and planted in moist, sandy soil.
Prune the shoot stub back to the branch collar to improve healing.
AIRLAYERING


ADVENTITIOUS ROOTS
POLYTHENE COVERING
RING OF BARK REMOVED
GRAFTING CLAY

PREPARATION OF NURSERY BED

- The seed bed should be thoroughly prepared, well-manured, and of 2m x 1m size.
- The seeds are closely sown, about 8-10 cm apart at 2 cm depth in rows during February-March or July-August.
- The seed bed should be kept moist.
- The seeds germinate in about 15-20 days after sowing under favourable conditions.

- The seedlings are ready for transplanting in the nursery rows during August- September when they have attained a height of 10-15 cm.
- The distance between the seedlings is maintained at 25-30 cm apart.
- The seedlings to be inarched can be trans- planted to pots at 7 cm height.

Land preparation for planting and planting

- The land is well ploughed, harrowed and leveled.
- Pits of 90 cm x 90 cm size are dug during the hot weather and left open to the hot sun for a few months.
- Before the beginning of rains, the pits are filled with the original soil mixed with about 30 kg compost.
- The best time of planting guava trees in most parts of northern India is the monsoon season (June-September).
- It is necessary that the site selected for planting guava should be protected from the south-west direction by a high wind-break specially in northern India.

- In poor soil, distance of 4 to 6 m is maintained and in rich soil planting should be done at a distance of 6 to 8 m.
- Square system as well as rectangular system of planting are followed.
- However, rectangular system is more beneficial as the east-west spread has greater bearing on the yield.
- High density planting of trees with a distance of 3.6 x 3.6 m has been found successful in increasing the field per unit area but the quality and size of the fruits are affected or reduced in this system.

Meadow orcharding

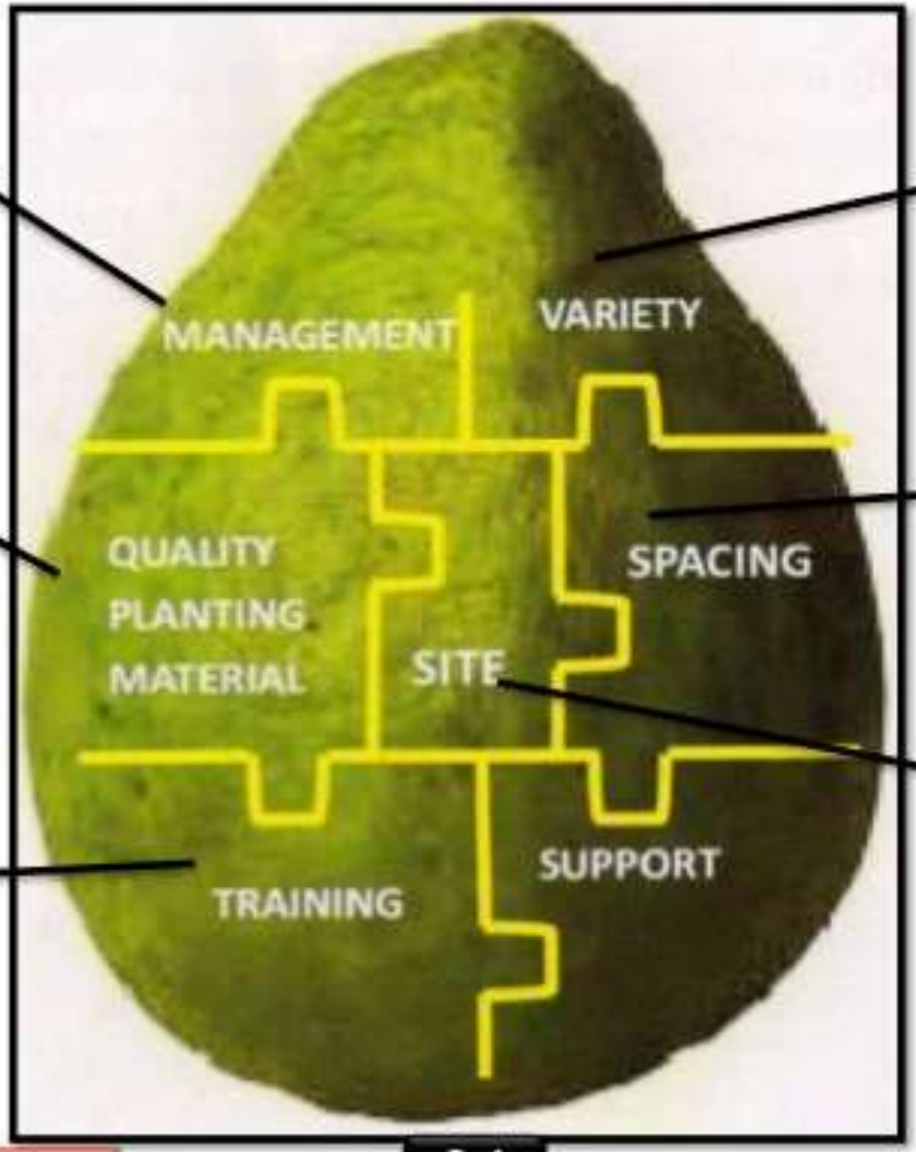
- ✓ Meadow orcharding also known as Ultra- high density planting
- ✓ 5000- 100000 plants/ ha in order to maintain tree form
- ✓ Sever top pruning is practiced similar to mowing of grassland
- ✓ Plants intended to produce yield after 2 years age
- ✓ Heavy use of growth regulators as well as pruning.

Component for meadow orchard system

- ✓ Water
- ✓ INM
- ✓ IPM

- ✓ True to type
- ✓ Healthy
- ✓ Free from disease & pest

- ✓ Plant trained for making dwarf canopy



- ✓ Dwarf
- ✓ Suitable to market

- ✓ Varieties
- ✓ Root stock
- ✓ Plant utilize maximum light

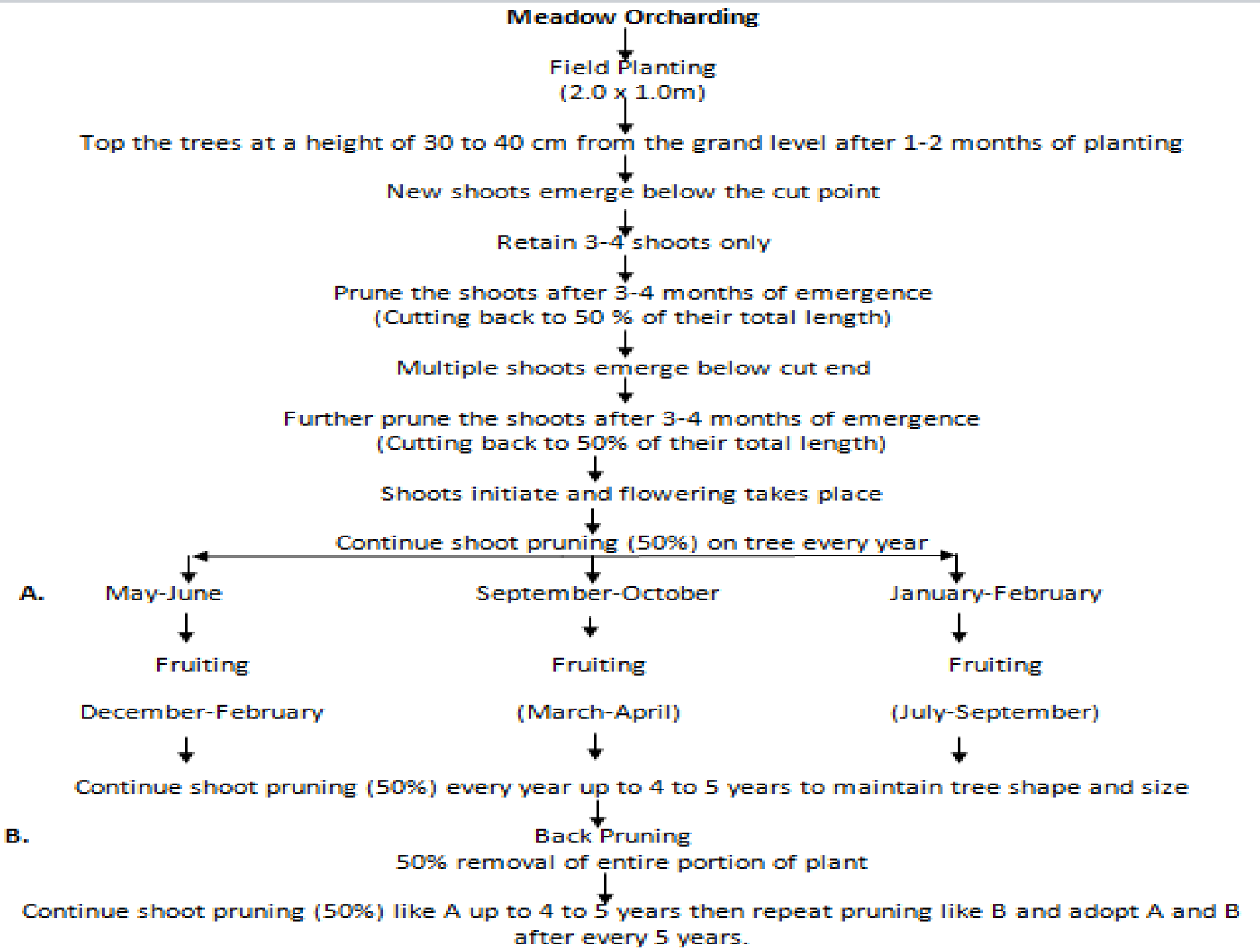
- ✓ Suitable to guava
- ✓ well fertile
- ✓ Near to source

Establishing Meadow Orchard

- Medow orchard system is a new concept of guava planting which has been developed for the first time in India at Central Institute for Subtropical Horticulture, Lucknow

Planting:-

- The planting is done at 2.0 m (row to row) X 1.0 m (plant to plant), which gives a density of 5000 plants ha^{-1}


Meadow Orcharding
Field Planting
(2.0 x 1.0m)
Top the trees at a height of 30 to 40 cm from the grand level after 1-2 months of planting
New shoots emerge below the cut point
Retain 3-4 shoots only
Prune the shoots after 3-4 months of emergence
(Cutting back to 50 % of their total length)
Multiple shoots emerge below cut end
Further prune the shoots after 3-4 months of emergence
(Cutting back to 50% of their total length)
Shoots initiate and flowering takes place
Continue shoot pruning (50%) on tree every year
A.
May-June
September-October
January-February
Fruiting
Fruiting
Fruiting
December-February
(March-April)
(July-September)
Continue shoot pruning (50%) every year up to 4 to 5 years to maintain tree shape and size
B.
Back Pruning
50% removal of entire portion of plant
Continue shoot pruning (50%) like A up to 4 to 5 years then repeat pruning like B and adopt A and B
after every 5 years.

Fertilizer Application

Sl.No	Age of tree (years)	Nitrogen (g)	Phosphorus (g)	Potash (g)	F.Y.M*. (kg)
1	1-2	75	65	40	10-15
2	3	150	130	40	20
3	4	225	195	120	30
4	5	300	260	160	40
5	6	375	325	200	50
6	7 & onwards	450	390	240	60

Pruning and Training

- Training is important in guava and has been found to increase the yield and quality of the fruits.
- The **open centre system** is good.
- All the shoots or suckers that arise from the base of the trunk should be removed.
- The branches that arise from the main trunk should be retained in the first year.
- In the beginning of the monsoon of the second year, the tree should be pruned for the main framework.

- The vertical twigs occurring from the main framework should be removed to allow more sunlight falling in the centre, while the horizontal growing twigs are retained and exposed to sun which forms the bearing branches.
- Guava requires light annual pruning after harvesting to promote new vegetative growth and flowering.
- The removal of dead wood, diseased and undesirable branches is needed to keep the plant in healthy condition.
- Pruning in April-May helps in increasing the, winter crop yields.

DISEASE CONTROL

Guava wilt

Guava wilt is a fungal disease and known to occur in U. P., Bihar, Rajasthan and Madhya Pradesh. It is a very serious and common disease of guava and occurs severely in alkaline soil.

Symptoms

There is yellowing of leaves followed by complete drying of leaves and twigs. Complete wilting of the trees occurs within 10 to 15 days of infection.



Control

- Uproot and burn the trees showing severe disease symptoms. .
- The infection can be minimized by drenching the soil with Brasicol and spraying the plant with Bavistin (0.1 %) at an interval of 15 days at the early stage of infection.

Anthracnose

- The disease is caused by *Goleosporium psidii*.
- It is a serious disease of the western districts and Terai regions of U.P.
- High humidity and frequent rains favour the spread and intensity of the disease attack.

Symptoms

✓The disease mostly affects the tender parts of the tree such as young leaves, shoots, flowers and fruits.

✓The growing tips turn dark brown and the dark necrotic areas extend back causing die-back.

Control

a. Pruning of diseased twigs and burning of fallen leaves and fruits are also helpful.
b. Dithane M-45 (0.2 %)
c. Well-maintained trees escape the attack of the disease.

Anthracnose

Disease symptoms on unripe and mature fruits

Fruit canker

•It is a serious bacterial disease of guava fruits caused by *Pestalotia psidii.*

Symptoms

•Appearance of raised dark brown cankerous spots on fruit surface. The infected fruits are misshapen and often crack.

Control

It can be effectively controlled by spraying Dithane Z-78 at monthly intervals during June to October.

Canker on the fruit

Styler end rot

✓It is also a serious disease and is common during rainy season. Causal organism is *Phomopsis psidii*.

Symptoms

➢The disease starts as circular, water-soaked lesions at the styler end.

➢This later on becomes reddish-brown in colour and the infected portion becomes soft with the advancement of rot, small white or light brown pycnidia (fungal spores) appear on the infected area.

Control

✓Spray Bavistin (0.1 %),

✓Topsin-M (0.1 %) or

✓Dithane, Z- 78 (0.2 %) at monthly intervals.

Stylar end rot (infected and healthy fruits)

Diplodia rot

- Recently a new disease of guava has come to light.
- It is caused by fungus of ***Diplodia*** spp.

Symptoms

✓The fruit becomes dried and shriveled up and attains a black colour.

✓From the affected fruits, it affects the twigs and branches characterized by discoloured patches and transfers to the roots.

✓The bark splits up and forms cracks in the branches ultimately leading to the death of the tree.

Control

a. Discoloured patches should be scrapped and Chaubattia paste or copper oxide in linseed oil should be applied.
b. Drenching of root zone with Bavistin has been found useful.

PEST CONTROL

Fruit fly (*Bactocers dorsalis*)

Fruit fly is a serious pest of the rainy season in U.P. and also western and southern India. It affects the fruits and feeds on the soft pulp.

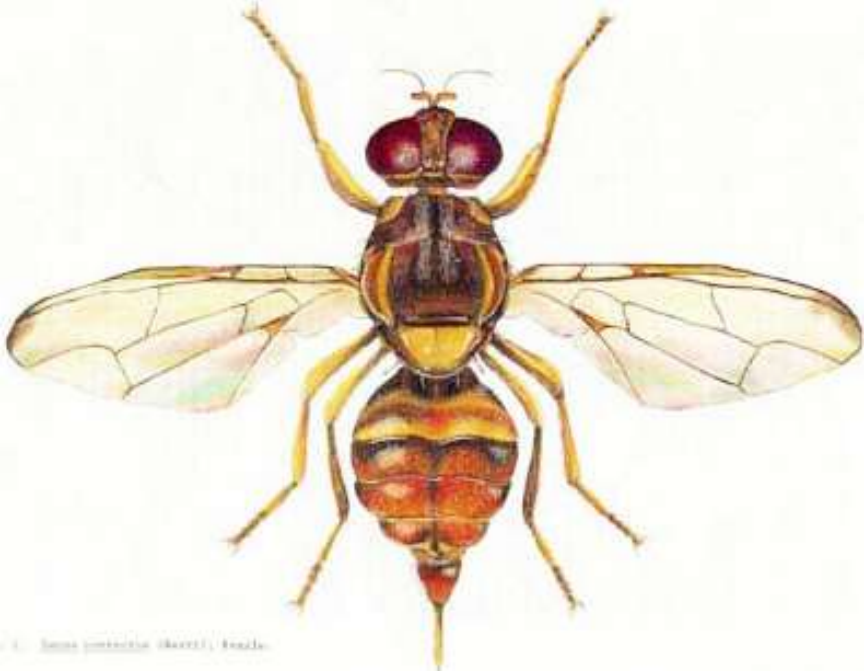
Symptoms

The infested fruits show depressions with dark green punctures and the fruits rot and fall down.

Control

a. Spray the trees during pre-oviposition period with Dimethoate 0.03 % or Malathion 0.05 %.

b. Burning of the infested fruits minimise the incidence.



Fruit fly adult

Fruit damaged by maggots

Egg laying

ATTACK OF FRUIT FLY

Scales (*Chloropulvinaria psidii*)

- These are the major pests of South India, Maharashtra, Punjab and U.P.
- Scales are **sucking insects** which suck the sap of the leaves, petioles, shoots and some- times fruits.
- The honey dew excreted by these insects encourages the development of sooty mould, thus reducing the photosynthetic activity and plant vigour.

Control

- Prune and destroy affected parts.
- Spray 2-3 times, at 10-12 days intervals, with 0.04 % Diazinon or Dimethoa- te or Phosphamidon or Monocrotophos (0.05 %) or Phenthoate (0.05 %).

Mealy bug (*Ferrisa virgata*)

•Mealy bugs attack the young leaves, twigs and flowers and suck the sap from them resulting in the drying of the affected parts.

•The yield is also considerably reduced.

Control

a. Band the base of the plant with polythene film to prevent the nymph from climbing up.

b. Treat the soil with Aldrin, Malathion or Thimet at the base of the tree.

c. Nicotine sulphate in water (1 : 600) can be sprayed for control.

d. Spray of 0.1 % Metacid is also effective.

Bark eating caterpillar (*Indarbela quadrinotata*)

- The caterpillar attacks the barks and feeds on them.
- The bark surface is seen covered with silken gallaries full of faecal matter which extends downwards from the bored hole.

Control

a. Remove the silken webs from the trunk.

b. Add Monocrotophos or DDVP (0.1 % emulsion) in the hole and plug them.

Bark eating caterpillar on Guava Plant

Flowering and fruiting

- ✓ There are three distinct flowering seasons with corresponding harvesting periods-rainy, winter and spring known as Bahar.
- ✓ It is desirable to take only one crop (bahar) in a year. In South India the rainy season crop is preferred even though it is of poor quality, since the price is high at this time.
- ✓ In North India, winter crop is of better quality and the fruits also escape the attack of white flies.
- ✓ In Western India, root pruning of guava to regulate the season of harvesting, as is done in the case of mandarins, is recommended in heavy soils only.
- ✓ In lighter soils, withholding of water serves the purpose. This practice is known as bahar treatment.

Bahar	**Month**		
	Water stress	**Flowering**	**Fruiting**
Ambe Bahar (February)	December-January	February-March	July- August
Hasta Bahar (October)	August-September	October-November	March- April
Mrig Bahar (June)	3rd week of April	June- July	November-December

Bahar Regulation

Methods followed for bahar regulation

1. Withholding irrigation
2. Root exposure
3. Flower thinning
4. Growth regulators
5. Shoot pruning

Withholding irrigation

- In some parts of India, irrigation is withheld from February to middle of May.
- This results in dropping of young fruits and leaves during (April-May) and the tree undergoes rest.
- At the end of May or early June, the soil of the orchard is ploughed, harrowed and manured with 45 kg FYM to individual tree.
- Immediately after application of the manure around the basin, the tree is irrigated.
- The first two irrigations should be given at an interval of three days and the subsequent waterings may be given at 10-15 days interval till the monsoon sets in.

Root exposure

- Various degree of root pruning has been found suitable for minimizing the rainy season crop.
- The practice of root exposure and pruning is done in regions with high atmospheric humidity and water table.
- The procedure involves exposing the upper roots of the tree of 1.5 ft radius around the trunk by removing the upper 8 cm of the soil.

- The main root system is not disturbed while the fibrous roots on them are removed by a pruning shear.
- This results in 'the shedding of leaves from the tree.
- At this stage, the exposed roots are again covered with soil mixed with manure and immediately irrigated.
- However, this technique has been found to have an adverse effect on the plant if repeated frequently.

Flower thinning

- This is also an effective method for the crop regulation.
- Thinning of flowers and small fruits by hand, twice during Apil-May at fifteen days interval has been found quite effective in this regard.
- However, the technique is costly and cumbersome.
- The total yield of the plant in a year is also reduced by this method.

Growth regulators

- Growth regulators such as NAD, NAA and 2,4-D have been found very effective in thinning of flowers and manipulating the cropping season in guava.
- Chemical treatment of NAD at 30 and 50 ppm, NAA at 100 and 125 ppm and 2,4-D at 15 and 30 ppm can be successfully used for thinning of summer flowers.
- Experiments conducted at Pantnagar have suggested that foliar spray of NAA @ 800 ppm twice in May at 15 days interval has been found effective in minimizing the rainy season crop.
- First spray should be done when about 50 % of flower buds are opened.
- This method can be applied on a large scale.

Shoot pruning

- The pruning of new shoot (current season) growths in 1st week of May has been found very effective for crop regulation.
- This method involves the removal of half to 3/4th portion of the shoot growth.
- This pruning automatically removes the flowers and flower buds of spring season flowering and consequently the rainy season crop can be reduced.
- This method has been found effective and economical without much adverse effect on total yield of the plant in a year.

Fruits management

- The formation of fruit is first noticed after 12 days from flowering.
- In guava, the initial fruit set is high but only few fruits reach maturity due to severe fruit drop.
- Spraying of GA3 @ 15 or 30 ppm in the month of January has been very effective in increasing fruit retention and ultimately the yield.
- Ninety per cent fruit retention can be had in trees treated with GA at 200 ppm.
- Parthenocarpic fruits in guava can be obtained by the application of GA3 at 1000 to 8000 ppm in lonolin paste.

Maturity

- From the time of flowering to maturity of its fruits, guava takes nearly five months.
- During the maturity, colour of the fruit changes from dark green to yellowish- green, which is the right stage of fruits to be harvested.
- The fruits are not allowed to ripen fully on the tree, as they become prone to severe fruit drop and damaged by birds, etc. and become unfit for consumption.

Harvesting and Yield

- Hand picking at regular intervals is suggested for guava.
- When the fruits start showing a colour change from dark green to greenish-yellow, they have attained maturity and is the correct stage for harvesting the fruits.
- The fruits should not be allowed to ripe or over- ripe on the tree itself.
- Seedling plants take 4-5 years to bear a crop while budded, grafted or layered plants bear within 2-3 years.
- The yield varies depending on the variety and prevail- ing agro-climatic conditions. About 1000 fruits per year per tree can be harvested from a 10-year old plant.

Storage and Marketing

- Guava should be marketed soon after their harvesting as they are highly perishable in nature.
- The harvested fruits lose their quality rapidly under storage and cannot stand transport and storage for a long period.
- Ripe but firm fruits can be stored well for about four weeks at a temperature ranging from 8.3 to 10°C with 80 to 90% relative humidity.
- Several growth regulators have also been tried to increase the storage life of guava fruits.
- Fruits treated with MH 1000 ppm (10 g in a litre of water) in addition to 6 % waxol treatment, extend the storage life of the fruits at room temperature.
- Dipping of fruits in solution of 1000 ppm Cycocell has been found suitable for storing guava at room temperature for 14 days.

- Guava fruits treated with 1 % calcium nitrate after harvest, have no weight loss, reduced respiration rate and less disease occurrence.
- These fruits maintain the edible and marketing quality of fruits for about 9 days at room temperature.
- For local consumption, ripe or mature fruits should be used which are freshly harvested from the tree.
- However, for distant markets and to avoid the damages during transportation, it is advisable to wrap fruits with perforated polythene bags.
- Wooden crates or bamboo baskets can be utilised in packaging.
- The fruits are arranged in circular rows alternated with thin layers of soft hay or straw in the baskets.

Industrial importance

- Several products like jam, jellies, cheese, canned slices are becoming popular in the export market.
- Availability of the fruits at a cheaper rate almost throughout the year except few summer months, facilitates the running of processing industry with a high margin of profit.
- Guava fruit is a profitable crop of the orchard as they are hardy, suitable to varied soil and climatic conditions and prolific bearer.
- Since it is rich in pectin, guava jelly is commercially prepared on large scale.
- Guava leaves are used for dyeing and tanning purposes

Medicinal value

- ✓ Guava is a rich source of vitamin C (260 mg per 100 g of the pulp) and minerals like calcium, phosphorous, etc.
- ✓ Guava seeds contain 80 % iron.
- ✓ Dehydrated guava juice powder is a source of Vitamin C
- ✓ The leaves are used for curing diarrhoea.
- ✓ Guava leaves and bark are powdered and used for dressing wounds and sores.
- ✓ Powdered leaves are applied to soothe rheumatic pains.
- ✓ A decoction of guava leaves could be gargled to relieve toothache and gum boils.
- ✓ The flowers of guava are said to be cooling and are used for treating bronchitis.

THANKYOU