KVK-HKD/Training Manual No. 02

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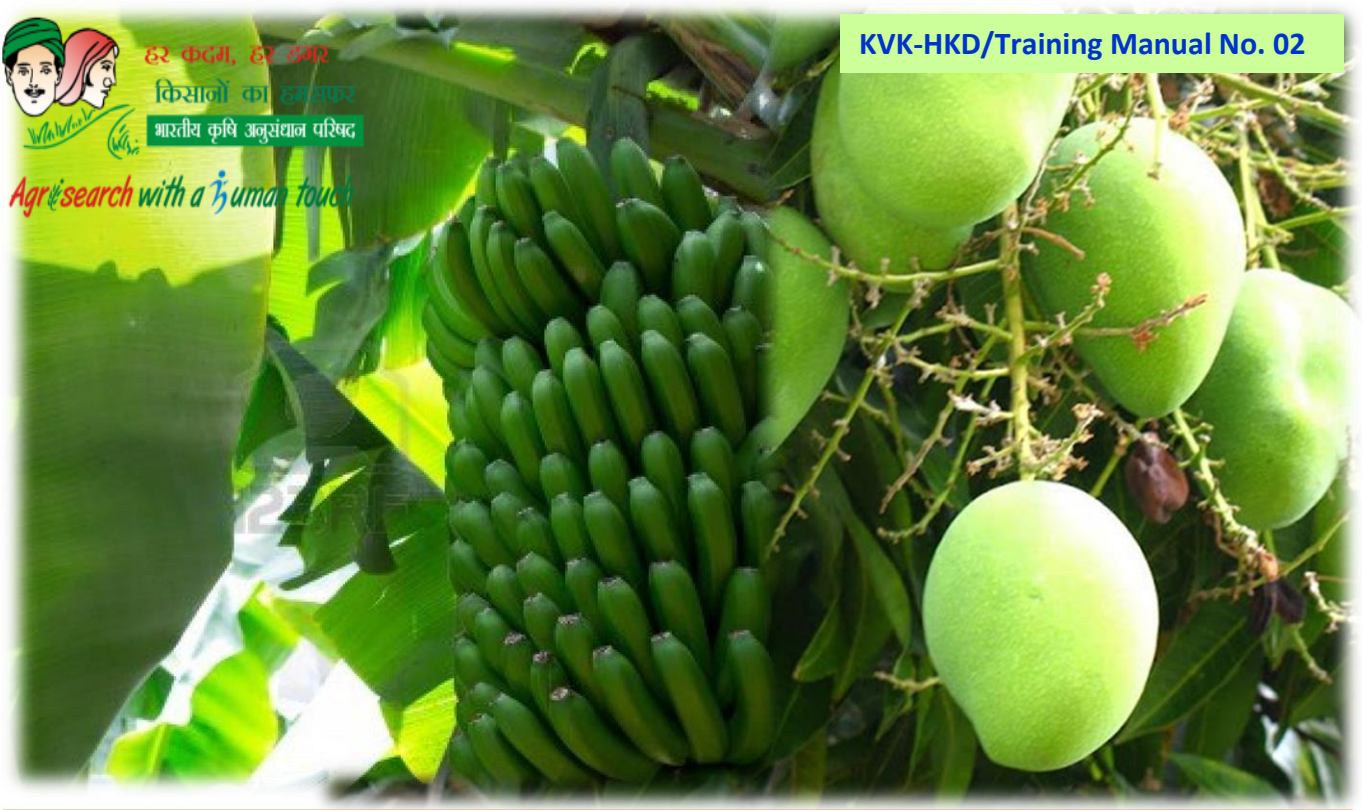
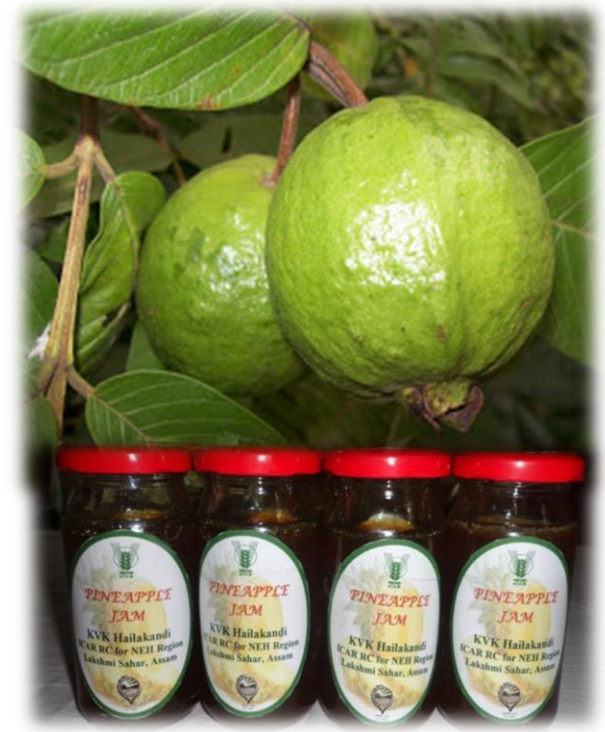


TRAINING MANUAL ON

Food security through horticultural crops and its value addition



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TRAINING MANUAL ON

Management of horticultural crops, nutrition garden and its value addition

Sk. Md. Azizur Rahman
Kabita Choudhury
Shamsher Singh
Thejangulie Angami

PREFACE

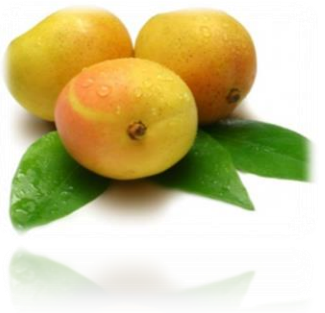
Horticulture is an integral part of our life today. Presently, horticulture has established its credibility in improving income through increased productivity, generating employment and in enhancing exports besides providing household nutritional security. India has now emerged as the second largest producer of fruits and vegetables in the world. North Eastern region having varied agro climatic condition is favourable for production of large number of horticultural crops in the form of fresh and processed products.

In India, due to improper and adequate postharvest handling facilities, there is a huge loss of horticultural crops due to its high perishability. This loss can be reduced to manifold times by proper post harvest technologies and its value addition.

In this training manual, authors have dealt with nursery raising of vegetable crops, nutrition garden, package and practices of some major fruit crops of Hailakandi district and its value addition.

The authors sincerely hope that this training manual will be very much fruitful for the farmers, rural youth, entrepreneurs and stakeholders. The support from all KVK staff and financial help from ICAR Research Complex for NEH Region, Umiam is duly acknowledged.

Authors



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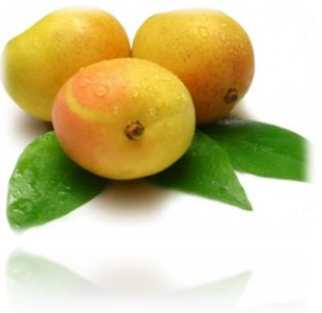


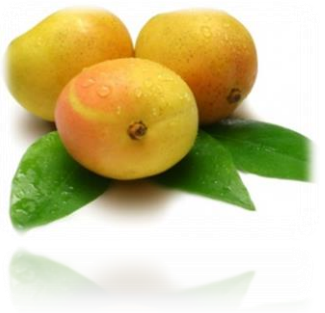
Chapter I

INTRODUCTION

The agro climatic condition of North – Eastern Region of India is considered suitable for growing a large number of tropical, subtropical and temperate fruits and vegetables. In Assam, fruits like banana, citrus, pineapple, papaya, jack fruits; vegetables like tomato, brinjal, cole crops, cucurbits and spices like ginger and turmeric are cultivated in commercial scale besides growing some minor fruits and vegetables indigenous to his region.

Despite having all the favourable factors, the desired level of development in horticulture has not been achieved because of a number of constraints. However the productivity of many fruits and vegetables is far below the national averages. Moreover, due to absence of proper storage and marketing facilities, farmers are forced to sell their produces at throwaway prices. The increased production of fruits and vegetables and other agricultural produce will be realized only when they will reach to the consumer in good condition and at a reasonable price. Importance of value addition lies in the fact that it has capability to meet food requirement of growing population by eliminating avoidable losses making more nutritive food items by proper processing and fortification.

Keeping the mentioned facts in view, KVK Hailakandi has set up several demonstration units on vegetable cultivation practices, nutrition garden and small scale processing units under TSP in the different tribal villages to increase the production and productivity of horticultural crops, reduce the post harvest loss as well as to provide nutritional security to the farmers.



Chapter II

Nursery Management and Quality Vegetables Seedlings Production

Vegetable nursery is a place where plants are cared for during the early stages of growth, providing optimum conditions for germination and subsequent growth until they are strong enough to be planted out in their permanent place. Seedlings of transplanted vegetable crops need to be first raised in well prepared nursery beds, followed by transplanting in the main field. Raising of seedlings in the nursery beds is economical as well as easier to take care of young, tender seedlings against pest and diseases. The cost of hybrid vegetables seed is very high. So, it is necessary to ensure the germination of maximum possible seeds in nursery. It is required the controlled conditions for nursery to protect against frost, heavy rain, severe cold, hot son, strong wind etc. Healthy seedlings grown in a well managed nursery will decide the yield and consequently the profit.

Site Selection and Soils for Seedbed

- Seedbed area should be well drained, free from water logging and sunny situation.
- The nursery should be made nearby water bodies to provide irrigation easy and in time.
- Loose, friable, fertile and healthy sandy loam to loam soils with plenty of organic matter are ideal for nursery beds.
- The soil p^H should be close to the neutral i.e. about 7.0.
- The area should be well protected from pet and wild animals.

Nursery Bed Preparation

- ✓ Nursery beds 1.00 m – 1.20 m wide to facilitates intercultural operations and and length as per the need/convenient but preferably 5 m.
- ✓ The beds are raised usually 15 cm high from the ground level.
- ✓ Between two beds should be left space about 30 cm to helps in weeding, nursery care against diseases and insect pest and also for draining out the excess rain water from the nursery beds.
- ✓ The nursery beds are dug 3 - 4 times with the spade and incorporated well rotten farm yard manure or compost @ 4 – 6 kg or Vermicompost 500g per square meter a few days before final preparation. If the soil is heavy mix 2-3 kg sand per square meter so that the seed emergence may not be hampered.
- ✓ During the ploughing, clots, stones and weeds from the field should be removed and land should be levelled.
- ✓ Nursery beds should be prepared in the east and west direction and line should be made along the width of the beds for seed sowing.
- ✓ Seed beds should be drenched with Formalin (40 – 50 ml/litre water) @ 4-5 litre of water per square meter soil surface to saturate it up to a depth of 15-20 cm about 15 – 20 days before sowing and cover the drench beds with polythene sheet for 15 days and put wit soil at the side and or before seed sowing, beds should be treated with 0.3% solution of captan or thiram (5 litres/m^2) to reduce the soil born fungal diseases.
- ✓ Seven dust @ 2g/kg of seeds mixed to control insects.
- ✓ Burning of leaves or straw on the beds is quite helpful in controlling certain soil borne diseases and pest.

Seeds Sowing

- ✓ After the seed bed preparation seeds are sown in the nursery bed either by broadcasting or in lines, but line sowing should be prefer.
- ✓ The seeds are sown in furrows 5 – 7cm apart along the width of bed and 0.5 – 1.0 cm between seeds at a depth of around 1.0 - 2.0 cm with the help of bamboo stick.

- ✓ Cover the seeds with treated fine mixture of sand, soil and well rotten and sieved FYM or leaf compost etc. (1:1:1). The beds require light irrigation manually with the help of sprinkler or rose can daily morning and evening till germination.
- ✓ The beds should be covered by a layer of paddy straw, dried grasses or banana leaves for 3 – 5 days to induce early and better seed germination, suppresses the weeds, protects from direct sunlight and raindrops and birds etc.
- ✓ The cover should be removed as soon as seedlings start emerging.

Seed Rate and Sowing Time

Seed Rate of Important Vegetables

Crop	Seed rate (g)		Sowing time
	OP varieties	Hybrids	
Tomato	400-500	250-300	September - October
Brinjal	400-500	200 - 250	July - August
Chilli	600-700	350-400	January-February & July - August
Capsicum	650	300-350	September - October
Cauliflower: Early Mid & late	600 400-500	250 - 300	Early season- June-July Mid season – August-September Late season- October-November
Cabbage: Early Mid & late	500 400	250 - 300	Early season- June-July Mid season – August-September Late season- October-November
Broccoli	500	250 - 300	September - October
Knol-khol	500	250 - 300	August-November

After Care

- ➢ To protected tender seedlings from strong sun or rains the beds should be covered with a thatch prepared with straw, leaves, plastic or green

shade net and placed about 1 m high from the soil surface by the use of suitable support.

- Irrigation in the beds depends upon the weather condition. If temperature is high, open irrigation is applied. Need not to irrigate the beds during rainy days.
- Irrigate the beds with 0.5 % urea or 1.0 % Calcium Ammonium Nitrate solution at early stage of seedlings to accelerates the seedling growth.
- Weeding in nursery beds is an important to get healthy seedling. It can be done either manually or spray pre emergence herbicide i.e. Stomp @ 3 ml/litre on the nursery beds after the seed sowing
- Thinning is a very important operation to remove weak, unhealthy, diseased, insect pests damaged and dense plants from the nursery beds keeping distance of about 0.5 to 1.0 cm from plant to plant to facilitates balance light and air to each and every plant.

Plant Protection Measures

Damping-off

- Damping off is a very serious disease in the nursery. Pre-emergence death of seeds is seen. In first instance girdling takes place on the stem near base of the stem and seedlings bent down near the ground and die.
- Damping off affected seedlings should be removed from the beds and buried in the soil otherwise spread will be more.
- Do not raise the seedling same site every year.
- Treat the nursery beds as discussed above. Drenching nursery beds @ 4 l/m^2 with Carbendazim (1.5 g/l), Captaf (2 g/l) or mixture with a Mancozeb (0.25%) and Carbendazim (0.5 %) is recommended on the appearance of Damping-off.

Leaf miner

- It is very small sized insect enter in the leaves from margin side and move from one place to other by eating the chlorophyll. Initially the infected part of the leaves become brown and later on dry.

- Spray neem seed kernel extract (4%), neem formulation (2 - 3%) and chemicals Monocrotophos or Metasystox 1.5 ml/litre of water is necessary to prevent leaf minor.

Leaf eating caterpillar

- Leaf eating caterpillar larvae gregariously feed and skeletonise the leaves.
- Spray neem seed kernel extract (4%), neem formulation (2 - 3%) and Cypermethrin 1.0 ml/ litre of water is useful to prevent leaf eating caterpillar

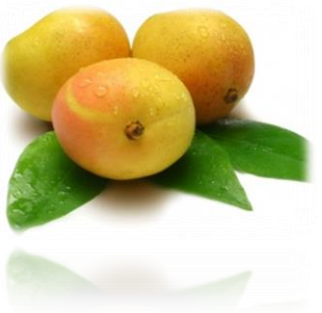
Hardening

- Hardening of seedlings before transplanting is essential to withstand transplanting shock and better setting in adverse environmental conditions in the main field.
- Hardening can be done remove of all the shedding nets, polythene sheets etc, exposure to the full sunlight and withholding of irrigations slowly and slowly 5 -7 days before uprooting seedlings.

Transplanting

- The seedlings are ideal for transplanting when they attain 10 – 15 cm height, 4 – 6 true leaves and 25 – 30 days old.
- Seedlings can be transplanted bare-root or with a soil ball containing roots.
- Use of seedlings with soil around the roots need be pressed.
- Transplanting should be done in the evening and watered at once.

Too old or too young seedlings both are unsuitable for transplanting in the main filed. Early establishment of seedlings in the field results in healthier growth and higher production. The first step in successful vegetable production is to raise healthy vigorous seedlings.



Chapter III

UTILIZATION OF HOUSEHOLD AREA AS NUTRITION GARDEN

It is one of the easiest ways of ensuring access to a healthy diet that contains adequate macro- and micronutrients by producing many different kinds of foods in the home garden by utilizing household areas.

Importance of Nutrition Garden

- direct access to a diversity of nutritionally-rich foods.
- increased purchasing power from savings on food bills and income from sales of garden products.
- fall-back food provision during seasonal lean periods.
- avoid eating pesticide-tainted vegetables often sold in the market.

Types of Nutrition Garden

i) **Large size garden**
Size: at least 500 sq m

ii) **Medium size garden**
Size: 150 to 200 sq m

iii) **Small size garden**
Size: less than 100 sq m

Garden Layout

Important points to be considered for laying out and planning of nutrition garden:

- Select an area which receives plenty of sunlight
- Rectangular gardens are better than square gardens, but any shape will do.
- Avoid the shade of big trees.
- Locate near a water source if possible.
- Vegetables which lose their quality and freshness rapidly after harvest, such as spinach, amaranth, fenugreek, mint, and radish, should be given priority in the garden.

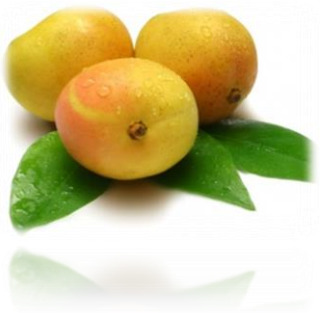
- Plant root crops along the ridges which separate plant beds.
- Climbing vegetables make good use of space. Grow them near the fences or walls
- Dig one or two compost pits in a shady, unused corner of the plot.

Nutrition Garden Management

- Sow or transplant seedlings in rows or lines with proper spacing.
- Remove some seedlings if plants are crowded where seeds are sown in the direct field.
- If seedlings die in the main field, replace them with new healthy seedling.
- Irrigate after transplanting.
- Remove weeds between the rows and between plants.
- Vegetables need regular watering for good growth and yield.
- Farm yard manure and compost are great fertilizers for vegetable gardens.
- Mix them in the soil about a week before sowing or transplanting.
- Apply a nitrogenous fertilizer, such as urea, in small quantities in standing crops for higher plant growth and yield. Apply urea only when the soil is moist; otherwise, give a light irrigation after application.

Crop Calendar

SEASON	CROP
Winter (Oct - Feb)	➢ Potato, Cauliflower, Cabbage, Knol-khol, Broccoli, French bean, Carrots, Tomato, Sprouts, Radish, Turnip, Beetroot, Onion, Garlic, Broad bean, Peas, Coriander , Spinach, Fenugreek and Mustard
Summer (Mar - June)	➢ Okra, Cowpea, Cluster bean, Eggplant, Chilli, Pumpkin, Bottle gourd, Bitter gourd, Ridge gourd, Ginger, Turmeric, Cucumber, Amaranthus and Colocasia
Rainy (July - Oct)	➢ Okra, Cowpea, Clusterbean, Chilli, Eggplant, Cucurbit vegetables (except melons) and Sweet potato



Chapter IV

Banana - Package of practices

Banana (*Musa paradisiaca*) is a perennial, monocotyledonous, herbaceous succulent plant belonging to the family Musaceae is an important fruit crop and is referred as 'Kalpatharu'- a plant of virtues owing to its multifaceted uses from underground stem up to male flower. It is also used as dessert fruit due to its rich and easily digestible carbohydrates with a calorific value of 67-137/100g fruit. Being a good source of vitamin C and minerals it makes healthy and salt free diet.

Soil and climate

Well drained, organic rich alluvial soils of pH 4.5-7.5 are ideal. Clay soil with good adequate drainage is good for this crop. Banana is basically a crop of tropical lowland. Mean temperature of 20-30^{o}C is optimum for its growth. Its growth declines with increase or decrease in mean temperature.

Varieties

Dwarf Cavendish, Giant Cavendish, Cheni Champa, Poovan, Nendran, Robusta, Malbhog, Red Banana, Rasthali.

Propagation

Sword suckers with a well developed rhizome weighing 500-700g are preferred. Water suckers are generally avoided**.** Micro propagation of banana is preferred owing to its faster multiplication, uniform disease free planting materials.

Planting

The pits of 60cmx60cmx60cm size are dug filled with a mixture of soil, sand and FYM in a 1:1:1 ratio. Suckers are planted in the centre of the pit and soil around it is compacted. The planting distance varies from 2mx2m

in case of dwarf varieties to 3mx3m in case of tall varieties. The best planting season of banana is during rainy season.

Manures and fertilizers

Manures and fertilizer requirement of banana is high due to its shallow root system. An application of 8-10kg FYM/plant is given during planting time. Fertilizer mixture comprising 180g N + 100g P_2O_5 + 250g K_2O plant/year is required. The full dose of Phosphorus and half dose of Potassium is applied at the time of planting while Nitrogen is given in 3 split doses at 2, 4 and 6 months after planting.

Irrigation

Banana plant requires heavy irrigation. Irrigation is given once in 7-10 days. Stagnation of water in the soils is not congenial for proper growth and hence drainage of soil is very essential

Aftercare

The removal of suckers, dry leaves and pseudostem from which the fruits have been harvested, constitute the main aftercare. Daughter suckers should be removed promptly until mother plant flowers. However, one daughter sucker is allowed when the mother plant flowers. The removal of dry leaves and useless pseudostem should be done in time. After all the fruits are formed, the pendant portion of the remaining inflorescence along with the heart should also be removed. The propping of plants with bamboo poles after flowering is necessary wherever damage by wind is apprehended. Bagging of bunches with perforated polythene bags is practised to protect the fruits against cold, sunburn, dust, insects and birds as well as to develop attractive colour.

Diseases and pests

Panama Wilt: Yellowing of leaves of top sides and later on hanging of leaves around pseudostem.

Dipping of planting materials in Carbendazim (1g/L) before planting followed by drenching at bimonthly intervals from 5 months after planting is useful.

Bunchy Top Virus: this disease is transmitted through aphid. The affected plants are characterized by marked stunting and bunching of leaves. The crown leaves are undersized.

The infected plant should be removed and burned. Spraying of Dimethoate (1.5ml/L)at fortnightly interval reduces the aphid significantly.

Pseudostem Borer: Cause drying of whole plants through making holes on the stem

Application of 3g of Carbofuran granules per plant should be applied for its control.

Rhizome weevil: Make tunnels in the corm and develops blackened masses of rotten tissues and causes withering and yellowing of leaves.

Clean cultivation, treatment of suckers with 0.2% Monocrotophos and soil application of Phorate (20g/plant) at the time of planting.

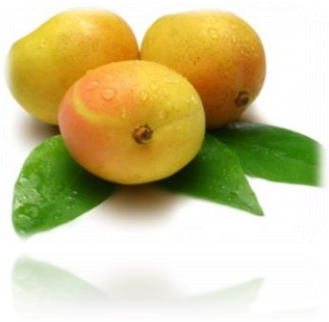
Scarring Beetle: Feeds on the skin of young fruits and make them unmarketable.

Bagging of fruit bunches and clean cultivation

Harvesting and yield

Generally tall varieties takes 14-18 months and dwarf varieties 12-15 months for fruit development, maturity and harvest. When the fruits have reached full size, ridges of the fruit become round from angular with a distinct change in colour from dark green to light green. The bunch is cut retaining about 15cm of the stem above the first hand.

The yield varies considerably from 10-30kg bunch/plant depending upon the cultivars, planting densities and cultural practices. Usually tall varieties yield 15-25 t/ha and dwarf varieties produce fruit around40-50 t/ha.



Chapter V

Pineapple - Package of practices

Pineapple (*Ananas comosus*) - 'Queen of tropical fruits' belongs to the family Bromeliaceae is one of the commercially grown fruit crops of North Eastern Hill Region. Pineapple are xerophytic, monocotyledonous, monoecious, monocarpic, herbaceous perennial CAM plants. Its pleasant flavour and exquisite taste qualifies pineapple as one of the choicest fruits. The fruits are eaten fresh as well as canned and processed in different forms. A good source of vitamin A and B, fairly rich in vitamin C, Ca, Mg, K, Fe. It is also a source of bromelin, a digestive enzyme.

Soil and climate

Sandy loam soils are ideal. The soil should be 45-60cm in depth without hard pan or stones. Pineapple prefers a soil pH of 5.0-6.0. Pineapple is a crop of humid tropics. The optimum temperature for successful cultivation is 22^{o}C – 32^{o}C. Their growth ceases below 20^{o}C and above 36^{o}C

Varieties

Kew: It is a late maturing variety grown for canning purpose. The plants are vigorous and leaves are long with straight margins. Fruit weight ranges from 1.5kg – 2.5kg and is oblong in shape. Eyes are broad and shallow making fruits more suitable for canning.

Queen: It is early maturing variety. The plants are dwarf, compact growth habit. Leaves are short, stiff and spiny along the margins. Fruit weight ranges from 0.9kg – 1.3kg. Eyes are small, prominent and deep set. This variety is suitable for table purpose.

Propagation

Pineapple is commercially propagated by vegetative means. Suckers of 55-60cm size weighing 500-750g and slips of 45-50cm size weighing

350-450g are usually preferred for planting since they flower comparatively earlier than crown.

Planting

Time of planting differs from region to region. In North Eastern Hill Region, the best time for planting is September. Planting of pineapple across the slope prove better for getting higher yield because of least soil loss. Planting is done at a spacing of 30cmx60cmx90cm in double row method of planting, which accommodates 43,500 plants/ha i.e. suckers should be planted at a distance of 30cm from plant to plant within the line and 60cm in between two lines and 90cm between two double rows.

Manures and fertilizers

A dose of 10-15 tonnes FYM/ha is applied before planting 15-20 days before planting. Application of 12g N, 4g P_2O_5 and 12g K_2O per plant per yearis useful to increase fruit size and yield. Half dose of N and K and whole amount of P_2O_5 should be applied three months after planting and remaining dose of N and K should be topdressed one year after planting.

Flower induction

To get uniform flowering in pineapple application of 25ppm Ethrel (6.25ml/100 litres of water) + 2% Urea + 0.05% $NaCO_3$ at 40-45 leaf stage is done. About 50ml of the solution is poured into the heart of the plant. Efficacy of flower inducing compound is reduced during rainy season. Therefore, these chemicals are not applied during rains. Plant start flowering in 45-50 days after chemical application.

Intercropping

For suppressing weed population and restoring soil fertility in pineapple, intercropping with leguminous crop like rice bean, cowpea and moong are most suitable in the first year of planting.

Mulching

Moisture stress and weed growth are the major problems in pineapple cultivation. Mulching with polythene followed by thatch grass gives better yield and quality and suppresses the weed growth.

Irrigation

Pineapple is grown mostly as rainfed crop. During scarcity of rainfall irrigating pineapple once in 10-15 days interval is advisable wherever facilities exist to ensure good crop.

Diseases and pests

Heart rot/stem rot/root rot: The green leaves turn yellowish green and tips turn brown. The central whorl of leaves when affected will come out with a gentle pool. Basal portion of the leaves shows sign of rotting and emits foul odour.

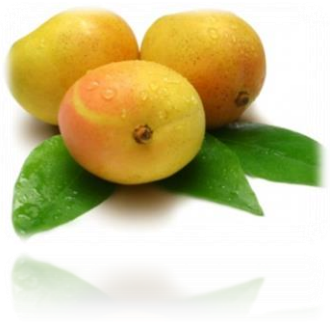
The disease is controlled by good drainage, proper selection of healthy planting material and prophylactic treatment of planting material with Dithane Z-78 (3g/litre of water).

Mealy Bug: The Nymphs and adults suck juices from leaves and tender shoots.

Application of Monocrotophos (Nuvacron) 2.5g/litre of water at vegetative stage and Endosulfan 2.5ml/litre of water at the fruiting stage is recommended to manage the pests.

Harvesting and yield

Pineapple attains flowering at 10-12 months after planting and attains harvesting 15-18 months after planting depending upon the variety, time of planting, type of planting material used. For local markets, harvesting is done at full mature stage when fruit turn orange yellow colour. For canning purpose, fruits are harvested with a slight colour change at the base of the developing fruit. The yield varies with the plant population e.g. with 43500 to 50000 population 35-60 t/ha and 53000 to 73000 population 60-105 t/ha depending upon the cultivars.



Chapter VI

Jackfruit - Package of practices

Jackfruit (*Artocarpus heterophyllus*) popularly known as 'Poor Man's Food' in eastern and southern parts of India belongs to the family Moraceae, is mainly grown in homestead for domestic uses and as a shade tree . The fruit are rich in vitamin A, C, minerals and carbohydrates. Tender fruits are used as vegetables, made into pickle and slices. Ripe fruits are used for preparation of dried products, canned products, pulp, beverage, jelly and nectar. The latex from the bark contains resin.

Soil and climate

It grows well in a rich, deep, alluvial and well drained soil. Drainage is the most important criterion for selecting the soil as the tree is sensitive to water stagnation. It as a tropical crop and thrives well in hot humid climate up to an elevation of 1500m. It can tolerate low temperature to some extent but sensitive to chilling cold and frost.

Varieties

Owing to heterozygosity (cross pollination) in nature, the natural crossing has given rise to the development of numerous types and forms varying in their fruit characteristics. Some types are available with their common names viz Gulabi, Hazari, Champaka, Rudrakshi, Singapore or Ceylon.

Propagation

Jackfruit is commonly propagated through seeds. Seeds should be sown immediately after extraction since they lose their viability during storage. Soaking seeds in 25ppm NAA for 24hr improves their

germination and seedling growth. Air-layering, grafting, budding are means of its vegetative propagation.

Planting

Land should be thoroughly prepared by repeated ploughing to a good tilth. It should be levelled properly with a gentle slope in one direction to facilitate drainage of excess water during heavy downpour. Seedlings are planted in Square system with a spacing of 10mx10m. Pits having a dimension of 1mx1mx1m are dug2 weeks before planting and exposed to the sun to destroy the soil borne pathogen. Pits should be filled with top soils mixed with 25 – 30kg well rotten FYM and 50fg of BHC to prevent termite attack. The vegetatively raised seedling is planted at the centre of each pit. After planting the soils around the seedling should be pressed firmly to avoid water logging. The ideal time of planting is mid June to end of August.

Manure and fertilizers

While planting 30kg FYM is to be applied in pits. Depending upon the age of plant, the FYM is to be applied 50 to 75kg/plant/year. NPK doses per plant per year up to 1-3 years are 200g N, 120g P_2O_5 and 60kg K_2O. Between 4-7 years is 400g N, 240g, P_2O_5 and 120g K_2O. Above 7 years is 600g N, 300g P_2O_5 and 240g K_2O.

After care

In frost prone regions, adequate measures should be taken to protect the young seedlings from frost damage. The orchard floor and tree basins should be kept free from weeds by repeated shallow soil operation for obtaining better growth of the plants. The young plants should be protected from stray goats and cattle. Protective irrigations are necessary initially at 12-15 days intervals depending on soil and climatic conditions. The plants should be trained by removing lower branches.

Intercropping

It is advisable to utilize the interspaces by growing some intercrops during the gestation period of jackfruit which gives extra income to the growers. Vegetables like radish, brinjal, chilli, cabbage etc. can be grown with assured irrigation facilities. Leguminous crops like pea, gram can also be grown which will add nitrogen to the soil.

Diseases and pests

Rhizopus rot: The pathogen usually infects the male inflorescence and small fruits. The rot starts near the stalk end which gets covered with mycelium.

Spray Dithane M-45 at 0.2% and Bavistin at 0.05% three times at 14 days interval starting in early March gives the best control.

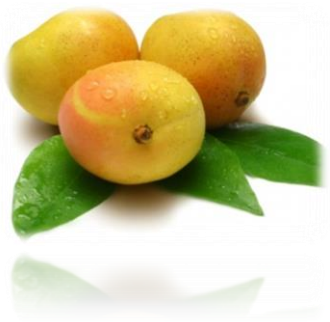
Shoot and trunk borer: The caterpillars bore into the shoots, buds and fruits and cause severe damage.

The infected parts should be cut and destroyed. Spraying of carbaryl @ 4g/litre in flowering season is recommended.

Harvesting and yield

Several indices are commonly used to determine the optimum time to pick jackfruit: *(a)* a dull hollow sound is produced when the fruit is tapped by finger; *(b)* the last leaf of the peduncle turns yellow*;(C)* fruit spines becomes well developed and wide spaced; *(d)* the spines yield to moderate pressure; *(e)* an aromatic odour develops. For distant market fruit should be harvested when still firm and without any aroma.

A full grown tree of 15-16 years old produces 250 fruits annually and the weight of each fruit varies from less than 1kg to 15-20kg. On an average about 40-50 tonnes of fruit/ha could be obtained.



Chapter VII

Value Addition of fruits

I) PREPARATION OF JACK FRUIT PICKLE

These are edible products preserved and flavored in a solution of brine and vinegar known to be good appetizers that aids digestion and palate. Spices and oil are also added to increase its shelf life.

Ingredients Required:

Jack fruit - 500 g, garlic - 15 g, onion - 65 g, jeera - 5 g, clove - 2 g, elaichi - 2 g, kali jeera - 5 g, chilli powder - 15 g, methi - 12 g, dhania powder - 25 g, ajowain - 5 g, black pepper - 5 g, mustard seed powder - 25 g, salt - 50 g, cinnamon - 2 g, heeng - 2.5 g, refine oil - 150 g, mustard oil - 150 g, vinegar - 5 g, citric acid - 5 g and lemon juice - 200 ml.

Flow Chart for the process

Peeling
↓
Slicing into big pieces
↓
Blanching at 90-95 ^{0}C, for 20 min
↓
Cooling
↓
Slicing into small, equal sized pieces
↓
Mixing with 4 % NaCl and 2 %Turmeric ← Grinding spices into fine powder ↓ Frying the spices in mustard oil
↓
Mixing properly
↓
Adding vinegar, salt and mustard oil
↓
Filling hot into bottles

↓

Cooling, Sealing, labeling and Storage

II) PREPARATION OF PINEAPPLE READY-TO-SERVE BEVERAGE (RTS)

The pineapple RTS beverage is prepared from the extracted pineapple juice, adjusting its total soluble solids (TSS) and acidity of 10% juice to 10°B and 0.5% acidity respectively.

Ingredients Required: Pineapple Juice - 1.0 kg, sugar - 600-700g, water - 4.0 liter, citric acid -10-15 g, pineapple colour -1.5 g and pineapple essence -15-20 ml

Flow Chart for the process

Slices from under-sized pineapple fruits, broken slices, cores, peel meat and trimmings

↓

Crushing/ pulping

↓

Juice Extraction with the help of muslin cloth

↓

Mixing of syrup with juice ← Syrup ↑ Sugar + Water + Citric Acid

↓

Addition of permitted essence & colour

↓

Mixing

↓

Bottling and Sealing

↓

Processing in boiling water (15-20 minutes at 85°C)

↓

Storing

III) PREPARATION OF PINEAPPLE JAM

The pineapple jam is a solid gel made from the fruit pulp or juice, sugar and pectin. The fruit content should be 45%. The total sugar content should be 68%.

Ingredients Required: Pineapple Pulp - 1.0 kg, sugar - 1.0-1.4 kg, citric acid - 10-15 g, pectin powder - 3.0-4.0g/kg, pineapple colour - 1.5 g and pineapple colour - 5-10 ml

Flow Chart for the process

Pineapples (Fresh and firm fruits)
↓
Crushing/ pulping
↓
Juice Extraction with the help of muslin cloth
↓
Addition of sugar & citric acid
(1.0-1.4 kg sugar/kg product & 5-10 g citric acid)
↓
Heating for 15-25 min.
↓
Addition of Pectin powder
(3.5-5.0 g/kg product)
↓
Test for end point
↓
Addition of colour and essence
(optional)
↓
Filling in sterilized glass jars while hot
↓
Cooling for 4-5 hours
↓
Sealing and storing

IV) PREPARATION OF GUAVA JELLY

The pineapple jam is a solid gel made from the fruit pulp or juice, sugar and pectin. The fruit content should be 45%. The total sugar content should be 68%.

Ingredients Required: Guava - 1.0 kg, sugar - 600-700g, water - 4.0 L and citric acid - 8 g

Flow Chart for the process

Matured & sound guava

↓

Cut into small slices

↓

Add equal quantity of water

↓

Boil under low flame for 30 min

↓

Strain the pectin extract

↓

Add sugar and acid

↓

Boil the extract up to 65º Brix

↓

Fill hot in to sterilized bottles

↓

Cool & store

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