Production Technology for Pineapple Variety 'Kew'

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Introduction

Pineapple (*Ananus comosus*, Bromeliaceae) is a herbaceous perennial, 90 to 100 cm in height with spreading leaves which gives the plant a rosette appearance. The plant bears a single fruit terminally on a peduncle protruding out from the centre of the rosette. Smooth Cayenne or Cayenne ('Maipuri', 'Kew', 'Sarawak', 'Esmeralda', 'Claire', 'Typhoon', 'Saint Michel') group is extensively cultivated in Hawaii, Philippines, Australia, South Africa, Puerto Rico, Kenya, Mexico, Cuba and Formosa. 'Kew' variety cultivated in India belongs to this group. The plant is spineless. The ovoid medium-sized fruit (1.5 to 2.5 kg) of 'Kew' is held on a short and strong peduncle. It ripens progressively, turning yellow from the base to the top, which is reflected in a strong internal maturity gradient too. The flesh is firm, close-textured, juicy and with a pale-yellow to yellow colour at maturity. And average acid range lies between 0.5 and 1.0% and total soluble solids (TSS) between 12° and 16° Brix. The plant is a poor producer of shoots and slips. The production cycle is longer than most other cultivars. 'Kew' is sensitive to many known pests (fruit borers, mites, symphillids, nematodes) and diseases (mealybug wilt, fusariosis, fruitlet core rot, butt rot) and to internal browning. However, it is considered tolerant to *Phytophthora* sp. and resistant to fruit collapse, caused by *Erwinia chrysanthemi* Burkbolder. It is recommended for commercial cultivation in Kerala for canning and table purpose. It was traditionally grown in the districts of Ernakulam, Kottayam, Pathanamthitta and the low elevation areas of Idukki district in Kerala. However, it is increasingly replaced by 'Mauritius' due to shorter duration, better fruit quality, keeping quality and transportability. In Kerala, pineapple is cultivated in an area of 12500 ha with a production of 102400 t and a low productivity of 8.2 t/ha, consistently stable over the last few years.

Cultivation

Soil

Pineapple is grown on various types of soils including very poor soils. The flavour and quality of fruit grown on light soils is considered to be superior. However the sandy and loamy soils rich in humus and the laterite soils on the hill slopes in South India are suitable for its cultivation. The plant is particularly sensitive to soil being waterlogged. Therefore, care should be taken to ensure proper drainage. It prefers soils with a pH range of 5.0-6.0.

Climate

Pineapple grows in warm and humid climate. The optimum temperature is from 15° to 32°C for normal growth. High temperature over 35°C is unfavourable for the development of fruits,

especially if the relative humidity is low. Exposure of the fruits to strong sunshine leads to sun scalding. It can be grown up to an elevation of 1,100 m above the sea level, if these places are free from frost, have a relatively high atmospheric humidity and an annual rainfall of 760-1,000 mm.

Season

Main season of planting is April-May and August-September, but it can be planted in all months except during heavy rains of June-July. The best time for planting is August. For getting maximum price and better keeping quality, the best planting time is April-May. During summer months, if there are no summer showers after planting, irrigation should be given three weeks after planting for proper establishment.

Cropping system

Kew can be grown as a pure crop in garden land, reclaimed lowlands and wetlands and as an intercrop in coconut and newly planted rubber plantations. In rubber plantation, it can be grown for the first 4 years only.

The majority (63%) of the small scale cultivators (less than 5 ha) grow the pineapple as monocrop while the majority of the medium (74%) (5 to 10ha) and large (77%) (more than 10ha) scale cultivators grow the pineapple as an inter crop on new or young rubber plantations. High productivity of pineapple cultivation in converted paddy fields is the most influential factor that led to the conversion of paddy fields into pineapple fields. Non- profitability of paddy cultivation and high cost of paddy workers are the other reasons reported in this regard.

Propagation

Pineapple is very easy to propagate vegetatively. Suckers arising in the lower axils of the leaves on the main stem form roots and can be used for propagation. Even the crown of leaves above the fruit and parts of the stem itself can be used. Another method of propagation is by slips, which are the propagules arising from the base the fruit. Suckers and slips should be preferred over the crown for planting as they come to bearing earlier and produce larger fruits.

Land preparation

The soil is brought to a fine tilth by 2-3 ploughing and harrowing. In hilly and dry regions, planting is done in trenches dug 90cm wide, 15-30cm deep and 90cm apart. In coastal regions trenches 90cm wide, 45cm deep and 90cm apart are dug. The trenches are to be aligned at a distance of 165 cm from centre to centre. The trenches are then filled with a mixture of soil and FYM.

Selection and treatment of suckers

Suckers are selected from disease and pest free healthy plants. Suckers are to be graded into those having less than 500g, 500-750 g and more than750g in weight to avoid competition between plants of different sizes. Suckers weighing 400-1000g or slips of 350-750g are considered ideal for planting. Keep suckers in open space under shade in a single layer for about 7 days for drying. Strip off a few lower old dried leaves. Allow the suckers to dry and cure for another 7 days. Dip the cured suckers in a solution of Monocrotophos (0.15%) or 0.05% quinalphos and Carbendazim (0.1%) to protect against mealy bugs and heart rot, respectively. Alternatively, a solution of Hilban (2.5ml/l) and Indofil (2.5g/l) can be used for dipping of

suckers. The graded and treated suckers are planted in different blocks or plots, to get uniformity in growth and flowering. Bigger suckers give early yield.

Planting

After preliminary land preparations, rake the soil and plant the suckers in double rows at spacing of 70 cm between rows and 30 cm between plants. Limit the depth of planting to 7.5 to 10 cm. Adopt triangular method of planting in each trench so that the plants in two adjacent rows are not opposite to each other. Plant population is 40400/ha.

High-density planting

High-density planting (up to 53,300 plants/ha) in paired rows is recommended for pure cropping in Kerala which, besides increasing the yield, is associated with other advantages like less weed infestation, protection to fruits from sunburn, increased production of suckers and slips per unit area and non-lodging of plants. Close planting also saves on the cost of providing shade to fruits, as it provides natural shade through upright orientation of the apical leaves and eventually results in uniformly coloured lustrous fruits.

Planting Methods

The planting method varies depending upon the topography of land, rainfall and drainage. There are five planting methods in practice, viz. raised bed or ridge (in paddy lands, poorly drained soils or high rainfall areas), flatbed (in soils with assured drainage), furrow (in areas with good drainage or poor rainfall), trench (in rainfed areas with water scarcity) and contour planting (in hilly areas or sloppy lands).

Pure cropping: Suckers are planted at 90 cm width in rows / strips, leaving the interspaces undisturbed. However, ploughing can be adopted in level land. Planting is done in paired rows of 70 cm distance between rows and 30 cm within the row. Suckers may be planted in triangular method in the paired rows. Interspace between the paired rows is kept at 150-170 cm. Contour planting may be adopted in sloppy areas.

Intercropping in coconut garden: Land preparation, spacing and planting are the same as described above. There can be three-paired rows in between two rows of coconut.

Intercropping in rubber plantations: System of planting is in paired rows at 70 x 30 cm. There will be only one paired row of pineapple in between two rows of rubber.

Wetlands / lowlands: Pineapple is highly sensitive to water stagnation and high moisture regimes. Hence it is important to provide good drainage, if grown in wetlands. In paddy lands, pineapple is planted in paired rows at 70 x 30 cm spacing on ridges taken at 60-90 cm height, depending on the water table and drainage requirement. The ridges are separated by drainage channels having 60 cm width. The width of the ridges varies from 120-150 cm. Wherever water stagnation and poor drainage are expected, a wider and deeper channel is given in between ridges.

Manuring

Kew pineapple plants require heavy manuring. Application of 20 to 30 t/ha of cow dung / FYM / compost at the time of planting is essential for good yield. It can absorb nitrogen in the from of

ammonia. Ammonium Sulphate, therefore, is the best fertilizer for it. It is recommended to give fertilizers at the rate of 8:4:8 g $N:P_2O_5:K_2O$ per plant per year (or 320:160:320 kg/ha/year). Nitrogen and potash should be applied in 6 split doses at bimonthly intervals, except during heavy rains. The first dose of fertiliser is given 2 months after planting. Entire phosphorus can be given at the time of planting. Application of fertilizer in rainfed areas has to be done when moisture is available. Sometimes zinc deficiency appears in pineapple which leads to a condition called Crookneck. Spraying of 0.5% zinc sulphate can prevent it.

Irrigation

Pineapple needs light and frequent irrigation due to its shallow root system. Irrigation is given only during dry months from January till the onset of monsoon. During summer months, the pineapple variety Kew may be irrigated wherever possible at 0.6 IW/ CPE ratio (50 mm depth of water) for good fruit size and high yield. It requires five or six irrigations during dry months at an interval of about 20 days. Mulching the crop with dry leaves at 6 t/ha will help to conserve moisture. If there is no irrigation facility, the crop should be scheduled for harvest before summer months (before March).

Weed control

Hariyali and nutgrass are the common weeds in pineapple plantations. Weeding is important from the economic point of view. Hand weeding especially in closely spaced crop is cumbersome and uneconomic. Therefore chemical control of weed is advisable. Application of Diuron at 3 kg/ha or Bromacil 2.5 kg/ha or a combination of Diuron (1.5 kg/ha) + Bromacil (2.0 kg /ha) in 600 litres of water as pre-emergence spray completely controls all types of weeds in pineapple plantation. It should be repeated with half of the dose, 5 months after the first application. Irrigation followed by the herbicide spray helps in carrying herbicides to the root zone of the weeds.

Pre-emergence (within a few weeks after planting) spray of diuron @ 1-1.5 kg/ha in 600 litres of water can also keep the field free of most weeds for about four months. For subsequent weed control, herbicide application is repeated. For controlling *Mikania micrantha* (vayara valli or American valli), spot-application of diuron can be adopted. Spraying should be done in moist soil, but avoiding rainy periods. Weeds in interspaces can be controlled by spraying glyphosate 0.8 kg/ha or a mixture of 2,4-D 0.5 kg/ha and paraquat 0.4 kg/ha. While spraying in interspaces, care should be taken that the herbicide shall not fall on pineapple plant.

Flower induction

Since pineapples flower erratically, induction of flowering is a common practice. This is done chemically by use of growth regulators which induces flowering and subsequent fruiting. Following growth regulators are recommended for different months to induce flowering.

Month	**Growth regulators & Concentration**
September-January	N AA 10 ppm (PIanofix 1 ml/4.5 litres of water)
March-May	Ethrel 10 ppm (2.5 ml/100 litres of water) + 2% urea + 0.04% sodium carbonate
All months	Ethrel 25 ppm (6.5 ml/100 litres of water) + 2% urea + 0.04% sodium carbonate.

The mixture is to be poured into the heart of the plant at 50ml per plant. If it rains within 24-36 hours after the application of the chemical the treatment should be repeated.

Pineapple cultivation in Kerala became commercially viable after the introduction of the flower inducing chemical Ethephon in this area by the beginning of the 1980s. The pineapple crop is very responsive to the induction of flowering by plant growth regulators. This had made it possible for farmers to schedule the flowering of the plant and harvest to synchronise with the season of high demand and price. In Kerala, for inducing uniform flowering, ethephon/ethrel is used. Apply 25 ppm ethephon (2-chloro ethyl phosphonic acid) in aqueous solution containing 2% urea and 0.04% calcium carbonate as follows: The mixture (50 ml/plant) is to be applied by pouring into the heart of 16-17 month old physiologically mature plants at 39-42 leaf stage. However, this duration can vary from 11-17 months depending on the size of sucker used for planting and the size of fruit required. Ethephon is applied during clear weather (when there is no rain within 36 hours of application). If it rains within 36 hours ethephon application is repeated. For treating 1000 plants, 50 litres of the solution would be required. (The ingredients for preparing 50 litres of the aqueous solution are ethephon 1.25 ml, urea 1 kg and calcium carbonate 20 g, made up to 50 litres with water. The dosage has to be fixed depending on the availability of commercial formulation and the active ingredient contents). Flowering will commence from 40th day after application and complete on the 70th day. Harvest over different months could be obtained by carefully phasing the planting and growth regulator application.

Earthing Up

Due to its shallow root system and weak stem pineapple plants are prone to lodging. Lodging of plants during fruit development results in lopsided growth and uneven development of fruits. Hence, earthing up is an important operation in pineapple cultivation, as it helps in promoting good anchorage. It involves pushing soil to the base of the plant from the periphery or into the trench from the ridge, where trench planting is common.

Mulching

Mulching is one of the cultural practices aimed at weed control and soil-moisture conservation. It is essential when pineapple is grown as a rainfed crop and is feasible where flatbed planting is followed. In South India, mulch of leaves or straw is spread on soil between the plants. Use of black polythene film as mulch is equally beneficial.

Removal of Suckers, Slips and Crowns

Suckers start growing with the emergence of inflorescence while slips grow with developing fruits. Only one or two suckers are retained on the plant for ratooning while additional suckers and all slips are removed. This is essential as the growth of these may weaken plant and hinder fruit development. Desuckering can be delayed as much as possible since fruit weight was found to increase with increasing number of suckers per plant. Increased number of slips delayed fruit maturity; therefore they are removed as soon as they attain the size required for planting. Where early harvest is required slips are removed as and when they sprout. Removal of crown is not recommended as it mars appeal of fruit, increases chances of disease infection and also makes handling difficult. However, partial pinching of crown by removing the inner whorls of leaflets along with the growing tips one and a half month after fruit set leads to increased fruit size.

Pests

Mealy Bug (*Pseudococcus brevipes / Pseudococcus bromeliae*)
The rapid spread of this malady in the pineapple field is largely due to the feeding habit of bugs. Symptoms first appear on roots which cease to grow, eventually leading to collapse of tissues. The most predominant symptom is wilting of leaves, commencing from leaf tips. Reddish-yellow colour develops in the wilting areas. Finally the plants rot and develop decaying suckers. Fruits developed are undersized. Ants of several species act as carriers of mealy bugs.

Control : Application of Phorate granules @ 1.75 kg/ai/ha at 100 days after planting controlls mealy bugs. This insecticide should not be applied at the time of flowering and fruiting because of its systemic nature. Indirect control of mealy bugs can be achieved by treating soil with either Chlordane (27.5 kg/ha) or Heptachlor (22.5 kg/ha) to check carrier ants.

Alternatively, Spray quinalphos 0.025-0.05% or fenitrothion 0.05% or fenthion 0.05% or chlorpyriphos 0.05% or dimethoate 0.05% or monocrotophos 0.05%. Care should be taken that the spray shall reach the base and also the sides of the plant. Destroy grasses and other monocot weeds, which serve as alternate hosts for the pest. For the control of mealy bugs, control of ants is necessary. Hence apply carbaryl to control ants in its colonies in the farm.

Scale insects (*Diaspus bromeliae*)
Scale-like bodies appear on the plant, especially on leaves. Other symptoms are similar to that of mealy bugs. The spraying of chemicals for the control of mealy bugs, mentioned above, will be sufficient for the control of scale insects.

Nematodes (*Meliodogyne* sp.)

During low population of nematodes there are no visible symptoms however, at a later stage plant growth is restricted and finally leaves become chlorotic.

Control : Healthy planting materials should be used for new plantings. The common method followed to control nematodes is soil fumigation with Ethylene Dibromide (EDB) at 100 kg/ha or EDB 15 at 250 to 350 litres/ha, 2-3 weeks before planting depending upon the severity of infection. Plants soaked in 1,500 ppm Nemacur solution and treated with 0.2 g/plant every 2 months were found free from nematodes.

Diseases

Black-rot or Soft-rot
A delay of some days between harvest and utilization of the ripe fruits leads to the development of black-rot or soft-rot. The fungus makes its entry through wounds caused during picking and packing. Infection starts at the stalk-end of the fruit, resulting in small, circular, water-soaked spots that are very soft. Gradually, fruit rots and emits foul smell.

Control : Dipping of fruits for 5 minutes in Thiabendazole (100 ppm) or

Benomyl (3000 ppm) minimise rotting. Avoiding injury to the fruit during harvest and transit reduces disease occurrence.

Heart-rot (*Phytophthora parasitica*)

Root rot / heart rot / fruit rot caused by *Phytophthora* sp. is common in poor drainage conditions. The disease causes complete rotting of the central portion of the stem. The top leaves turn brown and basal portion of leaves shows sign of rotting with foul odour. Finally the whole plant rots. Poor physical condition of the soil and inadequate drainage are responsible for spread of the disease.

Control : Providing drainage is most essential. The water table should be at least 60 cm below the soil surface. Badly affected plants should be destroyed and the remaining plants should be drenched with 0.2% zineb / mancozeb / ziram in the soil.

Leaf and Fruit-rot (*Cyratostomella paradoxa*)

Base or butt rot of planting material occurs when they are not dried and packed with little aeration. Fungus also destroys older plants by entering through wounds caused in the collar region while weeding or other operations. In severe conditions the entire plant may turn dark and rot within two or three days

Control : The disease can be controlled by dipping planting materials in 0.3% Dithane Z-78 or by spraying on leaves. Copper fungicide should not be used in pineapple as they cause leaf scorching. The diseased plants must be destroyed and suckers for propagation should never be collected from the infested area.

Leaf Spot (*Phytophthora* sp.)

It occurs frequently in moist, warm, climate. Initial symptoms are in the form of water soaked lesions on the leaves. The spots later on enlarge in size and gradually dries up.

Control : Affected plantations should be sprayed with Chlorthalonil / Zineb/ Mancozeb / Ziram 2g/l of water. Good soil drainage and use of healthy planting material helps in minimising the spread of the disease.

Thielaviopsis rot (*Thielaviopsis paradoxa*)

The symptoms start at the stem and advance through most of the flesh with the only external symptom being slight skin darkening due to water soaking of the skin over rotted portions of the flesh. As the flesh softens, the skin above readily breaks under slight pressure

Control : Careful handling of the fruit minimises mechanical injuries. Prompt cooling and maintenance of optimum temperature and relative humidity throughout postharvest handling operations reduces the incidence. Dipping of fruits for 5 minutes in Thiabendazole (100 ppm) or Benomyl (3000 ppm) minimises rotting.

Disorders

Multiple Crowns
Ordinarily fruit bears a single crown but in some cases fruit bears more than one. Consequently the top of the fruit will be flat and broad and fruit will be unfit for canning. Such fruits taste insipid and are corky. It is supposed to be a heritable character (found mostly in Cayenne group to which the variety Kew belongs).

Fruit and Crown Fasciation
Fasciated fruits are deformed to such an extent that they are totally useless. In certain cases, proliferation is so extreme that fruit is highly flattened and twisted with innumerable crowns. Fruit and crown fasciation is associated with high vigour of plants, which take longer time to flower. High fertility of soil, warm weather and calcium or zinc deficiency may favour fasciation.

Collar of Slips
The collar of slips is typified by the presence of a large number of slips arising from stem close to the base of the fruit, or even directly from the fruits itself. The excessive slip growth is at the expense of the fruit, resulting in small, tapered fruits, often with knobs at the base. High nitrogen fertilization and high rainfall along with relatively low temperature are supposed to be congenial for such an abnormality.

Dry Fruit and Bottle Neck
The dry fruit and bottle neck fruit types are very similar and may be derived from the same parent. In dry fruit type, fruit is small, flowers are absent and fruitlets do not develop. In bottle neck, lower fruitlets develop normally and upper ones do not develop and give the same appearance as dry fruits. Suckers are freely produced from both the types.

Sun-Scald/ Sun burn
This results when plant leans or falls over to one side, thus exposing one side of the fruit to direct sunlight. The cells of the exposed surface get damaged. Later shell surface assumes a brownish to black colour and cracks may appear between fruitlets. Affected fruits soon rot and become infested with pests. They must be cut as soon as noticed and safely disposed of where they will not contaminate other fruits. In high-density planting, intensity of sun-scald is very much minimised. Under favourable climate where leaf growth is luxuriant, leaves can be tied around the fruits to protect them from sun-scald. The other method is to cover sun-exposed portion of the fruit with dry straw or grass or with any other locally available materials. During summer months it is necessary to protect the fruits from scorching sun by putting dried grasses, coconut or arecanut leaves to prevent sunburn.

Harvesting
Pineapple is a perennial fruit crop and the returns continue, usually, for a period of 4 years in case of variety 'Kew'. Under natural conditions, pineapple comes to harvest during May-August. With the application of Ethephon and fertilizers the first yield is obtained within 20-22 months. Ethephon is applied at 16-17 months. Flowering occurs in 40-70 days after ethephon application. Kew pineapple will be ready for harvest by about 150-160 days after ethephon application, depending on the time of planting, the type and size of plant material used and the

prevailing temperature during fruit development. Observing the colour change is the most common method of determining the maturity of fruits. For long distance transportation, fully mature fruits in green itself just before colour change are harvested. With a slight colour change at the base of developing fruit, it could be harvested for canning purpose. But for table purpose, the fruit could be retained till it develops satisfactory uniform yellow colour. Harvesting is done with a sharp knife, severing the fruit-stalk with a clean cut retaining 5-7m of stalk with the fruit in such a way that the fruit is not damaged. Fruits are stacked in piles or on to the vehicles with the crown facing down. Fruits for fresh fruit market are often marketed with crowns.

Yield

The yield of pineapple fruit varies with the variety, agroclimate, agrotechniques and planting density. The fruit yield with a plant density of 20000-25000 plants/ha is about 25-35 t, 35000-40000 plants/ha about 40-50 t and that of 43,300-50000 plants/ha is 50-60 t/year, with the yield decreasing progressively from first year to fourth year which is the normal economic life span of Kew pineapple.

Ratoon Crop

The plant crop after harvest can be retained as ratoon crop for two more years. After the harvest of the plant crop, chopping the side leaves of the mother plant should be done for easy cultural operations. The suckers retained should be limited to one or two per mother plant. Excess suckers and slips if any should be removed. Earthing up should be done. Other management practices are same as for the plant crop.

Post Harvest Technology

Grading

After harvesting, the fruits are graded according to size, shape, maturity, and freedom from diseases and blemishes. The cut surface is treated with a suitable fungicide to control fungal decay.

Grading Standards

Class	Weight (g)
A	above 1500
B	1100 - 1500
C	800 - 1100
D	550 - 800
Baby	Less than 550

Packaging

For local markets, fruits are packed in bamboo baskets lined with paddy-straw. The first layer of fruits is arranged in such a way that they stand on their stumps. The second layer of fruits is arranged on the crowns of the first layer fruits. Each basket weighs 20-25 kg. For distant markets, fruit are wrapped individually with paddy straw and then packed.

For export purpose the pineapples are packed into fibreboard or wood containers. The fruits are placed vertically or horizontally in container. The interspace between the fruits should be filled

with straw and firm lining all around the container. For long-distance transportation, fruits are held at 7°C for 10-20 days.

Storage

When fruits are transported for long distances or to be stored for several days, refrigerated transport is required to slow down ripening process. In tropical areas, partially ripe, healthy and unbruised pineapple could be stored for almost 20 days when refrigerated at 10-13^{0}C with RH 85-90%. Fruits harvested in early stage of ripening are stored at 7-10°C. Exposure of pineapples to temperatures below 7°C results in chilling injury. Controlled atmosphere storage (3-5% O_2 and 5-8% CO_2) delayed senescence and reduced respiration.

Processing

A number of pineapple processing units are coming up in the State apart from the ones currently in operation, targeting overseas markets. Agreenco has set up a pineapple processing unit in Kannur at an investment of Rs 26 crore for exporting canned slices to the US. This unit will export 15,500 tonnes of packaged pineapple a year. The project is being set up in collaboration with Ashco Inc of the US.

Nirmal Agro Industries has set up another processing unit in Kochi, with plans to export 130 tonnes of canned pineapple a day to the US.

Nadukkara Agro Processing Co Ltd (NAPCL), maker of the `Jive' brand of packaged fruit juice is also there in the scene. Jive fights with brands such as Tropicana from Pepsi and Real from Dabur for its survival. Jive, which comes in two flavours - Splash, a mango-pineapple nectar, and Punch, a pineapple drink. NAPCL launches a mango flavour under the `Jive Mango Joozy' brand. NAPCL also makes candies from pineapple. The other stream of business is making pineapple and mango juice concentrates, which the company sells to other packaged drink makers in the national and international markets.

Marketing

In Kerala, major share of the produce reaches the market during the months of February to April and the arrivals are very low during the rainy months of June and July. In Ernakulam District a specialized local pineapple market has been functioning for the past 10-12 years at Vazhakulam. Pineapple trading is there in the market more or less throughout the year, even in lean seasons. It is estimated that only 30% of the total produce is reaching the market, whereas the rest is being traded at the farm gate itself. During the last five years, the lowest price received by the producer was Rs 5 per kg and the maximum price was Rs 22 per kg.

Apart from internal trade in other local markets, fresh fruits are being transported to other areas like Mumbai, Ahammedabad, Hyderabad, Bangalore, Delhi, Mysore, Surat etc and also to Middle East countries. During February – April months, on an average 100 t of fresh pineapple is getting transported daily to distant places like Mumbai, Banglore and sometimes it may go upto 500 t. Experience has shown that during this long journey, through torturous roads which were constructed very badly and virtually not maintained at all, as much as 30 per cent of the fruit could be damaged.

Cool Chain

Cool chain is essential during the transport of export quality commodity all the way from the farm to the customer. This helps in maintaining the temperature inside the box at the same low level as in the cold storage.

The various stages of the cool chain are :

1. Coldstore at the farm.
2. Refrigerated truck from farm to the airport
3. Coldstore at the airport.
4. Building up of the pallet in a coldstore at the airport.
5. Loading the aircrafts directly from the coldstore in a short time.
6. Cargo aircraft maintains coldstore temperature in hold.
7. Off loading direct into a coldstore in the receiving country.
8. Refrigerated truck to the customers.

Export

The export of pineapple from India have been almost negligible. Because of the perishability, from Kerala, pineapple in the fresh form is traded only on a limited scale and mostly in the neighbouring regions like Middle East. Exporters have found it extremely difficult to compete in the global market due to substantial price difference. One of the reasons may be the very high cost of air freight. Same is the case with pineapple products because India is a high cost producer of relatively poor quality which fetches the lowest prices. The raw material and processing costs are high to conform to the international norms. High cost of raw material and processing has to be compensated by premium price in the international market for export to flourish.

Functional Benefits and Uses

Pineapple fruits are primarily used in three segments, namely, fresh fruit, canning and juice concentrate with characteristic requirements of size, shape, colour, aroma and flavour. It is a wonderful tropical fruit having exceptional juiciness, vibrant tropical flavour and immense health benefits. Pineapple contains considerable calcium, potassium, fibre, and vitamin C. It is low in fat and cholesterol. Vitamin C is the body's primary water soluble antioxidant, against free radicals that attack and damage normal cells. It is also a good source of vitamin B1, vitamin B6, copper and dietary fibre. Pineapple is a digestive aid and a natural Anti-Inflammatory fruit. A group of sulfur-containing proteolytic (protein digesting) enzymes (bromelain) in pineapple aid digestion. Fresh pineapples are rich in bromelain used for tenderizing meat. Bromelain has demonstrated significant anti-inflammatory effects, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis and gout and speeding recovery from injuries and surgery. Pineapple enzymes have been used with success to treat rheumatoid arthritis and to speed tissue repair as a result of injuries, diabetic ulcers and general surgery. Pineapple reduces blood clotting and helps remove plaque from arterial walls. Studies suggest that pineapple enzymes may improve circulation in those with narrowed arteries, such as angina sufferers. Pineapples are used to help cure bronquitis and throat infections. It is efficient in the treatment of arterioscleroses and anaemia. Pineapple is an excellent cerebral toner; it combats loss of memory, sadness and melancholy.