

PASSION FRUIT CULTIVATION IN INDIA



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Passion Fruit (*Passiflora edulis* Sims) is a native of Brazil belonging to the family *Passifloraceae*. It is grown mostly in tropical and sub-tropical part of the world from South America to Australia, Asia and Africa. In India, passion fruit was introduced in early part of twentieth century in the Nilgiris, Coorg and Malabar areas of southern India. Passion fruit is a perennial, vigorous, climbing, woody vine that produces round or ovoid fruits. Fruits have a tough, smooth, waxy dark purple/yellow coloured rind with faint, fine white specks. Fruit contains orange colored pulpy juice with large number of small, hard, dark brown to black pitted seeds. The fruits are generally not used for table purpose. But they possessed unique flavor and aroma and high nutritional and medicinal properties. They are processed to make fruit juice and concentrate. The juice is delicious and has an excellent flavour. It is known for its blending quality. Fruits contain good proportion of reducing and non-reducing sugars and acids. Fruits are rich in Vitamin A (1300-2500 IU/100 g pulp), Vitamin C (30 –50 mg/100 g pulp) and minerals such as sodium, magnesium, sulphur and chlorides(Table1). Passion fruit is used for urinary infections and as a mild diuretic, digestive stimulant, and heart tonic and to treat asthma, whooping cough, bronchitis, coughs, gastric cancer etc. There is currently a revival of interest in the pharmaceutical industry, especially in Europe, in the use of the glycoside, *passiflorine*, especially from *P. incarnata* L., as a sedative or tranquilizer. Italian chemists have extracted *passiflorine* from the air-dried leaves of *P. edulis*. The juice of passion fruits is given as a digestive stimulant and treatment for gastric cancer.

Table1: Nutrient and approximate composition of passion fruit per 10 g of edible portions:

Composition	Species		
	P. edulis	P. edulis var. flavicarpa	P. quadrangularis
Moisture (%)	85.6	54.9	88.0
Protein (g)	0.9	0.7	0.9
Fat (g)	0.1	0.2	0.2
Carbohydrate (g)	13.6	13.1	10.1
Ash (g)	0.3	0.5	0.9
Ca (mg)	3.6	3.8	10.0
P (mg)	12.5	24.56	22.0
Fe (mg)	0.2	0.4	0.6
Vitamin A (IU)	717	2410	70
Thiamine (mg)	Trace	Trace	-
Riboflavin (mg)	0.1	0.1	-
Niacin (mg)	1.5	2.2	2.7
Ascorbic acid (mg)	30	20	20

Origin

The edible commercial species of passion fruit originated on the edges of South American rain forests in the Amazon region of Brazil and possibly in Paraguay and Northern Argentina. The purple passion fruit (*P. edulis*) is adapted to the cooler subtropics or at high altitudes in the tropics, while the golden passion fruit (*P. edulis* var. *flavicarpa*) is more suited to tropical lowland conditions. The two forms of passion fruit hybridize readily and produce fertile seedlings intermediate in appearance between the parents.

Area and Production

Passion fruit is a popular crop of grown in South America countries. The total global supply of passion fruit is estimated at 8.52 lakh tons. Brazil and Ecuador are the largest passion fruit producing countries. Brazil, Venezuela, south Africa, Sri Lanka, Australia, Papua New Guinea, Fiji, Hawaii, Taiwan and Kenya account for 80-90% of the world's passion fruit production. These countries have dominant share in the world export market. It is followed by Australia and New Zealand in export of the fruit to other countries. Kenya and South Africa also have a decent production of passion fruit and its area under cultivation is growing rapidly. Passion fruit is grown in most tropical and subtropical parts of the world, and it is particularly important commercially in Australia, Hawaii, South Africa and Brazil. Brazil is the world's foremost producer of passion-fruit, with about 90% of the production, followed by Peru, Venezuela, South Africa, Sri Lanka and Australia. Brazilian production is around 478,000 t with a yield of about 13.8 t/ha.

In India, though passion fruit was introduced in early part of twentieth century but its cultivation was limited to few districts of Karnataka, Kerala and Tamil Nadu. Since last one decade its cultivation started in some parts of northern India, especially North East states. The area under this crop is rapidly increasing in Mizoram, Nagaland, Manipur and Sikkim. and there is a great potential for its cultivation in these states. Presently passion fruit is cultivated in Munnar and Waynad of Kerala, Nilgiri hills and KodaiKanal of Tamil Nadu, Kodagu (Coorg) region of Karnataka and parts of Mizoram, Nagaland, Manipur and Sikkim. The estimated area and production of passion fruit is 9.11 thousand ha and 45.82

thousand tones, respectively. Manipur and Nagaland are the leading states in passion fruit production contributing 70 percent area and production of the country (Table 2). In Nagaland Kohima, Mokokchung, Wokha, Phek are main passion fruit producing districts (Table 3). The average productivity of passion fruit in India is around 5.02 tons/ha which much lower than countries like Brazil, Australia, Colombia etc where productivity is 30-35 tons/ha. There is immense potential passion fruit cultivation in North Eastern states, parts of Karnataka, Kerala and Tamil Nadu. These region has all sets of climate and sufficient rainfall for growing passion fruit successfully.

Table 2 : Area and production of Passion fruit in India

State	Area (ha.)	Production (T)	Productivity(t/ha)
Nagaland	7540	13741	1.98
Manipur	3,952	44,850	11.34
Meghalaya	943	-	-
Mizoram	820	7850	9.57
Sikkim	500	-	-
Karnataka	500	-	-
Kerala	300	-	-
Tamil Nadu	100	-	-

Table 3 : Area and production of passion fruit in Nagaland in 2013-14

District	Area (ha.)	Production (T)
Kohima	1400	2551
Mokokchung	1420	2588
Tuensang	525	956.78
Wokha	1070	1950
Zunheboto	690	1257
Phek	1225	2232.5
Mon	280	510.3
Dimapur	30	54.67
Peren	262	477.48
Longleng	155	282.48
Kiphire	483	880.2
Nagaland	7540	13741

Source: Jt. Director of Horticulture, Nagaland, Kohima

Climate and Soil requirement

Passion Fruit prefers a tropical and sub-tropical climate with moderate rainfall ranging between 100 and 250 cm. It is found growing at an altitude of 800-1500m above sea level. In purple passion fruit, cool temperatures are favourable for flower initiation and fruit set (18-23⁰ C), while relatively high temperatures seem necessary for promoting juice production (18-23⁰ C) and improvement in quality.

Yellow passion fruit grows under low land tropical conditions, whilst, the purple type tends more to be cultivated in subtropical areas or at higher altitudes in the tropics. The low temperature effects fruiting of the vines and upper parts suffered cold injury. It generally requires an average annual rainfall of 100 cm. In India, it is found to be grown in areas of receiving rain from between 100 cm and 250 cm.

Passion fruit is grown on many soil types but light to heavy sandy loams, of medium texture are most suitable. Soil with a pH of 6.5 to 7.5 is the most suitable. If the soil is too acid, lime must be applied. The soil should be rich in organic matter and low in salts because the vines are shallow rooted. Good drainage is essential to minimize the incidence of collar rot. Water logging and soil without drainage should be avoided.

Varieties

There are more than 500 species of *Passiflora* in the family *Passifloraceae*, but only one *Passiflora edulis* Sims, is known as passion fruit. There are two distinct forms of *Passiflora edulis* Sims, the standard yellow (*Passiflora edulis* f. *flavicarpa* Deg.) and the purple (*Passiflora edulis* f. *edulis*), differing in acidity and starch content. The yellow are more acidic and less starchy while the purple are less acidic and more starchy. Both two varieties, viz., purple Passion Fruit (*P. edulis*) and yellow Passion Fruit (*P. edulis* var. *flavicarpa*) are of commercial importance. The hybrids of these two have also been developed for cultivation.

Purple Passion Fruit

The vines of purple passion fruit are moderately vigorous and vines are more productive at higher elevation. Generally fruits are smaller than yellow passion fruit. about 4 to 5 cm in diameter and deep purple in colour when ripe. The average fruit weight ranges between 37-50 g. The juice content of the fruit varies from 35-38% and has a better flavour and aroma as fresh, canned and frozen juice or pulp than the yellow one. The seeds are black in colour. The Commercial cultivars of the purple form are Ouropretano, Muico, Peroba, Pintado etc. in South America. In India there is no standard cultivar. The local lines such as Ooty Purple, Coorg Purple, Moodabidri Purple, Thrissur Purple, Cherapunji Purple, Thaliparamba Purple and Ambalavayal Purple are cultivated by the growers.

Yellow Passion Fruit

The yellow form has a more vigorous vine. This type is suitable for lower elevation and is less productive at higher elevation due to its sensitivity to low temperature. The fruit is generally larger (weighs about 60 g.) than the purple variety, round in shape with yellow mottled spots and turns to golden yellow when ripe. Juice is more acidic and its recovery is comparatively less than the purple

variety. Seeds are brown. This form is inferior to the purple one with regard to juice content (25-30%) and flavour. The Commercial cultivars of the yellow are Mirim or Redondo and Guassu or Grande in South America and Golden Star in USA. There is no standard cultivar In India. The local lines such as Ooty Yellow, Coorg Yellow, Munnar Yellow are cultivated by the growers.

Hybrid Varieties

The hybrids of yellow and purple form have been developed for combining the desirable characteristics of both the forms of passion fruits. Several hybrid varieties have been developed in Brazil, Australia ,south Africa, etc. In India a hybrid of purple and yellow form was developed at Central horticultural Experimental Station, which is very popular among the farmers.

Kaveri Hybrid Passion fruit

This variety is a high yielding hybrid developed from Central Horticultural Experiment Station, Chettalli in 1986. This is a cross between purple and yellow varieties. Each plant bears 40-60 fruits per annum and produces 200 tonnes yield/ha over a three-year cropping period. Fruits ovoid to round and purple dotted. Fruits contain 25-30 per cent juice, 11.5-12.0 percent sugars and 3.0-3.5mg citric acid/100ml. Juice. This is tolerant to *Alternaria* leaf spot, *Fusarium* collar rot and nematodes.

The research work of development of new passion fruit varieties is in progress at CHES Chettalli (IIHR) , IHR , Bangalore , Banana Research Station ,Kerala . The performance of some of the elite lines at CHES Chettalli revealed that the fruit yield per vine was highest in PF-7 (10.94 kg) followed by Kaveri (10.24 kg), PF-3(9.07kg) and PF-2 (8.14 kg).The fruit weight was highest in Kaveri (101.4 g) followed by PF-2(99.5 g) and PF-7 (99.1 g). Fruit girth was highest in PF-7 (7.08 cm) followed by Kaveri(6.35 cm) and PF-3(6.15cm). Fruit length was highest in PF-7 (6.73 cm) followed by Kaveri(6.59 cm) , Few accessions were found promising. PF-3 is a seedling selection of Coorg yellow. The fruits are Yellow colour fruit. Average fruit weight is 95 g with 17.5 °Brix TSS and higher yield (9.07 kg per vine). PF-7 is a seedling selection of Thrissur yellow. The fruits are Yellow colour fruit. Average fruit weight is 99 g with 17.2 °Brix TSS and higher yield (10.9 kg per vine) (Table 4).

Table 4: Promising Passion fruit accessions at CHES Chettalli

Accessions	Yield (kg/vine)	Fruit wt. (g)	Fruit length (cm)	Fruit girth (cm)	Fruit Volume (ml)	Fruit colour	Pulp Wt.(g)	T.S.S. (° Brix)	Vitamin C (mg/100 g)
CHES PF1-6	3.64	58.7	5.71	5.37	59.8	Purple	19.3	18.1	59.66
CHES PF-1-8	6.19	71.1	5.93	5.71	71.4	Purple	23.9	17.2	65.12
CHES PF-1-12	5.97	67.1	5.64	5.64	67.6	Purple	19.5	15.6	77.09
CHES PF1-13	3.91	65.1	5.61	5.7	65.6	Purple	15.2	15.4	74.45
CHES PF-2	8.14	88.5	6.09	5.98	88.6	Yellow	44.3	17.6	35.99
CHES PF-2-11	1.99	44.1	4.91	5.03	44.6	Purple	13.1	17.1	66.97
CHES PF-3	9.07	94.5	6.35	6.15	94.8	Yellow	50.1	17.5	32.6
CHES PF-5	6.90	75.0	6.02	5.84	75.1	Purple	26.9	14.4	41.71
CHES PF-6	4.90	61.3	5.61	5.61	61.3	Purple	22.5	15.9	39.60
CHES PF-7	10.91	99.1	6.73	7.08	99.4	Yellow	42.0	12.2	39.78
CHES PF-9	6.29	73.1	6.10	5.68	73.38	Purple	29.5	14.7	46.46

Propagation

Passion fruit is propagated through seed, stem cutting as well as grafting. Recently serpentine-layering techniques has been standardized at IIHR, Bangalore. Seedlings and grafted plants are more vigorous than the plants raised by cuttings. Passion fruit vine originating from cutting or grafting starts fruiting much earlier (7-6 months) than those from seeds (10-12 months). In case of grafting on resistant rootstocks (yellow Passion Fruit) can be used to avoid damage due to wilt or root rot.

Seed propagation

Passion fruit vines are usually grown from seeds but seed propagation is not preferred for commercial multiplication as lot of variable is found in seed propagated plants. For seed propagation, fruits are collected from vines known for their performance in term of yield and quality. The seeds are extracted by fermentation method by heaping up the pulp for 72 hours and extracting the seeds and drying in shade. Sowing is done preferably during the month of March-April in a well-prepared seedbed. The seeds start sprouting in about 12-15 days after sowing and germination is completed in about a month. In some cases germination extends even up to 50-60 days. When the seedlings attain four to six leaves, they are transplanted in 10 x 22 cm. polythene bags filled with a mixture of soil, compost and sand in 2: 1 : 1 proportion. The seedlings are ready for transplanting in the field in about three months.

Propagation by stem cuttings

This is the most popular method of multiplication of passion fruit. Passion fruit is not a easy to root plant but rooting is satisfactorily under favourable conditions. The 30-35 cm long mature portion of the vines having 3 to 4 nodes is selected for the cutting. It should be raised in a suitable media preferable equal mixture of sand soil and farmyard manure. Rooting may be hastened by hormone treatment. It has been found that treatment cutting with 200 ppm NAA for very short period(3-5second) or 80 ppm NNA for 12 hour increased the rooting in cutting. Rooting takes place within a month and can be transplanted to the field in about three months.

Propagation by grafting

Grafting is used to multiply hybrid varieties on disease resistance rootstocks. The yellow passion fruit is resistance to nematode infestation and diseases and found to be a good rootstock for hybrid varieties. The seed yellow passion can be sown either in March or in October for raising the seedling depending upon the availability of the seed. Seedlings can be raised in seedbed or in pots. The plants became ready for grafting in 3 months. Scions from healthy young vines are preferred to those from mature plants. Generally both stock and scion should be of pencil thickness for grafting. The diameter of the selected scion should match that of the rootstock. Cleft graft, whip graft or side wedge graft methods can be used.

Passion fruit plants raised from cuttings face problems of higher infection of Phytophthora root rot under high temperature and high humidity conditions. To avoid these problems, experiment was conducted at CHES, Chettalli to find out suitable time and method for grafting of passion fruit on comparatively tolerant yellow passion fruit rootstock . It was observed that cleft grafting of passion fruit variety Kaveri (Scion) on yellow passion fruit root stock gave higher success in rainy season with highest success (75%) in the month of September. Lower success (30 %) was reported in March month. It was concluded that cleft grafting in the month of September is suitable for multiplication of grafting of Passion fruit under Coorg conditions.



Propagation by Serpentine Layering

In this method, the lateral shoots emerging from the main branches are given partial slanted cut below the nodes and shoots are allowed to root in rooting medium consisting of soil, sand and compost (1:2:1) with regular irrigation. This should be done in the month of February. The roots emerge profusely within 45 days. These plants should be separated during April _May. The method has been found highly successful with 90-95 percent success with 75 days of layering. The field survival of the plants propagated by this method is higher.

Spacing and planting

The land should be well prepared by deep ploughing, leveling and incorporation of manures. Proper spacing should be provided as this greatly influences the growth of the vine and production. A spacing of three metre from row to row and two metre plant to plant from is suitable. Pits of 45 x 45 x 45 cm size are dug and filled with a mixture containing three parts of top soil and one part of compost. Planting is done preferably on cloudy days during June-July after the onset of monsoon so that the plants are well established by the end of the monsoon. In Brazil, Australia, Colombia and other countries high planting density (2.0 x 1.25 m within the row and between the rows, respectively, with a

planting density of 4000 plants/ha is common. This results in higher productivity than normal density planting.

Training and pruning

Passion fruit is a woody vine it needs support for good growth and fruiting. For commercial cultivation, the vines are trained on a frame of wires and poles 1.5 to 2 meter above the soil surface. Among the different types of trellising, Kniffin system is the most economical. In which 2½ metre long poles are erected six metre apart and a wire is fixed on the top. Trellis should always run across the slope or in the direction of North-South for maximum and even exposure of vines to sunlight. In order to withstand the weight of the vines it is necessary to use eight or ten gauge wire, turning buckles and also strong stone pillars or cement or wooden poles. This is required for regulating yield of Passion fruit as the to support a heavy weight of vines and fruits under all conditions of weather at least for five years. Weak and faulty construction of trellis may result in sagging and loss of vines. If wooden pole is used it has to be treated with tar up to the portion that is buried in the soil to prevent deterioration and white ant attack.

The vines are supported with hardwood stake or gunny twine, which may be stretched vertically from the bottom of the plant to the top of the wire. Plants start growing very fast just after establishment and several branches arise from the base of the plants. All the shoots leaving only two vigorous shoots are removed as and when they appear. The main shoots are bound on stake or twine and all the lateral growth in these shoots are removed till they reach the wire. Once the main vines reach the wire, the tips are pinched so as to encourage leader formation. Two leaders are directed on either side of the wire, and are tied with loops around the wire until the leader of the adjoining plants meet, when the tips of the leaders are cut. This forces the leaders with laterals which are trained downwards hanging from the wire and all the tendrils obstructing downward growth of the laterals are to be removed as and when they come.

Passion fruit vines bear fruits only on current season's growth and systematic pruning of vine encourages new growth resulting in regular and higher yield of fruits. The lateral branches coming from leader branches are allowed to grow and fruit. Once the laterals have produced the fruits, they are cut back to four to six buds so as to induce regular bearing . Pruning is generally done twice in a year, first in March and April and another in October-November depending upon the harvest of the crop. Pruning is confined only to the cutting back of the laterals or buds of those laterals that have fruited. In

the case of old laterals cutting back is limited to the nearest active bud as otherwise with increasing age of the lateral, the basal buds become dormant or sterile. Indiscriminate and drastic pruning of inactive or dormant vine may lead to a setback in growth and reduction in yield.

Nutrition

The Nutrient removal pattern on whole plant (including fruits) analysis revealed that from an hectare area accommodating 1500 plants averaging 37 tons fruit yield the amount of different nutrients removed were : 202.5 kg N – 17.4 kg P, 184.2 kg K – 151.6kg Ca – 14.4 kg Mg – 25.0 kg S – 770. 4 g Fe, 2810.2 g Mn, 198.7 g Cu – 316.9 g Zn –295.8 g B.. This suggests the nutritional requirements of passion fruit in order to determine the optimum fruit yield and to improve the longevity of passion fruit vine and to recommend an optimum dose of fertilizer for the crops.. However, this may vary according to the fertility status of the soil. The fertilizer recommended for south Indian states is more than the recommended fertilizer schedule for Northeastern states. A fertilizer dose of 110g N, 60g P₂O₅ and 110g K₂O per vine per annum is recommended for the 4 year old orchards in South India. For Kaveri hybrid 100g N, 50g P₂O₅ and 100g K₂O per vine per annum is recommended. While 80g N, 40g P₂O₅ and 50g K₂O per vine per annum is recommended for the 4 year old orchards for North Eastern States. Nitrogen should be applied in 3 split dozes in the months of February-March, July-August and October -November along with farmyard manure evenly spread in a circle of 50-45 cm radius about the stem having sufficient moisture in soil at the time of fertilizer application to ensure better use efficiency, while potash should be given in the two split doses. In addition to this, 2-3 sprays of 0.5% Urea can be given during summer months. The foliar application of micronutrients is recommended for deficient areas. Surveys have been made to identify the nutrition disorders in passion fruit. In leaf nutrient concentration of passion fruit grown in Nagaland, Mizoram and Manipur in relation to fruit yield/vine showed that vines are severely underfertilized due to sub-optimum concentration of most of the nutrients (Table 3).

Table 3. Leaf nutrient composition of passion fruit vine in relation to fruit yield in northeast and south India

Location	Leaf nutrient concentration						Yield (kg/vine)
	N(%)	P(%)	K(%)	Ca(%)	Mg(%)	Zn(ppm)	
Wokha, Nagaland	2.4-2.8	0.12-0.14	1.2-1.6	1.1-1.6	0.12-0.14	14-16	2-3
Mokokchung, Nagaland	2.6-3.0	0.11-0.12	1.4-1.6	1.2-1.8	0.10-0.12	13-18	4-5
Kolasib, Mizoram	1.8-2.1	0.10-0.14	1.3-1.8	1.2-1.4	0.10-0.14	12-14	5-6

Aizawal Mizoram	1.9-2.6	0.11-0.12	1.8-2.0	1.4-1.6	1.3-1.5	12-15	4-6
Mamit Mizoram	2.0-2.4	0.10-0.12	0.98-1.1	1.3-1.8	0.11-0.13	15-16	2-3
Tamenglong, Manipur	2.6-3.1	0.14-0.16	0.92-1.2	1.3-1.5	0.13-0.15	13-15	3-4
Ukhrul, Manipur	2.5-3.4	0.12-0.14	1.1-1.3	1.2-1.4	0.12-0.14	15-18	4-5
Coorg (Karnataka)	2.1-2.7	0.06-0.17	2.3-2.9	1.4-1.6	0.18-0.24	-	6-8

The comparison of nutrient status reveals that higher fruit yield in Coorg is due to more favourable soil pH (5.8-6.2), allowing easy supply of nutrients. These observations suggest that passion fruit is nutritionally neglected in North East and needs proper fertilization to be exploited the potential of this crop to transform passion fruit industry.

Irrigation

Prolonged dry spell during January-March may reduce main summer crop and may also affect adversely the development of flowering laterals. If there is no rainfall during the dry months, supplementary irrigation may be given at fortnightly intervals. On an average, passion fruit requires irrigation of 12-15 litre /vine/day in summer and 6-8 litre /vine/day) in winter. Drip irrigation is very useful. Passion fruit vine responds significantly to fertigation. In a study on response of passion fruit to K fertigation showed highest commercial production.

Interculture

Passion fruit being shallow rooted having most of the feeder roots within 15 cm. of the soil surface require light digging. Deep digging is avoided and weed growth is checked by surface weeding or by scraping and scuffling. Mulching with dried leaves or grass is done to conserve moisture during summer months.

Diseases and Pests

Diseases

Brown spot: Brown spot is a serious disease followed by Root rot. The disease is caused by *Alternaria macrospora* Sims. and is recognized by the presence of concentric brown spots with greenish margin. Girdling of branches and premature defoliation of the leaves occur in severe cases. The appearance of the spot on the fruit causes spoilage during transit or storage. If the disease is not checked in time, the decline of the orchard results. The affected branches should be pruned and burnt and spraying with mancozeb or diathene Z- 78 (0.2%) should be done for the control of the disease.

Root rot: This disease caused by *Phytophthora nicotiana* var. *parasitica* has been found causing considerable damage. Rotting of the root starts and ultimately the plant dies. To control the disease, water logging should be avoided by providing proper drainage. Drenching with Bordeaux mixture (1%) may be done and affected plants should be mounded with soil to encourage new root formation.

Insect-Pests

Fruitfly (*Dacus sp.*) : The insect punctures the immature fruit while the fruit is developing and rind is still tender. Fruits become woody around the punctured area and in several cases, they are deformed and the pulp content is reduced. This can be controlled by a spray of malathion (0.05%). Spraying may be done only in the afternoon to minimize the destruction of insects pollinating the flowers.

Thrips (*Selenothrips sp.*) : This feeds on bud and developing fruits. Affected fruits are deformed and fruit weight and juice content are reduced. This is only observed to cause damage to the main summer crop. This can be effectively controlled by spraying with malathion (0.05%).

Mites (*Tetranychus sp.*) Mites feed on leaf and tender fruits. Defoliation of leaves and undersized fruits are resulted from this. It can be controlled by spray of Kelthane (0.05%)

Harvesting and Yield

The flowers are borne singly in the axils of the leaves in the terminal region of the new growth. Passion fruit flowers and fruits throughout the year under favourable conditions, yet there are two main periods of fruiting: the first harvest extends from August to December and the second one from March to May. The first fruits are obtained from the ninth month and full bearing is reached in 16-18 months. About 60-70 days are required from fruit set to the harvest of fruit. The fruit when ripe falls down from the vine. Harvesting is done when fruit turned slightly purple. Fruit should be harvested along with the stem. On an average, yield of 10-12 tonnes per hectare per year can be obtained. The vines are perennial and can produce yield for 10 to 15 years but maximum production can be obtained up to six years after which the yield declines. Fruits harvested should be disposed off quickly to prevent the loss in weight and appearance. About 10-20% loss in weight results from storage, and fruits wrinkle and give a bad appearance. To avoid this they can be stored in polythene bags and for transport to distant markets polythene-lined crates may be used.

Post harvest Handling and Marketing

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Processing

Passion fruit juice is sold to juice manufacturers and other processors as a single strength aseptic juice (14-16 ° brix) or frozen concentrate (50 ° brix).. Many buyers prefer to source concentrate over single strength form. The juice is used in ice cream, syrup, tropical cocktails, and juice blends, and is rich in carotene, vitamin C and A, and potassium. Demand for passion fruit concentrate is estimated by industry sources to have grown to 16,000 MTs. Growth in the European and US markets is estimated at around 6-8 percent annually. However, production frequently exceeds or falls short of demand as a result of erratic weather patterns and price reactions in Ecuador, the world's largest exporter of passion fruit juice. The market is therefore subject to "boom and bust" production cycles: as shortages lead to higher market prices and , surplus leads to lower prices.