

## Litchi-A promising fruit crop in Eastern India

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The Litchi (*Litchi chinensis* Sonn.) belongs to family Sapindaceae and is known as the queen of the fruits. Its systemic cultivation started in 1500 BC in China. It was introduced in Burma by the end of 17<sup>th</sup> Century. It came to India through Burma about 100 years later and from these places it spread to other parts of the tropical and subtropical areas. It is highly specific to climatic requirement, probably due to this reason, its cultivation is restricted to only few tropical and subtropical countries in the world, where it is grown commercially. India is the second largest producer of litchi in the World after China. Other major producing countries are Israel, Australia, Thailand, Taiwan, Vietnam, some parts of Africa and at higher elevations in Mexico and central and South America. India and China account for 91 per cent of the world litchi production but it is marketed locally. Among fruit crops, litchi ranks seventh in area and ninth in production but is sixth in terms of value in India. The national average productivity of litchi is 6.1 t/ha, which is much lower than the realizable yield of the crop under well managed condition. It is most popular fruit crops in India and mostly grown in Eastern India. It is introduced fruit crop and it has great potential of yield in India. The trend reveals that area of litchi is expanding.

**Table 1. Area, Production and Productivity of Litchi in India:**

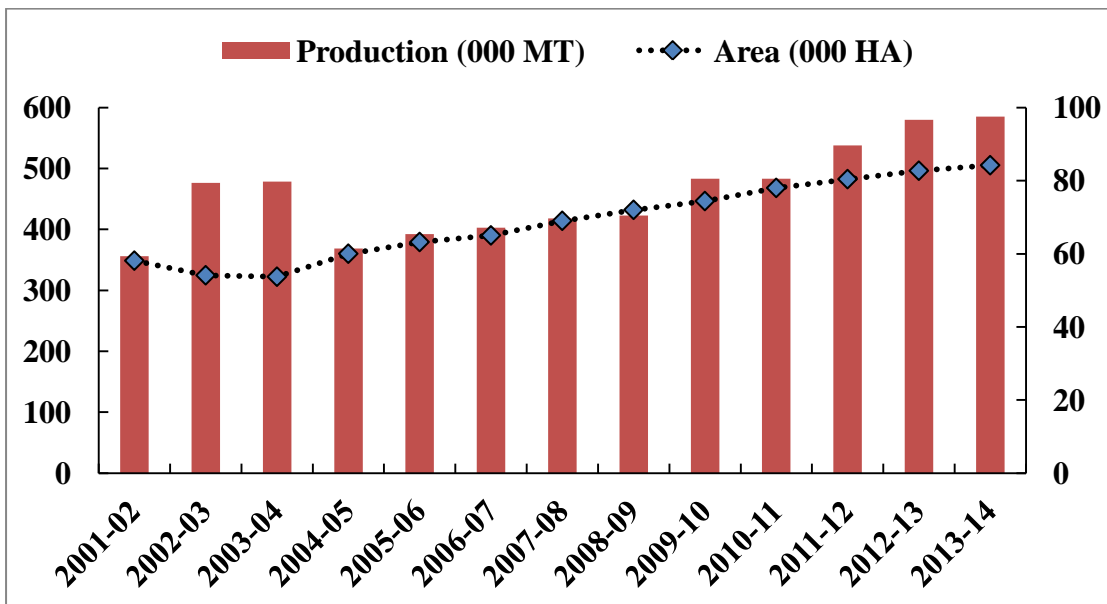
Year	Area (000 HA)	% of total fruit area	Production (000 MT)	% of total production	Productivity (MT/HA)
2001-02	58.1	1.4	355.9	0.8	6.1
2002-03	54.1	1.4	476.4	1.1	8.8
2003-04	53.7	1.1	478.5	1.0	8.9
2004-05	60.0	1.2	368.6	0.7	6.1
2005-06	63.2	1.2	392.1	0.7	6.2
2006-07	65.0	1.2	403.0	0.7	6.2
2007-08	69.0	1.2	418.0	0.6	6.1
2008-09	72.0	1.2	423.0	0.6	5.9
2009-10	74.4	1.2	483.3	0.7	6.5
2010-11	78.0	1.2	483.3	0.7	6.4
2011-12	80.4	1.2	538.1	0.7	6.7
2012-13	82.7	1.2	580.1	0.7	7.0
2013-14	84.2	1.2	585.3	0.7	7.0

(Source: Indian Horticulture Database, NHB, 2014, MoA, GOI)

It may be seen from the above table that the area under Litchi has increased from 58100 ha to 84200 ha in 2001-02 to 2013-14 and production also boosted from 355900 MT to 585300 MT in last decades.



**Fig1. Bearing potential in china cultivars**



**Fig: 2. Trends of area and production of Litchi**

**Nutritional Value:**

The food value of litchi mainly lies in its sugar content which varies from variety to variety. The fruit is also rich in Vitamin B<sub>1</sub>, Riboflavin & Vitamin C apart from proteins, fats,

carbohydrates, minerals, fibrous matter, calcium, phosphorus, iron and carotene. A highly flavoured squash is also prepared from the litchi fruits, which is used during summers. Various other products such as pickles, preserves and wine are also made from litchi in China. Dried litchi commonly called litchi-nut is very popular among the Chinese. Litchi is good source of antioxidant which protects the body from harmful free radicals. Depending upon the variety and climate, the fruit contains 60 % juice, 8% rag, 19 % seed and 13 % skin.

**Table 2: Nutritive value of litchi fruit:**

<b>Constituents</b>	<b>Fresh aril (per 100 gm)</b>
Calories	63-64
Moisture	81-85 %
Protein	0.68-1.0 g
Fat	0.30-.58 g
Carbohydrate	13.31-16.40 g
Fibre	0.23-0.40 g
Ash	0.37-0.50 g
Calcium	8-10 mg
Phosphorus	30-42 mg
Iron	0.40 mg
Sodium	3 mg
Potassium	170 mg
Thiamine	28 mg
Nicotinic acid	0.40 mg
Riboflavin	0.05 mg
TSS ( <sup>o</sup> Brix)	18-22
Ascorbic acid	24-60 mg

**Major litchi growing States:**

Bihar is the leading state in litchi production followed by West Bengal, Jharkhand, Assam, Chhattisgarh, Punjab Orissa, Uttarakhand, and Tripura etc. However litchi is also growing in some part of Himachal Pradesh and now a day it is being popular in Kerala and Tamil Nadu. However, it could not freely spread as other fruit crops due to its specific climate requirement.

**Table 3. States wise area, production and Productivity of Litchi (2013-14)**

<b>States</b>	<b>Area (000 HA)</b>	<b>Production (000 MT)</b>	<b>Productivity (MT/HA)</b>
Bihar	31.48	234.20	7.4
West Bengal	9.30	93.90	10.1

Jharkhand	5.27	58.24	11.1
Assam	5.38	48.08	8.9
Chhattisgarh	5.36	37.63	7.0
Punjab	1.85	28.00	15.1
Odisha	4.47	20.32	4.5
Uttarakhand	9.44	30.71	3.3
Tripura	3.88	20.18	5.2
Others	7.74	14.04	1.8

(Source: Indian Horticulture Database, NHB, 2014, MoA, GOI)

### **Litchi in Bihar:**

Bihar produces 44.2 % of total litchi production of the country and occupies nearly 38% of the area under litchi plantation in the country. In this state litchi is mainly cultivated in the districts of Muzaffarpur, Vaishali, Sitamarhi, West & East Chaparan, Darbhanga, Samastipur. Litchi is grown in area of about 31480 hectare with total production of about 234200 tonnes and productivity 7.4 t/ha which is high in comparison to average national productivity. The crop has tremendous potential for export to European and Gulf countries either in fresh or processed form and therefore, there is an imperative need to harness possible export prospects by development of basic infrastructure in the state.



**Fig 3. Popular shahi variety of litchi**

### Concentrated Pockets of litchi in India:

The details of concentrated pockets of Litchi in different states are listed below:

State	Districts
Bihar	Muzaffarpur, Vaishali, Sitamrhi, East Champaran, West Champaran, Katihar, Gopalganj, Siwan, Samastipur, Saran, Sheohar, Darbhanga, MadhubaniPurniya,, Begusarai, Saharsa, Bhagalpur, Araria, Kishanganj, Khagariya, Madhepura, Munger
Jharkhand	Ramgarh, Ranchi, Gumla, Hazaribagh
Assam	Dibrugarh, Bongoigaon, Kamrup, Golpara, Nalbari, Barpeta, Sonitpur, Nagaon, Lakhimpur, Golaghat, Jorahat,Cachar
West Bengal	Mushirdabad, 24- Parganas, Nadia, 24- Parganas South Malda, Uttar Dinajpur, DakshinDinajpur, Hubli, Coach bihar
Orissa	Sundergarh, Sambalpur, Angul, Deogarh
Chhattisgarh	Korba, Raigarh, Surguja, Jashpur, Surajpur, Balrampur, Koriya, Narayanpur
Madhya Pradesh	Shahdol, Sidhi, Malda, Dindori
Uttarakhand	Udham Singh Nagar, Champawat, Nainital, Dehradun, TehriGarhwal, PauriGarhwal,Haridwar, Almora
Punjab	Gurdaspur, Hoshiarpur
Tripura	West Tripura, North Tripura, South Tripura, Dhalai Tripura
Manipur	Imphal West, Bishunpur, Imphal East, Thoubal, Chandel, Churachandpur
Nagaland	Kohima, Dimapur, Wokha, Mokokchung, Mon, Peren, Tuensang, Phek, Kiphire, Longleng, Zunheboto
Meghalaya	Garo hills, East khasi hills, Ri-Bhoi
Sikkim	Phidang, Majhitar, Bhasmey, Rorathang, Makha, Ralep, Mulukey, Kitam, Pakzor, Chalamthamtheng, Kichudumra, Sagbari, Kamling

### Popular cultivars grown in India:

There are limited varieties of litchi in India which are resulting of local seedling selection and only few varieties got popularity or commercial importance. The varieties commonly grown in different states:

<b>States</b>	<b>Recommended cultivars</b>
Bihar	Shahi, China, Rose Scented, Bedana, Late seedless, late large red, purbi
Jharkhand	Shahi, China, Rose Scented, Bedana, Late seedless, Late large red, purbi
Orissa	Late large red
Assam	Shahi, China, Bombai, Deshi
Sikkim	Shahi
Manipur	Late large red
Meghalaya	Late large red
Nagaland	China, Late large red
West Bengal	China, Ellaichi, Bedana, Bombai, Late large Red, Purbi
Chhattisgarh	Shahi, Late Large Red
Madhya Pradesh	Shahi, Late Large Red
Uttar Pradesh	Shahi, China, Rose Scented, Bedana, Dehradun, Calcuttia
Uttarakhand	Shahi, China, Bedana, Rose Scented, Dehradun, Late seedless
Punjab	Rose Scented, Dehradun, Late Seedless
Himachal Pradesh	Rose Scented, Dehradun Calcuttia
Jammu & Kashmir	Rose Scented, Dehradun, Calcuttia
Tamil Nadu	Rose Scented, Dehradun, Late Seedless, Late Large Red, Calcuttia

### **Characteristics of Commercially Grown Litchi cultivars in Eastern India**

<b>Variety</b>	<b>Characteristics</b>
Shahi	Early maturing, regular bearer, heavy yielding, fruits are globous- heart or obtuse in shape. The colour is rose madder and fuchsia purple background with red tubercles at ripening and the weight ranges from 20-25 g, with T.S.S. of 19-22° brix
China	Late maturing, oblong to conical shaped fruit with dark pink colour skin, fruit weighing about 20-25 g, aril sweet juicy aroma with excellent quality, heavy yielder, resistant to fruit cracking and sun burning
Early Bedana	Fruits are oval or heart shaped. The colour is uranium green with carmine red tubercles at maturity and the fruit size is medium, weight ranges from 15 to 18 g. with T.S.S. of 17.2-19.8° brix
Late Bedana	Fruits are conical in shape. The colour is vermilion to carmine with dark blackish-brown tubercles at maturity and the fruit size is medium, with T.S.S. of 18-20° brix
Bombai	Fruits are obliquely heart shaped. The colour is carmine red and the fruit size is large, and weighs 15-20 g. with T.S.S. of 17° brix

Kasba	Mid-late maturing, fruits are oval to round in shape with deep red skin colour, fruit weighing about 22-25 g, high yielder, resistant to fruit cracking and sun burning
Rose Scented	Mid-early maturing, crimson red coloured fruit, aril with rosy aroma, excellent quality, regular bearer, heavy yielder
Dehradun	Fruits are obliquely heart to conical shape, bright rose pink coloured skin with attractive fruit weighing about 18-20 g, high yielder

### Arrival pattern in market:

The harvesting period of litchi differs state to state. The ripening commence from north eastern to central and then North to South India.

The arrival pattern of Litchi in Leading States is given below in the table.

S.No.	States	Season of availability
1	Tripura	15th April to end of April
2	Assam	3rd week of May
3	West Bengal	1st May to 3rd week of May
4	Bihar	3rd week of May to 2nd week of June
5	Jharkhand	3rd week of May to 2nd week of June
6	Uttarakhand	2nd week of June to 4th week of June
7	Punjab	3rd week of June to last week of June
8	Himachal Pradesh	3rd week of June to last week of June
9.	Tamil Nadu	15 <sup>th</sup> December to 15 <sup>th</sup> January
10.	Karnataka	15 <sup>th</sup> December to 15 <sup>th</sup> January
11.	Kerala	15 <sup>th</sup> December to 15 <sup>th</sup> January

### Production of planting material

National Research Centre on Litchi, Muzaffarpur has focused on production of quality planting materials and is supplying to litchi growers. The centre gives training on propagation technique to the farmers and nursery man. National Horticulture Mission also promotes the production of planting materials. They proposed two model nurseries out of which one shall in public sector and one in private sector in Bihar. The nurseries will primarily accommodate the nucleus material of varieties recommended to the state and build-up sufficient infrastructure for irrigation and nursery activity to propagate clones of such varieties in the form of soft wood grafts. The nurseries under the corporation and SAU have been left out as corporation shall concentrate more on processing part. The nurseries set up for mango will

also serve the purpose of planting material availability of Litchi. The state will also have four small nurseries (1 ha.) to prepare the planting material required for area expansion and rejuvenation of senile and old orchards. Simultaneously, activities of rejuvenation shall be started to increase productivity of the existing orchards. Rejuvenation of old and senile orchards shall include top-working, micro fertigation and gap filling in the existing plantations. Packages of clonally propagated materials, being quite new to the farming sector, need extension practices by way of demonstrations, campaigns and training.

### **Marketing of litchi in India:**

Farmers directly sell their produce to the middlemen. The fruit is sold through a post harvest contractor to the wholesale or commission agent, who undertakes the harvesting and packing, in addition to transporting the produce to the market. More than 65 % of the growers prefer sale through post-harvest contractor and about 20 % undertake self-marketing. Marketing of litchi is also linked with processing. Raw litchi are collected / purchased from growers by local traders who in turn either sale it to whole sellers or processing units and processing units established in producing areas also purchase directly from growers.

### **Catchment areas of Market**

The catchment areas of market of Litchi in leading states:

<b>States</b>	<b>Districts (Market)</b>	<b>Blocks</b>
Bihar	Muzaffarpur	Sahebganj, Baruraj, Hursepur, Minapur, Kanti, Paru-I, Paru-II, Kurhani, Sacra, Dholi, Bochacha, Gaihati, Katra, Aurai.
	Sitamarhi	Majorganj, Pariharpur, Riga, Bathnaha, Sursnd, Bazpatti, Pupri, Nanpur, Pumra, Belsand, Bairagnia
	East champaran	Raxaul, Ramgarhwa, Chiraiya, Dhaka ,Palahi, Mehsi ,Kesriya, Chakia, Areraj, Paharpur.
West Bengal	Murshidabad	Suti, Jangipur, Raghunathganj, Lalgola, Bhagwangola,Sagardighi, Jiaganj, Lalbagh, Domkal, Bahranpur, Hariharpura, Belaanga, Nawada



		,Bharatpura, Barwan,Khargram
Uttarakhand	Udham Singh Nagar	Rudrapur, Sitarganj, Khatima, Gosukuan, Chakarpar,Senapati, Bichwa, Pant Nagar, Bazpur, Kashipur, Jaspur
	Nainital	ManumaHami, Mallital, Tallital.
	Dehradun	Tapovan, Haripur, Kaiffi, Rajpur, Kishanpur, Garhi.
Punjab	Gurdaspur	Dhar, Pathankot, Batala, Phongota, Dunera, Sujampur,Madhampur, Chaki, Jakolar, Fatehgarh, Jaintipur, Bhet
	Hoshiarpur	Mukerian, Dasuya, Dholbaha, Hazipur, Namoli, Bhamotar,Dadiyal, Garhdiwala, Miani, Phuglana, Mahalpur, Lalwan
UttarPradesh	Saharanpur	Badshahrbagh, Raipur, Muzzafarabad, Kalsia, Behat,Chilkana, Rampur, Sarsawa, Pilkhani, Bhayla, Deoband, Gangoh, Lukhnauti, Nanauta

**Table 4. Market price of litchi in India during peak period: (Price Rs/Q and arrival in MT)**

Market	May		June		July		August		November		Annual	
	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival
Abohar	0	0	5688	10	5000	4	5500	4	0	0	5396	18
Amritsar	0	0	4228	211	0	0	0	0	0	0	4225	211
Bhopal	0	0	5952	141	6750	2	0	0	0	0	6351	143
Bhubaneshwar	8140	25	7506	21	0	0	0	0	0	0	7823	46
Chandigarh	8766	369	6012	561	5798	364	0	0	0	0	6859	1294
Dehradun	0	0	5613	243	6543	50	0	0	0	0	6078	284
Delhi	8356	3914	6255	6014	8225	882	0	0	0	0	7611	10810
Gangatok	0	0	7140	33	0	0	0	0	0	0	7140	33
Guwahati	2664	207	4186	121	0	0	0	0	0	0	3425	328
Jaipur	5505	551	4363	390	0	0	0	0	0	0	4934	941
Jammu	9250	6	6808	370	6362	187	0	0	0	0	7473	563
Kolkata	4557	310	7429	216	0	0	0	0	0	0	5993	526
Lucknow	4921	264	4059	555	0	0	0	0	0	0	4490	819
Patna	2415	497	3196	1220	0	0	0	0	0	0	2806	1717
Raipur	8020	253	7108	128	0	0	0	0	0	0	7564	381
Ranchi	3983	446	3950	414	0	0	0	0	0	0	3967	860
Shimla	0	0	6189	56s	5450	9	0	0	0	0	5820	65
Mumbai	0	0	0	0	0	0	0	0	1350	160	0	0

(Source: Indian Horticulture Database, NHB, 2014, MoA, GOI)



**Fig: 3. Price of litchi in Indian market**

### Exports and export potential

At present litchi fruits are exported by India mainly to the Netherlands, U.A.E., Saudi Arabia and Canada. APEDA and NAFED are the major export promoters of litchi. The demand from Arab countries, Europe and USA is increasing day by day. However, very little effort has been made by India to capture some part of the world market from China which is the main player.

**Table 5. Export of litchi from India (2013-14)**

Country	Quantity (MT)	Value (lakh)
China P RP	87	62
Thiland	19	20
Mauritius	1	1

(Source: Indian Horticulture Database, NHB, 2014, MoA, GOI)

### Domestic strengths for exporting Litchi from India are detailed below:

- India is the largest producer of litchi in the world.
- India produces superior litchi varieties having high pulp to stone ratio and with high yields.
- India has been gifted with unique ripening pattern of litchi, as litchi starts ripening from 15th April in Tripura, 1st week of May in Assam and West Bengal; 3rd week of May in Bihar & Jharkhand, and season ends after ripening terminates in Punjab in last week of June. Thus, India has 2.5 months time to export litchi.

- India is in advantageous position with regard to geographical location compared to Thailand and China, as India is nearer to Europe and Gulf countries for exporting litchi to these countries.
- India has not to compete with Madagascar, South Africa and Australia as these countries produce litchi during November to February months, nor is India to compete with Israel as its litchi arrives during July to October months.
- Indian litchi is earliest to arrive, as litchi ripens 15 days earlier than Thailand and Chinese litchi ripen one month later, i.e. in June. Thus during this period there is comparatively less competition from China for exporting litchi to European markets.
- Agri Export Zones have already been set up in litchi growing areas of Bihar, West Bengal and Uttarakhand states.
- Pack houses for exporting litchi are already available in Bihar, West Bengal and Uttarakhand states.
- A specialized fumigation chamber has been set up in Malda area of West Bengal.

### **Processed products in litchi**

However, litchi is mainly eaten fresh but different product like canned litchi, squash, cordial, syrup, RTS (ready to serve), jam, jellies, juice and dried or dehydrated products (nuts) can be manufactured.

- 1) **Freezed litchi:** It is the litchi frozen in syrup with or without stone after peeling and preserved with its natural flavor and quality for a long time. Litchi fruits remain in its excellent condition for 12 months when rapidly cooled and kept at  $-25^{\circ}\text{C}$ .
- 2) **Canned litchi:** It is of excellent quality and great in demand in both India and abroad. Fully mature ripe fruits of various varieties are washed, peeled and pulp destined and is filled in empty cans to which sugar syrup of 30-35<sup>0</sup> Brix (mixed with 0.2% citric acid and flavored with rose or vanilla essence) is added. Cans are closed after the temperature in the middle of the cane reaches  $85^{\circ}\text{C}$  and maintained for five minutes. The sealed cans are sterilized or processed in boiling water for 30 minutes and then immediately cooled in running water. They are then wiped out with dry cloth and stored in a cool dry place. Problem: pink discoloration after three months of storage possibly due to the formation of a tin anthocyanin complex.
- 3) **Litchi juice:** Litchi juice extracted with the help of basket press is preserved by 700 ppm  $\text{SO}_2$ . Juice is pasteurized at  $85^{\circ}\text{C}$  for 15-20 minutes during which 0.25% citric acid

dissolved in a little quantity of water may be added. After cooling 0.12 percent potassium meta-bi-sulphate dissolved in little quantity of water is thoroughly mixed. Juice is then filled in sterilized bottles and stored in cool and dry place.

- 4) **Squash:** Squash is prepared by blending the juice with sugar, citric acid and water added with 0.06% potassium meta-bi-sulphite and vanilla/rose essence and preserved chemically with 350 ppm SO<sub>2</sub>. As per F.P.O specification the squash must contain 25% juice and at least 40<sup>0</sup> Brix (T.S.S). First all the sugar syrup is prepared by dissolving sugar in water by heat application.
- 5) **Litchi Syrup:** It is the sweetened juice of litchi usually with a high concentration of sugar and containing a small quantity of fine pulp of the fruit usually with a low acid content. Syrup does not spoil due to high acid content.

**Litchi processing unit in Muzaffapur:**

Sl No.	Processing unit	Capacity	Products
1	Litchika International, Bela, Muzaffarpur	500 Tons	Litchi squash, Litchi canning & Litchi honey
2	Shyama Agro-industry, Ratwara Muzaffarpur	200 Tons	Squash & Canning
3	Premier Food Product, Khabra Road, Muzaffarpur	200 Tons	Squash & Canning
4	Thakur Litchi Industry, Muzaffarpur	200 Tons	Squash & Canning
5	Radha Krishna Implex Pvt. Ltd. Muzaffarpur	500 Tons	Pasteurised Litchi juice

- 6) **Cordial:** It is a clear, sparkling, sweetened juice from which pulp and their suspended materials are completely eliminated. It is mostly used after duration with certain alcoholic drinks. For its preparation juice is extracted and filtered. Filtered juice is stored and preserved by adding potassium metabisulphite the preserved juice is allowed to stand for atleast 10-15 days. Within this period suspended matter settles down and the supernatant is siphoned and used in cordial making by addind sugar, water, potassium metabisulphate and vanilla or rose essence.
- 7) **Jam:** Litchi jam is prepared from the fruit pulp. The pulp is heated with 1/4<sup>th</sup> quantity of water till it becomes soft and then is cooked with 3/4<sup>th</sup> quantity of sugar. When cooking temperature reaches to 102<sup>0</sup>C, citric acid @2g per kg is mixed with a little amount of water and is added. The cooking is stoped when the temperature reaches 106<sup>0</sup>C and sodium benzoate is @ 0.02% dissolved in little amount of water and is mixed with jam. The jam is transferred to a glass jar is layered with molten paraffin.

- 8) Litchi wine:** A quality litchi wine (a fermented beverage) with about 11% alcohol of typical rosy flavour and high nutritional value can be prepared by adjusting the fermentation process of the juice by using wine yeast (*Saccharomyces cerevisiae var. bayanus*). Litchi is very suitable for wine production as it is a distinctly delicious, aromatic fruit having a good source of minerals and vitamins. The fruit contains 27% reducing sugars, 0.5% acidity and its TSS is of about 20<sup>0</sup> brix.
- 9) Litchi nuts:** It is a dried product of litchi which is canned in syrup. The fruits are washed and dried followed by sulphur dioxide treatment to obtain good color. The fruits are then washed and dried in sun, with time to time turning so that an even colour is maintained, until the pulp contains 30% of its initial water content. For the first 2 hours the fruits are dried in shade to reduce the risk of skin cracking.