

Review Article

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## Status of Litchi Cultivation in India

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### ABSTRACT

Litchi is a popular subtropical fruit crop in India. It is the most delicious, juicy and nutritious fruit and mostly grown in Eastern India. Litchi cultivation is a source of livelihood security for a large population in litchi growing states as it provides both on-farm and off-farm employment. The world scenario of litchi cultivation reveals that India is the second-largest producer of litchi after China with a total acreage over 93,300 ha and a yearly output of over 568,200 t in 2016-17. However, with a productivity level of just 6.1 t ha<sup>-1</sup>, India lags behind several other litchi exporting countries. Litchi has particular climate and soil requirements, thus limiting its cultivation to a few states. Bihar is the leading litchi producing state followed by West Bengal, Jharkhand Assam and Chhattisgarh. Litchi varieties cultivated in India are highly diverse due to different climate and soil conditions. Major varieties are Shahi, China, Elaichi, Rose Scented, Bedana and Bombay. Litchi cultivation provides food, nutrition, employment opportunity, generate income, improve the socio-economic condition and poverty alleviation in rural areas of the different states of India. This paper discusses trends of litchi cultivation in major litchi growing states, commercially grown cultivars, their marketing and export potential in India.

#### Keywords

Litchi, Litchi cultivation, Major variety, Export, India

#### Article Info

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### Introduction

The Litchi (*Litchi chinensis* Sonn.) belongs to the Sapindaceae family and well known as the 'Queen of fruits'. Litchi was originated in near South China and North Vietnam in the year 1500 BC but has now spread to different countries. Globally, South-East Asian countries including China, India, Vietnam and Thailand are the largest producers of litchi,

but the fruit is also famous in Africa (South Africa and Madagascar), Australia, Indonesia, Spain, USA, Mexico, and Israel (Menzel, 2000; Rajwanshi *et al.*, 2017). The fruit was introduced in India about 100 years later through Burma, from which it has spread to other parts of the tropical and subtropical areas of the country (Ghosh, 2000). Litchi crop is very specific to the climate requirement; probably because of this reason,

its commercial cultivation is limited to few tropical and subtropical countries.

India is the 2<sup>nd</sup> largest producer of litchi in the world after China. It is one of the most famous fruit crops and mostly cultivated in the Eastern part of the country. In India, 568,200 metric tons of litchis are produced annually from 93,300 hectares (Anonymous, 2018). The average productivity of litchi in the country is 6.1 t ha<sup>-1</sup> in 2016-17, which is much lower than the potential productivity of the crop. The main reasons for low productivity are poor fruit setting/ retention in hot, dry spring and biennial bearing due to poor nutrient management (Menzel and Simpson, 1990). Litchi being specific to the climatic requirement, it is restricted to only a few states with 66% of the total production of the country is recorded in Bihar, West Bengal and Jharkhand. Litchi crop mainly helps small and marginal farmers to get some additional income from their homesteads. Litchi cultivation is livelihood security for a large population in the litchi growing states as it offers both on-farm and off-farm employment opportunity. In the present study, the status of litchi cultivation in India has been reviewed.

### **The trends in litchi cultivation**

In India, there has been a significant increase in area and production of litchi during the last three decades. The trend reveals that the area under litchi cultivation is expanding every year from 49,300 hectares in 1991-92 to 93,300 hectares in 2016-17 (Figure 1). Total production of litchi also boosted from 243,800 to 568,200 metric tons in the same time period. However, the productivity of litchi is stagnant about 6.1 t ha<sup>-1</sup>. The statistical analysis of time series data on area, production and productivity were done using SAS 9.3. The Augmented Dickey-Fuller Unit Root test was applied for detecting a trend in litchi cultivation using ARIMA procedure in

SAS 9.3, and the result is presented in Table 1.

The null hypothesis of this test was that the time series exhibits non-stationarity against the alternative of stationarity. Here, we had no evidence to reject the null hypothesis in case of area and production as p-value in these cases were > 0.05 at lag 1 and 2 both. Thus, there was a significant trend in area and production of litchi. However, the p-value for productivity was < 0.05, indicating that there was no trend in the productivity of litchi. Also, the same can be seen from the trends in the area, production and productivity in Figure 1.

### **The nutritional value and products of litchi**

The food value of litchi fruit lies in its sugar content which changes based on the varieties. Depending upon its variety and climatic condition, litchi contains 60% juice, 19% seed, 13% skin and 8% rag (Nath *et al.*, 2016). Litchi is a very good source of minerals, several vitamins and healthy antioxidant which helps in protection from harmful free radicals. The nutritive values of litchi fruit per 100 gm are shown in Table 2. Litchi is highly perishable fruit and several values added products are made from litchi. Litchi squash is a highly flavoured concentrated drink prepared from litchi pulp. Litchi nut is a dried litchi fruit, a very popular litchi product among Chinese. Several other products such as dehydrated litchi pulp, canned litchi, wine, juice, pickle, jelly, ice-cream and preserves are also prepared from litchi fruit.

### **Major litchi growing states**

Litchi is commercially grown in the eastern part of India such as Bihar, West Bengal, Jharkhand, Uttarakhand, and Uttar Pradesh. The crop is also gaining popularity in Punjab,

Himachal Pradesh, Jammu and Kashmir, Arunachal Pradesh, Tripura, Karnataka and Tamil Nadu because of its high profitability and better export potential (Pandey and Sharma, 1989; Cebeco, 2001). The major litchi growing states of the country are shown in Figure 2. Litchi could not freely spread like other fruit crops because of its specific climate and soil requirement. It requires warm subtropics climate, short dry, frost-free winters and long hot summers along with high rainfall and humidity (Mitra and Pathak, 2008). The soil should be a well-drained loamy soil, rich in organic matter and having 5 to 7 pH range. The area, production, and productivity of litchi in the major litchi growing states from 2011-12 to 2013-14 are shown in Figure 3.

The percentage of area and production of litchi in different states from the year 2011-12 to 2013-14 is shown in Table 3. It is evident that Bihar is the leading state in litchi production (40%) followed by West Bengal (16%), Jharkhand (10%), Assam (8.2%), Chhattisgarh (6.4), Uttarakhand (5.2%), Punjab (4.8%), Orissa (3.5%) and Tripura (3.4%) in 2013-14. Also, the state-wise value of the output of litchi is presented in Table 4.

The concentrated pockets of litchi in different states of India have been shown in Table 5. Bihar produces about 40% of total production and occupies about 37.4% of the area under litchi cultivation of India. In Bihar, litchi is mainly cultivated in Muzaffarpur, Vaishali, Darbhanga, Samastipur, Sitamarhi, West Champaran and East Champaran districts. Total litchi production in Bihar is about 234,200 tonnes from 31,480 hectare area under production with the productivity of 7.4 t ha<sup>-1</sup>, which is higher over the national productivity.

Litchi varieties cultivated in the country are highly variable due to different climatic and

soil conditions (Singh and Babita, 2002). The state-wise popular variety of litchi is demonstrated in Table 6. Cv. Shahi is the most popular and best variety of Indian litchi because of its delicate aroma and flavour. Cv. China is the second most popular variety of litchi. Litchi farmers are more interested in making new orchards of cv. China, because it gives high productivity and more profitability. Cv. Shahi is the early variety, harvested between 15 May to 31 May, while cv. China is considered as the late variety. Other major varieties are Rose scented, Bombai, Elaichi, Dehradun, Bedana, Late large red, Late seedless, Calcuttia, Purbi etc.

The characteristics of the most common varieties of litchi cultivated in India are shown in Table 7. In West Bengal, Ghosh *et al.*, (2000) found that cv. Bombai is the most common commercial variety, whereas cv. Bedana is superior in terms of quality with high pulp recovery and shrivelled seeds. Cv. Early Large Red is the earliest variety and matures in the first week of May. In Tripura, Das (2013) studied the climatic condition of state with respect to the number of fruits per plants, time of maturity, bearing habit, and quality parameters of litchi crops. Cv. Shahi, cv.Swarna Roopa, cv. Muzaffarpur, cv.Late Bedana and cv. Bombai was found excellent in performance. However, cv. Shahi showed good performance in all the aspects such as flavour, taste, aroma and other quality parameters with excellent market demand.

### **Arrival pattern in market and consumption**

India is gifted with unique ripening pattern of litchi, with harvesting period differs from state to state. The ripening of fruit commences from north-eastern part to the central part and then North to South India. The arrival time of litchi in the market of leading states of India is shown in Table 8.

Litchi fruits are primarily consumed afresh. In litchi, the whole tree is normally harvested at one go and its shelf life is very short, i.e. 4–6 days at room temperature (Vijayanand *et al.*, 2010). The fruits rapidly deteriorate its bright colouration and flavour within a few days; these make its transportation to distant market an uphill task. Several efforts to maintain its quality even for 7-10 days have not been successful leading to severe wastage and often causing a glut in the market and a large proportion of litchi fruits is rotting in India. However, in other countries, several other value-added products of litchi are popular. In China, dried nut (a dried litchi fruit) is very popular and exported to several countries on a large scale. Flavoured squash, dehydrated litchi pulp, canned litchi, juice, frozen fruits are some of the modes of preservation and consumption, which helps to avoid market glut and prevent rotting of litchi fruits. Frozen litchi fruits maintain its quality and flavour, if it is freshly harvested, rapidly cooled and kept at -25 °C at which it remains in a good state for 1 year (Morevil, 1973). Litchi pulp can be stored for a longer period if it is heated to 85 °C and added with 500 ppm SO<sub>2</sub> and 1% citric acid. The fruit can be stored for 6 months at 25–35 °C and 1 year at 4–5 °C (Sethi, 1985).

### **Litchi markets of the country**

Litchi fruit is a temperature-sensitive; its access to the distant market is constrained due to unavailability of transportation with cool chain facilities. It is essential for the product to reach distant market locations within 24-36 hours after harvesting to retain its desired flavour and colour at ambient temperature. The current litchi supply chains from the production location to the final consumers outside the state market often take more than 24-36 hours. Hence, goods refrigerated trucks and cold storage chain facilities are necessary for targeting distant markets while fruit

requires processing to increase its shelf life for export markets. Litchi markets can be broadly classified into three different categories: domestic, national and export market. According to the survey estimates in Bihar, about 80% of the total litchi produced in the state is being exported to the other states out of which the major markets are Delhi, Varanasi, Lucknow, Mumbai, Kanpur, Kolkata Chandigarh and Bangalore (Anonymous, 2010). The price of litchi (Rs/ Qtl.) and quantity of litchi arrival (MT) in the major markets are shown in Table 9. The average wholesale price and the annual arrival of litchi in the major market of litchi are shown in Figure 4. It indicates that Delhi as the highest-selling market, followed by Patna, Kolkata and Lucknow.

### **Exports potential**

Currently, Indian litchi is exported mainly to UAE, Nepal, Thailand, France, Saudi Arabia, Canada and several other countries. The Agricultural and Processed Food Products Export Development Authority (APEDA) and the National Agency for Export Development (NAFED) are the major export promoters of litchi fruits in the country (APEDA, 2017). The demand of litchi fruits from the USA, Arab nations, Europe and different other countries are increasing day by day. However, minimal effort has been made to capture the litchi world market from China, the leading exporter of litchi. The quantity and value for the export of litchi to different countries are shown in Table 10.

In conclusion, litchi is a climate and soil specific fruit plant, introduced in India in the 18<sup>th</sup> Century has well adapted to the climate of Eastern India and a very good source of minerals, vitamins and healthy antioxidant. Due to its increasing demand and profitability, the area under cultivation and production has increased manifold in the last

three decades. However, the lower productivity, poor nutrient management, biennial bearing of fruits, low shelf life and lack of cold chain transport and cold storage facility are the major constraints with litchi cultivation among all varieties of litchi in India, Cv. Shahi is the most popular and best variety in all aspects such as flavour, taste,

aroma with excellent market demand. Unique ripening pattern in a different part of the country makes litchi available for longer duration in the Indian market. APEDA and NAFED are promoting the export of litchi to the other country, but more effort need to be made to capture some part of the litchi world market.

**Table.1** Detection of trend in area, production and productivity of litchi

	<i>p</i> value	
	Lag 1	Lag 2
Area	0.0877	0.7772
Production	0.0982	0.1723
Productivity	0.0390	0.0010

**Table.2** Nutritive value of aril of litchi fruit per 100 g

Constituents	Fresh aril (per 100 g)	Dried aril
Calories	63-64	277
Moisture	81-85 %	17.99-22.3 %
Protein	0.68-1.0 g	2.9-3.8 g
Fat	0.30-.58 g	0.2-1.2 g
Carbohydrate	13.31-16.40 g	70.7-77.5 g
Fibre	0.23-0.40 g	1.4 g
Ash	0.37-0.50 g	1.5-2 g
Calcium	8-10 mg	33 mg
Phosphorus	30-42 mg	-
Iron	0.40 mg	1.7 mg
Sodium	3 mg	3 mg
Potassium	170 mg	1100 mg
Thiamine	28 mg	-
Nicotinic acid	0.40 mg	-
Riboflavin	0.05 mg	0.05
TSS ( °Brix)	18-22	NA
Ascorbic acid	24-60 mg	42 mg

Source: Singh *et al.*, (2012).

**Table.3** Percentage of area and production of litchi in different states

State	2011-12		2012-13		2013-14	
	% Area	% Production	% Area	% Production	% Area	% Production
Bihar	38.7	43.9	37.8	44.2	37.4	40
West Bengal	11.1	15.9	11.1	15.5	11	16
Jharkhand	6	10.7	6.4	10	6.3	10
Assam	6.6	7.7	6.8	8.6	6.4	8.2
Chhattisgarh	5.6	5	6	5.3	6.4	6.4
Uttarakhand	11.8	3.5	11.5	3.3	11.2	5.2
Punjab	2.1	4.6	2.1	4.6	2.2	4.8
Odisha	5.6	3.7	5.4	3.5	5.3	3.5
Tripura	4	3.1	4.2	3.1	4.6	3.4
Others	8.6	1.9	8.7	1.9	9.2	2.4

**Table.4** State wise value of output of litchi in Rs. Lakhs

S. No.	State/U.Ts	(AT CURRENT PRICES)			(AT 2011-12 PRICES)		
		2011-12	2012-13	2013-14	2011-12	2012-13	2013-14
1	Arunachal Pradesh	427	503	603	427	427	427
2	Assam	11544	15097	14744	11544	13808	13374
3	Bihar	84745	92817	84771	84745	91925	83956
4	Chhattisgarh	7225	10526	11731	7225	8235	10032
5	Haryana	266	872	1646	266	727	1219
6	Himachal Pradesh	1227	1600	1794	1227	1252	1339
7	Jammu & Kashmir	685	243	244	685	190	208
8	Jharkhand	20613	21077	21079	20613	20874	20876
9	Mizoram	326	340	381	326	326	332
10	Nagaland	38	480	837	38	450	725
11	Odisha	10667	13744	13386	10667	10752	10784
12	Punjab	9655	10451	11179	9655	10451	11036
13	Tripura	4076	4839	6429	4076	4412	4955
14	Uttar Pradesh	493	567	763	493	559	696
15	Uttarakhand	9895	11607	15991	9895	9978	15991
16	West Bengal	61836	67734	57031	61836	65243	68070
17	Chandigarh	23	29	0	23	23	0
	Total	223739	252526	242609	223739	239633	244020

Source: Horticultural Statistics at a Glance 2017

**Table.5** Major litchi producing belts in India

States	Districts
Assam	Dibrugarh, Goalpara, Sonitpur, Lakhimpur, Jorhat, Golaghat, Kamrup, Nalbari, Barpeta, Bongaigaon, Nagaon
Bihar	Muzaffarpur, Vaishali, East Champaran, West Champaran, Sitamarhi, Sheohar, Samastipur, Bhagalpur
Chhattisgarh	Korba, Raigarh, Surguja, Jashpur, Surajpur, Balrampur, Koriya, Narayanpur
Himachal Pradesh	Kangra (Palampur, Panchrukhi, Dharmshala), Sirmour (Paonta Sahib, Dhaula kuan)
Jammu & Kashmir	Jammu, Samba, Kathua, Udhampur, Reasi
Jharkhand	Ramgarh, Ranchi, Hazaribagh, Gumla
Madhya Pradesh	Shahdol, Sidhi, Madla, Dindori
Manipur	Imphal West, Bishnupur, Imphal East, Thoubal, Churachandpur, Chandel
Meghalaya	East Khasi Hills, Ri-bhoi, Garo Hills
Nagaland	Kohima, Wokha, Mokokchung, Tuensang, Zunheboto, Phek, Kiphire, Longleng, Mon, Dimapur, Peren
Odisha	Sambalpur, Debagarh (Deogarh), Sundergarh, Rayagada, Koraput
Punjab	Gurdaspur, Hoshiarpur, Ropar
Sikkim	North Sikkim (Phidang), East Sikkim (Majhitar, Bhasmey, Rorathang, Makha, Ralep, Mulukey), South Sikkim (Kitam, Pakzor, Chalamthamthang, Kichudumra), West Sikkim (Sagbari, Kamling)
Tamil Nadu	Tiruvarur, Vellore, Vilupuram
Uttar Pradesh	Saharanpur, Muzaffarnagar, Kushinagar
Uttarakhand	Nainital, Udham Singh Nagar, Haridwar, Dehradun, Almora
West Bengal	Malda, Murshidabad, 24 Parganas (North & South), Uttar Dinajpore, Cooch Behar

**Table.6** Major litchi producing states and variety cultivated

States	Recommended cultivars
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	Bombai, Bedana, Ellaichi, China, Late large Red, Purbi, Early large Red
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
Tripura	Shahi, Mazaffarpur, Swarna Roopa, Bombai, Late Bedana



**Table.7** Characteristics of commercially grown litchi cultivars in eastern India

Variety	Characteristics
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. weight: 20-25 g, T.S.S.: 19-22° brix
China	Late maturing, oblong to conical shaped fruit with dark pink colour skin, weight: 20-25 g, aril sweet juicy aroma with excellent quality, heavy yielder, resistant to fruit cracking and sun burning
Early Bedana	Oval or heart shaped, colour: uranium green with carmined tubercles at maturity, fruit size: medium, weight: 15-18 g. with T.S.S.: 17.2-19.8° brix
Late Bedana	Conical in shape, colour: 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, shape : oval to round with deep red skin colour, weight 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

**Table.8** The arrival pattern of litchi in leading states

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

**Table.9** Monthly average wholesale price (in Rs/ Qtl.) & total arrival of litchi in 2014

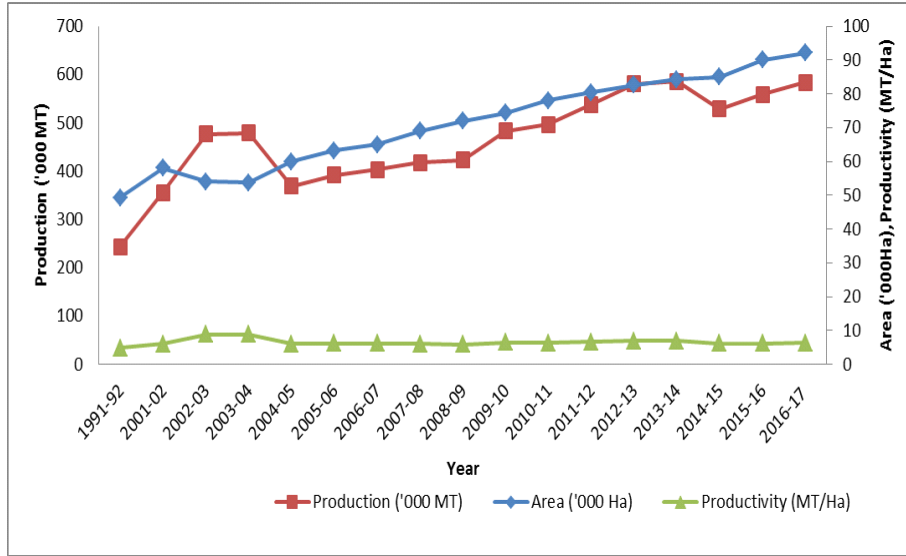
Market	May		June		July		August		November		Annual	
	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival	Price	Arrival
Amritsar	0	0	4646	291	0	0	0	0	0	0	4646	291
Bhubaneswar	10417	17	9722	21	0	0	0	0	0	0	10070	38
Chandigarh	4605	165	4910	446	5131	203	0	0	0	0	4882	814
Dehradun	0	0	4956	265	6821	11	0	0	0	0	5889	276
Delhi	8542	1811	7475	5919	7748	1273	0	0	0	0	7922	9003
Gangatok	0	0	7120	32	0	0	0	0	0	0	7120	32
Guwahati	3160	259	5062	283	0	0	0	0	0	0	4111	542
Jaipur	7578	316	6241	376	0	0	0	0	0	0	6910	692
Jammu	0	0	7967	206	6381	556	6000	7	0	0	6783	769
Kolkata	5443	540	4411	762	0	0	0	0	0	0	4927	1302
Lucknow	5739	302	4536	974	0	0	0	0	0	0	5138	1276
Mumbai	0	0	0	0	0	0	0	0	1350	160	1350	160
Patna	3325	202	4112	1769	0	0	0	0	0	0	3719	1971
Raipur	8400	271	7875	100	0	0	0	0	0	0	8138	371
Ranchi	4460	136	3925	235	0	0	0	0	0	0	4193	371
Shimla	0	0	6092	38	7275	45	0	0	0	0	6684	83

**Table.10** Export of Litchi from India - Country Wise

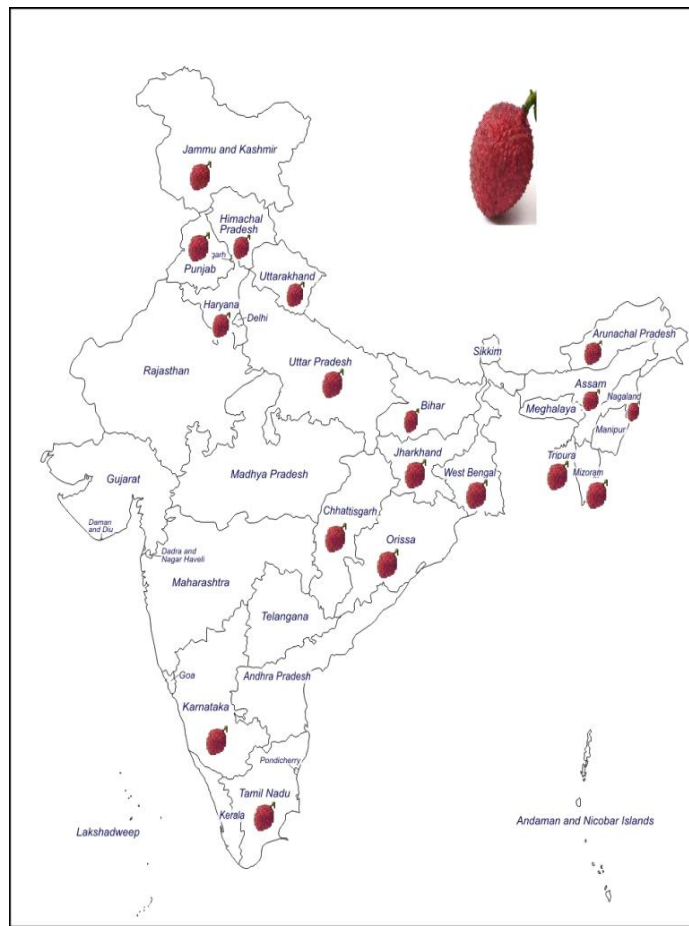
Country	2014-15		2015-16		2016-17	
	Qty (MT)	Rs. Lacs	Qty (MT)	Rs. Lacs	Qty (MT)	Rs. Lacs
United Arab Emirates	0.03	0.01	0.03	0.02	20.37	52.68
Nepal	44.6	17.73	9.4	3.84	53.96	30.77
Thailand	0	0	0	0	50	20.93
France	0	0	0	0	0.46	1.2
Kuwait	0.09	0.09	0.12	0.3	0.33	0.46
Canada	0	0	0	0	0.2	0.18
Qatar	0	0	0	0	0.05	0.06
Bangladesh	915	163.8	0	0	0	0
United Kingdom	0.08	0.2	0	0	0	0
Bahrain	0	0	0.2	0.16	0	0
Others	1.63	33.35	0.12	0.05	0	0
Total	961.43	215.18	9.87	4.37	125.37	106.28

Source: Horticultural Statistics at a Glance 2017

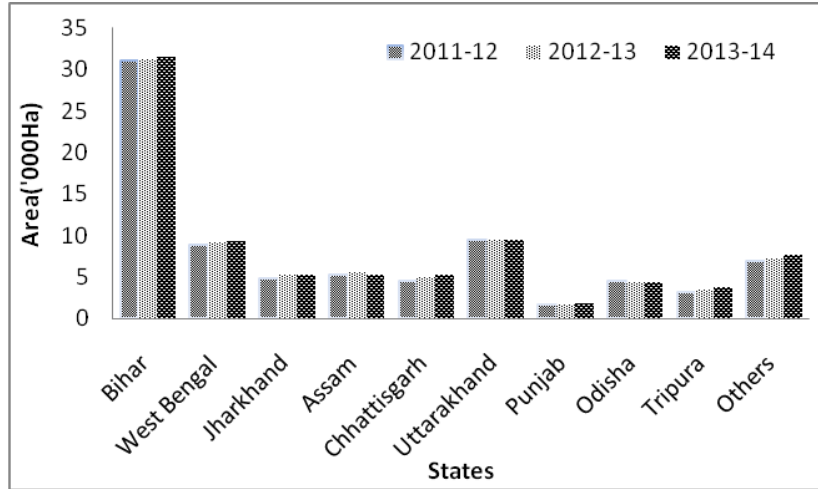
**Figure.1** Trend of area, production and productivity of litchi in India



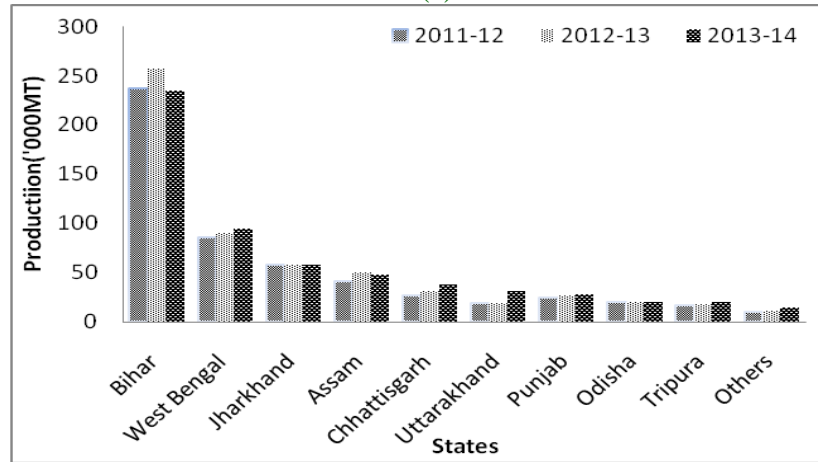
**Figure.2** Major litchi producing states of India



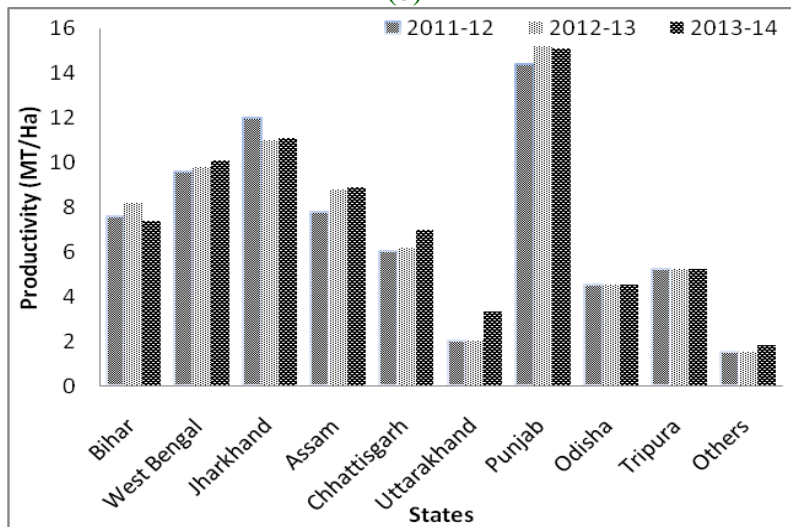
**Figure.3** State wise (a) area (b) production and (c) productivity of litchi



(a)

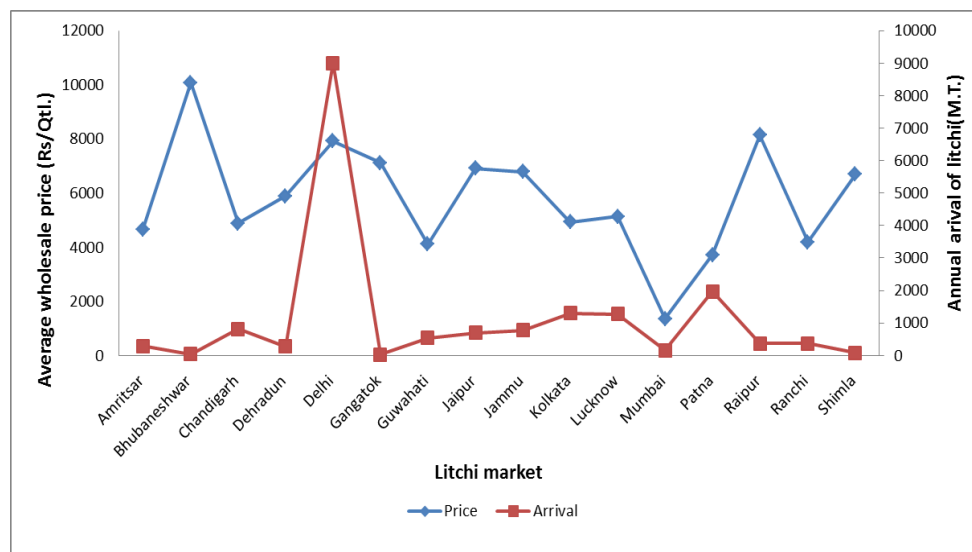


(b)



(c)

Figure.4 Average wholesale price and annual arrival of litchi in major market of litchi



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