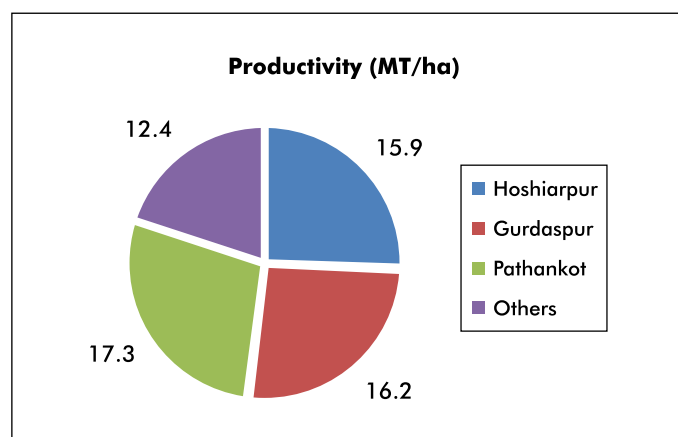


Prospects of litchi cultivation in Punjab

The scenario of litchi cultivation in the sub-mountainous regions of north India has been discussed in this article. Litchi based cropping system is generating direct and indirect employment opportunities. Above all, strategies to enhance the fruit productivity with the adoption of interventions like leaf analysis, choice of intercrops, INM, insect-pests and diseases management, post-harvest management, etc. have also been highlighted.

LITCHI, botanically known as *Litchi chinensis* Sonn, is widely grown under tropical and warm sub-tropical climatic conditions. It prefers cool, frost free winters and summers with high humidity and rainfall. In Punjab, litchi farmers are earning lucrative returns due to availability of fruits at the fag end of the season from mid to end of June in contrast to other litchi growing states of India. Litchi was introduced in Punjab by Justice D K Mahajan during 1920 at Pathankot. Initially, the acreage under litchi was increased at slow pace. However, litchi cultivation has gained momentum in Punjab after the end of 20th century. Presently, Punjab occupies an area of about 3142 ha with the production of 51504 MT and productivity of 16.4 MT/ha. The major litchi growing districts of Punjab are Pathankot, Hoshiarpur and Gurdaspur and these districts are contributing nearly 57.4, 14.3 and 13.9% respectively of the total area in the state. The crop is also grown in some pockets of Rupnagar, SBS Nagar, Union territory of Chandigarh, Patiala and Mohali districts. Litchi productivity is the highest at the national level among the other litchi growing states. Dehradun and Calcuttia are the leading cultivars of litchi in these zones; however, seedless cultivar due to its chicken tongue seed is also preferred but, only a few plants are found in some orchards or in the kitchen garden.



Litchi productivity in Punjab

Niche area

Litchi cultivation is a main source of livelihood and nutrition security for many, especially in the sub-mountainous zone of north India. Pathankot, Gurdaspur and Hoshiarpur districts situated in sub-mountainous region contributing nearly 85.6% to the total area under litchi in the state is known for litchi cultivation due to availability of conducive environment conditions. These districts are situated near the water bodies viz. network of canals, including Beas, Ravi and *Chakki* rivers; and seasonal rivulets which help in maintaining optimum micro climatic conditions for the development of better pericarp colour, fruit size and quality parameters.

Litchi Estate' at Pathankot has been established by the Government of Punjab to improve the quality and productivity in the pockets of sub-mountainous area of the state. It also provides farm machinery and hi-tech equipments, viz. digger, tractor, spray pump, rotavator, power tiller, pruner, etc. on custom hiring basis and also insecticides and fungicides on subsidized rates. Approximately 300 farmers are registered under litchi estate and availing these facilities. The State Horticulture Mission, Government of Punjab also provides subsidy to farmers for raising new litchi orchards, rejuvenation of old senile plantation, establishment of drip system, pack houses, purchase of machinery, etc.

Punjab Agricultural University (Department of Fruit Science and Krishi Vigyan Kendras) in collaboration with Department of Horticulture (Punjab) are organizing field days, technical lectures, seminars, meetings, demonstrations, awareness camps and farmer's scientist interface, etc. to provide an impetus for the litchi cultivation.

Krishi Vigyan Kendra (Gho) Pathankot and Department of Fruit Science, PAU, Ludhiana have prepared an action plan for rejuvenation and canopy management of old senile orchards of litchi in the region. Various OFT's on nutrition, bagging of litchi, fruit drop, leaf sampling technique, intercropping, canopy management and post-harvest management have also been executed and planned.

Table 1. Area, production and productivity of litchi in Punjab

Year	Area (ha)	Production (MT)	Productivity (MT/ha)
2010-11	1628	23881	14.7
2011-12	1672	24682	14.7
2012-13	1752	26520	15.1
2013-14	1848	28003	15.2
2014-15	1988	32108	16.2
2015-16	2152	34882	16.2
2016-17	2320	37637	16.2
2017-18	2708	43958	16.2
2018-19	2885	46940	16.3
2019-20	3057	50091	16.4
2020-21	3142	51504	16.4

Nursery production

Litchi plants are successfully propagated through air layering (also known as *Gootee*) technique. Under north India conditions, air layering is performed during mid-July to September. The air layers are prepared on previous season's terminal growth which is about 45-60 cm long and has thickness of 1.0-1.25 cm. A bark ring of 4 cm thickness is completely removed along with cambium from the middle of selected shoots with a sharp knife to prevent downward flow of carbohydrates and photosynthates through the girdling site. The wood portion of the shoot (xylem) should remain undisturbed so that water and mineral nutrients flow uninterrupted to the upper leaves. The shoots selected for this purpose should not be directly exposed to sun. It has been noted that the shoots facing north-eastern and north-western aspect of the tree canopy produce higher number of roots on the girdled portion. The sphagnum moss grass holds moisture for a long time so it is placed around the cut portion and wrapped with polythene strip. The ends should be tied tightly with string to prevent drying of moss grass. After a few weeks, roots start emerging from the growing points formed by the cambium at the upper end of the ringed portion and are easily visible through polythene sheet.

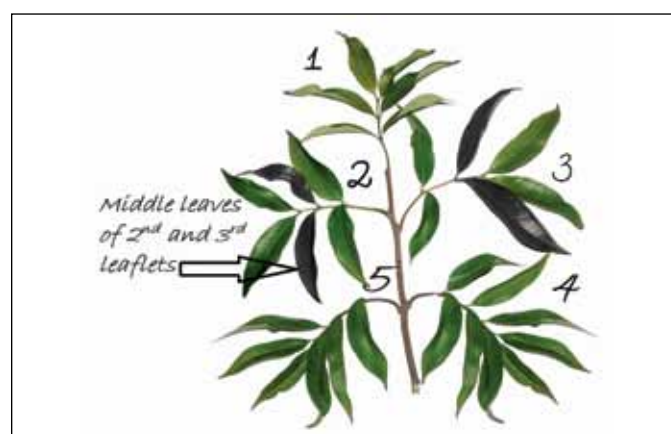
Gootee or marcot should be cut from the mother tree just below the rooted portion, when a good number of roots are developed. These should be dipped in water and kept under shade. Nursery beds should be prepared under partial shade. The excessive number of leaves and polythene covering around the rooted portion should be gently removed. Marcot should be transplanted in pre-prepared holes slightly bigger in size than the rooted portion. The space around the marcot should be filled with fine soil and gently pressed to avoid injury to tender roots. These rooted layers should be kept in the nursery for at least two years before transplanting in the field so that they develop sufficient root system.

The soil in pit for litchi plantation should be mixed with soil collected from the root zone of litchi orchards

as it contains *Mycorrhizae* fungus which helps in the improvement of nutrients uptake and root development.

Nutrition management

Integrated nutrient management is important for proper vegetative growth and fruit yield, which can be applied by assessing the nutrient status of soil and plant. Leaf samples from the mid-portion of 4-5 months old leaves of autumn flush should be collected at the advent of panicle initiation, i.e. during February-March from IInd and IIIrd pair of leaflets (from terminal apex to downwards). Litchi fruit production and quality will be improved if fertilizers are applied on the basis of soil and leaf analysis. To prevent the adverse effects of nutrient deficiency in the plant, fertilizer is applied as per PAU recommendations:



Leaf sampling technique in litchi

Table 2. PAU recommendations for fertilizer application

Plant age (Years)	FYM (kg/plant)	Fertilizers (g/plant)		
		Urea	Superphosphate	Muriate of Potash
1-3	10-20	150-500	200-600	60-150
4-6	25-40	500-1000	750-1250	200-300
7-10	40-50	1000-1500	1500-2000	300-500
Above 10	60	1600	2250	600

The proper fertilizer schedule needs to be followed, starting with the plantation of the litchi in the orchard. The whole of FYM, single super phosphate and muriate of potash should be applied in December. Whereas, urea should be applied in two equal splits, i.e. half dose in the middle of February and the other half in the mid-April after fruit set. The progressive farmers are applying urea (0.5 to 1.5 kg/tree) after fruit harvest to promote vegetative growth.

Canopy management

The best time to perform rejuvenation of old senile orchards is August-September. For reiterative pruning, tree is headed back up to primary limbs, i.e. about 1.5-2.5 m above the ground level with the help of pruning saw by taking full care that the cut is sharp and uniform. Bordeaux mixture is applied on cut end portion to avoid fungal diseases. The newly emerged shoots are kept well-spaced. The trees start emerging shoots within 25-30 days



Demonstration on canopy management in litchi

after rejuvenation and have a tendency of producing large number of sprouts after the operation which should be thinned out carefully by keeping about 4-5 branches on each pruned limb. Pruning is followed by application of recommended doses of fertilizers and light irrigation. The commercial bearing starts after 3-4 years from heading back operations.

Intercropping

Litchi tree has long juvenile period and therefore, additional income can be generated by growing intercrops between the rows in the orchard. Tall and exhaustive crops like cotton, bhindi, barseem, chari, maize, bajra, sugarcane, potato and creeper type vegetables should be avoided. Ploughing with disc harrow cultivators, tillers, etc. causes root injury and spread of root fungal diseases. Some orchardists plant plum, peach, kinnow and guava as filler crop and often hesitate to uproot them even after the main litchi orchard comes into bearing. In such orchards, litchi plants become compact, put forth very little vegetative growth and develop poor lateral branches.

Filler plants should be removed as soon they start interfering with the main crop. In young and non-bearing orchards, PAU has recommended various intercrops like moong, mash, toria, wheat, peas, gram and senji. Emphasis should be given to select legume field crops since they fix atmospheric nitrogen through symbiotic bacteria in their nodules for the mutual benefit of both plant and



Damage to root system due to excessive irrigation

soil. Intercrops or fillers should be provided with separate irrigation, fertilization, intercultural practices, etc. on the basis of given recommendations.

Fruit bagging

Punjab Agricultural University and AICRP (Fruits) recommends covering of litchi fruit bunches with white or pink non-woven polypropylene bags after 25-30 days of fruit set. This eco-friendly technology enhances fruit quality, improves pericarp colour development and also reduces fruit cracking and incidence of litchi nut borer.



Fruit bagging in Litchi

Irrigation

During pre-bearing stage, orchards are irrigated at weekly/fortnightly intervals. In bearing orchards, irrigation should be avoided in winters as water stress inhibits winter flushing and also promotes flowering in the coming season. But light irrigation may be applied during end-November or first week of December, depending upon rains, age of the orchard and soil moisture conditions just to provide protection against frost injury. Later on, regular irrigations should be initiated in bearing orchards with the advent of fruit set stage. It is advised that excessive irrigation should be strictly avoided as it leads to damage of roots thus causing decline and drying of trees. PAU has recommended that irrigation should be applied twice in a week during critical fruit development stages i.e. from IInd week of May to end-June to reduce fruit cracking and for proper size development.

Harvesting

Litchi is a non-climacteric fruit and harvesting is usually done on the basis of visual appearance and eating quality. Pericarp of red colour, flattening of tubercles, fruit size and optimum TSS/acid ratio is the most reliable maturity index to determine litchi fruit maturity. In Punjab, harvesting of Dehradun cultivar is initiated in the second week of June while, Calcuttia and Seedless Late cultivars are harvested during third week of June. These cultivars generally take 55 to 65 days from full bloom to maturity. Fruits are harvested in bunches. A whole panicle is removed with clippers/secateur along with few leaves. Fruits should not be pulled to avoid any peel injury.

Precooling

This technique is used to remove field heat of litchi fruits and checks rate of respiration, retards pericarp browning, extends storage life and market profit. Hydro-cooling, forced air cooling, evaporative cooling, etc methods are used for precooling.

Grading and packaging

Litchi fruits are graded and marketed on the basis of fruit weight and pericarp colour. Generally, the litchi fruits of 25-30 g are preferred by consumers. The different grades of litchi suggested by Directorate of Marketing and Inspection (DMI) based on the Equatorial Fruit Diameter (mm) are *Extra class* (33 mm), *Class I* (28 mm) and *Class II* (23 mm).

In the conventional marketing system, fruits are packed in jute sacks (*Palli*) or gunny bags, wooden boxes that deteriorates the fruit quality and affects the shelf life. PAU has recommended corrugated fiber board boxes of 2, 4 and 10 kg capacities and strength of 3-5 ply (designed by Punjab Horticultural Postharvest Technology Center (PHPTC)) for commercial marketing of litchi. The fruits packed in CFB boxes retain visual appearance, keeping quality and marketability. The transportation losses are also minimized with the packing of litchi fruits.

Table 3. Specifications of packing boxes of litchi

Capacity of box (kg)	Dimension of box (mm)
2 Kg	340 mm × 220 mm × 100 mm
4 Kg	340 mm × 220 mm × 190 mm
8-10 Kg	420 mm × 235 mm × 210 mm

Storage

Litchi is a highly perishable fruit and the major challenge after fruit harvest is to maintain the red pericarp colour and to prevent browning due to the degradation of anthocyanin caused by polyphenol oxidase (PPO)/ or peroxidase (POD) and enzymatic oxidation of phenolic compounds. Therefore, harvested fruits should be stored at low temperature to enhance shelf life. It can be stored at 2-3°C and 90-95% relative humidity. The fruits can be stored at low temperature for 1-2 weeks depending upon maturity.

Marketing

Litchi fruit is available in market for a limited time period due to short harvesting window and poor shelf life. This often gives rise to market glut and distress sale. More than 80% fruits are commercially sold through a pre-harvest contractor to a wholesaler or commission agent, who manages the harvesting, packaging and transportation. Now-a-days, self-marketing is the best alternative for growers to improve the income, and price disparity at grower and consumer levels. Traders from other states are also approaching the litchi growers in the state during harvesting season for direct marketing. The farmers are advised to form the cooperative groups or farmer producer's organizations (FPO) and create postharvest facilities like pack house and storage infrastructure.

Plant protection

Litchi fruit nut borer is major insect pest that causes heavy economic losses to growers. Tree branches should be lightly pruned after harvesting to remove hibernating pupae and to promote vegetative growth.

Clean orchard floor management practices should be followed by removing fallen fruits (mummies) from the orchard and regular ploughing destroy the carryover of pests to the next crop. NRC for Litchi, Muzaffarpur (Bihar) recommends to spray Novaluron 10 EC (1.5 ml/ litre of water) or Flubendamide 39.35 SC (1 ml/5 litre of water) or Spinosad (1 ml/4 litre of water) for the effective control of insect-pests of litchi. The first spray should be done at clove fruit size stage. The second spray should be done 15 days after first spray (when fruit attains large cardamom size) and third spray at 10 days after second spray. Incidence of leaf blight and panicle blight should be controlled with spray of copper oxychloride (0.1%) or Thiophanate methyl (0.14%).

Strengths

- ICAR has established Litchi Networking and Voluntary Centre at MS Randhawa Fruit Research Station, Gangian (Hoshiarpur) under AICRP on Fruits for the refinement of technology in befitting manner for the Punjab state.
- Government of Punjab has established 'Litchi Estate' at Pathankot to boost litchi cultivation in the sub-mountain zone of Punjab.
- Litchi fruit in the state is available in the month of June and demand for the fruit in distant markets is more due to non-availability of fruits. The harvesting period in other litchi producing states is done from mid-April to 1st week of June; hence, fruit growers are getting higher remunerative returns.
- Litchi growing areas are situated at the distance of 100-200 km from Chandigarh International Airport, Mohali and Sri Guru Ram Dass Jee International Airport, Raja Sansi, Amritsar. Therefore, farmers of Punjab will earn foreign exchange from the export of quality litchi fruits to Gulf countries.
- GAP for litchi has been standardized by the PAU, AICRP on Fruits and; hence interventions are disseminated by Department of Fruit Science, Krishi Vigyan Kendras and Regional Research Stations of PAU.
- Incubation Centre at PAU is organizing various training programme for rural youth in the field of processing, packaging, preoperation of array of value added products.
- NHB/APEDA/MIDH is providing subsidy to farmers for the establishment of orchards, cold storage, pack houses, processing units, Referee vans, etc.
- Healthy litchi plants are being provided to the growers of Punjab and neighbouring states by MS Randhawa Fruit Research Station (Gangian), PAU-Regional Station Gurdaspur, and State Government Fruit Nurseries.

Thrust area

- Awareness camps and training programmes should be organized to promote the nutritional importance of horticultural crops and their contribution in doubling farmer's income.
- Sound infrastructure system for grading, packaging and processing must be developed.

- Regular power supply to the litchi orchards should be ensured during peak litchi season.

Farmer-Scientist interface

Such type of activities encourage the young farmers for developing interest in the horticultural fruit crops and interact with the experts to solve the problems being faced for their successful cultivation. Dr Vishal Nath, Former Director, ICAR-NRC for Litchi, Muzaffarpur (Bihar) and his team (Drs. Amrendra Singh, S D Pandey,



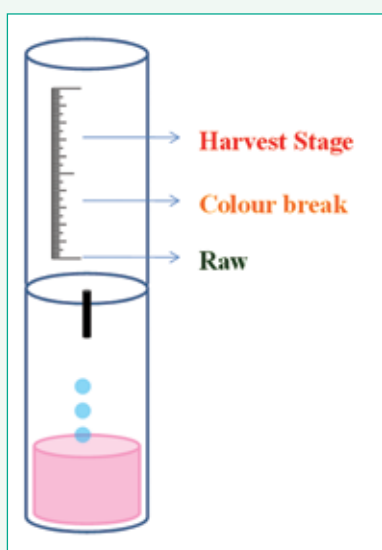
Farmer-scientist interface

Sanjay Kumar Singh, Kuldeep Srivastava and Evening Stone), and Dr B S Dhillon (Director, RRS Gurdaspur) also participated and interacted with the litchi growers of the state from time to time. Department of Fruit Science, PAU, Ludhiana in collaboration with KVK, Pathankot and Department of Horticulture, Punjab organized Litchi show-cum-Seminar at Pathankot. The main objective of this Litchi Show was to encourage the farmers to adopt latest technology, to increase litchi production and quality, so that they may get maximum return of their produce. More than 500 progressive fruit growers from Punjab, Himachal Pradesh and Jammu & Kashmir participated in the deliberations. Various departments of PAU, Self-help Groups and State departments also displayed their products and technologies. Fruit samples and the product made from litchi fruits were displayed for the competition. Winners were awarded with certificates and memento for quality fruit production.

For further information please write to:

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Development of a 'Litchi Maturity Kit' for judging optimum time of harvest



Diagrammatic representation of 'Litchi Maturity Kit'

A 'Litchi Maturity Kit', that provides an easy and handy option to accurately judge acidity of litchi fruit was developed. The kit is based on the established principle of neutralization of acids with a base (NaOH) using phenolphthalein as indicator. A reliable indicator of optimum fruit maturity is the attainment of 18–20°B TSS and acidity of less than 0.5%.

Source: ICAR Annual Report 2021-22

Girdling tool for litchi tree



In order to mechanize girdling, a selective wounding process that removes strips of bark of a litchi tree to increase fruit size and yield, a motorized girdling tool was developed. It mainly consists of a circular blade to cut the wood bark from the tree, safety cover to protect the operator from rotating blade, handle and a 12 V battery-operated motor. The time taken to complete one girdling (2–3 mm depth and 3–4 mm width) operation with the tool is 2–4 min as compared to 15 min with traditional knife. It was also demonstrated to litchi farmers in Muzaffarpur district for its popularization and adoption.

Source: ICAR Annual Report 2021-22