*Journal of Agricultural Development and Policy, 2018*
*Volume 28, No. 1, 64-73*

# Production and Marketing of Litchi in Punjab

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**Abstract**

*The study analyzed the cost-returns structure and economic viability of litchi cultivation in Punjab. A representative sample of 60 litchi growers was selected from four blocks of Pathankot and Hoshiarpur districts. The results of the study revealed that the expenditure incurred on planting costs had the largest share (42.31%) during the establishment of litchi orchards followed by land preparation. The annual operational/maintenance cost was low in the initial years, which then increased consistently during the subsequent years with the increase in the age of the orchard. Manures and fertilizers, inter-cultural operations, plant protection measures, pruning and training were the major components of operational cost. It was observed that net returns received by the litchi growers were quite high when they sold the produce themselves in the market rather selling through pre-harvest contractor. The benefit-cost ratio (BCR) greater than unity and Internal rate of return (IRR) greater than discount rate indicated that litchi cultivation was economically viable in the study area. The BCR and IRR were higher when litchi was sold directly by growers in the market rather selling to pre-harvest contractor. It was emphasised that due to highly perishable nature of litchi there is a need to develop storage facilities along with providing technical knowhow to litchi growers by concerned departments for getting remunerative returns as well as better management of litchi orchards.*

**Keywords**: *Costs, Economic viability, Returns, Benefit-cost ratio*

**JEL Classification:** *C83, Q12*

## Introduction

Litchi (*Litchi chinensis*) is an important sub-tropical evergreen fruit crop, which originated from China about 3000 years ago. India is the second largest litchi producing country with an area of 84.2 thousand hectare after China. In India, litchi reached from Myanmar and was firstly introduced in Bengal during 17$^{th}$century after it spread to other countries. The major litchi producing states are Bihar, West Bengal, Jharkhand and Assam which accounts for 64.2 per cent of the total production in the country. Area under litchi in Punjab during the year 2017-18 was 27 thousand hectares with a production of 43.96 thousand metric tons and its area is mostly located in Gurdaspur, Pathankot and Hoshiarpur districts (Anonymous, 2018). The mild climatic conditions and sufficient humidity in foothills of sub-mountainous region of Punjab are suitable for the production of litchi.

The market of litchi mainly depends upon the production scenario in the country. The

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quality depends upon infrastructure support, market information and cultivar codex. However, the supply chain from farm to the market is constrained by the timings, unavailability of cooling facilities to transport it to distant markets. The efforts to provide post-harvest marketing and management through research, by promoting production or development programmes, support the expansion of litchi market in the country. The litchi fruit adds to the country's total production of immense food over and above its nutritive value (Vishal, 2012).

In the domestic market, the crop is very popular and the demand for export is increasing particularly for dried, fresh and canned litchi fruits. In the world trade, India has negligible share. However, after meeting domestic demand, international markets can be a destination for export, promoting domestic production. With the introduction of new economic policy in the country, export process has been liberalized. Under this, many states and country is attempting to increase export. The attention of the government, planners, policy makers and farmers have been drawn for production, marketing and export of horticultural crops (Vishal, 2012). There is a need to explore more about profitability of litchi cultivation. Therefore, the combined study of litchi production scenario and marketing aspects will provide benefit to the producers, traders, consumers, extension workers and researchers for the betterment of litchi production and trade. Keeping in view the importance of litchi as an important fruit crop, the present study was undertaken to work-out cost-return analysis and marketing pattern of litchi for wider adaptation in the sub-mountainous region of Punjab.

## Data Sources and Methodology

In order to achieve stipulated objectives of the study, multistage sampling technique was used for the selection of districts and blocks. Firstly, two districts namely Pathankot and Hoshiarpur with the highest area under cultivation of litchi were purposively selected. Secondly, two blocks each from both of the selected districts with the highest area under litchi cultivation were chosen. For the selection of respondents, a complete list of litchi growers along with area under litchi orchards in selected villages was prepared and data were collected by personal interview method. A sample of 60 litchi growers was taken from the selected villages in both the districts. Apart from working out simple averages and percentages, discounted measures such as; benefit-cost ratio, net present value and internal rate of return along with undiscounted measures like annual rate of return was calculated to examine the economic viability of litchi orchards.

### Net present value

It is the sum of difference between cash outflows and cost inflows of a project which is discounted at the rate of 12 per cent per annum. Mathematically, it is written as under:

$$NPV = \sum_{t=1}^{n} \frac{(R_t - C_t)}{(1 + r)^t}$$

Where

NPV = Net present value

$R_t$ = returns from litchi orchard during time't'

$C_t$ = costs incurred on litchi orchard during time't'

r = discount rate (12% per annum)

n = economic life of orchards in years

### Benefit-cost ratio

The benefit-cost ratio was calculated by taking into account all the components of establishment costs and operational costs along with total returns at all the stages of useful life of litchi. Benefit-cost ratio was

worked out by discounting the stream of total returns and costs during the useful life period of the orchard at 12 percent.

$$BCR = \sum_{t=1}^{n} \frac{R_t}{(1+r)^t} \div \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

Where,
BCR = benefit cost ratio
$R_t$ = returns from orchard during time't'
$C_t$ = costs on orchard during time't'
r = discount rate
n = economic life of orchards in years

### Internal rate of return

The internal rate of return (IRR) is the discount rate 'r' that makes the net cash flow (both positive and negative) from an investment equal to zero.

### Annual rate of return (ARR)

It is rate of returns being generated from one hectare of litchi orchards per annum over the useful life of the litchi orchard. It is expressed in percentage terms and was estimated by using following formula:

$$ARR = \frac{\text{Average annual returns} - \text{Average annual cost}}{\text{Average annual cost}} \times 100$$

## Results and Discussion

The results and discussion part included socio-economic characters of respondents, cost-return structure, sale methods adopted, economic viability of litchi orchards, conclusions and policy implications under different heads:

### Socio-economic characters of the respondents

### Age-wise distribution

Age of a respondent plays a major role in the selection of an enterprise and decision making process. The data given in Table 1 shows that out of the total 60 respondents, majority of them i.e. 40 per cent belonged to the age group of 40-50 years. About 38 per cent of the total sampled respondents belonged to relatively old age group i.e. more than 50 years, while about 22 per cent of them belonged to relatively younger age group i.e. up to 40 years. Thus, majority of the respondents were less than 50 years of age.

### Education level

Education level improves the learning skills of an individual which ultimately helps to generate new avenues of income. Education level helps the farmer to acquire more knowledge with respect to farming practices on account of making this occupation more profitable. Educational profile of the sample respondents is shown in Table 2. Out of the total 60 respondents, most of them i.e. about 42 per cent had education up to matric, 36.67 per cent of them have attained education up to 10+2 level, 16.67 per cent were graduates and remaining only five per cent were post graduates. Thus, it can be inferred that the sampled growers were quite educated so as to adopt latest techniques for litchi production in the study area.

### Cost structure of litchi cultivation

Litchi cultivation involved two types of investments; firstly the initial investment incurred on the establishment of orchard and

**Table 1. Age-wise distribution of the sampled respondents, 2017-18**

| Age (years) | Litchi growers | |
|---|---|---|
| | Number | %age |
| Up to 40 | 13 | 21.67 |
| 40 – 50 | 24 | 40.00 |
| > 50 | 23 | 38.33 |
| Total | 60 | 100.00 |

**Table 2. Distribution of the sampled respondents according to education level, 2017-18**

| Education level | Litchi growers | |
|---|---|---|
| | Number | % |
| Upto Matric | 25 | 41.67 |
| 10+2 | 22 | 36.67 |
| Graduate | 10 | 16.66 |
| Post Graduate | 3 | 5.00 |
| Total | 60 | 100.00 |

secondly the annual operational/maintenance cost.

**Initial investment on the establishment of litchi orchard**

As litchi cultivation is long-term capital-intensive enterprise, the litchi growers have to dole out considerable amount of money while establishing litchi orchards. The major cost components for establishing litchi orchard included land preparation, digging and filling of pits, manuring and fertilizer application, plants and planting cost, irrigation, plant protection and transportation of inputs. Before planting litchi plants, the land is well prepared by giving on an average two ploughings followed by planking. Land is leveled with the help of tractor mounted leveler and laser leveler which improves irrigation efficiency. The operation of digging and filling of pits is labour intensive in nature. One metre deep pits with one metre diameter are dug and these pits are filled with the mixture of silt and farmyard manure. As per PAU recommendation, 180 litchi plants can be planted in one hectare of area for optimum yield. But in practice, the sampled litchi growers were found to maintain only 93-107 plants in one hectare. During the establishment of litchi orchards, the sampled farmers were found applying FYM and fertilizers to meet the requirement of litchi plants. Planting cost is one of the important components of initial investment. Planting cost basically includes the cost of plant and planting charges (Anonymous, 2017). Planting of litchi is done in the month of September. Besides transportation of inputs, irrigation and plant protection measures also become the part of establishment cost.

The item-wise details of initial cost have been presented in Table 3. The initial investment on sampled orchards was Rs 31950 per hectare. Plants and planting costs were Rs 13516 per ha and had largest share (42.31%) in initial establishment. The cost incurred on land preparation (ploughing, planking, land leveling & layout) was Rs 7499 per ha constituting about 23.47 per cent of establishment cost.The total expenditure incurred on other important components like; manure and fertilizers, irrigation, plant protection, transportation of inputs and fencing in aggregate was Rs.10935 per hectare. The relative share of the respective components was 10.10 per cent, one per cent, 3.87 per cent, 4.25 per cent and 15.01 per cent, respectively.

**Operational/maintenance cost**

In case of orchards, investment is not only required for the establishment but operations are also carried out for the maintenance of the orchards every year till the last year. The maintenance and operational cost of litchi orchard varies due to several factors like age of the tree, incidence of insect/ pests, distance from the market etc. Operational cost comprised of the components like; manures and fertilizers, insecticides/pesticides, irrigation, pruning/thinning, hoeing and replanting. Further, in litchi cultivation most of the operations are done by labour, which is hired, so labour cost was taken jointly along with the input application or operation involved.

**Table 3. Initial investment on sample litchi orchards in Punjab, 2017-18**

**(Rs/ha)**

| Sr. No. | Particulars | Cost incurred |
|---|---|---|
| 1. | Land preparation | |
| a. | Ploughing & Planking | 4404 (13.78) |
| b. | Leveling & layout | 3095 (9.69) |
| | Sub-total | 7499 (23.47) |
| 2. | Planting cost | 13516 (42.31) |
| 3. | Manuring and Fertilization | |
| a. | Farm Yard Manure (FYM) | 2484 (7.77) |
| b. | Urea | 263 (0.82) |
| c. | DAP/SSP | 479 (1.50) |
| | Sub-total | 3226 (10.10) |
| 4. | Irrigation | 318 (1.00) |
| 5. | Plant protection measures | 1237 (3.87) |
| 6. | Transportation of inputs | 1358 (4.25) |
| 7. | Fencing | 4796 (15.01) |
| | Total cost | 31950 (100.00) |

*Figures in parentheses are the percentages to the total.*

Technically, the commercial production of litchi orchard starts from tenth year onwards but sometimes better maintained orchards could generate remunerative returns even from eight years onwards. A perusal of Table 4 reveals the operational cost incurred on the sample litchi farms. It may be concluded from the analysis that the operational cost observed to be directly associated with the productivity. The annual operational cost was quite low during the initial few years and increased consistently during each succeeding year. It was highest during the age of 16-20 years of plantations and it came down afterwards in the

**Table 4. Operational cost of sampled litchi orchards in Punjab, 2017-18**

**(Rs per ha)**

| S. No. | Cost Items | Age (years) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Average (11-15) | Average (16-20) | Average (>20) | Overall Average |
| 1 | **Fertilizer application** | | | | | | | | | | | | | | |
| a. | FYM | - | 2547 | 2623 | 2715 | 2807 | 3061 | 3128 | 3288 | 3425 | 3543 | 4047 | 4646 | 4389 | 3702 |
| b. | Urea | - | 308 | 415 | 767 | 1037 | 1175 | 1242 | 1346 | 1451 | 1692 | 2102 | 2898 | 2729 | 1923 |
| c. | DAP/SSP | - | 521 | 613 | 1050 | 1138 | 1256 | 1363 | 1513 | 1606 | 1721 | 2069 | 2555 | 2391 | 1834 |
| d. | MOP | - | - | - | 304 | 481 | 634 | 732 | 882 | 1056 | 1190 | 1596 | 2274 | 2103 | 1406 |
| | **Sub-total** | - | **3376** | **3651** | **4836** | **5463** | **6127** | **6464** | **7028** | **7538** | **8145** | **9814** | **12373** | **11611** | **8865 (36.18)** |
| 2 | **Plant protection** | | | | | | | | | | | | | | |
| a. | Insecticides | - | 1300 | 1285 | 1312 | 1495 | 1601 | 1642 | 1686 | 1763 | 1821 | 2012 | 2439 | 2241 | 1895 |
| b. | Fungicides | - | 440 | 457 | 490 | 579 | 635 | 659 | 683 | 726 | 772 | 857 | 1112 | 923 | 796 |
| c. | Weedicides | - | - | - | - | 881 | 875 | 1048 | 1121 | 1126 | 1125 | 1180 | 1215 | 1147 | 955 |
| | **Sub-total** | - | **1740** | **1742** | **1802** | **2955** | **3111** | **3348** | **3490** | **3614** | **3718** | **4048** | **4766** | **4311** | **3646 (14.88)** |
| 3 | Irrigations | 3614 | 3712 | 3657 | 3675 | 3789 | 3837 | 3902 | 3916 | 3927 | 3957 | 4054 | 4371 | 4116 | 4028 (16.44) |
| 4 | Pruning | - | 1728 | 1954 | 2577 | 3109 | 3180 | 3255 | 3338 | 3674 | 3836 | 4218 | 4670 | 4509 | 3745 (15.28) |
| 5 | Hoeing | 2435 | 2750 | 3004 | 3127 | 3154 | 3202 | 3231 | 3305 | 3328 | 3355 | 3479 | 3684 | 3342 | 3337 (13.62) |
| 6 | Replanting | 498 | 500 | 357 | - | - | - | - | - | - | - | - | - | - | 54 (0.22) |
| | Interest @ 7% | 229 | 483 | 503 | 561 | 646 | 681 | 707 | 738 | 773 | 805 | 896 | 1045 | 976 | 829 (3.38) |
| | **Total cost** | **6777** | **14288** | **14867** | **16578** | **19116** | **20139** | **20908** | **21814** | **22853** | **23816** | **26510** | **30909** | **28866** | **24503 (100.00)** |

subsequent years up to the end of useful life of the orchard. It is seen that the annual maintenance cost or operational cost of litchi plants are directly proportional to fruit bearing ability and it was noticed that operational cost was maximum during the years, when the productivity was estimated to be the highest.

**Returns from litchi cultivation**

The sampled farmers either sold their produce through pre-harvest contractor or disposed-off it directly in the market. The costs and returns were quite different in these two methods of sale adopted by litchi growers. In this regard, the age-wise costs and returns of litchi orchard was assessed individually and discussed below:

**Year-wise cost and returns of litchi ( Pre-harvest contractor)**

Most of the litchi growers were used to make a pre-harvest contract of their litchi orchard and it is the most preferred method of sale adopted by the litchi growers for marketing their produce. On per hectare basis, the year-wise operational costs, gross returns and net returns obtained from the cultivation of litchi orchards on an average farm has been shown in Table 5. It can be observed that level of operational costs was higher than gross returns in the initial seven years of orchard plantation. In general, the commercial fruit bearing of litchi start from 8$^{th}$ year onwards but sampled farmers revealed selling of their produce from fourth year onwards in order to minimize the loss in the initial years. The litchi growers were also practicing inter-cropping in litchi orchards to utilize the vacant land to generate extra income till the plants grow up. The sampled farmers inter-cropped litchi orchards with fodder during kharif season and wheat in rabi season on the sampled farms. Net profit from inter-cropping on an average farm came out to be Rs 113748, Rs 98018 and Rs. 67127 per hectare, respectively. The net income turned out to be negative in the initial seven years of plantation. The gross returns overtake total costs after 7$^{th}$ year and the net profit increased consistently in each successive year from 8$^{th}$ year onwards and it reached at maximum level between the ages of 16-20 years of plantation. After 20 years onward the gross and net returns have been showing significant decline on average farm. At the end of the useful life of the litchi plant, the junk value of the plant have also been taken into account while calculating average net returns from the litchi orchards.

**Year-wise cost and returns of litchi (Direct sale by litchi growers)**

Only a small number of growers preferred to sell their produce directly in the market. The year-wise operational costs, gross returns and net returns on per hectare basis on average farm size have been given in Table 6. The litchi growers have to bear marketing as well as plucking cost, while direct selling in the market. Thus, the adding up of these costs has increased the total cost which varied from Rs 116023 per hectare to Rs 160358 per hectare

**Table 5. Year-wise cost and returns of litchi on average farm (marketed through pre-harvest contractor), 2017-18**

**(Rs/ha)**

| Particulars | Age of the orchard (years) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Average (11-15) | Average (16-20) | Average# (> 20) |
| **Gross returns** | 113748^ | 98018^ | 67127^ | 29853 | 54384 | 75752 | 102411 | 161926 | 203422 | 227515 | 323666 | 367456 | 186314 |
| **Total cost*** | 135519 | 111080 | 111659 | 113370 | 115908 | 116931 | 117700 | 118606 | 119645 | 120608 | 123302 | 127701 | 125658 |
| **Net returns** | -21771 | -13062 | -44531 | -83517 | -61524 | -41178 | -15289 | 43320 | 83777 | 106907 | 200364 | 239755 | 60656 |

on average farm from 4th year onwards to 16-20 year period. On the contrary, the growers reaped higher returns which ranged between Rs 34836 to Rs 428786 from 4th year to 16-20 year in the useful life of litchi. The results indicated that net returns received by the sampled litchi growers was relatively higher through direct sale than that of farmers who sold their produce through pre-harvest contractor. Year-wise trends indicate that average annual total cost, gross returns and net returns were highest during the 16-20 years of age of the orchard.

## Cost and returns of litchi orchards through different sale methods

## (Through pre-harvest contractor and direct selling in the market)

It can be observed from the data given in Table 7 that there was no major difference in the total cost components such as; land rent, establishment cost and operational cost as far as marketing through pre-harvest contractor and direct selling in the market is concerned. However, additional cost incurred in direct selling was marketing cost which amounted to Rs. 20571 per hectare there by increasing the total cost. Total cost in case of direct sale of litchi in the market (Rs.143144/ha) was higher as compared to marketed through pre-harvest contractor (Rs.120807/ha). During self-marketing of produce, gross expenditure increased because of harvesting cost as well as marketing cost. Harvesting cost included picking/plucking, grading, loading/unloading and packing material cost. By direct selling litchi, growers received higher price and thus higher gross returns vis-à-vis while making a contract with pre-harvest contractor. The estimates have been worked out at undiscounted rate and an average figure calculated by taking into consideration 30 years of useful life of the orchard. Net returns received by growers were 14.51per cent higher while direct selling in the market. The operational cost, total cost, total returns and net returns from litchi orchard have been presented in Table 7.

## Economic viability of litchi cultivation

Litchi plantation is an economic activity which requires huge investments every year and yields returns each year during its useful life. Cost and returns data do not give clear guidance to take litchi orchard vis-à-vis other annual crops. This was mainly because of the fact that costs incurred and returns obtained from litchi orchard over time was not comparable with annual crops grown in the area. So, in order to have clear picture regarding the economic viability of litchi orchard, the discounted indicators viz. Net Present Value (NPV), Benefit-Cost Ratio, Internal Rate of Returns (IRR) have been used. The net present value, benefit-cost ratio and

**Table 6. Year-wise cost and returns of litchi on average farm (direct selling), 2017-18**

**(Rs/ha)**

| Particulars | Age of the orchard (years) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Average (11-15) | Average (16-20) | Average# (> 20) |
| Gross returns | 113748^ | 98018^ | 67127^ | 34836 | 63469 | 88396 | 119505 | 188956 | 237374 | 265491 | 377690 | 428786 | 217108 |
| Total cost* | 135519 | 111080 | 111659 | 116023 | 120737 | 123663 | 126801 | 132995 | 137724 | 140827 | 152066 | 160358 | 151893 |
| Net returns | -21771 | -13062 | -44531 | -81187 | -57268 | -35266 | -7296 | 55961 | 99649 | 124664 | 225624 | 268429 | 65215 |

**Total cost includes establishment cost, operational cost and land rent*

*# includes junk value of plants at the end of useful life*

*^ Income generated from intercropping (Wheat and fodder)*

**Table 7. Average annual cost and returns structure of litchi orchards through different sale (Rs/ha)**

| Particulars | Methods of sale | |
|---|---|---|
| | Through pre-harvest | Direct selling in the market |
| Land rent | 96250 (79.67) | 96792 (67.62) |
| Establishment cost | 1262 (1.04) | 1278 (0.89) |
| Operational cost | 23295 (19.28) | 24503 (17.12) |
| Marketing cost | - | 20571 (14.37) |
| Total cost | 120807 (100.00) | 143144 (100.00) |
| Gross returns | 188172 | 234872 |
| Net returns | 67365 | 91728(14.51)* |

**Per cent increase in net return by direct sale over pre-harvest contractor*

internal rate of return were worked out at 12 percent discount rate. These parameters were worked out for both the cases separately where farmers sold their produce to pre-harvest contractors and sold themselves directly in the market and are presented in Table 8.

It can be observed from the table that the annual rate of returns were higher for pre-harvest contractor and was 65.35 per cent and for direct sale in the market, it was 64.08 per cent. NPV in case when sold through pre-harvest contractor and directly by farmers was recorded Rs.238294 and Rs. 388124 per hectare, respectively. The B: C ratio and IRR for litchi orchards were 1.33 and 24.10 per cent, respectively when produce is sold through pre-harvest contractor and in case of direct sale by the growers the corresponding figures were 1.37 and 26.61per cent, respectively. Since the benefit-cost ratio of litchi cultivation is greater than unity, it showed that all the farms were economically viable.

## Conclusion and Policy Implications

The study revealed that viability of litchi orchards increased significantly when produce is sold in the market themselves by the farmers instead of disposing-off through pre-harvest

**Table 8. Economic viability of sample litchi orchards in Punjab, 2017-18**

| Particulars | Produce sold through pre-harvest contractors | Produce sold by growers directly in the market |
|---|---|---|
| Net present value[@] (Rs/ha) | 238294 | 388124 |
| B:C ratio[@] | 1.33 | 1.37 |
| Internal rate of return (%) | 24.10 | 26.61 |
| Annual rate of return (%) | 65.35 | 64.08 |

*@ 12 per cent of annual discount rate*

contractors. Litchi has a long gestation period, so the orchards start bearing fruits at 8th year of plantation and onwards. In general, the net income was negative in the initial years which increased regularly in the succeeding years with age of the plantation and became highest at the age of 16 to 20 years. From 20 years onwards, corresponding to the declining productivity of plants, the costs and returns declined each year up to the end of useful life of orchards. The benefit-cost ratio was more than unity and IRR significantly higher than prevailing bank lending rates were indicative of that the investments in litchi cultivation were quite attractive. Thus, it justified the grower's investment decisions for litchi cultivation. The results concluded that the orchards retained by famers gave more profits as compare to the orchards leased-out to pre-harvest contractors. Therefore, farmers may be encouraged to sell their produce themselves in the market to get more profit instead of selling through pre-harvest contractors.

It was emphasized that Government should provide storage facilities to litchi growers to facilitate direct marketing as litchi fruit is highly perishable in nature. Latest technical knowhow be provided to litchi growers through extension activities by the concerned departments for better management of litchi orchards.

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Received: January 12, 2018 Accepted: May 20, 2018