

Research Paper

Economic Analysis of Litchi Production in Muzaffarpur District of Bihar

Sandeep Kumar¹, Sargam Swami¹, Meera Kumari^{1*}, Anita Kumari² and C.K. Panda³

¹Department of Agricultural Economics, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India

²SMS, Krishi Vigyan Kendra, Sabour, Bihar, India

³Department of Extension Education, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India

*Correspondence author: meera.bausabour@gmail.com (ORCID ID: 0000-0003-3422-7249)

Received: 09-02-2023

Revised: 19-05-2023

Accepted: 01-06-2023

ABSTRACT

The Study was carried out with an objective to estimate cost and returns of Litchi under different size of sample farms in Muzaffarpur District of Bihar. The empirical data were gathered from agriculture year 2018- 19 during production period of litchi through survey of litchi growers'. The multistage sampling techniques were used to select the location/ area where abundantly litchi orchard occupied and their respondents' for required information. Thus, a total 90 litchi growers (8 marginal, 18 small, 46 semi-medium and 18 medium) were selected with equal chance or opportunity of all farms categories in groups from 2 blocks from six selected villages of the Muzffarpur district of Bihar. The gross value of the litchi production on overall farms was estimated on an average in ₹ 2.95 lakhs per hectare against cost C as well as annual maintenance costs was in ₹ 65.93 thousand per hectare. The costs of production of litchi on overall farms was accounted on an average to be in ₹ 941.52 per quintal litchi, which were varies from ₹ 1197.58 per quintal litchi and estimated higher on marginal farms, followed by ₹ 1045.77 per quintal on small farms, ₹ 898.75 per quintal on semi-medium farm, and ₹ 872.97 per quintal on medium farms. Result revealed that cost of production of litchi decreased with increase in land owner farm groups. The establishment (first to fifth year's i.e. juvenile stage) costs of litchi orchard on overall farms were estimated to be ₹ 2.56 lakhs and further estimated amortized costs on an average was ₹ 1329.37 per hectare. The establishment and annual maintenance cost both were included fixed costs increases with increase in land possession of farms groups, but variable cost include in total costs (fixed and variable cost) were reduced with increase in land holding farms groups. The NPV of overall farms were on an average in ₹ 6.21 lakh, benefit-cost ratio (BCR) in ₹ 2.77 against one rupee spend. Internal rate of returns (IRR) value was obtained 25.64 percent greater than chosen discount rate as 15 and 20 per cent to make the decision about reinvestment opportunity to prioritize the area of reinvestment by litchi growers.

HIGHLIGHTS

- The costs of production of litchi on overall farms was accounted on an average to be in ₹ 941.52 per quintal litchi, and estimated higher on marginal farms.
- Cost of production of litchi decreased with increase in land owner farm group.

Keywords: Litchi, Cost, Return, IRR, Benefit cost Ratio

Litchi (*Litchi chinensis* Sonn; family *Sapindaceae*,) is an important perennial subtropical plant found in India. Although they have numerous varieties found and place of origin from China. This fruit have attractive deep pink or red colours and fragrant aril. Litchi is rich source of vitamin B1, riboflavin and vitamin C apart from proteins

(0.7%), fats (0.3%), carbohydrates (9.4%), minerals (0.7%), fibrous matter (2.25%), calcium (0.21%),

How to cite this article: Kumar, S., Swami, S., Kumari, M., Kumari, A. and Panda, C.K. (2023). Economic Analysis of Litchi Production in Muzaffarpur District of Bihar. *Econ. Aff.*, 68(02): 1153-1162.

Source of Support: None; **Conflict of Interest:** None 

phosphorous (0.31%), and carotene (FAO,2013). Indian agriculture scenario is changing over the period of time amidst this litchi fruits under the existing agro-climatic condition emerged as one of the potential horticulture sector plays a significant role of livelihood security of the farmers who were depends upon agriculture. In India, area under litchi plantation has 92.1 thousand hectare and approximately 583.4 thousand metric tons litchi fruits produce every year (Horticulture Statistics at Glance, 2017). Litchi production is estimated to be around 2.11 million tons in world, with more than 95 per cent of the area and production is in Asia (FAO, 2002).

As India accounts for one fifth of the global litchi production with productivity 6.30 metric tons per hectare. The litchi producing states of India where are mostly cultivating in Bihar, West Bengal, Assam, Punjab, Tripura, Himachal Pradesh, Jharkhand, Uttaranchal, Nagaland, Orissa. At present litchi fruits are exported by India mainly to the Netherlands, U.A.E., Saudi Arabia and Canada which earlier was mainly confined to SAARC countries. The APEDA and NAFED are the major export promoters of litchi. . Litchi export has been increased from 161.5 MT to 987 MT correspond years on 2007-08 to 2015-16. In recent years, domestic market for litchi has increased tremendously and good price has been realized in the distant south Indian market.

Bihar contributes 44.2 per cent of total litchi production of the country and occupies nearly 38 per cent of the area under litchi plantation in the country. In Bihar, major litchi growing districts are Muzaffarpur, Vaishali, Sitamarhi, West & East Champaran, Darbhanga and Samastipur. Litchi is grown in an area of about 30.92 thousand hectare with total production of about 4272.94 metric tons and productivity 13.8 t/ha, which is high productivity in Muzaffarpur district comparison to average national productivity of 6.3 tonnes per hectare (NHB, 2013-14). The important commercial varieties of litchi grown in the state are Shahi, Rose Scented, China, Kasela, Purbi, Early Bedana, Late Bedana, Late Seedless and Late large red (Anonymous, 2015).

The study showed that the costs and returns of litchi have been increased overtime. The litchi growers have been interest to horticultural plants seeks under knowledge about crucial inputs requirement

opportunity and costs of production against subtropical environment to improve the profitability and productivity of litchi orchard in Muzaffarpur district of Bihar. Litchi orchard have requires a long period investment including cost of production and value addition needs a proper planning to make the economic success of the enterprise. The study was conducted to work out the cost of production of litchi and to analyze the financial status of litchi growers.

The process of economic development and introduction of new technology especially for seasonal fruits should be created and perishability should be lengthened, to meet the demand. Technological progress implies the application of improved technical know-how in the production activity that will help in capital-saving, labour saving, and promote balanced growth. It also needs entrepreneur's ability to understand the possibilities of using scientific inventions for commercial purposes. The per capita income is increase with increase in per capita consumption. The litchi trend is changing over a period of time, particularly due to changing climatic conditions and shrinkage of land under net sown area. Since litchi is one of the most demanding fruit for the season in domestic market, it seeks expansion and fair economic policies so that the actual price of the fruit is realized. For the farmers with the intensive use of labour and capital in litchi production, disposal of produce become as important as the adoption of new methods and practices. There are numbers of growth centres in Bihar particularly Muzaffarpur district for litchi production but their level of production and technology has not been fully exploited to a desired commercial line due to some serious economic and technical constraints and also due to lack of efficient marketing system.

Presently, many government documents, road maps, policy papers suggested shifting on high value crop production, especially towards horticultural plants for increasing farm income. The study confront suggesting possible corrective measures to bring about the desired improvement in costs of production and socio-economic characteristics of litchi grower, to estimate costs & returns of litchi orchard in Muzaffarpur district of Bihar.

MATERIALS AND METHODS

The empirical study of litchi growers bring upon costs and returns data was collected for the agricultural year 2018-19. The multistage sampling technique was used of litchi grower selection and location area under abundance of litchi orchard for collect required information. Muzaffarpur is a nucleus district because area under litchi plants were more than 7.42 thousand hectare, 43.75 thousand MT of litchi produce (District Horticulture Office Muzaffarpur, 2016) and possess the first rank among entire litchi producing district of Bihar. Therefore, in the first stage the selection of district as a Muzaffarpur and two blocks namely Musahari and Kanti were selected purposively on the basis of where area under litchi orchard to higher concentration of litchi plants. In the second stage, Kanti block of selected three villages names were (i) Akuran Khargi (ii) Madukar Chhapra and (iii) Maisahan and Musahari block of three villages names were (i) Jhapaha (ii) Jamalabad and (iii) Bhikenpur selected randomly. From each selected villages 15 farmers were selected from exhaustive list of farmers having at least a small plot of litchi following simple random sampling without replacement (SRSWOR) technique. A list of respondents having litchi orchard from each selected village were prepared and categorized into four groups viz., marginal (up to 1 ha.), small (> 1 to 2 ha), semi-medium (>2 to 4 ha) and medium (> 4 ha). Thus, total 90 litchi growers (8 marginal, 18 small, 46 semi- medium and 18 medium) were selected equal chance opportunity of all farm categorized groups of land owner scale from 2 blocks from six selected villages of the selected district. The data regarding costs and returns were collected through survey method to get the cross sectional data from the selected litchi growers through personal interview with the help of specifically pre-tested schedules required for the study. The economic life of litchi was found to be around 35 years. Agricultural produce harvested from an entity's biological assets have been measured at its fair value less costs to sell at the point of harvest. Hence, litchi tree orchards are biological assets they agricultural produce such as picked fruits and processed fruit. The calculation of the cost of cultivation was done by using the input and output price prevailing in the study area during the period of study.

1. The details of cost concepts are given below:

Cost concepts include Cost A₁, Cost A₂, Cost B, and Cost C

| | |
|---------------------|--|
| Cost A ₁ | Value of hired labor/ contract labor + hired machinery (i.e. Draft Power) +imputed (Draft Power) value of owned machinery + market rate of seeds, fertilizers, manures, pesticides, insecticides and irrigation charges + land revenue + depreciation + interest on working capital+ miscellaneous expenses. |
| Cost A ₂ | Cost A ₁ + rent paid for leased in land |
| Cost B | Cost A ₂ + interest on the fixed capital excluding land + rental value of owned land |
| Cost C | Cost B + imputed value of family labor |

2. Establishment cost: All the costs worked out by the litchi growers from preparation of land up to planting of plants were devoted as establishment costs. We have not included the cost of land in the establishment cost. Establishment cost pertains to the cost worked out on land preparation, planting material, tools, etc.

Establishment cost = Land preparation (Pit digging + Layout) + Cost of plants + Cost of planting of plants + equipment and other costs

- (i) Fixed cost = Land revenue + Rental value of land (income capitalised method) + Depreciation + Interest on fixed capital @ 8% p.a.
- (ii) Variable cost = Cost of manures and fertilizers including labour cost + Irrigation charges including labour cost + Labour cost of training and pruning and weeding + Plant protection chemical charges including labour cost + Staking charges + Picked up litchi fruits and interest of working capital 12.5% p.a.

Total establishment cost = Fixed cost + Variable cost

3. Amortization of fixed cost

The annual amortization of cost was estimated from the investment made on litchi cultivation up to the first flowering (*i.e.*, the first 5 years of litchi plantation) under the assumption that the rate of interest is 3 per cent and expected life of litchi orchard is to be 40 years. To estimate the per hectare cost of litchi orchard, an amortized cost was worked out by using the compounding cost method given below and added it to maintenance

cost to estimate the annual cost in cultivation (Suraj Kumar et al. 2016).

$$A = P = \frac{1(1+i)^n}{(1+i)^n - 1} \dots(1)$$

where,

- A = Annual sum in rupees (Amortized cost)
- P = Present sum of the establishment cost in rupees
- i = Interest rate (3 % per annum)
- n = Economic life of the orchard (in years).

4. Total maintenance cost: The total maintenance cost was obtained by adding the variable cost and fixed cost.

(i) Fixed cost = It included interest on fixed capital, amortise cost, rental value of land. According to the income capitalization model, land values are based solely on future income flows. The model is;

$$V = \frac{NR}{r} \dots(2)$$

Where, V = Value, NR is net return to the asset, and r is the discount rate @ 20 % used to discount future returns. Net land returns (NR) can be estimated as net from litchi enterprise raised by different categories of farms (owner) returns to land, or alternatively net cash rents are often used.

(ii) Variable cost = It included expenses on items like plants protection measures, manures and fertilizers, chemicals, irrigation, weeding and hoeing, training and pruning, harvesting, transportation and interest on working capital @ 12.5 %.

Total maintenances cost = Fixed cost + variable cost

The financial analysis were done by determining NPW (Net Present Worth), Benefit – Cost Ratio (B-C ratio) and Internal Rate of Return (IRR)

5. Net Present Value (NPV): Costs and returns for litchi production of given year 2018 cross sectional data collect and net present value include gross returns and establishment and cost C as well as annual maintenance cost discount rate @ 15 per cent were taken for analysis. The precaution above precede data of amortized costs was exclude from fixed cost of annual maintenance or cost B. The establishment and annual maintenance costs in cash outflow were absolute amount proceed for

discounting of costs and returns on forty year life span of litchi orchard.

$$\sum_{t=1}^n \frac{Bt - Ct}{(1+i)^t} - K \dots(3)$$

Where,

- Bt = Benefit in the tth year
- Ct = Cost in the tth year
- N = Number of years
- i = Discount rate
- K = Initial Investment

6. Benefit-Cost ratio: Benefit-cost ratio (BCR) is the ratio derived by dividing the present value of benefits, by present value of cost. This ratio measures the return or benefit per units of investment. B-C ratio of more than one obtained from enterprise asset of litchi picked up and sale. The investment criteria benefit-cost (B-C) ratio was estimate as follows:

$$B: C \text{ ratio} = \frac{\sum_{t=1}^N \frac{Bt(1+i)^{-n}}{Ct(1+i)^{-n}}}{\dots}$$

Where,

- Bt = Benefit in the tth year
- Ct = Cost in the tth year
- N = Number of year
- i = Discount rate

7. Internal Rate of Return (IRR)

IRR =

$$\left(\frac{\text{Lower}}{\text{discount rate}} \right) + \left(\frac{\text{Difference between}}{\text{two discount rate}} \right) + \left(\frac{\text{Present worth of the cash flow at lower discount rate}}{\text{Absolute difference between the present worth of the cash flow at two discount rate}} \right) \dots(5)$$

Where,

- Lower discount rate was 15 per cent
- Higher discount rate was 20 per cent.

RESULTS AND DISCUSSION

Depending upon the requirement of litchi cultivation management practices are undertaken which protect trees from insect pest infestation and disease epidemics affecting the growth of the tree,

productive life of a litchi trees ranges between 5-35 years.

1. Costs and Returns of Litchi Production

The expenditure incurred on litchi cultivation was estimated by using standard cost concept. Cost A, cost B and cost C were computed for assessing the investment of litchi cultivation. It could be seen from Table 1 that the gross value of the litchi production was estimated ₹ 2.95 lakhs per hectare of overall farm groups which allocate to medium farms group ₹ 3.34 lakhs higher followed by semi-medium farms group ₹ 3.11 lakhs, small farms group ₹ 2.55 lakhs and marginal farms ₹ 2.12 lakhs respectively.

It can be seen from table 1 that Cost A was of marginal farm group (₹ 38.32 thousand).

Higher cost of cultivation per hectare as well as annual maintenance cost A of litchi followed by small farm group (₹ 36.34 thousand), semi-medium farm group (₹ 33.02 thousand) and medium farm group (₹ 31.67 thousand) similarly, marginal farms group of cost B was worked out in ₹ 58.34 thousand per hectare of litchi higher followed by small farm group in ₹ 68.41 thousand, semi-medium farm group in ₹ 70.23 thousand and in ₹ 70.33 thousand for medium farms group. The litchi growers have used different inputs costs in the form of labor costs and material costs *viz.* fertilizers, manures, insecticides, pesticides irrigation etc. on wide range, which affected the cost of cultivation. The costs of production of litchi of overall farms was

on an average account to be in ₹ 941.52 per quintal of litchi which were varies in ₹ 1197.58 per quintal higher on marginal farms, followed by in ₹ 1045.77 per quintal on small farms, ₹ 898.75 per quintal on semi-medium farm, and ₹ 872.97 per quintal on medium farms. This trend show that increase in land holding of farms group tendency to decrease in cost of production of litchi produce.

2. Establishment Cost of Litchi Orchard

The cost incurred to establish a new litchi orchard (non-bearing stage i.e. juvenile stage) indicates the period of plantation to first fruiting is the establishment cost. The establishment costs were two major categories include variable costs (i.e. direct cost) and fixed (i.e. indirect cost) or overhead costs. Variable costs are that vary in total in direct proportion to changes in activity. While, fixed cost are costs that remain constant in total regardless of changes in activity. Variable cost were consist of labour and material costs incurred of performing different agricultural practices like lay-out, digging of pits, filling of pits, pruning and training, plant protection, irrigation, manures and fertilizers application, preparation of land and draft power and other part of fixed costs includes depreciation, land revenue and interest on fixed capital. The costs of litchi production for different farms group were presented in Table 2. The establishment (first to fifth years i.e. juvenile stage)costs of litchi orchard on overall farms were on an average estimated to be

Table 1: Cost of cultivation (annual maintenance cost concept) of litchi orchard and returns (In ₹ per hectare)

| Particulars | Type of farmers | | | | Overall (n=90) |
|--------------------------------|--------------------|------------------|------------------------|-------------------|----------------|
| | Marginal (n1=8) | Small (n2=18) | Semi-medium (n3=46) | Medium (n4=18) | |
| Cost A | 38319.50 | 36359.97 | 33024.42 | 31673.51 | 33893.17 |
| Cost B | 58339.88 | 58517.30 | 58191.26 | 58164.16 | 58265.31 |
| Cost C | 67591.26 | 66667.55 | 65806.81 | 64739.41 | 65925.15 |
| Yield (qtls /ha) | 56.44 | 63.75 | 73.22 | 74.16 | 70.02 |
| Gross value of the produce (₹) | 211650.00 | 255000.00 | 311185.00 | 333720.00 | 295607.00 |
| Net income over | | | | | |
| Cost A | 173330.50 | 218640.03 | 278160.58 | 302046.49 | 261713.83 |
| Cost B | 153310.12 | 196482.70 | 252993.74 | 275555.84 | 237341.69 |
| Cost C | 144058.74 | 188332.45 | 245378.19 | 268980.59 | 229681.85 |
| Cost of Production (₹/quintal) | 1197.58 | 1045.77 | 898.75 | 872.97 | 941.52 |
| Net income over total cost | 145777.57 | 191027.30 | 250126.42 | 272458.65 | 233496.02 |

Table 2: Establishment cost of non-bearing litchi orchard (Up to 5 years) (In ₹ per hectare)

| Sl. No. | Particular costs | Categories of farms | | | | Overall (n=90) |
|---------------------------|--|---------------------------------|-------------------------------|-------------------------------------|--------------------------------|---------------------------|
| | | Marginal (n ₁ =8) | Small (n ₂ =18) | Semi-medium (n ₃ =46) | Medium (n ₄ =18) | |
| (I) Variable costs | | | | | | |
| (i) | Labour costs | 77696.28 (29.66) | 71103.51 (27.72) | 64842.5 (25.43) | 61180.66 (23.89) | 66504.9 (25.96) |
| (ii) | Draft power | 23326.71 (8.90) | 21347.36 (8.32) | 19467.63 (7.63) | 18368.24 (7.17) | 19966.73 (7.79) |
| (iii) | Material cost | 92588.56 (35.34) | 84732.12 (33.03) | 77271.06 (30.30) | 72907.36 (28.47) | 79252.09 (30.94) |
| (iv) | Sub-total working capital | 193611.6 (73.90) | 177183 (69.06) | 161581.2 (63.36) | 152456.3 (59.53) | 165723.7 (64.70) |
| (v) | Interest rate of working capital@12.5% | 24201.44 (9.24) | 22147.87 (8.63) | 20197.65 (7.92) | 19057.03 (7.44) | 20715.46 (8.09) |
| (vi) | Total variable cost (i + ii + iii + v) | 217813 (83.14) | 199330.9 (77.70) | 181778.8 (71.28) | 171513.3 (66.98) | 186439.2 (72.78) |
| (II) Fixed costs | | | | | | |
| (vii) | Rental value of land | 36360.02 (13.88) | 47528.49 (18.53) | 61907.37 (24.28) | 67885.53 (26.51) | 57955.97 (22.62) |
| (viii) | Land revenue | 1858.5 (0.71) | 1858.5 (0.72) | 1858.5 (0.73) | 1858.5 (0.73) | 1858.5 (0.73) |
| (ix) | Depreciation | 2683.6 (1.02) | 3594.75 (1.40) | 4054.75 (1.59) | 8562.42 (3.34) | 4742.404 (1.85) |
| (x) | Fixed costs | 40902.12 (15.61) | 52981.74 (20.65) | 67820.62 (26.59) | 78306.45 (30.58) | 64556.88 (25.20) |
| (xi) | Interest on fixed capital @ 8 % per annual | 3272.169 (1.25) | 4238.539 (1.65) | 5425.65 (2.13) | 6264.52 (2.45) | 5164.55 (2.02) |
| (xii) | Sub-total (II) | 44174.29 (16.86) | 57220.28 (22.30) | 73246.27 (28.72) | 84570.97 (33.02) | 69721.43 (27.22) |
| (xiii) | Total establishment cost (I+II) | 261987.29 (100.00) | 256551.18 (100.00) | 255025.07 (100.00) | 256084.27 (100.00) | 256160.63 (100.00) |
| (xiv) | Amortized cost | 13286.32 | 13535.36 | 14050.32 | 14518.38 | 13291.37 |
| (xv) | Expected life of tree (in years) | 40 | 40 | 40 | 40 | 40 |

Figures in parentheses indicate the percentage to the total establishment cost.

₹ 2.56 lakhs per hectare which were distributed to variable costs ₹ 1.86 lakhs (72.78 %) and fixed cost ₹ 69.72 thousand (27.22%). The establishment costs of labour was in ₹ 66.50 thousand highest expenses (25.96 %) for litchi production taken from among the variable cost incurred followed by material cost in ₹ 79.25 thousand (42.47%), draft power in ₹ 19.96 and interest on working capital in ₹ 20.71 thousand (8.09%). Whereas, the fixed establishment cost (i.e. indirect cost) of overall farms incurred by rental value of land, interest on fixed capital, depreciation, land revenue, were estimated to on an average account to be in ₹ 57.96 thousand (22.62 %), in ₹ 5.16 thousand (2.02%), in ₹ 4.74 thousand (1.85), and in ₹ 1.83 thousand (0.73%) per hectare, respectively. The direct and indirect establishment costs of different categories of farms groups were worked out similar cost trend. The establishment of total variable cost worked out by marginal, small, semi-medium and medium farmers were on an average account to be in ₹ 2.18 lakhs (83.14%), in ₹ 1.99 lakhs

(77.70 %), in ₹ 1.81 lakhs (71.28%) and in ₹ 1.71 lakhs (88.39%) per hectare respectively, whereas the establishment of fixed cost on marginal farms were worked out in ₹ 77.60 thousand (26.27%) lowest cost followed by small ₹ 98.73 thousand (33.12%), semi-medium in 1.24 lakhs (40.72 %) and medium farms in ₹ 1.40 lakhs (44.98%) for medium farmers of the total cost, respectively.

Subsequently, it can be seen that the difference in per hectare total establishment costs of litchi orchard on marginal farms were highest investment worked out followed by small, semi-medium and medium farms. These trends indicate that investment costs were reduced by increase in land holding farms group because among different categories of farmers were less it may be primarily due to costs was decrease in per unit area under number of litchi trees with increase in land holding. The difference between establishment cost of marginal and small farmers is visible in spite of equal number of trees per unit land, it may be due to poor management

practices undertaken by the marginal and small farmers compare to semi-medium and medium litchi orchard.

3. Annual Maintenance Cost of Litchi Orchard

The litchi farms practices were worked out annual maintenance cost to upkeep the condition of orchard so that higher profit is drawn from per hectare on an average annual maintenance cost as well as cost of cultivation on litchi orchard. Annual maintenance cost of litchi orchard it can be include variable costs are that vary in total in direct proportion to changes in activity. While, fixed cost are costs that remain constant in total regardless of changes in activity.

The annual maintenance total cost of litchi orchard of overall farms were on an average estimate to be ₹ 65.93 thousand per hectare which were consist of variable cost in ₹ 41.55 thousand (63.03%) and fixed cost in ₹ 24.37 thousand (36.97%, Table 3) of the annual maintenance total cost. The annual maintenance total cost among variable cost of labour on overall farms were on an average accounted to be in ₹ 20.07 thousand (30.45 per cent) higher followed

by material cost ₹ 11.18 thousand (16.95%), interest on working capital in ₹ 4.62 (7.00 %), draft power in ₹ 3.19 thousand (4.84 %), miscellaneous cost in ₹ 1.18 thousand (1.79 %), depreciation in ₹ 948.00 and land revenue in ₹ 372 (0.56 %). Whereas rental value of land of fixed annual maintenance costs on overall farms were worked out on an average account to be in ₹ 11.48 thousand (17.42 %) higher, followed by amortised cost in ₹ 11.08 thousand (16.81%) and interest on fixed capital ₹ 1.81 thousand (2.74 %), of the annual maintenance total cost. The annual maintenance total cost incurred by different category of farmers was exhibits almost similar trend to be appeared. The marginal farmers of total variable costs were worked out on an average account to be in ₹ 47.57 thousand (70.38 %) of the total annual maintenance cost, followed by small farmers ₹ 44.51 thousand (66.76 %), semi-medium ₹ 40.64 thousand (61.76 %), and medium farms ₹ 38.24 thousand (59.08 %) of the annual maintenance total cost.

Whereas total fixed annual maintenance cost incurred by marginal farms were on an average

Table 3: Annual maintenance cost of bearing-litchi orchard (After 5th year) (In ₹ per hectare)

| Particulars | Type of farmers | | | | Overall (n=90) |
|-------------------------------------|---------------------------------|-------------------------------|-------------------------------------|--------------------------------|-------------------|
| | Marginal (n ₁ =8) | Small (n ₂ =18) | Semi-medium (n ₃ =46) | Medium (n ₄ =18) | |
| (I) Variable Cost | | | | | |
| Labor cost | 23663.00 (35.01) | 21372.00 (32.06) | 20016.00 (30.42) | 17321.00 (26.76) | 20073.00 (30.45) |
| Draft power | 3330.74 (4.93) | 3540.95 (5.31) | 3129.73 (4.76) | 2926.74 (4.52) | 3189.24 (4.84) |
| Material cost | 12858 (19.02) | 12316 (18.47) | 10671 (16.22) | 10582 (16.35) | 11177 (16.95) |
| Miscellaneous cost | 1525 (2.26) | 1245 (1.87) | 1125 (1.71) | 1085 (1.68) | 1177 (1.79) |
| Land revenue | 372 (0.55) | 372 (0.56) | 372 (0.57) | 372 (0.57) | 372 (0.56) |
| Depreciation | 537.00 (0.79) | 719.00 (1.08) | 811.00 (1.23) | 1712.00 (2.64) | 948.00 (1.44) |
| Total working capital | 42285.74 (62.56) | 39564.95 (59.35) | 36124.73 (54.89) | 33998.74 (52.52) | 36936.24 (56.03) |
| Interest on working capital @ 12.5% | 5285.72 (7.82) | 4945.62 (7.42) | 4515.59 (6.86) | 4249.84 (6.56) | 4617.03 (7.00) |
| Total variable cost | 47571.46 (70.38) | 44510.57 (66.76) | 40640.32 (61.76) | 38248.58 (59.08) | 41553.27 (63.03) |
| (II) Fixed Cost | | | | | |
| Rental value of land | 7203.20 (10.66) | 9417.04 (14.13) | 12269.64 (18.64) | 13449.56 (20.77) | 11484.68 (17.42) |
| Amortized cost | 11334.19 (16.77) | 11099.01 (16.65) | 11032.99 (16.77) | 11078.81 (17.11) | 11082.12 (16.81) |
| Sub-total fixed cost (II) | 18537.39 (27.43) | 20516.05 (30.77) | 23302.63 (35.41) | 24528.38 (37.89) | 22566.80 (34.23) |
| Interest on fixed capital @ 8 % | 1482.99 (2.19) | 1641.28 (2.46) | 1864.21 (2.83) | 1962.27 (3.03) | 1805.34 (2.74) |
| Fixed costs | 20020.39 (29.62) | 22157.33 (33.24) | 25166.84 (38.24) | 26490.65 (40.92) | 24372.14 (36.97) |
| Annual maintenance of total costs | 67591.84 (100.00) | 66667.90 (100.00) | 65807.16 (100.00) | 64739.23 (100.00) | 65925.41 (100.00) |

Figures in parentheses indicate percentage to the total annual maintenance cost.

estimated to be in ₹ 20.02 thousand (29.62 %), small farm in ₹ 22.16 thousand (33.24%), semi-medium farm in ₹ 25.16 thousand (38.24 per cent) and medium farm in ₹ 26.49 thousand (40.92 per cent) of the annual maintenance total cost. It can be observed that fixed costs under both establishment and annual maintenance cost of litchi orchard according to increase with increase in land holding, but total costs under establishment and annual maintenance of litchi orchards were reduce with increase in land holdings.

4. Investment Evaluation per hectare of the Litchi Production

To explain the litchi production an investment was economically feasible test though the farmers help in decision making process they put in first priority. Generally, costs and returns of litchi orchards were down within a production cycle or year in investment analyzing the Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) are measurements (presented in Table 4) to understand the time value of money and opportunity cost (i.e. interest or discounting rate create the lending and deposit of time value of money). A rupee today is worth more than a rupee in future.

5. Net Present Value (NPV)

The net present value or worth was worked out per hectare resource using discount rate account to be 15 per cent. The NPV of overall farms were to be get in ₹ 6.21 lakhs earned per hectare from litchi orchard, which earn were varied to in ₹ 3.37 lakhs on marginal, in ₹ 4.85 lakhs on small, in ₹ 6.73 lakhs on semi-medium, and in ₹ 7.51 lakhs, on medium farms. It may be observed that net present

value (NPV) was increase with increase in land possession by farms groups. These NPV test was more than zero or positive, it said that economically very sound position.

6. Benefit-Cost Ratio (BCR)

Benefit cost ratio indicates that one rupee expenses for litchi production they earn more as in ₹ 1.94 on marginal, in ₹ 2.37 on small, in ₹ 2.92 on semi-medium, in ₹ 3.16 on medium farms. After that benefit-cost ratio (BCR) of overall farms was estimate to be in ₹ 2.77 earned from one rupee their expenditure. Thus, benefit-cost ratio (BCR) was increased with increase in land owner farm groups.

7. Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is the ratio to make the present value of total benefit equal to the present value of total cost. IRR indicates the productivity of capital with contrast marginal cost of money to the as expressed in percentage with limited budget of litchi growers. Internal rate of returns (IRR) of overall farms were account to be 22.64 % opportunity cost as reinvestment a good method of prioritize, since the value was not change by such a way of applying obtained result in percentage (IRR) higher than the market rate of interest were chosen as two discount rate that 15 per cent lower discount rate and 20 per cent higher discount rate for IRR of litchi production evaluation. After that IRR of semi-medium farms were estimated to be 25.87 % higher followed by 25.67 % on small farms, 25.38% on medium farms and 23.03 % on marginal farm. IRR value was obtained greater than chosen discount rate as 15 and 20 per cent to make the decision about reinvestment opportunity to open prioritize by litchi growers.

Table 4: Investment analysis of litchi orchard

| Particulars | Category of farms | | | | Overall farms (n=90) |
|---|------------------------------|----------------------------|----------------------------------|-----------------------------|----------------------|
| | Marginal (n ₁ =8) | Small (n ₂ =18) | Semi-medium (n ₃ =46) | Medium (n ₄ =18) | |
| Net present worth (NPW in ₹) discounted rate @15% | 336532.42 | 485027.23 | 673486.41 | 750575.83 | 621256.26 |
| Benefit cost ratio (BCR in ₹) discounted rate @ 15% | 1.94 | 2.37 | 2.92 | 3.16 | 2.77 |
| Internal rate of return (IRR in %) [Discount rate chosen as 15 % lower & 20 % higher] | 23.03% | 25.67 % | 25.78 | 25.38 % | 25.64 % |

8. Per hectare Annual Investment of Litchi Orchard for Juvenile Stage

In the juvenile stage of litchi orchard initial period of time was consumed generally as one to fifth year for development orchards. So that annual investment consist of variable and fixed cost were worked out as labour cost as layout, digging pits, draft power as machine and bullock labour, material costs as seedling plant (planting material), manures and fertilizer, irrigation charge, plant protection measure, interest, rental value of land, land revenue and depreciation show in Table 5.

In Table 5 revealed that total establishment cost per hectare of litchi cultivation of overall farms was estimated to be in ₹ 2.56 lakhs, which were distributed to approximately around in ₹ 50.00 thousand annually expenses up to fifth year except first year investment. However, initial year expenditure was account to be in ₹ 59.21 thousand higher expenditure than that of rest years. After those variable costs were one third expenses of the annual investment. While the fixed costs were one fourth expenditure of the annual establishment cost. In total establishment costs were reduced with

Table 5: Annual investment of non-bearing litchi orchard (In ₹ per hectare)

| Sl. No. | Particulars items | Overall farms | | | | | Overall |
|-------------------|--|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| | | I year | II year | III year | IV year | V year | |
| 1 | Labor cost | 20561.67 (34.73) | 9628.55 (19.77) | 12528.82 (25.13) | 12211.40 (24.82) | 12828.68 (26.08) | 68113.30 (26.59) |
| 2 | Draft Power | 4852.72 (8.20) | 6186.93 (12.71) | 3100.26 (6.22) | 3223.29 (6.55) | 3357.80 (6.83) | 20449.62 (7.98) |
| 3 | Material Cost | 19075.38 (32.21) | 17181.57 (35.28) | 15645.57 (31.38) | 14104.25 (28.67) | 15244.80 (30.99) | 81168.78 (31.69) |
| 4 | Total working capital | 44489.76 (75.14) | 32997.05 (67.76) | 31274.65 (62.72) | 29538.93 (60.04) | 31431.27 (63.90) | 169731.69 (66.26) |
| 5 | Interest rate of working capital @12.5% | 5561.22 (9.39) | 4124.63 (8.47) | (3909.33 (7.84) | 3692.37 (7.50) | 3928.91 (7.99) | 21216.46 (8.28) |
| 6 | Total variable cost (Sl. No. ii + iii+iv+vi) | 50050.98 (84.53) | 37121.68 (76.23) | 35183.98 (70.56) | 33231.30 (67.54) | 35360.18 (71.89) | 190948.15 (74.54) |
| Fixed Cost | | | | | | | |
| 7 | Rental value of land | 7272.00 (12.28) | 9505.70 (19.52) | 12381.47 (24.83) | 13577.11 (27.59) | 11591.19 (23.57) | 54327.48 (21.21) |
| 8 | Land revenue | 371.00 (0.63) | 371.00 (0.76) | 371.00 (0.74) | 371.00 (0.75) | 371.00 (0.75) | 1855.00 (0.72) |
| 9 | Depreciation | 840.16 (1.42) | 840.16 (1.73) | 840.16 (1.68) | 840.16 (1.71) | 840.16 (1.71) | 4200.78 (1.64) |
| 10 | Sub-Total | 8483.16 (14.33) | 10716.85 (22.01) | 13592.63 (27.26) | 14788.26 (30.06) | 12802.35 (26.03) | 60383.26 (23.57) |
| 11 | Interest on fixed capital @ 8 % | 678.65 (1.15) | 857.35 (1.76) | 1087.41 (2.18) | 1183.06 (2.40) | 1024.19 (2.08) | 4830.66 (1.89) |
| 12 | Fixed costs | 9161.81 (15.47) | 11574.20 (23.77) | 14680.04 (29.44) | 15971.32 (32.46) | 13826.54 (28.11) | 65213.92 (25.46) |
| 13 | Total establishment cost (vii + xiv) | 59212.80 (100.00) | 48695.88 (100.00) | 49864.02 (100.00) | 49202.62 (100.00) | 49186.72 (100.00) | 256162.07 (100.00) |
| 14 | Amortized cost | 2561.66 | 2106.69 | 2157.23 | 2128.67 | 2127.92 | 11082.12 |
| 15 | Expected life of tree (in years) | 40 | 40 | 40 | 40 | 40 | 40 |
| 16 | Marginal | 60559.08 | 49803.23 | 50998.03 | 50321.67 | 50305.26 | 261987.3 |
| 17 | Small | 59302.51 | 48769.84 | 49939.85 | 49277.52 | 49261.46 | 256551.2 |
| 18 | Semi-medium | 58949.75 | 48479.73 | 49642.78 | 48984.39 | 48968.42 | 255025.1 |
| 19 | Medium | 59194.59 | 48681.08 | 49848.96 | 49187.84 | 49171.8 | 256084.3 |
| 20 | Overall farms | 59212.24 | 48695.59 | 49863.83 | 49202.51 | 49186.47 | 256160.6 |

Figures in parentheses indicate percentage to the year wise of total establishment cost.

increase in land holding except medium farms expenses range similar to small farms.

CONCLUSION

The establishment and annual maintenance costs both were increased with increase in land possession but variable costs include in total costs (fixed and variable) were reduced with increase in land owner farms groups. Thus, It may be concluded that increase in land ownership farm groups reflected to decreased in cost of production of litchi. . The gross value of the litchi production on overall farms was estimated on an average in ₹ 2.95 lakhs per hectare against cost C as well as annual maintenance costs was in ₹ 65.93 thousand per hectare. The costs of production of litchi on overall farms was accounted on an average to be in ₹ 941.52 per quintal litchi, which were varies from ₹ 1197.58 per quintal litchi and estimated higher on marginal farms, followed by ₹ 1045.77 per quintal on small farms, ₹ 898.75 per quintal on semi-medium farm, and ₹ 872.97 per quintal on medium farms. The net present value (NPV) was increased with increase in land custody by farms groups. Thus, net present value (NPV) was test more than zero as well as positive indicating that economically sound position. Similarly, in case of benefit-cost ratio (BCR) it was more than one rupee increased with increase in land owner farm groups. However, internal rate of returns (IRR) (%) was observed higher on semi-medium followed by small, medium and marginal land owner farm groups of selected household. The estimated internal rate of returns (IRR) for litchi enterprise was found more than chosen discount rate of 15 and 20 per cent also indicated that there is huge scope for investment on these sector and can set their priority to make decision on entrepreneurs development.

REFERENCES

- Christian, R.R. and Zala, Y.C. 2014. "Cost and returns of citrus in Middle Gujarat". *Int. Res. J. Agril. Econ. and Statistics*, 5(1): 23-26.
- Gangwar, L.S., Singh, D. and Mandal, G. 2008. "Economic Evaluation of Peach Cultivation in North Indian Plains". *Agril. Econ. Res. Rev.*, 21: 123-129.
- Hatai, L.D. 2018. "Cost of Cultivation and Economic Returns Analysis of Cashewnut in West Garo Hills of Meghalaya". *Econ. Aff.*, 63(2): 399-405.
- Helmets, Glenn A. 2004. "Land Valuation and the Income Capitalization Model" (2004). *Cornhusker Economics*, 77.
- John L. Sorrels and Homas G. Walton. 2017. "Cost Estimation: Concepts and Methodology" Research Triangle Park, NC 27711. <https://www.slideshare.net/profracumardvr3/epacmcostestimationmethodchapter-7thedition-2017>
- Kammardi, Prakash T.N. 2017. "Areca nut Economy at the Cross Roads". *Special Scheme on Cost of Cultivation of Areca nut in Karnataka (GOI), Department of Agricultural Economics, University of Agricultural Sciences, GKVK, Bengaluru*. www.costofcultivationkarnataka.in
- Kayastha, R., Sharma, R., Singh, N. and Sharma, N. 2020. Economic Analysis of Marketing of Litchi (*Litchi chinensis*) in Himachal Pradesh. *Econ. Aff.*, 65(3): 343-348.
- Kumar, A., Singh, R., Singh, P.K., Yadav, B. and Choudhri, H.P.S. 2022. Economic Aspects of Potato Cultivation in Sultanpur District of Uttar Pradesh. *Econ. Aff.*, 67(01 Spl.): 15-18.
- Kumari, M. and Panda, C.K. 2020. Analysis of demand supply and production constraints in major fruits & vegetables in Bihar. *Econ. Aff.*, 65(2): 225-232.
- Khuda, B., Hassan, I. and Akhter, M.S. 2006. "Profitability and Cost in Growing Mango Orchards". *J. Agric. & Soc. Sci.*, 02(1): 46-50.
- Kumar, S.P. and Pundir, R.S. 2016. "An economic analysis of production of pomegranate in middle Gujarat" *Int. J. Forestry and I Crop Improvement*, 7(1): 101-107.
- Kireeti, K. Guleria, C., Mukherjee, N.D. and Sharma, L.R. 2014. "A study of the cost of production of apples in Shimla district of Himachal Pradesh" *Society for Scientific Development in Agric. and Tech. Progressive Research*, 9(Conf. Spl.): 866-870
- Varghese, P.K. 2007. "Economics of Cardamom Cultivation in Kerala". *Indian J. Agril. Econ.*, 62(1): 99-112, 200.
- Veer Sain, V.P. Luhach, Singh, Mehla Mohinderand Vedjyoti. 2013. "Economics Analysis of Guava Production in Haryana" *IOSR J. Agric. and Vet. Sci. (IOSR-JAVS)*, 5(5): 07-11.