

Economic Analysis of Guava (*Psidium guajava* L.) in Sonapat District of Haryana

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Received: 18-06-2019

Revised: 22-10-2019

Accepted: 21-11-2019

ABSTRACT

The present study has been designed to investigate cost of cultivation and returns per hectare of guava fruit. A sample of thirty guava farmers was taken purposively from various villages in Rai block of Sonapat district of Haryana. On the basis of the nature of data, various statistical and economic tools were used for estimation of cost and returns of guava production. The average first year establishment costs per hectare for guava has been worked out to be ₹ 77527. The per hectare per year returns from guava orchards have been worked out to be ₹ 223308. The economic viability of the guava, mainly net present value, internal rate of return, benefit-cost ratio and payback period have been computed as ₹ 599313.66, 26.11 per cent, 1:3.09 and 7 years, respectively. The findings of study shows that guava growing is a step towards the diversification and commercialization of agriculture in the state and it also helps in doubling the farmers' income. Keeping in view all the facts, there is need to develop early fruit bearing varieties of guava, timely supply of necessary inputs to make guava cultivation more profitable.

Highlights

- Guava growing is a step towards the diversification and commercialization of agriculture in the state and it also helps in doubling the farmers' income.

Keywords: Guava, returns, benefit-cost ratio, NPV, PBP and IRR

Guava (*Psidium guajava* L.), the "poor man's fruit" or "apple of the tropics" is a popular tree fruit of the tropical and subtropical climate and is native to the tropical America stretching from Mexico to Peru. It has been adopted in India having a production of 2.27 million metric tonnes with an area coverage of 0.20 million hectares (Kumar *et al.* 2017). Whereas among different states, Haryana is most important guava producing state comprising of 12089 hectare area under the crop and production 137022 MT during 2017-18 (Horticultural department government of Haryana). Now-a-day's guava is considered as one of the exquisite, nutritionally valuable and remunerative crop, which is used

for both, fresh consumption and processing. In addition to this, it also gives good economic returns involving very little input, which has prompted several farmers to take up guava cultivation on a commercial scale. Whereas, marketing of guava crop is one of the major problem faced by the growers, which have a direct impact on their prosperity (Nandal and Punia, 2003). Therefore, an attempt has been made to assess the economic analysis of guava in Sonapat district of Haryana during the agricultural year 2017-18.

How to cite this article: Kumar, R., Kumar, N., Dhillon, A., Bishnoi, DK., Kavita and Malik, A.K. (2019). Economic analysis of guava (*Psidium guajava* L.) in sonapat district of Haryana. *Economic Affairs*, 64(4): 747-752.

MATERIALS AND METHODS

Multistage stratified sampling technique was adopted to select the ultimate unit of sample. Out of twenty two districts of Haryana state Sonapat district was selected, on the basis of highest production which accounted about 14.96 per cent of total guava production in the state during 2017-18. A sample of thirty guava farmers was taken purposively from various villages in Rai block of Sonapat district of Haryana. Primary data pertaining to the year 2017-18 were collected from selected respondents by conducting personal interviews with help of specifically designed schedule.

Amortization of fixed cost

The annual amortization of cost was computed from the investment made on establishment of guava fruits, having 12 per cent rate of interest per annum as per bank guidelines and expected life of 25 years. Thus, annual amortization was worked out by using the compounding cost formula and by adding it to maintenance cost for estimating the annual cost of cultivation of guava fruits of respective farmers.

$$I = B \frac{i}{1 - (1 + i)^n}$$

Where,

I = Annual cost (in ₹), B = Present fixed cost (in ₹), i = Interest rate (12% per annum) and n = Economic life of the guava orchard (in years).

Economic viability

To examine the economic feasibility of orchard while studying the economics of guava cultivation, four indicators were used viz., net present value (NPV), internal rate of return (IRR), cost benefit ratio and payback period. The detailed method used to find out these indicators are given below.

Net present value

Future net returns were discounted to their net present value by using the following formula:

$$N.P.V. = \frac{R_1}{(1+r)^1} + \frac{R_2}{(1+r)^2} + \dots + \frac{R_{n-1}}{(1+r)^{n-1}} + \frac{R_n}{(1+r)^n}$$

Where, R_1, R_2, \dots, R_n are the net returns in the period 1, 2, n , respectively, ' n ' is the life span

in years of the investment in the guava orchard, ' r ' is the discount rate (prevailing interest rate) and N.P.V. is net present value of returns $R_1, R_2, R_3, \dots, R_n$.

Internal rate of return

In estimating the internal rate of return, the investment cost and incremental gross returns for each year in the life of guava orchard were calculated. The internal rate of return was calculated at the different rate of discount until it satisfies the relationship $B - C = 0$ where ' B ' is the sum of discounted stream of positive value (returns) and ' C ' is taken as the sum of discounted stream of negative values (costs).

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

Benefit: Cost ratio

The benefit cost ratio is the ratio between the sum of discounted net benefits of returns (R) and the sum of discounted cost (K), i.e. $B = R/K$. If this ratio is greater than 1.00 then the investment in guava orchard is considered to be economically viable.

Payback period

It is the period within which the cost of guava orchard is fully recovered from its own returns. For this condition, the following relationship must be used,

$$PBP = \sum_{j=1}^{n^*} C_j \leq \sum_{j=1}^{n^*} B_j$$

RESULTS AND DISCUSSION

Establishment cost of guava orchard

The results presented in Table 1, indicated that the average total establishment cost of guava orchard in Sonapat district was estimated ₹ 77527 per hectare. The highest cost item of expenditure was permanent fencing which was worked out to be ₹ 14085 per hectare, that constitute 18.17 per cent followed by digging and filling of pits ₹ 10663 per hectare, contributing 13.75 per cent, plant ₹ 8250, which constituted 10.64 per cent, manures and fertilizers which was found to be ₹ 7465 per hectare,

constituting 9.63 per cent to total establishment cost and plantation ₹ 6875, contributing 8.87 per cent of total establishment cost, equipments ₹ 6695 contributing 8.64 per cent, preparation of land and layout ₹ 6688 contributing 8.63 per cent and transportation of plants ₹ 6408 contributing 8.27 per cent. In case of guava plantation ₹ 11502 per hectare subsidy was provided by government under National Horticulture Mission (NHM) scheme to increase the area under guava cultivation in the state.

Table 1: Establishment cost of guava orchard in Sonapat district of Haryana

Sl. No.	Particulars	Value (₹/ hectare)	Percent
1	Preparation of land and layout	6688	8.63
2	Digging and filling of pits	10663	13.75
3	Cost of irrigation	2808	3.62
4	Cost of plant	8250	10.64
5	Cost of replacement plant	1420	1.83
6	Manures and fertilizer	7465	9.63
7	Transportation of plant	6408	8.27
8	Plantation cost	6875	8.87
9	Intercultural operation	3085	3.98
12	Permanent fencing	14085	18.17
13	Cost of equipments	6695	8.64
14	Miscellaneous	3085	3.98
Total cost		77527	100

Operational cost of guava orchard

It is clear from the data in the Table 2 that the operating cost per hectare increased over years because of higher expenses incurred on various inputs and hike in picking cost. This increase may be attributed to the direct relationship between the physical input requirement and age of the plants. The annual operating cost ranges from ₹ 45223 in the first year to ₹ 88914 per hectare in the seventh year. The operational cost keeps on increasing up to seventh year of the establishment of an orchard and thereafter it becomes more or less stabilized. The operational cost per hectare per annum from first to seventh years were found to be ₹ 13547.71 on plant protection (20.34%), ₹ 11776.57 on manure and fertilizers (17.68%), ₹ 9131.29 on intercultural and hoeing (13.71%), ₹ 9080.14 on irrigation (13.63%), ₹ 8802.29 on picking (13.22%), ₹ 7136.00 on watch

and ward (10.72%) followed by ₹ 3991.57 on pruning and cutting (5.99%), were the major constituents of operational cost of a guava orchard per annum per hectare. Similar findings were also reported by Naphade and Tingre (2008) and Sharma *et al.* (2006).

Cost and returns from guava orchard

Data presented in Table 3 reveals the cost and returns per hectare of guava orchard at different ages i.e. from the year of establishment to seventh-year age of orchard. It was observed that there was no production of guava up to the age of three years since the bearing of fruits usually starts after attaining three years of age. The per hectare production of fruits starts increasing gradually from nearly 53 quintals in fourth year to about 270 quintals in seventh year orchard age. However, after attaining the age of seven year it remain almost static with advance in age of the plants. Hence, the gross returns per hectare from guava orchard increase up to seventh year age of the plants. The gross returns per hectare worked out to be ₹ 422280 in the seventh year that was full bearing stage. This rate of return was expected to be more or less same up to age of 25 years.

Taking into account the rental value of land, amortized fixed cost, operational cost, expected depreciation on fixed investment and interest on operational cost, the net returns per hectare have been worked out over time. The total cost varied from ₹ 127753 per hectare in the first year to ₹ 198972 per hectare in the seventh year. The net returns from inter cropping ranges from ₹ 39223 to ₹ 16335 per hectare during the first year to fifth year of the guava orchard. Even after taking the returns from intercropping in the orchard the orchardist has to bear a loss of ₹ 88530, ₹ 101549, ₹ 118758 and ₹ 65519 per hectare in first, second, third and fourth year, respectively. During the fifth year the net returns become positive and worked out to be ₹ 8551 per hectare. The net returns scale up to seventh year i.e. ₹ 223308 per hectare and after that it become more or less stable up to the age of 25 years. The net returns were negative in first four initial years and then were found to be positive from the fifth year to seventh year and onwards. In the seventh year the cost and returns were almost stable as the orchard was fully matured. Net returns from guava orchard up to seventh year are presented in

Table 2: Operational cost of guava orchard in Sonapat district of Haryana (₹/hectare)

Sl. No.	Particulars	Years							Total cost	Average cost per annum
		1	2	3	4	5	6	7		
1	Manure and fertilizer	10657	11162	11404	11723	12243	12438	12809	82436	11776.57(17.68)
2	Plant protection	12468	13090	13420	13935	13740	13963	14218	94834	13547.71(20.34)
3	Pruning and cutting	—	—	4743	5078	5660	6025	6435	27941	3991.57(5.99)
4	Intercultural and hoeing	7655	8600	8655	9113	9743	9938	10215	63919	9131.29(13.71)
5	Irrigation cost	6410	8160	9185	9453	9965	10058	10330	63561	9080.14(13.63)
7	Replacement and causality	743	780	887	955	1025	1059	1410	6859	979.86(1.47)
8	Watch and ward	6150	6595	6853	7362	7465	7563	7964	49952	7136.00(10.72)
9	Picking cost	—	—	—	6585	12855	19733	22443	61616	8802.29(13.22)
10	Miscellaneous	1140	1748	1880	1973	2428	2800	3090	15059	2151.29(3.23)
Total operational cost		45223	50135	57027	66177	75124	83577	88914	466177	66596.71(100)

Figures in parentheses are the percentage to the average cost per annum

Table 3: Cost and return from guava orchard in Sonapat district of Haryana (₹/ hectare)

Sl. No.	Particulars	Years						
		1	2	3	4	5	6	7
1	Rental value of land	64118	69725	72808	75640	82469	83910	86407
2	Amortized fixed cost	9885	9885	9885	9885	9885	9885	9885
3	Operational cost	45223	50130	57030	66175	75123	83573	88910
4	Expected depreciation on fixed cost investment @4%	3101	3101	3101	3101	3101	3101	3101
5	Interest on operational cost @12% PA	5427	6016	6844	7941	9015	10029	10669
6	Total cost (1 to 5)	127753	138857	149668	162742	179592	190497	198972
7	Production (qtls)	—	—	—	53	118	188	270
8	Price (₹/qtls)	—	—	—	1345	1456	1510	1564
9	Gross returns#	—	—	—	71285	171808	283880	422280
10	Net returns	-127753	-138857	-149668	-91457	-7784	93383	89323
11	Return from inter cropping	39223	37308	30910	25938	16335	—	—
Total net returns		-88530	-101549	-118758	-65519	8551	93383	223308

Gross return has been worked out by taking average price (₹1564 per quintal) received by farmers during peak marketing season of the current period in Sonapat market.

Fig. 1. Nandal and Punia (2003) also revealed that net return per acre from guava orchard was ₹ 45248. On an average the cost of production per quintal was found to be ₹ 136.77 for guava cultivation. Economics of guava crop cultivation shows that grower had to face losses during the first three years of cultivation. The net present value for one hectare guava orchard was ₹ 599313.66. A very high internal rate of return of 26.11 per cent per annum pointed that investment on guava orchards is highly profitable and internal rate of return exceed than present market interest rate. At discount rate of 12 per cent, on an average the benefit cost ratio was found 1:3.09. The payback period of investment of guava orchard was found to be seven years. Similar findings were also reported by Kumbhar et al. (2014) and Kumar et al. (2019).

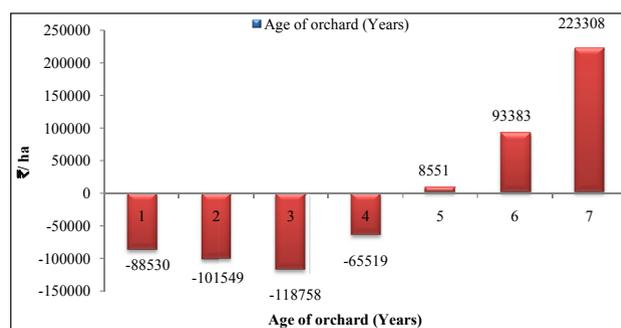


Fig. 1: Net returns from guava orchard

Economic viability of guava orchard

To examine the economic feasibility of guava orchard, four indicators were used viz., net present value (NPV), and internal rate of returns (IRR), benefit-cost ratio and payback period which are discussed as below:

Net present value (NPV) of guava orchard

Costs and returns data presented in Tables 3 do not serve as true guide for making choice to go for guava orchard *vis-à-vis* other annual crops. This was due to the fact that cost incurred and returns gained from guava orchard over time are not comparable with annual crops grown in the area. Returns from investment in annual crops can be obtained within a year, while minimum three to four years period must be lapsed after planting before any returns are obtained over operational costs from guava orchards. Hence, it is necessary to estimate the net present value of future returns which can be determined by discounting both the costs as well as returns at the prevailing rate of interest. In the present study the prevailing interest rate of 12 per cent per annum was taken as discount rate of the costs and returns to determine NPV of the guava orchard.

Table 4: Per hectare net present value of guava orchard in Sonapat district of Haryana ($r = 12\%$)

Year	Negative returns (₹)	Positive returns (₹)	Discount coefficient $1/(1+r)^n$	Present value	
				Negative returns (₹)	Positive returns (₹)
1	-88530	—	0.8929	-79044.89	—
2	-101549	—	0.7972	-80953.92	—
3	-118758	—	0.7118	-84529.31	—
4	-65519	—	0.6355	-41638.51	—
5	—	8551	0.5674	—	4851.95
6	—	93383	0.5066	—	47310.63
7 (and onward up to 25 years)	—	223308	3.7317	—	833317.72
Total	-374355	325242	—	-286166.64	885480.30

Net present value (NPV) = 885480.30 – 286166.64 = 599313.66

The net present value thus computed is showed in Table 4. The figure given in this table showed that net present values (NPVs) for one hectare guava orchard was ₹ 599313.66 for the entire life (25 years) of the guava orchard. The positive NPV of guava cultivation is a profitable crop enterprise in the Sonapat district of the state.

Internal rate of return (IRR) of guava orchard

In estimating the internal rate of return, the

investment cost, gross returns from first to seventh year and the life of guava orchard have been depicted in Tables 5. The net cash flow was obtained by using these single values which may have negative and positive signs according to quantum of costs and benefits or returns in every year.

Table 5: Internal rate of return from one hectare of guava orchard in Sonapat district of Haryana (₹/ hectare)

Year	Net cash Flow	Present value Coefficient $r = 26\% (1/(1+r)^n$	Corresponding present value (₹)	Present value coefficient $r = 27\% (1/(1+r)^n$	Corresponding present value (₹)
1	-88530	0.7937	-70262.13	0.8333	-73775.23
2	-101549	0.6299	-63963.59	0.6944	-70519.86
3	-118758	0.4999	-59367.64	0.5787	-68725.46
4	-65519	0.3968	-25994.72	0.4823	-31596.74
5	8551	0.3149	2692.49	0.4019	3436.37
6	93383	0.2499	23336.92	0.3349	31273.71
7 (and onward up to 25 years)	223308	0.9493	211986.09	1.6221	362227.58
Total	—	—	18427.43	—	152320.37

IRR = 26 + 1 (18427.43)/(18427.43 + 152320.37) = 26 + 0.11 = 26.11 per cent

To find out the present value, the discounted rate was estimated by different discount rate at random until the difference between the sum of discounted streams of positive and negative values is reduced either to zero or to a lowest minimum value. Thus, computed values of internal rate of returns are shown in Tables 5. The data presented in this Table indicates a very high internal rate of return of 26.11 per cent per annum indicating that investment on guava orchards is highly profitable and internal rate of return is comparatively more than the present market interest rate i.e. 12 per cent per annum.

Benefit-Cost ratio of guava orchard

At discount rate of 12 per cent, on an average the benefit cost ratio obtained was equal to 1:3.09. It indicates that at the prevailing rate of interest at 12 per cent per annum on investment of ₹ 1.00 would fetch a return of ₹ 3.09. Since this ratio was greater than unity, it shows that the investment in guava orchard is considered to be economically viable. Nandal and

Punia (2003) reported similar observation that the IRR, net present value, benefit-cost ratio and payback period of guava have been observed 17.25 per cent, ₹ 200099.75 per acre, 1:4.02 and 8 years, respectively.

Payback period of guava orchard

As depicted in Table 3, the net cost incurred during the first five years of the guava plantation was ₹ 374355 per hectare. These costs are more than the return of ₹ 325242 per hectare. These costs are fully recovered in seventh year of establishment of guava plantation. Thus, the payback period of investment of guava orchard is seven year. Bhat *et al.* (2011) reported similar observation that the IRR, net present value, benefit-cost ratio and payback period of kinnow have been observed to vary from 14.75 per cent to 16.00 per cent, ₹ 7468 to ₹ 11649 per acre, 1:1.07 to 1:1.65 and 7.2 to 7.8 years, respectively, depending on the size of the orchards.

CONCLUSION

In the light of above discussion, it may be said that although the initial investment in guava orchard establishment is very high yet it is an economically viable enterprise. Per hectare establishment cost of guava orchard was estimated ₹ 77527. The total cost varied from ₹ 127753 per hectare in the first year to ₹ 198972 per hectare in seventh year. Average per year net return for the sample as a whole was ₹ 223308 among the different age groups of guava orchard. The economic viability of the guava, mainly net present value, internal rate of return, benefit-cost ratio and payback period have been computed as ₹ 599313.66, 26.11 per cent, 1:3.09 and 7 years, respectively. The orchards indicating that guava cultivation was a profitable enterprise. It has a vital potential in increasing the income and gainful employment of family community. Guava growing is a step towards the diversification and commercialization of agriculture in the Haryana state.

SUGGESTIONS AND POLICY IMPLICATIONS

Keeping in view the findings of the present study it is suggested that the guava fruit growers, policy makers and researchers to make profitable enterprises by taking these steps.

- ♦ The early fruit bearing varieties should be developed to make guava fruit profitable.
- ♦ Quality planting material suited to the area should be provided to the farmers.
- ♦ Insurance of guava orchard should be encouraged at lower insurance premium to minimize the risk due to natural hazards.
- ♦ The government should make adequate arrangement for timely supply of necessary inputs at reasonable prices to the growers so as to increase per hectare productivity as well as net returns.

ACKNOWLEDGEMENTS

Authors wish to acknowledge Chaudhary Charan Singh Haryana Agricultural University and all the farmers who participated in the study and made the study successful.

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