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Research Note

An Economic Evaluation of Investment on Aonla (*Emblica officinalis* G.) in Gujarat*

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Abstract

The economic viability of aonla plantation in Gujarat has been studied through a sample of 120 aonla growers spread over 12 selected villages of the Kheda and Anand districts for the agricultural year 2003-04. It has been found that establishment of aonla orchard involves high investment, but the annual net returns are also quite high, after the third year of plantation. The values of economic parameters, viz. NPV, BCR, IRR and PBP have been found to be Rs 652652, 5.25, 65.03 per cent and 55 months, respectively at 10 per cent discount rate. Under varying cost and return situations, values of all these feasibility parameters have satisfied the acceptance rules for the investment proposition. It has confirmed the economic viability, stability and certainty of investment on aonla orchard. The study has suggested that financial institutions should give credit to aonla producers in the area.

Introduction

Aonla or Indian gooseberry (*Emblica officinalis* G.) is an indigenous fruit of Indian subcontinent and its fruit is a rich source of vitamin C. It is highly valued among indigenous medicines. Its hardy nature, suitability to various wastelands, high productivity, and nutritive and therapeutic value have made aonla an important fruit. It can be judged from the fact that area

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under aonla has expanded rapidly in the past couple of decades in India as well as in the Gujarat state. It was being cultivated mainly in the Kheda and Anand districts of central Gujarat, but during the past decade, its cultivation has spread over the entire state. Currently, area under aonla in the state is around 8,000 hectares with the annual production of about 56,000 tonnes. Proper farm business data are not available on the cost of its production and marketing. A study on the economic status of its production may help the extension workers and policymakers to devise appropriate policy for the production of this crop. It may also be useful to the financial institutions for fixing scale of loan and subsidies, which will ultimately benefit the aonla growers. Considering these facts, the present study was undertaken with the following specific objectives:

1. To appraise the economic feasibility of investment on aonla cultivation, and
2. To estimate the profitability (per hectare) in aonla cultivation.

Methodology

Sampling Design and Database: The central Gujarat having about 48 per cent of the total area of aonla in the state was selected for the study. The selection of sample was made using two-stage stratified random sampling technique. Two districts, viz. Kheda and Anand, in the central Gujarat were selected purposively, as they had the highest area under aonla — about 79 per cent in the central Gujarat. Two talukas from each district — Nadiad and Thasra from Kheda district, and Anand and Umreth from Anand district — having maximum area under aonla were selected purposively. The number of villages from each selected taluka was decided on the basis of relative area of aonla in the taluka. In all, 12 villages were chosen at random, 9 from the Kheda and 3 from the Anand district. Ten growers were selected from each of these villages at random in proportion to number of growers in the size group of different holdings. Thus, in all, 120 growers comprising 20 marginal (<1 ha), 29 small (1 ha to < 2 ha), 41 medium (2 ha to < 4 ha) and 30 large (4 ha & above) farms were selected for the study. The data were collected during the agricultural year 2003-04.

Statistical Analysis: Simple and weighted average and percentage methods were used for tabular analysis. Analysis for specified objectives was carried out using various standard statistical tools.

Amortization of Fixed Cost: The annual amortization of cost was computed from the investment made on aonla up to the first flowering (i.e. for the first 3 years of aonla plantation) stage, assuming that the rate of interest to be 10 per cent and the expected economic life of aonla orchard to be 35 years.

Thus, annual amortization cost was worked out using the compounding cost formula and by adding it to maintenance cost for estimating the annual cost of cultivation of aonla orchard of respective farm groups.

$$A = P \frac{I(1+I)^n}{(1+I)^n - 1} \quad \ldots(1)$$

where,

A = Annual sum (in Rs),

P = Present sum (in Rs),

I = Interest rate (10 % per annum), and

n = Economic life of the orchard (in years).

Computation of Economic Parameters : The economic feasibility of investment on aonla was assessed by computing the economic parameters, viz. net present value (NPV), benefit cost ratio (BCR), internal rate of return (IRR) and pay back period (PBP) with the conventional methods (Gittinger, 1982). Sensitivity analysis for these four parameters was also carried out to assess the economic viability of aonla production (Annon., 2001).

Net Present Value (NPV): In the present study, the net cash inflow and outflow from aonla orchard during its life time were discounted at the rate of 10 per cent and NPV was computed as per Equation (2):

$$NPV = \sum_{t=0}^{T} \frac{Rt - Ct}{(1+I)^t} \quad \ldots(2)$$

where,

Rt = Returns in the t^{th} year (in Rs),

Ct = Cost in the t^{th} year (in Rs),

I = Discount rate (10 % per annum),

t = Present age of orchard (in years), and

T = Expected life of orchard (in years).

Benefit Cost Ratio (BCR): It was worked out by discounting the future gross returns and cost during the life period of orchard at the rate of 10 per cent, using Equation (3):

$$BCR = \frac{\text{Gross present value of income (B)}}{\text{Gross present value of cost (C)}} \quad \ldots(3)$$

$$B = \sum_{t=0}^{T} \frac{Bt}{(1+I)^t} \quad \text{and} \quad C = \sum_{t=0}^{T} \frac{Ct}{(1+I)^t}$$

where,

Bt = Benefit from orchard in the t^{th} year,

Ct = Cost of orchard in the t^{th} year,

I = Rate of discount (10% per annum),

t = Age of orchard (in years), and

T = Economic life of orchard (in years).

Internal Rate of Returns (IRR) :IRR is that discounted rate at which NPV is zero.

Pay Back Period (PBP) : It was calculated by Equation (4):

$$PBP = \frac{\text{Investment}}{\text{Net annual cash flow}} \qquad \ldots(4)$$

Since the cash flow was not constant from year to year, the PBP was determined by calculating the cumulative proceeds in successive years until the total was equal to the original outlay.

Sensitivity Analysis: Sensitivity analysis for the above four parameters was made with the following assumptions/situations:

(a) 10 per cent increase in costs,

(b) 10 per cent decrease in returns,

(c) 10 per cent increase in costs and ten per cent decrease in returns, and

(d) 10 per cent increase in returns.

Results and Discussion

Investment Pattern in Aonla Orchards

A close perusal of results presented in Table 1 reveals that, on an average, the total investment per hectare was Rs 4,25,430. It was highest in large farms (Rs 4,41,772), followed by medium (Rs 4,37,532), small (Rs 4,10,026) and marginal (Rs 3,98,446) farm groups. It was due to more investment on machinery and irrigation infrastructure by large and medium farms than small and marginal farms. In the total investment per hectare, land accounted for the highest share, varying from about 87 per cent on medium farms to about 96 per cent on marginal farms. The initial investment

Table 1. Investment pattern in aonla orchard on different farm groups

(Rs/ha)

Sl No.	Items	Farm group				All farms
		Marginal	Small	Medium	Large	
1	Land value	381499 (95.75)	386382 (94.23)	382489 (87.42)	387222 (87.65)	384448 (90.37)
2	Planting material	2626 (0.66)	2741 (0.67)	2552 (0.58)	2692 (0.61)	2645 (0.62)
3	Bullock, cart and bullock-drawn implements	0 (0.00)	438 (0.11)	2178 (0.50)	846 (0.19)	1062 (0.25)
4	Tractor and tractor-drawn implements	0 (0.00)	0 (0.00)	21383 (4.89)	20262 (4.59)	12371 (2.91)
5	Sprayers and other implements	1462 (0.37)	606 (0.15)	601 (0.14)	514 (0.12)	724 (0.17)
6	Electric motor and oil-engine	6711 (1.68)	11226 (2.74)	17236 (3.94)	19726 (4.46)	14652 (3.44)
7	Farm-house	2248 (0.56)	5890 (1.43)	8333 (1.90)	7521 (1.70)	6525 (1.53)
8	Fencing and pipeline	3900 (0.98)	2743 (0.67)	2760 (0.63)	2989 (0.68)	3003 (0.71)
	Total	**398446** (100.00)	**410026** (100.00)	**437532** (100.00)	**441772** (100.00)	**425430** (100.00)

Note: Figures within the parentheses indicate percentages to total.

on aonla orchards, land, electric motor, oil-engine, tractor and tractor-drawn implements and farm-house together accounted for about 98 per cent. The similar results were reported by Khunt *et al.* (2003) for pomegranate in the Saurashtra region.

Cost of Establishment

The establishment cost of aonla orchard included cost on human labour, bullock labour and tractor charges, material cost, rent of land, interest on fixed capital, interest on working capital, and depreciation charges incurred up to the first bearing stage of orchard (for the period 1 - 3 years). The results (Table 2) showed that on an average, the total cost of establishment per hectare amounted to Rs 34,033 per year. It was highest on medium farms (Rs 34,997), followed by large (Rs 34,995), small (Rs 32,880) and marginal (Rs 31,807) farms. On an average, of the total establishment cost, rent of land accounted for the highest share (51.98%), followed by material cost (21.26%), human labour cost (10.18%), interest on fixed capital (6.76%), bullock labour and tractor charges (5.11%), interest on working capital

Table 2. Cost of establishment of aonla orchard on different farm groups

(Rs/ha/year)

Sl No.	Items	Farm group				All farms
		Marginal	Small	Medium	Large	
1	Cost on human labour	3690 (11.60)	3435 (10.45)	3403 (9.73)	3374 (9.64)	3465 (10.18)
2	Cost on bullock labour and tractor	1868 (5.87)	1625 (4.94)	1927 (5.51)	1431 (4.09)	1739 (5.11)
3	Total labour cost	5558 (17.47)	5060 (15.39)	5330 (15.24)	4805 (13.73)	5204 (15.29)
4	Total material cost	8123 (25.54)	7661 (23.30)	6770 (19.36)	6691 (19.12)	7236 (21.26)
5	Cost on rent of land	15795 (49.66)	17264 (52.51)	18014 (51.52)	18831 (53.81)	17690 (51.98)
6	Interest on fixed capital	859 (2.70)	1254 (3.81)	3150 (9.01)	3112(8.89) (6.76)	2300
7	Interest on working capital	1360 (4.28)	1346 (4.09)	1356 (3.88)	1290 (3.69)	1348 (3.96)
8	Depreciation	112 (0.35)	295 (0.90)	347 (0.99)	266 (0.76)	255 (0.75)
	Total cost	**31807** (100.00)	**32880** (100.00)	**34967** (100.00)	**34995** (100.00)	**34033** (100.00)

Note: Figures within the parentheses indicate percentages to total cost.

(3.96%). Thus, on an average, expenditure on rent of land, planting material and labour accounted for a major share of about 89 per cent in the total cost of establishment of aonla orchard.

Cost of Production and Returns from Aonla Orchard

The annual cost consisting of amortized and maintenance costs and returns from aonla orchard are presented in Table 3. The data reveal that on an average, the total annual cost incurred per hectare was Rs 46,272. It showed an increasing trend with increase in size of farm, being highest (Rs 49,036) in large farms, followed by medium (Rs 48,966), small (Rs 44,011) and marginal (Rs 40,671) farm groups. The overall amortized cost was Rs 10,587 per hectare per annum, which was 22.88 per cent of the total annual cost, while the annual maintenance cost was Rs 35,685 (77.12 %) to total annual cost.

The average annual production was 9638 kg/ha and showed an increasing trend with increase in size of farm. Annual gross return varied from Rs 98,719/ha on marginal farms to Rs 1,17,696/ha on large farms, with an

Table 3. Cost and returns from aonla orchard on different farm groups

(Rs/ha/year)

Sl No.	Particulars	Farm group				All farms
		Marginal	Small	Medium	Large	
1	Amortized cost	9894	10228	10887	10886	10587
		(24.33)	(23.24)	(22.23)	(22.20)	(22.88)
2	Maintenance cost	30777	33783	38079	38150	35685
		(75.67)	(76.76)	(77.77)	(77.80)	(77.12)
3	**Total cost**	**40671**	**44011**	**48966**	**49036**	**46272**
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
4	**Production (kg)**	**8520**	**9620**	**9912**	**10183**	**9638**
5	Gross returns	98719	107901	112590	117696	110560
6	**Net returns**	**58048**	**63890**	**63624**	**68660**	**64288**

Note: Figures within the parentheses indicate percentages to total cost.

average of Rs 1,10,560/ha. The overall annual net return amounted to Rs 64,288/ha, which was the highest (Rs 68,660/ha) in large farms, followed by small (Rs 63,890/ha), medium (Rs 63,624/ha) and marginal (Rs 58,048/ha) farm groups. Thus, farmers of large-size farm group were found more efficient in utilizing their resources in aonla production compared to other farm-size groups.

Stage-wise Cost of Production

The cultivation of aonla demanded large investments from establishment to maturity. The requirement of investment was not uniform over the period and varied according to different stages of orchard. Therefore, analysis of cost on orchard management at different stages was carried out. The cost of cultivation of aonla comprised various cash and non-cash costs. Details of cost components involved at different stages of orchard are given in Table 4.

It was found that rent of land emerged as the major cost incurred at different stages of orchard accounting for about 45 per cent to 52 per cent, followed by material cost (21-28%), total labour cost (15-18%) and interest on fixed capital (6-7%). Thus, rent on land, material cost and labour cost together accounted for a lion's share of about 89 per cent in total cost of cultivation at different stages of orchard.

The annual production of aonla in early-bearing and mature-bearing stages was 8181 kg/ha and 11202 kg/ha, respectively. The net returns per hectare were Rs 55,965 and Rs 86,567 at early-bearing and mature-bearing stages of orchard, respectively.

Table 4. Average cost of production at different stages of aonla orchard on overall farm group

(Rs/ha/year)

Sl No.	Items	Stage of orchard		
		Pre-bearing stage	Early-bearing stage	Mature-bearing stage
1	Human labour cost	3465 (10.18)	6528 (16.76)	6238 (15.97)
2	Bullock labour and tractor cost	1739 (5.11)	505 (1.30)	0 (0.00)
3	Total labour cost	5204 (15.29)	7033 (18.06)	6238 (15.97)
4	Total material cost	7236 (21.26)	9914 (25.46)	10798 (27.65)
5	Rent of land	17690 (51.98)	17690 (45.42)	17690 (45.30)
6	Interest on fixed capital	2300 (6.76)	2300 (5.91)	2300 (5.89)
7	Interest on working capital	1348 (3.96)	1752 (4.50)	1773 (4.54)
8	Depreciation	255 (0.75)	255 (0.65)	255 (0.65)
9	**Total cost**	**34033** (100.00)	**38944** (100.00)	**39054** (100.00)
10	**Production (kg)**	**0**	**8181**	**11202**
11	Gross return	21563*	94909	125621
12	**Net return**	**(-) 12470**	**55965**	**86567**

Note: Figures within the parentheses indicate percentages to total cost.
*Returns from inter-crops.

Economic Feasibility of Aonla Orchard

To find the economic feasibility of aonla production, data about production and income per hectare per annum, cash outflow and inflow and economic evaluation under varying situations were collected and are discussed below.

Annual Production, Cost and Income

The year-wise production, cost, income and net return per hectare are given in Table 5.

The results show that aonla-bearing started at the age of 4 years and the yield increased continuously from 2673 kg/ha in the fourth year to 14168 kg/ha in the eleventh year. Thereafter, it decreased marginally and again increased to a highest plateau of 14240 kg/ha in the fifteenth year. It started

Table 5. Year-wise production, cost, income and net return from aonla orchards on overall farms from the planting year

Year	Production (kg/ha)	Total cost (Rs/ha)	Income (Rs/ha)	Net return (Rs/ha)
1	0	15509	0	(-)15509
2	0	9689	0	(-) 9689
3	0	12122	0	(-)12122
4	2673	14924	28446	13522
5	4887	14570	53852	39282
6	6360	15067	71379	56313
7	8193	16043	95812	79769
8	9627	18354	111429	93075
9	11827	18993	142047	123054
10	13701	20682	161399	140717
11	14168	19247	165444	146197
12	13951	19928	163665	143737
13	13477	19772	162026	142255
14	13380	18062	153656	135594
15	14240	17621	170258	152637
16 – 25	12026	16956	132100	115144
26 – 35	9058	16172	100448	84277

decreasing in the later age of orchard. More or less, same tend was noticed in the case of income. The maximum income was Rs 1,70,258/ha in the fifteenth year of orchard.

In the absence of production, net returns were in negative during the first three years of plantation. It turned positive from the fourth year, was maximum (Rs 1,52,637) in the 15th year, and declined thereafter, but remained positive till the economic life of orchard, i.e. up to 35 years.

Economic Evaluation of Investment on Aonla

The estimated values of various parameters used to test the economic viability of investment on aonla orchard along with the sensitivity analysis of investment under varying situations are presented in Table 6.

It is evident from the results that under normal cost and returns situation, the net present value (NPV) was positive (Rs 6,52,652) at 10 per cent discount rate, which indicates the financial soundness of the investment on aonla orchard. The benefit cost ratio (BCR) was found much higher than unity (5.25), indicating the worthiness of the investment. The internal rate of return (IRR) was found higher than the normal bank interest rate and pay back period (PBP) was found to be 55 months.

Table 6. Sensitivity analysis of economic feasibility of aonla cultivation on overall farm group (10% discount rate)

Sl No.	Situations	NPV (Rs)	BCR	IRR (%)	PBP (months)
1	With normal costs and returns	652652	5.25	65.03	55
2	10% increase in cost	637283	4.77	61.23	57
3	10% decrease in returns	572018	4.72	60.84	57
4	10 % increase in cost & 10% decrease in returns	556648	4.29	57.16	60
5	10% increase in returns	733287	5.77	68.95	54

The feasibility on changing the cost and returns for 10 per cent rate of discount revealed that under all the four varying situations of costs and returns, values of NPV, BCR, IRR and PBP satisfied the acceptance rules of investments. These indicated the level of stability and certainty of economic viability of investment on the aonla orchard.

Conclusions and Policy Implications

It has been found that establishment of aonla orchard involves high investment, but the annual net realization has been found quite high — Rs 55,965/ha at early-bearing stage and Rs 86,567/ha at mature-bearing stage of orchard. With normal cost and returns as well as in varying situations of cost and returns, values of all the feasibility parameters have satisfied the acceptance rules for the investment proposition. These have confirmed the economic feasibility, stability and certainty of investment on aonla orchard.

As the aonla cultivation is highly profitable, there is a potential in generating more returns per unit area through expansion of area under this crop for the farmers of Gujarat in general, and of Central Gujarat in particular. However, the crop requires huge initial investment, and therefore, financial institutions should provide adequate credit to the aonla growers in the area.

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