RESEARCH ARTICLE

An economic analysis of production of pomegranate in middle Gujarat

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ABSTRACT : The area and production of pomegranate in Gujarat is increasing noticeably from last decade.The economic viability of pomegranate cultivation has been studied in middle Gujarat. The study was based on the data collected from 90 Pomegranate grower spread over total 9 blocks of the Vadodara, Chhota udepur and Kheda district for the agricultural year 2013-14. Pomegranate cultivation involves high initial investment, but same time annual net return was also high. The establishment cost of pomegranate orchard was found to be Rs. 81063. The average per ha net return was found Rs. 88686 and average production was found 5482 kg per hectare. The value of economic parameters, *viz.,* NPV, BCR, IRR and PBP was found Rs. 993842, 3.07, 47.66 and 58 month, respectively at 10 per cent discount rate. In all the varying situations of cost and return in sensitivity analysis, values of all these economic parameters satisfied the acceptance rules for investment proposition. This indicates that in varying situations of cost and return, the economic viability of investment on the pomegranate cultivation was stable and certain.

KEY WORDS : Economic analysis, Production, Pomegranate

INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to family *Punicaceae* and is favour table fruit of the tropical and sub-tropical regions of the world. The fruit is native of Iran (Persia) and extensively cultivated in countries like Spain, Egypt, India, Iran and China. Due to its hardy nature, easy adoptability to marginal and wasteland and

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consistent productivity and nutritive and therapeutic value, importance of Pomegranate is increasing in India. The area and production of pomegranate in Gujarat has expanded in the last decade. Gujarat ranks 3rd in area under cultivation and 4th in production of pomegranate in the country. Currently area under pomegranate cultivation in Gujarat is 9370 ha with the annual production of 99330 tonnes. In last decade, Gujarat has seen noticeable progress in total area under cultivation and production of pomegranate by 131 per cent and 159 per cent, respectively. So far, proper data regarding cost of cultivation of pomegranate and its marketing are not available; this study may help the extension worker, policy maker and farmers for understanding the economic

aspect of pomegranate cultivation. It may also helpful to the financial institutions for fixing scale of finance of loan and subsidies. Considering these facts, the present study was undertaken with following objectives:

– To study the investment pattern in pomegranate orchard.
– To compute the costs and returns in pomegranate cultivation.

EXPERIMENTAL METHODS

Sampling design and data collection:

The study was undertaken in middle Gujarat which accounted for 15.04 per cent of total production in Gujarat. The selection of sample was made using multi-stage sampling technique. Three districts Vadodara, Chhota udepur and Khedawere selected purposively, as they had maximum area under pomegranate cultivation in middle Gujarat. At the second stage three talukas from each of the districts- Waghodiya, Karajan and Savli from the Vadodara district, Sankheda, Nasavadi and Jetpur-pavi from the Chhota udepur district and Kapadvanj, Balasinor and Virpur from Kheda district were selected on the base of relative area under cultivation of pomegranate in respective talukas. At the third stage 10 pomegranate growers from each of the talukas were selected at random but in proportion to number of growers in the size group of different holdings. Thus, in all, 90 growers comprising of 28 marginal (<1 ha), 23 small (1 ha to <2 ha), 21 medium (2 ha to <4 ha) and 18 large (4 ha and above) farmers were selected for the study. The data were collected for the year 2013-14.

For the evaluation of the specific objectives of the study, primary and secondary data were collected from different sources. Primary data were obtained from sample farmers through personal interview method with the help of pretested questionnaire. Secondary data regarding area, production, cropping pattern, rainfall pattern and land use pattern were collected from Directorate of Horticulture and District Horticulture Officer of respective districts.

Statistical analysis :

In tabular analysis, simple and weighted averages and percentage methods were used for comparing and analysing the obtained data. Analysis of specific objectives were carried out using various standard statistical tools.

Amortization of fixed cost :

The annual amortization of cost was calculated from the investment made on pomegranate cultivation up to the first flowering (*i.e.,* the first 3 years of pomegranate plantation) under the assumption that the rate of interest is 10 per cent and expected economic productive life of pomegranate orchard is to be 25 years. To estimate the per hectare cost of pomegranate, an amortized cost was worked out by using the compounding cost formula given below and added it to maintenance cost to estimate the annual cost in cultivation.

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

where,

A = Annual sum in rupees (Amortized cost)
P = Present sum of the establishment cost in rupees
I = Interest rate (10 % per annum)
n = Economic life of the orchard (in years).

Economic feasibility of investment :

The economic feasibility of investment on pomegranate 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).Sensitivity analysis for these four economic parameter was also carried out to assess the economic viability of pomegranate production.

Net present value (NPV) :

In the present study, the net cash inflow and outflow from pomegranate orchard during its life time were discounted at the rate of 10 per. It was calculated as below :

$$NPV = \sum_{t=0}^{T} \frac{R_t - C_t}{(1+I)^t}$$ ....(2)

where,

R_t = Returns in t^{th} year (in rupees)
C_t = Cost in t^{th} year (in rupees)
I = Discount rate (10 % per annum)
t = Age of orchard (in years)
T = Expected life of orchard (in years).

Benefit cost ratio (BCR) :

BCR was computed by discounting the future gross returns and cost during the life period of orchard at the rate of 10 per cent. It was computed as below:

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

$$B = \sum_{t=0}^{T} \frac{B_t}{(1+I)^t}$$

$$C = \sum_{t=0}^{T} \frac{C_t}{(1+I)^t}$$

where,

B_t = Benefit from orchard in t^{th} year

C_t = Cost of orchard in t^{th} year

I = Rate of discount (10% per annum)

t = Age of orchard (in years)

T = Economic life of orchard (in years).

Internal rate of returns (IRR) :

IRR is that discounted rate at which NPV is zero (Gawankar *et al.*, 2005).

$$IRR = NPV = 0$$

Pay back period (PBP) :

Pay back period of an investment on orchard was calculated by equation (4).

$$....(4)$$

$$PBP = \frac{\text{Investment}}{\text{Net annual cash flow}}$$

Sensitivity analysis :

Sensitivity analysis for the above four parameters were made with the following assumption situation:

10 per cent increase in costs

10 per cent decrease in returns,

10 per cent increase in costs and 10 per cent decrease in returns and

10 per cent increase in return

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Investment pattern in pomegranate orchard :

A scrutiny of results presented in Table 1 reveals that, on anaverage, the total investment per hectare was Rs. 2666341. It was highest in large farms (Rs. 2826746), followed by medium (Rs. 2783394), small (Rs. 2676484) and marginal (Rs. 2565565) farms groups. It was due to more investment on mechanization in terms of machinery and irrigation infrastructure by large and medium farms compared to small and marginal farms. On an average, out of total investment, land accounted for highest share of 98.54 per cent followed by planting material (0.94%). The investment on land, planting material, tractor and tractor drawn implements, and tube well and motors together accounted for 99.86 per cent. The similar results were also reported by Khunt *et al.* (2003) for pomegranate in saurashtra region in Gujarat and Gondalia and Patel (2007) in aonla in middle Gujarat.

Cost of establishment :

The establishment cost of pomegranate orchard includes various costs like human labour cost, tractor charges, material cost, rental value of land, interest on fixed capital, interest on working capital and depreciation charges incurred during the gestation period of orchard (for the period of 1-3 year). The results (Table 2) reveals

Items	Farm size groups				
	Marginal	Small	Medium	Large	All farms
Land value	2541000 (99.04)	2646000 (98.86)	2740500 (98.45)	2730000 (96.57)	2627625 (98.54)
Planting material	22764 (0.88)	29434 (1.09)	26544 (0.95)	28896 (1.02)	25309.(0.94)
Bullock cart and bullock-drawn implements	313 (0.012)	250 (0.009)	200 (0.006)	0 (0.000)	238(0.008)
Tractor and tractor drawn implements	0 (0.00)	0 (0.00)	14000 (0.50)	20000 (0.70)	6000 (0.22)
Sprayers and other implements	1488 (0.057)	800 (0.029)	600 (0.021)	350 (0.012)	1038 (0.038)
Tube well, motor etc.	0 (0.00)	0 (0.00)	0 (0.00)	35000 (1.23)	4375 (0.16)
Farm house and store room	0 (0.00)	0 (0.023)	1550 (0.055)	12500 (0.442)	1756 (0.07)
Total (1 to 8)	2565565 (100.00)	2676484 (100.00)	2783394 (100.00)	2826746 (100.00)	2666341(100.00)

Table 1 : Investment pattern in pomegranate orchard in different farm size group (Rs./ha)

Note: Figures within the parentheses indicate the percentage to their total.

that on an average, total cost of establishment per hectare was found Rs. 81063 per year. It was highest in large farms (Rs. 86661), followed by small (Rs. 81512), medium (Rs. 81496) and marginal farms (Rs. 76611). On an average, out of total establishment cost, material cost accounted for highest share (48.10%), followed by rental value of land (27.46 %), labour cost (16.99%), interest on working capital (5.01%), depreciation (1.49%) and interest on fixed capital (0.95%). Thus, on an average, expenditure on material, rent of land and labour accounted for lion share of 92.55 per cent of total establishment cost of pomegranate orchard.

Annual cost of production and return from pomegranate orchard :

The annual cost consists of amortization cost, maintenance cost and return from the orchard presented in Table 3. The total annual cost per hectare of an average

farm was found Rs.108022. It was highest (Rs. 114720) in large farm size followed by medium (Rs. 109674), small (Rs. 107720) and marginal (Rs. 106799) farm size groups. Overall, annual amortized cost was estimated to Rs. 26792 per hectare which contributed 24.80 per cent to total annual cost, while annual maintenance cost was Rs. 81230 per hectare sharing 75.20 per cent to total annual cost.

The average annual production was 5482 kg/ha. On an average annual gross return was found Rs. 196708/ ha which varies from Rs. 189121/ha medium farms to Rs. 203622/ha on large farms. The overall annual net return amounted to Rs. 88686/ha which was highest in small farms (Rs. 95448), followed by large farms (Rs. 88902), Marginal farms (Rs. 85944) and medium farms (Rs. 79447). So, it can be inferred from the analysis that the resource use efficiency in pomegranate production was higher in small farm size group compared to other farm size group.

Table 2 : Per hectare cost of establishment of pomegranate orchard					(Rs./ha)
Items	Farm size groups				
	Marginal	Small	Medium	Large	All farms
Human labour cost					
Family	3482 (4.54)	2972 (3.65)	1859 (2.28)	1649 (1.90)	2575 (3.18)
Hired	8555 (11.16)	9352 (11.47)	10476 (12.86)	10634 (12.27)	9589 (11.83)
Sub-total (a+b)	12037 (15.71)	12324 (15.12)	12335 (15.14)	12283 (14.17)	12164 (15.01)
Tractor cost	1413 (1.84)	1587 (1.95)	1491 (1.83)	2104 (2.43)	1610 (1.99)
Total labour cost (1+2)	13451 (17.56)	13911 (17.07)	13826 (16.97)	14387 (16.60)	13774 (16.99)
Total materialcost	36503 (47.65)	40395 (49.56)	39776 (48.81)	40227 (46.42)	38992 (48.10)
Rental value of land	22145 (28.91)	22050 (27.05)	22050 (27.05)	22838 (26.35)	22260 (27.46)
Interest onfixed capital	228 (0.29)	286 (0.35)	610 (0.75)	2147 (2.48)	767 (0.95)
Interest on working capital	3851 (5.02)	4323 (5.30)	4151 (5.09)	4009 (4.63)	4063 (5.01)
Depreciation	433 (0.57)	547 (0.67)	1083 (1.33)	3053 (3.52)	1207 (1.49)
Total cost (3 to 8)	76611 (100.00)	81512 (100.00)	81496 (100.00)	86661 (100.00)	81063 (100.00)

Note: Figures within the parentheses indicate the percentage to their total

Table 3 : Per hectare cost and returns from pomegranate orchard					Rs./ha/year
Particular	Farm size groups				
	Marginal	Small	Medium	Large	All farms
Amortized cost	25320 (23.71)	26940 (25.01)	26935 (24.56)	28641 (24.97)	26792 (24.80)
Maintenance cost	81479 (76.29)	80780 (74.99)	82739 (75.44)	86079 (75.03)	81230 (75.20)
Total cost (1 + 2)	106799 (100)	107720 (100)	109674 (100)	114720 (100)	108022 (100)
Production (kg.)	5310	5566	5307	5878	5482
Gross returns	192743	203168	189121	203622	196708
Net returns	85944	95448	79447	88902	88686

Note: Figures within the parentheses indicate the percentage to their total

Table 4 : Average cost of cultivation at different stages of pomegranate orchard on all farm size group			(Rs./ha/year)
Items	Stage of orchard		
	Pre-bearing stage (0-3 years)	Early-bearing stage (4-7 years)	Mature-bearing stage (8-25 years)
Human labour cost			
Family	2575 (3.18)	14990 (20.77)	16750 (20.91)
Hired	9589 (11.82)	5309 (7.36)	13047 (16.25)
Sub-total (a + b)	12164 (15.01)	20299 (28.13)	29797 (37.16)
Tractor cost	1610 (1.99)	1156 (1.60)	483 (0.60)
Total labour cost (2 + 3)	13774 (16.99)	21455 (29.73)	30280 (37.77)
Total material cost	38992 (48.10)	23433 (32.47)	26334 (28.73)
Rental value of land	22260 (27.46)	22740 (31.51)	22470 (28.05)
Interest on fixed capital	767 (0.95)	893 (1.24)	699 (1.39)
Interest on working capital	4063 (5.01)	2812 (3.90)	2547 (2.68)
Depreciation	1207 (1.49)	837 (1.16)	914 (1.36)
Total cost (4 to 9)	81063 (100.00)	72170 (100.00)	83244 (100.00)
Production (kg)	0	4409	7600
Gross return	30480*	158739	269417
Net return	(-) 50583	86569	186174

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

Table 5 : Year-wise production, cost, income and net return from aonla orchards on overall farms from the planting year			
Year	Production (kg/ha)	Income (Rs./ha)	Total cost (Rs./ ha)	Net return (Rs./ha)
1	0	32550	55308	-22758
2	0	28636	51259	-22623
3	0	30713	52531	-21818
4	3253	116760	40722	76038
5	4083	144947	44818	100129
6	4423	161596	44015	117581
7	5670	194460	50669	143791
8	6148	218600	49744	168856
9	6477	228631	52576	176355
10	6878	247621	55599	192022
11	7606	264462	55759	208703
12	8046	277423	56519	220904
13	8775	304723	59246	245477
14	9222	319211	60398	258813
15	9820	340444	61893	278551
16-20	8421	288215	61792	226483
21-25	6484	235594	59730	175864

Stage-wise cost of production :

From the time of establishment to the maturity, pomegranate cultivation needs huge investment. The requirement of investment was not uniform over the period of time and was varied according to different stages of orchard. Therefore, analysis of cost on orchard management at different stages was carried out. Details of cost components involved at different stages of orchard are given in Table 4. As can be seen from Table 4 that material cost accounted for highest share in total cost ranges from 29 to 48 per cent across the different stages of pomegranate orchard, followed by labour cost (17-38%) and rental value of land (28-31%) and interest on working capital (3-5 %).

The annual production of pomegranate in early-bearing and mature-bearing stages was 4409 kg and 7600 kg per hectare. The net returns per hectare were Rs. 86569 and Rs. 186174 at early-bearing and mature-bearing stages of pomegranate orchard, respectively.

Economic feasibility of pomegranate orchard :

To find the economic feasibility of pomegranate 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 bearing in pomegranate starts at the age of 4 year and the yield increased continuously from 3253 kg/ha in fourth year to 9820 kg/ha in fifteenth year. Thereafter, yield decline in late mature bearing stage of orchard. Same trend was observed in case of income. The highest income (Rs. 340444) was observed in fifteenth year of orchard plantation.

In the first three years of plantation, net returns were

remained negative in the absence of production. It turned positive from the fourth year was maximum (Rs. 278551) in the 15th year and declined, thereafter, but still remained positive up to the end of the economic life of orchard (25 years) Waghmode *et al.* (2014).

Economic evaluation of investment on pomegranate:

The economic worthiness of an investment on pomegranate orchard was tested by estimated values of various parameters along with sensitivity analysis of an investment under varying situation. The sensitivity analysis of economic feasibility of pomegranate cultivation on overall farm group is presented in Table 6.

It is evident from the results that under normal cost and returns situation, the net present value (NPV) was found positive (Rs. 993842) at 10 per cent discount rate, which indicate the financial soundness of the investment on pomegranate orchard. The benefit cost ratio (BCR) was found more than unity (3.07) indicate the worthiness of the investment. The internal rate of return (IRR) was found more (47.66%) than normal bank rate of interest and payback period was found to be 4 years and 10 month. All criteria of economic feasibility revealed that by and large, the investment on pomegranate orchard was profitable and economically viable proposition. Similarly Hile *et al.* (2014) worked on the economic analysis and impact assessment of production technology of paddy, Grover *et al.* (2013) on marketing of kinnow, Singh *et al.* (2014) on economic analysis of groundnut crop and the results found were more or less similar to the present findings.

Conclusion and policy implications :

The establishment of pomegranate orchard involves high initial investment but at the timeper hectare annual net realization has also been found quite high *i.e.* Rs. 86569 in early bearing stage and Rs. 186174 in mature

Table 6: Sensitivity analysis of economic feasibility of pomegranate cultivation on all farm size groups (10% discount rate)

Situations	NPV (Rs.)	BCR	IRR (%)	PBP Y: M	
With normal costs and returns	993842	3.07	47.66	4	10
10% increase in cost	945829	2.79	44.03	5	1
10% decrease in returns	846445	2.76	40.16	5	1
10 % increase in cost and 10% decrease in returns	798432	2.51	43.65	5	4
10% increase in returns	1141239	3.38	51.42	4	7
Y = Year				M = Month	

bearing stage. In sensitivity analysis, we found that in all varying situation of cost and returns, value of all feasibility parameters have satisfied the acceptance rules for the investment proposition. Pomegranate cultivation was found highly profitable in our results, but still there is more scope for increasing return by using drip irrigation, water soluble fertilizers, changing planting method etc. It require huge investment in the adoption of certain technology, so financial institution should provide adequate timely and hassle free credit to pomegranate growers in the area.

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