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Research Note

Economic Evaluation of Peach Cultivation in North Indian Plains

L.S. Gangwar*[a], Dinesh Singh[b] and Goutam Mandal[c]
[a]Central Avian Research Institute (CARI), Izatnagar, Bareilly - 243 122, Uttar Pradesh
[b]Division of Plant Pathology, Indian Agricultural Research Institute (IARI), New Delhi - 110 012
[c]HCP Division, Central Institute of Post-harvest Engineering & Technology (CIPHET), Malout, Hanumangarh Bye Pass, Abohar - 152 116, Punjab

Abstract

The production constraints and economics of peach (*Prunus persica* (L) Batsch.) cultivation in Punjab and Uttarakhand have been presented. The investment in peach orchards has been found a profitable business. The internal rate of return (IRR) has been found to vary from 20.98 per cent to 23.80 per cent, depending on the size of peach orchards. The net present value, benefit-cost ratio and IRR at 12 per cent discount rate have been reported as Rs 44,807, 1.681 and 22.20, respectively for the overall category of orchards. The economic productive life of peach orchards in Punjab and Uttarakhand has been calculated up to 24 years. The optimum size of peach orchards is above 2.0 ha. It has been revealed that the peach orchards are worth retaining as long as they give the income of Rs 5,713 over the annual maintenance cost. The economic appraisal of investment methods has indicated that annual amortization method may be preferred, because of its simplicity, efficiency and close to real situation results. To achieve the targets of fruits production, priority should be given to proper post-harvest management, including establishment of mechanical grading, packaging, on-farm processing, cold storage and quality control measures to minimize post-harvest losses and provide remunerative prices to the peach growers.

Introduction

India is the second largest producer of fruits and vegetables in the world. It has made fairly good progress on horticultural scenario of the world with a total production of over 130 million tonnes of fruits and vegetables in 2002-03 (NHB, 2005). The major fruits produced are apple, banana, citrus, mango, grapes and stone fruits (peach, nectarine, plum, apricot and cherry). Fruits and vegetables, besides their nutritional value, are labour-intensive and help in generation of additional income and employment through on-farm packaging; processing, and marketing of fresh produce and value-added processed products. As per priority given to the horticulture sector, Government of India has constituted National Horticultural Mission to double the fruits & vegetables production by year 2010.

During the past few years, cultivation of stone fruits, especially peach, plum and apricot, has become popular in the subtropical climate of north Indian plains. Stone fruits are cultivated on nearly 0.31 million ha area with annual production of 2.52 million tonnes and average productivity of 8.13 tonnes/ha (2002-03). Peach (*Prunus persica* (L) Batsch.) is one of the most important stone fruits grown in Punjab, Haryana and the adjacent areas of Western Uttar Pradesh, Uttarakhand and Himachal Pradesh. The demand for stone fruits and their processed products has increased because of rise in health concerns and nutritional awareness. The demand of these fruits is expected to improve further in near future. As per FAO production data 2006, peach production in India was 1.5 lakhs tonnes.

* Author for correspondence, E-mail: lalscari@gmail.com, gangwar_iisr@yahoo.com

Because of its refreshing, health promoting, and delicious qualities, peach fruit is popular all over northern India. It is also a rich source of vitamin A, iron and proteins. The harvesting season of peach ranges from April to July. Peach is generally consumed as fresh, however, delicious squash and other processed products could be prepared from its varieties, viz. *Sharbati*, *Shan-e-Punjab*, *Saharanpuri*, *Prabhat* and *Florda Red,* cultivated in the north Indian plains. The peach kernel oil is utilized in manufacturing of a large number of cosmetics and pharmaceutical products. The growth potential in peach cultivation is highly exciting for agro-processing, development of value-added products and employment generation through entrepreneurship development in the rural areas. Since there were hardly any studies available on the economics of peach production, the present study was undertaken in the states of Punjab and Uttarakhand. The main objectives of the study were to (i) workout the costs and returns from peach orchards, (ii) determine the profitability of peach cultivation through different investment appraisal methods, (iii) suggest a better method for economic appraisal of the orchards, and (iv) work out the economic productive life of peach orchards in the study area.

Database

The data for this study were collected from two randomly selected districts, viz. Firozpur (Punjab) and Haridwar (Uttrakhand). From each district, two tehsils having maximum area under peach orchards, were purposively selected and from each tehsil, five villages were randomly selected. A list of farmers from each selected village was obtained and arranged in the ascending order of proportion to landholding allocated to peach orchards. From each selected village, a sample of 3 peach growers was selected randomly; thus a total sample of 60 peach orchards was selected. The required information was collected through personal interview with the help of a survey schedule. The farmers were divided into three groups, according to the size of orchards, viz. (i) less than 1 ha, (ii) 1-2 ha and (iii) above 2 ha. The primary data were collected on various aspects of establishment of orchards, maintenance cost, production constraints and marketing problems, post-harvest management and annual economic returns from orchards, during the years 2002-03 and 2003-04. The age of peach orchards ranged from less than one year to 25 years in the selected districts. The costs and returns for different groups of orchards were compiled from the survey data. The orchards were divided into four groups, viz. up to 4 years, 5-10 years, 11-20 years and above 20 years, representing the establishment, increasing yield, constant yield and decreasing yield periods, respectively for the purpose of analysis.

Methodology

Estimating Returns and Economic Feasibility of Investment in Peach Orchards

Several techniques are available for evaluating the economic viability of investment in orchards (Gittinger, 1974), and we have used the project evaluation techniques. Besides the present value summation method commonly used, i.e. net present value, benefit-cost ratio, payback period and internal rate of return, the annual amortization method (George, 1974; Subrahmanyam and Mohandas, 1982; Lee *et al.,* 1988; Gangwar and Singh 1998; Padmanaban and Ramasamy, 1999, Gangwar *et al.*, 2005), which is utilized for working out the repayment capacity, was also used for making a comparison of these two methods. The amortized establishment cost could be used as a guideline to take decision on replanting of peach orchards. The amortization formula used was:

$$P = \frac{B}{(1 + i)^n} \qquad \ldots(1)$$

where,

P = Amount of annual payment
B = Initial amount
n = Number of year (life period of plantation)
i = Interest rate

Using the amortized establishment cost, one can work out the absolute profit expected in a year from the orchards by deducting amortized cost along with maintenance cost from gross returns. The investment criteria like benefit-cost (B-C) ratio and capital value (CV) of the orchard can be derived as follows:

$$\text{(i) BC Ratio} = \frac{\text{GR}}{(\text{AEC} + \text{MC})} \quad \ldots(2)$$

where,

GR = Annual gross return, per hectare

AEC = Amortized establishment cost per hectare, and

MC = Maintenance cost per hectare

$$\text{(ii) CV} = [\text{GR} - (\text{AEC}+\text{MC})]\ \text{DAPV} \quad \ldots(3)$$

where, GR, AEC and MC are the same as in Equation (2) and DAPV is deferred annuity present value of Re 1, which is obtained by multiplying the present value of Re 1 per annum for the (n-r) bearing years at an interest rate of 'i' by present value of Re 1 for 'r' non-bearing years at an interest rate of 'i' where 'n' is the total life period of the plantation.

Results and Discussion

Costs and Returns from Peach Orchards

Peach is one of the popular stone fruits in Punjab and Uttarakhand and it occupied an area of 1317 ha and 14,155 ha, with annual production of 19755 Mt and 33698 Mt, respectively in 2003-04 (Punjab Statistical Abstracts, 2004). The area under peach orchards has increased during the past few years in both the selected states. The age-wise costs and returns from peach were calculated on the basis of annual cash inflow and cash outflows (Table 1). The establishment cost included expenditure on land preparation, cost of planting material, labour wages for pit digging, layout designing, wages for planting orchard, etc. The maintenance cost included expenditure on manure and fertilizer, labour wages for inter-cultural operations, expenditure on plant protection chemicals, irrigation, harvesting, post-harvest handling and transportation cost up to local market. This information was used for computing the measures of investment and economic productive life of peach orchards. Maintenance costs of peach orchards were obtained by using the quantity of inputs used per plant on an average plant density of 200 plants per hectare (i.e. plant to plant and row to row distance varies from 6 to 8 metres). The inputs were valued at the market prices of 2003-04. The returns from peach orchards start from the fifth year of plantation and continue beyond 25 years like Nagpur mandarins, which give economic returns up to 30 years (Gupta and George, 1974). The total establishment cost of peach orchard was worked out to be Rs 52,817. The amortization cost over 25 year at the interest rate of 8 and 12 per cent was Rs 4,948 and Rs 6,734, respectively. The maintenance cost from fifth year onward varied from Rs 8,753 to Rs 17,335 per ha. The average gross returns from per ha peach orchards amounted to Rs 28,137 per year.

The measures of investment worth of peach orchards have been presented in Table 2. Since the net present value (NPV) and benefit-cost (B-C) ratio are functions of discount rate, these measures were obtained at 6 per cent, 9 per cent and 12 per cent discount rates, as charged by various financial institutions. The NPV at 6 per cent discount rate varied from Rs 1,06,930 to Rs 1,33,562 per ha, depending up on the size of orchards.

The benefit cost (B-C) ratio for the overall groups was 1.681 at 6 per cent discount rate. The internal rate of returns (IRR) was 20.98 per cent, 21.72 per cent, 23.80 per cent and 22.20 per cent for small, medium, large and overall peach orchards, respectively. The payback period varied from 7 to 8 years for all the categories of orchards. The uniform annual returns, which help in determining the replacement period of orchard, could be computed by dividing the NPV by present value of annuity of Re 1 over the expected life of orchards. At a discount rate of 12 per cent, the present value of Re 1 received at the end of 25 years was Rs 7.843. Hence, the uniform annual returns at 12 per cent discount rate from peach orchards of different sizes were Rs 4,810, Rs 5,582, Rs 6,746 and Rs 5,713, respectively. It reveals that as long as the net returns were higher than Rs 4,810 per ha from peach orchards of below 1 ha, they should not be replanted. The old peach orchards of above 2 ha size should not be replaced by new plantations unless the annual net returns from these orchards fall below Rs 6,746 per ha. The result indicates that peach orchards of size up to 1 ha and above 2 ha would need replantation after 24 years and 25 years, respectively. The study has concluded

Table 1. Age-wise cost and returns of peach in different sizes of orchards

(Rs / ha)

Age	Below 1ha		1-2 ha		Above 2 ha		Overall	
Years	Cost	Returns	Cost	Returns	Cost	Returns	Cost	Returns
1	15431	0	16543	0	16880	0	16285	0
2	10297	0	10629	0	11188	0	10705	0
3	12474	0	12704	0	13631	0	12936	0
4	12873	0	12701	0	13098	0	12891	0
5	13094	21579	13371	22651	14636	24551	13700	22927
6	13468	22758	13744	24901	14356	28763	13856	25474
7	14247	26862	14521	25324	14368	31982	14379	28056
8	14284	28766	14997	29779	15393	36825	14891	31790
9	15249	32061	15624	34688	16381	40882	15751	35877
10	15667	36548	15943	38406	16409	44649	16006	39868
11	16077	38754	16342	41099	17355	48662	16591	42838
12	15375	38844	16053	43872	17015	46047	16148	42921
13	15662	37655	14629	41883	16042	42577	15444	40705
14	15872	39253	13720	40673	14354	38061	14649	39329
15	14115	39564	14722	39449	13162	39542	14000	39518
16	14022	38751	14433	41772	13465	32701	13973	37741
17	13741	32836	14071	37240	14509	30658	14107	33578
18	13394	29735	13667	34662	12965	30981	13342	31793
19	12878	29706	13209	32763	11350	29874	12479	30781
20	11387	28618	12081	26884	12763	27554	12077	27685
21	12077	27642	11541	25339	12357	25984	11658	26322
22	11352	21567	10774	20839	10734	21865	10620	21443
23	10044	18278	10497	17774	10030	21087	10190	19046
24	9864	14569	10164	16271	9732	16645	9920	15828
25	8753	12497	9459	14559	9135	13842	9116	13633

Note: Inter-cropping during establishment (pre-bearing) period of peach orchards is a common practice in Punjab and Uttarakhand. The expenditure includes only maintenance costs of trees after deducting returns from inter crops. Cotton, wheat, pulses, oilseeds, jowar, and vegetables are the important inter-crops grown in the peach orchards.

that the economic productive life of peach orchards was up to 24 years in the study area.

The average cost and gross and net returns from peach orchards have been presented in Table 3. It shows that the net returns over maintenance cost and over total cost were Rs 14,655 and Rs 7,921 respectively. The ratio of returns to maintenance cost worked out to be 2.09 for peach orchards.

The ratio of returns to maintenance cost has been worked out to be 2.31 for kinnow mandarin grown in Punjab. The comparative economics of this competing crop of kinnow has been worked out for tractor-operated farms which have electric motor or diesel engine as source of irrigation. The opportunity cost of land and other scarce resources used in the cultivation of this competing crop were also taken into account (Gangwar *et al.,* 2005). Therefore, it was concluded that peach cultivation was more profitable than the competing crop. The study has revealed that peach cultivation in Punjab and Uttarakhand was a profitable venture.

Table 2. Measures of investment worth per hectare of peach orchards

Sl No.	Measure of investment worth	Size of the orchards in ha (n=25)			
		Up to 1ha	1 – 2 ha	Above 2 ha	Overall
1.	**Payback period (years)**	8	8	7	8
2.	Net present value (Rs)				
	a) Discount rate = 6%	1,06,930	1,20,446	1,33,562	1,20,313
	b) Discount rate = 9%	64,539	73,856	84,858	74,517
	c) Discount rate = 12%	37,728	43,782	52,909	44,807
3.	**Internal rate of returns (%)**	20.98	21.72	23.80	22.20
4.	Benefit cost ratio				
	a) Discount rate = 6%	1.615	1.684	1.740	1.681
	b) Discount rate = 9%	1.305	1.543	1.606	1.545
	b) Discount rate = 12%	1.353	1.402	1.470	1.409
5.	**Uniform annual return (Rs)**	4,810	5,582	6,746	5,713

Table 3. Average costs and return from peach orchards

(Rs/ ha)

Sl No.	Particulars	Amount
1.	Establishment cost amortized over 25 years @ 12 per cent per year	6,734
2.	Average maintenance cost	13,482
3.	Total cost per year	20,216
4.	Average gross income per year	25,886
5.	Net income per year	5,670

Economic Evaluation of Peach Cultivation

The economic productive life as well as profitability of peach orchards were calculated with the help of different investment appraisal methods and project evaluation techniques. The benefit-cost (B-C) ratio, net present value (NPV) and minimum income required for taking decision on replantation of orchards based on the present value summation methods and annual amortization method along with IRR and payback period have been presented in Table 4. The discounted and amortized values of returns were calculated at the rate of 12 per cent, because the financial institutions advance short-term loan to the peach growers/farmers at this rate of interest. A perusal of Table 4 revealed that the payback period was 8 years.

The NPV worked out to be Rs 44, 807, the benefit-cost ratio as 1.409 and internal rate of return (IRR) as 22.20 under the present value summation method. Under the amortization method also, the NPV and B-C ratio were similarly at Rs 42,877 and 1.281, respectively. Both these measures clearly indicated that peach cultivation in Punjab and Uttarakhand was a profitable venture. Peach cultivation could be a vital alternative for crop diversification endeavours, if infrastructure facilities were developed for scientific post-harvest handling, storage, packaging, transportation and marketing.

Comparison of Two Investment Appraisal Methods

A comparison of the results obtained from the two appraisal methods revealed that the amortization method had slightly underestimated the benefit-cost (B-C) ratio and present (capital) value of the peach orchard; however, the difference in B-C ratios was not large (Table 4). There was a wide difference in income calculated under present value method and amortization method. The amortization method suggested an income of more than Rs 6,734 over the maintenance cost for retaining the peach orchards, as this income was enough to meet amortized establishment cost. The present value method required an income of more than Rs 5,713 for retaining the old peach orchards. Hence, the present value method appeared more realistic as the peach orchards have to compete with other crops, viz. kinnow, vegetables, cotton, wheat, paddy, oilseeds and sugarcane in the study area. In view of the fact that

Table 4. A comparison of two methods of investment worth for per ha peach orchards

Measure of investment worth	Present value method	Amortization method
Benefit-cost ratio	1.409	1.281
Net present value (Rs)	44,,807	42,877
Minimum net income required before re-plantation of orchard (Rs)	> 5,713	> 6,734
Internal rate of return (per cent)	22.20	-
Pay back period (years)	8	-

peach orchards have long productive life like other fruit crops and that it is difficult to collect information on costs and returns for all the years as required in the present value summation method, the amortization method is more useful and convenient. The annual amortized establishment cost could be treated as fixed cost in the case of other commercial crops to know the net income during any year of peach orchard. Of course, the establishment cost during pre-bearing period has to be collected and analyzed for both the methods.

Conclusions

The study has revealed that investment in peach orchards is an economically profitable, financially viable and socially acceptable business in both Punjab and Uttarakhand. It could play a vital role in strengthening the on-farm primary processing-based agro-industry and generate employment opportunities through entrepreneurship development, to meet the demand of fresh and processed peach products in the domestic markets. Excluding the rental value of land (opportunity cost), investment in peach orchards has a pay back period of eight years. The economic productive life of peach orchards was approximately 24 years. The orchards need to be replanted when the annual (net) returns over maintenance cost falls below Rs 4,810, Rs 5,582, Rs 6,746 and Rs 5,713 for the orchards of the size of below 1 ha, 1-2 ha, above 2 ha and for overall size group, respectively. The optimum size of peach orchards is above 2 ha. A positive correlation has been observed between the size of peach orchards and net returns apparently due to economies of scale. The comparison of results obtained from the present value method and amortization method has shown that the peach plantations are worth retaining as long as they give an income of Rs 5,713 over the maintenance cost. Regarding the method of economic appraisal of investment in peach orchards, the annual amortization method may be preferred (over the present value summation method) because of its simplicity, equal efficiency and close to real situation results. To enhance peach production in the study area, there is a need to develop infrastructural facilities to reduce post-harvest losses and value-addition through on-farm primary processing at the peach orchards level.

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