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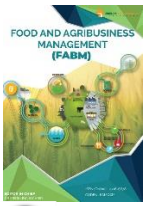

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RESEARCH ARTICLE

FINANCIAL FEASIBILITY ANALYSIS OF SWEET ORANGE PRODUCTION IN SINDHULI, NEPAL

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ABSTRACT

Although the sweet orange business has been one of the prime sources of income for farmers of the Sindhuli district of Nepal, they are still unaware of the feasibility of this business. Therefore, research was conducted with the objective of analyzing the feasibility of sweet oranges in Sindhuli. Data sources for the study included both primary and secondary sources. To acquire primary data for the study, focus group discussions and household surveys via questionnaires were done, while secondary data were extracted from various journals, research articles, annual reports, and publications of governmental institutions. A total of 95 respondents were selected using simple random sampling from the Golanjor rural municipality. The Benefit Cost Ratio (BCR), Net Present Value (NPV), Internal Rate of Returns (IRR), and Pay-Back Period (PBP) were used to assess the feasibility. From the analysis, the BCR, NPV, IRR, and PBP were calculated to be 2.09, NPR 23,863,688, 32.44%, and 6 years, 10 months, and 18 days, respectively. A BCR of more than one, a positive NPV, an IRR greater than the bank rate, and a payback period shorter than the 20-year project duration indicated that sweet orange production in Sindhuli is financially feasible and lucrative. Likewise, the result of the sensitivity analysis suggested that the sweet orange production business can also withstand the undesired conditions, such as a decrease and increase in production cost and price, respectively, by 10% and delayed production by 1 year.

KEYWORDS

Benefit-Cost Ratio, Internal Rate of Returns, Net Present Value, Payback Period, Sensitivity analysis

1. INTRODUCTION

In Nepal, agriculture is the major source of livelihood for the majority of the population, contributing 27% to the Gross Domestic Product (MoALD, 2021). The share of horticulture in the total agricultural gross domestic product has increased in recent years, where fruits alone contribute 7% to the total Agriculture GDP in Nepal (MoALD, 2018). The country has a greater scope for producing various fruits and vegetables due to its rich climatic diversity. The agro-climatic condition of the mid-hills of Nepal is highly suitable for fruit cultivation, mainly citrus fruits (FAO and MoAC, 2011). Citrus fruits, belonging to the Rutaceae family, itself cover a wide range of fruits.

Sweet orange (Citrus sinensis L. Osbeck), commonly known as Junar in Nepal, is an evergreen flowering tree with tight-skinned citrus fruit possessing a comparatively better shelf life than loose-skinned mandarins. It is a hybrid between *Citrus maxima* (Pomelo) and *Citrus reticulata* (Mandarin) and is believed to originate from Southeast Asia (Xu et al., 2013). However, the fruit is consumed all over the world as an excellent source of vitamin C (Etebu and Nwauzoma, 2014). Nepal also has a great potential to grow sweet oranges in large areas by using appropriate varieties. Sweet orange is the second most important citrus fruit after mandarin in terms of area and production in Nepal and is the continuous source of income generation for the farmers in the mid-hills. As of now, only local cultivars are being adopted in Nepal (NCRP, 2017). The local cultivars have excellent fruit physicochemical properties (NCRP, 2017). It is grown in 49 districts of Nepal, but Ramechhap and Sindhuli districts contribute to the major areas in production.

Sindhuli district, lying at an altitude between 168 to 2797 masl, is one of the major producers of sweet oranges in terms of both quality and quantity. In Nepal, the production of sweet oranges was 43,061 Mt in 6,646 ha of land in 2018/19A.D whereas Sindhuli alone produced 8,881 Mt of sweet oranges (MoALD, 2020). Farmers of Sindhuli have been cultivating sweet oranges as one of their major sources of income for many years. In addition, a suitable climate and increased market demand have created more potential for expanding fruit production in the district; however, farmers are still unaware of its feasibility. So the survey research was conducted to assess the financial feasibility of sweet orange production and identify major problems faced by sweet orange growers in its production and marketing.

2. METHODOLOGY

Golanjor rural municipality, one of the coverage areas under the Prime Minister Agriculture Modernization Project, Project Implementation Unit, Sindhuli, was selected as the study site for the study. A list of sweet orange growers prepared by the Junar Superzone was consulted for the samples required for the research. Out of the total sweet orange growers', 95 farmers were selected by a simple random sampling method in the study area.

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Both primary and secondary data were used in the study. Primary data were collected through Focus Group Discussion (FGD) and household surveys. FGD was carried out with 8/8 farmers in 3 areas under the study site to collect data related to the production economics of sweet oranges. Likewise, a household survey through a questionnaire was carried out to collect data related to problems faced during sweet orange production and marketing. Various journals, research articles, MoALD, and reports of PMAMP, PIU, Sindhuli, and the Agriculture Knowledge Centre of Sindhuli were consulted for the secondary data collection.

The collected data were compiled and sorted using MS Excel software packages and analyzed by Microsoft Excel and SPSS (Statistical Package for Social Science) software version 22. Various formulae were used for analyzing economic data, and tables and graphs were used to represent the findings. Among data related to economics, the cost of production of sweet oranges was calculated for one hectare of land yearly for 20 years.

2.1 Cost of Production

The cost incurred during sweet orange production was grouped into two categories.

Initial investment cost: Initial investment cost included all the expenditure incurred during the pre-bearing period (first four years) for sweet orange orchard establishment, like land preparation, pit digging and filling, fertilizers, cost of plant material, manures, plant protection chemicals, expenditure incurred on different operations viz., weeding, irrigation, tiller use, application of FYM, training, and pruning, and land lease, water charges, and land tax.

Operating cost: Expenses incurred on material inputs viz., manures, fertilizers, plant protection chemicals, and on human labor utilized for application of material inputs, irrigation, tiller use, weeding, training, and pruning including, land lease, water charges, and land tax, etc. were considered as operating costs during the bearing period (5th to 20th year).

The cost of production in sweet orange was calculated for one hectare of land yearly for 20 years.

For the production of sweet oranges, both variable and fixed costs were concerned.

Mathematically,

TC= TFC+TVC

Where TC= Total Cost

TFC= Total Fixed Cost

TVC= Total Variable Cost

- **Variable costs**

Variable costs included the cost incurred on variable inputs such as labor cost, fertilizer (organic and chemical) cost, and cost for plant protection. Variable costs were also calculated on a per year per hectare basis. Under labor costs, the cost for training, pruning, weeding, irrigation, and fertilizer application were considered.

- **Fixed costs**

Fixed costs included the sapling, pit digging, and land preparation costs in the 1st year, along with land lease, land tax, and water charge. From 2nd year, only land lease, land tax, and water charge were taken as a fixed cost. Likewise, 5% pit filling and nursery cost was considered a part of the fixed cost in the 2nd year.

2.2 Return Per Hectare

The total return per hectare from each year was calculated up to the 20th year.

Mathematically,

Total Return per hectare= Quantity of sweet orange produced per ha (kg) * Farm gate price (NRs/kg)

2.3 Financial Feasibility Analysis

The discounted cash flow technique, with the advantage of reducing the cash flows to a single point of time, was used to determine net present value, benefit-cost ratio, and internal rate of returns whereas the undiscounted technique was used to obtain the Payback period. In addition, three different assumptions were considered to analyze the sensitivity of the sweet orange enterprise to determine the change in output with a 10% change (increase or decrease) in the input parameters.

i. Net Present Value (NPV): Net present value is simply the net present worth of the cash flow stream. The discount rate of 12.00 percent per annum was considered for the study.

$$NPV = \sum_{=1}^{n} \frac{B_t - C_t}{(1+i)^t}$$

Bt = Benefits from each year

Ct = Costs in each year

t = Numbers of years

i = Discount rate

ii. Benefit Cost Ratio (BCR): The Benefit-Cost Ratio is the ratio of gross returns to cost of cultivation which measures the returns of benefits per unit cost of investment. The benefit-cost ratio was calculated by discounting the net returns during the life period of the sweet orange orchard establishment at a discount rate of 12.00 percent per annum. The following formula depicts the estimation of the benefit-cost ratio:

$$BC\ ratio = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}}$$

Where, B_t = Benefit in each year

C_t = Cost in each year

n = Number of years

i= Discount rate

iii. Internal Rate of Returns (IRR): The trial and error method was used to determine the internal rate of returns in the study. The calculated IRR greater than the market rate of interest represents a viable investment. The formula given below was used for calculating IRR:

$$\text{IRR} = [lower\ \ discount\ \ rate\ ] + [difference\ between\ \ the\ \ two\ discount\ rates\ ] \times \left[\frac{Net\ present\ value\ at\ \ lower\ discount\ rate}{Absolute\ difference\ between\ the\ net\ \ present\ value\ at\ the\ two\ discount\ rates}\right]$$

iv. Payback period (PBP): An undiscounted technique was used to determine the Payback period. Here, net returns from each production year were successively added until the investments were completely recovered. Since the cash flows are not uniform, the payback period was calculated by successively reducing the net cash flows from outstanding investments.

v. Sensitivity analysis: Since the values of input parameters are often subject to great uncertainty, sensitivity analysis can be favorable to assess the outcome of the project at a given change in these parameters. So, to determine how much the output changes to a given change in input parameters and assess the suitability of sweet orange production even in the risk condition, sensitivity analysis was carried out considering the following risk situations, once at a time.

2.4 Indexing

Problems related to production and marketing were ranked by the use of the index. The scaling technique, which provides the direction and extremity attitude of the respondents towards any prepositions, was used to construct the index. The intensity of production and marketing problems being faced by the sweet orange growers were identified by using 5 point scaling technique, comparing most serious, serious, moderately serious, a little bit, and least serious with scale values of 1, 0.8, 0.6, 0.4, and 0.2, respectively, indicating the severity of problems.

The index was calculated as,

$$\text{Index (I)} = \sum \left(\frac{S_i F_i}{N}\right)$$

where I= Index value for intensity of the problem

$\sum$ = summation

S_i =Scale value at i^{th} priority

F_i = frequency of i^{th} priority

N= total number of respondents

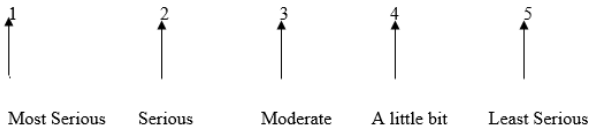

Figure 1: Scale of rating

3. Results and Discussion

3.1 Costs and Return of Sweet Orange Farming

3.1.1 Production Costs of Sweet Orange

Production costs of sweet oranges were estimated up to the 20th year. The table below shows the cost incurred in the 1st year of sweet orange establishment and maintenance for 1 hectare of land.

Table 1: The cost incurred in the sweet orange orchard establishment and maintenance in the 1st year for 1 hectare of land

S.N.	Particulars	Cost per ha (NPR)
1	Application of FYM	32000
2	Irrigation and Maintenance	16000
3	FYM	25000
	Total variable cost	**73000**
1	Sapling Cost	62500
2	Land preparation (tiller in hr)	20000
3	Pit Digging and Seedling Establishment	150000
4	Tools and Equipment	50000
5	Land lease	100000
6	Water Charge	1000
7	Land tax	1000
	Total Fixed Cost	**384500**
	Total Cost	**457500**

The table below shows the initial investment costs incurred in each year of the sweet orange orchard up to the 4th year.

The cost was highest in the 1st year as it included both establishment and maintenance costs. Similarly, the result revealed that the variable costs increased over increasing years.

Table 2: Initial Investment Cost Incurred In Sweet Orange Production

Years	Fixed cost	Variable cost	Total cost (NPR)
1st	384500	73000	457500
2nd	115750	73625	189375
3rd	102000	76325	178325
4th	102000	88325	190325

The table below presents the fixed, variable, and total operating costs of each year from the 5th to the 20th year. The results revealed that the cost went on increasing up to the 10th year and 10th year onwards the total cost remained constant.

Table 3: Operating cost incurred in sweet orange production from 5th to 20th year

Years	Fixed cost	Variable cost	Total cost (NPR)
5th	102000	121225	223225
6th	102000	149925	251925
7th	102000	186725	288725
8th	102000	210225	312225
9th	102000	214225	316225
10th-20th	102000	255225	357225

3.1.2 Returns from The Sweet Orange Orchard

The study revealed that sweet oranges started fruiting in the third year; however, the economic returns from the sweet orange were witnessed only from the 5th year of orchard establishment. According to the findings, the returns from the sweet orange increased with increasing years and were highest in the 13th, 14th, and 15th years (45,833 kg fruits per ha; NPR 16,04,167 returns per ha). It was reported that 15th year onwards the production decreased (Figure 2)

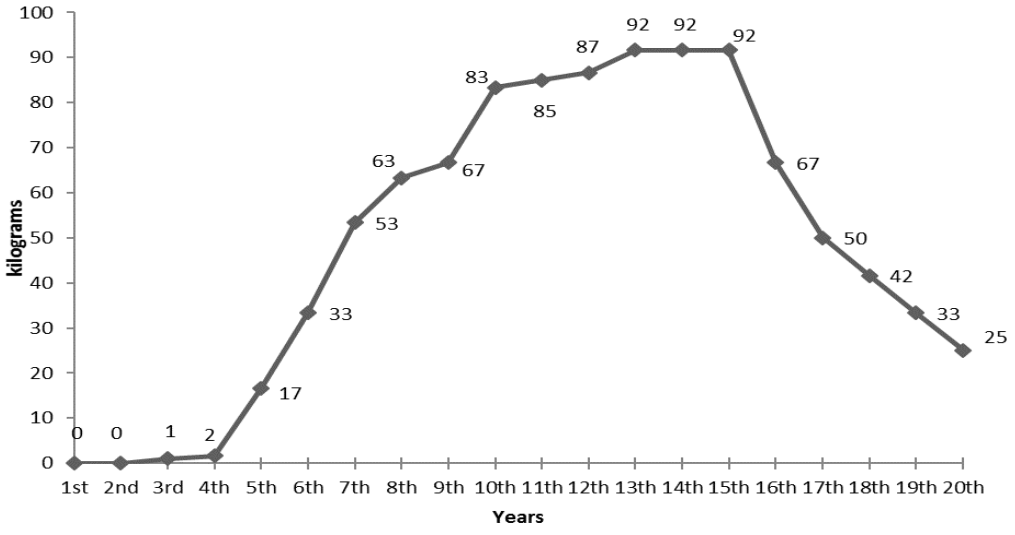

Figure 2: Sweet orange productions per plant in different years in the study area of the Sindhuli district

3.2 Financial Feasibility And Sensitivity

3.2.1 Financial Feasibility Techniques

The financial feasibility of Sweet Orange was assessed using indicators like Net Present Value, Benefit-Cost ratio, Internal Rate of Returns, and Payback period. The analysis result shows that sweet orange farming in Sindhuli district is financially feasible because NPV, BC ratio is positive whereas IRR (32.44%) is above the interest rate of the bank (12%), and the payback period was 6 years 10 months and 18 days (Table 4)

Table 4: Financial feasibility analysis of sweet orange farming in Sindhuli, Nepal

S.N.	Feasibility criteria	Value	Conclusion
1	NPV	NPR. 23,86,368	Feasible
2	BC ratio	2.09	Feasible
3	IRR	32.44	Feasible
4	PBP	6 years 10 months and 18 days	Feasible

Similar results were found by researchers in different citrus fruits in their previous studies. Has a in acid lime production and in sweet orange production reported a B: C ratio to be 2.08 and 2.2, respectively (Abhilash et al., 2018; Ogunlade et al., 2020). Similarly, in mandarin cultivation found the IRR to be 30% and 29.68%, respectively (Kaysar et al., 2017; Subrahmanyam and Mohandoss, 1982). Likewise, in their previous study related to Mandarin production found the payback period to be 8 years (Gangwar and Singh, 1998).

Sensitivity analysis: Sensitivity analysis is conducted to measure the sensitivity of sweet orange cultivation when changes occur in production, production cost, and production price of sweet orange. The results of sensitivity analysis of the sweet orange production revealed the parameters like NPV, IRR, and BC ratio to be positive, higher than the market rate, and greater than unity, respectively, making the investment in the sweet orange financially feasible even at different risk conditions (Table 5).

Table 5: Sensitivity analysis of sweet orange production for different risk in Sindhuli, Nepal

S.N.	Conditions	NPV (in NPR)	IRR (in %)	BC ratio	Conclusion
1	10% increase in cost	21,66,642	29.86	1.89	Feasible
2	10% decrease in price	19,28,005	29.65	1.88	Feasible
3	1-year delay in production	18,54,770	26.36	1.84	Feasible

Based on the results, sweet orange farming is still feasible if the sensitivity level of the above-mentioned three criteria is changed by 10%.

3.2.2 Problems On Production And Marketing

Production problems: Insect pest was ranked as the topmost problem during sweet orange production as stated by most of the farmers with an index value of 0.855 as shown in the table below. According to them, Chinese citrus fly infestation was the major insect pest that damaged the fruit and caused fruit drop. The observations made through the survey about the perception of farmers on constraints in the production of sweet oranges are documented in the table below.

Table 6: Problems Faced In Production Of Sweet Orange

Problems	Index	Rank
Insect pests	0.855	I
Disease	0.728	II
Unavailability of input in time	0.493	III
Lack of proper irrigation facility	0.463	IV
Lack of quality nursery sapling	0.459	V

Marketing problems: Inadequate market information with an index value of 0.855 was considered the topmost problem in sweet orange marketing as expressed by most of the farmers in the study area as presented in the table below.

Table 7: Problems faced in the marketing of sweet orange

Problems	Index	Rank
Inadequate market information	0.855	I
Low price offered by traders	0.827	II
Unorganized market	0.619	III
Lack of storage facility	0.377	IV
Difficulty in transportation	0.330	V

4. Conclusion

Higher benefit-cost ratio, shorter payback period, positive NPV, and IRR greater than opportunity cost ascertain the feasibility of the sweet orange enterprise in Sindhuli, Nepal. Results of sensitivity analysis revealed that the sweet orange production business can also withstand undesired conditions such as an increase and decrease in the production cost and price, respectively, by 10% and one delay in the production. Insect pests and the inadequate market information are ranked as the topmost problems for the production and marketing of sweet oranges among farmers in the study area of Sindhuli, respectively. The government and other concerned organizations must develop strategies to reduce the major problems during the production and marketing of sweet oranges. Similarly, future research can be focused on the market chain analysis, and disease and pest dynamics in sweet orange.

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