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Research Article

Financial Feasibility and Prospects of Commercial Acid Lime Farming in Nepal

Sanjiv Subedi[1]*, Krishna Prasad Timsina[1]

[1]Nepal Agricultural Research Council, National Agricultural Policy Research Centre, Khumaltar, Lalitpur, Nepal.

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***Corresponding author**
Sanjiv Subedi,
Nepal Agricultural Research Council, National Agricultural Policy Research Centre, Khumaltar, Lalitpur, Nepal
Email: sanjiv.subedi@gmail.com

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Abstract

Research was conducted to assess the economics of commercial acid lime production and prospects of lime farming in Nepal. Morang, Sunsari, Chitwan and Nawalparasi districts of Nepal were selected as the study area after having consultation with concerned agricultural personnel. Altogether 70 farmers (19% of the sampling population) were randomly selected from the sampling frame to collect the primary information. The financial analysis of acid lime farming per hectare of land estimated NPV (12% discount rate) NRs. 4828734/ha, BCR 2.2, IRR 40% and the Pay-back period of 5 years, 5 months and 26 days. The BCR greater than one, IRR three times higher than discount rate, high NPV (return on investment more than cent percent) and payback period less than one-third of the total productive age of the lime orchard showed the financial feasibility of commercial acid lime farming in Nepal. The regression revealed that the import, production and productive area were found to be increased at the rate of 32, 6, and 8 percent per annum respectively while that of productivity was found to be decreased by 2.4 percent per annum ($p< 0.010$). There is a huge opportunity for acid lime farming in Nepal as the demand is much higher than the domestic production resulting voluminous import. Agribusiness promotion strategies focusing on market development should be introduced that would contribute to enhance the national acid lime production and promote the domestic market.

Keywords: acid lime productivity; domestic market; financial analysis; import

Introduction

Acid lime (Citrus aurantifolia Swingle) is an important fruit of commercial value, ranking third after mandarin and sweet orange in Nepal. The productive area, production and yield of acid lime in the year 2018/19 in Nepal has been reported 5638 ha, 39580 mt and 7.02 mt/ha respectively (MoALD, 2020). It has been reported that there is a great potentiality for acid lime farming in Nepal; the domestic market opportunities exist for both main as well as off season productions (Dhakal *et al.*, 2002). The traditional cultivation of acid lime in Nepal has been limited to range of 800 m to 1400 masl in mid hill districts, producing a very small volume during its main season, September to December. This way the national production couldn't meet the domestic demand The demand of acid lime and lemons in the country are so high that every year, more than 90 % of the total demanded quantity has been fulfilled through

import; the import of acid lime from India is voluminously increasing almost every year (Dhakal *et al*., 2005).

The increasing demand for lime and lemon is mainly due to the increase in population, consumers' preference, awareness on nutritional importance, tourist inflow and establishment of small and medium agro-processing industries in the country. On the other side, the national production and productivity of acid lime in Nepal is very low even though high yielding varieties have been released. Very less number of farmers are doing the commercial lime farming in Nepal. Perhaps, only few farmers might have been benefited cultivating these high yielding varieties. The national yield of acid lime in Nepal in the year 2018/19 has been reported 7 mt/ha (MoALD, 2020); while, two high yielding varieties: Sunkagati-1 (34.5 mt/ha) and Sunkagati-2 (26.9 mt/ha) were released in 2015 for upland condition of terai, inner terai, foothills and river basin areas (Gotame, 2020). Even now, the acid lime growing farmers don't have proper technical knowledge and information regarding financial feasibility, profitability estimation and market situation. The acid lime farming in Nepal could be made more profitable and sustainable agro-enterprise through financial analysis and business plan preparation; moreover, demand-supply projection based on trend analysis of national production and import.

Seeking the studies on production economics of citrus fruits, there have been some studies on mandarin (Regmi et al., 2020) and sweet orange (Parajulee et al., 2021). Relating to marketing, Dhakal et al. (2005) conducted a study on marketing survey of acid lime and lemon in Nepal. Moreover, reviewing the past studies on economic analysis of perennial horticultural crops of commercial value, there are some studies done in Nepal on coffee (Acharya and Dhakal, 2014) and large cardamom (Baniya et al., 2019). However, studies on economics of production and financial feasibility of acid lime farming hasn't been done yet; trend analysis of import is also lacking. So, it is quite necessary to document the findings in these concerns. This research aimed to analyze the trend of import, production, productive area and productivity of acid lime in Nepal along with financial analysis of acid lime farming through field survey among the commercial farmers whose farm had started the production.

Methodology

Selection of the Study Area

The selection of the study area was done on the basis of consultation with National Citrus Research Program (NCRP), NARC, technical experts and the entrepreneur farmers who are involved in commercial acid lime production. The two terai (Morang, Sunsari), and two inner terai (Chitwan, Nawalparasi) districts of Nepal were selected for the purpose of the study. The high yielding popular varietiy, Sunkagati-1, developed by National Citrus Research Program NCRP, Nepal Agricultural Research Council (NARC) basically recommended for terai and inner terai regions was found to be popular and mostly cultivated in the study sites.

Sampling Procedure and Data Collection

The sampling frame was prepared by identifying the commercial farmers cultivating high yielding variety such as Sunkagati-1 in the study area. This work was accomplished consulting the horticultural experts of local and federal government, producer and entrepreneurs of improved saplings. The simple random method of sampling was used to select the sample from the sampling frame of 360 commercial acid lime growing farmers. Altogether, 70 respondent farmers (19% of sampling population) were selected to collect the primary information for the purpose of the study. A pre-tested interview schedule was used to collect the primary information; relevant literatures were reviewed for the secondary information.

Methods and Techniques of Data Analysis

Data entry and analysis were done using the computer software packages like: Statistical Package for Social Sciences (SPSS) and Microsoft Excel (MS-Excel). The following analyses were performed.

Cost of Acid Lime Production

The total cost of production was calculated by summing the fixed costs and variable costs incurred in the production process. Fixed costs include the costs such as: land rent and taxes, interest while variable cost includes the costs on use of variable inputs such as: fertilizers, nutrients, manures, insecticides and labor cost for intercultural operations (irrigation, manuring, training, pruning, etc.) and harvesting.

Gross Margin and Net Profit

Gross margin is the difference between the gross returns and the total variable cost while net profit is calculated after deducting the fixed cost from gross margin.

Financial Feasibility Analysis of Acid Lime Farming

The following analyses were done to assess the financial feasibility.

- Net Present Value/Worth (NPV)
- Benefit Cost Ratio (BCR)
- Internal Rate of Return (IRR)
- Pay Back Period (PBP)

Net Present Value (NPV)

It is simply the present worth of net benefit of the project discounted at the opportunity cost of capital. Generally, higher the NPV better will be the project performance. For the project to be financially feasible, the NPV should be positive. The NPV is the difference between the present value of benefit stream and present value of cost stream considered at a certain discount rate.

Mathematically,

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

Where,

B_t = Incremental benefit of the year/cash inflows

C_t = Incremental cost of the year/ cash outflows

t = the time of the cash flow (number of years)

n = total time of the project (total productive years)

i= interest rate/discount rate

Benefit Cost Ratio (BCR)

It is defined as the ratio of present worth of incremental benefit stream (cash inflows) to present worth of incremental cost stream (cash outflows) due to enterprise.

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

Where,

B_t = Incremental benefit in the t^{th} period

C_t = Incremental cost in the t^{th} period

t = the time of the cash flow (number of years)

n = total time of the project (total productive years)

i= interest rate/discount rate

Internal Rate of Return (IRR)

It is the rate of return which equates the discounted benefits with the discounted costs. It is the discount rate which equates the present worth of benefits to present worth of costs. The rate at which the net present value of the project is equal to zero is the Internal Rate of Return (IRR) to the project. It represents the average earning capacity of an investment from the project. Thus, it is that value of 'i' which makes:

$$\sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} = 0$$

The method for interpolating the value of IRR lying between the two discount rates, too high on one side and too low on the other (between a spread of five percentage points) will be done as mentioned below:

$$IRR = L_i + \frac{(H_i - L_i)\ NPV \text{ at } L_i}{NPV \text{ at } L_i - NPV \text{ at } H_i}$$

Where, H_i= Higher discount rate

L_i= Lower discount rate

Pay-Back Period (PBP)

Payback period was calculated by successively deducting the initial investment from the net returns until the initial investment is fully covered. Payback period represents the length of time required for the stream of cash proceeds produced by the investment to be equal to the original cash outlay. It is the time required for the project to pay for itself. The shortest payback period is the best.

Trend Analysis of Import, Production, Area and Productivity of Acid Lime in Nepal Using Regression

The secondary data on import, productivity, production and productive area of acid lime in Nepal for last ten years were collected from relevant government sources. The linear regression was run in MS-Excel and the trend equations were derived. Separate regression was run for the dependent variables: import, productivity, production and productive area of acid lime over years (independent variable). The regression model can be written as,

$LnY = \alpha 0 + \beta i Xi + ei$

Where;

LnY = Dependent variable (in natural log form)

$\alpha 0$ = Constant

βi = Coefficient

Xi = independent variable

ei = Error term

Results and Discussion

Cost of Production in Acid Lime Farming

The average total cost of production of the acid lime growing farmers was estimated NRs.4,13,165, NRs.4,91,971 and NRs.522330 in the first (base), second and 3-7-year period respectively. In overall, the share of investment cost, variable cost and fixed cost in the total cost in the base year was 36, 34 and 30 percent respectively. While in the second year period, the share of variable cost and fixed was 57 and 43 percent and that of in 3-7-year period was 62 and 38 respectively. Seeking the share in the total cost among the variable cost items, the share of FYM was highest in the base year (9.2%) and second year (19.2%) as well, while in the 3-7-year period, the highest share was of human labor cost (19.5%) followed by FYM (17.5%) (Table 1). Sundar and Selvi (2019) also reported the highest share of human labor cost (42%) in the total variable cost followed by manuring cost (15%). Moreover, Abhilash et al. (2018) reported that the share of human labor cost was the highest (44.5 %) among the variable cost items followed by FYM cost (18%) in the Indi Taluk, Vijayapura, India.

Financial Feasibility of Acid Lime Farming in Nepal

The financial feasibility appraisal of acid lime farming is illustrated in Table 2 and Table 3.

The financial feasibility analysis of acid lime farming was carried out assuming that the commercial productive period of the acid lime plant will be up to age of 20 years (Table 2). This assumption has been taken reviewing the publications of NCRP (NCRP, 2015; NCRP, 2018) and NFDC (NFDC, 2021). Moreover, consultation with technical experts were also done. The data on cost and returns associated with acid lime farming right from the base year to current productive year were collected from the field survey among commercial farmers. The highest age of the plant in the commercial acid lime orchard was found to be 7 years; thus, primary data on cost and returns up to 7 years were collected from the field survey. While, for rest of the productive years, the projection of cost and returns were done reviewing the study report of NFDC (NFDC,

2021) and consultation with expert during KII. The financial analysis was carried out using the discounted appraisal techniques such as: Net Present value, Internal Rate of Return, Benefit cost ratio and undiscounted, Pay-back period which is better illustrated in Table 2.

Table 1: Estimation of costs incurred in acid lime farming

S.N.	Costs items	Year 1 (Base year)		Year 2		Average of Year 3 to Year 7	
		Mean (NRs./ha)	% of total cost	Mean (NRs./ha)	% of total cost	Mean (NRs./ha)	% of total cost
1.	Layout	9655	2.4	-	-	-	-
2.	Sapling	104875	25.3	-	-	-	-
3.	Equipment	34171	8.3	-	-	-	-
	Investment Cost Total	**148701**	**36**	-	-	-	-
4.	Farm Yard Manure	38048	9.2	94419	19.2	91407.75	17.5
5.	Chemical Fertilizers	10823	2.6	35591	7.2	57456.3	11
6.	Human labour	70282	17	86439	17.6	101854.4	19.5
7.	Disease/pest management	9734	2.5	31018	6.3	28728.15	5.5
8.	Micronutrients	2206	0.5	17375	3.5	24549.51	4.7
9.	Irrigation	8910	2.2	15018	3.1	19848.54	3.8
	Variable cost total	**140003**	**34**	**279860**	**56.9**	**323844.6**	**62**
10.	Land rent	82059	19.7	123849	25.2	120135.9	23
11.	Bank Interest	42402	10.3	88262	17.9	78349.5	15
	Fixed cost total	**124461**	**30**	**212111**	**43.1**	**198485**	**38**
	Total cost	**413165**	**100**	**491971**	**100**	**522330**	**100**

Source: Field survey, 2022

Table 2: Financial feasibility estimates of acid lime farming

Year	Total income (Bt) NRs./ha	Total cost (Ct) NRs./ha	Incremental benefit (INB) NRs./ha	Discount factor (at 12%)	Present value of Bt (NRs./ha)	Present value of Ct (NRs./ha)	Present value of INB (NRs./ha)
Base year1	0	413165.4	-413165	1	0	413165.4	-413165
2	0	435269.9	-435270	0.892857	0	388633.9	-388634
3	447768.8	475933.9	-28165.1	0.797194	356958.5	379411.6	-22453.1
4	687633.3	495789.2	191844.1	0.71178	489443.8	352893	136550.8
5	944058.8	514254.3	429804.5	0.635518	599966.5	326817.9	273148.5
6	1073057	545204.6	527852.6	0.567427	608881.4	309363.7	299517.7
7	1256200	580469.1	675730.9	0.506631	636430	294083.7	342346.3
8	1303949	522330	781618.8	0.452349	589840.2	236275.6	353564.7
9	1421304	522330	898974.2	0.403883	574040.9	210960.3	363080.6
10	1563435	522330	1041105	0.36061	563790.2	188357.4	375432.8
11	1711961	522330	1189631	0.321973	551205.6	168176.3	383029.3
12	1866037	522330	1343707	0.287476	536441.2	150157.4	386283.8
13	2024651	522330	1502321	0.256675	519677.4	134069.1	385608.3
14	2186623	522330	1664293	0.229174	501117.5	119704.6	381412.9
15	2350619	522330	1828289	0.20462	480983.3	106879.1	374104.2
16	2491656	522330	1969326	0.182696	455216.3	95427.74	359788.6
17	2616239	522330	2093909	0.163122	426765.3	85203.34	341562
18	2694726	522330	2172396	0.145644	392471.7	76074.41	316397.3
19	2856410	522330	2334080	0.13004	371446.4	67923.58	303522.8
20	2913538	522330	2391208	0.116107	338281.5	60646.05	277635.5
Total	**32409867**	**10250376**	**22159490**	**8.365777**	**8992958**	**4164224**	**4828734**

Source: Field survey, 2022

Table 3: Financial indicators for feasibility of acid lime farming

Financial indicators	Value
Payback period	5 years 5 months 26 days
Net present value at 12%	NRs. 4828734
Internal rate of return	40 %
Discounted benefit cost ratio	2.2
Return on investment	116 %

Source: Field survey, 2022

The financial analysis of acid lime farming per hectare of land estimated Pay-back period of 5 years, 5 months and 26 days. Calculating the pay-back period is the undiscounted technique of investment appraisal which calculates the time period where the enterprise gives the breakeven. Moreover, using the discounted appraisal technique- NPV and BCR, the NPV at 12% discount rate was calculated NRs. 4828734/ha while the BCR was estimated 2.2. Abhilash (2018) reported that BCR were 2.83 and 2.09; Payback period 5.17 and 5.21 years; IRR 28 and 23 per cent in Indi and Sindagi taluks respectively in Vijayapura district of India. The benefit cost ratio of other citrus fruits such as for mandarin production in Dailekh district of Nepal has been reported 1.62 (Regmi, 2020). Moreover, the estimated benefit cost ratio was 2.81 for sweet orange production in Sindhuli district of Nepal (Parajulee et al., 2021). The value of NPV showed that the acid lime farming could earn NRs.48,28,734/ha assuming the commercial productive period of each lime plant is 20 years. In addition, the value of BCR indicated that with the unit investment in acid lime farming, it will give 2.2 times returns. Furthermore, the estimated value of IRR (40%) for the acid lime farming indicated that the earning capacity of the commercial acid lime farming is 40 percent. All of the estimated value of the financial indicators discussed above showed the financial viability/feasibility of commercial acid lime farming in Nepal (Table 3). Bhandari and Aryal (2017) also emphasized on exploring the potentiality of fruit production in Nepal to substitute the import and promote the export which will contribute to raise living standard of farmers.

Prospects of Acid Lime Farming in Nepal

The prospects of acid lime farming in Nepal has been discussed mainly through trend analysis of its productivity, productive area, production and import. The trend analysis of import showed the overview of the demand-supply situation of acid lime over the decade. As the prevailing domestic production of acid lime is unable to meet the national demand, increased production, productive area and productivity could substitute the import. However, the trend analysis revealed the declining productivity, slightly increasing production and productive area which seemed to be unable to substitute the import though out the decade.

Compound Annual Growth Rate (CAGR) of Import, Productivity, Production And Productive Area of Acid Lime in Nepal

CAGR of import, productivity, total production and productive area of acid lime in Nepal has been estimated based on last ten years' data (in natural logarithm) of all the respective variables Table 4. The findings revealed that the import, production and productive area were found to be increased at the rate of 32, 6, and 8 percent per annum respectively while that of productivity was found to be decreased by 2.4 percent per annum ($p<0.010$). The acid lime farming of Nepal is subjected to declining productivity and very slowly increased production and area. The improvement in productivity could be done by increasing the use of improved saplings and farming technologies. With the increased productivity, the domestic production could substitute the import and contribute to national GDP. Bhandari and Aryal (2017) reported that horticultural crops including citrus fruits can contribute in food security, improve nutritional status and provide employment, increase income and increase overall GDP of the country. The import of lime and lemon in Nepal from India in the year 2019/20 has been reported to be of monetary value NRs.803351656 (MoICS, 2020). There is a huge opportunity for acid lime farming in Nepal as the domestic production is unable to meet the demand and thus resulting high import. Dhakal et al. (2005) conducted a survey in Kalimati market which revealed that the domestic lime contributes only 5.5 % of total demand and rest was imported from India which explored the huge market opportunity for increased production and import substitution. This showed the tremendous domestic market opportunities for commercial acid lime production in Nepal.

Table 4: CAGR of import (2011-2020), productivity (2010-2019), total production (2010-2019) and productive area (2010-2019) of acid lime in Nepal

Parameters	Intercept	CAGR	R^2	P-value
Import (NRs./year)	17.47	.32***	0.93	0.000
Productivity (mt/ha)	2.12	-.024***	0.70	0.003
Production (mt)	9.87	.058***	0.86	0.000
Productive area (ha)	7.74	0.083***	0.94	0.000

Note: *** Significance at 1 percent level

Source: Field survey, 2022

Conclusion

The commercial acid lime production in Nepal has been revealed as a profitable enterprise. The BCR greater than one, IRR three times higher than discount rate, high NPV (return on investment more than cent percent) and payback period less than one-third of the total productive age of the lime orchard showed the financial feasibility of commercial acid lime farming in Nepal. The FYM cost was found to have highest share in the total cost during the unproductive years (first two years of planting); however, human labor was found to have the highest share after the production

begins. The findings revealed that the rate of increase in import is much higher compared to total production and area of acid lime. In addition, the declining trend of lime productivity has been revealed. There is a huge opportunity for acid lime farming in Nepal as the demand is much higher than domestic production resulting voluminous import from abroad. An appropriate strategies needed be formulated to minimize the import and enhance the balance of payment. Agribusiness promotion strategies focusing on market development should be introduced that would contribute to enhance the national acid lime production and promote the domestic market.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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