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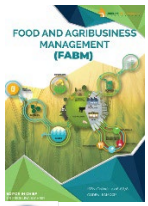

RESEARCH ARTICLE

ECONOMICS OF PRODUCTION AND MARKETING OF MANDARIN IN SAHIDBHUMI RURAL MUNICIPALITY

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ABSTRACT

This research explores the production and marketing of mandarin orange (*Citrus reticulata Blanco*) in Sahidbhumi Rural Muincipality, Dhankuta, Nepal, highlighting the challenges and opportunities faced by local farmers. Dhankuta district is suitable for mandarin production, though farmers struggle with outdated farming methods, limited access to better seeds and irrigation, pest problems, and difficulty reaching markets.

Mandarin orange cultivation holds substantial importance for the agricultural economy of Dhankuta district, contributing significantly to the income of rural households and local markets. Thus, this study aims to evaluate the status, challenges, and potential of mandarin production and marketing in Dhankuta, including farmer practices, post-harvest handling, supply chains, market potential, stakeholder roles, and socio-economic impacts.

For this study, we collected household level information from randomly selected 93 mandarin growers and market related information from purposively selected six traders. The results showed that the average cultivated area is 0.212 ha, the total production per year is 1.99 tonnes and hence the productivity is 10.15 t/ha. The benefit-cost ratio of 5.42 with the total production cost of Rs. 24,670.49 and total revenue of Rs.133,904.18 indicates that mandarin farming can be highly profitable. However, farmers face significant challenges, including fluctuating prices, reliance on middlemen, and inadequate storage facilities.

A SWOT analysis highlights strengths like favourable growing conditions and high demand, but also weakness in infrastructure and climate change threats. These findings can guide policymakers, experts, and farmers in strengthening Nepal's mandarin industry and agricultural growth.

KEYWORDS

Mandarin Orange, Benefit Cost Ratio, Production, Marketing Channel, Problems

1. INTRODUCTION

Agriculture is the major source of livelihood for around 60% population of Nepal and contributes 25.8% of the total GDP (MoALD, 2020). Moreover, horticulture crops are of great importance for increasing the share of agriculture in GDP. Fruits and spices account for 7.04% to the total AGDP (MoALD, 2020).

Globally, citrus is cultivated in 114 countries. Among these, 53 countries grow citrus commercially with a total production of more than 115 million tons while Nepal produces only 0.22 million tons (NCRP, 2016). Mandarin oranges, known scientifically as Citrus reticulata Blanco, are a significant fruit crop globally and are widely cultivated in subtropical regions, including Nepal. Mandarin oranges were likely introduced to Nepal from Southeast Asia and China, which are believed to be the centers of origin for Citrus reticulata (MoAD, 2016).

Nepal is noted for the production of quality mandarin and sweet orange. The sub-tropical climates of mid hill districts ranging from 800 to 1400 masl altitude along with favorable agro-climatic condition across the country are considered quite suitable for growing citrus fruits. Moreover, the production areas with deep sandy loam soil and soil pH range of 5.0 to 6.5 are the most suitable for the cultivation of citrus (NCRP, 2024).

Horticultural commodities contribute 14% of the total agriculture GDP and of which fruit only contributes 7.04% GDP. Citrus has been grown in 62 districts: Dhankuta, Terathum, Sindhuli, Ramechhap, Dhading, Kavre, Gorkha, Lamjung, Tanahun, Kaski, Syangja, Myagdi, Palpa, Salyan, Dailekh, Baitadi, Dadeldhura are the major producers: important cash crop for hill farmers of Nepal contributing the 26.84% of the total fresh fruits production.(Bishnu Prasad & Shiva Chandra, 2019). The total area under cultivation, productive area and production of citrus in Nepal during 2021/22 was 49,306 ha, 32,317 and 3,06,149 mt., respectively. While, the total area under cultivation, productive area and production of mandarin in Nepal during 2021/22 was 27,982 ha, 18,481 ha and 1,85,346 mt., respectively (MoALD, 2021).

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Table 1: Major varieties of citrus found in Nepal

S.N.	Fruits	Varieties
1	Mandarin	Dhankuta local, Pokhara local, Kinnow Pongkan, Markat, Nagpur Santra, Unsu, Thai Tanzarin, Khoku local
2	Sweet Orange	Junar local, Navel orange, Washington navel, Yoshida navel, Tarakko nucellar
3	Acid lime	Mexican, Vanarasi, Local lime
4	Lemon	Nepali amilo, Eureka round, Eureka oblong, Lisbon, Panta1, Sun Kagati1
5	Pomelo	Thai (white pulp) and Local (Red pulp)
6	Muntala	Japanese Round
7	Jyamir	White Jyamir, Black Jyamir

Source: (AITC, 2022)

Although mandarin has been grown widely as an important commercial fruit crop in mid-hilly terrain, farmers are not fully acquainted with orchard management and post-harvest practices. Despite the ecological advantage, the production of mandarin fruits is still insufficient to meet the domestic demand of the country (Acharya et al., 2023).

There are several constraints to fruit development in Nepal of which production constraints, socio economic constraints, infrastructure constraints, institutional constraints, policy constraints and human resources constraints are major. The government, semi- government, NGOs/INGOs and other private agencies should pay adequate attention to solve these problems and constraints and develop proper technology for fruit cultivation in Nepal.(Atreya & Manandhar, 2016). The yearly decline in mandarin production, one of the important citrus fruits in the mid-hills of Nepal could be attributed to underdeveloped and non-systematic market leading to low profitability and hence reducing their motivation (Kathayat & Bhatta, 2023).

This study is crucial and timely because it aims to provide clear insights into the problems affecting mandarin orange production in Dhankuta. The information gathered will probably be valuable for policymakers, agricultural professionals and farmers who are looking to improve both the productivity and profitability of this crop.

2. Research Methodology

2.1 Site selection

Sahidbhumi Rural Municipality is located in the Dhankuta District of Koshi Province, Nepal. Sahidbhumi spreads across approximately 99.55 square kilometers (38.44 square miles). It lies within the Dhankuta District, with coordinates ranging approximately from 26.4°N to 27.2°N latitude and 87.1°E to 87.8°E longitude. Dhankuta district itself is known for its hilly and mountainous terrain, part of the Mahabharat Range. We can infer that Sahidbhumi would also have similar features, with potential valleys and streams depending on its specific location within the district.

2.2 Preliminary survey

The initial survey involved engaging directly with the local community to gather essential insights into the demographic makeup, socio-cultural dynamics, and geographical features of the area. This was achieved through observing the surroundings firsthand and engaging in conversations with the farmers and residents.

By immersing ourselves in the local environment and interacting with community members, we aimed to gain a deeper understanding of the unique characteristics and challenges faced by the people living in the area. This invaluable information informed the development of questionnaires and the design of our sampling approach, ensuring that our research was tailored to accurately capture the perspectives and experiences of the individuals we sought to study.

2.3 Sample size and sampling procedure

To ensure accurate insights while acknowledging the impracticality of gathering data from the entire population, we decided to select a representative sample focusing on mandarin growers within the command area mandarin zone. As per CBS 2021, the total number of households in Sahidbhumi RM is 4090 while only 57.94 % households are involved in mandarin population, so the total number of households surveyed was 2370, representing 57.94% of all households. Utilizing Raosoft web software (http://www.raosoft.com/samplesize.html) with the following parameters:

Margin of Error: 10%

Level of Confidence: 95%

Household: 2370

Response Distribution: 50%

The calculated sample size required for the survey was 93 households.

A total of 93 producers and 6 available traders were selected as the sample for the survey.

2.4 Research instruments/design

This survey was focused on finding out the status of production and marketing of mandarin in Sahidbhumi RM. The following methodologies were employed for data collection:

2.4.1 Preparatory phase

During the initial phase, a comprehensive literature review was conducted to inform the study design. Customized questionnaires and checklists pertaining to mandarin production and marketing were developed. The sampling criteria and methodological approach were refined and finalized to ensure robust data collection and analysis.

2.4.2 Survey schedule design

The survey schedule was prepared to collect primary information from respondents. Structured, semi-structured and unstructured questionnaire was included.

2.4.3 Pretesting of questionnaire

Questionnaire was tested among 10 mandarin growers to check the validity and reliability of the questions and final questionnaire was prepared after the feedback from the pretesting.

2.4.4 Entry on mwater surveyor

The final version of questionnaire was uploaded manually in the mwater surveyor portal, which is a mobile application for conducting offline surveys. On mwater surveyor data entry becomes easier and data can be synced in the server when we are back online and can directly export the data in excel or csv format.

2.4.5 Field survey

Field survey was conducted in the target site during which a series of questions were asked to farmers to collect data. Also, the trader, input suppler and consumers were questioned to collect the useful data.

2.4.6 Key informant interview

Experienced leaders, municipality head, ward head, agriculture officers, progressive farmers and representatives of farmers group were asked a series of questions about the present scenario of mandarin production and marketing in the area, current yield statistics, the number of households involved, marketing economics and many problems related to mandarin farming.

2.4.7 Focus group discussion

The targeted group of farmers were brought together in discussion to draw out information about common farming and marketing problems and the best effort was given to identify sustainable solutions to the identified problems. The participants were farmers, farmer group leaders, local leaders, mandarin trader, input supplier representing all ethnic group and genders. Efforts were made to ensure the FGD was inclusive and participatory.

2.5 Methods and techniques of data analysis

The data collected during the survey through mwater surveyor app was exported into excel file format and analyzed using various tools like SPSS, MS-Excel. The data is represented in textual, tabular and graphical form for easy understanding and interpretation. A Benefit-Cost Ratio (B-C ratio) is the ratio of benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms.

The B-C ratio will be calculated using the following formula:

B-C ratio = $\sum_{t=1}^{n} \frac{bt}{(1+i)t} / \sum_{t=1}^{n} \frac{ct}{(1+i)t}$

For benefit- cost ratio analysis, the cost of production and return from production were collected. For analyzing the cost of production, only variable costs were collected. For analysis of return, gross return and net return from mandarin production were collected. The gross return was calculated as:

Gross return = Price of Mandarin (Rs. /Unit) × Total Mandarin quantity marketed (kg)

The net return will be calculated as:

Net return = Gross Return – Gross Cost

where,

Gross cost = Production Cost + Marketing Cost of mandarin

For finding the importance of different production and marketing problems five-point scale was used based on the farmer's perception about them. It comprises very high importance, high importance, normal importance, less importance and the least importance to the different problems using numeric value 1, 2, 3, 4 and 5 respectively. The index of importance was conducted by using the following formula(Gautam et al., 2020);

$I_{imp} = \sum \frac{SiFi}{N}$

where,

$\sum$ = Summation

I_{imp} = Index of Importance

Si = Scale value

Fi = Frequency of importance given by the respondents

N = Total number of Respondents

3. Results and Discussion

In this section, major findings that were obtained after the analysis of statistical information collected during research work are discussed and interpreted.

3.1 Education of the farmer

Most respondents in the research site were literate (59.13%), while only 4.30% pursued higher studies.

Table 2: Education level of the farmer

Education Level	Frequency	Percentage
Illiterate	22	23.65
Literate	55	59.13
SLC	12	12.9
Bachelor and above	4	4.30
Total	93	100

3.2 Major occupation of the households

The majority, accounting for 87.09%, were engaged in agriculture sector making it the predominant livelihood in the area. A smaller portion of households, 4.30% were involved in government services and jobs, while 5.37 rely on foreign employment. Additionally, 3.22% of households were involved in other occupations like teacher, reporter and business.

Table 3: Occupation of the households

Occupation	Frequency	Percentage
Agriculture	81	87.09
Government Jobs	4	4.30
Foreign Employment	5	5.37
Others	3	3.22
Total	93	100

3.3 Soil test

Only 2.15% of the respondents had done soil test till date while most of the respondents were unaware of such test at all.

Table 4: Soil test

Soil Test Status	Frequency	Percentage
Yes	2	2.15
No	91	97.84
Total	93	100

3.4 Varieties of Mandarin

A vast majority i.e. 94.62 % of households grow the Khoku local variety, indicating that this is the most common type of mandarin in the area. A smaller percentage, i.e., 5.37%, grow grafted mandarins, believing that smaller trees lead to reduced production.

Table 5: Varieties of Mandarin

Mandarin Variety	Frequency	Percentage
Khoku local	88	94.62
Grafting	5	5.37
Total	93	100

3.5 Sources of irrigation

The majority of households i.e. 56.98 % do not have the irrigation available for mandarin orchard while, 25.80 % rely on surface water like natural well and streams. A smaller percentage, 9.66% use plastic pond to store water for irrigation and 7.52% has access to an irrigation channel which was constructed through public participation.

Table 6: Irrigation source

Irrigation Source	Frequency	Percentage
Not Available	53	56.98
Surface water	24	25.80
Plastic Pond	9	9.66
Irrigation Channel	7	7.52
Total	93	100

3.6 Status of subsidy for Mandarin cultivation

Out of 93 mandarin growers, 35 reported receiving subsidies in various forms, such as fertilizers, pesticides, sprayers, and plants, while 58 did not. Essentially, the majority of mandarin growers i.e. 62.36% were not benefitted from subsidies for mandarin cultivation.

Table 7: Subsidy status

Subsidy Status	Frequency	Percentage
Yes	35	37.63
No	58	62.36
Total	93	100

3.7 Production analysis

On average, site had 72 trees covering 0.21 hectares, with each plant yielding around 0.03 tons annually. The total annual production was about 1.99 tons, though this value can range from 0.05 tons to as much as 30 tons. Productivity per hectare also varies widely, averaging 10.15 tons per hectare but ranging from 0.33 to an impressive 199.65 tons per hectare.

Table 8: Production analysis

	Mean	Standard Deviation	Minimum	Maximum
Number of trees	72.34	76.57	10	300
Total Cultivated Area (ha)	0.212	0.173	0.050	0.751
Production per plant (t)	0.03	0.07	0.00	0.50
Total production per year (t)	1.99	4.61	0.05	30
Productivity (t/ha)	10.15	24.55	0.33	199.65

3.8 Marketing channel

The majority of transactions, 67.74 % followed the Producer – Wholesaler – Retailer – Consumer model, where products pass through both wholesalers and retailers before reaching the consumers.

A small portion, 19.35% involved direct sales from Producers to Consumers. Additionally, 12.90% of the transactions go through Producer – Retailer – Consumer channel, where producers sell to retailers, who then sell to consumers.

Table 9: Marketing channel

Marketing Channel	Frequency	Percentage
Producer- Consumer	18	19.35
Producer – Retailer - Consumer	12	12.90
Producer – Wholesaler – Retailer - Consumer	63	67.74
Total	93	100

3.9 Traders information

Out of all 6 traders available in the site, 5 of them were wholesalers and just 1 retailer, indicating that wholesalers play a much larger role in the market within the study site. This suggests that most of the products were distributed through wholesalers, with fewer products being sold directly to consumers by retailers.

Figure 1: Distribution of Trader Types in Study Area

3.10 Production analysis and B-C ratio

Table 10: Production analysis and B-C ratio

Particulars	Amount (Rs.)
Fixed Costs	
Lands	0
Saplings	8.70
Pit	290.3
Total Fixed Cost	299
Variable Costs	
Cost of Nursery Management	6132.07
Fertilizers and Pesticides	9566.2
Labors	3592.7
Transportation and Marketing	1451.6
Water and Irrigation	11.1
Cost of Harvesting	50.02
Cost of Packaging and Grading	0
Cost of Training and Pruning	3567.8
Total Variable Cost	24371.49
Total Cost	24670.49
Total Revenue	133904.18
B-C Ratio	5.42

A B-C Ratio of 5.42 in mandarin production indicates that for every unit of cost spent, the farmer gains 5.42 units of benefit in return. This high ratio reflects the profitability and economic efficiency of mandarin cultivation in the Dhankuta region, demonstrating that the returns on investment significantly exceed the costs involved in production, such as labor, inputs and transport. It highlights that resources are being utilized efficiently, making mandarin farming a highly rewarding sector. Such a favorable B-C Ratio serves as an economic benefit for farmers to continue or expand production, while also attracting potential investments in infrastructure, technology and market development. Additionally, the strong profitability implied by this B-C Ratio can help farmers mitigate risks like price volatility or climate related challenges. Ultimately, a B-C Ratio of 5.42 underscores the financial sustainability of mandarin production in the Dhankuta, providing motivation for continued investment and improvement in the sector.

3.11 Problems in Mandarin production

Various problems related to the production and marketing of mandarin were studied in the study site. Major production problems in the study area were identified and ranked based on their seriousness by the respondents with the help of the scaling technique. The details of various production problems faced by the mandarin farmers in the study site are presented in the table below:

Table 11: Production constraints faced by farmers

Technological constraints	Index	Rank
Facilities and equipment	0.91	I
Poor technical knowledge	0.82	II
Unavailability of inputs	0.45	III
Abiotic stress	0.44	IV
Insect pest damage	0.35	V

3.12 Problems in marketing

Several problems in marketing in the study area were faced by the mandarin farmer. Major marketing problems in the study area were identified and ranked based on their seriousness by the respondents with the help of the scaling technique. From the results obtained from the study, price variation was found to be the major marketing problem followed by a middleman, lack of storage, and lack of transportation.

The details of various marketing problems faced by the mandarin farmers in the study site are presented on the table below:

Table 12: Marketing constraints faced by farmers

Technological constraints	Index	Rank
Price variation	0.93	I
Middleman	0.73	II
Lack of storage	0.53	III
Lack of transportation	0.31	IV

3.13 SWOT Analysis

SWOT analysis means strength, weakness, opportunities and threats related to any enterprise. The strength, weakness, opportunities and threat analysis related to mandarin production and marketing was done through field visits and interviews.

Table 13: SWOT analysis

Strength	Weakness
Favorable climatic conditions	Scattered growers
Excellent taste	Poor transportation
High demand	Storage facility
Government support in policies	Poor credit
Intercropping	Research constraints
	Seasonality of the crop
Opportunities	**Threats**
Export potential	Bad weather
Diversified climate	Incidence of citrus decline
Employment opportunity	Political instability
Utilization of sloppy land	High cost of input
	Increasing labor cost

4. Summary and Conclusion

4.1 Summary

The study presents a comprehensive analysis of mandarin orange production and marketing in Dhankuta, Nepal, focusing on the socio-economic characteristics of the respondents, agricultural practices, and the challenges faced. Most respondents were male (66.67%), with an average age of 52.9 years. The predominant ethnic group was Rai (91.39%), and agriculture was the primary occupation for 87.09% of households.

The study revealed that only 2.15% of respondents had conducted soil tests, indicating a lack of awareness about soil management. A significant majority (94.62%) grew the Khoku local variety of mandarin, yet 56.98% reported no access to irrigation, highlighting the limitations in cultivation practices.

Additionally, while 62.36% of farmers did not receive any subsidies, those who did found them helpful. The production analysis indicated an average yield of 0.03 tons per plant, with a total annual production of about 1.99 tons per household.

The benefit-cost ratio of 5.42 suggests that mandarin farming is financially rewarding, yet farmers face critical challenges, including price variations, reliance on middlemen, and inadequate storage and transportation facilities.

A SWOT analysis identified favorable climatic conditions and high demand as strengths, while poor infrastructure and climate-related threats were recognized as weaknesses and external challenges. The findings emphasize the need for improved farming techniques, better market access, and supportive policies to enhance the productivity and sustainability of mandarin production in the region.

4.2 CONCLUSION

The study concludes that mandarin orange production in Dhankuta district has significant potential for economic growth and improved livelihoods for local farmers. Despite the favorable agro-climatic conditions and a high benefit-cost ratio of 5.42 indicating profitability, the sector faces numerous challenges hindering its development.

These challenges include reliance on traditional farming practices, lack of access to modern agricultural inputs, inadequate irrigation, and insufficient pest management, alongside market inefficiencies such as price volatility and reliance on middlemen. These issues have substantial socio-economic impacts, limiting farmers' incomes and reducing their capacity to invest in improved farming practices.

To address these challenges, the study advocates for the adoption of improved farming techniques, enhanced agricultural extension services, and infrastructure development to facilitate better market access.

Additionally, increasing awareness and support for sustainable farming practices will be crucial in mitigating the effects of climate change and ensuring the long-term viability of mandarin production. The insights gathered from this research provide valuable information for policymakers, agricultural professionals, and farmers, guiding efforts to bolster the mandarin orange industry and contribute to the broader agricultural growth of Nepal.

5. SUGGESTIONS

For Future Researcher

- Explore Advanced Farming Techniques
- Climate Change Impact Studies
- Market Chain Analysis
- Comparative Studies with other Regions

For Farmers

- Adopt improved Farming Techniques
- Implement Integrated Pest management (IPM)
- Diversify Income Sources
- Access Agricultural Training and Support
- Improve Market Access

For Policy Implications

- Strengthen Agricultural Extension Services
- Infrastructure Development
- Support for Climate-Resilient Farming
- Market Access and Fair Pricing
- Research and Development Investments

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