ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2821-2983 (Online)
CODEN: MBMJAO

Malaysian Business Management Journal (MBMJ)

DOI: http://doi.org/10.26480/mbmj.01.2022.07.10

RESEARCH ARTICLE

PRODUCTION, MARKETING AND BENEFIT COST ANALYSIS OF CARROT IN MADHYAPUR THIMI, BHAKTAPUR

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ARTICLE DETAILS

Article History:

Received 20 November 2021
Accepted 24 December 2021
Available online 28 December 2021

ABSTRACT

A study was conducted to analyse the production, marketing and Benefit Cost ratio of carrot in Madhyapur Thimi municipality, Bhaktapur district, Nepal from February to April 2021. A total of 60 respondents were selected randomly for the study. Facts were accumulated via head to head interview method using a semi-established questionnaire. Socio-demographic study showed that 58% males and 42% females were involved in carrot farming. Almost 80% carrot produced by the farmers in this area was found to be collected in the nearest collection center. In the study area, all the respondents were found cultivating F1 hybrid variety 'Nepa Dream'. The cost of production of the carrot in the main season was Rs.29997 per ropani (0.05 ha). The average yield of carrot was 2057 kg per ropani. Gross income from the carrot production was Rs.99137 per ropani. The net profit was Rs.69139 per ropani and the average Benefit- Cost Ratio was 3.36. Unavailability of inputs in required quantity and time and lack of labor were major problems followed by lack of technical skills, proper marketing channel and postharvest loss.

KEYWORDS

Carrot, Marketing, Production, Profitability.

1. INTRODUCTION

Carrot (Dacus carota) is a crucial root vegetable grown all over the global in spring, summer season and autumn in temperate place and during wintry weather in tropical and sub-tropical regions. It is a dicotyledonous herbaceous crop, under the family Umbelliferae, which is grown as annual crop for its root. Fresh carrots are firm and crisp, with clean and unblemished skin. Vibrant-orange color shows excessive carotene content material, smaller sorts are the maximum soft (Britannica, T., 2020).

Carrot roots are used as a vegetable for soups, stews, curries and pies, grated roots are used as salad, smooth roots as pickles and gajar halwa. Carrot jam is likewise well known and the roots as circle and cuts can be dried out. Carrot juice is a wealthy supply of beta carotene that is a herbal pigment that is utilized by body to make nutrition A and it has good amount of fiber (Manglani, 2019). It is sometimes used for coloring buffer and other food articles. Carrot tops are utilized for extraction of leaf protein, as fodder and furthermore for the poultry feed.

Nepal produces around 31,405 tons of carrots annually on 2,685 hectares of land, as consistent with the record of the Ministry of Agricultural Development. The Central Region is the largest producer of carrots within the country. It grows 12,330 tons of the vegetable, accounting for 39 percent of the total output. The Eastern Region comes second with 10,000 tons, or 32 percent of the overall. The Western Region takes third place with 5,100 tons, or 16 percentage of the entire carrots grown in the country. The area, production, and productivity of carrot in Nepal in the year 2018/19 has been reported to be 3,360 ha, 37,362 mt, and 11.12 m/ha respectively (MoALD, 2020).

The Bhaktapur district with an area of 119 km^2 is the smallest district in the country. Significant portion of land is under farming compared to other districts in the valley. Many farmers have been growing carrot instead of their usual crops such as wheat and rice because of its high return. Farmers have been switching to carrot farming because the market for this product is still growing. Out of 11,900ha of land in Bhaktapur, 11106 ha of land are suitable for agriculture but only 8077 ha have been cultivated. Among them 2620 ha of land is irrigated round the year whereas the land that has partial irrigation facility is about 3271 ha (DADO, 2016).

After production, marketing is the most important function, which involves the flow of products and services from the factor of initial agricultural manufacturing until they may be inside the palms of customers (Kohls et al., 1980). Considering the vital importance of carrot production in the livelihood improvement of farmers, this study was conducted to analyse economic aspects along with the cultivation practices and some problems associated with it.

2. MATERIALS AND METHODS

2.1 Study Area, Sampling Technique, and Sample Size

The research was conducted in ward no.8 and 9 of Madhyapur Thimi Municipality of Bhaktapur district, which is one of the most potential regions for vegetable production. For the study, 60 respondents were selected using a Simple random Sampling (SRS) method among the farmers who have been cultivating carrot since long period. The information about the carrot cultivators in this area was collected from Madhyapur Thimi municipality office. Some local agro-vets around the site were also used as the information source.

2.2 Sources of data

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Both the primary and secondary data were used for the data collection. Primary data were collected through field visits, Key Informant's Interview (KII), and a pre-tested semi-structured questionnaire survey among the farmers, while the secondary data were collected reviewing various published and unpublished sources as related journal, books and reports.

2.3 Data analysis

The collected data were tabulated and analyzed using Microsoft Excel.

2.4 Socio-economic variables

Socio economic variables of the farmers were used for comparative descriptive analysis of the study ample. Variables such as gender of respondent, family size, age, occupation, education status, land holding, were analyzed by descriptive tools such as frequencies and percentage.

2.5 Profitability analysis

The profitability of vegetable farming from the viewpoint of an individual farmer was measured in terms of gross return, gross margin, net profit, and undiscounted benefit-cost ratio.

- Gross Return (GR) = Total production x average market price (Islam et al., 2020)
- Gross Margin (GM) = Gross Return – Total Variable Cost (Sapkota et al., 2019)
- Net profit = Gross Return – Total Costs (Noonari et al., 2015)

Where, Total Costs = Total fixed costs + Total variable costs (Noonari et al., 2015; Paudel & Adhikari, 2018)

Here, total fixed costs included depreciation of fixed assets, land tax, land rent, and agricultural loan interest; while the total variable costs included labor cost, cost of seeds, fertilizers, micronutrients, plant protection, marketing cost, and miscellaneous.

- **Undiscounted Benefit-Cost Ratio (BCR)** $= \frac{\text{Gross return}}{\text{Total cost}}$ (Amgai et al., 2016; Subedi et al., 2019; Poudel et al., 2019)

2.6 Problem Ranking

Problems related to production of carrot were ranked with the use of index. Scaling techniques, which provides the direction and extremity attitude of the respondents towards any proposition was used to construct index (Miah, 1993). The intensity of problems faced by the farmers in carrot production was computed by using five point scaling technique comparing most serious, serious, moderate, a little bit serious and least serious with the scores of 1, 0.8, 0.6, 0.4 and 0.2 respectively. The formula used to find the index for intensity of production problems is given below (Maharatha, 2019).

$I_{prob} = \Sigma (S_i f_i)/N$

I_{prob}= Index value for intensity of problem

Σ = summation

S_i= Scale value of i^{th} intensity

Fi= Frequency of i^{th} response

N= total number of respondents

3. Results and Discussion

3.1 Socio-demographic status of the respondents

The study showed that the respondents in between 40-60 ages were found maximum (48%), while the youths between ages 20-40 years were found to be inclined more towards foreign employment rather than agriculture. Both male and female were equally involved in carrot cultivation among which 58% were male and 42% were female. In the study area 36% were illiterate, 37% had primary education, 20% with secondary education, 5% higher secondary education and 2% with degree. Almost 50% of the respondents had family size less than, 40% had family size between 5 and 10 and 10% had family size of greater than 10. The main occupation of the respondents in the study area was agriculture with 75%, 5% in service and 8% in business and 12% in foreign employment.

Farmers were cultivating carrot in their own land as well as land on rent. There were only 25% of the respondents who hand their own land and 75% had their own as well land on lease for carrot cultivation. 50% of the respondents had land holding of 1-4 ropani, 25% with 4-7 ropani and 17% with more than 7 ropani of land holding for carrot cultivation. Most of the respondents were found self-inspired for carrot cultivation because of its high return and other reasons were climatic and soil suitability for growth and development of carrot in the study area. Majority of farmers (60%) were involved in carrot production for more than 10 years and 40% below 10 years. Almost all the farmers bought seed from agro-vets and they were using Nepa dream variety.

3.2 Agronomic practices adopted by farmers

All the farmers had their seed from agro-vets. All the respondents in the study area were found to be using Hybrid variety viz. Nepa Dream. Few years back, they were using other carrot varieties. They switched over to this variety based on the facts that this variety had relatively higher yield and this variety is slightly affordable to the farmers. Discussing about the seed rate, farmers were using 150-200gms seed/ropani for broadcasting and 100gms for line sowing. In spite of higher seed rate, about 75 percent of the farmers were following broadcasting method, because of lack of technical supports from any agencies and line sowing method was found to be more labor-intensive. Carrots were ready for harvesting in 120 days after sowing and were done in the month of Falgun/Chaitra, manually by uprooting plants. Roots are harvested after loosening soil with a spade and by pulling out roots by grasping top. After harvesting green tops from carrots were removed and then they were washed with water and sorting was done to remove the carrots which were unsuitable to market due to damage by insects, diseases, immature, over-mature, misshapen etc.

Carrot Rust Fly was the main carrot pest, which was best controlled by using crop rotation. Also, the common pesticides used by the respondents were Metacil, Acetamiprid and Malathion. Farmers also used Neem, Titepati and Urine for the control of some insect pests.

Some other issues include forking, which is caused by rocky or lumpy soil, poor drainage, insufficient water, or high nitrogen levels in the soil. "Greening" also occured at the shoulders of the carrots when soils were washed away around the tops of the roots. If the tops of the carrots are exposed then some soil should be pushed or mulching over the tops should be done to prevent greening. Splitting was also seen, caused by alternating dry and wet periods. To prevent splitting in carrot, regular irrigation was provided by the farmers in the study area. Soil was improved over time by digging in plenty of well-rotted organic matter to increase the soil's water-holding capacity.

There was about 12% loss in the yield after harvest and only 88% of the produce went to the market. Among the damaged goods 5% was damage from insect pest and disease and 7% was damage from splitting and greening. The damaged produce was used in making poultry feed and fodder.

3.3 Types of fertilizers used by the respondents

Table 1: Manure and Fertilizer dose applied by the respondents

Manure/fertilizers	Average dose (kg/ropani)	Method of application
Poultry manure	500	once at the time of land preparation
Urea	25	Half N is applied as basal dose and remaining half splited twice and top dressed at 30 DAS and 60 DAS during hoeing and weeding.
DAP	15	Once at the time of land preparation
MOP	15	Once at the time of land preparation

Recommended dose of fertilizer for better yield of carrot is 20 ton/ha FYM or compost and 50:40:40 kg/ha. N: P: K.

3.4 Cost of Carrot Production

Table 2: Detailed cost of production of Carrot per ropani

S.N	Variable cost	Cost/ropani(Rs)
	Labor	7966
	Tractor	1000
2	Seed	2958
3	Poultry Manure	4036
4	Urea	1174
5	DAP	994
6	MOP	680
7	Irrigation	1703
8	Harvesting	1182
9	Miscellaneous	1940
10	Total Variable cost	22691
	Fixed cost	
1	Land Tax	260
2	Land lease	5693
3	Loan	6891
4	Repair and Maintenance	1446
5	Depreciation	918
	Total Fixed cost	7240

The total variable cost for carrot production in the study area in one ropani land was calculated NRs. 22,691. The profitability of any agricultural production depends on the cost of inputs. The major cost attributing items that were being used were Seed, Land preparation, poultry manure, Fertilizers (Urea, DAP and Potash), and Labor cost (Seed sowing, weeding, fertilizer application, harvesting, and packing). In the examine vicnicity, labor cost became located to be the primary principal cost attributing items among all variable items observed by means of poultry manure and seed in this recognize. The cost incurred by means of seed within the observed location was located higher than a similar kind of study conducted in the organic and inorganic carrot of Chitwan (Adhikari, 2009). In the study area, farmers cultivated Nepa Dream, F1 variety which cost NRs 2400 per 100gm which resulted in higher cost incurred in the seed. The cost incurred in DAP and Potash was lesser than other variables due to lower use of it than the recommended dose. The combination of both organic fertilizer (poultry manure) and Inorganic fertilizer (Urea, DAP and potash) in the study area was found effective. The impact of hen manure and NPK fertilizer at the increase and yield of carrot in Rwanda had found a widespread influence on increase and yield of carrot (Habimana, 2014).

3.5 Benefit Cost Analysis of Carrot production

Benefit cost analysis of carrot production in Madhyapur Thimi municipality has been presented in table 4. This was based on information obtained from 60 respondents. As shown in Appendix 2, the average yield was 2057 kg/ropani, average price Rs 48 per kg, average cost of production was 29997 Rs/ropani, and average gross income was 99137 Rs/ropani and average net profit of 69139 Rs/ropani. The average benefit cost ratio in the present study came out to be 3.36 compared to 2.87 reported in case of irrigated main season carrot. (VDD, 2067).

As shown in the table 4, the maximum cost of production was 39070 Rs/ha, whereas minimum was 23575 Rs/ha, maximum yield was 2350 kg/ha and minimum was 1700kg/ha, maximum Gross income was 115000 Rs/ha and minimum 76500 Rs/ha, maximum benefit cost was 4.74 and minimum was 2.15.

This was during the main season.

Planting – Kartik-Mangsir

Harvesting – Falgun- Chaitra

Table 3: Benefit Cost Analysis of Carrot in Madhyapur Thimi municipality, Bhaktapur District, 2021

	Cost (Rs/Ropani)	Yield (kg)	Price (Rs/kg)	Gross income (Rs/ropani)	Net profit (Rs/ropani)	Benefit cost ratio
Maximum	39070	2350	50	115000	90725	4.74
Minimum	23575	1700	45	76500	42070	2.15
Mean	29997	2057	48	99137	69139	3.36
Standard Deviation	3909.24	160.7	2.429	9538.21	10303.07	0.546

The average yield of carrot in the study area was 2057 kg per ropani. The productivity of carrot in Bhaktapur district was 18.97mt/ha and productivity of Nepal was 11.12mt/ha (MoAD, 2020). Productivity of the study site was higher as compared to productivity of Bhaktapur district and of whole country. One of the reason for higher productivity was farmers were using F1 hybrid seed. There was proper irrigation with farmers being highly commercialized for carrot production.

3.6 Carrot marketing

Major carrot production sites in this area are Manohara Khola, Bode phant and Mulpani and main market Centre's are Bhaktapur, Balkhu and Kalamati. The carrot produced by the farmers in this area is collected by about 80% in the collection Centre. From collection Centre, 80% goes to the wholesalers at Balkhu and Kalimati market and remaining 20% goes directly to the Bhaktapur local market. Carrots from Bhaktapur are supplied to Kalimati and Balkhu wholesale market.

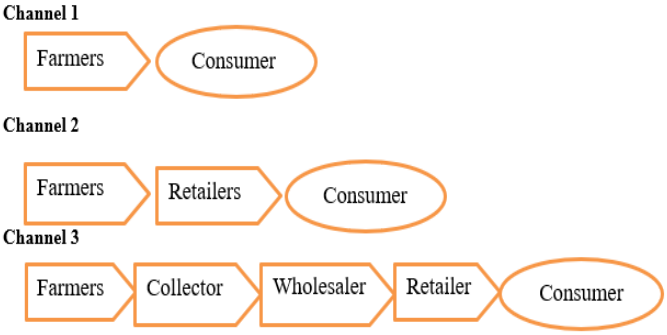

Figure 1: Marketing channel of Carrot in Madhyapur Thimi municipality, Bhaktapur district, 2021

Farm-gate selling was not a prominent marketing practice in the study area. However, some farmers sell their carrot to the buyers at the farm-gate. In this mode of marketing, buying and selling of carrots was done in an individual basis. Buyers go to the farms, usually at a fixed time given by producers. In case of direct selling farmers bring their produce in bamboo baskets to the nearby markets on foot.

Selling of carrots through collection center was the main marketing mode in this area, about 80 % carrots supplied through the collection center (Figure No.8). Farmers collect their carrots in their collection centers, and buyers/traders purchase their produce from these collection centers.

3.7 Market price status of carrot

Generally, price of the carrots depends on the demand and supply situation in the market. It was found that during the production period, the wholesale price ruled very low while during the lean period, the prices were quite high which is due to seasonal and perishable nature of the carrot roots. The price of carrot rise from April/May with maximum in October (NRs. 120/kg) and price become less than average from January. The minimum price is seen in the month of February.

3.8 Problems faced by the farmers

Problem ranking based on the farmer's perception revealed that the shortage of inputs especially seeds and fertilizers, was the major problem in the area due to which input cost became very high. Farmers were seen to be lacking the technical knowledge such as seed sowing methods, plant protection measures and fertilizers application which made it to appear as

the second most important problem. Also, respondents in the study area reported that they were facing problem of shortage of labor during intercultural operations and harvesting, however the involvement of whole family as labor in carrot production decreased the problem of labor shortage. Some marketing problems were considered as a little bit serious ones, followed by post-harvest losses in carrot production and marketing in Madhyapur Thimi (Table 2).

Table 2: Problems faced by the respondents in Carrot cultivation and marketing

Problems	Frequency					Total	Index	Overall Rank
	1	0.8	0.6	0.4	0.2			
Inputs	29	26	5	0	0	60	0.88	1
Technical	30	19	11	0	0	60	0.863	2
Labor	1	15	26	9	9	60	0.566	3
Marketing	0	0	11	31	18	60	0.376	4
Postharvest	0	0	7	20	33	60	0.313	5

Note: Scale value ranges from 1 to 0.2; where 1 = most serious, 0.8 = serious, 0.6 = moderate, 0.4 = little bit serious and 0.2 = least serious

4. Conclusion and Suggetions

The present study showed that the average benefit cost ratio was 3.36 and net profit was Rs 69139 per ropani. Farmers were found using Nepa Dream variety seed only because of its higher productivity. They had no any clear concept about NPK and manure requirement for carrot production in the field. Also, they lacked knowledge about proper intercultural operation of carrot. Unavailability of inputs and shortage of labor was ranked first and second problem in the study area respectively. The major marketing channel adopted by the farmer in Madhyapur Thimi was Producers-Collectors-Wholesalers-Retailers-Consumer. However, higher productivity and easy access to market of Kathmandu valley showed higher potentiality of carrot production and major way of uplifting economic condition of the people in the study area.

These findings made us to suggest the farmers to develop agri-mechanization in the study area as an immediate need to decrease the high cost of labor. Apart from this, local government's support is needed to ensure storage facilities to reduce the price fluctuation and post-harvest losses. Farmers training on improved package of practices and marketing on carrot is needed and organic carrot farming should be encouraged to improve agro tourism in Bhaktapur district.

Acknowledgement

The authors owe their thanks to all the respondents of ward no. 8 and 9 of Madhyapur Thimi Municipality of Bhaktapur district, who provided reliable data to complete this study. Similarly, we would like to express our heartfelt gratitude and respect to the supervisor Prof. Dr. Shanta Man Shakya for his constructive suggestions during the entire period of the study. Also, the entire HICAST team is well appreciated for creating suitable academic environment to conduct this study. Likewise, we are grateful towards the entire members of Prime Minister Agriculture Modernization Project (PMAMP), Bhaktapur for their co-operation and technical instructions.

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