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A Study on Cultivation and Marketing of Organic and Conventional Vegetables in the Nilgiris District, Tamil Nadu

A. S. Nivethitha [a*], M. Prahadeeswaran [a], S. Padma Rani [a] and S. G. Patil [b]

[a] Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore 641003, India.
[b] Department of Physical Sciences and Information Technology, Tamil Nadu Agricultural University, Coimbatore 641003, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To find out the cost of cultivation, marketing costs, marketing margins, price spread, marketing efficiency and constraints faced by organic and conventional Carrot and Potato growing farmers.
Study Design: Multistage Sampling was used.
Place and Duration of Study: The Nilgiris district in Tamil Nadu was chosen for the research. A primary survey was conducted to gather first-hand information related to the study.
Methodology: The costs and returns, the Acharyas-Agarwal's method and Shepherd's method of Marketing efficiency and the Response priority index were used in this study.
Results: The cost of cultivation of organically and conventionally grown carrot were Rs.6,28,165.24 and Rs.6,50,567.84 with B: C ratios of 3.56 and 2.15 respectively. The cost of cultivation of organically and conventionally grown potato were Rs.4,97,869.79 and Rs.5,48,894.71 with B: C ratios of 2.37 and 1.71 respectively. Organic vegetable marketing was done through producer-retailer-consumer and producer-consumer channels. For conventional vegetables, producer-

**Corresponding author: E-mail: nivethithaehkn@gmail.com;*

wholesaler-retailer-consumer and producer-retailer-consumer were the marketing channels. The Acharyas-Agarwal's and Shepherd's method of marketing efficiencies in channel-I and II for organic carrot were 1.97, 7.37, 13.07 and 13.07 respectively and for conventional, the marketing efficiencies in Channel – I and II of carrot were 0.98, 2.16, 1.52 and 3.47 respectively. The marketing efficiencies measured by the Acharyas-Agarwal's and Shepherd's method in channel I and II of organically grown potato were 1.71, 7.59, 15.97, and 15.97 respectively and for conventionally grown potato, they were 1.21, 2.36, 1.52 and 3.08 respectively. The major constraints faced by organic and conventional farming farmers were lack of awareness on certification procedures and pests and disease incidence respectively.

Conclusion: As major inputs were prepared in the field, the cost of cultivation for organically grown carrot and potato is lower than for conventionally grown carrot and potato. They have high B:C ratios since organic produce fetches a higher price than conventional produce. The B:C ratio for conventional carrot indicates higher returns than potato. The channel – II in organic and conventional marketing of carrot and potato has higher marketing efficiency because they have less intermediaries.

Keywords: Organic cultivation; cost and returns; marketing channels; marketing efficiency; response priority index; carrot; potato; constraints.

1. INTRODUCTION

Organic Agriculture is a production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved. In 2020, there were more than 4,21,000 hectares or 0.7 per cent of the global vegetable area under organic management. Australia had the largest organic area of 35.7 million hectares. In 2020, over 74.9 million hectares of organic agricultural land, including in-conversion areas, were recorded. International Federation of Organic Agriculture Movements research indicates that there were 3.4 million or more organic growers worldwide in 2020. The majority of organic farmers were found in Asia followed by Africa, Europe and Latin America with fifty-six per cent, twenty-four per cent, twelve per cent and one per cent respectively [1]. The total area and production under organic farming in India were 26,57,889.33 hectares and 3468991.98 MT respectively. India occupied 9thrank in area under organic farming. Tamil Nadu's total organic farming area and production in 2020- 21 were 14,086.32 hectares and 24,068.86 MT respectively [2]. The total organic farming area in the Nilgiris was 8,313 hectares [3].

Vegetables are significant components of Indian agriculture and nutritional security because of their short duration, high yield, nutritional richness, economic viability, and potential to produce on-farm and off-farm jobs, Our country has varied agro-climates with unique seasons, allowing us to grow a diverse range of vegetables. Our country is blessed with diverse agro-climates with distinct seasons, making it possible to grow a wide array of vegetables. India's area, production and productivity of vegetables in 2020-21 were 1,08,59,000 hectares, 20,04,45,000 MT and 18.5t/ha respectively. India ranked 2nd position in area and production after China. In India, Tamil Nadu remained first in the productivity of vegetables. Tamil Nadu's area, production and productivity of vegetables are 3,34,946.45 ha, 82,02,896.48 MT and 24.4MT/ha respectively in 2020-21 [4].

Vegetables are important sources of proteins, vitamins, minerals, dietary fibre, micronutrients, phytochemicals, and antioxidants in our daily diet. They are not only nutritious, but they also include a variety of phytochemicals, such as antioxidants and anti-carcinogenic substances (e.g. flavonoids, glucosinolates and isothiocyanates). Dieticians recommend eating 300g of vegetables every day. When ingested in sufficient quantities, increase appetite and include a good amount of fibre. Furthermore, it neutralises the acids produced during the digestion of fatty and proteinous foods, provides healthy roughage that promotes digestion, and contributes in the prevention of heart disease.

The Nilgiris District is situated at the North Western part of the State in the Western Ghats and surrounded by Coimbatore and Erode

District in the east, Kerala State in the west and Karnataka State in the north. It is located at an altitude of 2000mts. The average minimum and maximum temperatures are 4^0c and 23^0c respectively. Organic farming is a solution for preventing soil erosion and preserving the heritage of the district. The scope certificate for the Nilgiris has been issued for making the district organic. The Nilgiris is a horticultural district which occupied a special significance in the hilly regions of Tamil Nadu. It is home for many hill cultivated crops such as vegetables, fruits, flowers, spices and plantation crops. The Nilgiris district has its major area under cultivation of Tea, Coffee, Potato, Carrot, Cabbage, Garlic, Pepper, Ginger, Beans, Banana, Mandarin orange, Gerbera and Carnation. Carrot(*Daucus carota*) and Potato (*Solanum tuberosum*) are selected for the study based on their wider cultivation area of 8,15.74ha and 3,725.49ha respectively [3].

2. METHODOLOGY

2.1 Sampling Design and Method of Data Collection

The sample carrot and potato growing farmers were spread over three blocks Ooty, Coonoor and Kotagiri of the Nilgiris except for Gudalur including which makes up the entire district. It was based on the primary data collected during 2021-2022. Multistage sampling was adopted for the selection of district, blocks and villages based on the large area of cultivation. For the selection of sample respondents in each village, simple random sampling was used. The respondents are interviewed with a pre-prepared interview schedule and the total sample size constitutes 120 farmers. Of these, there were 60 organic carrot and potato farmers and 60 conventional carrot and potato farmers. 50 market intermediaries consisting of Commission agents, wholesalers and retailers of organic and conventional vegetables were interviewed.

2.2 Tools of Analysis

2.2.1 Cost and returns

The cost concepts as per the Commission for Agricultural Costs and Prices approach were used to find out the cost incurred in per hectare cultivation of carrot and potato organically and conventionally. The different concepts were explained below [5,6,7],

Cost A1 = It includes the value of hired human labour, the value of bullock labour (owned and hired), machine power (owned and hired), the value of seeds, the value of manures (owned/purchased), the value of fertilizers, the value of plant protection chemicals, irrigation charges, depreciation of implements and farm buildings, land revenue and interest on working capital.

Cost A2 = Cost A1 + Rent paid for leased in land
Cost B1 = Cost A2 + Interest on owned fixed capital
Cost B2 = Cost B1 + Rental value of owned land
Cost C1 = Cost B1 + Imputed value of family labour
Cost C2 = Cost B2 + Imputed value of family labour

Cost C3 = Cost C2 + 10% cost of C2

In case of organic farming, the value of manures, bio-fertilizers and other plant-protection bio-inputs were commonly taken as organic inputs for easier calculation. The Gross return is calculated by multiplying the total quantity of yield by the price/kg of product. The Net return is obtained by subtracting the cost of cultivation from the gross return and expressed in Rs./ha. The total cost of cultivation is the cost C3 obtained by using cost concepts.

The Benefit-Cost Ratio (BCR) is calculated for finding the success of the farm business. It is the ratio of gross return and cost of cultivation. It can be expressed as under,

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Gross return (Rs./ha)}}{\text{Cost of cultivation (Rs./ha)}}$$

The B:C ratio calculated from gross return and cost of cultivation as per CACP approach reflects all explicit and implicit costs incurred during cultivation.

2.2.2 Price spread

For the assessment of farmers' share in consumers' rupee, the price spread is calculated [8]. It is the difference between consumers' price and producers' price. The price spread is calculated by,

$$F_S = \frac{F_P}{C_P} X\ 100$$

F_S = Farmers' share in consumers' rupee
F_P= Farmers' price
C_P= Consumers' price

2.2.3 Marketing efficiency

2.2.3.1 Acharyas-Agarwal's method

The Marketing efficiency by Acharyas-Agarwal's approach is calculated by [9,10],

ME = FP/ (MC+MM)

where,

ME = Marketing efficiency
FP = Price received by the farmer
MC = Total marketing cost
MM = Net marketing margin

2.2.3.2 Shepherd's method

The Shepherd's method of calculating marketing efficiency is,

ME = (V/I – 1)

Where,

ME = Marketing efficiency
V = Price paid by the consumer (value of goods purchased)
I = Total Marketing Cost

2.2.4 Response Priority Index

For analyzing the constraints faced by the farmers, the ResponsePriority Index (RPI) was constructed as a product of the Proportion of Responses (PR) and Priority Estimate (PE) where PR for the ith constraint is the ratio of the number of responses for a particular constraint to the total responses. It is expressed as [11,12],

$$(RPI)_I = \sum_{j=1}^{k} f_{ij} X_{[(k+1)-j]} / \sum_{i=1}^{1} \sum_{j=1}^{k} f_{ij}$$

Where,

RPI_I= Response priority index for ith constraint,
f_{ij} = Number of responses for the jth priority of the ith constraint (i= 1, 2……, I; j= 1,2,3…..k),
$\Sigma_{j=1}^{k} f_{ij}$ = Total number of responses for the i^{th}constraint
K = Number of priorities (1- Strongly agree, 2- Agree, 3-Moderate, 4- Disagree, 5- Strongly disagree),
$X_{((k+1)-j)}$ = Scores for the j^{th}priority
$\Sigma_{i=1}^{k}\Sigma_{j=1}^{k} f_{ij}$ = Total number of responses to all the constraints

The larger the RPI, the higher was the importance for that constraint.

3. RESULTS AND DISCUSSION

3.1 Cost and Returns

The cost of cultivation for organically grown carrot was Rs.6,28,165.24, with a B:C ratio of 3.56. The price prevailing at the time of study was taken for calculating returns. Untreated conventional seeds were allowed for organic farming and therefore carrot seeds of different brands like Romance, Zubera, Techila, Natuna, and Korada were purchased and used. The seed requirement for carrot was 3.75kg/ha. Due to more prevalent nematode infestation in the soil, the farmers used more than recommended. 100g of carrot seeds were contained in 1 packet, which can cost nearly Rs.5000 depending upon the brand. The organic farmers prepared most of the inputs on-farm thereby reducing their reliance on external sources and as a result the total cost was reduced. The major organic inputs used were Panchakavya, Dasakavya, Jeevamirtam, Agniasthram, Vermicompost, vermiwash, Neem cake, Neem seed kernel extract, Neem cake, *Metarhizium anisopliae, paecilomyces lilacinus, Trichoderma viride, Bacillus subtilis, Pseudomonas fluorescens,* Rhizobial culture, Azophos, VAM etc. They were delivered to plants via the roots and leaves at weekly intervals. The carrot cultivation required between 300 and 375 labourers per hectare. The organic practices varied from farmer to farmer depending on his knowledge and experience.

The cost of cultivation for conventionally grown carrot was Rs.6,50,567.84 with a B:C ratio of 2.15 [13]. Depending on the use of farm machinery, the required machine power can take anywhere between 3 and 10 hours. The tiller was the most common machinery. The farmyard manure was applied once a year or every half-year. A shipment of FYM that weighed about 15 tonnes costs on an average of Rs. 30,000 and the distance it must travel increased the cost. Fertilizer was mixed and distributed by the Nilgiris Cooperative Marketing Society (NCMS),

Mettupalayam. For carrots, a total of 12 to 15 bags of fertilizer known as No 4 (made by NCMS) with an NPK ratio of 6:12:6 were used [14]. It was identified that farmers used micronutrient blends. Twice weekly irrigation was administered and avoided if there is heavy rain. High rainfall increased the need for plant protection chemicals since it made pests and diseases like root rot more common. Some of the carrots deformed to spherical shape due to nematode infestation in the soil. The quality, colour and shape determines the price of carrot.

The cost of cultivation for organically grown potato was Rs.4,97,869.79 with B:C ratio of 2.37. The organic potato farming farmers used organic inputs as explained in organic carrot cultivation. The cost of cultivation for conventionally grown potato was Rs.5,48,894.71 with B:C ratio of 1.71. Growing potatoes organically and conventionally required equivalent amount of seeds and labour. The potato farmers either purchased seeds from mandis or used previous harvest potatoes as seeds. The seed requirement of potato cultivation per hectare was 50 bags for large size potato seeds and 75 bags for small size potato seeds (less germination percentage). The price per bag weighing 45kg of potato seeds varied according to market situations from Rs.1500 to Rs.2500 on an average. The use of machine power, FYM, irrigation and plant protection measures were adopted as similar to carrot. The overall of potato was raised with the use of normally expensive, high-quality potato seeds. The NCMS No.4 fertilizer of 20- 25 bags were required for potato cultivation. The labour requirements for potato cultivation per hectare varied between 100 and 125 from sowing to harvest. The potato tubers will loose their economic worth because of greening which is caused due to exposure of tubers to sunshine [15]. The cost of cultivation for organic and conventional carrot and potato is presented in (Table 1).

3.2 Marketing Channels and Price Spread

The marketing channels for organic carrots and potatoes were 1)producer-retailer-consumer and 2) producer-consumer. The Organic vegetables were sold to retail outlets like hypermarkets or organic stores located at different places. The persons who are aware of the benefits of organic vegetables were the predominant buyers. The organic retailers bought less quantity of organic produce compared to conventional vegetable quantity bought by conventional retailers because of less demand for organic produce among consumers. The packing and transportation cost of producer in channel-I of organic carrot and potato was added to the marketing cost of retailer. Few farmers have their own stores and sell directly.

The marketing of conventional carrot and potato involved two major channels namely 1) producer-wholesaler-retailer-consumer [16] and 2)producer-retailer-consumer. For conventional carrot and potato marketing, the private mandis and NCMS played a major role. Most of the farmers preferred selling of vegetables through mandis and NCMS where traders bought vegetables during auction which in turn sold to retailers in different districts and states. The Nilgiris Cooperative Marketing Society was one of the important auction centres for potatoes. It was established in 1935 exclusively for hill vegetables. The loading, unloading charges and transport cost were added to the consumer price of vegetables. The farmers get higher returns when they sell good quality produce. In conventional carrot and potato marketing channel – I, farmers were found to sell at Mettupalayam mandis to traders which is then transported to retailers at various places and ultimately to consumers in different districts and states. In channel-II, the retailers sold vegetables at local markets in the Nilgiris. They bought vegetables from nearby mandis which incurred very less charges for loading, unloading and transportation. The traders in the Nilgiris local markets procured only less quantity of vegetables from farmers when compared to traders in plains.

The price spread for organic carrot and potato in channel – I was Rs.24.42 and Rs.26.36 respectively. The channel – II in organic carrot and potato marketing has no difference between consumers' price and producers' price because of no intermediaries. The marketing channels with more intermediaries have higher difference between consumers' price and producers' price. The price spread of conventional carrot in channel – I and II were Rs.13.91 and Rs.9.55 respectively and for conventional potato the price spread in channel – I and II were Rs.13.83 and Rs.9.00 respectively. The channel – II in both conventional carrot and potato have more farmers' share in consumers' rupee. The channels were explained in (Table 2 and 3).

Table 1. Cost of cultivation for organic and conventional carrot and potato as per the CACP approach (Rs/ha)

S. No	Particulars	Carrot		Potato	
		Organic	**Conventional**	**Organic**	**Conventional**
1.	Value of seeds	122329.18 (19.47)	139895.83 (21.50)	99791.68 (20.04)	96333.33 (17.55)
	Value of organic inputs	110554.18 (17.60)	-	125316.68 (25.17)	-
	Value of manures	-	87666.68 (13.48)	-	87308.33 (15.91)
	Value of fertilizers	-	30442.50 (4.68)	-	62645.83 (11.41)
	Value of chemicals	-	16325.00 (2.51)	-	40250.00 (7.33)
	Irrigation charges	12433.33 (1.98)	12095.83 (1.86)	11373.33 (2.28)	12983.33 (2.36)
	Value of machine labour	24035.83 (3.83)	23208.33 (3.57)	26395.00 (5.30)	26761.68 (4.88)
	Value of hired human labour	185048.33 (29.46)	169808.33 (26.10)	84816.68 (17.04)	78283.33 (14.26)
	Depreciation	3468.33 (0.55)	2601.00 (0.40)	2033.33 (0.41)	1897.78 (0.35)
	Interest on working capital	57655.30 (9.17)	60088.10 (9.24)	45461.20 (9.13)	50682.90 (9.23)
	Land revenue	25	25	25	25
	Cost A1	515549.48 (82.07)	542156.60 (83.33)	395212.90 (79.38)	457171.51 (83.29)
2.	**Cost A2(cost A1 + Rent paid for leased in land)**	515549.48 (82.07)	542156.60 (83.33)	395212.90 (79.38)	457171.51 (83.29)
3.	Cost A1	515549.48 (82.07)	542156.60 (83.33)	395212.90 (79.38)	457171.51 (83.29)
	Interest on owned fixed capital	2183.33 (0.35)	2074.03 (0.32)	1946.00 (0.40)	1782.00 (0.32)
	Cost B1	517732.81 (82.42)	544230.63 (83.65)	397158.90 (79.77)	458953.51 (83.61)
4.	Cost B1	517732.81 (82.42)	544230.63 (83.65)	397158.90 (79.77)	458953.51 (83.61)
	The rental value of owned land	27266.50 (4.34)	25903.00 (3.98)	24300.00 (4.88)	22250.00 (4.05)
	Cost B2	544999.31 (86.76)	570133.63 (87.64)	421458.90 (84.65)	481203.51 (87.67)
5.	Cost B1	517732.81 (82.42)	544230.63 (83.65)	397158.90 (79.77)	458953.51 (83.61)
	The imputed value of family labour	26060.00 (4.15)	21291.68 (3.27)	31150.00 (6.26)	17791.68 (3.24)
	Cost C1	543792.81 (86.57)	565522.31 (86.93)	428308.90 (86.03)	476745.19 (86.86)
6.	Cost B2	544999.31 (86.76)	570133.63 (87.64)	421458.90 (84.65)	481203.51 (87.67)
	The imputed value of family labour	26060.00 (4.15)	21291.68 (3.27)	31150.00 (6.26)	17791.68 (3.24)
	Cost C2	571059.31 (90.90)	591425.31 (90.90)	452608.90 (90.90)	498995.19 (90.90)
7.	Cost C2	571059.31 (90.90)	591425.31 (90.90)	452608.90 (90.90)	498995.19 (90.90)

S. No	Particulars	Carrot		Potato	
		Organic	Conventional	Organic	Conventional
	10% of C2	57105.93 (9.09)	59142.53 (9.09)	45260.89 (9.09)	49899.52 (9.09)
	Cost C3	628165.24 (100)	650567.84 (100)	497869.79 (100)	548894.71 (100)
8.	**The Total Cost of cultivation**	628165.24	650567.84	497869.79	548894.71
9.	Total Yield (kg/ha)	40066.68	46841.68	22591.68	27975.00
10.	Grossreturns (Rs/ha)	2236922.74	1400566.23	1180867.11	939960.00
11.	Netreturns (Rs/ha)	1608757.50	749998.39	682997.32	391065.29
	B : C ratio	3.56	2.15	2.37	1.71

Figures in parentheses indicates percentage to total cost. (Source : Primary survey 2021-22)

Table 2. Marketing channels in selling of organic and conventional carrot

S. No	Particulars	Organic		Conventional	
		Channel - I	Channel - II	Channel – I	Channel – II
1.	**Producer**				
	Producers' Price	55.83(69.57)	65.00 (100)	29.90(68.25)	35.45(78.78)
	Packing	-	-	0.65 (1.48)	0.65(1.44)
	Washing	0.94 (1.17)	0.94 (1.44)	0.94 (2.15)	0.94 (2.09)
	Loading and unloading	0.25 (0.31)	0.38 (0.58)	2.39 (5.46)	0.26 (0.58)
	Transport	-	2.25 (3.46)	0.36 (0.82)	1.88 (4.18)
	Loss	1.40(1.74)	1.05 (1.62)	0.89 (2.03)	1.05 (2.33)
	Commission*	-	-	2.99 (6.82)	3.55 (7.89)
	Marketing cost	2.59 (3.22)	4.62 (7.11)	8.22 (18.76)	8.33 (18.51)
	Net price	53.24(66.34)	60.38(92.89)	21.68(49.49)	27.12(60.27)
2.	**Wholesaler**				
	Purchase price	-	-	29.90(68.25)	-
	Loading and unloading	-	-	1.19 (2.72)	-
	Transportation	-	-	1.67 (3.81)	-
	Loss	-	-	0.44 (1.00)	-
	Marketing cost	-	-	3.33 (7.60)	-
	Sale price	-	-	35.47(80.96)	-
	Marketing margin	-	-	2.24 (5.11)	-
3.	**Retailer**				
	Purchase price	55.83(69.57)	-	35.47(80.96)	35.45(78.78)
	Loading and unloading	2.82 (3.51)	-	0.38 (0.87)	0.38(0.84)
	Transportation	2.76 (3.44)	-	1.06 (2.42)	1.00 (2.22)
	Loss	1.42 (1.77)	-	0.89(2.03)	0.35 (0.78)
	Marketing cost	7.00 (8.72)	-	2.33 (5.32)	1.73 (3.84)
	Sale price	80.25 (100)	-	43.81 (100)	45.00 (100)
	Marketing margin	17.42(21.71)	-	6.01 (13.72)	7.82 (17.38)
4.	**Consumer**				
	Consumers price	80.25 (100)	65.00 (100)	43.81 (100)	45.00 (100)
	Price spread	24.42(69.57)	-	13.91(68.25)	9.55 (78.78)
	Marketing efficiency (Acharyas and Agarwals)	1.97	13.07	0.98	1.52
	Marketing efficiency (Shepherds)	7.37	13.07	2.16	3.47

Figures in parentheses indicates percentage to consumers' price. (Source : Primary survey, 2021-22)

Table 3. Marketing channels in selling of organic and conventional potato (Rs/kg)

S. No	Particulars	Organic		Conventional	
		Channel – I	Channel – II	Channel – I	Channel – II
1.	**Producer**				
	Producers' Price	52.27(66.48)	65.67 (100)	33.60(70.84)	32.20(78.16)
	Packing	-	-	1.16 (2.45)	1.16(2.82)
	Loading and unloading	0.44(0.56)	0.67(1.02)	1.55(3.27)	0.46 (1.12)
	Transport	-	2.89 (4.40)	0.67 (1.41)	1.56 (3.79)
	Loss	1.30 (1.65)	0.31 (0.47)	0.09(0.19)	0.96 (2.33)
	Commission*	-	-	3.36 (7.08)	3.22 (7.81)
	Marketing cost	1.74 (2.21)	3.87 (5.89)	6.83(14.40)	7.36(17.86)
	Net price	50.53(64.26)	61.80(94.11)	26.77(56.44)	24.84(60.29)
2.	**Wholesaler**				
	Purchase price	-	-	33.60(70.84)	-
	Loading and unloading	-	-	2.04 (4.30)	-
	Transportation	-	-	1.56 (3.29)	-
	Loss	-	-	0.39 (0.82)	-
	Marketing cost	-	-	3.99 (8.41)	-
	Sale price	-	-	39.19(82.62)	-
	Marketing margin	-	-	1.60 (3.37)	-
3.	**Retailer**				
	Purchase price	52.27(66.48)	-	39.19(82.62)	32.20(78.16)
	Loading and unloading	3.05 (3.88)	-	0.67 (1.41)	0.67(1.63)
	Transportation	3.00(3.82)	-	1.78 (3.75)	1.78 (4.32)
	Loss	1.36 (1.73)	-	0.83 (1.75)	0.30 (0.73)
	Marketing cost	7.41 (9.42)	-	3.28(6.82)	2.75 (6.67)
	Sale price	78.63(100)	-	47.43 (100)	41.20 (100)
	Marketing margin	18.95(24.10)	-	4.96(10.46)	6.25 (15.17)
4.	**Consumer**				
	Consumers price	78.63 (100)	65.67 (100)	47.43 (100)	41.20 (100)
	Price spread	26.36(66.48)	-	13.83(70.84)	9.00 (78.16)
	Marketing efficiency (Acharyas and Agarwals)	1.71	15.97	1.21	1.52
	Marketing efficiency (Shepherds)	7.59	15.97	2.36	3.08

Figures in parentheses indicates percentage to consumers' price. (Source : Primary survey, 2021-22)

Table 4. Constraints faced by organic farmers in the cultivation of vegetables

S. No	Constraints	Index value	Rank
1.	Lack of awareness on certification agencies, procedures, document maintenance.	0.740	1
2.	Pest and disease incidence	0.733	2
3.	Inadequate supply of micronutrient	0.435	5
4.	Lack of knowledge on approved inputs and training	0.481	4
5.	High certification cost and Conversion losses	0.610	3

(Source: Primary survey, 2020-21)

Table 5. Constraints faced by conventional farmers in the cultivation of vegetables

S.No	Constraints	Index value	Rank
1.	High rainfall and soil loss	0.545	5
2.	Pest and disease incidence	0.718	1
3.	Loss in quality of the produce due to biotic and abiotic stresses	0.623	2
4.	Wild animals	0.560	3
5.	High wages for labour coupled with less supply	0.553	4

(Source: Primary survey, 2020-21)

3.3 Marketing Efficiency

The marketing efficiency of organic and conventional carrot and potato was given by Acharyas-Agarwal's method and Shepherd's method. The Acharyas-Agarwal's and Shepherd's method of marketing efficiencies in channel-I and II of organic carrot were 1.97, 7.37, 13.07 and 13.07 respectively and the marketing efficiencies in channel-I and II of conventional carrot were 0.98, 2.16, 1.52 and 3.47 respectively. The channel – II was more efficient than I for both organic and conventional carrot. The Acharyas-Agarwal's and Shepherd's method of marketing efficiencies in channel-I and II of organic potato were 1.71, 7.59, 15.97 and 15.97 respectively. The Acharyas-Agarwal's and Shepherd's method of marketing efficiencies in channel-I and II of conventional potato were 1.21, 2.36, 1.52 and 3.08 respectively. In both organic and conventional potato marketing, the marketing channel II was more effective. The marketing efficiency is high when it has less number of intermediaries. Organic marketing of vegetables has higher efficiency than conventional marketing. Organic farmers could take comparatively higher returns as it had less marketing costs and higher price. Though channel-I is more predominant in the selling of conventional vegetables, it had less efficiencies as it included mandi commission charges which is 10% in the case of Private and 7% in NCMS leading to higher marketing costs.

3.4 Constraints in Organic and Conventional Carrot and Potato Cultivation

The constraints faced by the farmers were listed and ranked by them during primary survey. Based on the ranking given by farmers, the index value was calculated and ordered. The constaint with higher index value denotes more prevalence. The major constraint faced by organic farmers was difficulties in certification of their farm. This was due to unawareness or improper information dissemination on existing certification agencies, cost of certification, procedures and document maintenance. The pest and disease incidence was unavoidable due to its cool climate. The farmers had to incur the yield loss during the conversion period as the soil needs it's time to become nutrient enriched using organic inputs [17]. They were not aware of many of the approved inputs which were allowed to use in the organic farm and they had difficulties in enriching the soil with micronutrients because of lack of training. Conventional vegetable growers also felt pests and diseases as major issue. The farmers harvested poor quality vegetables due to biotic and abiotic stresses which reduces profit. Inadequate labour supply coupled with high wages for labour and wild animals intrusion were an important issue. The topography and climatic condition of the study area also remained as challenges to the farmers of this district. The constraints were ranked in the Table 4 and 5.

4. CONCLUSION

Organic cultivation has higher returns than conventional as many of the inputs are prepared in the field [18,19,20]. Though the carrot cultivation has high cost, it gives more profit compared to potato cultivation due to increased yield of carrot per hectare. Organicfarming remains as a one stop solution for farmers profit, environmental and human health. The Ooty carrot and potato have their significance across various districts and states for its taste and quality. Advanced technologies are there to assist mankind. But that assistance should be in harmony with nature. The Government and other sections of society must follow the steps which mitigates the challenges and increases the welfare of the farmers and others involved in vegetable cultivation and marketing.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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