Price Spread, Marketing Efficiency and Postharvest Losses in Marketing of Selected *kharif* Vegetables in Palghar District of Maharashtra State, India

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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

Vegetables play an important role both in the regional and national economy of the agricultural sector. These crops are generally of short duration. The post-harvest losses in kharif vegetables due to insufficient storage, packaging, transportation, and handling technologies for perishable crops, such as vegetables, lead to significant wastage. The present study was undertaken to estimate these losses at various stages and price spread of selected vegetables in study area. The

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study was conducted in Palghar district of Maharashtra, involving 90 farmers, 6 commission agents, 9 wholesalers and 30 retailers, that the study involves multiple groups of stakeholders (farmers, commission agents, wholesalers, and retailers), with specific numbers from each group. The sampling technique used in this case likely purposive sampling. The important kharif vegetables were identified for the detailed analysis. In of case brinjal the total postharvest losses were 12.62 kg/q. out of which maximum postharvest losses of brinjal vegetables was observed to be highest (4.62 kg/q), at retailer level followed by (3.2 kg/q) at wholesaler level and (1.65 kg/q) at commission agent level. Similarly in case of okra, postharvest losses in kharif season was estimated to 13.52 kg /q, out of which the retailers level postharvest losses was highest at (5.12 kg/q), followed by (3.78 kg /q) at wholesaler level, (2.87 kg /q) at farmer level and (1.75 kg/q) at commission agent level .Whereas for cowpea total postharvest losses was workout to 12.73 kg/q out of which 4.12 kg /q postharvest losses was observed at retailer level, 3.65 kg /q losses at wholesaler level, 3.08 kg /q at farmer level and 1.88 kg /q postharvest losses at commission agent level. In study were identified channel-I (Producer-Commission agent-wholesaler-Retailer-Consumer), channel-II (Producer-Wholesaler-Retailer-Consumer) and channel-III(Producer-Consumer). For brinjal, the price spread was Rs. 2962.91 in Channel-I and Rs. 2634.72 in Channel II, with marketing efficiency of 1.01, 1.24, and 33.76 in Channels-I, II, and III, respectively. Channel-III exhibited the highest marketing efficiency, while Channel II had the lowest price spread. For okra, the price spread was Rs. 1939.70 in Channel-I and Rs. 1733.20 in Channel II, with marketing efficiency of 1.51, 1.85, and 28.84 in Channels-I, II, and III, respectively. Channel II demonstrated the highest marketing efficiency and lowest price spread. In the case of cowpea, the price spread was Rs. 4000 in Channel-I and Rs. 3260 in Channel-II, with marketing efficiency of 0.91, 1.76, and 29.76 in Channels -I, II, and III, respectively. Again, Channel III provided the highest efficiency, while Channel II had the lowest price spread. Channel-III emerged as the most efficient channel for all crops due to the direct sale to consumers, resulting in the highest marketing efficiency. Channel-II also showed better efficiency, especially in okra, while Channel-I consistently had the lowest efficiency across all crops.

1. INTRODUCTION

Vegetable production provides a promising economic opportunity for reducing rural poverty and unemployment in developing countries and is a key component of farm diversification strategies. Brinjal, okra, and cowpea were chosen for this study due to their high market demand and profitability in the Palghar district. Brinjal is widely cultivated and consumed, making it a staple vegetable in many households, while okra is valued for its nutritional benefits and versatility in cooking. Cowpea is particularly significant as a drought-resistant legume, providing essential protein and improving soil fertility through nitrogen fixation. Brinjal has origin in India. Its botanical name is *Solanum melongena* L it belongs to family Solanaceae. It has about 1.4 per cent protein, 4 per cent carbohydrate, 0.3 per cent fat, 0.3 per cent minerals and 1.3 per cent fibre [1]. According to 2022-23, brinjal production in india is 12810.3 thousand MT [2]. Okra (*Abelmoschus esculentus* (L.) Moench) is an important kharif season crop grown for its green fruits. Okra seeds contain 14-19% oil, with a significant proportion of linoleic acid as part of its nutritional content. According 2022-23, okra production in India was 7252.5 thousand MT [2]. Cowpea (*Vigna unguiculata*) belongs to family fabaceae. The cowpea grain is highly nutritious and contains about 22.8-28.9 % protein [1]. Cow pea production in India was 26,05.8 thousand MT [2].

Source: India agristat

2. MATERIALS AND METHODS

The study entitled, "Economic analysis of postharvest losses in marketing of vegetables in Palghar district (M.S.)" was undertaken with the specific objective to identify postharvest losses in marketing of vegetables with a sample of 90 vegetable cultivators and 6 commission agents,9 wholesalers,30 retailers of three tahsil of Palghar *viz.* Vasai, Palghar and Dahanu during 2023-24. Palghar district was selected purposively since it is a major producer of vegetables. The list of vegetable-growing farmers was collected from the village Panchayat, and from each village, ten farmers were selected randomly. The study was based on primary data. Data was collected

through personal interviews with the farmers and market intermediaries. A special schedule was used for this purpose.

Analysis of data: To arrive at a useful conclusion, the data collected from the selected sample respondents will be analysed by using simple statistical tools such as arithmetic mean, average, percentage, ratios, etc.

Tabular analysis: The data were arranged in suitable tables and cross tables. simple statistical tools such as arthimetic, averages percentages and ratios were used for analysis. For assessing Postharvest losses in vegetables the technique of "overall farmers assessment of commodity movement system" has been used. Farmers, wholesalers, commission agents, and retailers involved in vegetable marketing were contacted and interviewed to assess the losses at different stages of marketing.

Estimation of marketing cost: Cost incurred in the marketing of vegetables by growers and market functionaries on harvesting, grading, packing, transporting. etc. is worked out with the help of following formula:

$$MC = Cf + \sum Ci$$

Where,

MC = Total marketing cost
Cf = Cost incurred by vegetable grower
Ci = Cost incurred by i^{th} intermediary

Estimation of marketing margin: The market margin of all the market intermediaries is estimated by using following formula.

TM = $\sum$ (Pri - (Ppi + Cmi)
TM = Total market margin
Pri = sale price of ith intermediary
Ppi = purchase price of ith intermediary
Cmi = Cost incurred on marketing by ith intermediary

Estimation of marketing efficiency: The marketing efficiency identified marketing channels is judged by using Acharyas formula:

(Acharya and Agarwal 2004) i.e. ratio approach

$$MME = Fp \div (MC + MM)$$

Where,

MME = Modified measures of marketing efficiency
MC = Total marketing cost

Fp = Price received by vegetable grower
MM = Net marketing margin

Price spread: Price spread represented the difference between price paid by the ultimate consumer and net price received by the producer seller. A study of the price spread involves not only the ascertained of actual prices at various stages of marketing channel, but the cost incurred the process of movement of the produce from the farm to the consumer and the margin of various intermediaries.

Producers share in consumers rupee (PSCR): It refers to farmers net price to the retail price of the produce expressed in percentages.

$$PSCR = FNP / RP \times 100$$

Where,

PSCR= Producers share in consumers rupee
FNP = Farmers net price
RP = retailers price

Post harvest losses (PHL) %

$$Post\ harvest\ losses =$$

$$\frac{Quantity\ purchase - Quantity\ sale}{Quantity\ purchase}$$

$$PHL = \frac{QP - QS}{QP} \times 100$$

QP= Quantity purchase for trading
QS=Quantity sale during trading

3. RESULTS AND DISCUSSION

Section-I: Price spread and marketing efficiency of selected kharif vegetables (Brinjal, okra and cowpea)

Price spread marketing efficiency of Brinjal in kharif season: In study area i found that in kharif season these selected crops such as Brinjal, okra, cowpea were produced by study area farmers and marketed through three identified channels in study area. The identified channels were such as, it is channel-I that producer to commission agent to wholesalers to retailer to consumer was less efficient, however the price received in this channel for crops. However price received by farmer per quintal for brinjal was found to be Rs.3082.09/q [3,4] and marketing cost incurred by farmer in this channel

accounted to Rs.102.85/q [5]. The net margin of the commission agent was Rs. 449.14 per quintal, with the marketing cost incurred by Rs. 87.00 per quintal. Per quintal commission agent sold this produce to wholesaler at rate of Rs.3618.23 /q and wholesaler incurred marketing cost of Rs.373.00/q. However net margin received by wholesaler was estimated to Rs.852.67/q. Wholesaler sold this brinjal to retailer in the distance market at the rate of Rs.4843.90/q [6]. However marketing cost and net margin received by retailer was accounted to Rs.82.82/q and Rs.1118.28 /q. It is seen from Table 1 that the total marketing cost of brinjal in channel-I Rs.645.67/q, whereas total market margin received by market intermediaries was Rs.2420.09/q. The producer share in consumer rupee also estimated and it was found to be 49.28 per cent, whereas marketing efficiency was also worked out and it was 1.01.

Similarly in channel-II brinjal was directly sold to the wholesaler and wholesaler to retailer. Because of absence of one market intermediaries the gross price received by farmer was highest than channel-I and it was found to be Rs. 3410.28 /q. The wholesalers' marketing cost and net margin from this channel were estimated to be Rs. 372.62 per quintal and Rs. 920.40 per quintal, respectively. The purchasing price of the retailer was Rs. 4703.30 per quintal, and the marketing cost incurred by the retailer was Rs. 81.13 per quintal. The net margin received by the retailer was Rs. 1260.57 per quintal by selling brinjal at a rate of Rs. 60.45 per kilogram. The total marketing cost incurred by market intermediaries was Rs. 562.98 per quintal, and the total market margin earned by these intermediaries was estimated to be Rs. 2180.97 per quintal. The producer share in consumer rupee was 54.61%, and the marketing efficiency was 1.24.

In case of marketing channel-III producer were directly selling their produce to consumer without market intermediaries in the market. The producer received highest gross price of Rs.5740/q [7,8], due to absence of any other market intermediaries. So the Producer share in consumer rupee was therefore found to be highest 97.04 per cent and marketing efficiency was 33.76 [9].

Table 1. Price spread and marketing efficiency of brinjal in kharif season (Rs/q)

Particulars	Channel-I (P-CA-W-R-C)	Channel-II (P-W-R-C)	Channel-III (P-C)
Producer			
Gross price received by producer	3082.09	3410.28	5740.00
Marketing cost incurred by producer	102.85	109.23	170.00
Net price received by producer	2979.24	3301.05	5570.000
Commission Agent			
Purchase price	3082.09	-	-
Marketing Cost incurred	87.00	-	-
Net margin	449.14	-	-
Selling price	3618.23	-	-
Wholesaler			
Purchase price	3618.23	3410.28	-
Marketing Cost incurred	373.00	372.62	-
Net margin	852.67	920.40	-
Selling price	4843.90	4703.30	-
Retailer			
Purchase price	4843.90	4703.30	-
Marketing Cost incurred	82.82	81.13	-
Net margin	1118.28	1260.57	-
Selling price	6045	6045	-
Consumer			
Purchase Price of consumer	6045 (100.00)	6045 (100.00)	5740.00 (100.00)
Total Marketing cost	645.67 (10.68)	562.98 (9.31)	170.00 (2.96)
Total marketing Margin	2420.09	2180.97	-
Price spread	2962.91	2634.72	-
Producers share in Consumers rupees (%)	49.28	54.61	97.04
ME	1.01	1.24	33.76

Source: (Primary data collected from farmers and market intermediaries in study area)

Table 2. Price spread and marketing efficiency of okra in kharif season (Rs/q)

Particulars	Channel-I (P-CA-W-R-C)	Channel-II (P-W-R-C)	Channel-III (P-C)
Producer			
Gross price received by producer	3080.30	3412.10	4745.30
Marketing cost incurred by producer	102.52	109.23	164.52
Net price received by producer	2977.78	3302.87	4580.780
Commission Agent			
Purchase price	3080.30	-	-
Marketing Cost incurred	57.31	-	-
Net margin	497.49	-	-
Selling price	3635.10	-	-
Wholesaler			
Purchase price	3635.10	3412.10	-
Marketing Cost incurred	275.10	248.23	-
Net margin	299.93	444.77	-
Selling price	4210.13	4105.10	-
Retailer			
Purchase price	4210.13	4105.10	-
Marketing Cost incurred	78.84	82.05	-
Net margin	731.03	958.15	-
Selling price	5020	5145.30	-
Consumer			
Purchase Price of consumer	5020 (100.00)	5145.30 (100.00)	4745.30 (100.00)
Total Marketing cost	513.77 (10.23)	439.50 (8.54)	164.52 (3.46)
Total marketing Margin	1528.45	1402.93	-
Price spread	1939.70	1733.20	-
Producers share in Consumers rupees (%)	59.32	64.19	96.53
ME	1.51	1.85	28.84

Source: (Primary data collected from farmers and market intermediaries in study area)

Therefore, it was indicated from the Table 2 that market intermediaries posed the most hurdles in the marketing of brinjal. Due to their presence, the producer's share in the consumer rupee was very low, and marketing efficiency was also adversely affected by the presence of market intermediaries in brinjal.

Price spread and marketing efficiency of okra in kharif season: In okra crop in channel -I per quintal price received by farmer by selling produce to commission agent was found to be Rs.3080.30/q. The price spread of channel-I was Rs.1939.70 [10]. It is seen from Table 2 that the total marketing cost incurred by market intermediaries was Rs.513.77/q and total market margin earned by these intermediaries estimated to Rs.1528.45/q [11]. The producer share in consumer rupee found to be 59.32 per cent with marketing efficiency was 1.51 in channel-I.

In channel II, okra was sold directly to the wholesaler, who then sold it to the retailer. The total marketing cost of okra in this channel was Rs. 439.50 per quintal, and the total market margin for intermediaries was Rs. 1402.93 per quintal. The producer's share in the consumer rupee was 64.19%, with a marketing efficiency of 1.85. In contrast, in channel I, brinjal passed through multiple intermediaries, leading to a lower producer share and reduced marketing efficiency.

In Marketing Channel III, the producer sold their produce directly to the consumer, without any intermediaries. The producer received the highest price of Rs. 4745.30 per quintal. As a result, the producer's share in the consumer rupee was the highest at 96.53%, and the marketing efficiency was 28.84.

Price spread and marketing efficiency of cowpea in kharif season:

Table 3. Price spread and marketing efficiency of cowpea in kharif season (Rs/q)

Particulars	Channel-I (P-CA-W-R-C)	Channel-II (P-W-R-C)	Channel-III (P-C)
Producer			
Gross price received by producer	3550.00	4020.00	4950.00
Marketing cost incurred by producer	108.23	120.62	166.32
Net price received by producer	3441.77	3899.38	4783.680
Commission Agent			
Purchase price	3550.00	-	-
Marketing Cost incurred	249.42	-	-
Net margin	1050.58	-	-
Selling price	4850.00	-	-
Wholesaler			
Purchase price	4850.00	4929.38	-
Marketing Cost incurred	416.91	408.41	-
Net margin	743.29	312.21	-
Selling price	6010.20	5650.00	-
Retailer			
Purchase price	6010.20	5650.00	-
Marketing Cost incurred	89.29	104.73	-
Net margin	1250.51	1525.27	-
Selling price	7350.00	7280.00	-
Consumer			
Purchase Price of consumer	7550.00 (100.00)	7280.00 (100.00)	4950.00 (100.00)
Total Marketing cost	863.86 (11.44)	633.76 (8.70)	166.32 (3.36)
Total marketing Margin	3044.37	1645.89	-
Price spread	4000.00	3260.00	-
Producers share in Consumers rupees (%)	45.59	53.56	96.64
ME	0.91	1.76	29.76

Source: (Primary data collected from farmers and market intermediaries in study area)

In Channel I, the price received by the farmer for cowpea was Rs. 3550 per quintal, with a marketing cost of Rs. 108.23 per quintal. The farmer sold their produce to a commission agent, who received a net margin of Rs. 1050.58 per quintal and incurred a marketing cost of Rs. 249.42 per quintal. The commission agent sold the produce to a wholesaler at Rs. 4850 per quintal, with a marketing cost of Rs. 416.19 per quintal, and a net margin of Rs. 743.29 per quintal. The wholesaler sold the cowpea to a retailer in the distant market at Rs. 6010.20 per quintal. The retailer's marketing cost was Rs. 89.29 per quintal, and the net margin received was Rs. 1250.51 per quintal. From the Table 3, it can be seen that the total marketing cost of cowpea in Channel I was Rs. 863.86 per quintal, while the total market margin for intermediaries was Rs. 3044.37 per quintal. The producer's share in the consumer rupee was 45.59%, and the marketing efficiency was 0.91.

In Channel II, cowpea was directly sold to the wholesaler, who then sold it to the retailer. The wholesaler's marketing cost was Rs. 408.41 per quintal, and the net margin was Rs. 312.21 per quintal. The retailer bought the cowpea at Rs. 5650 per quintal, with a marketing cost of Rs. 104.73 per quintal. The retailer's net margin was Rs. 1525.27 per quintal, selling the cowpea at Rs. 72.80 per kilogram. The total marketing cost incurred by market intermediaries was Rs. 633.76 per quintal, and the total market margin earned was Rs. 1645.89 per quintal. The producer's share in the consumer rupee was 53.56%, and the marketing efficiency was 1.76.

In Channel III, the producer sold the cowpea directly to the consumer, without any market intermediaries. The producer received the highest gross price of Rs. 4950 per quintal. Therefore, the producer's share in the consumer rupee was the highest at 96.64%, and the marketing efficiency was 29.76.

Section-II: Post-harvest losses in selected kharif vegetables (Brinjal, okra and cowpea)

Per quintal postharvest losses of selected vegetables in kharif season:

Table 4. Per quintal post-harvest losses of selected vegetables in kharif Season (Kg/q)

Vegetables	Farmer (N=90)	Commission Agent (N=6)	Wholesaler (N=9)	Retailer (N=30)	Total
Brinjal	3.15 (24.96)	1.65 (13.07)	3.2 (25.36)	4.62 (36.61)	12.62 (100.00)
okra	2.87 (21.23)	1.75 (12.94)	3.78 (27.96)	5.12 (37.87)	13.52 (100.00)
Cowpea	3.08 (24.19)	1.88 (14.77)	3.65 (28.67)	4.12 (32.36)	12.73 (100.00)

Source: (Primary data collected from farmers and market intermediaries in study area)
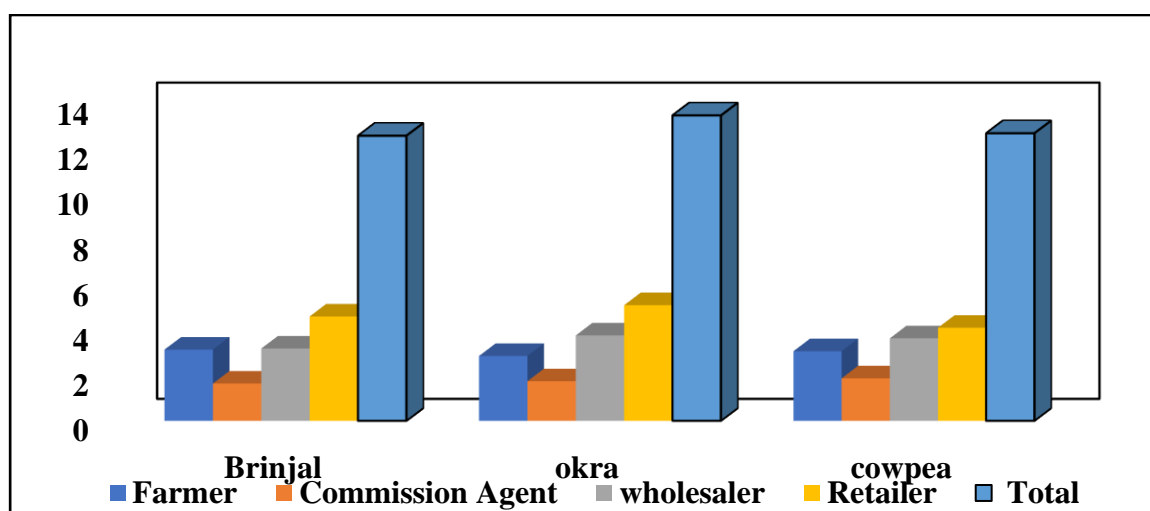
Fig. 1. Postharvest losses in selected *kharif* season vegetables

The per quintal postharvest losses of vegetables during kharif season in the study area were estimated at various stages including farmers, commission agent, wholesaler and retailers The primary and secondary market intermediaries in the marketing of vegetables include farmers, commission agents, wholesalers, and retailers. In case of brinjal the total postharvest losses estimated to 12.62 kg per quintal [12,13], out of which maximum postharvest losses of brinjal vegetables was observed to be highest (36.61%) and (4.62 kg/q) [14,15,16] ,at retailer level followed by 25.36 per cent (3.2 kg/q) at wholesaler level and 13.07 per cent (1.65 kg/q) at commission agent level .Similarly in case of okra, postharvest losses in kharif season was estimated to 13.52 kg /q [14], out of which the retailers level postharvest losses was highest and accounted to 37.87 per cent (5.12 kg/q) [16], followed by 27.96 per cent (3.78 kg /q) at wholesaler level, 21.23 per cent (2.87 kg /q) at farmer level [15] and 12.94 per cent (1.75 kg/q)

[14,15] and at commission agent level .Whereas for cowpea total postharvest losses was workout to 12.73 kg/q [17,15] out of which 4.12 kg /q [15] postharvest losses was observed at retailer level, 3.65 kg /q losses at wholesaler level, 3.08 kg /q at farmer level [17] and 1.88 kg /q postharvest losses at commission agent level [18-21].

4. CONCLUSION

Postharvest losses in kharif season vegetables were highest in okra, cowpea, brinjal with 13.52 kg/q, 12.73 kg/q,12.62 kg/q respectively. Maximum losses were at retailer level 5.12 kg/q, 4.12 kg/q ,4.62 kg/q respectively, followed by losses were at wholesaler level 3.78 kg/q, 3.65 kg/q,3.20 kg/q respectively, followed by losses were at farmer level 2.87 kg/q,3.08 kg/q,3.15 kg/q, followed by losses were at commission agent 1.75 kg/q,1.88 kg/q,1.65 kg/q respectively.

For brinjal in kharif season the producer share in consumer rupee (PSCR) was lowest in channel-I (49.28%), 54.61 per cent in channel-II and highest in channel -III (97.04%) with marketing efficiency for channel-I, channel-II and channel -III was 1.01, 1.24, 33.76 respectively.

For okra in kharif season the producer share in consumer rupee (PSCR) was lowest in channel-I (59.32%), 64.19 per cent channel-II and highest in channel-III (96.53%) with marketing efficiency for channel-I, channel-II and channel -III was 1.51,1.85, 28.84 respectively.

For cowpea in kharif season the producer share in consumer rupee (PSCR) was lowest in channel-I (45.59%), 53.56 per cent channel-II and highest in channel-III (96.64%) with marketing efficiency for channel-I, channel-II and channel -III was 0.91,1.76, 29.76 respectively.

Policy Implications

1. The postharvest losses were observed to be in all vegetables during three seasons. There was not season wise significant difference in postharvest losses of vegetables. Therefore it is recommended that government should provide infrastructure for cold storage in producing areas for benefits of the farmers and market functionaries during unfavourable price situations and linkage to processing industries.
2. The postharvest losses were observed to be highest at retailer level, because of most handling and highest storage period at retailer level. Therefore it is recommended that retailer should use portable cold storage structures to store their vegetables during marketing.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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