



Comparative profitability of capsicum (*Capsicum annuum*) cultivation under different protected structures in Haryana

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ABSTRACT

An economic analysis of capsicum production in Haryana under different protected structures has been done in the present study. Sonapat, Karnal and Hisar districts were purposively selected as cultivation under all types of protected structures (natural ventilated polyhouses, net houses, and walk-in-tunnels) is practice in these districts. The results obtained in this study indicated that the naturally ventilated polyhouse has the highest total cost (Cost C_2) incurred on capsicum in the district of Sonapat followed by Hisar and Karnal. Net returns were found highest in Karnal district followed by Hisar and Sonapat, respectively. B:C ratio was found highest in Karnal among all these three selected districts. In case of net house, the highest total cost incurred on capsicum in Karnal district followed by the districts of Sonapat and Hisar. However, Hisar district gave the highest net returns followed by Karnal and Sonapat. B:C ratio was found highest in Hisar as compared to Sonapat and Karnal districts, while, in walk-in-tunnel structures, highest total cost incurred on capsicum in Sonapat district among all districts. Net returns were found highest in Sonapat district in comparison to all districts. B:C ratio was equal recorded in Sonapat and Hisar district. It was calculated from the study that producer's share in consumer rupee was found highest in market channel-III (producer to direct consumer) which was proved to be most efficient channel in marketing of capsicum.

Key words: B:C ratio, Capsicum, Cost, Marketing, Protected cultivation

India is an agriculture-based economy 58% of the rural households depend upon agriculture as their principal source of livelihood (Anonymous 2019). Agriculture contributes 15.87% share to gross value added (GVA) at current price in Indian economy but at base prices (2011-12) the share of Agriculture and allied was 14.39% during 2018-19 (Ministry of Statistics and Programme Implementation). Nowadays, major changes have been noticed in the agriculture such as shifting from the traditional agriculture to modern agriculture. However, now-a-days farmer diversify the traditional agriculture with high value crops, floriculture, vegetable cultivation etc. to gain more profit per unit. While, the vegetable crops also offer better crop diversification and crop intensification.

Capsicum (*Capsicum annuum* L.) is a vegetable crop belongs to the family Solanaceae and is believed to have originated from South America. Capsicums are cultivated as annual vegetables while the eatable parts are botanically fruit. The crop is cultivated in many regions of the world including India, China and Europe (Kumar *et al.* 2016).

India contributes one fourth of world production of capsicum with an average annual production of 326 thousand MT from an area of 24 thousand ha during the period 2017-18. In Haryana area and production from capsicum was 4.43 thousand ha and 36.19 thousand MT during the period 2018-19 (Anonymous 2019). While, capsicum is usually grown in Haryana from August-September to March under polyhouses and in open field conditions it is grown in January and last up to June (Kumar *et al.* 2016). Singh *et al.* (2011) and Rao *et al.* (2013) studied that duration of the crop was extended under polyhouse cultivation. Keeping in view the above concerns, study was conducted to analyse the comparative economics of capsicum cultivation under different types of prevailing protected structures in the state.

MATERIALS AND METHODS

In order to achieve the stipulated objectives, present study was carried out in Haryana during 2017–18. Sonapat, Karnal and Hisar districts which were purposively selected due to availability of all types of protected structures, i.e. naturally ventilated polyhouses (NVPH), net houses, and walk-in-tunnels are available in these districts. Villages were selected from each block on the basis of predominance of capsicum cultivation area. The respondent farmers were purposively selected from each of the selected village for

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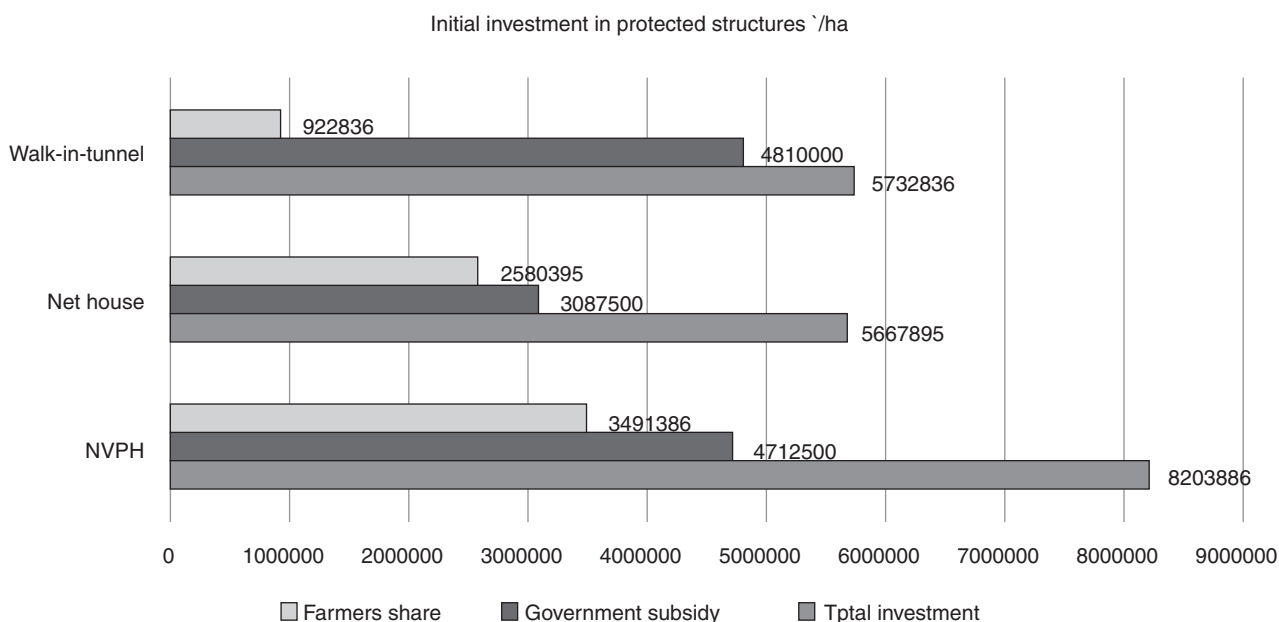


Fig 1 Initial investment on construction of protected structure.

getting required information on capsicum cultivation using pre-tested and well-structured schedule. The total sample size of 180 respondents has been selected from all these three districts out of which 107 from NVPH [Sonepat (33), Karnal (42) and Hisar (32)], 49 from net house [Sonepat (14), Karnal (18) and Hisar (17)] and 24 from walk in tunnel [Sonepat (13) and Hisar (11)] structures. From each district a sample of 60 respondents has been considered for the analysis. The cost and returns of cultivation of vegetable crops was worked out by using various cost concepts and income measures (Meena *et al.* 2016). The marketing efficiency of different marketing channels was worked out by Acharya's method, Shepherd's method, Conventional method (Acharya and Agarwal 2011).

RESULTS AND DISCUSSION

Initial investment on construction of protected structure:

The cost incurred on all type of protected structure was different to each other. In these structures NVPH was found costlier as compared to others.

Haryana Govt./Department of Horticulture under National Horticulture Mission (NHM) provides the subsidy for establishment of these protected structure up to 50% for all and 65% to the farmers having total land holding below 2 ha. In case of NVPH the total investment on area one-ha (10000 m²) was worked out to be ₹ 8203886/ha in which ₹ 4712500 as government subsidy. Senthil *et al.* (2018) estimated or reported that total investment around ₹ 38.74 lakhs per/4000 m² required for erecting polyhouse in Tamil Nadu. In net house, initial investment cost on the establishment of one-ha net house structure was found to be ₹ 5667895 in which ₹ 3087500 was government subsidy. In case of walk-in-tunnel structures, the establishment of one-ha walk-in-tunnel structure the investment was found to be ₹ 5732836.00 in which ₹ 4810000 was government

share (Fig 1).

Cost and returns of capsicum under NVPH in Haryana

Cost structure: On an average cost of cultivation (C₂) in Haryana state, ₹ 870581 was spent on capsicum/ha (Table 1). Among the different components of cost of cultivation of capsicum, the depreciation cost accounted for the largest portion (40.11) followed by seedling (19.60) interest on fixed capital (13.87), human labour (9.56), rental value of land (6.21), fertilizers (4.45), plant protection (3.16), interest on working capital (2.33), field preparation (1.60) and irrigation charges (0.57). Singh *et al.* (2016) and Nimbrayan *et al.* (2018) reported that initial cost of establish the structures was higher. Cost of cultivation in Sonepat district was highest, ₹ 896670.75, followed by Karnal (₹ 867103) and Hisar (₹ 847969). In the comparative study of capsicum under NVPH in different districts in Haryana was observed that seedling cost was higher in Hisar (₹ 176680) as compared to Sonepat (₹ 173891) and Karnal (₹ 161265), respectively. While, in case of human labour cost, it was higher in Karnal (₹ 87882), followed by Sonepat (₹ 84007) and Hisar (₹ 77277), respectively. However, rental value of land was higher in Sonepat (₹ 64865) as compared to Karnal (₹ 57657) and Hisar (₹ 36035). Kumar *et al.* 2017 and AERC, 2017 reveals that the major components of cost have been incurred are seed/ seedlings and manure and fertilizers. A comparison of various income measures from capsicum cultivation under NVPH in Haryana (Table 1) reveals that gross return varied between ₹ 1235525–1436297. Overall benefit cost ratio was 1.40 and it varies from 1.29–1.46.

Cost and returns of capsicum under net houses in Haryana

Cost structure: On an average cost of cultivation (C₂) in Haryana state, ₹ 679708 was spent on capsicum/ha. Among the different components of cost of cultivation

Table 1 Item-wise break up of costs and returns in capsicum crop under different protected structures (₹/ha)

Particular	NVPH				Net houses				Walk-in-tunnels		
	Hisar	Karnal	Sonepat	Haryana	Hisar	Karnal	Sonepat	Haryana	Hisar	Sonepat	Haryana
Field preparation	13343 (1.57)	14386 (1.66)	14040 (1.57)	13923 (1.60)	16473 (2.48)	14430 (2.08)	14035 (2.07)	14980 (2.20)	13590 (1.63)	13880 (1.60)	13735 (1.61)
Seedling cost	176680 (20.84)	161265 (18.60)	173891 (19.39)	170612 (19.60)	173385 (26.06)	169761 (24.42)	176618 (26.02)	173254 (25.49)	171985 (20.59)	156170 (17.97)	164077 (19.26)
Fertilizers	41581 (4.90)	41548 (4.79)	33148 (3.70)	38759 (4.45)	46564 (7.00)	43320 (6.23)	31388 (4.63)	40424 (5.95)	32370 (3.88)	33539 (3.86)	32955 (3.87)
Plant protection	25451 (3.00)	22174 (2.56)	35023 (3.91)	27550 (3.16)	29240 (4.39)	26847 (3.86)	25946 (3.82)	27344 (4.02)	32123 (3.85)	32891 (3.79)	32507 (3.82)
Irrigation	4447 (0.52)	5222 (0.60)	5125 (0.57)	4931 (0.57)	4567 (0.69)	5337 (0.77)	4917 (0.72)	4940 (0.73)	4177 (0.50)	4560 (0.52)	4368 (0.51)
Hired labor	48598 (5.73)	56116 (6.95)	56116 (6.47)	52949 (6.08)	49500 (7.44)	56250 (8.09)	45998 (6.63)	50249 (7.39)	51957 (6.22)	55566 (6.39)	53761 (6.31)
Family labor	28678 (3.38)	31765 (3.94)	29875 (3.33)	30106 (3.46)	27056 (4.07)	28657 (4.12)	26957 (3.97)	27557 (4.05)	26876 (3.22)	27956 (3.22)	27416 (3.22)
Interest on working capital (7%)	22067 (2.60)	15213 (1.89)	22150 (2.47)	19810 (2.33)	21517 (3.23)	20497 (2.95)	19850 (2.93)	20621 (3.03)	20013 (2.40)	19154 (2.20)	19584 (2.30)
Depreciation cost	341141 (40.23)	341141 (42.27)	341141 (38.05)	341141 (40.11)	148468 (22.31)	148468 (21.36)	148468 (21.88)	148468 (21.84)	333933 (39.99)	341141 (39.26)	337537 (39.61)
Rent paid for leased-in land	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Interest on fixed capital	109943 (12.97)	120610 (14.94)	123276 (13.75)	117943 (13.87)	112610 (16.92)	116610 (16.78)	120610 (17.77)	116610 (17.16)	112076 (13.42)	119276 (13.73)	115676 (13.58)
Rental value of owned land	36035 (4.25)	57657 (7.14)	64865 (7.23)	52852 (6.21)	36036 (5.42)	60567 (9.33)	64865 (9.56)	55255 (8.13)	36035 (4.31)	64865 (7.46)	50450 (5.92)
Total cost	847969 (100)	867103 (100)	89667 (100)	870581 (100)	665420 (100)	695047 (100)	678657 (100)	679708 (100)	835140 (100)	869003 (100)	852071 (100)
Gross return	1235525	1436297	1266297	1276999	1186104	1149038	987000	1107380	1186104	1231571	1208837
Net return	387555	399194	262506	349752	520683	453990	308342	427672	350963	362567	356765
Benefit-cost ratio	1.46	1.46	1.29	1.40	1.78	1.65	1.45	1.63	1.42	1.42	1.42
Returns over variable cost	562212	839227	609227	627321	696386	664123	520774	627094	525952	574666	550309
Cost A ₁	562212	839227	609227	627321	696386	664123	520774	627094	525952	574666	550309
Cost A ₂	673312	597069	657069	669678	489717	484914	466225	480285	660151	656904	658528
Cost B ₁	783255	777679	801930	787621	602327	601524	586835	596895	772228	776181	774205
Cost B ₂	819290	835337	866795	840474	638363	666389	651700	652151	808263	841046	824655
Cost C ₁	811933	809445	831805	817728	629384	630182	613792	624453	799104	804138	801621
Cost C ₂	847969	867103	896670	870581	665420	695047	678657	679708	835140	869003	852071
Cost C ₃	932766	953813	986337	957639	731962	764552	746523	747679	918654	955903	937278

of capsicum, the seedling cost accounted for the largest portion (25.49%) followed by depreciation (21.84%), interest on fixed capital (17.16%), human labour (12.44%), rental value of land (8.13%), fertilizers (5.95%), plant protection (4.02%), interest on working capital (3.03%), field preparation (2.20%) and irrigation charges (0.73%). Sreedhara *et al.* (2013) studied that the total variable cost was higher as compared to fixed costs. Cost of cultivation of Karnal district was highest, ₹ 695047, followed by Sonepat (₹ 678657) and Hisar (₹ 665420). In the comparative study

of capsicum under net houses in Haryana was observed that seedling cost was accounted higher in Sonepat (₹ 176618) as compared to Hisar (₹ 173385) and Karnal (₹ 169761), respectively. In human labour higher cost was incurred in Karnal (₹ 84907) followed by Hisar (₹ 76556) and Sonepat (₹ 71957), respectively. A comparison of various income measures from capsicum cultivation under net house in Haryana (Table 1) reveals that gross return varied between ₹ 987000–1186104. Benefit cost ratio was higher in Hisar followed by Karnal and Sonepat with 1.78, 1.65 and 1.45,

respectively. Murthy *et al.* (2009) and Kumar *et al.* (2018) reported that a higher return from capsicum was under net house.

Cost and returns of capsicum under walk-in-tunnel in Haryana

Cost structure: On an average cost of cultivation (C₂) in Haryana state, ₹ 852071 was spent on capsicum/ha (Table 1). Among the different components of cost of cultivation of capsicum, the depreciation cost accounted for the largest portion (39.61%) followed by seedling (19.26%), interest on fixed capital (13.58%), human labour (9.52%), rental value of land (5.92%), fertilizers (3.87%), plant protection (3.82%), interest on working capital (2.30%), field preparation (1.61%) and irrigation charges (0.51%). Cost of cultivation of Karnal district was highest, ₹ 869003 as compared to Hisar (₹ 835140). In the among variable costs under walk-in-tunnel structures in Haryana was observed that seedling cost was accounted higher in Hisar (₹ 171985) as compared to Sonapat (₹ 156170). A comparison of various income measures from capsicum cultivation under walk-in-tunnel in Haryana are given in Table 1. The table reveals that gross return was higher from Sonapat ₹ 231571 while lower from Hisar ₹ 1186104. The gross return was increased with increase in the production. Benefit cost ratio was 1.42 from both districts.

Channel wise description and price spread of capsicum in different channels in selected districts

Channel -I: Producer→Wholesaler-cum-commission agent→Retailer→Consumer: In the channel-I of the capsicum, two intermediaries namely wholesaler-cum-commission agent and retailer were involved between

producers and consumers in the Hisar, Karnal and Sonapat markets of Haryana. Producers received a net price of ₹ 1453/q accounting for 46.14% of consumer's price in Hisar market, followed by Sonapat and Karnal with ₹ 1360 (42.50%) and ₹ 1315 (42.44%)/quintal, respectively (Table 2). Purchase price of wholesaler-cum-commission agent was ₹ 1600, 1550 and 1500/quintal in Hisar, Sonapat and Karnal markets. In next phase wholesaler-cum-commission agent sold the produce to the retailer. The sale price of wholesaler-cum-commission agent was ₹ 2100, ₹ 2050 and ₹ 1950/quintal in Hisar, Sonapat, and Karnal, respectively. Sale price of retailer or purchase price of consumer was ₹ 3200, ₹ 3150 and ₹ 3100/q in Sonapat, Hisar and Karnal, respectively. The retailer received net margin of ₹ 769, ₹ 686 and ₹ 673/q sharing about 24.03, 22.13 and 21.37% of the consumer's price in Sonapat, Karnal and Hisar markets, respectively.

Channel- II: Producer→Supermarket→Consumer: It is clear (Table 2) that marketing margins, price spread and cost in the channel-II. In this channel the supermarkets (reliance fresh, easy-day, etc.) are involved between the producer and consumer. The producer's share of consumer's price was 69.20, 62.39 and 61.08% in Hisar, Karnal and Sonapat, respectively. The sale price of producer for the produce in Hisar was ₹ 2000/q and ₹ 1900/q each in Sonapat and Karnal. Therefore, net price receive by the producer was ₹ 1868/q in Hisar followed by Karnal ₹ 1715 and Sonapat ₹ 1710/q, respectively. Cost incurred by the supermarket was ₹ 121/q in Sonapat followed by Karnal ₹ 108 and Hisar ₹ 96/q, respectively. Purchase prices of consumer was ₹ 2800/q in Sonapat while ₹ 2750 and ₹ 2700/q in Karnal and Hisar.

Channel-III: Producer→Consumer: In this channel, no intermediaries between producer and consumer were

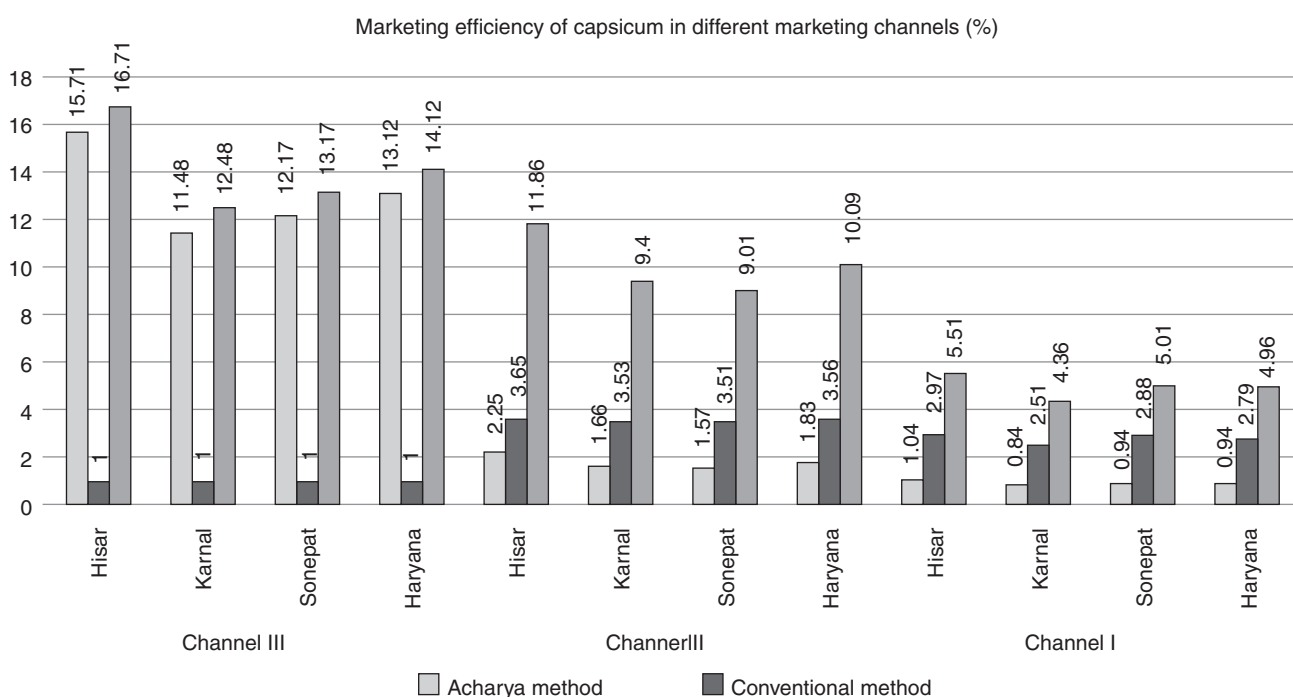


Fig 2 The marketing efficiency of capsicum through different marketing channels in different markets.

Table 2 Price spread of capsicum in different channels (₹/q)

Particular	Hisar	Karnal	Sonepat	Haryana
<i>Channel -I (Producer→Wholesaler-cum-commission agent→Retailer→Consumer)</i>				
Net price received by producer	1453(46.14)	1315(42.44)	1360(42.5)	1376(43.69)
Packing material	15(0.48)	15(0.48)	14(0.45)	14(0.47)
Loading and unloading charges	6(0.19)	8(0.26)	8(0.25)	7(0.23)
Transportation	35(1.12)	49(1.58)	55(1.72)	46(1.48)
Post-harvest losses	90(2.87)	112(3.62)	112(3.51)	104(3.33)
Sub total	146(4.66)	184(5.95)	189(5.93)	173(5.51)
Sale price of producer/ purchase price of wholesaler	1600(50.79)	1500(48.39)	1550(48.44)	1550(49.21)
Loading and unloading charges	6(0.19)	8(0.26)	8(0.25)	7(0.23)
Post-harvest losses	42(1.34)	54(1.75)	60(1.88)	52(1.66)
Sub total	48(1.53)	62(2.01)	68(2.13)	59(1.89)
Net margin of wholesaler	451(14.34)	387(12.51)	431(13.49)	423(13.45)
Sale price of wholesaler/ purchase price of retailer	2100(66.67)	1950(62.9)	2050(64.06)	2033(64.55)
Cost incurred by retailer	377(11.97)	464(14.97)	381(11.91)	407(12.93)
Commission @ 8%	168(5.33)	156(5.03)	164(5.13)	162(5.16)
Loading and unloading charges	6(0.19)	8(0.26)	8(0.25)	7(0.23)
Transportation	35(1.11)	50(1.61)	45(1.41)	43(1.38)
Post-harvest losses	168(5.33)	250(8.06)	164(5.13)	194(6.16)
Sub total	377(11.97)	464(14.97)	381(11.91)	407(12.93)
Net margin of retailer	673(21.37)	686(22.13)	769(24.03)	709(22.52)
Sale price of retailer/ purchase price of consumer	3150(100)	3100(100)	3200(100)	3150(100)
<i>Channel-II (Producer→Supermarket→Consumer)</i>				
Net price received by producer	1868(69.20)	1715(62.39)	1710(61.08)	1764(64.17)
Packing material	15(0.56)	15(0.55)	14(0.52)	14(0.54)
Loading and unloading charges	6(0.22)	8(0.29)	8(0.29)	7(0.27)
Transportation	35(1.31)	49(1.78)	55(1.96)	46(1.69)
Post-harvest losses	75(2.79)	112(4.08)	112(4.01)	99(3.64)
Sub total	131(4.88)	184(6.70)	189(6.78)	168(6.13)
Sale price of producer/ purchase price of supermarket	2000(74.07)	1900(69.09)	1900(67.86)	1933(70.3)
Cost incurred by supermarket	96(3.56)	108(3.94)	121(4.32)	108(3.94)
Loading and unloading charges	6(0.22)	6(0.22)	6(0.21)	6(0.22)
Post-harvest losses	90(3.33)	102(3.72)	115(4.11)	102(3.72)
Sub total	96(3.56)	108 (3.94)	121(4.32)	108(3.94)
Net margin of supermarket	604(22.37)	741 (26.97)	779(27.82)	708(25.75)
Sale price of supermarket/ purchase price of consumer	2700(100)	2750 (100)	2800(100)	2750(100)
<i>Channel -III (Producer→Consumer)</i>				
Net price received by producer	2068(94.02)	2115(91.98)	2310(92.41)	2164(92.77)
Packing material	15(0.68)	15(0.65)	14(0.58)	14(0.64)
Loading and unloading charges	6(0.27)	8(0.35)	8(0.32)	7(0.31)
Transportation	35(1.61)	49(2.13)	55(2.2)	46(1.99)
Post-harvest losses	75(3.42)	112(4.88)	112(4.49)	99(4.28)
Sub total	131(5.99)	184(8.02)	189(7.59)	168(7.23)
Sale price of producer/ purchase price of consumer	2200(100)	2300(100)	2500(100)	2333(100)

involved. The producer sold their produce direct to consumers. The results (Table 2) reveal that producer received a net price of ₹ 2310/q, accounting for 92.41% of consumer price in Sonapat followed by Karnal ₹ 2115 (91.98%) and Hisar ₹ 2068 (94.02%)/q, respectively. The marketing cost incurred by the producer was ₹ 189/q in Sonapat while ₹ 184 and ₹ 131/q in Karnal and Hisar. Sale price of producer for the produce was ₹ 2500/q in Sonapat followed by Karnal ₹ 2300 and Hisar ₹ 2200/q. In overall Haryana state average producer received a net price of ₹ 2164/q. The marketing cost incurred by the producer was ₹ 168/q in Haryana. Sale price of the produce to consumer was 2333/q.

Marketing efficiency: The marketing efficiency in Hisar, Sonapat and Karnal markets under channel-I were 1.04, 0.94, and 0.84%, respectively. In channel-II, marketing efficiency according to acharya's method in Hisar, Karnal and Sonapat was 2.25, 1.66 and 1.57%, respectively (Fig 2). In case of channel-III, marketing efficiency in Hisar, Sonapat and Karnal were 15.71, 12.17 and 11.48%, respectively. From this efficiency index, it is clear that channel-III was the most efficient among all marketing channels in different markets. Bishnoi *et al.* (2017) revealed that producers obtained maximum share in consumer rupee from direct marketing of polyhouse capsicum.

The finding of the study indicated that the in NVPH highest total cost incurred on capsicum in Karnal ₹ 695047/ha followed by Sonapat and Hisar with ₹ 867103 and ₹ 847969/ha, respectively. Gross returns from capsicum were highest from Karnal ₹ 1436297/ha followed by Sonapat and Hisar with ₹ 1266297 and ₹ 1235525/ha, respectively. Benefit-cost ratio was recorded highest in Karnal and Hisar, i.e. 2.00 while in Sonapat it was 1.29. The finding of the study indicated that in net house the highest total cost incurred on capsicum in Karnal ₹ 642474/ha followed by Sonapat and Hisar with ₹ 678657 and ₹ 665420/ha, respectively. The gross returns from capsicum were highest from Hisar ₹ 1186104/ha followed by Karnal and Sonapat with ₹ 1149038 and ₹ 987000/ha, respectively. Benefit-cost ratio was highest recorded in Hisar 1.78 as compared to Sonapat (1.65) and Karnal (1.45), respectively. The producer's share in the consumer's rupee was found highest in channel-III (producer to consumer) which accounted 94.02, 92.41 and 91.98% for capsicum in Hisar, Sonapat and Karnal, respectively. Marketing efficiency also showed that the channel III is the most efficient marketing channel.

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