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Supply Chain Analysis of Seed Potato in Punjab

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Abstract

The present study was carried out to analyze the supply chain of seed potatoes in Punjab. Primary data was collected from 25 potato growers from three state districts to fulfill the study's objectives. The study has also covered 35 marketing intermediaries to examine the cost and return from the different potato supply chains. The study has identified the four supply chains of seed potatoes referred to hereafter as SPSCs. The producer's sale price was the highest in the case of SPSC-II (Rs 2147.56/q) and the lowest in the case of SPSC-I (Rs 1335.60/q). The total marketing cost was the highest in SPSC-III (Rs 518.26/q) and the lowest was reported for SPSC-II (Rs 352.44/q), the reason being the less involvement of intermediaries in this supply chain. The producer's share in the consumer rupee was the highest for SPSC-II and the lowest for SPSC-III. The study pointed out the role of awareness generation, price incentives, and better infrastructure facilities for potato growers to encourage them to use potato supply chains that could enhance farmer's returns. It also focuses on capacity building for quality production and the encouragement of FPOs to boost potato production and procurement. The expansion of potato cultivation and better integration of the farmers with supply chains will contribute towards sustainable crop diversification in Punjab.

Keywords: Supply Chain, Seed Potato, Market Intermediaries, Marketing Cost, Marketing Margin

JEL classification:- G14, M30, M39, Q13

Introduction

Producing vegetables is one of the viable options because of its quick growth, low cost (compared to producing fruits), and rising demand. Potato is considered one of the major vegetable crops of Punjab. In Punjab, approximately 2.73 lakh hectares of vegetables were planted in 2019–20. Out of this, 73.79 per cent of the area was planted with potatoes. During the 2019–20 growing season, 1.46 percent of Punjab's total cropped land was devoted to growing vegetables, from which 1.06 per cent of the area was under potato crops. Around 2870,000 lac tonnes of potatoes were produced in 2019–20. (Government of Punjab 2020). Punjab contributes approximately 5 per cent to the country in terms of potato output. (Government of India, 2019; Anantia, 2008; Jairath, 2008; Dastagiri et al., 2009).

The potato crop requires seeds as a key input. If the farmer does not obtain excellent seeds, a large portion of their labor and expenditures will be fruitless. Only seeds with guaranteed genetic and physical purity can be counted on to respond to fertilizers and other agricultural inputs (Dahiya and Pandey, 1992). The yield from the farmer's other expensive inputs—such as equipment, irrigation, chemical fertilizers, herbicides, etc.—as well as his labor and land depend on the seed. Seed should be renewed every year for hybrid kinds and every four years or sooner for open-pollinated crops like wheat and rice. Even in an agriculturally developed state like Punjab, it was 3.48 percent for certified seeds and 4.43 percent for quality seeds (Sidhu, 1995).

Certified/quality seeds can also play an important role in increasing potato yield and production in the state. The usage of low-quality seeds is a key limitation resulting in reduced production in the nation (21.1t/ha) (GOI, 2015). The repeated multiplication of seed tubers in the field increases the chances of infection and the accumulation of various bacterial, fungal, nematode, and viral diseases. Degeneration of seed reduces production by around 40%. (Salazar, 1996).

After the production of the crop marketing is the major challenge faced by the producer. Marketing of fruits and vegetables is typically more challenging, because of the perishable and heavy nature of the crop, the marketing procedure is more complicated and more prone to risks. Regarding potatoes, India has gone through a revolution in the past 55 years, but planners must consider marketing as a means of further progress. Post-harvest losses for potatoes have been estimated to be as high as 17 percent of the yearly

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crop, with other estimates indicating losses as high as 30 percent. The marketing of potato crops depends upon the availability of the product in the market. The price may vary from day to day. Various government and private agencies like producers, contractors/traders, wholesalers, retailers, etc. are involved in the marketing of potatoes. Agencies like NAFED (National Agricultural Co-Operative Marketing Federation), APEDA (Agricultural and Processed Food Development Authority) interferes in the marketing of potato for export purposes and to uphold the fluctuations in the prices of the crop. In India, sixty percent quality of produce is lost in the supply chain of produce from farm to consumer. Effective potato marketing is required to raise the producer's share in consumer rupees (Johl and Dahiya, 1999). With the improved supply chain management mechanism, there will be a significant reduction in the wastage of fruits and vegetables which in turn will benefit both the farmers and consumers in terms of improved returns and decline in prices, respectively.

In order to understand price distribution and potato marketing effectiveness, the current study was conducted. The study's specific goals included estimating the marketing costs and margins of various functionaries for potatoes under various supply chains, analysing price spreads, marketing efficiency, and producer's share in consumer rupees in various supply chains, and suggesting usable solutions to improve potato marketing functions and improve marketing efficiency.

Data Sources and Methodology

The primary data were employed in the study to evaluate seed potato supply chains. The data related to marketed surplus, produce handling, transportation costs and problems faced, etc., were gathered from the farmers. Finally, information about the seed potato was determined to the supply chain existing in Punjab. Districts, Patiala, Jalandhar and Ludhiana were selected purposively for the study. In the next stage, four blocks were selected from the selected districts. Furthermore, 25 seed potato growers were interviewed.

To estimate price spreads, marketing margin, producer's share in consumer rupee and marketing efficiency in different marketing channels of potato 10 of each commission agent, wholesaler, trader and five pre-harvest contractors were selected at random. The marketing channels in the study area were identified and marketing cost, marketing margin, producer's share in consumer rupee, marketing efficiency, etc. were calculated using standardised formulae.

Marketing efficiency

The marketing efficiency of various channels in the study area has been computed by using Acharya's method as under:

$$ME = \frac{RP}{MC+MM} - 1$$

Where,

ME = Marketing Efficiency

RP = Retailer's price

MC = Total marketing costs

Results and Discussion

Basic Characteristics of the Potato Growers

The average age of seed potato growers was approximately 45 years. The average family size of a potato grower is about four members. On an average, land devoted to potato crops was 29.75 acres from a total operational holding of 39.79 acres. The gross cropped area was 109.33 acres with cropping intensity of 274.77 per cent.

Table 1. Descriptive statistics of the potato growers, 2019-20

Particulars	Values
Average age (years)	44.8
Average family size	4.30
Land holding	
Owned land	22.75
Leased in land	17.04
Operational holding (acres)	39.79
Area under potato (acres)	29.75
Land use pattern	
Net sown area (acres)	39.79
Gross cropped area (acres)	109.33
Cropping intensity (%)	274.77

Supply Chain of Seed Potato

The four different supply chains of seed potatoes were identified in the study area. The identified supply chains of potatoes are represented in Fig1. The identified supply chains of seed potato were represented by SPSC (Seed Potato Supply Chain).

SPSC-1: Producer → Pre-harvest contractor (using cold store) → Consumers were involved in the disposal of the produce in the case of SPSC I. Pre-harvest contractor (PHC) made an agreement with farmers and ensured a fixed price to the producer. PHC buys all the produced material and, after performing the operations of cleaning and grading, stores the produced material in cold storage and, before the next sowing, sells the material to consumers.

SPSC-II: Producer (by the means of cold store) → Consumers were involved in SPSC II. In this chain, the producer directly sells the produce to the consumers. In the peak season, the producer stores the produced material in cold storage and sells it directly to the consumer before the next sowing of the crop.

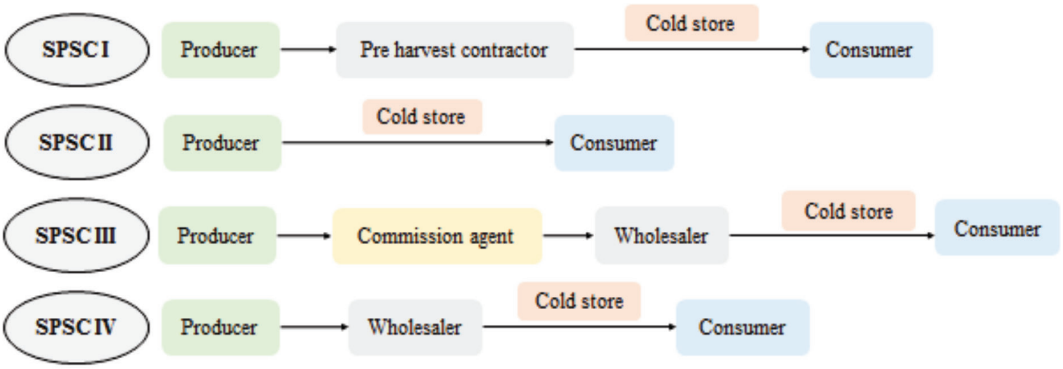

Fig 1: Identified supply chains of seed potato

SPSC-III: Producer → Commission agent→ Wholesaler (using the cold store) → Consumers were involved in the marketing of seed potato. Commission agents buy the produce from the producers and sell it to the wholesaler by getting their margin.

SPSC-IV: Producer → Wholesaler (by the means of cold store) → Consumer were involved in the marketing of the produce. The wholesaler directly buys the produce from the producer and sells it to the consumer.

Price Differentials for Seed Potato Supply Chains

The price differentials in the case of seed potato supply chains at different stages of marketing are depicted in Table 2.

The SPSC-II, where the producer/farmer realized a price of Rs. 2147.56/q had the highest net price paid to the farmer. After SPSC-II, SPSC-IV was the second highest in terms of net price paid to farmers/producers at Rs. 1686.04/q. Furthermore, the producer's net price in SPSC-III was Rs 1416.96/q, in SPSC-I it was Rs 1335.60/q. The producer's sale price was likely to be Rs 2500/q in SPSC-II. In SPSC-IV, the producers' sale price was Rs 1788.10/q contrary to Rs 1557.14/q in SPSC-III and Rs 1400 /q in SPSC-I.

The wholesalers' sale price was the highest in SPSC-IV at Rs 2176.8/q, but the margin of the wholesaler was the highest in the case of SPSC-III (Rs 1198.11/q) with wholesalers' sale price of Rs 1935.22/q. The pre-harvest contractor sale price was Rs 1707.40/q with a margin of Rs 772.60/q. Surprisingly, the consumer purchase price was the same in both SPSC-III and SPSC-IV which was to the tune of Rs 3133.33/q followed by SPSC-II (Rs 2500/q) and SPSC-I (Rs 2480/q).

Marketing Cost of Producers

The details of marketing costs incurred by producers for different supply chains are reported in Table 3. The total marketing costs incurred by the producer for different supply chains indicate that the SPSC-II incurred the highest cost of Rs 352.44/q while the marketing cost was lowest at Rs 64.44/q in SPSC-I. The marketing cost was highest in SPSC-II because the producer has to bear all the expenses such as grading, cost of packaging material, stitching, etc. In the case of SPSC-III, the charges paid by the consumers were Rs 140.18/q, contrary to SPSC-IV (Rs 102.06/q).

Costs Incurred By Wholesalers

Wholesalers were involved in only two of the four identified supply chains of seed potatoes. Data about expenses borne by the wholesalers is portrayed in Table 4. The market level cost incurred highest in SPSC-III (Rs 388.79/q) followed by SPSC-IV (Rs 378.08/q). In SPSC-III,

Table 2. Price differentials for different seed potato supply chains of Punjab, 2021-22 (Rs/q)

Particulars	SPSC-I		SPSC-II		SPSC-III		SPSC- IV	
	Price	Margin	Price	Margin	Price	Margin	Price	Margin
Net price received by the producer	1335.56	-	2147.56	-	1416.96	-	1686.04	-
Producers' sale price	1400.00	-	2500.00	-	1557.14	-	1788.10	-
Wholesalers' sale price	-	-	-	-	1935.22	1198.11	2176.89	956.44
Pre-harvest contractor sale price	1707.40	772.60	-	-	-	-	-	-
Consumer purchase price	2480.00	-	2500	-	3133.33	-	3133.33	-

Table 3. Components of market-level costs incurred by producers for different supply chains of seed potato in Punjab, 2021-22 (Rs/q)

Particulars	SPSC-I	SPSC-II	SPSC-III	SPSC- IV
Grading	44.44	50.00	48.62	48.62
Cost of bag	-	56.00	66.00	34.00
Loading/ Unloading	5.00	7.00	5.50	5.50
Stitching cost	-	4.94	13.94	13.94
Transportation	15.00	4.50	6.12	-
Storage cost	-	220.00	-	-
Commission to Storekeeper	-	10.00	-	-
Total	64.44	352.44	140.18	102.06

Table 4. Market level costs incurred by wholesalers for different seed potato chains in Punjab, 2021-22 (Rs/q)

Particulars	SPSC-I	SPSC-II	SPSC-III	SPSC- IV
Commission to Commission Agent	-	-	40.00	-
Loading/ Unloading	-	-	5.22	5.22
Re-grading	-	-	64.00	64.00
Re-packaging	-	-	15.00	15.00
Storage	-	-	220.00	220.00
Transportation	-	-	-	50.71
Spoilage @ 2%	-	-	33.86	33.86
Total	-	-	378.08	388.79

the total marketing cost was highest because of the large expense borne on transportation of produce in comparison to SPSC-IV.

Costs Incurred By Pre-Harvest Contractors

The market-level costs incurred by the Pre-harvest contractor are presented in Table 5. Pre-harvest contractors were involved in SPSC-I. The expenses borne by the Pre-harvest contractors were to the tune of Rs 307.40/q in SPSC-I, which includes the cost of storage (Rs 220/q), cost of packaging material (Rs 34/q), spoilage (Rs 28/q) and loading and unloading (Rs 5/q).

Table 5: Market level costs incurred by pre-harvest contractor (PHC) for different seed potato supply chains in Punjab, 2021-22 (Rs/q)

Particulars	SPSC-I
Loading/ Unloading	5.00
Storage	220.00
Transportation	20.40
Cost of Packaging material	34.00
Spoilage @ 2%	28.00
Total	307.40

Price Spread, Marketing Margin, and Marketing Efficiency

Table 6 illustrates that the producer's sale price was Rs. 2147.56/q in SPSC-II, the highest among all the selected chains, followed by SPSC-IV (Rs. 1686.04/q), SPSC-III (Rs. 1416.96/q), and SPSC-I (Rs. 1335.60/q). The consumer's purchase price was Rs 3133.33/q, which was the same as that of SPSC-III and SPSC-IV. The consumer purchase price was somehow the same in both SPSC-I and SPSC-II with a value being Rs 2500 per q.

The total marketing cost was Rs 518.26/q in the case of SPSC-III, Rs 490.85/q in SPSC-IV, Rs 371.84/q in SPSC-I, and Rs 352.44/q in SPSC-II, because of the less involvement of intermediaries in this chain (SPSC-II). The wholesaler's margin was Rs 1198.10/q in SPSC-III which is the highest in contrast to SPSC-IV (Rs 956.44/q) and the pre-harvest contractor margin was Rs 307.40/q in SPSC-I, respectively.

The total marketing margin was Rs. 1198.10/q in SPSC-III followed by Rs 956.44/q in SPSC-IV and Rs 772.60/q in SPSC-I. The highest price spread of Rs 1716.36/q was observed in SPSC-III, followed by SPSC- IV (Rs 1447.29/q), (Rs 1144.44/q) in SPSC-I and Rs 352.44/q in SPSC-II. It was observed that the producer share in the consumer rupee was the highest in SPSC-II (83.2%) followed by SPSC-

Table 6. Price spread, marketing margin, and marketing efficiency of seed potato among different seed potato supply chains in Punjab, 2021-22 (Rs/q)

Particulars	SPSC-I	SPSC-II	SPSC-III	SPSC- IV
Producer's price	1335.56	2147.56	1416.96	1686.04
Consumer's Price	2480.00	2500	3133.33	3133.33
Marketing cost	371.84	352.44	518.26	490.85
Producer's level	64.44	352.44	140.18	102.06
Wholesaler's level	-	-	378.08	388.79
Pre-harvest contractor's level	307.40	-	-	-
Marketing margin	772.60	-	1198.10	956.44
Wholesaler's margin	-	-	1198.10	956.44
Pre-harvest contractor's margin	772.60	-	-	-
Price spread	1144.44	352.44	1716.36	1447.29
Producer's share in consumer rupee (%)	53.85	85.90	45.22	53.80
Marketing efficiency*	1.16	6.09	0.82	1.16

**By using Acharya's approach*

Table 7. Degree of value addition (%) for different supply chains of seed potato

Particulars	SPSC-I	SPSC-II	SPSC-III	SPSC- IV
Wholesaler's level	-	-	61.91	43.94
Pre-harvest contractor	45.25	-	-	-
Consumer's level	31.15	-	38.24	30.52

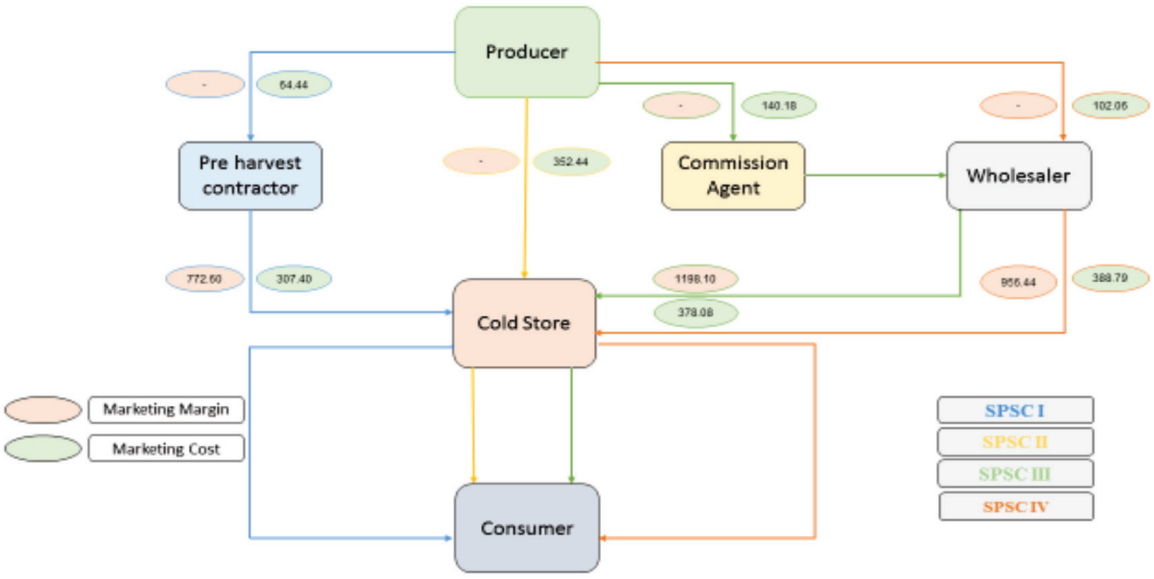

Fig 1: Graphical presentation of marketing cost and marketing margin of different Seed Potato Supply Chains (SPSCs)

IV (51.8%), SPSC-I (51.61%) and the lowest in SPSC-III (43.2%).

Acharya's method was used to calculate the marketing efficiency of each selected supply chain. According to Acharya's approach, the index of marketing efficiency was the highest in the case of SPSC-II (6.09) and the lowest in SPSC-III (0.82).

Degree of Value Addition

In SPSC-I, the degree of value addition was 45.25 per cent at the pre-harvest contractors' level and 31.15 per cent at the consumer level (Table 7). As a result, the degree of value addition in SPSC-III was 61.91 per cent at the wholesaler's level and 38.24 per cent at the consumer's level. The degree of value addition in SPSC IV was 43.94 per cent at the wholesale level and 30.52 percent at the consumer level. In a nutshell, the degree of value addition was the highest in SPSC-III, followed by SPSC-I and SPSC-IV, and the difference in value addition was due to the difference in the number of intermediaries involved in the supply chain.

Conclusion and Policy Implications

The study revealed that the average age of seed potato growers was 44.8 years, and the average family size was approximately 5 members. The cropping intensity of selected farmers was 274.77 per cent. Four marketing channels of seed potatoes were found to be widely employed throughout the research region.

For seed potatoes, the producer's sale price was Rs. 2147.56/q in SPSC-II, the highest of all the chains and it was lowest at Rs. 1335.60/q in SPSC-I. The total marketing cost was the highest in SPSC-III Rs 518.26/q, it was the lowest Rs 352.44/q in SPSC-II, because of the less involvement of intermediaries in this chain. The wholesaler's margin was Rs 1198.10/q in SPSC-III which is the highest in contrast Rs 956.44/q in SPSC- IV and the pre-harvest contractor margin was Rs. 307.40/q in SPSC-I respectively. The total marketing margin was Rs. 1198.10/q in SPSC-III followed by Rs 956.44/q in SPSC-IV and Rs 772.60/q in SPSC-I. The highest price spread of Rs 1716.36/q was observed in SPSC-III which was due to the highest high marketing cost and large marketing margin of intermediaries, followed by SPSC-IV Rs 1447.29/q, Rs 1144.44/q in SPSC-I and Rs 352.44/q in SPSC-II. The producer share in the consumer rupee was highest in SPSC-II 85.90% and lowest in SPSC-III 45.22%, the index of marketing efficiency was highest in SPSC-II (6.09) and lowest in SPSC-III (0.82), compared to SPSC-I (1.16) and SPSC-IV (1.16). The degree of value addition was the highest in SPSC-III, the difference in value addition was due to the difference in the number of intermediaries involved in the supply chain. In order to increase the producers' share in the consumer rupee, the export of seed potatoes should be increased, and FPO should be developed to increase the trade of potatoes.

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