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Cultivation of Stone-fruits in Uttarakhand: Market Accessibility of Farmers and Monopsonist Behaviour of Intermediaries

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Abstract: *Food production in India has increased manifold from 51 million tonnes in 1950-51 to about 252 million tonnes in 2014-15. However, farm income has not grown in the same proportion, as the Situation Assessment Survey (2003,2013) of farmers' data reveal. In this paper, I focus on two important supply-side factors responsible for farmers' exploitation- dependence on intermediaries, and lack of market accessibility due to poor infrastructure. This paper analyses the supply chain of stone-fruits in Uttarakhand, a hill state in northern India. Uttarakhand is the leading producer of stone-fruits in India. I use original survey data constructed by doing a primary survey in Nainital district of Uttarakhand. The main objective is to trace the supply chain of stone-fruits and analyse the distribution of profits along this chain, while accounting for the topography of the hills and how it affects farmers' incomes and dependence on intermediaries. The study finds that high post-harvest (marketing) cost coupled with poor infrastructure and information asymmetry helps traders in wielding power over the farmers. Rich farmers fare relatively well as compared to their poor counterparts. This is primarily due to their dependence on the traders for credit- both for agricultural and non-agricultural purposes. In lieu of this, farmers are bound to sell their harvest to the traders. Also, because these traders deal in bulk and help the farmers dispense-off their produce quickly in the absence of storage amenities, farmers prefer to deal with them, even if this implies additional cost in the form of commissions of traders and transporters. However, calculations show that after accounting for opportunity cost of family labour, even the farmers with large landholdings incur losses. This study finds that in the absence of sound infrastructure, intermediaries become indispensable to the farmers. Policy implications of the paper include an urgent need to develop storage and food-processing infrastructure that will be as helpful to the farmers as the roads that help in improving market accessibility. Also, mere ICT tools such as cell phones can do little to increase farmers' profits, if not done in conjunction with an improvement in credit-lending and agricultural marketing institutions.*

Keywords: *Agricultural Markets and Marketing, Agricultural Finance and Credit, Agricultural Policy and Food Policy, Farmers Income, Labour Cost.*

Introduction

Agriculture contributes about 14% of the share in Indian GDP and continues to provide employment to a predominant share of almost 54% of the working population (State of Indian Agriculture Report, 2015-16). Food production in India has increased manifold from 51 million tonnes in 1950-51 to about 252 million tonnes in 2014-15. However, farm income has not grown in the same proportion, as revealed by the Situation Assessment Survey (SAS) report of farmer households and Cost of Cultivation Survey data. Income realized from cultivation at current prices was abysmally low at about Rs 25,380 in 2003 (almost equal to Rs 70 a day) (SAS 2003, Narayanamoorthy 2006) and only about Rs 101 a day during 2011-12 (SAS, 2013).

The Indian farmer earns very less and is trapped in poverty for various reasons. An important reason for the same is that the farmer is not linked to the consumer directly and gets a small fraction of what the consumer spends on the product. There is substantial evidence of agrarian distress (Rao and Suri, 2006) increasing number of farmers suicides (Posani, 2009) and exploitation of farmers by intermediaries in the supply chain. Since agricultural production has been increasing over the years and India became a self-sufficient nation in terms of food long ago, it seems a paradox as to why a farmer is not getting enough remuneration from farming, despite rise in output as well as price.

The exploitation of farmers by intermediaries in the form of low prices is one of the major reasons as to why the income of farmers in India is abysmally low (Mitra S and S, 2017). Given the ever-increasing

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cost of agricultural inputs, the unpredictable nature of production and prices, it is important to ascertain as to how much profit is made by the farmer at the end of the entire venture once the product reaches the consumer. Given the long agricultural supply chain with a large number of actors, which is one of the distinguishing features of agriculture in developing economies like India, it is important to ascertain the income earned by the farmer eventually, keeping into account all the costs borne by him. Only a small share of what the consumer pays for the product reaches the actual producers. Conventional theories focus mainly on sources of production costs, ignoring the role of marketing costs and margins that accrue to trade intermediaries. Yet there is considerable evidence of the importance of intermediaries and associated mark-ups that drive large wedges between consumer and producer prices (Bardhan, Mookherjee, and Tsumagari, 2013). In developing countries, small farmers often cannot access organised markets directly. Instead, they sell to middlemen who resell their output to distant buyers. These middlemen appear to earn large margins, and they appropriate most of the gains from rising consumer prices. The large size of the market, poor transport, marketing and infrastructural facilities ensure that many isolated regional markets exist for farm produce. The wholesalers and processors in these markets enjoy significant clout and are able to buy farm produce at a low price. The market structure is oligopsonistic between the producers and intermediaries and oligopolistic between the intermediaries and consumers.

India's impressive economic growth over the past two decades and a more inclusive growth in recent years have resulted in per capita income steadily increasing in real terms as well as at market prices both in urban and rural areas. Studies of food demand in India consistently find that Indian households tend to consume more high value products such as milk and dairy products, fruits and vegetables, meats, poultry, and fish as their incomes rise, while their consumption of traditional staple grains remains stable or declines (Gandhi and Mani, 1995; Meenakshi, 1996; Srivastava *et al.*, 2013; Singh and Mathur, 2008). Consumer expenditure trends for fruits and vegetables depict very significant increase in the country. The share of vegetables and fruits in consumer expenditure has increased from 10.7 percent in 1987-88 to 15.7 in 2007-08 in rural and from 13.9 percent to 16.6 percent in urban India (Sharma and Jain, 2011). This income-induced diet diversification has resulted in consumers moving away from inferior cereals such as jowar and bajra to superior grains such as wheat and rice and more recently from cereals to high value food products such as milk, egg, meat, and fruits and vegetables a natural corollary to the negative income elasticity for cereals in India and positive income elasticity for high quality food. The change is occurring both among rural and urban households (NCAER, 2014).

On the supply side, farmers too have exhibited an increasing tendency towards the cultivation of high-value crops as most of these have a higher net return per hectare of land than staples or other widely grown crops. In India, it has been observed that small and marginal farmers have started participating relatively more in fruits and vegetables production as these crops are more promising in the augmentation of farm incomes (Birthal *et al.*, 2013). Evidence from some countries in Asia also shows that diversification was responsible for developing innovative supply chains that created income and employment opportunities in primary production (Goletti, 1999; Barghouti *et al.*, 2004; Deshingkar and Start, 2003).

However, despite this improvement, the cultivation of these high value crops is fraught with several difficulties and challenges due to their highly perishable nature as compared to the traditional crops. Poor basic infrastructure like rural roads, power, transport, etc coupled with inadequate post-harvest technologies for handling of perishable horticultural produce aggravate the problem for the farmers. Also, there is not a clear micro-picture to show that the cultivation of horticultural crops can yield higher

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profits to farmers vis-a-vis the traditional crops. It is not known as to how much of the price paid by the consumers for these crops is appropriated by the farmers. Keeping this in mind, this paper plans to analyse the supply chain of stone-fruits (primarily peach, apricot, plum, pear and apple) and draw inferences on how much profit is made by the farmer and whether the macro-level evidence of better income from the cultivation of high-value crops is verified at the micro level as well. This area is relatively unexplored as not many studies have addressed the issue of value addition in the supply chain at the micro-level. The economic contribution of various intermediaries in the long marketing chain for various agricultural commodities also needs to be studied. It is generally believed that middlemen in agricultural value chains in developing countries appropriate significant margins. However, there is little evidence on how large these margins are, and why they occur (Mitra *et al.*, 2017).

This paper will try to document the supply chain of stone-fruits in Uttarakhand, a hill state in northern India and analyse the profits of farmers and traders. This is done by using the data obtained from two hundred farmers for the year 2018-19. The findings show that farmers growing stone-fruits earn small nominal profits. These profits become zero or negative when implicit costs like family labour are included. Also, small farmers fare worse than their rich counterparts who get a better price for their produce. We indicate the main reasons why farmers earn less and are dependent on the intermediaries who reap large profits and the overall problems faced by farmers in a hill economy.

Literature Review

This paper connects various strands of inter-related literature, dealing with crop diversification, marketing margin of farmers, role of middlemen, marketing of the produce and price transmission. Existing studies which reveal the actual income that a farmer gets are extremely limited in both Indian as well as international literature. In the Indian context, the body of such literature is extremely old and limited. Hugar and Hiremath (1984) in their study on marketing of vegetables in Belgaum city found that marketing cost incurred by producer sellers for cabbage, brinjal and tomato was Rs. 7.73, Rs. 8.62 and Rs. 8.17 per quintal respectively in the supply chain of producer to consumer with the involvement of wholesalers and retailers. But, in the supply chain with involvement of cooperative society and retailers, the marketing cost per quintal declined by almost 10%. Naidu and Tirupathaiah (1991) worked out price spread in groundnut marketing under different chains in Vijayanagaram district of Andhra Pradesh. They found that a large proportion of their produce was transferred through the village merchant followed by direct sale to oil miller. The share of the producer in the consumer rupee was found to be higher in the direct sales to oil miller *i.e.*, 86.63 per cent compared to the supply chain that involved the village merchant *i.e.*, 79.66 per cent. Vedini (1997) conducted the study on cost and margins in Jasmine flower marketing. The study was conducted in Mysore city. It was interesting to note that all the sample farmers sold their produce at their nearest markets in Mysore district. It was significant to note that the trader cum commission agents are playing a very crucial role in Jasmine flower marketing than the direct sale to consumer. The study results explicitly indicate that Jasmine flower trade is a profitable venture with a price spread of nearly 49 per cent among all the intermediaries. The net return per kg of flower trade was the highest in case of retailers due to creation of form utility. Devaraia (1998) conducted a study in Hassan district of Karnataka on channels and price spread in potato marketing. He selected 200 farmers from 30 village and 40 market intermediaries indexing 15 commission agents, 15 retailer vendors and 10 cart vendors. The study identified 3 supply chains, first chain included commission agent and retailer for the movement of the produce to nearby markets of the district, second chain included commission agent and retailer for the movement of produce to distant market of Bangalore and third chain included

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commission agent and cart vendor. The price spread analysis revealed that producers got the net price of 48.57, 51.15 and 52.32 per cent of the consumers rupee in first, second and third supply chain respectively.

Recent prominent studies of agricultural marketing include one by Chand et al (2011) followed by that of (Nilabja, 2013). Chand, Prasanna, and Singh (2011) have studied the marketing efficiency of different horticultural commodities in the Indian states of Andhra Pradesh, Punjab, Karnataka, West Bengal and Tamil Nadu. They found that marketing efficiency increases as the number of stakeholders in the supply chain decrease and that the maximum portion of the consumers rupee is appropriated by the retailer whereas farmer gets the minimum share. Nilabja (2013) has conducted a comprehensive analysis of new marketing channels post the marketing-reforms and the impact that these have had on the price advantage delivered to the farmers. The study conducted in eleven Indian states shows that modern marketing channels have improved the gains accrued by farmers as compared to the traditional channels, but there is still a long way to go in the implementation of the market reforms. Mitra *et al.* (2017) found that middlemen margins were between 28% and 38% of the wholesale price for potatoes. This suggests that farmers could earn 65-83% more if they could sell directly in wholesale markets. Also, there was negligible pass-through from retail to farm-gate prices. For a one rupee increase in the price that end-consumers paid, middlemen received 80 paise more, but farmers received a mere 2 paise more an insignificant. This suggests that the trader-farmer link in West Bengal's supplychain has extraordinarily large imperfections.

In the international literature, studies on marketing margins and farmers shares have been conducted in African countries such as Sudan (MoA, 2011). Arndt *et al.* (2000) estimate middleman mark-ups of 111 percent in food crops, 52 percent in export crops, 59 percent in food processing, and 36 percent in textile and leather in Mozambique. Fafchamps and Hill (2005), McMillan, Rodrik, and Welch (2002) and Nicita (2004) estimate rates of pass-through are less than 50 percent from border prices to producer prices in the case of Ugandan coffee, Mozambique cashews, and a range of Mexican agricultural goods respectively. Sihvonen (2005) in a study on retail-farm price study conducted in Finland noted that the share of retail trade in consumers price of food has increased rapidly over the past five years. When market margin was calculated found that the share of the retail price all along the supply chain has been progressive. Farmers in turn have been receiving an increasingly lower proportion of the retail price of the food. The farmers share in the price of minced meat had declined from 33.6 per cent in 1999 to 23 per cent in 2004. Farmers share for pork chops have declined from 19.4 per cent to 15 per cent for the same period. The two leading food retail chains increased their market share from 55 per cent in 1990 to nearly 80 per cent in 2005. This increased concentration meant that large retail outlets exert more control over others in food supply chain. Guvheya (1999) found that in horticultural marketing in Zimbabwe, prices flow from wholesale levels in both directions to farmers and retailers. On the issue of price transmission, their results indicated that only $0.35 of a $1 increase in wholesale prices were immediately transmitted to the farm level whereas $0.97 of a $1 price decrease at the wholesale level would be immediately transferred to the farm level or rural markets, indicating asymmetric price transmission between these two levels. Their analyses however yielded symmetric price transmission between the wholesale and retail levels. They argued that the market structure along the channel is such that wholesalers wield greater market power on farmers, whereas market efficiency characterized the wholesale and retail levels. Minten and Kyle (1999) examined retail margins, price transmission, and price asymmetry in urban food markets of Zaire. They estimate price transmission between wholesale and retail levels and found that while price increases at the wholesale level were in most cases

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completely transmitted within the same week to the retail level, this was not the case for price decreases. But producer-wholesaler level price transmission was not studied.

A possible policy implication of asymmetric price transmission is that consumers do not benefit as much from a price decline at the farm level, whereas farmers do not benefit from an increase in prices at the retail level. Reasons for asymmetric price transmission have been widely cited in the literature including menu costs (Heien, 1980; Bailey and Brorsen, 1989; Heien, 1980) inventory management (Blinder, 1994; Wohlgenant, 2001), government intervention to increase producer prices (Gardner, 1975; Vavra and Goodwin, 2005), market power of agents particularly middlemen (Zacharriase and Bunte, 2003) and presence of search costs (Abdulai, 2002).

Our study can be seen as a contribution to this literature in the sense that we try to document the scenario of agriculture in Uttarakhand, a hilly state dominated by agriculture, which has been hitherto largely overlooked in the literature. Most of the research so far has only been conducted in states like Uttar Pradesh, Punjab, Andhra Pradesh etc whose topography is completely different from that of hill states like Uttarakhand and Himachal Pradesh. As a result, agricultural policy recommendations for such states cannot be generalised to states like Uttarakhand. Our study can have new state-specific policy implications. Also, the reason why farmers are dependent on intermediaries has not been dealt with in-depth in the literature. Addressing the question of farmer's share in consumer rupee is of paramount importance in present times when farming is increasingly becoming a non-lucrative occupational option (Nilabja, 2013; Agarwal and Agrawal, 2017). More research is needed in order to understand the increasingly complicated relationships among prices along the supply chain and the underlying behaviour of agents. Many observers have asserted that middlemen are more apt to increase than to lower the prices of food items. As a result, cost increases are completely and rapidly passed on to consumers, whilst there is a slower and less complete transmission of cost savings. However, very few studies have addressed the question as to how much of this increase in consumer price of a good is appropriated by the producer, here the farmer. Our paper is an effort to draw a holistic picture of how a crop reaches the consumer from the fields, who all are the stakeholders in the supply chain and what remuneration they get in the process.

Stone-fruits in Uttarakhand

Uttarakhand is a small hill state in north India that was carved out of Uttar Pradesh in 2000. Out of a total geographical area of 5.35 million hectare in the state, 4.6 million hectares (86%) is hilly area and 0.74 million hectares (14%) is plain area. Only about 14 percent of the geographical area is cultivable which is mainly attributed to the topography of the state. Because of its location and diverse climate, the state has certain unique advantages for development of horticulture, agro-processing industries, organic farming, off season vegetable cultivation and cultivation of medicinal and aromatic plants which can be gainfully exploited. Agriculture is a predominant sector in the state economy which contributes around 23.4% in State Domestic Product. The state produces different varieties of cereals, fruits, vegetables and spices. Uttarakhand ranks first in the country in production of peach, plum, pear and apricot, as shown in Figures 1, 2 and 3 respectively. The state ranks third in the country in production of apple behind Jammu and Kashmir (69.0%), Himachal Pradesh (24.0%), with a share of 7% (Directorate of Economics and Statistics; Kumar, 2011) as shown in Figure 4. Uttarakhand has been chosen as the site for the study because agriculture continues to be the mainstay of more than half of the working population in Uttarakhand. However, the structure of this employment is basically low-yielding agriculture. With a limit on the development of industries and service sector in the state, agriculture,

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particularly the cultivation of horticultural crops can provide sustainable source of income and employment to the people.
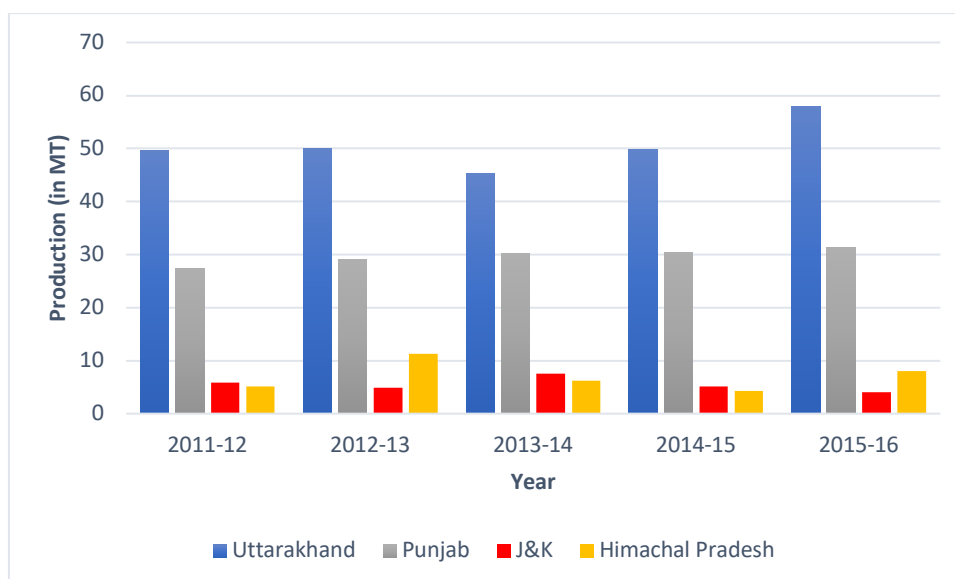

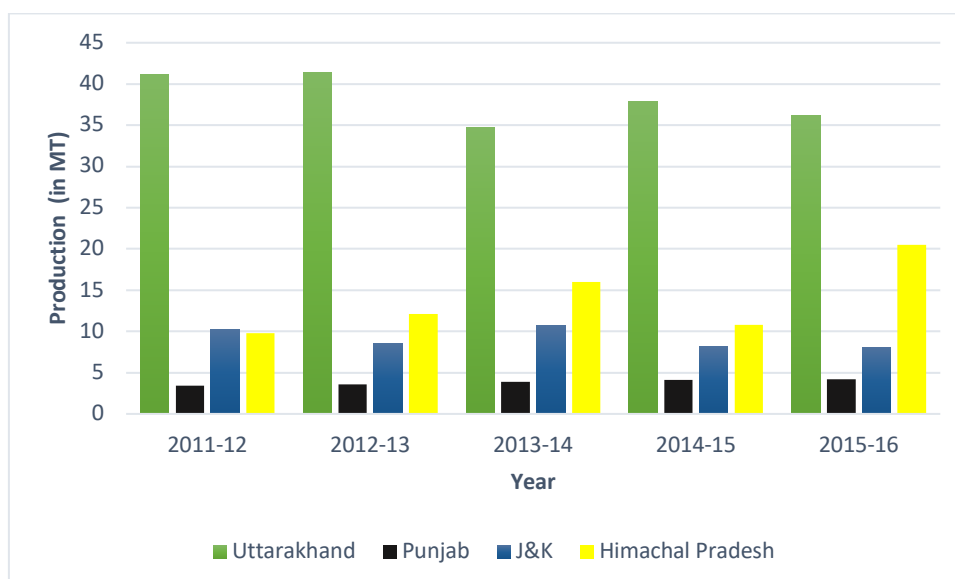*Figure 1. Peach Production in India. Source: National Horticulture Database.*

Figure 2. Plum Production in India. Source: National Horticulture Database.
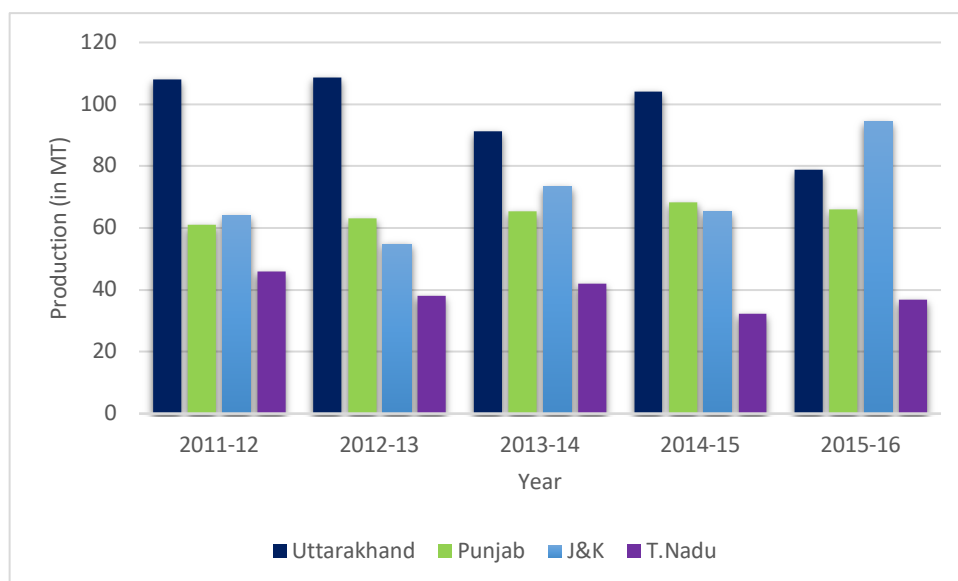
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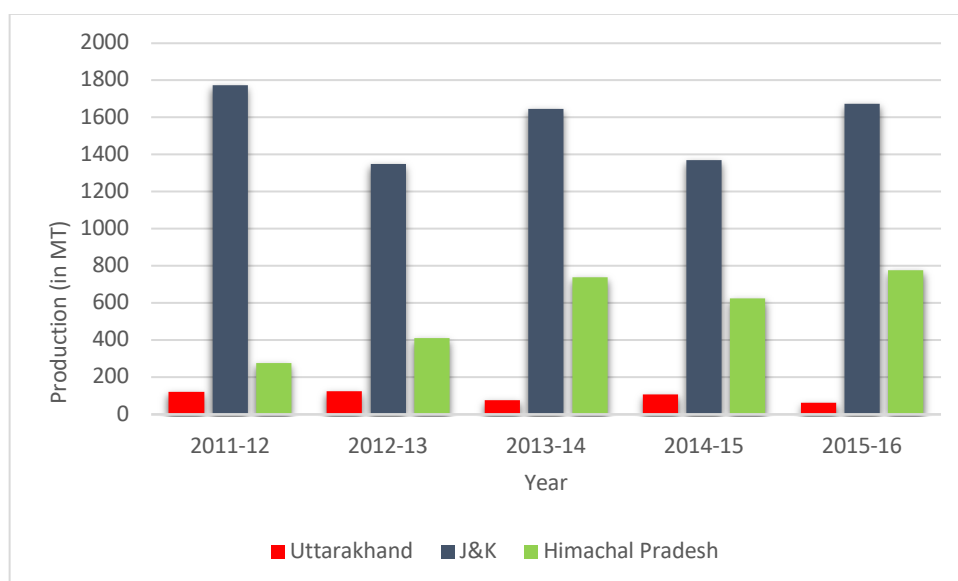**Figure 3. Pear Production in India.** *Source: National Horticulture Database.*

Figure 4. Apple Production in India. *Source: National Horticulture Database.*

There are thirteen districts in Uttarakhand, out of which ten districts are totally or partially hill districts. Nainital and Almora in Kumaun region are the two highest producers of stone-fruits in Uttarakhand, as shown in Figure 5. In Nainital district, there are eight blocks out of which Ramgarh, Betalghat and Dhari blocks have the highest production of stone-fruits, as shown in Figure 6.
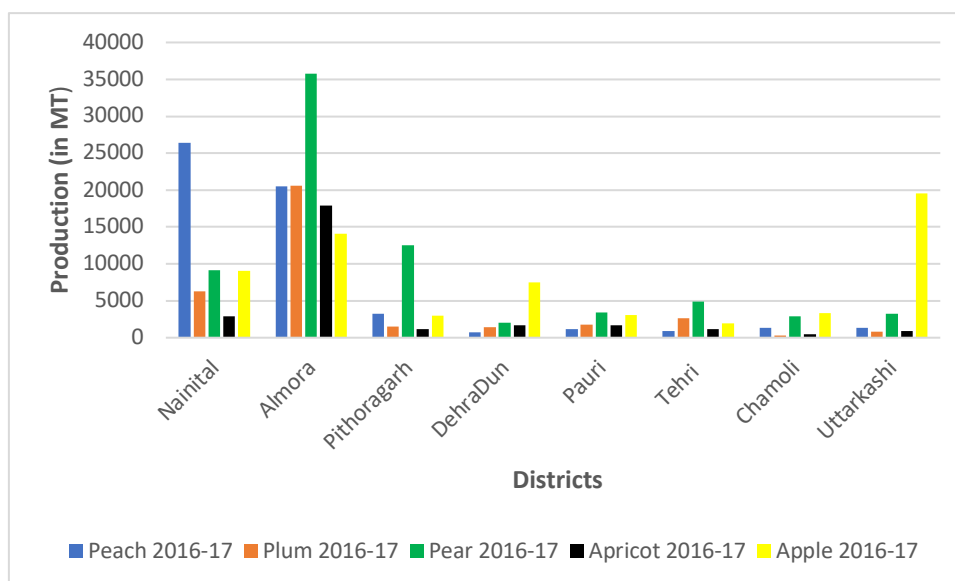
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Figure 5. District wise Production of Fruits in Uttarakhand. *Source: Directorate of Horticulture and Food Processing, Uttarakhand.*
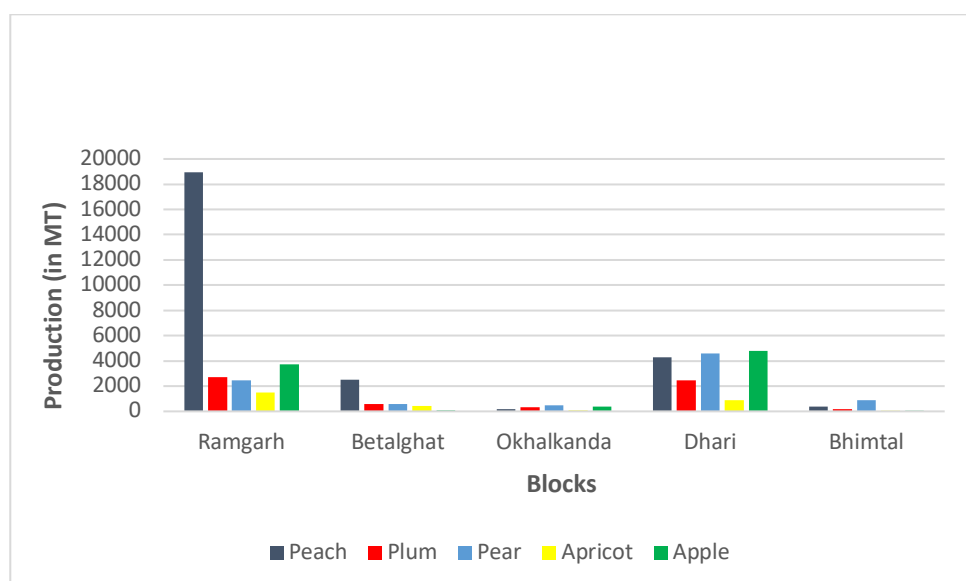

Figure 6. Block wise Production of Fruits in Nainital district of Uttarakhand. *Source: Directorate of Horticulture and Food Processing, Uttarakhand.*

From the orchards where these stone-fruits are grown, and harvested in the months of mid-May till August, they are transported to three main markets- Haldwani *mandi* in Uttarakhnad, Azadpur Market in Delhi and APMC Fruit Market in Mumbai. The fruits that reach these markets are graded according to their quality, with size being the only tangible quality parameter on the basis of which grading is done. Fruits of the best quality (largest size) are usually sent to Mumbai, medium-size fruits are sent to Delhi and small-size (lowest grade) fruits are sold in Haldwani. Although this is the prominent practice, yet it

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is not widespread. Farmers from remote villages or the ones distant from the market with poor connectivity even sell good grades of fruits in Haldwani *mandi* as the price they receive somewhat compensates for the fare that is to borne by the farmers in transporting fruits over long distance to Mumbai. Although there are no farmer cooperatives, yet most of the farmers (mostly small and marginal) collectively transport their harvest through trucks. Affluent farmers prefer to sell their harvest in Mumbai as the fruits are exported to other countries and therefore fetch higher price. Farmers either do not pluck the fruits on Fridays (as the *mandis* are closed on Saturday) or they sell these at throwaway prices in the nearest *mandis*, despite the grade of the fruit. There is high wastage, about 20-30 % of total produce, particularly for distant villages.

Data and Methodology

A comprehensive field survey was conducted in Nainital district of Uttarakhand. The district was chosen for three specific reasons. First, it has the second-highest area under the cultivation of stone-fruits in the state (highest in the production of peaches). Second, Nainital is the only district in Uttarakhand which has both plains as well as hilly terrain, the other districts of the state being either completely hilly or lying in the plain areas. Third, Haldwani *mandi*, the biggest agricultural market of Uttarakhand which deals with the maximum volume of fruits, vegetables and other crops is situated in Nainital district. Multi-stage stratified random sampling was conducted for the study. Two blocks, Ramgarh and Betalghat were chosen for the survey. Villages were taken as the First Stage Unit (FSU). Based on net area sown, twelve villages in Ramgarh and eight villages in Betalghat were chosen for the field survey. Stratification was done on the basis of (a) distance from the nearest town and (b) the SC and ST population in a village. Based on these parameters, six villages from Ramgarh were chosen out of which three were near and three were far from a given town. Similarly, four villages from Betalghat were chosen using this parameter out of which two were near and two were far from a given town. Likewise, on the basis of caste composition data of villages, six villages from Ramgarh were chosen out of which three had high and three had low share of SC and ST population. Similarly, four villages from Betalghat were chosen using this parameter out of which two had high and two had low shares of SC and ST.

Farmers were chosen as the second stage unit. At the village level, 10 farmers were chosen from each village on the basis of the size of their landholdings: 5 small and marginal famers (<25 *naali*[1]), 3 medium farmers (25-50 *naali*) and 2 large farmers (>50 *naali*). Total sample size consists of 200 farmers. The survey was done from October 20, 2018-March 30, 2019. This is shown in Table1. The distribution of the sample-size of farmers as per gender and category for Ramgarh, Betalghat and the overall study is shown in Table 2.

Size Class	0-25 *naali*	25-50 *naali*	50 *naali* and above
Sample Size	100	60	40

Table 1. Sample Distribution across Size Classes (all villages). *Note: 1 naal = 0.05 acre. Source: Field survey.*

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[1] 20 *naalis* = 1 acre. This is the standard unit for land classification in Uttarakhand where lands are fragmented and too small, mostly in the shape of terraces. The land records of government bodies also employ this unit for land details.

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Well-designed questionnaires pre-tested in a pilot study were employed to assimilate the data. The supply chain was traced in the forward direction. Since it was known beforehand that the bulk of the production of these farmers is sent to Haldwani and Delhi markets, the other actors of the supply chain, namely commission agents, transporters, wholesalers etc. were interviewed in these markets.

Ramgarh	General	SC_ST	Total
Male	96	23	119
Female	1	0	1
Total	97	23	120
Betalghat	General	SC_ST	Total
Male	68	10	78
Female	2	0	2
Total	70	10	80
	General	SC_ST	Total
Male	164	33	197
Female	3	0	3
Total	167	33	200

Table 2. Distribution of farmers according to gender and caste in Ramgarh block. *Source: Field survey.*

Results: Costs, Revenues and Profits

The cost of production has been divided into labour cost, cost for material (inputs), cost for credit and land rent. Table 3 shows the per kg production cost of fruits by an average household in a particular group. We see that the actual cost of production (C1) is 85.40, 88.94 and 87.72 rupees respectively across the three size classes. The cost is less for the largest size group. The other rows of Table 3 depict the implicit costs of cultivation. These include costs on imputed labour, imputed material and imputed credit. For all the costs C1, C2, C3 and C4, the costs are the least for the largest size group of land holding.

Size Class (naalis) Cost	0-25 naali	25-50 naali	50 naali and above
C1 (Actual Cost)	85.40	88.94	87.72
C2 (C1+Imp Labour)	125.72	130.63	127.48
C3 (C2+ Imp Material)	128.69	135.2	130.75
C4 (C3+Imp Land Rent+Imp Credit)	135.78	146.23	141.50

Table 3. Cost of Production (Rs/kg) across Size Classes (All Villages). *Cost in Rupees. Imp: imputed. Source: Calculations from primary survey.*

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Size Class (*naalis*) Cost	0-25 *naali*	25-50 *naali*	50 *naali* and above
Total Cost	85.40	88.94	87.72
Total Imp Cost	144.99	143.48	138.2
Labour Cost	20.95 (24.53)	20.91 (23.51)	22.76 (25.94)
Imp Labour Cost	43.70	41.78	37.20
Material Cost	59.56 (69.74)	62.38 (70.13)	57.96 (66.07)
Imp Material Cost	73.72	70.50	68.56
Interest Cost	4.56 (5.33)	5.20 (5.84)	6.65 (7.58)
Imp Interest Cost	15.12	16.53	17.24
Land Rent	0.32 (0.37)	0.45 (0.50)	0.35 (0.39)
Imp Land Rent	12.45	14.67	15.20

Table 4. Distribution of Costs (Rs/kg) across Size Classes (All Villages). *Cost in Rupees. Figure in brackets are percent of the total cost. Source: Calculations from primary survey.*

Size Class (*naalis*)	0-25 *naali*	25-50 *naali*	50 *naali* and above
Material Cost	**59.56 (100)**	**62.38 (100)**	**57.96 (100)**
Pre-Harvest Cost	**12.43 (20.86)**	**13.89 (22.26)**	**10.48 (18.08)**
Saplings	3.45 (5.7)	4.23 (6.78)	2.28 (3.93)
Pesticides/Fertilisers	6.75 (11.33)	7.05 (11.30)	6.75 (11.64)
Equipment	2.23 (3.74)	2.61 (4.18)	1.45 (2.50)
Post-Harvest Marketing Cost	**47.13 (79.13)**	**48.49 (77.73)**	**47.48 (81.91)**
Wood	18.63 (31.27)	20.28 (32.51)	21.78 (37.57)
Pine Leaves	8.45 (14.18)	9.30 (14.90)	8.14 (14.04)
Transportation	20.05 (33.66)	18.91 (30.31)	17.56 (30.29)

Table 5. Classification of Material Costs into Pre-Harvest and Post-Harvest (Marketing) Costs across Various. Land Classes (All Villages). *Figures in brackets are % of the total. Costs are in Rupees. Source: Calculations from primary survey.*

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Table 4 shows the distribution of costs across all land classes when these are classified into total cost, material cost, interest cost and`cost of land rent and these costs as a percentage of the total cost. From the tables, it is clear that material cost is the highest contributor in the cost of production, with the share ranging from 66-70%. This is followed by labour cost which has a share of 23-25%. Interest cost ranges between 5-8%.

Since material costs are the highest in the overall cost of production, we categorise it further to see the components and their respective share in the material cost. We have divided the market costs into two components- pre-harvest cost (which includes cost on buying new saplings, pesticides, fertilisers and equipment), and post-harvest cost or marketing cost (which comprises cost on wood planks or *baardaana* for making packing boxes, pine leaves or *peerul* for providing cushion to the fruits while transportation takes place and the cost of trucks for transporting the fruits to the markets. This is shown in Table 5 from where we see that across all the land classes, pre-harvest costs form a tiny proportion of the total costs with a share of around 10-13%. On the other hand, more than three-fourths of the total material cost is dominated by post-picking cost or marketing costs. Both transportation and wood consist of the highest costs which together comprise about 65% of the total marketing cost. Cost on pine leaves is about 8-9% of the marketing cost. All these marketing costs are higher than the individual components of pre-harvest cost, showing it takes more money for the farmers to get the produce to the market rather than in producing it.

Table 6 discusses the revenues and profits of the farmers across all land classes. Average price (or price) in the table is the sum of the prices received by the farmers at different periods of time by selling various quantities of fruits divided by the quantity sold in the given time period. This is shown in the second row of Table 6 and we see that farmers in the largest land class get the highest revenue per kg. We see that average revenue is highest for the largest land classes (128Rs/kg) which means that farmers with larger landholdings receive better price for their produce. The actual profits received (difference between revenue and actual cost) is shown in the third row of the table (X1). We see that farmers with the largest land classes receive the highest monetary profits. We then start calculating profits after accounting for imputed cost on labour, material and land and credit. From the table, we see that the profits after accounting for imputed labour are positive only for the largest land class. This too is a very small amount of 0.30 rupees. Profits become negative for all land classes after accounting for imputed costs. The least amount of loss is faced, expectedly by the farmers from the largest land class.

Size Class (*naalis*) Profit	0-25 *naali*	25-50 *naali*	50 *naali* and above
Price (per kg) : P	112.50	114.33	128.08
Profit Actual: X1	27.10	25.39	40.36
Profit (X1+Imp Labour): X2	-13.22	-16.30	0.30
Profit (X2+Imp Material): X3	-16.19	-20.87	-2.67
Profit (X3+Imp Land+ Imp Credit): X4	-23.28	-31.90	-13.42

Table 6. Average Price Received and Profit accrued (Rs/kg) across Size Classes (All Villages). Price and Profit in Rupees. *Source: Calculations from primary survey.*

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Conclusion

This study finds that farmers involved in the cultivation of stone fruits in Uttarakhand earn positive nominal profits, but these quickly become negative when implicit costs on labour, material etc are accounted for. Also, large farmers fare comparatively better compared to their small counterparts. We find that post-harvest marketing costs are the highest contributor in costs, implying it is difficult for the farmer to take his produce to the market than to produce it. Improving market accessibility in terms of expansion and other opportunities like better infrastructure can help farmers reduce the costs and earn better profits, but many factors act as impediment in this direction.

Observations from the field study show that labour shortage has become an important issue in the cultivation of stone-fruits. While earlier, there was an abundance of labour supply which kept the wages at bay, these wages have increased in the past years. Many workers have shifted to employment in the construction sector where they are paid comparable wages for most part of the year, as compared to in agriculture, where their demand is only seasonal. A rampant increase in real estate projects in the rural areas has driven most of the labour force away from agriculture. Also, migration of the young male workforce from the villages to the urban areas in search of job opportunities has also caused a dearth of agricultural labour, thus driving up their wages and increasing the cost of production of the farmers. While most of the labour activities are not particularly skill-intensive such as spraying fertilisers, plucking the fruits, transporting etc, but there are certain jobs which can only be performed by skilled labour, such as pruning the trees, grading and packing the fruits. These skill-intensive activities are paid higher price as compared to the unskilled activities. But, the dearth of labour has resulted in an increase in wages for both of them. As a result, all farmers have to employ their family labour, including females and children in the agricultural activities. Thus, the implicit labour costs are high.

Other observations suggest that farmers are completely dependent on intermediaries to market their produce because of a variety of reasons. The most important reason behind this is the lack of physical infrastructure in terms of cold-stores and agro-processing units. There are virtually no cold chains that can store the fruits for some time and increase the window of the stone fruits availability in the market, thereby ensuring better price to the farmers. Since these fruits are of a highly perishable nature, this coupled with an absence of storage facilities causes distress sale on part of the farmers who are in need of immediate cash post the harvesting season. Also, fruits are transported in regular trucks and not the refrigerated ones. It takes one day for the fruits to reach Haldwani, two days to reach Delhi (Azadpur) and up to four days to reach Mumbai (Fruit market APMC). Farmers have to bear the entire loss if product is damaged due to temperature, moisture, animals or other reasons. Also, there are no processing industries in the region. Private buyers, NGOs buy only the best grade, but in small quantities from the farmer (20-50 kilogram maximum for the entire season). Farmers are often reluctant to sell to these actors as they prefer to dump their entire harvest in *mandis* where the traders buy large quantities (40-60 kg every day from every farmer) throughout the season.

Also, there is high dependence of the farmers on the traders for credit- both for agricultural and non-agricultural purposes. Although credit forms a small component of the total costs in our study (5-7%), we find that about 78% of the farmers in our sample had taken loans from intermediaries whereas only 12% of the farmers had borrowed from formal sources such as government banks or cooperatives. Also, farmers from the smallest land class borrow the most from intermediaries (40%), and large farmers borrow the least (4%). Small farmers enter into informal contracts with the traders who provide the farmers with help- both in cash (for agricultural activities as well as for functions like marriages) and in-kind (in the form of inputs like fertilizers, pesticides, wooden planks for packing the fruits, or in the form

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of ration to feed the family during slack season). In lieu of this, farmers are bound to sell their harvest to the traders. Also, because these traders deal in bulk and help the farmers dispense-off their produce quickly in the absence of storage amenities, farmers prefer to deal with them over government procurers or non-government organisations that specialise in agro-processing, even if this implies additional cost in the form of the commissions of traders and transporters. Finally, there prevails an information asymmetry between the farmers and traders. Farmers have to accept whatever price is quoted for the fruits by the traders in the mandis. There is no way to verify the price and even if it is done, farmers are bound to the traders by informal contracts in lieu of the credit. There are important policy implications of the findings- an urgent need to develop storage and food-processing infrastructure that will be as helpful to the farmers as the roads that help in improving market accessibility. Also, ICT tools such as cell phones can do little to increase farmers' profits, if not done in conjunction with an improvement in credit-lending and agricultural marketing institutions.

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