

RESEARCH PAPER

Exploring Constraints in Risk Management Practices: A Study of Apple Growers in Himachal Pradesh, India

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ABSTRACT

This study investigated the socio-economic characteristics and constraints faced by apple growers during adopting risk management practice in Himachal Pradesh. Data were collected from 432 farmers across eight blocks through a multi-stage sampling technique. The demographic profile revealed that 94.2% of respondents were male with 67.5% engaged in farming as their primary occupation. Education levels varied, with 26.4% of respondents completing senior secondary education. The majority of farmers (54.5%) had small landholdings of less than one hectare. In terms of income, 39.6% of farmers earned between ₹ 2 and ₹ 4.5 lakh yearly from apple cultivation, while 32.9% earned more than ₹ 4.5 lakh. The study highlighted several important constraints that limit farmers' capacity to increase productivity while mitigating risk. Marketing difficulties were mostly caused by delayed payments in contract farming (mean score 3.67), which had a substantial impact on the financial stability of farmers with smaller land holdings. Herbicide and plant protection expenditures were among the production obstacles, with a mean score of 4.44 reflecting farmers' concerns about environmental implications. Additionally, limited access to technical advice and the mismatch of available guidance with local farming conditions further exacerbated the challenges faced by farmers. This study highlights the critical need for improved marketing structures, financial assistance, and targeted technical coaching to support Himachal Pradesh apple producers in increasing resilience and optimizing farm management practices. Addressing these obstacles is crucial to increasing the region's apple agricultural sustainability.

HIGHLIGHTS

- Apple growers in Himachal Pradesh face challenges like delayed payments, high production costs and limited access to technical support, which affect their ability to manage risks effectively.
- The study suggests improving marketing systems, providing timely financial support, and offering targeted technical training to help farmers overcome these challenges and sustain apple farming.

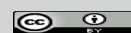
Keywords: Apple cultivation, risk management, socio-economic constraints, Himachal Pradesh, farmers' productivity

Horticulture is a critical component of India's agricultural economy, contributing considerably to economic growth and food security while accounting for around 33% of gross agricultural value added (GVA) (Department of Agriculture & Farmers Welfare, 2024). Consumers' growing preference for fruits and vegetables has resulted in increased demand for horticulture products. As a result,

farmers are moving focus away from conventional food crops and into higher-value horticulture crops, in line with the population's changing nutritional choices. Apple growing has emerged as a major

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agricultural industry in Himachal Pradesh, often referred to as the “Apple State of India” produces nearly 34 varieties of tropical and temperate fruits (Kaur, 2019). Apple holds the dominant position by occupying about 49 per cent of the total agricultural area and 79 per cent of the whole fruit production of the state (Negi, 2020). Districts like Shimla, Kinnaur, Kullu, and Mandi have perfect climates for large-scale apple farming. This has turned apple cultivation into a vital source of revenue for the local inhabitants, propelling the state’s rural economy (Singh and Vatsa, 2015).

Despite its importance, apple production in Himachal Pradesh confronts a number of challenges that affect both output and profitability. These risks are widely characterized as production, marketing, institutional, personal, and financial hazards (Ali and Kapoor 2008). Unpredictable weather patterns, insect outbreaks, and diseases such as powdery mildew and San Jose scale all offer substantial challenges to apple harvests. Furthermore, Himachal Pradesh apple producers face additional hurdles due to a lack of availability of high-quality rootstock, manpower constraints, price volatility and inadequate storage facilities during peak harvest seasons cause increased input costs and force farmers to sell their goods at cheap rates, resulting in lower profitability (Kireeti and Sharma 2017; Thakur *et al.* 2022).

To mitigate these risks, Farmers use a variety of risk-mitigation tactics, ranging from informal methods like crop diversification to formal ones like insurance and contract farming. However, socioeconomic factors such as education level,

income, and resource availability often limit their capacity to apply these tactics (Saleh *et al.* 2016; Thakur *et al.* 2020). Understanding how these elements influence farmers’ risk perceptions and decisions is critical for creating successful risk management solutions. The study was conducted to investigate the socioeconomic profile of apple growers and identify the major challenges they face while implementing risk management strategies. Understanding these difficulties allows politicians and agricultural professionals to implement tailored measures to help apple producers and improve the industry’s sustainability.

METHODOLOGY

The study was conducted in Himachal Pradesh (Table 1) which is divided into four major crop zones low hill subtropical, mid-hill sub-humid, high hill temperate wet, and high hill temperate dry zone based on the agro-climatic conditions of the state. A high hill temperate wet and dry zones was selected for the study since this region occupies 77.30 per cent of total apple cultivated area and 84.42 per cent of total apple production of the state. A multi-stage sampling technique was adopted to select respondents, ensuring representation from apple-dominant zones and effectively managing the geographically diverse population.

In the first stage, eight blocks, namely Jubbal & Kotkhai, Theog, Rohru, Narkanda, Kullu, Nagar, Pooh and Kalpa, were selected on the basis of highest apple production (2022-23) out of the 25 blocks falling in temperate region of Himachal Pradesh. In the second stage, 10 Per cent panchayat

Table 1: Sample design outlay for the study

High hill temperate wet zone		Total No. of Panchayat	Selected No. of Panchayat	Number of respondents
1	Jubbal & Kotkhai	51	5	60
2	Theog	59	6	72
3	Rohru	37	4	48
4	Narkanda	28	3	36
5	Kullu	76	8	96
6	Nagar	49	5	60
Temperate Dry Zone				
1	Pooh	27	3	36
2	Kalpa	24	2	24
Total		351	36	432

from each block was selected randomly, in the third stage from selected panchayat 12 apple growers were selected through snowball sampling due to the dispersed nature of apple growers and the challenges of accessing comprehensive grower lists.

Thus, making a sample size of 432 apple farmers.

RESULTS AND DISCUSSION

Socio-personal profile of Apple growers

The study of socio-personal variables (Table 2) showed that the demographic composition was predominantly male, with 94.2% of the surveyed farmers being men, and only 5.8% were women.

Table 2: Socio-personal profile of Apple growers (n=432)

Sl. No.	Particulars	Category	Frequency	Percentage
1	Gender			
		Male	407	94.2
		Female	25	5.8
2	Marital Status			
		Married	409	94.7
		Unmarried	23	5.3
3	Age			
		Under 20 years	17	3.9
		21-30 Years	81	18.8
		31-40 years	137	31.6
		41-50 years	132	30.6
		51-60 Years	62	14.4
4	Education			
		Above 61 Years	3	0.7
		No formal education	35	8.1
		Upto Primary	84	19.4
		Upto Matrix	85	19.8
		Senior Secondary	114	26.4
5	Land holding			
		Graduation	100	23.1
		Post Graduation	14	3.2
		Less than 1 hectare	236	54.5
		1.01-2 hectare	126	29.2
		2.01-4 hectare	40	9.3
		4.01-10 hectare	28	6.5
		More than 10 hectares	2	0.5

6	Income (Apple farming)		
	Less than 1 lakh	11	2.5
	1-2 lakh	108	25.0
	2 - 4.5 lakh	171	39.6
	More than 4.5 Lakh	142	32.9
7	Family Size (Numbers)		
	1-3 Members	42	9.7
	4-6 Members	245	56.8
	7-9 Members	112	25.9
	Above 9 Members	33	7.6

Most respondents were married (94.7%), while 5.3% were unmarried. The majority of farmers were in the middle age group, with 31-40 years constituting 36.6%, followed closely by the 41-50 age group at 30.6%. Younger farmers, under the age of 30, made up 22.7%, while 3.9% were under 20, and a very small proportion were over 61 years. Regarding education, 26.4% of respondents had completed senior secondary school, 23.1% were graduates, and 8.1% had no formal education. Most of the farmers were marginal (54.5%) and small (29.2%) had landholdings of less than 1 hectare and between 1.01-2 hectare respectively. In terms of income, 39.6% earned between ₹ 2 to ₹ 4.5 lakh annually from apple farming, with 32.9% earning more than ₹ 4.5 lakh. Family size was typically between 4-6 members for 56.8% of the respondents.

Table 3: Socio-economic profile of farmers (n=432)

Sl. No.	Particulars	Category	Frequency	Percentage
1	Selling method			
		By agent	176	40.7
		Through contract farming	7	1.6
		Direct sale	232	53.8
		Retail sale	11	2.5
		Selling in APMC	6	1.4
2	Social Participation			
		Yes	102	23.6
		No	330	76.4
3	No. of worker in farm			
		1	29	6.7
		2	180	41.7
		3	67	15.5
		4	63	14.6

	More than 4	93	21.5
4	Irrigation source		
	Drip irrigation	16	3.7
	Sprinkler	1	0.2
	Rainfed	415	96.1
5	Training availed		
	Yes	138	31.9
	No	294	68.1
6	Experience (years)		
	Less than 1 year	1	0.2
	1-5 years	6	1.4
	6-10 years	21	4.9
	More than 10 years	403	93.5
7	Occupation		
	Only farming	291	67.5
	Farming and livestock	46	10.6
	Farming and business	46	10.6
	Farming and service	49	11.3

The socio-economic profile (Table 3) showed that the majority of farmers (53.8%) preferred direct sales for their produce, while a smaller portion used agents (40.7%), and very few engaged in contract farming (1.6%). The study also found that most farmers (76.4%) did not participate in social activities. Regarding labour, two workers were most commonly employed (41.7%), while farms with more than four workers constituted 21.5%. Irrigation was predominantly rainfed (96.1%), with minimal adoption of modern techniques such as drip irrigation (3.7%). Additionally, only 31.9% of farmers availed themselves of formal agricultural training, leaving the majority (68.1%) without training. The study found that 93.5% of farmers had

more than 10 years of experience, while very few (0.2%) had less than 1 year of experience. Farming alone was the primary occupation for 67.5% of farmers, while others supplemented their income with livestock rearing, business, or service.

Constrains faced by apple growers in managing risk

Apple grower's practices different adaptation strategies timely to cope with various risks. In this process they face various constraints in adaptation in their field and these constraints (Table 4) faced by farmers were categorised into marketing, production, socio-economic and technical constraints.

Marketing Constraints

Farmers' marketing constraint (Table 4) showed important challenges that limit their capacity to enhance farm operations and maximize profitability. The most important limitation discovered was payment delays and late delivery of inputs in contract farming, with a mean of 3.67 and a TWS of 1588, ranking first among marketing constraints. Around 54.5% of apple growers have small landholdings of less than 1 hectare, therefore delays can significantly undermine farmers' financial security, since they rely on prompt payments to reinvest in the next crop cycle. Similarly, delayed input delivery disrupts the timing of agricultural activities such as planting and harvesting, thereby reducing crop output and quality. Another important concern in contract farming is uneven negotiating power between farmers and purchasers (mean 3.65, TWS 1581). Farmers, especially those with smaller landholdings or who sell through intermediaries, sometimes find themselves in a disadvantaged negotiating position. This imbalance leads to

Table 4: Constrains faced by apple growers in managing risk (n=432)

Sl. No.	Particulars	Mean	Sd.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	TWS	Rank
Marketing Constraints										
1	Negative influence of insurance officials.	3.02	0.71	12	78	251	90	1	1306	III
2	Contract farming leads to unequal bargaining power between farmers and buyers.	3.65	0.87	76	173	143	40	0	1581	II
3	Delays in payments and late delivery of inputs are common in contract farming.	3.67	0.91	89	159	140	43	1	1588	I

contracts that may not completely represent fair market prices, and farmers have little bargaining power to demand better terms. Furthermore, negative impact from insurance authorities comes third most important constraints with a mean score of 3.02 and a TWS of 1306. These concerns are exacerbated by the fact that the majority of farmers (53.8%) rely on sales directly, leaving them more vulnerable to market volatility without the buffer of steady pricing that contract farming may provide. However, only a tiny proportion (1.6%) of farmers engage in contract farming due to different perceived obstacles, complicating their marketing tactics. According to demographics, farmers with low social participation (76.4% do not belong to farmer groups or cooperatives), which limits their collective bargaining power and access to market information, making them more vulnerable to these issues. Market constraints, such as price volatility, financial risks, and losses due to inadequate infrastructure, have been identified by (Ali & Kapoor, 2008; Anap *et al.* 2014; Bhat *et al.* 2019; Wani & Songara, 2019; Shah *et al.* 2022; Thakur *et al.* 2023), particularly in regions such as Himachal Pradesh, where high transportation costs and limited storage facilities impede market access.

Production Constraints

The production constraints (Table 5) emphasized many major obstacles that apple producers confronted when using risk management strategies. The most important limitation was the use of herbicides that contribute to air, water, and soil pollution, which ranked first with a mean score of 4.44 and TWS of 1919. This issue reflected farmers' increased understanding of the environmental effect of their agricultural techniques, as well as the possible long-term harm to soil health and crop quality. Furthermore, need-based plant protection measures being an expensive technique ranks 2nd, with a mean score of 4.24 and a TWS of 1833, showing that while these measures are required for crop health, the financial burden they inflict is significant. The high prices of insecticides, fertilizers, and other inputs make it especially difficult for small and marginal farmers, who account for the vast majority of respondents (54.5% own less than one hectare of land). The high cost of foliar spray as a long-term fertilizing strategy (mean 4.08, TWS 1765) adds to this financial burden, making it difficult for these farmers to invest in sustainable practices regularly. Another significant obstacle is the high expense of constructing windbreaks and shelter

Table 5: Constrains faced by apple growers in managing risk (n=432)

Sl. No.	Particulars	Mean	Sd.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	TWS	Rank
Production Constraints										
1	Treated rootstock has a limited shelf-life.	3.51	0.61	15	206	199	12	0	1520	VIII
2	Hybrid seeds need to be produced every year.	3.62	0.72	39	213	160	18	2	1565	VI
3	Foliar spray is an expensive method of fertilizing plants in the long run.	4.08	0.74	131	217	74	10	0	1765	III
4	Need-based plant protection measures are time and energy-consuming.	3.81	0.72	69	227	124	12	0	1649	V
5	Need-based plant protection measures are an expensive method.	4.24	0.74	179	185	63	4	1	1833	II
6	Use of herbicides contributes to air, water, and soil pollution.	4.44	0.69	240	145	45	2	0	1919	I
7	Mulching materials like plastic films are costly and unaffordable for everyone.	3.59	0.80	57	175	169	31	0	1554	VII
8	Availability of mulching materials like compost and manure is limited.	2.87	0.93	29	66	171	155	11	1243	IX
9	Wind breaks and shelter belt structures are costly to build.	3.90	0.79	103	199	118	10	2	1687	IV

belt structures (mean 3.90, TWS 1687), which are critical for protecting orchards from poor weather conditions, particularly in areas prone to strong winds or temperature fluctuations. Farmers also identified the time and energy-consuming nature of need-based plant protection measures (mean 3.81, TWS 1649), which contributes to the labor-intensive nature of apple farming, particularly since a significant portion of farmers (41.7%) manage their farms with only two workers, limiting their ability to efficiently implement such measures. The study discovered that producing hybrid seeds every year (mean 3.62, TWS 1565) is another problem, as it adds ongoing expenditures, while the cost of mulching materials like plastic films (mean 3.59, TWS 1554) further burdens the farmers' financial resources. Finally, the limited shelf life of treated rootstock (mean 3.51, TWS 1520) and the limited availability of mulching materials like compost and manure (mean 2.87, TWS 1243) highlight the logistical and resource constraints that complicate the adoption of more sustainable farming practices. These production constraints are exacerbated by the fact that 96.1% of the farmers rely on rainfed irrigation, making their farming practices highly dependent on unpredictable weather patterns. Furthermore, 68.1% of the farmers have not availed any training, which may limit their awareness of more efficient or cost-effective production techniques. These production constraints are further impacted by

natural growth process and uncertainties such as weather variability, pests, and diseases, all of which can have a major impact on crop yields (Komarek AM *et al.* 2020). Furthermore, high input prices and a lack of technical expertise in both production and quality assurance provide substantial hurdles (Ali and Kapoor, 2008). Traditional farming techniques, low technology levels, and labor shortages are major production constraints that influence adaptation strategies (Khan *et al.* 2020), while environmental risks and insufficient labor and financial resources also impede productivity (Anap *et al.* 2014; Wani and Songara, 2019). Furthermore, obstacles associated with the creation of apple orchards, such as inadequate planning and inappropriate management techniques, reduce total output.

Socio-Economic constraints

Socioeconomic constraints (Table 6) provide considerable challenges for apple growers, limiting their ability to control risks and implement management methods. One of the most pressing difficulties, as represented in the highest-ranked statement, is untimely crop insurance (mean score 4.28), which delays critical financial assistance when farmers need it following crop failure. This issue is particularly difficult for small-scale and marginal farmers (83.7%), who frequently lack alternative financial means to deal with delays.

Table 6: Constrains faced by apple growers in managing risk (n=432)

Sl. No.	Particulars	Mean	Sd.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	TWS	Rank
Socio-economic Constraints										
	Red tapism hampers the insurance process.	3.25	0.74	17	136	221	57	1	1407	V
	The process of crop insurance is too lengthy and hectic.	3.04	0.77	7	110	219	88	8	1316	VII
	Crop insurance registration is complex.	3.22	0.77	11	152	200	63	6	1395	VI
	Crop insurance benefits are not available on time.	4.28	0.76	186	197	35	12	2	1849	I
	Premium rates in crop insurance are high.	3.79	0.75	73	214	129	16	0	1640	IV
	Limited credit limit under KCC.	3.83	0.85	89	217	94	29	3	1656	III
	It is financially infeasible to visit the KVK regularly	2.43	0.81	4	51	104	245	28	1054	VIII
	Diversification is difficult for farmers to adopt.	4.03	0.96	158	177	58	33	6	1744	II

High crop insurance premium rates (mean score 3.79) also worsen the situation, since many farmers, particularly those with small landholdings, find it financially impossible to cover their crops, leaving them subject to production and market hazards. Another significant constraint identified by the study is the limited credit limit under the Kisan Credit Card (KCC) scheme (mean score 3.83), which hinders farmers' ability to invest in risk mitigation strategies such as irrigation systems, high-quality seeds, or crop diversification. Furthermore, the bureaucratic red tapism involved in the insurance process (mean score 3.25) and the complex registration requirements (mean score 3.22) discourage many farmers from fully utilizing crop insurance programs, particularly those with lower levels of education or limited exposure to formal financial systems. These concerns are exacerbated by the fact that applying for and claiming crop insurance is generally time-consuming and stressful (mean score 3.04), preventing farmers from participating in these schemes. Another key socioeconomic limitation for apple farmers is the difficulty in adopting diversification, which is ranked as the second most important by respondents (mean 4.03, TWS 1744). Diversification, which might possibly offer farmers with a buffer against changing market and weather circumstances. Farmers face financial, technological, and informational challenges when attempting to diversify their agricultural methods. Furthermore, visiting Krishi Vigyan Kendras (KVKs) for technical guidance or training is financially prohibitive for many farmers, particularly those from distant or economically challenged regions (mean score 2.43). Because of their lack of regular involvement with

agricultural extension services, some farmers miss out on essential risk management advice. These risks arise from socioeconomic variables such as changes in labor availability, market access, and overall economic conditions, all of which have an impact on agricultural outcomes (Ali and Kapoor, 2008; Thakur *et al.* 2024). Farm households have identified poverty, poor education levels, a lack of assets, credit restrictions, and unfavorable land tenure patterns as the key socioeconomic constraints limiting their adaptation choices (Khan *et al.* 2020). Financial limitations significantly limit farmers' ability to invest in their fields (Anap *et al.* 2014; Wani and Songara, 2019). Furthermore, farmers' poor educational status, lack of financial assistance, and restricted access to supplies such as fertilizers and pesticides all reduce farming efficiency (Shah *et al.* 2022).

Technical constraints

Technical constraints (Table 7) pose significant challenges for apple farmers, impacting their ability to effectively implement best practices and enhance productivity. A major concern, highlighted by the highest-ranked statement, is the lack of accessible technical advice in remote areas (mean score 3.28). This deficiency means that many farmers cannot obtain timely and relevant guidance on crop management, pest control, and risk management practices, which are crucial for optimizing yields and minimizing losses. The unavailability of technical support is particularly detrimental to small-scale farmers, who may lack the resources or knowledge to make informed decisions independently. Another notable issue is that the technical advice available is not always perceived as helpful (mean score

Table 7: Constrains faced by apple growers in managing risk (n=432)

Sl. No.	Particulars	Mean	Sd.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	TWS	Rank
Technical Constraints										
1	Technical advice is not available in remote areas.	3.28	0.80	14	174	169	72	3	1420	IV
2	Technical advice is not always helpful.	3.39	0.85	30	183	149	67	3	1466	III
3	The distance to SAU is a significant barrier for farmer	3.71	0.70	53	215	153	11	0	1606	I
4	Research stations' findings and recommendations are not easily accessible or applicable to local contexts	3.56	0.80	44	201	145	41	1	1542	II

3.39). Farmers often find that the recommendations provided do not align with their local farming conditions, leading to dissatisfaction after following the guidance. This mismatch highlights the need for localized and context-specific information that addresses the unique challenges faced by farmers in different regions. The further study found distance to State Agricultural Universities (SAUs) as a significant barrier for farmers seeking support (mean score 3.71). Many farmers lack the means to travel to these institutions, limiting their access to critical research findings and recommendations. Additionally, the information disseminated by research stations is often not readily accessible or applicable to local contexts (mean score 3.56). This disconnects between research and practice hampers farmers' ability to implement innovative techniques that could mitigate risks. The technical constraints perceived by farm households affecting their adaptation strategies include inadequate information on climate change and insufficient government support, as identified by Khan et al. (2020). Technical limitations include a lack of knowledge and inadequate government funding for education (Anap et al. 2014; Thakur et al. 2023). Furthermore, Wani and Songara (2019) and Shah et al. (2022) have identified restricted distribution of novel agricultural technology and a lack of access to contemporary farming instruments as important technical challenges. Addressing these technical barriers is critical to increasing the overall productivity and sustainability of apple cultivation in the region.

CONCLUSION

In conclusion, the study emphasizes the numerous constraints that apple producers confront, which limit their capacity to control risks and increase output. Farmers with marginal and small landholdings have especially difficult marketing challenges, such as delayed payments and late supply of inputs in contract farming. These farmers also have less negotiating leverage, which frequently results in unequal contracts. The majority of production difficulties are financial and environmental. Herbicide usage and the high expense of required plant protection measures place further strain on small farmers, who already have limited resources. Socioeconomic barriers worsen the situation,

particularly with the difficult and expensive crop insurance procedure. High premiums and restricted financing availability prohibit many farmers from engaging in risk management, leaving them susceptible to market fluctuations and crop disasters. Technical restrictions also impede farmers, particularly those in distant locations who lack timely, practical guidance on crop management. The disparity between research and actual farming techniques makes it more difficult for them to implement innovative ways that may assist. In short, overcoming these challenges requires a coordinated effort. Improving access to timely payments, affordable insurance, expert advice, and strong institutional support can help farmers better handle the various risks.

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