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Perceived Constraints in High-Density Apple Cultivation by the Farmers of the Mid-Hills Area of Himachal Pradesh

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Abstract

The study was carried out in area of Kandaghat and Solan blocks of Himachal Pradesh, India from November 2021 to April 2022 to study the constraints in high-density apple cultivation by the farmers of the mid-hills area of Himachal Pradesh, India. The present study fully relied on the primary data through a properly structured schedule for the production year 2021–2022, with a sample size of 60 farmers involved in high-density apple plantations. Garret's ranking technique was used to find constraints perceived by the high-density apple cultivators. The objective of the research was to identify the prevailing problems of the high-density apple sector in the selected area. In this study the major problems faced by the high-density apple growers in production were the high cost of high-density apple plants, followed by identifying the disease, costly labor, and lack of technical guidance. Major marketing-related constraints expressed in the marketing of high-density apples were the problem of fluctuation of price, the high price of transportation, distant market, and high commission charges, further the data revealed that the major environmental and other related constraints were that the grading process and certification process seemed to be costly, problems from hailstorms were also found. The study also highlighted the need of proper marketing facilities as marketing helps in improving the living standard and eliminate the constraints in product and services.

Keywords: Garrets ranking technique, mid-hills, production constraints

1. Introduction

India is the fifth-largest apple grower in the world, and nearly all of it comes from the three Himalayan regions of Jammu and Kashmir, Himachal Pradesh, and Uttarakhand (Dewan, 2017). The area planted with this crop has significantly increased over the past 50 years in the state of Himachal Pradesh, which is renowned as the "apple bowl of India" (Anonymous, 2017). The apple is the most important temperate fruit crop in India's northern Himalayan region. For instance, it accounts for 643.85000 t of the state of Himachal Pradesh's apple fruit production and 114.65000 ha of territory currently under apple fruit cultivation (Anonymous, 2021). The cultivation of apples is thought to be the best way to utilize the natural resources of the hills because it offers significantly better compensation than field crops, generates more income and employment, and as a result, has led to the farming industry shifting its focus from field crops to horticulture (Samriti et al., 2021). The fruit-growing industry is evolving quickly. Choosing the ideal procedure can be challenging for a fruit grower (McKenzie and Rae, 1978).

A wide variety of temperate fruits can be grown in Himachal

Pradesh's dry temperate climate (Mehta et al., 2013). According to Gangwar et al. (2008), temperate fruit is crucial in boosting farmers' economies. The socioeconomic situation of rural populations in the High Hills region of the State has been completely changed by apple cultivation (Sharma et al., 2018).

In the past 60 years, a high-density plantation system that uses dwarf trees with close spacing has replaced the traditional production system that used standard trees with wide spacing (Robinson, 2011). Global trends demonstrate that a high-density plantation system's intensification in plantations leads to higher yield and production per unit area (Dhiman, 2018). A novel cultivation method called high-density planting allows for the accommodation of more plant's unit⁻¹ area than is possible with traditional planting density (Goswami et al., 2014). The advent of high-density apple orchards may be one of the most significant changes to apple production methods. Early and consistent quantities of high-quality fruit are capable of being produced by these orchards. The best possible use of the work force will be made possible by high-density orchards, ensuring an efficient operation (Heinicke, 1975). When compared to conventional spacing, a high-density plantation



achieved a much higher yield unit⁻¹ area without sacrificing fruit size or quality (Kumar et al., 2021). Crop production and product quality can both be improved by irrigation. In apple orchards with large human concentrations, the importance of water interactions is significantly greater (Jiang and He, 2021). High-yielding, high-yielding efficiency, and quality food production are possible with high-density planting techniques, enabling an earlier investment return. Early production also gives growers of new cultivars opportunities, which benefit from greater pricing. Because of this, growers in Europe and America have embraced high-density planting greatly during the past 30 years (Werthein et al., 2001; Hampson et al., 2002). Although the establishment costs for these high-density orchards are significantly higher, which makes their adoption difficult, the shorter break-even year results in early profitability, which lowers the interest cost and produces early returns (Hassan et al., 2020). High-density orchards use 70–80% less fertilizer and pesticides (Jahangeer, 2019), it is important to consider the vigour and productivity unit⁻¹ area when choosing plant varieties and plant densities (Srivastava et al., 2017). After being planted, the high-density orchard bears fruit within two to three years and maintains a high tree density of more than 1500 trees a⁻¹ (Shubhi, 2013).

Determining a tree's size and fruit-producing potential using this factor is the most popular and reliable method (Jimenez and Diaz, 2004; Wright et al., 2006). Primary Thinning within 28 days after Full Bloom in conjunction with Secondary Thinning for determining crop load within 60 days After Full Bloom is the preferred method for obtaining "Fuji" fruits of the desired size, quality, and quantity (Koike et al., 2003). In addition, HDP maintenance necessitates consistent technical assistance, stringent training, pruning, and chemicals to maintain optimum growth (Majid et al., 2018). Kireeti and Sharma (2017) in their paper have explained that problems like the poor state of the roads and the issues facing apple growers in Himachal Pradesh go hand in hand. Additionally, they said that dealing with persistent traffic jams, a lack of trucks, and issues related to post-harvest loss had made produce marketing a nightmare for growers.

There is a need to identify the prevailing problems faced by the apple growers to find out the required measures to overcome the problems, so the objective of the research is to determine the perceived constraints of high-density apple growers in the mid-hill's areas of Himachal Pradesh.

2. Materials and Methods

The research area was located in the Solan district which falls under the mid-hills' zones of Himachal Pradesh, India from November 2021 to April 2022. The area was selected purposively because of its wider adaptability for growing high-density apples. The primary data was obtained through the use of a pre-tested structure schedule administered to farmers selected by multistage random sampling.

In the first stage, two blocks out of five blocks that were Solan of latitude and longitude of 30.904486 and 77.096733, and Kandaghat having latitude and longitude of 30.9702143 and 77.1053673 were selected on the basis of the maximum area under high-density apple farming in all the blocks. In the second stage, a list of villages growing high-density apples from selected blocks was prepared. From this list, three villages from each selected block were taken randomly, thus six villages were selected from the two blocks. In the third stage, a sample of ten farmers from each selected village was selected by adopting the probability proportional to size method, thereby a sample of sixty farmers was selected for the study.

Garrett's Ranking Technique was used to prioritize the imminent challenges/constraints.

2.1. Garrett ranking technique

Respondents were asked to rank them according to their degree of importance such that the most important factor will be ranked first. To find out the most significant factor influencing the respondent, the outcome of the rankings was converted into percent position by using the

Following formula:

$$\text{Percentage position} = (100 \times (R_{ij} - 0.50) / N_j) \dots\dots\dots (1)$$

Where R_{ij} = Rank given for the i th variable by j th respondents

N_j = Number of variables ranked by j th respondents.

The percent position estimated was converted into scores with the help of Garrett's Table. The scores of each individual rank corresponding to that particular factor were added and the mean values of the score were calculated. The factors the having highest mean value has to be considered to be the most important factor.

3. Results and Discussion

3.1. Constraints and challenges

Important constraints being faced by the farmers practicing high-density plantation in the apple in the selected area were divided into three categories, production constraints, marketing constraints, and environmental and other than these constraints, and were presented in tables (Table 1).

3.1.1. Production constraints

Further, to obtain scores for each factor, garret value was multiplied with corresponding frequencies of that particular rank. By adding each row, the total Garret scores were obtained and the mean value of Garret score was be used to determine the most important factor influencing the consumer (Table 2).

It was seen that at an overall level, the high cost of high-density apple plants was reported as the major constraint with rank I (Table 3). The second largest constraint being faced by the high-density apple farmers was identifying the disease.

Table 1: Production constraints being faced by the high-density apple farmers in the study area

Sl. No.	Constraints	Ranks given by the respondents				
		I	II	III	IV	V
1.	Lack of availability	7	40	11	1	1
2.	High cost	22	35	1	1	1
3.	Identifying of disease	13	38	7	1	1
4.	Small land holding	8	43	6	2	1
5.	Costly labor	6	51	1	1	1
6.	Unskilled labor to handle fruits	3	33	9	14	1
7.	Lack of technical guidance	7	45	6	1	1
8.	Establishing the orchard	3	36	10	3	8
9.	Lack of knowledge about the variety	7	18	15	13	7

Table 2: Calculation of percent position and garret value

Sl. No.	$100 (R_{ij} - 0.5) / N_j$	Calculated value	Garret value
1.	$100 \times (1 - 0.5) / 5$	10	75
2.	$100 \times (2 - 0.5) / 5$	30	60
3.	$100 \times (3 - 0.5) / 5$	50	50
4.	$100 \times (4 - 0.5) / 5$	70	40
5.	$100 \times (5 - 0.5) / 5$	90	25

Table 3: Calculation of Garret's score and ranking

Sl. No.	Constraints	Rank given by the respondents					Total	GMS*	Rank
		I	II	III	IV	V			
1.	Lack of availability	525	2400	550	40	25	3540	59.00	VI
2.	High cost	1650	2100	50	40	25	3835	63.75	I
3.	Identifying of disease	975	2280	350	40	25	3685	61.16	II
4.	Small land holding	600	2580	300	80	25	3625	59.75	V
5.	Costly labor	450	3060	50	40	25	3625	60.41	III
6.	Unskilled labor to handle fruits	225	1980	450	560	25	3240	54.00	VII
7.	Lack of technical guidance	525	2700	300	40	25	3590	59.93	IV
8.	Establishing the orchard	225	2160	500	120	200	3205	53.41	VIII
9.	Lack of knowledge about the variety	525	1080	750	520	175	3050	50.83	IX

*Garret mean score

guidelines had forced many of them to sell their produce for a throwaway price. Singh et al. (2022) suggested choosing a multi-level or a complex set of marketing channel systems to cover the maximum market and risk associated with it. Price fluctuation was a multifaceted problem attributed to various factors which, when combined, culminating in dangerous consequences for the most vulnerable. Although price risk can

The result further noted that the key problem was costly labor, which was placed at rank III. There was a shortage of skilled labor and was also costly, as reported by Kireeti and Sharma (2017) in their study. Further, lack of technical guidance ranked IV, there was a need to know the technical know-how while cultivating apple fruit crops. There were also several other constraints like small land holding, lack of availability of high-density apple plants, unskilled labor to handle the fruits, and establishing the orchard, which were ranked in their ascending order as Vth, VIth, VIIth, VIIIth, whereas the least ranked constraints were found to be lack of knowledge about the variety at rank IXth.

Further, to obtain scores for each factor, garret value was multiplied with corresponding frequencies of that particular rank.

3.1.2. Marketing constraints

In high-density apple farming, the most important constraint reported by the farmers that they were facing was the problem of fluctuation of price. Fluctuation of price in market place exclusively for high-density apple produce was the major constraint with the rank I in both the blocks of Solan district of Himachal Pradesh (table 4 and 5). Almost all the farmers in the study area expressed distress for price fluctuation for the fruits. Wani and Songara (2019), stated that fluctuation of price in the market was a big problem for the growers. Prabhu (2008), also opined that lack of information on marketing channels and absence of proper governmental

technically be good news for farmers, price fluctuation was extremely dangerous as farmers and other agents in the food chain risk losing their investment if the price falls. The next constraint that ranked II was the high price of transportation. Followed by rank III, price instability was the major constraint perceived by the high-density apple farmers. Das et al. (2014), in their paper also stated that while marketing fruits, the major



Table 4: Marketing constraints being faced by high-density apple farmers in the study area

S I . No.	Constraints	Levels to measure				
		I	II	III	IV	V
1.	Price instability	15	38	5	1	1
2.	High transportation charge	23	26	9	1	1
3.	Malpractices by traders at the time of auction	8	35	11	5	1
4.	High commission charge	8	40	10	1	1
5.	Distant market	13	30	15	1	1
6.	The high price of packing material	17	38	3	1	1
7.	Inadequate facility for storage	11	36	3	9	1
8.	Price fluctuation of product	18	39	1	1	1

constraint being faced by the farmers was the fluctuation of the price of the fruits in the market. Further, Gaurav *et al.* (2018) stated that poor access to good credit facilities due to a lot of formalities in obtaining subsidies and institutional finance were some key constraints faced by farmers in cultivation. High price for packaging and high commission charges, were other highly severe problems related to the study area which were ranked IV and Vth respectively.

Distant market ranked VI after high commission charges. The farmers expressed that the packaging cost for the apple fruit goes very high per peti (per peti). Inadequate facilities for storage and malpractices by traders at the time of auction ranked VII and VIII respectively. Kumar *et al.* (2019), had stated that some of the suggested methods to increase efficiency include providing cold storage facilities to farmers at the village level and adequate refrigerated transportation facilities for the efficient movement of fruits and vegetables from the point of production to the various consumption centres.

Table 5: Calculation of Garret's score and ranking

Sl. No.	Constraints	Rank given by the respondents					Total	GMS*	Rank
		I	II	III	IV	V			
1.	Price instability	1275	2280	150	40	25	3770	62.83	III
2.	High transportation charge	1725	1560	450	40	25	3800	63.33	II
2.	Malpractices by traders at the time of auction	600	2100	550	200	25	3475	57.91	VIII
3.	High commission charge	600	2400	500	40	25	3565	59.41	V
4.	Distant market	975	1800	750	40	25	3590	59.83	VI
5.	High price of packing material	1125	2280	250	40	25	3720	62.00	IV
6.	Inadequate facility for storage	825	2160	150	360	25	3520	58.66	VII
7.	Price fluctuation of product	1350	2340	50	40	25	3805	64.41	I

*Garret Mean Score

3.2. Environmental and other constraints

Environmental changes and pollution pose numerous threats to the farming community. Crop damage caused by climate change was putting a lot of strain on farmers. The cultivation of high-value crops, particularly horticultural crops, had begun to show signs of unsustainable growth due to factors such as declining soil fertility, erratic weather patterns, and the emergence of numerous insects, pests, and diseases. The use of the same cropping sequence year after year had resulted in micronutrient loss, resulting in a deterioration in overall soil health. It was illustrated from Table 6 and 7 that the process of grading and certification was costly and were the two main constraints being faced by the farmers in the selected area.

The grading process and certification process seemed costly and ranked I and II respectively. Further, problems from hailstorms were also found to be a major constraint in the study area and were ranked III. Muskaan et al. (2022) analyzed that farmers who installed anti-hail nets had more yield than those who did not install nets in their orchards. So, to

Table 6: Environmental and other challenges related to farming being faced by the high-density apple farmers in the study area

Sl. No.	Constraints	Levels to measure				
		I	II	III	IV	V
1.	The grading process is costly	21	36	1	1	1
2.	Wind storm	3	40	15	1	1
3.	Hail storm	10	39	9	1	1
4.	Fluctuation in temperature	9	41	6	3	1
5.	Wild animal menace	2	29	7	16	6
6.	The certification process is costly	14	40	4	1	1

overcome this constraint, it is suggested to install an anti-hail net. Fluctuation in temperature and wind storm ranked IV and V respectively whereas, problems like wild animals' menace ranked VI in the selected study area.



Table 7: Calculation of Garret's score and ranking

Sl. No.	Constraints	Rank given by the respondents					Total	GMS*	Rank
		I	II	III	IV	V			
1.	The grading process is costly	1575	2160	50	40	25	3850	64.16	I
2.	Wind storm	225	2400	750	40	25	3440	57.33	V
3.	Hail storm	750	2340	450	40	25	3605	60.08	III
4.	Fluctuation in temperature	750	2460	300	120	25	3630	59.60	IV
5.	Wild animal menace	150	1740	350	640	150	3030	50.50	VI
6.	The certification process is costly	1050	2400	200	40	25	3715	61.91	II

*Garret mean score

4. Conclusion

Small landowners had to face challenges in switching to high-density apple farming. As a result, a number of issues and limitations with their production and marketing that they face were identified in order to promote the production and effective marketing of the high-density of apple.

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