



Adopting High-Density Plantation: Socioeconomic Perspectives from Himachal Pradesh's Citrus Growers

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ABSTRACT: High-Density Plantation (HDP) has emerged as a transformative technique in citrus cultivation in Himachal Pradesh, a region characterized by its challenging terrain. Although fruit production has increased significantly, small, marginal and semi-medium farmers in the region continue to face socioeconomic challenges that hinder optimal productivity. This research aims to assess the socioeconomic impact of HDP on citrus farmers, focusing on various factors such as literacy, family composition, dependency ratios, sources of income and livestock ownership. A mixed-method sampling approach was employed, with data gathered from 100 households in citrus-growing areas across the state. The findings show a high literacy rate of 98.07 per cent among farmers, indicating a strong ability to embrace modern farming techniques. The average family size was 3.45, with a dependency ratio of 3.90, suggesting that workers often support several dependents. Agriculture remains the primary occupation for 53 per cent of the households, while 35 per cent are engaged in the service sector. Livestock, including cows, buffaloes and young stock, plays an essential role in supporting farming activities. While HDP has the potential to increase yields and improve economic returns, challenges such as dependency burdens and resource limitations persist. The study emphasizes that HDP could significantly improve productivity and income for small-scale farmers, provided there is adequate support in terms of resources and agricultural practices.

Keywords: High-Density Plantation (HDP), Citrus, Socioeconomic profile, Agricultural Innovation.

INTRODUCTION

India's agricultural growth has been significantly influenced by horticulture, with production reaching 355.48 million tons in 2022–2023 (Anonymous, 2023). Traditional farming is limited by the steep topography of Himachal Pradesh, horticulture becomes essential. However, a variety of fruits from temperate to tropical zones can be grown in the area due to its varied temperature, geography and altitude differences. Himachal Pradesh has been named the 'Horticultural State of India,' due to its utilization of these advantages, yielding 814.61 thousand tons of fruit production on 2,35,785 hectares of land (Anonymous, 2023).

Farmers and experts continue to worry about the low productivity despite the notable increase in fruit production and cultivated area. The lack of plant protection measures, reliance on unirrigated-less fertile terrain and scant orchard planting are major obstacles. Citrus fruits, especially those grown under high-density planting have become more popular in recent decades because of their shorter production cycles, which has changed the face of citrus farming worldwide. Better alternatives such as rootstocks that control vegetative growth, facilitate high-density planting and speed up fruiting have replaced conventional methods and

cultivars as a result of ongoing research and development works (Bali *et al.*, 2022).

A greater number of plants may grow in an unit area due to High-Density Planting techniques, which maximize solar energy absorption and improve space use. In Himachal Pradesh, HDP techniques influenced by American and European ways are rapidly replacing traditional extensive planting systems, which are typified by huge, challenges to manage trees, extended gestation periods and low yields. High yielding fruit types grafted onto dwarfing clonal rootstocks are the major objective of HDP in order to provide higher output while preserving controllable tree sizes. HDP is acknowledged as a crucial approach to increase fruit output and provide a number of benefits, such as increased productivity, early fruiting, easier orchard management, higher yields, better fruit quality and higher financial returns per unit area (Sharma, 2023).

In Himachal Pradesh, citrus cultivation under HDP is predominantly concentrated in regions of Kangra, Bilaspur, Mandi, Hamirpur, Una and in parts of Solan and Sirmour districts, situated at elevations ranging from 365 to 915 meter above mean sea level (Anonymous, 2024). Compared to traditional citrus farming, HDP citrus production offers larger yields and bigger economic returns in a shorter period of time,

which has the potential to significantly improve the socioeconomic circumstances of small, marginal and semi-medium farmers (Khan *et al.*, 2020). Additionally, under high density plantations, this study attempted to investigate the socioeconomic features of small, marginal and semi-medium citrus growers.

MATERIALS AND METHODS

The study employed a mixed-method sampling approach while conducting the survey for the selection of respondents during 2024-25. Districts and clusters were selected on the basis of purposive sampling technique which covered the highest active no. of citrus clusters and the crop under the clusters was at fruit setting stage. Households from clusters were selected using simple random sampling technique thus, making a total sample of 100 units. Primary and secondary data were collected in order to achieve the objectives of the study. Simple statistical tools like average and percentages were used to analyse the data. The sex ratio, literacy index, literacy rate and dependency ratio were calculated using the following formulae:

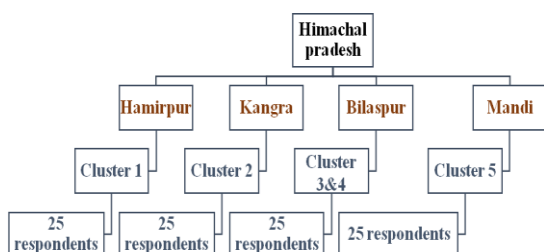


Fig. 1. Sampling design.

Table 1: Literacy status of sampled household.

Particulars	Farm Size			
	Marginal	Small	Semi medium	Overall
Literacy rate(%)	97.60	99.20	95.24	98.07
Literacy index	3.69	3.74	3.57	3.70
Sex ratio	916	1018	1375	972

Table 1 reveals that the overall literacy rate was remarkably high, reaching 98.07 per cent. Similarly, small, marginal and semi-medium farmers also exhibited relatively high literacy levels. The literacy

$$\text{Literacy rate} = \frac{\text{Total no. of literate person}}{\text{Total population}} \times 100$$

$$\text{Literacy index} = \frac{\sum W_i X_i}{\sum X_i}$$

Where;

W_i =Weights (0, 1, 2, 3 and 4) for illiterate, primary, middle, matriculation, and secondary and above respectively.

X_i = Number of persons in respective category.

$$\text{Sex ratio} = \frac{\text{Number of females}}{\text{Number of males}} \times 100$$

$$\text{Dependency ratio w.r.t total workers} = \frac{\text{No. of dependents in the family}}{\text{Total workers}}$$

$$\text{Dependency ratio w.r.t average family size} = \frac{\text{No. of dependents in the family}}{\text{Average size of family}}$$

RESULTS AND DISCUSSION

The size and composition of the family, dependency, farm size and animal holdings are all factors that affect citrus farmers and can be found in a household's socioeconomic profile.

Literacy rate. The socioeconomic standing of the households in the research area is significantly influenced by literacy. Thus, determining literacy levels and rates is crucial to comprehend how these affect the area's citrus growers. Because better literacy levels are linked to more knowledge and a stronger predisposition to accept innovative ideas and technology, literacy is a crucial measure of the quality of human resources.

index, ranging from 3.57 to 3.74, suggests a strong degree of educational parity among the surveyed respondents. Similar results were also observed in a study by Kumar, 2022.

Table 2: Family size and structure of workers in the study area.

Particulars	Farm size			
	Marginal	Small	Semi medium	Overall
Average size of family (No.)	3.68	3	3.6	3.45
Male (%)	52.26	49.55	42.11	50.86
Female (%)	47.74	50.45	57.89	49.14
Joint family	0.37 (37.76)	0.15 (15)	0.8 (80)	0.32 (32.36)
Nuclear family	0.61 (62.24)	0.85 (85)	0.2 (20)	0.67 (67.64)

*Figures in the parenthesis () represents the percentage to the total

Table 2 indicates that the average family size was 3.45. Overall, males constituted 50.86 per cent of family members in the study area, while females accounted for 49.14 per cent. Additionally, nuclear families comprised 67.64 per cent of the households, whereas

joint families made up 32.36 per cent. These findings suggest that family size remained relatively consistent across small, marginal and semi-medium farmers, with no significant variations observed.

Occupational structure. Fig. 2 illustrates the occupational structure of the sampled households. The data indicate that 53 per cent of households were engaged in the agriculture sector, making it the predominant occupation. Additionally, the service sector played a significant role, employing 35 per cent of the households. Notably only 12 per cent of the households were involved in business activities. Similar trends were also observed in a study by Thakur *et al.* (2022); Vishal (2012).

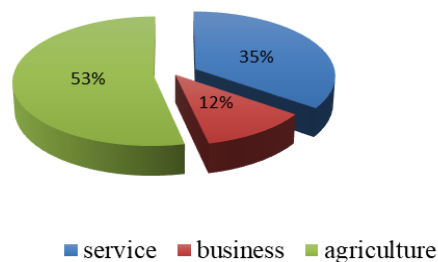


Fig. 2. Occupational structure of the sampled households.

Table 3: Distribution of the workers in the study area.

Particulars	Farm size			
	Marginal	Small	Semi medium	Overall
Average no. of workers	2.91 (79.08)	2.42 (80.67)	2.8 (77.78)	2.74 (79.54)
Average no. of dependents	0.77 (20.92)	0.58 (19.33)	0.8 (22.22)	0.71 (20.46)
Dependency ratio w.r.t total workers	3.78	4.17	3.5	3.90
Dependency ratio w.r.t family size	0.21	0.19	0.22	0.20

* Figures in the parenthesis () represents the percentage to the total

Table 3 represents the proportion of workers within households, making an average to 79.54 per cent. This percentage varied slightly across different farming categories with 79.08 per cent among marginal farmers, 80.67 per cent among small farmers and 77.78 per cent among semi-medium farmers. The overall proportion of dependents was 20.46 per cent. Additionally, the overall dependency ratio of 3.90 indicates that on an average, each independent worker was responsible to support approximately four dependent members in the family.

LIVESTOCK HOLDING

In any study area, cattle represent a vital component of the farming system. Overall, the findings indicate that citrus growers in the research region owned 43 per cent buffaloes, 39 per cent cows, 14 per cent young stock and 4 per cent sheep and goats as shown in figure 3. A similar distribution pattern was observed among small, marginal and semi-medium farmers in the study area.

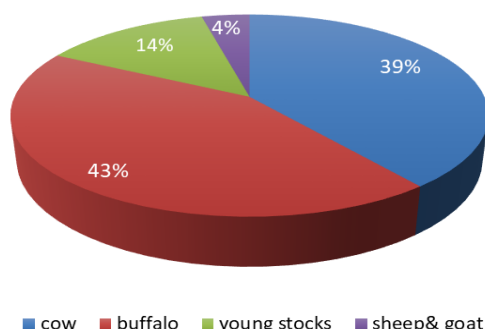


Fig. 3. Livestock inventory of sampled households of study area.

CONCLUSION AND POLICY IMPLICATIONS

The study identifies key areas where policy interventions could enhance the livelihoods of citrus farmers in Himachal Pradesh. Given the high literacy

rate, there is an opportunity to promote the adoption of modern farming techniques through agricultural training and extension services. With a significant proportion of nuclear families, policies that focus on family welfare, particularly initiatives to empower women in agriculture, would be beneficial. The high dependency ratio highlights the financial pressure on working family members, suggesting the need for targeted social welfare programs such as micro-financing and insurance schemes. Agriculture remains the dominant occupation for many households, but there is also increasing participation in the service sector, which points to the potential for policies encouraging livelihood diversification through skill-building programs and support for small enterprises. Livestock ownership plays a critical role in farming, indicating a need for better veterinary care, improved access to feed, and livestock insurance. Finally, promoting protected cultivation through subsidies and financial assistance could increase farm productivity and income. Overall, the study underscores the importance of comprehensive policies that address education, social welfare, agricultural innovation and economic diversification to improve the income and employment outcomes for farmers.

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