



# Determinants of Vegetable Production among Smallholder Farmers in Diverse Agro-Climatic Zones of Himachal Pradesh

Parul Barwal, Subhash Sharma, Chinglembi Laishram<sup>1</sup> and Diksha Bali<sup>1</sup>

Department of Social Sciences, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan-173 230, India

<sup>1</sup>ICAR-National Institute of Agricultural Economics and Policy Research, Pusa, New Delhi-110 012, India

E-mail: [parulbarwal1994@gmail.com](mailto:parulbarwal1994@gmail.com)

**Abstract:** The study was conducted to examine the factors affecting the vegetable production among smallholder farmers in Himachal Pradesh. The primary data collected with structured questionnaire and analyzed by using descriptive and multiple regression analysis. Multiple regression analysis showed that the factors like farm size, experience, farm workers and extension services were positive and significant relationship with vegetable production. The coefficient of age (-0.002) showed negative and significant relationship with vegetable production means older age farmers usually use traditional practices on the field due to lack of knowledge about modern inputs and technology. The 74 per cent variation in the model was explained by the independent variables under study while the remaining 26 per cent was due to other variables like sowing time, irrigation facilities, improved and quality seeds etc. Lack of irrigation facility, price fluctuations and lack of transportation facilities were found to be significantly different from different zones as revealed by significant chi-square value 8.38, 7.86 and 11.80. The improving education, access to modern agricultural practices, reducing regional disparities in input and market access could significantly enhance vegetable production in Himachal Pradesh. They suggested that the farmers need to be educated to apply the recommended package of practices in order to avoid increasing the cost of cultivation unnecessarily and decrease the cost of production.

**Keywords:** Vegetables, Farm size, Market availability, Smallholder farmers

India is second largest producer of vegetables in the world with annual production of 204.63 million tonnes from an area of 11.35 million hectares having productivity of 18.02 tonnes/hectare (NHB, 2023). The production of vegetables increases every year to fulfill the demand, though farmers are unaware about the quantity to produced and supply to the market as they lack understanding about market trends and forecast about future demand. This led to rapid fluctuations of prices in vegetables marketing due to glut or scarcity (Reddy et al 2018). Among all the North-Western states, Himachal Pradesh has the highest rate of growth in fruit and floriculture crops and ranks second in vegetable production (Sharma et al 2003). Shimla, Sirmaur, Solan, Kangra, Mandi and Kullu are the main vegetables producing districts. In Himachal Pradesh, the area under vegetables is 9,199 thousand hectares, with a production of 1,875.24 thousand metric tonnes and a productivity of 20.38 MT/ha (Directorate of Economics and Statistics, 2023). There is a good scope for commercialization of the agriculture sector for enhancing income and generating additional gainful employment opportunities. It is a hilly and mountainous state in India, which is separated by the Shiwalik hills from the monotonous plains of Punjab. It has a unique landmass represented by mountainous ranges, hills and valleys. Moreover, vegetables are highly seasonal, resulting in fluctuations in market arrival and prices. These irregular patterns along with lack of market

intelligence increase the despairs of the growers (Kundu et al. 2019). With the above background, this study was conducted to examine the factors affecting vegetable production in Himachal Pradesh.

## MATERIAL AND METHODS

**Selection of the sample:** Stratified multistage random sampling technique was used to select the ultimate respondents i.e. the vegetable growers. The selection of sampled households was done from all the four agro-climatic zones of Himachal Pradesh. At the first stage, two niche areas/ blocks from each agro-climatic zone were selected purposively on the basis of area under vegetable cultivation. At the second stage, a list of gram panchayats from each selected blocks was prepared and out of which 5 were selected from each selected block. At the third stage, a list of vegetable growers of the selected gram panchayat was prepared and out of which 10 farmers from each selected were selected randomly for collection of the primary data. Thus, sample of 400 vegetable growers were selected for the present study (Table 1).

## Analytical Tools

**Multiple regression analysis:** Multiple regression analysis was carried out to examine the different factors affecting the vegetable production of the farmers. The model equation is specified as follows:

**Table 1.** Selected blocks from each agro-climatic zones of Himachal Pradesh

Zones	No. of selected blocks	No. of selected blocks	Latitude	Longitude
Sub-Montane and Low Hills Sub-Tropical Zone (Zone-I)	2	Una	31°28'48"N	76° 16'48"E
		Nadaun	31°48'12"N	76° 23'0"E
Mid-Hills High Humid Zone (Zone-II)	2	Balh	31°40'24"N	76° 59'0"E
		Kangra	32° 05'36"N	76° 15'48"E
High Hills Temperate Wet Zone (Zone-III)	2	Kullu	31° 57'30"N	77° 06'30"E
		Theog	31° 13'34"N	77° 25'24"E
High Hills Temperate Dry Zone (Zone-IV)	2	Kalpa	31° 32'36"N	78° 14'0"E
		Lahaul	32° 34'24"N	77° 02'0"E

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7$$

Where,

Y= Gross returns (Rs./year),  $a_0$ =Constant,  $X_1$  = Farm size (Bigha)

$X_2$ =Age of farmer (years),  $X_3$ =Education (No. of schooling years)

$X_4$ =Years of experience (No. of years),  $X_5$ =Farm workers (No.)

$X_6$ =Extension Services (1 if yes, otherwise 0),  $X_7$ =Market availability (1 if yes, otherwise 0)

$a_1$  to  $a_7$  are the regression coefficients

**Garrett's ranking:** Garrett's ranking technique was used to analyze these various constraints experienced by the farmers in different zones in the study area. The prime advantage of this technique over simple frequency distribution is that the constraints are arranged based on their severity from point of view of the farmers (Zalkuwi et al 2015). The farmers were asked to assign the rank for each category of the constraints proposed by them. The per cent position for each rank was calculated with the help of the following formula.

$$\text{Per cent position} = \frac{100 (R_{ij} - 0.50)}{N_{ij}}$$

Where,

$R_{ij}$  = Rank given to the  $i^{\text{th}}$  factor by the  $j^{\text{th}}$  respondent,

$N_{ij}$  = Number of factor ranked by the  $j^{\text{th}}$  respondent,

Further, in order to test the significant difference for the problems among different zones, Chi-Square test was used. The quantity  $\chi^2$  describes the magnitude of the discrepancy between theory and observation. The detail of approximate Chi-square test ( $\chi^2$ ) is given as under:

$$\chi^2 = \sum_{i=1}^n \frac{(O - E)^2}{E} \sim \chi^2 (L - 1) \text{d.f.}$$

Where, O = Observed values, E = Expected values, L = Number of different zones

## RESULTS AND DISCUSSION

Farm size, age, education, experience, family workers, extension services and market availability were major seven

variables analyzed. All these variables were significantly influenced the vegetable production in the study area (Table 2). At overall level, the coefficient of farm size (0.13) was positive and significant factor for vegetable production this means that 1 per cent change in farm size, the vegetable production will change by 0.13 per cent Aburr (2014) and Umar and Abdulkadir (2015) also made similar observations. Education showed the positive and significant relationship with vegetable production across all the zones. Educated households were exposed various aspects of production information and able to manage farm production better. The coefficient of experience was positive and statistically significant in all zones. This implies that the farmers having more years of experience, tends to be more efficient in producing vegetables. Adeoye (2020) found that experience gathered over time in the production of the commodity may be put into use to improve practices in the production. The coefficient of age (0.003 and 0.002) was positive and significant relation with vegetable production in Zone-I and Zone-II. The positive value implied that older age farmers were more years of experience in the production of vegetables as compared to the younger farmers. Age is one of the important determinants of agricultural production because age of farmer may affect adoption of agricultural innovations. In case of Zone-IV, the coefficient of age showed negative and significant relationship with vegetable production. At the older age farmers usually use traditional practices on the field due to lack of knowledge about modern inputs and technology.

The extension services and farm workers had positive and significant relationship with vegetable production. If there is 1 per cent increase in extension services and farm workers, the production will increase by 0.05 and 0.03 per cent, respectively. The extension services provide latest information on production techniques. The adjusted  $R^2$  indicates that 74 per cent variation in the model was explained by the independent variables under study while the remaining 26 per cent was due to other variables like sowing

**Table 2.** Estimates of multiple regression analysis for vegetable production

Variables	Zone-I	Zone-II	Zone-III	Zone-IV	Overall
Constant	4.01 (0.15)	3.12 (0.16)	4.10 (0.14)	4.33 (0.07)	4.35 (0.05)
Farm size	0.16* (0.02)	0.10* (0.01)	0.12* (0.02)	0.14* (0.02)	0.13* (0.01)
Age	0.003*** (0.001)	0.002*** (0.001)	-0.002 (0.002)	-0.002** (0.001)	-0.003* (0.001)
Education	0.02*** (0.02)	0.01*** (0.01)	0.02** (0.01)	0.01 (0.02)	0.01* (0.001)
Experience	0.01** (0.01)	0.01** (0.00)	0.02* (0.00)	0.02* (0.01)	0.01* (0.002)
Farm workers	0.02 (0.03)	0.02*** (0.01)	0.03 (0.02)	0.04*** (0.03)	0.03*** (0.02)
Extension services	0.03 (0.05)	0.02 (0.03)	0.06*** (0.04)	0.06** (0.04)	0.05** (0.02)
Market availability	0.10*** (0.06)	0.25* (0.13)	0.21*** (0.12)	0.01 (0.04)	0.07* (0.02)
R <sup>2</sup>	0.70	0.78	0.72	0.75	0.74

\*, \*\*, and \*\*\* significant at 1 per cent, 5 per cent & 10 per cent level of significance, respectively  
 Figures in parenthesis are standard error

time, irrigation facilities, improved and quality seeds etc.

### Problems Faced by Vegetable Growers

**Garret ranking technique:** The major constraints were identified first and then farmers' were asked to give rank to the problems according to superiority of problems between 1 to 17 (Table 3). The fluctuation in prices were 1st ranked problem with the Garret mean score (56.29) followed by high wage rate, high input cost, lack of transportation facilities, unavailability of irrigation facilities, high commission charges and insect/pest disease were the major problems faced by farmers. These constraints highlight the significant challenges faced by vegetable growers; affect their production efficiency, cost-effectiveness, and overall profitability.

**Chi-square test:** Chi square test shows that a problem faced by farmers was varying between different zones (Table 4). The major production problems faced by farmers were high wage rates (87%), scarcity of skilled labor (83%), high input costs (78%), lack of irrigation facilities (77%), and insect/pest attacks/diseases etc. (76%). The high wage rate is of significant concern due to the shortage of local labor and increased migration to urban areas for non-agricultural employment, resulting in greater dependence on expensive hired labor. This increased labor cost directly impacts production expenses, reducing profit margins and overall economic viability for farmers. About 90 per cent of farmers in Zone-II reported that the pest and disease problems,

indicating widespread crop losses due to limited pest management practices. The lack of irrigation facilities showed a significant difference across the zones, with Zone-IV

**Table 3.** Production and marketing constraints of sampled vegetable farmers

Particulars	Garret mean score	Rank
Fluctuation in prices	56.29	I
High wage rate	54.57	II
High Input cost	52.88	III
Transportation facility not available/costly	52.61	IV
Lack of irrigation facilities	50.94	V
High commission charges	50.59	VI
Insect/pest/ disease attack	50.44	VII
Non-availability of good quality seeds/planting material	50.35	VIII
Scarcity of skilled labour	50.3	IX
Lack of subsidy for inputs	49.69	X
Lack of marketing facilities nearby	49.44	XI
Lack of storage facilities	49.36	XII
Lack of technical Knowledge	48.69	XIII
Wild animals/Monkey menace	46.12	XIV
lack of market information	45.96	XV
lack of packing material	43.76	XVI
Non-availability of chemicals/ pesticides/fertilizers on time	40.17	XVII

**Table 4.** Zone-wise problems faced by vegetable growers (Multiple response %)

Particulars	Zone-I	Zone-II	Zone-III	Zone-IV	Overall	Chi-Square
<b>Production constraints</b>						
High Input cost	75	70	75	90	78	2.90
Insect/pest/ disease attack	65	90	80	75	76	4.13
Lack of irrigation facilities	55	80	84	87	77	8.38*
High wage rate	75	86	94	94	87	2.78
Lack of technical Knowledge	69	83	71	75	75	1.54
Non-availability of good quality seeds/planting material	60	70	85	80	73	4.71
Scarcity of skilled labour	82	84	70	95	83	3.80
Lack of subsidy for inputs	67	75	70	78	72	1.53
Wild animals/Monkey menace	70	70	82	72	74	1.35
Non-Availability of chemicals/ pesticides/fertilizers on time	55	72	65	82	69	5.68
<b>Marketing constraints</b>						
Transportation facility not available/costly	55	67	70	95	72	11.80*
High commission charges	69	67	90	85	78	5.08
lack of market information	60	70	77	84	73	4.33
lack of packing material	67	65	75	80	72	2.05
Lack of marketing facilities nearby	60	55	50	90	64	15.20*
Lack of storage facilities	70	50	80	70	68	7.04
Fluctuation in prices	67	70	92	96	81	7.86*

\* Significant at 5 per cent level

having the highest percentage of affected farmers (87%) and Zone-I having the lowest (55%). This indicates a disparity in infrastructure development, with regions lacking investment in water resource management facing higher production risk. Price fluctuations were also a major issue, affecting 81 per cent of farmers overall, particularly in Zones III and IV. Unpredictable market prices arise due to supply-demand mismatches, poor market linkages, and inadequate government intervention, leading to income instability. The unavailability or high cost of transportation was reported by 72 per cent of farmers, with significant variation across zones. Poor infrastructure and a lack of efficient transport facilities increase logistics costs, reduce profit margins, and limit access to distant markets. This is especially pronounced in Zone-IV, where 95 per cent of farmers reported this issue. The unavailability of marketing facilities, reported by 64 percent of farmers, significantly affected Zone-IV (90%). Without access to nearby markets, farmers were forced to sell their produce at lower prices to local agents, leading to reduced earnings. Various significant problems such as lack of irrigation facilities, transportation facilities and price fluctuations in Zone-IV which means other zone farmers does not faced these problem as much as compare to Zone-IV. Lack of irrigation facility and lack of transportation facilities were found to be significantly different from different zones as revealed by significant Chi-square value (8.38, 11.80).

Similar trend was observed in earlier studies(Kumar 2011, Sharma 2019, Barwal et al 2022).

### CONCLUSION

Several factors significantly impact the vegetable production in Himachal Pradesh, such as farm size, age, education, experience, number of farm workers, availability of extension services, and market access. Farm size, more years of farming experience, higher levels of education, and access to extension services were positively associated with increased vegetable production. However, vegetable growers faced numerous production marketing constraints such as high input costs, insect/pest attack, scarcity of skilled labor and price fluctuations, lack of transportation facilities, and high commission charges. The study concluded that improving the education, access to modern agricultural practices, and reducing regional disparities in input and market access could significantly enhance vegetable production in Himachal Pradesh. Training on modern methods of production should be provided to the farmers before vegetable sowing and along the guidance of appropriate practices suited to small and marginal farms.

### AUTHOR'S CONTRIBUTION

Dr. Subhash Sharma provides as conceptualization, supervision and guidance, Dr. Diksha Bali helped in the

selection of sampled vendors for the collection and sorting the data, analysis of data Dr. Chinglembi assisted in interpretation of data and write up of the article.

### REFERENCES

- Abur CC 2014. An assessment of irrigated tomato farming on resource productivity of farmers in Vandeikya local government area of Benue state: Application of technical efficiency model. *Global Journal of Human-Social Science* **14**(1): 43-50.
- Adeoye IB and Ibe RB 2013. Market Structure and performance of fresh tomatoes in Ibadan Metropolis, Oyo state. *Acta Horticulturae* **2**: 1007-1008.
- Barwal P, Sharma S, Bali D, Laishram C and Kashyap P 2022. Resource use efficiency and constraint analysis of mango cultivation in Kangra district of Himachal Pradesh. *Indian Journal of Ecology* **49**(5):1736-1742.
- Directorate of Economics and Statistics. 2023. *Statistics Outlines of Himachal Pradesh 2023*. Directorate of Economics and Statistics, Government of Himachal Pradesh.
- Kumar BR 2011. *Economics of cropping systems under the rainfed situations in Belgaum and Dharwad districts of Karnataka*. M.Sc. Thesis. Department of Agricultural Economics, University of Agricultural Sciences, Dharwad, Karnataka, India.
- Kundu P, Kishor N and Ghosal A 2019. Vegetables marketing scenario and trends in prices and arrivals of vegetables in different markets of South 24 Parganas District of West Bengal, India. *International Journal of Microbiology and Applied Science* **8**(12): 1821-1840.
- National Horticulture Board. 2023. *Horticulture Data Base 2023*. National Horticulture Board, New Delhi.
- Reddy SA, Chakradhar P, Kumar PP and Teja S 2018. Demand forecasting and demand supply management of vegetables in India: a review and prospect. *International Journal of Computer Technology* **17**(1): 7170-7178.
- Sharma D 2019. *Economics of farming systems in Chamba district of Himachal Pradesh*. Ph.D. Thesis. Department of Agricultural Economics, Extension Education & Rural Sociology, College of Agriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur, Himachal Pradesh, India.
- Sharma R, Parasher RS, Sharma KD, Wani MH, Sharma ML, Singh NR and Singh RK 2003. *System oriented socio-economic assessment of transitions in hill agriculture*, DR Y S Parmar University of Horticulture and Forestry Nauni, Solan (H.P.), A NATP Research Report.
- Umar ASS and Abdulkadir MB 2015. Analysis of resource-use efficiency and productivity of residual soil moisture tomato production in Kaduna State, Nigeria. *International Letters of Social and Humanistic Sciences* **51**: 152-157.
- Zalkuwai J, Singh R, Bhattarai M, Singh OP and Rao D 2015. Analysis of constraints influencing sorghum farmers using Garrett's ranking technique: A comparative study of India and Nigeria. *International Journal of Scientific Research and Management* **3**(1): 2435-2440.

---

Received 21 September, 2024; Accepted 29 October, 2024