International Journal of Agriculture Extension and Social Development

Profitability analysis of major vegetables in Mandi district of Himachal Pradesh (India)

Kshama Kumari, RS Prasher, Chaman Negi and Divya Sharma

Department of Social Sciences (Agricultural Economics), College of Forestry, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Corresponding Author: Kshama Kumari

Abstract
The present study was carried out to study the socio-economic status, cost of cultivation and net returns of major vegetables grown in different blocks of Mandi District of Himachal Pradesh. The farmers from these blocks grow vegetables on a commercial scale so it was purposively selected. Multi-stage random sampling was employed for the selection of blocks, panchayats, and ultimate respondents. Altogether 90 respondents were selected for the study. Further, the study highlighted that 49.17 per cent of the surveyed people were engaged in agriculture. The overall cost of Tomato crop was Rs 148186.62 followed by Pea crop i.e. Rs 135054.81 and Cauliflower crop was Rs 127631.20. The cropping intensity in the study area varied from 145.10 to 164.88. The net returns were found to be positive for all the vegetables crops. Net returns varied from Rs 180181.06 to Rs 213561.91 per hectare for different vegetables. The findings of the study revealed that despite of different problems faced by the farmers, overall farmers in the study area were getting good profits from vegetable production.

Keywords: Cost of cultivation, gross return, net returns, socio-economic analysis, vegetable production

Introduction
India is one of the world's largest, low-cost producers of fruits and vegetables. Agriculture is the dominant sector of the Indian Economy. India occupies the second position in the cultivation of fruits and vegetables after China with horticulture crops contributing about 28 percent to India's Gross Domestic Product (GDP). Vegetable cultivation performs a principal function in the Indian financial system with the aid of imparting employment and providing raw materials to food processing industries and it also offers greater manufacturing so that it gives higher profitability and export earnings from overseas exchanges. In the year 2022-23, India exported fresh fruits and vegetables worth Rs. 13185.30 crores which comprised Fresh Fruits worth Rs. 6,219.46 crores and vegetables worth Rs. 6,965.83 crores (APEDA, 2023).

In Himachal, vegetables are grown in the areas from the Shivalik foothills (elevation of 400 meters) to the high Alpine zone up to 4,000 meters. The production of field crops is not particularly high in the hilly areas of the state. This is largely due to the mountain terrain, which makes mechanized modern agriculture impossible in these areas. Due to the region's agro-climatic characteristics, sectors such as horticulture (fruit and vegetable growing) have a comparative advantage (Choudhary *et al.* 2017). The important vegetables grown in the state are tomato, cauliflower, cabbage, pea, and capsicum. Vegetable production is mostly done by small and marginal farmers (with less than 2 hectares of land), helping the resource-poor farmers to benefit most from the growth in vegetable production. Profit

Mandi is primarily an agricultural district of Himachal Pradesh. Green peas, tomato, capsicum, cauliflower are the major commercial crops in the district. The agro-climatic condition of the district is ideally suited for cultivation of seasonal and off-seasonal vegetables. Total production for different crops in Mandi district Pea is 55191 MT per hectare, Tomato is 24848 MT per hectare, and Cauliflower is 21898 MT per hectare for the year 2018-19.

The vegetables have wide importance in improving the productivity of land, perk up economic conditions of the farmers and entrepreneurs, enhancing exports, and providing nutritional security to the population. Vegetables compared to other food items provide low-cost nutrition sources. It may be cultivated in a short period and multiple crops can be grown in a single crop season. The production of vegetable crops increased from 5 lakh metric tons in 1998-99 to 185.88 lakh metric tons in 2018-19 (NHB, 2019). In Himachal Pradesh total area under horticulture is 340.21 thousand hectares with a production of 2682.09 thousand metric tonne with vegetables occupying an area of 91.99 thousand hectares and a production of 1878.13 thousand metric tonne.

Materials and Methods
This section provides an overview of the study area's characteristics, the sampling procedures used, the types and sources of data, and the various statistical tools and techniques used to analyze the data.

The present study was conducted in the Mandi district of Himachal Pradesh. Mandi district was selected purposively because of its wider adaptability for growing vegetables.

The important commercial vegetables grown in Mandi district are cauliflower, pea, and tomato. The vegetables grown in the district also enjoy a price advantage due to their off-season nature in the area. The results were further analyzed at Department of Social Sciences, College of Horticulture and Forestry Neri, Dr. Y S Parmar University of Horticulture and Forestry Nauni, Solan H.P. A multistage random sampling design was used to select the respondents. In the first stage, three development blocks (Balh, Karsog, and Seraj) blocks in the districts were selected. In the second stage, three panchayats from each block were selected, randomly. In the third stage, a list of farmers growing vegetables was prepared from the selected panchayats, and a sample of 10 vegetable growers was taken assigning random numbers using a simple random technique from each panchayat, thus comprising a sample of 90 vegetable growers in total for final survey.

Distribution of sampled farmers according to their size of land holding
For the analysis of data, total respondents were divided according to the size of their land holdings into three categories, *viz*., marginal (<0.8 ha), small (0.8-1.08 ha), and medium (>1.08 ha). The distribution of the sampled farmers is presented in Table 1.

Nature and sources of data
Both primary and secondary data were gathered in order to achieve the goals of the current study. Primary information was collected on a pre-tested and well-structured schedule by personal interview method. Secondary data pertaining to the area, production, productivity, market arrivals, and prices were collected from different government offices, revenue offices, and Department of Horticulture, Agriculture as well as from the various available literature and websites.

Analytical Techniques
1. Tabular analysis
A simple tabular analysis was used to examine the socio-economic status, resource structure, income, and expenditure pattern of vegetables. Simple statistical tools like averages and percentages were used to compare, contrast, and interpret the results. The following type of indices has been used for the estimation of different parameters. Literacy rate, Literacy Index, Dependency ratio, Cropping intensity and Cost of cultivation were calculated by the given formulas.

$$\text{Literacy rate (\%)} = \frac{\text{Total number of literate persons}}{\text{Total Population} - \text{Population below 5 years}} \times 100$$

Literacy Index = $\sum W_i X_i / W_i$

Where;
W_i = Weights (0,1,2,3,4 and 5) for illiterate, primary, middle, high school, and graduation.
X_i = Number of persons in the respective category.

$$\text{Dependency ratio w.r.t. total workers} = \frac{\text{Number of dependents in a family}}{\text{Total workers}}$$

$$\text{Dependency ratio w.r.t. average size of family} = \frac{\text{Number of dependents in a family}}{\text{Average of family}}$$

$$\text{Cropping intensity} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

2. Cost concepts
CACP (Commission for Agricultural Costs and Prices) were used in the study to calculate the cost of cultivation and farm income measures.

3. Cost analysis: Following farm management cost concepts were used

Cost A₁ included
1. Value of seed/seedling.
2. Value of manures, fertilizers and plant protection chemicals.
3. Hired human labour
4. Bullock labour/tractor.
5. Owned and hired machinery.
6. Irrigation charges.
7. Depreciation on implements and farm buildings.
8. Interest on working capital.
9. Other miscellaneous charges.

Cost A_2: Cost A_1 + rent paid for leased in land
Cost B_1: Cost A_1 + interest on the fixed capital assets excluding land

Cost B_2: Cost B_1 + rental value of owned land
Cost C_1: Cost B_1 + imputed value of family labour
Cost C_2: Cost B_2 + imputed value of family labour
Cost C_3: Cost C_2 + value of management input (10% of Cost C2)

4. Farm income measures
For the purpose of working out returns the following concepts were used:
Farm business income: Gross Income- Cost A1
Family labour income: Gross Income- Cost B2
Net farm income: Gross income - Cost C3
Farm investment income: Farm business income - Imputed value of family labour

Results and Discussion
Literacy status
The data pertaining to literacy rate of sample households was given in Table 2. From that it can be observed that the overall literacy rate was found higher in case of males (84.18%) in comparison to females (73.01%). The literacy index varied from 3.11 to 3.24 in males and from 2.78 to 2.85 in case of females. The findings showed that the literacy rate is high in the study area and literacy index showed that highest proportion of the sample family members were educated up to Graduation.

Land use pattern

Land use pattern determines the type of farming system in the area. Farm categories wise land use pattern of sample farmers has been summarized in Table 3. The average size of holding on marginal, small and medium farms was 0.62, 0.89 and 1.53 hectares, respectively. Among the different categories of the farm, the operational land varied from 75.28 to 80.55 per cent with an overall area of 78.64 per cent. Under overall category, 1.12 per cent of total land was under forest and 5.63 per cent was under pastures. Under different categories, area under vegetables varied from 52.22 to 55.00 per cent with overall area of 53.93 per cent.

Cropping pattern

Table 4 explains that main crops grown in kharif season were capsicum, beans, ginger, tomatoes and maize. Cropping pattern of any region depends mainly on altitude, soil type, availability of resources, management factors and micro climate. It was evident from the table that in an overall farm category, 0.11 hectare area was cultivated under cereal crops and 0.41 hectare under vegetables. Among the vegetable crops, highest area was under tomatoes (0.26) followed by beans (0.07) and capsicum (0.05). The main crops grown in rabi season were pea, cauliflower and wheat. The total area cultivated under cereal crops in rabi season was 0.12 hectare and 0.31 hectare under vegetable crops.

Level of investment

It can be observed from the Table 5 that the overall investment per farm for major implements was Rs 62360.67. The overall investment per farm for minor implements was Rs 17584.75. The total investment per farm was Rs 47788.99, Rs 87915.24 and Rs 144857.50 for marginal, small and medium farmers, respectively, with overall investment was Rs 79945.42.

Cost and return of selected vegetables

It may be observed from table 6 & 7 that, in case of Tomato, overall net return was Rs 212779.21 per hectare. Overall output-input ratio was 2.42 and it was noted to increase as the farm size increases. In case of cauliflower overall gross return was Rs 307812.26 per hectare. Overall net farm income earned was observed ₹ 180181.06 per hectare. Overall output-input ratio was 2.40 and it was noted to increase as the farm size increases. Overall gross return for pea was Rs 348616.72 per hectare and overall net farm income earned was ₹ 213561.91 per hectare. Overall output-input ratio was 2.57 and it was noted to increase as the farm size increases. Based on total cost, the cost of production per quintal of selected vegetables was estimated to be ₹ 1362.13 per quintal in pea followed by ₹ 1034.74 in tomato and ₹ 647.35 in cauliflower.

Table 1: Distribution of sampled households according to their land holdings.

Category of farmers	Size of land holdings (ha)	No. of farmers	Percentage of farmers (%)
Marginal	< 0.8 ha	42	46.67
Small	0.8-1.08 ha	31	34.44
Medium	>1.08 ha	17	18.89
Overall		90	100.00

Table 2: Educational status of sample households in the study area (No.)

Particulars	Marginal		Small		Medium		Overall	
	Male	Female	Male	Female	Male	Female	Male	Female
Illiterate	0.19	0.45	0.29	0.58	0.35	0.71	0.26	0.54
Primary	0.07	0.00	0.03	0.03	0.00	0.00	0.04	0.01
Middle	0.14	0.10	0.10	0.00	0.12	0.00	0.12	0.04
High school	0.79	0.95	0.77	0.77	0.76	0.71	0.78	0.84
Graduation	1.50	1.07	1.32	1.32	1.47	1.47	1.43	1.23
Non-school going	0.14	0.19	0.45	0.55	0.24	0.71	0.27	0.41
School Going	0.60	0.55	0.19	0.23	0.53	0.35	0.44	0.40
Total	3.43	3.31	3.16	3.48	3.47	3.94	3.34	3.49
Literacy Rate (%)	90.28	80.58	76.53	67.59	83.05	64.18	84.18	73.01
Literacy Index	3.24	2.85	3.12	2.82	3.11	2.78	3.17	2.83

Table 3: Land use pattern of sample households (ha)

Particulars	Marginal	Small	Medium	Overall
Field crops	0.08	0.11	0.22	0.12
IR	0.06	0.05	0.11	0.07
UIR	0.02	0.06	0.11	0.05
Vegetable crops	0.34	0.49	0.80	0.48
IR	0.30	0.38	0.76	0.42
UIR	0.04	0.11	0.04	0.06
Pasture land	0.04	0.04	0.10	0.05
Forest land	0.00	0.00	0.05	0.01
Fallow land	0.05	0.04	0.08	0.05
Orchard	0.05	0.11	0.19	0.10
Total operational land	0.47	0.71	1.20	0.69
Land put to non-agricultural use	0.07	0.09	0.10	0.08
Total land holding	0.62	0.89	1.53	0.89

Table 4: Cropping pattern of the Sample farmers (No.)

Particulars	Marginal	Small	Medium	Overall
Kharif				
Maize	0.09	0.11	0.17	0.11
Capsicum	0.04	0.06	0.07	0.05
Beans	0.05	0.07	0.13	0.07
Ginger	0.03	0.02	0.02	0.03
Tomato	0.21	0.24	0.42	0.26
Rabi				
Wheat	0.10	0.12	0.18	0.12
Cauliflower	0.09	0.10	0.23	0.12
Pea	0.07	0.11	0.28	0.12
Other vegetables	0.04	0.09	0.11	0.07
Orchard area	0.05	0.11	0.19	0.10
Gross cropped area	0.77	1.03	1.80	1.05
Net sown area	0.47	0.71	1.20	0.69
Cropping intensity	163.83	145.07	150	154.76

Table 5: Average investment on implements and tools.

Major Implements	Marginal	Small	Medium	Overall
Plough	717.86	1001.61	811.76	833.33
Foot Sprayer	1114.29	1174.19	994.12	1112.22
Tractor	25833.33	41774.19	61764.71	38111.11
Power Tiller	10619.05	24919.35	38117.65	20738.89
Knapsack Sprayer	1114.29	1808.39	2235.29	1565.11
Sub Total (1.)	39398.81	70677.74	103923.53	62360.67
Minor Implements				
Pickaxe	1078.69	1420.32	1415.00	1259.89
Pruning Scissors	83.33	72.58	150.00	92.22
Khilna	397.44	531.37	580.74	478.19
Plastic Crates	3116.43	10922.90	32611.76	9923.83
Chaff Cutter	3714.29	4290.32	6176.47	4377.78
Sub Total (2)	8390.18	17237.50	40933.97	17584.75
Total (1+2)	47788.99	87915.24	144857.50	79945.42

Table 6: Cost and return of major vegetable crops

Particulars	Tomato				Cauliflower				Pea			
	Marginal	Small	Medium	Overall	Marginal	Small	Medium	Overall	Marginal	Small	Medium	Overall
Yield (q/ha)	122.91	147.23	192.26	144.39	165.95	221.47	237.50	198.59	85.55	110.61	114.26	99.60
Total cost of cultivation ('000 ₹)	132.70	150.09	182.99	148.19	111.89	144.55	135.69	127.63	120.75	147.02	148.57	135.05
Gross returns ('000 ₹)	307.28	368.08	480.65	360.97	257.22	343.28	368.13	307.81	299.43	387.14	399.91	348.62
Net returns ('000 ₹)	174.58	217.99	297.66	212.78	145.34	198.73	232.44	180.18	178.67	240.12	251.34	213.56
Cost of production ('000 ₹/q)	1.08	1.02	0.95	1.03	0.67	0.65	0.57	0.65	1.41	1.33	1.30	1.36

Table 7: Farm profitability in major vegetables on different farm categories.

Particulars	Tomato				Cauliflower				Pea			
	Marginal	Small	Medium	Overall	Marginal	Small	Medium	Overall	Marginal	Small	Medium	Overall
Yield (q)	122.91	147.23	192.26	144.39	165.95	221.47	237.50	198.59	85.55	110.61	114.26	99.60
Gross return ('0000 ₹)	30.73	36.81	48.07	36.10	25.72	34.33	36.81	30.78	29.94	38.71	39.99	34.86
Farm business income ('0000 ₹)	25.60	29.90	37.58	29.34	20.86	27.26	28.70	24.55	23.52	30.96	29.61	27.23
Family labour income ('0000 ₹)	22.94	26.37	33.76	26.17	17.79	22.91	25.56	21.02	21.43	26.34	26.53	24.09
Net farm income ('0000 ₹)	17.46	21.80	29.77	21.28	14.53	19.87	23.24	18.02	17.87	24.01	25.13	21.36
Farm investment income ('0000 ₹)	20.61	25.91	34.21	25.01	18.12	25.02	27.18	22.21	20.35	29.21	28.83	25.00
Output input ratio	2.32	2.45	2.63	2.42	2.30	2.37	2.71	2.40	2.48	2.63	2.69	2.57

Conclusion
Considering the performance of the vegetable crops in terms of cost of cultivation, gross returns and net returns it can be concluded that vegetable production is an economically viable approach where proper irrigation is practiced. The diverse agro-climatic conditions of Mandi have provided nearly unlimited scope for growing all types of vegetables. The majority of the sample farmers were dependent on Government agencies for seed and fertilizers, whereas plant protection chemicals were being purchased from the open market because of their superior quality.

Declaration: No conflict of interest by the authors.

References
1. Akter S, Islam MS. Economic analysis of winter vegetables production in some selected areas of Narsingdi district. J Bangladesh. 2011;9:241-54.
2. Ankita. Value chain analysis of commercial vegetables: a case study of Kullu District of Himachal Pradesh [MSc thesis]. Nauni (India): Dr. Y.S. Parmar UHF; 2017. 89 p.
3. Bala B, Sharma RK, Sharma N. Cost and return structure for the promising enterprise of off-season vegetables in Himachal Pradesh. Agric Econ Res Rev. 2011;24:141-8.
4. Baruah PK, Barman RN. Economic analysis of production and marketing of tomato in Barpeta district of Assam, Jorhat, India, Agricultural Science Society for Northeast India. J Agric Sci Soc North East India. 2000;13:175-81.
5. Choudhary H, Bisht D, Badal PS, Singh V, Shah R, Saryam M. Profitability of vegetables in hill agriculture: an economic analysis. Int J Curr Microbiol Appl Sci. 2017;6:1674-82.
6. Department of Agriculture & Farmers Welfare. Area and production of horticulture crops for 2021-22. 2022. https://agriwelfare.gov.in/en/StatHortEst
7. Kambhar JS. Economics of production and marketing of rabi onion in Pune district [MSc thesis]. Maharashtra (India): MPKV; 2000.
8. Kumar V, Chauhan SK, Bala B, Gupta M. Estimation

of cost of cultivation of commercial crops in Himachal Pradesh. Res Rep Dept Agric Econ Ext Educ Rural Sociol. 2011;53:20-3.

9. Lokapur S, Kulkarni GN. Economic production of vegetables in Belgaum district in Karnataka. Int Res J Agric Econ Stat. 2014;5:139-42.

10. Nandeshwar NS, Jagannath, Pritesh T, Shashikumar M. Economics of production and marketing of vegetable in Akola district. Glob J Biol Agric Health Sci. 2013;2:78-82.

11. National Horticulture Board (NHB). Horticultural crops for 2019-20 (Second advance estimates). 2019. http://nhb.gov.in

12. Singla R, Chahal SS, Kataria P. Economics production of green pea (*Pisum sativum* L) in Punjab. Agric Econ Res Rev. 2006;19:237-50.