

Growth, Diversification and Temporal Dynamics of Major Crops in Himachal Pradesh

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Abstract

Crop diversification is widely recognized as a successful agricultural growth strategy. Farmers in Himachal Pradesh have shifted towards cash crops such as fruits and vegetables since the late 1960s, particularly in the districts of Shimla, Solan, Kullu, and Lahaul-Spiti. This study analyzed the temporal dynamics and growth rates of area, production and yield of major crops, and crop diversification, measured with the Herfindahl-Hirschman Index (HHI) in Himachal Pradesh from 1991-92 to 2021-22. Data were collected from various government records. This study showed that the area and production under wheat, maize, and rice were recorded as high in the districts Kangra and Mandi during all the study periods. According to the categorizations of the HHI, district Kinnaur was highly diversified with 0.127 HHI value and district Hamirpur was less diversified which lie in the specialized category with 0.453 HHI value during 2001-02, whereas all other districts were recorded as moderately diversified, and some were recorded as less diversified during all the study periods from 1991-92 to 2021-22. The study emphasized the need to target high diversification; therefore, the government and other stakeholders should support technology through the varietal improvement and extension programmes.

Keywords: Area, Production, Yield, Major Crops, Growth, and Crop Diversification.

JEL Classifications: O13, Q10, Q19, R11.

Introduction

Himachal Pradesh is an agrarian economy that accounts for approximately 1.7 per cent of India's entire geographical area (Sharma, 2005; Chaudhary and Singh, 2020; GoHP, 2020). Himachal Pradesh is the only state in the nation where 89.96 per cent of the population lives in rural areas, according to the Census of India 2011 (GoHP, 2017; Chaudhary and Singh, 2018). Agriculture is an essential activity that meets the needs of the growing population and is regarded as the backbone of the state's economy (Devi and Prasher, 2019). In the state's total work force, agriculture and allied activities employed about 53.95 per cent. This sector plays a vital role in the state's income, constituting a significant portion of the Gross State Domestic Product (GSDP) at around 14.74 per cent (GoHP, 2025).

Agriculture has shifted towards high-value cash crops like fruits and off-season vegetables in Himachal Pradesh, particularly in parts of Shimla, Kullu, Solan, and Lahaul & Spiti. This transformation started in the late 1960s and gained momentum in the 1970s and 1980s, utilizing the region's natural advantages (Sharma, 2005; Sharma et al.,

2006; Sharma, 2011). It is recorded as a sustainable way to promote farm income, create jobs, and preserve natural resources (Joshi et al., 2004; Sharma, 2005; Sharma et al., 2006; Sharma, 2011; Kumar et al., 2012; Sarial, 2019). Diversification is crucial for economic development, promoting agricultural growth and the shift to high-value cash crops (Sharma, 2005; Sharma and Chauhan, 2013; Raj, 2010). Moreover, the agricultural diversification through the cultivation of high-value off-season vegetable crops has significantly improved the standard of living and quality of life for the rural communities (Chaudhary and Singh, 2020).

Although many studies have analyzed agricultural growth and crop diversification in Himachal Pradesh, most of them are limited to specific crops, regions, or short time periods. This study is based on the district-level analysis covering the temporal patterns of major crops over an extended period. It represents a comparative assessment across districts and time periods, offering deeper insight into regional variations and evolving agricultural patterns in Himachal Pradesh. This study incorporates the following objectives, i.e., to examine the temporal dynamics of area, production and yield under major crops; to analyse the growth trends of area, production and yield under major crops; and to measure the level of crop diversification in Himachal Pradesh.

Materials and Methods

This study is based on secondary data, which have been collected from various departments, such as the Department of Agriculture, Horticulture, Annual Season and Crop Report, Department of Land Records and the Department of Economic & Statistics of Himachal Pradesh. Data related to area, production, and yield of different major crops (like rice, wheat, barley, maize and potato) have been collected for the period of 1991-92 to 2021-22. The analysis involved the use of statistical tools like Percentages and Compound Annual Growth Rates (CAGR). The Herfindahl-Hirschman Index (HHI) has been utilized to find out the crop diversification. The entire study period has been categorized into four time periods, namely first period (1991-92 to 2000-01), second period (2001-02 to 2010-11), third period (2011-12 to 2021-22) and overall period (1991-92 to 2021-22).

Herfindahl-Hirschman's Index (HHI)

To assess the magnitude under diversification, Herfindahl-Hirschman Index (HHI) has been utilized. This index has been comprehensively utilized in the literature, particularly in agricultural diversification research. Furthermore, the index has been computed based on the proportion of gross cropped area allocated to different crops within a specific geographical region.

$$HHI = \sum_{i=1}^n P_i^2$$

Where P_i represents the proportion of area under the i -th crop, n represents the total number of crops being grown. It is a measure of concentration. The HHI value decreases with an increase in diversification. When a value is one there is complete specialization, and approaches to zero when there is complete diversification (Gupta and Tewari, 1985; Devi and Prashar, 2018; 2019; Islam and Rahman, 2012).

Compound Annual Growth Rate (CAGR)

CAGR has been computed by fitting an exponential function. This analysis was carried out for the entire state. To compute CAGR, the regression was employed. The function used the following specification,

$$Y_t = ab^t \quad (1)$$

With the help of a logarithmic transformation, the function (1) was converted into a linear function:

$$\text{Log } Y_t = \text{Log } a + t \text{ Log } b \quad (2)$$

Where,

Y = dependent variable (area),

t = independent variable (time in years),

a = intercept,

b = regression coefficient $(1+r)$,

r = compound annual growth rate.

The CAGR (%) is computed by using the formulation,

$$\text{CAGR} = (\text{antilog } b - 1) \times 100 \quad (3)$$

Student t -test has been used to determine the growth rates' significance level (Jagrati et al., 2014; Ayele et al., 2021; Verma et al., 2025).

Results and Discussion

Temporal Dynamics of Area, Production and Yield under Major Crops (1991-92 to 2021-22)

The area, production and yield of major crops at the state level are shown in Table 1 for the selected periods from 1991-92 to 2021-22. The percentage area under wheat was recorded as high, followed by maize, across all study periods. This growth in the area for these crops indicates that they are the primary cereal crops in the state. The percentage of production of wheat was slightly more (40.31 per cent) as compared to maize (40.02) during the year 1991-92, whereas it has been higher under maize during other periods. The yield under potato was recorded as high throughout the entire study period.

Rice was the third crop contributing the highest percentage, but the area under rice cultivation has shown a decreasing trend, from 10.13 per cent in 1991-92 to 9.69 per cent in 2021-22, due to several factors. It can be due to the state's hilly terrain and limited irrigation facilities. Farmers are shifting to less water-demanding and more profitable crops like maize, vegetables, and fruits. Similar findings are also observed in the study on agricultural diversification in Himachal Pradesh, where the authors observed that the area under rice and barley has decreased and the area under wheat, maize, and vegetables has increased during the different study periods from 1972-73 to 2011-12 (Devi and Prasher, 2018). The results are also in consonance with the study on agricultural development and crop diversification in Himachal Pradesh: understanding the patterns, processes, determinants and lessons, where author observed that the area under rice and barley decreased and the area under maize and wheat have increased but the area under potato showed consistent trends during the period from 1972-73 to 1999-2000 (Sharma, 2005). The similar findings are also verified with the study crop diversification in Himachal Pradesh: patterns, determinants and challenges, where author found that the area under rice, wheat and barley has decreased and the maize and vegetables have found increasing trends during the period from 1982-83 to 2004-05 (Sharma, 2011).

District-wise Area, Production and Yield under Major Crops in Himachal Pradesh (1991-92 to 2021-22)

The percentage area, production and yield under rice during the different study periods are shown in Table 2. The percentage area under rice was recorded as high in the district of Kangra, followed by Mandi, during all the study periods. The area was recorded as very low in Lahaul-Spiti, followed

Table 1: Area under Major Crops in Himachal Pradesh: 1991-92 to 2021-22

Crops	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Rice	10.13	7.00	1.24	10.24	8.15	1.71	9.91	9.39	1.70	9.69	8.87	2.53
Wheat	46.51	40.31	1.55	46.56	37.80	1.74	47.05	29.35	1.12	46.91	37.78	2.23
Barley	3.41	2.42	1.27	3.18	2.06	1.39	2.77	1.89	1.23	2.65	1.66	1.73
Maize	38.22	40.02	1.88	38.27	45.57	2.55	38.86	52.23	2.41	38.53	41.36	2.97
Potato	1.73	10.25	10.62	1.76	6.42	7.80	1.42	7.14	9.02	2.21	10.33	12.92

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

by Kinnaur, across all periods, mainly due to unfavourable climatic conditions, high altitude, a short growing season and limited cultivable land. These results are confirmative with the study diversification of agricultural crops in Himachal Pradesh, where the authors found that the percentage gross cropped area under rice was observed to be high in district Kangra followed by Mandi, whereas it is observed low in district Lahaul-Spiti followed by Kinnaur, during the different study periods from 1991-92 to 2016-17 (Chaudhary and Singh, 2020). The percentage share of production was recorded as high in the district Kangra, followed by Mandi, during all the study periods. Whereas, it is recorded as low in Lahaul-Spiti, followed by Kinnaur during all the study periods. The yield under rice was recorded as high in the Una district from 1991-92 to 2011-12, and it was recorded as high in the Sirmaur district during 2021-22, whereas it was recorded as low in Lahaul-Spiti.

The percentage area, production and yield under wheat during the different study periods are shown in Table 3. The percentage area of wheat was recorded as high in Kangra district, followed by Mandi, whereas it was recorded low in Lahaul-Spiti followed by Kinnaur during all the study periods, mainly due to their extreme cold climate, high altitude, short growing season, and limited cultivable land. The percentage share of production was recorded as high in the Kangra district, followed by Mandi, whereas it was recorded low in Lahaul-Spiti followed by Kinnaur during all the study periods. Yield values generally increased over time for all the districts from 1991-92 to 2021-22, except Hamirpur and Kinnaur, indicating improvement in agricultural efficiency due to better technology, irrigation, and inputs.

The area, production and yield under barley during the different study periods are shown in Table 4. The percentage area of barley was recorded as high in district Shimla with

Table 2: District-wise Area under Rice in Himachal Pradesh: 1991-92 to 2021-22

Districts	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Bilaspur	3.33	2.99	1.11	2.20	1.75	1.35	2.21	1.99	1.53	1.65	1.23	1.70
Chamba	3.55	3.06	1.07	3.47	2.90	1.42	4.61	3.98	1.46	2.92	2.31	1.81
Hamirpur	3.95	3.76	1.18	3.13	2.63	1.42	2.42	2.02	1.42	1.26	0.77	1.40
Kangra	43.43	46.12	1.31	46.25	45.51	1.67	48.86	48.28	1.68	48.95	48.48	2.26
Kinnaur	0.03	0.03	1.24	0.04	0.04	1.69	0.01	0.01	1.67	0.00	0.00	0.00
Kullu	3.09	4.16	1.67	2.01	1.77	1.49	2.00	1.98	1.69	0.42	0.25	1.33
L&S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mandi	26.58	21.69	1.01	24.52	24.75	1.71	25.03	22.34	1.52	26.32	20.15	1.75
Shimla	4.12	3.98	1.20	2.94	2.18	1.26	1.66	1.45	1.48	0.23	0.13	1.23
Sirmaur	5.72	7.47	1.62	7.30	8.24	1.91	8.37	11.25	2.28	13.07	21.64	3.78
Solan	4.25	3.97	1.16	4.10	4.51	1.86	2.62	3.59	2.32	2.36	2.42	2.35
Una	1.94	2.78	1.77	4.03	5.71	2.40	2.21	3.11	2.39	2.83	2.64	2.13

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

Table 3: District-wise Area, Production and Yield under Wheat in Himachal Pradesh: 1991-92 to 2021-22

Crops	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Bilaspur	6.91	7.04	1.58	7.44	7.87	1.84	7.34	6.56	1.00	6.54	7.66	2.35
Chamba	5.21	4.56	1.36	6.04	5.92	1.71	5.56	9.98	2.01	6.93	6.34	1.83
Hamirpur	9.37	10.26	1.70	9.34	8.45	1.57	9.43	8.61	1.02	9.59	6.92	1.45
Kangra	23.72	26.60	1.74	26.23	24.63	1.63	26.01	25.91	1.11	27.01	27.02	2.01
Kinnaur	0.17	0.13	1.16	0.11	0.11	1.76	0.05	0.07	1.57	0.02	0.01	1.11
Kullu	5.98	6.85	1.78	5.82	6.47	1.93	5.39	5.37	1.11	2.80	2.50	1.79
L&S	0.07	0.07	1.58	0.03	0.03	1.74	0.01	0.01	1.10	0.02	0.02	2.00
Mandi	17.84	17.40	1.52	17.58	20.73	2.05	19.84	17.75	1.00	19.23	18.23	1.90
Shimla	7.77	6.76	1.35	4.82	3.45	1.24	2.62	3.60	1.53	1.80	2.09	2.33
Sirmaur	8.04	7.35	1.42	7.67	7.89	1.79	7.07	7.06	1.12	7.77	7.90	2.04
Solan	6.45	5.53	1.33	6.49	6.68	1.79	6.88	6.32	1.03	7.19	6.52	1.82
Una	8.45	7.44	1.37	8.43	7.76	1.60	9.79	8.76	1.00	11.09	14.78	2.67

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

19.28 per cent and 19.47 per cent during 1991-92 and 2001-02, whereas the same was recorded as high in Chamba with 18.14 per cent and 26.14 per cent during 2011-12 and 2021-22. The area was recorded as very low in Una with 0.11 per cent during 1991-92, while negligible during other periods, mainly due to their relatively warmer climate, lower altitude, and limited suitability for barley, which thrives better in cooler and higher-altitude regions. The production was recorded highest in Mandi during 1991-92 and 2001-02, whereas it was recorded highest in Chamba during 2011-

12 and 2021-22. The yield was recorded higher in Kinnaur during 1991-92, and 2011-12, then Mandi in 2001-02, followed by Shimla during 2021-22.

The area, production and yield under maize during the different study periods are shown in Table 5. The percentage area of maize was recorded as high in district Kangra, followed by Mandi, during all the study periods. It was recorded as low in Lahaul-Spiti, followed by Kinnaur during all the study periods, mainly due to their high altitude, extremely

Table 4: District-wise Area, Production and Yield under Barley in Himachal Pradesh: 1991-92 to 2021-22

Crops	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Bilaspur	1.68	1.67	1.26	1.07	1.07	1.39	1.17	0.95	1.00	0.83	0.83	1.56
Chamba	13.66	11.10	1.03	17.88	19.96	1.55	18.14	21.72	1.47	26.14	21.25	1.27
Hamirpur	0.70	0.70	1.27	0.44	0.44	1.39	0.21	0.20	1.13	0.54	0.54	1.56
Kangra	11.15	12.04	1.37	9.37	8.25	1.22	11.28	11.39	1.24	9.33	9.85	1.65
Kinnaur	5.30	7.69	1.85	5.57	5.38	1.34	3.89	4.87	1.53	4.36	3.71	1.33
Kullu	12.59	15.76	1.59	13.89	14.26	1.42	14.78	14.95	1.24	9.20	8.75	1.49
L&S	2.71	2.69	1.26	2.30	2.30	1.39	2.14	1.77	1.01	2.26	2.26	1.56
Mandi	15.15	17.91	1.50	16.07	21.58	1.86	15.48	12.63	1.00	17.52	19.52	1.74
Shimla	19.28	15.16	1.00	19.47	15.05	1.07	13.96	14.66	1.29	12.05	17.69	2.29
Sirmaur	10.46	9.48	1.15	8.03	6.87	1.19	10.85	9.69	1.09	11.05	12.08	1.71
Solan	7.23	5.70	1.00	5.89	4.83	1.14	8.10	7.16	1.08	6.72	3.51	0.82
Una	0.11	0.11	1.26	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

Table 5: District-wise Area, Production and Yield under Maize in Himachal Pradesh: 1991-92 to 2021-22

Crops	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Bilaspur	8.60	7.82	1.71	8.69	8.94	2.62	8.83	7.99	2.18	10.37	6.09	1.57
Chamba	8.67	11.34	2.45	9.25	10.72	2.95	9.42	11.67	2.98	11.02	13.90	3.37
Hamirpur	10.37	10.97	1.99	10.73	9.48	2.25	10.76	7.64	1.71	12.15	9.05	1.99
Kangra	18.42	16.46	1.68	19.45	14.74	1.93	19.32	15.08	1.88	17.91	13.93	2.08
Kinnaur	0.14	0.14	1.89	0.13	0.13	2.55	0.05	0.05	2.41	0.03	0.03	2.68
Kullu	5.63	3.76	1.25	5.56	7.07	3.25	5.66	8.20	3.49	3.83	4.43	3.10
L&S	0.01	0.01	1.87	0.01	0.01	2.55	0.01	0.01	2.41	0.00	0.00	0.00
Mandi	15.74	16.26	1.94	16.18	19.74	3.11	16.54	17.97	2.62	16.73	24.00	3.84
Shimla	6.60	6.63	1.89	5.05	5.26	2.65	3.53	3.65	2.50	1.82	1.68	2.46
Sirmaur	8.23	9.64	2.20	7.77	9.03	2.97	7.22	8.95	2.99	6.90	11.41	4.42
Solan	8.01	7.96	1.87	8.10	7.49	2.36	7.92	9.24	2.81	7.48	7.25	2.59
Una	9.60	9.01	1.76	9.09	7.39	2.07	10.75	9.54	2.14	11.76	8.23	1.87

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

cold climate, and short growing season. The production was recorded highest in Kangra district during 1991-92, whereas it was recorded higher in Mandi during all other periods. The yield was recorded higher in Chamba during 1991-92, followed by Kullu during 2001-02 and 2011-12, whereas it was recorded higher in Mandi during 2021-22.

The area, production and yield of potato during the various study periods are given in Table 6. The percentage area under potato was recorded as high in district Shimla, followed by Mandi, during all periods. The area was recorded

as low in Bilaspur, Hamirpur and Solan during all the study periods. The production was recorded higher in Shimla during all the study periods. The yield was recorded higher in Lahaul-Spiti during 1991-92 to 2011-12, whereas it was recorded higher and similar in Kangra, Lahaul-Spiti and Shimla during 2021-22.

Growth Rates of Major Crops (1991-92 to 2021-22)

Growth rate trends of area of major crops during various study periods are given in Table 7. Rice, wheat, barley and

Table 6: District-wise Area, Production and Yield under Potato in Himachal Pradesh: 1991-92 to 2021-22

Districts	1991-92			2001-02			2011-12			2021-22		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Bilaspur	0.18	0.16	9.35	0.06	0.06	7.78	0.15	0.15	9.13	0.99	1.00	13.00
Chamba	3.64	3.20	9.34	4.36	5.80	10.39	8.75	7.73	7.97	5.30	4.64	11.31
Hamirpur	0.08	0.07	9.36	0.08	0.08	7.82	0.08	0.08	8.96	0.99	1.00	13.00
Kangra	8.04	6.92	9.13	11.29	11.26	7.78	14.32	12.94	8.15	8.28	8.34	13.02
Kinnaur	1.98	1.62	8.68	1.43	0.92	5.03	0.99	1.20	10.96	4.64	4.67	13.01
Kullu	6.99	6.67	10.13	7.38	7.50	7.93	11.39	8.09	6.41	5.96	6.00	13.01
L&S	6.65	18.35	29.28	5.86	10.85	14.44	7.08	16.63	21.19	8.61	8.67	13.02
Mandi	12.73	9.83	8.19	16.89	18.89	8.73	20.82	17.24	7.47	10.60	10.67	13.01
Shimla	47.40	40.24	9.01	38.27	30.12	6.14	22.04	19.96	8.17	37.75	38.02	13.02
Sirmaur	9.31	9.53	10.86	10.78	10.92	7.90	5.82	6.40	9.93	9.93	10.00	13.01
Solan	0.82	1.26	16.44	0.79	0.79	7.81	0.68	0.39	5.15	1.99	2.00	13.00
Una	2.17	2.15	10.52	2.81	2.81	7.80	7.87	9.18	10.54	4.97	5.00	13.00

Source: Computed from various statistical records.

Note: A = Area in per cent, P = Production in per cent, Y = Yield in Metric Ton / Hectares

Table 7: Compound Annual Growth Rates (CAGR) of Area under Different Crops in Himachal Pradesh: 1991-92 to 2021-22

(% per annum)				
Crops	1991-92 to 2000-01	2001-02 to 2010-11	2011-12 to 2021-22	1991-92 to 2021-22
Rice	-0.33 (0.002)	-0.78*** (0.001)	-1.56** (0.006)	-0.60 (0.000)
Wheat	-0.30 (0.002)	-0.23* (0.001)	-1.29*** (0.002)	-0.53 (0.000)
Barley	-0.61 (0.004)	-1.34*** (0.003)	-0.90** (0.003)	-1.31 (0.000)
Maize	-0.44*** (0.001)	-0.09 (0.000)	-0.55** (0.002)	-0.38 (0.000)
Potato	0.02 (0.005)	-3.09*** (0.005)	5.05*** (0.011)	-0.46 (0.002)

Note: ***, **, * denotes 1%, 5% and 10% level of significance.

*Figures in the parentheses indicate the standard error of respective coefficients.

maize recorded the lowest and negative growth rate during all the study periods, which can be due to shifting cultivation patterns, declining profitability of cereals, increasing focus on high-value horticulture crops, fragmentation of land holdings, and changing climatic conditions. These results are confirmed with the study, trends in growth of agriculture in Himachal Pradesh where author observed that the negative growth rate trends under the area of rice, wheat, barley and maize during the study period 1989-90 to 2011-12 (Devi and Prasher, 2018).

Growth rate trends of production under major crops during various study periods are given in Table 8. Rice exhibits consistent positive growth rate trends during all study periods. Wheat and barley show negative growth during the first two decades, though wheat recovers slightly in the most recent period. Maize shows mixed trends, growth declined in the middle period, and a sharp increase with 5.24 per cent per annum in the recent decades. Potato indicates the most dynamic pattern, with strong recent growth trends with 9.93 per cent at 1 per cent significant level, despite a decline in the middle period, indicating a shift towards high-value crops. These results are in consonance with the study, trends in growth of agriculture in Himachal Pradesh where the authors observed that the positive growth rate trends under the production of rice and maize and negative

under wheat and barley during the study period 1989-90 to 2011-12 (Devi and Prasher, 2018).

Growth rate trends of yield under major crops during various study periods are given in Table 9. Rice showed positive growth in all the study periods. Wheat and barley showed negative growth in the initial decades, both recorded positive with 1 per cent significant level in the overall period. Maize and potato showed negative growth during 2001-02 to 2010-11, except other periods it showed positive. Overall, despite early setbacks, most crops exhibited recovery and positive yield growth in the long run. The results are verified with the study, trends in growth of agriculture in Himachal Pradesh, where the authors observed that the positive growth rate trends under the yield of rice and maize and negative under wheat and barley during the study period 1989-90 to 2011-12 (Devi and Prasher, 2018).

Crop Diversification Index (Herfindahl) (1991-92 to 2021-22)

Crop diversification as the strategy of practice farming from conventional lower-value crops to high-values crops (Kremen et al., 2012; Neogi and Ghosh, 2022). It is the method that enables a farmer to cultivate a wide variety of crops in a particular area to promote production activities, which reduce the overall cultivation and production risk

Table 8: Compound Annual Growth Rates (CAGR) of Production under Different Crops in Himachal Pradesh: 1991-92 to 2021-22

(% per annum)				
Crops	1991-92 to 2000-01	2001-02 to 2010-11	2011-12 to 2021-22	1991-92 to 2021-22
Rice	1.73*** (0.003)	0.71 (0.014)	0.48 (0.012)	0.78*** (0.002)
Wheat	-3.39 (0.029)	-4.55* (0.022)	1.45 (0.015)	0.67 (0.004)
Barley	-2.88 (0.017)	-3.50** (0.013)	0.03 (0.011)	-0.14 (0.003)
Maize	1.08* (0.004)	-0.14 (0.017)	5.24 (0.039)	0.100 (0.005)
Potato	3.14 (0.038)	-4.56* (0.022)	9.93*** (0.017)	0.192 (0.006)

Note: ***, **, * denotes 1%, 5% and 10% level of significance.

*Figures in the parentheses indicate the standard error of respective coefficients.

Table 9: Compound Annual Growth Rates of Yield under Different Crops in Himachal Pradesh: 1991-92 to 2021-22
(% per annum)

Crops	1991-92 to 2000-01	2001-02 to 2010-11	2011-12 to 2021-22	1991-92 to 2021-22
Rice	2.07*** (0.004)	1.51 (0.015)	2.08* (0.011)	1.39 (0.002)
Wheat	-3.09 (0.028)	-4.32* (0.021)	2.79* (0.014)	1.21*** (0.004)
Barley	-2.28 (0.017)	-2.18* (0.011)	0.94 (0.011)	1.18*** (0.003)
Maize	1.53** (0.005)	-0.05 (0.017)	5.83 (0.040)	0.49 (0.005)
Potato	3.13 (0.036)	-1.52 (0.019)	4.65 (0.006)	0.65 (0.004)

Note: ***, **, * denotes 1%, 5% and 10% level of significance.

*Figures in the parentheses indicate the standard error of respective coefficients.

through diversified crop rotation like inter- and multiple-cropping (Neogi and Ghosh., 2022). The level of crop diversification at the state level can be understood through changes in the area share contributed by major crops in agriculture.

Table 10 illustrates the district-wise crop diversification during different years in the state. Initially, in 1991-92, the highest diversification was observed in Shimla district, possessing a Herfindahl-Hirschman Index (HHI) value of 0.165. Kinnaur emerged as the second most diversified district with a 0.179 HHI value. Many districts were found to be moderately diversified according to the diversification index values. Based on these values, all districts are observed to be moderately diversified, except Bilaspur (0.400), Hamirpur (0.435) and Una (0.383) were less diversified. During 2001-02, Kinnaur (0.127) was found highly diversified, whereas other districts were recorded moderately diversified except Bilaspur and Una were categorized in low diversification

while Hamirpur was categorised under specialized category.

During 2011-12, Kullu (0.191) was found to be highly diversified but in moderately diversified category, while Hamirpur (0.469) was less diversified under the specialized category. During 2021-22, Sirmaur (0.152) was found to be highly diversified under moderate diversification category, while Kinnaur (0.364) was less diversified. These similar diversification categories were considered with the study of agricultural growth and crop diversification in western Himalayan state of Himachal Pradesh (Dhanta and Negi, 2018). The overall value of the diversification index has decreased from 1991-92 to 2021-22, indicating an emerging trend of diversification in the state. The limited size of land holdings and the high-risk nature of hill agriculture may hinder the specialization of crops in the state.

Table 11 shows that the district-wise categorization of crop diversification in Himachal Pradesh remained largely

Table 10: Crop Diversification Index (Herfindhal) across Districts in Himachal Pradesh: 1991-92 to 2021-22

Districts	1991-92	2001-02	2011-12	2021-22
Bilaspur	0.400	0.434	0.432	0.315
Chamba	0.287	0.278	0.245	0.210
Hamirpur	0.435	0.453	0.469	0.348
Kangra	0.281	0.271	0.307	0.226
Kinnaur	0.179	0.127	0.237	0.364
Kullu	0.224	0.214	0.191	0.243
Lahaul & Spiti	0.219	0.300	0.253	0.289
Mandi	0.283	0.278	0.294	0.185
Shimla	0.165	0.161	0.222	0.275
Sirmaur	0.263	0.232	0.217	0.152
Solan	0.287	0.297	0.320	0.244
Una	0.383	0.363	0.409	0.357
H.P	0.265	0.255	0.255	0.182

Source: Computed from various statistical records.

*The value near 0 indicates high diversification, and the value near 1 indicates low diversification.

*HHI values 0.150 = highly diversified, 0.150 – 0.300 = moderately diversified, 0.301 – 0.450 less diversified, and > 0.450 = specialized.

Table 11: Crop Diversification Categories across Districts in Himachal Pradesh: 1991-92 to 2021-22

Categories	1991-92	2001-02	2011-12	2021-22
Highly diversified	-	Kinnaur	-	-
Moderately diversified	Chamba, Kangra, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan	Chamba, Kangra, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan	Chamba, Kinnaur, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur	Chamba, Kangra, Kullu, Lahaul & Spiti, Mandi, Shimla, Sirmaur, Solan
Less diversified	Bilaspur, Hamirpur, Una	Bilaspur, Una	Bilaspur, Kangra, Solan, Una	Bilaspur, Hamirpur, Kinnaur, Una
Specialized	-	Hamirpur	Hamirpur	-

Note: Districts arranged as per HHI values.

moderate over time. Only district Kinnaur achieved high diversification and district Hamirpur achieved specialized category in 2001-02, while other districts are observed in moderately and less diversified categories. Overall, the pattern indicates stability with limited improvement toward higher diversification.

Conclusions and Policy Implications

The foregoing analysis indicates that wheat has emerged as a dominant crop followed by maize and rice among others major cereal crops during all the study periods. As per the district-wise analysis, the area and production under rice, wheat and maize were recorded as high in district Kangra, followed by Mandi during all the study periods. The growth rates of area under all cereal crops were recorded negative during all the study periods whereas potato recorded negative growth in area, and it has recorded positive for production and yield for the overall study periods. The production and yield recorded positive only for the rice except other cereal crops. As per the diversification index district Kinnaur solely recorded highly diversified with HHI value 0.127 as per the categorization of the index during the period 2001-02.

For the growth and development of agriculture, various factors should be encouraged in the state, such as infrastructure, road connections, availability of inputs like hybrid seeds, fertilizers, the emergence of new markets, market awareness among the farmers, provision of irrigation facilities, and the presence of a network of research and development institutions. Further, more efforts are needed in areas such as promoting scientific cultivation methods, advocating for organic farming, establishing agricultural universities, promoting intensive cultivation, and implementing long-term planning to boost investments in agriculture and research and development activities.

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