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CHANGING CROPPING PATTERN AND CROP DIVERSIFICATION IN HIMACHAL PRADESH DURING THE LAST FIFTY YEARS (1970-71 TO 2023-24)

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The cropped area under Himachal Pradesh has witnessed a significant transformation in its cropping pattern over the past few decades. The historical dominance of foodgrains has waned, giving way to an increased cultivation of high-value crops such as fruits and vegetables. The cropping pattern in India, including Himachal Pradesh, has undergone significant transformations over the last five decades due to economic, technological, environmental, and policy-driven factors. This paper examines the changes in the cropping pattern, highlighting shifts from traditional food crops to cash crops, diversification towards horticulture, and the impact of climate change on agricultural practices. The comparative analysis reveals that while both Himachal Pradesh and India have experienced an increasing trend in crop diversification over the years, to understand the key drivers influencing crop diversification in Himachal Pradesh, several explanatory variables have been examined. These include infrastructural factors such as the percentage of gross irrigated area (PGIA), road density (RD), Annual Rainfall (AR) and agricultural credit (AC), along with technological factors such as fertilizer use per hectare (FUPH). Each of these factors has played a significant role in shaping the cropping patterns in the state.

KEYWORDS: ***Cropping Pattern, crop diversification, agricultural credit, road density, annual rainfall***

INTRODUCTION

In Himachal Pradesh, where more than 90 percent of the households are rural, the most important income provider is agriculture. To increase the farm income, farmers in the state have started diversifying their agriculture towards apple crop in the late sixties and early seventies and vegetables in the late eighties. This diversification drive in the state has been a successful attempt because of many favourable factors like favourable agro climatic conditions, demand of perishable goods in the neighboring markets, advancement in the transportation networks, development in the technological sector, farmer friendly schemes, programs and trainings, dependency on agriculture, better communication through mobiles, construction of local mandi's and storage houses etc. The shift of farmer's choice from low value cash crops towards high value cash crops has increased the net income of the farmers, as the production of high value cash crops has increased to more than double in comparison to that of low value crops (Singh 2014).

Agriculture remains a crucial sector of the Indian economy, contributing significantly to GDP and employment. Over the last four decades, cropping patterns have shifted due to various factors such as Green Revolution technologies, liberalization, government policies, climate change, and market demands. In Himachal Pradesh there limited area, increase in population, climate adversities, roads connectivity, mountain restriction and many such problems restrict agriculture in states. To overcome these challenges the agriculture of Himachal Pradesh needs to be diversified, as more than seventy percent of its population directly or indirectly is dependent on agriculture for their livelihoods. Sharma (2011)in his

study on crop diversification has highlighted the factors like rapid economic growth, slowdown of demand for cereals, increasing demand for high value commodities, increasing availability of advanced technologies, declining agricultural prices, changing role of government, expanding role of private sector, improving supply chain management.

Crop diversification has not only helped in growing more crops but it has also increased the production, income and employment. The diversification of agriculture towards high value cash crops like fruits and vegetables has made a significant impact on the economic status of the farmers, as their income has increased after crop diversification and so have the employment opportunities. (Kumari, 2007). Crop diversification through variety of crops also leads to a variety of produce. This lowers the agricultural related risks like crop failure, shortage of production, less variety of crops, low income etc. crop diversification as the most viable solution to transform agriculture and overcome the constraints of mountains specificities in Himachal Pradesh. (Sharma,2011)

During the decade of 1980s, non-food grain crops like potatoes, oilseeds and sugarcane have experienced quite high rate of growth in their areas (Chand *et al*., 2008). With India achieving self-sufficiency in food grains production by late 1970s, there was a turnaround in policy towards diversification as a result of which the area under cereal crops started declining after 1983-84. From early1990s, diversification towards horticulture received a real boost.

2. OBJECTIVES

i) To examine the nature of cropping pattern change over time in Himachal Pradesh during the last fifty years.
ii) To prepare Crop-Diversification index of Himachal Pradesh and India last five decades.
iii) To analyze the factors that are responsible for change in cropping pattern in Himachal Pradesh during last five decades.

3. DATABASE AND METHODOLOGY

The primary objective of this study is to analyze the cropping pattern and crop diversification in both Himachal Pradesh and India. To achieve this, we conduct a comparative analysis at both levels using secondary data. This study relies entirely on secondary data, which has been collected, examined, and analyzed to derive meaningful results and conclusions.

The secondary data on cropping patterns has been sourced from various government publications, including the *Statistical Abstract*, *Economic Review*, , *National Horticultural Board*, and reports from the Ministry of Agriculture, Government of Himachal Pradesh, as well as the *Census of India*.

i) **Correlation and Regression**:- To analyze the relationships between factors, both correlation and regression analyses are employed as needed. A correlation matrix, based on the Pearson correlation coefficient, is constructed to examine the interrelationships among variables. Regression analysis, however, is the most crucial method for accurately estimating the relationship between dependent and independent variables. **.**

ii) **Crop Diversification Index (CDI)**

a) The Simpson Index (SI) will provide a clear dispersion of crops in a geographical region (Joshi et. al., 2003). Mathematically, SI is defined as:

$$SI = 1 - \left(\sum_{i=1}^{N} P_i^2\right)$$

Where N is the total number of crops and Pi represents area proportion of the i-th crop in total cropped area. The index was used to measure the diversification. . This index takes a value zero when there is complete concentration and approaches one when diversification is perfect. Thus the Simpson Index (SI) is bounded by Zero and one. The value of Simpson Index (SI) increases with the increase in diversification and assumes 0 (zero) value in case of perfect concentration i.e. when only one crop is cultivated.

4. DISCUSSION AND RESULT

4.1 Changing Cropping Pattern in Himachal Pradesh 1970-71 to 2023-24

The Cropped area under Himachal Pradesh has witnessed a significant transformation in its cropping pattern over the past few decades. Despite a largely constant net cultivated area, the escalating demand for food, fueled by a burgeoning population and rapid urbanization, has exerted considerable pressure on agricultural land. This has inevitably led to intensified cropping practices and a notable shift from traditional food crops towards more commercially viable alternatives. The historical dominance of foodgrains has waned, giving way to an increased cultivation of high-value crops such as fruits and Vegetables. As per the Govt. of Himachal Pradesh survey, agriculture contributes about 18.00 per cent of total GDP and provides employment to 50.00 per cent of the country's workforce. India is the largest producer of pulses, rice, wheat, spices and spice products in the world. It has many areas to choose for business such as dairy, meat, poultry, fisheries and food grains etc. India has emerged as the second largest producer of fruits and vegetables in the world. India exports a large quantity of agricultural

materials like food grains, fruits, vegetables, pulses, tea, spices etc and the government is earning good revenue from it. There are many exporting products in which India is leading the world like tea and coffee etc.

Declining Share of Food Grains

However, the observed decline in the cultivation of paddy, pulses and barley crops highlights specific areas requiring further research, targeted support, and strategic interventions to ensure a more balanced and resilient agricultural growth trajectory. The overall share of total rice cultivation (comprising Aus, Aman, and Boro varieties) has decreased considerably from 11.50% in 1970-71 to 7.03% in 2023-24. Aus rice, traditionally a significant crop reliant on monsoon rains, has experienced a steep decline in its share, Similarly, the percentage of area under pulses has also declined from 7.85% in 1970-71 to 2.91% in 2023-24. This decline can be attributed to its inherent vulnerability to monsoon variability and comparatively lower yields. The most common pulse in the Himalayan states is rajmash and along with rajmash, black gram, yellow gram, black peas, white peas, masur, kulth etc. also hold importance. But due to the restriction of climate and size of landholdings, the cultivation of pulses is becoming difficult in the Himalayan states due to which area under pulses in these states has shown a decline.

Conversely, wheat a high-yielding winter crop heavily dependent on irrigation, has witnessed a substantial expansion in its cultivation, increasing its share from 34.76% in 1970-71 to 38.17% in 2000-01 but it dropped in 2023-24 (31.03%) . This growth is a direct consequence of improved irrigation facilities, agricultural credit, rainfall and government initiatives promoting wheat cultivation, and its potential for higher productivity. Barley cultivation has shrunk considerably, from 4.50% in 1970-71 to just 2.75% in 2023-24. This decline could be attributed to the greater profitability of alternative crops, the limited suitability of certain regions in Himachal Pradesh. The percentage area under total food grains experienced a significant drop from 91.71 % in 1970-71 to 67.70 % in 2023-24.In contrast to the decline in some traditional crops, oilseed cultivation, particularly rapeseed & mustard has significantly decreased from 2.46 % in 1970-71 to 1.06 % in 2023-24. The Himalayan states lack in all these important factors due to uneven terrain which ultimately is leading to a decrease in the share of cereal crops in agriculture of Himalayan states. Apart from this climate is not very suitable for the cultivation of cereal crops in these states and most of its area is covered with snow throughout the year.

Shift towards Fruits and Vegetables

Farmers in the state have diverted towards vegetables from 90's. The percentage of area under vegetables increased over time. The percentage area under vegetable has witnessed increase in its share from 2.25% in 1970-71 to 9.26% in 2023-24. Fruits cultivation has shown a steady upward trend, expanding from 1.37 % in 1970-71 to 23.30 % in 2023-24. As the profits of vegetables and fruits were higher, because of the fact that there is a daily demand for vegetables, This expansion has been facilitated by improvements in cold storage facilities, enabling better preservation and marketing of the produce, alongside a growing consumer market. The cultivation of ginger, a high-value spice, has also experienced a sharp increase,

In this state's fruits and vegetables has been very rapid due to supportive climatic conditions. The share of food grains and pulses however has decreased mainly because fruits and vegetables give better returns. In Himachal Pradesh the diversification towards high-value food commodities directly contributes in the development of advanced supply chains and opens new ways for expanding income, generating employment and promoting exports. Due to the change in the living standards of population their food requirements are also changing. The demand of population shifted from food grains to fruits and vegetables. Due to urbanization the land in the plain areas around these states has been converted from agriculture to non-agriculture (Deshingkar et al. (2003); Pokharel (2003); Wickramasinghe et al. (2003); Barghouti et al. (2004); Pingali (2004)

Table 1 Percentage Share of Gross Cropped Area under Different Crops in Himachal Pradesh, 1970-71 to 2023-24

Crops	1970-71	1980-81	1990-91	2000-01	2010-11	2023-24
Wheat	34.76	34.70	37.76	38.17	36.52	31.03
Maize	28.23	28.50	32.12	31.23	29.31	23.32
Paddy	11.50	9.23	9.18	8.54	7.62	7.03
Barley	4.5	3.63	2.95	2.78	3.51	2.75
Total Cereals	83.74	79.41	84.32	82.79	77.12	64.54
Total pulses	7.85	5.51	4.01	3.51	5.42	2.91
Total food grains	91.71	84.89	88.53	86.15	82.55	67.60
Total oilseeds	2.46	2.01	2.13	1.95	1.70	1.06
Total fruits	1.37	2.86	4.51	6.12	9.31	23.30
Total Vegetables	2.25	2.14	2.96	3.67	3.87	9.26
Total Gross Area	100.00	100.00	100.00	100.00	100.00	100.00

Sources: Government of H.P, *Statistical Abstract*, Department of Economics & Statistics Shimla

Figure 1 Trends of the Percentage Share of area under Wheat, Maize and Paddy in Himachal Pradesh, 1970-71-to 2023-24

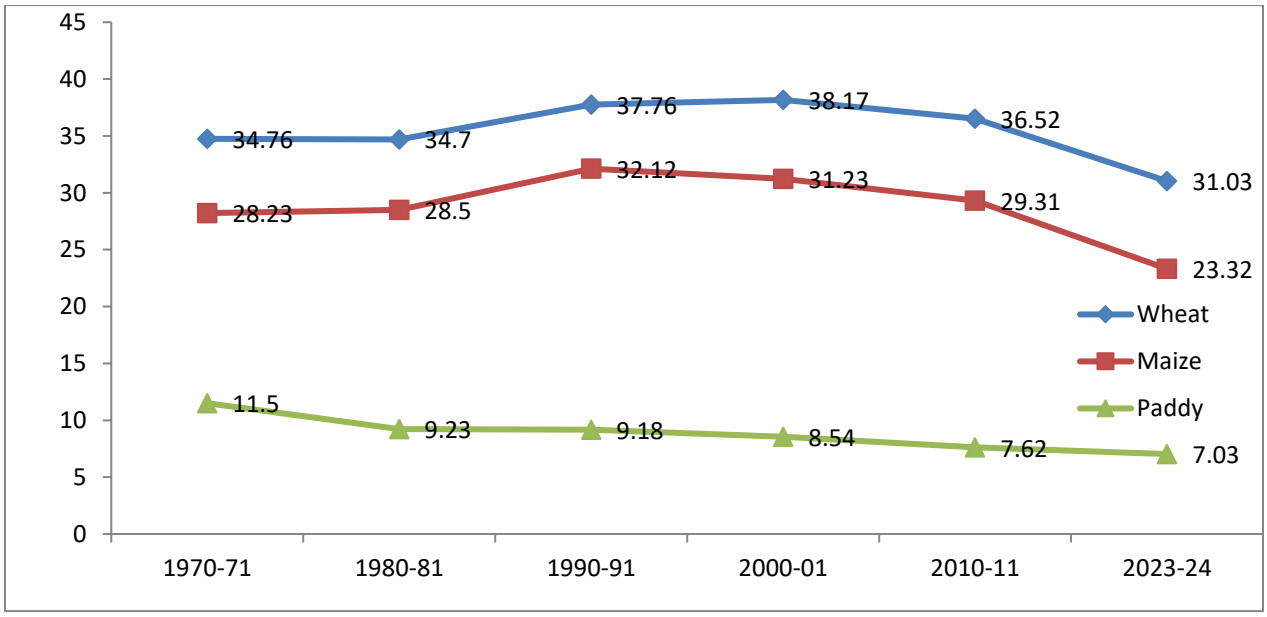


Figure 2 Trends of the Percentage Share of area under Oilseeds and Pulses in Himachal Pradesh, 1970-71 to 2023-24

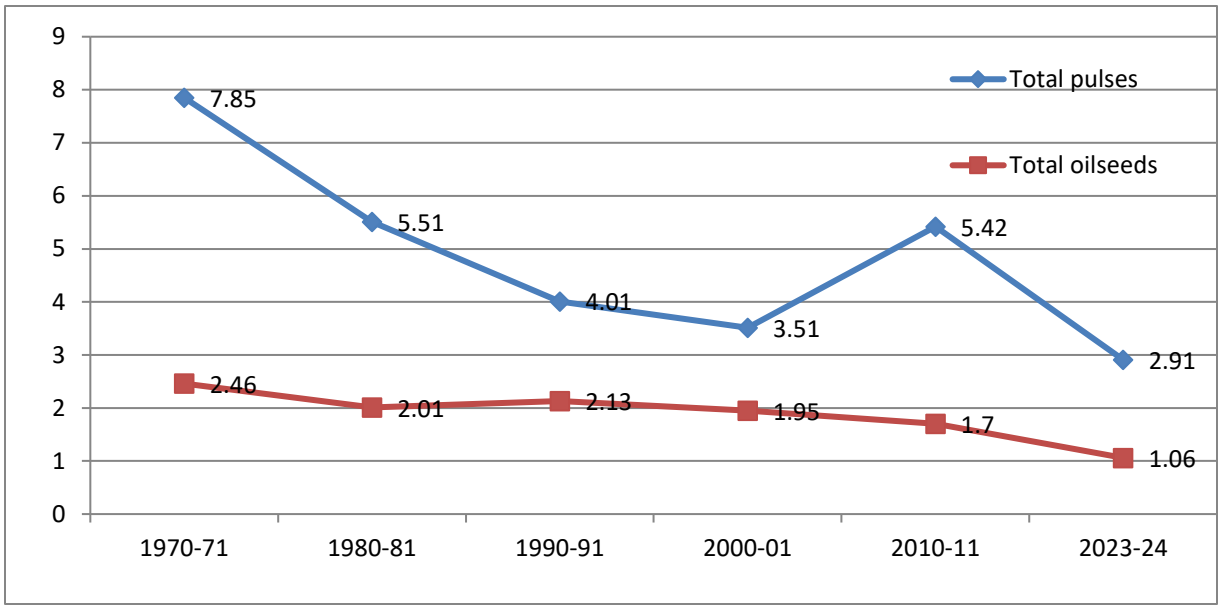
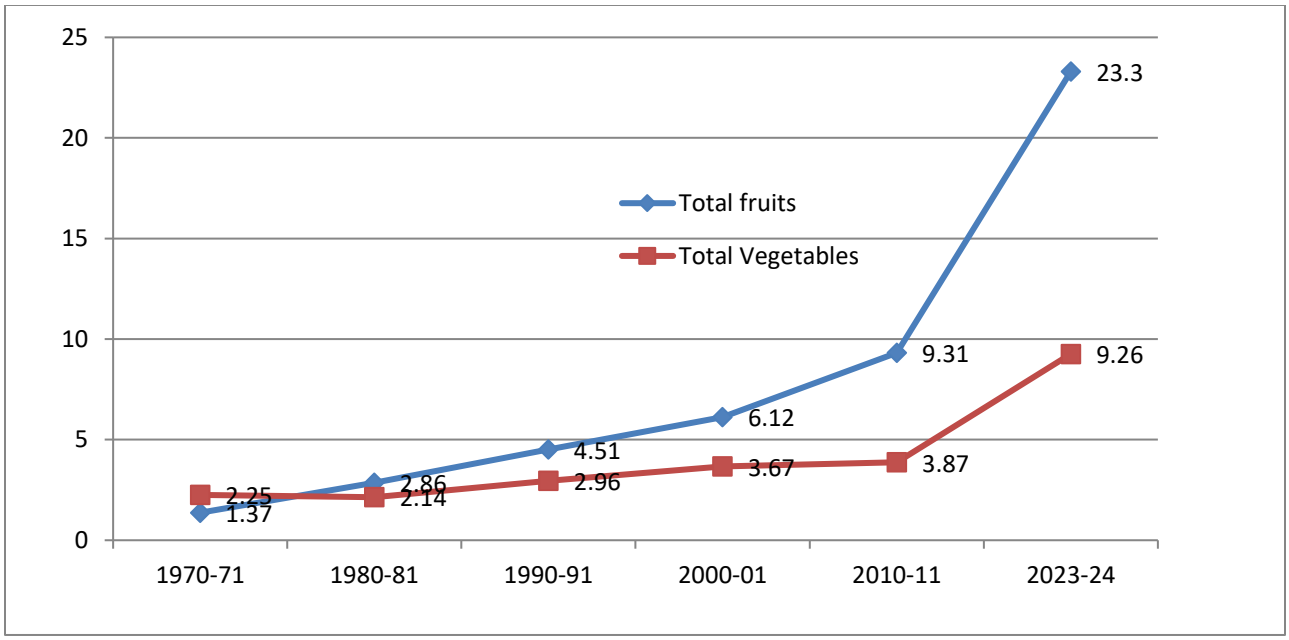


Figure 3 Trends of the Percentage Share of area under Fruits and Vegetables in Himachal Pradesh, 1970-71 to 2023-24



4.2 Crop Diversification of Himachal Pradesh and the Whole of India

Crop diversification is a critical indicator of agricultural development, reflecting shifts in cropping patterns over time. Analyzing the trend in diversification provides insights into the adaptability of agriculture to economic, climatic, and policy-driven changes. This study evaluates the nature of crop diversification in Himachal Pradesh vis-à-vis the whole of India by constructing a crop diversification index and assessing the percentage of non-foodgrain area over different time periods. Agricultural diversification in favour of high-value crops and examined the role of small holders in India, Birthal, et al. (2007).

The crop diversification index for Himachal Pradesh exhibited a consistent increase over the years. It rose from 0.73 in 1995-96 to 0.79 in 2023-24.In contrast, the

national figures for India were relatively higher, progressing from 0.80 in 1995-96 to 0.82 in 2010-11 and reaching 0.84 in 2023-24**.** The data indicate that while diversification increased in both Himachal Pradesh and India, Himachal Pradesh's index remained consistently lower than the national average, highlighting a relatively slower pace of diversification within the state (Table 2 & Figure 3). Crop diversification in South Asia agricultural diversification in favourof high-value commodities took place on account of rising per capita income, changing food consumption pattern, increasing urbanization and development of infrastructure, including roads, the speed of agricultural diversification was however slow in most of South Asian countries, Joshi, et al. (2003)

A parallel trend is observed in the percentage of non-foodgrain area to gross cropped area. In Himachal Pradesh, this share increased from 11.01 % in 1995-96 to 16.68 % in 2009-10 and further to 32.40 % in 2023-24. Comparatively, for India, the corresponding figures were 29.16%, 32.32 %, and 35.75 **%** during the same periods (Table 2 & Figure 4).

India exhibited a slightly higher percentage of area under non-foodgrain crops than the state average, indicating a stronger movement towards diversification in recent years. To further understand these trends, statistical measures such as mean, standard deviation, and coefficient of variation (CV) were analyzed: The average crop diversification index for India (0.8252) remained higher than that of Himachal Pradesh (0.7613), reinforcing the observation of greater diversification at the national level. The standard deviation of the index for India (0.013) was lower than that of Himachal Pradesh (0.017), suggesting more stability in India's diversification trends compared to the state. The CV for Himachal Pradesh (0.0003) was notably higher than that of India (0.0002), indicating greater fluctuations in diversification trends within the state. A similar statistical comparison of the percentage of area under non-foodgrains revealed: Mean Value of the percentage of non-foodgrain area in Himachal Pradesh (16.83%) was lower than the national average (32.04%). The standard deviation for Himachal Pradesh (4.18) was greater than that of India (2.73), suggesting higher variability in cropping patterns in the state. The CV for Himachal Pradesh (0.107) exceeded that of India (0.091), further confirming greater fluctuations in the state's agricultural diversification.

Table 2 Crop Diversification Index and Percentage of Area under Non-foodgrains in Himachal Pradesh and the Whole of India, 1995-96 to 2023-24

Years	Crop diversification index		% of non-foodgrains area	
	Himachal Pradesh	India	Himachal Pradesh	India
1995-96	0.7325	0.8079	11.01	29.16
1996-97	0.7429	0.8076	14.88	29.06
1997-98	0.7410	0.8090	13.41	28.59
1998-99	0.7445	0.8134	13.09	28.99
1999-00	0.7475	0.8107	14.00	28.40
2000-01	0.7487	0.8073	14.14	27.95
2001-02	0.7517	0.8126	14.33	28.39
2002-03	0.7445	0.8141	13.97	28.72
2003-04	0.7437	0.8108	15.59	28.13
2004-05	0.7523	0.8142	12.07	31.10
2005-06	0.7476	0.8134	15.47	31.19
2006-07	0.7569	0.8178	14.62	30.92
2007-08	0.7591	0.8206	14.88	31.64
2008-09	0.7621	0.8195	15.75	32.01
2009-10	0.7654	0.8237	16.68	32.32
2010-11	0.7432	0.8266	15.43	32.17
2011-12	0.7578	0.8328	15.24	33.24
2012-13	0.7689	0.8324	14.35	34.20
2013-14	0.7653	0.8320	17.23	33.92
2014-15	0.7623	0.8368	17.76	33.87
2015-16	0.7712	0.8289	18.44	34.54
2016-17	0.7765	0.8421	19.29	34.80
2017-18	0.7687	0.8377	21.05	33.67
2018-19	0.7757	0.8423	19.91	34.45
2029-20	0.7824	0.8411	21.30	34.85

2020-21	0.7854	0.8443	19.13	35.17
2021-22	0.7898	0.8478	20.20	35.75
2022-23	0.7925	0.8434	22.36	35.58
2023-24	0.7985	0.8419	32.40	36.46
Mean	**0.7613**	**0.8252**	**16.83**	**32.04**
SD	**0.0173**	**0.0136**	**4.187**	**2.738**
CV	**0.0003**	**0.0002**	**0.107**	**0.091**

Sources: Statistical Abstract & Economic Review of West Bengal, Statistical Appendix Indi

Figure 4 Trends of the Crop Diversification Index in Himachal Pradesh & India, 1995-96 to 2023-24

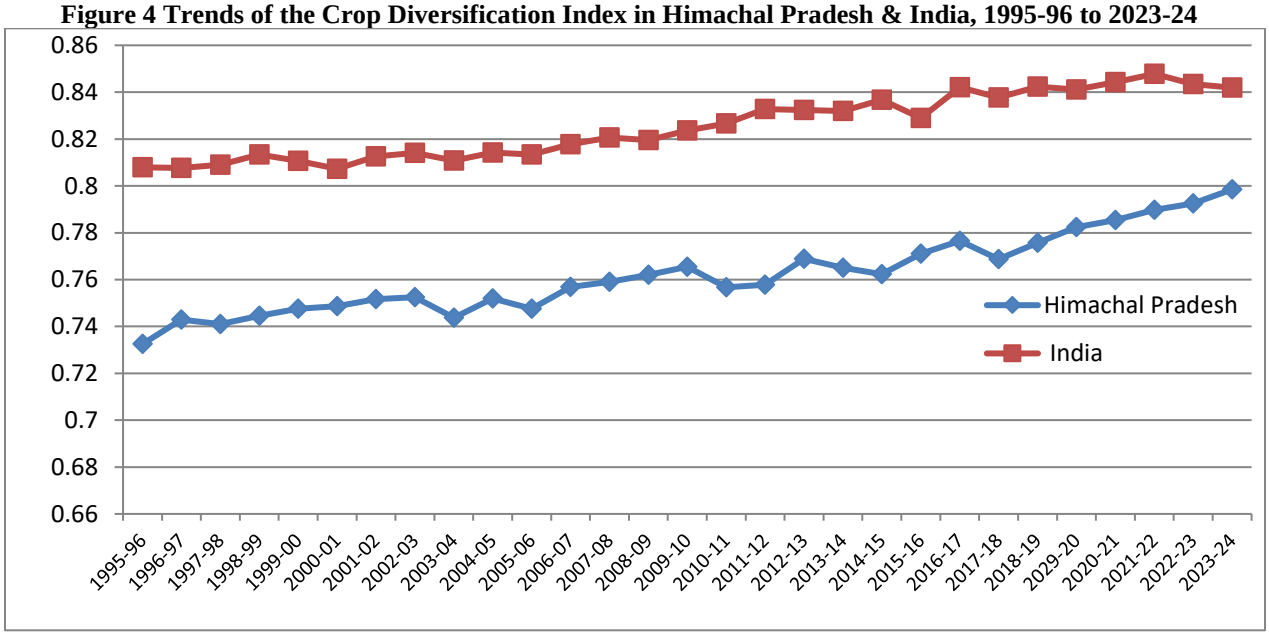
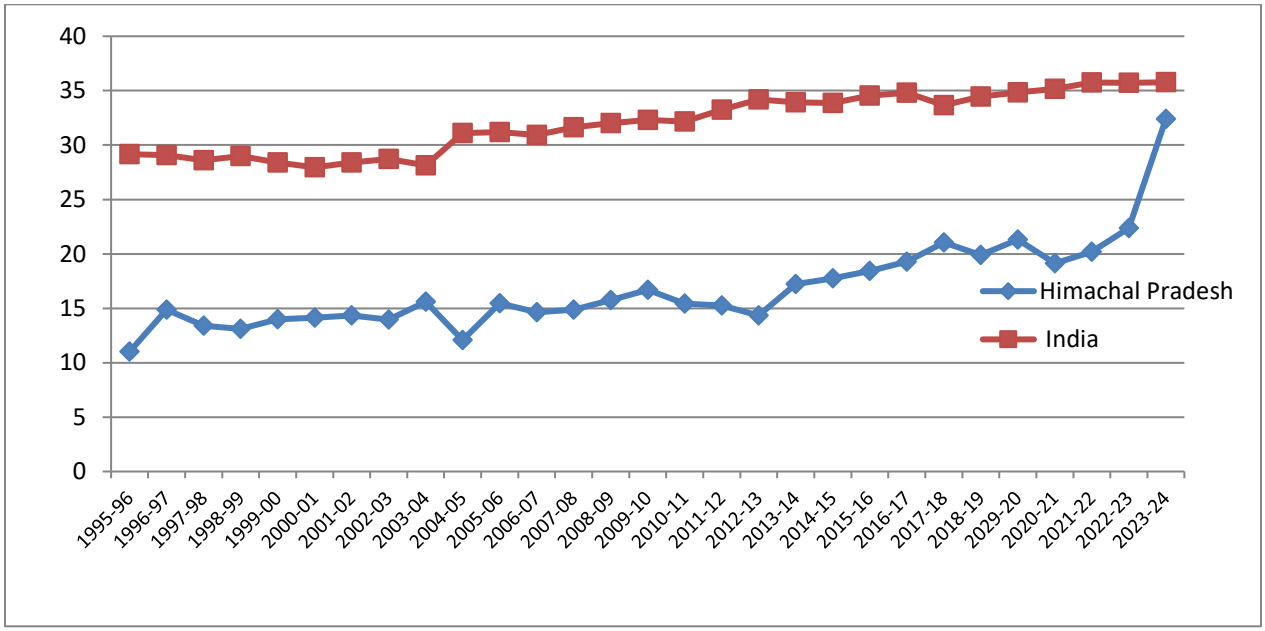


Figure 5 Trends of the Percentage Share of Non-foodgrains Area in Himachal Pradesh & India, 1995-96 to 2023-24



The Crop Diversification Index (DI) in Himachal Pradesh has grown at a CAGR of 0.52%**,** which is significantly higher than India's overall growth rate of 0.18%**.** This suggests that farmers in Himachal Pradesh

have been shifting towards a more diverse cropping pattern at a faster rate than the national average. The percentage of land under non-foodgrains in Himachal Pradesh has increased at a CAGR of 3.79%, outpacing the national growth rate of 0.77%. This indicates a substantial shift away from traditional foodgrain production towards cash crops, horticulture, and other high-value agricultural products.

Table 3 Compound Annual Growth Rate (CAGR) of DI and Percentage of Non-foodgrains area, 1995-96 to 2021-22

State/Country	Variable	CAGR	Level of Significant
Himachal Pradesh	**Crop diversification index**	0.52	1 per cent
	% of non-foodgrains area	3.79	1 per cent
India	**Crop diversification index**	0.18	1 per cent
	% of non-foodgrains area	0.77	1 per cent

4.3 Factors Influencing Crop Diversification

It is noted that the basic infrastructure is required for the development of agriculture in Himachal Pradesh across space and time. Irrigation is one of the prime factors for the improvement of agricultural productivity. To examine the forces which influence the diversification in favour of high valued crops in the state a number of explanatory variables are studied. Large-scale irrigation comes from various canals constructed over the years and that helps farmers diversifying their cultivation towards more remunerative crops like fruits and Vegetables. the Simpson index and concentration of non-food crops, on several possible factors such as income, land distribution, irrigation intensity, institutional credit, road density, urbanization and market penetration, Jha, et al. (2009)

Infrastructure and Crop Diversification

The development of agriculture in Himachal Pradesh has been fundamentally dependent on the availability and improvement of basic infrastructure over space and time. Among the various infrastructural elements, irrigation stands out as a crucial factor in enhancing agricultural productivity. The availability of large-scale irrigation, primarily through an extensive network of canals constructed over the years, has played a pivotal role in transforming the agricultural landscape. This has enabled farmers to diversify their cultivation towards high-value and more remunerative crops such as vegetables and oilseeds, as well as to adopt summer paddy cultivation, which is entirely dependent on irrigation. To understand the key drivers influencing crop diversification in Himachal Pradesh, several explanatory variables have been examined. These include infrastructural factors such as the percentage of irrigated area (PIA), road density (RD), and agricultural credit (AC), along with technological factors such as fertilizer use per hectare (FUPH). Each of these factors has played a significant role in shaping the cropping patterns in the state.

Irrigation , Rainfall and Crop Diversification

Irrigation is one of the primary determinants of crop diversification in Himachal Pradesh. The percentage of irrigation area increased over time, The percentage of irrigated area has witnessed increase in its share from 18.11% in 1995-96 to 21.18% in 2023-24. Rainfall has shown a steady fluctuate trend, expanding from 1384 mm in 1995-96 to 1324 mm in 2023-24. The expansion of irrigation facilities has facilitated the transition from traditional cereal-based farming to more profitable crop choices. The availability of water through canals and other irrigation sources has allowed farmers to shift towards high-value crops, thereby improving overall farm income and productivity.

Role of Chemical Fertilizers and Road Density to changing Cropping Pattern

The use of chemical fertilizers has played a crucial role in transforming agricultural productivity and diversification over the years. From 1995-96 to 2023-24, the per-hectare fertilizer application has witnessed a significant rise, increasing from 30.41 kg to 68.78 kg. This substantial growth has led to improved soil fertility and higher crop yields, enabling farmers to transition toward nutrient-intensive and high-value crops. Chemical fertilizers supply essential nutrients like nitrogen (N), phosphorus (P), and potassium (K), which accelerate plant growth and enhance resistance to pests and diseases. As a result, farmers have been able to optimize their land use, expand crop varieties, and meet the growing demand for food, fiber, and biofuels. Additionally, the widespread adoption of fertilizers has contributed to global food security by ensuring stable and increased agricultural outputs.

Road density (RD) is another crucial factor influencing the cropping pattern in Himachal Pradesh. Defined as the total road length per unit of geographical area, road density plays a vital role in improving market access, reducing transportation costs, and facilitating the movement of agricultural inputs and outputs. The correlation between road density and crop

diversification is evident, as better connectivity encourages farmers to cultivate perishable, high-value crops that require efficient supply chain management. Over the years, road density in Himachal Pradesh has seen remarkable growth, rising from 0.42 km/sq km in 1995-96 to 1.33 km/sq km in 2023-24(Table-4) This expansion has significantly contributed to agricultural transformation by improving access to markets, enabling timely delivery of agricultural inputs, and promoting commercialization of farming.

Agricultural Credit and Crop Diversification

The availability of agricultural credit has played a crucial role in promoting crop diversification in Himachal Pradesh. Access to credit empowers farmers by providing them with the financial resources needed to invest in modern agricultural practices, high-yield crop varieties, mechanization, and improved irrigation techniques. Institutional credit, in particular, reduces financial constraints, enabling farmers to adopt innovative and diversified cropping patterns that enhance productivity and profitability.

A strong positive correlation exists between agricultural credit and the diversification index in Himachal Pradesh. When farmers have access to reliable credit, they are more willing to take calculated risks, moving away from a heavy dependence on traditional staple crops and exploring more lucrative and resilient alternatives. This shift not only improves farm incomes but also strengthens the overall agricultural sector by mitigating the risks associated with mono-cropping and climate variability.

Over the years, the expansion of agricultural credit in Himachal Pradesh has been remarkable change. The total agricultural credit disbursed has increased significantly, rising from ₹1.1 billion in 1995-96 to ₹91.86 billion in 2023-24. This substantial growth reflects the increasing institutional support for farmers and highlights the role of credit accessibility in transforming the agrarian landscape. With better financial backing, farmers are now able to integrate high-value crops,

Table 4 Diversification Index in Relation to Percentage of Irrigated Area, Road Density and Fertilizer Use per Hectare Agricultural Credit in Himachal Pradesh, 1995-96 to 2023-24

Year	Diversification Index	Percentage of Gross Irrigated area	Fertilizer use per hectare(kg)	Road density (km/sq.km)	Credit to agriculture (Commercial Bank) Rs, in billion	Annual Rainfall(mm)
1995-96	0.7325	18.11	30.41	0.42	1.10	1384
1996-97	0.7429	18.49	35.30	0.42	1.22	1454
1997-98	0.7410	18.19	36.00	0.43	1.19	1381
1998-99	0.7445	18.87	40.72	0.47	1.51	1144
1999-00	0.7475	18.70	38.50	0.49	1.8	1068
2000-01	0.7487	19.09	37.00	0.51	2.12	991.8
2001-02	0.7517	18.93	42.00	0.53	3.01	990.4
2002-03	0.7445	19.79	41.91	0.54	4.00	1034.5
2003-04	0.7437	18.83	49.00	0.58	4.04	878.5
2004-05	0.7523	19.20	47.00	0.59	8.01	1248.5
2005-06	0.7476	19.70	48.80	0.58	10.00	1218.4
2006-07	0.7569	19.81	52.11	0.59	13.03	1034.5
2007-08	0.7591	20.23	51.50	0.63	14.07	1114.2
2008-09	0.7621	20.30	59.12	0.65	17.00	956.6
2009-10	0.7654	19.77	54.80	0.8	22.00	1259.4
2010-11	0.7432	20.53	59.13	0.84	24.00	1108.3
2011-12	0.7578	21.24	54.12	0.86	28.00	951.6
2012-13	0.7689	21.52	50.30	0.91	33.01	1211.9
2013-14	0.7653	20.96	51.30	0.96	41.03	1008.78
2014-15	0.7623	20.70	54.00	0.98	45.00	1210.5
2015-16	0.7712	22.08	57.21	1.00	59.02	921.5

2016-17	0.7765	23.57	61.40	1.00	57.00	1182.2
2017-18	0.7687	22.14	63.20	1.13	58.00	1182.1
2018-19	0.7757	21.66	61.81	1.11	65.6	1217.7
2019-20	0.7824	22.87	64.22	1.32	65.25	567.8
2020-21	0.7854	22.69	64.75	1.32	68.79	1037.6
2021-22	0.7898	23.68	65.30	1.32	75.43	1086.4
2022-23	0.7925	22.92	67.00	1.33	80.22	1331.1
2023-24	0.7985	21.18	68.78	1.33	91.86	1324

Sources: Government of H.P, *Statistical Abstract, Economic Review*, various issues, RBI

This study examines the extent to which fluctuations in the Diversification Index (DI) can be explained by variations in key economic and infrastructural factors, specifically the share of farm fertilizer used per hactare (FUPH), road density (RD), and percentage of gross irrigated area (PGIA). As presented in Table 5, the results indicate that between 1995-96 and 2023-24, DI variation is primarily driven by FUPH and PGIA, which together account for 86% of the total variation. The coefficient of FUPH is statistically significant at the 5% level, while percentage of irrigated area and agricultural credit exhibit even higher significance at the 1% level. Furthermore, the overall model demonstrates strong explanatory power, with an F-value of 51.47, reinforcing its robustness and reliability.

In addition to analyzing DI, we also investigate the determinants of changes in the percentage of the area under non-foodgrains (PNFA). Specifically, we assess the extent to which PNFA variations can be attributed to road density (RD) and percentage of gross irrigated area (PGIA). As illustrated in Table 6, between 1995-96 and 2023-24, these two factors collectively explain 85% of the variation in PNFA. The coefficient of FUPH is statistically significant at the 5% level, indicating its notable impact on land-use diversification, while percentage of irrigated area and agricultural credit exhibit even higher significance at the 1% level. Annual rainfall has negative impact on non-foodgrains cultivation. Moreover, the overall model is significant at the 1% level, with an F-value of 36.04, highlighting a moderate but meaningful relationship between the explanatory variables and PNFA trends.

These findings underscore the critical role of infrastructure and mechanization in shaping agricultural diversification and land-use patterns. The strong influence of FUPH and PGIA on DI suggests that technological advancement and financial support play a crucial role in diversifying agricultural activities. Similarly, the impact of RD and PGIA on PNFA highlights the importance of infrastructure and investment in influencing cropping patterns and land allocation. Future research could explore additional factors such as climate variability, market accessibility, and policy interventions to provide a more comprehensive understanding of agricultural diversification trends over time.

Table 5 Percentage of Irrigated Area, Fertilizer Use Per Hectare, Agricultural Credit and Road Density in Relation to Diversification Index in Himachal Pradesh, 1995-96 to 2023-24

Variables	***Coefficients***	***Standard Error***	***t-Value***	***P-Value***
Intercept	0.7225	0.0293	24.628	0.000***
Percentage of Gross Irrigated area(PGIA)	0.0005	0.0017	0.2998	0.766
Fertilizer use per hectare(kg/Ha)(FUPH)	0.0002	0.0002	1.970	0.0383**
Road density (km/sq.km)(RD)	0.0007	0.0197	0.032	0.974
Agricultural Credit (Rs, in billion)(AC)	0.0004	0.0001	2.440	0.0224**
Adj R-squared	0.88			
R Square	0.86			
Significant F-Value	51.47	*Number of obs =*	*29*	

Table 6 Percentage of Irrigated Area, Fertilizer Use Per Hectare, Agricultural Credit ,Road Density and Rainfall in Relation to Percentage of non-foodgrains area(NFA) in Himachal Pradesh, 1995-96 to 2023-24

Variables	*Coefficients*	*Standard Error*	*t-Value*	*P-Value*
Intercept	49.8403	9.4116	5.296	0.000***
Percentage of Gross Irrigated area(PGIA)	-1.9384	0.4630	-4.186	0.000***
Fertilizer use per hectare(kg/Ha)	0.1576	0.0668	2.359	0.027**
Road density (km/sq.km)(RD)	-8.4940	5.4093	-1.570	0.130
Agricultural Credit (Rs, in billion)(AC)	0.2621	0.0547	4.794	0.000***
Annual Rainfall(mm)(AR)	-0.0023	0.0020	-1.165	0.255
Adj R-squared	0.87			
R Square	0.85			
Significant F-Value	36.04	Number of obs = 29		

, *** Indicates coefficient significant at 1 percent level ,
** Indicate coefficient significant at 5 percent level, *Indicates coefficient significant at10 percent level.

5. CONCLUSION

The Cropped area under Himachal Pradesh has witnessed a significant transformation in its cropping pattern over the past few decades. Despite a largely constant net cultivated area, the escalating demand for food, fueled by a burgeoning population and rapid urbanization, has exerted considerable pressure on agricultural land. This has inevitably led to intensified cropping practices and a notable shift from traditional food crops towards more commercially viable alternatives. The historical dominance of foodgrains has waned, giving way to an increased cultivation of high-value crops such as fruits and Vegetables. The overall share of total rice cultivation has decreased considerably from 11.50% in 1970-71 to 7.03% in 2023-24. Aus rice, traditionally a significant crop reliant on monsoon rains, has experienced a steep decline in its share, Similarly, the percentage of area under pulses has also declined from 7.85% in 1970-71 to 2.91% in 2023-24. This decline can be attributed to its inherent vulnerability to monsoon variability and comparatively lower yields

In summary, this paper examines changes in the cropping pattern within the agricultural landscape of Himachal and India. The study analyzes crop diversification using the Simpson Index (SI) to assess shifts over time. Over the past fifty years, key crops such as wheat, maize, rice and oilseeds. The data highlights a structural transformation in Himachal Pradesh's agriculture, with a decline in foodgrain dominance and an increase in high-value crops like fruits and vegetables**.** The shift towards diversification into horticulture indicates a response to changing market dynamics, irrigation improvements, and agricultural credit. This study examines the extent to which fluctuations in the Diversification Index (DI) can be explained by variations in key economic and infrastructural factors, specifically the share of farm fertilizer used per hactare (FUPH), road density (RD), and percentage of gross irrigated area (PGIA). As presented in the results indicate that between 1995-96 and 2023-24, DI variation is primarily driven by FUPH and PGIA, which together account for 86% of the total variation

The comparative analysis reveals that while both Himachal Pradesh and India have experienced an increasing trend in crop diversification over the years, Himachal Pradesh's progress has remained slower and more volatile than the national average. The higher fluctuations in Himachal Pradesh's diversification trends indicate a need for more stable and sustained agricultural policies. Encouraging a balanced mix of food and non-food crops through technological advancements, market incentives, and improved irrigation facilities can further promote diversification, enhancing agricultural resilience and profitability in the state. In this state's fruits and vegetables has been very rapid due to supportive climatic conditions. The share of food grains and pulses however has decreased mainly because fruits and vegetables give better returns. In Himachal Pradesh the diversification towards high-value food commodities directly contributes in the development of advanced supply chains and opens new ways for expanding income, generating employment and promoting exports.

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