

Dynamics of Apple Cultivation in Himachal Pradesh: Growth, Productivity, and Economic Value

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Abstract

Apple cultivation has emerged as a cornerstone of the horticultural economy in Himachal Pradesh, playing a vital role in income generation, employment, and nutritional security in hill regions. This study examines the growth dynamics, production trends, regional distribution, and economic significance of apple cultivation using secondary time-series data from 2003–04 to 2024–25. The analysis reveals that while the area under apple cultivation has expanded steadily (CAGR 1.47%), production exhibits significant fluctuations (CAGR 1.08%) due to climatic variability, including irregular snowfall, hailstorms, and declining chilling hours. Productivity trends show a negative growth rate (–0.38%), indicating challenges such as ageing orchards and limited adoption of modern technologies. District-level analysis highlights spatial disparities, with traditional apple belts like Shimla dominating production, while cultivation is gradually shifting toward higher-altitude regions. Comparative analysis with Jammu & Kashmir reveals a substantial productivity gap, despite Himachal Pradesh maintaining a significant share in national apple area. However, the economic value of apple production has grown considerably (CAGR 8.81%), driven by improved price realization and market demand. The findings underscore that although apple cultivation continues to support rural livelihoods and structural transformation in agriculture, its sustainability is increasingly threatened by climate change and technological constraints. The study suggests the adoption of high-density plantations, climate-resilient practices, and improved value chain infrastructure to enhance productivity and ensure long-term sustainability of the apple sector.

I. Introduction

Fruits and vegetables in developing countries like India are significant in enhancing the economic well-being as well as nutritional security especially to rural populations. Planting orchards not only will provide a diversified food basket, but will also lead to the ecological sustainability and the diversification of crops. The growing of fruit, however, is a long term planning in terms of land, labour and capital. The initial cost of orchards is relatively high; however, the cost of maintaining the orchards is relatively similar to the cost of maintaining the orchards when they are in production (Bakhr, 1985). Apple farming has become the most important horticultural activity in Himachal Pradesh as the state has favourable agro-climatic and topographical situations. Apple growing allows a proper use of the resources of the hills and has much greater returns than the traditional farming. It has increased a gradual change in the subsistence farming sector towards commercial horticulture which has in turn changed the state cropping pattern structurally. Currently, apple constitutes almost 85 percent of all fruit production, and approximately 49 percent of the fruit-growing acreage in the state. It is estimated that the annual turnover of the apple industry is 5000-6000 crore, the industry contributes around 5 percent to the state GDP and the industry sustains the livelihood of close to 1.7 lakh orchardists families. Thus, apple cultivation is not only an economic activity but also a key driver of rural development and income stability. Horticulture especially the cultivation of apples is also of great nutritional value. Apples contain high levels of carbohydrates, vitamins, minerals and readily soluble sugars, which give us instant energy. Since the diets in the hill areas are usually lacking vital nutrients, the encouragement of fruit farming will assist in enhancing nutritional status of the small and marginal farmers. Also, the apple farming helps in soil conservation, creation of employment and provision of supplementary income which means that it is a multifunctional agricultural activity (Pandey & Tiwari, 2010). The state has in recent decades been actively encouraging temperate fruit growing by institutional means, by setting up a Directorate of Horticulture. Apples are adapted to high altitudes (over 5,000 feet) and have superior storage and transportation qualities than other temperate fruits like pears, plums, and peaches (Coulter, 2004). Farmers also experience the socio-economic change that came with the use of apples to cultivate crops. In the World Bank project report (2024), one of the young growers remarked: “Apples are our livelihood, and in the days of my grandfather, this entire area was a very poor place. Apple cultivation helped to improve our lives. This sentence sums up the progress of Himachal Pradesh into an economy of subsistence to a successful horticulture-based economy. Although it has succeeded,

the apple industry is experiencing a number of challenges, such as climate changes, lack of productivity, old plants, and inadequate infrastructure, among others, leading to the need to thoroughly examine the nature of its development and sustainability.

II. Literature Review

The body of literature on apple production in Himachal Pradesh underscores the economic importance of apple production, the changing systems of production, and the new challenges of sustainability. The initial researchers like Negi (1963) and Mehta (1966) highlighted the economic prospects of the hilly areas under fruit cultivation and studied the impacts of grounds on the input application and the profitability of farms. Later studies by Rana et al. (1978) and Verma and Singh (1982) also discovered important factors that determine the level of production in apples such as fertilizer use, availability of labour and the age of the orchard but also noted the expensive nature of harvesting and marketing. Sikka and Swarup (1985) showed how apple farming was financially viable than conventional crops in terms of job creation and improvement of rural incomes. All these initial investigations brought about the effective establishment of apple production as a lucrative and revolutionary farming enterprise in hilly economies. Recent works have been done on growth patterns, productivity, and technological progress. The authors of Singh (2012), Pratap et al. (2013), and Kireeti et al. (2015) have documented a considerable growth in the Apple production, especially in such districts like Shimla, Kullu, and Kinnaur, which were encouraged by the use of high density plantations. Wani and Songara (2018) investigated the correlation between area and productivity, which showed inconsistencies because of climatic variability. Sustainability and climate resilience are becoming more and more a focus of contemporary research. Yasmin et al. (2023) stressed the need to address agro-climatic and infrastructural constraints for sustainable horticultural growth. Divyanshu et al. (2025) concluded that Natural Farming is more profitable and healthier in the soil whereas Jangta and Attri (2025) observed that despite the increased area of apple cultivation, the production rate has not increased because of climatic stress. Moreover, Pathania et al. (2025) did a district-wide climate vulnerability assessment and found that there were vast spatial differences in climate change sensitivity. In their work, they emphasized the importance of specific adaptation measures, such as crop diversification, better irrigation, and technologies that are resistant to climate change.

III. Data and Methodology

3.1 Nature and Sources of Data

The analysis is based on secondary time-series data spanning 2003–04 to 2024–25, sourced from official publications of the Department of Horticulture and Economics & Statistics Department of Himachal Pradesh, along with the Ministry of Agriculture & Farmers Welfare, Government of India. The dataset comprises key indicators including cultivated area (ha), production (MT), productivity (MT/ha), proportional share in total fruit area and output, district-level distribution, and the value of production at current and constant prices, enabling a comprehensive assessment of growth and structural dynamics.

3.2 Analytical Tools and Techniques

(i) Compound Annual Growth Rate (CAGR)

To measure the long-term growth of area, production, productivity, and value, CAGR is calculated as:

$$CAGR = \left(\frac{Y_t}{Y_0} \right)^{\frac{1}{n}} - 1$$

Where:

Y_t = value in the final year, Y_0 = value in the base year, n = number of years

This helps in identifying whether growth is expanding, stagnant, or declining over time.

Trend analysis is employed using time-series data from 2003–04 to 2024–25 to identify long-term growth patterns, capture fluctuations arising from climatic variability, and examine structural changes in the horticultural sector. In addition, share analysis is used to assess the relative importance of apple cultivation by estimating its proportion in total fruit production and cultivated area, thereby highlighting its dominance within the sector. District-wise comparative analysis is carried out to examine regional disparities, growth patterns, and shifting cultivation zones, enabling the identification of high-growth regions such as Kinnaur and Lahaul-Spiti, as well as declining areas like Kangra. Furthermore, an inter-state comparative analysis between Himachal Pradesh and Jammu and Kashmir is conducted based on area, production, and share in national output to evaluate relative performance and competitiveness. Finally, value analysis is undertaken using both current and constant price estimates to assess the economic significance of apple cultivation and to distinguish between real growth and price-driven changes.

IV. Results and Discussion

4.1 Status of Apple Production in Himachal Pradesh

Himachal Pradesh is uniquely blessed with an agro-climatic environment that provides ideal conditions for apple cultivation, making it one of the few regions in India naturally suited to high-quality temperate fruit production. Building on this natural advantage, the state has developed a robust apple economy over the decades, and its performance in terms of area, production, productivity, and market contribution reflects the central role that apples play in Himachal's horticultural landscape. The following section examines the current status of apple production in Himachal Pradesh, highlighting key trends and developments.

Table 4.1 Trends of Apple Production in Himachal Pradesh (from 2003-04 to 2024-25)

Year	Production (in MT)	Area (in ha.)
2003-04	459492	84112
2004-05	527601	86202
2005-06	540356	88560
2006-07	268402	91804
2007-08	592576	94726
2008-09	510161	97438
2009-10	280105	99564
2010-11	892112	101485
2011-12	275036	103644
2012-13	412395	106440
2013-14	738723	107686
2014-15	625199	109553
2015-16	777126	110679
2016-17	468134	111896
2017-18	446574	112634
2018-19	368603	113154
2019-20	715253	114144
2020-21	481062	114646
2021-22	611901	115016
2022-23	672343	115680
2023-24	506687	116000
2024-25	582856	116024
Average	534213	105049
CAGR	1.08	1.47

Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2003-04 to 2024-25).

The apple economy of Himachal Pradesh has shown considerable fluctuations over the last two decades, reflecting the combined influence of natural conditions, technological adoption, and market dynamics. Table 4.1 shows that during the period from 2003–04 to 2024–25, the area devoted to apple cultivation has steadily increased, rising from 84,112 hectares in 2003–04 to 1,16,024 hectares in 2024–25, registering a compound annual growth rate (CAGR) of 1.47%, production trends have been highly inconsistent.

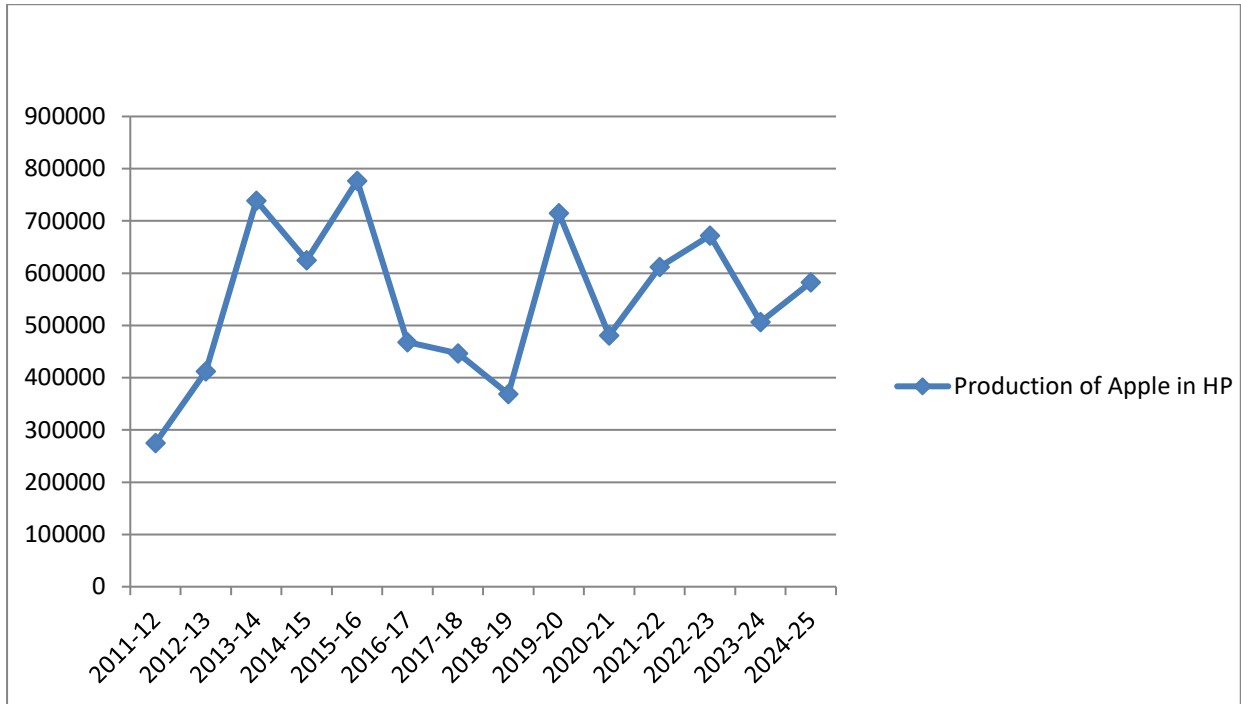


Figure 4.1: Trends of Apple Production in HP from 2011-12 to 2024-25 (in MT)

Source: Department of Horticulture, Government of Himachal Pradesh, Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2011-12 to 2024-25).

Apple production has oscillated between extreme highs and lows due to climatic uncertainties such as hailstorms, frost, irregular chilling hours, and pest attacks. For instance, production plummeted to 2.68 lakh MT in 2006–07 and 2.75 lakh MT in 2011–12, while bumper crops were recorded in 2010–11 (8.92 lakh MT) and 2015–16 (7.77 lakh MT). The average production during the period stood at 5.34 lakh MT, with a modest CAGR of 1.08%, indicating slower growth in output compared to the expansion in cultivated area.

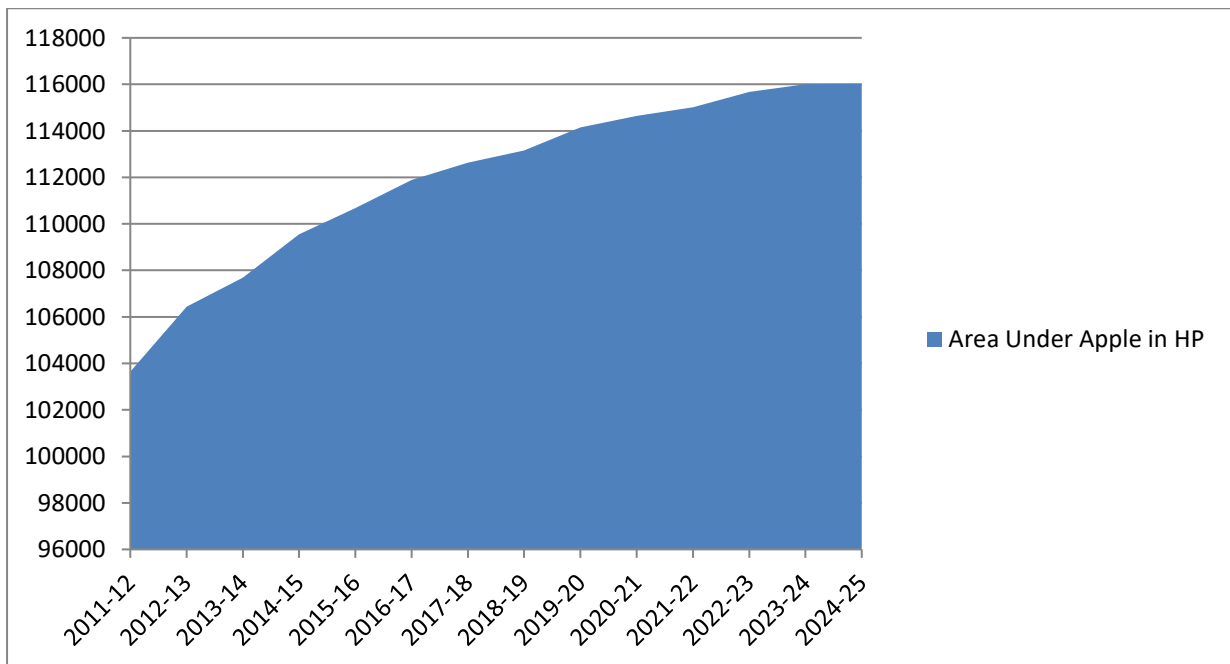


Figure 4.2: Area Under Apple Production in HP From 2011-12 to 2024-25 (in ha)

Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2011-12 to 2024-25).

This mismatch suggests that productivity per hectare has not improved significantly, largely due to the aging of orchards, inadequate technological interventions, and the heavy dependence on climatic conditions. In recent years, production has continued to display instability, with 506,687 MT in 2023–24 and a slight recovery to 582,856 MT in 2024–25. Overall, while the area under cultivation shows a steady upward trajectory, the production figures underline the volatile and risk-prone nature of apple farming in Himachal Pradesh, highlighting the urgent need for scientific orchard management, introduction of high-density plantations, and climate-resilient practices to stabilize yields.

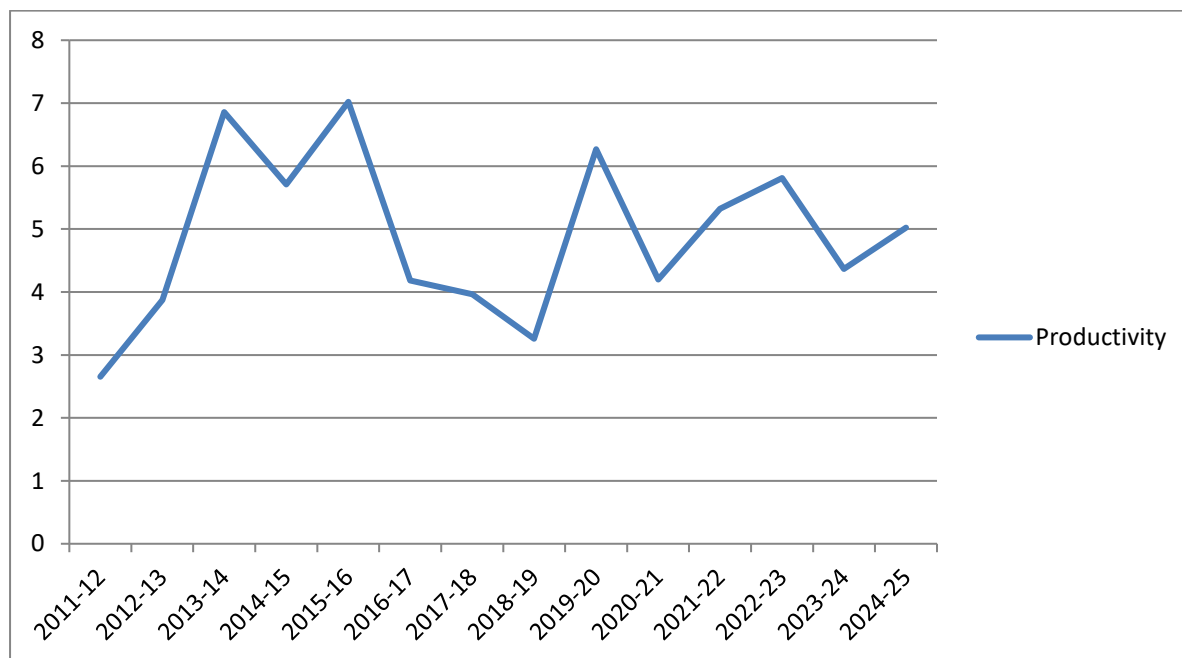


Figure 4.3: Productivity of Apple Production in Himachal Pradesh (MT/ha)

Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2011-12 to 2024-25).

The productivity of apple in Himachal Pradesh has shown high fluctuations over the period 2011–12 to 2024–25. In 2011–12, productivity was 2.65 MT/ha, which improved to 6.86 MT/ha in 2013–14, reflecting a bumper crop year. However, this was followed by a sharp decline to 3.25 MT/ha in 2018–19, indicating crop stress possibly due to climatic factors such as irregular snowfall, hailstorms, and inadequate chilling hours.

From 2019–20 onwards, productivity revived, reaching 6.26 MT/ha, and again fluctuated in the range of 4.19–5.81 MT/ha in the following years. In 2024–25, productivity was recorded at 5.02 MT/ha, which is above the early period levels but below the peak years, showing moderate performance.

Overall, the data suggests that while Himachal Pradesh has the potential to achieve higher productivity levels (above 6 MT/ha), the volatility in output remains a major concern, largely influenced by climate variability, ageing orchards, and lack of modernization in cultivation practices.

Table 4.2 Share of Apple in the Horticultural Sector of Himachal Pradesh (in Percentage)

Year	In Production	In Area
2003-04	82.05	46.10
2004-05	76.25	46.12
2005-06	77.69	46.20
2006-07	72.71	46.49
2007-08	83.12	47.24
2008-09	81.22	47.61
2009-10	73.28	47.83
2010-11	86.79	48.03
2011-12	73.77	48.30
2012-13	74.21	48.75

2013-14	85.26	48.79
2014-15	83.14	48.83
2015-16	83.66	48.80
2016-17	76.50	48.81
2017-18	78.99	48.79
2018-19	74.41	48.74
2019-20	84.60	48.92
2020-21	77.03	48.83
2021-22	81.15	48.78
2022-23	82.53	48.92
2023-24	79.51	49.13
2024-25	77.51	48.96
Average	79.34	48.13
CAGR	-0.258	0.2741

Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2002-03 to 2024-25).

Apple has remained the dominant fruit crop of Himachal Pradesh, contributing significantly to both production and area under fruit cultivation. The data highlights in the table 4.2 that between 2003-04 and 2024-25, the share of apple in total fruit production has fluctuated considerably, ranging from a low of 72.71% in 2006-07 to a high of 86.79% in 2010-11. On average, apple accounted for nearly 79.34% of total fruit production in the state. However, the Compound Annual Growth Rate (CAGR) of production share was slightly negative (-0.258), indicating stagnation and cyclical fluctuations influenced by climatic factors, alternate bearing, and production shocks. In contrast, the area share under apple cultivation has remained relatively stable, averaging 48.14% with a marginal positive growth rate (CAGR is 0.2741). This shows that almost half of the fruit-growing area in Himachal Pradesh is consistently devoted to apple, reflecting its central role in the horticultural economy. The slow but steady increase in area share, despite production fluctuations, indicates that farmers continue to rely heavily on apple cultivation, although productivity is vulnerable to weather uncertainties, diseases, and other constraints. Overall, the data suggests that apple remains the backbone of Himachal’s horticulture, with stable area dominance but production vulnerability, highlighting the need for diversification, better orchard management, and climate-resilient practices to stabilize yields.

Table 4.3 District wise production of Apple in Himachal Pradesh (In MT)

Year	Shimla	Kullu	Mandi	Chamba	Kinnaur	L/Spiti	Kangra	Solan	Sirmour	Bilaspur	Una	Hamirpur	Total
2023-24	281106	102860	47727	9980	58299	705	350	95	5534	24	1	6	506687
2022-23	346993	145103	59174	26270	83324	518	333	26	10593	2	1	6	672343
2021-22	369720	115049	49792	18240	48678	751	252	26	9377	7	1	8	611901
2020-21	247179	92260	49143	14451	73330	310	336	23	4017	4	0	9	481062
2019-20	437024	131194	57158	28083	56864	302	304	19	4291	5	0	9	715253
2018-19	169962	76019	43968	12688	61673	302	298	17	3670	4	0	2	368603
2017-18	251897	78948	42078	18959	52189	300	285	15	1896	6	0	1	446574
2016-17	265987	89570	38344	11734	60210	305	277	14	1688	4	0	1	468134
2015-16	482388	143475	48608	24018	75202	272	324	14	2821	4	0	0	777126
2014-15	407751	104589	24709	26054	59196	277	309	23	2290	1	0	0	625199
2013-14	499422	152654	24229	7189	54044	200	322	18	644	1	0	0	738723
2012-13	259779	87906	9015	2739	52020	169	259	25	481	2	0	0	412395
2011-12	168634	44619	4417	3074	53290	126	400	19	457	0	0	0	275036
2010-11	602684	191212	22315	10789	63781	194	425	38	673	1	0	0	892112
2009-10	171945	54385	8659	3962	40289	193	401	28	242	1	0	0	280105
2008-09	336753	77409	30300	8640	55169	577	502	34	776	1	0	0	510161
2007-08	349262	160124	32283	7744	41550	473	423	27	689	1	0	0	592576
2006-07	163301	43730	16625	3533	40277	191	443	53	245	4	0	0	268402

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2005-06	310252	140633	36421	10367	41101	193	650	59	680	0	0	0	540356
2004-05	318449	141844	20131	7564	38066	209	710	68	560	0	0	0	527601
2003-04	294402	98781	23261	8811	33074	135	595	66	367	0	0	0	459492
CAGR	-0.22	0.192	3.48	0.05	2.73	8.18	-2.49	1.74	13.79	0	0	0	0.466

Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2002-03 to 2024-25).

4.2 District-wise Apple cultivation Trends in Himachal Pradesh

Table 4.3 shows the production of apples in the district of Himachal Pradesh during 2003-04 to 2023-24. The data clearly indicate that Shimla district is the leading producer and has the highest share of total production of apples during the period. Its production varied between a high of 602,684 MT in 2010-11 to 281,106 MT in 2023-24, with a great deal of variation because of climatic variability, unpredictable snowfall, and extreme weather conditions. The other major apple producing regions are Kullu, Mandi and Kinnaur which are also always important contributors to the state economy. Though being a smaller and high-altitude area, Kinnaur demonstrates significant improvement in recent years, up to 58, 299 MT in 2023-24, primarily thanks to favourable agro-climatic conditions and the demand of high-quality late-season varieties. On the other hand, the production in the districts like Lahaul-Spiti, Kangra, Solan, Sirmour, Bilaspur, Una, and Hamirpur is very minimal as the climatic conditions are unfavorable, there is less area of orchard and diversification has been made in other horticultural crops. The Compound Annual Growth Rate (CAGR) analysis indicates that there is a mixed growth pattern across districts. The highest growth rates were positive in Sirmour (13.79%) and Lahaul-Spiti (8.19) yet the base production is very low in these areas. There was also moderate positive growth over time in Kinnaur (2.736%), Mandi (3.481%), and Chamba (0.595%). Shimla registered a minor decrease of -0.22% CAGR, which indicates a great variability and instability in production. Kangra showed the highest negative growth of -2.495% CAGR, which shows a declining suitability of the apples due to increasing temperature and alteration in rainfall distribution. In summary, the state total production of apples records a positive but insignificant CAGR of 0.4667, indicating the slow but consistent long-term growth even when climatic risks are on the rise.

The table is clear on the increasing significance of high-altitude areas, the susceptibility of mid and lower-hilly areas, and the adaptive measures like high-density plantation, irrigation facilities and climate-resistant varieties that can be used to maintain production in the future.

Table 4.4 District Wise Area Under Apple Production in Himachal Pradesh (In Ha)

Year	Shimla	Kullu	Mandi	Chamba	Kinnaur	L/Spiti	Kangra	Solan	Sirmour	Bilaspur	Una	Hamirpur	Total
2022-23	42315	27390	17009	12603	10926	1797	571	200	2737	23	13	96	115680
2021-22	42292	27256	16933	12436	10926	1793	570	94	2601	21	11	83	115016
2020-21	42085	27258	16930	12405	10911	1776	525	73	2580	18	8	77	114646
2019-20	41765	27209	16849	12407	10891	1762	530	59	2574	21	4	73	114144
2018-19	40961	27053	16748	12539	10973	1746	493	54	2500	21	3	63	113154
2017-18	40566	26794	16638	12594	11179	1702	455	42	2579	21	3	61	112634
2016-17	40160	26633	16568	12510	11219	1682	434	45	2566	21	2	56	111896
2015-16	39728	26029	16434	12554	11164	1673	423	58	2592	10	2	12	110679
2014-15	38781	25813	16311	12818	10953	1653	396	60	2753	5	1	9	109553
2013-14	37542	25624	16077	12997	10487	1579	393	65	2912	5	1	4	107686
2012-13	37249	25372	16018	12766	10116	1473	420	71	2948	6	1	0	106440
2011-12	35778	24503	15842	12509	10100	1410	430	85	2980	6	1	0	103644
2010-11	34612	24002	15687	12196	9999	1320	431	87	3144	6	1	0	101485
2009-10	33579	23870	15531	11990	9838	959	450	95	3248	4	0	0	99564
2008-09	32195	23663	15353	11842	9671	812	454	100	3344	4	0	0	97438
2007-08	31323	23179	15135	11473	8874	734	453	108	3443	4	0	0	94726
2006-07	30666	21824	14964	11023	8473	685	444	112	3609	4	0	0	91804
2005-06	29671	20821	14832	10441	8151	621	430	112	3477	4	0	0	88560
2004-05	29029	20524	14567	9853	7720	533	419	112	3441	4	0	0	86202
2003-04	28247	20383	14365	9451	7392	434	404	111	3321	4	0	0	84112

CAGR	2.04	1.4	0.84	1.44	1.97	7.36	1.74	2.98	-0.962	9.13	0	0	1.60
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Source: Department of Horticulture, Government of Himachal Pradesh — Departmental Statistical Data at Glance (Area, Production & Productivity reports for 2002-03 to 2024-25).

Table 4.4 depicts the area of the districts where apples are being cultivated within Himachal Pradesh during 2003-04 to 2022-23. The statistics indicate that Shimla still has the highest share of apple orchards, which grew to 42315 ha in 2022-23, in comparison to 28247 ha in 2003-04, remaining the heart of the apple belt in the state. Other major contributors are Kullu, Mandi, Chamba and Kinnaur where the cultivated area has been steadily increasing over the years. Kullu expanded by 20,383 ha to 27,390 ha and Mandi expanded by 14,365 ha to 17,009 ha showing a consistent growth. Kinnaur with its high-quality late-variety apples is also experiencing an increase, with 7,392 ha increasing to 10,926 ha, confirming its increasing popularity in commercial apple production. Conversely, the share of districts like Lahaul-Spiti, Kangra, Solan, Sirmour, Bilaspur, Una and Hamirpur is a minor share because of less suitability of climatic conditions and less orchard land. Interesting trends were noted in the Compound Annual Growth rate (CAGR): Lahaul-Spiti has the highest growth (7.36%), which is a new growth as a result of favourable cold climate when climate warming shifted cultivation zone upwards. The CAGR of Bilaspur (9.13) is also high, but the actual area is very small. Solan (2.98%), Shimla (2.04%), Kinnaur (1.97%), and Chamba (1.44%) represent moderate growth, and Sirmour (-0.96%) represents negative growth trend, which may be as a result of diversification of crops or decreased profitability. In general, the total area under apple cultivation in the state has grown by 1.60 per cent with a cumulative CAGR of 84,112 ha in 2003-04 to 115,680 ha in 2022-23, showing gradual, but continuous growth of apple cultivation. The data indicates that there is a gradual movement of the zone of apple growing to higher altitudes due to climate change and adjusting temperature needs. It further emphasizes the scientific management of orchards, new, high density plantations, irrigation facilities and varieties that are climate-resistant to continue the future of apple production in Himachal Pradesh.

4.3 Comparative Analysis of Apple Cultivation in Himachal Pradesh and Jammu & Kashmir

While Himachal Pradesh has carved a distinct identity in apple cultivation, a meaningful assessment of its performance becomes more insightful when compared with Jammu and Kashmir the leading apple-producing region in India and its closest climatic and horticultural counterpart.

Table 4.5 Recent Trends Production and Area under Apple in J&K and HP

Year	Himachal Pradesh		Jammu and Kashmir	
	Area (in ha)	Production (in MT)	Area (in ha)	Production (in MT)
2022-2023	115.68	672.34	171.61	2146.35
2023-2024	116.24	506.69	172.14	2064.3
2024-2025	116.24	582.85	164.41	2045.29

Source: Ministry of Agriculture & Farmers Welfare, Government of India. (2025). *Area and Production Estimates of Horticulture Crops (3rd Advance Estimates 2024-25)*. National Horticulture Board / DES-Agri.

Table 4.5 shows the recent trends in the area and production of apples in Himachal Pradesh (HP) and Jammu & Kashmir (J&K) over the last three years (2022–23 to 2024–25). According to the data, despite the fact that the area under apple cultivation in Himachal Pradesh has not changed dramatically, growing slightly, as in 2022-23 to 115.68 thousand hectares, to 2024-25 to 116.24 thousand hectares, the production of apples has changed considerably. HP production dropped drastically to 506 69 thousand MT in 2023-24 (compared with 672 34 thousand MT in 2022-23) mainly because of unfavorable weather conditions and reduced fruit set although this has partially improved to 582 85 thousand MT in 2024-25.

Conversely, J&K still has a far more extensive area of apple-growing than HP, growing in 2022-23 to 171.61 thousand hectares, and in 2023-24 to 172.14 thousand hectares but then declining to 164.41 thousand hectares in 2024-25, perhaps as a result of or Despite higher production in J&K than in Himachal Pradesh, it is declining in value, with 2146.35 thousand MT in 2022-23 and 2045.29 thousand MT in 2024-25, which means that there are challenges in yield, market instability, and weather unpredictability.

Generally, the table shows that J&K leads in the production of apple in the country with Himachal Pradesh taking a major but relatively minor role in apple production. The two states demonstrate stagnation or minor decrease in area and production variability because of climate change, pest infestation and change in snowfall and chilling hours. The trends indicate that there is an urgent need to have high density plantations, advanced technology of cultivation, irrigation systems and climate resistant varietal development to provide stability in yields and sustainability of the apple economy.

The comparison also points out that Himachal Pradesh is a major apple-producing state with a stable area under production whereas the production is very climate-sensitive and characterized by annual variations. The region of Jammu & Kashmir has a greater area under cultivation and much higher productivity, making it the largest in the production of apples in India. Such productivity disparity implies that Himachal should embrace superior orchards management, varieties, and climate-adaptable practices to be more competitive.

Table 4.6 Share of HP and J&K in Total Nation Apple Production and Area

Year	Area share of HP	Production share of HP	Area share of J&K	Production share of J&K
2022-2023	38.03	23.37	56.41	74.63
2023-2024	38.22	19.29	56.60	78.61
2024-2025	39.21	21.72	55.47	76.23

Source: Ministry of Agriculture & Farmers Welfare, Government of India. (2025). *Area and Production Estimates of Horticulture Crops (3rd Advance Estimates 2024-25)*. National Horticulture Board / DES-Agri.

Table 4.6 presents the comparative share of Himachal Pradesh (HP) and Jammu & Kashmir (J&K) in the total national apple cultivation area and production for the years 2022–23 to 2024–25. The data clearly shows that J&K dominates India’s apple industry, accounting for the highest share both in area and production. In 2022–23, J&K contributed 56.41% of the total area and 74.63% of total apple production, whereas HP contributed 38.03% area and only 23.37% of national production. The share of production from HP dropped further to 19.29% in 2023–24, despite maintaining almost constant area, indicating a sharp decline in yield due to unfavourable climatic conditions. However, HP shows a slight improvement in production share to 21.72% in 2024–25, suggesting partial recovery. Compared to HP, J&K maintains a consistently higher share of national production, contributing 78.61% in 2023–24 and 76.23% in 2024–25, even though its area shares decline slightly from 56.60% to 55.47% over the same period. This indicates that J&K has higher productivity per hectare and more favourable agro-climatic conditions for apple cultivation, along with wider adoption of high-density plantations and modern orchard management practices.

Overall, the table highlights that while HP has a significant share in apple cultivation area, its production share remains much lower than J&K due to lower productivity, climate variability, and ageing orchards. In contrast, J&K remains the leading apple-producing state in India, contributing more than three-fourths of total national apple output. The trend suggests a need for technological upgrades, varietal improvement, and climate resilience strategies in Himachal Pradesh to enhance productivity and competitiveness.

4.4 Value of Apple Cultivation in Himachal Pradesh

As a high-value commercial crop, apple cultivation holds exceptional economic significance in Himachal Pradesh, contributing substantially to farm incomes, regional livelihoods, and the overall horticultural economy of the state.

Table 4.7 Value of Apple Production in Himachal Pradesh (Rs. in Lakh)

Year	At Current Price	At Constant Price	Total
2011-2012	123577	123577	358993
2012-2013	239415	185320	639254
2013-2014	299625	331959	756644
2014-2015	283141	280946	653401
2015-2016	264471	349219	694073
2016-2017	190274	210365	646732
2017-2018	228215	200677	698639
2018-2019	191710	165639	670432
2019-2020	372067	321413	907817
2020-2021	206996	216175	776075
2021-2022	267465	274970	1049853
2022-2023	266436	300470	988886
CAGR	6.611635	7.685019	8.810721

Source: Economics & Statistics Department, Government of Himachal Pradesh. (2024). *Himachal Pradesh Statistical Year Book 2022-23*. Himachal Pradesh Government.

Table 4.7 illustrates the value of the production of apples in Himachal Pradesh at current prices, constant prices, and the summation of the economic value between 2011-12 and 2022-23. The statistics indicate a considerable growth in the economic worth of the apple industry through the years even though the quantity of production has changed. The value at current prices grew by 266,436 lakh in 2022-23 compared to 123,577 lakh in 2011-12, and at constant prices (adjusted by inflation), the value grew by 300,470 lakh compared to 123,577 lakh. The aggregate value of apple production also shows a significant rise of ₹358,993 lakh in 2012-13 to ₹988,886 lakh in 2022-23, which is an indication of the developing commercial importance of the apple economy in the state. The changes that can be observed in the various years are the changes in the yield of the apples due to the instability of the climate, snowfall and the attacks of pests. As an example, there was a significant drop in value in the year 2016-17 because of the poor production of apples due to the unfavourable climatic factors, and 2019-20 is characterized by an abrupt increase in value to 907817 lakh because of the high crop and favourable prices in the market. Compound Annual Growth Rate (CAGR) shows high economic growth in long term: 6.61 at current prices, 7.69 at constant prices, total value 8.81 indicates that apple sector has been a strong and steadily growing sector of the horticulture economy of Himachal Pradesh.

In general, this table demonstrates the growing financial importance of apple production, which is boosted by the growing market demand and quality varieties and enhanced marketing channels. It is also indicative though of the sensitivity of the industry to climate variability as to the importance of climate-resilient technologies, storage and processing, and the role of policy to continue the economic expansion of apple production in the state.

Table 4.8 Himachal Share in Total Nation Apple Value (in Percentage)

Year	Share of HP (Current)	Share of HP (constant)
2011-2012	34.42	34.42
2012-2013	37.45	47.73
2013-2014	39.59	62.17
2014-2015	43.33	59.17
2015-2016	38.10	66.17
2016-2017	29.42	53.95
2017-2018	32.66	52.11
2018-2019	28.59	46.65
2019-2020	40.98	61.13
2020-2021	26.67	54.20
2021-2022	25.47	58.04
2022-2023	26.94	58.02

Source: Ministry of Agriculture & Farmers Welfare, Government of India. (2025). *Area and Production Estimates of Horticulture Crops (3rd Advance Estimates 2024-25)*. National Horticulture Board / DES-Agri.

Table 4.8 presents the percentage share of Himachal Pradesh in the total national value of apple production, measured at both current and constant prices from 2011–12 to 2022–23. The table reveals significant variability over the years, indicating fluctuations in Himachal’s contribution to the national apple economy. At current prices, Himachal’s share ranged from a peak of 43.33% in 2014–15 to a low of 25.47% in 2021–22, reflecting changes in production volume, market conditions, and competitive performance relative to Jammu & Kashmir, the leading apple-producing state. Meanwhile, at constant prices (adjusted for inflation), Himachal recorded a very high share of national value, reaching 66.17% in 2015–16 and 62.17% in 2013–14, highlighting years of strong performance and high productivity. The declining trend after 2015–16 at both price levels suggests increasing production bottlenecks, climatic vulnerabilities (such as irregular snowfall, rising temperatures, reduced chilling hours, and hailstorms), and growing dominance of J&K supported by modernization of orchard management and high-density plantation technology. Although Himachal’s share improves slightly in 2019–20 to 40.98% (current) and 61.13% (constant), it again drops in subsequent years, stabilizing around 26–27% at current prices and 58% at constant prices by 2022–23. This indicates that Himachal remains a significant but declining contributor to national apple value, with lower relative price realization and productivity gaps compared to J&K. Overall, the table highlights the need for strategic intervention in Himachal Pradesh through introduction of high-density plantations, advanced storage and grading facilities, quality variety replacement, and adaptation to climate change to enhance competitiveness and restore its share in the national apple market.

Table 4.9 CAGR of apple Cultivation in Himachal Pradesh

Component	CAGR
Production (2003-04 to 2024-25)	1.08
Area (2003-04 to 2024-25)	1.47
Productivity (2003-04 to 2024-25)	-0.38
Value (2011-12 to 2022-23)	7.68

Source: Author's Compilation

Table 4.9 presents The Compound Annual Growth Rate (CAGR) analysis of the apple cultivation in Himachal Pradesh; it presents mixed trends during the study period. The apple production showed a marginal positive CAGR of 1.08 percent between 2003-04 and 2024-25, which was slow and was mainly due to climatic uncertainties, old orchards, and pest related problems. Conversely, the region under apples grew slightly faster at 1.47 percent indicating a growth of orchard land, but the growth in the area has not been proportional to the production. The negative CAGR of -0.38 percent in productivity shows worrying productivity decline of 1/3 hectare, which indicates the problems of low chilling hours, severe weather conditions, and insufficient use of modern orchard management technologies. Nevertheless, the economic value of apple production has a positive growth of 7.68 percent between 2011-12 and 2022-23, which is mostly fuelled by the enhanced price realisation, enhanced packaging and the increasing market demand.

The trend analysis of apple production in Himachal Pradesh depicts a complicated scenario of a gradual growth in the cultivation area, irregular levels of production, and escalating economic value amidst the high levels of climate induced susceptibility. The area covered by apple cultivation increased steadily between the years 2003-04 and 2024-25 by 1.47 CAGR, as the region with apple cultivation kept increasing to 1,16,024 ha, thus showing that farmers still prefer and choose to grow apples. Nonetheless, the volatility in production was quite high as it ranged between 268,402 MT (2006/07) and 892,112 MT (2010/11) with an average production of 534,213 MT and a low CAGR of 1.08, indicating a fluctuating productivity situation. This volatility is mostly explained by extreme weather conditions like hailstorms, frost, decreasing chilling hours, random rainfall and pest attacks which indicate that the crop is sensitive to climate.

Although the area has increased, there has been poor and uneven growth in productivity. Productivity ranged from 2.65 MT/ha in 2011–12 to 6.86 MT/ha in 2013–14, before dropping again to 3.25 MT/ha in 2018–19, and stabilizing around 5.02 MT/ha in 2024–25. The productivity CAGR of -0.38% (Table 3.9) indicates that there has been a negative growth in efficiency and yield performance indicating old orchards, low adoption of high density plantation and lack of technology. There is a positive trend in economic returns of apple production; however, it is in opposite direction. Apple production value rose significantly 8.81 CAGR in 2022-23, ₹9,88,886 lakh as compared to 2011-12 ₹3,58,993 lakh due to improved market price, better packaging, and market links.

At the district-level, there are evident regional differences. Shimla is the largest producer with the largest share in the past but with a negative CAGR (-0.22%), which indicates the instability of production. Kullu, Mandi and Kinnaur are the other contenders and Mandi and Kinnaur are the ones that have seen a positive growth (3.48% and 2.73% CAGR). Lahaul Spiti and Sirmour have the highest CGAR values, which is explained by low base production, and Kangra has the most negative rate (-2.49%), which means that it is less suitable to grow apple because of the warming of the climate. The data implies a geographical relocation of the apple production to the elevated areas due to the increase of the temperatures and the climatic pressure in the lower belts.

On the national level, Himachal Pradesh is far behind Jammu & Kashmir. J&K has a much greater production and productivity with over 76 percent national apple production with a contribution of 19-22 percent compared to the 38-39 percent contribution with the 38-39 percent national apple area of HP.

V. Conclusion and Policy Implication

Apple production has become the staple of the horticultural sector in Himachal Pradesh and there has been a considerable growth of area and increase in economic importance. Nevertheless, the industry is marked by strong volatility of production and a drop in productivity, which is mostly attributed to climatic fluctuations and old orchards. Although the crop still sustains the rural livelihoods and income generation, its sustainability in the long-term is doubtful. To stabilize production, it is crucial to overcome technological deficiencies, enhance management of orchards, and adopt climate-resilient practices. In general, productivity and resilience reinforcement is essential to the sustainability of growth and competitiveness of the apple industry.

The results of this research propose that to promote the growth of apple production in Himachal Pradesh, the development of the policy should be holistic and aim at increasing the productivity levels, climate

agility, and value chain. The falling productivity even with the increase in the area underlines the necessity to replace senile orchards with high-density plantations with the help of subsidies and the availability of quality planting material. As the apple production becomes more susceptible to climatic variability, climate-resilient practices, such as irrigation growth, anti-hail systems, and low-chilling variety development, should be prioritized in policies. Additionally, post-harvest infrastructure including cold storage, grading and transport facilities should be invested in to minimize losses and enhance price realization. Value addition and increase in the income of farmers can be strengthened by strengthening market linkages and agro-processing industries. It should also embrace regional diversification policies that should encourage the appropriate crops in the low altitudes where the productivity of apple is dwindling. Lastly, enhancing extension services, training of farmers and involvement of the private sector will be important in the adoption of modern technologies and long term sustainability and competitiveness of the apple economy.

References

- [1]. Bakhru, H. M. (1985, June 9). Nutritional value of fruits. *The Economic Times*.6.
- [2]. Coulter, H. (2004). *Wholesale market management manual: Support for agricultural producers*. European Union.
- [3]. Department of Horticulture. (2025). *Departmental statistical data at a glance: Area, production and productivity reports (2002–03 to 2024–25)*. Government of Himachal Pradesh.
- [4]. Divyanshu, Sharma, S., Chandel, R. S., Vashishat, R., Verma, S. C., Verma, S., ... & Kumar, A. (2025). Evidence of transitioning apple farming to an agro-ecological model in Himachal Pradesh. *Frontiers in Nutrition*, 12, 1611137.
- [5]. Economics & Statistics Department. (2024). *Himachal Pradesh statistical year book 2022–23*. Government of Himachal Pradesh.
- [6]. Jangta, J., & Attri, K. K. (2025). Analysis of long-term trends in apple cultivation and its productivity in the state of Himachal Pradesh (India). *Applied Fruit Science*.
- [7]. Kireeti, K., & Guleria, C. (2015). An analysis of the factors affecting the apple production and productivity in Shimla. *Economic Affairs*, 60(4), 741.
- [8]. Mehta, P. (1966). A study in input-output relationship in apple industry. *Annual Research Report*.
- [9]. Ministry of Agriculture & Farmers Welfare. (2025). *Area and production estimates of horticulture crops (3rd advance estimates 2024–25)*. Government of India (National Horticulture Board / DES-Agri).
- [10]. Negi, L. S. (1963). *Agricultural potentialities of hills*. Department of Agriculture, Himachal Pradesh.
- [11]. Pandey, M., & Tewari, D. (2010). *The agribusiness book: A marketing and value-chain perspective*. IBDC Publishers.
- [12]. Pathania, S., Pathania, A., Sharma, R., et al. (2025). Economic analysis of climate-induced vulnerabilities and adaptation strategies on apple farming in a temperate region of Himachal Pradesh, India. *Applied Fruit Science*.
- [13]. Pratap, M., Vaidya, C. S., & Singh, R. (2013). Baseline data on area, production and productivity of horticulture crops in Himachal Pradesh. Agro-Economic Research Centre.
- [14]. Rana, R. S., Jain, S. C., & Gupta, K. K. (1978). Economic optima in apple cultivation—A case study of Kumarsain block of Shimla district. *Financing Agriculture*, 10(2), 162–167.
- [15]. Singh, R. (2012). Impact of high density apple plantation under horticulture in Himachal Pradesh. Agro-Economic Research Centre.
- [16]. Sikka, B. K., & Swarup, R. (1985). Economics of citrus production in Himachal Pradesh. Agro-Economic Research Centre.
- [17]. Verma, H. S., & Singh, H. (1982). Production, cost and returns from apple orchards in Himachal Pradesh. *Punjab Horticulture Journal*, 21(1–2), 247–255.
- [18]. Wani, F. A., & Songara, M. (2018). Status and position of apple crop in area, production and productivity in Himachal Pradesh. *International Journal of Multidisciplinary Research and Development*, 5(11), 106–111.
- [19]. World Bank. (2024). *Boosting apple cultivation in Himachal Pradesh*. World Bank's Himachal Pradesh Horticulture Development Project.
- [20]. Yasmin, B., Roy, A., Mandal, M. H., Siddique, G., & Ghosh, S. (2023). Challenges and prospects of apple cultivation in Himachal Pradesh. *Space and Culture, India*, 52–67.