



Apple Cultivation In Himachal Pradesh: A Spatio-Temporal Analysis

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Abstract

Apple cultivation, which occupies nearly half of the total area under fruit crops and makes nearly four-fifths of total fruit production in Himachal Pradesh, makes a significant contribution to the State's economy and society. It generates direct and indirect employment for lakhs of workers within and outside the State. Among districts, Shimla and Kullu lead in production and acreage. Under the impact of climate change, Apple cultivation is, however, gradually shifting to higher altitudes in Lahul and Spiti and Kinnaur districts.

This spatial shift in Apple cultivation demand that the State Government must focus on the development of the basic infrastructure and training for apple growers in new areas in view of its socio-economic contribution to the State and its market network.

Keywords: Apple orchards, Spatio-temporal, production, climate change, high altitudes, infrastructure, training, economy, livelihoods.

Introduction

The terrain and agro-climatic conditions of Himachal Pradesh are undergoing tremendous change. This change in climatic conditions has brought altitudinal variations in the geographical locates which when coupled with fertile, deep and well-drained soils favour the cultivation of temperate to sub-tropical fruits. These create areas suitable for the cultivation of a variety of stone fruits like apple, mango, litchi, peach, plum and apricot as well as the citrus variety of lemon and orange. Apple is the dominant 'King of fruits' and dominates the fruit based economic networking within and outside the State. This changed scenario of climate change across the verdant heights of the State has opened up several areas amenable to apple growing. This has made it mandatory for the geographer to examine and analyse the changed trends in expansion to orchards and their impact on the apple production in the State.

Review of Literature

The state of Himachal Pradesh being primarily is a temperate hilly state & known for the production of commercial

temperate fruits crops [2] that includes apple, peach, plum and apricot, walnut, strawberry and cherry etc. Amongst this apple is grown in the largest area and most preferred by the fruit growers in the state [3]

The state of Himachal Pradesh being primarily is a temperate hilly state & known for the production of commercial temperate fruits crops (Kashirsagar 2006) that includes apple, peach, plum and apricot, walnut, strawberry and cherry etc. Amongst this apple is grown in the largest area and most preferred by the fruit growers in the state (Kumar, Karol, Singh, and Vaidya 2007).

Sharma I, Randev A. K. and Gill Jagjeet Singh (2018) conducted a cost analysis of apple cultivation kullu district of Himachal Pradesh. They segregated the farming on the basis of land ownership. The farmers having less than one hectare of land were placed in group of marginal farmers, 1-2 ha as small, 2-4 ha as semi medium and more than 4 ha as Medium farmers. It can be said that the marginal area consuming trees show less price contribution than that of the medium farms which contributes much higher economy to the district financial infrastructure.

Samriti, Sharma, R., Dev, K., Pathania, A. and Sharma, S. (2021) say that “the net revenue calculated as ` 1.73 lakh and output-input ratio implied that each rupee spent would yield a profit of ` 1.63 in the study area”.

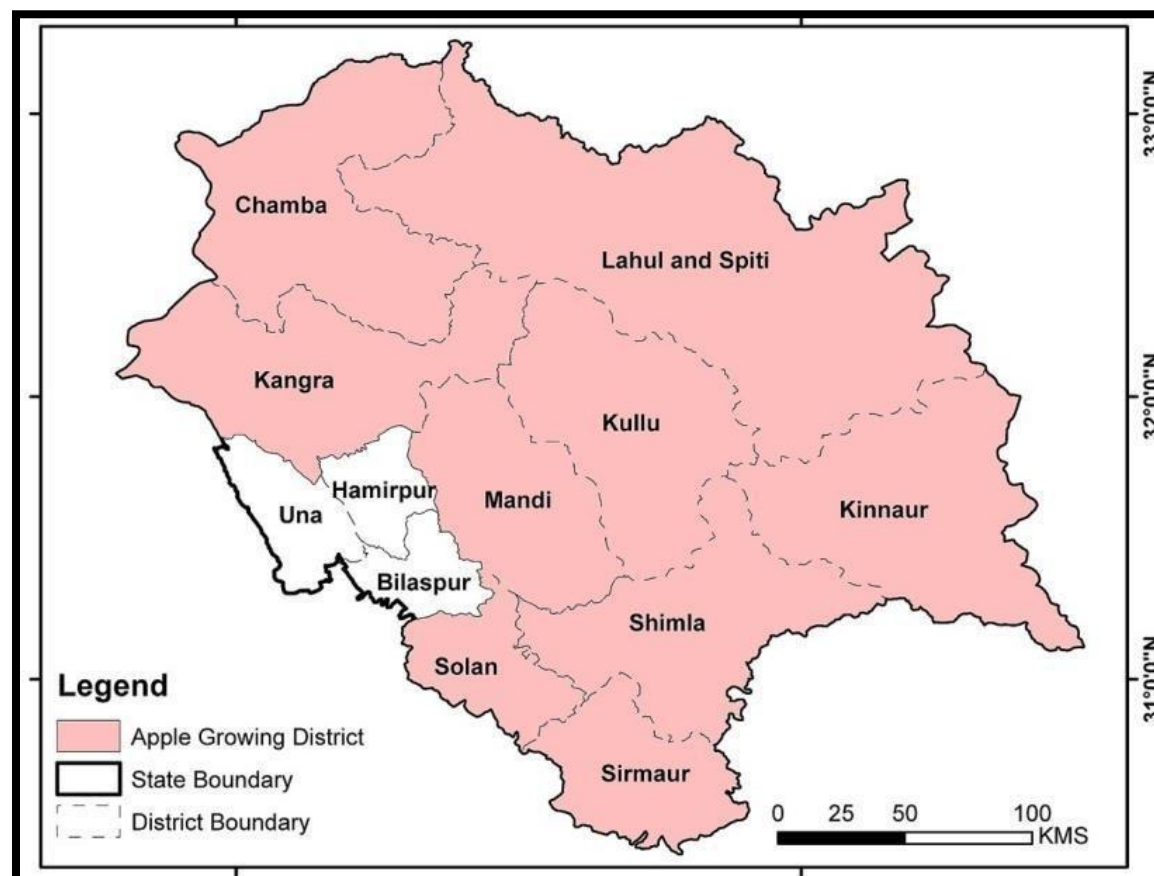
Globally, China is the leading producer of apples followed by the United States, Turkey and Poland, whereas, India ranked 5th with an average yield of about 2316 metric tones (FAO, 2019). Over the previous two decades, the worldwide volume of fruit production has steadily increased from 29.40 million metric tonnes to 33.63 million metric tonnes between 2010 and 2017. The area under apple cultivation in India expanded by 58 per cent from 1.95 lakh hectares in 1991- 92 to 3.08 lakh ha in 2018-19 (Economic survey, 2019-20).

The state has witnessed a major shift in area from food grain towards horticulture crops over last five years from 2012-13 to 2017-18 (Horticulture Development in Himachal Pradesh at a Glance, 2018). The area under fruits, which was merely 792 hectares in 1950-51 with total production of 1200 tonnes, has increased to 2.32 lakh hectares during 2018-19 with production of 4.95 lakh tones.

According to Wani Firdous Ahmad and Songara Dr. Manoj (2017) the horticulture sector is the main component for the development of Himachal Pradesh. Horticulture is improving the productivity of Land, generating employment, improving economic conditions of the farmers and entrepreneurs, enhancing exports and providing nutritional security to the people is widely acknowledged.

Sharma T and Singh Dr. T (2022) looked at the Role of APMC to strengthen the apple economy of Himachal Pradesh and showed that the changes made in the APMC Act, direct marketing, contract farming, corporate entry, promotion of agri processing and exports etc have began to make inroads in to agricultural marketing in the country.

Map-1: Apple Growing Areas of Himachal Pradesh



Source: PLoS One. 2020(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7351220/>)

Objective:

The main objective of the study is to examine spatio-temporal changes taking place in Apple cultivation in Himachal Pradesh during the last fifteen years and the causes and social, economic and policy implications of such changes.

Research Questions:

The following are some of the research questions provoked by the study objectives:

- (i) What is the status of the growth of apple orchards in Himachal Pradesh
- (ii) How have the 15 years from 2005 to 2020 influenced the growth of apple orchards
- (iii) How have the apple orchards been influenced by climatic changes in the past decades.
- (iv) What is the position of the apple orchards vis-à-vis other fruits being cultivated in Himachal Pradesh.

Study Area

Himachal Pradesh is a mountainous State in North-Western India over an area of 55,673 square kilometer within the 30° 22' and 33° 12' North latitude and 75° 47' and 79 ° 04' East longitudes. The State is bordered by Jammu and Kashmir and Ladakh in the North, Punjab on the West and South-West, Haryana and Uttarakhand in the South-East and Tibet in the East. Five rivers flow through the State and the terrain gradient varies as one moves from the South to the North. It varies in height from 610meters to 1220 meters above the mean sea level in the hills to 1220 to 3660 meters in the middle Himalayas and more than 6710 meters in the Pir Panjal ranges. At present the State (Map-1) has 12 districts and 117 tehsils and sub tehsils (Census 2011). According to the Census 2011, the State has a population of 6,864,602 lakh people with a density of 123 persons per square kilometer.

Database and Methodology

The methodology used for data collection for this paper is based on a mixed method approach where primary and secondary data analysis has been utilized. The analysis of the data has been examined statistically as well as quantitatively to ascertain the ground realities that affirm the shift of the orchards to the newer heights of Himachal Pradesh.

Historical Background Section

Himachal Pradesh was the first state where the apple varieties "RED Delicious" and "Royal Delicious" were planted. These conventional plants reach a height of 30 to 35 feet and produce 40 to 60 boxes at their peak. The process of switching to the most recent spur and high-color strain varieties is already under way and could be sped up.

In the current study, various locations were checked to confirm the change, and during FGD in Shimla, local farmers' stories were written down.

- Shimla District (elevation 1500-2700 m),
- Bharmour (elevation 2200-3200 m in the Chamba district),
- Leo (elevation 3500-4500 m in the Kinnaur district),
- Kullu and Manali (elevation 2000-2300 m) in 2019.

In order to select 100 apple growers, 20 were chosen from each of the five target areas (Rampur/Shimla, Leo, Bharmour, Kullu, and Manali), who had lived in the area for a considerable amount of time and owned apple orchards. With the participants' informed consent, interviews were gathered via questionnaire.

Himachal Pradesh's Directorate of Horticulture, located in Shimla, the provincial capital, manages the state's horticulture data and implements horticulture-related programmes. These facts were used to compute the cultivation area and production percentages.

Discussion

To select 100 apple growers, 20 from each of the five target areas (Rampur/Shimla, Leo, Bharmour, Kullu, and Manali), targeted purposive sampling techniques were used. The apple growers were long-time residents of the target areas who owned apple orchards. Using a questionnaire, interviews were gathered with participants' informed consent.

Implementing horticulture-related programmes and keeping track of the state's horticulture data is the Directorate of Horticulture, Himachal Pradesh, located in the provincial capital Shimla. The production percentages and cultivation area were computed using these data.

Historical Perspective

In 1916, the first apple orchard in the state was planted in Kotgarh in Thanedar Panchayat, which is located in the Shimla district. As a consequence of this development, Kotgarh experienced significant advancements in both its economic and social standing. Samuel Evans Stokes, an American missionary who first introduced the delicious high-quality apples in a small orchard in Kotgarh block, is given credit for starting the first apple boom in the state. Samuel Evans Stokes was later given the name Satyanand Stokes. Later on, he conducted experiments in other regions, particularly in upper Shimla, which is responsible for almost 80 percent of the state's total apple production. The apple-growing belt includes Rohru, Jubbal, Kotkhai and Kotgarh.

Besides Shimla, most of the apple cultivation is concentrated in the districts of Kullu, Mandi, LahaulandSpiti, Kinnaur and Chamba. Apple has been dominating the fruit scenario in Himachal Pradesh since its cultivation started in Kotgarh. The data available clearly shows the increase in acreage under apple in the State over the past century. In 1951, apple had covered just 10 percent area of the total area under fruits which increased to 38.38 percent in 1974 and further 40.25 percent in 1995, 71 percent in 2005 and presently 79.38 percent (1995).¹ Hence it can be inferred that apple has spread to several other parts of the State beginning from its traditional node. The growth of the fruit and expansion of its orchards in the State may be understood by analyzing this spatial spread during the 15 years period from 2005-06 to 2019-20.

Table-1: District-wise Area under Apple in Hectares

S No.	District	2005-06	2019-20	Percentage area under apple	
				2005-06	2018-19
1 (5)	Chamba	811.0	12575.6	1.74	11.14
2 (9)	Kangra	8.7	467.6	0.018	0.004
3 (3)	Kinnaur	2529.7	11010.3	5.44	9.76
4 (2)	Kullu	8242.7	26880.3	17.73	23.82

¹The period from 1951 to 2004 has already been analysed by the author in her publication "Diffusion of Apple Orchards in Himachal Pradesh: A Geographical Analysis" published in The Deccan Geographer, Volume 44, Number 1, June 2006

5 (7)	Lahaul&Spiti	64.3	1716.6	0.13	1.52
6 (4)	Mandi	1730.3	16674.6	3.72	14.78
7 (1)	Shimla	32442.0	40697.6	69.80	36.07
8 (6)	Sirmaur	623.0	2552.6	1.34	2.26
9(10)	Bilaspur	1.3	21.0	0.00	0.01
10(11)	Hamirpur	0.0	61.6	0	0.05
11(8)	Solan	21.0	46	0.04	0.04
12(12)	Una	0.0	3	0	0.00
	Total	46474.0	112807.3	99.95	99.45

Source: Statistical Abstract, Himachal Pradesh, Shimla²

The Apple cultivation in the State is highly concentrated in two districts, namely Shimla and Kullu, both in combine has three-fifths (59.89 per cent) of total area under the apple cultivation. Shimla district alone have more than one-third (36.07 per cent) of the total cultivated areas under the Apple orchards in the State. Kullu district has another 23.82 percent. Mandi (14.78 per cent), Chamba (11.14 percent) and Kinnaur (9.76 percent) follow in order. Sirmaur, and Lahaul&Spiti have only a negligible share. In remaining districts of Solan, Kangra, Una, Hamirpur, and Bilaspur apple orchards are negligible or nil (Table 1).

Changing pattern, 2005-19

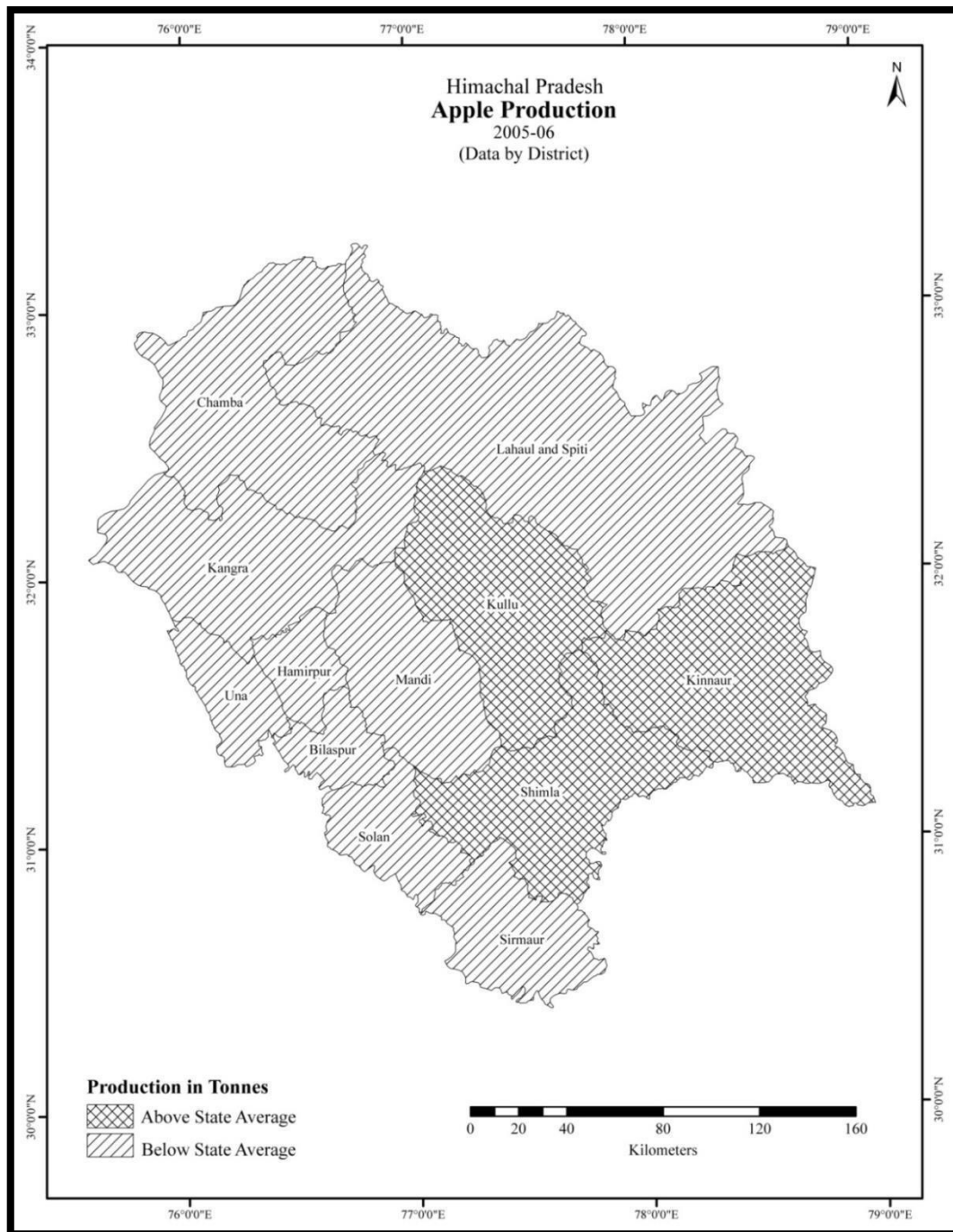
Table-2: District-wise Production of Apple Fruit(in Tonnes)

S No.	District	2005-06	2018-19	Percentage	Status
1	Chamba	7154.6	19910	35.93	Increased
2	Kangra	601	295.6	49.18	Decreased
3	Kinnaur	39814.6	56908.6	69.96	Increased
4	Kullu	108735.6	95387	87.72	Decreased
5	Lahaul & Spiti	197.6	301.3	65.58	Increased
6	Mandi	24392.3	47734.6	51.09	Increased
7	Shimla	264000	286294.3	92.21	Increased
8	Sirmaur	495	3285.6	15.06	Increased
9	Bilaspur	1.3	5	26	Increased
10	Hamirpur	0	4	0	Increased
11	Solan	60	17	28.33	Decreased
12	Una	0	0	0	Increased
	Total	283353	510143.3	55.54	Increased

Source: Statistical Abstract, Himachal Pradesh

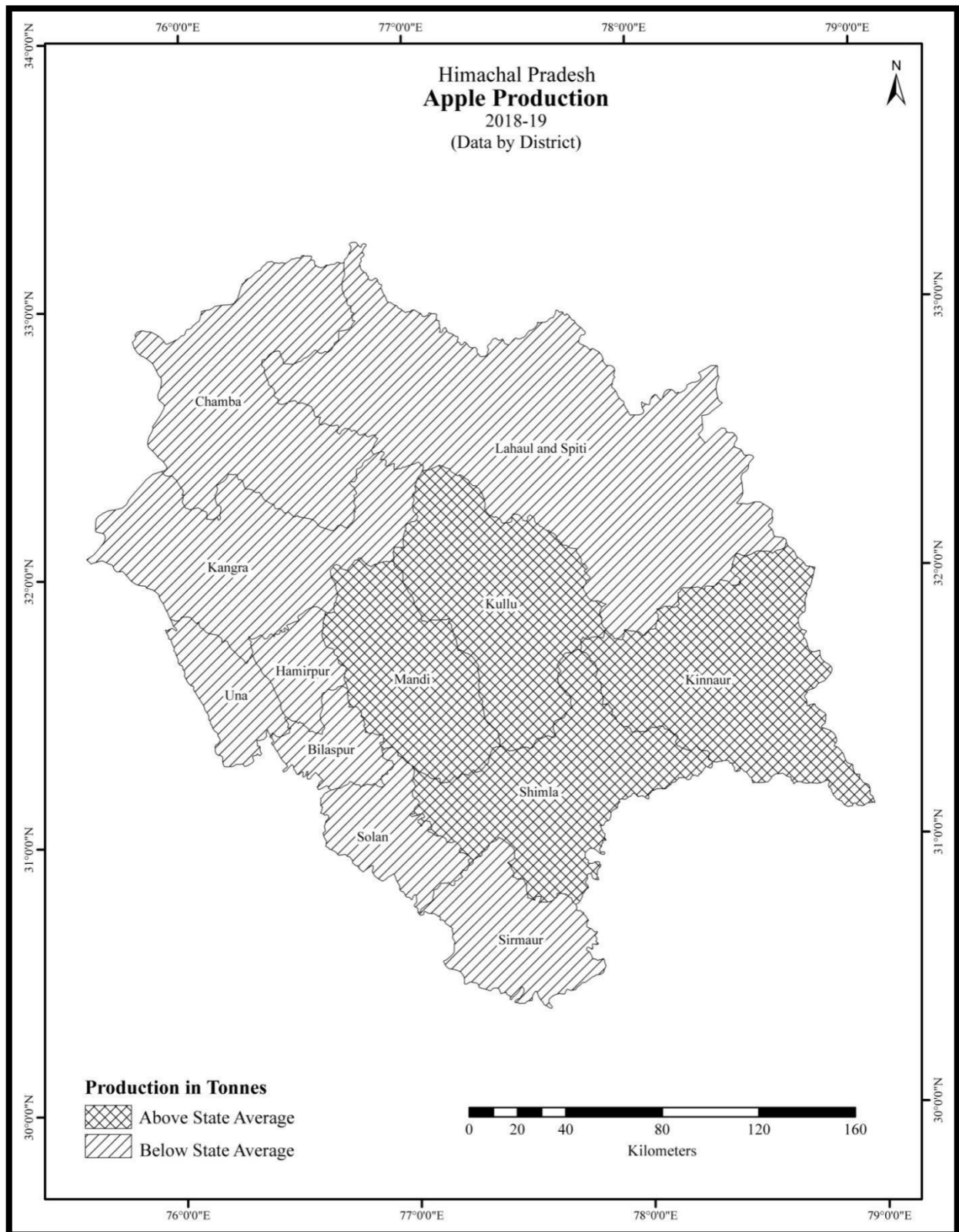
Map 2: Himachal Pradesh: Apple Production, 2005-06s

²Statistical Abstract, Himachal Pradesh, Shimla (2019).



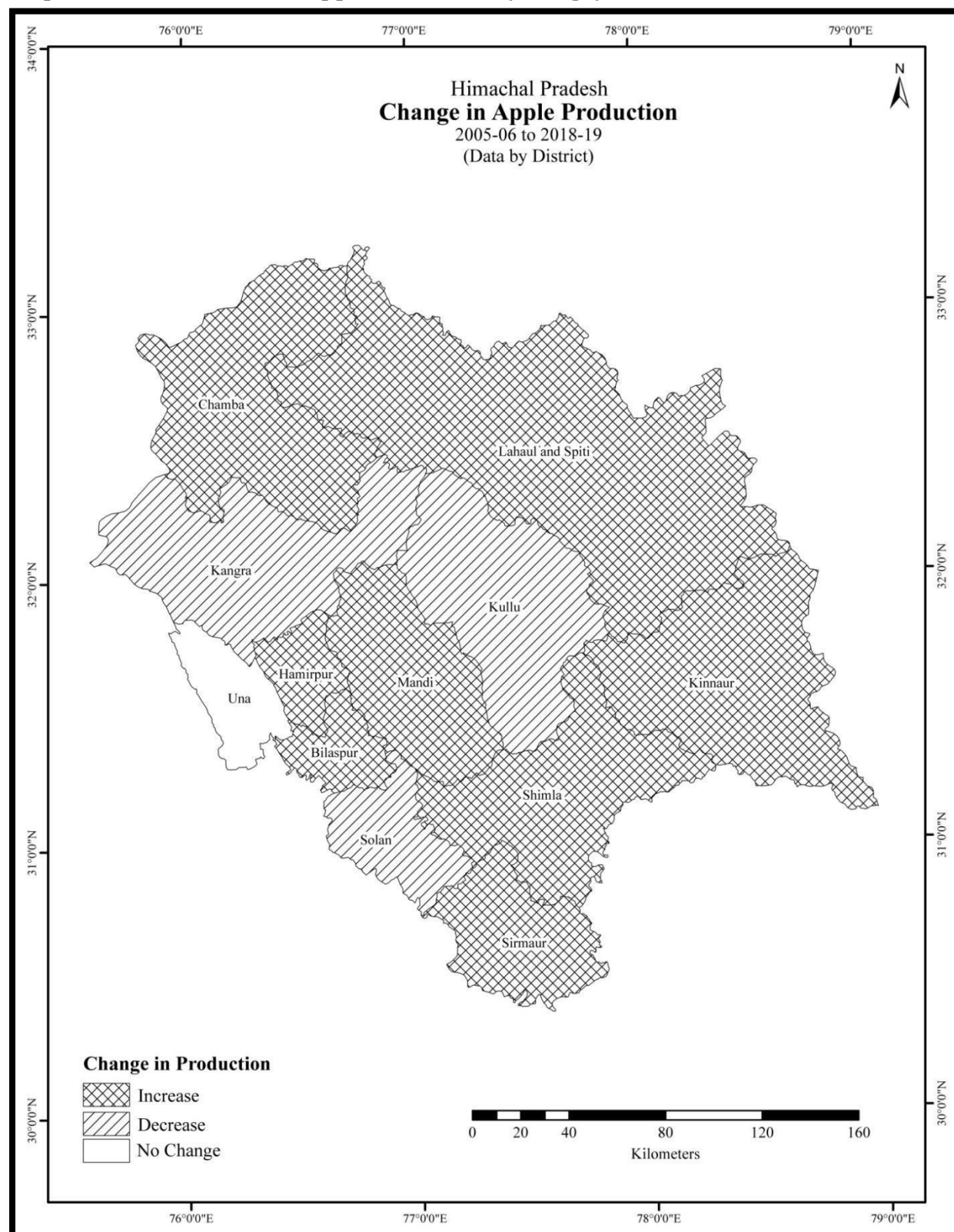
Source: Statistical Abstract, Himachal Pradesh

Map 3: Himachal Pradesh: Apple Production, 2018-2019



Source: Statistical Abstract, Himachal Pradesh

Map 4: Himachal Pradesh: Apple Production(Change)



Source: Statistical Abstract, Himachal Pradesh

The production of apples in given district-wise in Table-2 and an attempt has been made to compare the comparative increase in production tonnage of apples. The districts that

showed a percentage increase in apple production were Kinnaur (69.96 percent), Mandi (51.09 percent), Sirmaur (15.06 percent) and Shimla (92.21 percent). In contrast districts that saw a marked decline in apple production tonnage were Kullu (87.72 percent), Kangra (49.18 percent) and Solan (28.33 percent) even though their overall production was not very high as compared to the total of the State.

Prominent apple producing districts in 2005-06 were Shimla, Kullu, Kinnaur, Mandi and Chamba while the prominent districts in 2018-19 were Shimla, Kinnaur, Mandi and Kullu in that order. However, districts like Hamirpur, Bilaspur, Kangra showed very little acreage under apple.

Thus, it was observed that during the study period apple has increased its acreage in Chamba, Kinnaur, Lahul & Spiti, Mandi and Sirmaur. It is also necessary to take cognizance of the fact that the apple production has decreased significantly in Shimla and remained almost the same in Kullu.

Temperature Gradients in Apple Growing Zones of Himachal Pradesh

There has been a general trend toward higher temperatures at higher elevations in apple-growing regions of the mountain state of Himachal Pradesh in India. This trend has been observed in recent years. This was necessary for the chill unit requirements of apple cultivation, which has shown decreasing trends of up to 2400 m amsl from Bajaura in Kullu and 1221 m amsl in Sarbo in Kinnaur at 2400 m amsl. This was necessary for the apple cultivation chill unit requirements. The Dhundi observation station, which is located at 2700 metres above sea level (amsl), has demonstrated an increase in chill units to the order of 25.0 CUs per year. At a higher altitude, the area shows signs of becoming more suitable for apple cultivation, as indicated by the increased curve of the chill unit at 2700 m amsl. These findings are the result of the perceptions held by local farmers, which have clearly and persistently shown that apple cultivation is expanding upwards to higher altitudes in the regions of Lahaul and Spiti. In Lahaul and Spiti, the average land use on farms has shifted towards apple cultivation by more than two percent, but in the majority of other apple growing areas, which are located at lower elevations, this trend has been observed to be moving in the opposite direction. Although it appears that the income of farmers has decreased by more than 27 percent in Kullu and Shimla, it has increased by more than 10 percent in the Lahaul and Spiti region.

Climatic change adversely affects crop physiology, biochemistry, biotic stress like disease pest incidence, which ultimately results in the reduction of yield and quality of fruit crops (Rajatiya et al., 2018).

Apple mostly require a chilling period of about 1000-1600 hours at or below 7°C along with short days and cool nights that is possible only at higher altitudes (Awasthi et al., 2001). In the past few years, there is no regular snowfall resulting in lesser chilling hours. This resulted in the replacement of apple orchards with other crops and apple belts are

shifted to higher altitudes (Sharma et al., 2013). Apple growth is divided into 4 stages viz., Dormant stage from December-March, Flowering and fruit set stage from April-May, Growth and development stage from June-September and Pre-dormant stage from October-November. Each stage has specific requirements of weather parameters like temperature, rainfall, snowfall, humidity, evaporation etc (Randev, 2009).

In Himachal Pradesh, evidences of climate change could be clearly deciphered by changes like receding snowfall in the Himalayas and shifting of temperate fruit belt to upper reaches, adversely affected productivity of apples, changes in rainfall pattern, shifting and shortening of Rabi season (Rana et al., 2012). Problems of climate change also vary in nature and intensity across mountain regions, with higher elevation regions experiencing more rapid temperature rise (Shrestha and Devkota, 2014) of climate change also vary in

This gradual shift has occurred as a result of changes that have crept in to engulf the optimal conditions for growing apples in certain regions of Himachal Pradesh. The phrase "optimum apple growing conditions" has been engulfed by these changes. Because the conditions have been continually changing, farmers are also moving their orchards to higher elevations in response to this trend. When compared to the cultivated elevation of 1200 metres to 1500 metres during the 1980s, some farmers claim that they have moved their orchards to elevations between 1500 metres and 2500 metres in recent decades. This is in contrast to the elevation at which they were located during the 1980s. Apple orchards are now being cultivated at an altitude of more than 3,500 metres, as can be seen from the newly developed orchards of Leo village, which are located in the upper Kinnaur and Keylong areas of the Lahaul and Spiti district. This change occurred after the 2014 to 2015 time slot.³

Apple growing provides a significant portion of the world's population with their primary means of subsistence as well as their primary means of achieving financial security. The State makes a significant contribution to India's overall high-quality apple production, which is a national total.

Conditions in the Atmosphere Necessary for the Persistence of Apple Orchards

The National Horticulture Board of India has specified the following as the ideal climate conditions for apple cultivation in various parts of Himachal Pradesh:

- (i) A mean temperature of 21 °C to 24 °C during the growth period of six months, which is from March to August.
- (ii) An average annual rainfall of 100 to 125 centimeters and between 1000 and 1500 hours of freezing temperatures.
- (iii) The total number of hours during which the temperature is lower than 7 degrees Celsius is what is referred to as the "chilling hours."

³PLoS One 2020

Apples require a specific range of chilling hours in order to develop properly, and this range is one of the most critical factors in their development. Any deviation from those climatic conditions, which are optimally suited to the growth of apples, can result in unfavourable fruit development and, as a result, affect apple production. The adverse effect of reduced chilling hours has been responsible for the abnormal flowering and blooming that has been observed. As a direct consequence of this, several crops now have a significantly increased risk of dormancy in their apple buds. The topic of analysing the shift in mentality that occurred in the apple orchards was extensively discussed with the orchardists and the apple workers. In the early 1980s, it came to light that apple trees were known to be grown at elevations ranging from 1200 metres to 1500 metres above sea level. Due in large part to the sudden warming of the surface temperatures that has occurred over the course of the years spanning from the 1980s to the present, apple orchards were able to be cultivated at an elevation of more than 3,500 metres in less than twenty years.

This change has led to big changes in production and the spread of diseases that usually affect apples, such as scab diseases, early leaf drop, alternaria, and alternaria alternata. There is a reason why these diseases sometimes become widespread when the weather creates the perfect conditions for disease spread. Apples don't like spring frost, which has become a recurring problem because spring frost can happen late or early in warmer climates. Many of the orchardists in the Shimla area say that global warming has changed the texture and flavour of the fruit in a bad way. With the rise in surface temperature, apple farmers have moved their orchards to higher elevations to keep the best growing conditions. It is known that apple orchards are moving around, but not much is known about why and what other steps could be taken instead. There hasn't been a lot of research on how climatic factors affect how farmers make decisions, but farmers who move their orchards have pointed out a number of factors in addition to the social and economic effects. It is important to note that the fact that there are new places to grow apples at higher altitudes has definitely encouraged and motivated new farmers in those areas to start growing apples as well. So, farmers at higher altitudes can take advantage of the fact that their environments naturally offer the best chilling hours. Orchardists who used to grow apples at lower altitudes are trying to move their orchards to higher altitudes in some places, but most of them have switched to growing other profitable crops like mushrooms and vegetables to make ends meet.

This research's main objective is to investigate the crucial elements, particularly the climatic processes, that led to the relocation of apple orchards in Himachal Pradesh's higher altitude regions. To do this, it will examine and analyse how various climate factors have changed over time. The exact mechanisms causing the steady decline in cultivated areas and consequently apple production in the lower altitudes of Himachal Pradesh have not been investigated, despite previous studies' suggestions that climate change is a factor in the altitudinal shifting of apple orchards. The intended method for the study is a

thorough investigation of the various climatic parameters, including variations in minimum, mean, and maximum surface temperatures, chilling hours, rainfall pattern, and the relationship between the area cultivated for apples and trends in apple production from 1975 to 2020 in the State of Himachal Pradesh.

The Genesis of Changed Circumstances

There are 12 districts in Himachal Pradesh, but only 9 of them are suitable for moving apple orchards to higher Himalayas. The primary factor is that this State is suitable for apple cultivation due to the presence of a specific number of chilling hours needed for apple cultivation. The threat that the relocation of apple orchards to higher altitudes poses to the lower survival of apple orchardists in the high-altitude districts of Kangra, Sirmaur, and Solan in the near future is a major source of concern. In accordance with their altitude, these apple-growing regions have been divided into three groups. As these:

- (a) At a high altitude (Lahul and Spiti, Kinnaur and Chamba providing adequate chilling hours at 2500m to 3500m and above)
- (b) Mid altitudinal (Kangra, Kullu, Mandi and Shimla reduced current chilling hours at 1500 m to 2500 m)
- (c) Low in altitude (Solan and Sirmaur with chilling hours at 1000 m-1500m).

The number of chilling hours was figured out because this is an important part of how apples grow. It is a key factor in how strong an apple bud will be when it tries to wake up from its winter sleep. The lack of snowfall in the lower and middle apple belts, is the cause. Even though higher elevations receive a lot of snowfall, traditional varieties struggle to perform as well as they should at lower and middle elevations.

According to snowfall patterns, the low- and middle-altitude apple belts have been gradually losing snow for more than a decade. The low altitude apple belt is defined as being between 4,500 and 5,500 feet above sea level, and the middle altitude apple belt is defined as being between 5,500 and 7,000 feet above sea level. The high-altitude belt lies above that. There used to be significant snowfall at these lower elevations when it snowed in the higher reaches, but that is no longer the case. The amount of snowfall in low and middle elevations has decreased over the past ten years or so. The principal causes of the declining snowfall are attributed to climate change and meteorological variables, according to Surender Paul, Director of the India Meteorological Department in Himachal Pradesh.

It is currently difficult to obtain the "chilling hours" of more than 1,000, which are required by the traditional apple varieties. This is because there is not an abundant amount of snow. Because of this, the soil and, ultimately, the plant are unable to absorb the nutrients normally available to them. Because of these factors, traditional varieties are having trouble performing at their optimal level and producing high-quality fruit at these elevations. Growers have been forced as a result of this to adopt contemporary varieties that require comparatively significantly fewer 'chilling hours.' The lifespan of the traditional varieties, on the other hand, is significantly longer when compared to that

of the newer varieties. In the more established orchards, there are some trees that are almost 80 years old. The argument against new, modern varieties of apple trees is that the traditional markets will not accept the taste and quality of the apples that are produced by these trees.

Concerns Voiced by Orchardists

Orchardists in Himachal Pradesh have prospered for half a century thanks to apple production, which accounts for more than 90% of the state's output, according to orchard owners' groups and experts.

In 1916, the first apple orchard in Himachal was planted 85 kilometres from Shimla in Kotgarh's Thanedar Panchayat. This not only helped Kotgarh grow economically and socially, but it also helped put this town on the map globally. Gram Panchayat Head Amar Singh Nalwa an apple orchardist, enlightened the public about this 100 years later in 2016, while speaking at an event organized to commemorate Himachal Pradesh's 100-year history of apple cultivation.

Stokes, the founder of apple orchards in Himachal Pradesh, promoted apple cultivation in other areas from a small orchard in Kotgarh. This was particularly true in the upper Shimla region, which currently produces 80% of all the apples in the State. Since then, Himachal Pradesh has become synonymous with apples, which account for 89% of the State's \$3,500 billion fruit economy (USD 520 million). For many years, Vidya Stokes, Stokes' daughter-in-law and former Himachal Pradesh minister for irrigation and public health, managed the family's orchard in Kotgarh. In November 2021, Dr. Vijay Stokes, his grandson, donated 50 bighas of apple orchards to Kotgarh in order to develop a knowledge-based hub.

Vinod Chauhan, an apple grower from Banot village in the Kotgarh region, claimed that before deciding to cultivate apples, the locals had primarily been growing pulses, wheat, and maize. "At first, the locals had their doubts about the viability of apple farming in the region. Some residents chose to cultivate it in the early 1930s after observing Stokes' orchard's success. According to Chauhan, Kotgarh's fifth generation is also interested in apple orchards. He claimed that by the 1960s, "apple cultivation had bloomed throughout the entire region, bringing unprecedented prosperity."

Himachal Pradesh's most important fruit crop is apple. It makes up 49% of all the land that is used to grow fruit and 85% of all the fruit that is grown. From 400 hectares in 1950–51 to 3,025 hectares in 1960–61 and 1,11,896 hectares in 2016–17, the area where apples are grown has grown a lot. Though at the moment, though, the amount of land that will be used to grow apples in the future is changing. This is because the weather affects how apples grow and how much they produce. Some farmers are moving their orchards to higher ground, while others are shifting to fruits and vegetables that do well in cooler weather, as well as mushrooms and other things.

These things have to be taken into account because apple production isn't consistent. This is because of many things, but the main ones are weather changes and changes in the market. The apple was the most popular fruit in Himachal Pradesh's thriving fruit industry until the WTO, GATT, and the liberalisation of the economy came along. The changes in apple production over the last few years have been brought to the government's attention. This has made it necessary to look into and use the State's huge horticultural potential by diversifying horticulture production in its different agro-ecological zones.

Government Initiatives to Support Apple Growers

The government is also aware of the fact that fruit farmers want, to get a better price for their crops. The state's Marketing Intervention Scheme has raised the price of buying apples to INR 7.00 per kg. The price of buying citrus fruits B and C grade, like Kinnow, Sagntra, and Malta, up to 500 MT, has also gone up to INR 7.00 per kg. and '6.50 per Kg., and the price of buying Galgal fruits up to 100 MT has gone up to INR 5.50 per kg. While the price to buy mangoes is INR 5.50 per kg. for seedling mangoes up to 300 MT and INR 6.50 per kg. for grafted mangoes up to 200 MT. Under this scheme, 30,658 MT of C-grade Apple fruit worth INR 21.46 crore have been bought this year.

The weather-based Crop Insurance Scheme was first started in Himachal Pradesh in 6 Blocks for the apple crop and 4 Blocks for the mango crop during the Rabi season of 2009-10. Due to its popularity, this plan's coverage was extended for several years in a row. Also, 19 Blocks have been covered under the Add-on cover scheme to protect the apple crop from hailstorms. But as of 2016-17, the scheme is now called Restructured Weather Based Crop Insurance Scheme (R-WBCIS). In this plan, the amount of insurance has been changed, and a bidding system has been added. During the 2016-17 Rabi season, 95,283 farmers with apple and other fruit crops like peach, plum, mango, and citrus fruit were covered by the Restructured Weather-Based Crop Insurance Scheme. They insured their 79,22,387 trees, and the State Government paid a 25 percent premium subsidy of INR 14.05 crore.

As SahuNetrananda (2020) discussed, why are apple orchards in the Himalayas moving to higher elevations? and stated that "as of 2014, apples are being cultivated at an elevation of over 3500 metres." Using Mann-Kendall and Sen's slope tests, the temperature trend during the growth period, winter session, as well as the annual rainfall has been evaluated." Chilling hours, total annual rainfall, and mean surface temperature during the apple-growing season all play a role in the shift northward (towards higher altitude), according to historical data. During the period from 2000 to 2014, the average surface temperature in all districts rose by nearly 0.5°C. Global warming is the primary cause of these changes.

Conclusion

Early 2000s orchard shifting trials in Himachal Pradesh's high lands began to yield fruit, and by 2015 the new apple orchards had begun bringing in significant income for farmers. However, the fact that these shifted orchards enriched farmers at higher elevations while harming those at lower elevations is cause for concern. As a result, apples in those areas had a decreased quality and shape. In these lower-altitude areas, farmers have changed their farming practises to include peas, potatoes, and plums as a more diverse crop mix.

People's lives are being impacted in numerous ways by the region's spatiotemporal agro-climatic impact. In part because of the decline in rainfall due to climate change, the apple crop has been phased out. Other crops can take its place, but the practices of the plains could soon spread to Himachal Pradesh's hills and pollute the soil and air there.

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