



Transition Landscapes: Spatio-Temporal Analysis Of Vegetable Agriculture In Himachal Pradesh Over Three Decades

¹Dr. Shivjeet Kaur, ²Kamalpreet Singh

¹Assistant Professor, ²Research Scholar

Department of Geography

Punjabi University, Patiala, Punjab

ABSTRACT

Vegetable cultivation is emerging as an essential component of agricultural growth in Himachal Pradesh. The main objective of this study is to analyse the spatial-temporal changes in vegetable cultivation across the districts of Himachal Pradesh from 1990-91 to 2020-21. This study is based on secondary data collected from the annual season and crop reports of Himachal Pradesh. It notes that vegetable cultivation has increased over the years, with notable shifts in its distribution from a few high-performing districts to a broader regional spread. Consequently, new districts have entered the high vegetable cultivation category, while some districts remain in the low category due to climatic and infrastructure limitations. Furthermore, it identifies suitable climatic conditions, availability of irrigation, market linkages, and improved technologies as important factors driving temporal trends. In low-performing districts, the government must provide training and raise awareness among farmers regarding off-season vegetable cultivation and protected farming techniques.

KEYWORDS: Agriculture, Cultivation, Climate, Hill Farming, Spatio-temporal

INTRODUCTION

India is the second-largest producer, consumer, and exporter of vegetables, accounting for 8.6% of the world's vegetable production, next to China, which reflects a nationwide trend of growing vegetable production (according to FAO). In India, most of the population is vegetarian, and vegetables play a significant role in food and nutritional security (Amit et al., 2023). Farmers have adopted vegetable production due to changing food

habits and increasing awareness towards a balanced diet and the concept of nutritional security (Agropedia, 2009). From 1997-98 to 2020-21, the estimated production of vegetables was 196.27 million tons from 108,598 hectares (Dhakre & Bhattacharya, 2013). Vegetables are classified into cool-season and warm-season crops depending on varying temperature requirements. Cool-season vegetables typically thrive between 7°C and 18°C, while warm-season vegetables require high temperatures, ranging between 18°C and 30°C. Dhakre and Bhattacharya (2013) conducted a study related to spatial-temporal variations in cropped area, production, and productivity of vegetables across India. The study emphasises the role of climatic, market linkages and infrastructure affecting vegetable cultivation variations. It provides a foundational understanding of national-level patterns important for regional comparisons. Singh and Khshwahas (2020), in their study, used decomposition analysis to know the long-term trends in vegetable cultivation. They find substantial regional disparities, with certain states leading in vegetable productivity, and further notice the influence of policy interventions and technological advancements on vegetable sector growth. Kumar and Singh (2014) explore the vegetable production and marketing in the Solan district of Himachal Pradesh at the micro-level. They focused on the importance of market accessibility, irrigation infrastructure, and farmer awareness in determining the success of vegetable cultivation. Their findings support the need for targeted interventions in hill agriculture. Sharma and Mehta (2009) conducted a study related to crop diversification patterns in Himachal Pradesh and identified vegetables as a major component of agricultural transformation in the state. They underline the factors which affect diversification, such as improved transport networks, price incentives, and agro-ecological suitability. Also, their study highlights the significance of vegetables in enhancing income stability and resource optimization in hill regions. Singh and Nand (2011) conducted a study related to protected cultivation in India and its transformative impact on vegetable production. They concluded that protected cultivation enhances crop quality and productivity, especially in areas with climatic limitations and identifies challenges such as high initial costs and limited technical knowledge.

The state of Himachal Pradesh's economy is based primarily on agriculture, which plays a significant role in raising farmer earnings and creating jobs, and the cultivation of vegetables has become a key part of the state's agricultural diversification. Vegetables are vital protective foods, enriched with nutrients, antioxidants, and nutraceuticals, offering both health benefits and income opportunities to farming communities (Noopur et al., 2023). Also, it plays an important role in providing balanced nutrition to most of the Indian population as these are a valuable source of proteins, vitamins and to some extent carbohydrates (Varmudy, 2001). Over the past three decades, there has been a noticeable transition in Himachal Pradesh from traditional cereal-based cropping patterns towards more remunerative horticulture, driven by favourable climatic conditions, improvements in protected cultivation technologies, availability of improved varieties, and better market access (Singh et al., 2017). In Himachal Pradesh, diverse agro-climatic zones—from sub-tropical low hills to temperate high mountains—allow for the year-round cultivation of a wide range of vegetable crops, both in open fields and under controlled environments. Vegetables such as peas, potatoes, cabbage, cauliflower, and beans have become prominent, with both seasonal and off-season cultivation practices gaining momentum.

OBJECTIVES OF THE STUDY

- I. To know the spatial and temporal patterns of vegetables in the study area
- II. To identify factors responsible for changes in vegetable cultivation
- III. To draw a conclusion and make suggestions.

METHODOLOGY

This work is based on secondary data. The unit of study is the district. The data of vegetables collected from the Annual season and crop reports of Himachal Pradesh: 1990-91, 2005-06 and 2020-21. The three-year average is taken for 1990-91, i.e., 1989-90, 1990-91, 1991-92, and so on. Simple percentages are used for driving the results, which are shown with tables and simple choropleth maps.

STUDY AREA

Himachal Pradesh occupies an area of 55,673 square km, situated between latitudes 30° 22' and 33° 12' N and longitudes 75° 45' and 79° 04' E. The state's diverse landscape and mountain ranges set it unique. Its elevation ranges from less than 600 meters to more than 4500 meters above sea level, increasing from west to east and south to north. Snowfall provides water for Himachal Pradesh's five perennial rivers: the Chenab, Ravi, Beas, Sutlej, and Yamuna. The annual rainfall ranges from 50 mm in Lahaul and Spiti to over 3400 mm in Dharamshala, with an average of 1193 mm. It has a population of 68,56,509 overall, according to the 2011 census. It borders Punjab to the west, Haryana to the southwest, Uttarakhand to the southeast, and Jammu & Kashmir to the north.

RESULTS AND DISCUSSION

A. Spatial distribution of vegetable cultivation: 1990-91

Vegetables hold a prominent place in Himachal Pradesh's cropping pattern and affect the economy of its many people. In the study area, vegetables are grown both in the summer and winter seasons. Vegetables cover 26918 hectares, which is 2.78 per cent of the total cropped area. The share of vegetables varies between the highest of 32.57 per cent in the Lahaul & Spiti district and the lowest of 0.69 per cent in the Bilaspur district. The study area is divided into three categories to determine the spatial pattern of vegetable cultivation.

I. Category of High per cent Share of Vegetables cultivation (>4 per cent)

The vegetable cultivation category has a high share of three districts named Lahaul & Spiti, Shimla and Kinnaur. Lahaul & Spiti district stands out with a remarkable 32.56 per cent share of total vegetable cultivation. The district of Shimla and Kinnaur follows with a 9.72 per cent share and 4.22 per cent of total vegetable cultivation. This category covers more than 40 per cent of the study area under vegetables and is situated in the eastern and norther-eastern parts of Himachal Pradesh. These districts are suitable for growing a broad range of

vegetables, such as potatoes, peas, and cabbage, due to their mild temperature, rich soil, and well-established infrastructure supporting cultivation.

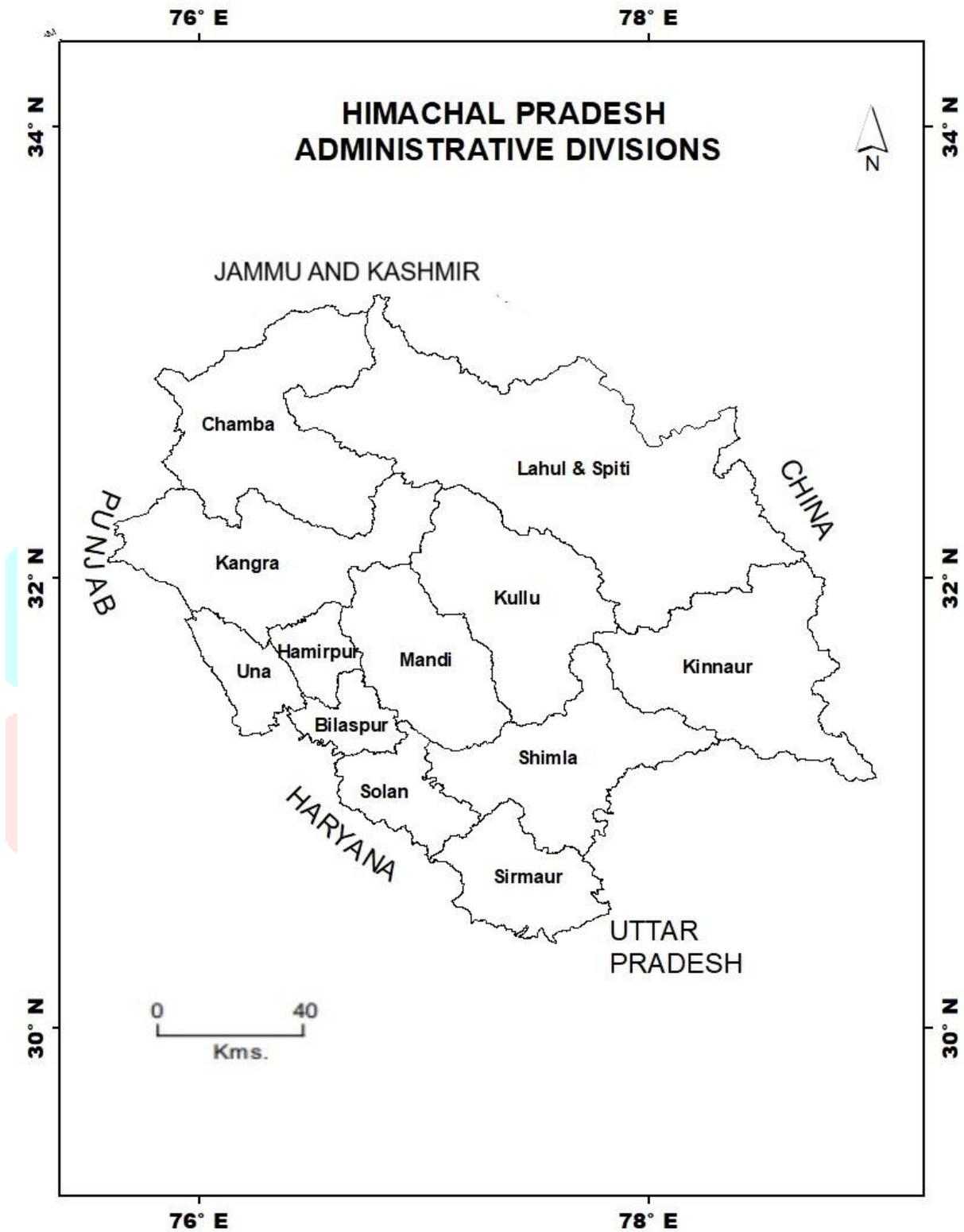
II. Category of Moderate per cent Share of Vegetables cultivation (2-4 per cent)

The Moderate share of vegetable cultivation includes four districts named Solan, Kullu, Sirmaur and Mandi. The share of vegetable cultivation is 3.62 per cent in Solan district, 3.36 per cent in Kullu, 2.91 per cent in Sirmaur and 2.64 per cent in Mandi, benefiting from distinct climate and strategic focus on vegetable cultivation. These districts allow the cultivation of vegetables in cool temperate climates, especially in areas where fruits may not be cultivated. Also, districts have mixed cropping systems in which vegetables serve as an additional source of agriculture. This category is known for cultivating numerous vegetables like potatoes, cabbage, mushrooms, etc., and for producing off-season vegetables, including peas and beans.

iii. Category of low per cent share of Vegetable cultivation (<2 per cent)

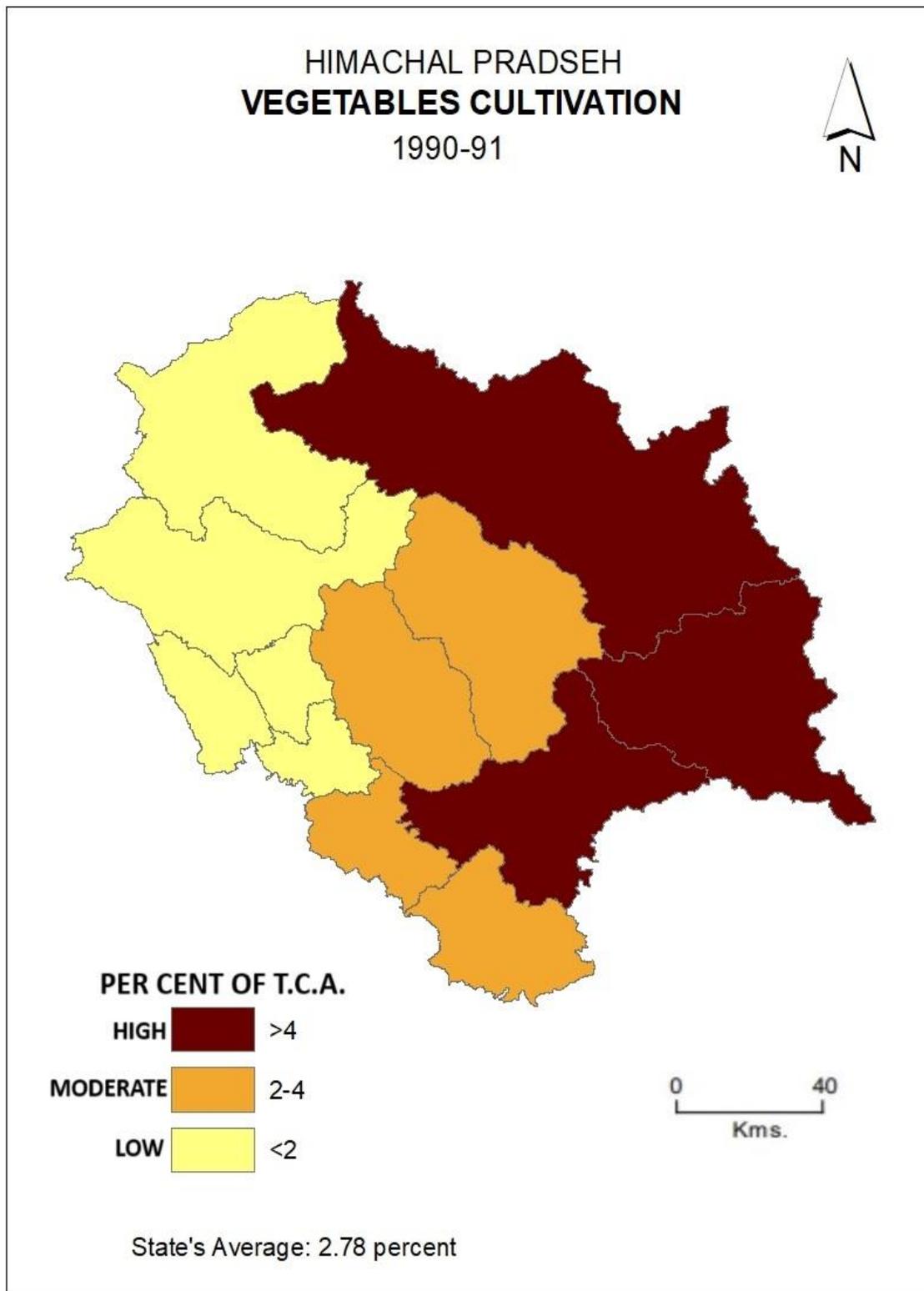
The category of low share of vegetable cultivation consists of five districts named Chamba (1.11 per cent), Una (1.04 per cent), Kangra (0.95 per cent), Bilaspur (0.79 per cent) and Hamirpur (0.21 per cent). This category covers the western and northern-western parts of the study region. The district situated in the northwestern parts has a slightly higher contribution within the category, famous for its diverse agricultural systems. On the other hand, western districts have very low vegetable cultivation areas because they focus on other staple crops like maize, wheat, and rice.

Fig: 1



Source – Remote Sensing Centre of Himachal Pradesh, Shimla

Fig.2



Source – Annual season and crop report of Himachal Pradesh – 1990-91

B. Spatial distribution of vegetable cultivation: 2005-06

Vegetable farming is a major agricultural activity in Himachal Pradesh, and its distribution differs throughout the districts. In Himachal Pradesh, vegetables share 38083 hectares with 4.08 per cent of the total cropped area in 2005-06. The percentage share of vegetable cultivation varies from the highest of 31.92 per cent in the Shimla district to the lowest of 0.50 per cent in the Kinnaur district. The wide variety of vegetables found in the state, such as peas, tomatoes, potatoes, cabbage, cauliflower, and beans, is made possible by its varied topography and temperature. The state is divided into the following categories to determine the spatial distribution of vegetable agriculture.

i. Category of high per cent share of vegetable cultivation (>4)

The category of high per cent share of cultivation consists of six districts named Lahaul & Spiti, Shimla, Sirmaur, Solan, Kullu and Mandi. The Lahaul & Spiti district stands out with the highest share of vegetable cultivation, with a 70.07 per cent share. The district is well-known for cultivating many temperate vegetables, particularly in places like Theog and Lahaul valley, which are essential to the region's vegetable sector. The Shimla and Sirmaur districts followed with 11.25 per cent and 6.03 per cent shares. Both districts benefit from a subtropical climate, fertile soil and the availability of irrigation, making it possible for a wide range of vegetables. The district of Solan, also known as the "Mushroom City of India", contributes 5.63 per cent, followed by Kullu and Mandi with 4.84. Temperate crops, including potatoes, cauliflower, cabbage, and peas, grow well there due to their higher altitude and milder environment.

ii. Category of moderate per cent share of vegetable cultivation (2-4)

The category of moderate share of vegetable cultivation comprises two districts named Kinnaur and Una. The Una district, situated in the western part, benefits from a tropical climate, coupled with suitable irrigation, which makes it ideal for growing tomatoes, capsicums, cabbages, and beans, and contributes 2.10 per cent of total cropped area under vegetables. The district of Kinnaur is famous for its off-season vegetables, particularly during the summer, and shares 2.15 per cent.

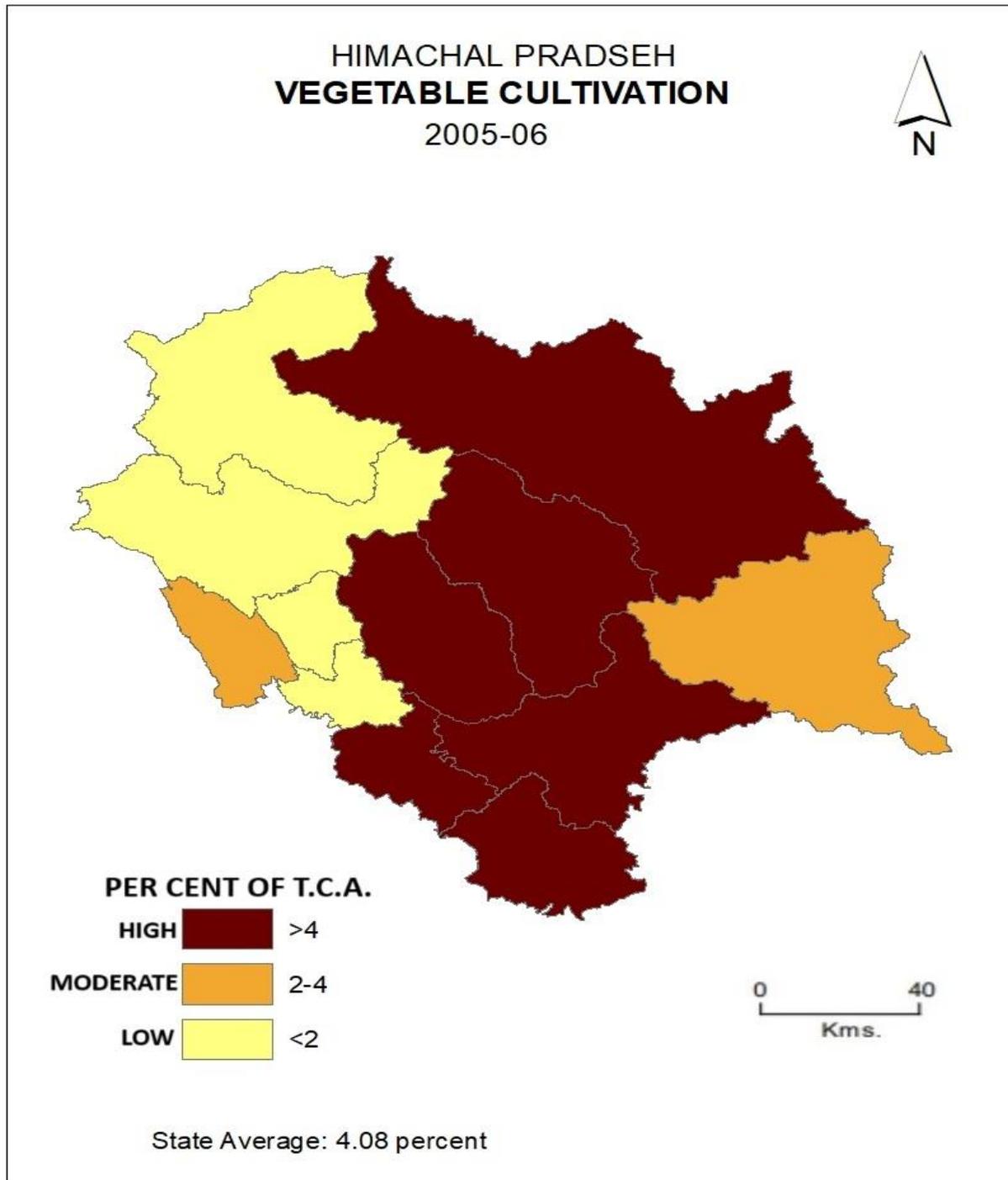
iii. Category of low per cent share of vegetable cultivation (<2)

The low percentage of the vegetable cultivation category includes four districts: Chamba, Kangra, Bilaspur and Hamirpur. This category covers the western and northwestern parts of the study region. The percentage of vegetable cultivation is 1.56 per cent in Chamba, followed by Kangra at 1.21 per cent, Bilaspur at 0.70 per cent, and Hamirpur at 0.34 per cent. In the Kangra, Bilaspur, and Hamirpur districts, the agricultural focus is more on traditional crops like wheat, maize, and pulses. Also, due to the district's hot and arid climate, there is a low percentage of vegetable cultivation.

C. Spatial distribution of vegetable cultivation: 2020-21

Vegetable cultivation in Himachal Pradesh plays an important role in the state's agriculture and economy. It covers 43082 hectares with 4.79 per cent of the total cropped area. The per cent share of vegetable cultivation ranges from 68.21 per cent in the Lahaul & Spiti district to the lowest of 0.30 per cent in the Bilaspur district. The state is grouped into the following categories to understand the spatial distribution of vegetable cultivation.

Fig: 3



Source – Annual season and crop report of Himachal Pradesh – 2005-06

i. The Category of high per cent share of vegetable cultivation (>4 per cent)

This category of high per cent share of vegetable cultivation consists of seven districts: Lahaul & Spiti, Sirmaur, Kullu, Kinnaur, Shimla, Solan and Mandi. It covers the northeastern, eastern and Southern parts of Himachal Pradesh. Lahaul & Spiti district stands first with a 68.21 per cent share of the total cropped area, with the cultivation of off-season vegetables like peas and potatoes, which are grown in cold climatic conditions. Sirmaur district contributes 10.20 per cent, especially known for the cultivation of tomatoes, cauliflower, and capsicum, benefiting from their good irrigation facilities and access to markets. The Kullu district also contributes 9.64 per cent, followed by Shimla with 8.68 per cent, Solan with 8.24 per cent and Mandi with 4.77 per cent.

ii. The Category of moderate per cent share of vegetable cultivation (2-4 per cent)

This category includes two districts: Una and Chamba, situated in the northwestern part of Himachal Pradesh. In these districts, cultivation of vegetables is present but not a dominant agricultural activity and is known for its off-season vegetables. Vegetables are usually cultivated in this category for local consumption, and any surplus is sold at local markets. These regions benefit from access to important markets, advanced farming methods, and a favourable climate.

iii. The Category of low per cent share of vegetable cultivation (<2 per cent)

This category consists of three districts, Kangra, Hamirpur and Bilaspur. These districts are situated in the western part of the study area. These districts have the lowest share of vegetable cultivation, with less than one per cent of their total cropped area under vegetables. In this category, farmers primarily focus on cultivating staple crops like wheat and maize, which are more suited to their climatic conditions. Also, limited irrigation facilities and lower market access are other main reasons for low cultivation in this zone.

D. Volume of change in vegetable cultivation

Himachal Pradesh noted significant variations in vegetable cultivations during the study period, reflecting a compound relationship between socio-economic and physical elements. From 1990-91 to 2005-06, it shows a positive increase of 1.3 per cent, which further increased by 0.7 per cent from 2005-06 to 2020-21. Overall, the study area noted an increase of 2.01 per cent in vegetable cultivation.

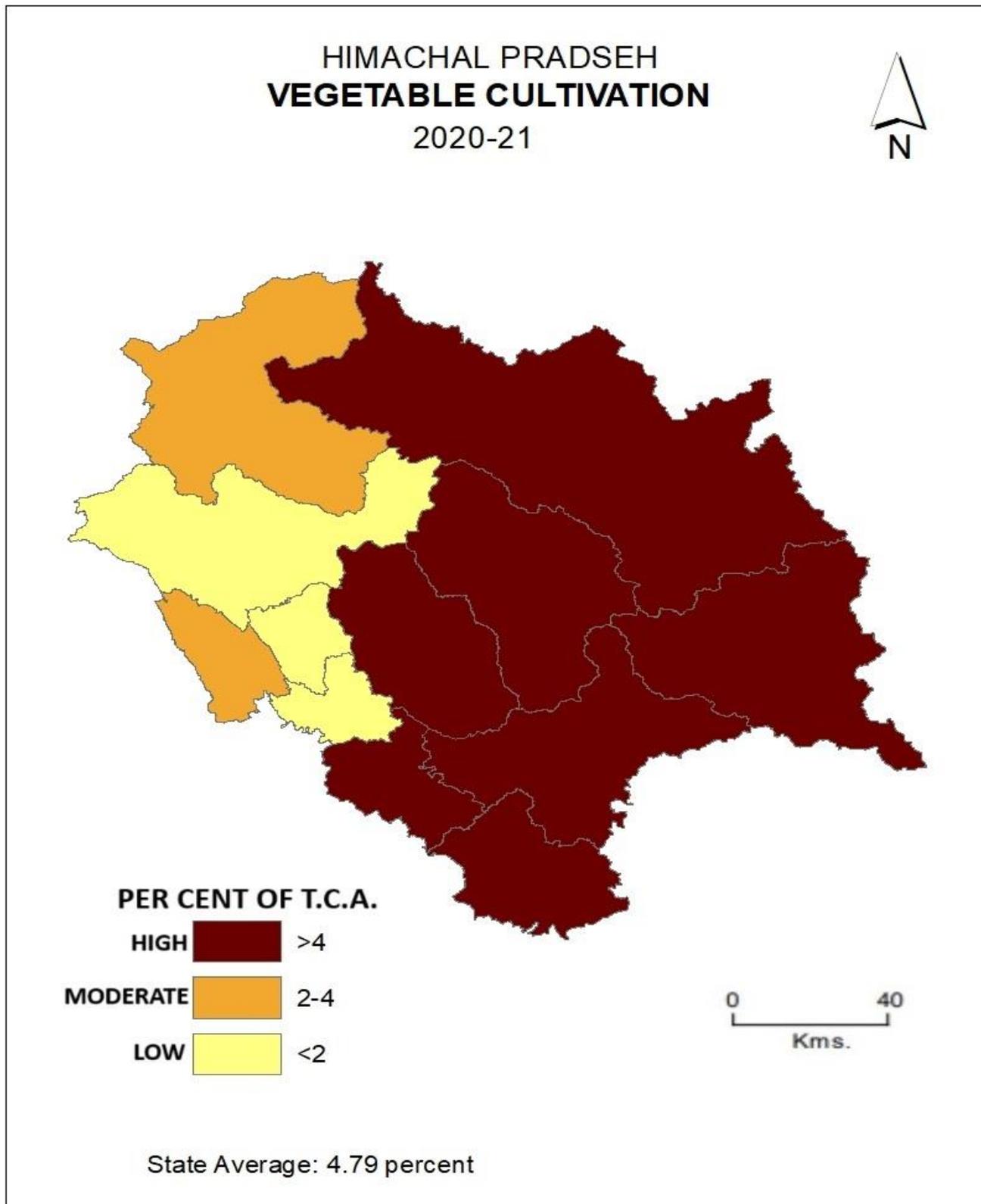
I. Changes in the level of vegetable cultivation from 1990-91 to 2005-06

From 1990-91 to 2005-06, vegetable cultivation shows increasing trends across Himachal Pradesh.

- i. In the high percentage category, there were three districts in 1990-91 named Lahaul & Spiti, Shimla and Sirmaur, which increased to six in 2005-06. The districts Sirmaur, Solan, Kullu and Mandi joined this category with a positive increase of 3.12 per cent, 2.01 per cent, 1.48 per cent and 2.20 per cent. The district of Kinnaur left this category due to a negative decrease of -2.07 and joined the moderate category. While Lahaul & Spiti noted the highest increase of 37.5 per cent and remained in the highest category.
- ii. The moderate category of vegetable cultivation had four districts in 1990-91 named Solan, Kullu, Sirmaur and Mandi, which decreased to two in 2005-06. The districts Sirmaur, Solan, Kullu and Mandi left the

moderate category to join the high category, and districts Kinnaur and Una joined the moderate Category. Una, with a positive increase of 1.06 per cent, left the low category and joined the moderate category.

Fig: 4



Source – Annual season and crop report of Himachal Pradesh – 2020-21

- iii. In the low share category, there were five districts in 1990-91, which decreased to four in 2005-06. Una left the low category and joined the moderate category with a positive increase of 1.06 per cent. Other districts named Chamba, Kangra, Bilaspur and Hamirpur remained in the low cultivation category.

II. Changes in the level of vegetable cultivation from 2005-06 to 2020-21

From 2005-06 to 2020-21, vegetable cultivation shows almost positive trends of 0.71 per cent across the study region.

- i. In 2005-06, there were six districts in the high category, which increased to seven in 2020-21. The district of Kinnaur joined the high category with a positive increase of 6.73 per cent and left the moderate category. Other districts named Kullu, Sirmaur and Solan also show positive trends and remained in the high category, while Lahaul & Spiti shows a decrease of -1.86 per cent but still lies in the high category.
- ii. The category of moderate share had two districts named Una and Kinnaur in 2005-06, which remained two in 2020-21. Kinnaur district left the moderate category to join the high category, and Chamba district joined the moderate category with a positive increase of 1.13 per cent and left the low category.
- iii. In 2005-06, the low category had four districts, which decreased to three in 2020-21. The Chamba district left the low share category and joined the moderate category. Other districts in this category are Kangra, Hamirpur and Bilaspur.

III. Changes in the level of vegetable cultivation from 1990-91 to 2020-21

Overall, Himachal Pradesh noted a positive increase of 2.01 per cent from 1990-91 to 2020-21, due to advanced horticultural technologies and suitable climatic conditions.

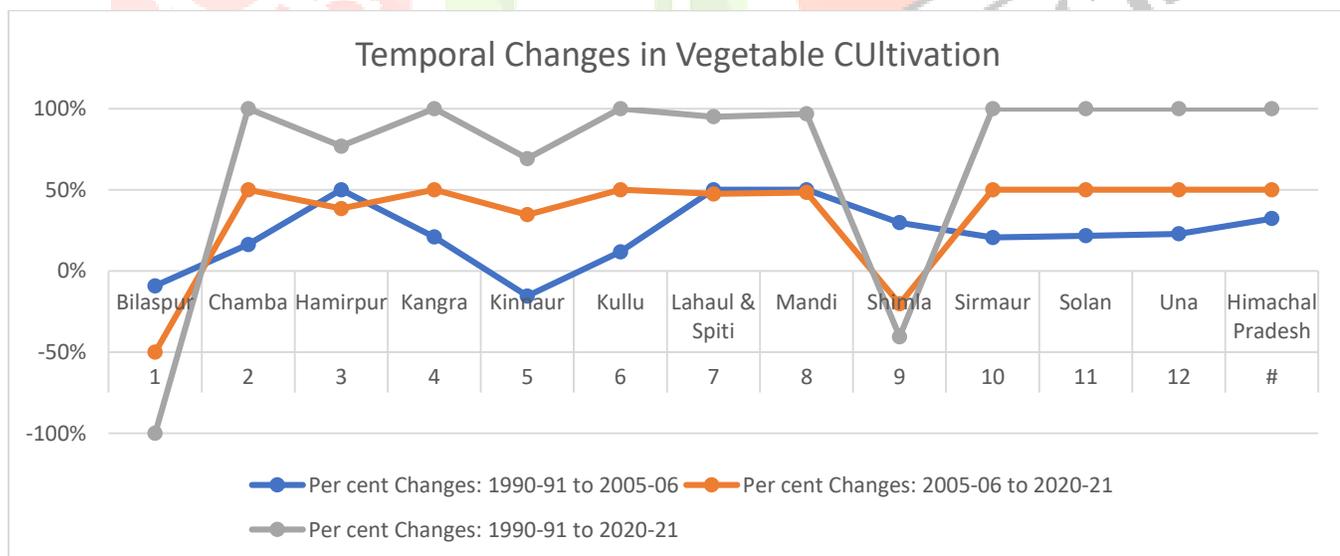
- i. In the category of high percentage, there were three districts in 1990-91, which increased to seven in 2020-21. The districts that were in the high category during 1990-91 were Lahaul & Spiti, Shimla and Sirmaur. The districts Sirmaur, Solan, Kullu, Mandi and Kinnaur joined the high percentage category in 2020-21. The district of Lahaul & Spiti notes the highest positive increase of 35.64 per cent due to advanced horticulture technologies and supportive climatic conditions. Other districts, Sirmaur and Kullu, also noted positive increases of 7.54 per cent and 6.28 per cent.
- ii. The moderate category had four districts in 1990-91, which decreased to two in 2020-21. Districts that were in the moderate category in 1990-91 were Solan, Kullu, Sirmaur and Mandi. In 2020-21, all these districts left the moderate category to join the high category in 2020-21 and districts Chamba and Una joined the moderate category with a positive increase of 1.68 per cent and 2.31 per cent.
- iii. In the low percentage category, there were five districts in 1990-91, which decreased to three in 2020-21. The districts of Una and Chamba were left low category and joined the moderate category, and the other districts are Kangra, Hamirpur and Bilaspur.

Table 1. Spatial Pattern and Temporal Changes in Vegetable Cultivation: 1990-91, 2005-06 and 2020-21

Sr. No	District	Per cent Share of Vegetables in 1990-91	Per cent Share of Vegetables in 2005-06	Per cent Share of Vegetables in 2020-21	Per cent Changes: 1990-91 to 2005-06	Per cent Changes: 2005-06 to 2020-21	Per cent Changes: 1990-91 to 2020-21
1	Bilaspur	0.79	0.7	0.3	-0.09	-0.4	-0.49
2	Chamba	1.11	1.66	2.79	0.55	1.13	1.68
3	Hamirpur	0.21	0.34	0.31	0.13	-0.03	0.1
4	Kangra	0.95	1.21	1.57	0.26	0.36	0.62
5	Kinnaur	4.22	2.15	8.88	-2.07	6.73	4.66
6	Kullu	3.36	4.84	9.64	1.48	4.8	6.28
7	Lahaul & Spiti	32.57	70.07	68.21	37.5	-1.86	35.64
8	Mandi	2.64	4.84	4.77	2.2	-0.07	2.13
9	Shimla	9.72	11.25	8.68	1.53	-2.57	-1.04
10	Sirmaur	2.91	6.03	10.45	3.12	4.42	7.54
11	Solan	3.62	5.63	8.24	2.01	2.61	4.62
12	Una	1.04	2.1	3.35	1.06	1.25	2.31
#	Himachal Pradesh	2.78	4.08	4.79	1.3	0.71	2.01

Source – Annual season and crop reports of Himachal Pradesh: 1990-91, 2005-06 and 2020-21

Fig: 5



Source – Annual season and crop reports of Himachal Pradesh: 1990-91, 2005-06 and 2020-21

CONCLUSION AND SUGGESTIONS

In conclusion, Himachal Pradesh's vegetable cultivation has expanded in the last thirty years, expanding both in terms of acreage and distribution throughout the state. In 1990-91, the percentage share of vegetable cultivation varied from the lowest of 0.21 per cent in Hamirpur to the highest of 32.57 per cent in Lahaul & Spiti. During this period, vegetable cultivation had a high percentage in north-eastern areas to moderate in Central parts and Lowest in western districts due to favourable climatic conditions and agricultural infrastructure. In 2005-06, the percentage of vegetable cultivation ranged from 1.21 per cent in Kangra to the highest of 70.07 per cent in Lahaul & Spiti, whereas in 2020-21 it ranged from the lowest of 0.30 in Bilaspur to the highest of 68.21 per cent in Lahaul & Spiti. In summary, the central and eastern districts, particularly Lahaul & Spiti, Shimla, Solan, Kullu, and Sirmaur, have emerged as major hubs due to their favourable climate, better access to irrigation, and proximity to markets. Conversely, the western districts, such as Bilaspur, Hamirpur, and parts of Kangra, have seen lower levels of vegetable cultivation, primarily due to their focus on staple crops, limited irrigation, and reduced market accessibility.

The changing pattern reflects that vegetable cultivation is becoming a key component of hill agriculture, providing better income and employment opportunities for farming communities. The eastern and central districts of Lahaul & Spiti, Shimla, Kullu, Kinnaur, etc., note growth, while districts situated in the western part of the study area, like Bilaspur and Hamirpur, registered negative growth. The remaining districts demonstrate moderate growth. It also indicates a shift towards diversification in agriculture, supported by government initiatives and the growing interest of farmers in commercial crops. In low cultivation areas, to encourage balanced vegetable cultivation throughout the state, it is necessary to improve market accessibility and irrigation infrastructure in the western districts of low cultivation zones. The government should educate and train farmers about protected agricultural methods and off-season vegetable cultivation, particularly in districts with poor performance. Infrastructure, including cold storage, rural roads, and transportation, should be improved to reduce post-harvest losses and ensure greater earnings for vegetable producers. The agroclimatic conditions and potential of vegetable cultivation must be taken into consideration when implementing district-specific programs. Promoting cooperatives and Farmer Producer Organisations (FPOs) can aid in group marketing and guarantee that farmers receive higher prices.

REFERENCES

- [1] Amit, Ghanghas, B.S., Yadav, V.P.S., and Chahal, P.K. (2023). Knowledge status of onion growers regarding pre- and post-harvest management practices. *Indian Res. J. Ext. Edu.* 23 (1): 59-63.
- [2] Annual season and crop report of Himachal Pradesh – 1990-91
- [3] Annual season and crop report of Himachal Pradesh – 2005-06
- [4] Annual season and crop report of Himachal Pradesh – 2020-21
- [5] Dhakre, D. S., & Bhattacharya, D. (2013). *Growth and instability in area, production and productivity of vegetable crops in India*. *Journal of Crop and Weed*, 9(1), 101–107.
- [6] Kumar, S., & Singh, B. (2014). *Production and marketing of vegetables in Himachal Pradesh: A case study of Solan district*. *Economic Affairs*, 59(4), 653–659. <https://doi.org/10.5958/0976-4666.2014.00006.3>
- [7] Marketing of vegetables in India by Vigneshwara Varmudy, Daya Publishing House, Delhi- 110035
- [8] Noopur, K., Chauhan, J. K., Walia, S. S., Verma, M. R., Dhar, U., Choudhary, S., & Chikkeri, S. S. (2023). Constraints in vegetable production in India: A review. *Indian Res. J. Ext. Edu.*, 3(3), 14-19
- [9] Sharma, H. R., & Mehta, R. (2009). *Crop diversification in Himachal Pradesh: Patterns and determinants*. *Indian Journal of Agricultural Economics*, 64(2), 169–187
- [10] Singh, A. K., & Kushwaha, R. (2020). *Trends and decomposition analysis of area, production and productivity of major vegetables in India*. *Indian Journal of Economics and Development*, 16(3), 511–516. <https://doi.org/10.5958/2322-0430.2020.00197.9>
- [11] Singh, A. K., & Nand, P. (2011). *Protected cultivation of vegetables in India: Problems and prospects*. *Indian Journal of Agricultural Sciences*, 81(12), 1170–1175.
- [12] Singh, A.K.; Sabir, N., and Noopur, K. (2017). *Horticulture based plasticulture cum covered cultivation for livelihood security*. *Indian Horti.*, 62(5), 68-74