

Changing Trends in Vegetable Production in the Karnal Division: 2010-2011 to 2020-2021

Neha¹, Dr Sudhir Malik²

¹Research Scholar, Department of Geography, Baba Mastnath University, Asthal Bohar Rohtak

²Professor, Department of Geography, Baba Mastnath University, Asthal Bohar Rohtak

ABSTRACT

This study examines the changing trends in vegetable production within the Karnal Division of Haryana, India, from 2010-11 to 2020-21. Recognized as a crucial agricultural region, the Karnal Division comprises the districts of Kaithal, Karnal, and Panipat, each contributing uniquely to the vegetable output. The research recognises the significance of vegetable farming in enhancing farmers' incomes, creating employment opportunities, and promoting economic diversification. Utilizing secondary data collected from the Horticulture Department in Panchkula, the study analyzes production patterns of key vegetables, including potatoes, onions, tomatoes, cauliflower, and radishes, among others. Results indicate notable fluctuations in production across the three districts. While Panipat experienced substantial growth in cauliflower, bhindi, and brinjal production, Karnal faced significant declines in cauliflower and peas, highlighting challenges that may stem from environmental factors or market dynamics. Kaithal demonstrated a balanced production strategy, with increases in bhindi and carrots alongside some reductions in other crops. The overall findings reveal a general increase in bhindi and carrots for the Karnal Division, contrasting with declines in cauliflower and onions. The study underscores the importance of adapting agricultural practices to enhance productivity and sustainability. It also highlights the need for strategic interventions to address the challenges faced by specific districts. By providing insights into the evolving landscape of vegetable production, this research contributes valuable knowledge to optimize agricultural practices and boost the economic viability of the Karnal Division. The findings advocate for a diversified approach to vegetable cultivation, emphasizing the need for continuous monitoring and support for farmers in the region.

Keywords: Vegetable Production, Karnal Division, Haryana, Agricultural Trends, Crop Diversification

INTRODUCTION

India stands as a prominent producer of vegetables globally, contributing significantly to the world's total vegetable output. Vegetable farming plays a crucial role in the agricultural economy of India, significantly contributing to various economic aspects (Birtal et al., 2013). One of the primary benefits of vegetable farming is its potential to enhance farmers' incomes through higher profit margins compared to traditional field crops. (Dev, 2019) Vegetables typically offer quicker returns due to their shorter growth cycles, allowing farmers to harvest multiple crops within a year (Keatinge et al., 2011). Moreover, vegetable farming is labor-intensive, which translates into significant job creation across various sectors. Vegetable farming also fosters economic diversification within the agricultural sector (Behera & France, 2016). By reducing reliance on staple crops like wheat and rice, farmers can mitigate risks associated with monocropping systems.

The country's extensive production is supported by a diverse range of climatic conditions and soil types across various agro-climatic zones, allowing for a wide variety of vegetables to be cultivated (Solankey et al., 2021). The diversity in climatic conditions enables the cultivation of numerous vegetable types, including root vegetables like potatoes, carrots, and radishes; leafy greens such as spinach and lettuce; fruiting vegetables including tomatoes, brinjals and peppers; as well as flowering vegetables like cauliflower and broccoli. Among these, potatoes and onions are particularly significant crops. Other notable vegetables include okra and ginger, where India also holds a strong position in production. Vegetable farming in India is characterized by various cultivation practices that depend on factors such as seasonality, sowing techniques, and soil management (Krishna et al., 2024). Different vegetables are sown and harvested at specific times of the year, with methods like direct sowing or transplanting employed based on the crop type. The choice of soil type ranging from alluvial to loamy affects vegetable selection and yield. For example, cauliflower thrives in well-drained soils with good organic matter, while crops like radish are commonly grown in regions with suitable climatic conditions. Haryana is a crucial state in India's agricultural landscape, known for its dynamic contributions to the sector. Over the past few decades, the state has experienced remarkable growth in the area dedicated to vegetable cultivation, which has significantly bolstered overall productivity (Malik et al., 2019).

The growth in vegetable cultivation in Haryana can be attributed to several factors. The state's diverse agro-climatic conditions allow for the year-round production of a wide variety of vegetables, including tomatoes, cucumbers, carrots, and leafy greens. This adaptability to different growing conditions enables farmers to optimize their cropping schedules (Kumar et al., 2019). As a result, Haryana has become a major supplier of vegetables to not only neighboring states but also metropolitan areas like Delhi, where demand is high. The economic significance of vegetable production in Haryana is further amplified by its export potential (Kumar et al., 2023).

India, being one of the largest producers of vegetables globally, has a burgeoning market for exporting fresh produce. Haryana's proximity to major transportation hubs facilitates the efficient movement of goods, making it easier for farmers to access international markets (Ghanghas et al., 2017). Farmers in Haryana are increasingly adopting a mix of traditional and modern agricultural practices, which has played a vital role in boosting productivity. The state has been at the forefront of adopting high-yield variety (HYV) seeds, which have been proven to produce significantly higher yields compared to traditional varieties (Pawar & Malik, 2023). Given the growing significance of vegetable production in the state, this study is an attempt to identify the changing trends in vegetable production within the Karnal division that of Haryana from 2010-2011 to 2020-2021.

Objectives of the Study

The objective of this study is to analyse the changes in vegetable production patterns in the Karnal division from 2010-2011 to 2020-2021.

Study Area

The Karnal Division, located in the northern Indian state of Haryana, is a significant agricultural region that comprises the districts of Kaithal, Karnal, and Panipat. This division is known for its rich agricultural heritage and diverse cropping patterns, making it a vital contributor to the state's economy. Karnal Division is situated within the Indo-Gangetic plain, which is known for its alluvial soil that supports extensive agricultural activities. The region has a generally flat topography, making it suitable for agriculture, with variations in land use across its districts. Agriculture is the backbone of the Karnal Division's economy. The region primarily cultivates a variety of crops, including wheat, rice, and an increasing number of vegetables. Farming provides livelihoods for a substantial portion of the population, contributing to rural employment and income generation.

DATA SOURCES & METHODOLOGY

The current study relies on secondary data sources. Information for this research has been gathered from the Horticulture Department in Panchkula, Haryana. The data collected comprised of various vegetables production that includes potato, onion, tomato, raddish, carrot, cauliflower, chillies, bhindi, brinjal, arbi, peas, leafy vegetables and other for the districts of Kaithal, Karnal and Panipat. The data has been compiled and organized using MS Excel, and graphs have been created with the same software.

RESULT & DISCUSSION

Vegetables Production in Karnal Division: -

The Karnal Division, which includes Karnal district, is known for cultivating a diverse array of crops, particularly vegetables such as tomatoes, onions, potatoes, cauliflower, peas, spinach, radishes, and carrots. To maintain soil fertility and prevent diseases, farmers in the division frequently practice crop rotation, alternating vegetable crops with staples like wheat or rice. As in other regions of Haryana, irrigation plays a vital role in agriculture within Karnal Division. Farmers utilize a variety of irrigation methods, ranging from traditional canal systems to modern techniques like drip irrigation. Additionally, the government of Haryana provides support to farmers in this division through various agricultural schemes, subsidies, and initiatives designed to enhance productivity and promote farmer welfare (Malik et al., 2019). The government offers subsidies for various inputs, including fertilizers, seeds, and agricultural machinery, to alleviate the financial burden on farmers. Agricultural credit is accessible through institutional sources such as banks and cooperatives, with specialized loans often featuring lower interest rates and flexible repayment options (Choudhury, 1978). Efforts are also focused on improving market access for farmers, with the establishment of agricultural markets (mandis) and infrastructure development facilitating better market linkages (Kumar et al., 2020). Additionally, government agencies invest in agricultural research and extension services to develop new crop varieties, enhance farming techniques, and equip farmers with the latest knowledge to boost productivity.

Spatial Pattern of Production in Karnal Division: 2010-11: -

Table 1 presents the vegetable production in tonnes for potatoes and onions across the districts of Kaithal, Karnal, and Panipat, as well as the total figures for the Karnal division in Haryana during the 2010-11 period. In Kaithal, potato production was recorded at 10,821 tonnes, while onion production reached 14,288 tonnes. Karnal district reported significantly higher figures, with 61,127 tonnes of potatoes and 45,282 tonnes of onions produced. Panipat contributed 28,500 tonnes of potatoes and 10,896 tonnes of onions to the overall totals. The combined production for the Karnal

division, encompassing Kaithal, Karnal, and Panipat, amounted to 100,448 tonnes of potatoes and 70,466 tonnes of onions during 2010-11.

Table 1: Pattern of Vegetables Production in Karnal Division, 2010-11 (Production in Tons)

Dist rict s	Pot ato	On ion	To mat o	Ra dis h	Ca rro t	Cab bag e	Cauli flowe r	Chi llie s	Bh ind i	Bri nja l	A r bi	Pe as	Leaf y Veg.	Ot her s	Tot al
Kait hal	10,821	14,288	5,610	6,020	8,910	7,210	13,000	3,000	2,050	5,310	0	2,810	4,910	8,050	91,989
Kar nal	61,127	45,282	65,440	40,907	7,965	27,530	55,570	12,419	11,355	24,615	0	14,440	24,148	53,973	4,44,771
Pani pat	28,500	10,896	7,740	11,820	6,005	4,820	64,610	9,190	7,260	25,860	588	6,590	15,620	36,370	2,35,869
Kar nal Divi sion	1,00,448	70,466	78,790	58,747	22,880	39,560	1,33,180	24,609	20,665	55,785	588	23,840	44,678	98,393	7,72,629

Source: Haryana Horticulture department, 2010-11

Table 2: Pattern of Vegetables Production in Haryana, 2020-21 (Production in Tons)

Dist rict	Pot ato	On ion	To mat o	Ra dis h	Ca rro t	Cab bag e	Caulif lower	Chi llie s	Bh ind i	Bri nja l	A r bi	Pe as	Le afy Ve g.	Oth ers	Tota l
Kait hal	14,250	18,166	11,180	9,760	9,680	10,200	12,730	3,450	3,990	6,870	310	7,720	10,820	18,510	1,37,636
Kar nal	1,43,920	22,350	18,340	24,750	4,800	3,050	29,880	3,205	10,500	7,520	4,500	1,990	23,200	1,45,500	4,43,505
Pani pat	11,700	26,500	24,075	57,000	72,000	96,000	1,72,500	19,360	41,650	51,000	630	17,500	57,640	2,67,885	9,15,440
Kar nal Divi sion	1,69,870	67,016	53,595	91,510	86,480	1,09,250	2,15,110	26,015	56,140	65,390	5,440	27,210	91,660	4,31,895	14,96,581

Source: Haryana Horticulture Department, 2020-21

Table 3: Changing Pattern of Vegetables Production in Haryana, 2020-21 Production in Tons)

Dist rict s	Pot ato	On ion	To ma to	Ra dis h	Ca rro t	Cab bag e	Cauli flowe r	Chi llie s	Bh ind i	Bri nja l	A r bi	Pe as	Leaf y Veg.	Oth ers	Tot al
Kait hal	3,429	3,878	5,570	3,740	770	2,990	-270	450	1,940	1,560	310	4,910	5,910	10,460	45,647
Kar nal	82,793	22,932	47,100	16,157	3,165	24,480	25,690	9,214	855	17,095	4,500	12,450	-948	91,527	1,266
Pani pat	16,800	15,604	16,335	45,180	65,995	91,180	1,07,890	10,170	34,390	25,140	42	10,910	42,020	2,315	6,79,571
Kar nal Divi sion	69,422	3,450	25,195	32,763	63,600	69,690	81,930	1,406	35,475	9,605	4,852	3,370	46,982	3,3502	7,23,952

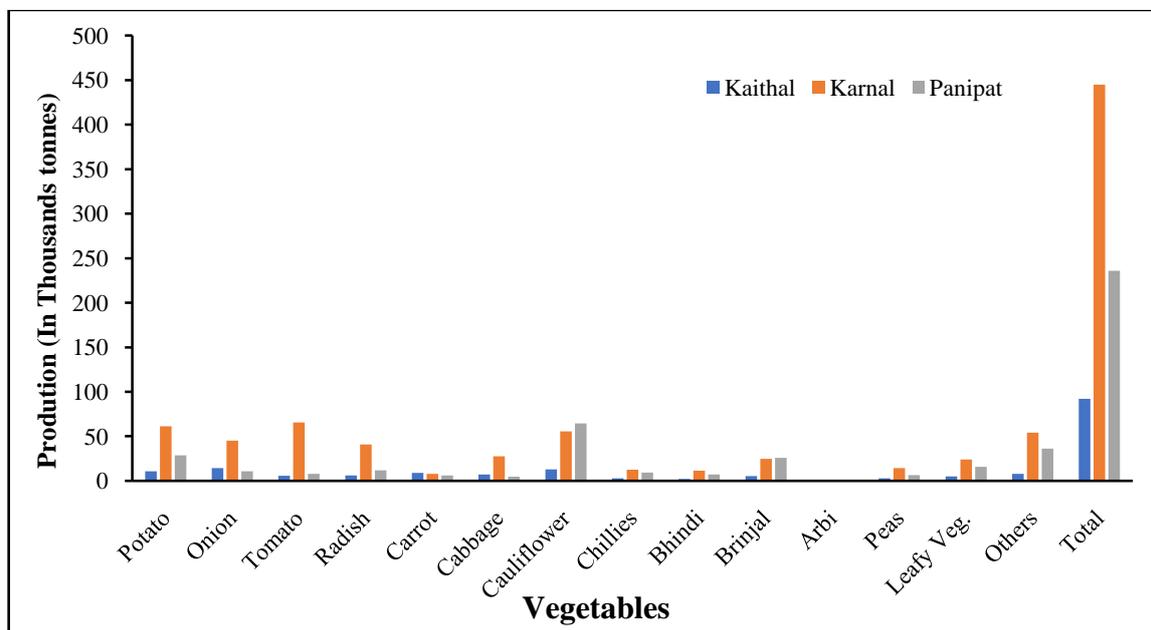
Source: Haryana Horticulture Department, 2010-11 to 2020-21

Additionally, in Kaithal, tomato and radish production were recorded at 5,610 tonnes and 6,020 tonnes, respectively. Karnal district again reported higher figures, with 65,440 tonnes of tomatoes and 40,907 tonnes of radishes produced. Panipat added 7,740 tonnes of tomatoes and 11,820 tonnes of radishes to the overall production (Table 1).

The total production for the Karnal division, which includes Kaithal, Karnal, and Panipat, reached 78,790 tonnes of tomatoes and 58,747 tonnes of radishes during the specified agricultural period. Kaithal produced 8,910 tonnes of carrots and 7,210 tonnes of cabbages. In the Karnal area, production included 27,530 tonnes of cabbages and 7,965 tonnes of carrots. Panipat contributed 4,820 tonnes of cabbages and 6,005 tonnes of carrots.

During the study period, the combined output for the Karnal division amounted to 22,880 tonnes of carrots and 39,560 tonnes of cabbages (Fig. 1). Furthermore, Kaithal produced 13,000 tonnes of cauliflower and 3,000 tonnes of chillies. In the Karnal district, the figures were 12,419 tonnes of chillies and 55,570 tonnes of cauliflower. Panipat contributed 9,190 tonnes of chillies and 64,610 tonnes of cauliflower to the overall production.

During the designated agricultural season, the total output for the Karnal Division comprising Kaithal, Karnal, and Panipat reached 133,180 tonnes of cauliflower and 24,609 tonnes of chillies. Besides, in Kaithal, bhindi and brinjal production was recorded at 2,050 tonnes and 5,310 tonnes, respectively. Karnal district made a significant contribution, reporting 11,355 tonnes of bhindi and 24,615 tonnes of brinjal (Table 1).



Source: Based on table 1

Figure 1: Pattern of Vegetable production in Karnal Division, 2010-11

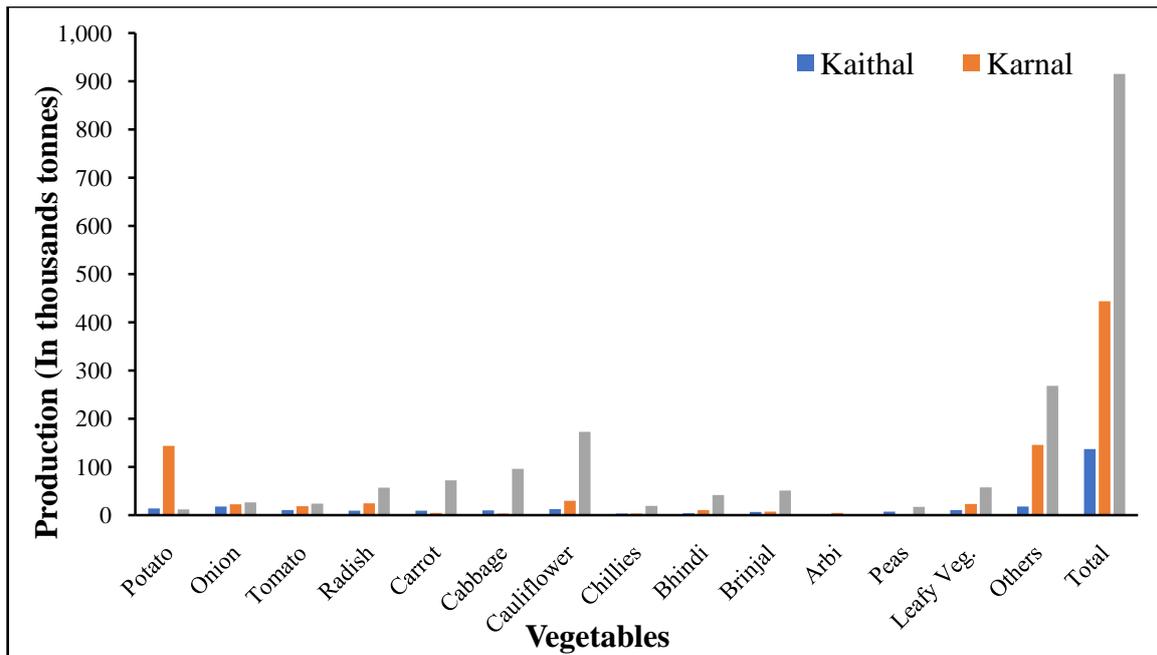
Panipat district reported a production of 7,260 tonnes of bhindi and 25,860 tonnes of brinjal. The total production for the Karnal Division, which includes Kaithal, Karnal, and Panipat, amounted to 20,665 tonnes of bhindi and 55,785 tonnes of brinjal during the specified agricultural period.

While no arbi was produced in Kaithal, the district did yield 2,810 tonnes of peas. Similarly, there was no arbi production in the Karnal area, but it produced 14,440 tonnes of peas. Panipat recorded 6,590 tonnes of peas and 588 tonnes of arbi.

During the designated agricultural season, the combined output for the Karnal Division reached 23,840 tonnes of peas and 588 tonnes of arbi. The Karnal Division, including Kaithal, Karnal, and Panipat, produced 44,678 tonnes of leafy vegetables and 98,393 tonnes of other vegetables (Table 1).

Spatial Pattern of Production in Karnal Division: 2020-21: -

Table 2 displays the vegetable production in tonnes for potatoes and onions in the districts of Kaithal, Karnal, and Panipat, along with the combined totals for the Karnal Division during the 2020-21 agricultural year. In Kaithal, potato production reached 14,250 tonnes, while onion production totaled 18,166 tonnes. Karnal district reported significantly higher figures, with 143,920 tonnes of potatoes and 22,350 tonnes of onions.



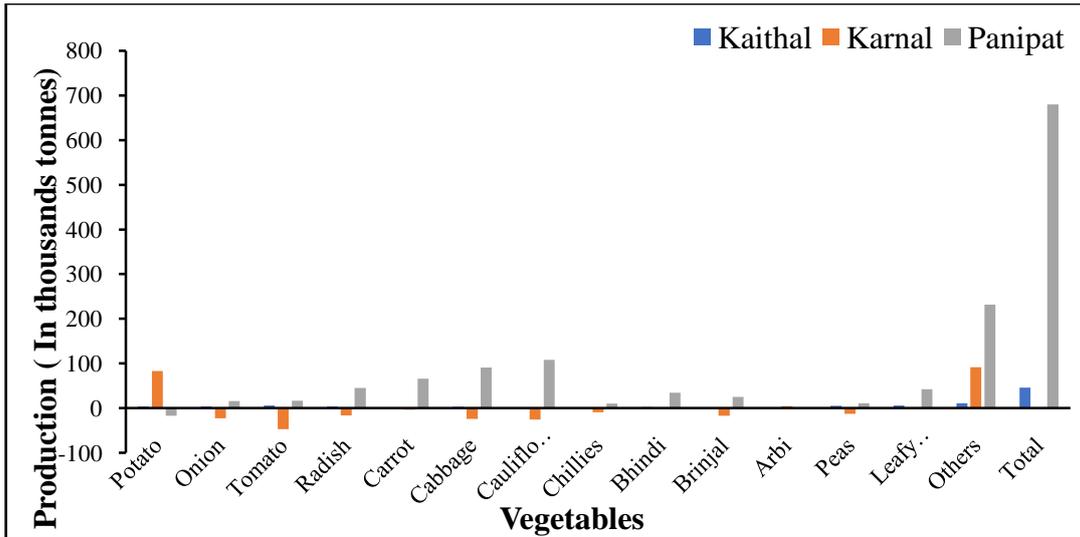
Source: Based on table 2

Figure 2: Pattern of Vegetable production in Karnal Division, 2020-21

Panipat reported a production of 11,700 tonnes of potatoes and 26,500 tonnes of onions. The total production for the Karnal Division, which includes Kaithal, Karnal, and Panipat, reached 169,870 tonnes of potatoes and 67,016 tonnes of onions during the specified agricultural period. In Kaithal, 11,180 tonnes of tomatoes and 9,760 tonnes of radishes were produced. The Karnal area recorded 24,750 tonnes of radishes and 18,340 tonnes of tomatoes. Panipat contributed 24,075 tonnes of tomatoes and 57,000 tonnes of radishes. During 2020-21, the Karnal Division collectively produced 53,595 tonnes of tomatoes and 91,510 tonnes of radishes (Table 2). In Kaithal, 9,680 tons of carrots and 10,200 tons of cabbages were produced. 3,050 tons of cabbages and 4,800 tons of carrots were recorded from the Karnal area. With 72,000 tons of carrots and 96,000 tons of cabbages, Panipat produced a significant amount. During the designated agricultural time, the Karnal division, which includes Kaithal, Karnal, and Panipat, produced 1,09,250 tons of cabbages and 86,480 tons of carrots combined. 12,730 tons of cauliflower and 3,450 tons of chilies were produced in Kaithal. 3,205 tons of chilies and 29,880 tons of cauliflower were recorded from the Karnal area. With 1,72,500 tons of cauliflower and 19,360 tons of chilies, Panipat produced a significant amount (Fig. 2). The total production in Karnal division comprised of 2,15,110 tons of cauliflower and 26,015 tons of chilies. 3,990 tons of Bhindi and 6,870 tons of Brinjal were produced at Kaithal. 10,500 tons of Bhindi and 7,520 tons of Brinjal were recorded from the Karnal area. With 41,650 tons of Bengali curry and 51,000 tons of brinjal, Panipat produced a significant amount of produce. Simultaneously, the region produced 56,140 tons of Bhindi and 65,390 tons of Brinjal combined. In Kaithal, the production of Arbi was 310 tons, while peas production reached 7,720 tons. Karnal district reported 4,500 tons of arbi and 1,990 tons of Peas production. Panipat recorded 630 tons of arbi and a significant production of 17,500 tons of peas (Table 2). The combined production for the Karnal Division, which includes Kaithal, Karnal, and Panipat, reached 5,440 tonnes of arbi and 27,210 tonnes of peas during the specified agricultural period. In Kaithal, the production of leafy vegetables reached 10,820 tonnes, while other vegetables reached 18,510 tonnes. Karnal district reported 23,200 tonnes of leafy vegetables and a substantial production of 145,500 tonnes of other vegetables. Panipat recorded 57,640 tonnes of leafy vegetables and an impressive production of 267,885 tonnes of other vegetables. The combined production for the Karnal Division reached 91,660 tonnes of leafy vegetables and 431,895 tonnes of other vegetables.

Changing Pattern of Production in Karnal Division: 2010-11 to 2020-21: -

Table 3 illustrates the changing patterns of potato, onion, and tomato production in tonnes across the districts of Kaithal, Karnal, and Panipat, as well as the aggregated figures for the Karnal Division from 2010-11 to 2020-21. In Kaithal, potato production increased by 3,429 tonnes, onion production rose by 3,878 tonnes, and tomato production grew by 5,570 tonnes (Map 1). In contrast, Karnal district experienced significant changes, with potato production rising by 82,793 tonnes, while onion production decreased by 22,932 tonnes and tomato production fell by 47,100 tonnes. Panipat saw a decline in potato production by 16,800 tonnes, but an increase in onion production by 15,604 tonnes and tomato production by 16,335 tonnes. Overall, the changing pattern for the Karnal Division shows an increase in potato production by 69,422 tonnes, a decrease in onion production by 3,450 tonnes, and a substantial decline in tomato production by 25,195 tonnes.

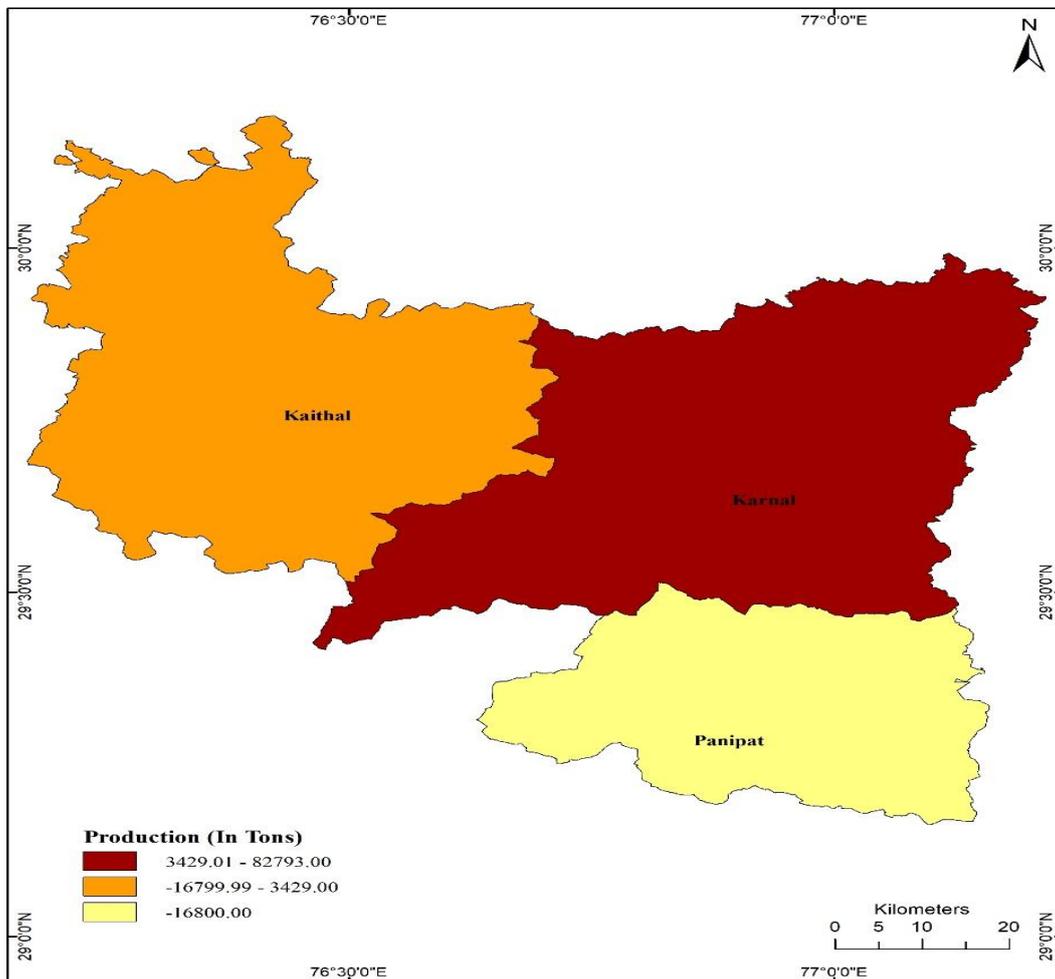


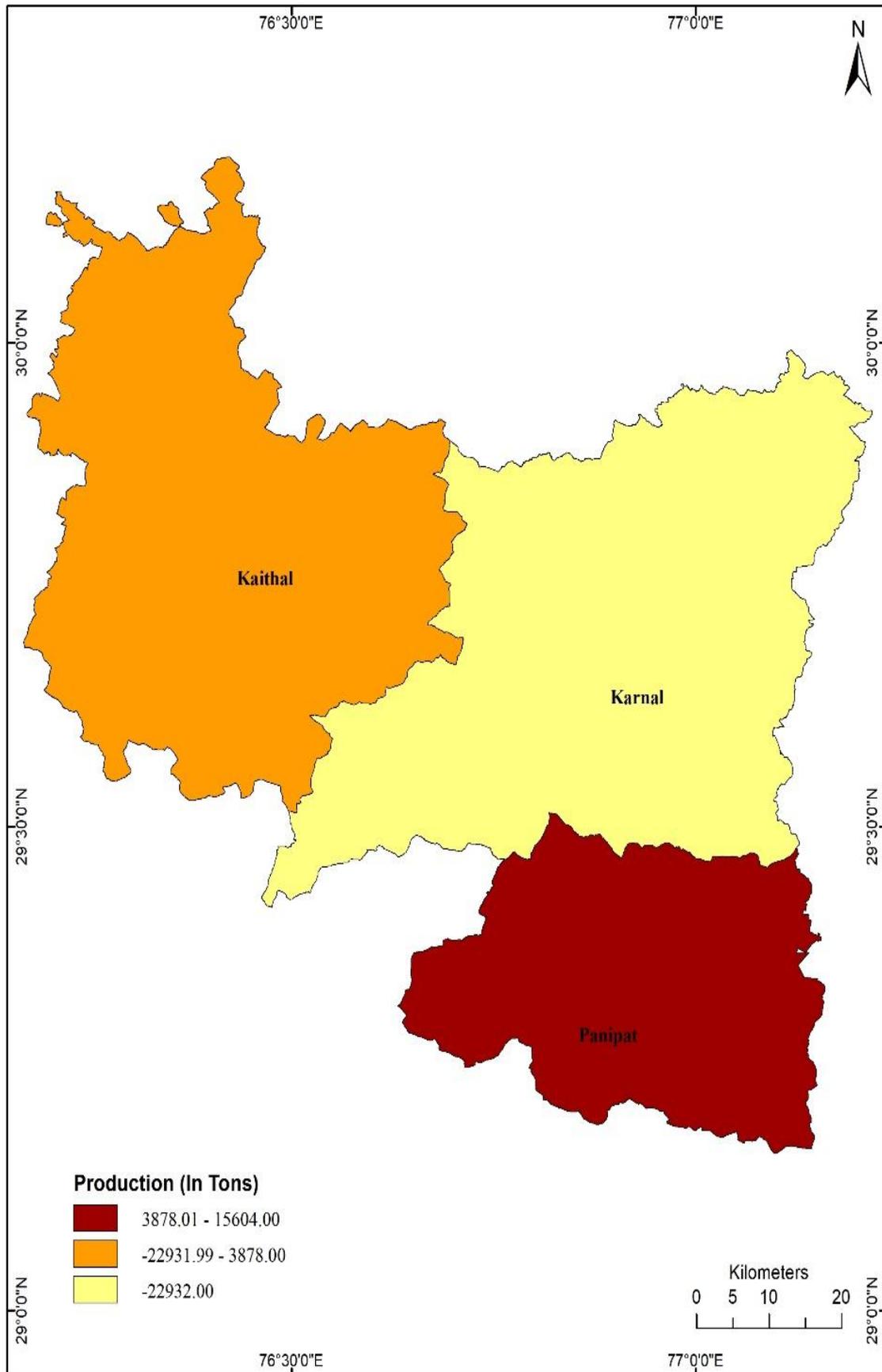
Source: Based on table 3

Figure 3: Changing Pattern of Vegetable Production in Karnal Division, 2010-11 to 2020-21

In Kaithal, radish production increased by 3,740 tonnes, while carrot production decreased by 770 tonnes, and cabbage production rose by 2,990 tonnes. Significant changes were observed in the Karnal area, where radish production dropped by 16,157 tonnes, carrots fell by 3,165 tonnes, and cabbage experienced a remarkable decline of 24,480 tonnes (Map 2). In Panipat, radish production surged by 45,180 tonnes, carrot production increased by 65,995 tonnes, and cabbage production rose by 91,180 tonnes.

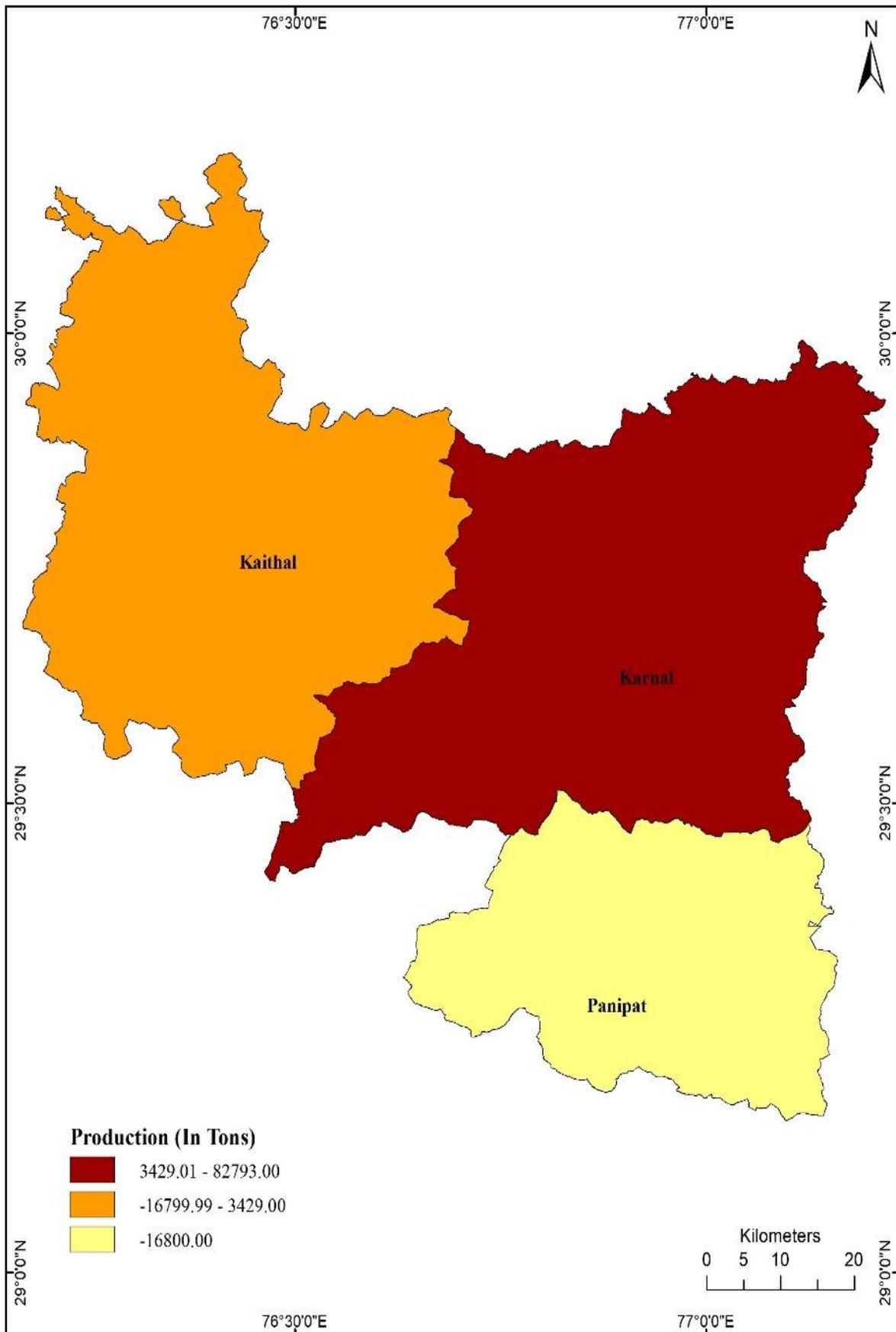
Map 1: Changing Pattern of Potato and Onion Vegetables in Kaithal Division, 2010-11 to 2020-21

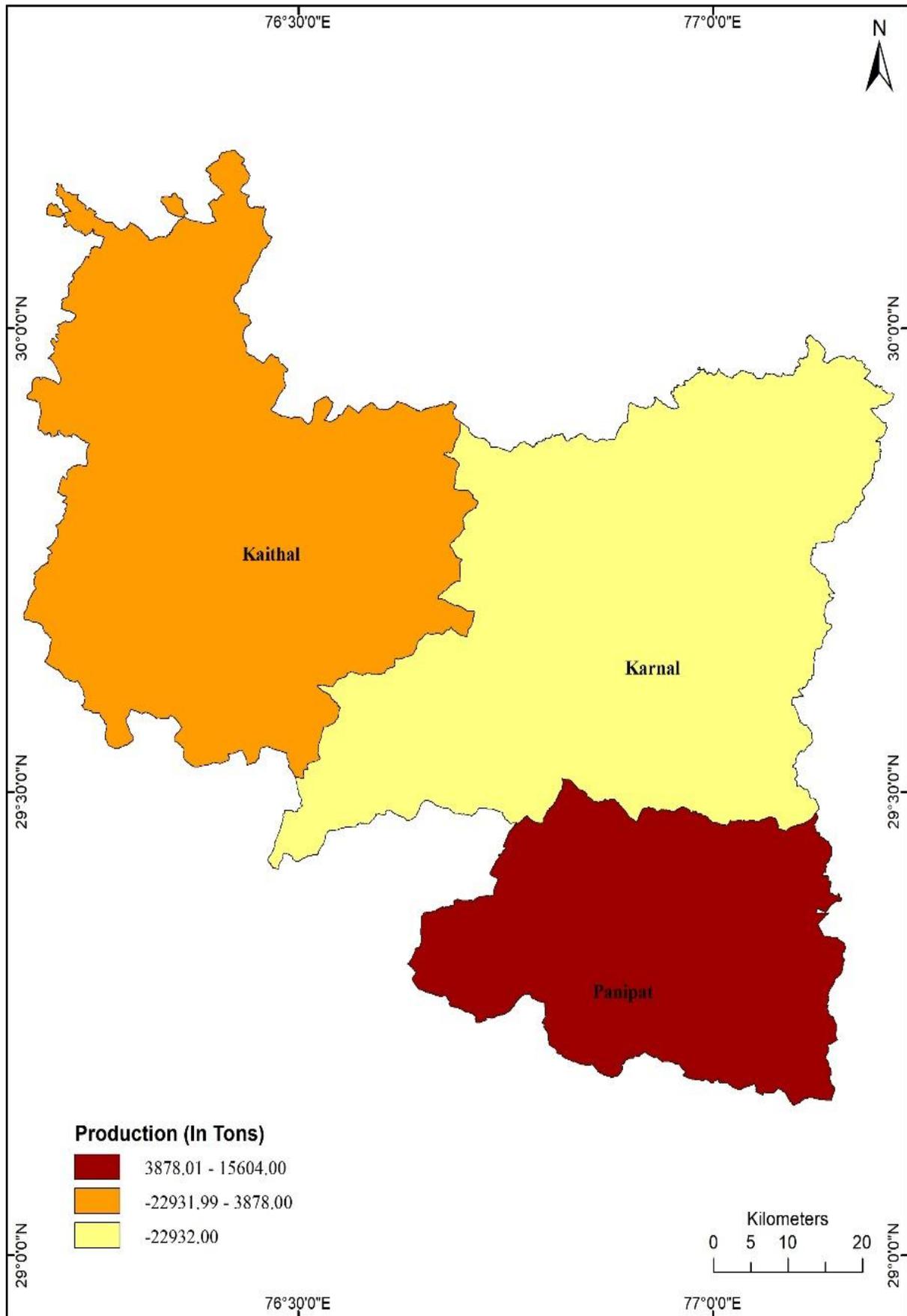




Source: Haryana Horticulture Department, 2010-11 to 2020-21

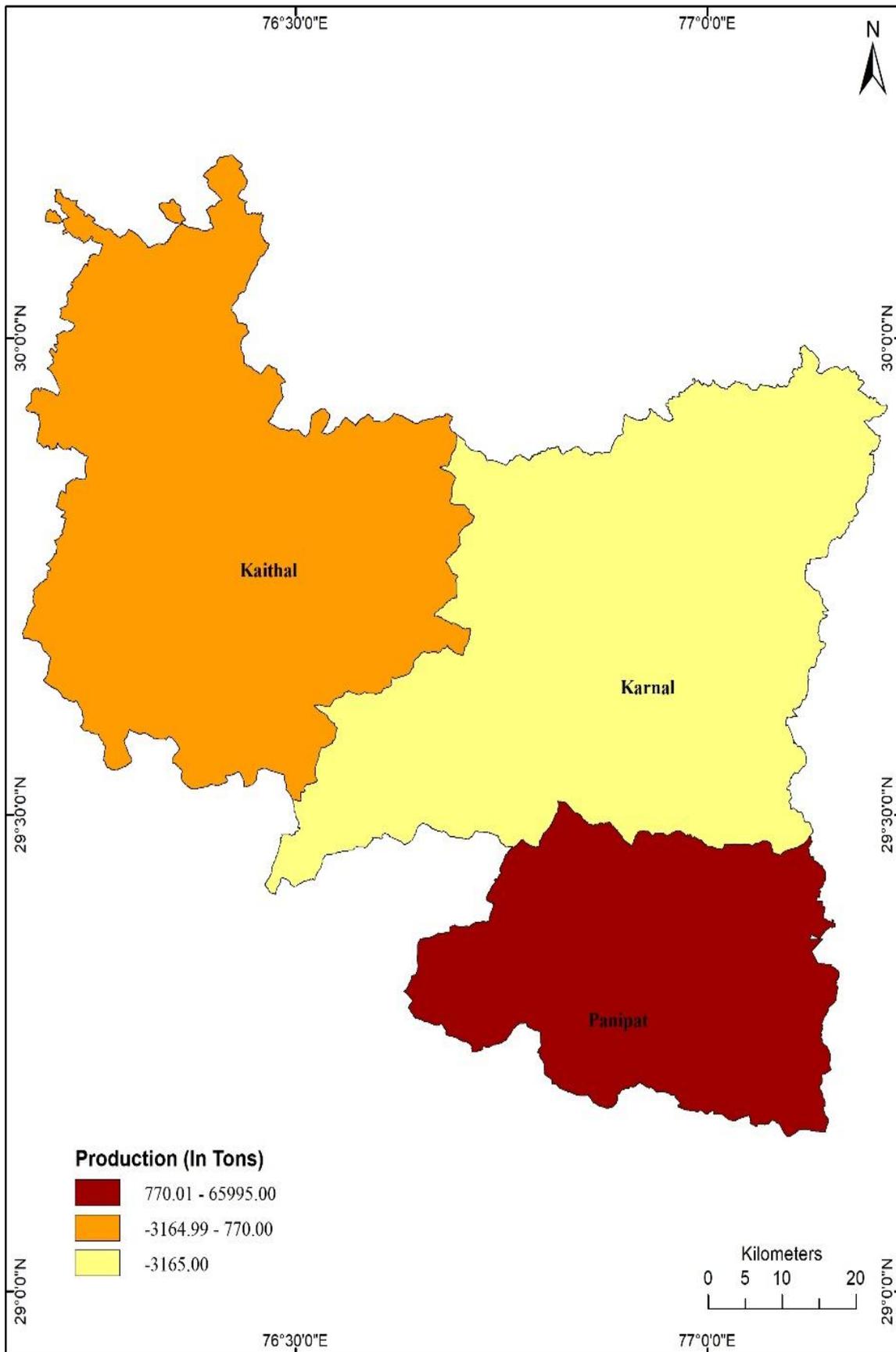
Map 2: Changing Pattern of Tomato and Radish Vegetables in Kaithal Division, 2010-11 to 2020-21

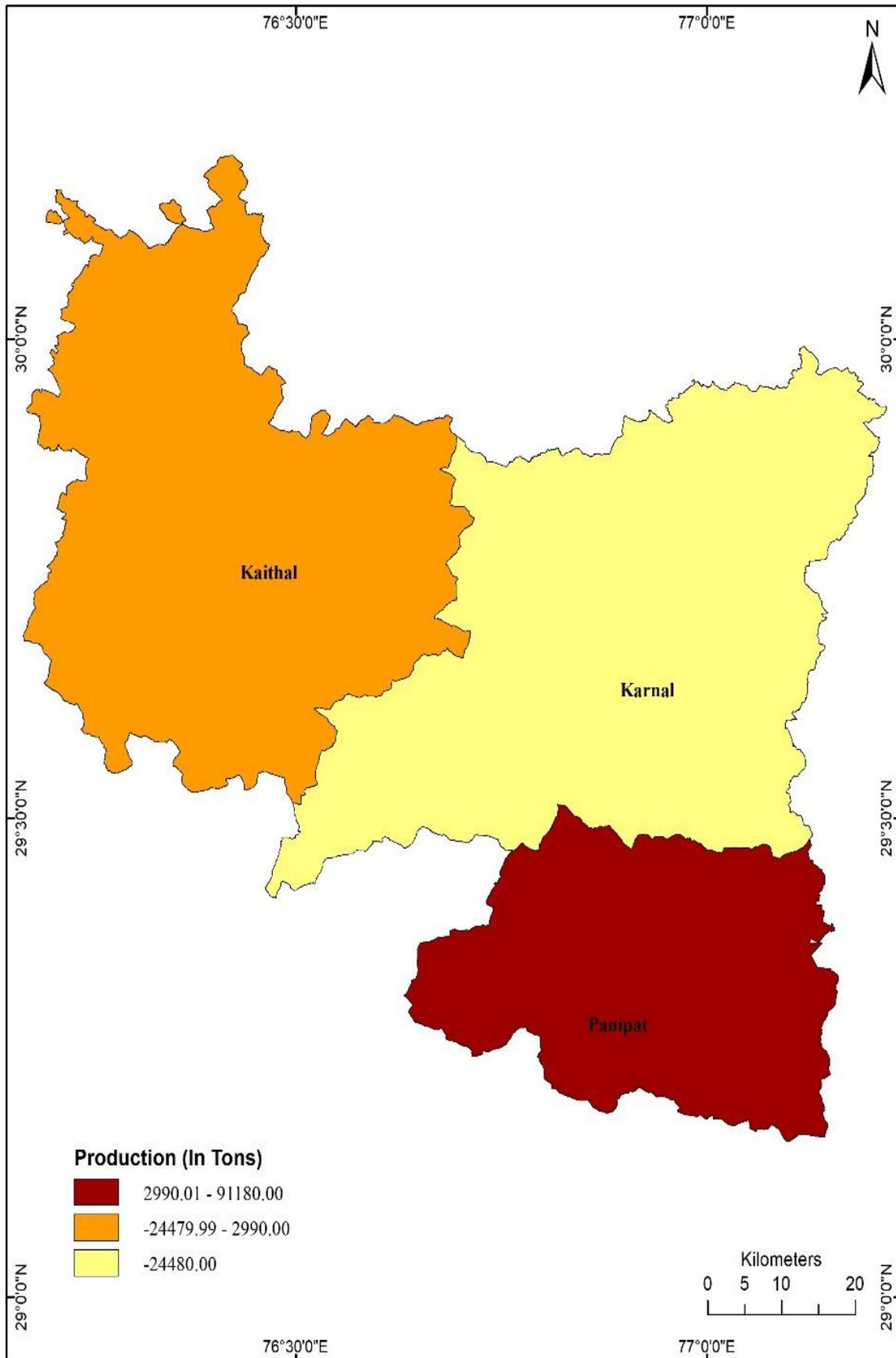




Source: Haryana Horticulture Department, 2010-11 to 2020-21

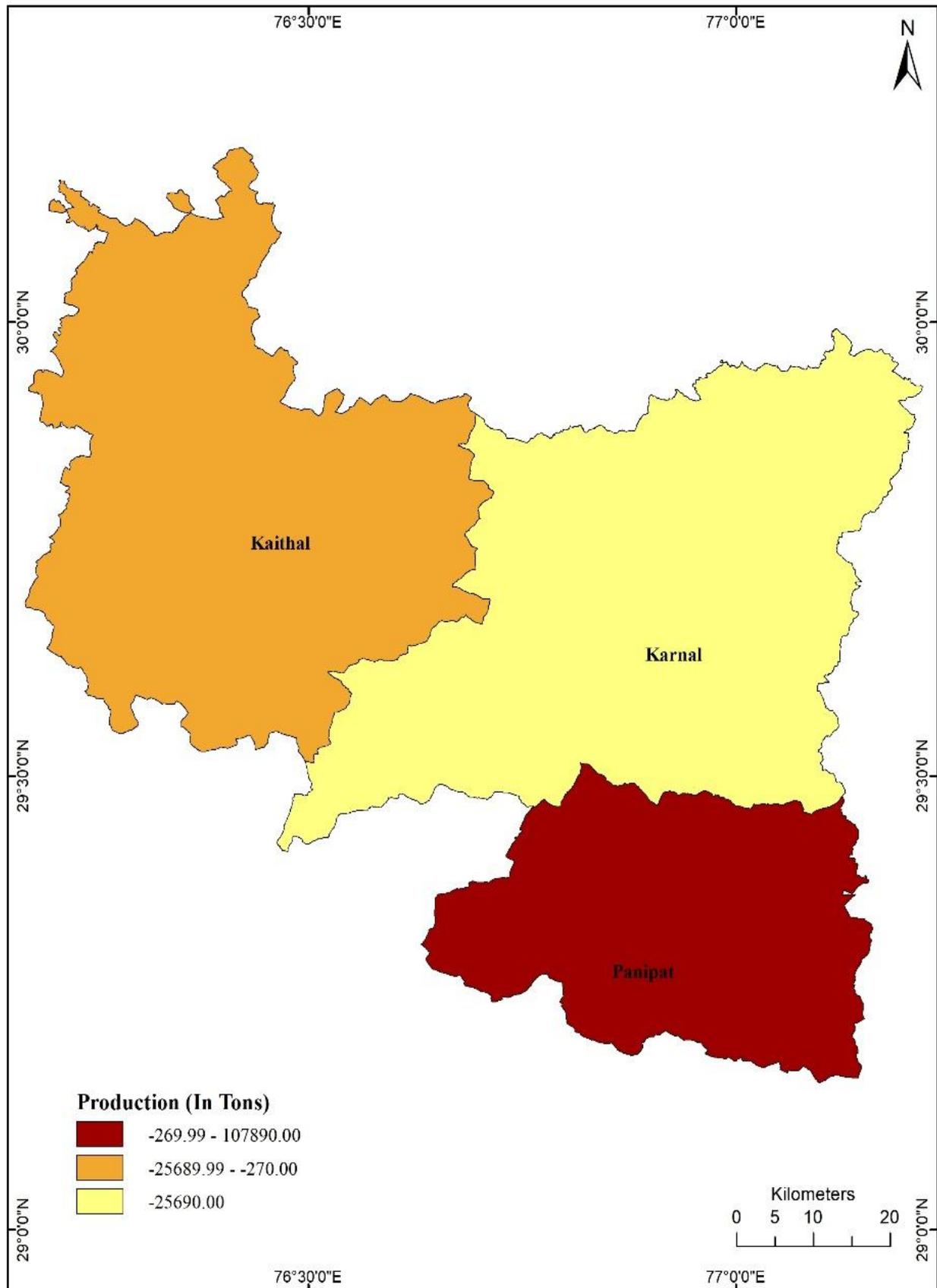
Map 3: Changing Pattern of Carrot and Cabbage Vegetables in Haryana, 2010-11 to 2020-21

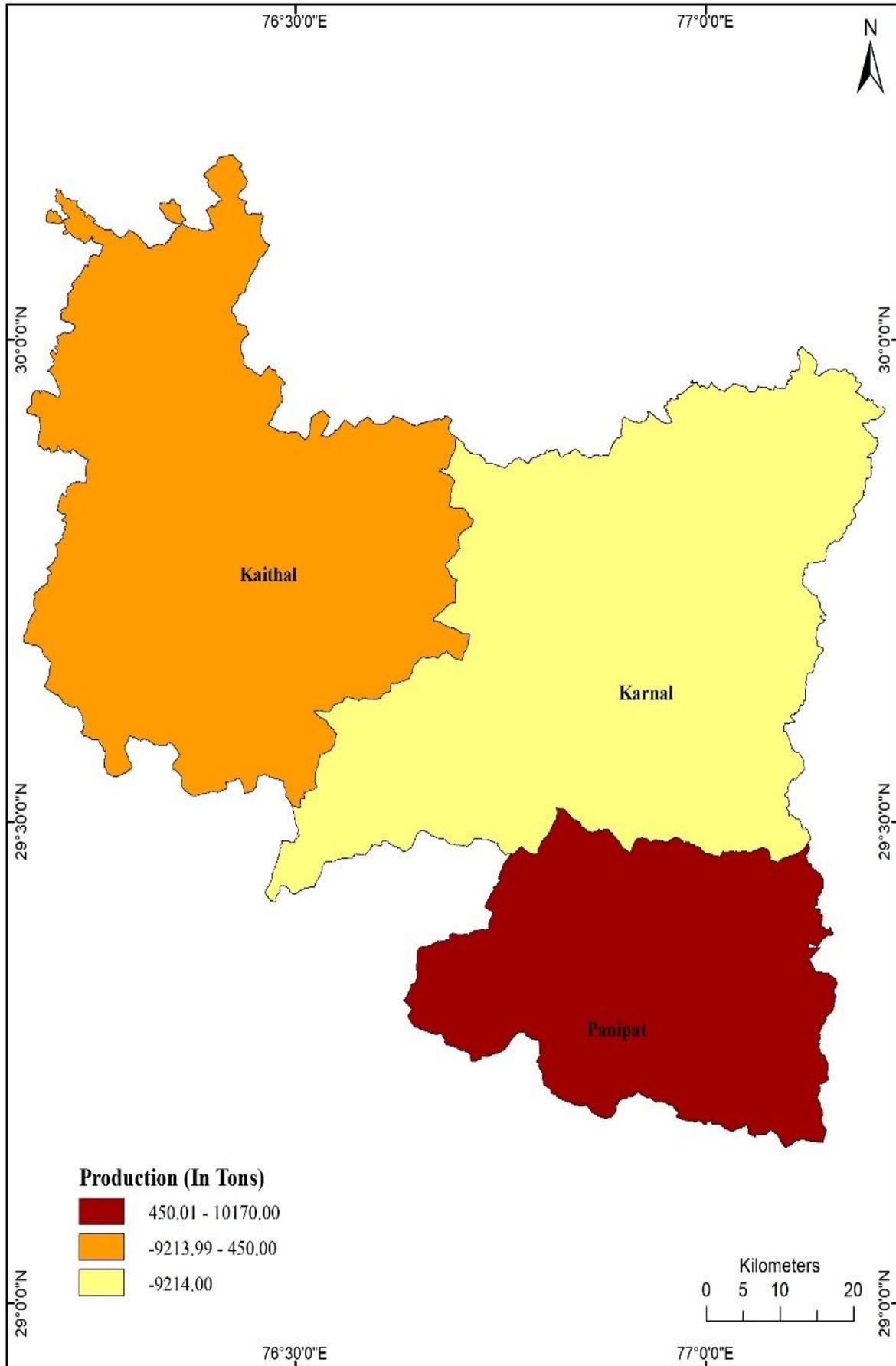




Source: Haryana Horticulture Department, 2010-11 to 2020-21

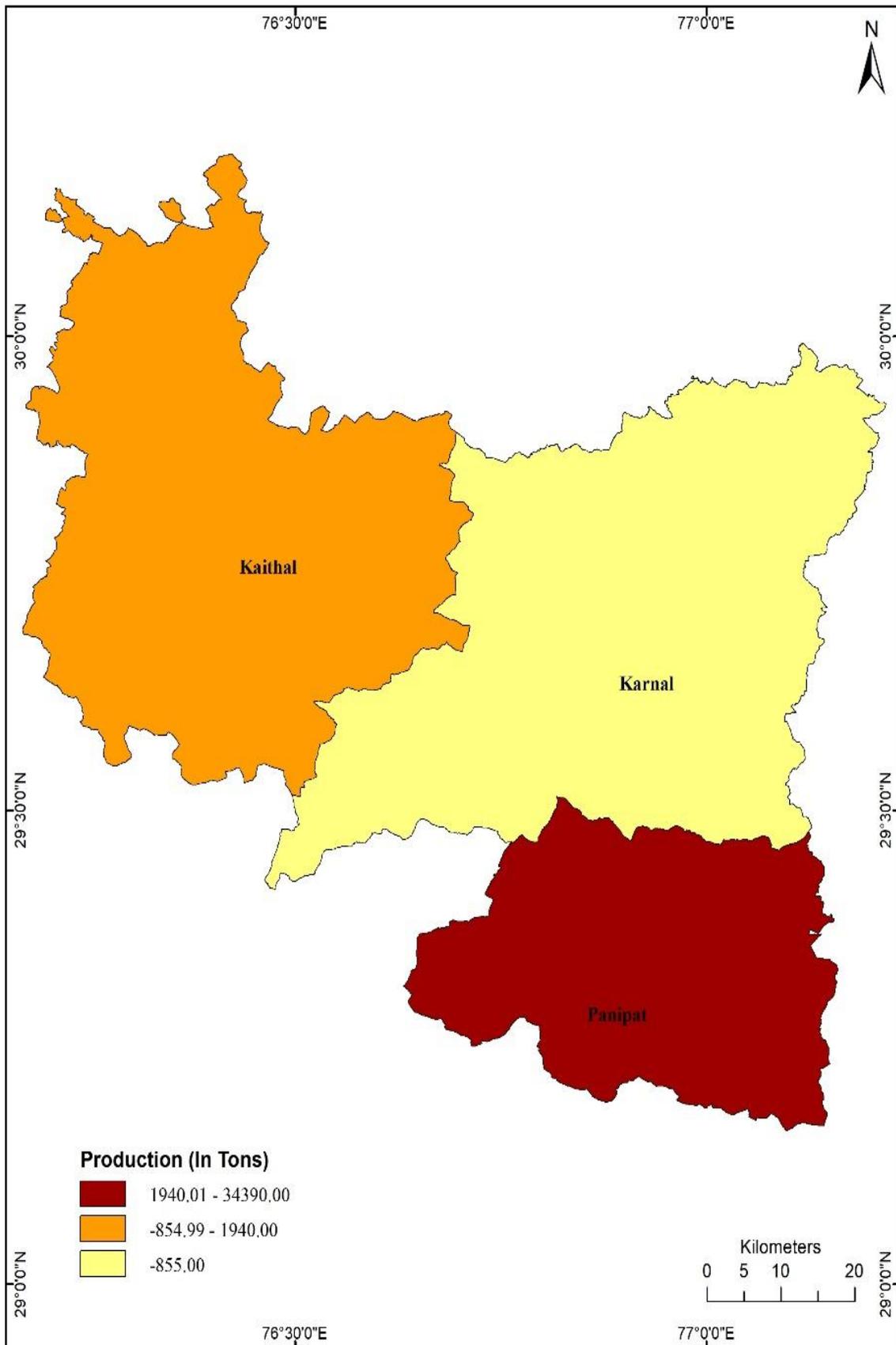
Map 4: Changing Pattern of Cauliflower and Chillies Vegetables in Haryana, 2010-11 to 2020-21

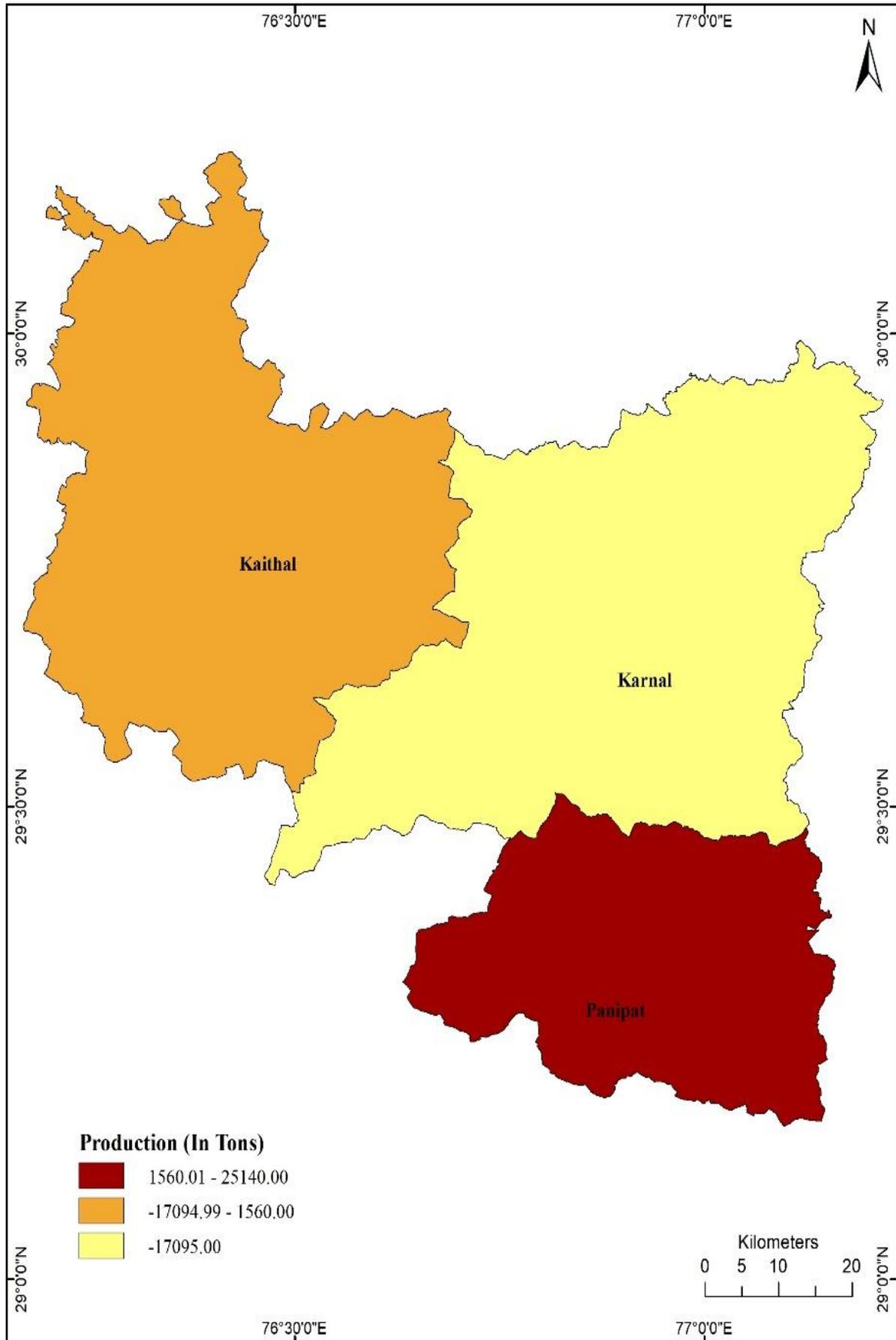




Source: Haryana Horticulture Department, 2010-11 to 2020-21

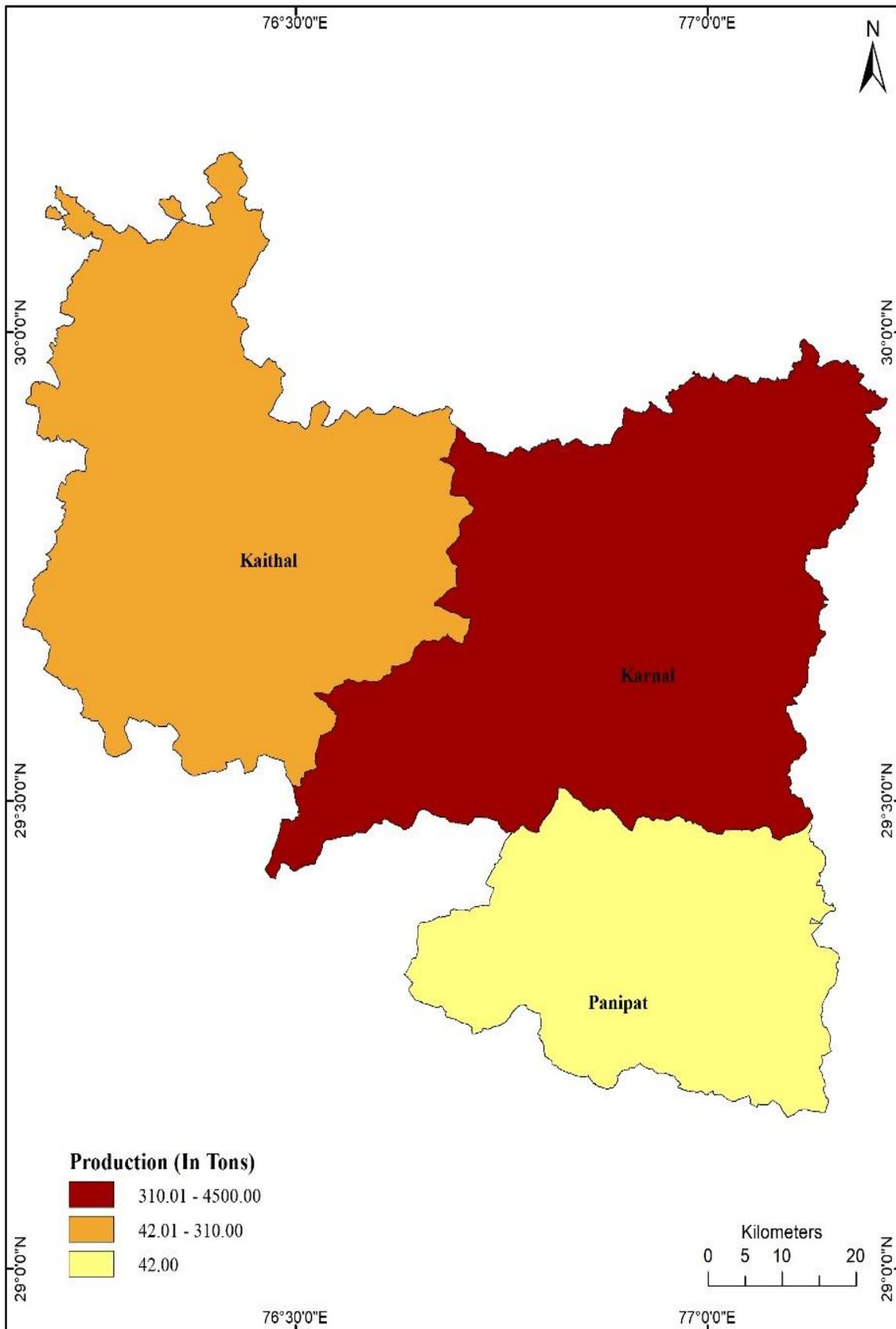
Map 5: Changing Pattern of Bhindi and Brinjal Vegetables in Haryana, 2010-11 to 2020-21

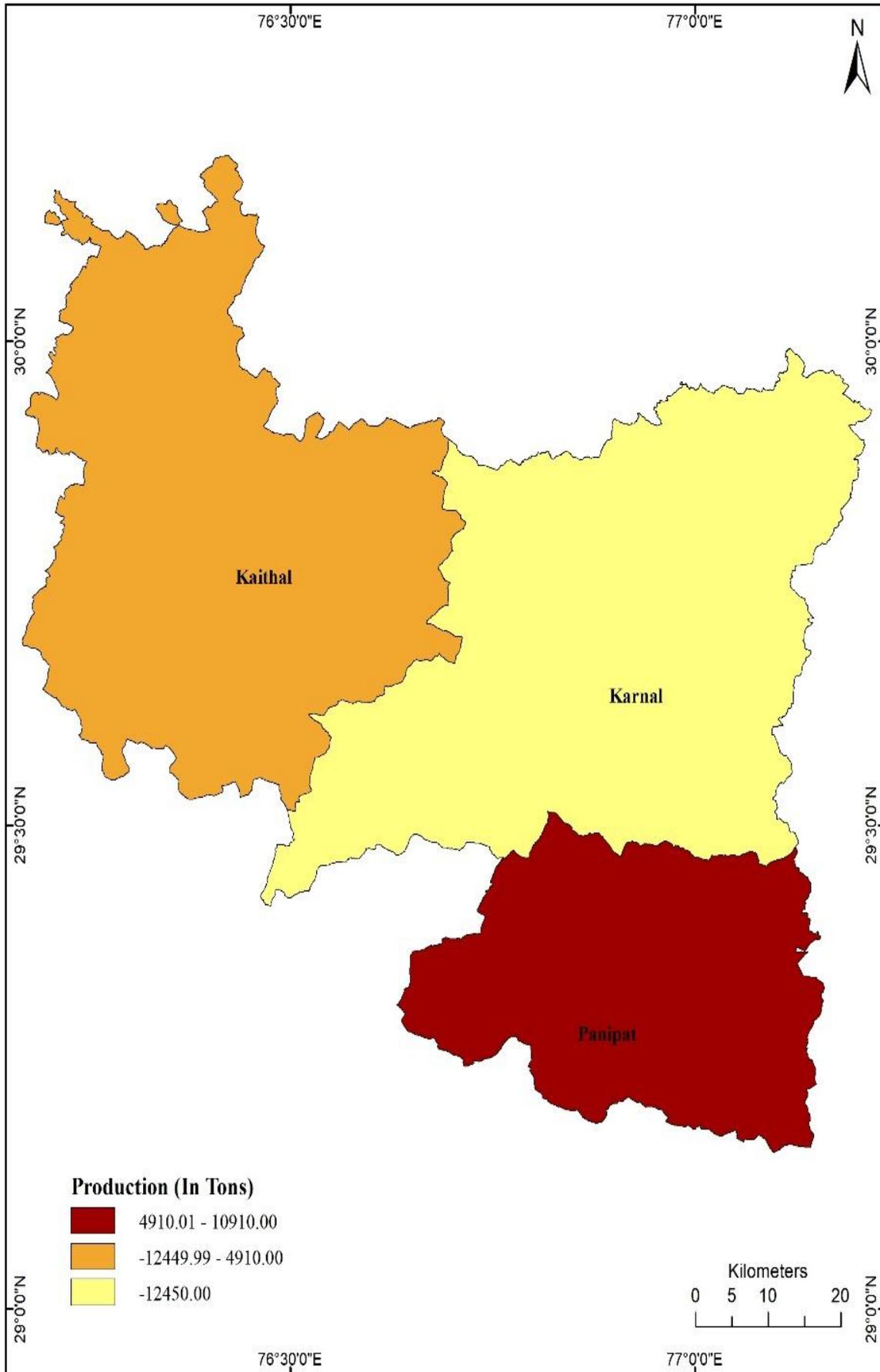




Source: Haryana Horticulture Department, 2010-11 to 2020-21

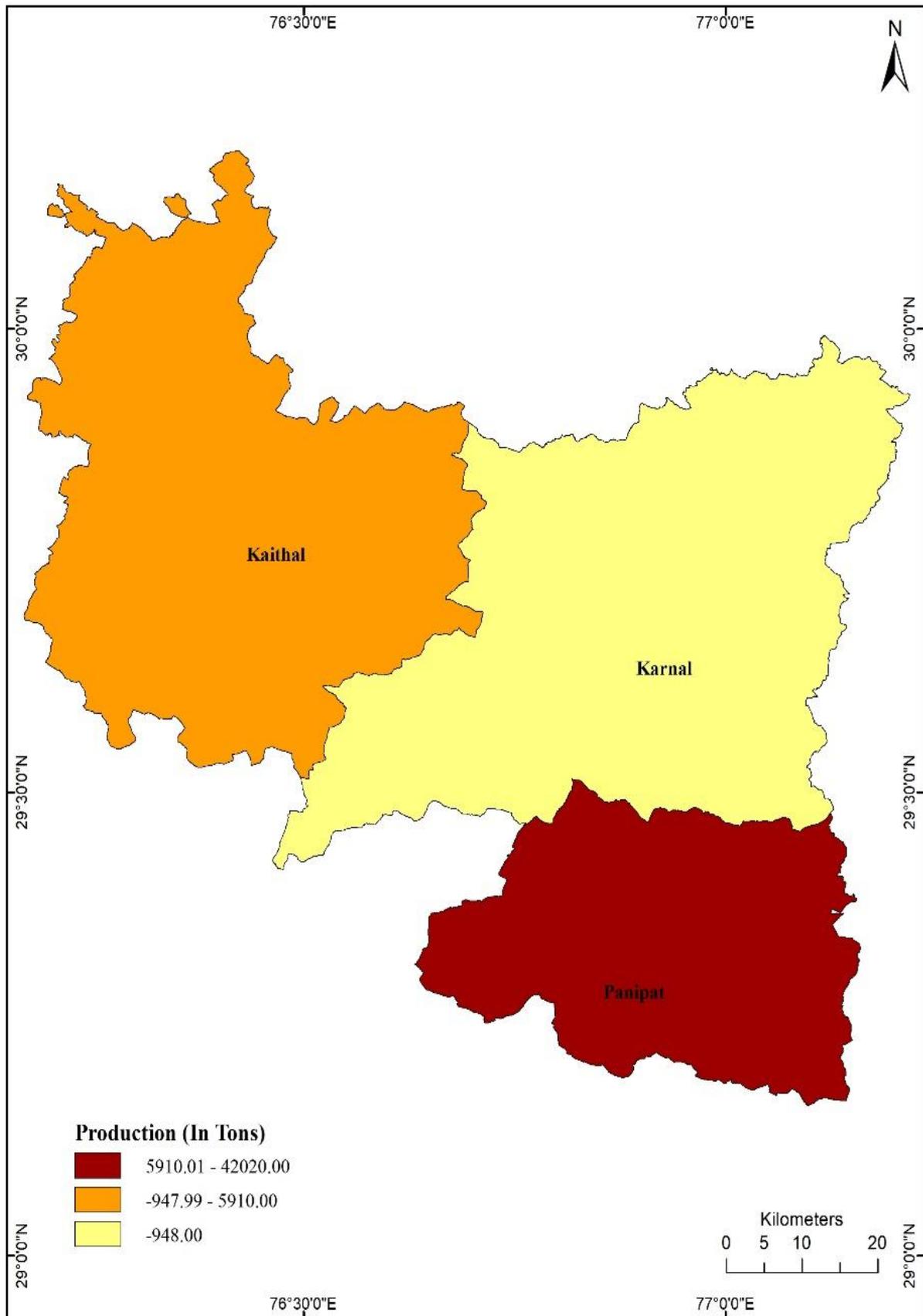
Map 6: Changing Pattern of Arbi and Peas Vegetables in Haryana, 2010-11 to 2020-21

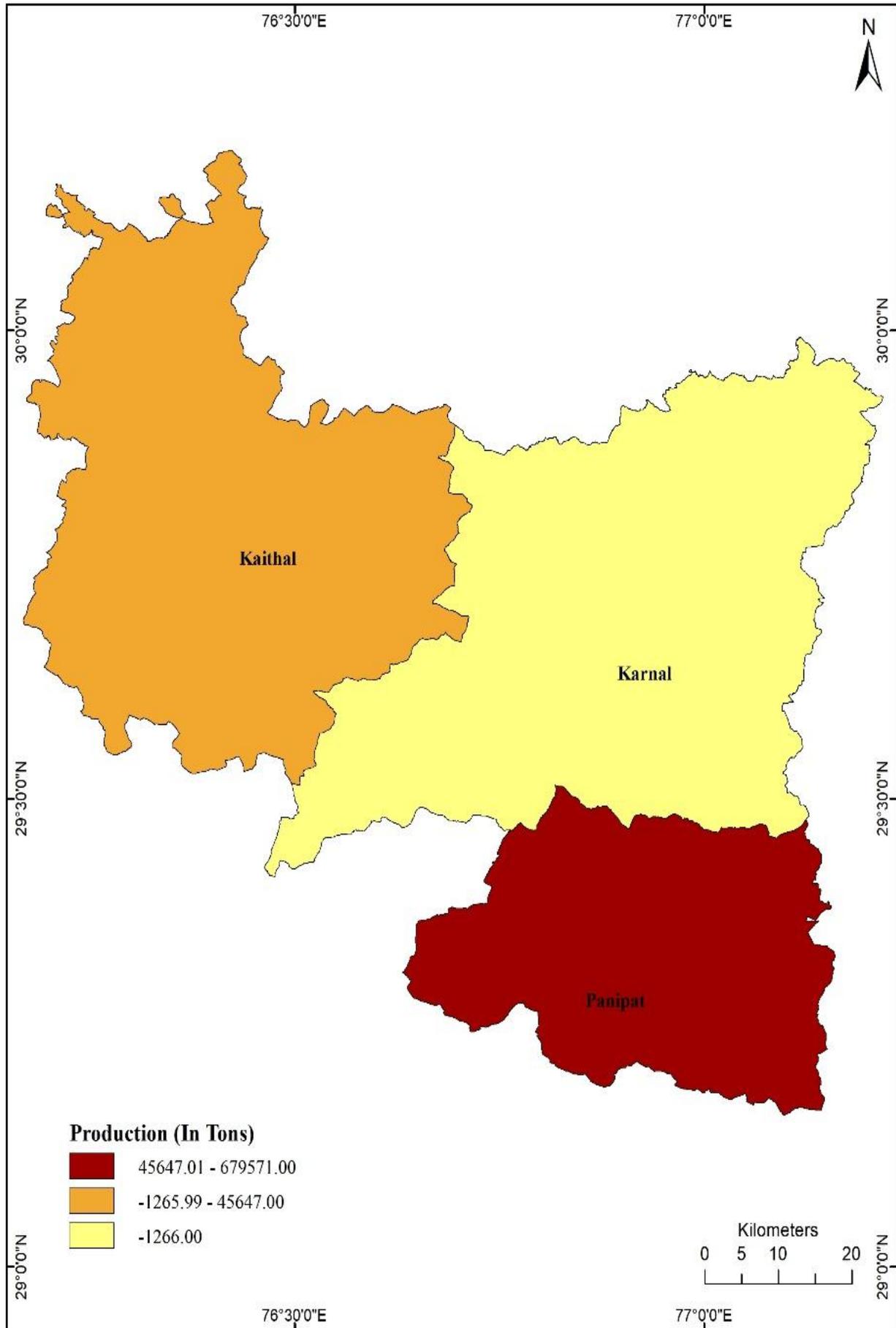




Source: Haryana Horticulture Department, 2010-11 to 2020-21

Map 7: Changing Pattern of Leafy Veg. and Total Vegetables in Haryana, 2010-11 to 2020-21





Source: Haryana Horticulture Department, 2010-11 to 2020-21

Overall, in the Karnal Division, which includes Kaithal, Karnal, and Panipat, the shifting trend indicates a decline of 32,763 tonnes in radish production, a rise of 63,600 tonnes in carrots, and a gain of 69,690 tonnes in cabbage production. Besides, cauliflower production decreased slightly by 270 tonnes, while chilies saw an increase of 450 tonnes and bhindi production rose by 1,940 tonnes. The Karnal area experienced significant shifts, including a sharp decline in cauliflower output of 25,690 tonnes. Additionally, chilies dropped by 9,214 tonnes, and curry powder production fell by 855 tonnes. Cauliflower production in Panipat saw a dramatic increase of 107,890 tonnes, while chilies rose moderately by 10,170 tonnes and bhindi experienced a significant boost of 34,390 tonnes. Over the specified period, the Karnal Division, which includes Kaithal, Karnal, and Panipat, recorded a notable rise in bhindi production of 35,475 tonnes, a slight gain in chilies production of 1,406 tonnes, and a decrease in cauliflower production of 81,930 tonnes. Kaithal reported an increase of 4,910 tonnes in pea output, while arbi production fell by 310 tonnes and brinjal production rose by 1,560 tonnes. Conversely, Karnal experienced a significant decline in pea output of 12,450 tonnes, although arbi production increased by 4,500 tonnes. Brinjal production, however, saw a substantial decrease of 17,095 tonnes. Panipat also made gains, with bean output rising moderately by 10,910 tonnes, arbi production increasing slightly by 42 tonnes, and brinjal production growing significantly by 25,140 tonnes. Leafy vegetable output in Kaithal increased by 5,910 tonnes, along with a rise of 10,460 tonnes in other vegetables. The Karnal region experienced a decrease of 948 tonnes in leafy vegetable output, while other vegetable production rose significantly by 91,527 tonnes. Finally, Panipat reported a substantial increase in leafy vegetable output of 42,020 tonnes, with production of other vegetables soaring by an impressive 231,515 tonnes.

In conclusion, the agricultural production trends across the districts of Kaithal, Karnal, and Panipat from 2010-11 to 2020-21 show that Panipat experienced remarkable growth in cauliflower, bhindi, and brinjal production, Karnal faced significant declines, particularly in cauliflower and peas. Kaithal demonstrated a mix of gains in bhindi and peas, alongside some reductions in other crops. Overall, the Karnal Division exhibited a notable increase in bhindi and carrots, contrasted by a decline in cauliflower.

CONCLUSION

The analysis of vegetable production in the Karnal Division and across Haryana over different years reveals significant trends and variations. During 2010-11, Karnal district emerged as the leading producer, with a strong focus on potatoes and tomatoes, indicating both a preference and suitability for these crops. Kaithal and Panipat districts displayed varied production patterns, with Kaithal excelling in onions and cauliflower, while Panipat demonstrated remarkable yields in cauliflower and radish. The overall production in the Karnal Division underscored its significance as a major agricultural hub, with a clear trend toward concentrated production of specific vegetables, particularly root crops. By 2020-21, Karnal continued to dominate with substantial potato production, though it showed a decline in other categories like onions and tomatoes. Panipat experienced a remarkable increase in total production, driven by exceptional yields in radish and cabbage, showcasing a diversification in crop production. Kaithal maintained balanced production across various vegetables, indicating a strategic focus on multiple crops. This period marked a substantial increase in overall vegetable production in Haryana. However, the changing pattern of vegetable production in 2020-21 revealed challenges for certain districts. Kaithal reported modest total production with notable increase in onions and tomato production but faced issues with cauliflower production. In contrast, Karnal experienced significant declines across multiple vegetable categories, reflecting severe challenges that could be linked to environmental factors or market conditions. Meanwhile, Panipat exhibited remarkable growth in total production, driven by substantial increase in production in radish and cabbage. Overall, the study found that vegetable production in the region has seen increased focus especially in context of diversifying the agricultural sector.

REFERENCES

- [1]. Behera, U. K., & France, J. (2016). Integrated farming systems and the livelihood security of small and marginal farmers in India and other developing countries. *Advances in agronomy*, 138, 235-282.
- [2]. Birthal, P. S., Joshi, P. K., Roy, D., & Thorat, A. (2013). Diversification in Indian agriculture toward high-value crops: The role of small farmers. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*, 61(1), 61-91.
- [3]. Choudhury, B. (1978). Vegetable Production in India. In *Symposium on Vegetable growing in the Asian and Pacific Region*, 101, 47-54.
- [4]. Dev, M. (2019). Transformation of Indian agriculture? growth, inclusiveness and sustainability. *Indian Journal of Agricultural Economics*, 74(1), 9-61.
- [5]. Ghanghas, B. S., Nain, M. S., & Malik, J. S. (2017). Adoption of post-harvest management practices by vegetable growers in Haryana state. *Indian Journal of Extension Education*, 53(1), 104-110.
- [6]. Keatinge, J. D. H., Yang, R. Y., Hughes, J. D. A., Easdown, W. J., & Holmer, R. (2011). The importance of vegetables in ensuring both food and nutritional security in attainment of the Millennium Development Goals. *Food Security*, 3(4), 491-501.
- [7]. Krishna, H., Hebbar, S., Kumar, P., Sharma, S., Kumar, R., Tiwari, S. K., & Behera, T. K. (2024). Navigating Challenges and Prospects in Off-Season Vegetable Production. *Vegetable Science*, 51, 97-105.

- [8]. Kumar, A., Bajwan, A., Yadav, S., Kumar, R., Kumar, V., Sharma, R. K., & Choudhary, D. R. (2023). Growth and trend in area, production and productivity of vegetables in Haryana vis-à-vis India. *The Indian Journal of Agricultural Sciences*, 93(10), 1120-1125.
- [9]. Kumar, A., Yadav Sumita, M. K., & Rohila, A. K. (2019). Constraints faced by the farmers in production and marketing of vegetables in Haryana. *Indian journal of agricultural sciences*, 89(1), 153-60.
- [10]. Kumar, R., Kumar, N., Bishnoi, D. K., Malik, A. K., & Kumar, P. (2020). A study of production and marketing of potato in Kurukshetra District of Haryana. *Indian Journal of Economics and Development*, 16(2), 307-312.
- [11]. Malik, D. P., Bishnoi, D. K., & Kumar, N. (2019). A Study into Economics of Vegetable Cultivation in Haryana. *Indian Journal of Economics and Development*, 15(2), 317-321.
- [12]. Pawar, N., & Malik, D. P. (2023). Economic analysis of hybrids vis-à-vis HYVs of okra and bottle guard in Haryana. *Vegetable Science*, 50(2), 316-321.
- [13]. Solankey, S. S., Kumari, M., Akhtar, S., Singh, H. K., & Ray, P. K. (2021). Challenges and opportunities in vegetable production in changing climate: Mitigation and adaptation strategies. *Advances in Research on Vegetable Production Under a Changing Climate Vol. 1*, 13-59.