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Manuscript ID:
IJWGAFES-2026-030903

DOI: 10.5281/zenodo.23556473

DOI Link:
https://doi.org/10.5281/zenodo.23556473

Volume: 3
Issue: 9
September
Year: 2026
E-ISSN: 3066-1552

Submitted: *08 Aug 2026*

Revised: *15 Aug 2026*

Accepted: *16 Sept. 2026*

Published: *30 Sept. 2026*

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How to cite this article:
Khandvi, B. R., & Gangurde, G. M. (2026). Temporal Variations in Cropping Pattern and Crop Diversification in Niphad Tehsil of Nashik District, Maharashtra. International Journal of World Geology, Geography, Agriculture, Forestry and Environment Sciences, 3(9), 14–19. https://doi.org/10.5281/zenodo.23556473

Temporal Variations in Cropping Pattern and Crop Diversification in Niphad Tehsil of Nashik District, Maharashtra

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Abstract:

Irrigation development, market demand, horticulture expansion, and changing agricultural methods have caused major changes in the crop composition in Niphad Tehsil in Nashik District. The present study is to explore the temporal change in cropping patterns and crop diversification in Niphad Tehsil by using selected reference years, such as 2011-12, 2020-21, and 2024-25. The research work is based on secondary data collected mostly from the District Social and Economic Review of Nashik District issued by the Government of Maharashtra.

Percentage distribution, absolute change, crop-wise areas, and Simpson Diversification Index (SDI) were used for analysis. The results show a significant change in cropping pattern. The share of pulses declined sharply from 11.14 percent in 2011-12 to 0.85 percent in 2024-25, while the fiber crops came down from 12.23 percent to mere 0.01 percent. Oilseeds rose from 8.29 percent to 23.59 percent and vegetables from 15.85 percent to 23.07 percent. The share of planted area under fruits, especially grapes, was also considerable. The SDI fell from 0.841 in 2011–12 to 0.780 in 2020–21 and remained constant at 0.779 in 2024–25. The results indicate that the agricultural change in Niphad is not only in terms of increased diversification but also in terms of restructuring and higher concentration in chosen commercial and horticultural crop categories.

Keywords: *Crop Diversification, Cropping Pattern, Temporal Variation, Simpson Diversification Index.*

Introduction:

Cropping pattern is the percentage of land put under cultivation for different crops during a certain agricultural year. Changes in crop composition are a reflection of the influence of irrigation, soil conditions, climatic variability, technology, market demand, government policies, and farmers' economic decisions. It is therefore an essential indication of agricultural transformation.

In different irrigated areas of Maharashtra, a steady change has taken place in the agricultural land use pattern from traditional food crops to commercial and high-value horticulture crops. Nashik District is one of the important agricultural regions of Maharashtra, notably famous for grapes, onions, vegetables, and other horticulture commodities.

Nashik District has an important agricultural tehsil called Niphad Tehsil. The expansion of irrigation and access to agricultural markets has motivated farmers to change their conventional planting patterns. Important constituents of the agricultural economy have included crops including grapes, onions, vegetables, sugarcane, and oilseeds.

The older agricultural pattern of Niphad consisted of grains, pulses, and other traditional crops. But the relative importance of different crop categories has altered with growing commercialization. Grapes have become an important horticultural and export-driven commodity, while onions are an important market-oriented vegetable crop. These changes impact farm income, employment, irrigation demand, production costs, and agricultural sustainability.

Therefore, the present study is an attempt to explore the temporal fluctuations in the cropping pattern of Niphad Tehsil and to estimate the extent of crop diversity throughout selected reference periods.

Study area site:

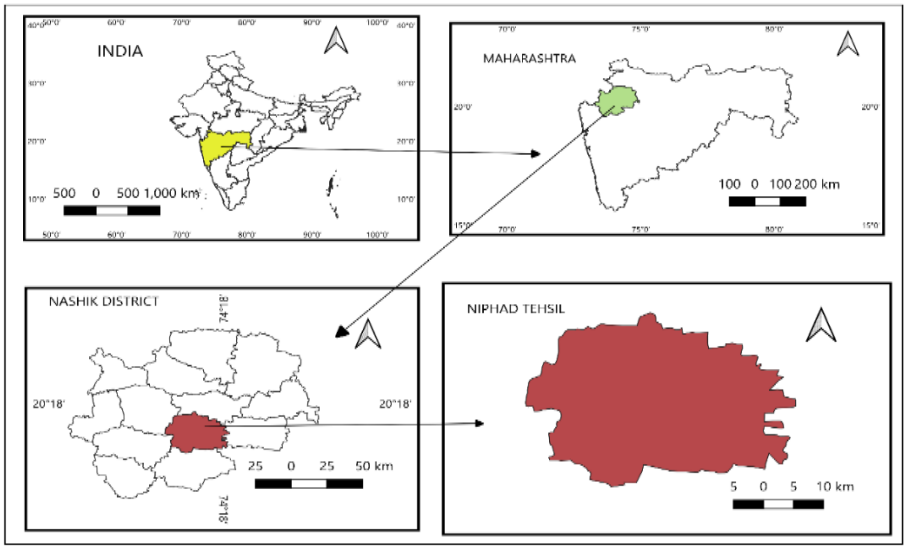

Figure 1 Location Map

Niphad Tehsil is the main agricultural belt of the district and is located in the central part of the Nashik District of Maharashtra State, India. The study area falls between latitude 19°55′38.37″ N to 20°14′25.23″ N and longitude 73°53′46.1″ E to 74°05′22″ E, covering an area of about 1,056.14 sq. km. According to the 2011 Census, the tehsil had a population of 493,251. Population density was about 467 persons per square kilometer. The town of Niphad is the administrative headquarters of the tehsil. It is about 40 km from the district headquarters, Nashik. The study area lies in the Godavari River basin and belongs to the Godavari & Kadva river systems. The region is semi-arid with average annual precipitation of about 500-600 mm. The availability of productive agricultural lands, particularly the black cotton soils, ensures a favorable environment for the cultivation of food and commercial crops. Canal irrigation and groundwater resources are the basis of the development of agriculture in the region. These resources have resulted in intensive crop production. Niphad has developed into an important commercial and floricultural agriculture region of the Nashik District.

Objectives

The study has the following objectives:

1. To analyze temporal variation in the cropping pattern of Niphad Tehsil.
2. To assess agricultural diversification in Niphad Tehsil over selected research periods

Data Collection and Methodology:

1 Data source:

The present study is based on the primary and secondary data collected from DSA, Maharashtra State Data Bank social and economic review report Statistics, Government of Maharashtra and Department of Agriculture. Additionally, data was sourced from the District Statistical Abstracts in Nashik.

2 Percentage Distribution:

The percentage share of each crop group was calculated using:

Formula: $P_i = \frac{A_i}{T} \times 100$

Where:

Pi = Percentage share of crop group i

Ai = Area under crop group i

T = Total cropped area

3 Absolute Change:

Absolute change was calculated as:

Formula: $AC = A_t - A_0$

Where:

AC = Absolute change

At = Area in the terminal year

A0 = Area in the initial year

4 Simpson Diversification Index:

Simpson Diversification Index (SDI) was used to evaluate crop diversification. The indicator indicates the degree of concentration or diversification of different crop groupings.

Formula: $SDI = 1 - \sum_{i=1}^{n} P_i^2$

Where:

SDI = Simpson Diversification Index

P_i = Proportion/share of the ith crop group in the total cropped area

n = Number of crop groups

The SDI value is between 0 and 1. A higher concentration or specialization is indicated by a score closer to 0, and a higher crop diversification by a value closer to

Cropwise area under major crop groups

Table 1. Area under Major Crop Groups in Niphad Tehsil Crop-wise

Sr. No.	Crop Group	2011–12 (ha)	2020–21 (ha)	2024–25 (ha)
1	Cereals	18,669.00	26,414.00	24,846.10
2	Pulses	9,157.00	2,431.00	855.1
3	Sugarcane	8,319.00	8,145.00	6,061.00
4	Spices	249	0	20
5	Fruits	15,890.00	24,581.50	21,963.30
6	Vegetables	13,023.00	11,340.75	23,248.40
7	Oilseeds	6,811.00	20,082.00	23,768.50
8	Fibre Crops	10,052.00	41	10
	Total	**82,170.00**	**93,035.25**	**1,00,772.40**

Source: District Social and Economic Review, compiled by a researcher.

Interpretation:

The area under different crop groupings has changed considerably (Table 1). The overall cropped area increased from 82,170 ha in 2011-12 to 100,772.40 ha in 2024-25.

Cereals rose from 18,669 ha to 24,846.10 ha. Pulses fell sharply from 9,157 ha to 855.10 ha. Oilseeds increased considerably from 6,811 ha to 23,768.50 ha.

Horticultural crops of importance like grapes and fruit production increased from 15,890 ha to 21,963.30 ha. Vegetable agriculture including onion increased from 13,023 ha to 23,248.40 ha.

Thus, onions and grapes are key crops in the commercial transformation of Niphad, but for the quantitative diversification analysis, they are kept under the Vegetable and Fruit groups, respectively, to prevent duplication counting.

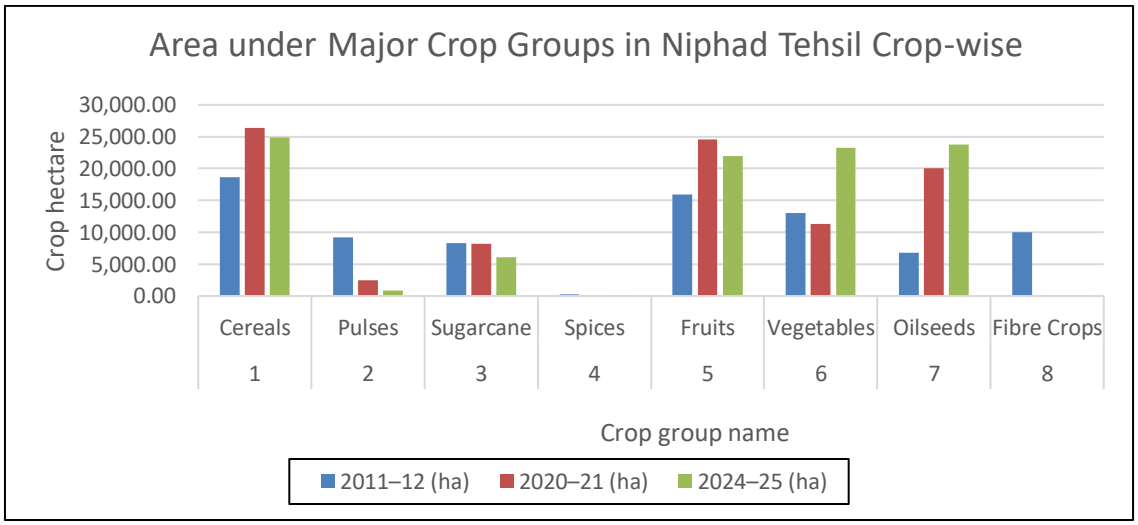

Figure 2

Fig.2 The graph indicates that cereals were still a major group of crops during the study period. By 2024-25, the area under pulses and fiber crops decreased drastically, whereas that under oilseeds and vegetables increased greatly. Sugarcane went into a slow decline but fruit farming remained of importance. The cropping pattern of Niphad Tehsil as a whole shows a trend of commercial and horticultural crops, particularly oilseeds, vegetables and fruits.

Percent distribution of temporal change in major crops:

Table 2 shows the major crop groups in Niphad Tehsil and their temporal changes

Sr. No.	Major Crop Group	2011–12 (%)	2020–21 (%)	2024–25 (%)	Change 2011-12 to 2024-25 (Percentage Points)
1	Cereals	22.72	28.39	24.66	1.94
2	Pulses	11.14	2.61	0.85	−10.29
3	Sugarcane	10.12	8.75	6.01	−4.11
4	Spices	0.3	0	0.02	−0.28
5	Fruits	19.34	26.42	21.79	2.45
6	Vegetables	15.85	12.19	23.07	7.22
7	Oilseeds	8.29	21.59	23.59	15.3
8	Fibre Crops	12.23	0.04	0.01	−12.22

Source: Researcher's calculation based on District Social and Economic Review data

Analysis: The percentage distribution clearly shows a reorganization of the agricultural system in Niphad. Pulses share reduced drastically from 11.14% in 2011-12 to a mere 0.85% in 2024-25. Fiber crops also saw a huge fall from 12.23% to 0.01%. Oilseeds had the biggest rise, climbing from 8.29% to 23.59%, a jump of 15.30 percentage points. Vegetables increased from 15.85 to 23.07 percent. The group of fruits like grapes increased from 19.34% to 21.79%. Therefore, horticulture still has good importance in the agricultural economy of Niphad.

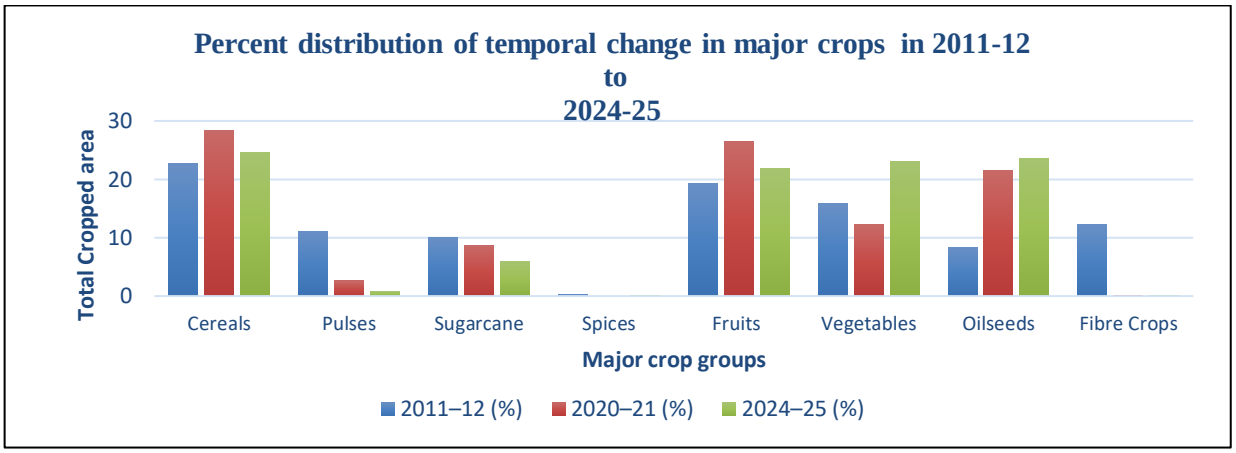

Figure 3

Fig. 3. The chart illustrates significant variations in the agricultural practices of Niphad Tehsil across the years 2011-12, 2020-21, and 2024-25. Cereals remained a significant category of crops, while the proportion of fruits increased until 2020-21 and persisted at a notable level in 2024-25. Significant advancements were observed in vegetables and oilseeds, particularly during the 2024–25 period. The proportion of pulses and fiber crops, nonetheless, declined significantly. There is a consistent shift from conventional food and fiber crops to commercial and horticultural crop categories in agricultural practices.

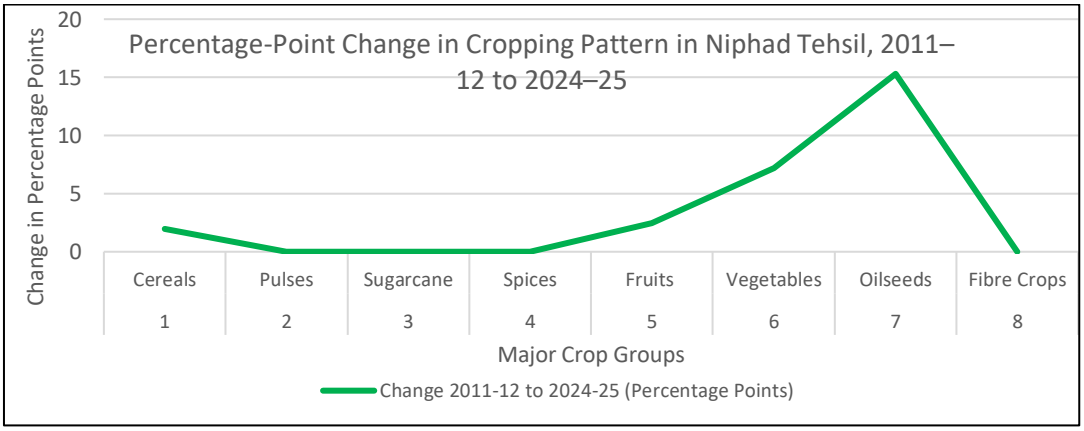

Figure 4

Fig. 4. The biggest increase was in oilseeds (+15.30 percentage points), followed by vegetables (+7.22), fruits (+2.45), and cereals (+1.94), the graph. However, fiber crops showed the highest decline at -12.22 percentage points, followed by pulses at -10.29, sugarcane at -4.11, and spices at -0.28. The changes are indicative of a major reorientation of the cropping pattern with emphasis on oilseeds, vegetables, and horticultural crops and a decline in the importance of traditional pulses and fiber crops.

Crop Diversification Analysis:

Crop diversification is the extent of the distribution of cultivated areas among different crop types. The present study was conducted to estimate the agricultural diversification in Niphad Tehsil by utilizing the Simpson Diversification Index (SDI) for selected reference years 2011–12, 2020–21, and 2024–25. The index was generated on the basis of the percentage contribution of each crop category to the total planted area.

Table 3. Simpson Diversification Index in Niphad Tehsil

Reference Year	**SDI**	**Interpretation**
2011–12	**0.841**	High diversification
2020–21	**0.78**	Moderate–high diversification
2024–25	**0.779**	Moderate–high diversification

Source: Calculated by researcher

Interpretation: The SDI has fallen from 0.841 in 2011-12 to 0.780 in 2020-21 and has been almost unchanged at 0.779 in 2024-25. This shows a slight decrease in diversification of crops and more concentration of some groups of crops. It is

observed that the agricultural pattern in Niphad is concentrated on commercially important crops, mainly oilseeds, vegetables, and fruits.

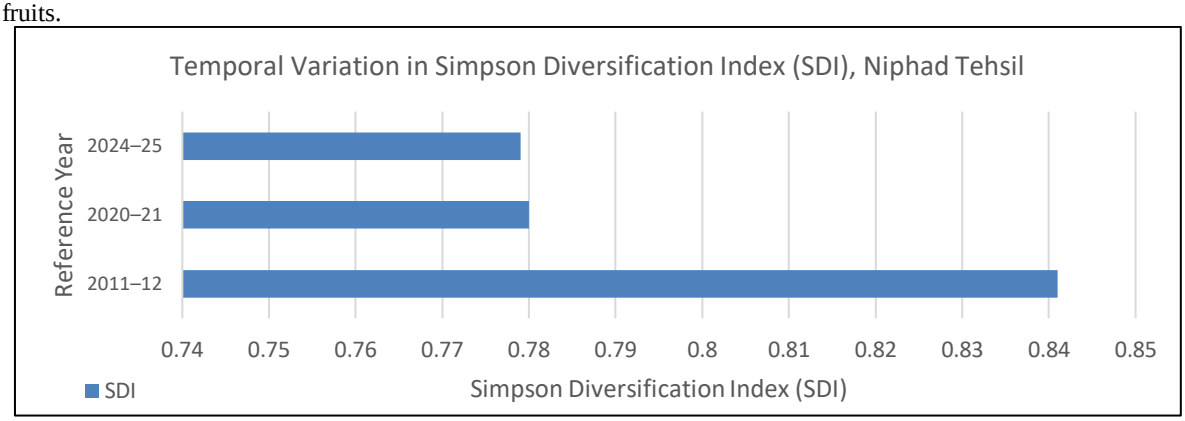

Figure 5

Fig. 5 From the graph it is seen that SDI was highest at 0.841 in 2011–12 and dropped to 0.780 in 2020–21. It hardly fluctuated; it was 0.779 in 2024-25. This indicates a small decline in crop diversification followed by a period of relative stability.

Results and discussion:

The results indicate that the cropping pattern of Niphad Tehsil has significant time variations in the years 2011-12, 2020-21, and 2024-25. The total area under agriculture has gone up from 82,170 ha in 2011-12 to 93,035.25 ha in 2020-21 and further to 100,772.40 ha in 2024-25. That's a sign of more farming. Cereals played a significant role throughout the period of the study. Pulses showed a drastic decline from 11.14% to 0.85%. Again, the production of fiber crops was hit hard. Vegetables increased from 15.85% to 23.07% and oilseeds from 8.29% to 23.59%. Fruits continued to take up a substantial part of the cropped acreage. These changes show a gradual shift from the traditional cropping pattern to the commercially important groups of crops. SDI also supports this reform. The SDI decreased from 0.841 in 2011-12 to 0.780 in 2020-21 and is projected to be 0.779 in 2024-25. This means a small decrease in crop diversification and an increase in the concentration of certain crop groups. However, the values of SDI are quite high, indicating that Niphad still has a fairly diversified agricultural system. Overall results indicate that the agricultural landscape of Niphad Tehsil is in the process of change in respect of its commercial and structural transformation, with increasing importance of oilseeds, vegetables, and fruits and decreasing importance of pulses and fiber crops. The change is indicative of a great change in the relative importance of reasonably diverse groups of crops in the agricultural economy of the study area.

Implications for sustainability:

The changing cropping pattern of Niphad Tehsil has major implications for the sustainability of agriculture. The increasing share of oilseeds, vegetables, and fruits provides scope for commercialization and diversification of farm income. But the sharp fall in pulses and fiber crops is a matter of concern for food security, soil health, and balance in the cropping system. Thus, efficient water management, crop rotation, balanced nutrient use, and climate-resilient farming practices can lead to sustainable agricultural development in the region.

The findings lead to the following recommendations:

1. Promote diversification of crops without losing economically profitable crops.
2. Promote water-saving irrigation techniques such as drip and sprinkler irrigation.
3. Encourage balanced production of food grains, pulses, oilseeds, and horticultural crops.
4. Management of crops for sustainable production of grapes and onions.
5. Strengthening of farmer producer organizations (FPOs) and collective marketing mechanisms.
6. Upgradation of cold storage, processing & value addition facilities for horticultural crops & onions.
7. Promote soil testing and balanced fertilizer use.

Conclusion:

The study reveals a significant change in the cropping pattern of Niphad Tehsil during the period of time of 2011-12, 2020-21, and 2024-25. The analysis shows a gradual shift from traditional crops to commercial and horticultural crop groups, especially oilseeds, vegetables, and fruits. But the share of pulses and fiber crops decreased substantially.

The Simpson Diversification Index has fallen from 0.841 in 2011-12 to 0.779 in 2024-25. Some crops experienced an increasing concentration, while overall crop diversification slightly decreased. However, the rather high values of SDI demonstrate that the agricultural system is still relatively diversified. The changing cropping pattern of Niphad Tehsil is evidence of the continuing commercialization and structural change in agriculture. This requires balanced crop planning, careful management of water, and sustainable farming practices.

Acknowledgments:

I, Bhaskar Ratan Khandvi, sincerely thank my research guide, Dr. G.M. Gangurde, for invaluable direction, constructive recommendations, consistent encouragement, and academic support during this study project. I am also grateful to Dr. B. S. Jagdale, Principal, and Dr. R. V. Patil, Head, Department of Geography, MGV's L.V.H. Arts, Science, and Commerce College, Panchavati, Nashik, for granting me permission and giving the necessary assistance and facilities to carry

out this research. I also express my heartfelt gratitude to all those who directly or indirectly contributed to the effective completion of this study.

Financial support and sponsorship
Nil.

Conflicts of interest
The authors declare that there are no conflicts of interest regarding the publication of thesis paper.

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