

## THE GEOGRAPHICAL STUDY OF SPATIO-TEMPORAL CHANGE IN AGRICULTURAL PATTERN IN SANGLI DISTRICT

Miss. More S.D., Dr. Kale C. N.

Ph.D. Research Student, Dept. of Geography, Karmaveer Bhaurao Patil Mahavidyalaya, Pandharpur

Associate Professor, Dept. of Geography, Karmaveer Bhaurao Patil Mahavidyalaya, Pandharpur

| Article Info                                                                                                                                                                                                                                                                                               | ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <p><b>Article History:</b><br/>Received: 21<sup>st</sup> Sep 2025<br/>Accepted: 06<sup>th</sup> Oct 2025<br/>Published: 20<sup>th</sup> Oct 2025</p> <p><b>Keywords:</b><br/>Spatio-Temporal Change,<br/>Agricultural Pattern,<br/>Cropping Pattern,<br/>Fruit Farming,<br/>Sugarcane,<br/>Irrigation.</p> | <p>Agriculture is the backbone of the economy of Sangli district and an integral part of its socio-cultural fabric. Located in western Maharashtra, the district presents a unique geographical contrast – fertile irrigated western tehsils supported by the Krishna and Warna river basins and drought-prone eastern tehsils like Jat and Atpadi that rely on dryland agriculture. This study investigates the spatio-temporal transformations in agricultural practices in Sangli district from 1991 to 2021 with reference to the current situation (2023-24). Using primary and secondary data sources – census reports, district socio-economic summaries, agricultural records, field surveys and interviews – the analysis examines the growth and decline of cereals, pulses, oilseeds, cash crops and fruit cultivation. The results indicate a decisive shift from subsistence-oriented cereals and pulses to irrigation-supported cash crops and horticulture. Cereal production declined steadily (-0.56% average annual growth), while pulses production remained stable (0.028% growth). Oilseeds growth remained moderate but volatile (2.19% growth), while cash crops like sugarcane remained stable (3.70% growth). Irrigation, cooperative sugar factories and assured markets. The most notable trend was observed in fruit cultivation, which recorded an annual growth of 18.27%, supported by drip irrigation and international demand for grapes and pomegranates. Local disparities are evident - western tehsils like Miraj, Tasgaon and Walwa dominate commercial crops, while eastern tehsils like Jat and Atpadi still rely on cereals and pulses.</p> |

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## INTRODUCTION

Agriculture plays a central role in shaping the economy, society, and culture of Sangli district. Situated in the western part of Maharashtra, Sangli is a well-known agricultural hub with a unique geographical identity. The district falls in a transitional zone between the drought-prone eastern plateau and the relatively fertile western river basin. This dual setting provides Sangli with both challenges and opportunities in agricultural development. On one side, the Krishna and Warna river basins supply assured irrigation and fertile alluvial soils, encouraging the cultivation of commercial crops such as sugarcane, grapes, pomegranates, and other fruits. On the other side, the semi-arid eastern tahsils like Jat and Atpadi face recurring droughts and water scarcity, where dry farming practices and subsistence crops such as cereals and pulses dominate. This geographical diversity has resulted in significant spatio-temporal variations in cropping patterns across the district. Over time, the district has emerged as a leading producer of horticultural crops in Maharashtra, especially grapes and pomegranates, which are exported nationally and internationally. At the same time, it continues to maintain a strong base of traditional crops such as cereals (416,467 ha in 1991 → 347,356.90 ha in 2021), pulses (81,234 ha in 1991 → 80,756.10 ha in 2021), and oilseeds (52,421 ha in 1991 → 78,905.70 ha in 2021). This balance of subsistence farming and commercialized cash cropping makes Sangli an ideal case for the geographical study of changing agricultural patterns.

## IMPORTANCE OF THE STUDY

The present study holds great importance in understanding the changing dynamics of agriculture in Sangli district, where geographical diversity, irrigation facilities, and socio-economic conditions play a vital role in shaping land use and cropping patterns.

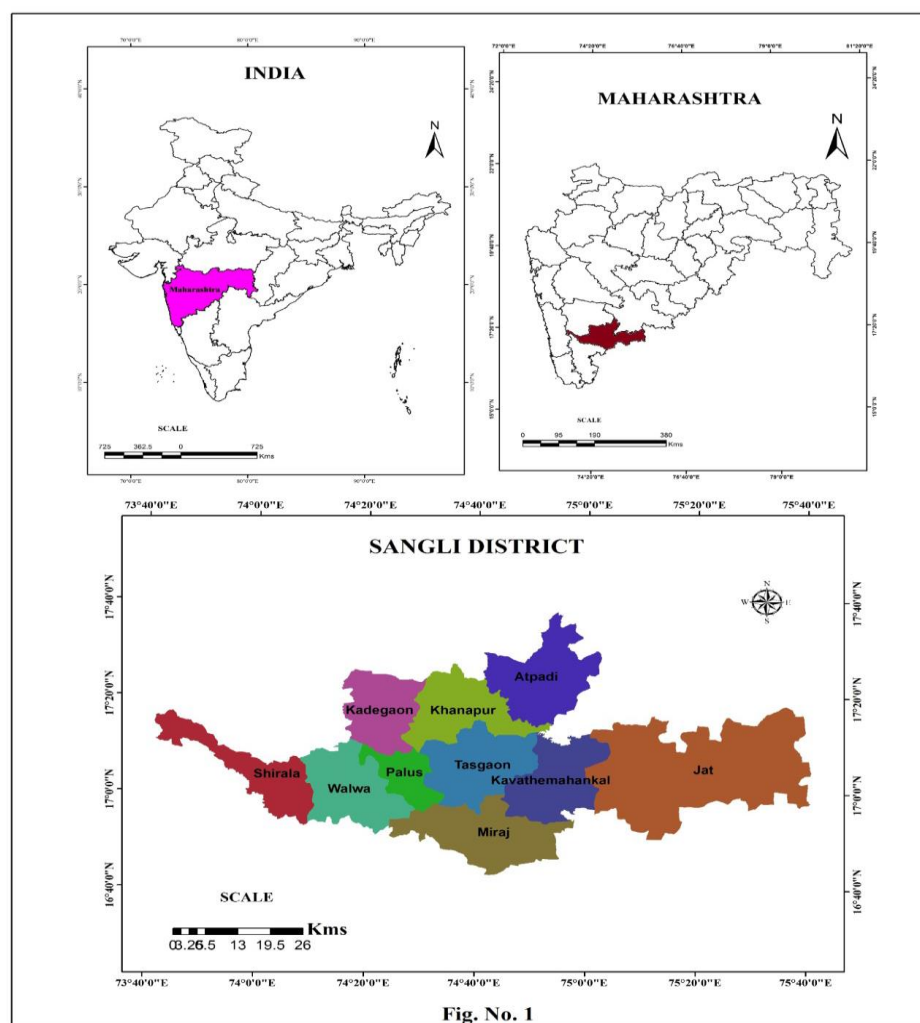
1. Over the last three decades, Sangli has witnessed a steady decline in traditional food crops like cereals (416,467 ha in 1991 → 347,356.90 ha in 2021, -5.617% avg decadal growth) and pulses (81,234 ha in 1991 → 80,756.10 ha in 2021). At the same time, cash crops and fruit farming have increased remarkably (cash crops: 48,869 ha in 1991 → 117,763 ha in 2021; fruit farming: 2,710 ha in 1991 → 58,297.07 ha in 2021). Studying these shifts is important to evaluate the food security versus commercialization balance.
2. The Krishna and Warna river basins, along with canal irrigation and tube wells, have transformed agriculture from subsistence to commercial farming. Tahsils like Miraj, Tasgaon, and Walwa have benefitted from irrigation and show high shares of fruit farming and oilseeds, while drought-prone tahsils like Jat and Atpadi still depend heavily on dry farming. This study highlights regional disparities created by irrigation.
3. Sangli is now nationally and internationally known for grapes, pomegranates, and sugarcane. The spatio-temporal analysis helps to understand how global markets and

cooperative sugar factories have shaped local agriculture, creating new opportunities for farmers while also exposing them to risks of market fluctuations.

4. Knowledge of agricultural pattern change is essential for district-level agricultural planning, irrigation management, and government schemes. For instance, the growth of horticulture requires cold storage, marketing facilities, and export infrastructure, while the decline of cereals and pulses raises concerns about food security.
5. Fruit farming and sugarcane expansion have increased water demand in Sangli. By studying temporal growth rates (fruit farming: +182.67% avg decadal growth; cash crops: +37.05% avg decadal growth), this research provides insights into the sustainability of current cropping trends in relation to soil fertility, water availability, and climate change.
6. Spatio-temporal analysis reveals how some tahsils (like Tasgaon and Miraj) are rapidly diversifying, while others (like Jat and Atpadi) remain traditional and drought-prone. This imbalance directly affects rural livelihoods, income levels, and migration patterns, making this study socially significant.

## STUDY AREA

The study area of this research is Sangli district, located in the western part of Maharashtra, covering both irrigated and drought-prone regions. Geographically, Sangli district lies between 16°45' N to 17°37' N latitudes and 73°41' E to 75°41' E longitudes, forming part of the Krishna and Warna river basins. The western tahsils such as Miraj, Tasgaon, and Walwa are fertile and irrigated with black cotton soils, while the eastern tahsils like Jat and Atpadi fall in the semi-arid zone with recurring drought conditions. Administratively, the district consists of 10 tahsils—Shirala, Walwa, Palus, Kadegaon, Khanapur, Atpadi, Tasgaon, Miraj, Kavathe Mahankal, and Jat—showing wide variations in crop distribution. According to Census 2011, Sangli district had a population of 2,822,143 with a density of 329 persons per sq. km, while the projected population in 2023 is around 3.1 million. The district spreads over an area of 8,578 sq. km, ranking it as one of the important agricultural districts in western Maharashtra. While western tahsils specialize in sugarcane, grapes, and pomegranates, eastern tahsils remain dominated by cereals and pulses. This geographical diversity makes Sangli an ideal region for analyzing the spatio-temporal change in agricultural patterns.



## OBJECTIVES OF THE STUDY

1. To study the spatio-temporal change in agricultural pattern of Sangli district from 1991 to 2021.
2. To examine the growth and decline of cereals, pulses, oilseeds, cash crops, and fruit farming.

## DATABASE AND METHODOLOGY

The study is based on both primary and secondary data. Secondary sources include the Census of India (1991, 2001, 2011), District Statistical Abstracts (1991–2021), Agricultural Census, irrigation department records, and IMD rainfall data. Primary data were collected through field surveys, questionnaires, and farmer interviews in selected tahsils, supported by ground observations. The methodology involved compiling tahsil-wise land use and cropping data for 1991, 2001, 2011, and 2021, along with cropping percentages for 2023–24 to assess the present scenario. Growth rates were calculated to classify crops into high, moderate, and low categories, while Weaver's Method was applied to determine the district-level crop combination.

Comparative analysis of inter-decadal changes was then carried out to highlight disparities between irrigated western tahsils and drought-prone eastern tahsils.

### AGRICULTURAL PATTERN

Agriculture in Sangli district exhibits distinct spatial diversity influenced by soils, irrigation, and climate. In 2023–24, tahsil-wise cropping pattern shows dominance of cereals (42.63% in Jat, 10.48% in Miraj), pulses (39.28% in Jat, 11.5% in Miraj), cash crops (24.04% in Walwa, 12.82% in Miraj), oilseeds (24.94% in Walwa, 12.54% in Tasgaon), and fruit farming (21.34% in Tasgaon, 19.89% in Miraj, 24.33% in Jat). This variation reflects both subsistence and commercial farming practices across the district.

At the district level, the crop combination has been calculated using Weaver's Method, which measures the minimum corrected deviation from the theoretical distribution of crops. The results show a 3-crop combination consisting of Cereals (43.3%) + Cash Crops (24.0%) + Oilseeds (13.6%), together accounting for 80.90% of the total cropped area with a corrected deviation of 576.8. This indicates that cereals form the subsistence base, cash crops represent commercial orientation, and oilseeds ensure crop diversification, while fruit farming and pulses remain regionally significant.

**TABLE NO. 1**

**AGRICULTURAL PATTERN : SANGLI DISTRICT (2023-24)**

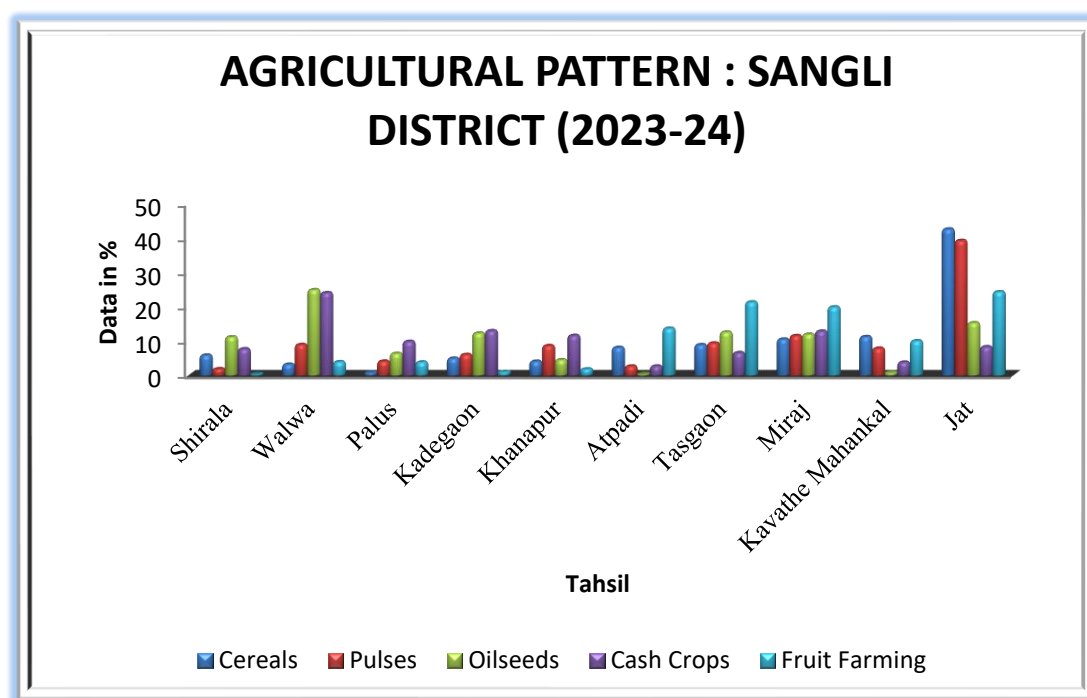
| Sr. No. | Tahsil           | Cereals  | Pulses  | Oilseeds | Cash Crops | Fruit Farming | Total  |
|---------|------------------|----------|---------|----------|------------|---------------|--------|
|         |                  | in %     | in %    | in %     | in %       | in %          | in %   |
| 1       | Shirala          | 5.82     | 1.83    | 11.15    | 7.65       | 0.31          | 6.13   |
| 2       | Walwa            | 3.16     | 8.93    | 24.94    | 24.04      | 3.88          | 11.67  |
| 3       | Palus            | 0.85     | 4.05    | 6.32     | 9.82       | 3.81          | 4.27   |
| 4       | Kadegaon         | 4.9      | 6       | 12.26    | 12.94      | 1             | 7.6    |
| 5       | Khanapur         | 4.02     | 8.6     | 4.45     | 11.56      | 1.78          | 6.16   |
| 6       | Atpadi           | 8.07     | 2.62    | 0.33     | 2.61       | 13.66         | 5.62   |
| 7       | Tasgaon          | 8.86     | 9.34    | 12.54    | 6.54       | 21.34         | 9.83   |
| 8       | Miraj            | 10.48    | 11.5    | 11.94    | 12.82      | 19.89         | 12.07  |
| 9       | Kavathe Mahankal | 11.21    | 7.83    | 0.79     | 3.76       | 10.02         | 7.61   |
| 10      | Jat              | 42.63    | 39.28   | 15.27    | 8.25       | 24.33         | 29.04  |
| Total   |                  | 278587.7 | 63688.1 | 83410.6  | 147246     | 48494         | 621427 |

Source: Sangli District Socio-economic Abstract Report (2023-24)

**TABLE NO. 2**  
**DISTRICT-LEVEL CROP COMBINATION**

| Scale    | Crop Combination | Key Crops                                               | % Share (Combined) | Corrected Deviation |
|----------|------------------|---------------------------------------------------------|--------------------|---------------------|
| District | 3-crop           | Cereals (43.3%) + Cash Crops (24.0%) + Oilseeds (13.6%) | 80.90%             | 576.8               |

Source: Compiled by Researcher, 2025



**Fig. No. 2**

In Sangli district, there is a clear difference in the dominance of different crops in the tehsils according to cropping pattern, which can be broadly classified into high, medium and low categories (in Table No.1 and Fig. No.2).

Cereals fall in the high category in Jat (42.63%), medium in Miraj (10.48%), Tasgaon (8.86%) and Atpadi (8.07%), while low in Palus (0.85%) and Walwa (3.16%). The dominance of cereals in Jat is mainly due to semi-arid conditions, limited irrigation and dependence on dry land farming, where food security crops are preferred.

The share of pulses shows medium levels in Jat (39.28%) and Miraj (11.5%), Tasgaon (9.34%), Khanapur (8.6%) and Walwa (8.93%), but is low in Palus (4.05%) and Atpadi (2.62%). This distribution reflects the suitability of pulses in dry soils, low water requirements and traditional preference in drought-prone eastern tehsils.

Oilseeds are more abundant in Walwa (24.94%), Tasgaon (12.54%), Kadegaon (12.26%) and Miraj (11.94%), but fall to a lesser extent in Atpadi (0.33%) and Kavathe Mahankal (0.79%). Their abundance in the western tehsils is linked to good irrigation and market support, while

their absence in the arid regions indicates the risk of crop failure without assured water.

Cash crops have a higher share in Walwa (24.04%), Miraj (12.82%) and Kadegaon (12.94%), while they are lower in Atpadi (2.61%) and Kavathe Mahankal (3.76%). Their share is high in the western tehsils due to the presence of cooperative sugar factories and irrigated lands, while in the eastern tehsils, the scarcity of irrigation water limits them.

Fruit farming is emerging as a high-end crop in Tasgaon (21.34%), Jat (24.33%) and Miraj (19.89%), while it is moderate in Atpadi (13.66%) and Kavathe Mahankal (10.02%), but very low in Shirala (0.31%) and Kadegaon (1%). This distribution reflects the expansion of horticulture in the grape and pomegranate belts supported by irrigation and export demand, while the low share in other tehsils reflects traditional crop preferences and limited infrastructure.

Overall, the high-end crops are cereals and pulses in drought-prone Jat, cash crops and oilseeds in irrigated Walwa, and fruit farming in Tasgaon and Miraj. The middle range is seen in mixed tehsils like Khanapur and Kadegaon, while the lower range is seen in tehsils like Palus, Atpadi and Shirala where diversity is limited. These differences highlight the role of irrigation, soil fertility and market access in shaping Sangli's agricultural system.

## CHANGE OF AGRICULTURAL PATTERN

The agricultural landscape of Sangli district has undergone significant transformation from 1991 to 2021. Traditional dominance of cereals has steadily declined, while fruit farming, cash crops, and oilseeds have experienced notable growth driven by improved irrigation, government support, and changing market demands. Over the 30-year period, fruit farming led with a remarkable average decadal growth rate of 182.67 percent and an impressive annual growth rate of 18.267 percent. Cash crops and oilseeds followed with solid decadal growth rates of 37.05 percent and 21.97 percent, and annual growth rates of 3.705 percent and 2.197 percent, respectively. This shift reflects farmers' adaptation towards more profitable and sustainable cropping patterns, resulting in diversification and overall expansion of cultivated area in the region.

## CHANGE OF AGRICULTURAL PATTERN

The agricultural pattern of Sangli district has undergone a significant change in the last three decades, shifting from food crops to commercial and horticultural crops. Cereal production decreased from 416,467 hectares in 1991 to 347,356 hectares in 2021 (decadal average growth of -5.61%), while pulses production remained almost constant with minor fluctuations. Oilseeds showed rapid growth till 2011 but declined thereafter, indicating instability. In contrast, cash crops grew steadily from 48,869 hectares in 1991 to 117,763 hectares in 2021 (+37.05% average decadal growth), and fruit cultivation increased dramatically from 2,710 hectares to 58,297 hectares (+182.67%). This trend clearly reflects a shift from subsistence agriculture to market-

oriented, irrigation-based agriculture in Sangli district.

**TABLE NO. 3**  
**AGRICULTURAL PATTERN CHANGE : SANGLI DISTRICT**  
(1991, 2001, 2011, 2021 YEAR)

| Sr. No. | Land Use Category | 1991 (ha) | 2001 (ha) | Growth Rate 1991–2001 (%) | 2011 (ha) | Growth Rate 2001–2011 (%) | 2021 (ha)  | Growth Rate 2011–2021 (%) | Total Avg Decadal Growth Rate (%) | Total Avg Annual Growth Rate (%) |
|---------|-------------------|-----------|-----------|---------------------------|-----------|---------------------------|------------|---------------------------|-----------------------------------|----------------------------------|
| 1       | Cereals           | 416,467   | 434,184   | 4.25%                     | 383,737   | -11.62%                   | 347,356.90 | -9.48%                    | -5.617                            | -0.5617                          |
| 2       | Pulses            | 81,234    | 90,716    | 11.67%                    | 91,907    | 1.31%                     | 80,756.10  | -12.13%                   | 0.283                             | 0.0283                           |
| 3       | Oilseeds          | 52,421    | 64,713    | 23.45%                    | 110,831   | 71.27%                    | 78,905.70  | -28.81%                   | 21.97                             | 2.197                            |
| 4       | Cash Crops        | 48,869    | 64,459    | 31.90%                    | 67,440    | 4.62%                     | 117,763    | 74.62%                    | 37.05                             | 3.705                            |
| 5       | Fruit Farming     | 2,710     | 7,260     | 167.90%                   | 16,563    | 128.14%                   | 58,297.07  | 251.97%                   | 182.67                            | 18.267                           |
|         | Total             | 601,701   | 661,332   | 47.83%                    | 670,478   | 38.74%                    | 683,078.77 | 55.23%                    | 47.27                             | 6.05%                            |

Source: Sangli District Socio-economic Abstract Report (1991, 2001, 2011, 2021)

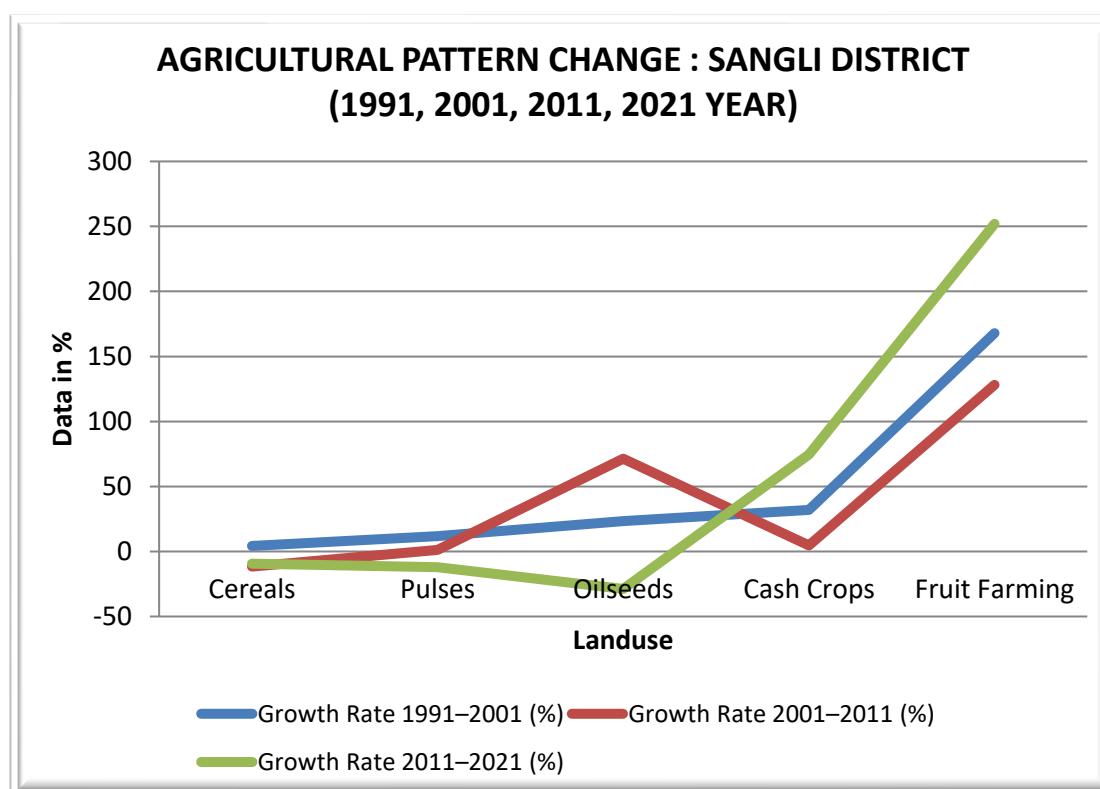


Fig. No. 3

Fruit farming and cash crops show the highest growth in Sangli district. Fruit farming recorded an average annual growth rate of 18.267%, rising from 2,710 ha in 1991 to 7,260 ha in 2001 (+167.90%), then to 16,563 ha in 2011 (+128.14%), and further to 58,297.07 ha in 2021 (+251.97%). This remarkable increase is mainly due to the expansion of grapes and pomegranates in irrigated tahsils like Tasgaon, Miraj, and Jat, supported by drip irrigation, international export demand, better storage, and government horticulture promotion schemes. Cash crops also show high growth with an average annual rate of 3.705%, increasing from 48,869 ha in 1991 to 64,459 ha in 2001 (+31.90%), then 67,440 ha in 2011 (+4.62%), and finally 117,763 ha in 2021 (+74.62%). The expansion of sugarcane, backed by cooperative sugar factories, irrigation from Krishna and Warna rivers, and assured market procurement, explains this steady rise (in Table No.2 and Fig. No.3).

Oilseeds fall under the moderate growth category with an average annual rate of 2.197%. The area increased from 52,421 ha in 1991 to 64,713 ha in 2001 (+23.45%), then surged to 110,831 ha in 2011 (+71.27%). However, it declined to 78,905.70 ha in 2021 (-28.81%), showing instability. This moderate trend is linked to government MSP policies and the suitability of oilseeds under semi-irrigated conditions. Yet, frequent pest attacks, rainfall dependency, and low profitability compared to sugarcane and fruit crops have prevented oilseeds from achieving consistently high growth (in Table No.2 and Fig. No.3).

Pulses and cereals belong to the low or declining category. Pulses recorded an average annual growth of just 0.0283%. Their area rose from 81,234 ha in 1991 to 90,716 ha in 2001 (+11.67%), reached 91,907 ha in 2011 (+1.31%), but dropped to 80,756.10 ha in 2021 (-12.13%). Stagnation of pulses is due to their low yields, weak irrigation preference, vulnerability to erratic rainfall, and poor profitability compared to commercial crops. Cereals declined steadily, showing a negative average annual growth rate of -0.5617%. The area dropped from 416,467 ha in 1991 to 434,184 ha in 2001 (+4.25%), then fell sharply to 383,737 ha in 2011 (-11.62%), and further to 347,356.90 ha in 2021 (-9.48%). The decline of cereals is due to the diversion of land and irrigation to sugarcane, grapes, and other high-value crops, as well as declining profitability of cereals in commercialized regions.

## KEY FINDINGS

The study shows that there has been a steady decline in cereals and pulses, placing them in the low or negative growth category. Cereal cultivation fell from 416,467 hectares in 1991 to 347,356.90 hectares in 2021, registering a negative average annual growth rate of -0.5617 percent. Pulses also remained stagnant, with an average annual growth rate of only 0.0283 percent, with minor fluctuations over time. This decline is mainly due to land conversion to higher-value crops such as sugarcane and fruits, weak profitability of cereals and pulses, and their dependence on erratic rainfall.

- 1) Oilseeds fall in the medium growth category, with their cultivation increasing from 52,421 hectares in 1991 to 110,831 hectares in 2011, before declining to 78,905.70 hectares in 2021. This volatility has resulted in an average annual growth rate of 2.197 percent. The expansion of oilseeds was supported by semi-irrigated conditions and government minimum support price policies, yet frequent pest attacks, insecurity of rainfall variation, and limited profitability compared to sugarcane and fruit crops hampered their sustainable growth.
- 2) Cash crops have shown steady and consistent expansion, placing them in the high growth category. The area under cultivation has increased from 48,869 hectares in 1991 to 117,763 hectares in 2021, with an average annual growth rate of 3.705 percent. This growth is strongly linked to the expansion of sugarcane farming in irrigated tehsils based on cooperative sugar factories, irrigation infrastructure from the Krishna and Warna rivers, and assured market purchases, making cash crops a stable and profitable option for farmers.
- 3) The most notable trend is observed in fruit farming, which achieved the highest growth rate among all categories. The area under cultivation increased from just 2,710 hectares in 1991 to 58,297.07 hectares in 2021, registering an exceptional average annual growth rate of 18.267 percent. This rapid expansion has been driven by the success of grapes and pomegranates due to drip irrigation technology, strong international export demand, cold storage facilities and government horticultural incentive schemes. Thus, fruit farming has emerged as the backbone of agricultural diversification in Sangli.

Finally, the study highlights specific spatial-temporal differences in crop distribution in the district. While drought-prone eastern tehsils like Jat and Atpadi are still dominated by cereals and pulses, cash crops, oilseeds and fruit cultivation are more prevalent in western irrigated tehsils like Walwa, Miraj and Tasgaon. This east-west divide reflects the significant role of irrigation, soil fertility and market infrastructure in shaping agricultural outcomes. This broad trend clearly demonstrates the structural change that has taken place in Sangli's agriculture, shifting from subsistence food crops to commercial, market-oriented farming systems.

## CONCLUSIONS

A spatio-temporal analysis of Sangli district's agricultural system (1991-2021) shows a decisive transformation from subsistence-based food crops to irrigation-supported, market-oriented cash crops and fruit farming. Cereals and pulses have stagnated or declined, while oilseeds, sugarcane, grapes and pomegranates have emerged as new drivers of agricultural

development. This change reflects the impact of irrigation expansion, cooperatives, government policies and global market linkages. However, it also poses challenges of water scarcity, food security and regional imbalances, as drought-prone tehsils in the east remain traditional and vulnerable, while irrigated tehsils in the west lead the way in commercialization. Overall, Sangli's agricultural transition represents both opportunities for economic growth and risks for sustainable resource management, requiring ongoing monitoring and balanced planning for the future of the district.

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