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A geographical study of agriculture productivity analysis in Chhatrapati Sambhajnagar District using Sapre and Deshpande methods

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Abstract

The basis of India's economy, agriculture is vital to revenue production, food security, and economic expansion. This research uses Sapre and Deshpande's Weighted Average Index for 2021–2022 to assess agricultural production throughout the tehsils of Chhatrapati Sambhajnagar District. Tehsils are categorized into high, moderate, and low productivity zones based on index values, revealing notable differences in productivity. To evaluate the levels of agricultural production, spot regional differences, and emphasize the main crops that influence output in various tehsils. Sillod and Phulambri are high productivity zones (index below 3.51), which are bolstered by effective production of oilseeds, pulses, wheat, and maize. With balanced crop diversification, Soegaon, Vaijapur, Kannad, and Khuldabad exhibit moderate production (3.52–4.74). In Gangapur, Chhatrapati Sambhajnagar, and Paithan, low productivity zones (over 4.74) draw attention to resource constraints and less-than-ideal methods. The results serve as a foundation for resource optimization and focused agricultural planning aimed at increasing output.

Keywords: India's economy, agriculture, revenue production, food security, economic expansion

Introduction

The primary occupation of Indians, practiced across the Indian states, is agriculture, which is regarded as the foundation of our economy. Both the evolution of our civilization and the shift in socioeconomic level may be attributed to agriculture. Agriculture is a dynamic activity that is influenced by a variety of meteorological conditions, technical inputs, and socioeconomic infrastructure, which leads to its diversity. There are several techniques to gauge agricultural progress. One of the most crucial agronomic concepts to comprehend during the entire agricultural growth process is agricultural efficiency.

In addition to being a source of food, agriculture is the main source of income for 60% of Indians. Food and nutrition security, health, and the elimination of poverty are all directly impacted by agricultural development, which also has several indirect consequences on the economy as a whole. Agriculture is the biggest sector and provides a substantial portion of GDP of India. Crops and agricultural methods have changed significantly as the agriculture industry has grown. The results of farming are the output of agriculture. The agricultural efficiency evaluates the production of a certain unit of land. It examines the land's capacity, production, and fertility. Verifying future plans for the usage of agricultural land is beneficial. Agricultural efficiency is caused by a variety of factors. In the research area, the agricultural production of several crops is fluctuating. The research emphasizes crop yield and efficiency in agriculture.

Review of Literature

Many academics have sought to examine agricultural production by recommending and enhancing various strategies, according to Stamp (1952) ^[17]. Shafi (1960) ^[12] chose a number of nations and a few key crops to determine agricultural productivity on a worldwide scale. The ranking coefficient and areal unit were calculated. Many others assessed agricultural production in terms of grain equivalents per population, according to Khuro's (1964) ^[19] analysis. Measuring farming profitability in terms of the return for the whole amount of human labor or paid-out costs in proportion to the output, as well as determining output in

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relation to input or output-input ratio. According to Sapre-Deshpande (1964) ^[14] and Bhatia (1967) ^[2], productivity is determined by allocating weight to the ranking order of output per unit area with the percentage share under each crop. Buck (1967) ^[20] used his method to calculate Uttar Pradesh's agricultural efficiency. Furrow irrigation is widely used because it may be applied to a wide range of soil types and land slopes, according to Cantor's (1967) ^[21] research. Both big and tiny streams of irrigated water may be used with it.

According to Singh (1975) ^[22], land in emerging nations is too small to support any growth in the cultivated area, and the growing population strain on available land forces geographers and agricultural scientists to consider ways to increase agricultural productivity. Hussain (1976) ^[23] calculated the productivity value per unit area in monetary terms. The correlated yield and concentration index ranking coefficient approach, developed by Jasbir Singh in 1976 ^[24], is used; it assigns appropriate weight to the per hectare yield area occupied and the ranking of the many crops he also researched. Murthy (1976) ^[25] asserts that irrigation, a fundamental input on the majority of our nation's farmed land, has been essential in increasing food production since other inputs, like as fertilizers, better seeds, etc., only give their fair share when a reliable supply of water is available.

Objective

- 1) To Assess the agriculture productivity levels
- 2) To identify crop contributions to productivity.

Study area

With the exception of a tiny area in the north and northwest that is under the Tapi drainage system, the majority of Aurangabad District, which is in the state's central elevated region, is located inside the Godavari Basin. In the southern part of the district, the Godavari River and its tributaries define the area. Latitudes 19°17'N to 20°40'N and longitudes 74°39'E to 76°40'E are its geographic coordinates. The districts of Jalgaon to the north, Jalna to the east, Ahmednagar to the south and southwest, and Nashik to the west enclose it. It also has smaller borders with Buldhana district in the northeast and Beed district in the south. With a total size of 10,100 square kilometers, the district makes up 3.28 percent of Maharashtra. Just 1.40% of this is urban, with the rest 98.60% being rural. The population of Aurangabad district, as reported in the 2011 Census, is 3,695,928, which is equivalent to the population of Liberia. It is ranked 72nd out of 640 districts in India. The district's population increased by

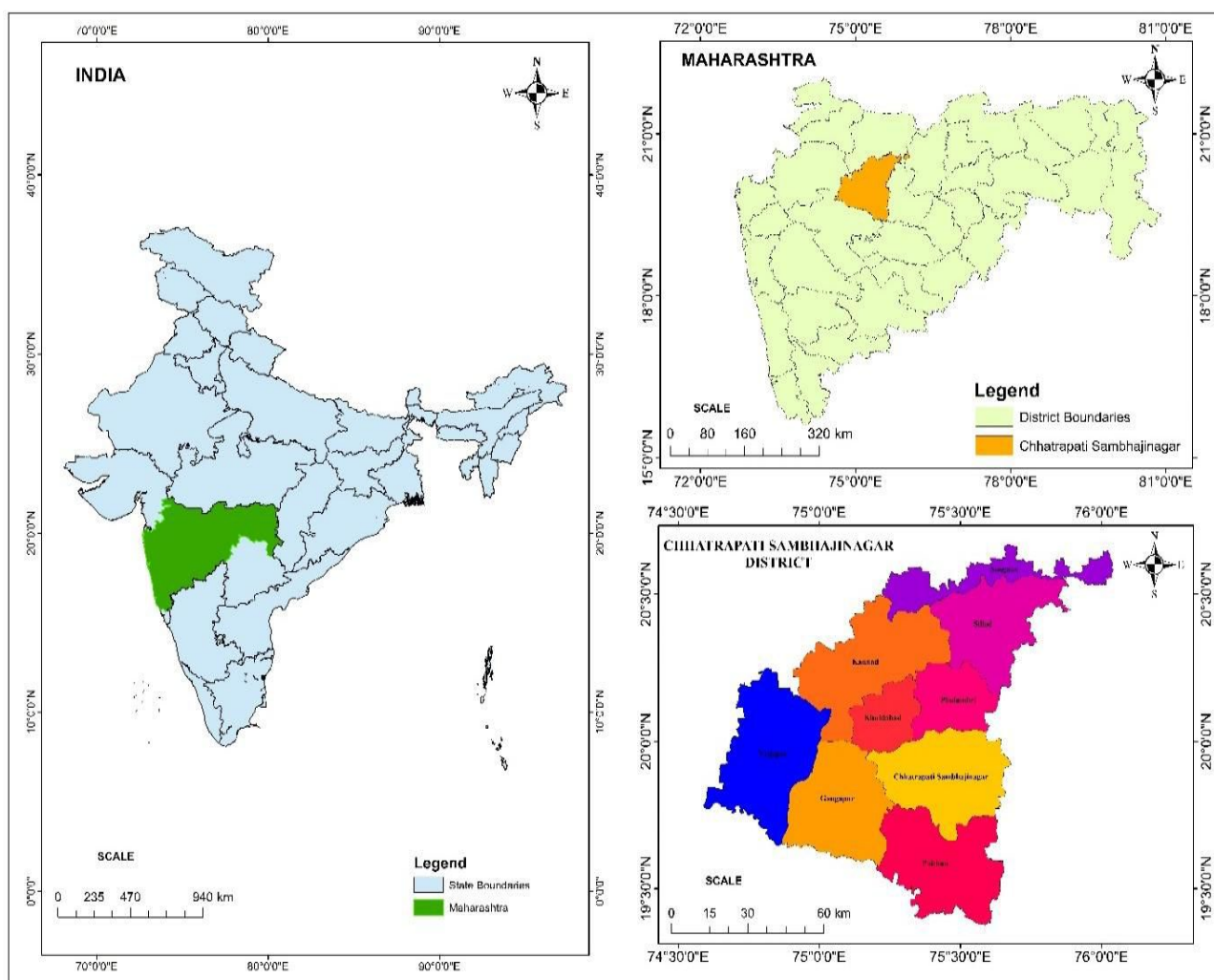


Fig 1: Location map

Materials and Methods

Evaluating the district's agricultural output index for the years 2021–2022 is the main goal of this study. Nine of the main crops grown in the area were specifically selected for in-depth examination in order to accomplish this goal. Secondary sources provided the information used in this study. The Department of Economics and Statistics, the Chhatrapati Sambhajnagar District Handbook, and the district's socioeconomic overview were the specific sources of the data required for the research. These resources provide in-depth analyses of the productivity and agricultural performance of the chosen crops, guaranteeing a strong basis for the research. This method seeks to provide a precise evaluation of the district's agricultural production over the given time frame.

In 1964, V.D. Deshpande and S.G. Sapre proposed a minor modification to Kendall's "ranking coefficient" approach. Instead of using the "simple average of ranks," "weighted average rankings" were used. The weighted rankings of the various crops show the proportion of cropland dedicated to

each crop. The formula used to calculate the productivity index can look like this:

$$\text{Weighted average of ranks} = \frac{\sum(R \times A) +}{\sum A}$$

Whereas,

R = Ranking of yield of individual crops

A = Crop land share in %

Results and Discussion

This research uses the Sapre and Deshpande approach to assess agricultural crop productivity for 2021–2022 across different tehsils in the region. Key crops including wheat, maize, legumes, and cotton are taken into account, along with crop acreage, production, and ranking across tehsils. Tehsils are categorized into high, moderate, and low production levels using a Weighted Average Index, which offers information on the performance of the local agricultural sector.

Table 1 (A): Agriculture crop area, productivity and ranking by Sapre and Deshpande method (2021-22)

Tehsils	Kannad					Soegaon					Sillod				
	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A
Wheat	18432	2406	1	12.78	12.78	1556	2028	1	2.95	2.95	24173	2268	1	15.72	15.72
Jowar	2840	1027	5	1.97	9.85	1444	785	5	2.74	13.71	461	1246	5	0.30	1.50
Bajara	1969	606	6	1.37	8.19	1123	281	7	2.13	14.93	673	447	7	0.44	3.06
Maize	49627	2036	2	34.41	68.83	8775	1693	2	16.66	33.32	50334	1794	2	32.74	65.48
Pulses	15279	1046	4	10.59	42.38	4378	1262	3	8.31	24.94	22056	1296	4	14.35	57.38
Sugarcane	1501	48	8	1.04	8.33	16	0	0	0.03	0.00	103	41	8	0.07	0.54
Cotton	42891	588	7	29.74	208.19	31156	490	6	59.16	354.96	39043	580	6	25.39	152.36
Spices	5976	0	0	4.14	0.00	437	0	0	0.83	0.00	4532	0	0	2.95	0.00
Oil Seeds	5696	1427	3	3.95	11.85	3779	951	4	7.18	28.70	12373	1573	3	8.05	24.14

Source: Computed by researcher

Table 1 (B): Agriculture crop area, productivity and ranking by Sapre and Deshpande method (2021-22)

Tehsils	Phulambri					Chhatrapati Sambhajnagar					Khuldabad				
	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A
Wheat	13547	2279	2	17.72	35.44	8280	3274	2	9.20	18.39	6235	1752	2	13.27	26.54
Jowar	137	890	5	0.18	0.90	7689	712	5	8.54	42.70	1655	839	5	3.52	17.61
Bajara	1218	884	6	1.59	9.56	6511	264	6	7.23	43.39	1171	896	4	2.49	9.97
Maize	25495	2713	1	33.35	33.35	9594	5050	1	10.66	10.66	13879	1676	3	29.53	88.60
Pulses	8641	1826	4	11.30	45.21	16964	1380	4	18.84	75.37	6759	753	6	14.38	86.30
Sugarcane	997	97	8	1.30	10.43	325	67	8	0.36	2.89	745	80	8	1.59	12.68
Cotton	22840	490	7	29.88	209.13	37204	79	7	41.32	289.26	12362	443	7	26.31	184.14
Spices	1777	0	0	2.32	0.00	193	0	0	0.21	0.00	708	0	0	1.51	0.00
Oil Seeds	1797	2002	3	2.35	7.05	3273	2496	3	3.64	10.91	3479	2230	1	7.40	7.40

Source: Computed by researcher

Table 1 (C): Agriculture crop area, productivity and ranking by Sapre and Deshpande method (2021-22)

Tehsils	Vaijapur					Gangapur					Paithan				
	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A	Area	Productivity	Rank	Area %	R*A
Wheat	11042	1575	2	7.09	14.17	13082	2161	2	10.37	20.73	11080	1643	1	9.36	9.36
Jowar	3897	507	6	2.50	15.01	6783	607	5	5.37	26.87	7344	696	5	6.20	31.00
Bajara	4969	788	5	3.19	15.95	2919	244	7	2.31	16.19	6080	568	6	5.13	30.80
Maize	44619	1880	1	28.64	28.64	12830	1436	3	10.17	30.50	2707	1396	2	2.29	4.57
Pulses	15774	1328	4	10.12	40.50	18252	1104	4	14.46	57.85	25480	946	3	21.51	64.54
Sugarcane	2196	72	8	1.41	11.28	6619	72	8	5.24	41.96	9803	63	8	8.28	66.22
Cotton	63297	489	7	40.63	284.38	60315	496	6	47.79	286.75	52718	501	7	44.51	311.58
Spices	915	0	0	0.59	0.00	584	0	0	0.46	0.00	217	0	0	0.18	0.00
Oil Seeds	9094	1456	3	5.84	17.51	4821	2694	1	3.82	3.82	3009	726	4	2.54	10.16

Source: Computed by researcher

Table 2: Weighted average index of tehsils using the Sapre and Deshpande method (2021-22)

Sr.	Name of Tehsils	Weighted Average Index
1	Kannad	3.70
2	Soegaon	4.74
3	Sillod	3.20
4	Phulambri	3.51
5	Chhatrapati Sambhajnagar	4.94
6	Khulatabad	4.33
7	Vaijapur	4.27
8	Gangapur	4.85
9	Paithan	5.28

Source: Computed by researcher

Table 3: Classification of tehsils by productivity levels based on index values

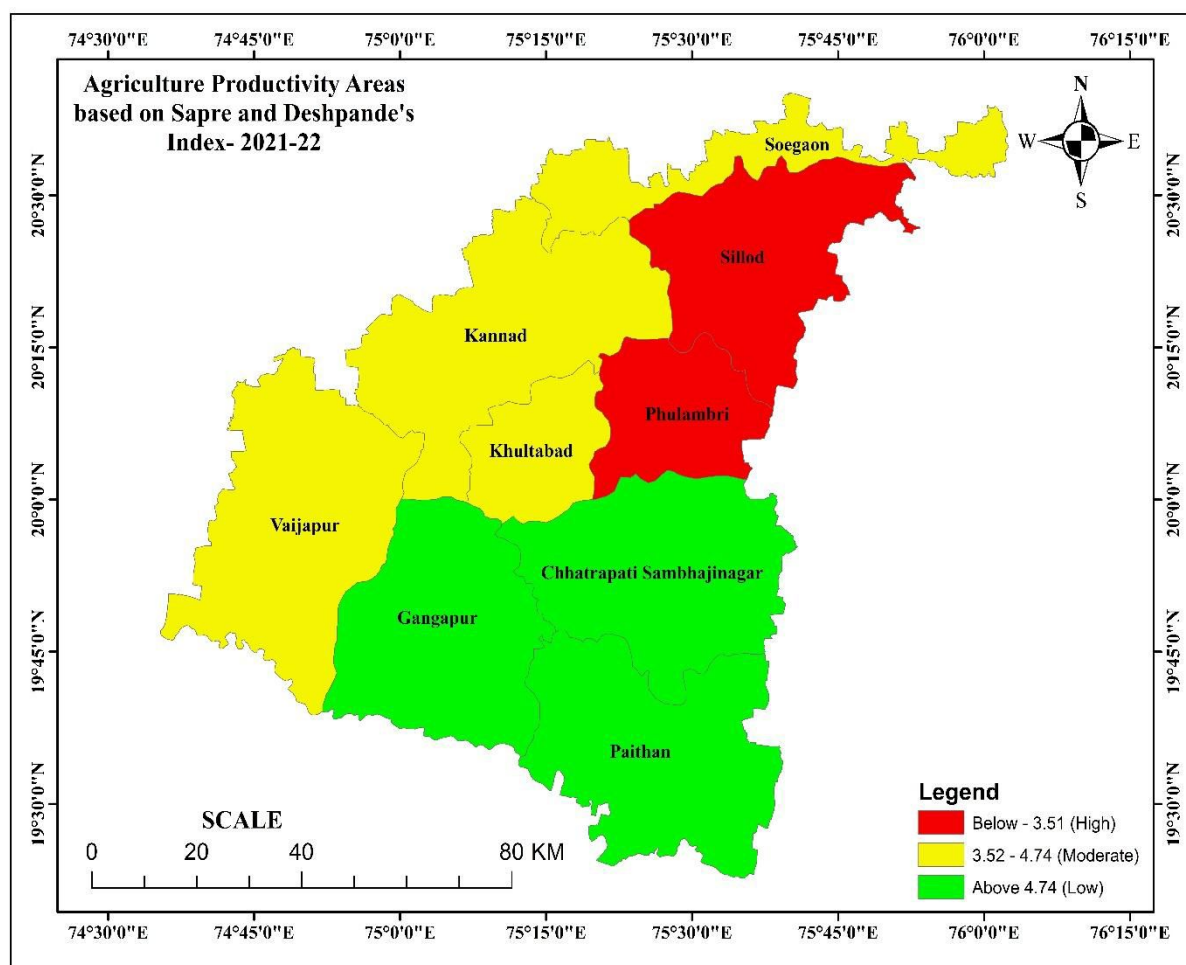
Sr. No.	Index value	Level of productivity	No. of tehsils	Tehsils	% of Area
1	Below 3.51	High	2	Sillod, Phulambri	22.22
2	3.51 to 4.74	Moderate	4	Kannad, Vaijapur, Khuldabad, Soegaon	44.44
3	Above 4.74	Low	3	Gangapur, Chh. Sambhajnagar, Paithan	33.33

Source: Computed by researcher

High productivity areas

Sapre and Deshpande's Weighted Average Index offers a thorough evaluation of agricultural productivity in the Chhatrapati Sambhajnagar District. The importance of agriculture is highlighted by the fact that the district's net sown area makes up 23.87% to 22.22% of its entire geographic area. A number below 3.51 is classified as high productivity according to the measure. Sillod (3.20) and

Phulambri (3.51), two of the tehsils with the highest levels of production, are notable for their efficient use of resources and agricultural practices. Wheat, maize, oilseeds, and pulses are the main crops in Sillod tehsil that contribute to this high level of production. A strong yield is guaranteed by these crops' suitable climate and sufficient soil fertility. The main crops grown in Phulambri tehsil are oilseeds, wheat, and maize.

**Fig 2:** Agriculture productivity areas based on Sapre and Deshpande's index-2021-22

Moderate productivity areas

The net sown area of Chhatrapati Sambhajinagar District accounts for 41.43% to 44.44% of the total area, according to Sapre and Deshpande's Weighted Average Index, which measures agricultural production in the district. A balanced agricultural production with room for improvement is indicated by moderate productivity numbers, which fall between 3.52 and 4.74. This group of tehsils includes Soegaon (4.74), Vaijapur (4.27), Kannad (3.70), and Khuldabad (4.33). Thanks to ideal climate and diverse crop production, these tehsils demonstrate consistent agricultural success. The main sources of agricultural output in Kannad tehsil include oilseeds, bajra, pulses, wheat, and maize. Similar trends can be seen in Vaijapur tehsil, where the mainstays of the agricultural sector are wheat, maize, oilseeds, bajra, and pulses.

Low productivity areas

Despite making up a sizable portion of the net sown area 34.69% and 33.33% of the district's total area, respectively areas with agricultural productivity values above 4.74 are categorized as having low productivity levels according to Sapre and Deshpande's Weighted Average Index. Gangapur (4.85), Chhatrapati Sambhajinagar (4.94), and Paithan tehsils (5.28), are included in this group. These poor production levels point to underlying issues that restrict output, such a lack of resources, inadequate irrigation, or less-than-ideal farming methods. The main crops of Gangapur tehsil that contribute to agricultural output are pulses, oilseeds, wheat, and maize. The main crops grown in Chhatrapati Sambhajinagar tehsil are pulses, oilseeds, wheat, and maize. The same group of crops, including oilseeds, pulses, maize, and wheat in the Paithan Tehsil.

Conclusion

The research identifies notable differences in agricultural output among the Chhatrapati Sambhajinagar District's tehsils, which are divided into zones of high, moderate, and poor productivity. Tehsils with high levels of production, such as Sillod and Phulambri, demonstrate effective farming methods and ideal circumstances that may be used as templates for other regions. Tehsils with moderate production show steady performance, although there is potential for development with better resource management and contemporary methods. Targeted interventions are necessary since the low productivity tehsils continue to confront issues like insufficient irrigation and scarce resources. For growth to be fair and sustainable, these inequities must be addressed through infrastructural development and customized agriculture policy. In the end, raising productivity in regions that aren't functioning well can boost the district's total agricultural production and financial stability.

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