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Address for correspondence:
Dadasaheb Randive
Assistant Professor, Raje Ramrao College, Jath
Email:
dadasaheb2008@gmail.com

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Agriculture And Maize Cultivation Dynamics in Solapur District

Dadasaheb Randive
Assistant Professor, Raje Ramrao College, Jath

Abstract

This study focuses on the field of agricultural economics. Therefore, the geo-climatic conditions, physical factors, and basic infrastructure of the district need to be assessed using secondary data. Studying the area, production, and productivity of Maize in the Solapur District is also one of the major objectives of this study.

These studies investigated the agricultural landscape and dynamics of maize cultivation in the Solapur District of Maharashtra, India. Emphasizing the region's agro-climatic environment, soil characteristics, and socio-economic factors, this study explores the implications of maize as a considered crop amidst changing agricultural practices. Using secondary data, it analyzes trends in cropping patterns, yield variations, input usage, and farmers' preferences. This research highlights the impact of irrigation infrastructure, government schemes, and market user-friendliness on maize production. The findings reveal an ongoing move towards maize due to its flexibility and economic profits compared to habitual crops. The paper concludes with recommendations for enhancing efficiency and sustainability during policy support, farmer education, and scientific interventions.

Key Word: - *Maize Cultivation, Maize production, Maize Marketing, Agricultural Dynamics, Productivity Trends, Sustainable Agriculture*

Introduction

This study examines the agricultural profile of Solapur District. In this paper, the researcher reviews the study area, peculiarities, and trends in production and the area under maize cultivation in the Solapur district. It also highlighted the climatic conditions of the district, rainfall, soil, cropping patterns, and landholding patterns. The Solapur was identified as Sonalipur, Sonalapur, and Sandalpur in the previous period. It is a portion of the region ruled by the Rashtrakutas, Chalukyas, Yadavas, Delhi's Sultan, Mughals, and Marathas. Following the beat of the Marathas in 1818 in the hands of the British, this area became a partition of British India. In 1838, the British produced the district of Solapur, abolished it in 1864, and reenergized it in 1869. It was an area office of Bombay territory, and in 1960. With the configuration of Maharashtra, Solapur has become a significant district situate.[1]

Methodology

The present study is based on secondary data and adopts a descriptive and investigative research approach to study the dynamics of agriculture and maize cultivation in the Solapur District of Maharashtra. All data were collected from government publications such as the *Socio-economic Abstracts of Solapur District* (2000–2016), *Socio-economic Survey of Solapur District* (2015), and reports from the Directorate of Economics and Statistics, Government of Maharashtra.

This study focuses on agricultural indicators such as area under cultivation, production, and productivity of maize across selected tehsils—specifically Mohol, Karmala, and Pandharpur—wherever maize cultivation is major. Statistical tools, such as Compound Growth Rate (CGR), Coefficient of Variation (CV), and Simple Growth Rate (SGR), were used to evaluate chronological trends and variability. A comparative analysis across tehsils was conducted to understand regional disparities in cultivation practices. Geographical and agro-climatic parameters were also considered to contextualize the findings within the ecological structure of the district.

Geographical Location of the District

Solapur District is the most developed district in Maharashtra. In terms of area, it occupies 4th rank among the 33 districts in Maharashtra. The Solapur district is geographically located on the southeastern border of Maharashtra State. The district lies between latitude 17.10 to 18.32° north and longitudes 74.42 to 76.15° east.[2]

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The average annual rainfall was 547.43 of the districts. Kharif and Rabbi are the major agricultural seasons in this district.

Agriculture Profile of The Solapur District

Agriculture is the core means of socioeconomic development for people in the district. A large segment of the district population depends on the agricultural sector and allied activities for their livelihood. Many textiles, sugar factories, hand looms, and vermillion industries in the district provide gainful employment and contribute to district development. The industrial centers are Solapur City, Tikekarwadi, Akluj, Kem, Modlimb, Mandrup, Maindargi, and Karkamb.

The district has ten regulated market yards, consisting of one main market yard and nine sub-market yards. The main market yard is in Solapur, and sub-market yards exist in every tehsil place. They provide services for storage facilities for different agricultural goods.

Soil Profile, Climate, And Rainfall: -

According to meteorology, the average rainfall falls in the Solapur district. The highest temperature was 43.2 and the lowest temperature was 13.3-degree centigrade. In the district, the climate is described as waterless, except in March, April, and May.

It is estimated that this area is out of the total cultivated area. Very shallow soils occupy approximately 10 % of the area, shallow soils 20 %, medium deep soils 45 %, and deep soils 25 % area. In Karmala tehsil about 50 % soil is black, and the remainder is red and light.

According to geography, the Solapur district has divided into three parts;

A) **Eastern Zone:** Barshi, North Solapur, South Solapur, and Akkalkot tehsils are located in the eastern zone. In this zone, the soil is medium to deep black and rich in color. The main crops in the eastern zone are jawar, Bajra, and Pulses.

B) **Central or Transitional Zone:** Mohol, Mangalwedha, Pandharpur and Madha tehsils fall under the central or transitional zone. Sensible soil and uncertain rainfall are marks of a central or transitional zone. Kharif and Rabbi Crops are grown in the central or transitional zones.

C) **Western Zone:** Karmala, Sangola, Malshiras, and Pandharpur tehsils are located in the western zone. Thin and poor soil types are not retentive to humidity quality and insufficient and unsure rainfall in the western zone. Rabbi crops are regularly grown in the Karmala, Pandharpur, and Madha tehsils. In addition to Kharif crops, Bajra and Groundnut were grown in Sangola and Malshiras tehsil, respectively.

The soil in the district has generally been classified into three types: I) Black, II) Coarse Gray, and III) reddish.

Land Use Pattern: -

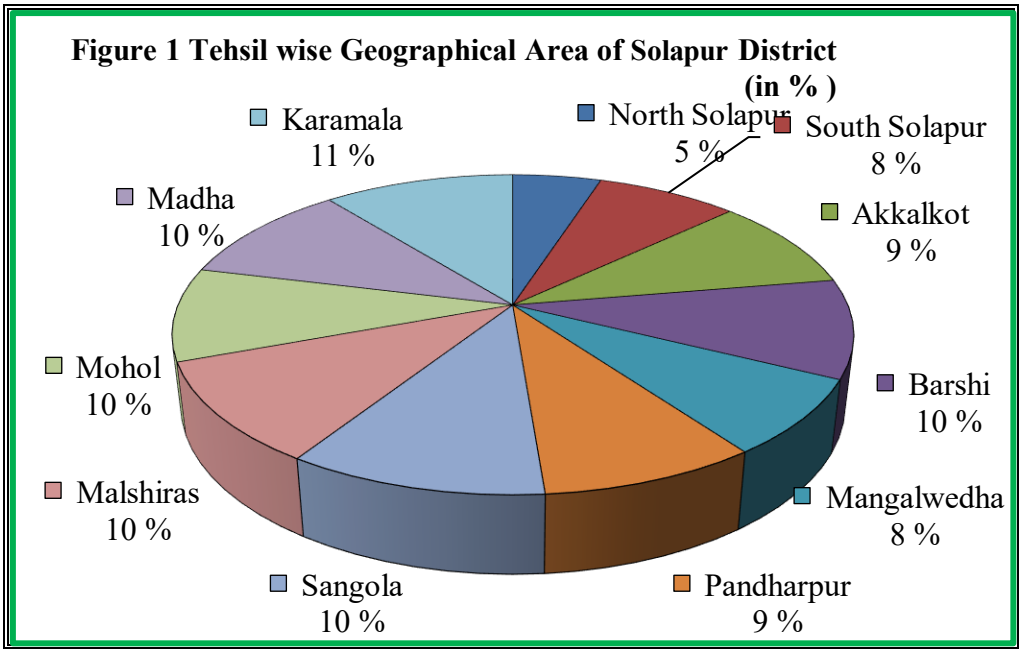
The area of the district covered 4.84 % of Maharashtra state. Solapur is one of the six districts in the Pune division. The district is significant in terms of geographical area and population. The Solapur district has a geographical area of 14,895.3 sq. km, which occupies 4.84 per cent area of the total state.

Table No. 1 Tehsil wise Geographical Area of Solapur District

Sr. No.	Name of tehsil	Area (sq. km)	% to total
1.	North Solapur	746.3	5.01
2.	South Solapur	1195.3	8.02
3.	Akkalkot	1390.3	9.33
4.	Barshi	1483.1	9.96
5.	Mangalwedha	1140.9	7.66
6.	Pandharpur	1303.6	8.75
7.	Sangola	1550.6	10.41
8.	Malshiras	1522.2	10.22
9.	Mohol	1408.4	9.46
10.	Madha	1544.9	10.37
11.	Karmala	1609.7	10.81
Total		**14895.3**	**100**

Source: Socio-economic survey of Solapur district, 2015

Table No. 1 indicates tehsil wise total geographical area of the Solapur district. Out of the total area of the district 170.79 sq. km (1.15 %) has an urban area whereas the remaining 14724.21 sq. km (98.85 %) is a rural area.



According to the area of the district, Karmala has the largest tehsil (10.81 %) and North Solapur has the smallest tehsil (5.01%) in the Solapur district. The data further revealed that tehsils such as Karmala, Madha, Marshila and Sangola occupy more than 40 per cent of the total geographical area of the district.

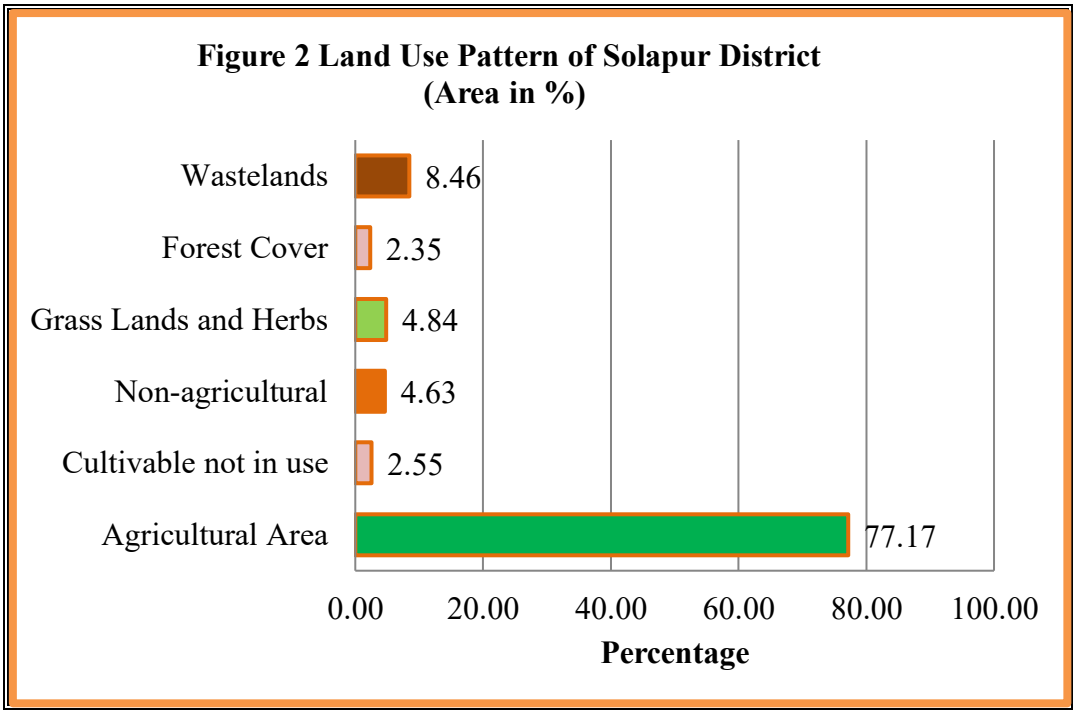
Land is a scarce productive natural resource; it must be used rationally and efficiently for sustainable development. Over time, changes in land-use patterns have occurred in any geographical territory. Land use patterns also correlate with structural changes in the economic setup and reforms in government policies. A strong infrastructure base is needed for the efficient use of land, and efficient utilization of land is not possible. For example, if the irrigation infrastructure is inadequate and less developed, the area under irrigation will be less, which will reduce productivity and hamper efficient land utilization.

The use of land for agricultural purpose is 11495 sq km in the district, which consists of approximately 77.17 per cent of the total district area. This implies that the district has a significant amount of agricultural land. The cultivable but not in-use area was recorded to be 380 sq km which occupies 2.55 per cent of the total district area. The non-agricultural area covers an area of 690 sq km. However, grassland and herb area cover 720.3 sq. km. The forest convergence area of the district was 350 sq. km. This accounts for 2.35 per cent of the total district area. This implies that the district does not have significant forest coverage. It is further seen from Table 3.2 that the wasteland area is 1260 sq km (or 8.46 per cent of the total district area), which indicates a significant amount of inefficient land use in the Solapur district.

Table No. 2 Land Use Pattern of Solapur District

Sr. No.	Land Use Pattern	Area (sq. km)	% to total
1.	Agricultural Area	11495	77.17
2.	Cultivable not in use	380	2.55
3.	Non-agricultural	690	4.63
4.	Grass Lands and Herbs	720.3	4.84
5.	Forest Cover	350	2.35
6.	Wastelands	1260	8.46
Total		**14884.6**	**100**

Source: Socio-economic survey of Solapur district, 2015



There is 77.17 per cent land area used for agricultural purposes and reaming 22.83 per the area is non-agricultural.

Cropping Pattern: -

The nature of cropping patterns is an important factor in determining the growth prospects of the agricultural sector. The Solapur district exhibits a mixed cropping pattern. The district holds the highest rank with respect to sugarcane farming and sugar industry. The Solapur district is highly industrialized, but agriculture continues to be the major occupation of rural people. Most rural life depends on the agricultural sector in the Solapur district. The district is famous for growing Jawar, Groundnut, Pulses, and sugarcane.

Table No. 3 Agricultural Crops in Solapur District

Sr. No.	Particulars	Crops
1.	Kharif crops	Jowar, Bajra, Rice, **Maize**, Cotton, Groundnuts, etc
2.	Rabbi crops	Wheat, Gram, Jowar, **Maize,** etc
3.	Cereals	Jowar, Rice, Wheat, Bajra, **Maize**, Bali, Nachni, etc
4.	Oil seeds	Groundnut, Sesame, Jawas, Karadi, Mustard etc
5.	Pulses	Dal, Tur (Red gram), etc
6.	Cash crops	Pomegranate, Sugarcane, Cotton, Chillies, Tobacco, Banana, **Maize,** etc

Source: Socio-economic survey of Solapur district, 2015

The major crops cultivated in the district are rice, jowar, bajra, wheat, maize, pulses, cotton, sugarcane, oil seeds (sunflower, groundnut, and soybean), turmeric, onions, and other vegetables. This district is also well known for its fruit production. The major fruits produced in the district are mangoes, bananas, grapes, and oranges. Sangola is the most important tehsil pomegranate producer. Sunflower, red gram, groundnut, horse gram, moth bean, and black gram are the main rain-fed kharif crops in the district and are normally grown on medium-deep and shallow soils. Rabbi jowar, marigold, and gram are mainly rain-feed crops commonly grown in medium-deep and deep soils. Sugarcane, sunflower, wheat, and summer groundnuts are the major irrigated crops grown in this district. The area under fruit and vegetable crops under irrigated conditions has increased rapidly under fruit crop ber, pomegranate, and grapes has occupied a major area, while few hectares have under mango and sapota, and these fruits of the district have captured the national as well as international market common vegetables under irrigated conditions: onion, chili, brinjal, tomato, okra, bitter gourd, cucumber, and leafy vegetables. A small area has flowers and is mainly marigold, chrysanthemum, tuberose, or rose.

Land Holding Pattern: -

According to the agricultural census 2011, in the district, there are 5.65 lakh landholders hold around 11.91 lakh hectares of land.

Table No. 4 Distribution of Land Holders and Area

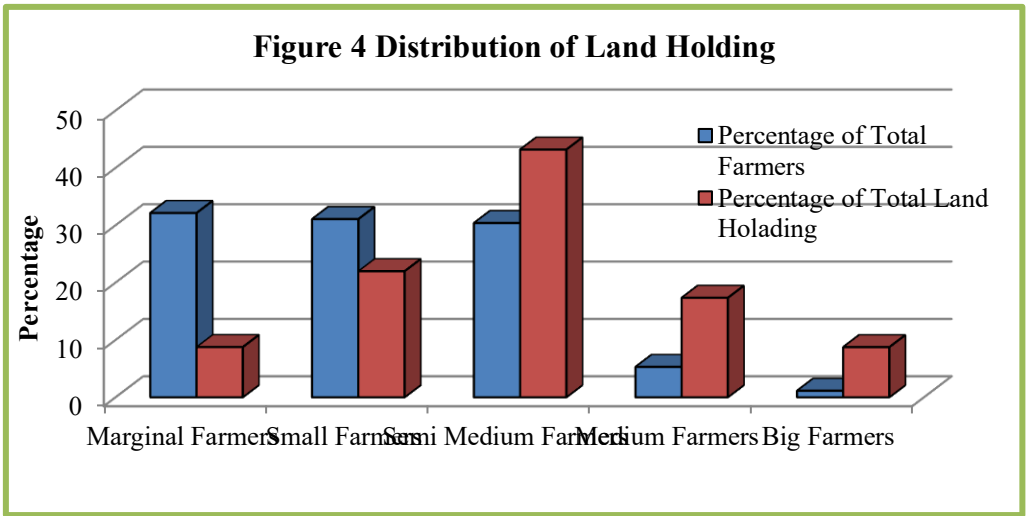
Sr. No.	Distribution	Landholders	Land
1.	**(Marginal)** Below 1.00 hectare	181672 **(32.13)**	104227.74 **(8.75)**
2.	**(Small)** 1.00 hectare to 1.99 hectare	175693 **(31.07)**	261869.30 **(21.98)**
3.	**(Semi-medium)** 2.00 hectare to 5.00 hectare	171783 **(30.38)**	514505.90 **(43.19)**
4.	**(Medium)** 5.00 hectare to 10.00 hectare	29936 **(5.29)**	206569.14 **(17.34)**
5.	**(Big)** Above 10.00 hectare	6305 **(1.13)**	103989.91 **(8.74)**
Total		565389 **(100)**	1191161.99 **(100)**

Source: Socio-economic survey of Solapur district, 2015

Notes: -

1) landholders in numbers.
2) Land in hector.
3) In brackets figures per cent to the total.

Table No. 4 indicates that in the Solapur district, marginal and small farmers are around 63.2 per cent and they have 30.73 per cent of the land. Semi-medium and medium farmers are 35.67 per cent and they have 60.53 per cent of the total district land.



The landholding pattern of Solapur district reveals that 1.13 per cent of big farmers have 8.74 per cent of hectare land and 32.13 per cent of marginal farmers have only 8.75 per cent of the land. In short, the number of small farmers is significantly higher in the Solapur district.

Area, Production, And Productivity of Maize in Solapur District: -

Area Under Maize Production in Selected Tehsil: -

For the present study, the researcher selected three tehsils, namely Mohol, Karmala, and Pandharpur, because it has the highest maize area in the Solapur district. The separate areas of maize production in these three selected tehsils are shown in Table 5.

Table No. 5 Area under Maize Cultivation in Solapur District from 2000 to 2016

(In Hector)

Year	Mohol	SS+NS+A	Karmala	M(1)+B	Pandharpur	M(2)+S+M(3)
2000-2001	2008	789	1930	1541	3064	5136
2001-2002	2980	1910	1793	1770	2485	5767
2002-2003	4321	1751	1577	2273	7456	13513
2003-2004	4321	1751	1577	2273	7456	13513
2004-2005	4321	1751	1577	2273	7456	13513
2005-2006	3003	605	2060	1472	6120	14105
2006-2007	5637	3575	2825	2336	6237	8534
2007-2008	5637	3575	2825	2336	6237	8534
2008-2009	700	4036	3147	2366	4100	8319
2009-2010	700	4036	3147	2780	4100	8319
2010-2011	2745	4410	3996	4466	3907	7595
2011-2012	2745	4410	3996	4466	3907	7595

2012-2013	2745	4410	3996	4466	3907	7595
2013-2014	1720	2376	594	3394	544	8677
2014-2015	8829	4685	10836	10600	3600	20563
2015-2016	2373	4555	5336	4674	1977	8355
Average	**3424.06**	**3039.06**	**3200.75**	**3342.88**	**4534.56**	**9977.06**
SD	**2066.14**	**1434.97**	**2375.49**	**2223.78**	**2084.49**	**3989.80**
CV	**60.34**	**47.22**	**74.22**	**66.52**	**45.97**	**39.99**
CGR	**1.12%**	**12.40%**	**7.01%**	**7.68%**	**-2.88%**	**3.30%**
Growth in 2015-16 over 2000-2001	**18.18**	**477.31**	**176.48**	**203.31**	**-35.48**	**62.68**

Source: Socio-economic Abstract of Solapur District, 2000 to 2016

Note: - 1) SS (South Solapur), NS (North Solapur), A (Akkalkot), M (1) (Madha), B (Barshi), M (2) (Malshiras), S (Sangola), M (3) (Mangalwedha)

Table 5 shows the tehsil-wise area under maize and its average, standard deviation, compound growth rate, and coefficient of variance from to 2000-2001 to 2015-2016. The area of maize has fluctuated because of various physical and economic difficulties affecting the area under maize production.

The following major observations can be drawn based on Table no. 5

1. In Mohol tehsil, the area of maize was the 2008 hector in 2000-2001 and it has reached 2373 hector in 2015-2016. In Karmala tehsil, the area covered by maize was 1930 hector in 2000-2001 and it is increased to 5336 hectares in 2015-2016. The area under maize production was 3064 hectares in Pandharpur tehsil in 2000-2001 which increased to 3600 hectares in 2014-15 but reduced in 2015-16 up to 1977.
2. The average area under Maize production during 2000-2001 to 2015-16 is recorded as 3424.06 hectares in Mohol, 3200.75 hectares in Karmala, and 4534.56 hectares in Pandharpur tehsil. This implies that the Pandharpur tehsil must have the maximum average area under maize production in the study region.
3. The standard deviation was recorded as a maximum of 3989.80 hectors in Mangalwedha, Malshiras, and Sangola tehsils, and the minimum was found to be 1434.97 hectors in South Solapur, Akkalkot, and North Solapur tehsil groups. This implies that the comparative area under maize is more unstable in terms of Mangalwedha, Malshiras and Sangola tehsils.
4. The maximum compound annual growth rate in the area under maize was 12.40 per cent in the South Solapur, Akkalkot and North Solapur tehsil groups. Pandharpur tehsil recorded negative 2.88 per cent growth in the area under maize production during the study period. Tehsils, such as Karmala, Madha, and Barshi also recorded significant compound growth rates in the area under maize production during the study period. Except for Pandharpur tehsil, there was an increasing trend in the area of maize production in the study region.
5. The simple growth rate in the area under maize production in 2015-16 from to 2000-2001 was a maximum of 477.31 per cent in the South Solapur, Akkalkot and North Solapur tehsil groups. It was recorded as negative at 35.48 per cent in Pandharpur tehsil.

In summary, it can be stated that except for the Pandharpur tehsil, there is an increasing trend in the area under maize production in the Solapur district. The maximum average area under maize production was found in the Malshiras, Mangalwedha and Sangola tehsils.

Trend In Production and Productivity of Maize in Solapur District

This section deals with the trends in the area, production, and productivity of maize in Solapur district from 2000 to 2016. In the Solapur district, the maize (Maka) crop occupies a large area, and its production is significantly higher. This crop requires rainfall of between 508 and 762 mm. (20 and 30 in). Maize is usually grown as a kharif crop, followed by a rabbi of wheat or gram. The farmer sows maize after the first rain in the monsoon, which is usually early in June.

Table No. 6 The area under Maize, Production, and Productivity in Solapur District From 2000 to 2016

Year	The area under Maize Production in Hector	Simple Growth Rate of Area	Production of Maize in (00 Mt)	Simple Growth Rate of Production	Productivity of Maize in (kg/ha)	Simple Growth Rate of Productivity
2000-2001	14498	0	350	0	814	0
2001-2002	16705	15.22	275	-21.43	1190	46.19
2002-2003	30900	84.97	474	72.36	1749	46.97
2003-2004	30900	0.00	49	-89.66	645	-63.12
2004-2005	30900	0.00	384	683.67	1388	115.19
2005-2006	27365	-11.44	478	24.48	168	-87.90
2006-2007	29144	6.50	472	-1.26	1481	781.55
2007-2008	29144	0.00	472	0.00	1481	0.00

2008-2009	23082	-20.80	551	16.74	1654	11.68
2009-2010	23082	0.00	551	0.00	1654	0.00
2010-2011	27119	17.49	559	1.45	2109	27.51
2011-2012	27119	0.00	305	-45.44	1599.39	-24.16
2012-2013	27119	0.00	746.7	144.82	2656	66.06
2013-2014	17305	-36.19	149	-80.05	1054	-60.32
2014-2015	54113	212.70	979	557.04	2210	109.68
2015-2016	27270	-49.61	563.36	-42.46	2066	-6.52
Average	**27235.31**		**459.88**		**1494.90**	
SD	**8855.44**		**220.78**		**629.00**	
CV	**32.51**		**48.01**		**42.08**	
CGR	**4.30%**		**3.22%**		**6.41%**	

Source: Socio-economic Abstract of Solapur District, 2000 to 2016

Figure 5 Trend in Mazie Productivity (kg/ha) in Solapur District

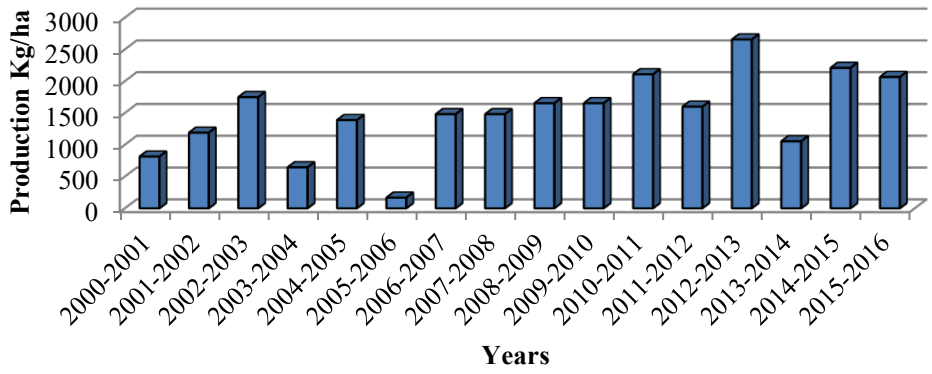


Table 6 provides information about the area, production, and productivity of maize in the Solapur district. The area of maize increased from 14498 hectares in 2000-2001 to 27270 hector in 2015-16. Maize production also increased from 350 MT in 2000-2001 to 563.36 MT in 2015-16. Likewise, maize productivity increased from 814 kg per hectare in 2000-2001 to 2066 kg per hectare in 2015-16.

It is further revealed from the data that the average area, production, and productivity of maize during the study period recorded to 27235 hectors, 459.88 metric tonnes, and 1494.90 Kg per hectare respectively. Similarly, the standard deviations of the area, production, and productivity of maize were 8855.44 hectares 220.78 metric tonnes and 629 kg per hectare, respectively, during the period under consideration in Solapur district. A moderate coefficient of variance was observed for area, production, and productivity. The compound growth in area, production, and productivity of maize in the Solapur district are recorded at 4.30 per cent, 3.22 per cent, and 6.41 per cent respectively. This means that there is an increasing trend in the area, production, and productivity of maize in Solapur district. The maximum simple annual growth rate of the area under maize was found to be 212.70 per cent in 2014-15 over 2013-14. Similarly, the maximum simple annual growth rate of maize production was 683.67 per cent in 2004-05 over 2003-04. Similarly, the simple annual growth rate of maize productivity was 781.55 per cent in 2006-07. Overall, there is an increasing trend in the area, production, and productivity of maize in Solapur District.

Results

1. **Expansion of Maize Cultivation**:The area under maize cultivation in Solapur District increased from 14,498 hectares in 2000–01 to 27,270 hectares in 2015–16, indicating a Compound Growth Rate (CGR) of 4.30%. This suggests growing reliance on maize as a staple and cash crop.
2. **Production and Productivity Trends**:Maize production rose from 350 metric tons in 2000–01 to 563.36 metric tonnes in 2015–16, with a CGR of 3.22%. Productivity improved significantly from 814 kg/ha to 2066 kg/ha over the same period, with a CGR of 6.41%.
3. **Tehsil-wise Performance**:
   - **Pandharpur** had the highest average area under maize cultivation (4534.56 ha) but showed a declining growth rate (-2.88%) toward the end of the study period.
   - **Karmala** and **Mohol** demonstrated consistent growth in maize field, with CGRs of 7.01% and 1.12%, respectively.
   - The South Solapur, North Solapur, and Akkalkot groups experienced the most significant growth (477.31%) from 2000 to 2016.
4. **Land Use and Cropping Pattern Shifts**:The gross cropped area increased by 30.17% from

2003–04 to 2017–18, indicating intensification of agriculture. The area sown more than once increased significantly (439.36%), pointing to better land utilization.

5. **Soil and Rainfall Constraints**:Despite progress, uneven rainfall distribution and variability in soil depth and quality across tehsils continue to constrain consistent maize yields.
6. **Farmer Demographics and Landholding**:Marginal and small farmers (63.2% of total landholders) account for only 30.73% of agricultural land, underscoring the dominance of small-scale agriculture and the need for targeted support.

Discussion

The study revealed significant spatial and temporal variations in maize cultivation across the Solapur district, driven by both environmental and socioeconomic factors. The increase in area under maize cultivation, especially in tehsils such as Karmala and Mohol, indicates a growing preference for maize owing to its relatively lower water requirement and better market value compared to traditional crops such as jowar and bajra. However, the declining trend observed in Pandharpur tehsil suggests localized constraints, such as water scarcity, soil degradation, or inadequate institutional support.

Rainfall variability and soil heterogeneity play crucial roles in determining the cropping patterns in the district. While central and western tehsils struggle with shallow, less fertile soils and irregular rainfall, eastern zones benefit from deeper soils and relatively stable agroclimatic conditions. This disparity affects not only maize yield, but also the reliability of agricultural income in different regions.

The data further suggest a moderate but consistent improvement in maize productivity over the study period, influenced by the expansion of irrigation infrastructure (notably the Ujani Dam), better seed varieties, and government support schemes. Despite these gains, fluctuations in annual production highlight ongoing vulnerability to climate extremes and market uncertainties.

Additionally, the increasing contribution of small and marginal farmers to maize cultivation emphasizes the potential of this crop as a livelihood option for resource-poor households. However, land fragmentation, inadequate access to extension services, and limited mechanization continue to hamper productivity growth.

Overall, while maize is emerging as a vital crop for agricultural diversification and economic stability in Solapur, region-specific interventions are required to address the underlying ecological and institutional challenges that limit its full potential.

Concluding Remark: -

Currently, the problem of livelihood health is becoming very serious for humans, Animals, Birds, and others. Humans are conscious of their health, but they do not have any idea of health problems. It is not better for the development of agricultural methods; hence, there is a need to look after animal health problems in human life. These animals contribute directly and indirectly to promoting the progress, development, and growth of agriculture in the district. Animals are beneficial for the progress, growth, and development of humans. There is need of "one village, one animal primary health center" in the rural area of Solapur district.

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