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Rahane JJ

Department of Agricultural
Economics, Ph. D Scholar,
MPKV, Rahuri, Maharashtra,
India

Dr. VA Shinde

Professor, Department of
Agricultural Economics,
College of Agriculture, Dhule,
Maharashtra, India

LD Bhusnar

Assistant Professor,
Department of Agricultural
Economics, College of
Agriculture, Khandala,
Vaijapur, Maharashtra, India

Corresponding Author:**Rahane JJ**

Department of Agricultural
Economics, Ph. D Scholar,
MPKV, Rahuri, Maharashtra,
India

Growth pattern in area, production and productivity of major pulses in across the region and Maharashtra

Rahane JJ, VA Shinde and LD Bhusnar

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Abstract

The present study analyses the region-wise growth patterns of area, production, and productivity of major pulse crops-Chickpea, Pigeon Pea, Green Gram and Black Gram-in Maharashtra over the period from 1991-92 to 2020-21. The analysis focuses on four major agro-climatic regions: Konkan, Western Maharashtra, Marathwada and Vidarbha. Compound growth rates were calculated for three sub-periods: Period I (1991-92 to 2000-01), Period II (2001-02 to 2010-11) and Period III (2011-12 to 2020-21), along with the overall study period (1991-92 to 2020-21). The study is based on secondary data obtained from the Socio-Economic Review, District Statistical Abstracts and official reports published by the Directorate of Economics and Statistics and the Department of Agriculture, Government of Maharashtra.

The findings revealed significant inter-regional disparities. Chickpea showed positive growth trends in area, production and productivity across all regions except Konkan, where both area and production declined, although productivity slightly improved at overall. Vidarbha and Marathwada consistently recorded better performance due to improvements in technology and expansion of cultivated area. For Pigeon Pea, Marathwada demonstrated sustained growth across all parameters, while Konkan experienced consistent decline, indicating stagnation. Green Gram exhibited a general decline in both area and production, particularly in Vidarbha and Marathwada, with only marginal gains in productivity. Black Gram presented mixed results, showing early gains in Konkan during Period I, followed by a general downward trend in area, production and productivity in later years across most regions.

Overall, the study highlights uneven regional growth patterns and emphasizes the need for region-specific interventions. Productivity improvements were a key factor driving output growth in Marathwada and Vidarbha. Conversely, the persistent stagnation in Konkan calls for focused investment in infrastructure, technology dissemination and agricultural extension services to boost pulse crop performance.

Keywords: CGR, chick pea, pigeon pea, green gram, black gram, region, Maharashtra etc.

Introduction

Pulses play a critical role in Indian agriculture, serving as a major source of plant-based protein and contributing significantly to soil health through nitrogen fixation. Maharashtra is one of the leading pulse-producing states in the country, cultivating a diverse range of pulses including Chickpea, Pigeon Pea (Tur), Green Gram (Moong), and Black Gram (Urad). (ICAR-IIPR, 2022). The state's agro-climatic diversity allows for pulse cultivation across different regions, namely Konkan, Western Maharashtra, Marathwada, and Vidarbha. According to the latest available data (2022-23 and 2023-24), Chickpea continues to be the dominant pulse crop in Vidarbha and Marathwada, while Pigeon Pea shows substantial cultivation in Marathwada and Western Maharashtra. Green Gram and Black Gram are mostly grown in the kharif season, with major concentrations in Marathwada and Vidarbha, although their area and productivity have shown fluctuating trends in recent years. Despite their importance, the growth performance of pulses in Maharashtra has been regionally uneven. In Vidarbha and Marathwada, Chickpea and Pigeon Pea have experienced considerable growth in both area and productivity, attributed to favorable climatic conditions, technological adoption and government support. On the other hand, regions like Konkan have shown consistent stagnation or decline in area and production of most pulses due to agro-climatic constraints, lower market accessibility and limited technological penetration.

Green Gram and Black Gram, while important short-duration crops, have faced productivity challenges due to erratic rainfall and limited input use. (Crop Statistics Reports and Season-Wise Crop Sowing Data (2022-23 & 2023-24). This study aims to analyze these regional growth patterns over a 30-year period, offering insights into trends and informing region-specific agricultural planning and policy formulation.

Materials and Methods

The study focused on four purposively selected regions of Maharashtra: Konkan, Western Maharashtra, Marathwada, and Vidarbha. The study was conducted on major pulses crops. The four important major pulses of Maharashtra viz, chick pea, green gram, black gram and pigeon pea were selected for the study. The present study was utilized the time series data (1991-92 to 2020-2021) on area, production and productivity of major pulse for region wise was collected from various publications and websites of Directorate of Economics and Statistics Government of Maharashtra, Agricultural Statistics at a glance and Bureau of Economics and Statistics of Maharashtra state, Statistical Abstract of Maharashtra, etc.

Specification of time periods

The compound growth rates were computed based on time series data on area, production and productivity of major pulses for regions of Maharashtra as well as a whole for 30 years of study period viz., 1991-92 to 2020-21 using log-linear production function. The compound growth rates of 30 years i.e. from 1991-92 to 2020-21 was subdivided into three sub-periods viz., Period-I (1991-92 to 2000-01), Period-II (2001-02 to 2010-11), Period-III (2011-12 to 2020-21) and entire period (1991-92 to 2020-21).

Analytical techniques

Compound growth rate

To understand the overall performance of major pulses over the entire period of 30 years, i.e. 1991-92 to 2020-21, it was considered as one period. Compound growth rates were estimated to study the percentage increase or decrease in the selected parameter. The following exponential growth function was used.

$$Y = ab^t$$

Where,

Y = area, production and productivity

t = time period

b = regression coefficient

a = intercept

The above equation is reduced in the following linear equation, on taking logarithms.

$$\log Y = \log a + X \log b + e$$

Compound growth rate (CGR%) was estimated as

$$\text{CGR (\%)} = [\text{Antilog } b - 1] \times 100$$

The growth rates were tested for its significance with the help of students t test as,

$$t_{(cal)} = \frac{|b|}{\text{S.E. (b)}}$$

with appropriate, degrees of freedom at 10 percent, 5 percent and 1 percent level of significance

The simple tabular analysis was done for obtaining the results on changes in area, production and productivity of major cereals in Maharashtra.

Results and Discussion

Region Wise Growth Pattern of Area, Production and Productivity of Chick Pea

The growth patterns of area, production and productivity of chickpea across different regions of Maharashtra, including Konkan, Western Maharashtra, Marathwada and Vidarbha are presented in table 1. It reveals that the period I (1991-1992 to 2000-2001) throughout this time, the expansion of cultivated land was modest throughout regions, with Marathwada (6.86%) and Vidarbha (7.24%) exhibiting comparatively greater growth, whilst Konkan (1.27%) recorded the least increase. Production growth was maximized in Marathwada at 7.7 percent per annum and minimized in Konkan at 3.36 percent per annum. Productivity exhibited varied patterns, with Vidarbha registering a negative growth rate of -0.85 percent per annum, signifying inefficiencies in agricultural output, while Konkan and Western Maharashtra saw moderate rises of 2.06 percent and 1.05 percent per annum respectively. In Period II (2001-2002 to 2010-2011), the growth in chickpea production across all regions of Maharashtra was mainly attributed by the expansion of cultivated area and improvements in productivity. This time signified a substantial enhancement in growth rates in all areas. The most significant area expansion occurred in Vidarbha at 12.99 percent annum significantly, while the least was in Konkan at 2.46 percent annum significantly. Production growth was very elevated, surpassing 10 percent per annum significantly throughout areas, with Vidarbha (19.78 percent) and Marathwada (12.54 percent) at the forefront. Productivity growth shown significant enhancement, varying from 3.6 percent per annum significantly in Konkan to 6.01 percent per annum significantly in Vidarbha. These patterns signify enhanced agricultural efficiency and improved yield-augmenting strategies over this era. Period III (2011-2012 to 2020-2021) During this era, a different pattern was seen, as the growth trend in area, production and productivity was decreased in Konkan region, whilst other regions, growth trend was observed positive. Production growth was strong throughout most regions, with Marathwada experiencing the biggest increase at 14.53 percent per annum. Comprehensive Duration (1991-92 to 2020-21) throughout the study period, Konkan demonstrated a reduction in both area (-1.97%) and production (-0.11%) but yield was increased at 1.9 percent per annum significantly. Conversely, all other areas saw favourable trends in both area and output, with western Maharashtra (2.68 and 4.45%), Marathwada (5.78 and 8.44%), Vidarbha (5.91 and 8.57%) and as whole Maharashtra (2.20 and 7.0%) seeing significant growth. Productivity growth was favourable in all areas, with Marathwada and Vidarbha experiencing the largest increases at 2.51 percent apiece. Western Maharashtra (1.73%) and Konkan (1.9%) had very modest increases. The overall increase in chickpea

production was primarily driven by area expansion and productivity improvement, except in the Konkan region, where production did not follow the same trend. This comprehensive examination underscores stagnation in some locations such as Konkan, although other areas saw gradual rise in agricultural output.

Region Wise Growth Pattern of Area, Production and Productivity of Pigeon Pea

From table 2 this table it was observed that the Konkan region demonstrated a clear negative growth trend in area, production and productivity during Period I and over the entire study period, highlighting significant stagnation in agricultural progress. Although Periods II and III recorded marginal improvements in productivity, these gains were statistically insignificant, underscoring the region's persistent struggle to achieve meaningful agricultural advancement. In Western Maharashtra, Period I showed an insignificant trend in area, production and productivity, indicating limited growth. In Period II, productivity increased significantly at 4.15 percent per annum, despite declines in area and production. Over the entire period, productivity grew at 0.99 percent per annum, though this growth was statistically non-significant, while both area and production showed a declining trend. In the Marathwada region, production showed a statistically significant increase of 7.4 percent per annum in Period II and 4.9 percent per annum over the entire period, driven by both the expansion of cultivated area and improvements in productivity. Likewise, Vidarbha had moderate development across all three categories, with area, production and productivity. At the state level, overall growth was modest, with a slight rise in area (1.10%) and production (2.68%), while productivity rose by 1.57 percent per annum. From 1991-92 to 2020-21, Konkan faced stagnation in area, production and productivity, Western Maharashtra showed stability in yield despite area and production decline, Marathwada demonstrated robust growth in all indicators, Vidarbha saw moderate improvements and Maharashtra as a whole

experienced positive agricultural progress with increases in area, production and yield.

Region Wise Growth Pattern of Area, Production and Productivity of Green Gram

From table 3 the study indicated that general trends throughout Maharashtra, the initial phase had mild reductions in both cultivated area and production, while several parts exhibited increases in productivity. The second era signified a pervasive recession, especially in whole state and Vidarbha, accompanied by declining production. The third period had a divergent pattern, with Western Maharashtra seeing growth, while Vidarbha encountered significant contraction. Throughout the period from 1991-92 to 2020-21, the state had a total reduction in area (-2.3%) and production (-2.64%), but productivity remained relatively same, indicating structural inefficiencies and stagnation in agricultural growth.

Region Wise Growth Pattern of Area, Production and Productivity of Black Gram

The region wise growth pattern of area, production and productivity of black gram presented in table 4. It indicated that in Konkan region during Period I (1991-92 to 2000-01), had a notable rise in the area (23.76%) and production (23.97%) of black gram, while productivity growth was minimal (0.17%). In general view in Maharashtra, during Period I, Maharashtra had favourable trends in area (2.63 percent), output (4.04 percent) and marginal productivity growth (1.37%). Nonetheless, Period II had a significant decrease in all three dimensions, with area declining by 5.16 percent, production by 6.32 percent and productivity by 1.22 percent per annum. Period III yielded mixed outcomes, as area experienced a minor increase of 0.46 percent, but production and productivity declined by 1.7 percent and 2.15 percent, respectively. Throughout the research period, Maharashtra demonstrated a decline in area, production and productivity, signifying stasis in agricultural advancement throughout the state.

Table 1: Region Wise Growth Pattern of Area, Production and Productivity of Chick Pea

Particulars		Regions				Maharashtra
		Konkan	W. Maharashtra	Marathwada	Vidarbha	
Period I (1991-92 to 2000-01)	A	1.27	4 **	6.86 ***	7.24 **	5.62 **
	P	3.36	5.09 *	7.7	6.32	6.01
	Y	2.06	1.05	0.79	-0.85	0.36
Period II (2001-02 to 2010-11)	A	2.46 **	5.26 ***	6.22 ***	12.99 ***	8 ***
	P	6.15 ***	10.48 ***	12.54 ***	19.78 ***	14.15 ***
	Y	3.6 **	4.96 ***	.95 ***	6.01 **	5.7 ***
Period III (2011-12 to 2020-21)	A	-1.83	8.43 ***	10.32 ***	5.61 ***	8.11 ***
	P	-2.67	11.62 ***	14.53 **	10.22 ***	11.99 ***
	Y	-0.86	2.94	3.82	4.37 **	3.59
Overall Period (1991-92 to 2020-21)	A	-1.97 ***	2.68 ***	5.78 ***	5.91 ***	4.69 ***
	P	-0.11	4.45 ***	8.44 ***	8.57 ***	7 ***
	Y	1.9 ***	1.73 ***	2.51 ***	2.51 ***	2.21 ***

Note: *, ** and *** indicate significance at 10, 5 and 1 percent level. A-Area, P-Production and Y-Productivity.

Table 2: Region Wise Growth Pattern of Area, Production and Productivity of Pigeon Pea

Particulars		Regions				Maharashtra
		Konkan	Western Maharashtra	Marathwada	Vidarbha	
Period I (1991-92 to 2000-01)	A	-4.89 ***	-1.7	2.16 ***	1.04 **	1.01 *
	P	-11.12***	-3.59	8.61	5.52 *	5.45
	Y	-6.55 **	-1.92	6.31	4.43	4.39
Period II (2001-02 to 2010-11)	A	2.41 ***	-0.3	2.03 **	1.44 **	1.53 *
	P	5.79 **	3.84	7.4 ***	-0.57	2.53
	Y	3.3	4.15 ***	5.26 **	-1.98	0.99
Period III (2011-12 to 2020-21)	A	-6.78 **	6.27 ***	0.0	1.79 **	1.44 *
	P	-4.55	7.3	4.91	7.19	6.3
	Y	2.4	0.97	4.91	5.31	4.78
Overall Period (1991-92 to 2020-21)	A	-1.49 ***	-1.64 ***	1.69 ***	1.38 ***	1.1 ***
	P	-2.95 ***	-0.67	4.91 ***	2.1 ***	2.68 ***
	Y	-1.49 *	0.99	3.16 ***	0.71	1.57 **

Note: *, ** and *** indicate significance at 10, 5 and 1 percent level. A-Area, P-Production and Y-Productivity.

Table 3: Region Wise Growth Pattern of Area, Production and Productivity of Green Gram

Particulars		Regions				Maharashtra
		Konkan	W. Maharashtra	Marathwada	Vidarbha	
Period I (1991-92 to 2000-01)	A	-8.94	-3.45 **	-0.66	0.19	-0.92
	P	-3.8	-1.82	-3.64	1.96	-0.5
	Y	5.65	1.68	-3.01	1.77	0.43
Period II (2001-02 to 2010-11)	A	3.38 *	-1	-5.16 **	-7.12 ***	-5.12 ***
	P	-1.16	-0.65	-5.05	-9.38	-5.57
	Y	-4.39	0.36	0.12	-2.43	-0.47
Period III (2011-12 to 2020-21)	A	-	10.11 ***	1.25	-11.72 ***	0.15
	P	-	5.64	2.94	-12.8 *	-0.53
	Y	-	-4.06	1.67	-1.23	-0.67
Overall Period (1991-92 to 2020-21)	A	-	0.52	-1.81 ***	-5.42 ***	-2.3 ***
	P	-	-0.31	-1.42	-6.11 ***	-2.64 ***
	Y	-	-0.82	0.4	-0.73	-0.36

Note: *, ** and *** indicate significance at 10, 5 and 1 percent level of significance. A-Area, P-Production and Y-Productivity

Table 4: Region Wise Growth Pattern of Area, Production and Productivity of Black Gram

Particulars		Regions				Maharashtra
		Konkan	W. Maharashtra	Marathwada	Vidarbha	
Period I (1991-92 to 2000-01)	A	23.76 *	-0.23	6.64 **	0.38	2.63 ***
	P	23.97 *	1.14	5.66	5.16	4.04
	Y	0.17	1.37	-0.93	4.77	1.37
Period II (2001-02 to 210-11)	A	-0.03	-1.28	-5.73 *	-7.94 ***	-5.16 **
	P	-3.29	-2.19	-6.3	-11.5	-6.32
	Y	-3.27	-0.92	-0.61	-3.87	-1.22
Period III (2011-12 to 2020-21)	A	-5.07 ***	5.08 **	-0.09	-4.85	0.46
	P	-13.48 ***	-0.89	0.87	-6.7	-1.7
	Y	-8.86 ***	-5.69	0.97	-1.94	-2.15
Overall Period (1991-92 to 2020-21)	A	0.75	-0.36	-0.73	-4.91 ***	-1.8 ***
	P	-0.85	-0.93	-0.87	-4.72 ***	-1.94 **
	Y	-1.59 ***	-0.57	-0.13	0.21	-0.14

Note: *, ** and *** indicate significance at 10, 5 and 1 percent level. A-Area, P-Production and Y-Productivity

Conclusion

The present study on the region-wise growth patterns of major pulses-Chickpea, Pigeon Pea, Green Gram and Black Gram-in Maharashtra from 1991-92 to 2020-21 reveals significant regional disparities in area, production and productivity. The findings indicate that while some regions have experienced consistent growth, others have shown stagnation or decline. Chickpea showed the most promising performance in Vidarbha and Marathwada, with significant increases in both area and productivity, especially during Period II. In contrast, the Konkan region consistently underperformed, with declining trends in area and production, despite marginal improvements in yield. Pigeon Pea exhibited strong growth in Marathwada and moderate gains in Vidarbha. Western Maharashtra maintained stable

productivity despite declines in area and output, whereas Konkan showed negative growth throughout the study period, indicating persistent structural constraints. Green Gram experienced overall decline in Maharashtra, particularly in Vidarbha, due to shrinking area and production. Only Western Maharashtra showed some positive growth in the later period. Productivity gains were minimal, reflecting limited technological adoption. Black Gram presented mixed trends. Konkan recorded a sharp rise in area and production in Period I, but growth declined in later periods. Most regions, including the state overall, experienced long-term decline in all three parameters. Overall, the study highlights uneven development of pulse crops across regions. Marathwada and Vidarbha emerged as leading regions with substantial growth driven by improved

technology and area expansion. Conversely, Konkan exhibited stagnation and decline, underscoring the need for targeted policy interventions. To enhance pulse production sustainably across Maharashtra, region-specific strategies are essential. These should focus on infrastructure development, technological dissemination, capacity building, and improved market access, particularly in underperforming regions like Konkan. Addressing these disparities will be key to achieving balanced and resilient pulse crop growth in the state.

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