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## Growth and instability of area, production and productivity of chickpea in Maharashtra

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**Abstract**

The present investigation emphasizes growth and instability of chickpea in Maharashtra. The time series data on area, production and productivity of chickpea was collected from various published sources viz., i) Season and crop reports, Departments of Agriculture, Government of Maharashtra, Pune, (ii) Statistical Abstract of Maharashtra State, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai, (iii) Epitomes of Agriculture in Maharashtra, Part-II (iv) Socio- economic Review and District Statistical Abstracts of all districts in Maharashtra, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai and (v) Census report viz., agricultural census. The compound growth rates districtwise, regionwise and for entire state, coefficient of variation and Cuddy Della Vella index was used for estimating the growth and instability in area, production and productivity of chickpea in Maharashtra. The study indicates that the production of chickpea was increased due to both area expansion and productivity improvement for the entire period in the State. Similar trend was observed for all regions viz; Western Maharashtra, Vidarbha, Marathwada and Konkan region for the entire study period. The area, production and productivity of chickpea increased at the rate of 4.01 per cent, 6.59 per cent and 2.48 per cent per annum, respectively during the entire period. It was revealed from the study that the area, production and productivity of chickpea were inconsistent or instable for the entire period in all the regions of the state except in Konkan region.

**Keywords:** Growth, area, production, productivity, instability, chickpea

**Introduction**

Maharashtra was the second largest chickpea growing state in India. There was a steady growth in area and production of chickpea over the years. However, the decline in its productivity in recent decades was of great concern. For the last few decades, chickpea farmers have stumbled upon many threats, as increasing cost of inputs, unsystematic and insufficient institutional and infrastructural facilities, that put lot of strain on the farmers to such an extent that they are losing the interest to continue in farming as a source of their livelihood. This was true in chickpea production of Maharashtra, as a result this crop continue to be the focus of attention for politician, policy makers, academicians and others. Maharashtra has made significant progress in the production of chickpea during the past three decades. In Maharashtra MPKV, Rahuri has released remarkable varieties of chickpea viz., Vijay, Vishal, Digvijay and Phule G-5, etc., to increase the productivity which are tolerant to drought. These varieties are responsible for the socio, economic and political changes in the farming communities in Maharashtra.

**Objectives**

1. To estimate the growth rates of area, production and productivity of chickpea.

**Experimental Methods Nature and source of the data**

The time series data required to fulfilled the objectives data was collected from secondary sources i.e., different published records of the state government, cooperative institutions viz., (i) Season and crop reports, Departments of Agriculture, Government of Maharashtra, Pune, (ii) Statistical Abstract of Maharashtra State, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai, (iii) Epitomes of Agriculture in Maharashtra, Part-II (iv) Socio-economic Review and District Statistical Abstracts of all districts in Maharashtra, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai and (v) Census report viz., agricultural census.

**Crop Covered**

Chickpea crop was purposively selected for the study.

**Period of Study**

To examine the growth, the period was considered from 1980-81 to 2017-18.

**Analytical Techniques****Compound Annual Growth Rates**

The compound growth rates were computed based on time series data on area, production and productivity of chickpea for each district, region as well as Maharashtra as a whole for 37 years of study period *viz.*, 1980-81 to 2017-18 using log-linear production function.

The following exponential growth function was used.  $Y = ab^t e$

Where,

Y = Dependent variable for which growth was estimated (i.e. area, production and productivity etc.)

a = Intercept or constant

b = Regression/trend coefficient

t = Periods in years (1, 2, 3...n)

e = Error terms with zero mean and constant variance

**Experimental Results**

The results obtained from the present investigation have been summarized under the following heads.

**Compound Growth Rates**

The districtwise, regionwise and statewide compound growth rates of area, production and productivity of chickpea for

different periods presented in Table. The time series data on area, production and productivity of chickpea were divided into four sub periods as period I (1980-81 to 1989-90), period II (1990-91 to 1999-2000), period III (2000-2001 to 2009-2010), period IV (2010-2011 to 2017-2018) and overall period (1980-81 to 2017-2018).

It was revealed from the Table 1, that the area, production and productivity of chickpea have fluctuated widely during the study period in different regions and State. The growth rates of area, production and productivity of chickpea for state was observed to be positive and highly significant at 1 per cent level of significance for the entire period of 37 years. The area, production and productivity of chickpea increased at the rate of 4.01 per cent, 6.59 per cent and 2.48 per cent per annum, respectively during the entire period. It clearly indicates that the production of chickpea was increased due to both area expansion and productivity improvement for the entire period in the state. Similar trend was observed for all regions *viz.*, western Maharashtra, Vidarbha, Marathwada and Kokan region for the entire period under study. The significant growth in production of chickpea was due to the high yielding chickpea varieties developed by the MPKV, Rahuri during the overall period 1980-2018. Among the different periods, the performance of area, production and productivity of chickpea was satisfactory in period I, II, III and entire period. The period IV (2010-11 to 2017-18) was unsatisfactory due to consistent drought years from 2011-12 to 2014-15 for overall Maharashtra. The hypothesis stated as an area, production and productivity of chickpea are fluctuating has been proved.

**Table 1:** District Wise Annual Compound Growth Rates of Chickpea in Maharashtra

Sr. No.	District	Period I (1980-81 to 1989-90)			Period-II (1990-91 to 1999-2000)			Period-III (2000-2001 to 2009-2010)			Period-IV (2010-11 to 2017-18)			Overall (1980-2018)		
		A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1	Thane	8.02***	8.94**	0.85	4.49**	7.08*	2.48NS	2.06***	5.59***	3.46**	-2.79NS	-3.02NS	-0.24***	3.53***	6.04***	2.42***
2	Raigad	16.67***	17.71***	0.9	0.11 NS	2.41 NS	2.3 NS	1.67 NS	4.92**	3.42**	12.78**	-12.32NS	-0.57*	3.04***	5.7***	2.59***
3	Nashik	11.38***	12.2**	0.74	3.27**	6.68**	3.3**	5.37**	10.19***	4.58***	6.35	5.06	-1.16	-2.68**	-0.55	2.22***
4	Dhule	15.97***	20.55***	3.95	3.21	4.64	1.38	12.01***	19.65***	6.91***	3.05	15.92	12.49	1.95***	4.97***	2.96***
5	Nandurbar	-	-	-	-	-	-	12.27***	24.13***	10.64***	-1.38	-4.04	-2.69	16.54***	18.15***	1.39 NS
6	Jalgaon	27.72***	31.84***	3.23	3.63*	3.71	0.08	5.39	9.38**	3.79**	2.66	3.64	0.94**	4.18***	7.05***	2.76***
7	Ahmednagar	9.00***	13.31**	3.95	8.88***	10.64***	1.62	6.92***	13.43	6.07***	14.68	14.13	-0.48***	5.31***	6.73***	1.35***
8	Pune	4.39***	7.48**	2.96	4.05***	6.47***	2.33	0.5	4.35	3.84***	9.78*	11.32	1.42	2.1***	4.08**	1.93***
9	Solapur	1.47	1.47	7.77	5.49**	9.51*	3.81	5.1***	12.91*	7.42	6.06	2.38*	-3.45	1.18***	3.37***	2.16***
10	Satara	3.93	7.1**	3.05	8.39***	12.05***	3.38*	4.15	8.54*	4.17	1.95	4.11	2.11	2.92***	4.49***	1.53***
11	Sangli	4.94*	15.86***	10.41**	3.86***	9.31***	5.25**	1.89	3.48	1.56	-2.57	-3.35	-0.85*	1.66***	4.89***	3.17***
12	Kolhapur	11.77	16.06	3.84**	-0.01	0.38	0.39	-4.37***	-1.92	2.53*	-5.42	-8.77	-3.59	1.23	3.12***	1.87***
13	Aurangabad	4.32	11.68	7.05	2.21	1.67	-0.53	7.46***	16.66***	8.55***	3.36	1.38***	-1.97**	1.6***	4.32***	2.68***
14	Jalna	2.15	5.56	3.33	4.08	4.81	0.7 NS	3.89*	8.33**	4.29*	12.03*	13.16	1.11**	2.7***	4.28***	1.55**
15	Beed	-3.89**	-1.33	2.66	3.35*	5.11	1.7	11.48***	17.19***	5.13**	14.46**	8.92	-4.85	2.88***	4.48***	1.55***
16	Latur	1.01	0.18	-0.81	5.31	6.42	1.06	7.86***	13.77***	5.51***	8.92	-2.66**	-10.65	4.82***	6.98***	2.25***
17	Osmanabad	-1.76	-0.11	1.69	5.39**	5.19	-0.19	4.43**	12.27**	7.51	4.84	-3.32*	-7.78	2.55***	4.12***	1.53**
18	Nanded	2.5	4.81	2.26	11.15***	11.73**	0.53	8.69***	14.82***	5.64*	4.91	0.32***	-4.37	5.31***	8.74***	3.26***
19	Parbhani	2.89**	9.15***	6.08**	8.48***	8.66*	0.16	3.3**	6.81*	3.37	-0.23	-5.74	-5.5	1.62***	3.47***	1.82***
20	Hingoli	-	-	-	-	-	-	6.01**	10.02**	3.8*	11.44*	16.4	4.43	12.26***	13.87***	1.44
21	Buldhana	9.99*	15.44**	4.95	11.72**	14.77**	2.73	17.93***	28.61***	9.08**	1.36	-1.53**	-2.85	6.15***	8.74***	2.44***
22	Akola	14.12***	20.58***	5.66*	13.91**	15.83**	1.75	17.41***	24.31**	5.82	8.14***	8.58	0.42***	5.74***	8.86***	2.95***
23	Washim	-	-	-	-	-	-	14.77***	23.62***	7.73*	-3.71	-11.74	-8.35	10.58***	11.92***	1.22
24	Amravati	12.05***	16.69***	4.14	10.9**	12.03**	1.02	14.13***	19.92***	5.07*	9.53**	8.49	-0.94*	6.55***	10***	3.24***
25	Yavatmal	14.36**	21.94***	6.63**	8.72***	6.07	-2.44	16.09**	20.28**	3.65*	20.76**	9.28	-9.51	8.62***	12.07***	3.17***
26	Wardha	14.36**	21.94***	6.63**	8.72***	6.07	-2.44	16.09**	20.28**	3.65*	20.76**	9.28	-9.51	8.62***	12.07***	3.17***
27	Nagpur	11.8***	15.05***	2.91	5.58***	5.3 NS	-0.27	13.49***	17.38***	3.41*	-3.53**	-6.4	-3	5.27***	7.66***	2.27***
28	Bhandara	5.3***	4.31	-0.94	-2.78	-3.76	-0.81	11.12**	14.85**	3.2	4.12	-0.29***	-4.02	-1.23	-0.08	1.18***
29	Gondia	-	-	-	-	-	-	4.92	8.6	3.53	0.57	-1.03	-2.11	25.74***	30.09***	3.39***
30	Chandrapur	-0.97	0.11	1.09	7.53***	9.81**	2.12	15.17***	20.76***	4.81**	-2.64	-5.06	-2.46	4.2***	6.07***	1.79***

Note: \*\*\*, \*\* and \* Significant 1, 5 and 10 per cent, respectively

**Table 2:** Region wise Compound Growth Rates of chickpea in Maharashtra

Sr. No.	Particulars		Period				Overall(1980-2018)
			I(1980-90)	II(1991-00)	III(2001-10)	IV(2011-18)	
1.	Western Maharashtra	A	8.52***	4.59***	4.63***	6.2	2.82***
		P	13.47***	6.78***	9.38***	6.51	5.07**
		Y	4.57	2.09	4.54***	0.3***	2.19***
2.	Marathwada	A	0.8	5.67**	6.64***	7.55*	3.5***
		P	3.78	5.97	12.43***	3.89	6.04***
		Y	2.96	0.29	5.43***	-3.4	2.46***
3.	Vidarbha	A	10.21***	8.48***	14***	5.3**	6.12***
		P	14.49***	9.3*	20.61***	2.17	9.01***
		Y	3.88	0.76	5.8**	-2.97	2.72***
4.	Konkan	A	11.94***	2.65**	1.89*	-4.85	2.23***
		P	12.95***	5.02*	5.45***	-4.46	4.77***
		Y	0.9	2.3	3.36**	0.15***	2.46***
5.	Maharashtra	A	6.28***	5.88***	8.24***	6.25*	4.01***
		P	10.78***	7.22*	13.93***	4.49	6.59***
		Y	-4.24	1.26	5.25***	-1.65	2.48***

(Source: Epitome, Commissioner of Agricultural, Pune)

Note: \*\*\*, \*\* and \* Significant 1, 5 and 10 per cent, respectively

### Instability in Area, Production and Productivity of Chickpea

The Coefficient of Variation and Cuddy Della and Vella instability index was used to measure the consistency and instability in area, production and productivity of chickpea crop. Coefficient of Variation and Cuddy Della and Vella instability index of chickpea for the period 1980-81 to 2017-18 for district, region and entire Maharashtra have been estimated and presented in Table 4.7.a, 4.7.b and 4.7.c. The Time series data on area (A), production (P) and productivity (Y) were divided into four sub periods as period I (1980-81 to 1989-90), period II (1990-91- to 1999-2000), period III (2000-01 to 2009-10), period IV (2010-11- to 2017-18) and overall period (1980-2018). In case of chickpea production, coefficient of variation was instable during overall period (1980-2017) for all the districts of Maharashtra viz; Raigad,

Nashik, Nandurbar, Pune, Kolhapur, Latur, Amravati, Gondia, Thane, Dhule, Jalgoan, Ahmednagar, Solapur, Satara, Sangli, Aurangabad, Jalna, Beed, Osmanabad, Nanded, Parbhani, Hingoli, Buldhana, Washim, Yavatmal, Wardha, Nagpur, Bhandara and Chandrapur. The production was mainly depending on area under chickpea crop and productivity. However, the area was fluctuating in all the districts. The productivity was stable in the district viz; Nashik, Pune and Amravati district of the State. It was revealed from the Table that the area, production and productivity of chickpea were inconsistent or instable for the entire period in all the regions of the state except in Konkan region. The area under chickpea in all the districts, regions and state was more or less instable and fluctuating. It was mainly due to the water shortage in *rabi* season, other competing crops and negligible or low technology adoption, infestation of pod borer, etc.

**Table 3:** Region wise Instability in Area, Production and Productivity of chickpea in Maharashtra

Sr. No.	Period		Region											
			Konkan			Western Maharashtra			Vidarbha			Marathwada		
			A	P	Y	A	P	Y	A	P	Y	A	P	Y
1.	Period I	CV (%)	41.19	43.18	18.47	28.65	52.96	25.69	35.75	63.65	24.25	9.47	33.87	26.59
		CDVI	19.01	19.86	18.28	13.58	28.77	21.61	16.3	35.24	20.28	8.07	30.27	24.69
2.	Period II	CV (%)	11.4	23.24	15.93	16.37	25.13	11.39	27.05	38.01	23.37	21.27	36.44	23.8
		CDVI	8.76	18.93	14.46	9.2	15.8	9.54	17.04	30.27	23.26	14.91	33.29	23.79
3.	Period III	CV (%)	1.89*	5.45***	3.36**	16.83	30.07	15.00	45.16	65.61	25.8	19.81	36.97	19.76
		CDVI	9.5	17.56	13.29	9.72	14.23	6.91	20.21	32.74	18.91	5.85	14.68	11.9
4.	Period IV	CV (%)	4.85 <sup>NS</sup>	4.46 <sup>NS</sup>	0.15***	6.2 <sup>NS</sup>	6.51 <sup>NS</sup>	0.3***	14.91	23.84	15.77	24.42	52.9	32.29
		CDVI	30.34	33.28	19.76	19.06	36.72	17.5	9.73	23.84	15.77	17.63	52.9	32.29
5.	Overall	CV (%)	2.23***	4.77***	2.46***	32.28	55.48	26.55	64.24	89.49	34.68	45.41	85.71	36.9
		CDVI	34.38	47.43	30.71	16.24	26.24	15.06	20.31	32.16	20.28	17.73	41.93	26.4

**Table 4:** Instability in Area, Production and Productivity of Chickpea in Maharashtra

Sr. No.	Period		Maharashtra		
			A	P	Y
1	Period I	CV (%)	22.14	47.36	25.06
		CDVI	11.27	29.9	21.25
2	Period II	CV (%)	20.13	30.82	17.03
		CDVI	12.1	23.96	16.63
3	Period III	CV (%)	25.94	43.35	18.47
		CDVI	9.94	17.5	9.31
4	Period IV	CV (%)	19.67	34.98	18.62
		CDVI	14.49	34.98	18.62
5	Overall	CV (%)	45.12	73.47	30.76
		CDVI	14.14	27.2	17.33

\*\*\*, \*\* and \* indicate significance at 1, 5 and 10 per cent level.

(Period - I: 1980-1990, Period-II: 199-2000, Period -III: 2000-2010, Period-IV: 2010-2017, Overall - 1980-2017-18.

## Conclusions

1. The growth of area, production and productivity was positive and significant for the overall period (1980-2018) in most of districts in Maharashtra *viz.* Thane, Raigad, Dhule, Jalgaon, Ahmednagar, Pune, Satara, Solapur, Sangli, Aurangabad, Jalna, Beed, Latur, Osmanabad, Nanded, Parbhani, Buldhana, Akola, Amravati, Yavatmal, Wardha, Nagpur, Gondia and Chandrapur. It indicates that the production of chickpea was increased by both area expansion and productivity improvement in these districts.
2. The Coefficient of Variation indicates that the area under chickpea was highly fluctuating and instable in all the districts of Maharashtra except Latur district. The CV was instable during overall period (1980-18) for all the districts Maharashtra *viz.*; Raigad, Nashik, Nandurbar, Pune, Kolhapur, Latur, Amravati, Gondia, Thane, Dhule, Jalgaon, Ahmednagar, Solapur, Satara, Sangli, Aurangabad, Jalna, Beed, Osmnabad, Nanded, Parbhani, Hingoli, Buldhana, Washim, Yavatmal, Wardha, Nagpur, Bhandara and Chandrapur. The area, production and productivity were inconsistent for the entire period in all the regions of the State except in Konkan region.

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