



Status, Growth and Variability of Chickpea Production in India

Neelam Kumari¹, Dharmpal Malik¹

10.18805/ag.D-6065

ABSTRACT

Background: Chickpea is the largest produced food legume in South Asia and the third largest produced food legume globally. It has been well recognized as a valuable source of protein in India where majority of the population is vegetarian. In spite of biggest producer of pulses in Asian Continent, India additionally imports a large quantity of pulses per year to satisfy the growing domestic demand. The current study aimed to study the growth in production and its possible causes to narrow down wide gap between demand and supply of pulses in India.

Methods: The investigation was relied mainly on the secondary data i.e. time series data on area, production and productivity of chickpea in major states and at all India level. The chickpea growing states were selected contributing at least 80 percent of share with respect to area during 2020-21. The paper examined time series data pertaining to the period 1970-71 to 2020-21. The analytical tools like compound growth rate and Cuddy-Della Valle Index were used.

Result: In all the major chickpea producing states area, production and productivity exhibited positive growth rate. But the main reason for increase in chickpea production was expansion in area as compared to productivity in recent years due to highest increase in MSP in recent years. At all India level, all the particulars exhibited positive growth. In Madhya Pradesh productivity of chickpea had shown higher instability than area while all the other states and India as a whole exhibited higher instability in area.

Key words: Chickpea, Growth rate, Instability.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an annual legume plant of the family *Fabaceae*. Chickpea is a *rabi* season crop. Based on their seed color and geographic distribution, chickpea biotypes are divided into two distinct groups as kabuli and desi. In India and Pakistan, the chickpea grown is Desi type, whereas Kabuli type chickpea is cultivated mainly in Turkey (Macar *et al.*, 2017). Desi (originated from India) cultivars have small, wrinkled and dark coloured seeds and Kabuli (originated from Mediterranean and the Middle East) cultivars have large, smooth coated and white to cream coloured (Purushothaman *et al.*, 2014). Chickpea is considered to be unique because of its high level of protein content that accounts for almost 40% of its weight (Merga and Haji, 2019). Chickpea seeds are used for food and feed purposes, not only for excellent nutritional value but also for rich bioactive compound contents, such as phenolics and flavonoids (Magalhaes *et al.*, 2017). As an annual grain legume, it is important not only for its highly nutritive value but also for its ability to maintain soil fertility by fixing atmospheric nitrogen (Dutta *et al.*, 2022).

Chickpea is the largest produced food legume in South Asia and the third largest produced food legume globally, with a cultivated area of 14.84 million ha, production of 15.08 million tonnes and an average productivity of 1.01 tonnes ha⁻¹ in 2020. Chickpea is grown all over the world under varied environmental conditions. Asia dominated in chickpea production with 86 percent of regional contribution followed by Africa (4.70%), Americas (4.60%), Europe (1.90%) and Oceania (1.80%). Although this crop is cultivated in all the continents around the world, India (73.46%), Pakistan (3.30%), Russia (1.93%), United

¹Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125 001, Haryana, India.

Corresponding Author: Neelam Kumari, Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125 001, Haryana, India. Email: luhachneelam12@gmail.com

How to cite this article: Kumari, N. and Malik, D. (2024). Status, Growth and Variability of Chickpea Production in India. *Agricultural Science Digest*. 1-9. doi: 10.18805/ag.D-6065.

Submitted: 20-05-2024 **Accepted:** 25-10-2024 **Online:** 27-12-2024

states of America (1.28%), Myanmar (3.19%), Australia (1.86%), Canada (1.42%), Turkey (4.18%), Mexico (0.83%) and Ethiopia (3.03%) are the major producing countries, together accounting for 94 percent of global production during 2020. India is the single largest producer of chickpea in the world, sharing for 73 percent (11.08 million tonnes) of the total production under chickpea (FAOSTAT, 2022).

Chickpea is an important source of protein for millions of people in the developing countries, particularly in South Asia, who are largely vegetarian either by choice or because of economic reasons. In addition to having high protein content (20-22%), chickpea is rich in fiber, minerals (phosphorus, calcium, magnesium, iron and zinc) and β -carotene (Jukanti *et al.*, 2012). It has been well recognized as a valuable source of protein for Indian vegetarian population. It is consumed as a dry pulse after cooking, germinating, soaking or as a green vegetable. It is also used for the preparation of various sweets and spicy dishes where either the split grains or flour (besan) are used besides dhal (Kumar *et al.*, 2019).

Notwithstanding its distribution throughout the country, five states viz, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Rajasthan together contributed more than 80 percent of total chickpea area in the country. Chickpea in India cultivated about 9.70 million ha producing 11.08 million tonnes of grains, contributing 35 and 42 per cent of the national pulses acreage and production, respectively.

The chickpea production in the country had gone up from 5.2 to 11.9 million tonnes during last five decades, registering a modest growth. During the same period, area increased from 7.83 to 9.99 million ha and productivity has steadily increased from 663 kg ha⁻¹ to 1192 kg ha⁻¹. Average yield of some of the improved chickpea varieties reported by Anonymous (2023) were like GJG 0809 (16q ha⁻¹), GNG 1958 (26.8 q ha⁻¹), CSJ 515 (24 q ha⁻¹) and Raj Vijay gram 201 (JSC 40) (15-20 q ha⁻¹). As we can see that the national productivity was much lower than the Average yield of high yielding varieties of chickpea in our country. So, it becomes necessary to know the reasons for this yield gap. In present study, trend and variability in area, production and productivity was estimated in all the major states as well as at country level. The study was under taken during 2021-22 and 2022-23 at CCS HAU Hisar, Haryana with the objectives to analyze the growth and instability in area, production and productivity of chickpea.

MATERIALS AND METHODS

The chickpea growing states were selected contributing at least 80 per cent of share with respect to area during 2020-21. As per the above criteria, Karnataka, Gujarat, Maharashtra, Rajasthan and Madhya Pradesh were selected. To study temporal variations in chickpea production, the study period was divided into the following five periods: overall study period (1970-71 to 2020-21) was divided into five sub-periods, as period-I (1970-71 to 1979-80), period-II (1980-81 to 1989-90), period-III (1990-91 to 1999-2000), period-IV (2000-01 to 2009-10) and period-V (2010-11 to 2019-20). To study the spatial movement of chickpea cultivation over time, the states were grouped into three zones based on their geographical location. The southern zone includes Karnataka while the western zone includes Gujarat, Maharashtra and Rajasthan. The central zone had only two states, Madhya Pradesh and Chhattisgarh. Also, the states which were bifurcated after 1970-71 were merged with the parent states. Hence, area and production of Chhattisgarh were combined with Madhya Pradesh.

Breusch-Godfrey test for Autocorrelation

A time series is a sequence of data points that occur in successive order over some period of time. Data used for study is also time series data and this data could be autocorrected. So, to know that about autocorrelation of data Breusch–Godfrey test was used in STATA. The Breusch-Godfrey test results indicate no evidence of autocorrelation in the residuals of chickpea data.

Growth rate

Growth rates refer to the percentage change of a specific variable within a specific time period. Growth rates can be beneficial in assessing a variables performance and predicting future performance. CAGR is a widely used method due to its simplicity and flexibility. The functional form is:

$$Y_t = ab^t \quad \dots (1)$$

Where,

Y_t = Area, production and productivity of pulses in the year t.

a = Intercept.

b = Regression coefficient.

t = Time variable.

The equation (1) was transformed into log-linear and written as:

$$\text{Log } Y = \text{log } a + t \text{ log } b \quad \dots (2)$$

Equation (2) was estimated by using Ordinary Least Square (OLS) technique.

The compound growth rate (r) was then estimated by using the equation (3)

$$r = (\text{antilog } b - 1) 100 \quad \dots (3)$$

Where,

r = Estimated compound growth rate per annum in percentage.

b = Antilog of regression coefficient value.

Instability index

Instability analysis represents the uncertainty, with the help of indicators like Coefficient of variation, standard deviation and instability index, etc. Instability analysis in the area, production and productivity of chickpea was studied using CDI (Cuddy-Della Valle index). Coefficient of variation around the trend (CVt) rather than co-efficient of variation around the mean (CV) was suggested by Cuddy and Della (1978) as a better measure of variability. A low value of this index indicates low instability and vice-versa. The formula for Cuddy-Della Valle index is given below:

$$CDI = CV_{\text{Trend}} = (CV) \times \sqrt{1 - \text{Adj. } R^2}$$

Where,

$$CV_{\text{Mean}} = (SD/\text{Mean}) \times 100$$

$$\frac{\frac{(RSS)}{(r-k)}}{\frac{TSS}{n-1}}$$

i.e. ratio of explained variation to total variation.

ESS = Variation explained by the explanatory variable.

TSS = Total variation.

Based on value of CDI, the range has been divided in three categories (Sihmar, 2014) i.e. low instability (0 to

15%), Medium instability (>15d" 30%) and high instability (> 30%).

RESULTS AND DISCUSSION

Area, production and productivity of chickpea in India

Chickpea is cultivated under rainfed as well as irrigated conditions as a winter season crop in India. Area and production share of chickpea in southern zone (Karnataka),

western zone (Gujarat, Maharashtra and Rajasthan) and central zone (Madhya Pradesh) depicted in Table 1. In these states, production of chickpea increased and area expansion was the main reason for increase. But in some of the traditional areas (Uttar Pradesh) chickpea has been drastically replaced by wheat and mustard. The crop found new niches in Karnataka and Maharashtra. Area under chickpea started increasing continuously from 2006-07 mainly on account of higher adoption of improved short-

Table 1: Area, production and productivity of chickpea in India: 1970-2021. Area: '000 ha, Production: '000 tonnes, Productivity: kg ha⁻¹

	Period	Southern zone		Western zone		Central zone	All India
		Karnataka	Gujarat	Maharashtra	Rajasthan	Madhya Pradesh	
Area	TE1973	1.95	0.63	4.60	19.65	21.70	7573.00 (100.00)
	TE1976	2.22	0.75	5.45	21.10	24.26	7707.67 (100.00)
	TE1981	2.17	0.92	6.31	20.45	26.88	7092.67 (100.00)
	TE1986	2.59	1.46	7.03	24.10	29.56	7290.00 (100.00)
	TE1991	3.09	1.87	9.46	19.61	32.96	6934.00 (100.00)
	TE1996	4.87	2.98	10.28	21.07	37.23	7006.00 (100.00)
	TE2001	5.27	1.23	12.69	22.55	37.15	6600.00 (100.00)
	TE2006	6.51	2.13	12.78	15.64	42.28	6896.33 (100.00)
	TE2011	7.00	1.91	15.34	15.55	38.75	8416.00 (100.00)
	TE2016	10.69	2.15	17.69	16.78	36.72	8809.67 (100.00)
Production	TE2021	9.25	4.77	20.41	21.11	28.02	9747.23 (100.00)
	TE1973	0.97	0.76	1.84	19.46	21.01	4939.00 (100.00)
	TE1976	1.64	0.88	3.39	21.50	24.49	4664.67 (100.00)
	TE1981	1.46	1.02	3.58	23.79	22.49	4474.33 (100.00)
	TE1986	1.42	1.75	3.91	24.38	28.38	5033.33 (100.00)
	TE1991	1.40	1.69	7.49	18.29	33.23	4900.67 (100.00)
	TE1996	3.03	3.40	8.16	19.57	39.52	5465.33 (100.00)
	TE2001	3.91	1.12	9.59	19.96	42.41	5258.00 (100.00)
	TE2006	3.72	2.22	9.48	11.67	47.53	5595.67 (100.00)
	TE2011	7.06	2.21	14.01	13.70	41.48	7585.67 (100.00)
Productivity	TE2016	8.58	2.76	14.58	14.18	43.27	7972.00 (100.00)
	TE2021	5.15	6.53	18.32	20.54	32.27	10975.89 (100.00)
	TE1973	-51.79	20.55	-62.12	-0.56	-3.27	652.00 (100.00)
	TE1976	-25.71	12.19	-37.67	-0.17	1.50	601.67 (100.00)
	TE1981	-32.24	12.06	-42.96	14.18	-14.71	627.67 (100.00)
	TE1986	-45.40	16.17	-44.19	0.39	-3.92	688.67 (100.00)
	TE1991	-54.65	-10.53	-16.63	-6.09	0.57	705.67 (100.00)
	TE1996	-38.36	-15.37	-20.25	-8.01	-7.73	778.67 (100.00)
	TE2001	-25.76	-19.66	-25.04	-15.04	8.28	793.33 (100.00)
	TE2006	-41.66	4.23	-26.79	-25.10	2.55	811.33 (100.00)
	TE2011	-18.85	14.38	-9.65	-15.64	3.23	901.67 (100.00)
	TE2016	-27.82	41.95	-18.48	-8.14	6.47	896.33 (100.00)
	TE2021	-43.23	33.16	-11.26	-2.13	-6.12	1125.00 (100.00)

Note 1: TE= Triennium ending.

Note 2: TE 1973: (1970-71to 1972-73); TE 1976: (1973-74to , 1975-76); TE 1981: (1978-79, 1979-80,1980-81); TE 1986: (1983-84, 1984-85, 1985-86); TE 1991: (1988-89, 1989-90, 1990-91); TE 1996: (1993-94, 1994-95, 1995-96); TE 2001: (1998-99, 1999-00, 2000-01); TE 2006: (2003-04, 2004-05, 2005-06); TE 2011: (2008-09, 2009-10, 2010-11); TE 2016: (2013-14, 2014-15, 2015-16); TE 2021: (2018-19, 2019-20, 2020-21).

Note 3: Area and production represented as percentage share of states to all India and productivity of state as percentage changes over productivity at all India level.

duration and wilt-resistant varieties in central, western and south India, particularly in Maharashtra and Karnataka. Similar finding was reported (Gowda *et al.*, 2013). Over the period, chickpea production share in states namely, Karnataka, Gujarat and Maharashtra increased significantly from 0.97 to 5.15 per cent, 0.76 to 6.53 per cent and 1.84 to 18.32 per cent, respectively.

Karnataka, Gujarat, Maharashtra, Rajasthan and Madhya Pradesh showed significant expansion during TE-2021. Madhya Pradesh was the largest chickpea cultivating and producing state throughout the study period. Productivity improvement has been witnessed in all the states and highest productivity was observed in Gujarat of 1498 kg ha⁻¹ in TE-2021. In Maharashtra, productivity increased more than four-fold over five decades. The availability of improved varieties and increased irrigation facilities resulted in raising productivity in different chickpea producing pockets of the country. Joshi and Saxena (2002) also reported that productivity of chickpea witnessed improvement in major states. Even though productivity across major chickpea cultivating states has increased the average productivity in India as a whole showed tenuous increase from 652 kg ha⁻¹ in TE-1973 to 896 kg ha⁻¹ in TE-2016 to a sharp incline to 1125 kg ha⁻¹ during TE-2021. This increase in productivity may be attributed to increased efforts by the government through NFSM pulses by undertaking new initiatives like seed hub and breeder seed production programs for quality seed production and seed minikit and cluster FLDs for distribution of quality seed,

establishment/strengthening of bio-fertilizer and bio-control production units for integrated pest management from year 2016-17. Area of chickpea moved from the traditional Indian green revolution belt to the central and southern parts. This result was also indicated by Joshi and Rao (2016) in their study.

Growth in area, production and productivity of chickpea in India

During period-I, all the major chickpea producing states exhibited positive growth rate in area (Table 2). Analyzing chickpea growth performance across periods, the results were quite clear, in the first and second decade, a declining growth rate was found in area, production and productivity. The decline in area under chickpea was mainly due to substitution with high yielding varieties of cereals particularly in Punjab, Haryana, Rajasthan, Uttar Pradesh, Bihar and West Bengal. The results were in line with Kumar (1978), Sadasivan (1989) and Lingareddy (2015). During period-II, increasing growth in productivity (0.74%) was observed. During period-III, IV and V all the particulars exhibited increasing trends. Similar trends were observed by Ahlawat *et al.* (2016) in period-I, II and III Narayan and Kumar (2015) for period-II, III and IV and with Kumar *et al.* (2019) for period-I, II, III and IV.

Karnataka enjoyed positive growth rate in area and production throughout the study period but productivity exhibited negative growth in period-II (2.81%) and period-V (0.46%). Similar growth trends were reported by Acharya

Table 2: Growth in area, production and productivity of chickpea in India: 1970-2021.

(Per cent)

	Period	Southern zone		Western zone		Central zone	All India
		Karnataka	Gujarat	Maharashtra	Rajasthan	Madhya Pradesh	
Area	Period-I	0.97	5.10	3.68*	1.21	2.22**	-0.18
	Period-II	6.13***	-4.39	4.45***	-5.13	1.05	-1.53
	Period-III	5.99**	-0.08	5.76***	3.13	1.59*	1.26
	Period-IV	8.51***	24.15***	8.24***	5.64	2.84**	4.32***
	Period-V	1.81	4.11	5.98**	2.54	-1.40	1.50
	Overall period	4.69***	3.30***	3.52***	-0.25	1.36***	0.43***
Production	Period-I	3.83	1.35	7.91	3.42	-0.61	-0.60
	Period-II	3.11	-8.37	8.61**	-5.66	2.09	-0.80
	Period-III	11.58**	0.46	7.09*	5.93	4.38***	2.96*
	Period-IV	8.87***	34.21***	13.93***	4.62	4.84*	5.99***
	Period-V	1.59	7.25	7.76*	5.78	1.46	3.48*
	Overall period	6.20***	4.66***	6.11***	0.42	3.03***	1.55***
Productivity	Period-I	2.96	-3.50	4.18	2.17	-2.77*	-0.40
	Period-II	-2.81**	-4.11**	3.97	-0.56	1.03	0.74
	Period-III	5.30**	1.04	1.25	2.70*	2.75***	1.69**
	Period-IV	0.31	8.05***	5.26***	-0.97	2.95**	1.60*
	Period-V	-0.46	3.22***	1.68	3.34**	0.25	1.95*
	Overall period	1.37***	1.37***	2.51***	0.72***	1.36***	1.11***

Note 1: Period-I: (1970-71 to 1979-80); Period-II: (1980-81 to 1989-90); Period-III: (1990-91 to 1999-2000); Period-IV: (2000-01 to 2009-10); Period-V (2010-11 to 2019-20) and overall period (1970-71 to 2020-21).

Note 2: ***, ** and * are significant at 1, 5 and 10 per cent respectively.

et al. (2012). Gujarat exhibited positive growth rate in production except period-II (-8.37%) and in area except period-II (-4.39%) as well as period-III (-0.08%) while productivity exhibited negative growth in period-I (-3.50%) as well as II (-4.11%). Maharashtra revealed positive growth rates in all the particulars and highest growth was observed in period-IV (area 8.24%, production 13.93% and productivity 5.26%). The results were in line with More *et al.* (2015) and the production increase was mainly owing to area expansion as productivity growth was not even as this crop is sensitive to weather at different states of growth.

Rajasthan reflected positive growth in production except period-II (-5.66%), area except in period-II (-5.13%) and overall period (-0.25%) and productivity in period-II (-0.56%) and period-IV (-0.97%). But the growth rates in area and production in Rajasthan were not significant. Increase in acreage was observed as the major reason for increased production in the state. Sood *et al.* (2020) observed similar trends in area, production and productivity in 2000s. Madhya Pradesh demonstrated positive growth rate in area except period-V (-1.40%) and in production except period-I (-0.61%) due to negative growth in productivity during this period (-2.77%). The growth rates of major chickpea producing states were in line with Maharjan and Grover (2018). Some government programs were introduced in period-II and as a result of which, increasing growth in productivity (0.74%) was observed. During period-III, IV and V all the particulars exhibited increasing trends in India and almost states due to government interventions like TMOP, ISOPOM, NFSM as a result of which area and productivity of chickpea increased and resulted in increased production. According to Kumar *et al.* (2019), improvement in productivity, has contributed to higher chickpea production in recent years. In order to give much needed fillip to pulse production, the government has included pulses in the NFSM and has been significantly increasing MSP for chickpea and most pulses. This has resulted in an above normal growth in chickpea production in recent years taking India towards achieving self sufficiency.

In all the major chickpea producing states area, production and productivity exhibited positive growth rates but the main reason for increase in chickpea production was expansion in area under this crop compared to productivity in recent years due to highest increase in prices among rabi pulses in last twenty years. Several cultivars with high yield potential, early maturity and durable resistance to fusarium wilt have been released for cultivation in the semi-arid regions of central and southern India and their adoption showed impact on enhancement of chickpea production in short season environments. The popularization of improved, disease resistant varieties and production technology through frontline demonstrations has led to significant increase in production and productivity in western Maharashtra. The soybean-chickpea rotation has become popular in central Madhya Pradesh. In Karnataka, improved varieties of chickpea have led to gradual shift in the cropping system from rabi sorghum to chickpea Gowda *et al.* (2009).

Trends in performance of chickpea in India

From Fig 1-3 the trends in area (Fig 1), production (Fig 2) and productivity (Fig 3) of chickpea are presented. The trends showed annual upward movement throughout the entire study period based on log linear graphs, nonetheless, a deliberate reflection of all the data pointed out that, there were variations in the upward movement in data sets. The R² values of area (0.16), production (0.56) and productivity (0.76) suggested that 16, 56 and 76 percent of variation in the respective trends were predicted by the independent variable (time) were highly significant ($P < 0.01$).

Instability in area, production and productivity of chickpea in India

The variability of chickpea in terms of area was depicted in Table 3. Increasing trend in the initial periods from period-I to III and decreased in period-IV and V. Instability indices were found on higher side during 1980 to 2010 and this might be due to impact of TMOP wherein additional area might have been brought under cultivation by increased

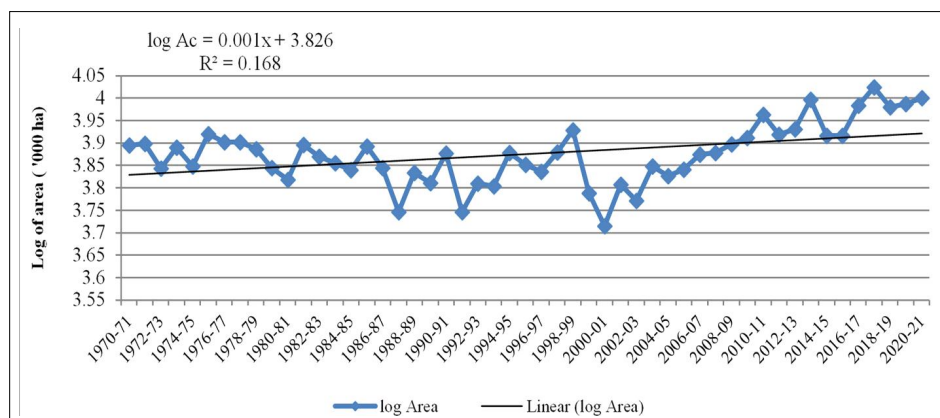


Fig 1: Trends in area of chickpea in India.

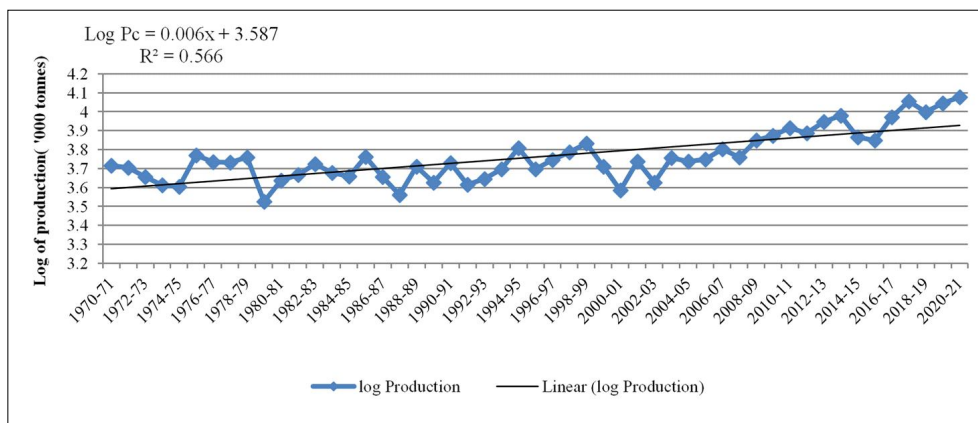


Fig 2: Trends in Production of chickpea in India.

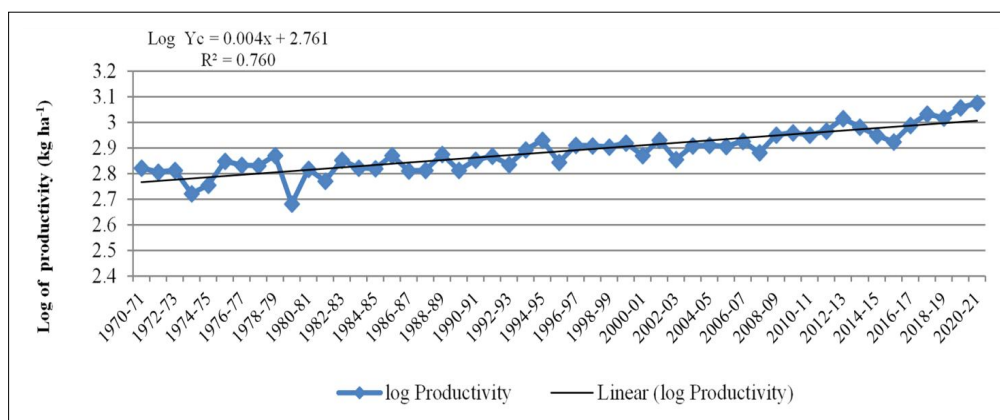


Fig 3: Trends in productivity of chickpea in India.

number of growers. Similar results were observed by Sharma *et al.* (2013). However, the variability in terms of productivity was decreasing from period-I to III but increased in period-IV and V. Devegowda *et al.* (2019) also exhibited similar trends in area, production and productivity instability during period-III and IV. Chand and Raju (2008) also indicated that the variability of the chickpea area increased from time to time but the variability of its productivity sharply decreased after 1988. Bisht and Kumar (2018) and Bairwa *et al.* (2020) observed similar trends in 2000s. In the first period, the maximum uncertainty in productivity caused the maximum variability in production. In the second period, the instability of the area increased marginally but productivity declined to half leading to decline in production instability. The productivity was more stable than area and production. So, we can say that variation in production was caused by area. The overall period was characterized by a higher degree of variability than individual time periods, which indicates variations in area allocation and productivity in states as well as country level. The results were in line with Kumar *et al.* (2019) for period-I, II, III and IV.

In Karnataka, area instability increased from period-I to III but declined in subsequent periods. Productivity instability declined drastically from period-I to II but showed

gain in period-III, IV and V. Production Instability declined from period-I to II but increased in period-III and registered decline in recent periods. During overall period, area and production were highly unstable but productivity was comparatively stable. In Gujarat, area, production and productivity instability followed irregular trend but area and production instability increased while productivity instability declined. The results were in line with More *et al.* (2015). In overall period, area and production registered high instability while productivity registered medium instability.

In Maharashtra, production and productivity instability increased from period-I to II, declined in period-III and IV but increased in period-V. Area showed instability decline from period-I to II increased in subsequent periods. In overall period, production was found highly unstable but area and productivity registered medium instability. In Rajasthan area showed higher instability than productivity but in period-IV and V productivity was found more instable. As in Rajasthan cultivation of chickpea lacks assured irrigation facilities. Due to which there is high risk of crop failure. Sood *et al.* (2020) observed similar results. In Madhya Pradesh, Production and productivity instability declined from period-I to III but showed increasing trend in recent periods. Area instability followed irregular trend but

Table 3: Instability in area, production and productivity of chickpea in India: 1970- 2021. (Per cent)

Period	Southern zone						Western zone					
	Karnataka			Gujarat			Maharashtra			Rajasthan		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Period-I	8.91	28.06	24.55	20.86	32.85	22.86	13.07	23.56	18.20	14.05	29.69	19.68
Period-II	12.86	19.38	10.17	43.64	50.68	14.91	6.84	29.12	20.81	23.32	30.72	12.26
Period-III	19.37	29.02	15.70	29.70	40.90	16.69	11.35	23.52	16.60	31.91	38.49	12.72
Period-IV	18.35	25.06	16.03	36.30	38.03	11.08	11.03	19.83	9.57	21.30	30.16	20.90
Period-V	12.01	12.58	16.08	32.52	44.63	8.63	14.59	27.30	16.28	21.63	29.57	11.69
Overall period	32.52	44.40	18.18	69.86	115.76	24.75	25.36	51.10	17.28	30.41	44.20	19.02
Period	Central zone						All India					
	Madhya Pradesh											
	A	P	Y	A	P	Y	A	P	Y	A	P	Y
Period-I	6.90	11.18	11.77				6.23	17.09	13.03			
Period-II	7.00	10.01	4.96				8.60	12.74	6.97			
Period-III	5.72	7.91	6.06				11.62	13.36	5.90			
Period-IV	8.28	17.16	10.30				4.56	9.21	6.08			
Period-V	12.02	16.68	12.02				7.65	12.50	7.59			
Overall period	11.18	18.68	12.30				13.90	22.20	9.44			

Note 1: Period-I: (1970-71 to 1979-80); Period-II: (1980-81 to 1989-90); Period-III: (1990-91 to 1999-2000); Period-IV: (2000-01 to 2009-10); Period-V (2010-11 to 2019-20) and overall period (1970-71 to 2020-21).

Note 2: A=Area, P=Production, Y= Productivity.

increased compared to period-I with time. Area and productivity showed low instability but production registered medium instability. In Madhya Pradesh chickpea productivity has shown higher instability than area while all the other states and India as a whole showed higher instability in area. High level of fluctuation in chickpea production may be due to biotic and abiotic stress and its cultivation on marginal lands.

CONCLUSION

The potential of pulses to help and address the future food security, nutritional and environmental sustainability needs has been acknowledged through UN declaration 2016 as international year of pulses. The results concluded that chickpea emerged as the major pulse crop and it performed better over the time period. Area and production share of chickpea showed considerable growth in southern zone (Andhra Pradesh and Karnataka), western zone (Gujarat, Maharashtra and Rajasthan) and central zone (Madhya Pradesh). The growth rates in area, production and productivity of chickpea (0.43%, 1.55% and 1.11%) in India from 1970-2021 reflected an increasing trend. However, area increase in case of chickpea was meagre. In all the major states except Madhya Pradesh as well as at all India level, area was found more unstable than productivity as planting of crop largely dependent on rains. The positive growth rate in productivity of chickpea during time period 1970-2021 indicated that technological and price support had been reflected positive towards production of the crop in major states as well as country level. Overall performance of chickpea was quite impressive which could be seen by positive growth rate and lower productivity variation, reflecting positive sign for achieving food and nutritional security.

ACKNOWLEDGEMENT

The authors are thankful to the Department of Agricultural Economics, CCS HAU for providing necessary facilities for work.

Author contributions

Conceptualization, resources, writing-review, editing, methodology, data curation, software, formal analysis, investigation and writing, original draft preparation were performed by Dr. Neelam Kumari.; supervision and validation was done by Dr. Dharmpal Malik. All authors have read and agreed to the published version of the manuscript.

Ethical approval

Authors declare this manuscript does not include any studies using animal and human beings.

Consent to publication

All authors read and approved the final manuscript.

Conflict of interest

The authors declare no conflict of interest.

REFERENCES

- Acharya, S.P., Basavaraja, H., Kunnal, L.B., Mahajanashetti, S.B. and Bhat, A.R.S. (2012). Growth in area, production and productivity of major crops in Karnataka. *Karnataka Journal of Agricultural Sciences*. 25: 431-436.
- Ahlawat, I.P.S., Sharma, P. and Singh, U. (2016). Production, demand and import of pulses in India. *Indian Journal of Agronomy*. 61 (4th IAC Special issue): S33-S41.
- Anonymous (2023). DPD, Bhopal. GoI, Ministry of Agriculture and Farmers Welfare, Directorate of Pulses Development, Vindhyachal Bhawan. Retrieved from <https://dpd.gov.in/VARIETIES-Web%20site.pdf>. Accessed on 20th March, 2023.
- Bairwa, K.C., Balai, H.K., Meena, G.L., Prasad, D., Kumari, Y., Singh, H. and Yadav, A. (2020). Inter-temporal performance of pulse crops: In Indian context. *Economic Affairs*. 65: 371-378.
- Bisht, A. and Kumar, A. (2018). Growth and instability analysis of pulses production in India. *International Journal of Agriculture Sciences*. 10: 6722-6724.
- Chand, R. and Raju, S.S. (2008). Instability in Andhra Pradesh Agriculture-A Disaggregate Analysis. *Agricultural Economics Research Review*. 21: 283-288.
- Devegowda, S.R., Singh, O.P., Kushwaha, S. and Nagaveni, M. (2019). Analysis of variability on pulses in India. *The Pharma Innovation Journal*. 8: 440-444.
- Dutta, A., Trivedi, A., Nath, C.P., Gupta, D.S. and Hazra, K.K. (2022). A comprehensive review on grain legumes as climate smart crops: Challenges and prospects. *Environmental Challenges*. 7: 1-13.
- Food and Agriculture Organization of the United Nations. (2022). FAOSTAT statistical database. [Rome]:FAO. <https://www.fao.org/faostat/en/#data>.
- Gowda, C.L.L., Srinivasan, S., Gaur, P.M. and Saxena, K.B. (2013). Enhancing the Productivity of Production of Pulses in India. [http://oar.icrisat.org/7101/1/EnhancingThe Productivity-2013.pdf](http://oar.icrisat.org/7101/1/EnhancingThe%20Productivity-2013.pdf).
- Gowda, C.L.L., Rao, P.P., Tripathi, S., Gaur, P.M. and Deshmukh, R.B. (2009). Regional Shift in Chickpea Production in India. *Milestones in Food Legumes Research*. pp: 21-35.
- Joshi, P.K. and Saxena, R. (2002). A Profile of Pulses Production in India: Facts, Trends and Opportunities. *Indian Journal of Agricultural Economics*. 57: 326-339.
- Joshi, P.K. and Rao, P.P. (2016). Global and Regional Pulse Economics: Current Trends and Outlook. IRPRI Discussion Paper 01544. Washington, D.C: International Food Policy Research Institute (IFPRI). http://ebrary.ifpri.org/cdm/ref/collection/p15738_collz/id/130480.
- Jukanti, A.K., Gaur, P.M., Gowda, C.L.L. and Chibbar, R.N. (2012). Nutritional quality and health benefits of chickpea (*Cicer arietinum* L.): A review. *British Journal of Nutrition*. 108: S11-S26.
- Kumar, B.L. (1978). Declining trend in production of pulses and factors affecting it. *Economic and Political Weekly*. 13: 1112-1114.
- Kumar, H., Bhatt, S., Devraj and Kumar, R. (2019). Growth and decomposition analysis of chickpea production in India. *Journal of Food Legumes*. 32: 186-188.
- Lingareddy, T. (2015). Pulses: Need for production expansion. *Economic and Political Weekly*. 50: 133-136.

- Macar, T.K., Macar, O., Mart, D.I. (2017). Variability in some biochemical and nutritional characteristics in Desi and Turkish Kabuli Chickpea (*Cicer arietinum* L.) Types. Celal Bayar University Journal of Science.13: 677-680.
- Magalhaes, S.C., Taveira, M., Cabrita, A.R., Fonseca, A.J., Valentao, P. and Andrade, P.B. (2017). European marketable grain legume seeds: Further insight into phenolic compounds profiles. Food Chemistry. 215: 177-184.
- Maharjan, N.K. and Grover, D.K. (2018). Estimation of growth trends and impact assessment of National Food Security Mission on chickpea production in India. Economic Affairs. 63: 941-951.
- Merga, B. and Haji, J. (2019). Economic importance of chickpea: Production, value and world trade. Cogent Food and Agriculture. 5: 1-12.
- More, S.S., Singh, N. and Kuthe, S.B. (2015). Performance of pulses crops in Gujarat state - A decomposition analysis. International Journal of Agriculture Sciences. 7: 510-515.
- Narayan, P. and Kumar, S. (2015). Constraints of growth in area production and productivity of pulses in India: An analytical approach to major pulses. Indian Journal of Agricultural Research. 49: 114-124. doi: 10.5958/0976-058X.2015.00017.7.
- Purushothaman, R., Upadhyaya, H.D., Gaur, P.M., Gowda, C.L.L., Krishnamurthy, L. (2014). Kabuli and desi chickpeas differ in their requirement for reproductive duration. Field Crop Research. 163: 24-31.
- Sadasivan, S. (1989). Pattern of pulses production: an analysis of growth trends. Economic and Political Weekly. 24: A167-A180.
- Sharma, M.K., Sisodia, B.V.S. and Lal, K. (2013). Growth and trends of pulse production in India. Journal of Food Legumes. 26 (1 and 2): 86-92.
- Sihmar, R. (2014). Growth and instability in agricultural production in Haryana: A district level analysis. International Journal of Scientific and Research Publications. 4: 1-7.
- Sood, S., Singh, H. and Sethi, D. (2020). Growth performance and instability of pulses in the state of Rajasthan. Indian Journal of Agricultural Research. 54: 1-5. doi: 10.18805/IJARE.A-5409.