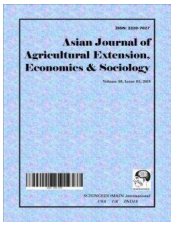

Asian Journal of Agricultural Extension, Economics & Sociology
14(2): 1-5, 2016; Article no.AJAEES.30567
ISSN: 2320-7027

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Performance of Growth and Instability of Chickpea (*Cicer arietinum*) in India

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2016/30567
Editor(s):
(1) Jurislav Babic, Faculty of Food Technology, University of Osijek, Croatia.
Reviewers:
(1) Upasana Mohapatra, Orissa University of Agriculture and Technology, India.
(2) Ejike Emmanuel Ikenganyia, Enugu State University of Science and Technology, Nigeria.
Complete Peer review History: http://www.sciencedomain.org/review-history/17367

Original Research Article

Received 17th November 2016
Accepted 22nd December 2016
Published 28th December 2016

ABSTRACT

The performance of Chickpea in India was studied with the objectives, to know about growth rates and variability in area, production and productivity. The secondary data on area, production and productivity of Chickpea in India were collected from various government publications of agriculture. Data pertaining to the period of 30 years *i.e.* from 1985-86 to 2014-15. From study, it was revealed that, the area under Chickpea in period-II (2000-01 to 2014-15) was increased. The growth rates in case of production for period-I (1985-86 to 1999-2000) was 2.02 per cent which is significant at 10 per cent level. In period-II (2000-01 to 2014-15), the growth rate was found 5.35 per cent which is significant at 1 per cent level. It was seen that, the growth rate of productivity of Chickpea for the period-I (1985-86 to 1999-2000) was 1.49 per cent which was significant at 1 per cent level. In period-II (2000-01 to 2014-15), it was found non significant. India exhibited low variation in period-I (1985-86 to 1999-2000) in area under Chickpea. India exhibited low variation of production in period-I (1985-86 to 1999-2000) and high variation in overall period. It means that, area and production of gram in India was constant for period-I (1985-86 to 1999-2000) & period-II (2000-01 to 2014-15).

Keywords: Chickpea; growth rate; co-efficient of variation; coppocks instability index.

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1. INTRODUCTION

Chickpea (*Cicer arietinum*) belongs to a legume of the family fabaceae, subfamily faboideae. It is commonly known as gram or bengal gram. It is the most important pulse crop of India. Chickpea has been known in India for a long time. Chickpea ranks third in world production among peas and beans. In 2014-15, the area, production and productivity were 8251000 Ha, 7332000 Tonne and 889 Kg/Ha respectively [1]. In India, major Chickpea growing states are Madhya Pradesh, Rajasthan, Bihar, Maharashtra and Uttar Pradesh, etc. Among these states, Maharashtra ranks third in acreage under Chickpea after Madhya Pradesh and Rajasthan. Madhya Pradesh produces the major share of 40 per cent in the Indian gram production. Maharashtra constitutes 1427000 Ha area, producing 1088000 Tonne with the productivity of 762 Kg/Ha in 2014-15 [1]. The area under Chickpea in Maharashtra contributes about 16.68 per cent of total area under Chickpea in India, whereas production of Chickpea in Maharashtra state accounted 14.83 per cent in the total production of Chickpea in India. The different pulses play important role in sustainable production system and household nutrition security. Role of pulses in Indian agriculture needs hardly any emphasis. India is a premier pulse growing country. The pulses are an integral part of the cropping system of the farmers all over the country because these crops fit in well in the crop rotation and crop mixtures followed by them. Pulses are a wonderful gift of nature as they nourish mankind with highly nutritive food and keep the soil alive and productive. On account of these virtues, pulse crops remain an integral part of the sustainable agriculture production systems of the semi-arid tropics.

Chickpea is a major pulse crop grown in India. Release of high – yielding varieties of Chickpea and development of other improved production technologies have resulted, increasing in area under this crop and production levels are also increasing. With this view, the present study primarily aims at studying the growth rates in area, production, and productivity of the crop in India. This helps in knowing the trends in the crop production over the period of the study.

2. OBJECTIVES

To study the growth rates of area, production and productivity of Chickpea in India.

To study the degree of instability in area, production and productivity of Chickpea in India.

3. MATERIALS AND METHODS

The study is based on 30 years data. Secondary data were collected from various government publications of agriculture sector or databases such as Annual reports of pulses, Indiastat.com, Mahastat.com. Data pertaining for the year 1985-86 to 2014-15. The entire study was split up into two sub periods. The growth rates were calculated for two sub periods i.e. period-I (1985-86 to 1999-2000) and period-II (2000-01 to 2014-15). In order to study the variability in area, production and productivity in Chickpea, coefficient of variation and coppocks instability index were estimated for the study period separately.

4. ANALYTICAL TOOLS

For the present study, following analytical tools were used.

4.1 Compound Growth Rate

The compound growth rate of area, production and productivity of Chickpea crop were worked out by fitting an exponential function as given below

$$Y = ab^t$$

Where,

Y= Area, Production and productivity
a= Intercept
b= Regression coefficient
t = Time period (years)

From the coefficient values, the rates of compound growths will be work out by using the formula,

$$\mathrm{CGR(r)} = [\mathrm{Antilog}(\log b) - 1] \times 100$$

Where,

r = Compound growth rate in per cent.

4.2 Coefficient of Variation

$$\mathrm{C.V.}(\%) = \frac{\sigma}{\bar{x}} \times 100$$

Where,

σ - Standard deviation
$\bar{x}$- Arithmatic mean

4.3 Coppocks Instability Index

$$\text{Delta M} = \frac{\sum \log (X_t + 1) - \log (X_t)}{N-1}$$

$$V \log = \frac{\sum[\{\log X_t + 1 - logX_t\} - m]^2}{N-1}$$

$$C.I.I = \left[\text{Antilog}\left(\sqrt{V \log}\right) - 1\right] \times 100$$

Where,

V log = Logarithmic variance of the series.

5. RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads.

5.1 Growth performance of Chickpea in India

The compound growth rates of area, production and productivity of Chickpea in India is presented in Table 1.

An attempt was made to estimate the growth rates of area, production and productivity of chick pea with the help of growth rate model explained in methodology. The results obtained are shown below,

5.1.1 Area

It was observed from Table 1 that, the growth rate of area was found non significant in period-I. In period-II and overall period, the growth rate was found 3.51 per cent and 0.94 per cent respectively which was both significant at 1 per cent level. From this, it indicates that, the area under chick pea in period-II was increased as compaired to period-I [2].

5.1.2 Production

It was observed that, the growth rates in case of production for period-I was 2.02 per cent which is significant at 10 per cent level. In period-II, the growth rate was found 5.35 per cent which is significant at 1 per cent level [3]. In overall period, it was found non significant. From this, it indicates that, the production is significant in India has been bought by the increased yield in which the returns were made possible due to adoption of modern techniques.

5.1.3 Productivity

It is most important criteria of measuring the growth of any crop output. The success or failure of any improvement in the art of agriculture is measured by the resultant increase or decrease in the productivity. It was seen that, the growth rate of productivity of Chickpea for the period-I was 1.49 per cent which was significant at 1 per cent level. In period-II, it was found non significant. In over all period, it was 1.11 per cent which was significant at 1 per cent level. The growth of area, production and productivity in period-II was greater than period-I.

5.2 Instability in Chickpea

The degree of instability in area, production, and productivity of Chickpea in different periods was measured by using co-efficient of variation and coppocks instability index, which measures the absolute variation. The higher the co-efficient of variation, the greater is the instability and *vice versa*. Table 2 presents the co-efficient of variation and coppocks instability index in area, production and productivity of Chickpea in India.

5.3 Co-efficient of Variation

5.3.1 Area

It was revealed from Table 2 that, the co-efficient of variation for Chickpea for period-I, period-II and overall period were 11.87 per cent, 16.87 per cent and 15.12 per cent respectively [5,6]. From this, it was seen that, India exhibited low variation in period-I.

5.3.2 Production

It was seen from Table 2 that, the co-efficient of variation for Chickpea for period-I, period-II and overall period were 17.38 per cent, 24.78 per cent and 25.27 per cent respectively. From this, it was observed that, India exhibited low variation in case of production in period-I and high variation in overall period.

5.3.3 Productivity

It was revealed from Table 2 that, the co-efficient of variation for Chickpea for period-I, period-II and overall period were 9.28 per cent, 9.98 per cent and 11.93 per cent respectively. From this, it was seen that, India exhibited low variation in all periods. It means productivity of gram in all periods were constant [7,8]. From the above discussion, it is clear that the extent of variation was highest during the period-II as compared to period-I in area, production and productivity.

Table 1. Compound growth rates of area, production and productivity of chickpea in India

Sr. no.	Particulars	CGR (%)		
		Period-I (1985-86 to 1999-2000)	Period-II (2000-01 to 2014-15)	Overall
1.	Area	0.52	3.51***	0.94***
2.	Production	2.02*	5.35***	2.06
3.	Productivity	1.49***	1.77	1.11***

*Note: CGR- Compound growth rate, Significant at 1% ***, 5% **, 10% **

Table 2. Co-efficient of variation and coppocks instability index in area, production and productivity of chickpea in India

Sr. no.	Particulars	Period-I (1985-86 to 1999-2000)		Period-II (2000-01 to 2014-15)		Overall period	
		C.V	C.I.I	C.V	C.I.I	C.V	C.I.I
1.	Area	11.87	18.41	16.47	11.96	15.12	15.27
2.	Production	17.38	24.21	24.78	19.80	25.27	22.50
3.	Productivity	9.28	11.43	9.98	10.07	11.93	10.79

Note: C.V- Coefficient of variation, C.I.I.- Coppocks instability index

5.4 Coppocks Instability Index

The coefficient of variation measures the relative variation including trend, while Coppocks instability index measures the variation around the trend. The instability index was computed using Coppocks instability index [4] is as follows,

5.4.1 Area

It was observed from Table 2 that, Coppocks instability index for the period-I, period-II and overall period were 18.41 per cent, 11.96 per cent and 15.27 per cent respectively.

5.4.2 Production

It was observed from Table 2 that, Coppocks instability index for the period-I, period-II and overall period were 24.21 per cent, 19.80 per cent and 22.50 per cent respectively.

5.4.3 Productivity

It was observed from Table 2 that, Coppocks instability index for the period-I, period-II and overall period were 11.43 per cent, 10.07 per cent and 10.79 per cent respectively.

6. CONCLUSIONS

From study it was concluded that, area under chick pea in period-II was increased. The growth rates of production for period-I was 2.02 per cent which is significant. In period-II, the growth rate was found 5.35 per cent which is significant. It was seen that, the growth rate of productivity of Chickpea for the period-I was 1.49 per cent which was significant and in period-II, it was found non significant. India exhibited low variation in period-I in case of area and production of Chickpea. It means that, area and production of gram in India was constant for period-I. The co-efficient of variation for Chickpea in case of productivity for period-I, period-II and overall period were 9.28 per cent, 9.98 per cent and 11.93 per cent respectively.

7. POLICY IMPLICATION

1. Besides cereals, Chickpea in rabi season emerge as a good substitute for the other pulses.
2. Being pulse crop (Chikpea) it is subjected to the various processing processes which is ultimately contributing to the employment generation among the rurals.
3. Subsidizing the Chickpea processing industries can be helpful in enhancing its production in rural area which is ultimately cause of increase in rural income.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/17367