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Omprakash Maurya
Faculty, RSM (PG) College Dhampur, Bijnor, Uttar Pradesh, India

Hemant Kumar
Scientist, Indian Institute of Pulses Research, Kanpur, Uttar Pradesh, India

Correspondence
Omprakash Maurya
Faculty, RSM (PG) College Dhampur, Bijnor Uttar Pradesh, India

Growth of chickpea production in India

Omprakash Maurya and Hemant Kumar

Abstract
Chickpea is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. It is also one of the major pulse crops cultivated and consumed in India and also known as Bengal gram. In India, chickpea accounts for about 45% of total pulses production. Similar to the case of other pulses, India is the major chikpea producing country and contributing for over 75% of total world chickpea production. The chickpea production in the country has gone up from 3.65 to 9.53 million tones between 1950-51 and 2013-14, registering a modest growth. During the period while the area has also gone up from 7.57 to 9.93 million ha, the yield has steadily increased from 482 kg/ha to 960. The present data were broadly partitioned into seven decades in order to demonstrate the trend of chickepea production in more convincing and simple manner. The compound growth rates of production and yield of chickpea were found positive and negative for area. However growth in yield was estimated positive after eighites. Overall there was positive growth rate of production and yield, and marginal negative growth in area. The yield effect has a greater say in chickpea each decades separately except ninties. The interaction of area and yield is not much. Overall the production is increased mainly due to area effect.

Keywords: Chickpea, growth rate, instability, interaction

Introduction
Chickpea is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. It is also one of the major pulse crops cultivated and consumed in India and also known as Bengal gram. In India, chickpea accounts for about 45% of total pulses production. Similar to the case of other pulses, India is the major chikpea producing country and contributing for over 75% of total world chickpea production.

Economic importance
Chickpea is cultivated for its seeds. There is a growing demand for chickpea due to its nutritional value. It is rich source of protein contain about 17-20%. In the semi-arid tropics chickpea is an important component of the diets of those individuals who cannot afford animal proteins or those who are vegetarian by choice. Chickpea is a good source of carbohydrates and protein and cholesterol free. It is also good source of dietary fiber, vitamins and minerals.

Climate and cultivation
Chickpea is an important *Rabi* crop mainly sown in September-November and harvested in February-April. Crop duration is 90-120 days, depending on the variety. Desi varieties are short duration while kabuli varieties take relatively longer period to mature. Similarly, cooler like northern India take longer period, compared to relatively warm weather in southern parts of India. It is best suited to areas having low to moderate rainfall and a mid-cold weather. Excessive rains soon after sowing or at flowering stage are harmful for the crop. Severe cold is injurious, and is very harmful. It is best suited to areas having moderate rainfall of 600-900 mm per annum. It has an indeterminate growth habit, which means that the growth cycle extends as long as moisture is available.

Data and Methodology
The time series secondary data on area, production and yield of chickpea during the period 1950-51 to 2013-14 were collected from various sources mainly "Agricultural Statistics at a Glance", a publication of the government of India and www.indiaagristat.com. The present data were broadly partitioned into seven decades in order to demonstrate the trend of chickpea production in more convincing and simple manner. The partition of the data in decade's terms could clearly show the chickpea production status and growth pattern in the country.
The compound growth rate has been determined by using the following exponential function.
$Y= ab^t$

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Where

Y = the variable for which growth rate is calculated

t= time variable

b= the regression coefficient

a= intercept

The log form of the above exponential equation is expressed as

Log (Y) = Log (a) + t Log (b)

The compound growth rate percentage (r %) can be expressed as

r % = (Antilog (b)-1) x 100

The coefficients of variation in percent (CV%) were computed using the formula

CV (%) = (Standard deviation / Mean) x 100

To study the contribution of area, yield and the interaction of area and yield towards increasing the chickpea production in India, a decomposition analysis has been performed and is expressed as

Production in the base year is given by

$P_o = A_o \times Y_o$

Similarly, the production in the n^{th} year is given by

$P_n = A_n \times Y_n$

Also $P_n = P_o + \triangle P$, $A_n = A_o + \triangle A$ and $Y_n = Y_o + \triangle Y$

There fore, $P_n = A_n \times Y_n$

$= (A_o + \triangle A)(Y_o + \triangle Y)$

$= A_o Y_o + A_o \triangle Y + \triangle A Y_o + \triangle A \triangle Y$

$= P_o + A_o \triangle Y + \triangle A Y_o + \triangle A \triangle Y$

or $\triangle P = P_n - P_o = A_o \triangle Y + Y_o \triangle A + \triangle A \triangle Y$

The first term on the right hand side can be considered as the yield effect, the second term as the area effect and the third term as the interaction effect.

Where,

A_o = area in the base year

A_n = area in n^{th} year

P_o = yield in base year

P_n = yield in n^{th} year

Y_o = yield in base year

Y_n = yield in n^{th} year

$\triangle A$ = Change in area ($A_n - A_o$)

$\triangle P$ = Change in production ($P_n - P_o$)

$\triangle Y$ = Change in yield ($Y_n - Y_o$)

Results and Discussions

Area, Production and Yield trend

In the green revolution period, overall growth in production of food grains was quite impressive, while pulses doesn't grow same pace with the overall food production. Keeping the drastic reduction in per capita availability of pulses, there is an urgent need for increasing chickpea and other pulses production through crop specific and region specific strategies.

Gloomy performance of expansion of chickpea area (-0.32% CGR) and consequent slow growth of production (0.49% CGR) is cause of concern, as India is the largest producing, consuming and importing country. Not only chickpea production growth is slow but also unstable (coefficient of variation of chickpea is 23.13%), as majority of chickpea is grown in marginal lands and under rain fed conditions. The effect of the instability in production transformed into higher price instability, because only one-third of India's chickpea production is actually marketed (the rest is consumed by farm households), year-to-year fluctuations in production tend to become transmitted to relatively thin markets. In the absence of stabilization policies (as in case of pulses), this could cause prices to fluctuate widely. Further, in the current scenario of food sector liberalization, Indian food sector is being exposed to international trade, which at times is a source of instability in supply. The instability in production, hence prices adversely effects farmer's motivation to cultivate chickpea and other pulses by increasing risk to farmer's incomes.

Decade wise area, production and yield of chickpea has been given in table 1. The area under chickpea in 1950-51 was 7.57 million ha which showed a decreasing trend (-0.32% CGR) and recoreded as 9.93 million ha in 2013-14. It was highest (9.93 million ha) in 2013-14. The production (0.49% CGR) and yield (0.82% CGR) of the crop witnessed an increasing trend. The production of chickpea was 3.65 million tons in 2013-14 as theits production was 9.53 million tons in the base year. Similarly, the yield of chickpea recorded 960 kg/ha in 2013-14 as against 482 kg/ha in 1950-51. It was highest 1036 kg/ha in 2012-13. The farmer could achieve this increasing trend in production and yield mainly introduction to resistant varieties against different diseased and insects and pests, better management and matching improved production and protection technologies

The coefficient of variation of the detrended data was used as measure of instability in the production of chickpea in the country. Table 2 revealed that the production and yield instability was of in medium order and area stability is in low order. Over all there is medium order of area, production and yield stability.

Table 3 presents the percentage contribution of area, yield and their interaction in increasing or decreasing the production of chickpea for each decades from 1950-51 to 2011-12 and the total period. The area effect has a greater say in chickpea each decades separately. Response to increase in production because of increase in acreage is evident during each decades and overall period. In sixties and nineties the production is decreased due the reduction in productivity. The interaction of area and yield is not much except the nineties. Overall the production is increased mainly due to yield affect.

Table 1: Area, Production and Yield of chickpea in India since 1950-51 to 2013-14

Year	Area (m. ha.)	Production (m. tons)	Yield (q/ha)
1950-51	7.57	3.65	4.82
1960-61	9.28	6.25	6.74
1970-71	7.84	5.20	6.63
1980-81	6,58	4.33	6.57
1990-91	7.52	5.36	7.12
2000-01	5.19	3.86	7.44
2011-12	8.32	7.70	9.12
2013-14	9.93	9.53	9.60

Table 2: coefficient of variation (CV%) and compound growth rate (r%) of chickpea in different decades

Period	Area		Production		yield	
	CV	r	CV	r	CV	r
1950-51 to 1959-60	13.68	4.51	21.11	6.54	10.91	1.95
1960-61 to 1969-70	9.14	-13.59	16.55	-2.13	14.66	0.75
1970-71 to 1979-80	5.91	-0.18	16.19	-0.59	12.37	-0.40
1980-81 to 1989-90	8.59	-1.42	12.23	-0.79	7.18	0.63
1990-91 to 99-2000	11.59	1.26	15.11	2.96	7.34	1.69
2001-02 to 2009-10	12.53	4.31	18.45	5.98	7.37	1.59
1950-51 to 2013-14	14.83	-0.32	23.13	0.49	18.20	0.82

Table 3: Percentage contribution of yield, area and their interaction in production of chickpea

Period	Yield	Area	Interaction
1950-51 to 1959-60	24	67	9
1960-61 to 1969-70	-54	147	7
1970-71 to 1979-80	77	31	-8
1980-81 to 1989-90	29	66	-5
1990-91 to 99-2000	-379	407	72
99-2000 to 2009-10	25	61	14
1950-51 to 2013-14	62	19	19

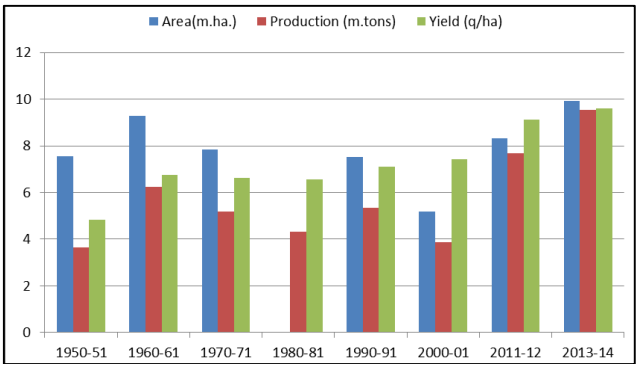

Fig 1: Bar Diagram of Area, Production and Yield of chickpea

Summary and Conclusions

Because of the high level of fluctuation in chickpea production (due to biotic and abiotic stress) and price (in the absence of an effective government price support mechanism) farmers are not very keen on taking up chickpea and other pulse crops cultivation despite the high whole sale chickpea and other pulse price in recent years. Nevertheless, improvement in yields, albeit modest, has contributed to higher chickpea production in recent years. Low yield in India compared to other chickpea growing countries is attributed to poor spread of improved varieties and technologies, abrupt climatic changes, vulnerability to pests and diseases, and generally declining growth rate of total factor productivity. In order to give muck needed fillip to pulse production, the government has included pulses in the NFSM has been significantly increasing MSP for chickpea and most pulses. This has resulted in an above normal growth in chickpea production in recent years.

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