

Growth, instability and decomposition analysis of lentil production in India

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ABSTRACT

Pulses are playing a major role in food basket of majority of Indian population, they are not only source of cheap proteins but also balanced diets and contributes to soil health. Lentil is one of the valuable pulses is major source of protein, high fiber content and provide vitamins and minerals. In India, it is mostly consumed as 'Dhal' and also used as 'Namkeen'. Lentil production in the country has gone up from 0.37 to 1.62 million tons between 1970-71 and 2017-18, registering a modest growth. During the period, the area has also gone up from 0.75 to 1.55 million ha, the yield has increased more than double from 497 to 1047 kg/ha. The present study is an attempt to examine the trends growth pattern, instability and decomposition analysis in lentil production through time series data for the period of 47 years (i.e. 1970-71 to 2017-18) which is divided into decade wise. The compound growth rates of area, production and yield of lentil was found positive for almost each decades as well as overall period during 1970-71 and 2017-18. The area, production and yield instability were of low order. Decomposition analysis reveals that overall the change in production is due to all the three component yield, area and interaction of yield and area, however in the recent years since 2000s contribution of yield is more and area contribution is negligible.

Key words: Growth rate, Instability, Interaction, Lentil

INTRODUCTION

Pulses are rich source of dietary protein and have high nutritive value for and are important for soil health maintenance by enriching soil nitrogen status. Due to their high protein, dietary fibers and micronutrient contents, pulses constitute an important part of a balanced healthy diet. Therefore, pulse crops are central to sustainable agriculture, and food and nutritional security of humans. Realizing importance of pulses for human health, the United Nation declared 2016 as International Year of Pulses. Amongst the major pulses in India lentil is one of the valuable pulse crop, is a major source of protein, high fiber content and provide vitamins and minerals. It is mostly consumed as 'Dhal' by removal of outer skin and separation of cotyledons and 'Namkeen' in the country. It is easy to cook and easily digestible with high biological value, hence also referred to patient. Dry leaves, stems, empty and broken pods are used as valuable cattle feed.

The Indian states Madhya Pradesh, Uttar Pradesh, West Bengal, Bihar, Jharkhand where lentil is grown on a large extent of area and production. There are a number of varieties that are grown in India depending on the suitability of the climate and soil. The area, production and yield of lentil cultivation is subjected to fluctuate in response to policies of the government and also conditions of cultivation. The Lentil production in the country has gone up from 0.37 to 1.62 million tons between 1970-71 and 2017-18, registering a modest growth. During the period of study the area has increased from 0.75 to 1.55 million ha, while the yield has steadily increased from 497 kg/ha to 1047 kg/ha. The recent liberalization has expanded the demand for lentil in Indian markets in addition to the growing domestic demand as a value-added product. In this article, an attempt has been made to analyze the trends, growth pattern, instability of lentil production in India and study the contribution of area, yield and yield-area interaction

to the change in total production during the last 47 years (1970-71 to 2017-18).

MATERIALS AND METHODS

The time series secondary data on area, production and yield of lentil during the period 1970-71 to 2017-18 were collected from "Agricultural Statistics at a Glance", a publication of the government of India. The present data were partitioned in decade wise in order to demonstrate the trend and growth pattern of lentil production in the country.

The compound growth rate has been determined by using the following exponential function adopted by Maurya (2016)

$$Y = ab^t$$

Where

Y = the variable for which growth rate is calculated (Area/Production/Yield)

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

b = the regression coefficient

a = intercept

The log form of the above exponential equation is expressed as

$$\text{Log}(Y) = \text{Log}(a) + t \text{Log}(b)$$

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

$$r \% = (\text{Antilog}(\text{Log}(b)) - 1) \times 100$$

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

$$\text{CV} (\%) = (\text{Standard deviation} / \text{Mean}) \times 100$$

(Moorti, 1991 and Devraj, 2019)

To study the contribution of area, yield and the interaction of area and yield towards increasing the lentil production in India, a decomposition analysis (Kumar, 2010) 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 nth year is given by

$$P_n = A_n \times Y_n$$

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

$$\text{Therefore, } P_n = A_n \times Y_n$$

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

$$= A_o Y_o + A_o Y + A Y_o + AY$$

$$= P_o + A_o Y + A Y_o + AY$$

$$\text{or } P = P_n - P_o = A_o Y + Y_o A + AY$$

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 nth year

P_o = yield in base year

P_n = yield in nth year

Y_o = yield in base year

Y_n = yield in nth year

A = Change in area (A_n - A_o)

P = Change in production (P_n - P_o)

Y = Change in yield (Y_n - Y_o)

RESULTS AND DISCUSSION

Decadewise area, production and yield of lentil has given in Table 1. The area under lentil crop was 0.75 m ha in 1970-71 which showed increasing trend and recorded more than double (1.55 m ha) in 2017-18. It was highest (1.60 m ha) in 2010-11. Similarly, the production and yield of the lentil crop in the country also witnessed on increasing trend during the period under study. The highest production of the crop was 1.62 m tones in 2017-18 as compared to 0.37 m tones in the base year 1970-71. The yield of the lentil showed an increasing trends and recorded highest and more than double 1047 kg/ha in 2017-18 as against 497 kg/ha in 1970-71. The area, production and yield of lentil observed upward tendency in almost all the decades as well as overall period. The farmer of the country could achieve this increase in production and yield mainly due to the development of high yielding varieties, shorter duration with of wilt resistant varieties; better management practices with improved production and protection techniques and government policy mainly increase in minimum support price.

Table 1. Area, production and yield of lentil during 1970-71 to 2017-18

Period	Area (m.ha)	Production (m.tons)	Yield (kg/ha)
1970-71	0.75	0.37	497
1980-81	0.93	0.47	498
1990-91	1.19	0.85	717
2000-01	1.48	0.92	619
2010-11	1.60	0.94	591
2017-18	1.55	1.62	1047

Table 2 presents the percentage contribution of the area, yield and their interaction in increasing or decreasing the production of lentil for each decade from 1970-71 to 2017-18 and overall period. The yield effect has a greater contribution in each decade separately except nineties as well as for overall period. The interaction of area and yield is more in seventies followed by eighties. Response to increase in production due to yield effect during each decades and overall the change in production is due to all three component yield, area and yield-area interaction. In order to give much importance of lentil production in the country the government has included lentil in National Food Security Mission and has been significantly increasing Minimum Support Price for the from from Rs.2250/quintal in 2010-11 to Rs.5100/quintal in 2020-21. This has resulted in an above normal growth in lentil production in recent years taking country towards achieving self sufficiency in pulses.

Table 2. Percentage contribution of yield, area and their interaction in change in production of lentil in different period

Period	Yield	Area	Interaction
1970-71 to 1979-80	175	-99	24
1980-81 to 1989-90	53	37	10
1990-91 to 99-2000	13	84	3
2000-01 to 2009-10	100	0	0
2010-11 to 2017-18	107	-4	-3
1970-71 to 2017-18	33	32	35

The compound growth rate and coefficient of variation in area and production and yield of lentil in different decades and for whole period under study are given in Table 3. The compound growth rate of area was found positive in each decades and overall period except first and second decades of this century

(-0.32% and -0.92%). It was highest (2.73%) during seventies followed by in nineties (2.34%). However, the growth rate in lentil production was estimated positive in all the decades as well as overall period. The highest growth rate in lentil production was observed during eighties (5.41%). Critical perusal of Table 3 indicated that the lentil registered highest growth rates in yield (5.96%) during the period 2010-11 to 2017-18. However the crop observed negative growth rates in yield (-1.81%) during seventies. As per decade-wise analysis of area instability ranges from 4.20 to 12.08 and it indicate stable area under lentil with reduced variability over the decades, despite lentil crop being grown predominately under no irrigation conditions in the country. Overall instability is higher in production than area and yield for almost all the decades as well as overall period.

Table 3. Coefficient of variation (CV%) and compound growth rate (r%) of Lentil in different period

Period	Area		Production		Yield	
	CV	r	CV	r	CV	r
1970-71 to 1979-80	12.08	2.73	13.46	0.92	7.40	-1.81
1980-81 to 1989-90	6.44	1.98	15.56	5.41	10.30	3.43
1990-91 to 99-2000	7.84	2.34	12.73	2.45	7.02	0.09
2000-01 to 2009-10	4.20	-0.32	7.08	0.04	6.04	0.04
2010-11 to 2017-18	7.11	-0.92	18.08	5.01	16.29	5.96
1970-71 to 2017-18	20.77	1.48	36.33	2.70	19.76	1.21

REFERENCES

- Devraj, Kumar H., Bhatt S. and Kumar R. 2019. Pulses production in India during last three plan periods- A growth analysis. *Journal of Food Legumes* **32**(4): 261-263.
- Omprakash Maurya, A. Amarender Reddy and Hemant Kumar. 2016. Growth and decomposition analysis of pigeonpea in India. *International Journal of Agricultural and statistics Science* **12**(1)189-191.
- Hemant Kumar and Devraj 2010. Growth rates of field pea in India-A decomposition analysis. *Agricultural situation in India*, **67**(3), 127-129.
- Moorti, T.V., Sharma, K.D., and Thakur, D.R.(1991). Trends in the production of Pulses and Oilseeds in Himachal Pradesh. *Agricultural Situation in India*, 303-308.