

Growth Rate of Major Pulses in India vis-a-vis Punjab

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Abstract

India holds the title of the world's largest pulse producer, contributing 27-28 per cent of the global production. Chickpea, pigeon pea, urad bean and moong bean are significant pulse varieties in India, with Punjab being a key producer of moong bean, black gram and pigeon pea. However, despite being a major producer in the past, Punjab's pulse cultivation has significantly declined from 413.7 thousand ha in 1970-71 to 33.5 thousand ha in 2021-22. The current research focuses on data related to the cultivation area, production and productivity of various pulses in Punjab and India spanning a period of 51 years from 1970-71 to 2020-21. The study revealed a significant decline in both the area and production of major pulses in Punjab except for moong bean which showed positive growth in area and production with the per cent of 2.19 and 3.16 annually due to its cultivation during the summer months utilizing fallow land after wheat harvesting and before paddy sowing. In India, lentil crop showed the highest growth rates in both area (1.29%) and production (2.58%) over the study period. In the Period-II, urad beans were the most stable with less instability (13.88%) followed by lentil (21.69%) and urad bean (5.60%). During the NFSM period, India witnessed notable growth in urad bean at 5.43 per cent per annum followed by moong beans (4.62%) and pigeon pea (2.46%) while chickpea declined by 0.42 per cent annually. The study provided comprehensive insights into the pulse cultivation landscape in India, emphasizing the need for sustainable practices, government support and strategic shifts in cropping patterns to ensure water conservation and economic stability for farmers.

Keywords: Pulses area, Production, Productivity, NFSM, Growth rate

JEL Classification: D24, Q18, O47

Introduction

India is the largest pulse producer globally, accounting for 27 per cent to 28 per cent of the world's total production. Chickpea accounts for 40 per cent of the total pulse production area in India, followed by pigeon pea which accounts for 15 per cent to 20 per cent. Further, urad and moong accounts for eight per cent to 10 per cent of total pulse production respectively. In India, more than 28 million ha land was cultivated with the pulses which makes the country the largest producer in the world. (Directorate of Pulse Development, 2022)

During 1970-71, Punjab had 413.7 thousand ha area under various pulses which declined to 33.5 thousand ha in 2021-22. The state is the main producer of moong bean, black gram and pigeon pea as staple pulses. The per cent share of Punjab pulses in India was around 0.4 per cent. The major pulse producing districts of the state are Sangrur, Ludhiana, Patiala, Bathinda, Fatehgarh Sahib, Mansa, Fazilka, Faridkot, Barnala and Moga. These districts have favourable climatic

conditions and agricultural practices followed by the farmers that contribute to the cultivation of pulses to meet the daily supplements and economic needs. (Agriculture Department, Punjab, 2021).

The Indian government has introduced various initiatives over the years aimed at enhancing pulse production and ensuring economic viability for farmers. These programs such as the National Pulse Development Program (1985), Special Food Grain Production Program (1988), Technology Mission on Oilseeds and Pulses (1991), Integrated Scheme on Oilseeds, Pulses, Oil Palm, and Maize (2004), and the recent National Food Security Mission on Pulses (2008) have been designed with the key objectives of promoting pulse cultivation, achieving self-sufficiency in pulse production within India and providing support to farmers. This support includes the distribution of high-quality seeds, demonstrations of improved agricultural techniques and subsidies on equipment like sprayers (Singh and Bansal, 2020). The present study examines the growth rate of major pulses in India vis-a-vis Punjab.

Data Sources and Methodology

The current research focuses on data related to the cultivation area (measured in thousand ha), production (measured in thousand tonnes), and productivity (measured in kg/ha) of various pulses such as chickpea, lentil, pigeon pea, moong bean, and urad bean spanning a period of 51 years from 1970-71 to 2020-21. This time period is divided into three distinct periods: Period-I (1970-71 to 1989-90) represents the Special Food Grain Production Program (SFGPP) on pulses, which was implemented in 1988 to support the National Pulses Development Program. Period-II (1990-91 to 2007-08) represents the time after the implementation of SFGPP. Period-III (2008-09 to 2020-21) signifies the period of the National Food Security Mission on Pulses (NFSM-P), which commenced in 2007-08 as a centrally sponsored scheme. The data for this study had been collected from official sources such as the Indian Institute of Pulse Research (IIPR) website and Indiatat.com. The objective is to analyze trends and instability in the area, production, and productivity of pulses in Punjab and India. Trend analysis in the area, production and productivity of pulses was studied using compound annual growth rate (CAGR). The compound growth rates were computed by using the exponential function of the form:

$$Y = AB^t$$

After substitution of log to equation:

$$\text{Log } Y = \text{Log } A + t\text{Log}B$$

Where Y= Area, Production and Productivity of pulses in the year 't'

A= constant, B= Regression Coefficient, t= Time in years

Compound Annual Growth Rate = $[\text{Antilog}B - 1] \times 100$

To test the significance of growth rates, correlation coefficients were estimated by the following formula:

$$r = \frac{\text{Cov}(Y_t)}{\sqrt{\text{Var}(t) \cdot \text{Var}(Y)}}$$

Where r = Correlation coefficient, Y= Area/Production/Productivity, t= Time

Coefficient of Variation

Coefficient of variation was calculated for area, production and productivity of major pulses and major pulses growing states by using following formula

$$\text{Coefficient of Variation (CV \%)} = \frac{\text{Standard deviation } (\sigma)}{\text{Mean } (\bar{X})} \times 100$$

Results and Discussion

The analysis of compound annual growth rates for major pulses in Punjab and India, as presented in table 1, indicated notable trends over different periods. The table provided an overview of the growth and decline patterns in pulse cultivation in India, specifically focusing on urad

bean, moong bean, pigeon pea, chickpea and lentil, during different periods. The data highlighted significant growth in urad bean cultivation during period-I with the per cent value of 3.09 whereas chickpea experienced negative growth rate of 0.94 per cent. In Punjab, pigeon pea led in growth rate with the per cent value of 17.04 but chickpea and urad bean observed negative growth rate of 9.79 and 5.80 per cent respectively during period-I. In period-II, lentil became the top performer in India with the per cent value of 1.38 per cent while Punjab faced negative growth rate in all pulses, attributed to a shift towards wheat and paddy cultivation during the Green Revolution. During the NFSM period, notable growth was observed in urad bean, moong bean and pigeon pea in India with the per cent value of 5.22, 4.69 and 2.49 per cent respectively while lentil growth rate declined by 0.50 per cent. In India, lentil showed the highest positive growth rate of 1.29 per cent over the fifty-one years, followed by urad bean (1.20%) while chickpea exhibiting the lowest positive growth rate of 0.43 per cent. Boosting domestic lentil cultivation area, production and productivity requires focusing on new areas like rice fallows, spreading advanced production techniques and implementing favorable policy measures (Varghese *et al.*, 2019). In Punjab, only moong bean noticed positive growth rate of 2.19 per cent because many farmers embraced summer moong cultivation as there was unused land available after the wheat harvest in April and before the paddy crop was sown (Grover and Singh, 2015) while chickpea, lentil and urad bean experienced negative growth rate of 12.30, 6.49 and 5.49 per cent respectively. This is due to limited Government support, hindering area and production growth (Grover and Singh, 2012). Overall, the data underscores the dynamic changes in pulse cultivation trends in India over different periods.

Table 2 discussed the instability index of major pulse crops in Punjab and India. In period-I, India experienced high instability in urad bean, moong bean and pigeon pea with a per cent value of 18.71, 15.97 and 12.73 respectively while chickpea had lower instability with 9.20 per cent. Punjab faced extreme instability during period-I particularly in moong bean and pigeon pea with an empirical value of 87.13 and 85.43 per cent. In the succeeding period, chickpea in India had the highest instability with a per cent value of 12.02 and Punjab showed maximum instability in chickpea, moong bean and lentil with the computed value of 94.22, 48.73 and 41.83 per cent respectively. In period-III, urad bean and moong bean exhibited high national instability with per cent value of 24.61 and 20.76 per cent respectively while lentil was more stable with 6.98 per cent. Over the study period, urad bean had the highest instability in India with the per cent value of 23.72 per cent as it indicated that government initiatives contributed to the enhancement of area, production and productivity of pulses with the support of better technology adoption rather than just led by higher

Table 1. Compound annual growth analysis of the area all the major pulses in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	-9.79***	-2.39	17.04***	16.96***	-5.80***
	Period-II	-13.84***	-8.10***	-3.39***	-9.74***	-4.83***
	Period-III	-4.56***	-4.15***	-2.42	10.20*	-4.48***
	Overall Period	-12.30***	-6.49***	-1.57**	2.19**	-5.49***
India	Period-I	-0.94***	1.64***	1.97***	2.70***	3.09***
	Period-II	0.24	1.38***	0.07	0.51	0.10
	Period-III	1.79***	-0.50	2.49***	4.69***	5.22***
	Overall Period	0.43***	1.29***	1.11***	1.13***	1.20***

***, ** and * indicate significance at 1, 5 and 10 percent level of significance, respectively.

(Source: IIPR, Indiatat.com)

use of inputs (Monga et al., 2022) and chickpea observed exceptionally high instability in Punjab with the per cent value of 138.10 because the pulses reduced drastically over the years mainly due to competition with irrigated wheat crop in Punjab (Dixit et al., 2019).

Table 3 presented an analysis of compound annual growth rates for major pulse production in Punjab and India. In period-I, India witnessed substantial growth in urad bean, moong bean and lentil with the per cent value of 5.43, 4.62 and 3.66 while chickpea declined by 0.42 per cent. Punjab excelled in pigeon pea and moong bean with an empirical value of 23.08 and 19.98 per cent but faced declines in chickpea and urad bean with a computed value of 11.32 and 5.44 per cent. In period-II, lentil performed well nationally with a per cent value of 1.15 but Punjab experienced negative growth in all pulses due to insufficient government support, impeding the growth of production (Grover and Singh, 2012). During the NFSM period, India saw notable growth rate in moong bean, urad bean and pigeon pea with a computed value of 9.09, 6.52 and 5.02 per cent. The rise in pulse production was a result of various initiatives, including programs like the National Food Security Mission – Pulses, Accelerated Pulses Production Programme and Rashtriya Krishi Vikas

Yojna that were introduced to enhance pulse cultivation in the country (Dixit et al., 2019). While in Punjab, only moong bean observed positive growth of 10.98 per cent during the period-III. On an overall, lentil displayed the highest positive growth in India with per cent value of 2.58 while in Punjab, only moong bean noticed positive growth rate with an empirical value of 3.16 per cent because summer moong cultivation has been adopted by majority of the farmers in the state due to availability of fallow land after harvesting of wheat during the month of April and before sowing of paddy crop (Grover and Singh, 2015).

Table 4 illustrates the instability index of major pulse crops production in Punjab and India. In period-I, the country faced high instability in moong bean, lentil and urad bean with the per cent value of 28.29, 25.15 and 18.71 respectively while chickpea exhibited lower instability with 14.97 per cent. This is due to the development of suitable technologies like high-yielding varieties along with matching production and protection technologies, quality seed producing units (Dixit et al., 2019). Punjab experienced extreme instability in pigeon pea and moong bean with the computed value of 101.72 and 97.46 per cent respectively. In the succeeding period, India saw extreme instability in moong bean and

Table 2. Instability Index of the major pulses area in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	53.02	41.40	85.43	87.13	46.82
	Period-II	94.22	41.83	20.93	48.73	29.35
	Period-III	25.99	37.15	61.96	61.02	27.91
	Overall Period	138.10	89.71	91.70	66.81	93.89
India	Period-I	9.20	10.95	12.43	15.97	18.71
	Period-II	12.02	9.10	3.30	8.26	7.31
	Period-III	9.52	6.98	12.89	20.76	24.61
	Overall Period	15.61	19.93	18.25	21.13	23.72

(Source: IIPR, Indiatat.com)

Table 3. Compound annual growth analysis of the production ('000 tonnes) all the major pulses in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	-11.32***	0.54	23.08***	19.98***	-5.44***
	Period-II	-12.74***	-9.93***	-3.40***	-10.20***	-3.19***
	Period-III	-3.70***	-5.67**	-1.18	10.98**	-2.35
	Overall Period	-11.17***	-5.75***	-0.37	3.16***	-5.18***
India	Period-I	-0.42	3.66***	2.46***	4.62***	5.43***
	Period-II	0.81	1.15**	0.87	-0.57	-0.26
	Period-III	3.84***	3.05***	5.02***	9.09***	6.52***
	Overall Period	1.55***	2.58***	1.32***	1.89***	2.44***

***, ** and * indicate significance at 1, 5 and 10 percent level of significance, respectively.

(Source: IIPR, Indiatat.com)

chickpea with a value of 18.73 and 15.45 per cent while urad bean being the least unstable with 7.31 per cent. Punjab exhibited maximum instability in chickpea, moong bean and lentil with an empirical value of 84.41, 55.02 and 47.89 per cent. In period-III, moong bean and pigeon pea had the highest instability on national as well as state level with 36.36 and 25.11 per cent nationally and 59.50 and 54.71 per cent on state level respectively. Over the study period, moong bean displayed the highest instability in India with 40.81 per cent while chickpea exhibited exceptionally high instability in Punjab with 147.28 per cent because of rapid declining of area, production and productivity of chickpea in Punjab significantly over the years (Grover and Singh, 2012)

Table 5 provided an analysis of compound annual growth rates for major pulse productivity in Punjab and India. In period-I, India experienced significant growth in urad bean, lentil and moong bean with the per cent value of 2.27, 1.99 and 1.87 per cent respectively while pigeon pea and chickpea had comparatively lower positive growth rate of 0.48 and 0.53 per cent respectively. The pulse productivity increased due to the distribution of superior seed varieties, implementing pest-resistant methods, offering extensive agricultural support, providing insurance coverage and ensuring a stable and

profitable market for pulse producers (Singh and Bansal, 2020). In Punjab, pigeon pea led in growth rate by 5.16 per cent followed by lentil and moong bean with the value of 3.01 and 2.59 per cent respectively but chickpea growth rate declined by 1.70 per cent during the period-I. In the succeeding period, pigeon pea performed best nationally with the per cent value of 0.80 while chickpea observed positive growth in Punjab with an empirical value of 1.28 per cent because productivity of chickpea increased with the time due to the advancement of appropriate technologies such as high yielding varieties (Dixit *et al.*, 2019). During the NFSM period, India witnessed notable growth in moong bean, lentil and pigeon pea with the per cent value of 4.20, 3.57 and 2.47 respectively while urad bean noticed maximum positive growth rate on state level with the per cent value of 2.23. On an overall, lentil displayed the highest positive growth in India with the per cent value of 1.27 followed by urad bean (1.22%) and chickpea (1.11%) while chickpea noticed maximum positive growth rate in Punjab with the per cent value of 1.29 followed by pigeon pea (1.22%) and moong bean (0.94%).

Table 6 outlines the instability index of major pulse crop productivity in Punjab and India. In period-I, India

Table 4. Instability Index of the major pulses production ('000 tonnes) in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	64.54	36.63	101.72	97.46	46.71
	Period-II	84.41	47.89	23.58	55.02	29.35
	Period-III	24.02	45.11	54.71	59.50	27.91
	Overall Period	147.28	79.28	104.59	71.33	93.89
India	Period-I	14.97	25.15	17.69	28.29	18.71
	Period-II	15.35	11.69	12.69	18.73	7.31
	Period-III	18.91	18.23	25.11	36.36	24.61
	Overall Period	33.79	37.42	27.41	40.81	23.72

(Source: IIPR, Indiatat.com)

Table 5. Compound annual growth analysis of the productivity (kg/ha) all the major pulses in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	-1.70*	3.01***	5.16***	2.59**	0.38
	Period-II	1.28**	-1.99***	-0.01	-0.51	1.71***
	Period-III	0.90	-5.26	1.28**	0.71	2.23**
	Overall Period	1.29***	0.46	1.22***	0.94***	0.33**
India	Period-I	0.53	1.99***	0.48	1.87***	2.27***
	Period-II	0.57*	-0.22	0.80	-1.07	-0.36
	Period-III	2.01***	3.57***	2.47***	4.20**	1.23
	Overall Period	1.11***	1.27***	0.20*	0.75***	1.22***

***, ** and * indicate significance at 1, 5 and 10 percent level of significance, respectively.

(Source: IIPR, Indiatat.com)

faced high instability in urad bean, lentil and moong bean with the computed value of 15.81, 15.28 and 14.70 per cent respectively while pigeon pea exhibited lower instability with 9.09 per cent. Punjab experienced significant instability particularly in pigeon pea and moong bean with 33.87 and 26.20 per cent respectively during the period-I. In the succeeding period, moong bean had extreme instability nationally with 14.37 per cent while urad bean was the most stable with 5.60 per cent. In Punjab, moong bean exhibited high instability with 15.54 per cent while chickpea was relatively stable with 11.95 per cent during period-II. In period-III, moong bean and lentil had the highest national instability with 19.85 and 16.82 per cent while chickpea being relatively stable with 10.87 per cent. During period-III in Punjab, lentil observed the maximum instability with 36.06 per cent while moong bean was less instable with 7.37 per cent. On an overall, lentil displayed high instability in India with 22.03 per cent followed by urad bean (20.82%) and moong bean (20.75%) while pigeon pea noticed lowest instability with 12.32 per cent. In Punjab during the study period, chickpea observed exceptionally high instability with 26.82 per cent followed by lentil (25.30%) and pigeon pea

(23.38%) while urad bean was less instable in the state with the value of 15.71 per cent. The increase in the productivity of pulses because of availability of improved seeds and irrigation, rainfall, facility of procurement by government agencies, resistance of crop to pest attacks, extension services, home consumption, availability of alternate crops, credit and assured market prices (Tuteja, 2006).

Conclusion and Policy Implications

The study has been conducted to analyze the growth rates of major pulses in India and Punjab. The study revealed a significant decline in both the area and production of major pulses in Punjab except for moong bean which showed positive growth in area and production with the per cent of 2.19 and 3.16 annually due to its cultivation during the summer months utilizing fallow land after wheat harvesting and before paddy sowing. In contrast, India witnessed an increase in pulse cultivation after the implementation of the National Food Security Mission. Lentil crops showed the highest growth rates in both area (1.29%) and production (2.58%) over study period. This growth was attributed to the proper use of fertilizers, high-yielding varieties and soil

Table 6. Instability Index of the major pulses productivity (kg/ha) in Punjab and India, 1970-71 to 2020-21

Particulars		Chickpea	Lentil	Pigeon pea	Moong bean	Urad bean
Punjab	Period-I	22.71	21.69	33.87	26.20	13.88
	Period-II	11.95	14.65	12.65	15.54	14.49
	Period-III	9.54	36.06	8.84	7.37	12.27
	Overall Period	26.82	25.30	23.38	20.75	15.71
India	Period-I	10.58	15.28	9.09	14.70	15.81
	Period-II	6.98	6.96	11.50	14.37	5.60
	Period-III	10.87	16.82	14.29	19.85	13.54
	Overall Period	19.23	22.03	12.32	20.09	20.82

(Source: IIPR, Indiatat.com)

health management practices enhancing soil fertility for pulse cultivation. Productivity of the pulses both in Punjab and India noticed positive growth in all the pulses over the study period.

The study emphasized the concerning decline in water levels in Punjab primarily due to the cultivation of water-intensive crops like wheat and paddy. In contrast, pulses require less water making them a viable alternative. Crops like chickpea and lentil have better drought resistance, need minimal irrigation. The study recommended government may initiate, mission similar to NFSM-P, to encourage farmers to cultivate pulses. Additionally, the establishment of procurement prices for pulses was deemed essential, as it guarantees farmers a stable income, thereby motivating continued pulse cultivation.

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