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RESEARCH NOTE

Growth analysis of area, production and productivity of pulses in India

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Pulses are important source of proteins, high in fibre content and provide ample quantity of vitamins and minerals. To study the growth rate of pulses cultivated in India, the secondary data of area, production and productivity of pulses for the country as a whole were collected from the website, www.indiastat.com for a period of 1990-91 to 2015-16. Compound annual growth rate (CAGR) was used to study the growth rate of area, production and productivity of major pulses cultivated in India. The highest significant growth rate of area and production was showed by bengal gram as 2.27 per cent and 1.28 per cent respectively whereas black gram marked the highest significant growth rate with respect to productivity (1.07 %). The growth rate of pulses were found to be lesser which might have a negative impact on food and nutritional security of nation since pulses are the major source of proteins

Key words: Growth rate, Protein, Pulse

Pulses are important source of proteins, high in fibre content and provide ample quantity of vitamins and minerals. Although, this crop group is important from the nutritional point of view, there were no significant increase in area and production during 1950-51 to 2005-16 as a result of marginalized treatment which pushes them to poor and marginal land piece (Ramachandra *et al.*, 2013). The productivity of pulses increased about 68 per cent to reach at 764 kg per hectare during 2013-14 from the level of 441 kg per hectare during 1950-51 (Anon., 2016).

The time series data of area, production and productivity of pulses were collected from 1990-91 to 2015-16 from www.indiastat.com. Compound annual growth rate was used to study the growth rate of area, production and productivity of different pulse crops in India.

Before calculating the growth rate, the exponential function of area, production and yield has to be estimated i.e.

$Yt = abtut$

Where,

Yt = Area or production or yield of pulses in year t

a= Intercept

b= Regression coefficient

t = Year which takes value 1, 2,3, …, n

ut= Error term

Logarithmic transformation was applied to the above exponential function and hence, the estimating equation was

$\log Yt = \log a + t \log b + \log ut$

The equation was estimated by ordinary least square technique (OLS). Compound growth rate (g) was then estimated by

$g\hat{} = (b\hat{}-1)\ 100$

Where,

g^ = Estimated compound growth rate in per cent per year and

b^ = Anti log of b

The standard error of the growth rate was estimated and tested for its significance by using t-test.

The compound annual growth rates of pulses are given in Table 1.

Among pulses, Bengal gram had the highest significant growth rate of production (2.27 %) with a variation of 23.76 per cent and a coefficient of determination value of 53.17 per cent. Black gram and pigeon pea were the other pulse crops which showed a positive significant growth rate of production (1.09 % and 1.00 %). Moth bean and green gram had a non-significant positive growth rate of production where moth bean was having the highest value of coefficient of variation (61.41 %) and lowest value of coefficient of determination (1.10 %). The amount of variation was least for pigeon pea (13.60 %). The total pulses also had a significant positive growth (2.14 %) with the highest value of coefficient of determination (70.89 %).

Area, production and productivity of pulses over the period 1990-91 to 2015-16 are presented in Figure 1 to 3. In case of area (Fig. 1) and production (Fig. 2), bengal gram showed an increasing trend whereas all other pulses showed a stagnant trend. Productivity of selected pulses (Fig. 3) exhibited more variation over the years compared to area and production.

The highest significant growth rate of bengal gram with respect to production was mainly due to the higher significant positive growth in its area and productivity. Higher minimum support price and higher procurement price could be the pulling factors for this higher growth rate (Anon., 2015). Bengal gram have so many other factors like short duration, lesser incidence of diseases and pests, major crop used in crop rotation, ability to withstand the drought conditions, wider adaptability from sandy soils to black soils, which influence its increased production. Black gram also showed a significant positive growth despite having a non- significant growth in area. The development of high yielding varieties like LBG 787, LBG 791 and LBG 792 (Jonathan, 2013) and development of yellow mosaic virus resistant varieties in Baba Atomic

Table 1. Growth rate of area, production and productivity of pulses in India from 1990-91 to 2015-16

Crops	Area			Production			Productivity		
	Mean (million ha)	C. V. (%)	CAGR (%)	Mean (million tonnes)	C. V. (%)	CAGR (%)	Mean (tonnes/ ha)	C. V. (%)	CAGR (%)
Black gram	3.11	6.938	0.030NS (0.107)	1.499	17.496	1.097** (25.592)	0.481	15.359	1.067** (33.379)
Pigeon pea	3.606	6.829	0.498** (33.336)	2.487	13.600	1.004** (31.613)	0.689	10.754	0.504^{NS} (12.692)
Bengal gram	7.371	15.333	1.278** (39.073)	6.141	23.764	2.270** (53.175)	0.825	10.248	0.979** (53.833)
Green gram	3.144	8.470	0.213^{NS} (3.801)	1.247	23.217	0.701^{NS} (5.191)	0.395	18.662	0.487^{NS} (3.559)
Moth bean	1.262	21.191	-0.915^{NS} (7.692)	0.315	61.415	1.011^{NS} (1.105)	0.241	50.602	1.943^{NS} (5.805)
Total pulses	18.798	7.922	0.636** (38.454)	14.282	20.064	2.137** (70.891)	0.755	13.845	1.491** (69.263)

**: Significant @ 1 % level of significance, *: Significant @ 5 % level of significance,
NS: Non-significant @ 5 % level of significance
Figures in the parentheses indicate coefficient of determination value in per cent

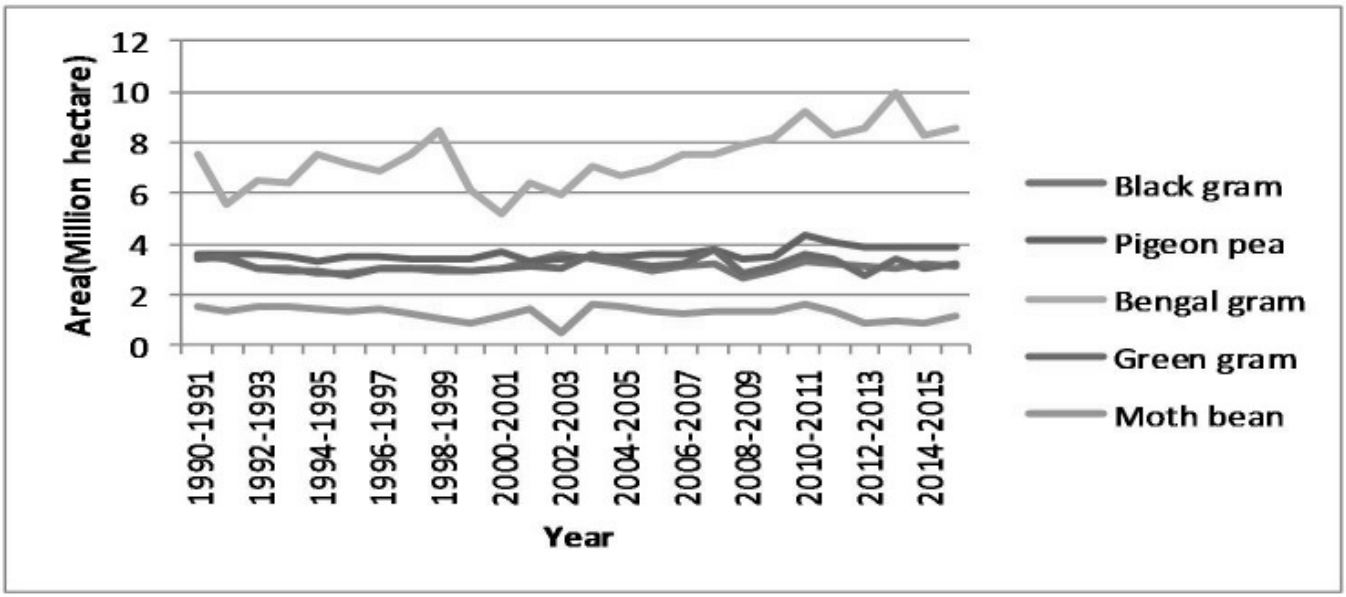

Fig. 1. Area of pulses during 1990-91 to 2015-16

Research Centre (BARC) (Deepa, 2016) are the reasons for this significant growth in spite of the non- significant growth in area. Pigeon pea also possessed a significant positive growth rate, because of the significant growth in area. This result was in agreement with the study conducted by Tuteja (2006). The development of improved varieties and increasing demand in the export market as India is the largest producer and exporter of pigeon pea in the world might be the reason for the positive growth of both area and production. Meanwhile, green gram and moth bean was having a non-significant growth of production as well as area. These two pulses majorly grown as inter crops or rotation crops in India with least importance as a major crop. That might be a reason for the stagnant growth of production and area. Tuteja (2006) also found the lesser growth rate of green gram.

The overall performance of pulses were found to be poor since the growth rates were either very small or non-significant in almost all the pulse crops considered for the study. Bengal gram was found to be having the highest significant growth rate of production as well as area among the food grains as 2.27 per cent and 1.28 per cent respectively whereas productivity was highest for black gram (1.07 %). These poor growth rates of pulse area, production and productivity are an alarm for the future since it could affect the food and nutritional security of the nation significantly.

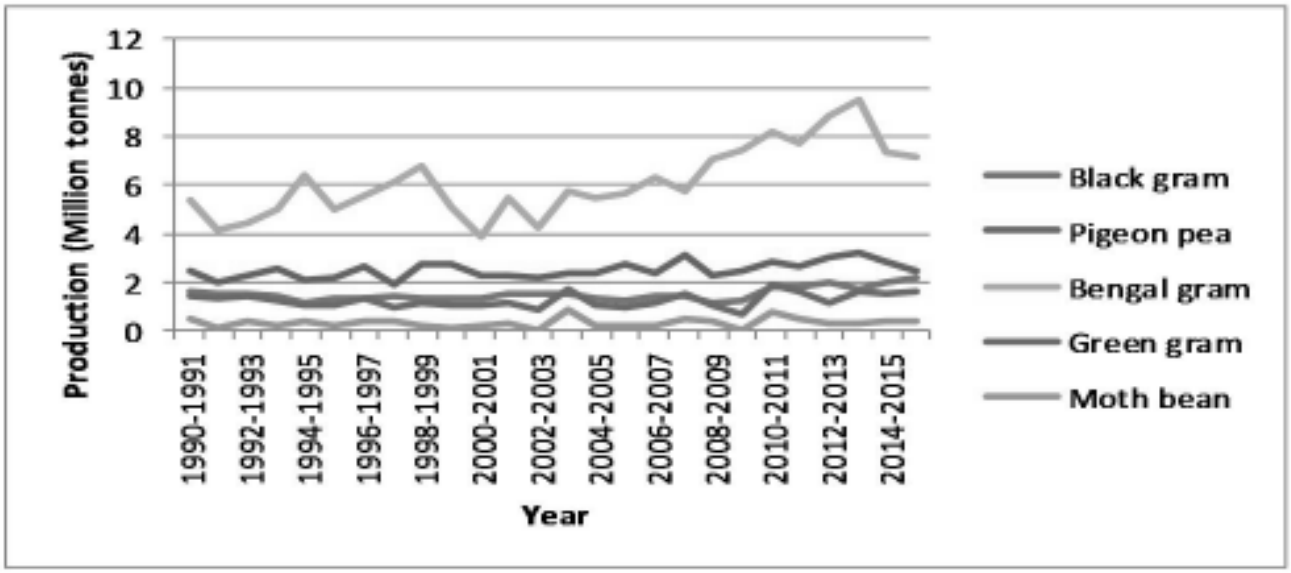

Fig.2. Production of pulses during 1990-91 to 2015-16

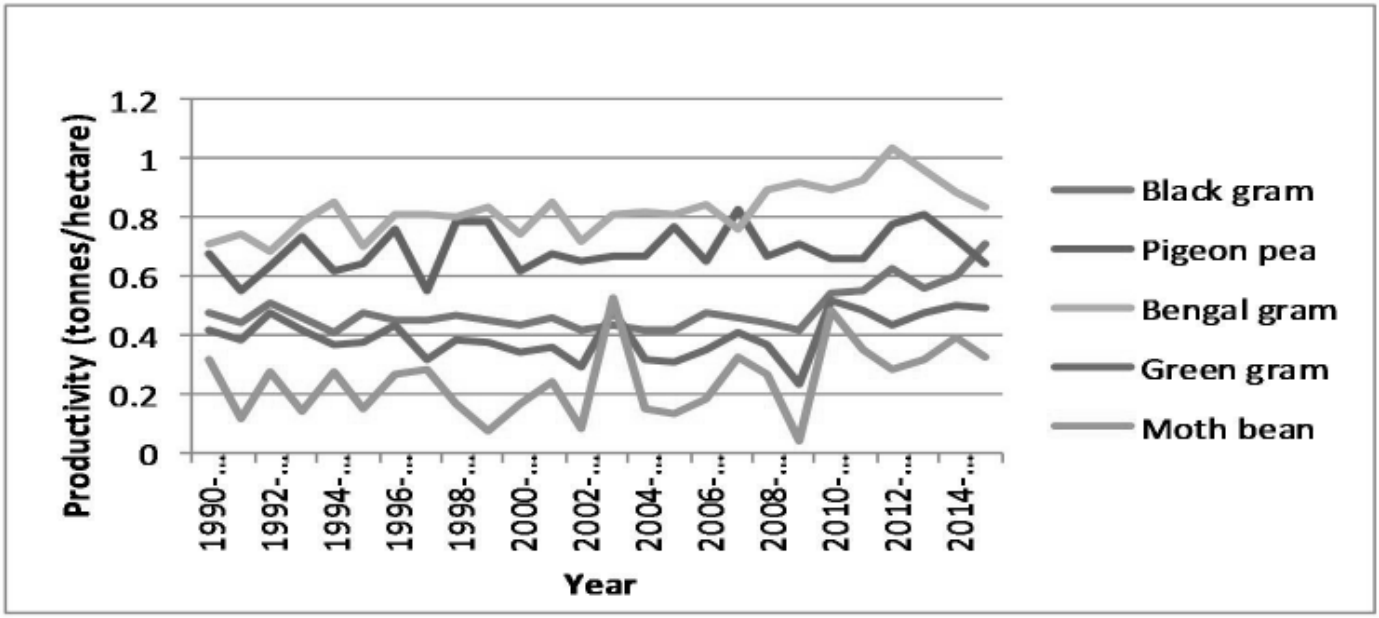

Fig. 3. Productivity of pulses during 1990-91 to 2015-16

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