Growth rate and trend analysis pattern of pulses production in Haryana state

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ABSTRACT

The present study was undertaken to analyze the trends in area, production and productivity of major pulse crops in Haryana state for the period 1966-67 to 2015-16 obtaining data from various issues of State Statistical Abstract of Haryana. Pulses were cultivated in Haryana in an area of 63.3 thousand hectares with production of 34.5 thousand tonnes during 2015-16. The results of the study revealed that the area under pulses in the state has declined at a rate of 5.53 per cent per annum which could be due to replacing the area under pulses by food grains. The production-wise scenario of gram and lentil indicated that because of decline in area under these crops production also declined during the study period. Only in case of lentil positive and significant growth rate was observed during the entire study period. The regression coefficients for total pulses in Haryana were negative and significant for area (0.025) and production (0.022) and positive and significant for productivity (0.022).

Keywords: Area; growth rate; major pulses; production; regression coefficient

INTRODUCTION

In Haryana state majority of the people are having vegetarian dietary habit that is why pulses are main source of protein in the human diet. Protein deficiency in human diet often leads to protein energy malnutrition (PEM) causing various forms of anemia. Pulse crops are considered as an important source of proteins, vitamins and minerals and are popularly known as 'poor man's meat' and 'rich man's vegetable'. These contribute significantly to the nutritional security of the country (Singh et al 2015). Besides being a rich source of proteins and essential amino acids, they maintain soil fertility through biological nitrogen fixation in symbiotic association with *Rhizobium* bacteria present in their root nodules (Pooniya et al 2015). Thus pulses help in sustaining crop productivity and soil health. Pulses are largely cultivated under energy-starved conditions, mostly on marginal and sub-marginal land and more than three-fourth of the area under pulses is still rainfed resulting in poor crop productivity (Choudhary 2013). According to Kumar and Dutt, the schemes Pradhan Mantri Krishi Sinchai Yojana and Pradhan Mantri Fasal Bima Yojana of Government of India have capacity to bring sea changes in pulses cultivation (Kumar and Dutt 2019).

Haryana is one of the most progressive agricultural states with only 1.4 per cent of the total geographical area of India. The acreage and production of pulses in Haryana have shown a continuous decline (Kumar et al 2018). Pulse crops however experienced a poor status in cropping pattern in Haryana and only 1.42 per cent area of total food grains was devoted to pulses sector during the year 2015-16. In Haryana, the area under pulses was 1,150 thousand hectares with production of 563 thousand tonnes during the year 1966-67 which declined to 63.3 thousand hectares with 34.5 thousand tonnes production in 2015-16. Possible reason of declining area under pulses was lack of improved varieties, low market price and no assured market (Nimbrayan et al 2019).

The area, production and productivity of pulses have been under influence of seasonal, biotic and abiotic factors in Haryana (Jaslam et al 2018). Gram, green gram, pigeon pea, lentil and mash are the most important pulse crops grown in the state. The neglect

of pulses is reflected in their declining share in total foodgrains production from over 21.72 per cent in 1966-67 to just 0.21 per cent in the year 2015-16 due to farmers cultivating pulses on marginal and sub-marginal lands, non-adoption of crop management practices and poor marketing infrastructure.

Keeping in view the above factors, the present study was planned to examine the growth and trends in area, production and yield of pulses in the Haryana state.

METHODOLOGY

The secondary time series data for the period 1966-67 to 2015-16 were collected on different variables such as area, production and productivity of major pulse crops in Haryana. To meet the objective of this study, secondary data were collected from State Statistical Abstract of Haryana and different published sources. The periods of study were classified as 1966-67 to 1975-76 (Period-I), 1976-77 to 1985-86 (Period-II), 1986-87 to 1995-96 (Period-III), 1996-97 to 2005-06 (Period-IV), 2006-07 to 2015-16 (Period-V) and 1966-67 to 2015-16 (Overall period) for the meaningful elucidation of results.

Analysis of data

Trend analysis: To measure the growth of area, production and productivity of pulse crops, compound growth rates were evaluated by fitting to the time series data in exponential function of the following form:

$$Y = abt \quad \text{.....(1)}$$

where Y= Index number of area, production, productivity as the dependent variable, t= Time variable (year) as independent variable, a= Intercept, b= Regression coefficient

Equation (1) can be expressed in logarithmic form as follows:

$$\log y = \log a + t \log b \quad \text{.....(2)}$$
$$\log y = A + B t \quad \text{.....(3)}$$

where A= log a, B= log b

The compound growth rate 'r' was computed as:

$$r = (\text{Antilog of } b \times 1) \times 100 \quad \text{.....(4)}$$

RESULTS and DISCUSSION

Pulses' contribution to total food grains in Haryana

The share of cropped area in 1966-67 under pulses out of total food grains showed drastically decreasing trends towards 2015-16 resulting in very low production in the state (Table 1). The share of cropped area under pulses to the total food grains as well as production decreased continuously during the study period. Kumar and Dutt (2019) also found regular decreasing area and production under pulses in the state.

Growth rates in area of major pulse crops

During the overall period, the area under gram declined at the rate of 6.37 per cent per annum. This may be attributed to low performance of pulse crops in irrigated area, high amount of risk involved due to insect pests and their sensitiveness to cold. In case of moong and mash, the growth rates of area were non-significant during the entire study period (Table 2). Lentil also showed significant but negative growth rates of -8.44, -9.44 and -5.43 during the periods 1986-87 to 1995-96, 2006-07 to 2015-16 and 1966-67 to 2015-16 respectively. Area under total pulses declined at the rate of 5.53 per cent per annum during overall period. Nimbrayan et al (2019) also found negative growth rate in area under pulses in the state.

Growth rates in productivity of major pulse crops

The perusal of data in Table 3 shows the growth rates of productivity of major pulse crops in the state. In case of gram crop productivity, the growth rate was non-significant. Yield of moong increased at the rate of 2.77 per cent per annum during the Period-V. The change in growth rate was non-significant during the rest of the periods. In case of lentil, the yield increased at the rate of 2.34 per cent per annum during the Period-I with a growth rate of 1.97 during overall study period. Yield of mash and total pulses showed non-significant growth during the study period.

Growth rates in production of major pulse crops

Table 4 presents the growth rates of production of major pulse crops under study in the state. In case of gram, production declined at the rate of 5.89 per cent per annum. In case of mash, production increased at the rate of 7.15 per cent per annum during Period-I. Lentil registered growth rate of production but the growth was negative and significant. Production of total pulses showed non-significant growth. Pulses were

Table 1. Contribution of pulses to total food grains in Haryana from 1966-67 to 2015-16 (area in '000 ha, production in '000 tonnes, yield in kg/ha)

Year	Pulses contribution to total food grains (% contribution)		
	Area	Production	Yield
1966-67	32.67	21.72	66.58
1976-77	26.15	17.40	66.05
1986-87	16.77	5.88	34.11
1996-97	11.46	3.29	32.37
2006-07	3.92	0.94	24.14
2015-16	1.42	0.21	18.59

Source: Various issues of State Statistical Abstract of Haryana, India

Table 2. Compound growth rates in area of major pulses in Haryana (1966-67 to 2015-16) (per cent/annum)

Crop	Period I (1966-67 to 1975-76)	Period II (1976-77 to 1985-86)	Period III (1986-87 to 1995-96)	Period IV (1996-97 to 2005-06)	Period V (2006-07 to 2015-16)	Overall period (1966-67 to 2015-16)
Gram	-0.42^{NS}	-5.51^{NS}	-2.11^{NS}	-13.58^{NS}	-9.17^{NS}	-6.37***
Moong	-4.15^{NS}	-4.70^{NS}	2.08^{NS}	4.53^{NS}	-11.81^{NS}	0.65^{NS}
Mash	3.74^{NS}	-5.75^{NS}	-5.74^{NS}	10.94^{NS}	-9.33^{NS}	-4.34^{NS}
Lentil	-1.66^{NS}	-1.95^{NS}	-8.44***	-6.68^{NS}	-9.44***	-5.43***
Total pulses	-0.66^{NS}	-5.01^{NS}	-1.89^{NS}	-10.26^{NS}	-10.70***	-5.53***

***Significant at 5 per cent LoS, NS: Non-significant

Table 3. Compound growth rates in productivity of major pulses in Haryana (1966-67 to 2015-16) (per cent/annum)

Crop	Period I (1966-67 to 1975-76)	Period II (1976-77 to 1985-86)	Period III (1986-87 to 1995-96)	Period IV (1996-97 to 2005-06)	Period V (2006-07 to 2015-16)	Overall period (1966-67 to 2015-16)
Gram	-3.44^{NS}	-4.48^{NS}	7.62^{NS}	-1.53^{NS}	-0.31^{NS}	0.51^{NS}
Moong	6.87^{NS}	0.45^{NS}	-1.43^{NS}	-3.35^{NS}	2.77***	-0.71^{NS}
Mash	3.21^{NS}	1.16^{NS}	0.15^{NS}	-4.65^{NS}	0.91^{NS}	-1.04^{NS}
Lentil	2.34***	0.12^{NS}	2.86^{NS}	2.35^{NS}	3.50^{NS}	1.97***
Total pulses	-3.05^{NS}	-4.08^{NS}	6.40^{NS}	-2.36^{NS}	-0.10^{NS}	0.46^{NS}

***Significant at 5 per cent LoS, NS: Non-significant

Table 4. Compound growth rates in production of major pulses in Haryana (1966-67 to 2015-16) (per cent/annum)

Crop	Period I (1966-67 to 1975-76)	Period II (1976-77 to 1985-86)	Period III (1986-87 to 1995-96)	Period IV (1996-97 to 2005-06)	Period V (2006-07 to 2015-16)	Overall period (1966-67 to 2015-16)
Gram	-3.85^{NS}	-9.75^{NS}	5.38^{NS}	-14.92^{NS}	-9.45^{NS}	-5.89***
Moong	2.36^{NS}	-4.27^{NS}	0.54^{NS}	1.01^{NS}	-9.84^{NS}	-0.09^{NS}
Mash	7.15***	-5.80^{NS}	-6.70^{NS}	7.98^{NS}	-6.08^{NS}	-4.78^{NS}
Lentil	1.42^{NS}	-3.15^{NS}	-7.83^{NS}	-5.22^{NS}	-8.15^{NS}	-3.63***
Total pulses	-3.60^{NS}	-8.92^{NS}	4.18^{NS}	-11.82^{NS}	-11.98^{NS}	-5.12^{NS}

***Significant at 5 per cent LoS, NS: Non-significant

under the influence of seasonal, biotic and abiotic factors in Haryana and may be due to these reasons the area under pulses was affected which in turn influenced the production.

The decrease in production and shrinkage in area of pulse crops in Haryana during the study period (Fig 1) is a cause of great concern. A substantial increment in area in case of moong and in productivity in case of lentil was noticed in the state (Fig2).

Trends in area, production and productivity

The trend analysis in area, production and productivity of major food grain crops in Haryana during 1966-2016 was worked out and data are depicted in Table 5. The regression coefficients of area and production of gram were significant and R^2 was fairly high in area and productivity. Regression coefficients of area, production and productivity of moong and mash were non-significant. It shows that there was no improvement in area, production and productivity of moong and mash during the period under study. In case

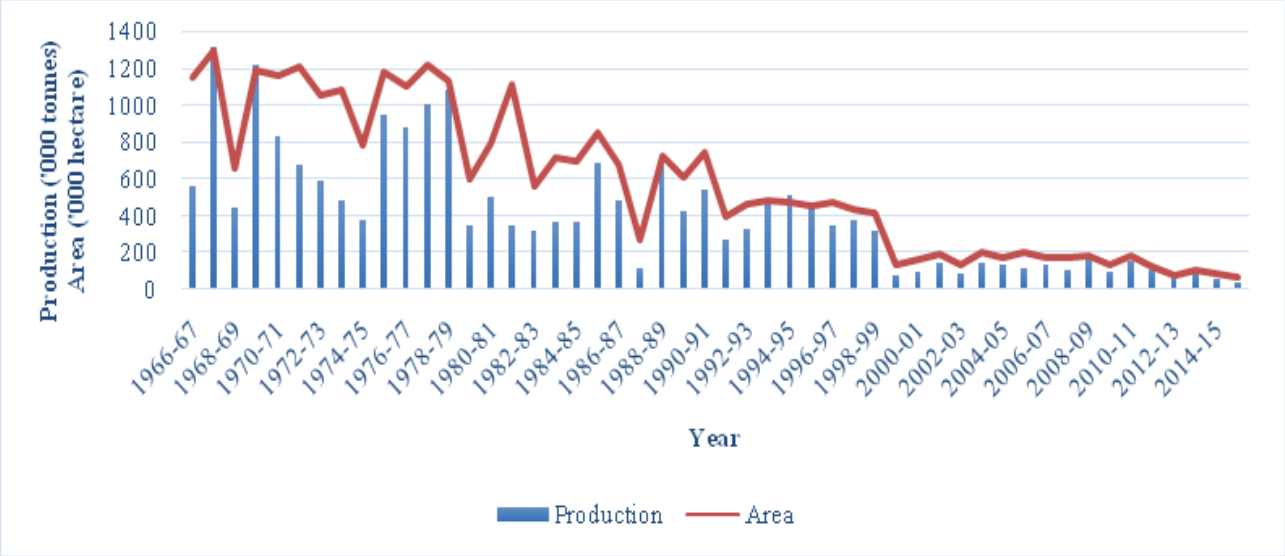
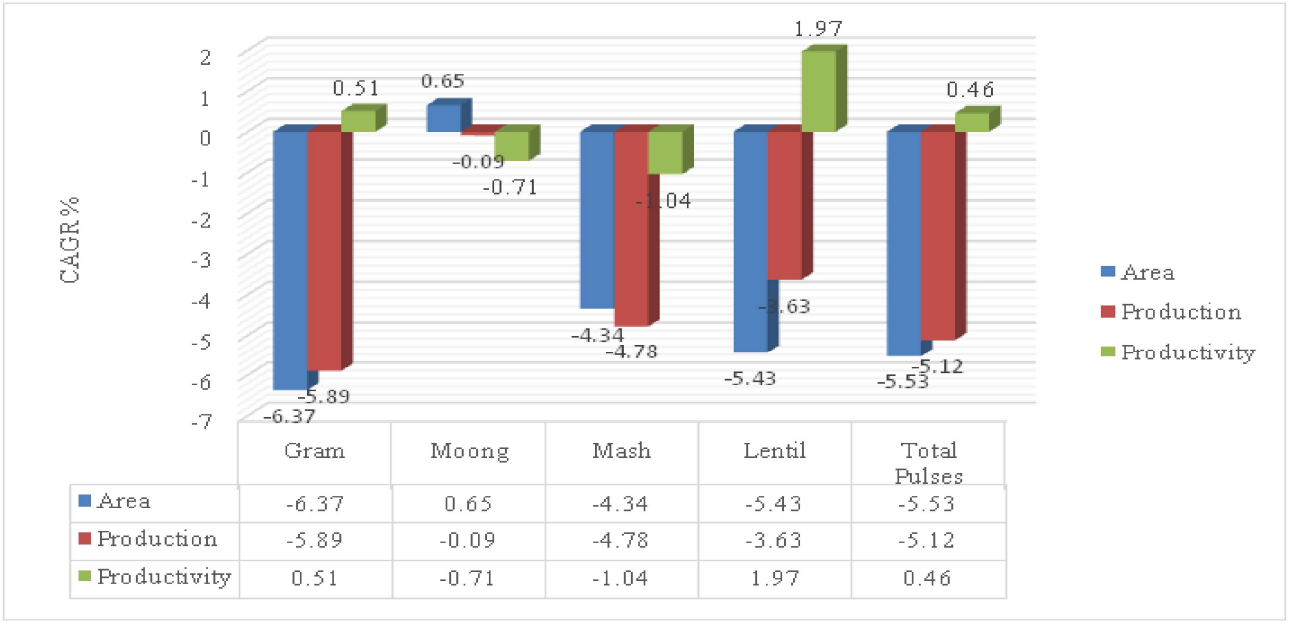


Fig 1. Trends in pulses production in Haryana



	Gram	Moong	Mash	Lentil	Total Pulses
Area	-6.37	0.65	-4.34	-5.43	-5.53
Production	-5.89	-0.09	-4.78	-3.63	-5.12
Productivity	0.51	-0.71	-1.04	1.97	0.46

Fig 2. CAGR in area, production and productivity of pulses in Haryana (1966-67 to 2015-16)

Table 5. Trend equations in area, production and productivity of major pulses in Haryana

Crop	Coefficient	t-value	p-value	R^2
Area				
Gram	-0.028***	-17.14	0.000	0.85
Moong	0.002^{NS}	1.05	0.291	0.02
Mash	-0.019^{NS}	-9.71	0.025	0.66
Lentil	-0.024***	-25.27	0.000	0.93
Total pulses	-0.025***	-17.61	0.000	0.86
Production				
Gram	-0.023***	-11.52	0.000	0.73
Moong	-0.000^{NS}	-0.17	0.862	0.00
Mash	-0.021^{NS}	-6.69	0.071	0.48
Lentil	-0.016***	-13.67	0.000	0.79
Total pulses	-0.022***	-11.23	0.000	0.72
Productivity				
Gram	0.000^{NS}	1.78	0.081	0.06
Moong	-0.001^{NS}	-1.91	0.066	0.08
Mash	-0.004^{NS}	-2.81	0.022	0.14
Lentil	0.008***	18.28	0.000	0.87
Total pulses	0.002^{NS}	1.82	0.072	0.06

***Significant at 5 per cent LoS, NS: Non-significant

of lentil, the regression coefficients of area, production and productivity were negative and significant. The regression coefficients of total pulses for area and production were found negative and significant. It shows that in case of total pulses, area and production declined during the period under study.

CONCLUSION

According to the findings of this study, it was concluded that in Haryana there was negative and significant growth rates for area of total pulses. It is found that area under gram and lentil declined significantly however the change in area under moong and mash was non-significant during the study period. In case of contribution of total pulses to food grains, area and production decreased continuously during the study period. The regression coefficient of total pulses for area and production was found negative and significant. Thus in case of total pulses, area and production declined during the period under study.

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