Pulses in Punjab: growth rate and decomposition analysis

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 Received: 15.06.2020/Accepted: 02.07.2020

ABSTRACT

Pulses are an important commodity group of crops that provides high quality protein supplementary cereal proteins for pre-dominantly large vegetarian population of Punjab. The state is known for its contribution of wheat and paddy to the national pool but it lags behind in production of pulses. Keeping this in view present study was undertaken to explore the status of pulses in Punjab with the computation of compound annual growth rate (CAGR) and decomposition analysis. For this purpose the secondary data from year 1985-86 to 2017-18 were taken. The results showed that the CAGR of area and production of total pulses in state showed a significantly negative growth of 6.13 and 5.60 per cent per annum respectively but positive growth (0.61%) was observed in case of yield. The decomposition analysis concluded that area effect (99.48%) was major contributing factor for change in production of total pulses followed by yield effect (3.87%). But interaction effect was found negative (-3.35%). Thus there is need to break the monoculture of wheat and paddy crops and regain the area under pulses by considering their invaluable benefits by providing improved varieties of seeds, pest resistant techniques, extension support, insurance coverage and sustained remunerative market for the produce of pulse growers.

Keywords: Pulses; growth; decomposition; area; production; yield

INTRODUCTION

Punjab being a pioneer state in early espousal of green revolution technology provided the driving force to scale up the agricultural yield after seventies and eighties. The impressive agricultural growth in Punjab is exemplified by the increase in the state's food grains production from 2 to 29 million tonnes during the years 1950-51 to 2011-12. The success story of wheat and rice was amazingly spine shivering. The production of wheat which was 1.02 million tonnes in 1950-51 increased tremendously to 17.9 million tonnes in 2011-12. Similarly the rice production in the state increased from 0.11 million tonnes in 1950- 51 to 6.54 million tonnes in1990-91 and further to10.5 million tonnes in 2011-12 (www.indiastat.com). The result of it led to the monoculture of wheat and paddy in Punjab instead of other crops and this pattern is still predominant in the state. But over the years the monoculture of wheat and paddy has adversely affected the agro-ecological parameters resulting in depletion of underground water, deterioration of soil health and crop residue burning. Also the relative profitability has started declining and the yield has become stagnated (Grover and Singh 2012). In order to ensure agricultural growth and sustainability of agriculture system, legumes play an important role by providing organic matter to the soil and diversifying the existing cropping pattern.

Pulses continue to be an essential component of sustainable cropping system as these have ability of biological nitrogen fixation, low water requirement and capacity to withstand abnormal weather conditions (Ahlawat et al 2016). It is considered as a viable option for diversification of Punjab agriculture (Mahajan 2017). But the area and production of pulses have declined significantly over the years. During 1970-71, Punjab had 413.7 thousand ha area under total pulses which declined to 49 thousand ha in 2014-15 and it was 30 thousand ha in 2017-18 (Anon 2018). The decline in pulses area despite of better technological advances in Punjab might be due to lack of assured market, ineffective government procurement,

unfavorable parity in prices and trade liberalization that make pulse farming less attractive compared to other crops (Joshi and Saxena 2002, Chand 2000). The other constraints are non-availability of quality seed, labour intensive and timeliness of field operations, price variability etc. Thus the growth trend in area, production, yield and the sources of change in pulses production in Punjab state were estimated by decomposition analysis.

METHODOLOGY

The study was based on secondary data pertaining to the area in hectare (ha), production in tonnes, yield in kg/ha of pulses (pigeon peas, urd bean, peas, mung bean, chick pea, lentil and total pulses) from the publications of Indian Institute of Pulses Research (IIPR) and official website (www.indiastat.com). A time period of 33 years from 1985-86 to 2017-18 was chosen for the analysis.

Tools used for analysis

Compound growth rate analysis: Trend analysis in the area, production and yield 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:

$$LogY= Log A + tLogB$$

where Y= Area, production and yield of oilseeds in the year 't', A= constant, B= Regression coefficient, t= Time in years starting from base year 1970-71

$$\text{Compound growth rate} = [\text{Antilog}B - 1] * 100$$

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

$$r = \{Cov\ (Yt)/\sqrt{Var(t).\ Var\ (Y)}\}$$

where r= Correlation coefficient, Y= Area/production/yield, T= Time

Decomposition analysis

Decomposition analysis was used to measure the relative contribution of area and yield towards the change in total production of pulses in Punjab. The decomposition analysis suggested by Minhas and Vidhyanathan (1965) and redeveloped by Sharma (1977) was used. The change in production was taken as the effect of three factors such as yield effect, area effect and interaction effect.

Here A_b= Area in base year, Y_b= Yield in the base year, Yc= Yield in the current year, Ac= Area in the current year, $\Delta P= A_b * \Delta Y + Y_b \Delta A + \Delta A\, \Delta Y$, ΔP= Change in production, ΔA= Change in area ($A_c - A_b$), ΔY= Change in yield ($Y_c - Y_b$) and Change in production= Yield effect + area effect + interaction effect

Thus the total change in production was decomposed into three effects viz yield effect, area effect and interaction effect due to change in yield and area.

RESULTS and DISCUSSION

Growth in area, production and yield of pulses

The growth of pulses has been computed for the period 1985-86 to 2017-18. The major highlights of the trend analysis of pulses crops in Punjab state have been shown in Table 1 (Fig 1). It was found that in case of total pulses both the area and production showed a significantly negative growth of 6.13 and 5.60 per cent per annum respectively but positive and significant in case of yield ie 0.61 per cent per annum. The declining growth rate of production may be due to the decline in area under pulses, dominant wheat and paddy monoculture and subsidies for irrigation. The intensive and highly mechanized farming led to more production of other profitable crops in the state. Further the pulses are risky in terms of profitability (Grover and Singh 2015), labour intensive and more adaptive in dry areas that replaced the area under pulses. The increase in yield of total pluses could be due to initiatives taken by the Government of India like National Food Security Mission 2007-08 to improve the status of pulses.

The crop-wise analysis of pulses depicts that negative and statistically significant growth trend was recorded in case of area under all pulse crops which shows the clear picture of dominance of wheat and paddy. Highest negatively significant growth rate was associated with chickpea in area and consequently in production with rate of 12.56 and 10.99 per cent per annum respectively. The pea and

Table 1. Compound annual growth rates of area, production and yield of pulses in Punjab (1985-86 to 2017-18)

Pulse	Area ('000 ha)	Production ('000 MT)	Yield (kg/ha)
Pigeonpea	-6.75***	-6.60***	0.16
Urdbean	-5.25***	-4.72***	0.56*
Peas	-2.51***	-1.15	1.40***
Mungbean	-3.84***	-3.48***	0.38
Chickpea	-12.56***	-10.99***	1.93***
Lentil	-8.37***	-8.42***	-0.27
Total pulses	-6.13***	-5.60***	0.61***

Significant at *10%, **5% and ***1% level of significance

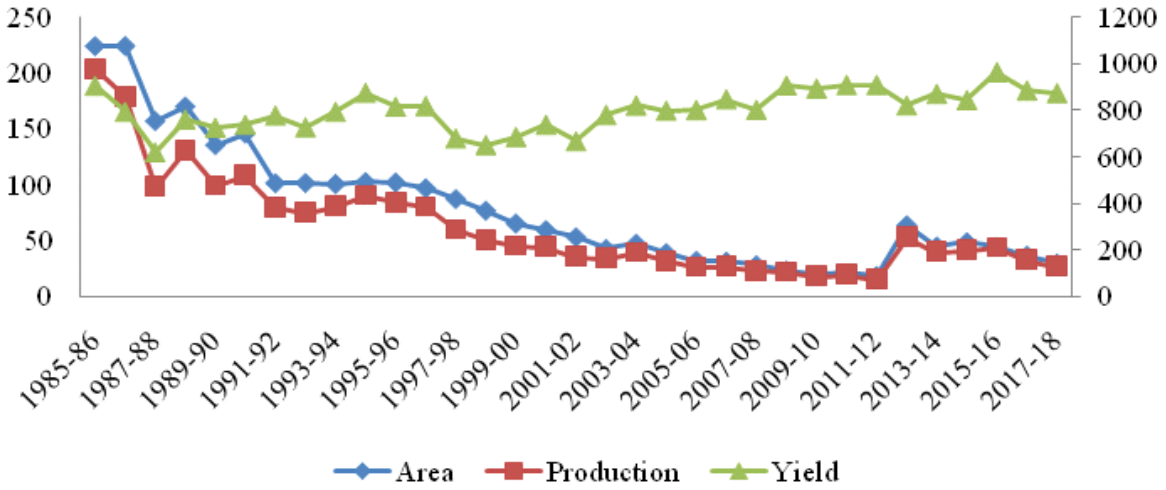

Fig 1. Area ('000 ha), production ('000 MT) and yield (kg/ha) of total pulses in Punjab, 1985-86 to 2017-18

mung bean acreage in Punjab decreased at the rate of 2.51 and 3.84 per cent per annum respectively which was the lowest among other pulse crops due to development of short duration varieties of mung bean which are cultivated as third crop between wheat and paddy. In case of yield, positive and highly significant growth rate was recorded in chickpea (1.93%) and pea (1.40%) and positive significant in urd bean (0.56%). The nutshell of trend analysis depicted that area and production under pulses crops had been declining which is the matter of concern for state agriculture.

Decomposition analysis of pulses

Decomposition analysis was carried out to estimate the per cent contribution of area effect, yield effect and interaction effect towards change in production. It is evidenced from Table 1 that production of pulses was declining during the study period. Therefore to know the contribution of area and yield in declining production of pulses, decomposition analysis was undertaken. Data given in Table 2 depict that area effect (99.48%) was major responsible factor for change in production of total pulses followed by yield effect (3.87%). But interaction effect was found negative (-3.35%).

Crop-wise analysis showed that even in case of all the pulses viz pigeon pea, urd bean, pea, mung bean, chicken pea and lentil, area effect was the leading factor responsible for change in the production. But in case of pigeon pea, urd bean, mung bean and lentil, the yield affect was also contributing ranging from 4.93 to 13.42 per cent. Whereas in case of pea and chickpea, yield effect contributed negatively because there was highly positively significant growth rate observed in yield of these crops viz 1.40 and 1.93 per cent per annum respectively. Hence decomposition analysis concluded that area under pulses was major responsible factor for declining trend in production of total pulses in Punjab which needs expansion by considering the invaluable benefits of pulses.

Table 2. Decomposition analysis of pulses in Punjab (1985-86 to 2017-18)

Pulses	Area effect	Yield effect	Interaction effect
Pigeonpea	99.60	6.09	-5.70
Urdbean	99.38	4.93	-4.31
Peas	102.38	-7.50	5.12
Mungbean	97.11	6.04	-3.16
Chickpea	100.48	-30.24	29.76
Lentil	99.07	13.42	-12.50
Total pulses	99.48	3.87	-3.35

Benefits of pulses

Majority of Indian population (40%) is vegetarian and pulses are playing significant role in providing protein (22%) and other important nutrients to the large population of the country (Avinash and Patil 2018). Singh (2013) reported that the by-products of pulses like leaves, pod coats and bran are fed to animals in the form of dry fodder and at the same time pulses can be grown on range of soil and climatic conditions and play important role in crop rotation, mixed and inter-cropping, maintaining soil fertility through nitrogen fixation, discharge of soil-bound phosphorus and thus contribute significantly to sustainability of the farming systems (Gowda et al 2013). Introducing a legume (summer mung bean) in rice-wheat cropping system is one of the alternatives to provide additional economic returns and employment (Kaur et al 2018). Grover and Singh (2012) opined that it can also help in diversification of Punjab agriculture at this stage of over-exploitation of the natural resources.

After the green revolution the performance of pulses in the state of Punjab has been found to be dismal and it is still prevalent due to enormous problems. As per Dhindsa and Sharma (1997), the negative growth of production of pulses can be mainly attributed to a decline in area and stagnancy in the yield. There is lack of an ineffective support price, lack of technological improvement, inadequate extension efforts and lack of government policy measures. Kaur et al (2018) said that major hurdles in the successful farming of pulses are the non-availability of quality seed, irrigation facilities, labour and other inputs availability. Although pulse cultivation has been observed to be somewhat profitable but it lacks assured returns due to lack of government procurement as well as low and unstable productivity (Kaur and Gupta 2018). Grover and Singh (2015) stated that pulse crops are risky in terms of yield and thereby profitability.

CONCLUSION

The study was carried out to compute the growth rate of the area, production and yield of pulses and to know about consequence of area, yield and interaction effect on the production of pulses in Punjab. It was concluded that area and production of pulses was declining whereas productivity was increasing with rate of 0.61 per cent per annum during the study period. Further decomposition analysis computed that area effect was the major contributing factor for change in production of total pulses because area under total pulses was declining with the growth rate of 6.13 per cent. The study suggested that expansion of area and improvement in yield of pulses might be done by providing improved varieties of seeds, pest resistant techniques, extension support, insurance coverage and sustained remunerative market for the produce of pulse growers.

Pulses can be produced with minimum use of resources; they do not require intensive irrigation and improve the quality of soil that leads the agriculture system towards sustainability. The study also suggested that government should make concerted efforts to develop short-duration varieties of pulses like mung dal that emerged as great source of additional income to the farmers.

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