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GROWTH AND DECOMPOSITION ANALYSIS OF AREA, PRODUCTION AND YIELD OF SOYBEAN

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ABSTRACT

India is the largest producer of oilseeds in the world and oilseed sector occupies an important position in the agricultural economy of the country. This paper explores the trend in area, production and productivity of soybean in Gujarat. The results showed that the CGRs of area, production and productivity of soybean were increased significantly over the period of last ten years (2010-11 to 2019-20) in Gujarat. The magnitude of instability in the production of soybean crop was higher as compared to area and productivity. The decomposition analysis concluded that all three effects were found positive for soybean in Gujarat during the study period. This clearly indicated that area, yield and their interaction effects contributed positively in increasing production of soybean in Gujarat.

Keywords: *soybean, compound growth rate, instability index, decomposition analysis*

INTRODUCTION

Oilseed crops have a vital role to play in the Indian agriculture, industry and export trades. Oilseeds are among the major crops that are grown in the country apart from cereals. Soybean has proved to be highly promising oilseed as well as leguminous crop under different agro climatic regions of India because of its high yield potentiality, wide adaptability, and short duration crop. The soybean (*Glycine max*. L.) is one of the important oilseeds as well as a pulse crop. It belongs to family Leguminoseae, sub family Papilionoideae. Soybean has emerged as golden bean of 21st century and it is largely used as oilseed. Soybean is fastest growing crop in India which replaced the crops like maize, cotton and pulses (Patil, 2015). The soybean crop has a prominent place as the world's most important seed legume, which contributes 25 per cent to the global vegetable oil production, about two-thirds of the world's protein concentrate. Oilseeds are major rainfed crops in India. Despite the deliberate efforts to boost the production of oilseeds domestically, it has not succeeded much in meeting the domestic oilseed demand (Jha *et al.,* 2012). Soybean is the cheapest source of high-quality protein. It is valued for its high (38-45 per cent) protein content as well as its high (approximately 20 per cent) oil content. Soybean is gaining ground globally due to its multipurpose use as human food, livestock feed, industrial purposes, and more recently, as a source of bio-energy (Myaka *et al.*, 2005). Soybean is a food legume and an excellent source of nutrition and health promoting phytochemicals at an affordable price. Besides its nutritive quality, functional properties of soy protein have opened avenues for producing new products and improving the quality of existing standard food products (Kumar *et al.*, 2018).

The major soybean growing states are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Andhra Pradesh, and Chhattisgarh. In India during 2018-19, production of soybean is about 11.00 million metric tonnes. Madhya Pradesh since beginning has been the major contributor to the soybean area and production, productivity of soybean in India is dominated by Madhya Pradesh and Maharashtra which contribute 89 per cent of the total production in the country (Kumar *et al.*, 2018). Gujarat is the minor soybean producing state in the country because soybean is newly introduced crop in Gujarat. During 2018-19, the area under soybean in Gujarat was 1.35 million hectare with 1731.3 MT productions and 1276.29 kg per hectare productivity (www.dag.gujarat.gov.in)

OBJECTIVE

To analyse the gowth and deecomposition of area, production and yield of soyabean in Gujarat

METHODOLOGY

The secondary time series data for last ten years (2010 to 2019) on area, production and yield of soybean were collected from various issues of Directorate of Agriculture, Agriculture, Farmers welfare & co-operation Department, Government of Gujarat and other official sources.

The compound growth rate (CGR) and Instability Index (II) was calculated by fitting the exponential function given below:

$$Y = a\, b^t \ldots\ldots\ldots\ldots (1)$$

Where,

Y= area/production/productivity

a = constant

b= regression co-efficient

t= time variable

Thus, natural log on both the sides of eq (1) was taken to convert it in to linear form.

$$\text{Log } Y = \log a + t \log b \ldots\ldots\ldots (2) \text{ and}$$

CGR (%) was worked out using following formula:

$$\text{CGR (\%)} = (\text{antilog of b-1}) \times 100$$

The simple co-efficient of variation (CV) often contains the trend component and thus over estimates the level of instability in time series data characterized by long-term trends. To overcome this problem, the Cuddy Della Valle Index was used to correct the CV.

$$\text{Instability Index (II)} = CV \times \sqrt{(1-R^2)}$$

Where, CV = co-efficient of variation

R^2 = co-efficient of determination from a time trend regression adjusted by the number of degrees of freedom.

Similar type of methods is also used by Devi and Jadav (2018), Devi *et al.,* (2019[a]) and Devi *et al.,* (2019[b]) for growth performance in area, production, productivity, price pattern and exports in India.

Decomposition Analysis

To measure the relative contribution of area, yield to the total production of soybean crop the decomposition analysis model as given by Minhas & Vaidhyanathan (1965) redeveloped by Sharma and Subramanyam (1984) and several research workers (Kalamkar, 2003) used this model and studied growth performance of crops on state. The method state that if A_0, P_0 and Y_0, respectively area, production and productivity in base year and A_n, P_n and Y_n are values of the respective variable in n^{th} year item.

$$P_0 = A_0 \times Y_0 \text{ and}$$

$$P_n = A_n \times Y_n \ldots\ldots\ldots\ldots (1)$$

Where, A_0 and A_n represent the area and Y_0 and Y_n represents the yield in the base year and n^{th} year respectively.

$$P_n - P_0 = \Delta P,$$

$$A_n - A_0 = \Delta P$$

$$Y_n - Y_0 = \Delta Y \ldots\ldots\ldots\ldots (2)$$

From equation (1) and (2) we can write

$$P_0 + \Delta P = (A_0 = \Delta A)\,(Y_0 + \Delta Y)$$

Hence,

$$P = \frac{A_0 \Delta Y}{\Delta P} \times 100 + \frac{Y_0 \Delta A}{\Delta P} \times 100 + \frac{\Delta Y \Delta A}{\Delta P} \times 100$$

Production = Yield effect + Area effect + Interaction effect

Thus, the total change in production can be decomposed into three components *viz.,* yield effect, area effect and the interaction effect due to change in yield and area.

Result and Discussion

Compound growth rate (CGRs) and Instability Index (II) of area, production and yield of soybean in Gujarat were computed and presented in Table 1. The compound growth rate of area, production and productivity of soybean was found to be positive and significant at the 1 per cent level of significance which was 11.48, 17.70 and 5.57 per cent, respectively. This showed that the area, production and productivity of soybean increased significantly in Gujarat over last ten years. For the estimation of inter annual fluctuation in area, production and productivity of soybean in Gujarat, the instability index was used. Further, the results of Instability Index (II) of soybean showed that the highest instability index was found for production (34.82) followed by area (30.03) and productivity (14.55).

Boyal *et al.*, (2015), Devi and Jadav (2020) and Jinjala *et al.,* (2020) conducted similar type of study on growth and instability in the area, production and productivity of cash crops and fenugreek, respectively.

Table 1: Compound growth rate (CGR) and instability index (II) of area, production and productivity of Soybean in Gujarat (2010-11 to 2019-20)

Sr. No.	Particulars	Compound Growth Rate (CGR %)	Instability Index (II)
1	**Area**	11.48**	30.03
2	**Production**	17.70**	34.82
3	**Productivity**	5.57**	14.55

* *Significant at 1 per cent level

Decomposition analysis

To determine how contribution of area, productivity and their interaction are responsible for the growth of soybean production in Gujarat during the 2010 to 2019, decomposition analysis was carried out. Growth in soybean production was decomposed into three factors *viz.,* area effect, yield effect and interaction effect. Table 2 shows that, the contribution of area, productivity and their interaction to the change in production over the years. All three effects were found positive for soybean in Gujarat during 2010-11 to 2019-20. This clearly indicated that area, yield and their interaction effects contributed positively in increasing production of soybean in Gujarat.

Area effect

It is revealed from the Table 2 that the area under soybean production in Gujarat plays a major role in growth of soybean production due to positive area effect by 66.94 per cent during 2010-11 to 2019-20.

Yield effect

It is revealed from the Table 2 that, yield effect was found to be positive and playing important role for increasing soybean production in the Gujarat by 20.31 per cent during 2010-11 to 2019-20.

Interaction effect

The interaction effect means the effect of change in area and yield together towards increase in production of soybean. It is evident from the Table 2 that, the interaction effect was influencing soybean production in the Gujarat by 12.75per cent during 2010-11 to 2019-20. The decomposition analysis was suggested that area was one of the important factors in overall development of soybean production followed by yield effect and interaction effect**.** These findings are in line with findings of Changela and Devi (2018) for pulses in Gujarat.

Table 2: Decomposition analysis of area, yield and their interaction towards increasing production of soybean (2010-2019)

Sr. No.	Particulars	Per cent
1	**Area effect**	66.94
2	**Yield effect**	20.31
3	**Interaction effect**	12.75

CONCLUSION

Soybean is one of the important largely used oilseeds as well as a pulse crop and emerged as golden bean of 21st century. The results showed that the CGRs of area, production and productivity of soybean were increased significantly over the period of last ten years in Gujarat. The magnitude of instability in the production of soybean crop was higher as compared to area and productivity. Decomposition analysis concluded that the area contributed significantly in the production of soybean and its impact on total soybean production in Gujarat was followed by yield effect, which impact on overall production of soybean by interaction (area and yield) effect was estimated to on overall increase in soybean production during the study period. The decomposition analysis suggested that area was one of the important factors in overall development of soybean production followed by yield and interaction effect.

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