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Analysis of growth trends for soyabean crop in India with special reference to Telangana and Zaheerabad mandal, Sangareddy district, Telangana state

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Abstract

Soybean (*Glycine max* (L) Merrill) is a significant leguminous crop known for its high productivity and contribution to soil fertility. This study examines the area, production, and productivity of soybean in India, Telangana, and Zaheerabad Mandal, Sangareddy District, Telangana, from 2019-2020 to 2023-2024 using secondary data. The compound annual growth rates were used to know the trends in area, production and productivity. Statistical 't' test also used to know whether there is significant change or not. In India there is a significant growth change for production, productivity, and it is not significant for area in soyabean. In Telangana there is a no significant growth change for area, production, and significant growth for productivity. The Compound Annual Growth Rates (CAGR) for area and production were 4.6 per cent and 3.9 per cent, respectively, indicating positive trends, while productivity declined by 0.6 per cent. Despite these trends, the statistical analysis using t-tests showed that none of the growth rates were significant at the 5 per cent level. The study highlights that there is need for improved agricultural practices to stabilize and enhance soybean productivity in the region.

Keywords: Telangana Soybean, Zaheerabad Mandal, Sangareddy District, Soybean Yield Analysis, Agricultural Trends

1. Introduction

Soybean (*Glycine max* (L) Merrill) is a leguminous field crop characterized by its bushy, erect, and leafy structure. This annual herbaceous plant typically reaches a height of 40– 100 cm. Soybean thrives in warm, moist climates, with soil temperatures of 15.5°C or higher promoting rapid germination and vigorous seedling growth. Sowing generally begins in early July, with pod development occurring by mid-July, and the crop is harvested in mid-September or early October.

Soyabean holds a significant position in global oilseed cultivation due to its high productivity, profitability, and essential role in maintaining soil fertility. In 2020-2021, the global cultivation area for soybeans was 136.82 million hectares, yielding 353.47 million tons. Brazil led first in soyabean production with 121.80 million tons, followed by the USA (112.55 million tons), Argentina (48.80 million tons), China (19.60 million tons), and India (12.61 million tons). India ranked fourth in terms of cultivated area, covering 12.91 million hectares or 9.34 percent of the world area, and fifth in production with 12.61 million tons in 2020-2021. India's soyabean cultivated area had been increased to 13.08 million hectares with production of 14.98 million tonnes in 2022-2023. The major soyabean-growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, and Telangana. In Telangana, the area under soyabean had reached to 0.297 million hectares during 2023-2024. (India stat, 2023).

2. Materials and methods

Present study was based on secondary data and confined to the period of 2019-2020 to 2023-2024. Data related to area, production, productivity of soyabean crop in India and Telangana was collected from Directorate of Economics and Statistics, Government of India.

Data regarding the area, production, and productivity of soybean crops in Zaheerabad Mandal, Sangareddy District, Telangana State, was collected from Village Revenue Office/ Mandal Revenue Office/ District – Joint Director of Agriculture Office, Directorate of Economics and Statistics, other state departments of Telangana, Government of India.

2.1. Analytical tools

2.1.1. Compound annual growth rate

Trend analysis was employed to analyze the data for Zaheerabad mandal, Sangareddy district. Compound Annual

Growth rates were used to study the growth in area, production, and productivity of soyabean crop in Zaheerabad mandal, Sangareddy district. The five years data for calculating CAGR was collected.

$$\text{CAGR} = \left(\frac{Fv}{Iv}\right)^{\frac{1}{N}} - 1$$

IV = Initial value
FV = Final value
N = Number of years

3. Results and Discussion

3.1. Growth trends area, production and productivity of India.

The data on the area, production and productivity and respective compound annual growth rates of soyabean crop in India from2019-2024 are presented in Table.1.

It is evident from the study that, the area under soyabean cultivation during 2019-20 was 12193 thousand hectares and there has been a 5 percent increase and an instantaneous 5 percent decrease in the years 2020-2021 and 2021-2022 respectively. This decline was attributed to gradual adjustments in cropping pattern. The area peaked in 2022-2023 with 13084 thousand hectares, reflected 7 percent increase over 2021-2022 due to increase in MSP, and recorded 0.6 percent decrease in area in 2023-2024. Soyabean production ranged from 11226 thousand tonnes in 2019-2020 to 13054 thousand tonnes in 2023-2024. The highest production 14985 thousand tonnes was recorded during 2022-2023 which attributed to increased area under soyabean due to surge in MSP by the government. The government has fixed the MSP of soyabean at Rs 4300 per quintal for the year 2022-2023 increasing by Rs 350 from Rs 3950 in 2021-2022 (08thJune 2022, CCEA, PIB, Delhi, Cabinet Committee on Economic Affairs). Productivity of soyabean crop showed an increasing trend ranging from 921 kg/ha in 2019-2020 to 1172 kg/ ha in 2023-2024. It is ascribed that, the percentage increase in production was found to be double (15.38%) than the percentage increase in area (7.71%) during 2022-2023 over 2021-2022.

The Compound Annual Growth Rate (CAGR) for the area, production, and productivity of soybean over this five-year period reflected a positive trend and recorded as 1.3 percent for area, 3.06 percent for production, and 4.9 percent for productivity. This growth can be attributed to favourable weather conditions, increased market demand for soybean products, higher MSP, and government support in the form of subsidies on seeds and fertilizers, (Mukyamanthri Beej Swavalamban Yojana in Rajasthan), as well as schemes encouraging farmers to cultivate soybean crop (Price support scheme).

The p value for area, production and productivity are 0.081,0.044 and 0.048 respectively. This analysis indicates that the area under soybean cultivation did not show significant growth, both production and productivity exhibited significant positive growth over the period from 2019 to 2024. The ‘t’ values are mentioned in the parenthesis.

Table 1: Compound annual growth rate of area, production and productivity of soyabean crop in India (2019-2024)

S.no.	Year	Area in ‘000’ hectares	% change over previous year	Production in ‘000’ tonnes	% change over previous year	Productivity in ‘kg/ha’	% change over previous year
1.	2019-2020	12193	-	11226	-	921	-
2.	2020-2021	12918	+5.95	12610	+12.33	976	+5.97
3.	2021-2022	12147	-5.97	12987	+2.9	1069	+9.53
4.	2022-2023	13084	+7.71	14985	+15.38	1145	+7.11
5.	2023-2024	13006	-0.60	13054	-12.89	1172	+2.36
	CAGR	1.3 (2.31)		3.06 (2.90)		4.9 (2.82)	

3.2. Growth trends of area, production and productivity of Telangana

The data on the area, production, productivity of soyabean crop in Telangana from 2019-2024 are given for discussion in Table.2.

The area under soybean cultivation was maximum of 297 thousand hectares during 2023-2024 there has been 47 percent increase over the year 2022-2023, while it was minimum in 2021-2022 with only 155 thousand hectares. The fluctuations in this trend can be attributed to various factors that includes increase in area was primarily due to farmers interest in growing soybean crop, market demand for soybean products, and the minimum support price (MSP) for soybean crop. Conversely, the decrease in 2020-2021 to 2021-2022 was due to changes in crop patterns, and few unfavourable weather conditions. Soyabean production ranged from 310 thousand tonnes in 2019-2020 to 481 thousand tonnes in 2023-2024. The highest production was recorded in 2023-2024 with 481 thousand tonnes, due to increased area under soyabean and also there was surge in MSP by the government, while the lowest production was recorded in 2020-2021 with 243.49 thousand tonnes. The decline in production during 2020-2021 over 2019-2020 due to mild unfavourable weather conditions and changes in cropping patterns. The productivity of soybean crop during 2019-2020 to 2023-2024 ranged from 1808 kg/ha to 1620 kg/ha, with a general decreasing trend. This decrease in productivity was largely due to adverse weather conditions, such as floods and droughts, which negatively impact crop yield.

The Compound Annual Growth Rate (CAGR) for soybean area and production indicates a positive trend, with area growing at 11.5 percent and production at 9.1 percent. However, the CAGR for productivity showed a negative trend with -2.2 percent. Overall, the area and production of soybean crop have shown an increasing trend, whereas the productivity has reflected negative trend.

The p value for area, production and productivity are 0.382, 0.736 and 0.044 respectively. This analysis indicates that the area and production of soybean cultivation did not show significant growth, but the productivity exhibited significant positive growth over the period from 2019 to 2024. The ‘t’ values are mentioned in the parenthesis.

Table 2: Compound annual growth rate of area, production, productivity of soyabean crop in Telangana (2019-2024).

S.no.	Year	Area in '000' hectares	% change over previous year	Production in '000' tonnes	% change over previous year	Productivity in 'kg/ha'	% change over previous year
1.	2019-2020	172	-	310.98	-	1808	-
2.	2020-2021	162	-5.81	243.49	-21.72	1503	-16.87
3.	2021-2022	155	-4.32	268.31	+10.19	1731	+15.17
4.	2022-2023	202	+30.32	326	+21.48	1612	-6.87
5.	2023-2024	297	+47.03	481	+47.55	1620	+0.50
	CAGR	11.50 (0.98)		9.1 (0.36)		-2.2 (-2.91)	

3.3. Growth trends of area, production and productivity in Zaheerabad mandal

The data on the area, production, productivity of soyabean crop in Zaheerabad mandal from 2019-2024 are given for discussion in Table.3.

The area under soybean cultivation shows an overall increasing trend from 2019-2020 to 2023-2024 with a Compound Annual Growth Rate (CAGR) of 4.6 percent. The area under soyabean cultivation during 2019-2020 was 3991 hectares and there has been 20 percent increase and 18 percent decrease in the year 2020-2021 to 2021-2022 respectively. The decline was due to various factors like crop rotation practices, market-driven decisions by farmers. There is an increase in the area from 2019-2020 (3991 ha) to 2020-2021 (4793 ha) and from 2021-2022 (3892 ha) to 2022-2023(4884 ha).

Production also follows an increasing trend with a CAGR of 3.9 percent. A significant 18 percent increase in production from 2019-2020 (2466 tonnes) to 2020-2021 (2924 tonnes) and maximum increase about 49 percent from 2021-2022 (2036 tonnes) to 2022-2023 (3038 tonnes) due to increased area under soyabean and also there was surge in MSP by the government. There was 30 percent decline in production during 2021-2022 (2036 tonnes) due to adverse weather conditions and decreased area. The productivity of soyabean fluctuates over the years, with a slight overall decrease indicated by a CAGR of -0.6 percent. The highest productivity was recorded in 2022-2023 (1555kg/ ha), while the lowest was in 2021-2022(1307 kg/ ha). The decrease in yield was due to factors such as pest attacks, unfavourable weather conditions, climatic conditions like flooding, droughts, irregular rainfall, inadequate use of fertilizers, and poor crop management practices.

The p-values for area is 0.091, production is 0.310, and productivity is 0.278 were all above 0.05, confirming that the changes in these variables over the period were not significant at the 5% level. Among all the three variables such as area, production and productivity none of the variables have shown significant growth rate. The 't' values are mentioned in the parenthesis.

Table 3: Compound annual growth rate of area, production and productivity of soyabean crop in Zaheerabad (2019-2024)

S.no.	Year	Area in hectares	% change over previous year	Production in tonnes	% change over previous year	Productivity in 'kg/ha'	% change over previous year
1.	2019-2020	3991	-	2466	-	1542	-
2.	2020-2021	4793	+20.08	2924	+18.56	1525	-1.10
3.	2021-2022	3892	-18.79	2036	-30.38	1307	-14.28
4.	2022-2023	4884	+25.51	3038	+49.18	1555	+18.99
5.	2023-2024	4987	+2.11	2985	-1.75	1495	-3.86
	CAGR	4.6 (2.21)		3.9 (1.16)		-0.6 (1.26)	

4. Conclusion

The study of soybean cultivation in India, Telangana, and Zaheerabad Mandal, Sangareddy District, Telangana, from 2019-2024 reveals varying trends in area, production, and productivity. While India experienced significant growth in production and productivity, the area under cultivation showed no significant growth. Telangana exhibited a strong increase in the area and production but faced a decline in productivity. In Zaheerabad Mandal, the trends were generally positive, but none of the growth rates were statistically significant. These findings underscore the need for improved agricultural practices to stabilize and enhance soybean productivity, particularly in regions like Telangana, where productivity has lagged despite increases in area and production.

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