### ****Original research article****

### ****DYNAMICS OF SOYBEAN PRODUCTION IN BULDHANA DISTRICT OF MAHARASHTRA****

### ****ABSTRACT****

### **S**oybean is a major oilseed crop in the state of Maharashtra and Buldhana is considered as the largest producer district of Soybean crop in Maharashtra. Buldhana district contributes to a major share in the total area under Soybean cultivation as well as total Soybean production in Maharashtra which is among the largest producers of Soybean in India. The research was done in order to understand the Production of Soybean crop in the select study area and the factors responsible for the increase or decrease in production viz., the effect area and yield has on the crop. To analyse changes in Soybean production in Buldhana district. The study was used **to analyse the effect of area and yield over the production of Soybean. The research was carried out in Buldhana district of Maharashtra for the period of 15 years from 2007-08 to 2021-22. The study was based on the time series data collected from authorized government sources on area, production and Yield of Soybean in Buldhana district for the duration of 15 years. The research used decomposition analysis as the research tool to determine the impact of area and yield over the increase or decrease in Soybean production. In additive decomposition model, the area effect and yield effect were calculated to determine the change in production of Soybean. The study also revealed the contribution of each effect over the change in production. The study derives the drivers behind the increase or decrease in production of Soybean in Buldhana district of Maharashtra. The present research reveals that, the yield effect was the driving factor behind the increase or decrease in production of Soybean in Buldhana district of Maharashtra over the study period as the area effect and yield effect were calculated for individual year. The yield effect contributed 84.88 percent to the change in production of Soybean in Buldhana district of Maharashtra while the remaining 15.12 percent was due to the yield effect.** It was concluded that, with the contribution of 84.88 percent, yield effect contributed a major share in increasing/decreasing the production of Soybean in Buldhana district of Maharashtra. However, the improvement was needed to stabilize the increased growth of yield.

### Keywords: Decomposition, growth, contribution in production, area effect, yield effect.

**1. INTRODUCTION**

Soybean is an important oilseed crop in Maharashtra as it was ranked 2nd in area under cultivation at 4595.03 thousand hectares and 1st in production of Soybean at 5500.25 thousand tonnes in year 2021-22 (Department of Agriculture and farmers welfare, 2024). **Buldhana district** plays a key role in the state's Soybean production with its ranks of 2nd in area under Soybean cultivation and 1st in Soybean production. In the year **2021-22**, Buldhana cultivated **443849 hectares** of soybean, yielding **750581 tonnes** with a productivity of **1.69 ton per hectare**. This positions Buldhana as the largest contributor to Maharashtra's soybean production, making it an important region for understanding production dynamics. It contributed to the 9.66 percent of the total area under Soybean cultivation and 13.65 percent of the total Soybean production in the state of Maharashtra in the agricultural year 2021-22. Soybean is majorly grown for its use in human and animal feed for its edible protein and oil content as well as in industrial use. This study used the **Additive decomposition model** to determine the components influencing changes in soybean production in Buldhana. Specifically, it examines the contributions of **area effect** and **yield effect**, providing insights into the role of area expansion and yield improvements in shaping production trends. Buldhana district shows its significance in this research in its substantial agricultural output, making it a representative case for the broader trends in soybean farming in Maharashtra. By applying this decomposition model, the study aims to identify the key components affecting the change in production and provide recommendations for enhancing productivity and formulating targeted agricultural policies.

**2. MATERIAL AND METHODS**

The study was based on the time series secondary data on area, production and yield of Soybean crop in Buldhana District of Maharashtra. The data was collected for 15 years from 2007-08 to 2021-22. The decomposition analysis was used to work out the change in production of Soybean in Buldhana district of Maharashtra. The studies Datarkar *et al.* (2016), Sharma (2016), Pathrikar *et al.* (2022), and Tiwari *et al.* (2022) used growth rate analysis to determine whether the area or the yield showed more growth and thus determining the pattern of change in production viz., increase or decrease in production of Soybean over the study period. However, some studies viz., Tayade *et al.* (2013), Hazari (2015), Datarkar *et al.* (2017) and Ninawe *et al.* (2020) used the decomposition analysis to determine the effect of area and yield s well as their interaction on the increase or decrease in production of Soybean in Maharashtra.

**Decomposition analysis:** Decomposition analysis is used to analyse the contributions of individual components influencing the change. In this study, it is applied to soybean production in Maharashtra to break down the changes in output into **area effect** and **yield effect.** This analysis isolated the impact of area expansion and yield improvements on production over time, providing insights into the relative importance of each factor and guiding policy decisions.

The **Additive Decomposition Model** by Minhas and Vaidyanathan (1965) in the book by Vani *et al.* (2020) was employed to decompose the change in soybean production into three components: area effect, yield effect, and interaction effect. The decomposition model (Vani, *et.al. 2020*) begins with the following equation:

Where,

Δ Qt represents the change in production,

Δ At and Yt represent the changes in area and yield, respectively.

To refine this decomposition, the interaction effect is split equally between the area and yield effects, eliminating its residual influence. The modified equation is:

∆ Qt = (∆ AtYt-1 +0.5 ∆ At ∆Yt )+(∆ YtAt-1 +0.5 ∆ At ∆Yt)

Thus, the absolute change in production is the sum of the **area effect** and **yield effect,** where:

**Area Effect**: The contribution of changes in area, with yield held constant at the previous year’s value, adjusted for interaction effects.

**Yield Effect**: The contribution of changes in yield, with area held constant, adjusted for interaction effects.

This model allowed to get clearer understanding of how area and yield each contribute to changes in production, helping to differentiate the factors driving growth in soybean output.

**3 Result and discussion:** The research reveals the factors driving the change in production of Soybean in Buldhana district of Maharashtra as well as how the area effect and yield effect affected the production of Soybean in the district.

**Table.1. Area and yield effect on change in production of Soybean in Buldhana**

|  |  |  |
| --- | --- | --- |
| Parameters | Average | Effect |
| Area (Hectare) | 322044.27  (25.31) | 24639.87  101.53 |
| Yield (Ton/Ha.) | 1.28  (43.07) | -94.47  -236741.51 |
| Production (Tonnes) | 415323.27  (49.86) | 24545.40  882.93 |

*Note: Figures in parentheses are the coefficient of variation in percentage*

From table 1. it was observed that over the period of 15 years from 2007-08 to 2021-22, the Soybean was cultivated under the average area of 322044.27 hectare with the average yield of 1.28 ton per hectare. The average production of Soybean during the period of 2007-08 to 2021-22 was 415323.27. The fluctuations were found to be more prominent in the yield at 43.07 percent which also affected the production as the C.V. of production was observed to be 49.86 percent.

The average area effect on the change in production was observed to be positive and significant at 24639.87. The area effect was observed to be negative in years 2009-10, 2015-16 and 2019-20 negatively affecting the change in production. During year 2015-16, though area effect was negative; the yield effect was also found negative with a large margin and negatively affected the production. The area effect was found maximum in year 2013-14 with the area effect of 66022 during which the yield effect was found negative and significantly affected the production. However, the change in production of Soybean in Buldhana during year 2013-14 was more due to the area effect [Appendix table 1.].

**Table 2. Growth and contribution of area effect and yield effect**

|  |  |  |
| --- | --- | --- |
| Parameters | % Growth | % Contribution |
| Area | 5.17  (171.67) | 15.12  (830.76) |
| Yield | 29.00  (367.64) | 84.88  (148.68) |
| Production | 34.17  (307.79) | 100 |

*Note: Figures in parentheses are the coefficient of variation in percentage*

The average yield effect during the study period was observed to be -94.47 in Buldhana district of Maharashtra. It was observed that, out of seven times when the yield effect was found negative, five times the change in production was observed to be negative viz., every time the change in production was negative it was due to the negative area effect[Appendix table 1.]. When the yield effect was positive, it was found more than area effect except in the years 2012-13, 2013-14 and 2018-19 where the area effect was found more dominant. The same can be observed in figure 1 as well as appendix table 1. The change in production was found to be maximum during the year 2016-17 at 543200 during which the yield effect was also found to be maximum at 528177.

The average annual growth in area was observed to be 5.17 percent while average annual growth in yield was 29.0 percent. Both together were responsible for the average annual growth in production of 34.17 percent. From table.2. it was observed that the yield effect contributed more to the change in production than the area effect at 84.88 percent. The appendix table 1. states that, though the yield effect affected the change in production more the area effect was also found dominant in years 2012-13, 2013-14 and 2018-19 during which area contributed more to the change in production of Soybean in Buldhana district of Maharashtra. It was also concluded that though yield effect was found to be the driving factor in the increase or decrease in the change in production of Soybean in Buldhana the yield is not consistent.

Datarkar *et.al.* (2017) also revealed similar results though in the Latur and Amaravati districts of Maharashtra which stated that with the contribution of 25.78 percent the yield affected the most to the production of Soybean in the selected areas viz., Latur, Amaravati and Ahmednagar districts of Maharashtra. Tiwari *et al.* (2022) were also of the view that, over the years in the major Soybean producing district, the yield was observed to be increasing over the last few years and it was essential to stabilize this increasing yield through various conventional as well as non-conventional means. The other research studies viz., Hazari (2015), Ninawe *et al.* (2020) and were of the contradictory view that, the area effect contributed a major role in increasing the production of Soybean in Maharashtra during their respective study periods. Datarkar et al. (2016), Sharma (2016) and Pathrikar *et al.* (2022) also revealed similar results with the growth in area resulting in the increased growth in production of Soybean during the study period.

**Policy implication:**

From the average yield effect of -94.47 it can be implied that, the yield over the period of study was found decreased on an average and there is a scope to increase the yield levels of Soybean crop in Buldhana district of Maharashtra. While the fluctuating yield effect as well as growth in the yield also depicts that, the yield levels were not stable during the study period. Thus, it was suggested that the government should lay more emphasis in stabilizing the yield level and promote high yielding varieties as well as yield improving technological innovations in the Soybean cultivation practices in Buldhana district of Maharashtra.

**Conclusion:**

The study revealed that the yield effect was found to be the driver behind the change in production of Soybean in Maharashtra. It was also concluded that the yield though dominant factor was found inconsistent. Thus, it was suggested that, the government should employ yield promoting technologies as well as high yielding varieties of Soybean in Buldhana as well as the state of Maharashtra. The government should also lay emphasis on improving the yield stability in Buldhana district of Maharashtra.

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**Appendix:**

**Table 1: Change in production/output of Soybean in Buldhana district of Maharashtra**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Area effect** | **Yield effect** | **Change in output** | **Growth in area** | **Growth in Yield** | **Growth in output** | **% Share of area** | **% Share of Yield** |
| 2007-08 | **0** | **0** | **0** | 0.0 | 0.0 | 0.0 | 0 | 0 |
| 2008-09 | 56767 | -370467 | -313700 | 14.845 | -96.88 | -82.04 | -18.10 | 118.10 |
| 2009-10 | -13895 | 101695 | 87800 | -20.225 | 148.03 | 127.80 | -15.83 | 115.83 |
| 2010-11 | 16387 | 243213 | 259600 | 10.471 | 155.41 | 165.88 | 6.31 | 93.69 |
| 2011-12 | 54797 | -96697 | -41900 | 13.169 | -23.24 | -10.07 | -130.78 | 230.78 |
| 2012-13 | 30899 | 25201 | 56100 | 8.257 | 6.74 | 14.99 | 55.08 | 44.92 |
| 2013-14 | 66022 | -17322 | 48700 | 15.343 | -4.03 | 11.32 | 135.57 | -35.57 |
| 2014-15 | 29571 | -319471 | -289900 | 6.174 | -66.69 | -60.52 | -10.20 | 110.20 |
| 2015-16 | -50 | -28650 | -28700 | -0.026 | -15.15 | -15.18 | 0.17 | 99.83 |
| 2016-17 | 15023 | 528177 | 543200 | 9.366 | 329.29 | 338.65 | 2.77 | 97.23 |
| 2017-18 | 8223 | -272223 | -264000 | 1.169 | -38.69 | -37.52 | -3.11 | 103.11 |
| 2018-19 | 38949 | -30120 | 8829 | 8.860 | -6.85 | 2.01 | 441.15 | -341.15 |
| 2019-20 | -9593 | 97008 | 87415 | -2.139 | 21.633 | 19.494 | -10.97 | 110.97 |
| 2020-21 | 29150 | 130101 | 159251 | 5.440 | 24.280 | 29.720 | 18.30 | 81.70 |
| 2021-22 | 47347 | 8139 | 55486 | 6.812 | 1.171 | 7.983 | 85.33 | 14.67 |
| Average | 24640 | -94 | 24545 | 5.17 | 29.00 | 34.17 | 15.12 | 84.88 |
| S.D. | 25017 | 223654 | 216718 | 8.87 | 106.62 | 105.17 | 126 | 126 |
| C.V. (%) | 101.53 | -236741.5 | 882.93 | 171.67 | 367.64 | 307.79 | 830.76 | 148.68 |