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

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

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

###  **S**oybean is a major crop in Maharashtra, with Yavatmal district emerging as a significant contributor to the state's production. Yawatmal is among the major Soybean producing as well as Soybean cultivating districts in Maharashtra. It contributed to 6.26 percent of total area under Soybean cultivation and 5.23 percent of total production of Soybean in Maharashtra which is among the largest producer states of Soybean crop in India. This research concerns with the various factors responsible for the change/ increase or decrease in production of Soybean in Yawatmal district. The present study aims to analyse changes in soybean production. The study was used **to determine the impact of area effect and yield effect over change in production of Soybean. The study was carried out in Yawatmal district of Maharashtra for the period of 15 years from 2007-08 to 2021-22. The study used time series secondary data on area, production and Yield of Soybean in Yawatmal district collected from authorized government sources for the duration of 15 years. Decomposition model was used as a research tool for this research. The additive model of decomposition was incorporated with a bit of improvement wherein, the area effect and yield effect on the production of Soybean were calculated. The study also revealed the contribution of each effect over the change in production viz., increase/decrease in Soybean production. The present research was worked out with the view of determining the drivers behind the production of Soybean in Yawatmal district of Maharashtra. In the present study it was revealed that, the yield effect was the major contributing factor during the overall study period which was observed from the average annual growth rate of 15.04 percent and the contribution of 85.58 percent by yield of Soybean crop in Yawatmal district of Maharashtra. Whereas the average annual growth in area was observed to be negative over the study period both collectively resulting in the AAGR of Production to be 12.12 percent. The crop was found unstable from the very high coefficient of variations and thus it was suggested to increase and stabilizing the yield of Soybean crop in the select district.** The present study concluded that, the increase or decrease in Soybean production was due to the yield effect in Yawatmal district of Maharashtra throughout the study period and the suggestions were made in response as to increasing and stabilizing the yield of Soybean crop to improve the overall performance of Soybean in Maharashtra.

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

**1. INTRODUCTION**

Soybean is a crucial crop in Maharashtra as well as India. Soybean alone contributed to kharif oilseed crop production of 12.98 million tonnes under the area of 12.146 million hectare (Department of Agriculture and farmers welfare, 2024). **Yavatmal district** plays a key role in the state's production. In the year **2021-22**, Yavatmal cultivated **287432 hectares** of soybean, yielding **287875 tonnes** with a productivity of **one ton per hectare**. Yawatmal district alone contributes to 6.26 percent of total area under Soybean cultivation and 5.23 percent of total Soybean production in Maharashtra. This positions Yavatmal as a major contributor to Maharashtra's soybean output, making it an important region for understanding production dynamics. The Soybean crop is widely cultivated for its oil and protein contents along with its industrial use as well as in animal feeds. This study employs **decomposition analysis** using the **Additive decomposition model** to dissect the factors influencing changes in soybean production in Yavatmal. 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. Yavatmal 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 drivers of the change in production, offering valuable projections and 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 Yawatmal District of Maharashtra. The data was collected for 15 years from 2007-08 to 2021-22. The previous works of Sharma (2016), Datarkar et al. (2016), Tiwari et al. (2022) and Pathrikar et al. (2022) used growth rate analysis to identify the change in area under cultivation of Soybean in Maharashtra as well as major Soybean producing states of India. Similarly, a few also used decomposition analysis to understand the effect of area, yield and their interaction over the increase or decrease in production of Soybean in the state of Maharashtra. In the present research, the decomposition analysis was used to work out the change in production of Soybean in Yawatmal district of Maharashtra.

**Decomposition analysis**

 Decomposition analysis is a quantitative approach used to assess the individual contributions of various factors to changes in a given phenomenon. In this research, it is applied to soybean production in Maharashtra to break down the changes in output into **area effect** and **yield effect.** This analysis helps isolate 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:

$$∆Q\_{t}=∆A\_{t}Y\_{t-1}+∆Y\_{t}A\_{t-1}+∆A\_{t}∆Y\_{t}$$

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 $(∆A\_{t}∆Y\_{t})$ 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 & Discussion:**

 The study revolved around the area effect and yield effect and their contribution in the production of Soybean in Yawatmal district of Maharashtra.

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

|  |  |  |
| --- | --- | --- |
| Parameters | Average | Effect |
| Area | 271611.60(12.23) |

|  |
| --- |
| 3229.61 |
| (1091.38) |

 |
| Yield | 0.91(46.14) |

|  |
| --- |
| -6271.27 |
| (-2268.89) |

 |
| Production | 236168.13(38.97) |

|  |
| --- |
| -3041.67 |
| (-3875.86) |

 |

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

 In table 1. it was observed that the average area under Soybean cultivation in Yawatmal was 271611.60 hectare during the study period with the C.V. of 12.23 suggesting less fluctuations in area. The average yield was 0.91 ton per hectare however, with the large fluctuations of 46.14 percent. This also affected the production with the fluctuations of 38.97 percent where the average production in Yawatmal was observed to be 236168.13 tonnes. The fluctuation in production was mainly due to the yield aspects of the Soybean production.

 The average effect of area on change in production was found to be 3229.61. The area effect was observed to be negative in year 2010-11, 2015-16 and 2016-17 at -100942, -5158 and -32018 respectively. During this period the yield effect was observed to be positive and significant. The average yield effect during the study period of 2007-08 to 2021-22 was -6271.27. The average change in production during the study period was -3041.67 fluctuation in the change in production reflected the fluctuations and the effect of yield over the production.

 It was observed that five out of six times when the yield effect was negative the production was found to have decreased [Appendix table 1.]. Every negative change in production was related to the negative yield effect. In year 2010-11 and year 2016-17 when the change in production was observed maximum at 146500 and 141500 respectively, the yield effect was found at its maximum at 247442 and 173518 respectively even when the area effect was negative. The can also be observed in figure 1.

 The average annual growth in area was -2.92 per cent contributing -24.05 percent to the total average change in production. The average annual growth in yield was 15.04 percent which contributed to the 87.58 percent of the total average change in production. The average change in production was 12.12 percent [table 2.]. The fluctuation in yield also reflected the fluctuation in the production of Soybean production in Yawatmal district of Maharashtra. During the overall study period the contribution of area effect was found dominant in the year 2011-12 and year 2021-22 at 124.68 percent and 84.43 percent.

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

|  |  |  |
| --- | --- | --- |
| Parameters | % Growth | % Contribution |
| Area | -2.92(-790.07) | 5.75(800.15) |
| Yield | 15.04(475.22) | 87.58(59.35) |
| Production | 12.12(440.49) | 100 |

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

 Tayade et al. (2013) revealed the highest growth in productivity/yield of Soybean at 17.75 percent during the period of 1985 to 1995 however the growth was observed to be high in area and production of Soybean during the period of 1995 to 2007. Similarly, Datarkar et al. (2017) revealed that the yield effect contributed to the increase in production of Soybean in the study area more than that of the area effect. Contrary to these, Sharma (2016), Hazari (2015), Ninawe et al. (2020), Pathrikar (2022) and Datarkar et al. (2016) were of the view that the change in production of Soybean was greatly due to the increase in area under Soybean cultivation. Tiwari et al. (2022) revealed that though the area effect was found dominant in the study; the yield of Soybean was found to be increasing gradually.

 The present research thus concluded that the growth in production of Soybean was majorly due to the growth in yield of Soybean as were the result obtained from appendix table 1. When the growth of Yield was observed to be negative, the growth in production was also found negative. It was thus also revealed that the yield effect contributed to 87.58 percent to the average total change in production and is concluded to be the driver behind the change in production of Soybean in Yawatmal district of Maharashtra. It was thus suggested to increase the yield of Soybean through various technological interventions rather than increasing the acreage under Soybean cultivation though the area effect also played a significant role in increasing the production of Soybean in Yawatmal district of Maharashtra during the study period. However, the negative yield effect strictly suggested the need to increase the acreage under Soybean cultivation in Yawatmal district of Maharashtra.

**4. Policy implication:**

 The present research revealed that the yield viz., productivity of Soybean played a key role in increasing the production of Soybean in Yawatmal district. Though area effect also contributed, it was found that the yield effect was the driving factor behind the change in production of Soybean in Yawatmal district. Thus, it was suggested to increase the acreage under Soybean cultivation in Yawatmal district of Maharashtra. It was suggested to increase as well as stabilizing the yield of Soybean in Yawatmal district through increased acreage as well as use of technological innovations.

**5. Conclusion:**

 The research concluded that, during the study period of 15 years from 2007-08 to 2021-22, the yield effect was found to be the driving factor behind the change in production of Soybean in Yawatmal district. The research revealed the negative average yield effect affecting the production negatively. The study concluded the direct relationship between the decrease in yield of Soybean to the decrease in growth of production of Soybean in Yawatmal district of Maharashtra. Thus, it was suggested to increase the yield of Soybean in Yawatmal district with an effort in stabilizing the yield of Soybean.

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**APPENDIX**

**Table 1: Change in production of Soybean in Yawatmal district of Maharashtra**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Area effect** | **Yield effect** | **Change in Production**  | **Growth in area** | **Growth in Yield** | **Growth in production** | **% Share area effect** | **% Share** **yield effect** |
| 2007-08 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | - | - |
| 2008-09 | 35787.6 | -265587.6 | -229800.0 | 10.73 | -79.64 | -68.91 | -15.57 | 115.57 |
| 2009-10 | 0.0 | 22900.0 | 22900.0 | 0.00 | 22.08 | 22.08 | 0.00 | 100.00 |
| 2010-11 | -100941.7 | 247441.7 | 146500.0 | -79.73 | 195.45 | 115.72 | -68.90 | 168.90 |
| 2011-12 | 31169.8 | -6169.8 | 25000.0 | 11.41 | -2.26 | 9.15 | 124.68 | -24.68 |
| 2012-13 | 23019.8 | 67980.2 | 91000.0 | 7.72 | 22.80 | 30.53 | 25.30 | 74.70 |
| 2013-14 | 53472.1 | -285972.1 | -232500.0 | 13.74 | -73.50 | -59.75 | -23.00 | 123.00 |
| 2014-15 | 8846.2 | -67846.2 | -59000.0 | 5.65 | -43.32 | -37.68 | -14.99 | 114.99 |
| 2015-16 | -5157.9 | 48457.9 | 43300.0 | -5.28 | 49.65 | 44.36 | -11.91 | 111.91 |
| 2016-17 | -32018.4 | 173518.4 | 141500.0 | -22.72 | 123.15 | 100.43 | -22.63 | 122.63 |
| 2017-18 | 1445.1 | -77545.1 | -76100.0 | 0.51 | -27.46 | -26.95 | -1.90 | 101.90 |
| 2018-19 | 22885.7 | 98020.3 | 120906.0 | 11.09 | 47.51 | 58.61 | 18.93 | 81.07 |
| 2019-20 | 7571.0 | -100310.0 | -92739.0 | 2.31 | -30.66 | -28.34 | -8.16 | 108.16 |
| 2020-21 | 0.0 | 50607.0 | 50607.0 | 0.00 | 21.58 | 21.58 | 0.00 | 100.00 |
| 2021-22 | 2364.8 | 436.2 | 2801.0 | 0.83 | 0.15 | 0.98 | 84.43 | 15.57 |