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Trends and dynamics in price behavior of major oilseeds in Chhattisgarh

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Abstract

The present study analyzes the trends and growth dynamics of groundnut and soybean in Chhattisgarh, focusing on their long-term price behaviour, market arrivals, and production performance. The objectives were to examine trends in arrivals and prices and to estimate the growth rates of area, production, and productivity. The analysis used secondary data covering 15 years (2008–2023) for area, production, and productivity, and 12 years (2013–2024) for arrivals and prices. Linear regression was used to capture time-based trends, while the compound annual growth rate (CAGR) method was employed to measure growth performance. The results indicated an inverse relationship between arrivals and prices for both crops. In Jashpur, groundnut arrivals declined from 67.23 tonnes in 2013 to 5.83 tonnes in 2024, while prices rose from ₹2898.25 to ₹4729.55, with arrivals decreasing at –18.95% annually and prices rising by 3.19%. For soybean, Kabirdham recorded a fall of -6.44% in arrivals and a price rise of 5.09%, whereas Rajnandgaon showed a -21.02% decline in arrivals and 5.23% growth in prices. Growth analysis further revealed that groundnut registered positive growth in area (4.45%) and production (4.75%) with stagnant productivity (0.08%), while soybean recorded negative growth in area (–5.25%) and production (–6.31%) with marginal decline in productivity (–1.12%). These findings highlight the supply-driven nature of price behaviour and the greater vulnerability of soybean compared to groundnut in Chhattisgarh.

Keywords: Price behavior, oilseeds, trend analysis, moving average, linear regression, Chhattisgarh

Introduction

Agriculture continues to serve as the backbone of the Indian economy, employing a substantial share of the workforce and contributing significantly to the nation's Gross Value Added (GVA). Within this sector, oilseeds hold a special place as they provide edible oils, feed, and raw materials for agro-based industries, while also ensuring nutritional security. Among the oilseeds, groundnut and soybean are particularly important for both India and Chhattisgarh. India ranks among the largest producers of these crops, yet the rising demand for edible oils often surpasses domestic supply, leading to heavy dependence on imports. This gap highlights the need to enhance oilseed productivity and stabilize market performance at the state level.

In Chhattisgarh, favorable agro-climatic conditions and a sizable share of cultivated area make groundnut and soybean vital to the state's oilseed basket. Groundnut is widely grown for its dual role as a food and oilseed crop, valued for edible oil and protein content. Soybean, on the other hand, has emerged as a dominant kharif crop, contributing not only to edible oil production but also to the poultry and livestock feed industry. Together, these crops are cultivated extensively in districts such as Jashpur, Kabirdham, and Rajnandgaon, where they form a crucial source of farm income.

Despite their importance, groundnut and soybean farmers face challenges such as fluctuating yields, unstable market prices, and climatic variability, which constrain profitability and sustainability. Analyzing the long-term behaviour of arrivals and prices, along with the growth performance of area, production, and productivity, is therefore essential for understanding the dynamics of these crops. By drawing on secondary data covering 15 years (2008–2023) for area and production, and 12 years (2013–2024) for arrivals and prices, the present study seeks to provide insights that can guide policy interventions, extension strategies, and resource management to improve oilseed development in Chhattisgarh.

Methodology

The present study is entirely based on secondary data collected from reliable government sources. Time series data for a period of 15 years (2008–2023) was used for analyzing the area, production, and productivity of major

oilseed crops in Chhattisgarh. Similarly, data on market arrivals and prices were obtained for 12 years (2013–2024). The major oilseeds selected for this study include soybean and groundnut, identified based on their extensive cultivation across the state. Districts with the highest area under each of these crops were purposively selected for detailed analysis. Data were sourced from the Directorate of Agriculture, Indrawati Bhawan, Naya Raipur, and the Agricultural Marketing Information Network (AGMARKNET), ensuring accuracy and consistency across variables and periods.

For examining the trends in market arrivals and prices, a time series analysis was carried out using both the moving average method and linear regression. The moving average technique helped smooth short-term fluctuations and highlight underlying trends.

$$Y_t = a + bt + E_t$$

Where,

Y_t = Time series yearly data of arrivals or prices
a = Intercept
b = Regression coefficient
t = Period in years 1,2,…, 10 E_t =Random Error

Linear growth rate (LGR)

$$LGR = \frac{b}{\bar{y}} \times 100$$

Where, b = Regression coefficient
$\bar{y}$ =mean of the dependent variable

The performance of a variable over time can be assessed using the Compound Annual Growth Rate (CAGR), which reflects its historical growth trend. In economic research, growth analysis is a common method used to examine the long-term behavior of specific variables. It provides a clear picture of how a variable has evolved over a given period and serves as a valuable tool for informing policy decisions. In this study, the growth rates of area, production, and productivity of various crops over 15 years were estimated using an exponential growth function of the following form:

$$Y = a^{B^t}$$

Log Y= log a+ t log B

Where,
Y Area/ production /productivity
a = Constant
B= Regression coefficient
t= time in years

Compound annual growth rate (%) = (Antilog B-1)100

Result and Discussion

1.1 Arrivals and Prices Trend of Groundnut Analysis in Jashpur District (2013–2024)

Groundnut arrivals in Jashpur showed a steep decline during 2013–2024. The fitted trend equation (Y=25.74−4.878X) indicated a consistent fall, with the regression coefficient (b) estimated at –4.878. Actual arrivals dropped from 67.23 tonnes in 2013 to 5.83 tonnes in 2024, while trend values declined from 52.57 to –1.09 over the same period. The Linear Growth Rate (LGR) confirmed an annual decline of –18.95%, and the t-value of –5.40, significant at 1%, established the statistical validity of this negative trend.

In contrast, groundnut prices in Jashpur exhibited a significant upward trend. The estimated regression coefficient (b) was 132.92, with the trend equation (Y=4161.89+132.92X) capturing steady price growth. Prices rose from ₹2898.25 in 2013 to ₹4729.55 in 2024, while trend values increased from ₹3430.8to to ₹4892.99. The LGR showed an annual growth of 3.19%, and the corresponding t-value of 5.81, significant at 1%, confirmed the robustness of this rising trend.

Table 1: Groundnut Arrivals Trend values in Jashpur(2013-2024)

Year (X)	Actual arrivals(y)	Trend value(Y)
2013	67.23	52.57
2014	61.80	47.69
2015	37.83	42.82
2016	19.85	37.94
2017	20.54	33.06
2018	23.32	28.18
2019	29.29	23.30
2020	8.29	18.43
2021	14.45	13.55
2022	12.70	8.67
2023	7.80	3.79
2024	5.83	-1.09
LGR	-	-18.95%
T	-	-5.40**

** denotes 1% level of significance
* denotes 5% level of significance

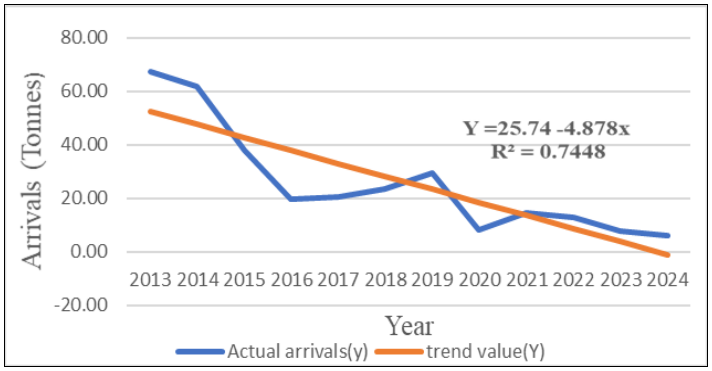

Fig 1: Groundnut Arrivals Trend in Jashpur (2013-2024)

Table 2: Groundnut Prices Trend values in Jashpur (2013-2024)

Year (X)	Actual prices(y)	Trend value(Y)
2013	2898.25	3430.8
2014	3488.64	3563.73
2015	3741.08	3696.66
2016	4174.9	3829.58
2017	4197.27	3962.51
2018	4476	4095.44
2019	4332.7	4228.36
2020	4366.64	4361.29
2021	4238.5	4494.22
2022	4459.08	4627.14
2023	4840.18	4760.07
2024	4729.55	4892.99
LGR	-	3.19%
T	-	5.81**

** denotes 1% level of significance
* denotes 5% level of significance

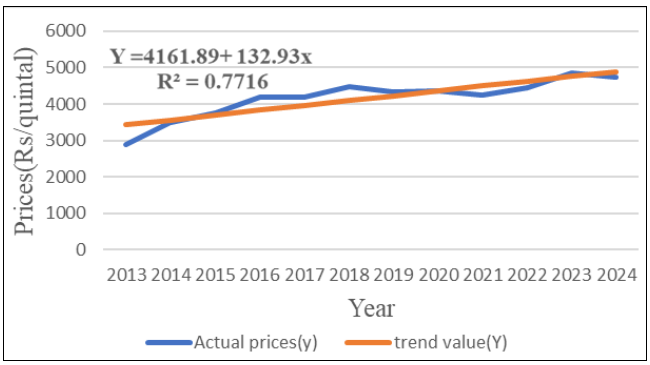

Fig 2: Groundnut Prices Trend in Jashpur (2013-2024)

1.2 Arrivals and Prices Trend of Groundnut Analysis in Surguja District (2013–2024)

Groundnut arrivals in Surguja displayed a slight upward trend during 2013–2024. The fitted equation (Y=6.273+0.0861X) gave a positive slope (b=0.0861) with trend values rising from 5.80 in 2013 to 6.75 in 2024. Actual arrivals fluctuated considerably, peaking at 17.22 tonnes in 2019 and falling to lows such as 2.73 tonnes in 2022. The LGR estimated a modest annual growth of 1.37%, but the corresponding t-value of 0.26 was non-significant, suggesting that variations were more likely driven by year-to-year fluctuations than by a consistent growth pattern.

Groundnut prices in Surguja showed a clear upward trend throughout the study period. The regression equation (Y=4527.94+255.38X) indicated a positive slope (b=255.38), with prices rising steadily from ₹2520.83 in 2013 to ₹6528.67 in 2024. Trend values also increased from ₹3123.37 in 2013 to ₹5932.51 in 2024. The LGR revealed an average annual growth of 5.64%, and the t-value of 5.75, significant at the 1% level, confirmed the statistical strength of this positive price trend.

Table 3: Groundnut Arrivals Trend values in Surguja (2013-2024)

Year (X)	Actual arrivals(y)	Trend value(Y)
2013	6.058	5.8
2014	3.933	5.89
2015	4.35	5.97
2016	4.3	6.06
2017	4.8	6.14
2018	6.658	6.23
2019	17.22	6.32
2020	6.736	6.4
2021	7.85	6.49
2022	2.733	6.57
2023	6.592	6.66
2024	4.05	6.75
LGR	-	1.37%
T	-	0.262(NS)

NS denotes non-significant

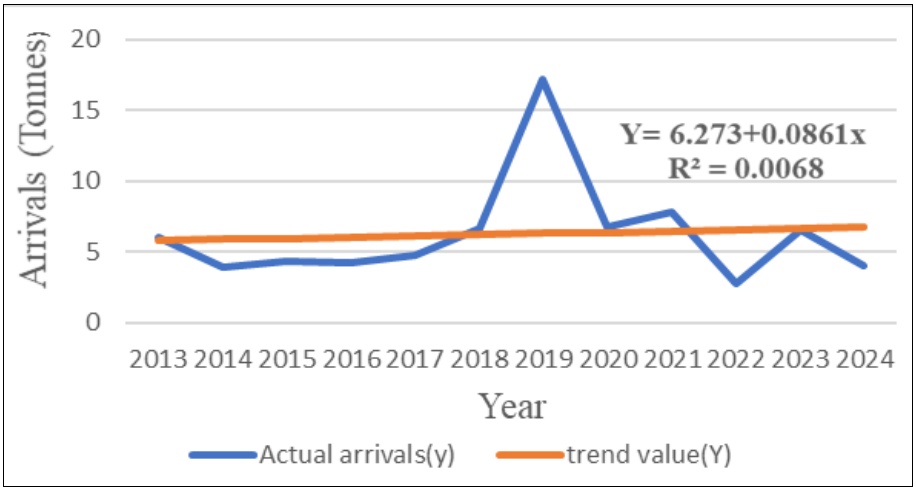

Fig 3: Groundnut Arrivals Trend in Surguja (2013-2024)

Table 4: Groundnut Prices Trend values in Surguja (2013-2024)

Year (X)	Actual prices(y)	Trend value(Y)
2013	2520.8	3123.37
2014	3201.4	3378.75
2015	4013.6	3634.12
2016	4057.5	3889.5
2017	4189.8	4144.88
2018	4803.3	4400.25
2019	4971.1	4655.63
2020	5054.5	4911.01
2021	5193.7	5166.38
2022	5395.4	5421.76
2023	4405.4	5677.14
2024	6528.7	5932.51
LGR	-	5.64%
T	-	5.75**

** denotes 1% level of significance
* denotes 5% level of significance

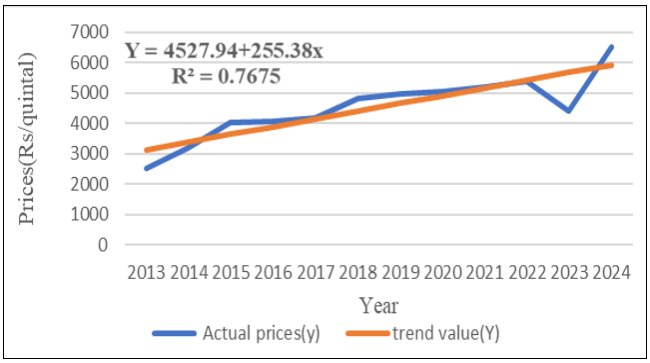

Fig 4: Groundnut Prices Trend in Surguja (2013-2024)

2.1 Arrivals and Prices Trend of Soyabean Analysis in Kabirdham District (2013–2024)

Soybean arrivals in Kabirdham showed a declining trend during 2013–2024. The fitted equation (Y=577.39–37.21X) indicated a negative slope (b=-37.21) with arrivals falling from 2343 tonnes in 2013 to much lower levels in later years, despite a minor recovery in 2019 and 2024. Trend values declined from 782.02 in 2013 to 372.76 in 2024, while the LGR showed an average annual decrease of -6.44%. However, the corresponding t-value of -0.66 was statistically non-significant, suggesting that the downward pattern may be largely due to year-to-year fluctuations rather than a persistent long-term decline.

In contrast, soybean prices in Kabirdham recorded a significant upward trend. The regression equation (Y=3774.93+192.12X) reflected a positive slope (b=192.12), with prices rising from ₹3313.50 in 2013 to ₹5694.50 in 2022. Trend values also increased from ₹ 2,718.28 in 2013 to ₹ 4,831.58 in 2024. The LGR confirmed an average annual price growth of 5.09%, while the t-value of 3.07, significant at the 1% level, validated the statistical robustness of this positive trend.

Table 5: Soyabean arrivals Trend values in Kabirdham (2013-2024)

Year (X)	Actual arrivals(y)	Trend value(Y)
2013	2343	782.02
2014	502	744.82
2015	166	707.61
2016	174	670.4
2017	261	633.2
2018	417	595.99
2019	623	558.79
2020	236	521.58
2021	157	484.38
2022	245	447.17
2023	407	409.97
2024	1399	372.76
LGR	-	-6.44%
T	-	-0.66(NS)

NS denotes non-significant

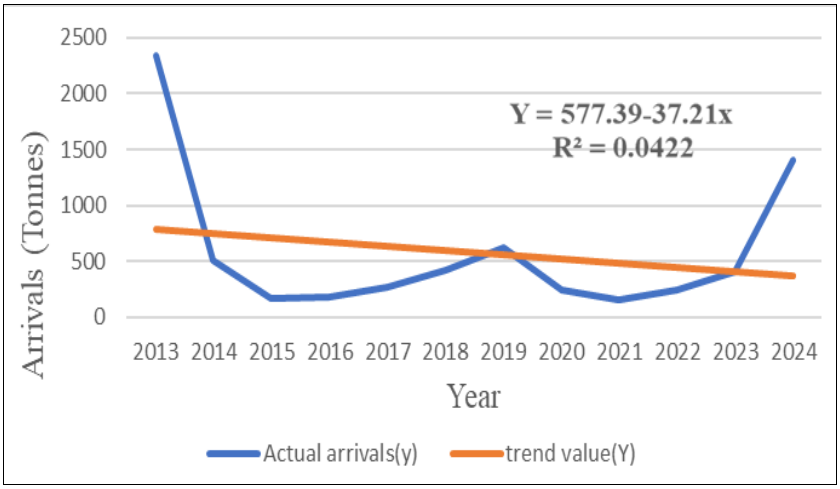

Fig 5: Soyabean arrivals Trend in Kabirdham (2013-2024)

Table 6: Soyabean Prices Trend values in Kabirdham (2013-2024)

Year (X)	Actual prices(y)	Trend value(Y)
2013	3313.5	2718.28
2014	3309.083	2910.4
2015	2986.333	3102.52
2016	3145.333	3294.63
2017	2556.083	3486.75
2018	3143.917	3678.87
2019	3396.583	3870.99
2020	3507.833	4063.11
2021	5414.417	4255.23
2022	5694.5	4447.34
2023	4690.917	4639.46
2024	4140.667	4831.58
LGR	-	5.09%
T	-	3.07**

** denotes 1% level of significance
* denotes 5% level of significance

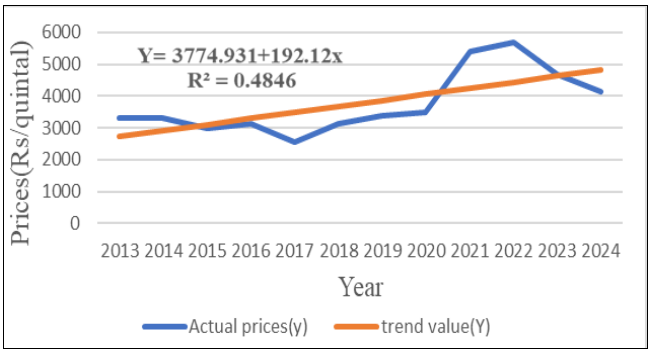

Fig 6: Soyabean Prices Trend in Kabirdham (2013-2024)

2.2 Arrivals and Prices Trend of Soyabean Analysis in Rajnandgaon District (2013–2024)

Soybean arrivals in Rajnandgaon declined sharply during 2013–2024. The fitted equation (Y=5596.17–1176.39X) reflected a steep negative slope (b=-1176.39), with actual arrivals falling from 14,973.83 tonnes in 2013 to just 400.94 tonnes in 2021, before a modest recovery to 1952.16 tonnes in 2024. Trend values also declined drastically, from 12,066.31 in 2013 to -873.95 in 2024. The LGR estimated an average annual decline of -21.02%, while the t-value of -4.54, significant at the 1% level, confirmed the statistical robustness of this negative trend.

In contrast, soybean prices in Rajnandgaon showed a consistent upward trend. The fitted trend equation (Y=3816.19+199.52X) yielded a positive slope (b=199.52), with prices rising from ₹3125.75 in 2013 to ₹5995.58 in 2021 and ₹5512.67 in 2022. Trend values similarly increased from ₹2718.81 in 2013 to ₹4913.58 in 2024. The LGR indicated an average annual price growth of 5.23%, and the t-value of 3.03, significant at the 5% level, validated the statistical significance of this rising price trend.

Table 7: Soyabean arrivals Trend values in Rajnandgaon (2013-2024)

Year (X)	Actual arrivals(y)	Trend value(Y)
2013	14973.8	12066.30
2014	4783.55	10889.91
2015	11502.7	9713.53
2016	10981.4	8537.15
2017	11184.6	7360.76
2018	3827.09	6184.37
2019	4829.6	5007.99
2020	1189.56	3831.6
2021	400.943	2655.21
2022	755.508	1478.83
2023	773.225	302.44
2024	1952.16	-873.947
LGR	-	-21.02%
T	-	-4.54**

** denotes 1% level of significance
* denotes 5% level of significance

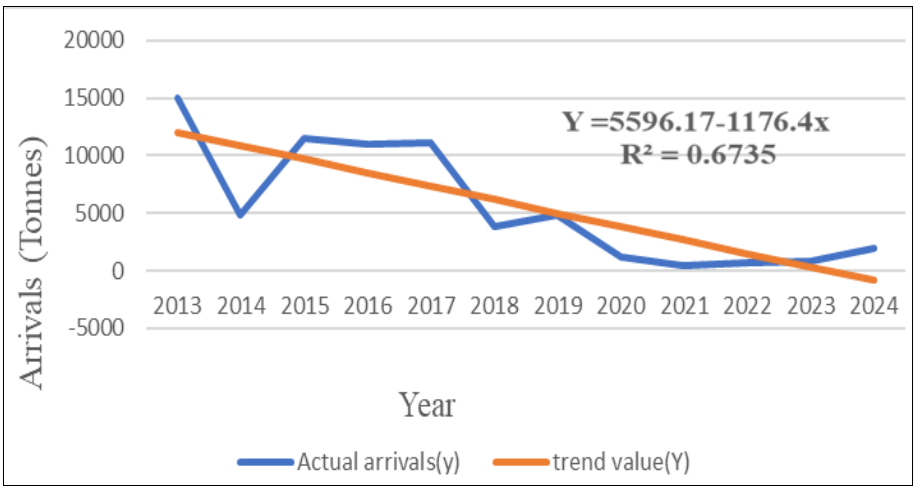

Fig 7: Soyabean arrivals Trend in Rajnandgaon (2013-2024)

Table 8: Soyabean Prices Trend values in Rajnandgaon (2013-2024)

Year (X)	Actual prices(y)	Trend value(Y)
2013	3125.75	2718.81
2014	3196.75	2918.34
2015	3158.17	3117.86
2016	3221	3317.38
2017	2637.08	3516.91
2018	3211.08	3716.43
2019	3496.92	3915.96
2020	3506.33	4115.48
2021	5995.58	4315
2022	5512.67	4514.53
2023	4546.58	4714.05
2024	4186.42	4913.58
LGR	-	5.23%
T	-	3.03**

** denotes 1% level of significance
* denotes 5% level of significance

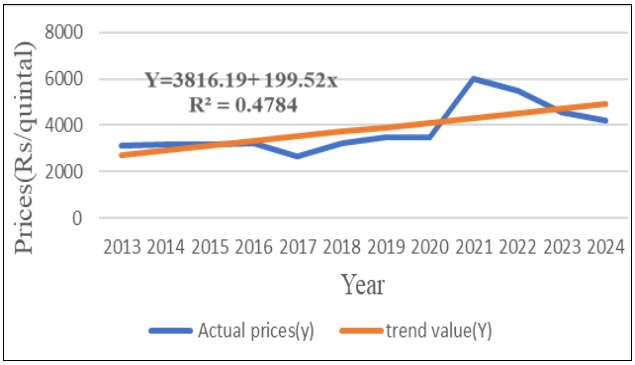

Fig 8: Soybean Prices Trend in Rajnandgaon (2013-2024)

3.1 Growth in area, production and productivity of Groundnut

The analysis showed that over the years, the area under groundnut cultivation in Chhattisgarh increased notably from 26.38 thousand hectares in 2008 to 49.84 thousand hectares in 2023. This expansion reflects growing interest in the crop over time. The area grew at a compound annual growth rate (CAGR) of 4.45 percent per annum, which was found to be significant at the 1% level of probability (p = 0.005). This suggests a consistent and meaningful rise in the land allocated for groundnut cultivation during the study period.

Similarly, groundnut production recorded a steady increase, rising from 32.94 thousand metric tonnes in 2008 to 56.73 thousand metric tonnes in 2023. The production grew at a CAGR of 4.74 percent per annum, which was also significant at the 1% level of probability (p = 0.006). This indicates that not only was the area under cultivation expanding, but the overall output of groundnuts also improved substantially.

In contrast, the productivity trend presented a slight decline over the period. The productivity of groundnut dropped from 1353 kg/ha in 2008 to 1138 kg/ha in 2023, with a very minimal CAGR of 0.08 percent per annum, which was not significant (p = 0.908). This indicates that although area and production increased significantly, yield improvements per hectare remained stagnant, signalling a need for interventions focused on productivity enhancement.

Table 9: Compound Annual Growth Rate of Groundnut in Chhattisgarh during 2008-2023(in percent).

Period	Particulars	Area (000'ha)	Production (000 'MT)	Productivity (Kg/ha)
2008-2023	Base year	26.38	32.94	1353
	Current year	49.84	56.73	1138
	CAGR	4.45***	4.74***	0.08*

***denotes significant at 1percent
** denotes significant at 5 percent
* denotes significant at 10 percent

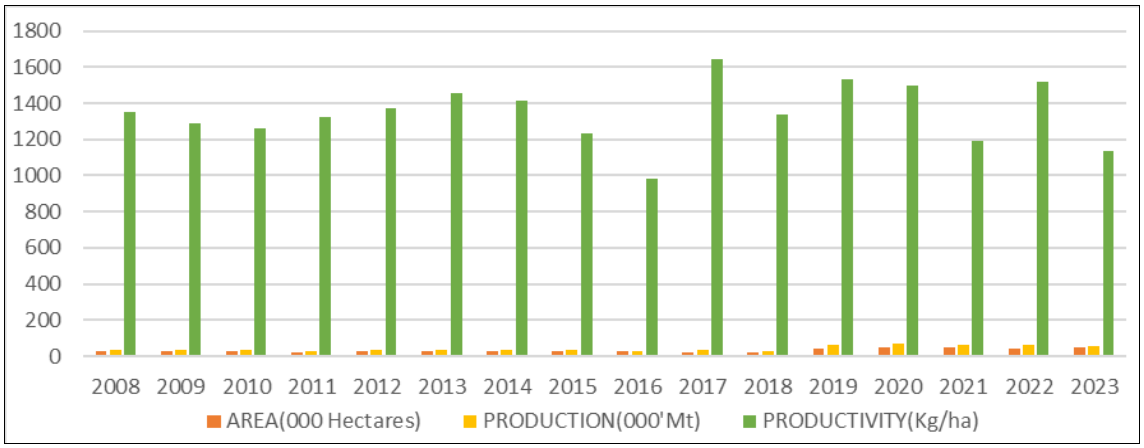

Fig 9: Area, Production, and Productivity of Groundnut in Chhattisgarh from 2008-2024.

3.2 Growth in area, production and productivity of Soyabean

The compound annual growth rate (CAGR) of soybean in terms of area, production and productivity for the period 2008 to 2023 in Chhattisgarh is presented in table 3.2 and depicted in figure 10. Over this period, the area under soybean cultivation decreased from 81.76 thousand hectares in 2008 to 37.74 thousand hectares in 2023, with a negative CAGR of -5.25 per cent. The p-value was 0.001699 and found to be the decline in area statistically significant at the 1% level of probability.

Similarly, soybean production showed a downward trend, decreasing from 79.86 thousand metric tonnes in the base year to 41.27 thousand metric tonnes in 2023. The CAGR for production was found to be -6.31 per cent and was also highly significant at the 1% level of probability(p-value =

0.005647).

On the other hand, the productivity of soybeans increased marginally over the years from 977 kg/ha in 2008 to 1094 kg/ha in 2023.The CAGR of productivity of soybean was -1.12 per cent and found to be not significant(p-value-0.626515). This indicates that the decline in productivity of soyabean over time is due to random variations.

Table 10: Compound Annual Growth Rate of Soyabean in Chhattisgarh during 2008-2023(in percent)

Period	Particulars	Area (000'ha)	Production (000 'MT)	Productivity (Kg/ha)
2008-2023	Base year	81.76	79.86	977
	Current year	37.74	41.27	1094
	CAGR	-5.25***	-6.31***	-1.12*

***denotes significant at 1 percent
** denotes significant at 5 percent
* denotes significant at 10 percent

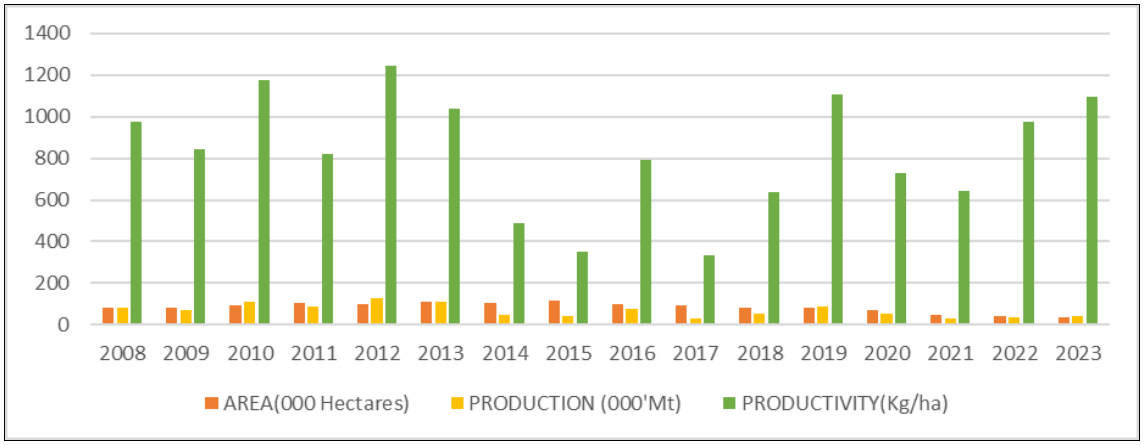

Fig 10: Area, Production and Productivity of Soybean in Chhattisgarh from 2008-2024.

Conclusion

Trend Analysis of Groundnut and Soybean

- The trend analysis of groundnut arrivals and prices in Jashpur and Surguja revealed a strong inverse relationship. In Jashpur, arrivals declined from 67.23 tonnes in 2013 to 5.83 tonnes in 2024, with an annual decline of -18.95% (LGR, t = -5.40, 1%). At the same time, prices rose from ₹2898.25 to ₹4729.55, increasing by 3.19% per annum (LGR, t = 5.81, 1%), clearly indicating a supply-shortage driven price rise. In Surguja, arrivals showed fluctuations, peaking at 17.22 tonnes in 2019, but overall recorded only a non-significant growth of 1.37% (t = 0.26). Prices, however, increased steadily from ₹2520.83 in 2013 to ₹6528.67 in 2024, with a significant annual growth of 5.64% (t = 5.75, 1%), reflecting the impact of strong demand despite unstable arrivals.
- For soybean, the pattern was even more severe. In Kabirdham, arrivals decreased from 2343 tonnes in 2013 to 1399 tonnes in 2024, showing an annual decline of -6.44% (LGR, t = -0.66, NS), while prices rose consistently from ₹3313.50 to ₹5694.50, with an annual growth of 5.09% (t = 3.07, 1%). In Rajnandgaon, arrivals dropped drastically from 14,973.83 tonnes in 2013 to 1952.16 tonnes in 2024, recording a sharp and significant decline of -21.02% per annum (t = -4.54, 1%). Meanwhile, prices increased from ₹3125.75 to ₹5512.67, with an annual growth of 5.23% (t = 3.03, 5%), confirming that declining arrivals were closely associated with rising prices across soybean markets.

Growth Performance (CAGR) of Groundnut and Soybean

- The growth performance of groundnut in Chhattisgarh showed encouraging results in terms of area and production, though productivity remained stagnant. The area under cultivation expanded from 26.38 thousand ha in 2008 to 49.84 thousand ha in 2023, registering a significant CAGR of 4.45% (p = 0.005, 1%). Similarly, production increased from 32.94 thousand tonnes in 2008 to 56.73 thousand tonnes in 2023, with a significant CAGR of 4.75% (p = 0.006, 1%). However, productivity exhibited no meaningful growth, dropping slightly from 1353 kg/ha to 1138 kg/ha, with a negligible CAGR of 0.08% (p = 0.908, NS). This indicates that while groundnut is expanding in cultivated area and total output, yield per hectare has remained stagnant, pointing towards the need for technological and management interventions.
- Soybean exhibited a declining growth performance across all parameters. The area under soybean cultivation contracted sharply at -5.25% CAGR, while production recorded a steeper decline of -6.31%, both significant at the 1% level. Productivity also registered a marginal negative growth of -1.12%, though statistically insignificant. These findings suggest that soybean production in Chhattisgarh is under increasing stress, with reductions in area and production driven by factors such as climatic variability, declining

profitability, and competition from alternative crops like paddy and maize. The stagnation in productivity further reflects the lack of technological advancement and resource-use efficiency in soybean cultivation.

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