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An analysis of the growth rate of minor millets in Chhattisgarh

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Abstract

Minor millets have historically formed an integral part of the rain-fed cropping systems of Chhattisgarh, particularly across its tribal-dominated southern plateau. This study examines the compound growth rate (CGR) of area, production, and productivity of minor millets in Chhattisgarh State and its five leading districts Bastar, Dantewada, Jashpur, Kawardha (Kabirdham), and Kanker over the twenty-three-year period from 2000-01 to 2022-23, using secondary time-series data published by the Directorate of Economics, Statistics & Evaluation, Government of India. The results show a statistically significant negative growth rate in area and production at the state level and in every sampled district, with the steepest decline in area recorded in Kawardha (-8.81% per annum) and the steepest decline in production also in Kawardha (-5.58% per annum). In contrast, productivity increased significantly across all districts except Bastar (non-significant), with Kanker recording the highest productivity growth (5.21% per annum). The Bastar Plateau region emerges as the dominant production hub of the state, and the top five producing districts together account for nearly three-fourths of total state output. The findings indicate that while yield gains have partly cushioned production losses, sustained policy support including market linkage development, processing infrastructure, and price incentives is required to arrest the continuing contraction in area under minor millets.

Keywords: Minor millets, Compound Growth Rate (CGR), Chhattisgarh, Area, Production and Productivity, Bastar Plateau

Introduction

Millets are among the oldest foods known to humankind and were possibly the first cereal grains to be cultivated for domestic use. They are small-seeded grasses that are hardy and well suited to dry zones, growing well as rain-fed crops under marginal conditions of soil fertility and moisture. Millets are also distinctive for their short growing season. The important millet crops grown in India are sorghum (great millet), bajra (pearl millet), ragi (finger millet), and the small millets, namely kutki/korra (foxtail millet), little millet, kodo millet, proso millet, and barnyard millet. These crops were traditionally referred to as coarse cereals, but in recognition of their nutrient richness they have since been notified as “Nutri-Cereals” by the Government of India. Minor millets have versatile uses for direct meals as well as in food processing, animal feed, and distilleries (Annual Report 2021. ICAR-IIMR, Hyderabad) According to the Food and Agriculture Organization (FAO), world production of millets stood at 88.16 million tonnes from an area of 126 million hectares, with India the largest producer, accounting for around 40.91% of world production (FAO, 2024).

In Chhattisgarh, the total area under minor millets in 2022-23 was 50.34 thousand hectares, with total production of 23.84 thousand tonnes and an average yield of 4.37 quintals/ha. Within the state, the top five districts of Chhattisgarh together account for 73.45% (17,519 tonnes) of total state output. Bastar leads with a 32.07% share (7,649 tonnes), followed by Dantewada with 13.75% (3,279 tonnes), Kabirdham (Kawardha) with 13.35% (3,184 tonnes), Kanker with 7.94% (1,894 tonnes), and Jashpur the leading district of the Northern Hills zone with 6.34% (1,513 tonnes) (Directorate of Economics, Statistics & Evaluation, Government of India, 2022-23).

Methodology

Study area

The study was conducted in the state of Chhattisgarh, focusing on five districts that account for the bulk of the state's minor millet production: Kawardha (Kabirdham), Jashpur, Dantewada, Bastar, and Kanker. The location of these five sample districts within Chhattisgarh is presented in Figure 1.

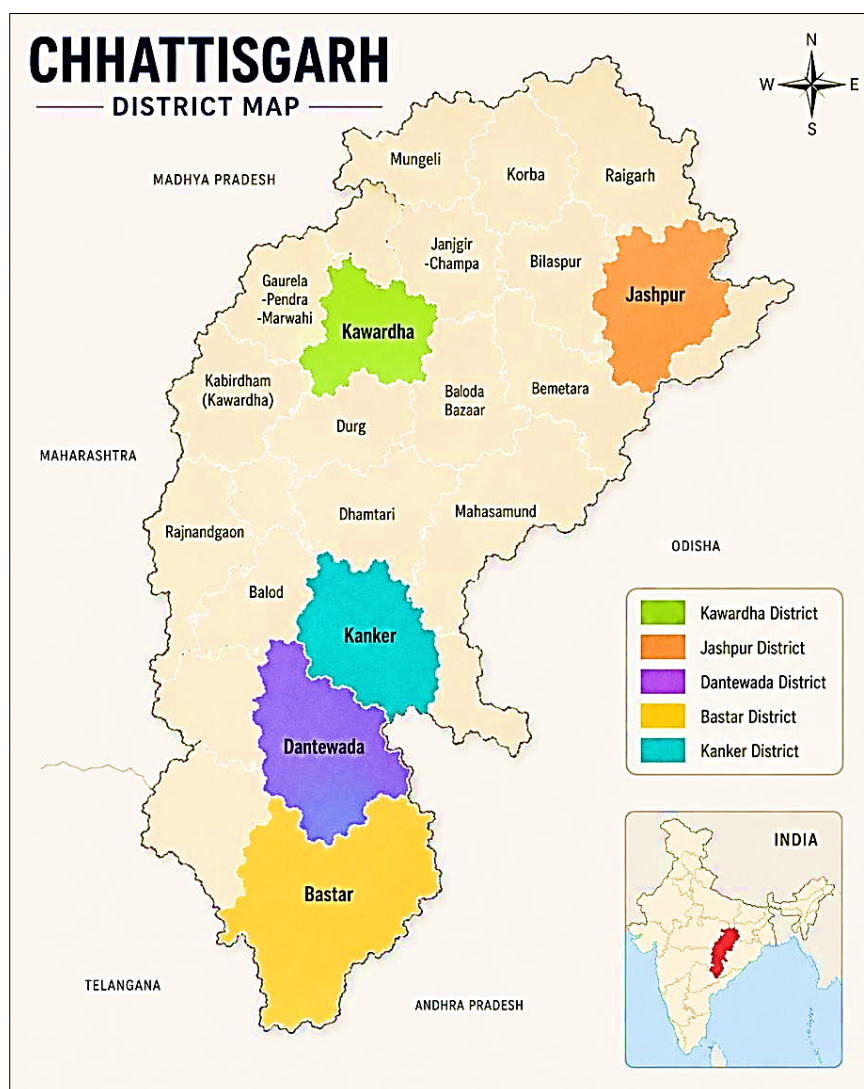


Fig 1: Map of Chhattisgarh showing the location of the five sample districts Kawardha, Jashpur, Kanker, Dantewada, and Bastar

Data collection

The study is based on secondary time-series data covering a twenty-three-year period, from 2000-01 to 2022-23, on the area, production, and productivity of minor millets. Data were sourced from the Directorate of Economics, Statistics & Evaluation (ES&E), Government of India (2023).

Analytical tools

Compound Growth Rate (CGR)

The compound growth rate in area, production, and productivity of minor millets was estimated by fitting an exponential growth function of the form $Y = a \cdot b^t$ to the time-series data, where the regression coefficient b was obtained from the log-linear form of the equation. The compound growth rate was then computed as:

$$CGR (\%) = [\text{Antilog}(b) - 1] \times 100$$

where b is the regression coefficient of time obtained from the fitted log-linear trend equation. The statistical significance of each estimated growth rate was tested using the corresponding p -value, with significance levels reported at the 1%, 5%, and 10% levels.

Results and Discussion

Compound growth rate (CGR) of area, production, and productivity of minor millets in Chhattisgarh

The compound growth rates (CGR) in area, production, and productivity of minor millets across the study area are presented in Table 1. The area and production of minor millets showed statistically significant negative growth for Chhattisgarh state as a whole and for every sampled district, significant at the 1% level. The steepest decline in area was recorded in Kawardha (-8.81% per annum), followed by Kanker (-8.51%) and Dantewada (-7.55%). In terms of production, Kawardha and Dantewada districts registered the sharpest negative growth, at -5.58% and -5.00% per annum, respectively.

Productivity (yield), by contrast, showed positive growth rates across all analysed regions. Except for Bastar district, where the positive growth rate of 4.63% was statistically non-significant (NS), productivity growth was significant across the rest of the study area. Kanker district recorded the highest productivity growth, at 5.21% per annum (significant at the 5% level), followed by Kawardha (3.54%) and Chhattisgarh state as a whole (3.12%). This indicates that yield improvements have partially cushioned the effect of the substantial contraction in cultivated area on total production.

Table 1: Compound growth rate (CGR) of area, production, and productivity of minor millets in Chhattisgarh

Districts	Area (CGR %)	P-value	Production (CGR %)	P-value	Productivity (CGR %)	P-value
Bastar	-6.18***	1.96E-20	-1.83***	2.84E-06	4.63NS	0.32
Dantewada	-7.55***	1.7E-21	-5.00***	4.8E-11	2.67***	1.77E-05
Jashpur	-6.04***	3E-14	-4.39***	2.77E-11	1.75***	1.49E-09
Kawardha	-8.81***	7.6E-17	-5.58***	9.89E-10	3.54***	5.27E-05
Kanker	-8.51***	3.8E-21	-3.75***	3.07E-08	5.21**	0.029
Chhattisgarh	-7.24***	2.6E-09	-4.34***	6.41E-11	3.12***	1.25E-10

Note: *** denotes significance at the 1% level; ** denotes significance at the 5% level; * denotes significance at the 10% level; NS = not significant.

District-wise and state-level trends in area, production, and productivity

Tables 2 to 7 present the year-wise area, production, and productivity of minor millets for Bastar, Dantewada, Jashpur, Kawardha, and Kanker districts, and for Chhattisgarh state as a whole, over the period 2000-01 to 2022-23. The

corresponding trends are depicted graphically in Figures 2 to 7. Across all districts, cultivated area shows a broadly declining trajectory over the study period, while productivity shows a gradual improvement, particularly from the mid-2010s onward, with a marked upturn in most districts from 2020-21.

Table 2: Area, production, and productivity of minor millets in Bastar District

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	31,526	5,145	0.16
2001 - 2002	31,342	7,742	0.25
2002 - 2003	29,802	4,517	0.15
2003 - 2004	29,303	7,354	0.25
2004 - 2005	27,400	7,603	0.28
2005 - 2006	26,521	5,173	0.20
2006 - 2007	22,026	5,416	0.25
2007 - 2008	20,508	5,270	0.26
2008 - 2009	21,655	4,663	0.22
2009 - 2010	19,206	3,630	0.19
2010 - 2011	18,234	3,822	0.21
2011 - 2012	14,201	3,024	0.21
2012 - 2013	13,652	3,211	0.24
2013 - 2014	13,506	2,635	0.20
2014 - 2015	12,749	2,827	0.22
2015 - 2016	12,175	1,328	0.11
2016 - 2017	11,719	3,489	0.30
2017 - 2018	11,613	2,755	0.24
2018 - 2019	10,951	3,592	0.33
2019 - 2020	9,177	2,646	0.29
2020 - 2021	9,456	8,034	0.85
2021 - 2022	9,070	6,988	0.77
2022 - 2023	9,330	7,649	0.82

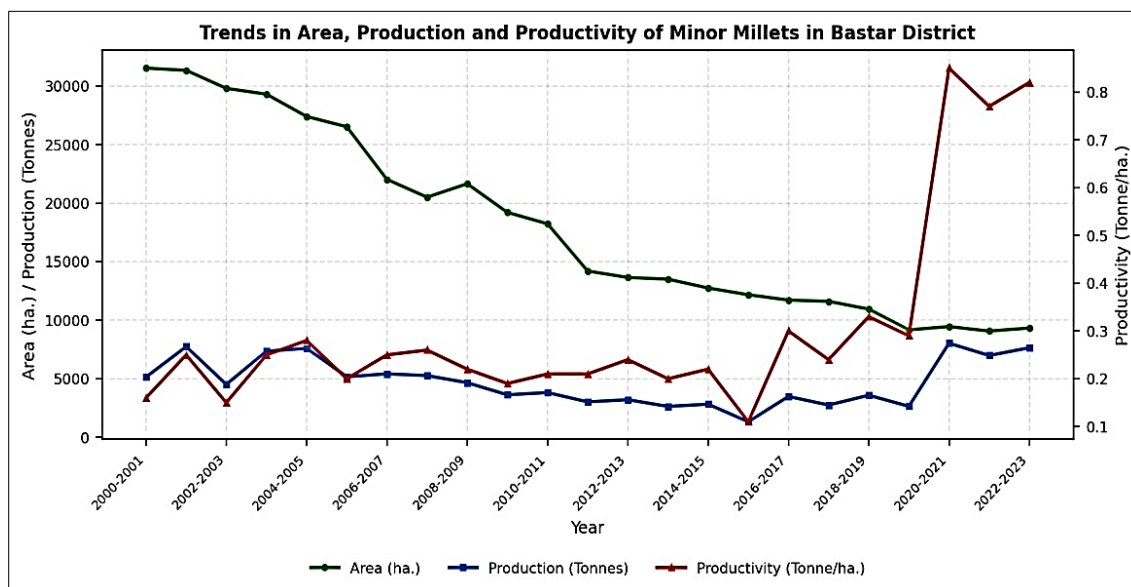
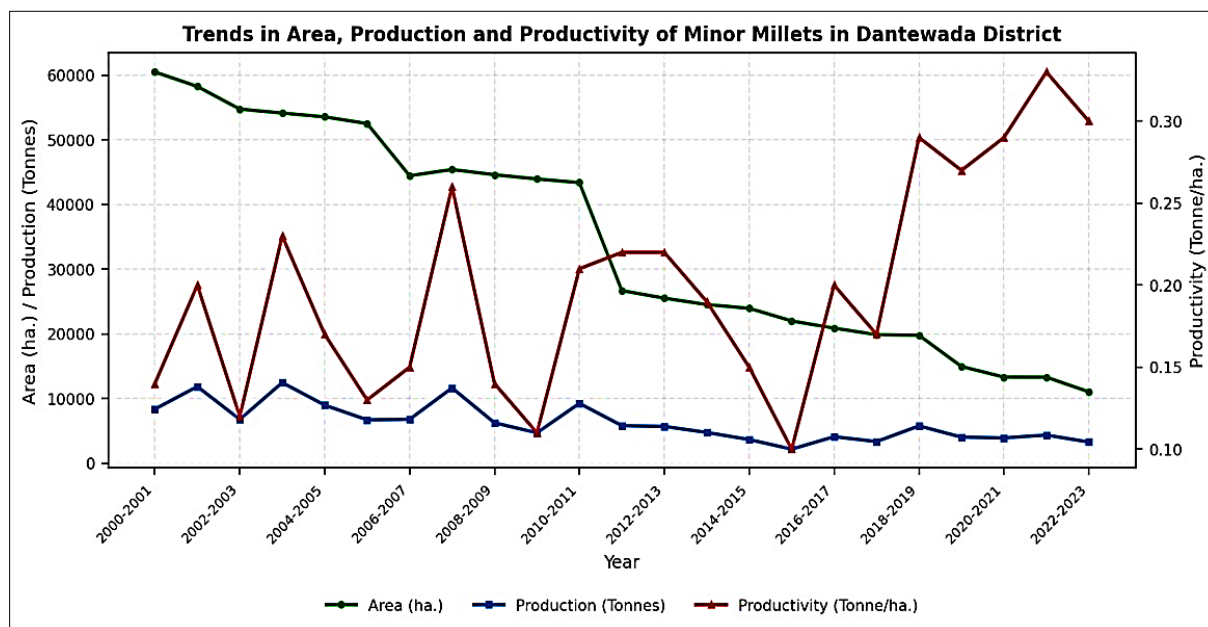
**Fig 2:** Trends in area, production, and productivity of minor millets in Bastar District

Table 3: Area, production, and productivity of minor millets in Dantewada District

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	60,511	8,377	0.14
2001 - 2002	58,271	11,858	0.20
2002 - 2003	54,765	6,788	0.12
2003 - 2004	54,156	12,468	0.23
2004 - 2005	53,572	8,988	0.17
2005 - 2006	52,533	6,711	0.13
2006 - 2007	44,471	6,790	0.15
2007 - 2008	45,431	11,647	0.26
2008 - 2009	44,620	6,251	0.14
2009 - 2010	43,964	4,717	0.11
2010 - 2011	43,397	9,261	0.21
2011 - 2012	26,696	5,815	0.22
2012 - 2013	25,533	5,698	0.22
2013 - 2014	24,544	4,766	0.19
2014 - 2015	23,964	3,663	0.15
2015 - 2016	22,007	2,176	0.10
2016 - 2017	20,897	4,109	0.20
2017 - 2018	19,893	3,352	0.17
2018 - 2019	19,782	5,778	0.29
2019 - 2020	14,965	4,043	0.27
2020 - 2021	13,325	3,922	0.29
Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2021 - 2022	13,314	4,364	0.33
2022 - 2023	11,046	3,279	0.30

**Fig 3:** Trends in area, production, and productivity of minor millets in Dantewada District**Table 4:** Area, production, and productivity of minor millets in Jashpur District

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	10,390	2,149	0.21
2001 - 2002	10,403	2,923	0.28
2002 - 2003	9,215	2,167	0.24
2003 - 2004	8,312	2,538	0.31
2004 - 2005	7,241	1,980	0.27
2005 - 2006	6,845	1,391	0.20
2006 - 2007	5,075	1,567	0.31
2007 - 2008	5,787	1,725	0.30
2008 - 2009	5,660	1,445	0.26
2009 - 2010	4,924	898	0.18
2010 - 2011	4,002	1,027	0.26

2011 - 2012	3,541	895	0.25
2012 - 2013	3,428	926	0.27
2013 - 2014	3,825	1,025	0.27
2014 - 2015	3,663	1,037	0.28
2015 - 2016	3,434	781	0.23
2016 - 2017	3,346	1,168	0.35
Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2017 - 2018	2,063	862	0.42
2018 - 2019	2,991	1,165	0.39
2019 - 2020	2,781	980	0.35
2020 - 2021	2,798	922	0.33
2021 - 2022	2,687	703	0.26
2022 - 2023	3,994	1,513	0.38

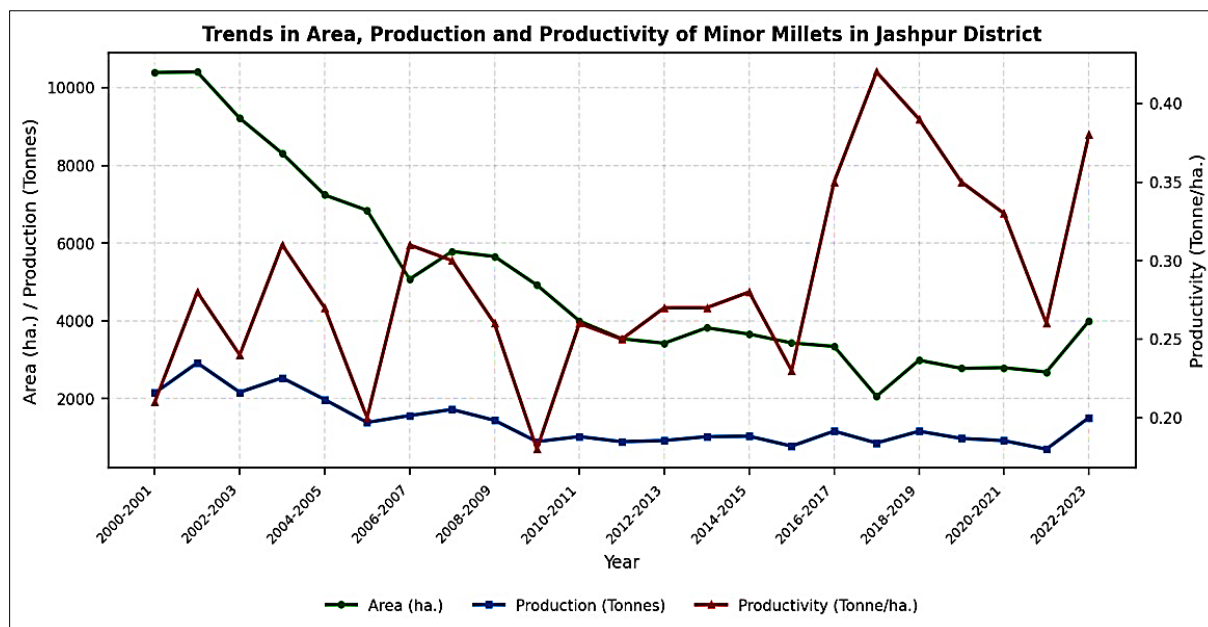


Fig 4: Trends in area, production, and productivity of minor millets in Jashpur District

Table 5: Area, production, and productivity of minor millets in Kawardha District

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	31,604	4,254	0.13
2001 - 2002	32,324	9,039	0.28
2002 - 2003	30,542	5,443	0.18
2003 - 2004	28,637	7,772	0.27
2004 - 2005	25,088	6,100	0.24
2005 - 2006	22,439	4,378	0.20
2006 - 2007	19,011	5,374	0.28
2007 - 2008	16,813	4,456	0.27
2008 - 2009	17,065	3,673	0.22
2009 - 2010	15,627	2,883	0.18
2010 - 2011	14,783	2,515	0.17
2011 - 2012	13,539	2,299	0.17
2012 - 2013	12,605	2,932	0.23
Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2013 - 2014	10,727	2,648	0.25
2014 - 2015	8,662	2,379	0.27
2015 - 2016	6,858	1,477	0.22
2016 - 2017	6,186	2,454	0.40
2017 - 2018	6,046	1,804	0.30
2018 - 2019	5,555	1,788	0.32
2019 - 2020	4,400	1,498	0.34
2020 - 2021	4,556	1,640	0.36
2021 - 2022	8,319	4,286	0.52
2022 - 2023	6,652	3,184	0.48

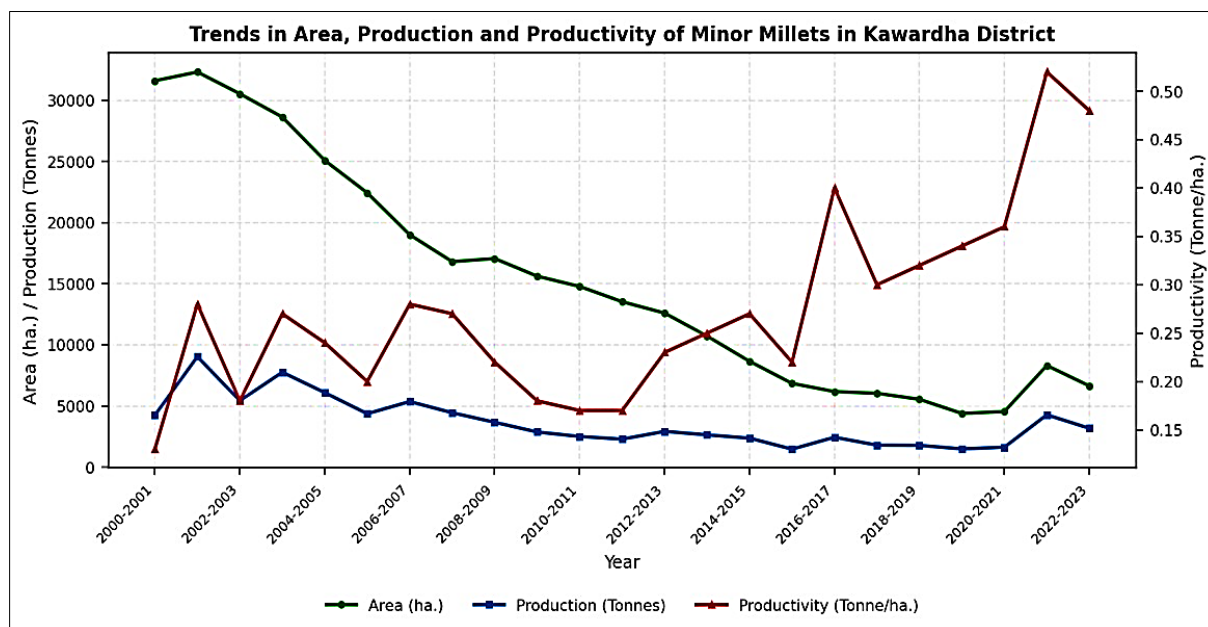


Fig 5: Trends in area, production, and productivity of minor millets in Kawardha District

Table 6. Area, production, and productivity of minor millets in Kanker District

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	26,025	3,614	0.14
2001 - 2002	24,341	6,030	0.25
2002 - 2003	21,523	1,828	0.08
2003 - 2004	21,889	5,642	0.26
2004 - 2005	20,906	4,409	0.21
2005 - 2006	20,439	3,641	0.18
2006 - 2007	19,575	2,379	0.12
2007 - 2008	19,677	5,018	0.26
2008 - 2009	19,620	3,812	0.19
Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2009 - 2010	19,677	5,612	0.29
2010 - 2011	16,875	5,431	0.32
2011 - 2012	16,442	2,154	0.13
2012 - 2013	15,487	3,135	0.20
2013 - 2014	14,298	3,160	0.22
2014 - 2015	13,878	4,392	0.32
2015 - 2016	12,498	1,946	0.16
2016 - 2017	11,185	5,232	0.47
2017 - 2018	9,908	1,733	0.17
2018 - 2019	7,470	3,122	0.42
2019 - 2020	4,324	1,666	0.39
2020 - 2021	2,843	1,253	0.44
2021 - 2022	3,562	2,121	0.60
2022 - 2023	3,596	1,894	0.53

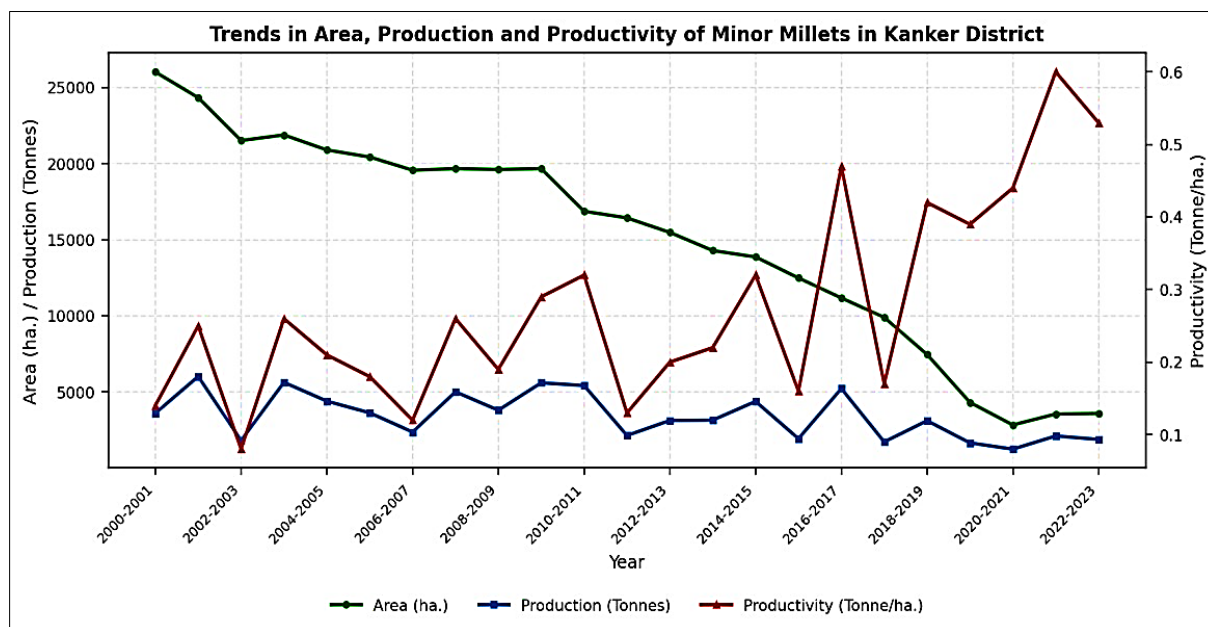


Fig 6: Trends in area, production, and productivity of minor millets in Kanker District

Table 7: Area, production, and productivity of minor millets in Chhattisgarh

Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2000 - 2001	3,00,780	48,538	0.16
2001 - 2002	2,89,849	74,695	0.26
2002 - 2003	2,70,498	44,061	0.16
2003 - 2004	2,61,654	69,946	0.27
2004 - 2005	2,27,932	56,421	0.25
Year	Area (ha.)	Production (Tonnes)	Productivity (Tonne/ha.)
2005 - 2006	2,53,394	43,812	0.17
2006 - 2007	2,08,739.54	44,655	0.21
2007 - 2008	2,14,938.54	57,149	0.27
2008 - 2009	1,89,788.48	37,818	0.20
2009 - 2010	1,79,161.43	33,258	0.19
2010 - 2011	1,66,279.47	36,315	0.22
2011 - 2012	1,59,586.92	33,719	0.21
2012 - 2013	1,46,086.97	34,067	0.23
2013 - 2014	1,35,338.9	29,865	0.22
2014 - 2015	1,24,226.97	30,475	0.25
2015 - 2016	1,12,826.68	19,236	0.17
2016 - 2017	1,11,523.99	32,885	0.29
2017 - 2018	84,121.86	21,160	0.25
2018 - 2019	83,536.02	28,320	0.34
2019 - 2020	75,890.04	21,029	0.28
2020 - 2021	57,662.48	24,769	0.43
2021 - 2022	68,812.72	31,682	0.46
2022 - 2023	66,621.85	29,131	0.44

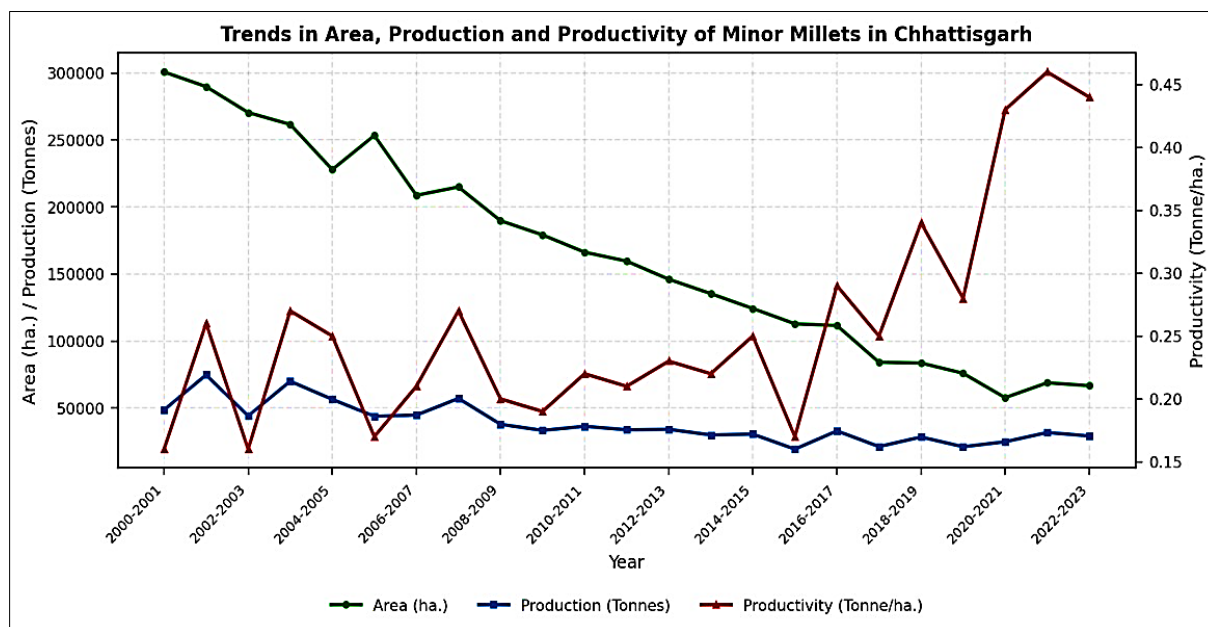


Fig 7: Trends in area, production, and productivity of minor millets in Chhattisgarh

Conclusion

The structural and statistical analysis undertaken in this study yields several important conclusions regarding the long-term trend performance and regional dynamics of minor millets in Chhattisgarh. Based on the compound growth rate (CGR) estimates for the period 2000-01 to 2022-23, minor millets are found to be experiencing a severe contraction in cultivated area across the state. The highly significant negative growth rates in area at the state level (-7.24%) and across every individual district, peaking in Kawardha at -8.81% confirm a sustained shift of land away from these traditional crops. This contraction in area has, in turn, directly depressed total production across the entire study area.

A more encouraging counter-trend, however, is observed in productivity. Yield growth rates were positive across all analysed regions, and statistically significant everywhere except Bastar district, where the 4.63% growth rate was non-significant. Kanker district recorded the highest significant productivity growth, at 5.21%. This positive yield growth suggests that recent improvements in production efficiency and farming practices have partly offset the production losses associated with the shrinking area under cultivation.

Geographically, the minor millet sector in Chhattisgarh is marked by a pronounced regional concentration. The Bastar Plateau (southern zone) stands out as the dominant production hub, accounting for 57.18% of cultivated area and 63.36% of total state output, supported by a superior regional yield of 5.24 quintals/ha. The top five producing districts Bastar, Dantewada, Kabirdham (Kawardha), Kanker, and Jashpur together account for 73.45% of total state production, indicating that targeted commercial and developmental interventions could be concentrated in these high-efficiency hubs for maximum impact. Overall, while productivity gains are evident and encouraging, the long-term commercial viability of minor millets in Chhattisgarh will depend on institutional interventions that strengthen market linkages, expand processing infrastructure, and provide price incentives to arrest the continuing decline in cultivated area.

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