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Effectiveness of minimum support price on area, production and productivity of major food crops in Chhattisgarh

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Abstract

The Minimum Support Price (MSP) policy is one of the principal instruments used by the Government of India to protect farmers from distress sales and to influence cropping decisions in favor of specific commodities. This study evaluates the effectiveness of MSP the central price support together with Chhattisgarh's state-level procurement incentives on the cultivated area, production and productivity of four major food crops of the state, namely paddy, wheat, maize and Bengal gram. Secondary time-series data on MSP, area, production and yield were compiled for the 26 agricultural years from 2000-01 to 2025-26 (Chhattisgarh's statehood baseline to the latest available season) from the Unified Portal for Agricultural Statistics (UPAg), AGMARKNET 2.0 and India Stat Agri. Compound Annual Growth Rate (CAGR), Spearman's rank correlation and log-linear regression were employed to examine the trends and their associations. The CAGR in MSP was positive and statistically significant for all four crops (6.44– 8.44%). Paddy's cultivated area had effectively reached saturation (~37–38 lakh ha), so its 265.77 per cent rise in production over the period was driven almost entirely by yield gains (CAGR = 3.98%, $p = 0.843$ with MSP); wheat and gram, by contrast, showed significant area expansion (CAGR = 2.12% and 2.33%, respectively) as farmers extended double-cropping onto post-monsoon rabi fallow land. Maize recorded the highest yield growth (CAGR = 5.13%) on the back of hybrid-seed adoption, while Bengal gram's yield growth remained weak and statistically non-significant, reflecting rainfed and terminal-heat constraints that price support alone cannot resolve. The study concludes that MSP has been an effective driver of crop output in Chhattisgarh, though the pathway of response yield intensification versus area diversification differs sharply across crops.

Keywords: Area, chhattisgarh, food crops, minimum support price, production, yield

Introduction

Agriculture remains the backbone of the Indian economy, contributing nearly one-fifth of the country's gross value added at current prices, employing about 46.1 per cent of the workforce and supporting close to 55 per cent of the population. Over the past five years the sector has grown at an average of about 4.4 per cent *per annum* at constant prices, aided by improved farm practices, technological integration and more resilient production systems. Yet population growth continues to outpace the expansion of the agricultural sector: sustaining food security is estimated to require agricultural growth of over 4.5 per cent a year alongside overall economic growth of about 7 per cent. India is the world's secondlargest producer of both rice and wheat, with output of 150.18 million tonnes and 117.94 million tonnes respectively in 2024-25, and the largest producer of pulses, at 25.68 million tonnes in the same year. Chhattisgarh, popularly known as the 'Rice Bowl of India', is one of the states where cropping patterns remain heavily skewed towards paddy, alongside wheat, maize and Bengal gram as the other major food crops. Government price support, both the central MSP and state-sponsored schemes such as the Rajiv Gandhi Kisan Nyay Yojana (RGKNY) and Krishi Unnati Yojana (KUY), which provide additional procurement bonuses and input subsidies has been used since the state's formation on 1st November 2000 to stabilise farm incomes and to encourage a degree of diversification away from paddy monoculture. In the 2024-25 marketing season alone, the state procured close to 14.9 million tonnes of paddy, benefiting more than 25 lakh farmers, with digital procurement and direct-benefit-transfer mechanisms improving transparency in the process. Much of the empirical literature on MSP effectiveness in India has concentrated on nationallevel trend s or on cereals such as paddy and wheat in isolation (Ali *et al.*, 2012; Singh, 2021) ^[2, 4],

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while comparable state-level evidence covering an entire basket of food crops and explicitly linking central MSP with state-level procurement bonuses remains limited, particularly for a state such as Chhattisgarh, where agro-climatic conditions and cropping systems vary markedly across the plains, the Bastar Plateau and the northern hills. Favorable output prices, together with assured marketing support, are understood to encourage farmers to adopt modern production technologies, which in turn raises productivity, improves profitability and can bring more area under cultivation of the supported crop (Chintapalli and Tang, 2012) ^[5]. The present study, adapting the national-level analytical framework of Somanathan *et al.* (2024) ^[6] to the state level, was therefore undertaken to examine whether the sustained rise in MSP for paddy, wheat, maize and Bengal gram over the past 26 years has translated into higher cultivated area, production and productivity of these crops in Chhattisgarh.

About Msp

The Minimum Support Price is announced twice a year by the Ministry of Agriculture, ahead of the Kharif and Rabi sowing seasons, on the recommendation of the Commission for Agricultural Costs and Prices (CACP). In arriving at its recommendation, the CACP takes into account the cost of cultivation, demand-supply conditions, domestic and international price trends, price parity across crops, the terms of trade between agriculture and non-agriculture, and a minimum margin over the cost of production, among other factors (Das, 2023) ^[7]. MSP is currently fixed for 23 agricultural commodities, including the four food crops examined here, and functions as a floor price: it obliges government agencies to purchase from farmers at the declared rate, without any corresponding obligation on farmers to sell. Besides safeguarding farmers against distress sales, MSP is widely used by both buyers and sellers as a benchmark while transacting in agricultural commodities, and its steady upward revision has been an important instrument for encouraging farmers to adopt modern technologies and to shift cropping patterns (Kumar, 2026) ^[8].

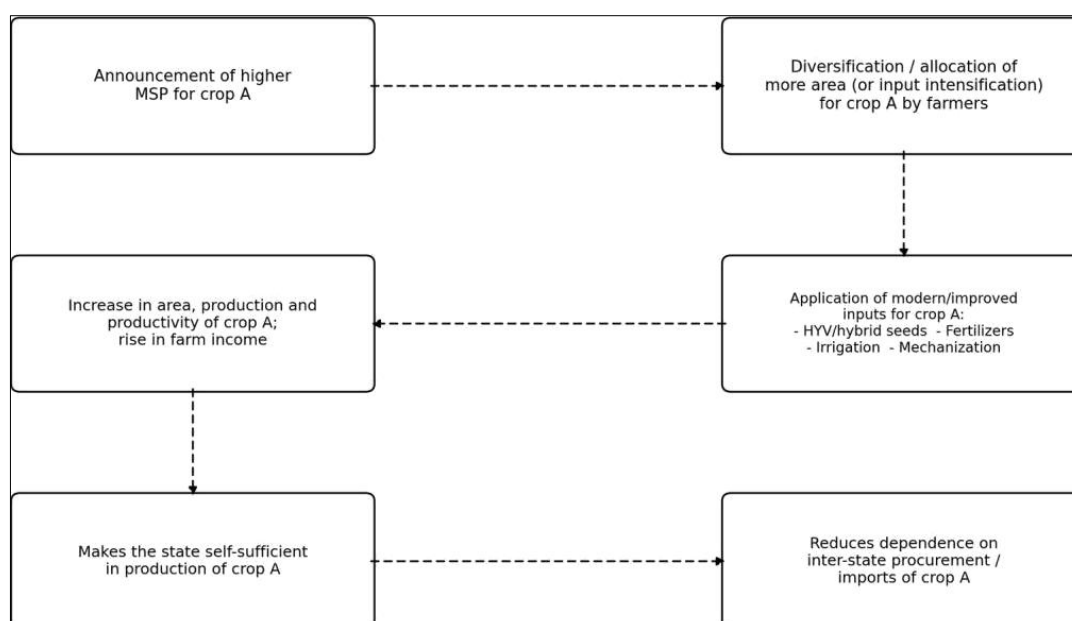
MSP of major food crops in Chhattisgarh

In Chhattisgarh, price support for food crops operates at two levels. The central government's MSP applies uniformly across

the country and is the principal instrument for wheat, maize and Bengal gram in the state. For paddy, however, the Chhattisgarh government has, since the mid-2000s, layered additional state procurement bonuses on top of the central MSP under successive schemes (most recently RGKNY and KUY), producing what this study refers to as the 'effective price' received by paddy growers. This effective price rose from 510 to 3,100 per quintal between ₹ ₹ 2000-01 and 2025-26, a 507.84 per cent increase, with a particularly sharp 70.47 per cent jump in 2008-09 (745 to 1,270) coinciding with the ₹ ₹ rollout of aggressive state-level bonus interventions. Over the same period, the central MSP of Bengal gram rose by 434.09 per cent (1,100 to 5,875/quintal), that of maize by 439.33 ₹ ₹ per cent (445 to 2,400/quintal), and that of wheat ₹ ₹ by 323.77 per cent (610 to 2,585/quintal), ₹ ₹ including a 42.86 per cent jump in 2007-08 (700 ₹ ₹ to 1,000) that marked a major national policy shift ₹ ₹ towards food security. The percentage increase in MSP for pulses of this kind has historically outpaced that for cereals nationally, and a broadly similar pattern is evident for Bengal gram relative to paddy and wheat in Chhattisgarh.

Theoretical framework

The expected relationship between MSP and crop performance draws on the theory of livelihood diversification, under which farm households continuously adjust their choice of crops in response to policy signals, environmental factors and resource constraints in order to improve returns and manage risk (Qian *et al.*, 2020) ^[9]. An announced increase in MSP for a given crop is expected to work through two channels that are not mutually exclusive: first, by making the crop more attractive relative to competing uses of land, prompting farmers to divert additional area to it; and second, by providing the price assurance needed to justify investment in yield-enhancing inputs — high-yielding or hybrid seed, fertilizer, irrigation and mechanization — on the area already under the crop. Either channel raises production, and, where the productivity channel dominates, output can continue to grow even where a crop's area has little room left to expand, as this study finds to be the case for paddy in Chhattisgarh. The conceptual pathway below, adapted from Somanathan *et al.* (2024) ^[6], traces this logic from a higher MSP announcement through to reduced dependence on external procurement for the crop in question.



Material and methods

Selection of crops

Paddy, wheat, maize and Bengal gram were purposively selected for the study as the major food crops of Chhattisgarh, together accounting for the bulk of the state's foodgrain area and forming the core of its cropping system. Paddy dominates the kharif season across all three agro-climatic zones of the state, while wheat and Bengal gram are grown mainly as rabi crops on post-monsoon fallow and irrigated land, and maize is cultivated extensively in the Bastar Plateau and Northern Hills zones.

Description of the study area

Chhattisgarh was carved out of Madhya Pradesh on 1 November 2000 and lies between 17°46' and 24°5' North latitude and 80° 15' and 84°20' East longitude, bordering Uttar Pradesh, Jharkhand, Odisha, Telangana, Andhra Pradesh, Madhya Pradesh and Maharashtra. The state is drained by the Mahanadi, Godavari, Narmada and Ganga river systems and is administratively divided into 33 districts, 251 sub-districts and 141 development blocks, spread across three broad agro-climatic zones — the fertile Chhattisgarh Plains, the tribal, forest-dominated Bastar Plateau, and the hilly Northern Hills. Of the state's total geographical area of 1,35,191 sq km, about 44.25 per cent (59,821 sq km) is under forest cover, and the cultivated area is 4.78 million ha, or 35 per cent of the geographical area, of which only about 23 per cent is net irrigated. Cropping intensity stands at 119 per cent and total foodgrain production is around 5 million tonnes; nearly 70 per cent of the state's population of 3.08 crore depends on agriculture as cultivators or agricultural labourers, most of them are small and marginal farmers cultivating under 2 ha.

Collection of data

The study is based on secondary data on MSP, cultivated area, production and productivity of paddy, wheat, maize and Bengal gram in Chhattisgarh, compiled for the 26 agricultural years from 2000-01 (the state's first year after formation) to 2025-26, from the Unified Portal for Agricultural Statistics (UPAg), AGMARKNET 2.0 and India Stat Agri. For paddy, the MSP series used is the effective price — the central MSP plus Chhattisgarh's state-level procurement bonus under RGKNY/KUY; for wheat, maize and Bengal gram, which do not receive a comparable state bonus, the central MSP series was used directly.

Analytical tools and techniques employed

Growth rates in MSP, area, production and yield of the four crops were estimated using the Compound Annual Growth Rate (CAGR), based on the semilog trend equation

$$\ln Z = \beta_0 + \beta_1 X + e$$

where Z is the dependent variable (MSP, area, production or yield), X is the time trend, β_1 is the trend coefficient, and e is the error term. The compound growth rate (r, in per cent) was then obtained as

Results and discussion

The results are organized around trends and compound annual growth rates in MSP, area, production and yield of paddy, wheat, maize and Bengal gram in Chhattisgarh between 2000-01 and 2025-26, followed by an assessment of the strength of association between MSP and these three agricultural outcomes.

Trends and CAGR in MSP of major food crops (2000-2026)

Fig. 1 depicts the trend in MSP (effective price for paddy; central MSP for the other three crops) between 2000-01 and 2025-26, and Table 1 presents the corresponding CAGR estimates. MSP

$$r = [\text{antilog}(\beta_1) - 1] \times 100$$

Coefficients of determination (R^2) from the underlying log-linear regressions are reported alongside the CAGR estimates as a measure of trend fit. The association between MSP and area, production and yield of each crop was further examined using Spearman's rank correlation coefficient,

$$\rho = 1 - 6\sum d^2/n(n^2 - 1)$$

where d is the difference between the ranks of the paired observations and n is the number of observations; Spearman's coefficient was preferred over Pearson's because a Shapiro-Wilk test indicated that the underlying series were not normally distributed. Statistical significance of all growth rates and correlation coefficients was assessed at the 1 and 5 per cent levels.

increased steadily for all four crops over the period, with paddy recording the highest compound growth (8.44%), followed by Bengal gram (7.79%), maize (7.47%) and wheat (6.44%); all four estimates were significant at the per cent level. The effective price of paddy rose by 507.84 per cent over the period (₹ 510 to ₹ 3,100/quintal), ₹ ₹ including a 70.47 per cent jump in 2008-09 (₹ 745 to ₹ 1,270) that coincided with the introduction of ₹ aggressive state bonus interventions. The central MSP of Bengal gram rose by 434.09 per cent (₹ 1,100 to ₹ 5,875/quintal), that of maize by 439.33 ₹ ₹ per cent (₹ 445 to ₹ 2,400/quintal), and that of wheat ₹ ₹ by 323.77 per cent (₹ 610 to ₹ 2,585/quintal), the ₹ ₹ latter including a 42.86 per cent jump in 2007-08

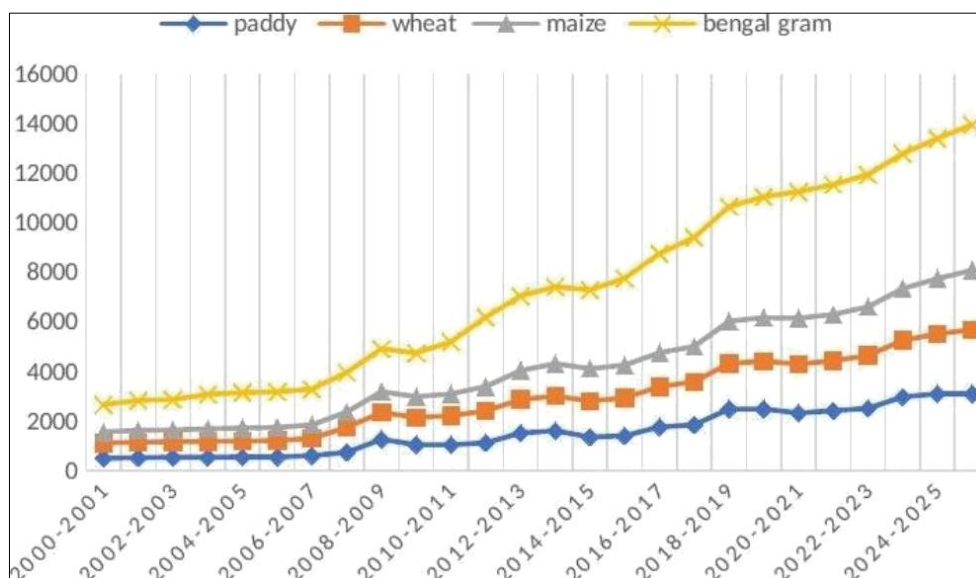


Fig 1: Trends in MSP of major food crops in Chhattisgarh (2000-2026)

Table 1: CAGR in MSP of major food crops in Chhattisgarh (2000-2026)

Crops	CAGR in MSP (%)
Paddy (effective price)	8.44*
Wheat	6.44*
Maize	7.47*
Bengal gram	7.79*

Note: Significant at p -value < 0.01

Trends and CAGR in area under major food crops (2000-2026)

Fig 2: and Table present the trend and CAGR in cultivated area of the four crops. Bengal gram recorded the highest and most significant CAGR in area (2.33%), followed by wheat (2.12%) and maize (1.11%); paddy's area growth was effectively nil (CAGR $\approx$ 0.01 %), and the underlying regression confirms this was not statistically significant ($\beta=0.010$, $p=0.919$). In absolute terms, the area under paddy declined marginally by 1.91 per cent (37.70 to 36.98 lakh ha) over the period, having hovered in a narrow 36–39 lakh ha band throughout, which points to the crop having reached a physical

saturation point early in the series. By contrast, the area under wheat expanded by 87.18 per cent (0.78 to 1.46 lakh ha) and that under Bengal gram by 80.71 per cent (1.40 to 2.53 lakh ha), while maize area rose by a more modest 18.28 per cent (0.93 to 1.10 lakh ha). The significant area expansion in wheat and Bengal gram reflects a structural shift towards double-cropping on rabi fallow land following the kharif paddy harvest, consistent with sustained central MSP support (CAGR of 6.44% and 7.79%, respectively) giving farmers the price confidence to bring residual-moisture land under a second crop.

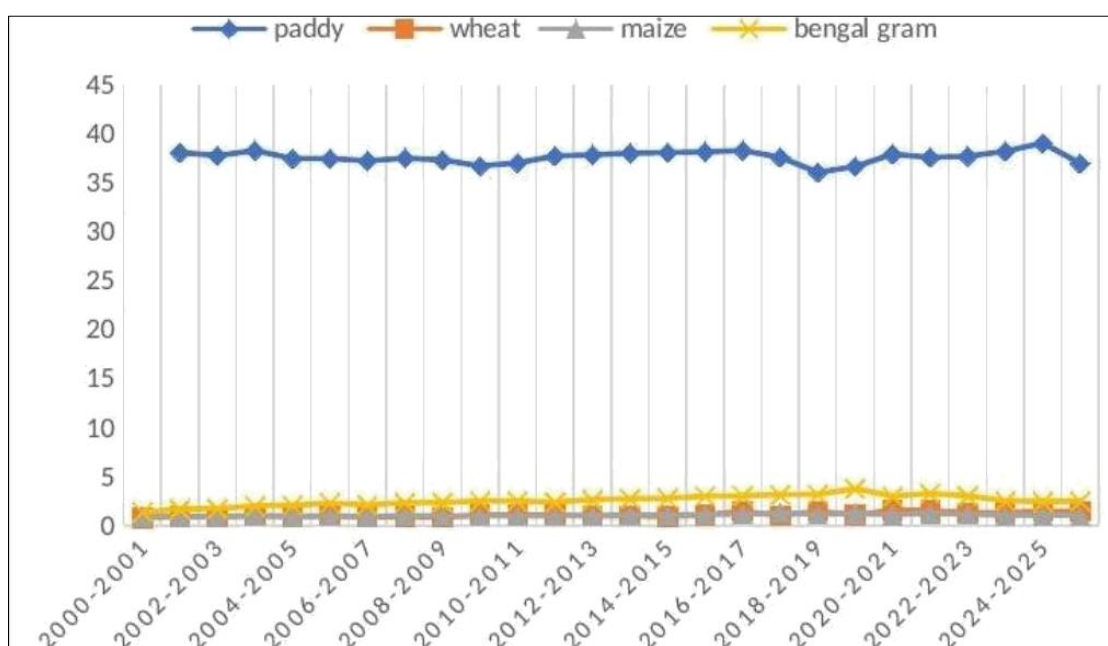


Fig 2: Trends in area under major food crops in Chhattisgarh (2000-2026)

Table 2: Growth (CAGR) in area under major food crops in Chhattisgarh (2000-2026)

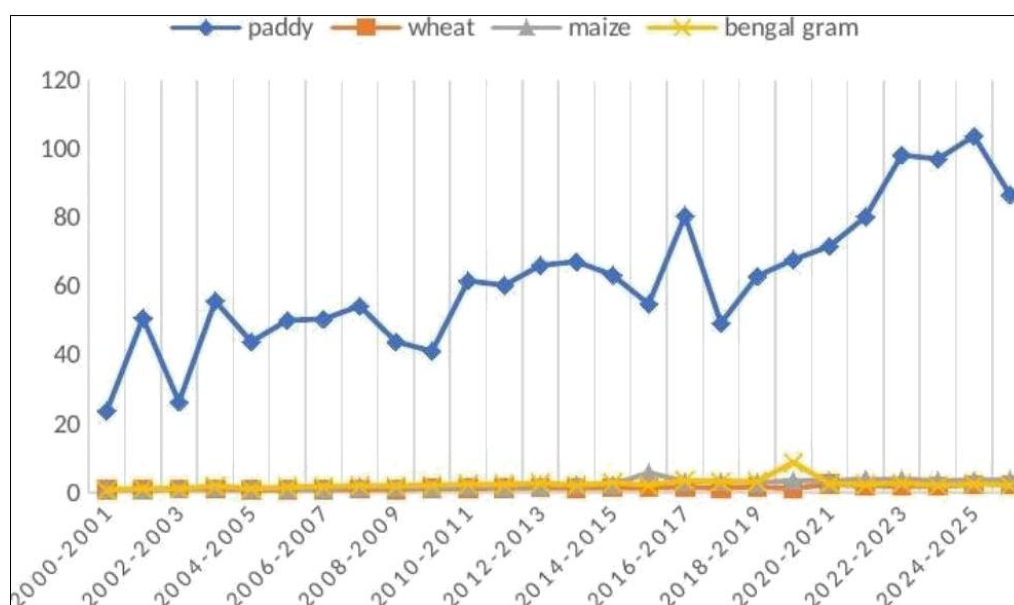
Crops	CAGR (%)
Paddy	0.01 (ns)a
Wheat	2.12*
Maize	1.11*
Bengal gram	2.33*

Note: Significant at p -value < 0.01 , non-significant ($p = 0.919$ from the log-linear regression; see^a Table 7).

Trends and CAGR in production of major food crops (2000-2026)

Fig 3: and Table show the trend and CAGR in production. Maize recorded the highest CAGR in production (6.40%), followed by Bengal gram (4.08%), paddy (3.98%) and wheat (3.87%); all four were significant at the 1 per cent level. Paddy production rose by 265.77 per cent over the period (23.69 to 86.65 lakh tonnes), driven almost entirely by yield gains given the near-static area. Bengal gram production rose by 195.83 per cent (0.72 to 2.13 lakh tonnes), wheat by 192.50 per cent (0.80 to 2.34 lakh tonnes), and maize by 192.06 per cent (1.26 to 3.68 lakh tonnes), the latter driven substantially by yield growth exceeding 148.81 per cent over the period. Paddy continues to

account for the largest absolute production volume in the state, reflecting its unmatched procurement infrastructure, but the statistically significant production growth recorded by wheat, maize and Bengal gram indicates that farmers have actively reallocated resources towards non-paddy crops where price signals and cropping-season opportunities allow it. This suggests that MSP functions as a necessary, but not on its own sufficient, catalyst for production growth, one that is realized fully only where price support is accompanied by high-yielding seed technology, extension support and assured market linkages.

**Fig 3:** Trends in production of major food crops in Chhattisgarh (2000-2026)**Table 3:** Growth (CAGR) in production of major food crops in Chhattisgarh (2000-2026)

Crops	CAGR (%)
Paddy	3.98*
Wheat	3.87*
Maize	6.40*
Bengal gram	4.08*

Note: Significant at p -value < 0.01

Trends and CAGR in yield of major food crops (2000-2026)

The trend and CAGR in yield are presented in Fig. and Table 4. Maize recorded the highest yield CAGR (5.13%), followed by paddy (3.98%) and wheat (1.92%); Bengal gram recorded the lowest yield CAGR (0.70%), and the underlying regression confirms this was not statistically significant ($p=0.444$, $R^2=0.025$). Paddy yield rose by 272.50 per cent (629 to 2,342 kg/ha) over the period — by far the largest yield gain among the four crops — and, combined with its near-static area, explains why paddy production growth was essentially yield-led. Bengal gram yield rose by 63.30 per cent (515 to 814 kg/ha) and wheat yield by 56.56 per cent (1,022 to 1,599 kg/ha), both lagging well

behind the growth in their respective cultivated areas (80.71% and 87.18%), while maize yield grew by more than 148.81 per cent, the second-highest gain after paddy, reflecting the state-wide shift from open-pollinated varieties to single-cross hybrid seed in maize-growing districts such as Bastar and Surguja. Bengal gram's weak and statistically non-significant yield growth is consistent with the crop's continued cultivation under rainfed conditions on residual soil moisture, which leaves productivity vulnerable to terminal heat stress, pod-borer infestation and moisture deficit regardless of the price signal it receives.

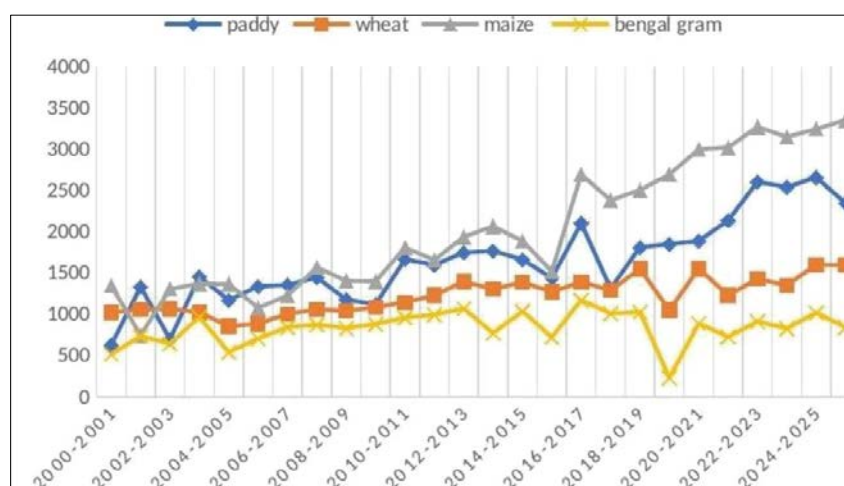


Fig 4: Trends in yield of major food crops in Chhattisgarh (2000-2026)

Table 4: Growth (CAGR) in yield of major food crops in Chhattisgarh (2000-2026)

Crops	CAGR (%)
Paddy	3.98*
Wheat	1.92*
Maize	5.13*
Bengal gram	0.70 (ns)a

Note: Significant at p -value < 0.01 ; non-significant ($p = 0.444$, $R^2 = 0.025$; see Table 7).^a

Spearman rank correlation between MSP and area, production and yield of major food crops (2000-2026)

Table presents the Spearman rank correlation between MSP and area, production and yield of each crop, with the corresponding scatterplots shown in Fig. 5, and Tables and report the coefficients of determination (R^2) and log-linear regression coefficients (β) underlying the CAGR estimates. Maize showed the strongest and most consistent association with MSP across all three parameters ($\rho=0.834$ with area, 0.921 with production and 0.952 with yield; R^2 of 0.617 , 0.778 and 0.870 respectively; all significant at $p<0.001$). The steady rise in central MSP (CAGR = 7.47%), combined with strong industrial demand from the starch- and feed-processing sectors, appears to have given maize growers the price security needed to invest in balanced fertilizer use and modern crop-management practices. Wheat also displayed strong positive associations ($\rho=0.765$, 0.890 and 0.810 with area, production and yield, respectively; all $p<0.001$), consistent with continuous central MSP support (CAGR = 6.44%) combined with the expansion of tube-well and canal irrigation across the central plains, which enabled a shift from single-crop rainfed systems towards rice-wheat rotation. Bengal gram recorded the highest CAGR in area of any of the four crops and a strong MSP-area correlation ($\rho=0.793$, $p<0.001$), reflecting how steady central MSP increases (CAGR= 7.79%) derisked the conversion of post-paddy winter fallow land into pulse acreage. Its MSP-production correlation was also significant and positive ($\rho=0.701$), but the MSP-yield correlation was weak and statistically non-significant ($\rho^{=0.321}$, $p=0.110$; $R^2=0.034$), reinforcing the earlier finding that yield gains in gram have not kept pace with its area expansion (Mahto and Patil, 2023) ^[10].

Paddy showed a markedly different pattern: its MSP-area correlation was weak and nonsignificant ($\rho=0.091$, $\rho=0.659$; $R^2=0.009$). consistent with the area having already reached physical saturation, whereas its MSP-production and MSP-yield correlations were strong and highly significant ($\rho=0.829$ and 0.843 , respectively; both $p<0.001$; R^2 of 0.706 and 0.731). This confirms that, unlike the other three crops, MSP support for paddy in Chhattisgarh operates almost entirely through the yield channel, encouraging adoption of high-yielding varieties, line transplanting and micro-irrigation on an already-fixed area rather than through further land conversion — a pattern similar to that reported for paddy in an already saturated growing region of Punjab by Ali *et al.* (2012) ^[2]. The log-linear regression coefficients in Table corroborate these patterns: paddy's area coefficient was statistically indistinguishable from zero ($\beta=0.010$, $p=0.919$) while its yield coefficient was highly significant ($\beta=0.039$, $p<0.001$); wheat ($\beta=0.021$) and Bengal gram ($\beta=0.023$) both showed significant positive area coefficients, consistent with continued rabi-fallow conversion; and maize recorded the steepest yield-regression slope of all four crops ($\beta=0.050$, $R^2=0.87$), underscoring its rapid technological progress. These results are broadly consistent with comparable state- and crop-level MSP-effectiveness studies elsewhere in India, including for gram (Mahto and Patil, 2023) ^[10], wheat in agriculturally comparable states (Singh, 2021) ^[4], and Jowar (Charankumar *et al.*, 2025) ^[3], all of which similarly report crop-specific rather than uniform responses to MSP revision, and align with the finding of Somanathan *et al.* (2024) ^[6] at the national level that MSP support tends to be most strongly associated with yield among crops whose scope for area expansion is limited.

Table 5: Spearman rank correlation between MSP and area, production and yield of major food crops (2000-2026)

Spearman correlation	MSP-Area	MSP-Production	MSP-Yield
Paddy	0.091 (0.659) ^{NS}	0.829 (<0.001)	0.843 (<0.001)
Wheat	0.765 (<0.001)	0.890 (<0.001)	0.810 (<0.001)
Maize	0.834 (<0.001)	0.921 (<0.001)	0.952 (<0.001)
Bengal gram	0.793 (<0.001)	0.701 (<0.001)	0.321 (0.110) ^{NS}

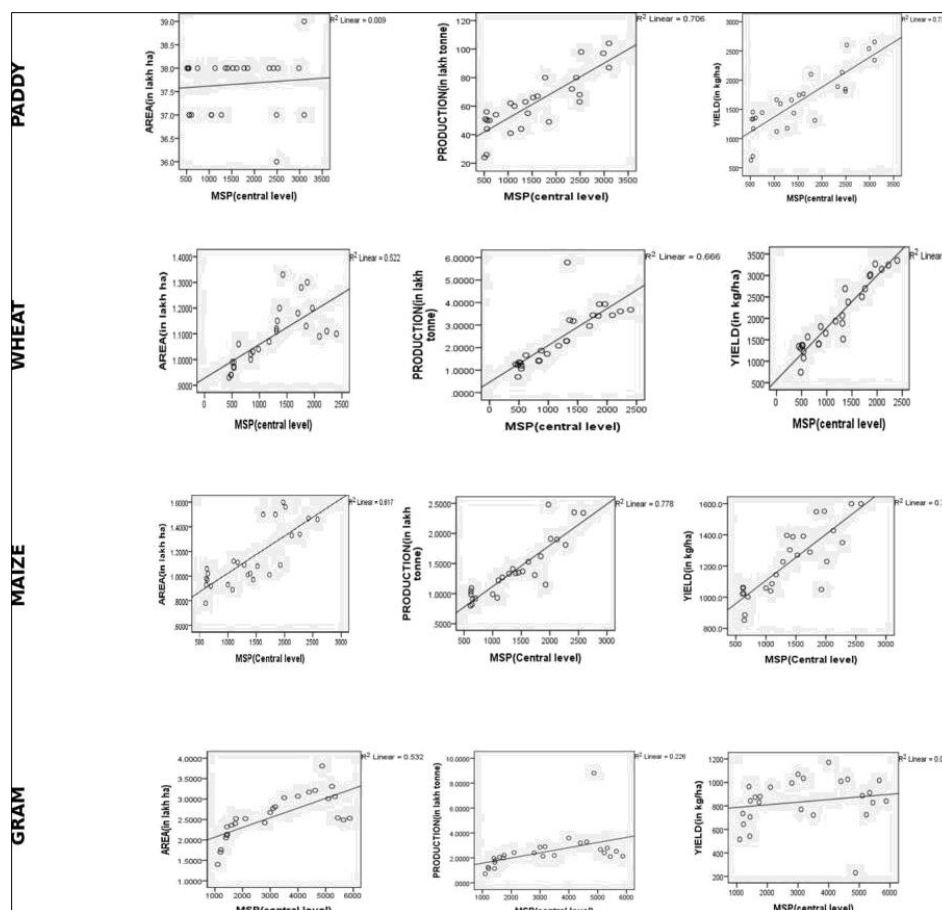
Note: Figures in parentheses are p -values.

Table 6: Coefficient of determination (R^2) of area, production and yield with MSP of major food crops (2000-2026)

Crops	R ² – Area to MSP	R ² – Production to MSP	R ² – Yield to MSP
Paddy	0.009	0.706	0.731
Wheat	0.522	0.666	0.907
Maize	0.617	0.778	0.870
Bengal gram	0.532	0.226	0.034

Table 7: Log-linear regression coefficients (β) of area, production and yield on time, major food crops (2000-2026)

Crops	β – Area	β – Production	β – Yield
Paddy	0.010	0.039	0.039
Wheat	0.021	0.038	0.019
Maize	0.011	0.062	0.050
Bengal gram	0.023	0.040	0.007

**Fig 5:** Scatterplots between MSP and area, production and yield of major food crops (2000-2026)

Conclusion

Chhattisgarh's price support system, comprising the central MSP together with state-level procurement bonuses for paddy under the RGKNY and KUY schemes, recorded a statistically significant and positive compound annual growth rate for all four major food crops examined, ranging from 6.44 per cent for wheat to 8.44 per cent for paddy's effective price, over the 26 years from 2000-01 to 2025-26. The response of area, production and yield to this sustained price support, however, differed markedly by crop. Paddy's cultivated area has effectively reached physical saturation at 36–38 lakh ha (CAGR≈0.01 % , nonsignificant), so its substantial 265.77 per cent rise in production was driven almost entirely by yield intensification (CAGR ≈ 3.98 % strongly correlated with MSP, $\rho=0.843$) ; price support for paddy in Chhattisgarh therefore now operates principally as an incentive for input intensification — high-yielding varieties, line transplanting and micro-irrigation — rather than for further land conversion. Wheat and Bengal gram, in contrast, showed significant and comparable area expansion (CAGR=2.12 % and 2.33 % , , respectively), reflecting farmers' use of assured MSP to extend double-cropping onto post-monsoon rabi fallow land, though

gram's yield growth remained weak and statistically non-significant (CAGR=0.70 % , $\rho =0.321$) , pointing to biological and moisture constraints — terminal heat stress and reliance on residual soil moisture — that price policy alone cannot resolve. Maize recorded the strongest overall response to MSP across all three parameters, consistent with its transition from open-pollinated varieties to single-cross hybrids and with rising industrial demand for maize-based starch and feed.

Overall, the study concludes that MSP policy, when reinforced by state-level procurement support, has been an effective instrument for raising the output of major food crops in Chhattisgarh, but that its effectiveness is channelspecific: yield-led for a crop such as paddy whose area is already saturated, and area-led for crops such as wheat and gram that retain scope for double-cropping on fallow rabi land. This implies that price policy for paddy would be better directed

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