PERFORMANCE OF INDIA'S CHILLI EXPORTS AND DOMESTIC PRODUCTION: AN ANALYSIS FROM 2000–01 TO 2021–22

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ABSTRACT

India is the leading global producer and exporter of chilli, which is crucial to the nation's agricultural exports and farmers' livelihoods. This study evaluated the performance of India's chilli exports and domestic production from 2000–01 to 2021–22. Utilizing secondary data, it analyzed trends, growth rates, and volatility in export quantity and value, alongside changes in cultivation area, production, and productivity of chilli in India. Linear and semi-log trend models were applied to ascertain growth patterns, while the Cuddy–Della Valle Instability Index was utilized to evaluate variability. The findings indicated substantial and statistically significant growth in both the value and quantity of chilli exports, with export value increasing at a faster rate than export volume. Notwithstanding a reduction in the area dedicated to chilli cultivation, production experienced a consistent increase attributed to significant enhancements in productivity. The volatility in export value and production was greater than that of area and productivity, reflecting the impact of price fluctuations and yield variability. The study emphasized a structural transition towards growth driven by productivity, which facilitated export expansion despite the decrease in acreage. The findings highlighted the critical role of technological advancements, yield-stabilizing strategies, and quality improvements aimed at exports in maintaining India's competitiveness in the global chilli market.

Keywords: Chilli exports, Production performance, Growth analysis, Instability index, India

Introduction

India holds a significant role in the global spice economy and is acknowledged as the leading producer, consumer, and exporter of chilli worldwide. Chilli substantially contributes to agricultural income, employment generation, and foreign exchange earnings. The crop is grown in many agro-climatic regions, with Andhra Pradesh, Telangana, Karnataka, Madhya Pradesh, and Tamil Nadu being the principal producing states. India exports chilli in multiple forms, including dried chillies, chilli powder, and processed products, serving both traditional and growing global markets. Since the economic liberalization, India's agricultural exports

have experienced a structural revolution driven by legislative reforms, technology advancements, market integration, and productivity improvements. In this environment, chilli exports have demonstrated significant development, albeit characterized by fluctuations in prices and quantities. The dynamics of domestic production, evidenced by changes in cultivated area, output, and productivity, have significantly influenced export competitiveness and supply stability.

Comprehending the enduring relationship between domestic production performance and export growth is crucial for evaluating the sustainability of India's chilli sector. Historically, area expansion facilitated output increase; however, current patterns suggest a transition towards productivity-driven production. Nonetheless, instability in production and export due to weather unpredictability, price fluctuations, and market uncertainty continues to pose significant hurdles. This study analyzed the performance of India's chilli exports and domestic production from 2000–01 to 2021–22, emphasizing trends, growth rates, and instability.

Review of Literature

Numerous studies have analyzed the production and export performance of chilli in India, underscoring its importance in the agricultural and international trade sectors. India has sustained a dominant status in the global chilli industry owing to advantageous agro-climatic conditions, extensive growing area, and robust export connections (Ramachandra et al., 2012). Their research recorded enduring trends in chilli cultivation and exports, indicating consistent output increase and diversification of export destinations.

Bansal et al. (2022) examined the export performance of Indian chilli in the post-liberalisation era and noted a substantial rise in both export quantity and value. The research attributed this expansion to increasing worldwide demand, enhanced quality standards, and India's comparative advantage in spice production. Nevertheless, the authors observed annual variations attributable to price volatility and international market conditions.

Research on India's spice exports following liberalization revealed that chilli exports reacted positively to trade liberalization and global market integration (Ramannagol & Nagoor, 2021). Their findings indicated that economic factors, including international prices and exchange rates, increasingly impacted export performance.

Bhavani Devi et al. (2018) examined the growth rates of area, production, and productivity of chillies across Indian states and determined that productivity growth was more influential than area expansion in increasing output. Regional differences in productivity were recognized as a significant obstacle to constant supply.

Recent studies have concentrated on value chain efficiency and regional production systems. Singh et al. (2023) investigated chilli farming in specialized locations and emphasized the significance of enhanced agronomic methods and market accessibility in augmenting farmers' income and ensuring production sustainability.

Data and Methodology

This study utilized solely secondary data spanning from 2000–01 to 2021–22. Data on chilli exports (both quantity and value) and domestic production variables (area, production, and productivity) were compiled from official publications of the Directorate General of Commercial Intelligence and Statistics, Kolkata. Trend analysis was conducted utilizing linear and semi-logarithmic regression models. The linear model represented absolute changes over time, but the semi-log model was employed to estimate percentage growth rates. Compound Growth Rates (CGR) were calculated using the semi-logarithmic coefficients. The Cuddy–Della Valle Instability Index was employed to quantify instability in exports and production variables, adjusting the coefficient of variation for trends in time-series data.

Results and Discussion

Performance of India’s Chilli Exports

Table 1 delineates the changes in India's chilli exports, measured by value and quantity, alongside their corresponding shares in India’s total spice exports, during the period from 2000–01 to 2021–22. The table presents a comprehensive overview of the growth and structural transformations in chilli exports, emphasizing their rising significance in India's spice export portfolio throughout time.

TABLE 1

INDIA’S EXPORT OF CHILLI DURING 2000-01 TO 2021-21

Year	Value (Rs. In Lakhs)	Share in Total Spices Export	Quantity (In Tonnes)	Share in Total Spices Export
2000-01	22973	12.63	62448	25.91

2001-02	25244	13.01	69998	28.78
2002-03	31515	15.10	81022	30.68
2003-04	36688	19.19	86575	34.03
2004-05	49903	21.23	138073	39.62
2005-06	40301	15.34	113174	32.30
2006-07	80856	21.24	149022	40.97
2007-08	109750	24.74	209000	47.05
2008-09	108095	20.39	188000	39.96
2009-10	129173	23.23	204000	40.58
2010-11	153554	22.45	240000	45.65
2011-12	214408	21.92	241000	41.89
2012-13	238061	19.65	301000	41.43
2013-14	272227	19.82	312500	38.24
2014-15	351710	23.61	347000	38.82
2015-16	399744	24.62	347500	41.21
2016-17	507075	28.47	400250	42.23
2017-18	425633	23.67	443900	43.18
2018-19	541118	27.74	468500	42.58
2019-20	671040	30.41	496000	41.05
2020-21	924126	29.84	649,815	36.94
2021-22	858458	28.31	557143	36.39

Source: DGCI&S., Calcutta.

Export earnings grew from Rs. 22,973 lakhs in 2000–01, representing 12.63 percent of the total spices export value, to Rs. 8,58,458 lakhs in 2021–22, while export volume increased from 62,448 tonnes to 557,143 tonnes over the same period. The initial years experienced a consistent upward trajectory, with export value more than doubling by 2004–05 and export volume increasing significantly to nearly 40 percent of the total spices export volume. Although a temporary decline occurred in 2005–2006 and again during 2008–2009, chilli exports subsequently experienced a robust recovery. From 2006–07 onwards, export growth accelerated, with chilli comprising nearly half of India's total spice export volume in certain years. The period from 2010–11 to 2014–15 was marked by steady growth and stable export shares, succeeded by a significant increase after 2015–16, when export value reached its peak at Rs. 9,24,126 lakhs and export quantity attained 6,49,815 tonnes in 2020–21, indicative of

favorable global demand and robust domestic supply conditions. Although a slight decrease in export value and volume was observed in 2021–22, chilli remained the leading spice, accounting for over 28 percent of the total spice export value and more than 36 percent of the export volume. Overall, the long-term trend demonstrated strong growth with periodic fluctuations, underscoring chilli's strategic importance and sustained competitiveness in India's spice export sector. Table 2 presents the results of trend and growth rates.

TABLE 2

TREND AND GROWTH RATES OF INDIA'S EXPORT OF CHILLI DURING 2000-01 TO 2021-22

Variables	Linear Model			
	a	b	t	R^2
Value	-111799.000 (31341.903)	31643.110 (2616.371)	12.094 **	0.890
Quantity	2260.384 (11054.916)	23113.116 (922.847)	25.045 **	0.972
	Semi-log Model			CGR
	a	b	t	R^2
Value	9.866 (0.074)	0.185 (0.006)	30.025 **	0.980	20.4
Quantity	11.079 (0.060)	0.109 (0.005)	21.876 **	0.964	11.5

Source: Computed by the Researcher

** Significant at one per cent level, * Significant at five per cent level

The analysis of the trend and growth rate of India's chilli exports from 2000–01 to 2021–22 demonstrated a robust and statistically significant upward trend in both export value and export volume. Linear trend analysis indicated that export earnings grew by Rs.31,643.11 lakhs annually (R^2 = 0.890), while export volume increased by 23,113.12 tonnes per year (R^2 = 0.972), reflecting consistent long-term growth. The semi-log model confirmed the rapid percentage growth, with export value and quantity rising at average annual rates of 18.5 percent and 10.9 percent, respectively. The compound growth rates further supported these findings, indicating a higher growth in export value (20.4 percent) compared to quantity (11.5 percent). Overall, the findings underscored substantial growth and enhanced global competitiveness of India's chilli exports.

Trends in Area, Production, and Productivity

Table 3 displays the trends in the area cultivated, production, and productivity of chilli in India from 2000–01 to 2021–22. It provides a comprehensive overview of fluctuations in cultivated area and production levels, as well as variations in yield performance over time, emphasizing the evolving production dynamics of chilli in the country.

TABLE 3
AREA OF CULTIVATION, PRODUCTION AND PRODUCTIVITY OF CHILLI IN INDIA DURING 2000-01 TO 2021-22

Year	Area (In Hectares)	Share in Total Area	Production (In Tonnes)	Share in Total Production	Productivity (Kg/ha)
2000-01	836500	34.88	983700	28.79	1176
2001-02	880000	31.86	1069000	30.38	1215
2002-03	827950	32.65	906994	29.92	1095
2003-04	824400	29.93	1289340	30.54	1564
2004-05	843280	31.97	1376580	31.12	1632
2005-06	742200	29.32	1023128	24.46	1379
2006-07	809437	30.62	1325273	28.41	1637
2007-08	836831	29.10	1370853	26.38	1638
2008-09	802896	27.23	1381531	25.65	1721
2009-10	809699	27.92	1470352	27.81	1816
2010-11	716428	23.54	1299191	21.90	1813
2011-12	793921	22.42	1448215	22.90	1824
2012-13	787530	24.82	1378400	23.76	1750
2013-14	791930	25.18	1376400	23.50	1738
2014-15	766620	24.01	1621480	26.28	2115
2015-16	742950	21.49	1497440	21.70	2016
2016-17	859790	20.86	2411150	23.13	2804
2017-18	678880	17.29	1718200	17.90	2531
2018-19	706710	17.53	1515560	16.45	2145
2019-20	623446	14.44	1841800	18.19	2954
2020-21	702047	15.65	2049213	18.56	2918
2021-22	882000	20.09	1836222	16.50	2081

Source: DGCI&S., Calcutta.

The trends in the area, production, and productivity of chilli in India from 2000–01 to 2021–22 exhibited significant fluctuations in cultivated area and output, coupled with a consistent increase in productivity. Chilli cultivated 8.37 lakh hectares in 2000–01, occounting 34.88 percent of the total spice area, with a production of 9.84 lakh tonnes and a comparatively low productivity of 1,176 kg per hectare. Although both area and production exhibited moderate growth during the initial years, a decline was observed in 2005–2006, indicating temporary shifts in cropping patterns or unfavourable production conditions. From 2006–07 onward, production remained stable despite a decline in cultivated area, primarily owing to continuous improvements in productivity, which increased consistently from 1,721 kg per hectare in 2008–09 to 1,824 kg per hectare in 2011–12. A significant enhancement in productivity after 2014–2015, reaching a zenith of 2,804 kg per hectare in 2016–2017, resulted in a considerable rise in total production despite only minimal growth in cultivated area. In subsequent years, production remained comparatively robust despite significant reductions in area, sustained by exceptionally high yields. However, variations in productivity during 2020–2021 and 2021–2022 suggested the emergence of yield limitations. Overall, although the share of chilli in total spice area and production decreased over time, growth driven by productivity improvements was instrumental in maintaining output, underscoring a structural transition towards intensification in chilli cultivation in India. Table 4 displays the results of the trend analysis and growth rates for the area under cultivation, production, and productivity of chilli.

TABLE 4
TREND AND GROWTH RATES OF AREA OF CULTIVATION, PRODUCTION AND PRODUCTIVITY OF CHILLI IN INDIA DURING 2000-01 TO 2021-22

Variables	Linear Model			
	a	b	t	R^2
Area	864146.500 (22398.461)	-7626.343 (1869.787)	-4.079 **	0.480
Production	959022.642 (100156.232)	42448.258 (8360.881)	5.197 **	0.600
Productivity	1041.258 (106.408)	74.942 (8.883)	8.437 **	0.798
	Semi-log Model			**CGR**
	a	**b**	**t**	**R^2**
Area	13.675 (0.030)	-0.010 (0.002)	-4.064 **	0.478	-0.001

Production	13.815 (0.062)	0.031 (0.005)	5.997 **	0.666	0.031
Productivity	7.048 (0.051)	0.041 (0.004)	9.693 **	0.839	0.042

Source: Computed by the Researcher

** Significant at one per cent level, and * Significant at five per cent level

The analysis of trends and growth rates for the area under cultivation, production, and productivity of chilli in India from 2000–01 to 2021–22, using linear and semi-log models alongside compound growth rates, demonstrated contrasting patterns between area and output variables, highlighting the growing significance of productivity in maintaining chilli production. The linear trend analysis revealed a statistically significant annual decrease of 7,626.34 hectares in the area under chilli cultivation ($t = -4.079$; $R^2 = 0.480$), indicating a reduction in acreage driven by factors such as crop substitution and regional shifts. In contrast, chilli production experienced a substantial annual increase of 42,448.26 tonnes ($t = 5.197$; $R^2 = 0.600$), while productivity demonstrated a robust and statistically significant upward trend, increasing by 74.94 kg per hectare annually ($t = 8.437$; $R^2 = 0.798$), indicative of technological advancements and enhanced agronomic practices. The semi-log model supported these findings, indicating a negative and statistically significant growth rate for area (−1.0 percent per annum), as well as positive and statistically significant growth rates for production (3.1 percent) and productivity (4.1 percent). The estimates of the compound growth rate further corroborate the ongoing expansion of output, primarily attributable to productivity improvements, thereby emphasizing a structural transition towards productivity-driven growth within India's chilli sector. Trend and growth rate analysis verified that increases in productivity were the main catalyst for output expansion.

TABLE 5
RESULTS OF INSTABILITY ANALYSIS

Variable	Coefficient of Variation (%)	Cuddy–Della Valle Instability Index (%)
Export Value	97.10	32.20
Export Quantity	61.08	10.22
Area	9.84	7.10
Production	27.36	17.31
Productivity	29.42	13.19

Source: Calculated by the author

The instability analysis of chilli export and production variables demonstrated significant disparities among them. Export value exhibited the greatest volatility, characterized by a high coefficient of variation (97.10%) and a Cuddy–Della Valle index of 32.20%, suggesting that price fluctuations rather than variations in quantity were the primary factors contributing to instability. Export quantity demonstrated moderate variability (CV 61.08%) while maintaining relatively low instability (CDV 10.22%), indicating consistent physical exports despite fluctuations in revenue. The area under cultivation remained largely stable (CV 9.84%; CDV 7.10%), indicating consistent land allocation, while production (CV 27.36%; CDV 17.31%) and productivity (CV 29.42%; CDV 13.19%) exhibited moderate instability attributable to yield variability and other factors affecting production. Overall, the results underscore that market dynamics had a substantial impact on export value, while fluctuations in production and productivity contributed moderately to overall instability, and the cultivated area remained relatively stable throughout the study period.

Linkage between Production and Export Performance

A definitive correlation was identified between domestic production trends and export performance. Productivity-driven production growth allowed India to maintain export expansion despite decreasing cultivated area. Periods of elevated productivity aligned with accelerated increases in export volume and worth, underscoring the significance of yield improvement in sustaining exportable surplus. The comparatively lower instability in export quantity relative to production further signifies efficient supply management facilitated by productivity improvements.

Conclusion and Policy Implications

The study revealed that India's chilli sector experienced substantial export growth from 2000–01 to 2021–22, primarily driven by productivity enhancements rather than expansion of cultivated area. Although export revenues increased swiftly, fluctuations in export value and production underscored susceptibility to variations in prices and yields. The findings indicated that policies should prioritize maintaining productivity growth through research and development, the dissemination of enhanced varieties, and the adoption of climate-resilient agricultural practices. Enhancing quality standards, encouraging value addition, and stabilizing export prices would further improve India's competitiveness in the international chilli market.

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