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Trends and growth analysis of rose cultivation in India: Evidence from area and production dynamics

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Abstract

Floriculture has emerged as a high-value agricultural enterprise in India, with rose cultivation playing a pivotal role due to its economic, cultural and industrial significance. The present study analyzes the trends in area and production of rose (cut and loose flowers) in India using time-series data from 2011-12 to 2023-24. Compound Annual Growth Rate (CAGR) and trend analysis were employed to assess growth dynamics and structural changes in the sector. The results revealed a statistically significant increase in area under rose cultivation, with a CAGR of 4.05 per cent, indicating steady expansion driven by rising profitability and market demand. Loose flower production exhibited a robust and highly significant growth (CAGR of 9.21 per cent), reflecting strong domestic demand and improvements in productivity. In contrast, cut flower production showed a declining and unstable trend (CAGR of -20.99 per cent), highlighting inefficiencies in marketing systems, inadequate infrastructure and export-related constraints. The findings indicate a structural shift towards a domestic market-oriented floriculture system, with farmers increasingly preferring loose flowers due to lower risk and stable demand. The study underscores the need for targeted policy interventions focusing on infrastructure development, market reforms and technological adoption to enhance the efficiency and global competitiveness of the floriculture sector in India.

Keywords: Rose cultivation, floriculture, trend analysis, compound annual growth rate, loose flowers, cut flowers, market efficiency, India

Introduction

Floriculture has emerged as a high-value sector of agriculture, contributing significantly to income generation, employment and export earnings. Among ornamental crops, Rose (*Rosa spp.*) occupies a prominent position and is widely regarded as the “queen of flowers” due to its aesthetic appeal, fragrance, and wide range of applications (Govindasamy *et al.*, 2023) ^[3]. Roses hold significant economical and cultural importance and are extensively cultivated across the world for ornamental, industrial and commercial purposes (Leghari *et al.*, 2016) ^[11]. In India, favourable agro-climatic conditions have facilitated the expansion of rose cultivation, making it one of the most important crops in the floriculture sector.

The crop has diverse value-added products, which enhance its economic potential. Roses are widely used in the perfumery, cosmetics, pharmaceuticals and food processing industries to produce products such as essential oils, rose water and gulkand (Hummer and Janick, 2009) ^[4]. Additionally, they are widely used in religious rituals, social ceremonies and landscaping, ensuring consistent domestic demand in the market (Govindasamy *et al.*, 2023) ^[3]. The multi purpose nature of roses makes it a commercially

viable crop with both domestic and export market opportunities.

In India, the area and production of roses have shown a significant increasing trend over the past decade. The area under rose cultivation increased from 26.33 thousand hectares in 2014-15 to 44.57 thousand hectares in 2024-25, while the production of loose flowers increased from 91.75 thousand metric tonnes to 208.45 thousand metric tonnes, indicating significant expansion driven by rising demand and profitability (MoA & FW, 2024-25). This growth reflects a shift towards commercialization and diversification within the agricultural sector.

Despite this positive trend, the floriculture sector faces several challenges, including price fluctuations, inadequate post-harvest infrastructure and inefficient marketing systems, which limit the realization of full economic benefits (Govindasamy *et al.*, 2023) ^[3]. Therefore, analyzing the trends in area and production of rose is essential to understand growth dynamics, assess productivity changes and identify constraints affecting the sector. Such analysis provides valuable insights for policy formulation, technological interventions and improving market efficiency, thereby enhancing the sustainability and

profitability of rose cultivation.

Methodology

The study was based on the time-series data on area and production of rose in India, collected from various published sources such as the Directorate of Economics and Statistics, Indiastat, APEDA for the period 2011-12 to 2023-24.

The data were summarized, tabulated and analyzed using statistical measures like trend analysis. In order to analyze the growth in area and production of rose, compound annual growth rates were computed using the following model (Rajini Devi *et al.*, 2025) ^[14].

$$Y = AB^Te^U$$

$$\text{Log}(Y) = \text{Log}(A) + t \text{Log}(B)$$

$$\text{CAGR} = (\text{Antilog}(B)-1) \times 100$$

Where,

Y = dependent variable (area and production)

A = Intercept

t = Year

B = Regression coefficient

CAGR = Compound Annual Growth Rate in terms of percentage.

Results and Discussion

Trends in Area under Rose Cultivation

The trend analysis of area under rose cultivation in India presented in Table 1. reveals a consistent and statistically significant increasing trend over the study period (2011-12 to 2023-24). The area expanded from 27.87 thousand hectares to 44.55 thousand hectares, indicating a substantial rise in land allocation towards rose cultivation.

The compound annual growth rate (CAGR) of 4.05 per cent, significant at the 1 per cent level, confirms the steady expansion. The high coefficient of determination ($R^2 = 0.88$) and t-value (8.86) indicate a strong and reliable upward trend.

The line graph of area under rose cultivation (Fig. 1) would show a gradual upward slope, with minor dips observed around 2014-15 and 2018-19, followed by a consistent rise thereafter. The upward trajectory indicates increasing farmer preference for floriculture, particularly roses, due to better economic returns. The findings were in consistent with Kankal *et al.* (2021) ^[6] reported that rose cultivation is a profitable enterprise, encouraging expansion in cultivated area. Similarly, Govindasamy *et al.* (2023) ^[3] highlighted the growing importance of floriculture in India, which supports the observed increase in area.

Table 1: Trend analysis of Area and Production of Cut and Loose Rose flowers in India

Year	Area ('000 ha)	Loose flowers Production ('000 tonnes)	Cut flowers Production ('000 tonnes)
2011-2012	27.87	66.17	27401.08
2012-2013	28.13	75.66	19902.76
2013-2014	30.87	96.09	166.47
2014-2015	26.33	91.75	120.95
2015-2016	29.41	113.19	188.76
2016-2017	34.33	126.94	250.27
2017-2018	35.57	138.93	229.62
2018-2019	32.82	181.71	200.94
2019-2020	36	147.14	283.32
2020-2021	37.55	149.67	348.56
2021-2022	40.21	180.73	184.66
2022-2023	41.31	210.37	339.1
2023-2024	44.55	181.25	320.3
CAGR (%)	4.05***	9.21***	-20.99*
R-squared	0.88	0.89	0.27

Note: *** and * indicates significance at 1% and 10% level respectively

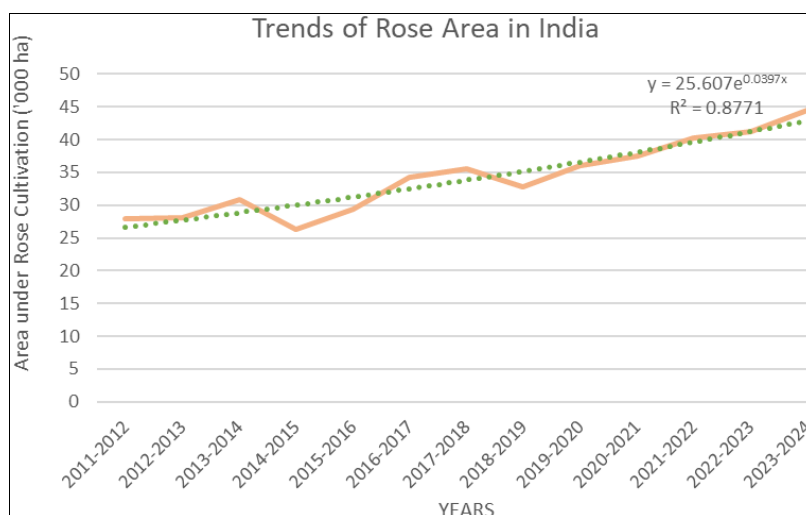


Fig 1: Trends in Area of Rose in India

Trends in Loose Flower Production

Loose flower production exhibited a rapid and highly significant growth trend during the study period (Table 1.). Production increased from 66.17 thousand tonnes in 2011-12 to 181.25 thousand tonnes in 2023-24, reflecting a near threefold increase. The CAGR of 9.21 per cent, significant at the 1 per cent level, indicates strong growth momentum. The R^2 value of 0.89 confirm the robustness and statistical reliability of the trend.

The rapid increase in loose flower production aligns with findings of Pandey *et al.* (2023) ^[13] and Taj *et al.* (2013) ^[16], who emphasized the importance of domestic demand and efficient marketing channels in driving flower production. The growth also supports observations by Singh *et al.* (2022) ^[15] that rising consumption in religious and social functions significantly boosts demand for loose flowers. Further, the higher growth rate of production compared to area suggests productivity improvements, which is consistent with Tiwari (2020) ^[17] and Verma (2023) ^[18], who reported that adoption of improved technologies enhances flower yield and profitability.

Trends in Cut Flower Production

In contrast to area and loose flower production, cut flower production exhibited a highly fluctuating and unstable trend (Table 1.). The data shows sharp variations across years, with an unusually high value in 2011-12, followed by inconsistent patterns in subsequent years. The negative CAGR of -20.99 per cent significant at the 10 per cent level, indicates an overall declining trend. The low R^2 value (0.27) suggests poor explanatory power of the trend model, reflects weak statistical significance. This instability is consistent with findings of Govindasamy *et al.* (2023) ^[3], who reported declining trends in rose exports despite high production potential. Similarly, Taj *et al.* (2013) ^[16] and Kumar (2023) ^[9] highlighted that long marketing chains and presence of intermediaries reduce efficiency, which may negatively affect cut flower production. The observed decline can also be linked to constraints identified by Singh *et al.* (2022) ^[15] and Kavitha *et al.* (2021) ^[7], such as: lack of cold storage facilities, price fluctuations, poor post-harvest management and limited access to export markets.

The results clearly indicate that rose cultivation in India is becoming increasingly domestic market-driven, with farmers preferring loose flower production due to its stable demand, lower risk, reduced dependence on infrastructure etc. However, the declining trend in cut flower production highlights structural inefficiencies in the floriculture sector.

Conclusion

The study clearly demonstrates that rose cultivation in India has undergone a significant transformation over the study period, characterized by a steady expansion in cultivated area and substantial growth in loose flower production. The positive and statistically significant growth in area (4.05%) and loose flower production (9.21%) reflects increasing farmer preference for floriculture as a remunerative enterprise, supported by strong and consistent domestic demand. The relatively higher growth in production compared to area further indicates improvements in productivity, likely driven by the adoption of improved technologies and better crop management practices. In

contrast, the declining and highly unstable trend observed in cut flower production (-20.99%) highlights structural inefficiencies within the floriculture value chain. The weak statistical reliability of the trend further suggests vulnerability to market fluctuations and infrastructural constraints. Issues such as inadequate cold chain facilities, poor post-harvest management, price volatility and inefficient marketing systems continue to limit the growth potential of the cut flower segment, particularly in export-oriented markets.

Overall, the findings indicate a clear shift towards a domestic market-driven floriculture system, with farmers increasingly favouring loose flower production due to its lower risk and stable demand. However, to ensure balanced and sustainable sectoral growth, it is imperative to strengthen cold chain infrastructure, promote efficient marketing systems through farmer-producer linkages, enhance export competitiveness and improve farmers' capacity in post-harvest management and value addition.

Competing Interests

Authors have declared that no competing interests exist.

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