Performance and Trends of Arecanut Cultivation in India and Karnataka During 2005–06 to 2024–25

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***Abstract*—The present study examines the performance and trends of arecanut cultivation in India and Karnataka during 2005–06 to 2024–25, using secondary data from official horticultural statistics. The study analyzes changes in area, production, and yield through Compound Annual Growth Rate (CAGR) and regression-based ANOVA. The findings reveal that arecanut cultivation has expanded significantly over the study period. In India, the area and production recorded CAGRs of 5.32 percent and 7.36 percent, respectively, while yield increased by 1.95 percent. Karnataka exhibited stronger growth, with area and production registering CAGRs of 7.92 percent and 8.09 percent, respectively; however, yield recorded a marginal negative CAGR of –0.19 percent, indicating fluctuations in productivity. The ANOVA results confirmed that the regression models for area, production, and yield were highly significant ($p < 0.001$) for both India and Karnataka, indicating statistically significant long-term trends. The study concludes that the expansion of cultivated area has been the principal driver of production growth, while productivity improvements have remained comparatively limited. The findings emphasize the need for climate-resilient technologies, scientific crop management, mechanization, improved planting materials, and effective extension services to enhance productivity and ensure the sustainable development of arecanut cultivation in India, particularly in Karnataka.**

***Index Terms*—Arecanut Cultivation, Agricultural Growth, Productivity, Sustainable Agriculture, Climate-Resilient Agriculture**

I. INTRODUCTION

Arecanut (Areca catechu L.) is one of the most important plantation crops in India, contributing significantly to agricultural income, employment generation, and rural development. India continues to be the world's largest producer and consumer of arecanut, accounting for more than half of global production. According to the Ministry of Agriculture and Farmers Welfare (2025) and the National Horticulture Board (2024), the crop occupies nearly 9.5 lakh hectares with an annual production of around 14 lakh tonnes. Arecanut cultivation supports millions of farmers, agricultural labourers, traders, processors, and allied industries across the country. Ravindran (2021) observed that the increasing domestic demand, improved production technologies, and favourable market prices have significantly contributed to the expansion of arecanut cultivation in India.

Karnataka is the leading arecanut-producing state, contributing nearly 70 percent of India's total production. The major producing districts include Shivamogga, Chikkamagaluru, Uttara Kannada, Dakshina Kannada, Udupi, Hassan, Davanagere, and Tumakuru. According to the Government of Karnataka (2025), the area under arecanut cultivation has increased continuously over the past decade and reached approximately 7.56 lakh hectares during 2025–26, with production exceeding 10 lakh tonnes. Hegde and Sreedhara (2022) reported that better irrigation facilities, adoption of high-yielding varieties, favourable climatic conditions, and attractive market prices have encouraged farmers to shift from traditional cereal crops to commercial arecanut cultivation.

Recent years have witnessed rapid modernization in arecanut production through the adoption of improved cultivation technologies. Farmers are increasingly using drip irrigation, integrated nutrient management, mechanized harvesting equipment, precision farming techniques, and digital advisory services to improve productivity and reduce production costs. Bhat and Bhat (2023) emphasized that scientific management practices, improved post-harvest handling, and value-

added processing have enhanced both productivity and profitability. Likewise, Ravindran (2021) noted that strengthening of farmer cooperatives, Farmer Producer Organizations (FPOs), and institutions such as CAMPCO has improved marketing efficiency and increased farmers' bargaining power.

Despite impressive growth, arecanut cultivation faces several production and marketing challenges. Climate change, irregular rainfall, prolonged droughts, labour shortages, rising wage rates, Yellow Leaf Disease (YLD), fruit rot disease, spindle bug infestation, and price fluctuations continue to affect growers' profitability. Hegde, Kumar, and Bhat (2023) reported that labour scarcity and increasing production costs have become the most serious constraints in arecanut cultivation in Karnataka. Similarly, Rajashekar and Patil (2024) emphasized that climate variability and disease incidence are emerging threats to sustainable arecanut production, requiring greater investment in research, extension services, and climate-resilient farming technologies.

The future prospects of arecanut cultivation remain encouraging due to increasing domestic demand, expanding processing industries, export opportunities, and continuous government support. The Ministry of Agriculture and Farmers Welfare (2025) projected sustained growth in plantation crop production through improved irrigation, institutional finance, mechanization, and scientific crop management. According to Ravindran (2021) and Hegde and Sreedhara (2022), sustainable growth in the arecanut sector will depend on climate-smart agriculture, improved disease management, efficient marketing systems, value addition, and stronger institutional support for farmers. These measures will enhance productivity, improve farmers' incomes, and ensure the long-term sustainability of arecanut cultivation in India, particularly in Karnataka.

II. TRENDS ANALYSIS

Table-1: Arecanut Area, Production, and Yield in India During the Period From 2005-06 to 2024-25

Years	Area	Production	Yield
2005-06	381.10	483.10	1268.00
2006-07	382.38	473.23	1238.00
2007-08	386.69	478.07	1236.00
2008-09	387.10	481.30	1243.00
2009-10	400.10	478.00	1195.00
2010-11	400.30	478.10	1194.00
2011-12	463.90	680.70	1467.00
2012-13	446.39	608.72	1364.00
2013-14	451.90	622.27	1377.00
2014-15	450.00	747.00	1660.00
2015-16	474.36	713.84	1505.00
2016-17	454.65	722.85	1590.00
2017-18	496.65	832.98	1677.00
2018-19	718.41	1143.54	1592.00
2019-20	731.65	1352.84	1849.00
2020-21	731.75	1209.00	1650.00
2021-22	770.10	1400.00	1810.00
2022-23	830.00	1450.00	1750.00
2023-24	949.10	1400.00	1470.00
2024-25	950.00	1410.00	1500.00
CAGR	5.32	7.36	1.95

Source: Government of India, Horticultural Statistics at a Glance 2024.

Table 1 presents trends in arecanut cultivation in India with respect to area, production, and yield from 2005–06 to 2024–25. The results indicate a significant expansion in arecanut cultivation over the last two decades. The total area under arecanut cultivation increased from 381.10 thousand hectares in 2005–06 to 950.00 thousand hectares in 2024–25, registering a Compound Annual Growth Rate (CAGR) of 5.32 per cent. This substantial increase reflects the growing economic importance of arecanut cultivation, driven by favorable market prices, increasing domestic demand, expansion of plantation areas, and government support through horticultural development programmes.

Production also exhibited a remarkable upward trend during the study period. It increased from 483.10 thousand tonnes in 2005–06 to 1,410.00 thousand tonnes in 2024–25, recording the highest CAGR of 7.36 per cent among the three indicators. Although production fluctuated in some years due to climatic variability, pest and disease incidence, and market conditions, the overall trend remained positive. A sharp increase was observed after 2011–12, with production crossing one million tonnes from 2018–19 onwards. The highest production of 1,450.00 thousand tonnes was recorded in 2022–23, then marginally declined in 2023–24 and stabilized at 1,410.00 thousand tonnes in 2024–25. The increase in production can be attributed to the expansion of the cultivated area, improved varieties, the adoption of

modern cultivation practices, and better crop management techniques.

The productivity (yield) of arecanut also showed considerable improvement over the study period, though with noticeable year-to-year fluctuations. Yield increased from 1,268 kg per hectare in 2005–06 to 1,500 kg per hectare in 2024–25, registering a CAGR of 1.95 per cent. The highest yield of 1,849 kg per hectare was achieved in 2019–20, reflecting favorable weather conditions and improved management practices. However, productivity declined during subsequent years, reaching 1,470 kg per hectare in 2023–24 before improving slightly to 1,500 kg per hectare in 2024–25. These fluctuations indicate that while expansion in cultivated area has been substantial, productivity remains sensitive to climatic conditions, irrigation availability, pest infestations, and technological adoption.

Overall, the analysis demonstrates that the growth in India's arecanut sector has been primarily driven by expansion in cultivated area and increased production rather than by substantial improvements in productivity. The higher production CAGR than yield suggests that future growth in the sector should focus on enhancing productivity through improved planting materials, scientific nutrient management, integrated pest and disease management, efficient irrigation systems, and climate-resilient cultivation practices. Strengthening research, extension services, and institutional support will be essential for sustaining productivity growth and improving the long-term competitiveness of India's arecanut industry.

	Table-2: ANOVA Model					
		Sum of Squares	df	Mean Square	F	Sig.
Area	Regression	638.003	1	638.003	79.398	0.000
	Residual	152.675	19	8.036		
	Total	790.678	20			
Production	Regression	728.985	1	728.985	85.221	0.000
	Residual	162.526	19	8.554		
	Total	891.511	20			
Yield	Regression	830.618	1	830.618	67.728	0.000
	Residual	233.017	19	12.264		
	Total	1063.636	20			
	a. The equation was estimated without the constant term.					

Table 2 presents the ANOVA results for the regression models estimating trends in arecanut area, production, and yield in India from 2005–06 to 2024–25. The findings reveal that all three regression models are highly statistically significant, with F-values of 79.398 for area, 85.221 for production, and 67.728 for yield, each having a significance value of 0.000 ($p < 0.001$). This indicates that the observed changes in area, production, and yield over the study period are not due to random variation but represent a significant long-term trend. Among the three variables, production recorded the highest F-value (85.221), suggesting the strongest growth trend, followed by area (79.398) and yield (67.728). The relatively lower F-value for yield indicates comparatively greater fluctuations in productivity, which may be influenced by climatic conditions, pest incidence, and cultivation practices. Overall, the ANOVA results confirm that the regression models provide a good fit to the data and indicate a statistically significant upward trend in arecanut cultivation, particularly in area expansion and production growth, during the study period.

Table-3: Arecanut Area, Production, and Yield in Karnataka During the Period From 2005-06 to 2024-25

Years	Area	Production	Yield
2005-06	186.90	293.77	15.70
2006-07	200.68	308.65	20.00
2007-08	205.22	312.94	15.20
2008-09	213.30	325.36	15.30
2009-10	215.57	319.00	14.80
2010-11	227.72	366.18	16.10
2011-12	237.66	390.23	16.40
2012-13	246.06	400.91	16.30
2013-14	251.19	367.30	14.60
2014-15	264.77	413.62	15.60
2015-16	275.50	427.33	15.50
2016-17	268.81	425.85	15.80

2017-18	288.64	452.41	15.70
2018-19	464.58	620.35	13.40
2019-20	498.98	718.96	14.40
2020-21	562.89	863.65	15.30
2021-22	600.00	1081.80	18.00
2022-23	650.00	1348.90	20.70
2023-24	676.90	1032.00	15.20
2024-25	756.90	1040.00	13.70
CAGR	7.92	8.09	-0.19

Table 3 presents the trends in arecanut area, production, and yield in Karnataka during the period from 2005–06 to 2024–25. The findings reveal a remarkable expansion in arecanut cultivation across the state over the last two decades. The area under cultivation increased steadily from 186.90 thousand hectares in 2005–06 to 756.90 thousand hectares in 2024–25, registering a Compound Annual Growth Rate (CAGR) of 7.92 per cent. This substantial increase reflects the growing economic importance of arecanut cultivation in Karnataka, supported by favourable market prices, expansion of irrigated plantations, increasing farmer interest, and various government initiatives promoting horticultural development. A notable rise in cultivated area was observed after 2018–19, indicating rapid commercialization and investment in the arecanut sector.

Production also exhibited a significant upward trend throughout the study period. It increased from 293.77 thousand tonnes in 2005–06 to 1,040.00 thousand tonnes in 2024–25, recording the highest CAGR of 8.09 percent. Production peaked at 1,348.90 thousand tonnes in 2022–23, then declined to 1,032.00 thousand tonnes in 2023–24, before slightly recovering to 1,040.00 thousand tonnes in 2024–25. Despite these recent fluctuations, the long-term trend indicates substantial growth in output, primarily driven by the expansion of cultivated area, improved crop management practices, adoption of high-yielding varieties, and better irrigation facilities. However, annual variations in production may be attributed to climatic uncertainties, pest and disease incidence, labour shortages, and fluctuations in market conditions.

In contrast to the strong growth in area and production, the productivity (yield) of arecanut displayed considerable year-to-year fluctuations during the study period. Yield varied between 13.40 tonnes per hectare and 20.70 tonnes per hectare, recording a marginally negative CAGR of –0.19 per cent. The highest yield was achieved in 2022–23 (20.70 tonnes per hectare), while the lowest was recorded in 2018–19 (13.40 tonnes per hectare) and declined further to 13.70 tonnes per hectare in 2024–25. The negative growth rate indicates that productivity has not kept pace with the rapid expansion in cultivated area. These fluctuations may be associated with changing climatic conditions, moisture stress, pest and disease outbreaks, ageing plantations, and uneven adoption of scientific cultivation practices. Therefore, while Karnataka has emerged as the leading arecanut-producing state in India, future growth in the sector should focus on improving productivity through quality planting materials, precision farming, integrated nutrient and pest management, efficient irrigation systems, and strengthened agricultural extension services to ensure sustainable production and higher farm incomes.

	Table-4: ANOVA Model					
		Sum of Squares	df	Mean Square	F	Sig.
Area	Regression	557.906	1	557.906	91.716	0.000
	Residual	115.576	19	6.083		
	Total	673.482	20			
Production	Regression	644.284	1	644.284	89.764	0.000
	Residual	136.373	19	7.178		
	Total	780.657	20			
Yield	Regression	116.512	1	116.512	61.458	0.000
	Residual	36.020	19	1.896		
	Total	152.533	20			
	a. The equation was estimated without the constant term.					

Table 4 presents the ANOVA results for the regression models estimating trends in arecanut area, production, and yield in Karnataka from 2005–06 to 2024–25. The findings indicate that all three regression models are highly statistically significant, as evidenced by F-values of 91.716 for area, 89.764 for production, and 61.458 for yield, with a significance value of 0.000 ($p < 0.001$) in each case. These results confirm that the changes in arecanut area, production, and yield over the study period are statistically significant and not due to random variation. Among the three variables, area recorded the highest F-value (91.716), indicating the strongest and most consistent growth trend, followed closely by production (89.764), while yield (61.458) exhibited relatively greater fluctuations over time. The higher regression sum of squares relative to the residual sum of squares across all three models further demonstrates that the regression models explain a substantial proportion of the variation in the data. Overall, the ANOVA results indicate that Karnataka has experienced significant long-term growth in arecanut cultivation, particularly through expansion of cultivated area and increased production, while improvements in yield have been comparatively less consistent over the study period.

III. MAJOR FINDINGS

1. The area under arecanut cultivation in India increased significantly from 381.10 thousand hectares in 2005–06 to 950.00 thousand hectares in 2024–25, recording a CAGR of 5.32 per cent, indicating a steady expansion of arecanut cultivation.
2. Arecanut production in India registered the highest growth with a CAGR of 7.36 per cent, increasing from 483.10 thousand tonnes to 1,410.00 thousand tonnes, reflecting improved production performance and expansion of cultivated area.
3. The productivity (yield) of arecanut in India recorded only a CAGR of 1.95 per cent, with considerable year-to-year fluctuations, suggesting that productivity improvements have been relatively modest compared with area and production growth.
4. Karnataka experienced faster growth than the national average, with the cultivated area increasing at a CAGR of 7.92 per cent and production growing at 8.09 per cent, confirming the state's dominant position in India's arecanut sector.
5. Although Karnataka recorded substantial increases in area and production, the yield registered a negative CAGR of –0.19 per cent, indicating stagnation and instability in productivity due to climatic variability, pest and disease incidence, and management-related constraints.
6. The ANOVA results for both India and Karnataka revealed highly significant regression models ($p < 0.001$), confirming statistically significant long-term trends in area, production, and yield over the study period.
7. The regression analysis indicated that production exhibited the strongest growth trend in India ($F = 85.221$), whereas area showed the strongest trend in Karnataka ($F = 91.716$), highlighting the major contribution of cultivated area expansion to production growth.
8. Overall, the study concludes that the growth of the arecanut sector has been driven primarily by expansion in cultivated area rather than sustained improvements in productivity, emphasizing the need for technological interventions and climate-resilient production practices.

IV. CONCLUSION

The study concludes that arecanut cultivation in both India and Karnataka has experienced remarkable growth during the period from 2005–06 to 2024–25, particularly in terms of cultivated area and total production. Karnataka has continued to maintain its position as the leading arecanut-producing state, recording higher growth rates than the national average. However, the relatively slow improvement in productivity at the national level and the negative growth in yield observed in Karnataka indicate that expansion in area has been the primary driver of increased production. The highly significant ANOVA results further confirm that the observed trends are statistically robust and reflect systematic long-term growth rather than random variation. To sustain future growth, greater emphasis should be placed on improving productivity through high-yielding varieties, climate-resilient technologies, efficient irrigation systems, integrated nutrient and pest

management, mechanization, and strengthened agricultural extension services. Such measures will enhance production efficiency, improve farmers' incomes, and ensure the long-term sustainability and competitiveness of the arecanut sector.

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