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ECONOMIC ASSESSMENT OF BLACK PEPPER CULTIVATION IN DAKSHINA KANNADA AND KODAGU DISTRICTS

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ABSTRACT

Black pepper (*Piper nigrum*), known as the "King of Spices," is one of India's most important export-oriented spice crops. Karnataka, and particularly the districts of Kodagu and Dakshina Kannada, account for a major share of India's black pepper area and production. Black pepper cultivation plays a multifaceted role in the economy of Dakshina Kannada and Kodagu districts — contributing to farm income, employment, trade, and exports. This study analyses the economics and performance of black pepper cultivation in Dakshina Kannada and Kodagu, focusing on costs, yields, income, and growth trends. Cultivation requires a high initial investment of ₹3.11 lakh in the first year and consistent annual costs of about ₹5.41 lakh until maturity. Since black pepper plants take three years to yield, the first two years bring no returns, making it a long-gestation crop. Break-even is achieved only in the sixth year, with cumulative profits beginning thereafter; by the seventh year, cumulative gross income reaches ₹11.02 lakh and gross profit about ₹3.15 lakh. The area under cultivation expanded steadily between 2011–12 and 2021–22, from 2,146 ha to 15,037 ha in Dakshina Kannada and from 10,643 ha to 98,445 ha in Kodagu, with Kodagu's growth nearly ten times faster. Production showed fluctuations in Dakshina Kannada, dipping in 2015–16 and 2017–18 before rising sharply to 82,704 MT in 2021–22, whereas Kodagu recorded rapid and consistent growth, reaching 4,46,940 MT in 2021–22 (over five times increase). Productivity in Dakshina Kannada fluctuated sharply (200–580 kg/ha), while Kodagu showed more stable upward trends (237–512 kg/ha). Overall, Kodagu emerged as the dominant hub for black pepper cultivation due to its larger area and stable yields, while Dakshina Kannada struggled with yield fluctuations despite land expansion. Hypothesis testing based on primary data indicates no significant year-wise differences in cultivation area or production within each district, but a significant difference exists between Dakshina Kannada and Kodagu in both area and production, confirming Kodagu's clear dominance in black pepper cultivation.

Keywords: Black Pepper Cultivation, Cost and Profitability.

INTRODUCTION

Black pepper (*Piper nigrum*), known as the "King of Spices," is one of India's most important export-oriented spice crops. Karnataka, and particularly the districts of Kodagu and Dakshina Kannada, account for a major share of India's black pepper area and production. Black pepper cultivation plays a multifaceted role in the economy of Dakshina Kannada and Kodagu districts — contributing to farm income, employment, trade, and exports. Beyond being a cash crop, it strengthens economic resilience, rural livelihoods, and agro-ecological sustainability. Its significance is likely to increase further with rising global demand for spices, provided challenges of productivity, price volatility, and disease management are effectively addressed. Kodagu has traditionally been the hub of pepper cultivation, with favorable agro-climatic conditions in the Western Ghats, while Dakshina Kannada contributes significantly through homestead gardens and mixed cropping systems.

Kodagu and Dakshina Kannada together account for a large share of Karnataka's pepper area and production. In Kodagu, pepper is often cultivated as an intercrop in coffee

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plantations, while in Dakshina Kannada it thrives in homestead gardens and mixed farming systems. The crop plays a dual role — as a cash crop generating farm income and as a subsidiary crop providing stability in mixed-cropping systems. Pepper provides supplementary and sometimes primary income to thousands of farming households. For coffee growers in Kodagu, black pepper acts as an additional source of revenue, helping farmers withstand fluctuations in coffee prices. In Dakshina Kannada, pepper grown in arecanut and coconut gardens diversifies farm income and reduces economic risk.

Role of Black Pepper Cultivation in the Economy of Dakshina Kannada and Kodagu Districts

1. **Agricultural Importance:** Black pepper (*Piper nigrum*), the "King of Spices," is one of the most valuable spice crops cultivated in Karnataka. Kodagu and Dakshina Kannada together account for a large share of Karnataka's pepper area and production. In Kodagu, pepper is often cultivated as an intercrop in coffee plantations, while in Dakshina Kannada it thrives in homestead gardens and mixed farming systems. The crop plays a dual role — as a cash crop generating farm income and as a **subsidiary crop** providing stability in mixed-cropping systems.
2. **Contribution to Farmers' Income:** Pepper provides supplementary and sometimes primary income to thousands of farming households. For coffee growers in Kodagu, black pepper acts as an additional source of revenue, helping farmers withstand fluctuations in coffee prices. In Dakshina Kannada, pepper grown in arecanut and coconut gardens diversifies farm income and reduces economic risk.
3. **Employment and Livelihood:** Black pepper cultivation is labor-intensive, particularly for trailing, pruning, harvesting, and post-harvest processing. It generates seasonal and regular employment for rural households, especially for women who participate in harvesting and processing.
4. **Export and Market Linkages:** Karnataka is one of the leading pepper-producing states in India, and a significant portion enters domestic and export markets through traders and processing units. Pepper from Kodagu is well-recognized for its quality, contributing to India's spice export basket and earning valuable foreign exchange.
5. **Role in Local Economy:** Pepper contributes to the agrarian economy of the Western Ghats, supporting ancillary businesses like nurseries, spice processing, transport, and marketing. Local markets and mandis in Kodagu and Dakshina Kannada thrive on pepper trade during harvest seasons, stimulating rural commerce.
6. **Socio-Economic Stability:** By providing a high-value crop option, pepper helps small and marginal farmers improve household welfare. It acts as a form of **economic security**, with dried peppercorns often stored and sold when market prices are favorable, functioning like a financial asset.
7. **Environmental and Cultural Role:** Pepper cultivation in these districts is largely **intercropped** with perennial crops (coffee, arecanut, coconut), supporting agroforestry systems that conserve soil and biodiversity.: It is also intertwined with the traditional farming culture of the Malnad and coastal regions.

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REVIEW OF LITERATURE

M.S. Yogesh (2017) "Management of Black Pepper Economy in Kodagu District of Karnataka, India" This paper attempts to know the management of the black pepper economy in Kodagu district, Karnataka, covering Virajpet, Madikeri, and Somwarpet taluks. Using the Benefit-Cost Ratio method, it evaluates pepper's economic viability. Findings highlight the need for systematic practices, adoption of high-yield varieties (e.g., Panniyur series, Sreekara), and improved post-harvest technologies. Private businesses are encouraged to support small and medium growers. Establishing processing units can boost value-added products, which have pharmaceutical, preservative, antioxidant, antiseptic, and antibiotic applications. Black pepper also holds substantial importance in India's national economy.

S.P.Subha and others (2020) "Economic Analysis of Pepper Cultivation in India" The study analyzes pepper cultivation and yield trends in India, with a focus on Kerala, using secondary data from journals, newspapers, books, and websites. Garrett's ranking technique was applied to identify cultivation problems. Key findings include: Area under cultivation in Kerala declined sharply, with a reported decrease rate of 223.59% per annum and a coefficient of variation (CV) of 35.43, showing large fluctuations. Production also declined at 211.17% per annum with a CV of 27.82, reflecting instability in output levels. Productivity of pepper showed a growth rate of 15.61% per annum, but with 46.78% variation, indicating inconsistent improvements. The study concludes with recommendations to address the declining area and production while stabilizing productivity.

RESEARCH GAP

The literature survey revealed some of the study was related to issues like Role of Black Pepper Cultivation in Enhancing Farmer's Income. Some studies are also related to economics of Black Pepper Cultivation there are only few studies focused on Growth in Area for Black Pepper Cultivation, Production and marketing of Black Pepper. Thus, the review of literature clearly shows that there is dearth of studies relating to Economic Assessment of Black Pepper Cultivation. There is limited evidence on the cost of cultivation, profitability, and returns of black pepper farming. Socio-economic and institutional factors such as credit access, labor constraints, and extension services are not well studied in the context of pepper. This study develops detailed enterprise budgets and cost–benefit analysis at the farm level, providing a clearer picture of net incomes and economic sustainability.

OBJECTIVES OF THE STUDY

1. To study the trends in Area, Pproduction and Pproductivity of Black Ppepper in Karnataka, Dakshina Kannada and Kodagu districts.
2. To conduct an economic assessment of black pepper cultivation in Dakshina Kannada and Kodagu districts.
3. To estimate the cost of cultivation, returns, and profitability of black pepper in in Dakshina Kannada and Kodagu districts.

Hypothesis of the Study

- There is no Significant differentiating between Area, Production and Productivity of Black Pepper in Dakshina Kannada and Kodagu Districts.

Methodology

The present study uses both secondary and primary data. The secondary data will be collected from horticulture department of Karnataka. The time series data will be used for the growth

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analysis. The primary data will be collected from field study using appropriate methodology. A Random Sampling Design was employed for selecting farmers and about 60 farmers were interviewed from the Dakshina Kannada and Kodagu district in Karnataka. The study was conducted with the help of a pre-tested schedule through the personal interview method. Both descriptive and inferential statistics will be used for data analysis. The econometric frontier methodology will be used for productivity analysis. After collection of data, these are arranged in tabular format. The analysis was done by using different statistical tools and the analysed data are presented in tabulated form. The data is analysed by using the Simple tables, chart, rank method is used to analyses the data, and Two-way ANOVA test was used to Hypothesis testing.

AREA, PRODUCTION AND PRODUCTIVITY OF BLACK PEPPER IN KARNATAKA

Karnataka is one of the leading black pepper-producing states in India, contributing a major share of the national output. The crop is concentrated in the districts of Dakshina Kannada, Kodagu, Chikkamagaluru, and Udupi, which enjoy a warm, humid tropical climate with abundant rainfall—ideal for pepper cultivation. Cultivation is typically practiced as a mixed crop under coffee and arecanut trees in traditional agroforestry systems, making efficient use of land and shade trees. This intercropping provides farmers with a profitable alternative to other plantation crops such as coffee, arecanut, coconut, and rubber. Black pepper plays a significant role in Karnataka's economy, particularly in the hilly and Malnad regions, by Generating steady income for farmers, supporting rural livelihoods, promoting commercial activities and local trade, Strengthening Karnataka's position in the spice market. In 2021–22, Karnataka's black pepper production was estimated at around 36,000 tons, accounting for about 32.6% of India's total output, making it the second-largest producer after Kerala. The state's long-standing tradition of pepper farming, combined with its favorable climate and mixed-cropping practices, ensures its continued importance in India's spice economy. Black pepper yield in Karnataka varies significantly but can reach up to 900-1350 kg per acre in the peak yielding stage (years 6–10) for well-managed plantations, with an average of 250-500 kg per acre after 3 years. Factors like the cultivar, age of the vine, irrigation, and overall crop management greatly influence the yield.

Table 2: Area, Production and Productivity of Black Pepper in Karnataka

Year	Area	Production	Productivity
2011-12	21701	61488	286
2012-13	26837	120316	453
2013-14	27960	170420	616
2014-15	32659	246418	762
2015-16	34985	207758	600
2016-17	37736	246482	660
2017-18	41554	257462	626
2018-19	148379	589630	401
2019-20	160774	774224	486
2020-21	215813	996224	471
2021-22	209709	1125423	548

Above table 1 explore that Area in Black Pepper cultivation expanded from 21,701 ha in 2011–12 to 209,709 ha in 2021–22, with a sharp jump after 2017–18 as pepper spread rapidly as an intercrop in arecanut/coffee/coconut plantations. Production of in Black Pepper Rose dramatically from 61,488 MT in 2011–12 to a record 1,125,423 MT in 2021–22, making

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Karnataka the largest pepper-producing state in India. Productivity of Improved initially, peaking at 762 kg/ha in 2014–15, but later declined and stabilized around 471–548 kg/ha in recent years due to disease pressure, climate stress, and inclusion of newly planted immature vines. Karnataka has seen massive growth in pepper area and output, but productivity has not kept pace, highlighting the need for better crop management, disease control, and yield improvement strategies.

SURVEY BASED ANALISIS ANA DATA INTERPRETATION

A survey of twenty villages of Dakshina Kannada and Kodagu district of Karnataka state has been conducted 30 farmers in Dakshina Kannada and 30 farmers Kodagu district total 60 farmers of Black Pepper Cultivators have been interviewed through questionnaire. The research findings are as follows,

Table 3: Distribution of Gender, Age and qualification of respondents and factor influenced involved in Black Pepper Cultivation

Characteristics		Respondents	Percentage	Rank
Distribution of Gender	Male	40	66.66	01
	Female	20	33.34	02
Distribution of Age	25 to 30	10	16.66	03
	30 to 35	12	20	02
	35 to 40	06	10	04
	40 and above	32	53.33	01
Qualification	Illiterate	02	3.33	4
	Primary and Higher Primary	10	16.66	3
	PUC and above	30	50	1
	Degree and above	18	30	2
Occupation	Agriculture	30	50	01
	Agriculture and Business	20	33.33	02
	Agriculture and Service	10	16.66	03
Land Holding	Below 2.5 Acre	20	33.33	02
	2.5 to 5 acres	22	36.66	01
	5 to 7.5 acres	10	16.66	03
	7.5 to 10 acres	08	13.33	04
Years of experience in Black Pepper cultivation	Up to 10 years	20	33.33	02
	10 to 15 years	28	46.66	01
	15 to 20 years	12	20	03

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Distribution of House hold income	Less than 2.5 lakhs	02	3.33	05
	2.5 to 5 lakhs	12	20	04
	5 to 7.5 lakhs	20	33.33	01
	7.5 to 10 lakhs	16	26.66	02
	10 and above	10	16.66	03
Share of Income from Black Pepper cultivation	Less than 2.5 lakhs	18	30	01
	2.5 to 5 lakhs	16	26.66	02
	5 to 7.5 lakhs	14	23.33	03
	7.5 to 10 lakhs and above	12	20	04

Source: field survey

Table 3 shows that all these factors influenced to involved in Black Pepper cultivation. Above table explained that out of the total 60 respondents 66.66% are male and 33.34% are female.

Majority of them that is 53.33% of them are aged between 40 years and above. 16.66% of them are aged between 25 to 30, 20% respondents are aged between 30 to 35years, only 10% age between 35 to 40.

50% of respondents are having PUC, 30% of them having degree. 16.66% respondents are having Qualification up to Primary and Higher Primary And only16.66 of them are illiterate.

50% of responds are depend on only in agriculture, 33.33% respondent are Agriculture and Service Business, 16.66% of them Agriculture and Service.

36.66% of respondents having 2.5 to 5 acres, 33.33 % of respondents having below 2.5 acre of land, 16.66% of them having 5 to 7.5 acres, 13.33% of them having 7.5 to 10 acres.

46.66% of the having 10 to 15 years of experience in Black Pepper cultivation, 33.33% of them having up to 10 years of experience, and 20% of them having 15 to 20 years of experience in ginger cultivation.

3.33% of respondent's family income Less than 2.5lak, 20% of them have 2.5 to 5 lakhs, 33.33% of them have 5 to 7.5 lakhs, 26.66% of them have 7.5 to 10 lakhs and 16.66% of them have 10 and above family income per year.

30% of respondents got Less than 2.5 lakhs in their total income from only Black Pepper cultivation, 26.66% of them got 2.5 to 5 lakhs, 23.33% of them got 5 to 7.5 lakhs, 20% of them got 7.5 to 10 lakhs and above from Black Pepper cultivation total family income.

Table 4: Average Cost of Cultivation and Income from Black Pepper Cultivation per Acre in study area

Particulars	**Age of the Plantation (in years)**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Rental value of Owned Land	20000	20000	20000	20000	20000	20000	20000
Land Preparation and Development	25000	10000	10000	10000	10000	10000	10000

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Planting Material(Per Plant 30 Rs 300 plants per 1 Acre)		9000	900	300	-	-	-	-
Infrastructure (Bore well & fence etc)		200000	-	-	-	-	-	-
Irrigation (Drip/Sprinkler)		20000	5000	5000	6000	6000	6000	6000
Labors Cost		15000	10000	10000	10000	10000	10000	10000
Depreciation		-	5000	5000	5000	5000	5000	5000
Manures & Fertilizers	**Fertilization**	5000	5000	10000	12000	15000	15000	15000
	Organic Manure	10000	10000	12000	12000	12000	12000	12000
	Plant Protection Chemical	4000	3000	5000	5000	5000	5000	5000
Transport		5000	2000	2000	2500	2500	2500	2500
Total		**311000**	**71900**	**70300**	**80500**	**82500**	**85500**	**85500**
Total Establishment Cost		**311000**	**382900**	**453200**	**533700**	**616200**	**701700**	**7,87,200**
Returns & Profitability (300 plants in 1 acre of land)								
Yield	**Average Production per plant (Dry Black Pepper in KG)**	-	-	1	1.5	2	3	3
	Total Production (Dry Black Pepper in KG)	-	-	300	4500	600	900	900
Income (Average price of 350 per KG dry Black Pepper)		-	-	**1,05,000**	**1,57,500**	**2,10,000**	**3,15,000**	**3,15,000**
Total Return		-	-	**1,05,000**	**2,62,500**	**4,72,500**	**7,87,500**	**11,02,500**

Source: field survey

The initial cost to establish a black pepper farm per acre can ₹701700, it depending on the specific region and farming practices, covering materials like plants and fertilizers, and labor for land preparation, planting, weeding, and other intercultural operations. The total establishment cost for the first six years can be significant, with one study showing an average of approximately ₹1,16,950 for cost of cultivation include materials and labor cost. High Initial Investment ₹3.11 lakh in 1st year, with consistent annual costs around ₹540842.9 until maturity. No Returns for First 2 Years. Break-Even Achieved in Year 6 the cumulative investment is recovered with a small net positive of ₹85,800in 6th Year. Cumulative Gross Income by Year 7: ₹11,02,500 and Gross Profit (Year 3–7): ₹3,15,300.

Table 5: Average Cost and Profit of Cultivation of Black Pepper Cultivation per Acre in Study Area.

Years	Cost of Cultivation	Return for Cultivation			Gross Cost	Gross Profit	Net Profit
		Yield	Price	Income			
1	311000	-	350	-	311000	-	-311000
2	382900	-	350	-	382900	-	-382900

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3	453200	300	350	1,05,000	453200	1,05,000	-3,48,200
4	533700	4500	350	1,57,500	533700	2,62,500	-2,71,200
5	616200	600	350	2,10,000	616200	4,72,500	-1,43,700
6	701700	900	350	3,15,000	**701700**	**7,87,500**	**85,800**
7	7,87,200	900	350	3,15,000	7,87,200	11,02,500	3,15,300

Source: field survey

Chart 1: Average Cost and Profit of Cultivation of Black Pepper Cultivation per Acre in Study Area

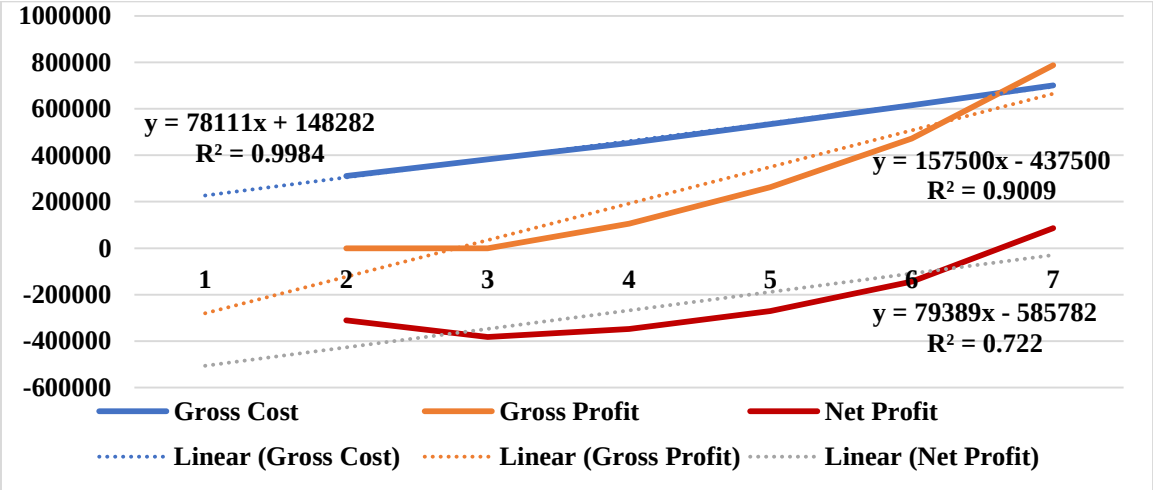

Table 5, chart 1 shows that This table presents a 7-year financial overview of Black Pepper cultivation, detailing the cost of cultivation, yield, income, gross cost, gross profit, and break-even point (BEP) progression. High Initial Investment ₹3.11 lakh in 1st year, with consistent annual costs around ₹540842.9 until maturity. No Returns for First 2 Years. Black Pepper plants take 3 years to start yielding, making early years financially negative. Typically, 3–4 years due to the long gestation period before full yield. The average yield for black pepper in Kodagu can range from 450 kg to 1,350 kg of dry pepper per acre Break-Even Achieved in Year 6 the cumulative investment is recovered with a small net positive of ₹85,800in 6th Year. Cumulative Gross Income by Year 7: ₹11,02,500 and Gross Profit (Year 3–7): ₹3,15,300. Black Pepper cultivation is a long-gestation, high-investment crop that becomes profitable only after 6 – 7 years. Sustained management, adequate funding, and disease control are crucial for success.

Hypothesis Testing

Hypothesis of the Study

- There is no Significant differentiating between Area, Production and Productivity of Black Pepper in Dakshina Kannada and Kodagu Districts.

Area, Production and Productivity of Black Pepper in Dakshina Kannada and Kodagu from 20211- 12 to 2021-22

Year	Dakshina Kannada			Kodagu		
	Area	Production	Productivity	Area	Production	Productivity
2011-12	2146	11111	312	10643	24972	237

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2012-13	2183	10611	491	10797	52269	489
2013-14	2241	11625	524	11002	49014	450
2014-15	2546	9578	380	14934	65644	444
2015-16	2736	7286	269	15096	61723	413
2016-17	3122	17927	580	15219	66294	440
2017-18	3558	7045	200	15875	65694	418
2018-19	5322	22498	427	65605	263693	406
2019-20	7146	29996	424	70757	217153	412
2020-21	13428	56935	424	97979	303735	412
2021-22	15037	82704	550	98445	446940	512

(Source: IndiaStat District Agriculture Portal)

Shows a continuous increase from 2146 ha (2011-12) to 15037 ha (2021-22). In Dakshina Kannada and 10643 ha (2011-12) to 98445 ha (2021-22) in Kodagu. Both districts expanded cultivation, but Kodagu much more aggressively. In Kodagu area under cultivation grew almost 10 times faster than in Dakshina Kannada. Fluctuates heavily — for example, a dip in 2015-16 (7286 MT) and 2017-18 (7045 MT), but then a sharp rise to 82704 MT in 2021-22 in In Dakshina Kannada. But in Kodagu Rapid growth, reaching 446940 MT in 2021-22 (over 5 time increase since 2011-12). Productivity (Yield/ha) lowest 200 kg/ha (2017-18), highest 580 kg/ha (2016-17) in Dakshina Kannada. In Kodagu Ranges between 237–512 kg/ha with a clear upward trend, peaking in 2021-22 (512 kg/ha). It shows More stable compared to Dakshina Kannada. Kodagu dominates — area and production are much larger than Dakshina Kannada throughout the period. Dakshina Kannada shows high fluctuations (200–580), while Kodagu remains relatively stable and improving (237–512). By 2021-22, Kodagu (512) surpassed Dakshina Kannada (550) only slightly, but due to much larger area, overall production is far higher. Kodagu is the main production hub, while Dakshina Kannada needs better crop management to stabilize yield despite increasing land use.

ANOVA table 1

Area of Black Pepper Cultivation in Dakshina Kannada and Kodagu from 20211- 12 to 2021-22

Source of Variation	Sum of Squares SS	df	Mean Squares MS	F	*p*-value
Between rows	*SSR*=8388992469.8182	*r*-1=10	838899246.9818	1.6169	F Dist (1.6169,10,10) = 0.2304
Between columns	*SSC*=6118457762.2273	*c*-1=1	6118457762.2273	11.7927	F Dist (11.7927,1,10) = 0.0064
Error (residual)	*SSE*=5188341559.2727	(*r*-1)(*c*-1) = 10	518834155.9273		
Total	*SST*=19695791791.3182	*rc*-1=21			

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F(10,10) at 0.05 level of significance =2.9782

As calculated ***FR* = 1.6169<2.9782**

So, *H*0 is accepted, hence there is no significant differentiating Area of Black Pepper Cultivation in Dakshina Kannada and Kodagu between Years.

F for between Dakshina Kannada and Kodagu

F(1,10) at 0.05 level of significance =4.9646

As calculated ***FC* = 11.7927>4.9646**

So, *H*0 is rejected, hence there is significant differentiating in area of Black Pepper Cultivation between Dakshina Kannada and Kodagu

ANOVA table 2

Production of Black Pepper in Dakshina Kannada and Kodagu

from 20211- 12 to 2021-22

Source of Variation	Sum of Squares SS	df	Mean Squares MS	F	*p*-value
Between rows	*SSR*=131250137045.273	*r*-1=10	13125013704.5273	1.9251	F Dist (1.9251,10,10) = 0.1583
Between columns	*SSC*=82818206101.1364	*c*-1=1	82818206101.1364	12.1474	F Dist (12.1474,1,10) = 0.0059
Error (residual)	*SSE*=68177885494.3636	(*r*-1)(*c*-1)=10	6817788549.4364		
Total	*SST*=282246228640.773	*rc*-1=21			

F for between years

F(10,10) at 0.05 level of significance = 2.9782

As calculated ***FR*=1.9251<2.9782**

So, *H*0 is accepted, Hence there is no significant differentiating Production of Black Pepper in Dakshina Kannada and Kodagu between Years.

F for between Dakshina Kannada and Kodagu

F(1,10) at 0.05 level of significance = 4.9646

As calculated ***FC*=12.1474>4.9646**

So, *H*0 is rejected, Hence there is significant differentiating in Production of Black Pepper between Dakshina Kannada and Kodagu.

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ANOVA table 3

Productivity of Black Pepper in Dakshina Kannada and Kodagu from 20211- 12 to 2021-22

Source of Variation	Sum of Squares SS	df	Mean Squares MS	F	*p*-value
Between rows	*SSR*=139222.2727	*r*-1=10	13922.2273	2.6522	FDist (2.6522,10,10) = 0.0699
Between columns	*SSC*=122.9091	*c*-1=1	122.9091	0.0234	FDist (0.0234,1,10) = 0.8814
Error (residual)	*SSE*=52494.0909	(*r*-1)(*c*-1)=10	5249.4091		
Total	*SST*=191839.2727	*rc*-1=21			

F for between Years

F(10,10) at 0.05 level of significance = 2.9782

As calculated ***FR*=2.6522<2.9782**

So, *H*0 is accepted, Hence there is no significant differentiating Productivity of Black Pepper in Dakshina Kannada and Kodagu between Years

F for between Dakshina Kannada and Kodagu

F(1,10) at 0.05 level of significance = 4.9646

As calculated ***FC*=0.0234<4.9646**

So, *H*0 is accepted, Hence there is no significant differentiating between Productivity of Black Pepper in Dakshina Kannada and Kodagu

SWOT analysis of Black Pepper cultivation in Dakshina Kannada

Strengths	Weaknesses
❖ **Rapid scale-up:** Area expanded from 2,146 → 15,037 ha (≈21.5% CAGR). Production rose 11,111 → 82,704 MT (≈22.2% CAGR). ❖ **Agro-ecology:** Humid tropics of the Western Ghats—good rainfall, shade-tree systems (Black Pepper /coconut) suit pepper as an intercrop. ❖ **Market access:** Proximity to Mangaluru for inputs, traders, and export logistics. **Farmer know-how:** long tradition with mixed, multi-storey cropping that spreads risk and costs.	❖ **Highly volatile productivity:** Yield swings 200–580 kg/ha (avg ≈ 416 kg/ha, CV ≈ 27%) → unstable incomes. ❖ **Disease pressure:** Foot rot/quick wilt (Phytophthora), pollu beetle, nematodes; monsoon-season losses if drainage and prophylaxis are weak. ❖ **Labour & cost intensity:** Staking/ pruning /harvest are manual; costs spike during peak season. ❖ **Post-harvest gaps**: Uneven drying/curing → quality downgrades and price discounts. **Fragmented marketing:** Smallholders depend on local traders; limited grading/branding.

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Opportunities	Threats
❖ **Stabilize yield:** Drip + fertigation, canopy/shade regulation, raised beds & drainage, mulching; adopt high-performing varieties (e.g., Panniyur series) and virus-indexed planting material. ❖ **Integrated disease management:** Pre-monsoon copper/Bordeaux sprays, Trichoderma/PGPR, sanitation, timely pruning—cut big monsoon losses. ❖ **Value addition & quality:** Blanching before drying, solar dryers, on-farm grading; diversify to white pepper, garbled grades, oils/oleoresins. ❖ Certification niches: Organic/NOP, Residue-Free, and GI-style regional branding ("Western Ghats Pepper") to access premium export markets. ❖ **Schemes & risk tools:** Tap MIDH/PMKSY for micro-irrigation & dryers; weather advisories; crop insurance where notified.	❖ **Climate variability:** Intense rain spells/drought pockets → spike in disease and flower/berry drop. ❖ **Global price swings & competition:** Vietnam/Indonesia output moves prices; currency risk. ❖ **Pest/disease evolution:** Resistance and new outbreaks if prophylaxis lapses. ❖ **Wildlife & land-use pressure:** Vine damage in some ghats pockets; peri-urban land conversion.

CONCLUSION

Black pepper (*Piper nigrum*), known as the "King of Spices," is one of India's most important export-oriented spice crops. Karnataka, and particularly the districts of Kodagu and Dakshina Kannada, account for a major share of India's black pepper area and production. Black pepper cultivation plays a multifaceted role in the economy of Dakshina Kannada and Kodagu districts — contributing to farm income, employment, trade, and exports. This study analyses the economics and performance of black pepper cultivation in Dakshina Kannada and Kodagu, focusing on costs, yields, income, and growth trends. Cultivation requires a high initial investment of ₹3.11 lakh in the first year and consistent annual costs of about ₹5.41 lakh until maturity. Since black pepper plants take three years to yield, the first two years bring no returns, making it a long-gestation crop. Break-even is achieved only in the sixth year, with cumulative profits beginning thereafter; by the seventh year, cumulative gross income reaches ₹11.02 lakh and gross profit about ₹3.15 lakh. The area under cultivation expanded steadily between 2011–12 and 2021–22, from 2,146 ha to 15,037 ha in Dakshina Kannada and from 10,643 ha to 98,445 ha in Kodagu, with Kodagu's growth nearly ten times faster. Production showed fluctuations in Dakshina Kannada, dipping in 2015–16 and 2017–18 before rising sharply to 82,704 MT in 2021–22, whereas Kodagu recorded rapid and consistent growth, reaching 4,46,940 MT in 2021–22 (over five times increase). Productivity in Dakshina Kannada fluctuated sharply (200–580 kg/ha), while Kodagu showed more stable upward trends (237–512 kg/ha). Overall, Kodagu emerged as the dominant hub for black pepper cultivation due to its larger area and stable yields, while Dakshina Kannada struggled with yield fluctuations despite land expansion. Hypothesis testing based on primary data indicates no significant year-wise differences in cultivation area or production within each district, but a significant difference exists between Dakshina Kannada and Kodagu in both area and production, confirming Kodagu's clear dominance in black pepper cultivation.

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