Plant Archives Vol. 25, No. 1, 2025 pp. 2532-2538 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.366

ECONOMIC ANALYSIS OF PINEAPPLE IN SHIVAMOGGA DISTRICT OF KARNATAKA INDIA

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(Date of Receiving-09-01-2025; Date of Acceptance-09-04-2025)

ABSTRACT

Among tropical fruits, pineapple (*Ananas comosus*) holds the distinction of being the second most important fruit globally. It is one of the most popular tropical fruits, has a worldwide market. The present study carried out in Shivamogga district, which ranks first in area and production in Karnataka. Soraba and Sagara taluks were selected purposively based on highest area under pineapple in these taluks. Total 60 respondents who are growing pineapple cultivation for agricultural year 2022-2023. Pineapple in crop-I was higher (Rs.1,57,029/ acre) compared to crop- II (Rs.79,786/acre). The average yield in crop- I (23.52 tonnes/acre) was more than crop- II (16.67 tonnes/acre). Returns per rupee in crop- I and crop- II were Rs. 3.35 and Rs. 4.34, respectively. The primary constraints raised by most pineapple growers pertains to Non – availability of required planting material. This issue held the highest significance, with Garrett rank of 76.68 followed by scarcity of labour during peak periods, delays in obtaining timely credit and Lack of agricultural consultancy. By mitigating these constraints, pineapple productivity may rise not just in the study area but also in other regions where the fruit is grown intensively. The findings of current study necessitate measures to be taken by concerned departments, organizations and institutes in taking proactive measures which contribute to the wellbeing of farmers and enhance their income along with encourage more farmers to adopt pineapple cultivation.

***Key words*:** pineapple, cultivation, labour, Plantlets.

Introduction

India's diverse climate ensures the availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetable production in the world, after China. As per National Horticulture Database (3rd Advance Estimates) published by National Horticulture Board, during 2021-22, India produced 107.24 million metric tonnes of fruits and 204.84 million metric tonnes of vegetables. The area under cultivation of fruits stood at 7.05 million hectares while vegetables were cultivated at 11.35 million hectares. Notably, India holds the top position in the production of key fruits, including mango, banana, lime and lemon (www.apeda.gov.in). The production and consumption of fruits per capita are often indicative of the standard of living. Despite India's climatic suitability for a variety of tropical, subtropical, and temperate fruits, the current fruit cultivation covers only 89 thousand hectares (www.ppqs.gov.in).With urbanization on the rise and the increasing demand for fruits in cities, there is a tremendous scope to expand the area under fruit cultivation and boost production. Presently, fruits are available at high costs, making them inaccessible to common people. To achieve self-sufficiency in fruit production and ensure affordability for all, it is essential to increase fruit cultivation and rejuvenate existing orchards.

Among tropical fruits, pineapple (*Ananas comosus*) holds the distinction of being the second most important

fruit globally. It is one of the most popular tropical fruits, has a worldwide market. Fruit and juice have good industrial demand also. The fruit is a good source of vitamin A and B and rich in vitamin C and calcium. It also contains phosphorus and iron (www.ppqs.gov.in.)

The origin of the pineapple is the American continent i.e., Brazil. It has spread throughout the tropical and subtropical regions as a commercial fruit crop. Pineapple, known for its delicious taste, is named after the Spanish word 'Pina' due to its resemblance to a pine cone. The scientific name Ananas is believed to have originated from the Tupi Indian word 'Nana,' used to refer to this plant. As a member of the Bromeliaceae family, pineapple is fondly known as the 'queen of fruits' because of its excellent flavor, taste, and distinctive shape. It holds immense significance as one of the most important commercial fruit crops globally, available throughout the year (Priya *et al*., 2013).

In India, where the Portuguese introduced it in 1548 A.D. Approximately 27.92 million tonnes of pineapple are produced in 85 countries around the world. India holds the sixth position in global pineapple production, contributing approximately 8 per cent to the total output. With an extensive cultivation area of 84,000 hectares, India manages to produce around 13,41,00 0 tonnes of pineapples. The country exports its pineapples mainly to Nepal, Maldives, United Arab Emirates, Saudi Arabia, Kazakhstan, Oman, Bahrain, Bangladesh, Zambia, Pakistan and Qatar.

In the vast lands of India, pineapple cultivation thrives, showcasing a delightful array of varieties, including the renowned 'Kew,' the regal 'Queen,' and the exquisite 'Mauritius.' The states involved in pineapple cultivation are Karnataka, Meghalaya, West Bengal, Kerala, Assam, Manipur, Tripura, Arunachal Pradesh, Mizoram, and Nagaland. Additionally, there are limited cultivation areas in the coastal regions of Tamil Nadu, Goa, and Orissa. Although Assam boasts the largest pineapple cultivation area, West Bengal emerges as the leading producer. Among the states, Karnataka, West Bengal, and Bihar are notable for their high productivity. However, it is important to note that India's overall productivity of 16.00 tonnes per hectare falls short in comparison to the world average of 22.58 tonnes per hectare (nhb.gov.in).

In India, successful pineapple cultivation takes place in states like West Bengal, Assam, Karnataka, Meghalaya, Bihar, Goa, and Kerala. It has become one of the most commonly consumed fruits in the country due to its year-round availability at moderate prices. Pineapple holds an important place among fruits, standing alongside mango and banana (Parvej *et al.*, 2020).

In Karnataka, the pineapple crop occupied an area of 2,960 ha during 2021-22 and was cultivated in 10 districts. Shivamogga, Uttar Kannada, Dakshina Kannada, Udupi, and Chikkamagalur were the most predominant pineapple-growing districts. In Shivamogga district, where the study was conducted, pineapple has been grown on a commercial scale. The area under pineapple in this district was 2,088 ha during 2021-22. The ODOP scheme is designed to enhance the overall marketing and export potential of chosen food products within each district, contributing to the growth and development of the local economy. In the case of Shivamogga district, pineapple has been identified as the "One District One Product" to receive special attention and support (www.pmfme.mofpi.gov.in).

The economics of pineapple production is crucial due to the lack of proper farm business data on its cost of production. Having accurate figures on establishment cost, operating expenses, and input requirements would greatly benefit pineapple producers and farm financing institutions. As the area under pineapple cultivation gradually expands in Shivamogga district, this study aims to analyze the cost of producing pineapple and assess its profitability. Additionally, the labour and input requirement of pineapple fruits will be studied in detail, and the challenges faced by pineapple producers in production will be documented to facilitate problem-solving efforts. Furthermore, the study also investigates the net returns and net return on variable cost of pineapple to analyze its pineapple performance. Given that such a study has not been conducted in detail in the study area, this research serves the overall objective of understanding the economics of pineapple production in Shivamogga district.

Materials and Methods

Shivamogga district was selected purposively which has seven taluks *viz.*, Bhadravathi, Hosanagar, Sagara, Soraba, Shikaripura, Shivamogga and Thirthahalli. Among seven taluks, Soraba and Sagara taluks were selected purposively based on highest area under pineapple in these taluks. A total of 60 respondents who are growing pineapple will be interviewed using well-structured pre-tested schedule.

The primary data was collected from the sample respondents during the month of May 2023 and the data was collected in respect of cultivation of pineapple pertaining to the agricultural year 2022-2023. The data pertaining to the cultivation practices, operations, costs, returns, harvesting and transportation costs were collected.

Cost and return components in pineapple cultivation

Variable Costs includes labour cost, material/input

Table 1: The labour utilization pattern in the pineapple production (Per acre).

S. No.	Operation	Crop I				Crop II		
		Human labour (Mandays)		Total	Machine Labour (hrs)	Human labour (Mandays)		Total
		Men	Women			Men	Women	
1	Land preparation	11.49	-	11.49(15.93)	4.91	-	-	-
2	Planting	11.42	2.26	13.68(18.96))	-	-	-	-
3	Fertilizer application	6.04	1.89	7.93(10.99)	-	4.19	1.22	5.41(12.56)
4	Intercultural operations	21.03	0.69	21.72(30.10)	-	20.66	0.69	21.35(49.56)
5	Plant protection chemicals	3.08	-	3.08(4.27)	-	2.94	0	2.94(6.82)
6	Growth hormones	1.14	1.23	2.37(3.28)	-	1.04	1.22	2.26(5.25)
7	Irrigation water	4.08	0	4.08(5.65)	-	3.74	0	3.74(8.68)
8	Paddy trash	5.94	1.8	7.74(10.73)	-	5.68	1.66	7.34(17.04)
	Total	**64.26**	**7.89**	**72.15(100)**	**4.91**	**38.28**	**4.8**	**43.08(100)**

Note: Figures in the parentheses indicates per cent share to the total labour requirement, Crop- II - ratoon crop

cost, fertilizers and plant protection chemicals. Wage rate for men and women labour is Rs. 300 to 450 and Rs.200 to 300 per day, respectively. Here women days were converted into mandays based on wage differential. The cost of machine labour both owned and hired was calculated at prevailing rates on hourly basis for the different type of operations prevailed in the study area. Prevailing rate in study area is Rs.800 to 1200. Planting material cost: Plantlets/slips purchased from other pineapple growers and the cost was worked out at the rate of Rs. 3 Per slip based on the prevailing rate in the study area.

Fixed Costs includes Interest on fixed capital (Interest on fixed cost was computed at the rate of 12 per cent per annum by taking the information from the Commission for Agricultural Cost and Price (CACP)).

Depreciation

$$\text{Depreciation} = \frac{\text{Purchase value} - \text{Junk value}}{\text{Economic life of the asset}}$$

The life span of the machineries, sprayers and other implements was taken as farmers configured.

Returns concepts

Gross returns = Number of Pineapples Harvested × Selling Price per Pineapple

Net returns = It is the difference between gross return and total costs incurred in pineapple cultivation.

Note: During the calculation of the cost of cultivating pineapples, we categorized the expenses into two crops *i.e.*, Crop I and Crop II, based on the age of the pineapple plants. Crop I encompass all the costs incurred up to the first harvest, which occurs between 14 to 15 months after planting. On the other hand, Crop II includes all the costs incurred up to the second harvest, which takes place between 8 to 10 months after the first harvest. The cost calculation is done separately for each Crop I and Crop II to track the expenses accurately.

Garrett's ranking technique

Garrett's ranking technique was used to rank the constraints faced by producers in the production of pineapple. The rank assigned to each constraint faced by each producer was converted into per cent position using the following formula.

Per cent position = $100 \times (R_{ij} - 0.5)/N_j$

Where,

R_{it} = Rank given for i^{th} item by j^{th} individual

Nj = Number of items ranked by j^{th} individual.

The per cent position of each rank was converted into scores by referring to Garrett tables given by Garrett and Woodworth (1969). Then for each factor, the scores of individual respondents were summed up and divided by the total number of respondents for whom scores were gathered. The mean scores for all the factors were ranked, following the decision criteria that higher the value, more important is the constraint or most important reason for the respondents.

Results and Discussion

Cost and returns in the pineapple cultivation

The cost and return structure and input utilization pattern in pineapple production have been presented as under.

Labour use pattern in pineapple production

The labour utilization pattern in pineapple production crop I

The typical labour utilization pattern per acre of Crop-I in pineapple cultivation is presented in the Table 1. Total 11.49 mandays were used for performing various operations. All surveyed participants utilize mechanization

Table 2: Inputs utilization pattern in the production of pineapple (Per acre).

S. No.	Inputs	Unit	Crop I	Crop II	Total
1	Suckers	No.	15064.00	0.00	15064
2	Human labour	Mandays	72.16	43.08	115.24
3	Machine labour	hrs	4.91	-	4.91
4	Chemical fertilizers				
	i) N	kg	270.44	217.39	487.83
	ii) P	kg	152.59	209.84	362.43
	iii) K	kg	91.98	65.22	157.20
	iv) Zinc	kg	2.10	1.01	3.11
	v) Sulphur	kg	54.84	40.70	95.54
5	Plant protection chemicals				
	i) Chloropyriphos	l	2.85	2.29	5.14
	ii) Diurex	kg	4.15	2.07	6.22
6	Growth regulators				
	i) NAA	l	0.50	0.64	1.14
	ii) Ethrel	l	1.55	1.88	3.43
7	Irrigation water	acre inch	14.80	10.64	25.44
8	Paddy trash	pendi	147.49	110.53	258.02

for land preparation, with a total of 4.91 hours of machine labour per acre was allocated to ploughing, harrowing, and leveling operations.

The labour utilization pattern in pineapple production crop II

In the context of Crop II, ratoon cropping stands out as a crucial agronomic practice embraced by farmers to effectively lower the cultivation expenses associated with pineapple cultivation in the studied region. In crop I, the total labour requirement was higher (72.15 mandays) as compared to that of crop II. The implementation of ratooning leads to a substantial reduction in the requirement for human labour and machinery for land preparation and planting (Table 1).

Input use pattern pineapple cultivation

For pineapple crop (Crop-I), the participating sample farmers adhered to the recommended spacing guidelines, resulted in planting of average quantity of 15064 healthy suckers per acre. Additionally, to enhance the nutritional well-being of the pineapple plants, an application of 270.44 kg of nitrogen, 152.59 kg of phosphorous, 91.98 kg of potash, 54.84 kg of Sulphur and 2.10 kg of Zinc was applied per acre (Table 2).

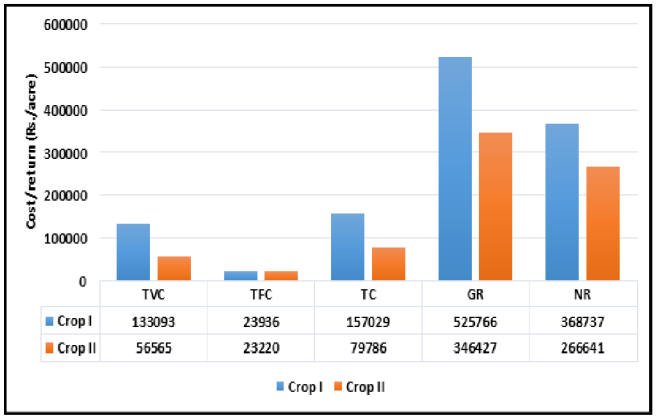

Fig. 1: Cost and returns in pineapple cultivation.

In the context of pineapple cultivation, the occurrence of diseases and pest infestations remained relatively minimal. The sample farmers employed 2.85 litres of chlorpyriphos for effective insect pest management and for weed management 4.15 kg of Diurex herbicide per acre used. Furthermore, the labour-intensive aspects of pineapple cultivation involved an average of 72.16 mandays per acre, dedicated to various labour-related tasks. The growth regulators such as NAA (0.5 litres) and Ethrel (1.55 liters) were applied per acre. Paddy trash is used to protect fruit from solar damage in mature fruit includes external sunburn or bleaching and internal sunburn or boiling. For crop I paddy trash about 147.49 pendi required.

In Crop II (ratoon crop), effectively curtail the cultivation expenses associated with pineapple production in the study area. Significantly, ratooning also eliminates the necessity for a key crop input – the seed material, which in this case refers to suckers.

To understand the economics of pineapple cultivation in Shivamogga district and costs and return involved in pineapple cultivation per acre basis was estimated and presented in Table 3 and 4. The total cost incurred in pineapple cultivation was Rs.2,36,814 per acre out of which 66.31 per cent from crop I and 33.69 per cent from the crop II (ratoon crop).

Cost of cultivation of pineapple crop

Cost of cultivation of pineapple crop I

The expenses associated with pineapple cultivation can be classified into two categories: variable costs and fixed costs. For Crop-I, the average total cost incurred by sample farmers was Rs. 1,57,029 per acre. Within this, the variable costs accounts to 84.76 per cent (Rs. 1,33,093) of the total cost per acre, with the material cost for pineapple cultivation accounted for Rs. 89,520 per acre.

Among the variable costs, spending on planting material (suckers) totaled Rs. 45,191 per acre (28.78 %). Notably, the most significant contributors to the total cost were expenses related to fertilizers, 18.40 per cent (Rs.

Table 3: Cost of cultivation of pineapple (Rs./acre).

S. No.	Particulars	Crop I Value (Rs.)	Percent share	Crop II Value (Rs.)	Percent share	Total Value (Rs.)	Percent share
I Variable cost							
	Material input						
1	Planting material	45191	28.78	-	-	45191	19.08
2	Chemical fertilizer	28899	18.40	20745	26.00	49644	20.96
3	Plant protection chemicals	5742	3.66	5281	6.62	11022	4.65
4	Growth hormones	3772	2.40	4584	5.75	11666	4.93
5	Irrigation charges	2960	1.89	2128	2.67	5088	2.15
6	Paddy trash	2956	1.88	2861	3.59	5816	2.46
	Labour input						
7	Machine labour	6000	3.82	-	-	6000	2.53
8	Human labour	28867	18.38	17235	21.60	46102	19.47
9	Interest on working capital @ 7%	8707	5.54	3701	4.64	12408	5.24
	Total variable cost	**133093**	**84.76**	**56565**	**70.90**	**189658**	**80.09**
II Fixed cost							
1	Depreciation	5746	3.66	5507	6.90	11254	4.75
2	The rental value of land	15600	9.93	15200	19.05	30800	13.01
3	Land revenue	25	0.02	25	0.03	50	0.02
4	Interest on fixed capital @ 12%	2565	1.63	2488	3.12	5052	2.13
	Total fixed cost	**23936**	**15.24**	**23220**	**29.10**	**47156**	**19.91**
	Total cost (I+II)	**157029 (66.31)**	**100**	**79786 (33.69)**	**100**	**236814 (100)**	**100**

Note: Figures in the parenthesis indicates per cent share to total cost

28,899) to the total cost of cultivation for pineapple during crop I. Regarding fixed costs, the total amount was Rs. 23,936 per acre *i.e.*, 15.24 per cent to the total cost of cultivation. Interest on fixed capital at rate of 12 per cent, added Rs. 2,565 per acre and land revenue cost was Rs. 25.

Cost of cultivation of pineapple crop II

For the pineapple crop II, which involves cultivating ratoon crop, a significant reduction in the overall cultivation cost has been observed. In Crop II, ratoon cropping stands out as a crucial agronomic practice embraced by local farmers to effectively curtail the cultivation expenses associated with pineapple production in the study area.

Table 4: Yield and return structure in the production of pineapple (Per acre).

S.	Particular	Unit	Crop I	Crop II	Total
1	Yield	t	23.52	16.67	40.21
2	Price	Rs. /t	22354	20769	43123
3	Gross return	Rs.	525766	346427	872193
4	Cost of cultivation	Rs.	157029	79786	236814
5	Cost of production	Rs./t	6676.4	4786.2	5889.43
6	Net return	Rs.	368737	266641	635378
7	Net return over VC	Rs.	392673	289862	682535
8	Return per rupee of expenditure	Rs.	3.35	4.34	3.68

The implementation of ratooning leads to a substantial reduction in the reliance on human labour, and machinery labour. Significantly, ratooning also eliminates the necessity for a key crop input – the seed material, which in this case refers to suckers. This streamlined approach brings about notable benefits in terms of cost savings and operational efficiency (Table 3).

The cumulative variable cost associated with pineapple cultivation was calculated at Rs. 56,565 which is 70.90 per cent of the total cost of cultivation. The total material cost for this crop was Rs. 35,596 per acre, while the labour cost amounted to Rs. 17,235 per acre. Additionally, the fixed cost, which remains constant regardless of output, was recorded as Rs. 23,220 per acre (29.10 %).

Consequently, the complete cost of cultivation of pineapple crop II summed up to Rs. 79,786. These results were in similar line with the study conducted by Vidanapathirana *et al.*, (2020) on Value Chain Analysis of Pineapple: Evidence from Gampaha District of Sri Lanka stated that, during the first year of cultivation, planting was the highest cost component (44%) while it was plant maintenance (67%) in the second year. It also revealed that considering the total cost for labour, machinery and input, the input cost was the highest cost

Table 5: Constraints associated with production of pineapple.

S.	Constraints	G.S.	R.
1	Lack of required planting material	76.68	I
2	Scarcity of labour during peak period	76.32	II
3	Non-availability of credit on time	59.73	III
4	Lack of agricultural consultancy	58.53	IV
5	High cost of plant protection chemicals	56.53	V
6	Incidence of high pest and diseases	46.40	VI
7	Difficulties in getting implements on hire basis	45.50	VII
8	Irregular electricity supply	31.23	VIII
9	High variation in yield	28.23	IX
10	Irrigation water shortage	25.83	X
GS: Garret Scores; **R:** Ranks			

component (71%), followed by labour cost (24%).

Yield and return structure in the production of pineapple

The yield and total return incurred through pineapple cultivation depicted in Table 4. Total gross return and net return obtained from pineapple cultivation was Rs. 8,72,389 and Rs. 6,35,575 per acre. Total yield obtained from pineapple cultivation was 40.01t/acre out which, Crop I yielded an average of 23.52 t/acre whereas in crop II (ratoon crop) yielded about 16.67 t/acre. Despite significant price fluctuations in the pineapple market, the calculations are based on the average price per tonnes. Return per rupee of expenditure was 3.35 for crop I and 4.34 for crop II which indicates that ratoon crop is also profitable. Net return over variable cost (VC) for crop I was Rs.3,92,673 and crop II was Rs.2,89,862.

Net return for crop I was 3, 68,737 and crop II was Rs.2, 66,641. Hence, the pineapple cultivation was economically profitable in the study area was accepted. These results were in similar line with the study conducted by Sharma *et al.,* (2016) on economics and constraints of pineapple cultivation in Dimapur District of Nagaland stated that, the total cost of pineapple production on average farm was estimated to be Rs.37,116.54 and the average gross income per hectare from pineapple production was Rs. 67,161.67, whereas the average net income per hectare of pineapple production was Rs. 30,045.13 per hectare.

Constraints associated with the production of pineapple

The primary concern raised by most pineapple growers in the surveyed region pertains to Non – availability of required planting material. This issue held the highest significance, receiving a prominent Garrett rank of 76.68. A scarcity of labour during peak periods next problem faced by farmers with a Garret score of 76.32. Pineapple cultivation is a labour-intensive crop and availability of labour was a problem especially during peak time of inter-cultivation and harvesting (Table 5).

Several challenges contribute to this scenario, including delays in obtaining timely credit, Lack of agricultural consultancy, the high cost of plant protection chemicals, Incidence of high pest and diseases, difficulties in accessing operation implements through hiring, irregular electricity supply, high variation in yield at the individual farmer level and irrigation water shortage. These challenges were reflected in Garret scores of 59.73, 58.53, 56.53, 46.4, 45.5, 31.23, 28.23, and 25.83, respectively.

Conclusion

The study shows that pineapple cultivation is more cost effective and profitable which offers higher returns to farmers. Pineapple cultivation is more capital intensive at the same time it was labour intensive. . For Crop-I, the average total cost incurred by sample farmers was Rs. 1,57,029 per acre. Within this, the variable costs accounts to 84.76 per cent (Rs. 1,33,093) of the total cost per acre, with the material cost for pineapple cultivation accounted for Rs. 89,520 per acre. In Crop II, ratoon cropping stands out as a crucial agronomic practice embraced by local farmers to effectively curtail the cultivation expenses associated with pineapple production in the study area. Total yield obtained from pineapple cultivation was 40.01t/acre out which, Crop I yielded an average of 23.52 t/acre whereas in crop II (ratoon crop) yielded about 16.67 t/acre. The primary constraints raised by most pineapple growers in the surveyed region pertains to non – availability of required planting material. This issue held the highest significance, receiving a prominent Garrett rank of 76.68. So, from the study, it was evident that pineapple cultivation can play on important role in the economic development of the study region.

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