



Comparative Economics of Cashew Cultivation under Conventional Farming versus Natural Farming System in Karnataka

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ABSTRACT: This study investigated (i) cashew area growth; production and productivity of cashew (ii) estimated cost and profit structure of cashew cultivation, (iii) the financial feasibility of cashew cultivation under conventional v/s natural farming system at Horticultural Research and Extension Centre, Kanabargi, Belagavi district. Data were analyzed using descriptive statistics and financial feasibility method. A study showed that annual maintenance cost of cashew under conventional system (Rs. 97,785/ha) was higher compared to natural farming system (Rs. 90,400/ha). Cashews are harvested once in a year. In natural cultivation, the average yield obtained in the orchard was higher (16.76 q/ha) compared to the conventional orchard (17.15 q/ha). However, the selling price was Rs. 25, 775 and Rs. 25,766 in conventional and natural farming system, respectively. The feasibility analysis showed that the discount rate of NPV @ 12% was positive at Rs. 9, 78, 395 and Rs. 8, 52, 919 in conventional and natural farming system. Correspondingly, B: C ratios were 2.43 and 2.35 in conventional and natural farming systems. The payback period was found higher in conventional farming at 5.11 years compared to 5.02 years in NFS. The internal rate of returns was 30 percent & 27 percent in conventional & natural farming system, respectively. Therefore, cashew investments were financially profitable in both the cultivation methods. However, cultivation of cashew in natural farming has shown several positive externalities, viz. improvement in soil fertility, nut quality, taste and also positive impact on human health through consumption of naturally produced cashew end product.

Keywords: Cashew cultivation, Conventional farming, Natural farming, Financial feasibility.

INTRODUCTION

Cashew (*Anacardium occidentale*) is called the favourite snack of the rich around the world. The cashew tree probably originated in Brazil and was introduced to India in the sixteenth century for afforestation and soil protection. From humble beginnings, cashew has become a major foreign exchange earner alongside tea and coffee as a crop design to combat soil erosion. Cashew is one of the most important nuts cultivated in the world, ranking first. Among the various nuts like hazelnuts, almonds, etc., cashew has an enviable place and is an indispensable snack at all important social functions and gatherings all over the world these days.

Cashew is an important plantation crop in the Indian economy. Identification of better clones, standardization of vegetative propagation methods and abundant plant material has increased cashew production, area, and productivity in India. Due to India's geographical conditions suitable for cashew cultivation, it is one of the largest producers of cashews in the world. In India cashews are grown on a total of 0.7 million hectare and the country produces more than 0.8 million tonnes (MT) annually. India's cashew production increased from 0.70 million tonnes (MT) to 0.77 million tonnes (MT) in 2019-20 and 2020-21. Commercial cultivation of cashew is practiced in eight states of our country, mainly on the west and east coast viz., Andhra Pradesh, Goa, Karnataka, Kerala,

Maharashtra, Odessa, Tamilnadu and West Bengal. In addition to these states, cashews are also grown in some pockets of Assam, Chhattisgarh, Gujarat, Meghalaya, Nagaland and Tripura. According to the data released by the National Horticulture Board (NHB, 2021), among the states in India, Maharashtra leads in terms of annual cashew nut production with 0.20 million tonnes (MT) in 2021-22, compared to 0.19 million tonnes produced in 2020-21.

Concept of cashew cultivation in natural farming system: Natural farming (NF) is a holistic ecological farming system that carefully observes natural conditions to create a mutually beneficial relationship

between the farmer and nature. In NF, external chemical inputs are not used and not much soil working. But, NF relies on the use of locally available natural inputs, intercropping, crop rotation, mulching with maximum functional biodiversity. With this practice, cashew fruit cultivation shows improvement in soil properties, microbial biodiversity and enzyme activity in the ecosystem. Ranjit Kumar *et al.* (2020) emphasized that Zero Budget Natural Farming (ZBNF) systems have reduced natural-scale production in high-input systems in the short term, mainly in the early stage of orchard but, produced potential returns in the long term.

Comparison between Conventional and natural farming system in cashew cultivation.

Specific Inputs used	Merits	Demerits
Natural Farming		
<ul style="list-style-type: none"> • Indigenous cow cetric • Jeevamritha and FYM • Ghanajeevamritha • Beejamritha • Mulching • Inter-/mixed/Poly crops • Local seedlings • Homemade materials for pest and diseases control- Agniastra, Neemastra, etc. 	<ul style="list-style-type: none"> • Regular and better farm income from intercrop • Low production cost • Less use of FYM/inputs • Improved family health- non-use of pesticides & food diversity • Improved soil health • Chemical free produce 	<ul style="list-style-type: none"> • Need of indigenous cow dung and urine • Possibility of lower yield • Cumbersome practices • More farm engagement • No established market/certification
Conventional farming		
<ul style="list-style-type: none"> • Synthetic fertilizers • Farm Yard manure • Chemical pesticides, herbicides • HYV/Hybrid seedlings • Heavy irrigation • Intensive tillage • Farm Mechanization • Mono-cropping systems 	<ul style="list-style-type: none"> • High yield potential • Convenience in farming • Less price for customers easy input availability • Market well- established 	<ul style="list-style-type: none"> • Rising cost of production • Health hazard for farmers & consumers • Unsustainable system • Loss of biodiversity • Pest resurgence

In this regard, this study attempts to assess the cost-benefit structure and analyze the financial feasibility of cashew orchard under conventional and natural farming systems in Belagavi district of Karnataka, India.

MATERIALS AND METHODS

This study was conducted at the Horticultural Research and Extension Centre (HREC) Kanabargi, Belagavi district of Karnataka. For the present study old/ already established cashew orchard was taken to impose both conventional and natural farming treatments and then the data on annual maintenance of both conventional and natural farming systems were recorded during the years 2019, 2020 and 2021. Along with the NF research conducted at HREC, Kanabargi, primary survey of 30 cashew growers in Belagavi district was also conducted to analyze comparative economics of cashew cultivation under both the systems. Therefore, the data collected at the research station and the farmer surveys were analyzed using descriptive statistics and financial feasibility method.

(i) Estimation of compound growth rate. Several methods are available to estimate growth. This study used an exponential function to estimate the compound growth rate, making it independent of time per unit time, and these are called 'geometric' or compound growth rates (Vikram and Muniyandi 2015). Compound growth rates were estimated by fitting an exponential trend equation of the following type.

$$Y = ab^t$$

Where,

Y = area/ production/ productivity

t = time variable in years

a = constant

and

$$b = (1+r)$$

Where,

r = Compound growth rates

Equations (1) can be linearized by taking the logarithms of both sides of the equations as follows:

$$\log y = \log a + t \log b$$

The compound growth rate is compounding using the following formula

$$\text{Compound growth rate (CGR)} = (\text{Antilog}(\log b) - 1) \times 100$$

(ii) Financial feasibility assessment. For the financial feasibility analysis, net present value (NPV), payback period, initial rate of return (IRR) and benefit-cost ratio (BCR) were evaluated using a technique borrowed from the study of Kerutagi *et al.* (2017).

RESULTS AND DISCUSSION

A. Compound annual growth rate

Growth indicators of area, production and productivity of cashew nut in Karnataka state and all India level were studied and the results are given in Table 1. The table shows that, the area under cashew cultivation in Karnataka recorded compound annual growth rate

(CAGR) of 1.51 percent and at all India level it was found to be 1.96 percent which was significant at 1 percent probability level. On the other hand, CAGR for the production of cashew was 2.64 percent in Karnataka and 0.85 percent in India, which was significant at 5 percent probability. Similarly, cashew productivity in Karnataka state was 11.11 percent and was found to be insignificant.

This was mainly due to strong fluctuation in climatic conditions and also poor management of the orchards. But at the all India level, the corresponding CAGR was -1.08 percent, which was significant at the 5 percent probability level.

B. Investment cost of cashew orchard

The costs of establishing a cashew orchard up to bearing can be broadly classified into establishment costs and maintenance costs. Therefore, the establishment cost included not only the expenses incurred at the time of planting in year zero, but also the expenses incurred from the maintenance of the plants until the bearing period, which is a maximum of three years after planting. Thus, the total cost of establishment (Table 2) was obtained as Rs. 2, 39, 819 and Rs. 2,24,837 per hectare, of which material cost was 38.32 and 40.88 per cent and maintenance cost was 61.68 and 59.12 percent in conventional and natural farming systems, respectively. While Guledagudda (2005) found that the total investment cost was 38,697.

Table 1: Compound annual growth rate of cashew.

Particulars	Compound annual growth rate		
	Area	Production	Productivity
Karnataka	1.51***	2.64*	1.11 ^{NS}
India	1.96***	0.85*	-1.08*

Note: *** indicates significant at 1 per cent level; * indicates significance at 5 percent level and ^{NS} indicates non significance

Table 2: Investment pattern of farmer's in cashew orchard in the study area.

Sr. No.	Particulars	Conventional farming (N= 15)		Natural farming (N= 15)	
		Value	%	Value	%
A	Investment Costs (Rs./ha)				
	Bore	40000	16.68	40000	17.79
	Pumpset	32000	13.34	32000	14.23
	Sprayer	1560	0.65	1560	0.69
	Plant material	13850	5.78	13850	6.16
	Digging of fit & planting	4500	1.88	4500	2.00
	Sub Total	91910	38.32	91910	40.88
B	Maintenance cost up to bearing period (Rs./ha)				
	I st year	53903	22.48	46628	20.74
	II nd year	47826	19.94	43493	19.34
	III rd year	46180	19.26	42806	19.04
	Subtotal (I+II+III+IV)	147909	61.68	132927	59.12
	Total Establishment Cost (A+B)	239819	100.00	224837	100.00

Table 3: Maintenance cost of cashew cultivated under conventional farming by farmers during gestation period in the study area (Rs./ha./year).

Sr. No.	Particulars	I	II	III	Total	%
I	Variable cost					
A	Labour cost					
2	Rotavator	1875	1875	1875	5625	3.80
3	Harrowing	1875	1875	1875	5625	3.80
4	Preparation of basin	7105	7440	7500	22045	14.90
5	Application of FYM	2450	2450	2450	7350	4.97
6	Application of chemical fertilizers	2450	2450	2450	7350	4.97
7	Application of PPC/SPRAYING	2450	2450	2625	7525	5.09
8	Basin cleaning/Weeding	7000	5800	5900	18700	12.64
9	Basin irrigation	1600	1400	1400	4400	2.97
10	Miscellaneous	875	700	1000	2575	1.74
	Total labour cost (A)	27680	26440	27075	81195	54.90
B	Material cost					
i	FYM	11954	7125	5004	24083	16.28
ii	Urea	967	1209	967	3142	2.12
iii	DAP	2718	3020	3020	8758	5.92
iv	MOP	3242	3242	3474	9959	6.73
v	Plant protection chemicals	1180	1180	1180	3540	2.39
	Total material cost (B)	20061	15776	13645	49482	33.45
	Managerial Cost (10% of TC)	4900	4348	4198	13446	9.09
	Total variable cost (A+B)	52641	46564	44918	144123	97.44
II	Fixed cost					
	Land Revenue	35	35	35	105	0.07
	Depreciation	1112	1112	1112	3336	2.26
	Interest on fixed capital	115	115	115	344	0.23
	Total fixed cost	1262	1262	1262	3785	2.56
	Total cost (I+II)	53903	47826	46180	147908	100.00

However, the results are consistent with the findings of Mahantesh Nayak and Manjunatha Palad (2018) wherein, the total establishment cost in Ratnagiri and Sindhudurga district of Maharashtra was Rs. 1,19,287 and Rs. 1,31,155 per hectare, respectively.

C. Maintenance costs of cashewnuts during gestation period (1st to 3rd year)

The maintenance costs shown in the results (Table 3) included labour wages and costs of materials used as well as fixed costs in a conventional cashew garden. It was found that most of the total maintenance costs were variable costs followed by fixed costs. Under the variable cost, labour cost was an important cost, which accounted for almost 54.90 per cent of the total maintenance cost, because agriculture requires more labour, such as loosening soil around the trunk and formation of the basin, watch and ward and land preparation etc. Among the material costs, the most important components are PPC, fertilizers and manure. Due to the sudden change in climatic condition in recent years, the attack of pests and diseases are the main factors that cause fruit drop. Therefore, farmers have tried to control these problems with various chemicals. Consequently, the costs of these items were found higher. In terms of fixed costs, the largest cost factor was the depreciation of farm building and machineries. The rental value of the land was not taken into account in the calculation of the years

In natural farming orchard, the maintenance cost (Table 4) included the labour wages as well as material costs and the fixed costs. Variable costs were found to form a major component followed by fixed costs. Under the variable cost the labour cost accounts for almost 68.53 per cent of the total maintenance cost because crops require more labour for the important operations like loosening the soil around the trunk, formation of basin, application of ghanajeevamrutha and Jeevamrutha, watch and ward pruning and land preparation etc. Among the material costs the main components were incurred in the production process of ghanajeevamrutha and Jeevamrutha, which are locally available. Cashew nut is a hardy crop which can withstand climate change, but now a day's tea mosquito bug (TMB) has created many problems, hence to control this pest at flowering stage farmers have tried to use different astras like Agniastra, Neemastra, Brahmastra etc at different intervals from budding to fruiting, so the costs of these products were found less than the variable costs. As in conventional farming, depreciation of farm building and machineries formed the largest cost component of fixed costs. The rental value of land was not taken into account in the calculation of the years.

D. Cashew maintenance cost during bearing period

The maintenance costs (Tables 5 & 6) shows in the results that after the establishment of the orchard, i.e. from the 5th year, repeated costs were incurred for the care of the plants to obtain a good harvest during the economic lifespan of the plants. Maintenance costs included annual costs of labour and other material inputs and fixed cost for orchards of different age groups. Under variable costs, labour costs constituted a

major cost calculation, which were 63 per cent and 69 per cent in the conventional and natural farming systems. In the natural farming system operations like harvesting, pruning, weeding, watering and application of fertilizers were carried out along with some additional activities such as application of ganajeevamrutha, Jeevamrutha and mulching. Among the material costs, the main components were fertilizers, PPC and FYM in conventional farming and preparation of materials like ganajeevamrutha, Jeevamrutha in natural farming. Nutrient supply through fertilizers, ganajeevamrutha and Jeevamrutha has been found essential in improving the yield of orchards during bearing period. Among the fixed costs, the largest cost component was the apportioned establishment cost.

E. Annual yields and returns in cashew production

Table 7 revealed that the average yield per hectare of NF and conventional orchards were 17.15 and 16.76 quintals, respectively. Due to the size, taste and quality of nut, the nuts of initial year received more favorable price than in the following years. As the plant ages, the size of the nut increases and the price become higher than before. However, health of trees at old age depends on the maintenance of orchards. The yield rate of cashew trees varies depending on the size of the orchard and the age of cashew trees. During the initial years (4th and 5th year) the yield was lower in natural farming orchard, and it gradually increased from 9th year and remained at the same level until 19th year, because the yield rate changes with the age of the orchard. Although the average yield in the natural farming orchard was lower than in the conventional method, the quality of the nuts was better and the production costs were also lower than in the conventional cultivation. Fertility has been increased in natural farming, but in conventional farming there was decline in soil fertility over the years due to poor management and inefficient use of production inputs. The results are in consistent with the findings of Lakshmi (2018).

F. Financial feasibility of investment in cashew cultivation

The results presented in the Table 8 revealed that the payback period was shorter in natural farming, i.e. 5.02 years, while in conventional farming it was 5.11 years. Therefore, investment on cashew would return 5.11 years ago if the interest rate for both orchards is 12 percent. The net present value at 12 per cent discount rate over the lifetime (30 years) of cashew was positive at Rs. 9, 78, 395 under conventional farming and Rs. 8, 82, 919 under natural farming system. The benefit-cost ratio was 2.43 in conventional farming and 2.35 in natural farming.

However, the ratios for both the orchards were greater than unity, indicating the higher return per rupee of cashew investment. The internal rate of return was found 30 per cent in the conventional farming system, while it was 27 per cent in the natural farming system. Throughout the study area, the internal rate of return was found higher than the current bank rate, and in

conventional it was higher than in natural farming orchards. Thus, the results of this study justify investment in cashew nut cultivation.

G. Economics of cashew cultivation under natural and conventional farming practices

In this study along with the farmers' survey simultaneously field research was conducted on cashew cultivation under both natural and conventional farming systems at HREC, Kanabargi and cost of cultivation of

old established cashew orchard was analyzed and the results are presented in Table 9. It was found that higher yield of 25.31 quintal per hectare was obtained in conventional cultivation than natural farming (23.57q/ha). On the other hand, the cost of cultivation was higher in conventional farming (Rs. 1, 02, 638/ha) compared to natural farming (Rs. 80, 688/ha).

Table 4: Maintenance cost of cashew cultivated under natural farming by farmers during gestation period in the study area (Rs./ha./year).

Sr. No.	Particulars	I	II	III	Total	%
I	Variable cost					
A	Labour cost					
1	Rotovator	1875	1875	1875	5625	4.23
2	Harrowing	1875	1875	1875	5625	4.23
3	Preparation of basin	8340	7350	6750	22440	16.88
4	Application of ghanajeevamruta	2625	2450	2450	7525	5.66
5	Mulching	3150	2450	2450	8050	6.06
6	Application of jeevamrutha	3150	2450	2625	8225	6.19
7	Application of PPC/SPRAYING	4375	4375	4375	13125	9.87
8	Basin Weeding	5560	4600	4500	14660	11.03
9	Basin irrigation	1125	1000	1000	3125	2.35
10	Miscellaneous	1200	800	700	2700	2.03
	Total labour cost (A)	33275	29225	28600	91100	68.53
B	Material cost					
i	Ghanajeevamruth	5000	5000	5000	15000	11.28
ii	Liquid jeevamrutha	3000	4200	4200	11400	8.58
iii	Plant protection chemicals	-	-	-	-	-
	Total material cost (B)	8000	9200	9200	26400	19.86
	Managerial Cost (10% of TC)	4239	3954	3891	12508	9.41
	Total Variable cost (I+II)	45514	42379	41691	129584	97.49
II	Fixed cost					
	Land Revenue	35	35	35	105	0.08
	Depreciation	978	978	978	2934	2.21
	Interest on fixed capital	101	101	101	304	0.23
	Total fixed cost	1114	1114	1114	3343	2.51
	Total cost (I+II)	46628	43493	42806	132927	100.00

Table 5: Maintenance cost of cashew cultivated under conventional farming by farmers during bearing period in the study area (Rs./ha./year).

Sr. No.	Particulars	Conventional farming (N= 15)	
		Value	%
I	Variable cost		
A	Labour cost		
1	Rotovator	2375	2.43
2	Harrowing	2125	2.17
3	Preparation of basin	11750	12.02
4	Application of FYM	4500	4.60
5	Application of chemical fertilizers	4500	4.60
6	Application of PPC/SPRAYING	4500	4.60
7	Basin cleaning/Weeding	12500	12.78
8	Basin irrigation	1750	1.79
9	Harvesting/threshing	16250	16.62
10	Miscellaneous	1250	1.28
	Total labour cost (A)	61500	62.89
B	Material cost		
i	FYM	8900	9.10
ii	Urea	1100	1.12
iii	DAP	3624	3.71
iv	MOP	4053	4.14
v	Plant protection chemicals	1180	1.21
	Total material cost (B)	18857	19.28
	Managerial Cost (10%)	8163	8.35
	Total variable cost (A+B)	88520	90.53
II	Fixed cost		
	Land Revenue	35	0.04
	Apportioned Establishment cost	1120	1.15
	Depreciation	7994	8.18
	Interest on fixed capital	116	0.12
	Total fixed cost	9265	9.47
	Total cost (I+II)	97785	100.00

Table 6: Maintenance cost of cashew cultivated under natural farming by farmers during bearing period in the study area (Rs./ha./year).

Sr. No.	Particulars	Natural farming (N= 15)	
		Value	%
I	Variable cost		
A	Labour cost		
1	Rotovator	2375	2.63
2	Harrowing	2125	2.35
3	Preparation of basin	10500	11.62
4	Application of ghanajeevamruta	3750	4.15
5	Mulching	4000	4.42
6	Application of jeevamrutha	4000	4.42
7	Application of PPC/SPRAYING	6250	6.91
8	Basin Weeding	10600	11.73
9	Basin irrigation	1225	1.36
10	Harvesting/threshing	16000	17.70
11	Miscellaneous	1250	1.38
	Total labour cost (A)	62075	68.67
B	Material cost		
i	Ghanajeevamrutha	6000	6.64
ii	Liquid jeevamrutha	6000	6.64
lii	Urea	-	-
iv	DAP	-	-
v	MOP	-	-
vi	Plant protection chemicals	-	-
	Total material cost (B)	12000	13.27
	Managerial Cost (10% of TC)	7537	8.34
	Total variable cost (A+B)	81612	90.28
II	Fixed cost		
	Land Revenue	35	0.04
	Apportioned Establishment cost	7495	8.29
	Depreciation	1140	1.26
	Interest on fixed capital	118	0.13
	Total fixed cost	8788	9.72
	Total cost (I+II)	90400	100.00

Table 7: Yield and returns structure of cashew grown by farmers in the study area.

Particulars period	Conventional		Natural farming	
	Yield (Q/ha)	Total value (Rs)	Yield (Q/ha)	Total value (Rs)
4th	4.45	111250	2.78	69420
5th	4.78	114720	3.70	92500
6th	6.10	158600	5.13	133380
7th	6.92	179920	5.92	153920
8th	7.68	207360	5.60	151200
9th	10.54	284580	7.50	202500
10th	11.30	305100	9.35	252450
11th	13.35	360450	10.63	286875
12th	17.25	465750	14.75	398250
13th	20.70	558900	18.70	504900
14th	22.51	562750	20.51	512750
15th	25.51	637750	22.50	562500
16th	25.77	644250	23.41	585250
17th	24.29	607250	23.41	585250
18th	23.70	592500	23.41	585250
19th	23.00	575000	24.79	619750
20th	22.25	556250	22.50	562500
21th	22.25	556250	20.51	512750
22th	22.25	556250	22.50	562500
23th	20.00	500000	22.50	562500
24th	20.00	600000	22.50	675000
25th	18.50	462500	22.50	562500
26th	18.50	462500	22.50	562500
27th	17.86	446500	18.70	467500
28th	17.86	446500	18.70	467500
29th	17.86	446500	18.70	467500
30th	17.86	535800	18.70	561000
Average	17.15	442044	16.76	431848

Table 8: Financial feasibility of investment in cashew orchard by farmers in the study area.

Sr. No.	Particulars	Conventional	Natural farming
1	Pay Back Period (Years)	5.11	5.02
2	NPV (Rupees/ha)	₹ 9,78,395	₹ 8,52,919
3	B: C Ratio	2.43	2.35
4	IRR (%)	30%	27%

Table 9: Economics of cashew cultivation under natural and conventional farming practices at HREC, Kanabargi.

Treatment	Yield (q/ha)	Annual maintenance cost			Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
		LC	MC	COC			
Conventional farming	25.31	73353	29284	102638	314864	212226	3.07
Natural farming	23.57	63992	16697	80688	294362	213673	3.65

Note: LC- Labour cost; IC- Input/material cost; COC – Cost of Cultivation

The farming cost includes amortized establishment costs, depreciation of farm machinery and interest on working capital. In natural farming, the benefit-cost ratio was slightly higher (3.65) than in conventional farming (3.07). This was mainly due to lower cultivation costs in ecological farming systems. Thus, it can be concluded from the above results that, in long run, cultivation of cashew both under natural and conventional system can be profitable.

CONCLUSIONS

In this background, the horticulture sector offers great opportunities to increase the income of the farmers. The research study was conducted at HREC, Kanabargi, Belagavi district Karnataka and evaluated the economics of cashew cultivation. The study showed that cashew cultivation was cheaper under natural cultivation compared to conventional cultivation method because labour costs and input costs were lower in NFS. The cost of maintaining the garden increased with the age of the crop. The natural farming system included regular monitoring and management strategies to avoid pests and diseases compared to conventional farming system. Although natural method of cultivation achieved a slightly lower yield on an average, it continued to help to improve the soil fertility and microclimate, i.e. positive externality in improving soil fertility, nut quality and human health due to the consumption of naturally grown cashew nuts that do not contain chemical residues.

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Conflict of Interest. None.

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