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Profitability analysis of cashew production in Wenchi municipality in Ghana

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ABSTRACT

This paper examines smallholder cashew farmers' socioeconomic characteristics and the profitability of cashew production in Wenchi Municipality of Brong-Ahafo Region of Ghana. The study used primary data which was collected from 140 randomly selected cashew farmers. Data for the 2009-2010 was collected through administration of a questionnaire. The methods of analysis used were discounted measures of project worth (net present value, benefit-cost ratio and internal rate of return). The results show that a one-hectare cashew plantation has a net present value of GH¢260.82 ($343.16) when discounted at 25%, a benefit-cost ratio of 1.13 and an internal rate of return of 43.85%. These indices show that cashew production is profitable. Government, non-governmental organizations and investors are therefore encouraged to consider cashew production in the Wenchi Municipality as an option to improve farm income and reduce poverty. Future studies on analysis of profitability of cashew apple processing are necessary because it can increase earning and add value to cashew production. Work on the analysis of the profitability of processing cashew apple is also necessary because existing research does not cover this important area and it was also not within the scope of the current study.

Keywords. Cashew, profitability, benefit cost ratio, internal rate of return Net present value.

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INTRODUCTION

Cashew (*Anacardium occidentale Linn*) is one of the non-traditional export crops given support by the government of Ghana. Cashew has a long history as a useful plant but only in the present century has it become an important tropical tree crop. The earliest reports of cashew are from Brazil (Mitchell and Mori, 1987). Cashew is grown as a smallholder crop in Ghana and the commercial plantations sector is very small. It is estimated that about 88% of cashew farms are owned by smallholders, with farms ranging in size from a minimum of 0.8 ha to 3.0 ha. Large plantations account for 12% of cashew farms and are between 4 ha to 40 ha (Osei-Akoto et *al.* 2005). According to estimates, there were 60,000 ha under cashew cultivation in 2008, producing about 26,454 tonnes of raw cashew nuts *per* year (MOFA, 2008).

In 2008, raw cashew nut exports from Ghana contributed 6.1% of GDP and 18.2% of agricultural GDP (Osei-Akoto, 2010). It has been estimated that the cashew sub-sector can contribute to economic growth by generating over 200,000 permanent and seasonal jobs, particularly for farm labourers and intermediaries (MOFA, 2008). Furthermore, off-farm marketing, distribution and processing of cashew nuts offer more than 5,000 permanent and seasonal jobs annually (MOFA, 2009).

The first ever recorded exports of cashew nuts from Ghana was in 1991, amounting to 15 metric tonnes and rose to 3,571 metric tonnes in 1997 (MOFA, 2007). According to the Ghana Export

Promotion Council (2005), in 2002, the country exported 3,893 metric tonnes of cashew valued at US$1,450,306. This export figure increased by 79.15% in 2003 to 6,338 metric tonnes, which was valued at US$1,598,636 (MOFA, 2007). Annual export of raw nuts reached 47,000 metric tonnes in 2006, contributing approximately US$ 23 million in foreign exchange earnings. This figure is considered small when compared with world excess demand of 430,000 metric tonnes of raw nuts, valued at US$270 million, and growing at a rate of 5-8% per annum (MOFA, 2007). A means of substantially solving the demand-supply gap aforementioned is by embarking on increasing small scale cashew production. However, the rationale of this effort must be anchored on the analysis of the profitability and viability of cashew production (MOFA, 2007). Therefore, this study was designed to assess the profitability of cashew production in Ghana.

MATERIALS AND METHODS

The Study Area

The study was carried out in the Wenchi Municipality in the Brong-Ahafo Region of Ghana as it is the major cashew production zone in Ghana. The study area lies between latitudes 7°27N and 8°30N and longitudes 1°30N and 2°36W. The Wenchi Municipality occupies an area of 7,619.7 square kilometres and a population density of 5-20 persons *per* square kilometre.

Data Collection

The study used both primary and secondary data. Primary data was mainly cross-sectional. It was collected from 140 cashew farmers randomly selected from a list of cashew farmers in the following farming communities: Akrobi, Awisa, Nkonsia and Abotareye, for the 2009-2010 production season. In each community 35 cashew farmers were randomly selected. Structured questionnaire was the main instrument used to collect the primary data. Variables included in the questionnaire were: initial capital outlay or establishment cost, area of land under cashew cultivation, labour input in land preparation, planting, weeding, fertilizer and pesticide application and harvesting, wage rate, the quantity of pesticides, quantity of fertilizer used in cashew cultivation, the costs of inputs and other miscellaneous inputs such as farm tools. Other variables included age, educational level, gender, whether or not farmers pruned their cashew trees and whether or not farmers used improved seeds. Also the study made use of secondary data on cashew production obtained from the Statistics, Research and Information Directorate (SRID) of Ghana's Ministry of Food and Agriculture (MOFA).

Analytical framework

Analysis of the data was done using the discounted measures of project worth. The Net Present Value (NPV), the Internal Rate of Return (IRR) and the Benefit-Cost Ratio (BCR) were used to estimate the profitability of cashew production in the Wenchi Municipality of the Brong-Ahafo region of Ghana as follows:

$$\mathrm{NPV} = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+r)^t} \quad (1)$$

$$\mathrm{IRR} = LDR + [HDR - LDR]\frac{NPV^{LDR}}{NPV^{LDR} + |NPV^{HDR}|} \quad (2)$$

$$\mathrm{BCR} = \frac{\sum_{t=1}^{t=n} \frac{B_t}{(1+r)^t}}{\sum_{t=1}^{t=n} \frac{C_t}{(1+r)^t}} \quad (3)$$

where:

B_t = Benefits in each project year, *t*
C_t = Costs in each project year, *t*
n = Number of years to the end of the project (*n* ranges from 1 to 25)
r = Discount rate
LDR = Lower discount rate
HDR =Higher discount rate
NPV^{LDR}= NPV at the lower discount rate.
$|NPV^{HDR}|$ = Absolute value of NPV at the higher discount rate

The NPV, BCR and IRR were averaged for all the respondents. The following assumptions were made in their calculation.

1. The analysis used a project life of twenty-five (25) years. This is because the average life span of cashew plants is 25 to 30 years (Sekar and Karunakaran, 1994).
2. Cashew farms are financed by borrowing. Because of this, the lending rate of the Agricultural Development Bank (ADB) to Agriculture and Forestry (25%) was employed as the discount rate.

3. The calculations are done in constant prices with the 2010 cropping season as the base year.
4. Environmental and climatic conditions prevailing are favourable.
5. A planting distance of 10.0m x 10.0m (intercropped with maize) was considered.
6. Maize is cultivated twice in a year during the first six (6) years of the cashew farm.
7. Additional cost due to intercropping with maize decreases by 5% each year. The cashew tree canopy forms with time and this reduces the available space for maize production and because of this the farmer spends less money on intercropping with maize as the years go by.
8. Cashew nut prices quoted by purchasing agencies operating in the municipality were used. Some of these agencies are Kona Agro Processing (a cashew nut processing factory), Agro-Industrial Farmers Company Limited, Cash Trade Company Limited, Home New Cashew Buying Centre, Evergreen Cashew Farmers, etc.
9. Risk of fires and wind-damage are minimal and hence ignored.
10. There is no taxation of any kind on the items sold.
11. Cashew trees are sold after twenty-five (25) years to charcoal burners to be used to produce charcoal.
12. Wooden storage structure is sold after twenty-five (25) years to be used for firewood.
13. Yearly costs and revenue estimates are based on current costs and revenue data collected from farmers.

In this study a sensitivity analysis was also carried out to assess the stability of the profitability indicators for a cashew plantation establishment, subject to various changes in costs and benefits structure with time. Here, a 10% increase in labour costs, 10% decrease in output prices and 10% increase in discount rates were considered.

RESULTS

Descriptive Analysis

Socioeconomic characteristics of respondents are presented in Table 1. About 64% of the sampled cashew farmers were males and 38.6% were females. The results of the study show that a greater percentage (74.3%) of the cashew farmers interviewed were above forty (40) years and none of the respondents was below twenty (20) years. Very few cashew farmers (25.7%) were between the ages of twenty-one (21) and forty (40) years. It was observed that a higher percentage of cashew farmers (47.1%) are illiterates. About 17 % of cashew farmers had only primary education while 15.7% of them were educated up to the middle or junior secondary school level. Close to 13% of the cashew farmers interviewed had senior secondary school education while only 7.2% got to the post-secondary and tertiary levels. Also, a greater proportion of cashew farmers (65%) financed their production through personal savings (See Table 1). The distribution of the household size indicated that most cashew farmers in the Municipality (57.9%) had a household size that ranged from 1 to 5 while the average farm size was found to be 1.33 hectares. The study also revealed limited extension visits to cashew farmers since 70% of farmers sampled had no extension contact

The results of the study revealed that a greater percentage of the cashew farmers (52.9%) pruned their cashew trees while 47.1% did not prune (See Table 2). The results showed that only 31.4% of the cashew farmers used improved varieties of cashew while the rest (68.6%) used local varieties (See Table 2).

Costs and Revenue Analysis of Cashew Production

The study grouped costs incurred in cashew farming into two, namely: investment or establishment cost and operating or maintenance costs. Investment costs as used in this study refer to all costs incurred before the cashew trees start bearing fruits (first three years). Conversely, operating costs refer to costs incurred from the time the trees start bearing fruits onwards (fourth year onwards). Tables 3 and 5 shows that early years of cashew farming (first three years), are characterized by high investment costs as against low operating costs of subsequent years. Generally, production costs comprised input cost, repairs, additional cost due to intercropping cashew with maize and contingency allowance. Labour costs constituted a major part of input costs. Table 3 presents details of quantities and costs of labour for the different farm operations.

Table 1: Socioeconomic characteristics of cashew farmers

Characteristic	Frequency	Percentage
Gender		
Male	86	64.4
Female	54	38.6
Total	140	100
Age		
≤20	0	0.0
21 – 40	36	25.7
41 – 60	68	48.6
61 – 80	36	25.7
Total	140	100.0
Education		
Illiterate	66	47.1
Primary	24	17.1
Middle School/JSS	22	15.7
SSS/Vocational/Technical	18	12.9
Post-Secondary/Tertiary	10	7.2
Total	140	100.0
Household Size		
1 – 5	81	57.9
6 – 10	40	28.6
>10	19	13.5
Total	140	100.0
Sources of Finance		
Personal Savings	91	65.0
Friends	10	7.1
Relatives	9	6.4
Cooperatives	12	8.6
Bank Loans	18	12.9
Total	140	100.0
Contact with Extension Officers		
Contact	42	30
No Contact	98	70
Total	**140**	**100.0**

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Table 4 presents detail costs resulting from intercropping cashew with maize. Other input costs consisted of cost of fertilizer (liquid and granular), cost of pesticides, cost of seeds, land rent and cost of storage structure. Table 5 presents the results of details of quantities and costs of the other input costs. A contingency cost allowance of 5% was added to take care of other costs likely to be omitted (Table 5). The results of the study showed that the total cost for establishing a hectare of cashew at a twenty-five (25) year rotation is GH¢10,966.20 (US$5,711.56).This study identified revenue coming from three main sources namely: sale of cashew nut, sale of maize and salvage value of assets remaining after the cashew farm is abandoned (refer to assumptions 11).

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Table 2: Pruning, cashew varieties, intercrops and economic part of cashew sold

Characteristic	**Frequency**	**Percentage**
Pruning		
Do pruning	74	52.9
Do not do pruning	66	47.1
Total	140	100.0
Cashew Varieties		
Improved	44	31.4
Local	96	68.6
Total	140	100.0
Intercropped arable crops		
Maize	91	65.0
Cowpea	12	8.6
Yam	13	9.3
Groundnut	7	5.0
Millet	4	2.8
Sorghum	13	9.3
Total	140	100.0
Economic part of cashew sold		
Apple	0	0.0
Nut	140	100
Total	**140**	**100.0**

Table 3: Annual labour quantities and costs *per* hectare for cashew farm operations

Labour Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10-24**	**25**
Man-days of labour											
Land clearing	25	0	0	0	0	0	0	0	0	0	0
Tree felling	25	0	0	0	0	0	0	0	0	0	0
Ridging/Digging	30	0	0	0	0	0	0	0	0	0	0
Cutting of pegs	2.5	0	0	0	0	0	0	0	0	0	0
Pegging/Lining	5	0	0	0	0	0	0	0	0	0	0
Planting/Sowing	5	0	0	0	0	0	0	0	0	0	0
Thinning	0	2.5	0	0	0	0	0	0	0	0	0
Refilling	0	2.5	0	0	0	0	0	0	0	0	0
Granular fertilizer application	0	5	5	5	0	0	0	0	0	0	0
Mulching	7.5	7.5	7.5	0	0	0	0	0	0	0	0
Weeding	90	90	90	90	90	75	75	75	75	75	75
Spraying	0	0	0	10	10	10	12.5	12.5	12.5	15	15
Pruning	0	2.5	2.5	5	2	7.5	7.5	7.5	10	10	10
Construction of fire belt	25	25	25	25	25	25	25	25	25	25	25
Harvesting	0	0	0	2.5	10	12.5	22.5	25	30	35	35
Drying	0	0	0	2.5	2.5	5	7.5	7.5	10	10	10
Transportation	0	2.5	2.5	2.5	2.5	5	5	5	5	5	5
Total labour (Man-days)	215	137.5	132.5	142.5	145	140	155	157.5	167.5	175	175
Wage(Gh¢)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total labour cost(Gh¢)	537.5	343.8	331.3	356.3	362.5	350.0	387.5	393.8	418.8	437.5	437.5

Table 4: Additional cost due to intercropping a one hectare cashew farm with maize

Input/Activity	Quantity/ Season	Unit Cost/ Season (GH¢)	Total Cost (GH¢)
Maize seed	22.5kg	1.00	22.5
NPK	125kg	0.80	100.00
Sulphate of Ammonia	125kg	0.60	75.00
Jute Sacks	25 sacks	1.00	25.00
Fertilizer application	10 man-days	2.50	25.00
Harvesting	10 man-days	2.50	25.00
Transportation (from farm to storage structure)	2.5 trip (KIA)	30.0	75.00
Dehusking	2.5 trip	15.0	37.50
Threshing	25 bags	1.50	37.50
Transportation (from storage structure to market)	25 bags	0.50	12.5
Total cost per season			435.00
Total cost for the year (two seasons)			**435x2 = 870.00**

The results of the study also showed that cashew nut is the main product of the cashew crop of economic importance in the study area. Even though the by-product (apple) may be economically useful, they are not valued in the study area (See Table 2). Revenue from maize is also factored into the revenue realized from the cashew farm. Finally, the assets remaining after the cashew farm is abandoned comprised the cashew trees and the storage structure. For the salvage value of the trees the results of the study revealed that each tree was sold at GH¢5.0 (US$2.60). Therefore, with hundred (100) trees per hectare, the salvage value of all the trees was calculated to be GH¢500.00 (US$260.42).

The salvage value of a storage structure remaining at the end of a cashew farm project was also calculated to be GH¢625.00 (US$325.52). Table 6 presents details of the revenue coming from the three revenue sources. At constant prices, the study calculated the total revenue generated from a hectare of cashew (intercropped with maize) at a twenty-five year rotation to be GH¢15,507.00 (US$8,076.56). Net returns or benefits were estimated at GH¢4540.80 (US$2,365.00). Table 7 presents the total revenue and the net benefits. The revenue was calculated using an average cashew nut price of GH¢0.80 ($0.42) per kilogramme of cashew nut and maize price of GH¢50 (US$26.04) per bag of 80 kilogrammes.

Profitability Analysis of Cashew Production

Table 7 presents details of the undiscounted and discounted costs, revenue and cash flow employed in calculating the net present value, benefit-cost ratio and internal rate of return of a hectare of cashew plantation establishment. Accounting for the time value of money by discounting at a rate of 25% (refer to assumption 2), the discounted costs for a hectare of cashew plantation was GH¢5012.74 (US$2610.80). Similarly, discounting at the same 25% discount rate, the discounted revenue for the farm was GH¢5671.6 (US$2953.96). The study also revealed the net present value, benefit-cost ratio and internal rate of return of a hectare of cashew plantation in the study area to be GH¢658.86 (US$343.16), 1.13 and 43.85% respectively. These profitability indicators are also presented in Table 7.

Sensitivity Analysis

With a 10% increase in labour costs, a cashew plantation establishment resulted in a positive net present value of Gh¢492.05 (US$256.28), benefit-cost ratio of 1.10 and an internal rate of return of 35.56%. With a 10% decrease in output prices, cashew plantation establishment resulted in a positive net present value of Gh¢85.7 (US$44.64). It also resulted in an internal rate of return of 26.2% and a benefit cost ratio of 1.02. When discount rate was increased by 10%, a positive net present value of Gh¢459.23 (US$239.18) was obtained. Though there has been a decline in the profitability indicators, it still represents positive returns on investment. It further maintained the internal rate of returns of 43.85% which is greater than the opportunity cost of capital. Table 8 summarizes the results of the sensitivity analysis

on the profitability indicators for a hectare of cashew plantation in the study area.

DISCUSSION

The results show that more men are involved in cashew production than women. This is consistent with the results of CASCA (2002) which revealed that most cashew farms are owned by men. It also shows that both men and women engage in cashew production as a business and a source of employment. Fewer numbers of youth involved in cashew production could be indicating that the future of the cashew industry, especially in the Wenchi Municipality is bleak. The youth constitute an energetic population and are likely to work effectively to increase yields; therefore there should be a concerted effort to attract more of this age group into cashew farming. Abang et *al* (2001) reported that education was positively related to the value of marginal farm products. This might be due to the fact that educated farmers are able to adhere to and adopt new farming technologies. Other research (Aderinola 1988; Aderinola and Kolawole 1996; Eremie and Akinwumi 1986 and Ojo 2000), investigated the productivity of sugar cane production, mechanized food crop farming, rice production and maize farming respectively and found out that farmers' socio-economic characteristics including education and experience were significant determinants of agricultural production and profitability. Wongnaa (2013) also observed a positive and significant relationship between educational level and cashew production. The implication of this is that education plays a very important role in cashew production and should be encouraged.

The results presented here suggest that most cashew farmers probably saw pruning as a very important cultural practice. In fully-grown trees, pruning of dead wood or branches, and those attacked by borer, is essential (Ohler, 1979). Pruning is important to get new vegetative branches when old ones are removed (Mole, 2000). Pruning also has the potential to increase cashew production by 0.43% (Wongnaa, 2013). The results of intercropping compares well with those of Frank et *al* (2011) who found that intercropping is a key factor for the profitability of a cashew production business since it allows higher incomes during the early years when the trees have not started fruiting.

Yaron *et al.* (1992) show that access to extension services can counter balance the negative effect of lack of years of formal education in the overall decision to adopt technologies. A unit increase in the number of farmers' contact with extension officers will increase cashew production by 12.5% (Wongnaa, 2013). The results presented in Table 3 imply that labour costs for cashew plantation establishment is highest in the first year than later years. These results also reveals that weeding and harvesting in cashew plantation establishments require large quantities of labour input and therefore contribute more to overall labour cost. The high cost of production observed in the early years of cashew production does not necessarily imply capital intensive nature of cashew production. These costs are due to intercropping during the early years. This does not however, defeat the importance of intercropping because intercropping contributes greatly to the cashew farm's revenue in the early years of production. The net present value presented in Table 7 is the present worth of the income stream generated by investing in cashew production. The positive net present value indicates that cashew plantation establishment in the study area is profitable. The benefit-cost ratio indicates that for every cedi or US dollar invested in cashew production, a return of Gh¢1.13 (US$0.59) would be expected. Since the benefit cost ratio is greater than one, we conclude that cashew plantation can pay for investment made in its establishment and leave farmers surplus income over cost. This is consistent with the results by Yadukumar *et al* (2003) who obtained a benefit-cost ratio of 1.72 in a study about the economic viability of investment in cashew orchards under different plant densities. Sudha and Reddy (1985) also studied the comparative economics of cashew in coastal Andhra Pradesh and observed that the benefit-cost ratio was 1.8 for cashew production. The internal rate of return (43.85%) presented in Table 7 is the maximum interest that a cashew plantation establishment in the Wenchi Municipality could pay for the resources used if the project is to recover its investment and operating costs and still break even. Since the internal rate of return calculated is greater than the opportunity cost of capital (25%), we suggest that cashew plantation establishment in the study area is profitable and viable.

Table 6: Estimated revenue streams per hectare

SOURCE/YEAR	1	2	3	4	5	6	7	8	9	10-24	25
Cashew											
Output(kg)		0	0	202.5	450	750	950	1250	1625	2000	2000
Price(Gh¢/kg)	0	0	0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Revenue from cashew (Gh¢)	0	0	0	162	360	600	760	1000	1300	1600	1600
Maize											
Output (bags/hectare/year)	36.25	30	28.75	25	20	0	0	0	0	0	0
Price(Gh¢/bag)	50	50	50	50	50	0	0	0	0	0	0
Revenue from maize (Gh¢/year)	1812.5	1500	1437.5	1250	1000	0	0	0	0	0	0
Salvage value of assets											
100 trees sold@GH¢5/tree											500
Wooden Storage structure sold for firewood											625
Total Farm Revenue (Gh¢)	**1812.5**	**1500**	**1437.5**	**1412**	**1360**	**600**	**760**	**1000**	**1300**	**1600**	**2725**

Table 7: Undiscounted and discounted costs, revenue and cashflow *per* hectare of

Cost and Revenue item	1	2	3	4	5	6	7	8	9	10-24	25
Revenue											
Cashew	0	0	0	162	360	600	760	1000	1300	1600	1600
Maize	1812.5	1500	1437.5	1250	1000	0	0	0	0	0	0
Salvage value											1125
Total revenue	1812.5	1500	1437.5	1412	1360	600	760	1000	1300	1600	2725
Total Costs	2,296	1,265.	1,219.6	1,259.7	1,167	1,131	475.1	515.9	523.8	556.5	556.5
Net Cash flow	-483.9	234.9	217.9	152.3	193.3	-530.9	284.9	484.1	776.2	1043.5	2168.5
Discount factor (25%)	0.8000	0.6400	0.5120	0.4096	0.3277	0.2621	0.2097	0.1678	0.1342	0.5179 *	0.0038
Discounted revenue	1450	960	736	582.04	445.67	157.26	159.37	167.80	174.46	828.64	10.36
Discounted Costs	1837.1	809.66	624.44	515.97	382.33	296.41	99.63	86.57	70.29	288.21	2.11
Discounted Net Cashflow	-387.12	150.34	111.56	66.07	63.34	-139.2	59.74	81.23	104.17	540.43	8.25

Σ(Undiscounted Cost) = GH¢10,966.20
Σ(Undiscounted Revenue) = GH¢15,507.00
Σ(Undiscounted Cash flow) = GH¢4540.80
Σ(Discounted Cost) = GH¢5012.74
Σ(Discounted Revenue) = GH¢5671.6
Σ(Discounted Cash flow) = GH¢658.86

NPV = GH¢658.86
BCR = 1.13
IRR = 43.85%
US$1 = Gh¢1.92

Table 8: Results of sensitivity analysis

Stimulus	NPV(Gh¢)	BCR	IRR (%)
10% increase in labour costs	492.05	1.10	43.85
10% decrease in output prices	85.70	1.02	26.2
10% increase in lending rate.	459.23	1.10	43.85

The results of the present study corroborate those of Sundaravaradarajan and Ramanathan (2003) who reported that the benefit-cost ratio and internal rate of return of new cashew plantations were 1.42 and 34.36% respectively, while for old plantations they were 1.06 and 17.17 %, respectively. The results of the sensitivity analysis presented in Table 8 indicate that cashew production in the Wenchi Municipality was still profitable even with a 10% increase in labour cost, 10% decrease in output prices and a 10% increase in lending rate.

CONCLUSIONS

The present study shows that cashew production is a profitable enterprise. The profitability indicators are for a relatively small cashew plantation. If the farm is larger, the rate of return would be expected to be better due to economies of scale. Since economic yield of the crop starts from the third to fourth year onwards, it could be inferred from the results that other cropping activities like intercropping with maize would provide income to poor farmers. The profitability of cashew cultivation also suggests that its production could add to aggregate food production and foreign exchange earnings. Labour input plays a very important role in cashew production; therefore employment in the study area would possibly reduce rural-urban migration. Further studies should be undertaken on value addition such as processing cashew apple into other products as it is likely to add to farmers' income, create employment for the youth and reduce poverty

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Conflict of interest None

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