Journal of Agricultural Science; Vol. 7, No. 3; 2015
ISSN 1916-9752 E-ISSN 1916-9760
Published by Canadian Center of Science and Education

Nursery Soil Amendments for Cashew Seedling Production: A Comparative Analysis of Coffee Husk and NPK

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Received: November 16, 2014 Accepted: December 25, 2014 Online Published: February 15, 2015

doi:10.5539/jas.v7n3p111 URL: http://dx.doi.org/10.5539/jas.v7n3p111

Abstract

Amendment of nursery soil with nutrient-containing compounds could promote seedling development. The utility of coffee husk and the optimum quantity needed in sole or combination with NPK for enhanced cashew seedling development was investigated. Medium size cashew nuts were raised for 20 weeks in six nutritional treatments. There were three coffee husk application rates (0.0021 g^{-1}Kg, 0.0041 g^{-1}Kg and 0.0062 g^{-1}Kg), CH and NPK (0.00208 g^{-1}Kg CH and 0.00016 g^{-1}Kg NPK), 0.00016 g^{-1}Kg NPK and a control in 3 Kg of soil. Leaf count (LC), stem girth (SG), plant height (PH) and leaf area (LA) were measured five times. Amended nursery soil significantly ($P < 0.05$) and positively affected the performance of cashew seedling. Potted nursery soil amended with higher (≥ 0.0041 g^{-1}Kg) CH concentration and CH/NPK significantly ($P < 0.05$) increased LC, SG, PH and LA at every periodic intervals of measurement. The five sequential intervals of measuring LC, LA, SG and PH showed different trend patterns: linear, quadratic and cubic with respect to each treatment. Post-experiment soil and plant nutritional test revealed that the N, P, K, Ca, Mg, soil pH, soil organic carbon (SOC), and soil organic matter (SOM) were significantly ($P < 0.05$) higher compared to the control. CH with 0.00625 g^{-1}Kg concentration increased soil pH, SOC, SOM, N, K, C, Mg and leaf N by 10.20%, 10.50%, 19.20%, 8.33%, 42.38%, 25.00%, 50.00% and 93.20% respectively. Post experiment evaluation revealed that the five nutritional treatments significantly aided higher biomass. However, addition of 18.75 g coffee husk to 3 Kg of soil was most effective for improved cashew seedling growth and development.

Keywords: cashew, coffee husk, growth, NPK, nutrient uptake

1. Introduction

Cashew plant (*Anacardium occidentale* L.) is an important tree-nut crop; according to Mofa (2007) it ranks third in international trade after hard nuts (*Cocos nucifera*) and almonds (*Prunus dulcis*). Cashew, an evergreen perennial may be up to 15 metres high, the medium sized alternately arranged leaves may be oval in shape (Grieve, 2004). The dense foliage characteristic makes it suitable as wind break for erosion control and degraded land reclamation.

Flowering occurs at the end of wet season. Panicles are produced at the end of new shoots with majority at the periphery of the tree canopy. The kidney shaped nut is the true fruit attached to the bottom of the apple, the pseudo fruit. Both nut and apple are good for confectionery purposes. The apple is three to six times richer in vitamin C than oranges (Franco & Janzantti, 2005; Soares et al., 2007; Sivagurunathan et al., 2010). The cashew nut is very rich in essential unsaturated fatty acids which are beneficial to both the heart and arteries. Akinhanmi and Atasie (2008) remarked that cashew nut consumption may prevent arteriosclerosis and hypertension.

Soil factor and the inherent nutrition determine crop productivity (Chintala et al., 2012a, 2012b). Documented reports (Rajesh et al., 2003; Veeken et al., 2005, Janvier et al., 2007, Lazcano et al., 2009; Yadessa et al., 2010) have indicated that amending agricultural soils with organic matter aided plant nutrition and enhanced physicochemical and biological characteristics of the soil on the field. The use of mineral and organic sources of nutrient in varied proportion evolved from long experiences in soil fertility management (Rajesh et al., 2003; Bationo & Waswa, 2011).

Information concerning the optimum quantity of nutritional constituents in nursery pot soil for cashew seedling is limited. In most cases, top soils are scraped for use as nursery soils to raise seedlings. The survival of seedling at transplanting is partly dependent on the nutritional condition of the medium in which they developed. Poor nutrition for seedlings at the juvenile stage may result in growth and developmental defects, poor establishment of seedling on the field, slow growth, reduced survival percentage etc.

Bulky organic residue from the processing of coffee contains degradable organic matter which can be utilized as composting product. Literature on the use of coffee waste as a soil amendment is limited; however, some experiments (Tenaw & Kelsa, 1998; Zake et al., 2000; Preethu et al., 2007; Nguyen et al., 2013) indicated that coffee waste (coffee husk) is a valuable organic fertilizer, particularly for highly weathered soils of the humid tropics. Tuan (2005) reported that coffee husk compost supplemented with lime and phosphorus fertilizer resulted in long time of composting process, slow degradation of organic matter.

Coffee husk are available wastes in coffee plantation, however, its utility in the composting system for soil nutrient amendment is low. It is therefore worthwhile to investigate its nutritional potential especially on cashew seedlings. Therefore, the present study seeks to investigate the nutritional status of various proportions of sole coffee husk and coffee husk-NPK combinations with respect to the seedling developments of cashew.

2. Materials and Methods

The soil for the experiment was sandy loam, collected within the plantation premises of the Cocoa Research Institute of Nigeria (CRIN), Ibadan (Lat. 0.7^{o}1′N and Long. 03^{o}52′E) at the depth of 0-15 cm.The collected soil was mixed, air dried and sieved with a 2 mm mesh. Coffee seed coats (husk) were obtained after plot harvest and processing of coffee at CRIN, Ibadan. The husks were air dried under shade, crushed, blended into powder and screen thorough 1mm sieve. Chemical analysis of the soil and the coffee husk (CH) was done as described by Cater (1993). Soil pH was determined with a pH meter while soil organic matter was done by wet oxidation method (Waikley & Black, 1943). Exchangeable K, Ca, Mg were extracted using ammonium acetate (Chintala et al., 2014a). The properties of the soil and the coffee husk are presented in Table 1. The polythene bags were filled with three kilogram soil.

Disease-free and viable Cashew nuts of medium size from the cashew germplasm plot at CRIN, Ibadan were planted at one nut per polythene bag. Following the recommendation of Zake et al. (2000), the treatments were incorporated into the soil by ring application at 4weeks after planting. The experiment involved six nutritional treatments, the concentrations of each nutritional treatment was presented in Table 2. The experiment was laid out in completely randomized design with three replications. The plot size was ten seedlings per treatment. The seedlings were monitored for six month. Manual weeding was done as at when due.

Plant height, stem girth, leaf area and the number of leaves/plant were recorded at every four weeks until the 20th weeks after planting when the experiment was terminated. At termination of the experiment, fresh biomass was obtained before destructive sampling. The root weight and length (25 roots of uniform length) were measured per plant. The root and shoot were oven-dried differently and their weight determined using the Metler sensitive weighing balance. The nutrients uptake of the Cashew leaves and the post experiment soil nutrient composition were determined at harvest for each treatment and left over soil following the method described by Tel and Hagarty (1984).

The data were subjected to the statistical analysis using SAS, version 9.2, SAS (2007). Analysis of variance was done using the PROC GLM procedure in SAS. Means were separated with Turkey's Studentized Range (HSD) and Duncan New Multiple Range Test (DNMRT). The data taken at intervals were further subjected to trend analysis in R (R-Team, 2010) using the orthogonal polynomial coefficients in Gomez and Gomez (1984) to understand the behavioural pattern of each parameter with sequence and timing.

3. Results

The results of the physico-chemical properties of the soil and the chemical compositions of the coffee husk (CH) before the experiment were presented in Table 1. The soil had higher proportion of the sand, clay, Ca and Mg; this indicates that the textural class of the soil used was sandy loam. The soil and the CH were slightly acidic with equal pH of 5.3 (Table 1).

Table 1. The properties of the soil and the coffee husk

Physical Properties	Soil	Coffee Husk
Sand	60.80 g kg^{-1}	-
Silt	9.00 g kg^{-1}	-
Clay	30.20 g kg^{-1}	-
Textural class	Sandy Loam	-
Chemical Properties		
Soil P^H (H_2O) 1:1	5.30	7.41
Organic matter	1.22%	-
Organic carbon	3.03g/kg	-
Total Nitrogen	0.06g	0.48%
Available Phosphorus	1.03mg kg^{-1}	19.10mgKg^{-1}
Exchangeable Bases		
K^+	0.27 cmol/kg	5.71mgKg^{-1}
Ca^{2+}	4.10 cmol/kg	8.00mgKg^{-1}
Mg^{2+}	2.00 cmol/kg	0.46mgKg^{-1}
Na+	0.92 cmol/kg	2.40mgKg^{-1}

Table 2 shows the treatments combinations and the various rates of the applied materials used for the experiment.

Table 2. Treatment combinations and concentrations of the treatments applied to the soil

S/N	Treatments	Treatment codes	Application rates (g^{-1}Kg)
1	Control	T1	-
2	6.25 g CH	T2	0.00208CH
3	12.5 g CH	T3	0.00416CH
4	18.75 g CH	T4	0.00625CH
5	6.25 g CH + 0.5 g NPK	T5	0.00208CH + 0.00016NPK
6	0.5 g NPK	T6	0.00016NPK

Note. CH - Coffee Husk.

Table 3 presented the ANOVA summary, the mean and the coefficient of variation of the four parameters measured at five periodic intervals. There existed significant ($P \leq 0.05$) variation among the six treatments for each interval of growth measurement with respect to the fifth leaf count and leaf area (Table 3). The first four initial periodic leave counts and the five periodic measured stem girth and plant height could not be distinguished by the six treatments (Table 3). The least coefficient of variation (9.65%) occurred in LA5 while the highest (95.26%) was observed in SG4.

Table 3. Summary of analysis of variance for four growth parameters measured at two weeks intervals

		Mean Squares				
	DF	LC1	LC2	LC3	LC4	LC5
Treatments	5	7.61	26.38	16.81	24.62	39.98*
Error	10	7.22	24.77	20.93	28.38	12.99
Mean		10.19	11.69	12.47	15.05	13.44
CV (%)		26.36	42.56	36.68	35.38	26.81
		SG1	SG2	SG3	SG4	SG5
Treatment	5	0.01	0.03	0.01	0.21	0.02
Error	10	0.01	0.04	0.01	0.33	0.02
Mean		0.35	0.64	0.54	0.60	0.77
CV (%)		29.23	32.67	25.63	95.26	20.32
		PH1	PH2	PH3	PH4	PH5
Treatment	5	5.49	24.91	10.81	43.22	31.36
Error	10	25.97	49.90	38.63	44.30	42.74
Mean		17.53	21.14	19.93	21.62	20.79
CV (%)		29.07	33.40	31.17	30.77	31.44
		LA1	LA2	LA3	LA4	LA5
Treatment	5	133.31***	136.85***	111.12***	109.24***	129.64***
Error	10	1.71	3.77	6.29	4.10	4.81
Mean		13.86	16.30	18.75	20.87	22.73
CV (%)		9.43	11.91	13.38	9.71	9.65

Note. LC - Leaf count; SG-Stem girth; PH - Plant height; LA - Leaf area; 1-5 epithet - Intervals of data recording; DF - Degree of freedom; CV (%) - Coefficient of Variation; *, ** and *** - Significance at P = 0.05, 0.01 and 0.001.

From Table 4, the values of leaf count and stem girth for the five intervals differs significantly ($P \leq 0.05$) in the first four treatments, T1 to T4. The five periodic measurements of the plant height of the cashew seedlings differed significantly ($P < 0.05$) under treatments T1, T3, T4 and T5. However, each of the five periodic intervals of the leaf area assessed significantly ($P \leq 0.001$) differed under each of the six treatments. Leaf count and stem girth did not differ in treatments T5 and T6. Moreover, the sole NPK treatment could not differentiate among the five measured periodic plant heights of the cashew seedlings. The highest means were observed in treatments T2, T3, T3 and T6 for leaf count (15.26), stem girth (0.62 cm), plant height (22.02 cm) and leaf area (28.3) respectively (Table 4).

Table 4. Variation and mean of the six treatments with respect to five intervals of data recording on leaf count, stem girth, plant height and leaf area

		Mean Squares					
	DF	T1	T2	T3	T4	T 5	T 6
Leaf Count	4	33.15*	35.35*	16.60*	10.16*	14.18	11.35
Error	8	7.95	6.57	2.69	2.24	11.94	3.28
Mean		14.06	15.26	12.93	13.00	10.30	9.87
CV (%)		20.04	16.79	12.69	11.51	33.56	18.34
Stem Girth	4	0.11**	0.11***	0.04***	0.09***	0.23	0.05
Error	8	0.01	0.01	0.01	0.01	0.35	0.02
Mean		0.58	0.60	0.62	0.51	0.70	0.47
CV (%)		16.51	8.46	12.40	17.35	84.39	35.23
Plant Height	4	3.91***	15.14	14.77*	30.76*	37.16*	58.25
Error	8	0.39	13.46	2.97	4.94	11.53	98.09
Mean		18.70	21.12	22.02	20.24	20.38	18.76
CV (%)		3.34	17.37	7.82	10.98	16.66	52.78
Leaf Area	4	49.03***	53.11***	31.69***	31.98***	23.88***	43.34***
Error	8	0.45	1.62	1.27	1.94	0.49	2.08
Mean		10.24	14.60	16.45	23.06	18.35	28.30
CV (%)		6.58	8.71	6.86	6.04	3.85	5.10

Note. DF - Degree of freedom; CV (%) - Coefficient of Variation; *, ** and *** - Significance at P = 0.05, 0.01 and 0.001.

Table 5 presents the response in trend of the juvenile growth parameters of cashew seedlings with respect to each of the six treatments. For the control (T1), the response of the five periodic measures of the leaf area (LA) from week four to 20 were significantly ($P < 0.01$) linear and quadratic, while the response of stem girth (SG) to the same treatment were significantly ($P \leq 0.05$) linear and cubic. The trend of response of LA and leaf count (LC) was significantly ($P \leq 0.05$) linear for the three treatments (T2, T3 and T4) which contain different levels of CH in sole (Table 5). The response of SG to the three treatments were significantly ($P \leq 0.05$) linear and cubic. Plant height (PH) showed significant ($P < 0.05$) linear trend response in T4 (the treatment with the highest content of CH in sole). Significant ($P < 0.01$) linear and significant ($P < 0.05$) cubic response was observed for LA and PH respectively in T5. In Table 5, only LA responded linearly at $P = 0.05$ level of significance when the treatment was solely NPK (T6).

Table 5. Trend analysis of the five intervals of growth measurements on leaf area, leaf count, plant height and stem girth with respect to six treatments

Sources of Variation	Df	MS_LA	MS_LC	MS_PH	MS_SG
T1					
Linear	1	184.07***	1.63	1.323	0.14700*
Quadratic	1	9.04**	106.88	14.059	0.00381
Cubic	1	2.80	6.08	0.091	0.28033**
Quartic	1	0.21	18.01	0.174	0.02835
Error	10	0.69	25.33	11.968	0.02051
T2					
Linear	1	210.41***	124.03***	35.64	0.027170***
Quadratic	1	1.80	0.21	16.72	0.00733
Cubic	1	0.25	4.80	3.27	0.17101**
Quartic	1	0.00	12.39	3.45	0.00348
Error	10	9.03	5.70	10.60	0.01215
T3					
Linear	1	125.83***	57.41**	4.56	0.11781**
Quadratic	1	0.02	0.15	21.0	0.01449
Cubic	1	0.65	8.01	7.15	0.06440 *
Quartic	1	0.27	0.87	27.83	0.00166
Error	10	2.30	3.70	33.98	0.01029
T4					
Linear	1	125.99***	38.53*	60.92*	0.26980***
Quadratic	1	1.24	1.52	24.15	0.00707
Cubic	1	0.64	0.13	23.41	0.09464**
Quartic	1	0.07	0.48	14.56	0.00031
Error	10	5.59	4.83	10.61	0.00827
T5					
Linear	1	95.52**	30.00	4.18	0.3513
Quadratic	1	0.16	16.10	40.42	0.1778
Cubic	1	0.29	10.21	70.23*	0.0460
Quartic	1	0.02	0.43	33.84	0.3742
Error	10	6.25	11.52	11.35	0.3658
T6					
Linear	1	170.36*	10.80	105.84	0.08427
Quadratic	1	2.21	22.88	49.40	0.00029
Cubic	1	0.68	1.20	77.76	0.12610
Quartic	1	0.14	10.52	0.00	0.00003
Error	10	18.04	53.68	132.15	0.04448

Note. *DF - Degree of freedom; MS_LA - Mean square leaf area; MS_LC - Mean square leaf count; MS_PH- Mean square Plant height; MS_SG- Mean square stem girth.

Fresh and dry root related parameters in Table 6 were significantly enhanced by T4, T5 and T6. T6 significantly enhanced the outstanding performance of the cashew seedling for fresh and dry biomass (Table 6). In a follow up pattern behind T6, biomass yield (fresh or dry) was also enhanced in the sequence of T5 > T4 > T3 > T2. For the five post-experiment variables assessed (Table 6), the lowest significant performance was observed in T1 (the control). Each of the five treatments significantly compensated for the root and shoot performances of cashew seedling.

Table 6. Post-experiment means of some agronomic parameters on the cashew seedlings raised on the six nutritional treatments

Treatments	RL (cm)	RFW (g)	RDW (g)	WPFW (g)	WPDW (g)
T1	15.77d	3.27d	1.05d	18.17e	9.12e
T2	20.70c	5.50c	2.58c	34.42d	16.41d
T3	24.80c	7.50b	3.12bc	35.53c	17.12cd
T4	31.72b	8.52ab	3.76ab	36.36bc	18.06c
T5	39.01a	9.36a	4.26a	37.30b	19.36b
T6	35.67ab	8.78ab	3.85ab	40.33a	20.52a
Mean	27.94	7.15	3.10	33.68	16.76
CV%	5.85	6.69	9.66	1.09	2.22

Note. RL - Root length; RFW - Root fresh weight; RDW - Root dry weight; WPFW - Whole plant fresh weight; WPDW - Whole plant dry weight. Means with the same alphabet are not significantly different.

Table 7 revealed the amount of various nutrient present in the leaves of cashew seedlings after being grown under different nutritional treatments. Among the six treatments, T4 had the highest N, P, K, Mg, Ca and Na; T6 followed in magnitude with respect to the mean values of P, K and Na (Table 7). The least mean for each nutrient was however obtained in T1 (control). The coefficient of variation for the six treatments ranged between 0.61% (P) and 18.27% (Ca).

Table 7. Mean nutrient uptake of cashew seedlings under different nutritional treatments

Treatments	N (%)	P (mg/Kg)	K (mg/Kg)	Mg (mg/Kg)	Ca (mg/Kg)	Na (mg/Kg)
T1	0.23d	14.22f	2.49f	0.50b	4.95bc	0.42e
T2	0.42b	16.43e	4.62d	0.57b	8.27bc	0.44e
T3	0.46b	18.52d	4.87c	0.60b	10.14ab	0.62d
T4	0.76a	31.44a	10.45a	1.17a	11.75a	0.94a
T5	0.43b	21.13c	4.41e	1.03a	10.74ab	0.72c
T6	0.32c	22.84b	7.25b	0.60b	5.40c	0.83b
Mean	1.453	20.763	5.682	2.336	9.041	0.862
CV(%)	1.71	0.16	1.85	1.59	18.27	2.91

Note. Means with the same alphabet are not significantly different.

The chemical properties in the residual soil after the experiment were presented in Table 8. Except for Nitrogen (which had the highest (36.5%) coefficient of variation), significant variation existed among the six treatments for all the chemical properties studied (Table 8). T3, T4 and T5 had significantly higher pH, the least pH (4.43) was observed in the control (T1). T4 significantly ($P \geq 0.05$) had the lead means for OC, OM, K and Mg. However, T6 significantly ($P \geq 0.05$) had the lead means for P and Na in the experiment (Table 8). All the treatments except T1 had equal mean for Calcium. In the study, the control (T1) had the least mean for all the measured chemical properties (Table 8).

Table 8. Post-experiment chemical composition of the residual soil media

Treatments	P^H	OC	OM	N	P	K	Na	Ca	Mg
T1	4.43d	1.03e	1.76e	0.08a	4.07f	0.12f	0.11c	1.53b	1.44d
T2	4.95b	1.77b	3.02bc	0.11a	4.56e	0.26c	0.11c	2.04a	2.34c
T3	5.20a	1.79b	3.13b	0.12a	4.81d	0.31b	0.12c	2.04a	2.35c
T4	5.10ab	2.32a	4.03a	0.14a	4.90c	0.46a	0.15b	2.27a	2.84a
T5	5.17a	1.62c	2.75c	0.12a	5.32b	0.23d	0.12c	2.13a	2.33c
T6	4.60c	1.31d	2.26d	0.11a	12.20a	0.15e	0.21a	2.13a	2.74b
Mean	4.907	1.640	2.827	0.108	5.977	0.256	0.138	2.025	2.39
CV(%)	1.74	1.1.67	3.47	36.50	0.161	5.14	11.73	6.70	1.57

Note. OC - Organic carbon; OM - Organic matter. Means with the same alphabet are not significantly different.

4. Discussion

Düring and Gäth (2002) and Lal (2008) had remarked that the production of urban and industrial organic wastes is increasing worldwide; agricultural wastes are equally on the increase in most farms; sometimes to the level of becoming a menace in plantations and fields (Chintala et al., 2013, 2014b). Agbeniyi et al. (2011) had reported on the encumbering status of heaps of cocoa pod husk in cocoa plantation in Nigeria. Coffee husk heap of waste litters most coffee plantations after coffee processing. Agricultural wastes such as cocoa pod and coffee husk are of great efficient importance as degradable organic matter for composting. Development of strategies for organic waste disposal that prevent soil degradation and water contamination is necessary. However, Khaled et al. (2012) had reported on the productivity and biosafety of organic manure that it releases nutrients gradually and allows greater production with minor environment impact.

Moyin Jesu (2007) remarked that cocoa pod husk increased soil OM, N, P, K, Ca, Mg and pH. The major mineral elements present in the coffee husk were N, P, K, Mg, C and Na. Obatolu and Agboola (1991) had reported that cocoa pod husk (CPH) manure contains high Ca, P, K and sizeable amount of useful organic constituents. The use of coffee husk as an organic amendment has been reported and reccommended by Veeken et al. (2005), Janvier et al. (2007), Lazcano et al. (2009) and Yadessa et al. (2010). According to them, amending agricultural soils with coffee husk as compost supplies plant nutrients and helps to improve the physicochemical and biological properties of the soil.

Miller and Miller (2000) admitted that the effect of organic material application to crop soil may not be apparent, but while its presence positively affects the immediate soil properties, nutrients are released gradually into the soil. The slow release of inherent nutrients in organic fertilizers had been identified to be responsible for the increase in crop yields from such plots in the subsequent years. The remark of Baldock and Nelson (2000) may explain for the reason for the slow nutrient release. According to them, the macronutrients, N, P and S present in the organic chemical structures are usually converted into inorganic forms before subsequent release into the soil as mineral nutrient.

The Nitrogen content in the soil was 0.06%; this is lower than 0.09% being the critical level (Thong & Ng, 1978; Egbe et al., 1989; Aikpokpodion et al., 2010) required for cocoa cultivation. It is noteworthy that optimum N for most crops according to Sobulo and Osiname (1981) is 0.15%. The exchangeable K (0.3 Cmol/kg) in this study was equivalent to the critical level identified by Folorunso et al. (2000) to be adequate for crop growth.

The combination of organic and inorganic fertilizer aid the released of nutrient from organic sources and also reduce the quantity of the organic manure necessary for application into the soil. The effectiveness of using the combination of coffee husk and NPK as one of the treatments in this experiment was reflected on leaf mineral composition and growth parameters. This is in line with the report of Ofori et al. (2003) on the combination of cocoa pod husk and NPK. Their report further reiterated that, smaller cocoa pod husk is needed in ratio with NPK for a suitable potting medium to nurse cocoa seedling.

Santos et al. (2008) found that applying untreated coffee husk or coffee peel gave imbalance of nutrients in the coffee seedling leaves. The higher phosphorus recorded in this study (0.00625) in the cashew leaves (T4:31.44) after termination of the experiment was in line with the study of Ogunlade and Aikpokpodion (2006). According to them, phosphorous concentration in leaf sample at specific growth stage is related to the performance of the crop. However, availability of P is enhanced in an acid soil following the application of organic amendments (Iyamuremye & Dick, 1996; Materechera & Mkhabela, 2002). The post experiment higher residual quantity of P seems to inform that the coffee husk has adequate nutrient composition. P availability as reported by Iyamuremye and Dick (1996) and Materechera and Mkhabela (2002) have been enhanced following the application of organic amendments to acidic soils. Coffee husk may also be a very important liming material for soil acidity amelioration.

The non-significant difference between sole NPK and NPK plus coffee husk on leaf count and stem girth of coffee in this study seem to suggest that the addition of coffee husk to NPK did not produce any compensatory influence on the number of leaves and stem girth of cashew seedling. However, the application of coffee husk at different sole rates resulted in positive and significant increase in leaf count, stem girth, plant height and leaf area. This is corroborated by some previous results (Rajesh et al., 2003; Veeken et al., 2005; Janvier et al., 2007; Lazcano et al., 2009; Yadessa et al., 2010); amendment of agricultural soils with organic matter as compost resulted in the improvement of the physico-chemical properties of the soil, nutrient release and morphological development of the hosted plants.

Most of the parameters exhibited significantly linear response. Hammed et al. (2011) and Adewale et al. (2013) obtained a corresponding result for growth parameters of established cashew seedlings on the field. The linearity feature of the increase in the number of leaves, girth circumference, plant height and leaf area in response to increasing time could be attributed to active cell division and elongation which accompany growth and development at juvenile stage (Adewale et al., 2013).

The result of the residual chemical composition of the medium after the termination of the experiment shows an increased in N, P and Na; Moyin Jesu (2008) and Ojeniyi et al. (2007) had made similar observation. Adejobi et al. (2011a, 2011b) found the residual effect of organo-mineral fertilizer and cocoa pod husk on the soil and leaf chemical composition like ours identified increase in N, P, K, Ca, Mg and pH. Magnesium and Calcium are additional nutrient to N, P and K in coffee husk. However, the better performance of treatments with coffee husk over NPK could be due to the additional presence of Mg and Ca in coffee husk. The richness of N, P, K, Ca and Mg and high pH in organic materials observed in the present result is consistent with the previous studies (Owolabi et al., 2003; Rajesh et al., 2003).

The present work therefore seems to confirm that organic materials such as coffee husk do release N, P, K, Ca and Mg into soil when used alone or in combination with NPK. Application of fertilizers as amendments improved the chemical characteristics of the soil. This is in reference to the Integrated Soil Fertility Management (ISFM) principle (Vanlauwe, 2004). The reduction in mineral fertilizer application through their supplementation with organic sources, such as coffee husk makes the use of soil nutrient amendments affordable to small holder farmers, guarantees and improves soil life.

5. Conclusion

This study clearly showed that coffee husk improved physico-chemical properties of soil, improved the nutrient in the nursery soil medium and actively supported the morphological development of the cashew seedling. Since good morphological development of seedling enhances their better field establishment, the use of coffee husk to amend nursery soil is recommended. The appropriation of this organic material in agricultural system of nursery seedling production will profitably claim the waste (i.e. coffee husk) and ultimately supply nutrient to growing seedlings without adverse impact on soil biomes

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