RESIDUAL EFFECTS OF COMBINED SOIL AMENDMENTS ON SOIL CHEMICAL PROPERTIES AND GROWTH PERFORMANCE OF WHITE SEED MELON (*Cucumeropsismannii*) AT KABBA NIGERIA.

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ABSTRACT

Field experiment was conducted between 2018 and 2019 cropping seasons at the Teaching and Research Farm of Ahmadu Bello University, College of Agriculture, Kabba, Kogi State to study residual effect of crop residues in combination with NPK fertilizer 15:15:15 (NPKF) on soil chemical properties and growth performance of white seed melon. The trial involved twelve treatments combination of plant residues and NPK 15:15:15 fertilizer (NPKF). The treatments were Control, 300 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Husk (CPH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Husk (CPH) + 100 Kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Waste (CPW) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Waste (CPW) + 100 kg/ha NPK fertilizer (NPKF), 4 t/haCocoa Bean Husk (CBH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/haCocoa Bean Husk (CBH) + 100 kg/ha NPK fertilizer (NPKF), 4 t/ha Kola Pod Husk (KPH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Kola Pod (KPH) + 100 kg/ha NPK fertilizer (NPKF), 2 t/ha *Tithoniadiversifolia*(Weed Mulch (WM) + 200 kg/ha NPK fertilizer (NPKF), 2 t/ha *Tithoniadiversifolia*(Weed Mulch (WM) + 100 kg/ha NPK fertilizer (NPKF). All the amendments tested significantly($p < 0.05$) improved soil chemical properties and growth performance of white seed melon relative to the plots previously treated with 300 kg/ha NPKF and control. Three cocoa plants residues in combination with NPKF at 4 t/ha CBH + 200 kg/ha NPKF, 4 t/ha CPW + 200 kg/ha NPKF and 4 t/ha CPH + 200 kg/ha NPKF respectively significantly ($p < 0.05$) improved soil N, available P, exchangeable k, Ca and Mg, Na, Fe, Al and ECEC in the second growing year relative toother soil amendments tested. All treatments increased number of leaf, number of branches, vine length, leaf length and leaf width of white seed melon compared to 300 kg/ha NPKF and control.

Keywords: White seed melon; crop residue; residual amendments; soil chemical properties; growth performance.

Introduction

Mann's cucumeropsis (*Cucumeropsismannii)* is one of the most important species of melon. It is animportant qualitycrop. The crop is primarily harvested for its large white seeds called egusi-itoo. The seeds are processed into soups and oil products and are also eaten individually as a snack (National Research Council, 2006). Benefits of white seed melon are many but soil fertility is one of the most important factors limiting its production. It is a very high nutrient – demanding crop and it requires adequate nutrition for maximum performance (National Research Council, 2006). A complete fertilizer should be applied before the propagation of white seed melon with periodical application of nitrogenous fertilizer (National Research Council, 2006). Growing of *Cucumeropsismannii*in savannahs with low fertility and organic matter was reported to be more challenging (National Research Council, 2006).Soil fertility management is one of the major constraints affecting the quality and quantity of agricultural production in developing countries particularly in Nigeria. Crop quality and quantity are largely dependent on ability of soil to supply essential nutrient elements for plant growth without a toxic concentration (Soil Fertility, 2nd ed., 1996). Soils of the tropics varied widely in physical and chemical properties. In West Africa soils of rainforest are generally acidic and of low to medium inherent fertility. Crop varieties with most high yielding potential cultivated on such soils without regular replenishment of nutrients either through organic or inorganic means are bound to experience low crop quality, yield or total failure due to nutrient loss through crop removal, leaching and erosion. The use of chemical fertilizers to return lost nutrients and achieve high crop yield is unsustainable due to its scarcity and high cost (Ojeniyi, 2000). Although inorganic fertilizers ensure quick availability of nutrients to crops but they have limited residual effect of the applied nutrients (Okigbo, 2000). In addition, inorganic fertilizer has not been helpful in intensive agriculture because it is often associated with reduction in crop yield, soil acidity, nutrient imbalance and degradation of soil physical attributes. Other limitations include nutrients leaching, erosion and volatilization (Ojeniyi, 2000). Chemical fertilizers are said to have the following characteristics (Jim Ellison, 2011); Water solubility of chemical fertilizers result in fast nutrient release. Many chemical fertilizers own high acid content like sulphuric and hydrochloric acids which when going through soil acidity successfully results in the death of Nitrogen fixing bacterium, the organism that plays a central role in refurbishing a maturing plants nitrogen demands.

Nutrient supply through application organic fertilizers is also faced with some challenges. Maintenance of organic matter in soil is constraint by high competing demands organic and agricultural wastes. Organic fertilizers are known to be slow released nutrient sources. This implies that crops can suffer initial starvation from nutrient immobilization prior to mineralization. They are also required in large quantities which may not be readily available to farmers (Agbede, and Kalu, 1995; Okigbo, 2000; Adekiya*et al*, 2012). Combination of crop or plant residue with synthetic fertilizers is the sustainable means of avoiding problems emanating from sole use of organic and inorganic fertilizers. Organic fertilizer was reported to improve soil characteristics and obtain high crop yields in addition with inorganic fertilizer (Cezar, 2004). Akanbi*et al.*, (2013) recognized the need to intensify studies into locally sourced, cheap, adoptable organic sources of plant nutrients. Babadele and Ojeniyi (2013) found that plant variety such as those of siam weed and sawdust used alone or combined further with NPK fertilizer at reduced rate supplied nutrients and improved yield. Organic amendments discharge their nourishing contents only when they break down through the intricate ecology of living creatures in the soil at that time they steadily discharge contents. All the components in the organic amendments are completely essential soil nutrients. The fact that the material is organic signifies that it is derived from a once living plant, animal or a mix of both, which assures us that all components there are crucial to life. Organic amendment is relatively cheaper and it has all the carbon and vitality to conform to the demands of soil microbes. The above characteristic of organic and inorganic fertilizers which complements each other makes its combination a necessary component for crop production. While the importance of the mixture has been demonstrated (Onunka*et. al.*, 2003).The objective of this experiment was to study the residual effect of combined amendments on soil properties and growth performance of white seed melon.

Experimental design and treatments

The study was conducted between 2018 and 2019 cropping seasons at the Teaching and Research Farm of ABU College of Agriculture, Kabba, Kogi State. Kabba is located in the Southern Guinea savanna Agro - Ecological Zone of Nigeria on latitude 7^0 50' N and longitude of 6^0 03'E and Altitude of 427 metres with average rainfall of 130 millimetres and mean annual temperature between 28.8^{0}C to 35^{0}C. The annual relative humidity is 81.2 percent.

Experimental design and treatments

The experiment was arranged in a randomized complete block with each treatment replicated four times. The area used was 24 m x 49 m (1176 m^2) in total. Each plot measured 4m x 3m with discard of 1m within the plots and 2m between the block. The trial involved twelve treatments combination of plant residues and NPK 15:15:15 fertilizer (NPKF).The treatments were Control, 300 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Husk (CPH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Husk (CPH) + 100 Kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Waste (CPW) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Cocoa Pod Waste (CPW) + 100 kg/ha NPK fertilizer (NPKF), 4 t/haCocoa Bean Husk (CBH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/haCocoa Bean Husk (CBH) + 100 kg/ha NPK fertilizer (NPKF), 4 t/ha Kola Pod Husk (KPH) + 200 kg/ha NPK fertilizer (NPKF), 4 t/ha Kola Pod (KPH) + 100 kg/ha NPK fertilizer (NPKF), 2 t/ha *Tithoniadiversifolia(*Weed Mulch (WM) + 200 kg/ha NPK fertilizer (NPKF), 2 t/ha *Tithoniadiversifolia(*Weed Mulch (WM) + 100 kg/ha NPK fertilizer (NPKF). Two seeds of white seeds melon were planted per hole and later thinned to one at a spacing of 1m x 1m before treatments application.After harvesting, the experimental plot was manually cleared by hoeing and two seeds of white seeds melon were replanted per hole and later thinned to one at a spacing of 1m x 1m with a total of twenty (20) plants per plot for evaluation of residual effect of the fertilizer materials applied during the first growing year.

Soil samples were randomly collected from 0 – 20 cm depth, thoroughly mixed to form a composite which was analyzed for physical and chemical properties prior to commencement of experiment. At the harvest, another set of composite samples were collected per plot basis and similarly analyzed for routine chemical analysis as described by Carter (1993). The soil samples were air-dried and sieved using a 2 mm sieve before making the determinations. Soil organic matter was determined by the procedure of Walkley and Black using the dichromate wet oxidation method (Nelson and Sommers, 1996), total N was determined by micro-Kjeldahl digestion method (Bremner, 1996), available P was determined by Bray-1 extraction followed by molybdenum blue colorimetry (Frank *et al*., 1998). Exchangeable K, Ca and Mg were extracted using 1.0 N ammonium acetate. Thereafter, K was determined using a flame photometer and Ca and Mg were determined by EDTA titration method (Hendershot and Lalande, 1993). Soil pH was determined in soil water (1:2) medium using the digital electronic pH meter. Particle size analysis was done using Bouyoucos hydrometer method (Sheldrick and Hand Wang, 1993). Soil bulk density was determined using the core method (Campbell and Henshall, 1991).

Data collection and statistical analysis

Five plants of white seed melon were randomly selected from each plot across the three blocks for growth determination. The parameters assessed included number of leaves, number of branches, vine length leaf length and leaf width. The data collected were subjected to analysis of variance (ANOVA) using the SPSS package (version 16) and treatment means were compared using the Duncan's multiple range test (DMRT).

RESULTS

Pre-Planting Soil properties

Table 1 shows soil properties of the experimental site at Kabba Nigeria prior to planting. The soil at the location was sandy loam, acidic, low in N, available P, exchangeable K and OM.Therefore, additional soil conditioner would be needed before the soil could effectively produce crop in accordance with the rating of Akinrinde and Obigbesan (2000).

Table 1: Pre-Planting Soil properties

Property	Values
Sand (%)	77.6
Silt (%)	11.9
Clay (%)	10.5
Textural Class	Sandy loam
Bulk density g/cm^3	1.45
Total porosity (%)	43.2
pH (H_20)	5.61
Organic Matter (%)	2.28
Total N (gkg^{-1})	0.17
Available P (mgkg^{-1})	13.41
Exchangeable K (cmolkg^{-1})	0.14
Exchangeable Ca (cmolkg^{-1})	2.13
Exchangeable Mg (cmolkg^{-1})	1.14
Na (cmolkg^{-1})	0.52
H (cmolkg^{-1})	1.37
Al (cmolkg^{-1})	0.75
ECEC	6.05
BS (%)	65.0

Table 2: Residual Effects of soil amendments on number of leaves of white seed melonat Kabba

Treatments	Weeks after planting (WAP)				
	2	8	14	20	26
Control	2.83l	13.69k	64.87l	131.67k	194.34j
300 kg/ha NPKF	3.48k	19.66j	87.68k	146.11j	215.47i
4 t/ha CBH + 200 kg/ha NPKF	4.70f	22.43ab	96.43a	169.21a	239.38a
4 t/ha CBH + 100 kg/ha NPKF	5.41b	20.62gh	92.52d	161.51e	238.11cd
4 t/ha CPH + 200 kg/ha NPKF	5.16c	21.42de	95.20c	163.00c	237.48de
4 t/ha CPH + 100 kg/ha NPKF	5.48a	20.51hi	91.00g	160.70f	238.14cd
4 t/ha CPW + 200 kg/ha NPKF	5.00e	20.93fgh	95.66b	164.10b	238.72bc
4 t/ha CPW + 100 kg/ha NPKF	4.10i	21.81cd	92.41e	162.41d	236.00f
4 t/ha KPH + 200 kg/ha NPKF	5.10d	20.94fg	92.00f	156.00i	234.72g
4 t/ha KPH + 100 kg/ha NPKF	3.48j	21.10ef	90.68gh	156.72h	231.10h
2 t/ha WM + 200 kg/ha NPKF	4.16h	20.17i	90.31i	163.00c	230.00i
2 t/ha WM +100 kg/ha NPKF	4.26g	19.68j	88.31j	157.72g	237.20e

NPKF = NPK fertilizer, CBH = cocoa bean husk, CPH = cocoa pod husk, CPW = cocoa pod waste, KPH = kola pod husk and WM = weed mulch: means with the same letters are not significantly different (*P*<0.05) from other.

The results on the residual effects of amendments on number of leaves of white seed melon are shown in Table 2. The results showed that soil treated with application of plant residues at 4 t/ha CBH +200 kg/ha NPKF, 4 t/ha CPW +200 kg/ha NPKF, 4 t/ha CPH +200 kg/ha NPKF, 4 t/ha KPH 200 kg/ha NPKF significantly ($p < 0.05$) increased number of leaves of white seed melon from 2 weeks after planting up to 26 WAP compared with 300 kg/ha NPKF and the control. Values on number of leaves recorded for the soils treated with weed mulch (WM) in combination with 200 or 100 kg/ha NPKF were significantly lower than values recorded for other amendments but significantly higher than the values on number of leaves obtained for plots treated with 300 kg/ha NPKF and control.

Table 3: Residual effects of soil amendments on vine length (cm) of white seed melonat Kabba

Treatments	Weeks after planting (WAP)				
	2	8	14	20	26
Control	4.69i	68.72i	171.91k	224.31k	280.77j
300 kg/ha NPKF	5.10f	70.31h	270.37j	523.72j	737.15i
4 t/ha CBH + 200 kg/ha NPKF	4.98g	80.14a	333.50a	614.14a	795.00a
4 t/ha CBH + 100 kg/ha NPKF	6.00a	77.78c	325.41c	595.73c	779.13d
4 t/ha CPH + 200 kg/ha NPKF	5.40d	78.20b	312.20e	595.78c	788.40c
4 t/ha CPH + 100 kg/ha NPKF	5.23e	75.10d	304.71f	575.16e	785.42e
4 t/ha CPW + 200 kg/ha NPKF	6.00a	80.42a	331.50b	600.73b	790.73b
4 t/ha CPW + 100 kg/ha NPKF	5.72c	78.38b	315.20d	586.00d	778.13e
4 t/ha KPH + 200 kg/ha NPKF	4.72i	77.38c	302.00g	572.40f	771.00f
4 t/ha KPH + 100 kg/ha NPKF	5.14f	73.48e	284.30g	565.17g	750.73g
2 t/ha WM + 200 kg/ha NPKF	5.90b	72.61f	284.15h	543.20h	746.35h
2 t/ha WM +100 kg/ha NPKF	4.68i	71.38g	278.14li	535.48i	745.98h

NPKF = NPK fertilizer, CBH = cocoa bean husk, CPH = cocoa pod husk, CPW = cocoa pod waste, KPH = kola pod husk and WM = weed mulch: means with the same letters are not significantly different (*P*<0.05) from other.

Table 4: Residual effects of soil combined amendments on number of branches of white seed melon at Kabba

Treatments	Weeks after planting (WAP)				
	2	8	14	20	26
Control	1.00e	1.70f	3.05k	5.00k	7.00k
300 kg/ha NPKF	1.02f	2.57e	5.00j	7.30j	9.39j
4 t/ha CBH + 200 kg/ha NPKF	1.04b	3.05a	6.01a	9.43a	10.93a
4 t/ha CBH + 100 kg/ha NPKF	1.02d	3.03bc	5.98c	9.38c	10.10d
4 t/ha CPH + 200 kg/ha NPKF	1.03c	3.04ab	6.00b	9.26d	10.92a
4 t/ha CPH + 100 kg/ha NPKF	1.00e	3.00bc	5.10f	7.43h	10.13c
4 t/ha CPW + 200 kg/ha NPKF	1.06a	3.05a	6.00b	9.40b	10.94a
4 t/ha CPW + 100 kg/ha NPKF	1.03c	3.02bc	5.84d	9.20e	10.52b
4 t/ha KPH + 200 kg/ha NPKF	1.02d	3.00bc	5.40e	8.05f	10.92a
4 t/ha KPH + 100 kg/ha NPKF	1.00e	3.00bc	5.08g	8.03g	10.01e
2 t/ha WM + 200 kg/ha NPKF	1.06e	2.99c	5.02h	7.37i	10.00f
2 t/ha WM +100 kg/ha NPKF	1.00e	2.70d	5.01i	7.30j	9.40k

NPKF = NPK fertilizer, CBH = cocoa bean husk, CPH = cocoa pod husk, CPW = cocoa pod waste, KPH = kola pod husk and WM = weed mulch: means with the same letters are not significantly different (*P*<0.05) from other.

Table 3 shows the residual influence of soil amendments on vine length of white seed melon in the second growing year. Observation revealed that there were variations in the values of vine length for each plot. Application of soil amendments showed that 4 t/ha CBH +200 kg/ha NPKF, 4 t/ha CPW+200 kg/ha NPKF, 4 t/ha CPH +200 kg/ha NPKF, 4 t/ha KPH+200 kg/ha NPKF significantly ($p < 0.05$) improved vine length of white seed melon relative to 300 kg/ha NPKF and control. Soil treated with combined application of plants residues with either 200 or 100 kg/ha NPKF showed significant vine length improvement over 2 t/ha WM in combination with 200 or 100 kg/ha NPKF, 300 kg/ha NPKF and the control. Highest and least values of vine length were observed from the plots treated with 4 t/ha CBH+200kg/ha NPKF and control respectively in most observations.

Number of branches of white seed melon was observably affected by soil amendments residue in the second growing season as shown in table 4. Soil previously treated with 300 kg/ha NPKF and control were significantly lower in number of branches of white seed melon compared with other soil amendments. Amendments in combination with either 200 or 100 kg/ha NPKF showed significant improvement on number of branches compared with 300 kg/ha NPKF and control.

Table 5 shows the result on leaf length of white seed melon as affected by residual amendmentsfrom 2 to 26 weeks after planting. Observations revealed that soil amendment applied in the first year showed significant effects on leaf length of white seed melon relative to plots treated with 300 kg/ha NPKF and the control. Highest values of leaf length recorded for 4 t/ha CBH + 200 kg/ha NPKF showed no significant differences at 2, 14 and 26 compared with 4t/ha CPW +200kg/ha NPKF. Plots treated with 300kg/ha NPKF and the control had the least values of leaf length respectively.

Table 5: Residual effects of soil amendments on leaf length (cm) of white seed melonat Kabba

Treatments	Weeks after planting (WAP)				
	2	8	14	20	26
Control	6.90f	9.70i	11.29g	12.54j	13.25h
300 kg/ha NPKF	6.79d	11.20h	12.60f	13.54i	14.55g
4 t/ha CBH + 200 kg/ha NPKF	7.20a	12.64a	14.05a	15.15a	16.00a
4 t/ha CBH + 100 kg/ha NPKF	7.00c	12.00e	14.00b	15.00d	15.88b
4 t/ha CPH + 200 kg/ha NPKF	7.20a	12.05c	14.00b	15.10b	16.00a
4 t/ha CPH + 100 kg/ha NPKF	7.01c	12.00e	14.00b	14.93e	15.27d
4 t/ha CPW + 200 kg/ha NPKF	7.23a	12.40b	14.05a	15.10b	16.00a
4 t/ha CPW + 100 kg/ha NPKF	7.10b	12.00e	13.98b	14.91e	15.41c
4 t/ha KPH + 200 kg/ha NPKF	7.00c	12.01d	14.00b	15.05f c	15.84b
4 t/ha KPH + 100 kg/ha NPKF	6.82e	12.00e	13.86c	14.58f	15.21e
2 t/ha WM + 200 kg/ha NPKF	7.01c	11.72f	13.42d	14.20g	15.00f
2 t/ha WM +100 kg/ha NPKF	7.00c	11.58g	13.00e	14.10h	15.00f

NPKF = NPK fertilizer, CBH = cocoa bean husk, CPH = cocoa pod husk, CPW = cocoa pod waste, KPH = kola pod husk and WM = weed mulch: means with the same letters are not significantly different ($P<0.05$) from other.

Values on leaf width of white seed melon as affected by residual sole and combined soil amendment between 2 and 26 WAP are shown in Table 6. At 2, 8, 14, 20 and 26 WAP, 4t/ha CBH +200kg/ha NPKF recorded highest value of leaf width andwas not significantly different from plot previously treated with 4t/ha CPW +200kg/ha NPKF but showed significant increased compared with the remaining soil amendments. Values on leaf width recorded for the soil treated with 300 kg/ha NPKF and control were generally lower than the values obtained for other soil amendments throughout the period of observations although 300 kg/ha NPKF was significantly higher than the control which was the least.

Table 6: Residual effects of soil amendments on leaf width (cm) of white seed melonat Kabba

Treatments	Weeks after planting (WAP)				
	2	8	14	20	26
Control	9.03i	11.95h	13.17l	15.17i	17.41j
300 kg/ha NPKF	9.13h	12.98g	15.10k	18.13h	19.41i
4 t/ha CBH + 200 kg/ha NPKF	9.50a	13.72a	17.00a	20.14a	22.00a
4 t/ha CBH + 100 kg/ha NPKF	9.41d	13.40c	16.53c	19.98c	21.70d
4 t/ha CPH + 200 kg/ha NPKF	9.44c	13.51b	16.58b	20.03b	21.89b
4 t/ha CPH + 100 kg/ha NPKF	9.41d	13.17c	16.28e	19.50e	21.40f
4 t/ha CPW + 200 kg/ha NPKF	9.49b	13.47b	16.98a	20.13a	22.00a
4 t/ha CPW + 100 kg/ha NPKF	9.40d	13.30d	16.37d	19.72d	21.51e
4 t/ha KPH + 200 kg/ha NPKF	9.41d	13.51b	16.52c	19.89c	21.83c
4 t/ha KPH + 100 kg/ha NPKF	9.37e	13.03ie	16.13f	19.41f	21.23g
2 t/ha WM + 200 kg/ha NPKF	9.28f	13.00ef	16.02i	19.40f	21.21g
2 t/ha WM +100 kg/ha NPKF	9.27g	13.00ef	15.66j	19.00g	20.86h

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Effects of residuum amendments on soil nitrogen content are shown in Table 7. The soil N was significantly increased by the residue of soil amendments after first planting from 0.21 to 0.58 %. The least value of N content was recorded for the control followed by the soil previously treated with 300 kg/ha NPKF. Significant increases in soil P content were noticed from the plots treated with combination of crop residue and synthetic fertilizer relative to 300 kg/ha NPKF and the control. Values of soil P obtained ranged from 25.49 to 8.08 %. Among the soil amendments applied previously, 300 kg/ha NPKF recorded the least value of soil P.

Table 7: Residual effects of soil amendments on soil physical and chemical properties after harvest at Kabba

Treatments	Soil chemical properties									
	N (%)	P (mg/kg)	K (cmol/kg)	Ca (cmol/kg)	Mg (cmol/kg)	Na (cmol/kg)	H (cmol/kg)	Al (cmol/kg)	ECEC (cmol/kg)	BS (%)
Control	0.20i	8.08j	0.12e	1.00n	0.12i	0.24e	1.01f	0.13i	2.62k	56.49g
300 kg/ha NPKF	0.31h	14.80i	0.37d	1.41ef	0.31h	0.41d	1.42bc	0.41bc	4.33ij	57.74f
4t/haCBH+200kg/haNPKF	0.49a	23.41a	0.66abcd	1.51a	0.31h	0.57ab	1.38cd	0.39cd	4.70cdef	62.34c
4t/haCBH+100kg/haNPKF	0.43c	22.10e	0.44cd	1.42de	0.62bc	0.43cd	1.27e	0.40bcd	4.58ghi	63.54b
4t/haCPH+200kg/haNPKF	0.46b	22.92c	0.48cd	1.26m	0.51ef	0.53bc	1.67a	0.25g	4.70efgh	59.15e
4t/haCPH+100kg/haNPKF	0.41e	21.37f	0.42cd	1.32l	0.43g	0.39d	1.44bc	0.20h	4.20j	60.95d
4t/haCPW+200kg/haNPKF	0.46b	23.00b	0.46cd	1.40fg	0.53de	0.41d	1.31de	0.18h	4.29ij	65.27a
4t/haCPW+100kg/haNPKF	0.43c	21.10e	0.59abcd	1.43cd	0.67ab	0.58a	1.46bc	0.38d	5.11abcd	63.99b
4t/haKPH+200kg/haNPKF	0.42d	22.78d	0..41cd	1.45b	0.42g	0.38d	1.43bc	0.30f	4.39hij	60.59d
4t/haKPH+100kg/haNPKF	0.39f	20.00g	0.46cd	1.38hi	0.42g	0.39d	1.47bc	0.35e	4.47ghij	59.28e
2t/haWM+200kg/haNPKF	0.39f	19.40h	0.54abcd	1.44bc	0.64bc	0.57ab	1.67a	0.44a	5.42a	61.07d
2t/haWM+100kg/haNPKF	0.36g	18.00i	0.54abcd	1.45b	0.60bcd	0.61a	1.62a	0.42ab	5.24abc	61.07d

NPKF = NPK fertilizer, CBH = cocoa bean husk, CPH = cocoa pod husk, CPW = cocoa pod waste, KPH = kola pod husk and WM = weed mulch: means with the same letters are not significantly different (P<0.05) from other

The results of the study on residual soil amendment on concentration of soil K after harvest revealed that all the amendments leftover significantly increased soil K concentration. Highest value of K was obtained for 4 t/ha CBH + 200 kg/ha NPKF although was not significantly different from 4 t/ha CPW + 200 kg/ha NPKF,2 t/ha WM + 200 kg/ha NPKF and 2 t/ha WM + 100 kg/ha NPKF but significantly higher than other.The soil calcium concentration after harvest was significantly increased by the residuum amendment relative to the value of calcium obtained for the plot previously treated with 300 kg/ha NPKF and the control. Among the amendments imposed previously, 4 t/ha CPW + 200 kg/ha NPKF had the highest value of Ca and it was significantly different from others. The values of soil Ca in the samples after harvest ranged from 1.00 to 1.51.Magnesium (Mg) content varied significantly across the plots treated in the past with different combination of amendments. All the residual amendments significantly improved soil Mg concentration compared to the control.The residue of amendments imposed previously significantly improved soil sodium (Na) concentration after harvest relative to the control. The value of Na ranged from 0.24 to 0.61. The results on soil exchangeable acidity revealed that residue of soil amendments significantly improved soil exchangeable acidity after harvest. The values of (H and Al) ranged from (1.01; 0.61) to (1.13; 0.44). The values of ECEC obtained showed that all the amendment residues had significant effect compared with the control. Values of ECEC ranged from (2.62 to 5.42). The soil base saturation experienced improvement with amendments residue compared to the control. The base saturation was increased from (56.49 to 65.28 %)

DISCUSSION

The findings revealed that soil amendment residues improved growth performance in term of number of leaf, vine length, number of branches, leaf length and width of white seed melon in the second year. Plots previously treated with 300kg/ha NPKF recorded the least value of growth parameters compared with other soil amendments applied in the past but significantly higher than the control in all observations. Better growth performance observed in the plot previously treated plant residues in combination with NPKF could be attributed to the ability of the fertilizer materials to gradually release its nutrients for the sustenance of crop growth and performance throughout the growing season compared with inorganic fertilizer which quickly releases it nutrient. This is in agreement with the findings of (Omisore*et al.,* 2009; Schippers, 2000;Akande*et al.,* 2012; Aderi*et al.,* 2011 and Ndor*et al.,*2013) that significant increase in growth parameters of fluted pumpkin were observed as the growth advanced in organic amendment treated plots. This observation confirmed the importance of organic amendments in promoting white seed melon performance even after a year application as it was observed in this research.This study has established that soil amendments contributed to the fertility of the soil and made nutrient available to plant for proper growth and development (Brady and Weil, 2007; Adeoluwa*et al.,* 2010). It is also clear that soil amendment increased the growth of green amaranths compared to the control. Soil fertility status was also improved. This is consistent with the findings of Liu and Stutzel, (2004) and Adeoluwa*et al.,* (2010). The finding is also in agreement with that of Plaster, (1992) and Prasad and Singh, (2000), who stated that soil treated with soil amendments increased number of leaves, plant height and dry matter weight per plant compared to the untreated soil.

CONCLUSION

This work on effects of residual soil amendments on soil properties and growth performance of white seed melon revealed that the selected crop residues were effective in improving soil chemical properties which translated to improvement in the growth parameters of white seed melon. This means that the nutrients in the fertilizer materials applied in the first growing yearcould still adequately support and sustain crop in the second growing year unlike synthetic fertilizer applied alone which would have released all its nutrients at once. Both 4 t/ha CBH + 200 kg/ha NPKF and 4 t/ha CPW + 200 kg/ha NPKF improved soil chemical properties and recorded higher growth parameters compared to 300 kg/ha NPKF and other amendments. 4 t/ha CBH + 200 kg/ha NPKF is more superior to 4 t/ha CPW + 200 kg/ha NPKF as observed in this experiment and is therefore recommended.

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