Soil fertility evaluation for Cashew production at Iyapo farm Estate, Offa, Kwara State

Abstract

Cashew (*Anacardium occidentale* L) is an important commodity crop with great potential as a foreign exchange earner. It is grown principally for it nuts and apple and is a hardy crop which is adapted to a wide range of agro-ecologies. As result of increased in the price of cashew nuts globally, many people developed interest in the cultivation of the crop. The Management of Iyapo farms Limited in its desire to key into this sector requested the technical assistance of Cocoa Research Institute of Nigeria (CRIN) to carry out soil fertility evaluation of the 50 hectares of land proposed for establishment of cashew. The farm was divided into three main sections (A, B and C) based on topography and four land use types (water logged, cassava plot, previously cultivated land and excavated land). section A was parallel to River Oyun followed by section B in the middle of the farm, while the last section C ran parallel to the road from Ijagbo town. The land use types were scattered within the three blocks. The water logged area was however confined only to section A which was close to river Oyun.

Soil samples were collected at soil depths of 0-20 cm and 20-40 cm and at a distance of 20 m apart. The soil collected was put in nylon bags and properly labelled. Soil samples collected were air dried, passed through 2 mm sieve and analyzed for some of its physical and chemical properties. In section A, total soil nitrogen at 0-40cm soil depth ranged between 0.07g/kg to 0.18g/kg with a mean value of 0.11 g/kg soil while mean soil available phosphorus at 0-40cm soil depth was 3.16mg/kg. The exchangeable potassium content across 0-40cm soil depth ranged between 0.09cmol/kg to 0.35 cmol/kg with a mean value of 0.25 cmol/kg and 0.19cmol/kg for 0-20 cm and 20-40cm soil depth respectively. In section B, nitrogen across the various soil depths ranged between 0.04 g/kg to 0.12 g/kg with nitrogen content of the soil decreasing with increasing soil depth. This falls below the soil critical level of 1 g/kg required for cashew and was grossly inadequate to meet nitrogen need for cashew. There is need for nutrient supplementation as Nitrogen fertilizer is required to meet the nitrogen needs of the cashew. Similarly, phosphorus was also inadequate across the soil depths with a range of 2.47 mg/kg to 4.51 mg/kg across the various soil depth and a mean value of 3.24 mg/kg and 2.65 mg/kg for 0-20cm and 20-40cm soil depths respectively. This was below the soil critical value of 3.7 mg/kg. There is therefore need to apply phosphorus fertilizer to boost cashew productivity.

Soil exchangeable potassium was adequate across the various soil depths with a range of 0.13 to 0.20 cmol/kg and a mean value of 0.18 cmol/kg and 0.16 cmol/kg for 0-20cm and 20-40cm soil depths respectively. There is no need for potassium fertilizer application. The results above indicated that sections A, B and C require 180kg/ha of urea and 31.5 kg of Single Super Phosphate (SSP). The cassava plot and previously cropped bare land requires 189 kg/ha urea and 9.9 kg/ha SSP, while the excavated land requires 194.2 kg urea 25.8 kg SSP and 32.28 kg MOP. Cashew should not be grown on the water-logged section.

Key words: Cashew, Soil fertility, nutrient management, fertilizer, yield

Introduction

Cashew is an important commodity crop with great potentials as foreign earner and source of industrial raw materials with the prospect of becoming a major commercial tree crop in Nigeria. Cashew as a result of its wide adaptation is often grown in very poor soils and this has affected its survival and establishment (Opeke, 2005; Topper, *et al*.2001). Cashew is a commodity crop of international recognition for its numerous importance, food security, foreign exchange earnings, and afforestation with its roles in mitigating the adverse effects of climate change. It is a hardy crop which survives where most tree crops cannot thrive (Ohler, 1979). Hence, it is cultivated in a variety of ecological zones of Nigeria which connotes a wide variety of soil. It is often grown on poor soils and this has affected its survival and adaptability. Cashew nuts production has the potential of increase in Nigeria if available resources are adequate annexed. Particularly important is the financial resources needed to boost cultivation and perform marketing functions that can further facilitate cashew production couple with appropriate record keeping for sustainability. Cashew nuts are among the healthiest and most popular nuts in the world and regular consumption can contribute to the reduction of risks of cardiovascular diseases (MTP 15). The cashew apple is edible fruit rich in vitamin C, sugars and contains considerable amount of tannins (35%, less in the yellow) and minerals, mainly calcium, iron and phosphorous. The fruit can be improved on for consumption and trade by removing the undesirable tannins and processing the apples into value-added products, such as juices, syrups, canned fruits, pickles, jams, chutneys, candy and coffee. The nuts are also processed for other value- added products.

Cashew however grows optimally with corresponding economic returns under ideal soil condition and proper management. Good soil management is a criterion for good quality and high yield of both cashew nuts and apples. This is however lacking in cashew production in Nigeria. Some of the components of good soil management include proper site selection and use of fertilizer. Proper site selection is critical in cashew production because it's a long term investment and this site should have deep soil (1-1.5 m), well drained with steady and continuous supply of nutrients.

Iyapo farm is interested in establishing about 50 hectares of cashew. Soil fertility evaluation is crucial to ensure appropriate recommendation of soil management practice to enhance establishment and yield of cashew. The objective of this work is to carry out soil fertility assessment of Iyapo farm for cashew cultivation.

Materials and Methods

Study Site

Kwara State is located between latitude 7°N and longitude 3°E and 7°E. It is geographically located at the Southern border of River Niger and in the Southern guinea savanna. The average annual rainfall in the State is 1202.4mm with two peaks in July and September and a dry spell in August, known as August break. The rainfall starts in late April and ends in October. The Average monthly temperature are fairly constant. However, February, March and April are the

hottest months, while June to September has lowest maximum temperature which coincides with the peak of the dry and wet seasons respectively (Ogunwale *et al*, 1999).

Parent materials

Kwara State has two distinct geologies. The soils were formed from basement complex rocks metamorphic and igneous rocks) which is about 95% and sedimentary rock along the Niger River bank which is about 5% of the total area. The metamorphic rocks include biotite gneiss, quartizite, augite gneiss and grantitic gnesis. The intrusive pegmatite and vein quarz (Lawal, 1977).

The farm is located at Ijagbo, Oyun Local Government area near Offa Kwara State. It is on latitude 8° 13.44¹N, longitude 0040 43.501¹ and 36.5 metres above sea level. The 49.547 hectares' farm which is located in the Southern Guinea Zone is bounded by River Oyun, a citrus farm, farm house and a road from Ijagbo at the four boundaries. The farm consisted of scattered locust bean trees, oil palm trees and a few cashew stands. Part of the farm was presently cultivated with cassava, while some had been previously cropped with maize. There was evidence of sand mining in the excavated lands while excavation of the top soil had been carried out.

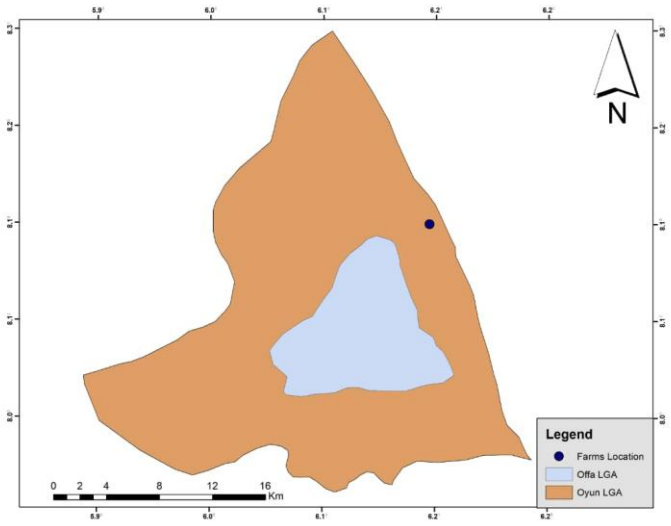

Figure 1: Map of Kwara State showing the location of Iyapo farm

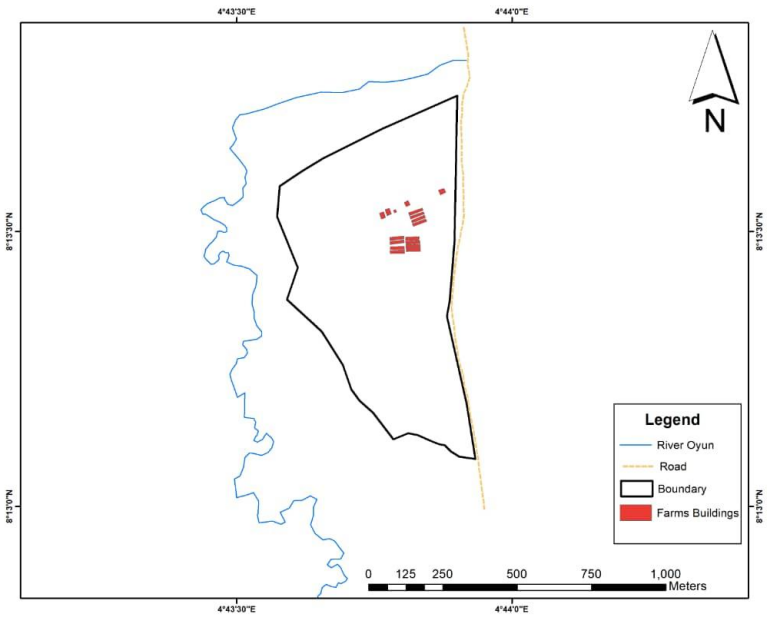

Figure 2: Map of Iyapo farm in Kwara State, Nigeria

Methodology

Field soil sampling

The farm sampled was divided into three main sections (A, B and C) based on topography and four land use types (water logged, cassava plot, previously cultivated land and excavated land). Section A was parallel to River Oyun followed by section B in the middle of the farm while the last section C ran parallel to the road from Ijagbo. The land use types were scattered within the three blocks. However, the water logged area was confined only to section A which was close to river Oyun. Soil samples were collected at the depth of 0-20cm and 20-40cm and at a distance of 20m apart. The observation spots were selected in such a way that biased points like anthills and rocky spots were avoided. The soil collected were put in nylon bags and properly labelled.

Laboratory analysis

The soil samples collected were bulked to form composite samples, air dried passed through 2mm sieve and analysed for some of its physical and chemical properties. Particle size was determined by Bouyoucos hydrometer methods; soil pH was measured in 1:1 soil - water ratio using the EDT BA350 digital pH meter while organic carbon was determined by the wet digestion dichromate acid-oxidation method. Total N was determined using Kjeldahl digestion method and available P by Bray P1 method. Exchangeable cations (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}) were extracted with 1 N ammonium acetate (NH_4OAc) buffered at pH 7.0 (Thomas,1982). Exchangeable K and Na in the extracts were read through the Jenway flame photometer (model

PFP7) and Ca and Mg were read on Atomic Absorption Spectrophotometer (AAS) Buck Scientific 200A model. Exchangeable acidity was extracted with 1 N KCl and determined by titration with 0.05 N NaOH using phenolphthalein indicator (Mclean, 1965) while the effective cation exchange capacity (ECEC) was by summation method and percent base saturation was calculated as follows:

$$\% \text{ Base saturation} = \frac{\text{Exchangeable bases}}{\text{ECEC}} \times \frac{100}{1}$$

The fertilizer computation was based on the chemical properties of the top soil (0-20cm) taking into consideration that both lateral and creeping roots are housed at this soil depth.

Results and discussion

Soil physical and chemical characteristics

Section A

Soil physical and chemical characteristics of block A is shown on (Table 1). Sand content of the 0-20cm and 20-40cm soil depth ranged between 662g/kg to 762.4 g/kg and 602.4g/kg to 742.4g/kg respectively, with a mean value of 682.4g/kg. Sand content decreased with increasing soil depth. Silt content of the top 0-2cm soil depth ranged between 72.8g/kg to 232.8g/kg with a mean value of 160.8g/kg. The silt content of 20-40cm soil depth ranged between 112.8 to 252.8 g/kg, with a mean value of 172.8 g/kg. Silt content increased with increasing soil depth. Clay content of the soil decreased with increasing soil depth. Clay at the top 0-20cm soil depth ranged between 124.8g/kg to 164.8g/kg with a mean value of 151.8g/kg. Clay in 20-40cm soil depth also ranged between 144.8g/kg to 168.8g/kg with mean value of 149.1g/kg. The textural class of the soil is sandy loam. Despite the high sand content of the soil, cashew thrives well on this soil because cashew is hardy and adapt to dry environment (Ohler, 1979). The soil is slightly acidic with soil pH increasing with increasing soil depth. At the top 0-20cm soil depth, soil pH ranged between 6.19-6.66 with a mean value of 6.54. Cashew thrives well in soil of pH of 5-7.7. The soil pH is therefore favourable for cashew production.

Soil organic carbon content in the top 0-20cm soil depth ranged between 16.2g/kg to 28.8g/kg with a mean value of 19.7g/kg. Organic carbon at 20-40cm soil depth also ranged between 10.1g/kg to 22.7g/kg with a mean value of 15.35 g/kg and organic carbon content decreased with increasing soil depth. Soil organic carbon content was medium and was sufficient to sustain cashew production. Total soil nitrogen in the top 0-20cm soil depth ranged between 0.07g/kg to 0.18g/kg with a mean value of 0.1 g/kg soil. While total N in 20-40cm soil depth ranged between 0.07g/kg to 0.16g/kg with a mean value of 0.12g/kg. This is highly inadequate for cashew production, as this value is well below the soil critical value of 1g/kg (Egbe *et al*, 1989) required for cashew production. There is therefore urgent need to apply nitrogen fertilizer. Soil available phosphorus decreased with increasing soil depth. Soil available

phosphorus in the top (0-20cm) soil depth ranged between 2.82g/kg to 3.47mg/kg with a mean value of 3.22mg/kg. Similarly, available phosphorus at 20-40cm soil depth ranged between 1.78mg/kg to 4.08mg/kg with a mean value of 2.62mg/kg. Mean soil available phosphorus in the top 0-20cm soil depth was below the soil critical level of 3.7mg/kg, phosphorus level than the critical soil. Phosphorus level all other locations had values. At 20-40cm soil depth, soil available phosphorus also fell below the soil critical phosphorus level with a ranged of 0.09 mg/kg to 0.16mg/kg and a mean value of 2.62 mg/kg. There is need for application of phosphorus fertilizer. Mean exchangeable potassium content across 0-40cm soil depth ranged between 0.09cmol/kg to 0.35 cmol/kg with a mean value of 0.25 cmol/kg and 0.19cmol/kg for 0-20 cm and 20-40cm soil depth respectively. This is above the soil critical potassium level of 0.12 cmol/kg soil required for cashew production. There is therefore no need for potassium fertilizer application. Exchangeable calcium across the various soil depth was high ranging between 4.82 cmol/kg to 7.43 cmol/kg with a mean value of 6.69 cmol/kg and 5.91 cmol/kg for 0-20cm and 20-40cm soil depth respectively. Calcium content of the soil was adequate for cashew production as soil exchangeable calcium content was well above the soil critical calcium value of 0.8 cmol/kg soil. There is therefore no need for calcium fertilizer application. Similarly, soil exchangeable magnesium across the various soil depth ranged between 0.84 cmol/kg to 1.38 cmol/kg with mean value of 1.12 cmol/kg at 0-20cm and 20-40cm soil depth. Soil exchangeable magnesium was adequate for cashew production as it was well above the 0.08 cmol/kg soil recommended for cashew production. Exchangeable acidity ranged between 0.18cmol/kg to 0.76cmol/kg in the top 0-20cm soil depth with a mean value of 0.28cmol/kg. Exchangeable acidity of 20-40cm soil depth also ranged between 0.40 cmol/kg to 0.68 cmol/kg with a mean value of 0.51 cmol/kg soil.

Table 1: Physical and chemical properties of soils of section A at Iyapo farm Estate Offa, Kwara State

		Soil physical properties				Soil chemical properties						
Location	Soil depth (cm)	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	pH	Org.C (g/kg)	Total.N (g/kg)	Avail.P (mg/kg)	Exch.K (cmol/kg)	Exch.Ca (cmol/kg)	Exch.Mg (cmol/kg)	Exch.acidity (cmol/kg)
A1	0-20	762.4	72.8	164.8	6.19	20.0	0.027	3.47	0.35	7.43	1.38	0.76
A2	0-20	662.4	172.8	164.0	6.61	28.8	0.183	3.62	0.22	7.58	1.04	0.18
A3	0-20	642.4	232.8	134.6	6.32	16.2	0.128	2.82	0.22	6.20	1.22	0.48
A4	0-20	682.4	164.8	152.8	6.35	13.9	0.053	2.98	0.20	5.53	0.83	0.56
Total	0-20	2749.6	643.2	607.2	25.47	78.9	0.391	12.89	0.99	26.74	4.47	1.12
Mean	0-20	687.4	160.8	151.8	6.37	19.7	0.10	3.22	0.25	6.69	1.12	0.28
A1	20-40	742.4	144.8	112.8	6.38	17.4	0.091	4.08	0.26	6.43	1.32	0.68
A2	20-40	642.6	192.8	164.8	6.62	22.7	0.145	2.76	0.26	6.55	1.21	0.60
A3	20-40	602.4	252.8	144.8	6.65	11.2	0.070	1.84	0.15	5.82	1.10	0.40
A4	20-40	722.4	132.8	144.8	6.50	10.1	0.162	1.78	0.09	4.82	0.84	0.44
Total	20-40	2709.8	691.2	599.2	19.51	61.4	0.468	10.46	0.76	23.62	4.47	2.12
Mean	20-40	677.45	172.8	149.8	4.80	15.35	0.117	2.62	0.19	5.91	1.12	0.51

Table 2: Physical and chemical properties of soils of section B at Iyapo farm Estate Offa, Kwara State

		Soil physical properties				Soil chemical properties						
Location	Soil depth (cm)	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	pH	Org.C (g/kg)	Total.N (g/kg)	Avail.P (mg/kg)	Exch.K (cmol/kg)	Exch.Ca (cmol/kg)	Exch.Mg (cmol/kg)	Exch.acidity (cmol/kg)
B1	0-20	802.4	32.8	164.8	6.24	18.1	0.119	4.51	0.17	5.53	0.97	0.62
B2	0-20	782.4	92.8	124.8	6.57	38.0	0.075	2.93	0.17	5.03	0.91	0.68
B3	0-20	782.4	92.8	124.8	6.53	7.00	0.067	2.47	0.17	5.53	0.95	0.64
B4	0-20	762.4	112.8	124.8	6.65	11.2	0.091	3.05	0.20	6.05	0.96	0.48
Total	0-20	3129.6	331.2	539.2	26.02	74.3	0.352	12.96	0.71	22.14	3.74	2.42
Mean	0-20	782.4	82.8	134.8	6.51	18.6	0.088	3.24	0.18	5.54	0.95	0.61
B1	20-40	782.4	92.8	124.8	6.63	10.5	0.101	3.05	0.20	5.28	0.97	0.88
B2	20-40	782.4	92.8	124.8	6.31	6.10	0.083	3.10	0.13	5.93	0.94	0.36
B3	20-40	762.4	92.8	144.8	6.66	3.20	0.039	2.82	0.13	5.86	0.80	0.56
B4	20-40	742.4	32.8	224.8	6.68	9.70	0.062	2.47	0.17	5.28	0.97	0.44
Total	20-40	3069.6	311.2	464.4	26.28	633.4	0.285	11.43	0.63	22.32	36.8	2.23
Mean	20-40	767.4	77.8	154.8	6.57	158.4	0.07	2.56	0.16	5.59	0.92	0.56

Section B

The sand in the top 0-20cm soil depth ranged from 762.4 g/kg to 802.4 g/kg with a mean value of 782.4 g/kg. In the 20-40cm soil depth, sand content ranged between 742.4g/kg to 782.4g/kg with a mean value of 767.4 g/kg, with sand content decreasing with increasing soil depth (Table 2). Silt in the 0-20cm soil depth ranged between 32.8-112.8g/kg with a mean value of 82.5 g/kg. Similarly, silt in 20-40cm soil depth ranged between 32.8g/kg to 92.8 g/kg with a mean value of 77.8 g/kg, with silt content increasing with increasing soil depth. Clay content across the 0-40cm soil depth ranged between 124g/kg to 224.8 g/kg with a mean value of 134.8 g/kg and 154.8 g/kg for 0-20cm and 20-40cm soil depth respectively. The textural class of the soil is loamy sand. This is ideal for cashew production. Soil pH content across the various soil depth ranged between 6.24-6.68 with a mean value of 6.51 at 0-20cm soil depth and 6.57 at 20-40cm soil depth. The soil is slightly acidic and okay for cashew production as it falls within the pH range recommended for cashew production. Soil organic carbon at the top 0-20cm soil depth ranged between 7 g/kg with a mean value of 18.6 g/kg. Soil in the 20-40cm soil depth ranged between 3.2 g/kg to 10.5g/kg with a mean value of 7.38 g/kg. Soil organic carbon content decreased with increasing soil depth. Organic carbon in the top 0-20cm was sufficient to sustain cashew production. However, at the lower 20-40cm soil depth soil organic carbon was insufficient. There may be need to apply organic fertilizer in subsequent years to enhance the organic carbon content of the soil. Nitrogen across the various soil depths ranged between 0.04 g/kg to 0.12 g/kg with nitrogen content of the soil decreasing with increasing soil depth. This falls below the soil critical level of 1 g/kg required for cashew and was grossly inadequate to meet nitrogen need for cashew. There is therefore need for nutrient supplementation as fertilizer to meet the nitrogen needs of cashew. Phosphorus was also inadequate across the soil depth with a range of 2.47 mg/kg to 4.51 mg/kg across the various soil depth and a mean value of 3.24 mg/kg and 2.65 mg/kg for 0-20cm and 20-40cm soil depth respectively. This was below the soil critical value of 3.7 mg/kg. There is therefore need to apply phosphorus fertilizer to boost cashew productivity. Soil exchangeable potassium was adequate across the various soil depth with a range of 0.13 to 0.20 cmol/kg and a mean value of 0.18 cmol/kg and 0.16 cmol/kg for 0-20cm and 20-40cm soil depth respectively. There is therefore no need for potassium fertilizer application. Soil exchangeable calcium and magnesium were also adequate. Soil exchangeable calcium had a mean value of 5.54 cmol/kg and 5.59 cmol/kg in 0-20cm and 20-40cm soil depth respectively. This was well above the soil critical level of 0.8 cmol/kg required for cashew. Similarly, exchangeable magnesium content ranged between 0.80 cmol/kg soil and 0.94 cmol/kg soil with mean value of 0.95 cmol/kg and 0.93 cmol/kg for 0-20cm and 20-40cm soil depth respectively. This was also well above the soil critical value of 0.08 cmol/kg soil required for cashew production. Mean exchangeable acidity was 0.61 cmol/kg and 0.56 cmol/kg for 0-20cm and 20-40cm soil depth respectively. This was also adequate for cashew production.

Table 3: Physical and chemical properties of soils of section C at Iyapo farm Estate Offa, Kwara State.

		Soil physical properties						Soil chemical properties				
Location	Soil depth (g/kg)	Sand (g/k	Silt (g/kg)	Clay (g/kg)	pH (cmol/kg)	Org. C (cmol/kg)	Total N (cmol/kg)	Avail P (cmol/kg)	Exch K(cmol/kg)	Exch Ca	Exch Mg	Exch. acidity
C1	0-20	782.4	92.8	124.8	6.48	18.10	0.167	3.74	0.30	5.27	1.16	1.08
C2	0-20	782.4	92.8	124.8	6.51	12.00	0.048	3.97	0.13	5.03	0.72	0.80
C3	0-20	802.4	172.8	24.8	6.47	14.30	0.111	4.90	0.28	9.13	1.04	0.72
C4	0-20	722.4	132.8	144.8	6.34	5.10	0.137	2.75	0.24	7.32	1.22	0.68
Total	0-20	3,089.6	391.2	519.2	25.8	49.50	0.463	15.06	0.95	26.75	4.14	2.56
Mean	0-20	772.4	97.8	129.8	6.45	12.38	0.12	3.77	0.24	6.68	1.04	0.64
C1	20-40	762.4	112.8	124.8	6.46	12.40	0.128	4.49	9.29	6.42	1.24	0.44
C2	20-40	782.4	92.8	124.8	6.67	10.50	0.045	4.20	0.11	6.18	0.55	0.76
C3	20-40	702.4	92.8	204.8	6.18	16.20	0.099	4.04	0.24	6.88	1.11	0.84
C4	20-40	742.4	112.8	144.8	6.56	11.20	0.115	4.43	0.24	6.61	1.20	0.60
Total	20-40	2989.6	411.2	599.2	25.87	50.30	0.287	17.16	0.85	26.09	4.10	2.64
Mean	20-40	747.4	102.8	149.8	6.47	12.57	0.10	4.29	0.21	6.52	1.03	0.60

Section C

The mean sand, silt and clay at the top soil (0-20cm) was 772.6, 97.8 and 129.8 g/kg soil respectively while the mean sand, silt and clay at the sub soil was 747.4, 102.8 and 149.8 g/kg soil respectively (Table 3). The soil has a very high sand fraction both at the top and sub- soil. Although the sand fraction at the top soil decreased by 3.2% at the sub-soil while the silt and clay both increased by 5% and 15% respectively.

The clay soil content is below 300 g/kg soil which can be considered low and the possibility of water deficit during the dry season is there. However, cashew has ability to adapt to dry environment more than many other tree crops as soon as it survives the first two years of establishment. It is still expected that with good agronomic practices, cashew will still establish despite the level of sand in the farm.

The pH of the soil at both depth was 6.46 and thus falls within the acceptable range of 5.50 to 6.50 for cashew cultivation. Hence, there is no need for any form of adjustment through liming. The average organic carbon and total N at the top soil (0-20cm) was 12.38 and 0.12 g/kg while at the sub soil (20-40cm), the mean was 12.57 and 0.10 g/kg soil respectively. This shows that the organic carbon and the total N at the top soil were higher than the values obtained at the sub soil, the values were however moderate for good cashew cultivation. This gives the possibility of using N- fertilizer particularly of organic origin so that the soil will not be acidified if inorganic N source is used like urea and other acidifying fertilizers.

The mean available P at both depth was 4.03mg/kg soil. The value is moderate for cashew production as this could fall below 3.7 mg/kg. There is need for routine management of the P through the use of natural rock phosphate (Sokoto rock phosphate) but if this is not available, single super phosphate could also be used as recommended in the findings of Ibiremo *et.al* (2005).

Similarly, the level of exchangeable K across the depth was 0.22 cmol/kg soils. The mean exchangeable cashew at the top soil was 6.68 cmol/kg soil while at the subsoil was 6.52 cmol/kg soil. The value of exchangeable calcium at the top soil decreased by 2.4% when compared with the value of exchangeable magnesium that was 1.03 cmol/kg soil which is moderate. The Ca/Mg ratio was 6.38. This value maintains the normal relationship provided for productive soil. This indicates that the soil matrix maintains a proper balance and hence there is no likelihood of nutrient imbalance in the soil. It is instructive that there is no need for adjustment in the content of the soil total N, available P and exchangeable potassium. These three major nutrients give the direction for the productivity of soil when pH is within the appropriate range of 5.50 to 7.50.

The mean value of N across the two soil depths was 0.11g/kg. This value is below the soil critical value of 1g/kg. The average value of soil available P of 4 mg/kg soil is higher than the soil critical value of 3.7 mg/kg soil. Similarly, the value of K was above the soil critical value for cashew production. Hence, there is no need for P and K fertilizers as at now. However, nitrogen fertilizer will be required for optimum production.

Table 4: Physical and chemical properties of water logged cassava plots previously cultivated and excavated land at Iyapo farm in Offa, Kwara State.

		Soil physical properties			Soil chemical properties							
Location	Soil depth (g/kg)	Sand (g/kg)	Silt (g/kg)	Clay (g/kg)	pH (cmol/kg)	Org. C (cmol/kg)	Total N (cmol/kg)	Avail P (cmol/kg)	Exch K(cmol/kg)	Exch Ca	Exch Mg	Exch. acidity
Water-logged	0-20	642.4	192.8	164.8	6.78	5.40	0.065	3.51	0.09	5.03	0.91	0.40
Water-logged	20-40	582.4	232.8	184.8	6.67	15.40	0.144	3.39	0.17	5.51	0.83	1.36
Cassava	0-20	742.4	92.8	124.8	6.56	12.40	0.082	5.12	0.22	8.76	1.02	0.44
Cassava	20-40	762.4	92.8	144.8	6.54	1.70	0.056	3.04	0.15	5.87	0.94	0.70
Cultivated	0-20	782.4	72.8	144.8	6.52	7.00	0.075	3.10	0.17	5.27	0.92	0.56
Cultivated	20-40	762.4	92.8	144.8	6.69	6.60	0.063	5.83	0.22	5.01	0.96	0.64
Excavated	0-20	722.4	112.8	164.8	6.56	5.40	0.050	2.12	0.09	6.61	0.81	0.68
Excavated	20-40	742.4	132.8	124.8	6.75	12.00	0.039	3.34	0.09	5.58	0.77	0.64

The sand content of the waterlogged area of the farm which occupied about 1/32 of the farm land (1.56 hectares) was lower than the other land use types - cassava, previously cultivated and excavated land. This might be due to washing away by erosion and the portion of the top soil was higher in sand content. Clay +silt content of the water- logged surface soil (0-20cm) was higher than other land use types. This might be the reason for more water retention which led to water logging because of poor drainage. The water logged portion was situated in the section area of the farm parallel to the major stream at the boundary of the farm. Exchangeable Ca and Mg contents were adequate for cashew in the water - logged area of the farm. The total nitrogen, available phosphorus and exchangeable potassium content were slightly below the amount required by cashew. Fertilizer will be required to supply the deficient N, P and K in that portion of the land.

Cassava plot on the land

The sand content of the top soil of the cassava plot was higher than water-logged and excavated portion of the land. The pH was slightly acidic. All the major nutrients except nitrogen were adequate and slightly above the amount required for cashew. There will be need for supplementation with nitrogen fertilizers.

Cultivated soil

The previously cultivated bare soil portion of the land had lesser amount of available P, exchangeable K and Mg in the top soil compared to the sub soil. This might be due to leaching and or run off. Total nitrogen and phosphorus in the previously cultivated bare land were low and below the critical values required by cashew. This implies that nitrogen and phosphorus fertilizers will be applied.

Excavated land

Total nitrogen, available phosphorus and exchangeable potassium were slightly below the critical nutrient values required by cashew in the excavated land. Exchangeable calcium and magnesium content of the soils were adequate and grossly above the critical values required. N, P and K fertilizer will be required for application on cashew to be planted on excavated land.

Conclusion

The soil fertility evaluation of the 49.56 hectares of land proposed for the establishment of cashew by the farm. The farm was divided into three main blocks (A, B and C) based on topography and four land use types (water-logged, cassava plot, previously cultivated land and excavated land). Block A was parallel to River Oyun followed by Block B in the middle of the farm, while the last block C ran parallel to the road from Ijagbo. Soil samples were collected at soil depth of 0-20cm and 20-40cm and at a distance of 20m apart. The soil collected was put in nylon bags and properly labelled. Soil samples collected were air dried, passed through 2 mm sieve and analyzed for some of its physical and chemical properties.

In the various land use types, section (A, B and C) requires 180 kg/ha of urea and 31.5 kg of Single Super phosphate (SSP) for optimum productivity. Application of fertilizers improved

growth and nut yield of cashew (ComCashew , 2018).The cassava plot and previously cropped bare land require 189 kg/ha urea and 9.9 kg/ha SSP, while the excavated land requires 194.2 kg urea 25.8 kg SSP and 32.28 kg MOP as showed in Table 5 below. Cashew should not be grown on the water-logged section because cashew will not thrive well there.

Table 5: Fertilizer recommendation for different land use types in Iyapo farm

Land Use Types	N, P and K Required			Fertilizer Recommendation		
	N kg/ha	P_2O_5 (Kg/ha)	K_2O(Kg/ha)			
Sections A, B and C	82.8	5.6	-	180	31.50	-
Cassava farm and previously cultivated bared land	84.78	1.97	-	189	9.9	-
Excavated land	87.4	5.10	22.97	194.2	25.8	38.28

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