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Characterization of Soils Based on Extractable Nutrient for Tomato Cultivation in Derived Savannah Region of Ogun State, Southwest Nigeria

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ABSTRACT

This study characterized soil samples collected from arable fields in tomato-growing communities at Ayetoro, Ilara, Imeko and Obada in Ogun State, Nigeria. A total of 32 soil samples were collected from 8 grids in each field. Soils were analyzed in triplicates for physicochemical properties and trace element including boron (B), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn). Results revealed low variation in pH and sand particles. Org C, total N, exchangeable bases, and Effective Cation Exchange Capacity (ECEC), silt and clay contents exhibited moderate variations. Extractable P and exchangeable K were highly variable. Concentrations of extractable B, Cu, Mn and Mo indicated moderate variation, while the different soils revealed very high variations for extractable Fe and Zn. Obada was highest in org C, total N, extractable P, exchangeable K and Na which were not significantly different from that of Ayetoro. Boron, Cu and Zn were higher at Ayetoro while Fe and Mo were higher at Imeko. Soil pH had good relationship with B, Zn, Mn, and Mo with correlation(r) of -0.569***, -0.646***, 0.571*** and 0.878***, respectively. The bi-plot from Principal Component Analysis (PCA) characterization of soil nutrient showed 89.79 % of total variation among the soils. Ayetoro with high inherent soil nutrient could better support tomato production.

Keywords: physicochemical properties, principal component analysis, soil nutrient, trace element, variation.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the most popular fruit vegetable crops and accounted for about 189.13 million metric tons of the world vegetable production (FAO 2023). Nigeria accounted for 10.8% of fresh tomatoes production in Sub-Saharan Africa making her the second largest producer of fresh tomatoes in the region after Egypt (Aminu and Sadi 2020; Ajibare *et al*., 2022). Tomato is consumed in large quantities by Nigerians and serves as a source of antioxidants in the diet (Adams, 1991; Idowu and Aduayi, 2006). It is also a good source of vitamins and minerals of importance in human diet. The antioxidant lycopene, found in tomato is a form of carotenoid which reduces the risk of prostate cancer (Kucuk, 2001; Kamenetzky *et al*., 2010). According to Sainju *et al*. (2003) consumption of tomato can reduce cancer development in the gastro-intestinal tract of the stomach, colon and rectum.

In southwestern Nigeria, tomato is a common crop particularly in the derived savanna region of Ogun state. This is partly due to the moderate rainfall and highly weathered soils which are often characterized with low fertility status (Idowu and Aduayi, 2007). The soils are typically low in nitrogen and organic carbon, poorly buffered with Low Activity Clay (LAC) minerals and are of poor water retention capacities (Ojanuga, 1979; Sobulo and Osiname, 1981; Oguntade *et al*., 2018). Tomato production requires good soil that is rich in both macro- and micro- nutrients without which tomato cannot grow optimally and bear good quality fruits (Sainju *et al*., 2003; Swetha *et al*., 2018). This is an indication that these soil nutrients are essential for activities that promote optimal crop growth and development. The soil environment on which tomato is grown has been reported to influence not only the nutrient composition of the harvested fruits but also the yield, taste and post-harvest quality of the fruits (Sainju *et al*., 2003).

The prime concern of resource poor small-scale tomato growing farmers in Nigeria is to obtain optimum yield with maximum returns possible (Abdul *et al*., 2020). This has been marred majorly by poor nutrient status of soil. Inadequate supply of fertilizers, high cost of input, pest and diseases are among other major causes of low yield. Meanwhile, to select and adopt an eco-friendly fertilizer regime that is sustainable in a particular soil environment, assessment and characterization of the nutrient status of such soil is required (Tagore *et al*., 2017). This is because adequate soil nutrient confer good potential, complements the opportunities in a healthy soil for crop growth and development. Requisite information on nutrient status of soil in a crop field is, therefore, an essential step needed not only for appropriate fertilizer regime but also for specific soil management and sustainable crop production (Yusoff *et al*., 2006).

In Ogun state, information on soil nutrient status particularly for tomato-growing communities is grossly inadequate for fertilizer recommendations. Often, when fertilizers are available, its application has been based on blanket recommendations, usage of which has resulted in nutrient imbalance and contamination of soil. Since farmers efforts to increase area of tomato cultivation in the derived savanna ecology of Ogun state are marred with challenges of low yield majorly due to poor soil nutrient status. This study was, therefore, aimed to assess soil properties of selected farm land in tomato-growing communities in order to determine (i) the content and extractable forms of macro and micro nutrients in the soils from the selected farmers field; (ii) the extractable forms of trace element of importance for tomato production including B, Cu, Fe, Mn, Mo and Zn; and (iii) the relationship between the trace element across the soils in the farmers field using principal component analysis (PCA).

MATERIALS AND METHODS

Description of the study area: The area spans the derived savannah ecology of two Local government areas (Yewa North, and Imeko-Afon) in Ogun State and Ilara, a border town between Republic of Benin and Nigeria Ogun State is located in southwestern Nigeria with a tropical climate with characteristic wet and dry seasons. The study area has erratic bimodal annual rainfall pattern in the wet season with the maximum precipitation in June and September. The farmers' fields used were arable farmland in four selected towns of Ayetoro, Ilara, Imeko and Obada. Location of the fields (Figure 1) was on latitude 7.2339° N, longitude 3.0595° E and 109.75 m above sea level (ASL) at Ayetoro. The field at Ilara was on latitude 7.4144° N, longitude 2.7736° E and 189.00 m ASL. Imeko field was on latitude 7.4692° N, longitude 2.8658° E and 243.00 m ASL while Obada site was on latitude 7.4232° N, longitude 2.9622° E and 217.12 m ASL.

Soil sampling and sample preparation: Soils were systematically collected with the aid of a soil auger from regular grid (12 m by 6 m) set using Global Position System (GPS). A total of 8 grid cells (points) were set for soil sample collection in each location (farmers' field who were tomato growers). Baseline soil samples were collected during land preparation prior to cropping in the 2018 cropping season. From each grid cell, 10 core soil samples were collected at 0-15 cm

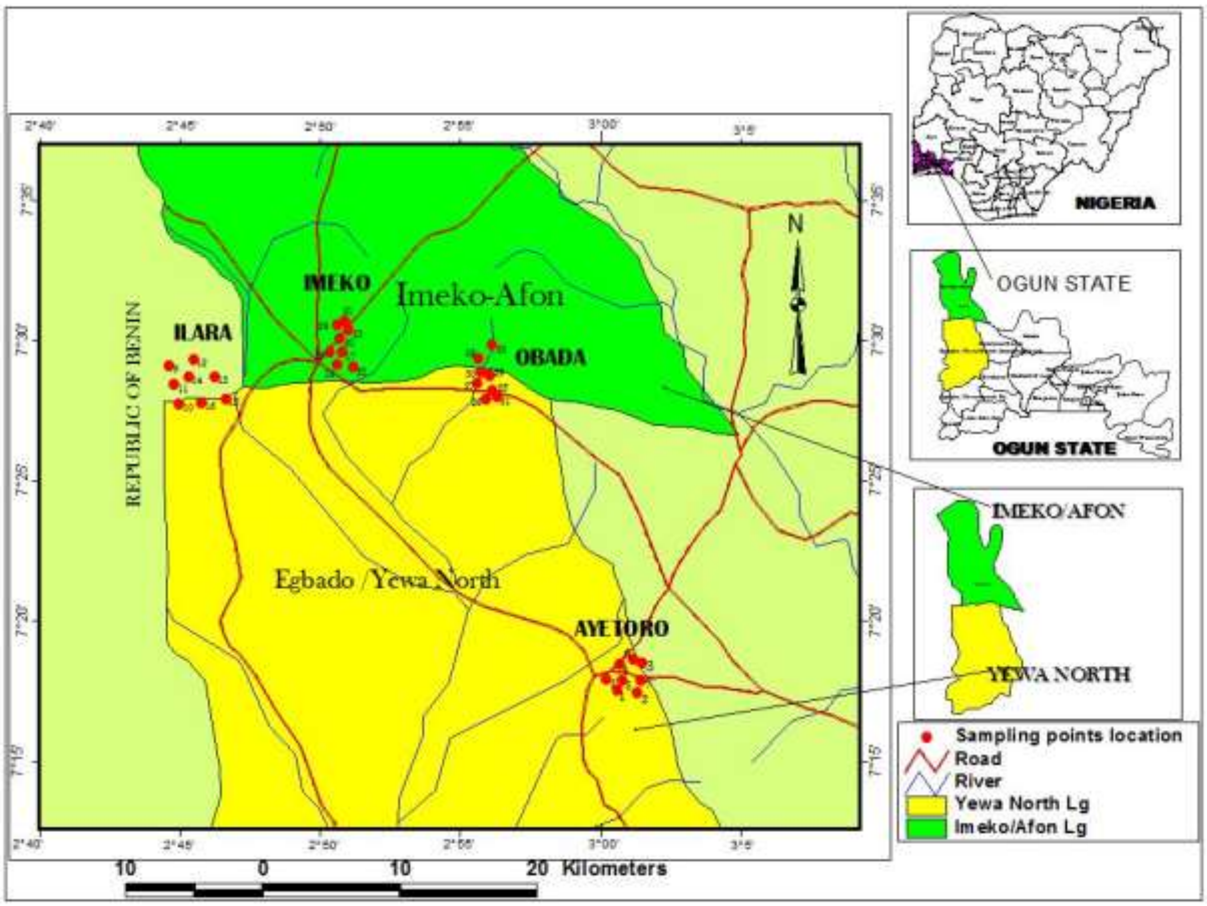

Figure 1: Location map of the study area and sampling sites.

depth using a soil auger. Core soil samples collected were bulked to form a composite sample such that in total, 32 composite samples were taken from the four study locations. The soil samples were later air-dried and sieved with 2 mm sieve for laboratory analyses.

Soil analysis: The soil was analyzed for pH (soil:water 1:2) with glass electrode pH meter (McLean, 1982). Organic carbon was determined byWalkley Black Method (1934). Total nitrogen was determined by the Kjeldahl method (Bremner, 1996). Soil extractable phosphorus was determined by

Bray-1-method (Nelson and Sommers, 1996). Exchangeable bases (Ca^{2+}, Mg^{2+}, K^+ and Na^+) were extracted with 1N Ammonium acetate at pH 7.0 (Rhoades, 1982). Calcium (Ca^{2+}) and Magnesium (Mg^{2+}) were determined on an atomic absorption spectrophotometer (AAS) while Potassium (K^+) and Sodium (Na^+) were determined on a flame photometer. Exchangeable acidity (Al^{3+} + H^+) in the soil was extracted with 1 N KCl and determined by titration method (Anderson and Ingram, 1993). Effective cation exchange capacity (ECEC) was calculated as the summation of the exchangeable acidity and exchangeable bases. The extractable trace metals (Cu, Fe, Mn, Mo and Zn) were determined with AAS (Model: Buck Scientific 210 VGP, Buck Scientific, Inc., East Norwalk, CT, USA). Extractable boron (B) was determined colourimetrically as described by Udo et al. (2009). The particle size distribution was determined by Bouyoucos hydrometer method (Gee and Bauder, 1986).

Statistical analysis: The soil properties measured were subjected to one-way Analysis of Variance (ANOVA) using Genstat package 12th Edition (Payne *et al*., 2009). Descriptive statistics used include mean, standard error (SE), and coefficient of variation (CV %) to determine the variability of the soil properties. Pearson’s moment correlation analysis (r) and Principal Component Analysis (PCA) were also carried out to determine interrelationship of nutrient between soil environments and soil properties variations. Significant mean values were separated using Fischer’s Protected Least Significant Difference (LSD) at 5% probability level.

Physicochemical properties of the soils: The pH of soils at Ayetoro and Obada was similar and falls within slightly acidic range (Table 1). For Ilara and Imeko the pH was also not different significantly ($p \leq 0.05$). The pH was neutral at Ilara while it was very slightly acidic at Imeko. Org C at Ayetoro and Obada was comparable and was classified as moderate when compared with soil fertility characteristics of tropical soils (FAO, 1976; Udo *et al*., 2009). At Ilara and Imeko, the org C was quite low and not significantly different from each other. This can be attributed to high rate of mineralization of organic matter in tropical soils (Sierra *et al*., 2015; Liyanage *et al*., 2021). Hence, soil amendment with organic materials like crop residues is an essential management strategy to enhance accumulation of organic matter in such soils. Total nitrogen in the soils followed a trend similar to org C (Table 1). Nitrogen content at Ayetoro and Obada soils was within the critical soil limit of 1.5-2.0 g kg^{-1} (Sobulo and Osiname, 1981). Total N at Ilara and Imeko were not different significantly but were up to 2 folds lower compared to Ayetoro and Obada. This indicated very low total N as it falls below the critical range of 1.1-2.0 g kg^{-1} reported by FFD (2012). This can be alluded to the fact that the soils were low in organic carbon and sandy textured hence, there is high tendency leaching of mobile nutrient like nitrogen. Deficiency of N in soil often results in stunted spindly growth with yellow leaves at the base of tomato plant (Needham, 1973), consequently reduction in yield and yield qualities such as; fruit size, colour, shelf life and taste (Winsor, 1973; Sainju, 2003).

RESULTS AND DISCUSSION

Extractable phosphorus was not significantly different in the soils across the four locations (Table 1). The extractable P at Ayetoro indicated deficiency but conversely, was very high at Ilara. The high level of extractable P at Ilara could have been due to neutral pH of the soil. Studies have shown that phosphorus is more likely to be available to crops at near neutral pH than at lower pH of below 4.0, as aluminum and iron oxides fix P at lower pH (Spark, 1995; Shiau*et al*., 2018). At Imeko and Obada, the extractable P was moderately low since it falls within the lower range of critical level of 10-16 mg kg^{-1} for crop production (Adeoye and Agboola, 1985). Adequate soil P promotes root proliferation and growth for better utilization of water and other mineral nutrients which spurs steady growth of tomato plant culminating in healthy foliage and fruits of better quality (Gould, 1983; Adb-Alla *et al*., 1996).

Soil collected from Obada had the highest contents of Ca and Mg which were significantly ($p \leq 0.05$) higher than the other three locations (Table 1). The pattern of exchangeable Ca and Mg in the soils were in the order Obada > Ayetoro > Ilara > Imeko. Across locations, the mean contents of Ca and Mg were higher than critical levels of 1.5 and 0.28 $cmol_c kg^{-1}$ for Ca and Mg, respectively in soils of southwestern Nigeria (Enwezor *et al*., 1990; Uponi and Adeoye, 2000). This implied that soils in this region can supply adequate amount of Ca and Mg needed for optimal growth of tomatoes. The Ca content in these soils confirms the assertion that most soils have adequate amount of Ca needed for tomato cultivation except if the pH of the soil is lower than 4.5 (Sainju, 2003). The exchangeable K in the soils was not different significantly across locations. The content of exchangeable K was in the order Obada > Imeko > Ayetoro > Ilara with the mean value of 0.15 $cmol_c\ kg^{-1}$. This concentration, according to FAO (1976) soil fertility classification, indicated that the exchangeable K at Obada and Imeko was in the medium (0.15-0.40 $cmol_c\ kg^{-1}$) class. Meanwhile, Ayetoro and Ilara are classified as soils having low content of exchangeable K which falls below critical level of 0.15 $cmol_c\ kg^{-1}$ (FAO, 1976; Uponi and Adeoye, 2000). Potassium supports vigorous growth, early flowering and setting of fruits which results in higher yield of tomatoes per plant (Varis and George, 1985) and its nutrition can influence the quality of tomato fruit (Sainju, 2003). Exchangeable Na was highest at Obada and lowest at Ilara. The content of Na at Obada was not significantly ($p \leq 0.05$) different from Ayetoro. In a similar trend, Na content at Ilara was similar to that of Imeko. The Na value at Ayetoro was in tandem with 0.15 $cmol_c\ kg^{-1}$ reported by Thomas *et al*. (2018) at the top soil of Apomu, Alagba, Matako and Eruwa soil series in southwest Nigeria. Sodium can stimulate growth of many species of crop plants including tomato (Lehr, 1953; Montasir *et al*., 1966). An increase of 12 % has been reported in dry weight of tomato grown on nutrient medium with addition of 1 mM NaCl (Wooley, 1957). Presence of Na in an environment where K is deficient such as at Ayetoro and Ilara, can lead to reduction in the critical level of K required by plant to meet its basic metabolic needs (Greenwood and Stone, 1998; Subbarao *et al*., 2003). The reduction often occurs as a result of substitution of a monovalent cation like Na for K in a biochemical reaction in the plant (Evans and Sorger, 1966; Wyn Jones and Pollard, 1983). The exchangeable acidity of Ayetoro and Obada soils was similar and was significantly higher than exchangeable acidity recorded at Ilara and Imeko (Table 1). Mean value of exchangeable Al+Hin the soils indicated low level of exchangeable acidity at the exchange site of the soils. Obada had the highest ECEC which was significantly ($p \leq 0.05$) higher than the content at Ayetoro. Ilara and Imeko were not different significantly in ECEC and were very low for crop production, having values lower than critical level 6.0 $cmol_c\ kg^{-1}$ reported by Esu (1991).

Table 1: Physicochemical properties of Ayetoro, Ilara, Imeko and Obada soils

Location	pH	Org C	Total N	Avail. P	Ca	Mg	K	Na	Al + H	ECEC	Sand	Silt	Clay	STC
		($g\ kg^{-1}$)		($mg\ kg^{-1}$)	($cmol\ kg^{-1}$)						($g\ kg^{-1}$)			
Ayetoro	6.23^{b}	16.44^{a}	1.63^{a}	8.68^{a}	5.59^{b}	2.71^{b}	0.14^{a}	0.15^{ab}	0.07^{a}	8.67^{b}	822.0^{c}	105.2^{a}	72.8^{a}	LS
Ilara	7.02^{a}	7.04^{b}	0.84^{b}	17.54^{a}	3.92^{c}	1.55^{c}	0.12^{a}	0.11^{c}	0.05^{b}	5.75^{c}	894.0^{ab}	57.5^{b}	48.5^{b}	S
Imeko	6.98^{a}	6.25^{b}	0.60^{b}	11.35^{a}	3.42^{c}	1.12^{c}	0.16^{a}	0.12^{bc}	0.05^{b}	4.86^{c}	919.8^{a}	32.8^{c}	48.8^{b}	S
Obada	6.24^{b}	17.62^{a}	1.80^{a}	11.73^{a}	7.25^{a}	3.94^{a}	0.19^{a}	0.17^{a}	0.06^{a}	11.61^{a}	869.8^{b}	75.5^{b}	54.8^{ab}	LS
LSD (0.05)	0.383	2.526	0.279	10.540	1.096	0.480	0.063	0.035	0.013	1.622	30.38	19.33	19.24	
Mean	6.62	11.84	1.22	12.32	5.04	2.33	0.15	0.14	0.06	7.72	876.40	67.8	56.2	
SE (±)	0.368	2.430	0.269	10.140	1.054	0.461	0.061	0.034	0.013	1.560	29.220	18.590	18.510	
CV (%)	5.6	20.5	22.1	82.2	20.9	19.8	39.5	24.9	22.8	20.2	3.3	27.4	32.9	

Org C = organic carbon; ECEC = effective cation exchange capacity; STC = soil textural class; LS = loamy sand; S = sand. Results were mean values calculated based on three replicates. Means with different superscripts letters within the same column are significantly different at $p \leq 0.05$ according to Fischer's protected LSD.

Generally, soils in the zone were dominated by large proportion of sand particles with the highest at Imeko and lowest at Ayetoro. The soils were however, low in silt and clay contents. The low proportion of silt and clay particles as depicted by soil textural class (STC) reflected the poor inherent nutrients in the soils. Soils with LAC are often prone to leaching of nutrients, low in cation exchange capacity and poor in water retention ability (Ojanuga, 1979; Sobulo and Osiname, 1981). In addition, Ilara and Imeko soils whose textures were sandy, manifested low level of exchangeable bases and were very poor in org C and total N. This showed deficiencies in major nutrients essential for tomato production in the soils and consequently low yield abounds. Sustainable production of tomato in these soils may therefore require organic amendment for improved yield. Assessment of physiochemical properties of soils in the zone indicated low variability for pH and sand particles with CV < 15 %. Org C, total N, exchangeable (Ca^{+}, Mg^{+}, Na^{+}), exchangeable (Al+H), ECEC, silt and clay contents of the soil exhibited moderate variations (CV 15 – 35 %). Meanwhile, extractable P and exchangeable K were highly variable (CV > 35 %) according to Wilding (1985). The CV for soil pH in this study was in consonance with short-range of 2-15 % soil pH spatial variability reported by Cavigelli *et al*. (2005). Observation in this study was also similar to CV values of 19.1 % and 23.0 % for org C and total N, respectively as reported by Bonmati *et al*. (1991).

Concentration of trace elements in the soils: The concentration of B in Ayetoro soil was significantly ($p \leq 0.05$) higher than amount recorded in the other three locations (Table 2). The lowest concentration of B recorded at Imeko was not significantly different from that of Ilara and Obada. Mean concentration of B in the soils was in the lower limit of critical range of 0.1-0.7 mg kg^{-1} for B reported by Maynard and Hochmuth (1997). This indicates that these soils might not be able to support tomato production sustainably because deficiency of boron is likely to occur except at Ayetoro. The relatively large proportion of clay particles which was significant at Ayetoro made it an exception with better potential for nutrients retention. Boron is one of the nutrients with high potential to leach from the root zone (Mengel and Kirkby, 1987; Davis *et al*., 2003). Hence, poor soils which are sandy such as in this study with low level of B might not support optimum growth, yield and quality tomato fruits. Soil treated with B has been reported to improve; marketable yield of tomatoes, shelf life of fruits, fruit firmness and nutrient contents including nitrogen, calcium and potassium (Davis *et al*., 2003). Copper content in the soils followed similar trend as B. The highest concentration of Cu at Ayetoro was significantly ($p \leq 0.05$) higher than in the other three locations (Table 2). Mean concentration of Cu in the soils indicated that the zone had moderate level of Cu which falls within the medium critical limit category of 0.21-2.0 mg kg^{-1} for Cu (Esu, 1991). Concentration of extractable Fe was highest at Imeko and lowest at Ayetoro. At Imeko, concentration of Fe was higher than critical class limit of above 5.0 mg kg^{-1} and was considered high (Esu, 1991). However, the lower concentration of Fe at Ayetoro, Ilara, and Obada was moderate based on the critical range of 2.51-5.0 mg kg^{-1} (Esu, 1991). Extractable Mn in the soils was not different significantly across the four locations. The Mn was in the order Ilara > Imeko> Ayetoro > Obada. Mean concentration of extractable Mn in the soils was above the critical limit of 25.0 mg kg^{-1} reported by Adeoye and Agboola (1985) indicating abundance of this mineral nutrient. Concentration of Mo in the soils was highest at Imeko followed by Ilara and was not significantly different from each other. The concentration of Mo at Obada was not significantly different from Ilara but was significantly ($p \leq 0.05$) higher than the lowest Mo recorded at Ayetoro. Extractable Zn was highest at Ayetoro and was not significantly different from the content at Obada. This could be due to high content of organic carbon in these soils (Srikanth *et al*., 2008). At Ilara and Imeko, the Zn content was significantly lower in 3 and 2 folds, respectively than the content at Ayetoro and Obada. Nevertheless, Ilara and Imeko are graded as soils with medium level of Zn while Ayetoro and Obada are categorized as soils with high Zn for crop production. Esu (1991) had reported critical level of 0.8-2.0 mg kg^{-1} and above 2.0 mg kg^{-1} for medium and high level of extractable soil Zn, respectively. The CV obtained for the trace elements were moderate for B, Cu, Mn and Mo while it was high for Fe and Zn according to Wilding (1985).

Table 2: Mean concentration of trace elements in Ayetoro, Ilara, Imeko and Obada soils

Location	Boron (mg kg^{-1})	Copper	Iron	Manganese	Molybdenum	Zinc
Ayetoro	0.26^{a}	0.53^{a}	2.69^{b}	38.71^{a}	1.48^{c}	4.54^{a}
Ilara	0.17^{b}	0.38^{b}	2.93^{b}	41.90^{a}	3.19^{ab}	1.47^{b}
Imeko	0.14^{b}	0.36^{b}	10.16^{a}	41.88^{a}	3.32^{a}	1.92^{b}
Obada	0.16^{b}	0.26^{b}	4.54^{b}	31.58^{a}	2.55^{b}	4.51^{a}
LSD (0.05)	0.053	0.115	4.436	10.940	0.759	1.266
Mean	0.18	0.38	5.08	38.52	2.63	3.11
SE (±)	0.051	0.111	4.266	10.521	0.730	1.218
CV (%)	28.1	28.9	83.9	27.3	27.7	39.1

Results were mean values calculated based on three replicates. Means with different superscripts letters within the same column are significantly different at $p \leq 0.05$ according to Fischer's protected LSD.

Correlation of soil pH and trace element: The correlation results showed that soil pH was significantly ($p \leq 0.05$) and negatively correlated with extractable B and Zn (Table 3). This indicates that as pH of the soil increases, B and Zn becomes less available for plant use due to low solubility. The observation was evident at Ilara and Imeko with high soil pH. Boron has been reported to be less available to crop plants as soil pH increases (Bunt, 1956; Davis *et al*., 2003). Several studies have also attributed decreasing available soil Zn due to poor solubility with increasing soil pH (Alloway, 2008; Thomas *et al*., 2018). Conversely, the soil pH was significantly ($p \leq 0.05$) and positively correlated with Mn and Mo. This indicated that concentration of Mn and Mo in the soil increased with the active acidity of the soil. Other studies have also reported soil pH as one of the key factors that determine the behaviour and bioavailability of metallic element in soils (Mazurek *et al*., 2017). Boron was significantly and positively correlated with Cu and Zn. The relationship between B and Mo in the soil was however negative, indicating a significant decrease in Mo as boron increased. Extractable Cu in the soil was also negatively correlated with Mo. A significant ($p \leq 0.05$) positive relationship exist between Fe and Mn in the soil. Manganese in the soil exhibited a non-significant positive and negative relationship with Mo and Zn, respectively. However, extractable Mo in the soil was significantly ($p \leq 0.01$) and negatively correlated with Zn indicating an inverse relationship.

Principal component analysis: The PCA bi-plot revealed 89.79% of the total variance among the soils (Figure 2). The PC-1 explains 56.42% of the variation loaded with lower values of Cu and Mn at Obada while PC-2 with 33.38% of the total variation showed higher values of Fe and Mo at Imeko. Soil from Ayetoro, was classified for the high concentrations of B, Cu and Zn. Soil sample from Ilara was characterized by high concentration of extractable Mn.

Table 3: Pearson moment correlation (r) of soil reaction and trace element in the soils assessed

	pH	B	Cu	Fe	Mn	Mo	Zn
pH	1						
B	-0.569^{**}	1					
Cu	-0.262^{NS}	0.524^{**}	1				
Fe	0.335^{NS}	-0.217^{NS}	-0.219^{NS}	1			
Mn	0.571^{**}	-0.163^{NS}	-0.147^{NS}	0.435^{*}	1		
Mo	0.878^{**}	-0.749^{**}	-0.479^{**}	0.305^{NS}	0.347^{NS}	1	
Zn	-0.646^{**}	0.438^{*}	0.112^{NS}	-0.074^{NS}	-0.318^{NS}	-0.507^{**}	1

*, ** = Significant at $p \leq 0.05$; $p \leq 0.01$ probability levels, respectively. NS = non-significant.

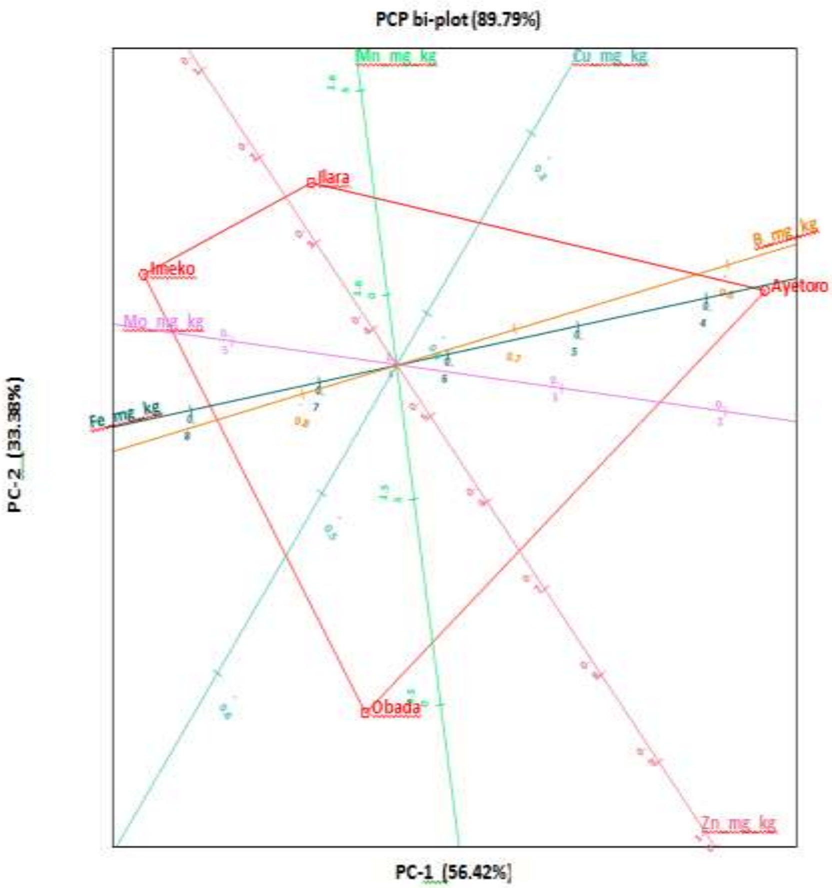

Figure 2: Principal component analysis of trace element in soils of Ayetoro, Ilara, Imeko and Obada.

This showed that the environment from where a soil sample was taken has a great influence on its elemental properties. This observation is in agreement with that of Balabanova *et al*. (2015) who reported that sampling locality has a great influence on elemental contents of a soil. The soil collected from Imeko was characterized by high concentrations of Mo and Fe. Hence, variability of these trace element can be attributed to inherent properties of geological and pedological soil forming factors in the area but could have been modified by previous soil management practices (Iqbal *et al*., 2005).

CONCLUSION

Soils from Obada and Ayetoro have the potential of supporting tomato production optimally under a good soil management than Imeko and Ilara. High levels of major macro nutrients (N, P, K) in Obada soil can encourage luxuriant growth of tomatoes than other locations. However, low levels of trace elements in Obada soil will be of disadvantage for tomatoes of marketable yield and quality. Comparatively, Ayetoro would be a better soil since tomatoes grown on such environment could explore significant amount of B, Cu and Zn from the soil in addition to inherent macro nutrients. Hence, it is economical and will be more sustainable to produce tomatoes of good yield, improve quality and shelf life at Ayetoro under good soil management strategies. Besides, tomatoes from such soil would be able to supply a good balance of B, Ca and Mg required for healthy living in human diet. Future studies would be geared towards comparing growth, yield and fruit qualities of different cultivars of tomatoes in these soils under different soil fertility management.

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