# VARIABILITY OF RESIDUAL SALT CONTENT IN SELECTED FARM SITES OF GIDAN KWANO, NIGERIA

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## ABSTRACT

In order to meet the expectation of farmers which is to have a bountiful harvest, various crops need to be cultivated commercially, but soil salinity which is affecting most part of the world, pose serious threat to plant production and the expectation of farmers. Thus, it is valuable, to test the salinity and analyze the chemical parameters of the soils from different farming locations. In the present research, experiments were conducted to assess the seasonal variability of residual soil salt content of selected site in the university farm at Gidan Kwano Minna, the soils were analyzed, and some chemical parameters were found to be more, which may be due to the type of fertilizers used in the various sites, the values of the chemical parameters analyzed are pH (which ranges between 6.25 to 6.88), EC (which ranges between 41 to 70µs/cm), Mn (which ranges between 0.13 to 0.33mg/l), Cu (which ranges between 0.10 to 0.23mg/l), Pbwas not observed form the various study locations, P (which ranges between 8.00 to 14.00mg/kg), Na (which ranges between (0.12 to 0.18mol/kg), K ( which ranges between 0.04 to0.16mol/kg),$Mg^{+}$ (which ranges between 1.10 to2.30mol/kg), $Ca^{+}$ (which ranges between 1.90 to3.10mol/kg), CEC (which ranges between 1.8 to 4.3) and Fe (which ranges between 0.06 to 0.18). It is therefore recommended that more research be carried out on the chemical applied to the soil and the water use for irrigation. Also maximum amount of water be applied to the farmland to assist in leaching excess salt compound present in the soil.

**Keywords**: Crop, farm, food, root, salt, soil

## 1.0 INTRODUCTION

Salt can be defined as an inorganic mineral that has the tendency to dissolve in water, salt is usually linked with sodium chloride common table salt (Jaleel *et al.,* 2007). They also stated that in real terms, salts that affect both surface water and groundwater are usually a combination of sodium, calcium, potassium, magnesium, chlorides, nitrates, sulfates, bicarbonates and carbonates. These salts often originate from the earth's crust as they are formed through weathering processes, where small amounts of rock and other deposits are dissolved over time and transported by water (Chukwu and Musa, 2008). This slow weathering may cause salts to accumulate in both surface and underground waters. Salt content in soils are increased through the application of fertilizers and other organic amendments to the soil.

The farm is an area of land devoted primarily for various agricultural activities for the purpose of food production. These activities include crop planting, animals and their products. It is often believed that farmlands facilitate agricultural activities which mean the production of crops and livestock either for sale or household consumption (Ntihinyurwa *et al*. 2019). Some of these crops include rice, wheat, yam, cassava; tropical fruits such as mangoes, cashew, citrus, bananas, and livestock's, such as poultry, piggery, diary and fisheries. (Mohammed *et al.,* 2010). Thus, it is clear that agriculture continues to be the key pillar of most African economy of which Nigeria is not excluded.

Soil is an important factor which is very relevant for agricultural activities. Soil simply refers to that top most part of the earth crust which constitutes water, mineral particles, air, organic matter and living organisms. It is a very complicated living medium which can also be seen as a non-renewable resource as its formation is an exceedingly gradual process, therefore much care and attention must be given to it in order to avoid it degradation which in turn affects the crops grown on it. One of such problems that could lead to soil degradation is salinization, which has become a worldwide threat that inhibits crop growth or leads to low yield crops, destruction of soil structure and erosion eventually (Yang *et al.,* 2011). He observed that salinity is so severe across the world and the region affected has grown wider than expected and therefore requires more attention to avoid it adverse effects. Salinity has the tendency of causing harm to the soil structure by making fine particles clog into aggregates, which is called flocculation which could inhibit plant growth and prevent proper root penetration. They stated that a soil that has high salt concentration also has a significant amount of sodium present in it which could hinder the germination of seedlings. They further stated that salt stress usually has effect on the growth of plants, and these salts exists in the soil due to chemicals added to the soil in the form of fertilizers, animal waste. This tends to pose negative effect on the soil rather than boosting the soil nutrient if not carefully checked.

The presence of certain salt elements in high concentration may prevent the absorption or utilization of other elements, this condition results in retarded growth, low yield, or even complete destruction of the plant (Jaleel *et al.,* 2007). For instance, the quantity of certain elements such as sodium, potassium, if increased in soil when added artificially as an input may lead to the adverse effects on the soil, by increasing the salinity of the soil. Jaleel *et al.,* (2007) stated that numerous soils become less productive each year due to salt buildup which has a significant role to play in soil degradation thus affecting approximately twenty percent of farms that are irrigated and about twelve percent of dry land. The earliest reaction to salinity in most plants is a tremendous decrease in the tendency of expansion of leaf surface, then by a cessation of expansion as the stress increases (Parida and Das, 2005**)**. The greatest danger of salinity on the germination of plant is linked to the reduction in the osmotic potential of the growth medium, especially the ion toxicity and nutrients insufficiency which could lead to retarded growth and eventually the destruction of the plant (Luo*et al.* 2005). Therefore, it is of great importance to study the problem of salinity which is caused by diverse factors such as the chemicals applied to the soil as fertilizer, pesticide and herbicides, the water use for irrigation, waste from animals such as urine and dung, and seek ways of avoiding further threats of salinity on the soil.

This study is aimed at identifying the effect of seasonal variability of residual soil salt content of selected site farms in Gidan Kwano, Minna that has been operated upon in the last fifteen years and to access the impact of salts on the soil properties in the farmland during the period of irrigation and rain feed agriculture

## 2.0 MATERIALS AND METHOD

### 2.1 Study Location

Gidan Kwano, a growing agricultural commercial farming community have been actively involved in agricultural activities in the last fifteen years. This is as a result of the sudden increase in population of one of the major cities in Niger State that is Minna. Situated along Kilometer 11Minna – Bida Road, South – East of Minna in the Bosso Local Government Area of Niger State. The land lies at about longitude of $06^0\ 28^1\ 45^1$E and latitude of $09^0\ 35^1\ 26^1$E. The site is surrounded Northwards by the Western rail line from Lagos to the northern part of the country and the eastern side by the Minna – Bida Road and to the North – West by the Dagga hill and river Dagga (Musa and Egharevba, 2009).The soil type found in this area is sandy-loam which is characterized as Alfisol (USDA, 2002). The major crops planted are yam, Guinea corn, Maize, Rice and Cassava.

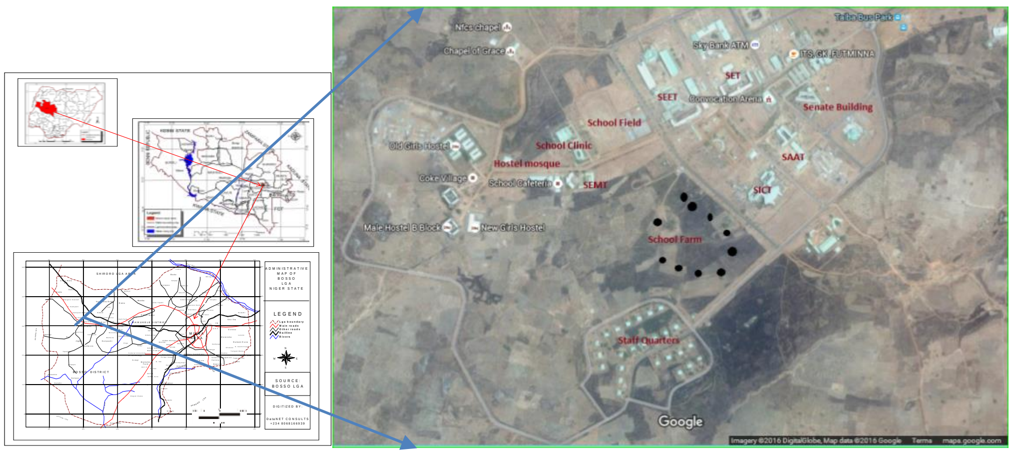


Figure 1: Extracted map of Niger State from Nigeria showing Minna and google map of the study locations in dotted blacks.

## 2.2 Climate

The climate of the area is sub-humid tropical; Minna has an average relative humidity of 48.9% and average monthly relative humidity ranges between 21% in February to 73% in August. The yearly precipitation within the study area ranges between 1600mm in the south and 1200mm in the north. The pattern of precipitation is monomial and is characterized by a lengthy mean yearly precipitation of about 1284mm. Precipitation commences in May and ends in October (Adeboye *et al.*, 2009).It is known to attain its peak between the months of July and August. The highest temperature in this region is usually between the months of February to April which gives a standard minimum temperature record of $21^0$C and maximum temperature of $41^0$C (Musa and Egharevba, 2009).

### 2.3 Sample Collection

Soil samples were randomly collected from different farm locations based on the type of farming operations been carried. Table 1 below shows the coordinates of the farms considered for the study and the various crops grown while Figure 1 shows google earth locations of the various study areas.

Table 1: Distribution of various farms and their coordinates.

| S/No | Type Farm Practice | Coordinate Longitude | Coordinate Latitude |
|---|---|---|---|
| **1.** | Eucalyptus plantation | $9^0$ 52.856$^1$ N | $6^0$ 46.322$^1$E |
| **2.** | Fallow Land | $9^0$ 52.818$^1$ N | $6^0$ 46.308$^1$E |
| **3.** | Yam Farm | $9^0$ 52.838$^1$N | $6^0$46.307$^1$E |
| **4.** | Afforestation site | $9^0$ 31$^1$ 217$^{11}$N | $6^0$ 27$^1$ 604$^{11}$E |

### 2.4 Soil Analysis

The soil samples were first air-dried at room temperature for 48 hours. After which some quantity of the samples were collected and placed inside a 1000 ml cylinder to determine the percentage composition of the various soil particles. This is in accordance with the works of Oguike and Mbagwu (2009). The remaining soil samples were analysed for pH, EC, organic carbon, available Phosphorus, Exchangeable Bases ($Na^+$, $K^+$, $Mg^{2+}$ and $Ca^2$), Cu, Pb, $Ca^{2+}$, CEC, Fe and Salinity. This was carried out according to Haluschak (2006).

## 3.0 RESULTS AND DISCUSSION

The various crops grown on the various study areas is presented in Table 2. It can be observed that eight different types of crops are grown on the randomly selected study area which is based on the popularity of the crops. The soil texture classification for the study area is in conformity with the works of Musa and Adeoye, 2010; Musa *et al*., 2012; and Musa *et al*., 2013 as presented in Table 3. Their study explained that there are basically five types of soils most commonly available for agricultural purposes. These include sandy loam soil, sandy clay soil, loam soil, clay soil and loamy clay soil. The values of the particle size analyzed ranged between 78.84 to

82.67 % for sand, 6 to 13.11 % for silt and 4 to 14.1% for clay. From the results obtained, sand has the maximum percentage followed by clay and silt respectively. This values obtained showed that a large fraction of the farm land where samples were collected are sandy in nature and mainly falls into the loamy sand textual class. This is similar to the works of Lawal *et al*., (2014). They worked on the impact of gradient positions on some properties of soils under a Tectona Grandis Plantation in Minna, Southern Guinea Savanna of Nigeria.Table3shows the most commonly farmed soil type (sandy loam) within the study area. It is known to support the growth of cereal crops which is one of the predominant crop types in this part of the country.

Table 2: Crops planted on the various site

| Location | Crops Grown | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J |
| Farm 1 | A | B | C | D | NG | NG | NG | NG | NG | NG |
| Farm 2 | NG | NG | NG | NG | E | F | G | NG | NG | NG |
| Farm 3 | NG | NG | NG | NG | NG | NG | NG | H | I | J |

*NG Crops not grown, A: Yam, B: Rice, C: Pepper, D: Maize, E: Okra, F: Pawpaw, G: Potato, H: Eucalypsus Plantation, I: Fallow Land, J: Yam Farm*

Table 3: Textural classification of soils for the various locations

| S/No. | Locations | Sand (%) | Silt (%) | Clay (%) | Textural class |
|---|---|---|---|---|---|
| | Farm 1W.S | | | | |
| 1. | A | 78.84 | 7.06 | 14.1 | Loamy sand |
| 2. | B | 79.86 | 7.03 | 13.11 | Loamy sand |
| 3. | C | 79.82 | 6.09 | 14.09 | Loamy sand |
| 4. | D | 78.88 | 8.04 | 13.08 | Loamy sand |
| | Farm 1 D.S | | | | |
| 5. | A | 79.98 | 9.02 | 11.0 | Loamy sand |
| 6. | B | 79.86 | 13.11 | 7.03 | Loamy sand |
| 7. | C | 80.02 | 11.85 | 8.13 | Loamy sand |
| 8. | D | 81.0 | 11.0 | 9.0 | Loamy sand |
| | Farm 2 W.S | | | | |
| 9. | E | 81.0 | 7.04 | 11.96 | Loamy sand |
| 10. | F | 80.0 | 6.0 | 4.0 | Loamy sand |
| 11. | G | 82.67 | 9.56 | 7.77 | Loamy sand |
| | Farm 2 D.S | | | | |
| 12. | E | 79.98 | 6.0 | 14.02 | Loamy sand |
| 13. | F | 81.02 | 6.02 | 12.96 | Loamy sand |
| 14. | G | 80.0 | 8.04 | 11.96 | Loamy sand |
| | Farm 3 W.S | | | | |
| 15. | H | 82.09 | 6.03 | 11.88 | Loamy sand |
| 16. | I | 78.03 | 9.01 | 12.96 | Loamy sand |
| 17. | J | 78.86 | 8.01 | 13.13 | Loamy sand |
| | Farm 3 D.S | | | | |
| 18. | H | 81.95 | 8.84 | 9.21 | Loamy sand |
| 19. | I | 78.804 | 10.02 | 11.176 | Loamy sand |
| 20. | J | 79.501 | 8.46 | 12.639 | Loamy sand |

*A: Yam, B: Rice, C: Pepper, D: Maize, E: Okra, F: Pawpaw, G: Potato, H: Eucalypsus Plantation, I: Fallow Land, J: Yam Farm*

### 3.1 Chemical Analysis

Bouksila *et al*., (2010) reported in their study that a land that has a shallow water table in line with elevated soil salinity usually results to complete soil degradation. In arid and semiarid climates, soil salinization is the greatest problem affecting irrigated land sustainability. Weathering of rocks is one of the major ways of obtaining minerals and there exist a relationship between the salt present and chemical composition of rocks from which soils originated, the fertilizer applied and the farming system practiced (Chukwu and Musa, 2008). Table 4 presents the various chemical parameters available within the study areas. These parameters observed are associated with the various types of fertilizers applied to the farmlands.

**Phosphorus (P):** Phosphorus is an important macronutrient which is mobile and has direct effect on the productivity of a soil in terms of quality and growth of the plant. The result obtained from this study as presented in Table 4 showed that the values of phosphorus for farm 1 ranged between 9 to 11 mg/kg and 11.5 to 14 mg/kg; for farm 2 it ranged between 8.5 to 11 mg/kg and 12.5 to 14 mg/kg while for farm 3 it ranges between 8 to 10 mg/kg and 10.5 to 14 mg/kg during the wet and dry seasons respectively. Phosphorus values obtained during the dry period were found to be higher than the values obtained during the raining period, this may be due to the organic manure and the inorganic fertilizer N:P:K which are added to the soil and are consequently reduced during the wet season through the process of leaching. The leaching process is much more intense during the wet season which is due to the rate at which rain falls within the study area. This is similar to the work of Kingshuk and Giichi (2014) who studied the salinity condition of 2011 Tohuku-Oki Tsunami affected agricultural lands in northeast Japan and found out that as a result of sufficient rainfall during the raining period, there was less problem of salinity in agricultural lands whereas during the dry period, the salt contents in the soil increased. This, they linked to high temperature rate which lead high rate of evaporation of the soil moisture content and insufficient rainfall to leach the excess salt ions present in the soils.

**Potassium (K):** Potassium is one of the most relevant macronutrients needed by plants to activate enzymes and for the formation of protein (Temilola*et al.*, 2014). From the results in Table 4, it was observed that the value of Potassium in the soils analyzed during the wet and dry seasons ranged from 0.06 to 0.10 Cmol/kg and 0.11 to 0.14 Cmol/kg for fam 1; for farm 2 the value ranges between 0.04 to 0.10 Cmol/kg and 0.11 to 0.16 Cmol/kg during the wet and dry season while farm 3 had values ranging between 0.03 to 0.09 Cmol/kg and 0.10 to 0.12 Cmol/kg during the wet and dry seasons respectively. The values obtained indicates a higher potassium content during the dry period as compared to the values during the raining period might be due to high temperature and leaching of nutrient in the soil. This is similar to the works of Yavitt *et al*., (2004) and that of Schoonover and Crim (2015).

Table 4: Various Parameters Analyzed in the Soils from the Various Locations.

| **Sample** | **pH in $H_2O$** | **Mn (mg/l)** | **Cu (mg/l)** | **Pb (mg/l)** | **Av. P (mg/l)** | **Exc. Bases** | | | | **EC (µS/cm)** | **CEC (cmol/kg)** | **Fe (mg/l)** | **% O/C** | **% O/M** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $Na^+$ (cmol/kg) | $K^+$ (cmol/kg) | $Mg^+$ (cmol/kg) | $Ca^{2+}$ (cmol/kg) | | | | | |
| **Farm 1 W.S** | | | | | | | | | | | | | | |
| **A** | 6.33 | 0.19 | 0.12 | 0 | 10 | 0.12 | 0.10 | 1.0 | 2.4 | 10 | 2.8 | 0.12 | 0.33 | 0.57 |
| **B** | 6.48 | 0.18 | 0.16 | 0 | 11 | 0.14 | 0.09 | 1.3 | 2 | 12 | 3 | 0.06 | 0.28 | 0.48 |
| **C** | 6.38 | 0.18 | 0.11 | 0 | 10.5 | 0.13 | 0.06 | 1.5 | 2.3 | 12.5 | 4 | 0.14 | 0.44 | 0.76 |
| **D** | 6.28 | 0.13 | 0.13 | 0 | 9 | 0.16 | 0.08 | 1.3 | 3.1 | 14 | 2.5 | 0.2 | 0.36 | 0.62 |
| **Farm 1 D.S** | | | | | | | | | | | | | | |
| **A** | 6.63 | 0.33 | 0.21 | 0 | 11.5 | 0.16 | 0.11 | 1.8 | 2.8 | 13 | 3.5 | 0.13 | 0.37 | 0.64 |
| **B** | 6.47 | 0.28 | 0.23 | 0 | 12.5 | 0.18 | 0.12 | 2.3 | 2.7 | 13.2 | 4 | 0.16 | 0.28 | 0.48 |
| **C** | 6.88 | 0.21 | 0.20 | 0 | 12 | 0.18 | 0.12 | 1.7 | 2.0 | 14 | 4.3 | 0.11 | 0.34 | 0.59 |
| **D** | 6.74 | 0.27 | 0.18 | 0 | 14 | 0.16 | 0.14 | 1.4 | 3.2 | 14 | 3.5 | 0.21 | 0.35 | 0.61 |
| **Farm 2 W.S** | | | | | | | | | | | | | | |
| **E** | 6.52 | 0.15 | 0.18 | 0 | 11 | 0.12 | 0.06 | 1.2 | 2.5 | 10 | 2.4 | 0.16 | 0.27 | 0.47 |
| **F** | 6.44 | 0.19 | 0.13 | 0 | 8.5 | 0.14 | 0.04 | 1.5 | 2.1 | 10.04 | 1.8 | 0.11 | 0.38 | 0.66 |
| **G** | 6.25 | 0.16 | 0.15 | 0 | 10.5 | 0.15 | 0.10 | 1.4 | 2.0 | 12 | 2 | 0.09 | 0.41 | 0.71 |
| **Farm 2 D.S** | | | | | | | | | | | | | | |
| **E** | 6.36 | 0.22 | 0.10 | 0 | 14 | 0.18 | 0.11 | 1.9 | 2.6 | 11.8 | 3.2 | 0.15 | 0.39 | 0.67 |
| **F** | 6.45 | 0.20 | 0.17 | 0 | 12.5 | 0.16 | 0.14 | 1.7 | 2.4 | 12.5 | 3.8 | 0.18 | 0.26 | 0.45 |
| **G** | 6.33 | 0.22 | 0.16 | 0 | 12.5 | 0.18 | 0.16 | 2.3 | 2.3 | 13 | 2.5 | 0.2 | 0.47 | 0.81 |
| **Farm 3 W.S** | | | | | | | | | | | | | | |
| **H** | 6.48 | 0.13 | 0.12 | 0 | 8 | 0.14 | 0.06 | 1.4 | 1.9 | 9 | 2.3 | 0.13 | 0.44 | 0.76 |
| **I** | 6.81 | 0.16 | 0.10 | 0 | 10 | 0.15 | 0.03 | 1.3 | 2.1 | 9.8 | 2 | 0.18 | 0.42 | 0.73 |
| **J** | 6.38 | 0.14 | 0.13 | 0 | 9 | 0.13 | 0.09 | 1.2 | 2.3 | 10.5 | 2.3 | 0.16 | 0.42 | 0.73 |
| **Farm 3 D.S** | | | | | | | | | | | | | | |
| **H** | 6.85 | 0.18 | 0.19 | 0 | 10.5 | 0.18 | 0.10 | 1.8 | 2.0 | 12 | 3.1 | 0.16 | 0.37 | 0.64 |
| **I** | 6.37 | 0.19 | 0.18 | 0 | 11.5 | 0.18 | 0.12 | 1.4 | 2.6 | 12.5 | 2.6 | 0.11 | 0.33 | 0.57 |
| **J** | 6.44 | 0.18 | 0.16 | 0 | 14 | 0.16 | 0.10 | 1.6 | 2.4 | 13 | 2.4 | 0.18 | 0.36 | 0.62 |

*A: Yam, B: Rice, C: Pepper, D: Maize, E: Okra, F: Pawpaw, G: Potato, H: Eucalypsus Plantation, I: Fallow Land, J: Yam Farm, EUC. (Eucalypsus Plantation), Yam F. (Yam farm), Fallow L. (Fallow land).Av. P. (Available Phosphorus), EC. (Electrical Conductivity),CEC(Cation Exchange Capacity), % OC (Percentage Organic Carbon), %OM (Percentage Organic Matter), Exc. Bases (Exchangeable Bases).*

**Magnesium (Mg)**: Magnesium content of the soil samples during the wet seasons from farms 1, 2 and 3 ranged between 1.0 to 1.5 Cmol/kg; 1.2 to 1.5 Cmol/kg and 1.2 to 1.4 Cmol/kg respectively while that of the dry season for farms 1, 2, and 3 ranges between 1.4 to2.3 Cmol/kg; 1.7 to 2.3 Cmol/kg and 1.4 to 1.8 Cmol/kg respectively. The values of obtained during the dry period are quite higher than the raining period this might be due to the consistent rainfall which leads to leaching of nutrient and also due to high temperature (Nduka*et al.*, 2008).

Increased level of magnesium in soils has been described by several researchers (Novak *et al.*, 2009; Bronick and Lal, 2005; Chen and Cutright, 2001; Huang *et al*., 1997) to cause high level of structural degradation which eventually leads to poor or lower infiltration rates and hydraulic conductivities. Magnesium is a divalent cation thus its excess in high level in soils either alone or in combination with sodium may lead to its deterioration in soil physical properties (Novak *et al.*, 2009). The hydration energy and radius of Magnesium is known to greater than calcium which weakens the attractive forces between individual soil particles thereby causing them to degenerate into smaller fragments (Novak *et al*., 2009; Bernasconi *et al*., 2006).

**Calcium (Ca):** The values obtained for the various soil samples from the different farms ranged between 2.0 to 3.1 Cmol/kg and 2.0 to 3.2 Cmol/kg for farm location 1during the wet season respectively while farms and 3 ranges between 2.0 to 2.5 Cmol/kg. The obtained values during the dry seasons for the farm locations 1, 2 and 3 ranges between 2.0 to 2.8 Cmol/kg; 2.3 to 2.6 Cmol/kg and 2.0 to 2.6 Cmol/kg respectively. The use of calcium as soils amendment is a common practice in Nigeria which increases its content in soils as most crops planted in this region are maize and corn. Excessive calcium uptake by a plant may lead to disturbances in ion balance, to the disadvantage of other nutrients (such as potassium and magnesium), or to changes in cytosol pH and a decrease in solubility of some ions, e.g. of iron (Giel and Bojarczuk, 2011)

**Sodium (Na):** The values obtained for the soil sample from the various farms land ranged from 0.12 to 0.16 Cmol/kg) and 0.16 to 0.18 Cmol/kg for farm location 1 while 0.12 to 0.15 Cmol/kg and 0.16 to 0.18 for farm location 2 and farm location 3 ranges between 0.13 to 0.15 Cmol/kg and 0.16 to 0.18 Cmol/kg during the wet and dry seasons respectively. The values of sodium obtained from the various farm land were observed to be relatively low and within permissible limits. This could be linked to the kind of soil improvement additives that are added to enhance crop growth. This further speculates that low amount of NPK fertilizer is been added to the soils. The low concentration of sodium in the study area indicates that the study area is free from the threat of salinization and in areas whereby sodium concentration in the soil is high, it may lead to high salt presence in the farmlands which will lead to turbidity of the soils and decrease in the osmotic activity of the soil (Getahun *et al*., 2014). The low concentration of $Mg^{+}$, $Na^{+}$, $Ca^{+}$, and $K^{+}$ have no detrimental effect on the soil because they are required in little amount in the soil but when in excess, would give rise to the problem of salinity which weakens plants as a result of the increase in osmotic pressure and the toxic effect of the soil, damage of soil structure due to lack of oxygen making it incapable of assuring plant growth. When the salt content of the soil is high, the rate at which percolation will take place in the soil will be reduced which will in turn give room to water logging thus reducing the growth rate at which root absorbs water from the soil. This is in conformity with the works of Patel and Pandey (2009).

**Organic Matter (OM):** The presence of OM in soil is believed to be a very important factor in soil fertility as it is known to be a major source of plant nutritive elements with a great influence on the physical and chemical properties of the soil (Zornoza *et al*., 2015; Liu *et al.*, 2008). An understanding of the OM variation in soils is of great importance to salinized soils (Delal *et al*., 2011). The OM values for the various soil samples obtained from farm location 1 ranged between 0.48 to 0.76 % while that of farm location 2 and 3 ranges between 0.47 to 0.71% and 0.73 to 0.76% respectively. During the dry season, the OM content for farm locations 1, 2 and 3 ranges between 0.48 to 0.64%; 0.45 to 0.81% and 0.57 to 0.64% respectively. The result obtained shows that farm locations 2 and 3 had the highest organic matter content which may be due to the organic manure applied to the farms as compared to farm 1.Thus, the two farm locations may have high soil fertility rate as compared with other farms which is in conformity with the works of Yang *et al*., (2012). They studied the spatial distribution of soil moisture, salinity and organic matter in Manas River water shed, Xinjiang-china.

**Manganese (Mn):** The values obtained for soil samples collected from farm location 1 ranged between 0.13 to 0.19 mg/l during the wet season while during the dry period it ranged between 0.20 to 0.33 mg/l, for farms locations 2 and 3 during the wet season the Mn values ranges between 0.15 to 0.19 mg/l and 0.10 to 0.13mg/l respectively while during the dry season it ranges between 0.10 to 0.17 mg/l and 0.16 to 0.19 mg/l respectively. This result indicates a low concentration of manganese content in farm 3 and a higher concentration in farm 1 respectively. These might be due to the organic and inorganic fertilizers that are applied in the farms and also the nature of the soil properties. This is similar to the work of Kingshuk *et al.,* (2014), they studied the Salinity status of the 2011 Tohoku-oki tsunami affected agricultural lands in northeast Japan and found out that due to inefficient and poor distribution of water by inadequate drainage management could lead to salinity.

**Copper (Cu):** The Cu content observed on farm location 1 ranges between 0.11to 0.16 Cmol/kg during the wet season while during the dry season the values ranged between 0.18 to 0.23 Cmol/kg, 0.13 to 0.18 Cmol/kg. On the second and third locations during the wet season, the values ranged between 0.13 and 0.18 Cmol/kg and 0.10 to 0.13 Cmol/kg respectively. During the dry season farm locations 1, 2 and 3 had values ranging between 0.18 to 0.23 Cmol/kg; 0.10 to 0.17 Cmol/kg and 0.16 to 0.1 9 Cmol/kg respectively. This result indicates a higher concentration of Cu in the various farms during the dry period as compared to the raining period this might be due to consistent rainfall which tends to leach away most of the available nutrient including Cu. The result also indicates that farm 1 and farm 2 has the highest concentration of copper compared to farm 3. This is similar to the work of Kingshuk *et al.* (2014).

**Iron (Fe):** The values obtained for the soil samples from the various farms ranged between 0.06 to 0.2 mg/l for farm 1 while during the dry period it ranged between 0.11 to 0.21 mg/l, 0.09 to 0.16 mg/l for farm 2 while during the dry period it ranged between 0.15 to 0.2mg/l and 0.13 to 0.18 mg/l for farm 3 while during the dry period it ranged between 0.11 to 0.18mg/l. This result indicates a higher concentration of iron in the various farms during the dry season thus leading to a high concentration of soil nutrient at the soil surface. This is similar to the work of Getahun *et al.*,(2014). They studied the evaluation of irrigation water quality and suitability for irrigation in the Fincha'a Nile basin of western Ethiopia and found out that nearly all irrigation water contains dissolved salts and trace elements which when applied to the soil moves by capillary action and when these water evaporates due to intense temperature leads to the concentration of these salts at the soil surface giving rise to salinization.

**pH:** The pH of any substance can be defined as the degree of acidity or alkalinity of that substance. It can also be express as the negative logarithm of hydrogen ion concentration in the substance (Portjanskaja *et al*., 2004; Thanasoulias *et al*., 2002). The pH value obtained from this study ranges from 6.25-6.88 for the soil sample, which indicates that the soil is slightly acidic. These values as compared with international standards of FAO (1976) and were found to be within acceptable range.

**Electrical Conductivity (Ec)**: Electrical conductivity is used to measure the degree of salinity of a given soil and also the rate at which a soil can conduct electricity. This is expressed in micro siemen per centimeters (μS/cm).It has been reported that the higher the value of electrical conductivity, the higher the salinity.The observed Ec values from Table 5 for the wet season ranged between 9.00 and 12.50 μS/cm while that of the dry season ranged between 11.8 to 13.2 μS/cm. it was observed from the Table 5 that the dry season had highest values of Ec. The low Ec values during the wet season could be linked to the dilution of the various salt metals in the water which is consequently leached away from their present position. When the electrical conductivity of the soil samples where compared with standards obtained from World Health Organization (WHO) of 2004; it was discovered that the values were within the recommended standard. This clearly shows that the sampled soil does not contain enough salt concentration to conduct electricity which makes them suitable for farming purposes. The presence of the various salt metals determined in this study have no detrimental effect on the soil as they are required in small amount in the soil for effective crop growth. This is in conformity with the works of Patel and Pandey (2009) and that of Getahun *et al*., (2014).

## 4.0 CONCLUSION

The United Nations estimated that the population projection by 2050 is expected to be about 8.9 billion inhabitants, which implies more agricultural activities to meet the food demands. Recently, the main aim is to increase the potential for food cultivation and its yield in the field which is to be accompanied by sustainable land management. This can be achieved through the various resource management with respect to human needs, maintenance of environmental quality, and the preservation of natural resources for the future. Soil salinity is extensively reported as the major agricultural problem, predominantly in irrigated agriculture. Approximately 20% of arable land and 50% of agricultural land in the world are under the stress of salinity. According to UNESCO and FAO estimated figures, the area of saline soils in the world is of $9.5 \times 10^7$ $km^2$.

This study has revealed that salinity of the soils that were identified within the study locations is gradually on the increase but still at a level that has no detrimental effect on the crops planted. Though identified as an age long farming practices, adequate management of the irrigation scheme and fertilizer application could improve the soil nutrient content irrespective of the soil condition. A proper management practices must be put in place to avoid the threat of salinity in years to come. Hence, the environment will be sure of a healthy soil which can sustain biological productivity, maintain environmental quality, and promote plant and animal health when best management practices are employed.

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