FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-
Vol. 8 No. 2, December 2022: Pp. 150-152.

Doi: https://doi.org/10.33003/jaat.2022.0802.20

# ASSESSMENT OF SOME MAJOR PLANT NUTIRENTS IN FADAMA AREA OF A RESEARCH FARM KUST, WUDIL

**A. Musa**
Department of Crop & Soil science
Faculty of Agriculture National Open University of Nigeria
Correspondent E-mail address: aliyugusau2020@gmail.com

## ABSTRACT

A study was conducted to evaluate the status of organic carbon, total nitrogen available phosphorus, pH, EC, CEC and exchangeable bases of soils from Fadama area of a research Farm. 20 soil samples were collected from the research areas at depths of 0 – 15 and 15 – 30cm. The samples were analyzed, in the laboratory for the parameters mentioned above. For all the properties, there was decrease with depths the results obtained indicated that the level of these properties was generally low as compared to standard measures. Simultaneous application of inorganic fertilizer and organic manure will improve soil fertility.

**Keywords**: Organic carbon, Total nitrogen, Available phosphorus, and Exchangeable bases

## INTRODUCTION

Soils are complex physical and biological systems that make up part of the earth's crust. They are, therefore, one of the most valuable natural resources of a nation. In agricultural production, it is an integral part, the ecological system that plant and animal kingdoms meet and establish the dynamic relation. Soils being the natural medium of plant growth are vital to life through their roles in food production, and other needs. (Thompson and Troeh, 1978). Although, soil fertility is affected by many natural phenomena, it can be improved by good management and decreased by bad management. Soil fertility declines when its content diminishes or when their physical, chemical and biological composition changes to the disadvantages of the growing plant, there by lower its ability to support and nourish plant growth. Fadama is a term used in the northern part of the country to identify "Hydromorphic" soils. These are low-lying areas including stream channels and streamless depression, which are water logged or flooded in the wet season (Tisdale, and Nelson1985). In the drier parts of the world, including the Nigerian savanna, stream channel Fadama is intensively cultivated because they are more fertile and more productive than upland soil (Kparmwang, 1990). These attributes are due to prolonged moisture either because of flowing water or low water table during, at least, part of the dry season. The water from these sources is used for irrigation. The Fadama are also generally higher in organic matter and nutrient content as compared to the upland soils (Kparmwang and Esu, 1990). Fadama soil is known to be rich in nutrients content with high fertility level. As far as the country is concerned the need for food sufficiency has brought a corresponding need to harness the fertility of Fadama soil as it shown the potential use for all year round. Fadama is a local (Hausa) name meaning the seasonally flooded or floodable plains, irrigable lands, or low laying plains along major savanna rivers or depressions on the adjacent low terraces (Adeyeye, 2005). This type of soil is under continuous cultivation especially in Northern Nigeria in areas around Kano, Kaduna, Bauchi, Plateau, Niger, Kebbi and Sokoto among others Several studies have been conducted both in Nigeria and other African countries on soil fertility using scientific soil assessment methods.

## MATERIALS AND METHODS

Kano University of Science and Technology research farm is located behind the University premises in the Northern part of Wudil Local Government Area in Kano State; located in the Savannah region of Northern Nigeria between latitudes $12^{0}11^{1}$N to $12^{0}14^{1}$N and longitudes ($7^{"}$ -$38^{0}$ E to $8^{"}$ – $38^{0}$ E). This part of the Savannah region has an annual rainfall ranging from 850 – 870mm per annum with annual mean temperature of $38^{0}$ C – $43^{0}$C, with relative humidity of 40% - 51.3% respectively. The Southern part of the research farm is hilly and will be characterized by rough topography that is not suitable for crop production.

A total of 20 samples were collected each at the depth of 0 – 15cm and 15-30cm. The samples were taken to laboratory and air-dried, ground using porcelain pestle and motar. The grounded soil samples were sieved using a 2mm sieve and the fine earth fraction was collected and kept for analysis. Chemical analyses were carried out in the laboratory on each of the prepared soil samples following standard laboratory procedures. Soil pH was determined in 1:2 soil/water using a caromel glass electrode pH meter (Smith 1983). Available phosphorus was extracted by Bray 1 Method as provided by Bray and Kute (1984). The concentration in samples was determined calorimetrically with a spectrophotometer at 882mm.

Organic carbon and organic matter were determined by wet oxidation method (Juo 1979). The exchangeable bases were determined using ammonium saturation method (Chapman, 1956). The bases, Ca and Mg were read on the atomic absorption spectrophotometer while Na and K on the flame emission photometer at

appropriate wavelength. Exchangeable acidity was extracted with 1ml KCl solution and determined by titrating with standard method. Electrical conductivity (Ec) was determined in 1:5 soil/water extract on a conductivity meter, the value was multiplied by a factor (6.4) to obtain the Ec of saturation extract. Exchangeable sodium percentage (ESP) was calculated using the formula:

$$Esp.\% \frac{Na}{CEC} \times 100$$

$$PSB = \frac{Na + Ca + Mg + K}{CEC} \times 100$$

**RESULTS**

Table. shows the percentage distribution of organic carbon, total Nitrogen and available phosphorus based on various locations of the research area as compared to the ratings for soil fertility in the Nigerian savannah as adopted by ESU (1991). The distribution of organic carbon in various locations of this research area was low. The highest value obtained is 4.64% and 3.01% as the lowest value. This greatly indicates differences in fertility rate because of the fluctuations in value. Total Nitrogen distribution was also "Low". The highest value obtained is 0.08% and the lowest is 0.03%. The amount of total Nitrogen decreases with depths. Available phosphorus varies with differences in depths. The highest value of the available phosphorus obtained is 14.2ppm. The lowest value obtained is 9.32ppm; the values of the available phosphorus differ in difference locations and depths. Others parameters determined were $P^H$ in water suspense and $P^H$ in $Nacl_2$, the highest value for $P^H$ is 5.40 and the lowest is 4.51. The gross $P^H$ determined ware seen to be slightly acidic which requires improvement for agricultural uses.

Table. Shows the exchangeable characteristics contained (values in Cmol (+).kg-1) 0.83 as the lowest and1.67 as the highest for Ca, and 0.70 as the lowest and 1.12 as the highest for Mg and 0.28 as the lowest and 0.46 for k. Ca and Mg being the dominant exchangeable bases this was also observed earlier by (Jones and Wild 1975). The total content of exchangeable bases tends to increase with soil depth. Going by the fertility category limit by Esu (1991) this Fadama area can be rated as low in ca – fertility, medium in Mg – fertility and high in-k-fertility. While the CEC ranged from 4.2 to 5.5 in cmol (+).kg-1 as earlier reported 2.16 – 9.6 cmol (+).kg-1 for savannah soils (Jones and Wild, 1975). The observed range puts this Fadama area soils in low CEC category. This is based on the limits <6, 6 – 12 and >12 cmol(+).kg-1 for low, medium and high CEC categories respectively.

**Table Distribution of Organic Carbon, Total Nitrogen and Available Phosphorus in the soils of the study area**

| Depth (cm) | pH | Organic carbon, % | Total N, % | Available P, mg kg$^{-1}$ | EC Ms cm-1 | Cmol kg$^{-1}$ | | | | | % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ca | Mg | K | Na | CEC | ESP | PBS |
| 0 – 15 | 4.51 | 4.11 | 0.08 | 10.3 | 5.8 | 1.15 | 0.80 | 0.45 | 0.31 | 4.8 | 6.46 | 56.46 |
| 15 – 30 | 5.21 | 4.13 | 0.04 | 9.32 | 4.7 | 1.12 | 0.92 | 0.36 | 0.28 | 4.3 | 6.51 | 62.33 |
| 0 – 15 | 5.20 | 4.22 | 0.04 | 12.2 | 5.6 | 0.91 | 0.70 | 0.45 | 0.46 | 5.5 | 8.36 | 45.81 |
| 15 – 30 | 5.10 | 3.01 | 0.03 | 10.0 | 3.9 | 1.67 | 0.81 | 0.31 | 0.34 | 5.0 | 6.80 | 62.60 |
| 0 – 15 | 5.20 | 3.25 | 0.08 | 14.2 | 4.8 | 0.87 | 0.96 | 0.39 | 0.55 | 4.8 | 11.46 | 57.71 |
| 15 – 30 | 5.30 | 3.14 | 0.05 | 9.56 | 3.7 | 1.12 | 1.10 | 0.30 | 0.47 | 4.2 | 11.19 | 71.19 |
| 0 – 15 | 5.21 | 4.26 | 0.07 | 13.3 | 4.6 | 0.83 | 0.80 | 0.33 | 0.49 | 4.8 | 10.20 | 51.04 |
| 15 – 30 | 5.30 | 3.54 | 0.06 | 11.2 | 4.3 | 0.95 | 0.90 | 0.28 | 0.37 | 4.5 | 8.22 | 55.55 |
| 0 – 15 | 5.40 | 4.64 | 0.04 | 14.2 | 4.7 | 0.91 | 0.88 | 0.46 | 0.36 | 4.7 | 7.65 | 55.53 |
| 15 – 30 | 5.11 | 4.30 | 0.03 | 11.4 | 3.7 | 1.26 | 1.12 | 0.38 | 0.32 | 4.3 | 7.44 | 71.62 |

## DISCUSSION

Organic C is an index of organic matter and plant nutrient content in soils. Table show that the content of organic matter in the soils varied. The organic carbon at the different depths (0-15 and 15-30cm) was low at the different locations of the Fadama this implies low organic matter content in the soils. Organic carbon decreases irregularly with depth in the flood plain Fadama soils (Esu, et. al. 1987). The content of organic Carbon did not vary among the locations but varies within the depth probably by virtue of poor drainage. The highest total N-obtained in the area was low. Like organic C, it also decreases with depth, but did not vary significantly between location and depth, suggesting that it is associated with organic matter content. The low N content of these soils could probably be due to the continuous leaching because of the seasonal flooding and the result those anaerobic conditions during the flooding. Rending and Taylor (1989) reported that N-mineralization under anaerobic conditions does not proceed beyond ammonium stage, which is subsequently lost as gas to the atmosphere. Because of their moderately low N content, these soils are very likely to respond to N fertilization. Similarly, if crop rotation should involve legumes the productivity of the soils will be maintained. Available phosphorus in this soil varies with depths. The values of the available phosphorus differ with difference locations and depths.

Table. Shows some exchangeable bases, available potassium varied moderately in the Fadama area. The results were similar to those reported by Singh (1997) in soils of Fadama elsewhere. The cation exchange capacity of these soils is low, thereby requiring appropriate soil management steps to be employed, if fertilizers are to be of benefit to crops, otherwise, the applied nutrients would be lost through leaching. The low CEC could be because of both low organic matter contents of the soils (Balasubramanian et al 1978). These results also show the values of Calcium and magnesium in the area both Ca and Mg did not varied among the locations and within depth. The value of calcium was low which corresponds to the values reported by (Kowal and Knabe, 1972). Sodium did not vary with depth and among locations. This low value corresponds to values reported by (Singh, 1997) for soils of the semi arid. The percentage base saturation of the Fadama area is (71%) this is in line with the reports of Ezenwa and Esu; (1999) that showed soils in semi arid parts of the tropics have a base saturation of > 35%. Table 1. Shows values for soil pH and EC, which were used as indicators of salinity. The soil pH ranged from 4.5 – 5.4 which is considered slightly acidic. Ipinmidum (1970) reported that Fadama soils are generally acidic.

## CONCLUSION

For all the properties analyzed, it was observed that there was decrease with depths, the results obtained also indicated that the level of these properties ware generally low as compared to standard measures. Simultaneous application of inorganic fertilizer and organic manure will improve soil fertility.

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