Original Article *Journal of Sustainability and Environmental Management (JOSEM), Vol. 1, No. 4 (2022), 383 – 390*
p-ISSN 2822-1729, e-ISSN 2822-1737 Available online at https://www.nepjol.info/index.php/josem

Ruderal Plants Biomass and Soil Physicochemical Parameters in Birnin Kebbi Metropolis, Kebbi State, Nigeria

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Abstract: This research was aimed to determine below ground biomass (BGB) of ruderal plants species and soil physicochemical parameters in seven homogenous sample plots in Birnin Kebbi Metropolis of Kebbi State, Nigeria and to assess their importance for energy flow in the ecosystems. Completely Randomize Design was adopted for monthly sampling (June-November 2019) and belowground biomass were collected after removing above ground biomass by digging 40 cm depth to collect fresh BGB in the central 20cm x 20cm quadrat using destructive method which was then oven dried at 650C for 48 hrs. Soil samples were collected between 0-15 cm depths using soil auger for analysis of soil physicochemical parameters using standard methods. Below ground biomass differed significantly between the months ($P \leqslant 0.05$) with gradual increase from a minimum values in June (18.18±0.82 gm-2/month) to a maximum values in October (71.92±1.93gm-2/month) and a decreased in November (61.31±1.36 gm-2/month). There was no significant difference among the sites ($P>0.05$). Site A, F and C recorded the highest value of Nitrogen (0.15±0.06%, 0.15±0.02% and 0.13±0.11%), Phosphorus (14.07±0.37mg/kg, 12.03±0.33mg/kg and 9.14±0.13mg/kg), Potassium (0.16±0.08 cmol/kg, 0.15±0.11 cmol/kg and 0.12±0.04 cmol/kg) and Organic matter (1.03±0.15%, 0.88±0.33% and 0.76±0.08%) respectively and the result was not statistically different ($P>0.05$).The research shows that ruderal plants adapted the ecological factors of the study area and provides based line information on below ground Biomass (BGB) of ruderal plants species in Birnin Kebbi town and also provide valuable information on the physical and chemical properties of soil that supports growth and development of the ruderal plants. Further research on the belowground biomass of most dominant ruderal plants in Birnin Kebbi ecological zone should be conducted to assess their contribution in providing land cover and soil compaction which can reduce percolation and carbon sequestration.

Keywords: *Biomass, Physicochemical parameters, Quadrats, Ruderal plant, Soil*

Conflicts of interest: None
Supporting agencies: None

Received 17.09.2022; Revised 3.11.2022; Accepted 16.11.2022

Cite This Article: Singh, D., Musa, J., Keta, J.N., & Tomar, N. (2022). Ruderal Plants Biomass and Soil Physicochemical Parameters in Birnin Kebbi Metropolis, Kebbi State, Nigeria. *Journal of Sustainability and Environmental Management*, 1(4), 383-390.

1. Introduction

Biomass is a very important component of ecosystems with respect to both structure and function. Root biomass production and disappearance fluctuates seasonally and below ground biomass increases through the growing season with adequate soil moisture. Savanna have a rich and complex below ground structure, with fine and coarse roots and a variety of below ground organs, such as rhizomes, bulbs, corms and xylopodia, as well as a rich micro-flora and fauna (Stanton, 1988). The top 10 cm of the soil is the most dynamic and sensitive to environmental conditions with respect to root growth. Thus, root growth has been shown to decline towards the end of the growing season not because of decreasing soil temperature (Rice et al., 1998). Root biomass and rhizosphere represent the main pool of organic matter and geobioelement data on belowground biomass production of Savanna ecosystems, occurring at large geographical and temperate scales shown on broader range; varied between 40 to 87% of total primary production (Gill and Jackson, 2000).

Fine root production and turnover are key processes in global carbon and nutrient cycling and may account for 20 to 33% of global terrestrial net primary productivity

(NPP) (Jackson et al., 1997), yet the accuracy of root turnover estimates at both local and global scales has been intensely debated and remains unresolved (Matamala et al., 2003; Strand et al., 2008). Critical for resolving this debate is to clearly identify which roots are turning over at what rate, or whether a group of roots have similar patterns of survivorship as an integrated unit of turnover (Matamala et al., 2003; Strand et al., 2008).

Root turnover is a central component of ecosystem carbon and nutrient cycling (Warren, 2015). In Savannah, decomposing of dead roots enriches soil by organic matter and nutrients influence soil quality, these processes are particularly important and are considered as one of their main features (Warren, 2015). Gill and Jackson (2000) found that root turnover rates increased exponentially with mean annual temperature and soil moisture for fine roots in the savannah. Therefore to understand patterns and controls of root turnover can be crucial for the evaluation of consequences of climate changes in savannah ecosystems (Gill and Jackson, 2000). Production of greater amount of living active roots (including greater amount of accumulated reserve substances) represents also higher resistance of stands to fluctuation of external conditions, different impacts, disturbances (Fiala, 1997).

Soil supports plant growth and acts as a reservoir of water and nutrients, in addition to being a physical medium, vital for producing the food and fibre that humans need and for the maintaining ecosystems functions on which all life ultimately depend (Voroney et al., 2015). Soil types with different structure and nutrients are important for proper plant growth and community development. The effects of environmental variables on plant species have been the subject of many ecological studies in recent years (Ramirez et al., 2007). The chemical composition and physical characteristic of the soil parent materials are important as other climatic factors (Schlesinger et al., 1990). Soils directly and indirectly affect plants productivity, water quality and the global climate through its function as a medium for plant growth and as a regulator of water flow and nutrient cycling. Soil conditions are among the important component that determines the study area, influencing plants growth and development and the carbon storage (Schlesinger et al., 1990). Most primary producers required nitrogen and phosphorous, which are available in the study area as nitrate, ammonia and phosphorous. The abundance of these molecules influences rates of production. Nitrogen (N) and phosphorus (P) are the most important soil parameters that can limit plant primary productivity in the study area (Augustine et al., 2003). This research work focuses on soil nutrients that influenced productivity of ruderal plants during the growing season as an increasingly important environmental variable for understanding the plant biomass.

2. Materials and methods

2.1. Study area

Birnin Kebbi, the study area, is the capital of Kebbi State, located in the North-western part of Nigeria. It lies between latitudes 12.45º N and Longitudes 4.2º E. It is bounded to the North-east by Argungu local government area, to the South by Kalgo local government area, to the East by Gwandu local government area, to the South-east by Aliero and Jega local government area and to the West by Arewa local government area (Abubakar, 2015). Wetland and Savanna soils have developed throughout Kebbi state, the soils are high in minerals but have problems associated with spillage, poor drainage, flood and erosion, the entire Kebbi State falls within the northern Guinea Savanna zone, characterized by heterogeneous mixture of vegetation, heavily disturbed by human influence and few trees of medium height which naturally provide habitat for a variety of wild life (Abubakar, 2015).

The study was conducted in seven relatively stable habitats for monthly sampling during a single rainy season (from June, to November, 2019). These study sites are fallow land with an evidence of human harvest and livestock grazing, no erosion or excavation of soil, and shared the same soil type (sandy soil) with exception of the soil of site C which was loamy sand. The sites were represented with letters A to G.

2.2. Study design

Completely Randomize Design (CRD) was adopted for monthly sampling due to homogeneity of the experimental plots. An online random number table was used to generate the random numbers, used to create a simple grids map of the plots representing sampling units (1mx1m). Ten (10) quadrat was chosen at random on each sampling date per plot (Ovington et al., 2012; Salisu and Rabiu, 2019).

Harvesting or Clipping Below Ground Biomass

All the below ground biomass of the living tissues (produced during the growing period) of plants at the ground level of each central 20cmx20cm randomly selected quadrats were collected by using hands and forceps (Ovington et al., 2012).

Determination of Plants Biomass

After removing aboveground biomass, belowground biomass were collected by digging out 40cm depth in the clipped central 20cmx20cm2 randomly selected quadrats using soil core and hand trowel, the live roots were then collected by hands and forceps by trial sampling to retrieve at least 80% of the roots and fine roots less than about 2mm diameter was collected (Ovington et al., 2012). Roots biomass were washed through 2mm sieves, in order to remove most of the soil attached to it, roots were separated into live and dead on the basis of their tissue necrosis (Todd et al., 1998), the sample was allowed to be free from external moisture at a room temperature and biomass of each quadrat were separately put into paper bags and properly labelled with pen which includes; Quadrat Number, sampling Date, sampling site, weight of empty paper bag, fresh weight (Woldemariam, 2015). The live biomass (samples) was transported to the laboratory,

Department of Biological Sciences, Federal University, Birnin Kebbi (FUBK), Permanent Site, to determine fresh weight using a 0.01g sensitive electrical weighing balance (Sartorius ED224S).

Drying of biomass

Paper bags containing the sample were put into laboratory Oven (DHG-9023) for determination of constant dry weight at 650C for 48hrs. At 48 hours samples were removed to weigh and return back to oven, after 24hrs it were removed again and re-weigh to determine constant dry weight (Buyinza et al., 2014). The constant dry weights were achieved when there was no change in the dry weight and it was recorded immediately.

Collection and preparation of soil samples

Soil samples were collected from all study sites, after clipping aboveground biomass, removing the surface litter. Seven soil samples were randomly collected from each Site at a depth between 0–15cm using soil auger by a gentle screwing clockwise direction, the sample were homogenize to make a composite sample and put into clean polythene bag, the bags were properly labelled and transported to the Agricultural Chemical Laboratory of Department of Soil Science Usman Danfodiyo University Sokoto. Soils were air dried under shed at room temperature for Three (3) days and then grind with plastic mortar and pestle to loosen the compacted soil particles. The grounded soil was sieved through a 2mm paper mesh-size to removed stones and plants particles for laboratory analysis.

Laboratory analysis

Nitrogen (%) was determined using Kjeldahl digestion method (Onyeika and Osieji, 2003), Potassium (cmol/kg) and Phosphorous (mg/kg) using atomic absorption spectrophotometer (Nag, 2007; Emmanuel et al., 2014), Organic Carbon (%) using Walkly and Black method (1934) and Organic matter (%) using method adopted by Fawole and Oso (2004), Na was determined on a flame photometer, while Mg, Ca and Mn were determine using atomic absorption spectrophotometer (Nag, 2007; Emmanuel et al., 2014), Carbon and Nitrogen ratio was obtained by dividing the value of percentage (%) organic carbon by the value of percentage (%) total nitrogen (Nag, 2007; Emmanuel et al., 2014).

Data analysis

Monthly below biomass and data obtained from soil chemical parameters of the seven Study Sites (A to G) were analysed using One-way analysis of variance in statistical software (Minitab) at 95% confidence level. The results were considered significantly different when $P \leq 0.05$and non-significant when $P>0.05$.

3. Results

3.1. Monthly below ground biomass (BGB) of the study sites

During the study periods, when the community below ground biomass was harvested, total biomass differed significantly between the months. Table1 revealed gradual increase in total BGB, from a minimum values in June (18.18±0.82 gm-2/month) to a maximum values in October (71.92 ± 1.93 gm-2/month) and a decreased in November (61.31 ± 1.36 gm-2/month). Results of monthly BGB indicated statistically significant difference among the months where $P \leq 0.05$.

Among the site, site A recorded the highest value of BGB (46.52±1.42 gm-2/month), followed by site F and C with 41.47±1.18 gm-2/month and 39.79±1.11 gm-2/month respectively. While the lowest value of BGB was recorded in site G with 28.31±0.86 gm-2/month (Table 1). Between the study sites, the ground biomass were not statistically significant using analysis of variance (One-way ANOVA) where $P>0.05$ at 90% confidence limit (Table 2).

During the study period, when below ground biomass was harvested, total biomass differed significantly between the months where $P \leq 0.05$.

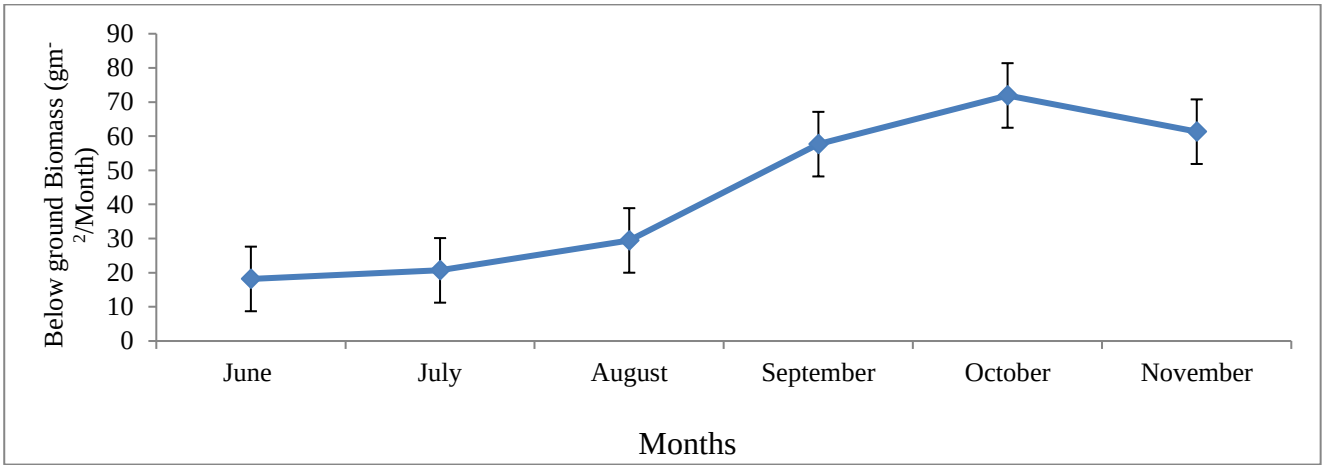

Figure 1: Variation of Monthly Below ground Biomass in the Study Area, 2019

Months	Sites								
	A	**B**	**C**	**D**	**E**	**F**	**G**	**Total**	**Mean**
June	19.25-±0.84	15.39±0.59	17.79±0.81	14.67±0.60	13.24±0.62	17.81±0.80	10.93±0.64	109.08±4.9	18.18±0.82
July	23.98±1.53	17.56±0.55	18.55±0.53	16.77±0.39	14.56±0.40	19.86±0.72	12.85±0.45	124.13±4.57	20.69±0.76
Aug	34.91±1.61	24.61±1.26	26.97±1.17	22.16±0.67	20.28±0.62	30.09±1.31	17.72±0.66	176.74±7.3	29.46±1.22
Sept	59.75±1.39	48.75±0.92	52.84±1.41	47.32±0.87	42.67±1.25	55.61±1.13	39.01±1.15	345.95±8.12	57.66±1.35
Oct	74.64±1.88	62.60±2.03	67.28±1.46	58.59±1.54	53.43±1.38	66.81±1.97	48.17±1.33	431.52±11.59	71.92±1.93
Nov	66.56±1.70	51.37±1.31	55.28±1.27	49.57±0.82	45.32±0.99	58.61±1.12	41.17±0.95	367.88±8.16	61.31±1.36
Total	279.09±8.95	220.28±6.66	238.71±6.65	209.08±4.89	189.5±5.26	248.79±7.05	169.85±5.18	1555.3±44.64	259.22±7.44
Mean	46.52±1.42	36.71±1.11	39.79±1.11	34.85±0.82	31.58±0.88	41.47±1.18	28.31±0.86	259.22±7.44	43.20±1.24

Key: Site A= Aliero Housing Estate, Site B= Tal'udu NEPA, Site C= Site Malala Quarters, Site D= Gwadangwaji Quarters, Site E= Gesse Phase II, Site F= Hilin Sukuwa Bye Pass and Site G= Nadaniya Model Primary School, Badariya and BGB= Belowground Biomass.

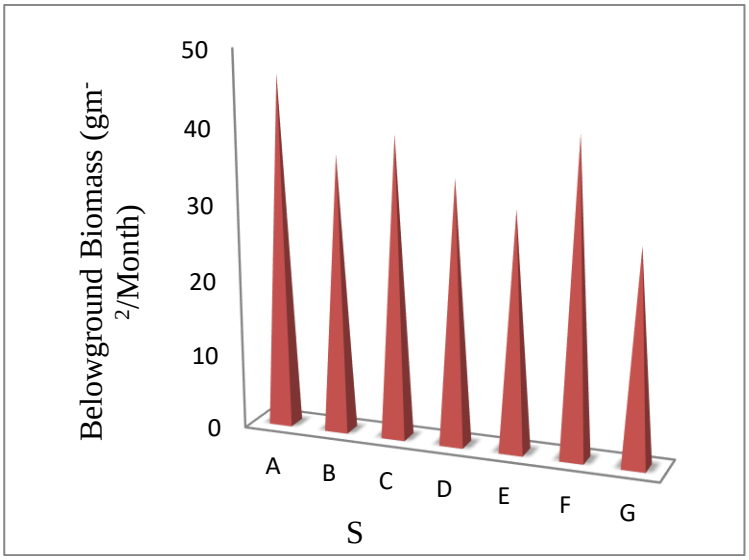

Figure 2: Variation of below ground Biomass among the study sites, 2019

Key: Site A= Aliero Housing Estate, Site B= Tal'udu NEPA, Site C= Site Malala Quarters, Site D= Gwadangwaji Quarters, Site E= Gesse Phase II, Site F= Hilin Sukuwa Bye Pass and Site G= Nadaniya Model Primary School, Badariya

Table 2: Analysis of Variance (One-way ANOVA) of Belowground Biomass Among the Study Sites, 2019

Source of Variation	Adj*SS*	*Df*	Adj*MS*	*F-value*	*P-value*
Sites	13688.5	6	2281.417	6.502559	1.43232E-06
Error	144900.7	413	350.8491		
Total	158589.2	419			

Table 3: Analysis of Below Ground Biomass (One-way ANOVA) of Monthly Comparism among the Sites, 2019

Source of Variation		AdjSS	Df	AdjMS	F	P-Value
	Site	949.070	6	21.090	2.551	**0.008**
July	Error	198.404	24	8.267		
	Total	1147.474	30			
	Site	2468.675	6	54.859	3.464	**0.001**
August	Error	380.100	24	15.838		
	Total	2848.775	30			
	Site	3370.676	6	74.904	2.740	**0.005**
September	Error	656.142	24	27.339		
	Total	4026.818	30			
	Site	5194.427	6	115.432	1.887	**0.048**
October	Error	1468.401	24	61.183		
	Total	6662.828	30			
	Site	4238.422	6	94.187	2.931	**0.003**
November	Error	771.212	24	32.134		
	Total	5009.634	30			

The value in **bold** are considered significant at 95% confidence level.

3.2. Soil chemical parameters

Table 4 contained soil chemical parameters of the study sites. Nitrogen content of the soil was found to vary among the sites from lowest of 0.09±0.21% in Site E to a highest of 0.15±0.02% in Site F, followed by Sites A and C with 0.14±0.06%, 0.13±0.11%, respectively, Sites B and D recorded 0.12±0.01% and 0.12±0.04% respectively, while Site G had 0.11±0.13%. The highest content of Phosphorous was obtained in Site A (14.07±0.37mg/kg) followed by Site F with 12.03±0.33mg/kg and lowest content was obtained in Site G of 4.27±0.25 mg/kg. Site A, has the highest content of Potassium of 0.16±0.01 (cmol/kg), followed by Site F with 0.15±011 (cmol/kg), and the lowest content of Potassium was obtained in Site E with 0.09±0.06 (cmol/kg).

The higher concentrations of Organic Carbon were obtained in Sites C and D with 0.58±0.011% and 0.45±0.2% respectively, followed by the Site E, with 0.35±0.05%, Site A recorded the lowest concentration of Organic Carbon of 0.29±0.01%. The highest content of Organic Matter was obtained in site A with 1.03±0.15%, followed by site F, with 0.88±0.33% and lowest content of Organic Matter was recorded in site G with 0.34±0.02%. Soil pH was found to vary among the sites, with site B recorded the highest pH of 7.47±0.27, followed by Site A with pH 6.93±0.53 and lowest Soil pH was obtained in Site E with 3.64±0.14. Highest content of Calcium was obtained in site C with 6.99±0.31, followed by sites F and A with 6.19±0.31 and 6.07±0.30 respectively, lowest content of Calcium was recorded in site G (3.29±0.26).

Higher content of Sodium was recorded in Site B with 0.09±0.11, followed by site F with 0.08±0.10, while lowest content of sodium was obtained in site E with 0.04±0.06. Highest content of Magnesium was obtained in site A and G with 0.92±0.11 and 0.90±0.06 respectively, followed by site F with 0.88±0.01 and lowest content was recorded in site E with 0.56±0.03. Highest cation exchange capacity (CEC) was recorded in site A with 7.84±0.30, followed by site F and C with 7.15±0.26 and 7.04±0.30 respectively, Site G recorded lowest content of CEC of 4.25±0.26. Carbon-Nitrogen ratio were higher in site G with 5.36±0.18 followed by site C with 4.46±0.39 and leowest content of Carbon-Nitrogen ratio was obtained in site F with 2.07±0.35 (Table 4).

There was a significant difference where $P>0.05$ at 95% confidence limit in the total Nitrogen, Soil pH Calcium, Sodium, Magnesium and Cation exchange capacity (CEC) of the soil properties of the study Sites while Phosphorus, Potassium, Organic Carbon, Organic Matter and Carbon and Nitrogen ratio shows non-significant difference where $P<0.05$ at 95% confidence limit (Table 5). Although significant difference were not proved, but the soil of Site A and F, recorded with (14.07mg/kg) and (12.03mg/kg) maximum mean value of Phosphorous. Site A (0.16 cmol/kg) and F (0.15 cmol/kg) recorded with highest value of potassium. The highest mean value of organic carbon 0.68 (%) was recorded in Site C (0.58%) and D (0.45%) and the lowest value of 0.29 (%.) were recorded in Site A. This may be due to the high accumulation of organic matter recorded in Site A. Site B, recorded with maximum mean value soil pH 7.47 while Site E recorded with lowest 3.64. Highest mean value of Calcium was obtained in site C (6.99) while lowest value recorded in G (3.29). Site B, recorded highest mean value of Sodium 0.09 while lowest value recorded in site E with 0.04. Site A, recorded highest mean value of Magnesium while E (0.56) recorded with lowest. Carbon-Nitrogen ratio was

higher in site G (5.36) while lowest value was obtained in site F with 2.07 Table 5.

Table 4: Mean ± S. E of Soil Chemical Parameters of the Study Sites, 2019

Soil Parameters	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Nitrogen (%)	0.14±0.06	0.12±0.01	0.13±0.11	0.12±0.04	0.09±0.21	0.15±0.02	0.11±0.13
Phosphorous (mg/kg)	14.07±0.37	6.27±0.33	9.14±0.13	7.06±0.22	6.03±0.16	12.03±0.33	4.27±0.25
Potassium (cmol/kg)	0.16±0.08	0.13±0.01	0.12±0.04	0.11±0.09	0.09±0.06	0.15±0.11	0.10±0.05
Organic Carbon (%)	0.29±0.01	0.34±0.02	0.58±0.11	0.45±0.02	0.35±0.05	0.31±0.07	0.59±0.04
Organic Matter (%)	1.03±0.15	0.58±0.08	0.76±0.08	0.47±0.01	0.39±0.01	0.88±0.33	0.34±0.02
Soil Ph	6.93±0.53	7.47±0.27	4.75±0.38	3.85±0.22	3.64±0.14	5.87±0.32	4.66±0.26
Calcium	6.07±0.30	4.87±0.21	6.99±0.31	4.19±0.35	3.99±0.32	6.19±0.31	3.29±0.26
Sodium	0.05±0.04	0.09±0.11	0.07±0.05	0.05±0.03	0.04±0.06	0.08±0.10	0.06±0.02
Magnesium	0.92±0.11	0.71±0.08	0.78±0.04	0.61±0.01	0.56±0.03	0.88±0.01	0.90±0.06
CEC	7.84±0.30	5.67±0.24	7.04±0.31	4.85±0.35	4.59±0.30	7.15±0.26	4.25±0.26
C:N	3.21±0.83	2.83±0.25	4.46±0.39	2.42±0.18	2.28±0.28	2.07±0.35	5.36±0.18

Key: Site A= Aliero Housing Estate, Site B= Tal'udu NEPA, Site C= Site Malala Quarters, Site D= Gwadangwaji Quarters, Site E= Gesse Phase II, Site F= Hilin Sukuwa Bye Pass and Site G= Nadaniya Model Primary School, Badariya, C:N= Carbon-Nitrogen ratio and CEC =Cation exchange capacity.

Table 5: Analysis of Variance (One-way ANOVA) of Soil Chemical Parameters in the study site, 2019

Parameters	*Source of Variation*	Adj*SS*	*Df*	Adj*MS*	*F*	*P-value*
	Sites	8.57143E-08	6	1.42857E-08	2.81312E-05	**0.08**
Nitrogen	Error	0.0319929	63	0.000507824		
	Total	0.031992986	69			
	Sites	1699.75502	6	283.2925033	492.2368633	6.21E-51
Phosphorus	Error	36.257804	63	0.575520698		
	Total	1736.012824	69			
	Sites	0.050921571	6	0.008486929	10.96911812	2.47444E-08
Potassium	Error	0.0487438	63	0.000773711		
	Total	0.099665371	69			
	Sites	1.171001343	6	0.19516689	86.62607212	1.60749E-28
O. C	Error	0.1419378	63	0.002252981		
	Total	1.312939143	69			
	Sites	3.773059971	6	0.628843329	14.39553912	2.94592E-10
O. M	Error	2.7520421	63	0.043683208		
	Total	6.525102071	69			
	Sites	0.87688	6	0.146146667	0.139396512	0.99
Soil pH	Error	66.05072	63	1.048424127		
	Total	66.9276	69			
	Sites	0.3976296	6	0.0662716	0.075888258	0.81
Calcium	Error	55.0165584	63	0.873278705		
	Total	55.414188	69			
	Sites	0.000003	6	5E-07	0.135193133	0.69
Sodium	Error	0.000233	63	3.69841E-06		
	Total	0.000236	69			
	Sites	0.00028	6	4.66667E-05	0.10840708	**0.54**

Magnesium	Error	0.02712	63	0.000430476		
	Total	0.0274	69			
	Sites	133.9727355	6	22.32878926	12.32958884	3.96557E-09
C:N	Error	114.0925088	63	1.810992203		
	Total	248.0652443	69			
	Sites	0.513809086	6	0.085634848	0.098397174	**0.31**
CEC	Error	54.8287639	63	0.87029784		
	Total	55.34257299	69			

The value in **bold** are considered significant at 95% confidence level.
Key: O. C= Organic Carbon, O. M =Organic Matter, CEC =Cation exchange capacity, C: N= Carbon Nitrogen ratio.

4. Discussion

It was already widely documented that land use or human activities can affect soil physicochemical properties and plant species distribution. Community productivity is generally lower when fewer species are present, both in artificially assembled (Hector et al., 1999; Hooper et al., 2005), and in natural communities (Gillman and Wright, 2006). When species richness is higher, there is also a higher probability for a community to contain one or more productive species that dominate this community (selection effect) (Hooper et al., 2005). Results of this research confirmed that plants productivity is influenced by species richness and available soil nutrients.

Higher below ground biomass (BGB) found in Site A, is related to higher species richness and high availability of soil nutrients, the results show a significant different between the study Sites and they have the same rough regularity of increased, since they are located in the same ecological zone receiving almost the same amount of rainfall and temperature. Soil with high organic matter content have better supplies of organic phosphate for plant uptake than the soil with low organic content, adequate phosphorus availability for plants stimulates early plant growth and hastens maturity (Solanki and Chavida, 2012).

Below ground biomass of the Sites was not statistically significant; due to the influence of the dominant species exist in the study sites, in Site B, Teprosia linearis and Urena lobata are the most dominant species, producing several roots or scaly underground stems which would contribute more underground biomass, while Mitracarpus scabrunzuce and Eleusin indica, in the Site A, and Digitaria debelis and Leucus martinicensis in Site F respectively, were the most dominant plants species produced small or few underground biomasses. Climate change influenced variation in the production of underground biomass, could be caused by increase in temperature stress and water shortage (White et al., 2000).

October marked the maximum value of below ground biomass. Minimum below ground biomass occurred in June, usually when most of the vegetation measurements started growing and the maximum Net Primary Production was measured in September where most of the grasses and herbs reached their peak standing biomass (flowers, seeds are produced), in October there was a decreased in above ground biomass due to decreased of rainfall, but below ground biomass slightly continue growing due available soil moisture (Ni, 2004).

In the tropical savanna, germination of seeds as well as shoot growth started with the onset of the rainfall, therefore, ruderal plants are able to rapidly initiate growth to absorb the water and nutrients, which may be available for only a short period of time (Jordan and Nobel 1982). Underground biomass declined from October to November, probably owing to soil moisture depletion, high temperature and low rainfall in November appeared to lead to desiccation and death of fine ephemeral roots, causing a decline in below ground biomass (Persson, 1980). When temperature is adequate, water and macronutrients are available plants growth would continue (Richard, 1988).

Vogt et al., (1986) argued that in many ecosystems rooting phenology depends on seasonal climatic changes. The result of this study revealed a progressive increased in below ground biomass from a minimum values in June (onset of rainfall) to a maximum values in October and slightly decreased in November. This may possibly due to the increased in number of plant species and plant body parts during the growing season, since soil nutrients and water are available required by all living organisms for growth and development when other environmental factors are favourable.

The pattern of total Nitrogen content observed could be related to the high content of soil organic matter in the study Site, therefore, the highest value of Nitrogen recorded in Sites F and A (0.15 and 0.14) respectively, was not surprising since were recorded with higher value for organic matter, which is the main source and store of soil Nitrogen. Soil with high organic matter content have better supplies of organic phosphate for plant uptake than the soil with low organic. These result indicated that, soil nutrient influenced productivity of ruderal plant community during the growing season. The highest value of phosphorus and organic matter recorded in Site A soil, this may possibly be relate to the highest value of organic matter recorded in the site, since it is organic matter that makes exchangeable cat-ions available to plants. The relative proportion of nitrogen and phosphorus in the soil is important in determine the amount of potassium in the soil.

5. Conclusion

It was found that the soil nutrient influenced productivity of ruderal plant biomass during the growing season. Below ground biomass of the sites was not statistically significant; due to the influence of the dominant species exist in the study sites, in Site B, *Teprosia linearis* and *Urena lobata* are the most dominant species, producing several roots or scaly underground stems which would contribute more underground biomass, while *Mitracarpus scabrunzuce* and *Eleusin indica*, in the Site A, and *Digitaria debelis* and *Leucus martinicensis* in Site F respectively, were the most dominant plants species produced small or few underground biomass.

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