Effect Of Faidherbia Albida On Soil Nutrients Management In The Semi-Arid Region Of Kano State. Nigeria.

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Abstract: Semi and region of the topic where production of arable crop is said to becoming a problem due to the degradation in the soil conditions some of which are made while few are natural can be ameliorated and improved if a planed agro-forestry practices can be adopted especially when leguminous trees as *Faidherbia A* .are incorporated.In work which was carried out at the teaching and research from of Audu Bako Collage of Agriculture Danbatta, in which a soil under *Albida canopy* was compared with the same way for the canopy, shows that organic carbon,nitrogen,Total P and K ware all significantly higher than the site not covered by the tree (*F. Albida*) canopy with the values of .3433,0463,19.9983,0.4645 and 0.152,0.1833,5.7523,0.1625respectively.

Keywords: Faidherbia Albida, Canopy, Agroforestry, Legumes, Atmospheric

INTRODUCTION

Soil in the arid and semi-arid regions are known for their low fertility and susceptibility to degradation mostly through wind erosion and nutrient-mining, this coupled with problems associated with these fragile environment has made it necessary to find a lasting solution for a sustainable agricultural production,one of the idea as a solution to theseproblems is the incorporation of agro-forestry trees with the annual crops by farmers in this region. While some trees within the region has a sealing effect on the soil pores ,like*eucalyptus C.*others like*Acacia* family been a leguminous trees has the ability to fixed atmospheric nitrogen and convert it into the soil nitrate form available for crop utilization, andbeen able to deep nutrient capture by their root system. Crops grown around the rooting zone of these trees have been shown to access to high level of nitrogen and a reduction in nutrient losses from erosion and leaching (Buresh, and Tian 2004). *Faidherbia Albida* formerly known as *Acacia albida* is among the most commonly grown trees in the arid and semi –arid region because of it's adaptation to the harsh environmental condition as well it's ability to the production of gum Arabic (Van Wyth, 1997)*FaidherbiaAlbida* is a multipurpose tree grown in addition to it's gum production, used in soil fertility improvement as well as fuel and fodder production in rural communities .

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It's extended lateralroot system plays a significant role in soil stabilization and possibly nitrogen fixation and mineral enrichment from the leaf litter (Pender, 2008). *FaidherbiaAlbida* has been shown to improve some physical and chemical properties of soils under it's canopy,it has been shown to values of total nitrogen and organic carbon while having no effect on soil texture, pH and available phosphorus (Zomer, etal., 2009).The tree litter has also shown to improve organic matter content as well as N,P,K,Ca,Mg and Na(Kamara and Hague, 1992.,Abdulfatih, 1994).

2.0 Materials and method.

2.1 Experimental site:

The study was conducted at the Teaching and Research farm of Audu Bako Collage of Agriculture Danbatta, whichis within the Sudan savannah Agro-ecological zone. The climate is characterized by an alternate hot raining season and cool dry season. The area is 470m(1539ft) above sea level with an annual rainfall of 464mm, mean annual temperature of 37^{o}C and located at latitude 11^{0}55'N, 8^{0}20'E (Areola, et a., 2000).The soil is characterized as sandy loam (Sanda, 2005).

2.2 Sampling Methods and Soil sample collection:

Soil samples were systematically collected at a various distances of the experimental units (4 and 6m away from the plant trunk)and those that are not covered by the tree canopy which serve as a control. Soil samples were collected at two depthof 0-15cm and 15-30cm from each selected sampling point. Each of the treatments were replicated three times. Collected samples were stored in air tight polythene bags and subsequently taken to laboratory for analysis.

2.3: Experimental Design:

The experimental design for the study is the 2*3 factorial design in completely randomized design (CRD) of the model $Y_{ij}=\mu+R+A_j + F_k+ (AF)_{jk}+ E_{ijk}$

2.4 Soil Analysis:

Collected soil samples were air dried, crushed and sieved through 2mm sieve to remove extraneous materials before

analysis. The following parameters over subsequently analyzed:

- pH was determined using pH meter as described by Mclean (1982)
- Organic Carbon was determined, by Nelson a Sommer (1982).
- Total Nitrogen was determined using Micro-kjeldahl method Bremner and Malvany, (1982).
- Total Phosphorous was determined using Bray-number two extract Olsen & Sommers (1982).
- Potassium was determined using flame-photometry method as described by Jackson 1962.

3.0 Results and discussions:

3.1 Effect of *Faidherbia Albida* on Soil Nutrients Management:

3.1a Soil pH:
The results for the mean value of the pHshows that control sample (6.7017) significantly differs from the soil under the canopy of *F. Albida* irrespective of distance from the trunk of the tree. All the values are towards neutral with the control sample giving only slightly higher value, this was also reported by Zomer, etal., (2009). The analysis of variance shows no significant difference in the treatments, distance, depths as well as the interaction between treatment and depths.

3.1b Organic Carbon:
There is a significant difference among all the treatments as for organic carbon content. Four (4m) meters away from the trunk gave the highest organic carbon values of 0.3433, followed by meters six (6m) had 0.1520, while control had the least organic carbon content of the soils as it was also reported by Raddad et al,. (2005). Sampling depths shows no significant, interaction between the treatment and depths shows no significant differences as far O.C. content also.

3.1c Total Nitrogen:
The mean value of total Nitrogen at both 4m and 6m distance (0.463 and 0.313) are higher than the value of the control which has 0.183. There is no significant difference as far as total N is concern. None significant effect between four and six meters distance and the control can be attributed to the deposition of blown litter from the adjoining trees as reported by Kamara and Haque (1992). There is no significant difference between depths and the interaction between treatment and depths.

3.1d Total Phosphorous:
There is a significant difference between each of the treatments as far as the value of total phosphorous. Four meters away from the trunk of the tree with a value of the total P of 19.958, is significantly different from the six meters distance (15.443), which is also significantly different from the control (5.752) value. However, sampling depths, as well as the interaction between depth and treatments had no significant effect at a=0.05.

3.1e Potassium:
Potassium level which is one of the element tested shows that four meter distance away from the tree trunk with the K value of 0.4645 significantly differing from those of six meters distance and the control value of 0.2596 and 0.1652respectively. Here also there is no significant different between the effect of depth and interaction between the treatments and depths at a = 0.05.

Conclusion:

The productivity of soils in the semi-arid region which are known to have been exposed to a lot of degradation problems can be improved significantly when leguminous trees especially *F. Albida*both wild and planted are allow to grow and be part of government policy to plant more and protect the existing wild ones, as it can be seen from the results of this work and many others that *Feidherbia Albida*significantly increases the availability of the essential nutrient elements required for plant growth especially the three most essential ones (NPK).

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Table 1.Mean values of pH, %OC, N, P, K of the soil covered by *F. Albida*.

Chemical characteristics	***F. Albida* Canopy**		**control**		
	Sampling depth		**cm**		
	0-15		**15-30**		
	Sampling distance (M)				
	4	6	4	6	
pH	6.2650[b]	6.3867[b]	6.2500[b]	6.1852[a]	6.7017
Org. carbon	.3433[a]	.3388[a]	.3132[a]	.3020[b]	.0152[c]
Nitrogen	0.463	0.3132	0.4152	0.3112	0.1833
Phosphorus	19.9583	19.8421	15.4417	15.3988	5.7523
Potasium	0.4645	0.3638	0.3752	0.2516	0.1625

Values with the same alphabets are not significantly different at a = 0.05.

Table 2.Analsyis of variance of the soil chemical characteristics covered by *F. Albida* canopy.

Source of variation	**DF**	**pH**	**OC**	**%N**	**AVP**	**K**
Treatment	2	6.618[ns]	47.536*	1.697[ns]	26.542*	7.504*
Depth	2	.109[ns]	.928[ns]	.776[ns]	.850[ns]	.118[ns]
Treatment Depth	2	0.16[ns]	1.888[ns]	1.168	1[ns].465[ns]	.253[ns]
Error	14					
Total	20					

ns = Not significant
* = Significant