SHORT COMMUNICATION

Effect of organic manure on growth and proximate composition of *Treculia africana* var. decne seedlings

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Abstract

A study on the effect of organic manure on seedling growth and proximate composition of T. africana seedlings was conducted to influence the growth and improve the nutritive quality of the plant as an alternative source of feed for dry season feeding. Three months old seedlings of T. africana were transplanted on the field containing samples of organic manure (poultry and cow dung) mix with top soil in a ratio of one kilogram of soil to 25 g of manure and a control (without manure) in a Randomized Complete Block Design which was replicated thrice. The seedlings were assessed for plant height, number of foliage, collar diameter and number of branches. Samples of the seedlings foliage were collected across the treatments and analyzed for proximate composition after the eighth week of transplanting. Seedlings under cow dung application recorded a significantly ($P>0.05$) higher values for number of foliage per plant (21.82), plant height (66.58 cm), collar diameter (12.96 mm) and number of branches (4.20) at 8 weeks after planting (WAP), followed by seedlings to which poultry manure was applied and lastly by the control. Proximate composition showed that the dry matter (DM) content values of the samples were high which ranged from 894.60- 896.30 g/ kg DM ($p<0.05$). The crude protein (CP) content followed the same trend as the DM with its values ranging between 143.6 and 149.30 g/kg DM ($p<0.05$) and the ether extract (EE) values ranging between 22.20 and 23.50 g/kg DM ($p<0.05$) for the samples collected respectively. The ash content did not vary significantly between the different manure and the control. The Crude fibre was quite significantly ($p<0.05$) low in the samples ranging from 162.10 and 166.70 g/kg DM. This study showed that cow dung is the most suitable manure for T. africana seedlings in terms of mineralization and it is relatively fast when compared with poultry manure, and the application of poultry manure has also it has positively influence the growth and development of T. africana seedlings while poultry manure increased the digestible fraction (i.e crude protein) of the plant.

Keywords: Organic manure, *Treculia africana*, Seedlings, Proximate composition, Nutritive quality.

Introduction

Multipurpose tree species and shrubs (MPTS) are important component of agro forestry systems in humid tropical West Africa and South American countries. This is because they can tolerate the acidic soil and high seasonal precipitation of these areas. Some of these MPTS have been elaborately researched on by the World Agroforestry Centre (ICRAF) and Alley farming network for tropical Africa (AFNETA) in high rainfall zones of Nigeria, in terms of their agronomic performance in several African countries.

Small holder livestock farmers have been using these MPTS as feed resources for their ruminant animals as an alternative source for herbaceous forages that have been found to be poor in both quality and quantity during the dry season (Topps, 1992).

Treculia africana Var. Decne (African breadfruit), a large evergreen tropical food tree species, it is a member of the Moraceae family. It is a common forest tree and that is grown in some parts of West African countries (Lawal, 1997). In some parts of Nigeria, the fruits are eaten ripe as a fruit or unripe as a vegetable and researches has made it known that the foliage is palatable to ruminant animals (Okusanya, *et al*., 1991). There are evidences that the roots, foliage, husk and bark of *T. africana* are used as ingredients in concoction for various types of ailments in some local communities (Lawal, 1997).

Due to its domestic and economic importance, the tree has been heavily exploited resulting in its current high endangered status. Furthermore, farmers prefers using inorganic fertilizers as opposed to organic manure but the usual unavailability of these fertilizers alongside its high price and potential pollution effects on environment makes organic manure a veritable alternative. In addition, for proper establishment of the seedlings, it requires very fertile soils and adequate manuring. Thus, this study also intends to investigate effects of different sources of organic manure on the growth performance and proximate composition of *T. africana* var. Decne seedlings

Materials and Methods

Experimental Site: The study was carried out on the field of Teaching and Research Farm, College of Animal Science and Livestock Production (COLANIM), Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State. The site lies within the derived savannah zone on latitude 70 13", 49.46"N and longitude 30 26", 11.98"E (Google Earth, 2006). It has a bimodal rainfall pattern with a mean annual rainfall of 1037mm and monthly mean temperature ranging between 22.50-33.72°C. The relative humidity ranges from 63% in January to 96% in August with yearly average of about 82% (Source: Agrometeorology Department, FUNAAB).

Land Preparation and seedlings transplanting: Three months old seedlings of *T. africana* were transplanted into the field using randomized complete block design. The land used was ploughed and allowed to rest for a period of two weeks before harrowing, an area of 1215m^2 was mapped out after harrowing. The land was subdivided into 3 equal plots of 405m^2 each. The spacing between seedlings in each plot was 2.5×2.5 m and 2.0 m between plots with a total of 54 planting holes/plot, each of which were 30 cm wide and 40 cm deep. Basal application of manure was done by mixing the soil that was removed from the holes with the manure in a ratio of one kilogram of soil to 25 g of manure before putting the seedlings in the hole thus resulting in 54 seedlings/plot. The manure was applied 2 weeks before the seedlings were transplanted. Data was collected for 8 weeks.

Soil Analysis: Soil samples were randomly collected from the plots at two depths (0-15 cm and 15-30 cm) after land clearing and before planting. The samples were bulked per replicate, mixed thoroughly before subsamples were taken for determination of pre planting nutrient content of the soil. Similarly, representative samples of the manures were analysed for total Nitrogen (N) using micro- kjeldahl method (Bremner and Mulvaney, 1982), organic

carbon (OC) was by wet digestion according to the procedure described by Nelson and Sommers (1982), available Phosphorus was by Bray 1 method (Anon, 1994). Exchangeable cations (K, Ca, and Mg contents) were determined by the barium chloride ($BaCl_2$) method (Hendershot and Duquette, 1986), while the percentages of sand, silt, and clay contents were determined by hydrometer method developed by United States department of Agriculture (USDA).

Measurement of agronomic and other parameters: measurement of growth parameters commenced 2 weeks after transplanting and this lasted for 8 weeks. Fifteen plants per replicate were selected and used for agronomic parameters which included plant height, number of foliage, number of branches and collar diameter at 10 cm above ground level. The measurement was taken forth-nightly throughout the experimental period. At the end of the experiment, foliage samples were harvested from each treatment, the fresh weights of the foliage sample were measured on the field, and sub samples were taken to the laboratory for estimation of dry matter content. The foliage sample was oven dried at 65°C for 72 hours to a constant weight in the drying cabinet for yield determination.

Proximate analysis: Proximate fractions (dry matter, crude fat, crude protein, and ash) were determined according to the standard method of the AOAC (2000). The nitrogen free extract (total carbohydrate) was calculated by difference while the organic Matter was calculated as DM–ash

Statistical Analysis: The data were subjected to 2-way analysis of variance (ANOVA) (SAS, 2002), using Randomized Complete Block Design (RCBD) while significant means were separated with Duncan's multiple range test as contained in the same package.

Results

The physico-chemical characteristics of the composite soil samples taken from the experimental site before planting and those of the organic manures used are shown in Table 1. The available phosphorous of the soil was determined to be 9.34% while total nitrogen was 0.14%. The exchangeable cations, K^+, Ca^{2+}, Mg^{2+} were determined to be 0.24, 2.83, 1.43 cmol/kg respectively. Poultry manure had higher nitrogen content (0.13%) compared to cow dung while cow dung recorded higher values for potassium, Ca and Mg.

The growth performance of *T. africana* seedlings on the field as affected by organic manure were presented in Table 2. Results showed that at eightweeks after planting (8WAP), seedlings to which cow dung was applied gave the highest significant ($P< 0.05$) values in plant height, number of foliage, collar diameter and number of

Table 1: Physico-chemical characteristics of the composite soil sample taken from 0-15cm soil depth and organic manure samples used for the experiment.

Treatments	Total Nitrogen (%)	Phosphorus mg/kg	Potassium cmol/kg	Calcium cmol/kg	Magnesium cmol/kg	Carbon (%)
Topsoil	0.14	9.34	0.24	2.83	1.43	0.38
Cow dung	0.10	5.2	0.21	6.03	2.12	0.18
Poultry manure	0.13	9.68	0.19	3.07	0.47	0.12

Table 2: Effect of organics manures on number of foliage, plant height, number of branches and collar diameter attributes in T. africana seedlings

Seedling parameters	Organic manure			
	Control	Cow dung	Poultry manure	SEM
2 WAP	9.32	8.53	9.02	0.39
4 WAP	10.57^{b}	13.57^{a}	12.20^{a}	0.60
6 WAP	12.58^{b}	18.05^{a}	14.78^{b}	0.75
8 WAP	17.02	21.82	18.10	0.74
Plant height				
2 WAP	46.15^{b}	52.68^{a}	48.68^{b}	1.16
4 WAP	50.48^{b}	57.97^{a}	52.43^{b}	1.30
6 WAP	54.32^{b}	62.27^{a}	55.82^{b}	1.43
8 WAP	59.67^{b}	66.58^{a}	61.80^{b}	1.54
Number of branches				
2 WAP	0.35^{a}	0.67^{b}	0.20^{ab}	0.08
4 WAP	0.52^{b}	1.82^{a}	1.08^{b}	0.25
6 WAP	1.23^{b}	3.87^{a}	1.95^{b}	0.34
8 WAP	2.28^{b}	4.20_{a}	2.45^{b}	0.41
Collar diameter				
2 WAP	9.20^{ab}	9.53^{a}	9.08^{b}	0.18
4 WAP	9.65	10.10	9.80	0.21
6 WAP	10.14^{b}	10.83^{a}	10.43^{ab}	0.21
8 WAP	11.74^{b}	12.96^{a}	12.20^{b}	0.20

Means along the same row with the different superscript are significantly ($P < 0.05$) different

DM= Dry matter, CP= Crude protein, EE= Ether Extract, CF= Crude Fibre, WAP = Weeks after planting.

branches, followed by seedlings to which poultry manure was applied and lastly by the control.

The effect of organic manure application on the proximate composition of foliage of *T. africana* seedling was presented in Table 3. The manure type had significant ($P<0.05$) effect on the proximate composition of *T. africana* seedlings foliage. Seedlings to which poultry manure was applied gave foliage with high dry matter (896.30 g/kg) and crude protein values (149.30 g/kg) compared to those from seedlings to which cow dung was applied. Foliage of seedlings with which cow dung was applied recorded higher values for ether extract (23.50 g/ kg)

Table 3: Effect of organic manure on the proximate composition (g/kg DM) of the foliage of T. africana seedlings

Treatments	DM	CP	EE	ASH	CF
Control	894.60^{b}	143.60^{b}	22.20^{b}	120.50	166.70^{a}
Cow dung	895.50^{a}	148.70^{a}	23.50^{a}	122.70	162.70^{b}
Poultry manure	896.30^{a}	149.30^{a}	22.20^{b}	123.80	162.10^{c}
SEM	0.60	1.72	0.15	0.87	0.45

Means along the same column with the different superscript are significantly ($P < 0.05$) different

DM= Dry matter, CP= Crude protein, EE= Ether Extract, CF= Crude Fibre

and Ash (123.80 g/kg) while seedlings on the control treatment had the highest value of 166.70 g/kg for crude fibre.

Discussion

The soil used for the field experiment had a pH value of 6.25 which is within the pH range of 5.5 to 6.3 that is required if maximum availability of soil nutrient is needed to occur for proper plant growth (Stewart, 2006).

Seedlings to which cow dung was applied gave the best performance in terms of plant height, number of foliage, collar diameter and number of branches, followed by seedlings to which poultry manure was applied and lastly by the control treatment. This may be due to the fact thatthe Organic Nitrogen (N) content of the manure undergoes a faster rate of mineralization (Gilbertson *et al.*, 1979) and also the soil properties such as moisture content, temperature, soil pH, aeration and soil structure and texture, agricultural practices (e.g., cultivation), substrate specificity, and available minerals may aid in the decomposition rate of Organic materials in the manure (Broadbent *et al.*, 1964; Kowalenko *et al.*, 1978; Clark and Gilmour, 1983). In addition, the physical properties of the soils significantly affect the mineralization rate of organic N. Under similar climatic conditions, the organic C accumulation in soils varies probably due to differences in soil types and the quality and quantity of litter accumulation.

Seedlings from cow dung gave the best number of foliage which is an indication that better leaf production could be enhanced by application of organic manure. This was confirmed by Edmeades and Lafitte (1993) but it does not follow their trend. Poultry manure >Cow dung> Control > Piggery manures when applied to *Acacia senegal* and this may be due to the amount of organic manure applied. The amount applied may not be enough to meet the requirement of the plant since the nutrient contents of various manure differs or it was not calculated based on the rate of mineralization of the manures (Sikora and Szmide, 2001; Titiloye *et al.*, 1985). The better performance in terms of plant height obtained from seedlings to which cow dung was applied was in agreement with the studies carried out by Opeke (1997), Imobighe (2004) and Okunomo *et al.* (2006) when they used *A. senegal*.

The organic manure effect on the DM content was higher in the seedlings to which manures were applied compared with the control. The values recorded were comparable with those previously obtained elsewhere for browse plants (Wong, 1982; Topps, 1992; Arigbede and Ekpenyong, 2004; and Arigbede *et al.*, 2006). Seedlings to which poultry manure was applied gave the highest value which is in agreement with the report of Adesogan *et al.* (2009) that poultry manure tends to increase the components such as the amounts of fibre, protein and mineral which make up the DM. The crude protein (CP) content as affected by organic manure indicated that seedlings to which poultry manure was applied gave the highest value, this could be as a result of higher organic Nitrogen contained in the manure and the stage of growth of the plant, since it has been established thatat this stage of growth, nutrients are found in higher proportion in the meristematic regions such as foliage, stem tips etc. for further growth and development of the plant (Carbrera*et al.*, 1994). The lowest CP value was observed in the control which is well above the threshold of 6.0% CP required by the microbes in the rumen of ruminant animals to support metabolic functions of their host (NRC, 1984). This makes the tree at this stage of growth more reliable than herbaceous legumes and grasses in

providing high quality protein supplement for dry season livestock production (Arigbede*et al.*, 2007).

The higher Ether extract (EE) value obtained from the seedlings to which cow dung was applied may be because of the higher percentage of carbon in the cow dung, which led to organic carbon accumulation that indirectly increases the C: N component of the seedlings hence more energy to the seedling composition. The low EE values observed in this experiment may be attributed to the fact that they are seedlings that are still in the growth stage. Arigbede *et al.* (2006) reported EE values ranging from 29.20-116.70 g/kg in an experiment with *T. africana* plant parts and 42.00 g/kg for *T. africana* by Edet (1982).

The ash content as affected by organic manure showed that poultry manure gave the highest value which was similar to other treatments. This may be due to the fact that it contains higher amount of minerals since it has been established that the ash content has been found to be a reflection of the mineral composition (Oyoyede, 2005).The result obtained showed the presence of high concentration of inorganic element in the seedlings indicating that it is in abundance in anticipation for growth.

The lower crude fibre (CF) values obtained from seedlings treated with different manures compared to the control, is an indication that addition of organic manure tend to reduce the fibre composition of the seedlings through increased CP. It had been established that CP is negatively correlated to CF i.e. an increase in CP content tends to lead to a decrease in CF content (Luginbuhl *et al.*, 1994).The lower values obtained reflected that the plant cells are still growing and maturation has not yet set in (Terashima *et al.*, 1993).

This study showed that application of cow dung positively influenced the growth and development of *T. africana* seedlings while poultry manure improved the nutritive quality of the plant. It is therefore concluded from this study that addition of organic manurefacilitated better establishment of *T. africana* seedlings and increased the digestible fractions of the seedlings.

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