



RESEARCH ARTICLE

EFFECT OF POULTRY MANURE ON SOIL PHYSIO-CHEMICAL PROPERTIES, AGGREGATE STABILITY AND BIOMASS YIELD OF *Panicum maximum*

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ABSTRACT

Fertilizer use is a key factor for increasing agricultural production in sub Sahara Africa and its utilization has increased rapidly in the last two decades. Adoption of chemical fertilizers has largely replaced traditional practices, such as recycling of crop residues and application of organic manures. Poultry manure was used as a soil conditioner to increase the biomass yield of *Panicum maximum* and to maintain soil fertility. The treatments were 0kg, 50kg, 100kg and 200kg per plot. Each plot has a dimension of 4m by 4m. The experiment lasted for 12 weeks. The results showed that poultry manure applied at the rates of 50kg/plot had the highest biomass yield amongst others. Based on the weekly plant height measurement, biomass yield was significantly higher at 12th week, available phosphorus, potassium, organic matter and stable aggregate improved with increasing rate of application of poultry manure. This study shows that poultry manure applied to the *Panicum maximum* improves the growth and biomass yield of the crop and also helps in sustaining aggregate stability with improved soil fertility.

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INTRODUCTION

The rising cost of inorganic fertilizers coupled with their inability to recondition the soil has directed attention to organic manures in recent times. Intensive cropping with inorganic fertilizer results in a decline of soil organic carbon with consequent deterioration of soil physical and chemical properties. Thus, farmers are reluctant to use chemical fertilizers especially at household levels (Adeniyi and Ojeniyi, 2003; Olanatan, 1994; Awodun *et al.*, 2007). Over application of inorganic fertilizer can lead to further break down of the soil and unfavorable changes in pH. Studies as shown that the decline in soil organic carbon can be arrested by the use of organic manure applications. Poultry manure is an organic manure which abounds in the peri-urban areas of southwestern part of Nigeria (Lopez-real, 1995). Poultry by-products have long been recognized as a valuable fertilizer for pasture and forage production. Because of the beneficial effects of poultry manure and its release of nutrients for a good response in plant growth, vegetable growers and horticulturists generally use poultry manure on their crops (Mithcell, 1995; Shang and Tiessen, 1998). Studies conducted by Ojeniyi, 2007 shows that Poultry Manure (PM) can effectively increase soil fertility, yield and nutrient content of crops. The appropriate used of poultry manure adds

nutritive value and thus economics value. Manure also improves biological activities, soil tilth, soil chemical properties and evidence describing the effects of organic inputs on soil aggregate stability Obi and Ebo (1995). However, knowledge concerning the relationships between aggregate stability and organic inputs noticeably is very limited the relationships between the effects of OM addition on aggregate stability and soil characteristics are also unclear. Even in soils with comparable clay content, Spaccini *et al.* (2002) observed that there could be positive or negative effects on aggregate stability with the same organic input. Tisdale and Oades (1982), reported that the impact of organic product addition on aggregate stability could be more significant when the C content of the soil is low, although Six *et al.*, (2000) argued that it is not in all cases. Concerning soil texture, Kinsbursky *et al.* (1989) observed that the effects were higher when the soil had a high clay content, which was contrary to the submission of Six *et al.*, (2000) who's works revealed that the effects of organic product addition were more marked in silty and sandy soils. Thus, we assume that the impact of organic matter additions depends on the initial level of aggregate stability. Notwithstanding, there seems to be little use of poultry manure nationwide, therefore More information is required to understand the benefits of poultry manure on crop production and the effects of the manure on soil conditioning.

Panicum maximum is a forage grass which has been discovered to be very good for feeds for livestock especially ruminant animals. Over the years it has been used for the development of paddock and raised as pasture crops. Guinea grass is a perennial, tufted grass with short creeping rhizome. The stem of this robust grass can reach a height of up to 2m. The leaves of *Panicum maximum* are the most useful part to attain high level of ruminant animal production. *Panicum maximum* has been shown to grow rapidly even on poor soil. It has also been observed that the application of poultry manure greatly enhanced its growth and production. Green Field (1989) noted that poultry manure helps in faster growth of *Panicum maximum* with more tillers produced within a short period of time which invariably encourage the establishment of a paddock or pasture land. It can also resolve the problems of soil degradation on pasture lands. Most farmers faces this likely problem when they want to established a pasture field for *Panicum maximum*. This study, therefore, seeks to evaluate the impact of poultry manure on soil aggregate stability with the possibility of reconditioning the soil physio-chemical properties for sustainable forage production and to determine the quantity required for optimum productivity.

MATERIAL AND METHODS

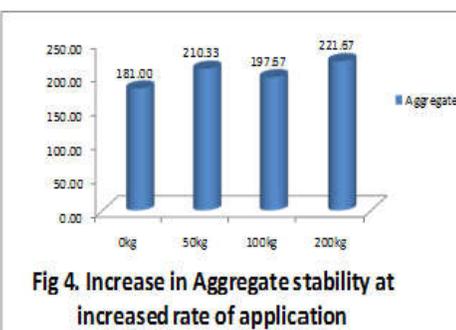
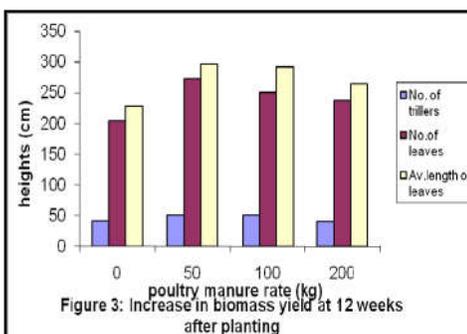
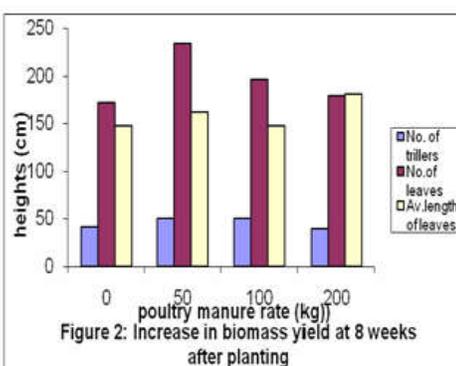
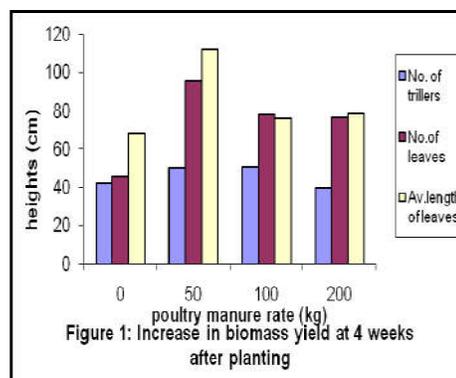
The experiment was carried out at the Ladoke Akintola University of Technology Ogbomoso Teaching and Research farm located on longitude 4^o10 East and Latitude 8^o10North in year 2009/2010 planting season. The climate of is characterized by a fairly high uniform temperature, moderate to heavy seasonal rainfall and high relative humidity. The mean temperature is 26.2^oc the minimum temperature is 24.3^oc while the highest is 28.7^oc these are experienced in March and July respectively.

Plot Layout

The experimental design was completely randomized design; with each treatments having three replicates. Well cured poultry manure which served as the treatment was applied two weeks before transplanting. The treatments were 0kg, 50kg, 100kg and 200kg. Each plot has a dimension of 4m by 4m with 2m interspacing between the plots. A total number of 35 stands were planted on each plot for adequate spacing. A sample of poultry manure was taking to the Laboratory and the result was as follows: % N – 3.67, % P – 1.94 and % K – 1.43. The experiment Lasted for 12 weeks. Weeding was done twice and Agronomic parameters were taking every four weeks, the parameters taken were number of tillers, numbers of leaves and mean leaves length. These were determined using measuring ruler graduated in cm. After twelve weeks the grass were cut at 5cm above ground level and weighed. The experiment was watered till the commencement of rainfall. Soil samples were collected after harvesting from 0–15cm depths diagonally from each plot and bulked for laboratory analysis. Soil pH was determined in water at ratio 1:2, total Nitrogen by Kjeldhal method (1964) while phosphorus was determined using Bray-1-P method (1948), particle size distribution by hydrometer method, CEC by ammonium acetate method and aggregate stability by wet sieve method. Descriptive statistic was used to interpret the result.

RESULTS AND DISCUSSION

The experiment lasted for three months. Although growth was initially very slow. Sign of green leaves were eminent. Recovery from stress was noticed as evidenced by the formation of new leaves.



Effect of Poultry Manure on Biomass Yield

The changes in the colour of the leaves of the plant after transplanting was in accordance with Chen (1995) who found

Table 1: means of measured physical and chemical properties after 12weeks

	%SILT	%CLAY	%SAND	Aggregate	%O.C	%O.M	%N	k(Cmol/kg)	AV.P(mg/kg)
0kg	11.00	12.00	77.00	181.00	0.68	1.17	0.07	0.17	5.01
50kg	12.00	12.00	76.00	210.33	0.75	1.29	0.08	0.18	5.50
100kg	11.00	13.00	77.00	197.67	0.79	1.36	0.08	0.21	5.73
200kg	11.00	13.00	76.00	221.67	0.84	1.44	0.08	0.23	6.73

out that the time necessary for *Panicum maximum* grass to turn green after transplanting might be lengthened by unfavourable environmental conditions. The luxuriant growth of plant could have been due to the application of poultry manure, however, the highest number of leaves and leave height was recorded in treatment B (50kg) follow by treatment C (100kg) and D (200kg). Figure 1, 2 & 3 shows the means in biomass increase. The number of tiller remains the same throughout the experiment. From this result, the application of cured poultry manure at the rate of 31,250kg/ha and 62,500kg/ha seems to be optimum requirement for *Panicum maximum* production as a forage grass for livestock production in Nigeria. At 12weeks after planting average number of leaves was 273.1 for 50kg/plot and 250.1 for 100kg/plot. Leave length was 296.3 and 291.6 respectively. Statistically there is no significant difference between the two rates (50kg/plot and 100kg/plot). However the application of 200kg/plot do not lead to higher leave length nor leave number, this could be due to over saturation of the soil with other nutrient which could constitute a limiting factor for nutrient absorption by the plant or adsorption within the soil matrices.

Soil physio-chemical properties.

Aggregate stability is a keystone factor in questions of soil fertility and environmental problems. Resistance of the aggregate to physical stresses determines soil sensitivity to crusting and erosion (Le Bissonnais, 1996a), germination and rooting of cultivated plants (Angers and Caron, 1998) and the ability of a soil to store carbon through the physical protection of organic molecules (Agboola *et al.*, 1982). Figure 4, illustrates the changes in the soil stable aggregates after harvesting at 12weeks. Aggregate stability increases with increased rate of PM application. However at 100kg/plot an increase that that is not progressive as others was observed, 50kg/plot and 200kg/plot significantly enhanced stable aggregate compared to 0kg/plot and 100kg/plot. These could be due to the bonding effect of the organic carbon that is been released to the soil from the manure, this collaborate the works of Obi and Ebo (1995) and Ojeniyi (2007). Particle size distribution remain constant with the textural class as sandy loam, application of PM could not alter the textural class because this can only be altered pedologically over a long period of time (table 1) . Organic carbon, organic matter, potassium and available phosphorus content increases with increase in rate of application. Nitrogen content was not significantly improved; this can be associated with leaching of nutrient from the topsoil to the sub soil and the uptake of nitrogen by planted crop during active growth. In terms of nutrient gained, nutrient gained by the soil as a result of the treatment was highest at 200kg/plot application followed by 100kg/plot and 50kg/plot, was least at 0kg application. Sample taking at the end of experiment shows the gains in phosphorus and potassium this agree with Agboola *et al.*,

(1982), there is an increasing trend in the amount of available phosphorus and potassium, this trend suggest that as the amount of PM applied increases the phosphorus and potassium content also increases.

CONCLUSION

It was observed that with the poultry manure application there were significant differences at all the levels at the weeks in which agronomic parameters were taken and differences exist in all the levels throughout the experiment. An application rate of 50kg/ha is capable of increasing yields by more than 100% of the normal yield while application rate of 200kg/plot could be recommended for soil fertility maintenance and aggregate stability improvement. This study thus indicates that poultry manure is a valuable source of plant nutrient and soil amendment whose adoption needed to be encouraged in pasture management.

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