# INFLUENCE OF POULTRY DROPPINGS ON SOIL CHEMICAL PROPERTIES AND PERFORMANCE OF RICE (*Oriza Sativa* L.)IN SOKOTO,SUDAN SAVANNA ZONE OF NIGERIA.


## Abstract

With proper management, poultry manure could be a sustainable source of fertilizer for increased rice production inSokoto. An experiment was conducted in a screen house at the botanical garden, biological science department of the Sokoto state polytechnic,to determine the influence of poultry dropping on some chemical properties of soil and performance of rice. The treatments consisted of three levels of poultry dropping: 2t, 5t and 10tha$^{-1}$ and a control (0tha$^{-1}$). The experiment was laid in a completely randomize design (CRD) replicated three times. The resultrevealed that treatments have significant ($P<0.05$) effect on soil organic carbon, available phosphorus, exchangeable K, Na, Ca, Mg , CEC andrice performance in which application of 10 th$^{-1}$ recorded the highest rice grains yield.This research therefore, concluded that application of poultry dropping is an important means of replenishing nutrients in the soil and that, application of 10 th$^{-1}$ can produces the best growth and yield of rice in the study area.


**Key words;** Poultry Droppings, Levels, Soil and Rice

## INTRODUCTION

Soil in the savanna region of Nigeria is relatively low in nutrients and organic matter content (Usman*et al.,* 2007).Furthermore, the soil of the Savanna is prone to degradation by wind that may also result in nutrient depletion (Ogunwole*et al.,* 2005; Auta and Ogunwole, 2007). Replenishment of nutrients and enhanced quality of tropical soils could be achieved through the addition of inorganic fertilizers, organic manures or both (Shangakkara*et al.,* 2004). However, the use of inorganic fertilizers alone is incapable of tackling the problem because, it fails to redress the problem of physical fragility and has yielded limited success in Africa (Obi and Ofoduru, 1997). Many small scale farmers in Nigeria have limited access to inorganic fertilizers due to high cost and unavailability during the growing season (Sobulo and Osiname, 1985). But,the Impact of the organic material as fertilizer has been seen overtime in providing growth regulating substances and improves the physical, chemical and microbial properties of the soil Belay *et al.,* (2001).Besides fertilizing crops, manures also supply other essential plant nutrients and serve as a soil amendment by adding organic matter, which helps improve the soil's moisture and nutrient retention. Organic matter persistence will vary with temperature, drainage, rainfall, and other environmental factors (Michael et al, 2013).Organic manure application on the farm has yielded good response of crops and residual effect on soils. Agboola and

Obatolu (1989), Lombin*et al.,* (1991), Ojeniyi and Adeniyan (1999), and Kwari (2003) have all demonstrated the use of organic manure as a sound strategy for maintaining soil fertility.

There are different types of manure including cow dung, poultry manure, compost, green manure etc. Poultry manure had been reported to improve growth and yield of maize (Ezeibekwe et al., 2009). It also improves the chemical and biological qualities of the soil which increases crop productivity than chemical fertilizers (Obi and Ebo, 1995).

Rice belongs to the grass family poaceae from the genus Oryzaof which two species are cultivated *Oryza sativa* and *Oryzaglaberima*. It is normally grown as annual plant, in the tropical area; it can survive as a perenial and can produce a ratoon crop for up to 30 years (IRRI, 2008).Rice is the staple food of over half of the world population. It is predominately dietary energy source for 17 countries in Asia and the pacific, 9 countries in North and South America and 8 countries in Africa. Rice provides 20% of the world dietary energy supply, while wheat supply 19 and maize supply 5% (FAO, 2004). In Nigeria, rice is a major cereal crop and is consumed by over 120 million population of the country(EIARD, 2013). Rice respond well to N.P.K fertilizer at the rate of 120:40:40kg/ha (short duration), 150:50:60kg/ha (medium duration), 150:50:80kg/ha for long duration (Ezui et al., 2008).

This study was aimed to determine the influence of poultry manure on soil chemical properties and performance of rice in Sokoto,Sudan Savanna agro-ecological zone of Nigeria

## MATERIAL AND METHOD

The pot experiment was conducted during the 2012/2013 dry season in a screen house at the Botanical Garden of the Biological Science Department, Sokoto State Polytechnic,Sokoto. Sokoto falls in the Sudan Savannah agro-ecological zone of Nigeria that is characterized by erratic and scanty rainfall that last for about four months (mid June - September) and dry period (October - May). The annual rainfall of the area is highly variable over the years and averages around 700mm (Rao, 1983)

Treatment consisted of three levels of poultry manure: 2t, 5t and 10tha$^{-1}$ corresponding to 7.5g, 18.75g and 37.5 g in 7.5kg of soil per pot respectively and a control (0tha$^{-1}$). An improved rice Variety (Faro$_{44}$) was planted as a test crop. The experiment was laid in completely randomized design (CRD) replicated three times.The poultry dropping was mixed evenly with soil and watered to field capacity and allow for a period of one week before planting. The soil was analysed before and after the experiment for pH, organic C,total nitrogen,available phosphorus,CEC and exchangeable bases contents using 1:1 soil-water ratio using a glass electrode pHmeter, modified Walkley-Black method as described by Nelson and Sommer (1982), Bray's no. 1 method as

described by Bray and Kurtz (1945), Kjeldahl digestion and distillation procedure as described in soil laboratory staff (1984), 1.0N neutral ammonium acetate ($NH_4OAC$) solution respectively. Data were collected on growth parameters, such as plant height, number of leaves per plant, number of tillers at 2 weeks interval and for yield at harvest. The data was subjected to analysis of variance (ANOVA). Significant difference in the treatments means was further seprated using least significant difference (LSD)

## RESULT AND DISCUSSION

**Table 1: Initial Soil and Poultry Dropping Analysis**

| SoilParameters | Value |
|---|---|
| pH ($H_2O$) 1:1 | 7.01 |
| Organic Carbon (%) | 2.87 |
| Total Nitrogen (%) | 0.09 |
| Available phosphorous ($mgkg^{-1}$) | 0.99 |
| Cation exchange capacity (CEC)($Cmol\ kg^{-1}$) | 9.42 |
| Exchangeable bases ($Cmol\ kg^{-1}$) | |
| Calcium ($Ca^{2+}$) | 1.35 |
| Magnesium ($Mg^{2+}$) | 0.55 |
| Potassium ($K^{+}$) | 0.31 |
| Sodium ($Na^{+}$) | 0.96 |
| Sand (%)(9.0) | |
| Silt (%) | (5.0) |
| Clay (%) | (86.0) |
| Texture | Clay |
| **Poultry Dropping** | |
| Total nitrogen (%) | 0.64 |
| Available phosphorous ($mgkg^{-1}$) | 1.68 |
| Potassium ($Cmolkg^{-1}$) | 0.54 |

Result for the initial soil properties is presented in Table 1. The result indicated that organic carbon content of the soil was high while, total nitrogen, and available phosphorus of the soil was very low (table 1). Exchangeable potassium and sodium were high while magnesium was moderate. Cation exchange capacity was moderate and exchangeable cassium was low according to the rating ofEsu (1991).

**Table 2: Influence of Poultry Manure on Chemical Properties of Soil**

| Treatment | pH | OC | TN | AP | Exchangeable bases Ca | Mg | K | Na | CEC |
|---|---|---|---|---|---|---|---|---|---|
| | | % | | mg/kg | Cmol(+)kg$^{-1}$ | | | | |
| 0 | 7.08 | 1.84c | 0.08 | 0.41d | 1.23c | 0.56b | 0.35b | 0.55b | 4.25b |
| 2 | 7.15 | 2.49b | 0.09 | 0.46c | 1.44b | 0.76a | 0.56a | 0.62b | 4.70b |
| 5 | 7.25 | 2.71ab | 0.10 | 0.51b | 1.65a | 0.75a | 0.55a | 0.58b | 5.45a |
| 10 | 7.26 | 2.82a | 0.12 | 0.57a | 1.77a | 0.84a | 0.57a | 0.75a | 5.27a |
| SE | 0.21 | 0.09 | 0.04 | 0.01 | 0.04 | 0.03 | 0.02 | 0.02 | 0.13 |
| SIG. | NS | * | NS | * | * | * | * | * | * |

Means followed by same letter (s)within the same raw are not significantly different at 5% level of probability.
NS=not significant.
*= significant at 5% level.

Influence of poultry dropping on chemical properties of soil is presented in Table 3. The result indicated that treatments had significant ($P<0.05$) effect on all the considered chemical parameters of the soil except on pH and total nitrogen. However, increased in pH was recorded due to treatments application as compare to the initial values with the highest increased due to application of 10th$^{-1}$ , even where the significant difference was recorded among treatments, application of 10tha$^{-1}$also gave the highest value of organic carbon, available phosphorous, exchangeable bases and cations exchange capacity of the soil at (2.82%, 0.57mg/kg, 1.77, 0.84, 0.57, 0.75 and 5.27Cmol(+)kg$^{-1}$) respectively. The least values were obtained in pot where no poultry dropping was applied(control). This could be attributed to the influence of poultry dropping on soil fertility as it decomposed and mineralized, resulting to animprovement in the soil condition and microbial activities. The result of this findings was similarly reported by (Balasubramanian and Singh, 1978) and (Wild, 1988) that, application of farm yard manure increased the availability of phosphorous in soil solution and reduced phosphorous adsorption in an experiment conducted on an Ultisol in Nigeria. Pierre and Morrean (1986) observed that the addition of farm yard manure combined with mulch had enhanced the physical properties of a soil. The authors reported that moisture retention, water infiltration and cation exchange capacity in the soil have improved following the application of organic matter (3 and 4 tons ha$^{-1}$) on a farmland. Poultry manure application is known to improve SOM and micro nutrient status and micro-nutrient qualities of the soil (Maerere*et al*, 2001:

Adeniyan and Ojeniyi, 2003).Adesodun*et al.,* (2005).Has found that application of poultry manure to soil increased soil organic matter, N and P and aggregate stability.

**Table 3: Influence of Poultry Manure on Growth Performance of Rice at 16WAP and Yield**

| Treatment | Plant Height (cm) | No. of Leaves/plant | No. of Tillers/plant | Stalk (g/pot) | GrainYield (g/pot) |
|---|---|---|---|---|---|
| 0 | 35.94b | 30.11c | 8.50c | 28.32b | 3.20b |
| 2 | 38.91ab | 32.47bc | 8.67c | 32.55ab | 4.35ab |
| 5 | 46.99a | 33.58b | 10.17b | 33.93ab | 5.20ab |
| 10 | 40.14ab | 52.25a | 15.59a | 38.67a | 6.32a |
| SE | 1.58 | 1.88 | 0.63 | 1.10 | 0.30 |
| SIG. | * | * | * | * | * |

Means followed by same letter (s) are not significantly different at 5% level.
* significant at 5% level.

The effect of different levels of poultry droppingon growth and yield parameters of rice is presented in Table 3. The result showed that, levels of poultry dropping had significant effect ($p<0.05$) on plant height, number of leaves and number of tillers per plant.

**Plant Height**

Application of5th$a^{-1}$poultry dropping gave the highest (46.99cm)plantheight at 16WAP. However, this was statistically similar with application of 10 and 2th$^{-1}$,while the lowest plant height (35.94cm) was recorded in pots where no poultry dropping was applied (control). This could be due the availability of the required nutrients by the plant throughout the growing period as stated by Farhad et al., (2009) that, the increase in plant height with poultry manure(PM) was mainly due to the reason of more availability of nutrients by PM throughout the growing season. These results are in accordance with the findings of Mitchell and Tu (2005) and Warren et al. (2006)

This result is compatible with the report of Obatolu and Ibireino (1999), and Opara – Nadi*et al.,* (2000) on increase in the height of maize treated with organic fertilizer. This indicates the significance of organic manure on this very important growth parameter of plant. Furthermore, Awotundun*et al.,* (2000) observed a similar increase in height of maize plant that had cow dung application. Also the report is in agreement with the results of Kwari (2003) who observed that the height of millet increased when 7.5 t $ha^{-1}$ cattle manure was added to soil relative the control plots. The positive influence of organic manure on plant height is also consistent with the report of Arunah*et al*., (2007) who had also observe that, the height of two sorghum varieties had significantly increased due to amendment of soil with quantities of organic materials that was applied at 2 – 4 t $ha^{-1}$ in Zaria.

**Number of Leaves and Tillers**

Application of poultry dropping at $10th^{-1}$recorded the maximum number of leaves and tillers per rice plant at 16WAP (52.25 and 15.59 respectively). While the minimum number of leaves and tillers were obtained from plants in control (30.11 and 8.50 respectively). This could also be attributed to the availability of the required plant nutrients in that treatment which help in promoting the vegetative growth of the plant.This is in line with the finding of Akanni (2005) that, manure application improved organic matter, N, P and exchangeable cation concentration of soil that could benefit growing crops. In a similar way, Agbede*et al* (2008) reported that application of 7.5t/ha poultry manure increase growth parameter (plant height, stem girth, leaf area) of Sorghum in south west Nigeria.

**Stalk and Grain Yield**

Effect of levels of poultry dropping on stalk and grain yield of rice is presented in Table 3. The result indicated that, treatment had significant effect ($p<0.05$) on stalk and grain yield.Application of $10th^{-1}$ recorded the highest stalk and grain yield. This was similarlyreported by (Farhad et al., 2009)) that, grain yield was significantly affected by the application of different levels of PM. These results are in accordance with the findings of Boateng et al. (2006) and Deksissa et al. (2008) that poultry manure significantly increased the grain yield.

## Conclusion

This research revealed that application of different levels of poultry dropping to soils under rice production have significant effect on soil organic carbon content, CEC, available phosphorus content, some exchangeable bases and rice productivity. Also that, application $10th^{-1}$gave the best rice yield which is therefore, recommended for farmers in the study area.

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