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Effect of Poultry Manure on Growth and Yield of Finger Millet (*Eleusine Coracana* L. Gaertn) In The Northern Guinea Savannah, Nigeria.

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Abstract

The study was conducted at Riyom, sub-station of the National Cereal Research Institute (Lat. 09 38'N, Long. 08 57'E: 1290M ASL) in the Northern Guinea Savannah of Nigeria in 2007, 2008 and 2009 wet seasons to investigate effect of poultry manure (0,4,8 and 12t/ha) on growth and yield of finger millet. Randomized complete Block design with three replications was used. Results showed that poultry manure had significant ($p \leq 0.05$) effect on plant height in all trials. Poultry manure applied at 8 and 12 t/ha produced taller plants than control and 4/ha manure rate. Application of 4/ha poultry manure produced taller plants than in control. Number of tillers/plant was similarly affected by poultry manure. Application of poultry manure significantly ($p \leq 0.05$) increased number of tillers in finger millet. Poultry manure applied at 8 and 12t/ha produced higher number of tillers than control and 4t/ha manure application rate. Poultry manure applied at 8 and 12t/ha produced significant ($p \leq 0.05$) delay in 50% maturity of finger millet in control treatment and 4t/ha manure. Application of 4t/ha manure similarly delayed maturity in finger millet over control. Poultry manure applied at 8t/ha delayed maturity in finger millet for 15, 14 and 12days in 2007, 2008 and 2009, respectively where compared to control. There were also significant ($p \leq 0.05$) effects of the different levels of poultry manure on number of spikes/tiller plant. Application of 8 and 12t/ha manure produced higher number of spikes/tiller and higher number of spikes/plant main stem than in control and 4t/ha poultry manure, respectively. In all years of trial, application of 8 and 12t/ha poultry manure produced significantly ($p \leq 0.05$) higher grain yield than 4t/ha poultry manure rate and control. In 2007, 2008 and 2009 poultry manure applied at 8t/ha increased grain yield by 372, 402 and 335%, respectively. It was therefore concluded that application of 8t/ha poultry manure enhanced good plant growth, increased tiller/plant, and number of spikes/plant, number of spikelets / main stem of plant, delayed maturity and overall increase in grain yield over other manure rates tried in this study. Thus, 8t/ha poultry manure is recommended for finger millet production, even though further research needs to be conducted to confirm or dispute the outcome of this study.

***Key words**: Finger millet, growth, poultry manure, grain yield, Riyom*

Introduction

In Africa, finger millet (*Eleusine coracana L. Gaertn*) is the second most widely grown millets. It accounts for 10% of total millets produced after pearl millet (*Pennisatum glaucum L.*) which account for 18.5 million hectares of area put to all millets in Africa (Obilana, 2002). The crop originates from Uganda and Ethiopia and was later taken to India over 3000 years ago where it was development by selection (Anon., 1996); Doggette, 1989). The cultivation of finger millet cuts across India, East, Central and West Africa. Agboola (1979) observed that in Africa,

the cultivation of finger millet decreases from the east to the west. In Nigeria, though finger millet is mainly produced in the northern part of the country, there is no annual hectare and yield records because it is often combined with pearl millet and other related cereals during production (FAO,1997).

Finger millet has high nutritive value. This has stimulated cultivation of the crop locally. About 130 million people in the semi-arid tropics of sub-saharan Africasubsist on the crop. Finger millet is important because it serves the dietry needs of many farm families and it also contributes to the income of many rural households. Though relatively low in total protein when compared to other cereals, its essential amino acids, especially methionine is much higher than other important millets of Africa (Finger millet > Pearl millet > teff (Obilana, 2002). Finger millet is used as food and fodder. It is rich in mineral such as calcium, iron, phosphorus and Zinc, amino acids such as cystine, leucine and phenylalamine which all together makes it an important remedy against malnutrition, especially kwashiorkor (Glew *et al.*, 2008). The good storing quality of the crop attracts its cultivation in drought prone areas and therefore, serves as an ensuring food security crop in places it is grown. In some places where finger millet is grown, increased cropping intensity has accentuated changes such as erosion of top soil, degradation in soil physical conditions and changes in number and composition of soil organisms. Also, the long term effect of continuous fertilization with mineral fertilizers in order to achieve and maintain optimum yields have over many years produced negative effects of reduced crop yield, soil acidity and nutrient imbalance (Kang and Juo, 1980; Okigbo, 1982; Obi and Ebo, 1995 and Ojeniyi, 2000). The negative changes due to mineral fertilizer usage calls for reviving the use of organic fertilizers such as poultry manure because poultry manure have been found to be richer in nitrogen than other livestock wastes (Hirzel *et al*., 2007). Poultry manure alongside other organics serves as organic amendment of soils and as well provides crop with nutrients (Sigh *et al.*, 2004). The current study aimed at determining the appropriate rate of poultry manure for the growth of finger millet at Riyom, in the northern Guinea Savannah ecological zone of Nigeria.

Materials and methods

The study was conducted at Riyom (09 38'N, 08 57'E: 1290M ASL) in 2007, 2008 and 2009 wet seasons. The meteorological data during most of the growth period (June – October of each year) of the test crop is presented in Table 1.

The experimental design was Randomized complete block with three replications. Four poultry manure levels (0,4,8 and 12 t/ha) were evaluated. The net plot size was $4m^2$. The experimental plot was ploughed each year, harrowed twice at the beginning of each rainy season and marked into plots according to specifications. Poultry manure which composed mostly NPK was applied and worked into the soil one week before transplanting was carried out. Finger millet seed was earlier seeded in a nursery near the experimental site. At three weeks old, the seedlings were

uprooted and transplanted to the plots marked out. Two plants were transplanted and later thinned to one plan per stand. Cultural practices were observed. At maturity, the crop was harvested on 22, 25 and 28 November 2007 2008 and 2009, respectively. Plant height (cm), tiller/plant, number of spike/plant, number of spikelets/main stem of plant, days to maturity and grain yield were assessed and the data was subjected to analysis of variance for test of significance of differences between mean after Duncan at 0.05 probability level.

Table 1: meteorological data, Riyom

Year	June	July	August	September	October	Total
			A: Rainfall (mm)			
2007	322.8	303.2	311.2	147.6	1.8	1085.7
2008	119.4	272.7	307.8	167.4	93.6	960.9
2009	129.5	167.8	299.4	190.3	195.8	987.8
			B: Temperature (^{o}C)			
2007	25.8	24.4	23.5	27.2	28.6	
2008	26.0	24.1	24.0	26.0	27.7	
2009	26.2	24.0	24.2	26.6	27.4	
			C: Relative Humidity (RH %)			
2007	88	96	94	66	68	
2008	86	95	96	74	66	
2009	90	94	92	72	69	

Source: NMA; 2009

Results and Discussion.

Plant height: Poultry manure had significant ($P \leq 0.05$) effect on plant height in all the years studied. Application of 8 and 12 t/ha of poultry manure were observed to produced taller plants than the control and 4t/ha manure.Application of 4t/ha however, was observed to produce taller plants also than the control throughout the trial period. The increase in plant height could be due to the poultry manure. Sridhar and Ashwini (2006) found out that increase in finger millet height and its dry matter yield were due to pill millipede (*Arthrasphaera magna*) compost applied to the crop. Ajakaye (1971) and Eltilib *et al.* (2006) also reported that poultry manure is an important supplier of nitrogen and phosphorus requirement of most cereal crops.

Number of tillers per plant: Application of poultry manure significantly increased number of tillers in finger millet. The application of 8 and 12 t/ha of poultry manure produced taller plants than the control and 4t/ha manure. Manure applied at 4t/ha also produced taller plants than the control in all of the years 2007, 2008 and 2009. The observed increased in tiller number might have been due to released nutrients in the poultry manure and its import into the plant resulting in increased growth

through increased cell number and tiller. Bajpai, *et al*. (2002) earlier reported that organic manure such as compost improved all crop growth parameters

Table 2: Effect of Poultry manure on plant height (cm) of finger millet.

Treatment	Plant height(cm)		
	2007	2008	2009
Poultry manure(t/ha)			
0	32.01^{c}	38.80^{c}	40.80^{c}
4	36.46^{b}	39.79^{b}	43.38^{b}
8	38.12^{a}	41.38^{a}	45.25^{a}
12	38.89^{a}	42.19^{a}	46.71^{a}
SE ±	0.250	0.260	1.500

Mean in a column with different superscript are significantly different ($P \leq 0.05$)

Table 3.Effect of Poultry manure on number of tiller per plant.

Treatment	Number of tillers		
	2007	2008	2009
Poultry manure(t/ha)			
0	2.26^{c}	2.34^{c}	2.42^{c}
4	4.94^{b}	5.02^{b}	5.63^{b}
8	6.72^{a}	6.89^{a}	7.29^{a}
12	7.19^{a}	7.10^{a}	7.73^{a}
SE ±	0.259	0.253	0.195

Mean in a column with different superscript are significantly different ($P \leq 0.05$)

Days to Maturity: Poultry manure had significant effect on days to 50% maturity. Application of 8 and 12 t/ha poultry manure led to delayed maturation of the finger millet plants in the control and 4t/ha manure in the years studied. Manure applied at 4t/ha, also delayed maturity. Similarly delayed maturity was observed with application of 4t/ha manure over the control during the period of trial. The delay in maturity was probably due to high levels of poultry manure used. Since poultry manure has been found to contain higher nitrogen than other animal wastes (Ajakaiye, 1971);luxurious consumption of nitrogen released from the poultry manure might have delayed maturity of the finger millet.

Number of Spike per Tiller of Plant: Poultry manure had significant effect on number of spike of plant tiller. A general increase in spike number was observed at increased levels of poultry manure in the period of study. At 8 and 12 t/ha of poultry manure used, higher number of spikes were produced than in the control and 4t/ha manure.

Table 4: Effect of Poultry manure on Days to 50% maturity of finger millet.

Treatment	Days to maturity		
	2007	**2008**	**2009**
Poultry manure(t/ha)			
0	61.74[c]	61.56[c]	63.61c
4	69.09[b]	68.96[b]	69.94[b]
8	76.99[a]	75.00[a]	75.33[a]
12	77.09[a]	74.55[a]	74.87[a]
SE ±	1.002	1.149	1.285

Mean in a column followed by unlike letter(s) differ significantly (P ≤ 0.05) DMRT

Manure applied at 4t/ha also produced higher number of spikes per tiller than control in all of the years studied. It is likely that the poultry manure furnished the plant with its nutrient and the uptake and import of assimilates produced in other vegetative parts of the plant was probably directed to the spike on the tiller hence the observed increased in number of spikes. Other workers (Ramamoorthy*et al.*, 2002), working on related crops reported that both organic manure and mineral nitrogen fertilizers increased yields in millet and wheat. Isa *etal.*(2010) also found out that organic manure increased yield in bread wheat.

Table 5: Effect of Poultry manure on number of spike/tiller plant

Treatment	Number of Spike/tiller plant		
	2007	**2008**	**2009**
Poultry manure(t/ha)			
0	4.89[c]	6.34[b]	6.51[b]
4	7.13[b]	7.93[a]	7.99[a]
8	8.58[a]	8.19[a]	8.21[a]
12	8.48[a]	8.40[a]	8.33[a]
SE ±	0.241	0.145	0.142

Mean in a column with different superscript are significantly different (P ≤ 0.05)

Number of spikelets per plant main stem: number of spikelets per plant of main stem of finger millet was significant. Increase in number of spikelets was observed at increasing levels of poultry manure. At 8 and 12t/ha of poultry manure, significantly higher number of spikelets were produced than in control and 4t/ha manure. Manure applied at 4t/ha also produced higher number of spikelets than in control in all of 2007, 2008 and 2009. The increase in number of spikelets could have resulted from different uptake of nutrients in the poultry manure to the active part of the plant for enhanced growth and spikelet formation. This finding is consistent with the results earlier obtained by Ramamoorthy (2002).

Table 6: Effect of Poultry manure on number of spikelets per plant main stem.

Treatment	Number of spikelets/plant main stem		
	2007	2008	2009
Poultry manure(t/ha)			
0	284.38[c]	482.44[c]	505.31[c]
4	462.48[b]	646.00[b]	673.06[b]
8	553.58[a]	746.00[a]	776.00[a]
12	551.01[a]	743.06[a]	753.00[a]
SE ±	27.570	24.659	23.542

Mean in a column followed by different superscript are significantly different ($P \leq 0.05$)

Grain yield (kg/ha): Poultry manure had significant effect ($P \leq 0.05$) on finger millet grain yield. Throughout the period of study, application of 8 and 12t/ha poultry manure increased grain yield than control and 4t/ha manure. Application of 4t/ha also resulted in higher yield than control in the study period. The low yield realised in the control suggests that the soil was not fertile and therefore could be used for fertilizer trial. Increase in yield was noticed with increased poultry manure usage upto 8t/ha as it tend to reduce as more manure was applied (Table 7). The increase in yield from increase poultry manure usage up to 8t/ha in 2007, 2008 and 12t/ha in 2009 suggests that the poultry manure affected the crop productivity. The present finding agrees with that of Ramamoorthy, *et al.*, (2002); Sridhar and Ashwini (2006) and Rangaraj *et al*., (2007) who all reported the increase in pearl millet and finger millet yield from the usage of organic and inorganic fertilizers.

Table 7: Effect of Poultry manure on Grain yield of finger millet.

Treatment	Grain yield (kg/ha)		
	2007	2008	2009
Poultry manure(t/ha)			
0	99.60[b]	126.40[c]	135.90[c]
4	428.50[a]	460.70[b]	459.50[b]
8	470.40[a]	634.10[a]	591.60[a]
12	463.80[a]	605.40[a]	601.90[a]
SE ±	15.224	12.760	12.411

Mean in a column followed by different superscript are significantly different ($P \leq 0.05$)

Conclusion

Considering parameter studied, poultry manure applied at 8 and 12t/ha produced par yield which were significantly different from other parameters. Since economic benefit is a major factor that motivates a farmer to go into production of a particular crop, this study therefore recommends the application of 8t/ha poultry manure. However, further investigation needs to be done.

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