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Growth and Yield Response of Finger Millet (*Eleusine Coracana* (*L*) *Gaertn*) To Poultry Manure in Jalingo Agricultural Zone, Nigeria.

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Abstract
Field trials were conducted at the Teaching and Research Farm, Taraba State College of Agriculture, Jalingo in 2017 and 2018 to determine the response of Finger millet to poultry manure application. The treatment evaluated were poultry manure compost at 0, 3, 6, 9, and 12 t/ha. The treatments were replicated four times and arranged in a randomized complete block design (RCBD). Parameters measures include; plant height, number of tillers, leaf area index, days to 50% heading, Number of spikes, Spike length, grain yield and 1000 – grain weight. The data were subjected to analysis of variance (ANOVA) and means differences were separated using Least Significant Difference (LSD) at P = 0.05. the results obtained showed that finger millet responded positively to poultry manure in all agronomic parameters evaluated with the best values obtained at 12 t poultry manure/ha. Finger millet plants in this treatments were tallest (26.37/26.51cm at 4WAS and 45.19/45.81cm at 8 WAS) in 2017 and 2018 respectively, with highest number of tillers/plant (7.89/8.05), highest LAI (40.44/40.79cm), as well as lowest number of days to 50% heading (103.31/103.08 days), highest number of spikes/plant (18.10/18.48), longest spikes (4.67/4.93cm) and highest grain yield (2.29/2.30 t/ha) in 2017 and 2018 cropping seasons respectively. The performance trend indicates that the best agronomic parameters could be obtained for finger millet by applying 12 t poultry manure/ha in Jalingo and its environs.

Key wards: Finger mellet; Grwoth and Yield; Jalingo Agricultural Zone; Nigeria; Poultry manure.

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I. Introduction

Finger millet (*Eleusine coracana* (L) *Gaertn*) is a robust, tufted, tillering, annual and a cereal grass grown mostly for its grain which grows up to 170cm high (1,2). The inflorescence is a panicle with 4 – 19 finger – like spikes that resemble a fist when mature hence the name finger millet (3). The crop is one of the most staple food cereals in Sub – sahara Africa and in many countries in South Asia (4). It is considered to be indigenous to the highland areas of Uganda and Ethiopia and is majority produced and locally consumed by the resource poor farming households (5). Comparatively, finger millet grains are considered nutritionally superior having contained more amounts of minerals such as calcium as well as essential amino acids than most other food grains (4). The grain is readily digestible and serve as a staple food, weaning food, or a cash crop which provides income generating opportunities. And the sprouted grains are used to make liquor and been and the by – products used for livestock feeding (6).

Though a minor millet compared with pearl millet, finger millet has a potential for food security and economic growth in dry land areas where frequent crop failures and acute food shortages are phenomena (7,8). The crop is well adapted and performs better than other food cereals in agronomically marginal areas and the grains have excellent storage quality even under poor storage conditions (9).

Finger millet is an orphan crop and research work to provide the necessary agronomic information for enhanced productivity of he crop is still scanty (1). The crop is cultivated by peasant farmers in most parts of Africa including Nigeria and average yield of the crop remain as low as 1 t/ha which is below the potential compared with the yield of 5 – 6 t/ha obtained in other parts of the world like Kenya and India (4, 10).

Finger millet adapts to wide range of soil conditions though it performs better in fertile, well drained sandy to sandy – loam soils with pH ranging from 5 – 7. However, it also grows on lateric or black heavy vertisols, and has some tolerance to alkaline and moderately saline soils (2). Continous cultivation and heavy application of synthetic fertilizers degrades the soil rapidly and is detrimental to soil health and soil productivity. This practice is not suitable for fragile soils or arid ecologies where finger millet is grown commercially.

Adoption of low input sustainable farming systems such as organic farming can guarantee soil fertility maintenance for enhance crop yield under zero inputs traditional cropping systems. The appropriate quantity of organic manure to be applied for effectiveness depends on the nutrient content of the material, the soil fertility status and the nutrient requirement of the crop. Such investigations have not been carried out effectively and continuously on finger millet in the study area. And poultry manure is commonly used as substitute for inorganic fertilizers which are scare and expensive but information on poultry manure requirement of finger millet in the study area is still lacking and the objective of this trial was to bridge this research gap.

II. Materials and Methods

The experiment was conducted in 2017 and 2018 cropping seasons at the Teach and Research Farm of the Taraba State College of Agriculture Jalingo (Latitude 8^0 89'N and Longitude 11^0 36'E). The area enjoys average annual rainfall of 700 – 1000mm distributed over seven months from April/ May to October/November and at elevation of 349 metres above sea level (1).

The land was cleared manually with machete, fine tilled manually and seed beds of 2m × 3 ($6.0m^2$) made with hand hoe. The plots were demarcated by 1.0mm wide pathways and arranged in four block spaced 1.5m apart. The treatments were five poultry manure (pm) rate viz; 0, 3, 6, 9 and 12 t/ha each replicated four times and laid out in a randomized complete block design (RCBD).

Composite soil samples were taken from the gross plot area for routine analysis in the laboratory using the procedure by Block (1965). The nutrient contents of the manure were also analysed for 2017 and 2018. The seeds of finger millet sourced from farmers seed banks in Jalingo were sown by drilling and later thinned to one plant pr stand spaced 20cm × 50cm three weeks after sowing (WAS. The poultry manure sourced from the College poultry farm was well composted under shade for four weeks before planting.

Weeding was done manually at three and six weeks after planting using a hand hoe. Data collected on five randomly tagged plants used for sampling were plant height, number of tillers, leaf area index, days to 50% heading, number of spikes, spike length, grain yield and 1000 – grain weight. Leaf area index was determined at 8 WAS using the formula as reported by (11).

Growth and yield data collected were subjected to analysis of variance (ANOVA) using Gen Stat Release 8.1. Treatment means were separated using the least significant difference (LSD) at 5% level of probability.

III. Results and Discussion

The poultry manure analyzed in 2017 and 2018 showed that it contained adequate levels of nutrients and organic matter (Table 1) and their regular use on farm land improves and sustains the quality of soil in the long run (1).

The finger millet tested responded to poultry manure application in all agronomic parameters assessed in both cropping seasons of 2017 and 2018 (Table 2). Plant height different significantly at P = 0.05 at each poultry manure (PM) rate and was highest in finger millet plants with highest PM rate (12 t/ha) in 2017 and 2018 (26.37/26.51cm at 4WAS and 45.19/45.81cm) respectively, while shortest plants were recorded in the control plots. Highest number of tillers per plant (7.89/8.05) in 2017 and 2018 were recorded on plants treated with 12 t/ha followed by 9 t PM/ha, while lowest number of tillers were recorded for the control plots. Also LAI were highest (40.44/40.79cm) in plants treated with 12 t PM/ha, while lowest values were recorded for the control plants in 2017 and 2018 respectively. This is similar to (1, 2) who reported similar trends.

Finger millet plants treated with 12 t PM/ha attained 50% heading earlier (103.31/103.8days) than the other treatments in 2017 and 2018. Both number and length of spikes were influenced by PM application to finger millet highest and longer spikes were observed in plants that received 12 t PM/ha (4.67/4.93cm) respectively in 2017 and 2018 (Table 2) than those in other fertilizer rates and the control plants. Grain yield and 1000 – grain weight followed a trend similar to that of number and length of spikes with the highest grain yield and 1000 – grain weight produced at 12 t PM/ha (2.29/2.30 t/ha) which is in agreement with the findings of (11, 1, 2) who reported similar highest grain yield and 1000 – grain weight with increase in organic manure application. While lowest yield figures was recorded in zero fertilizer plots.

Table 1: Some chemical properties of poultry manure used in the experiment

Soil parameter	Value	
	2017	2018
pH	7.2	7.2
N (%)	4.42	2.44
NH_4^+ (%)	0.14	0.13
K_2O (%)	1.70	1.70
Ca	3.64	3.64

Mg	2.18	2.18	
Mn	0.04	0.04	
Org. C (%)	36.3	62.3	
Organic matter	62.2	62.3	
C/N Ratio	14.5	14.5	

Table 2: Growth parameters of finger millet as influenced by poultry manure rates in Jalingo Agricultural Zone, Nigeria

Manure rate	Plant height (cm)				Tillers/plant		Leaf Area Index 4WAS	
t/ha	2017		2018		2017	2018		
	4WAS	8WAS	4WAS	8WAS				
0	17.82	22.29	17.85	22.43	2.39	2.79		
	23.81	23.95						
3	19.48	29.67	19.66	29.78	3.51	3.86		
	28.25	28.90						
6	23.31	37.15	23.56	37.76	5.28	5.95		
	38.16	38.76						
9	26.33	38.12	26.50	38.49	6.30	6.58		
	39.16	39.61						
12	26.37	45.19	26.51	45.81	7.89	8.05		
	40.44	40.79						
LSD (0.05)	1.23	2.03	2.01	3.15	0.78	0.81		
	0.83	0.91						

Table 3: Yield parameters of finger millet as influenced by poultry manure rates in Jalingo Agricultural Zone, Nigeria

Manure rate	Days to 50%		Number of spikes		Spikes length		1000 – Grain weight		Grain	Yield
t/ha	heading		per plant		(CM)		per plot (g)		t/ha	
2017	2017	2018	2017	2018	2017	2018	2017	2018		
0	112.10	112.09	5.28	5.63	3.47	3.71	2.23	2.48	2.51	2.21
3	109.19	109.18	9.14	9.66	4.14	4.50	2.26	2.79	2.81	2.25
6	107.11	107.09	12.15	12.48	4.24	4.69	2.28	2.88	2.91	2.27
9	105.10	105.10	16.15	16.76	4.58	4.84	2.29	2.95	2.98	2.28
12	103.31	103.08	18.10	18.48	4.67	4.93	2.30	3.12	3.17	2.29
LSD (0.05)	1.42	1.53	1.52	1.81	0.14	0.15	19.02	19.09	0.30	0.31

IV. Conclusion

The growth and yield indices of finger millet were maximized at the highest fertilizer rate indicating that further yield improvement could still be obtained at higher than 12 t pm/ha. However, farmers in Jalingo Agricultural Zone of Nigeria could adopt this fertilizer rate to maximize finger millet yield, while further trials using higher fertilizer rates are recommended to ascertain the best fertilizer rate for optimum performance of the crop.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest what so ever among the authors to disclose.

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