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COMPARATIVE EFFECTS OF POULTRY MANURE AND NPK RATES ON SUNFLOWER (*Helianthus Annuus L.*) PRODUCTION IN RIVERS STATE, SOUTHERN RAINFOREST, NIGERIA

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ABSTRACT: *A 2 x 4 x 3 rain fed factorial experiment arranged in a randomized complete block design, was carried out to compare the effects of poultry manure [PM] with N.P.K. (15:15:15) rates on sunflower in rivers state, southern rainforest of Nigeria. PM and NPK rates were 0, 5, 10, and 20g per seedling per pot. Data collected were plant height [at; 4, 6, 8 and 10 weeks after planting (WAP)]; number of leaves, leaf area (LA) at 6 WAP; head diameter, head weight, number of seeds per head and seed weight at harvest. Results show that NPK initially produced taller plants but PM increased growth rate with time over NPK. PM at 5, 10 and 20 g produced taller sunflower plants at 10 WAP over NPK rates. There was no significant difference in the number of leaves between plants that received PM and NPK, though NPK influenced higher LA. Head diameter, head weight and seed weight increased with doses of both fertilizers, 20 g PM produced sunflower plants with the widest diameter and weightiest seeds. While number of seeds increased with PM rates, the highest number of seeds with NPK application was at 5 g application. This was still lower than the highest number of seeds produced by sunflower plants fertilized with 20 g PM. Application of 20 g PM produced plants with highest growth rate, wider head diameter, highest number and seed weight. Twenty (20 g) PM application rate per seedling is recommended for Sunflower production in southern rainforest, Nigeria. A further study on higher PM levels is also recommended.*

KEYWORDS: Nigeria, Poultry manure, Southern Rainforest, Sunflower

INTRODUCTION

Sunflower is a member of the family: *Asteraceae* and genus*: Helianthus* (Andrew *et al*; 2013), with characteristic large sun-like inflorescences or head. It also possesses rough hairy stem and broad coarsely rough leaves (Khaleghizadeh, 2011). The plant is an erect annual herb that can grow to a height between 1 to 3.5 meters (Fernandez-Luqueno *et al*., 2014). Sunflower originated from North and Central American where it is grown for food, medicine, dye making, as flower, or oil. It is grown in the temperate Europe region (with Russia as the world's highest producer) and even in the tropical and sub-tropical region (Aakre, 1996; FAOSTATS, 2011). The crop has the ability to do well under various climatic and edaphic conditions (Seiler *et al.,* 2008, Kaleem *et al.,* 2011), but it is damaged by frost. It performs best between temperature range of 20 – 25 °C (Thomaz *et al.,* 2012). It is drought resistant giving moderate yield with rainfall as low as 300 mm, though yield is affected when drought stress occurs during the main growing stage and at flowering. Optimum rainfall for sunflower is between 500 – 750 mm per annum (Gholamhoseini *et al*., 2013, Ghaffari *et al.,* 2012) and best soil for sunflower is sandy loam to loamy soil (Radanielson *et al*., 2012).

Sunflower is mainly grown in the Sudan savannah region of Nigeria, owing to the favourable condition for seed setting and drying. An improved strain of the crop has been developed at

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Ahmadu Bello University, Samaaru-Zaria. A careful selection of cultivation or planting of sunflower towards the mid to end of the rainy season in the wetter derived Savannah and rainforest zone of Nigeria could be exploited in the cultivation of sunflower in these climatic zones.

The benefits of Sunflower is derived from the oils that is extracted from the seed, which can be consumed directly as cooking oil, in processed foods or non-food industries (Vermeercsh 1996). The oils are low in cholesterol and high in the "good" unsaturated fatty acids such as palmitic, stearic, oleic and linoleic acids (Baydar and Erbas, 2005; Seiler 2007). Cultivation of the sunflower in the southern rainforest zone would bring immense health benefits to the region.

It has been documented that soils in the Tropical rainforest region are inherently infertile with depleting organic matter levels and will require additional fertilization to raise the soil nutrient status (Grubb 1995). According to Mokhtariniya and Siadat (2011), price of chemical fertilizers are getting higher; also fertilizers negatively affect human health thus encouraging the use of organic manure for soil fertility. Yiridoe *et al*. (2005) after reviewing over 300 studies revealed that crops fertilized with organic manure had better health benefits over conventional inorganic fertilized crops. Crops fertilized with organic manure had up to 60% high antioxidant index than those fertilized with inorganic fertilizer. Organic manure in addition to the benefits above, improve the physical and chemical condition of the soil as well as crop response to inorganic fertilization (Adegbidi *et al.*, 2003; Kaur *et al*., 2005).

The objective of this study was therefore to evaluate the effect of poultry manure on the performance of Sunflower in comparison with the use of N.P.K 15:15:15 for sunflower production in the southern rainforest of Nigeria.

MATERIALS AND METHODS

The pot experiment was conducted at Aluu latitude 4.93°N and longitude 6.94 °E Ikwerre Local Government Area of Rivers State between May and August 2015.

Materials

Materials used for the study were polybags, sandy loam soil, shovel, wheelbarrow, hand gloves, meter rule, rope, sunflower seeds, watering can, poultry manure, N.P.K 15:15:15 and weighing scale.

The SSl 807 Sunflower variety used was obtained from the Institute of Agricultural Research of the Ahmadu Bello University, Samaaru-Zaria.

Methods

The experiment was laid out in randomised complete block design, with two factors, Poultry Manure (PM) and N.P.K 15:15:15 (NPK); at four rate (0, 5, 10 and 20 g) of application replicated three times, (2 x 4 x 3). Perforated bags were filled with sandy loam soil to a depth of 25 cm and arranged in three blocks in open field. Seeds were sown directly into the perforated polybags on 15th May, 2015. Fertilizer treatments were randomly allotted within the blocks. Application of nitrogen sources was done according to allotment three weeks after planting. The seedlings were rain fed; weeds were controlled by direct physical removal.

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Measurement of plant height was at 4, 6, 8 and 10 WAP. Number of leaves and Leaf Area (LA) were determined at 8 WAP. Harvesting took place on 18th August, 2015 after which measurement of head diameter, head weight, number of seeds and seed weight were taken.

RESULTS

The result of the physical analysis of soil used is shown in table 1. The sampling and analysis were done before the soil was dug to fill the polybags. Analysis values show that the soil was sandy loam.

Table 1: Particle size analysis result of soil used for the experiment

Soil physical parameter	Value
Soil sampling depth	15cm
% clay	10.20%
% silt	20.70%
% soil	69.10%
Soil textured class	sandy loam

The growth (height) response of sunflower to rates of applied PM and NPK is shown in table 2. In the early growth stage, the response of the sunflower plants to applied nitrogen levels was higher in plants receiving NPK doses. By 10WAP, plants receiving 20 g of PM had the highest growth rate, about 10% higher growth rate than sunflower plant that received 20 g of NPK. Generally sunflower plants height increased with age and Nitrogen (N) fertilization. Variation in plant height was due to N sources and rates ($P < 0.05$).

Table 2: Average Plant height (cm) response of sunflower variety to poultry manure and NPK doses in Rivers state, southern Rainforest

	Nitrogen Fertilizer Rate							
	0		5 g		10 g		20 g	
Weeks after planting	PM	NPK	PM	NPK	PM	NPK	PM	NPK
4WAP	13	14	15	19	19	24	23	25
6WAP	19	24	29	37	34	40	40	42
8WAP	52	54	62	68	80	79	98	102
10WAP	64	70	71	79	90	80	126	114

The vegetative growth response of sunflower plants to PM and NPK application rate is displayed on Table 3.. The tables shows that plants receiving PM doses produced more number of leaves than those receiving corresponding rates of NPK, but the leaf area (LA) were increasingly larger in plants that received NPK.

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Table 3: Effect of rate of poultry manure and NPK, on vegetative characteristic of sunflower in southern rain forest of Nigeria (8WAP)

	Poultry manure		NPK 15:15:15	
Rates (g)	**Number of leaves**	**Leaf area (LA) cm^2**	**Number of leaves**	**Leaf area (LA) cm^2**
0	13^a	66.0^a	14^a	43.6^a
5	15^a	77.5^b	15^a	82.69^b
10	19^b	94.65c	16^a	99.1^b
20	23^b	197^d	21^b	288.75^c
SE	0.91	1.20	1.10	1.18

Mean followed by same alphabet in the column are not significantly different at P < 0.05

The influence of rates of Poultry Manure and NPK on sunflower reproductive yield is highlighted in table 4. Irrespective of type of N fertilizer, head diameter, head weight, number of seeds per head and seed weight all increased with increasing rate of application. Plants that received lower rates of NPK had corresponding higher head diameter, head weight and more seeds than those that received corresponding rates of PM.

Table 4: Reproduction yield of sunflower as influence by rates of application of poultry manure and NPK

N sources	**Head diameter (cm)**	**Head weight (g)**	**Number of seeds**	**Seed weight (g) 20 seeds**
Poultry manure				
0	3^a	10^a	20^a	1.7^a
5	5^a	43^b	138^b	6.6^b
10	10^c	69.8^c	214^c	10.8^c
20	15^d	98.8^d	274^d	18.6^d
SE	1.25	1.89	1.78	2.10
NPK 15:15:15				
0	4^a	12^a	23^a	1.7^a
5	8^b	79.73^b	253^d	8.32^c
10	11^b	82.27^b	139^c	7.47^b
20	11^b	146.24^c	98^b	6.19^b
SE	1.57	2.14	1.98	2.15

Mean followed by same alphabet in the column are not significantly different at P < 0.05

However, at 20 g PM rate, head diameter, number of seed produced and seed weight were higher than those produced by sunflower plants that were fertilized by any rate of NPK. Also while NPK fertilized plant produced reduced quantity of seeds after application of 5 g, those fertilised with poultry manure positively influenced seed production in sunflower, as increasing levels of PM resulted higher seed production.

The difference in number of seeds and seed weight were significantly varied by rate of nitrogen sources (P < 0.05).

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DISCUSSION

Plant height

NPK doses increased growth of sunflower in this study. This corresponds to finding of Furtado *et al*. (2016) who reported that NPK rates had a quadratic effect on sunflower plant height while sunflower growth rate reduced with increasing rates of biochar, an organic fertilizer. This latter observation is opposite to findings of this study, where PM, another form of organic fertilizer, increased growth rate with increasing doses. The report of Oshundiya *et al*. (2014), that application of organic fertilizer increased plant height in sunflower in Abeokuta, Nigeria, is in line with the findings of this research. In the same vein, Makinde *et al.* (2011) reported that PM produced taller *Chorcorus olitorus* plants with higher growth rate, over plants that receive NPK doses.

Leaf Area and Number of Leaves

Poultry manure rates lead to higher leaf production in sunflower, though not significantly different from NPK rates. However, PM rates resulted in plants with higher LA compared with corresponding NPK rates. Makinde *et al*. (2011) also observed higher leaf production in *Celosia argentina*, with PM as against NPK fertilization. Oyedeji *et al*. (2014) also reported that PM produced larger leaves (leaf length) and greater number of leaves in three Amaranth plants than plants that received NPK.

Reproductive Yield

Head diameter, number of seeds per head and seed weight was highest at 5 g NPK rate per seedling among sunflower plants that received NPK. Beyond this rate there was a gradual reduction in values of these parameters. This finding is related to that of Oyinlola *et al*. (2010) who reported increase in capitulum or head diameter up to 120 kg N ha after which there was a reduction in head diameter.

The reproductive yield of sunflower increases with PM rates. Identical findings were reported by Wabekwa *et al*. (2014) in Wamdeo, North east Nigeria where increasing PM rate from 0 to 8 ton ha $^{-1}$ translated to increasing head diameter and grains (seeds) per head.

The yield advantage recorded with PM rates is due to its ability to improve soil fertility compared with the use of inorganic fertilizer (Posner *et al*. 2008). The initial slow growth that metamorphosed into higher growth rate and higher reproductive yield in sunflower plants receiving PM rate against NPK levels can be attributed to the slow mineralization of the organic manure, which occurs about one to two months after application (Posner *et al*., 2008; Ayeni and Adeleye, 2011).

CONCLUSIONS AND RECOMMENDATION

Pot experiment was carried out to evaluate the potential of poultry manure for sunflower production in Rivers State, southern rainforest zone of Nigeria. Poultry manure rates were compared with NPK 15:15:15 rates.

It was observed that PM application had an initial slow growth but produced taller sunflower plants than plants which received NPK. Beyond application rate of 5 g NPK, there were

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reducing reproductive yield. On the other hand, there was increasing reproductive yield with PM rates. Poultry manure rate of 20 g per seedling (equivalent to 2 ton/ha) is recommended for sunflower production in the southern rainforest. Since growth rate and reproductive yield became more pronounced at 20 g level of poultry manure application, further studies using higher poultry manure doses is recommended.

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