Effect of Mixed-manure Compost and Farm yard manures on growth and yield of Maize

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ABSTRACT

A field experiment was conducted at Oyo State College of Agriculture Research farm in Igboora, to characterize Farm yard manures with its maize base composted materials mixture of equal quantities (cow-dung, poultry, and Pig manures with maize stover in 3 of plant maize stover to 1mixed manures) on the performance and productivity of Maize spanning from 2010-2011 growing seasons. The treatments (control, compost, poultry, pig and cow-dung manures all applied at 5 t/ha) were evaluated in a randomized complete block design (RCBD) and replicated three times. Data were analysed using ANOVA and the means were separated using Duncan multiple range test. There were significant ($P<0.05$) in the manures considered except leaf numbers at 4-6 weeks after planting (WAP). However, the compost treatment gave higher values than the manures used separately in all evaluated parameters. Generally, vegetative growth increased rapidly in all the treatments from 4 to 10WAP .The observed trend of the result is compost>poultry>pig>cow-dung manures at 5 t/ha>control in the order shown for both vegetative and yield characters considered. The compost application resulted in a significantly higher than the manures, alone and control. The highest grain yield (11.4 t/ha), number of seeds/cob (845seeds), dehusk cob weight (0.56 kg), root biomass (0.76 kg) per treatment, maize filled length/cob (16.37 cm) and cob diameter (17cm) were recorded with the addition of compost, control was lowest in all characters considered. The study showed that compost amendment has a positive influence on nutrient release and management strategy for a sustainable maize production in the region.

Key words: Maize base Compost, Poultry manure, Piggery manure, Cow-dung manure, Farm yard manures.

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INTRODUCTION

Sustainable agricultural system must address issues of environmental, economic and social sustainability in its approach apart from inputs consideration. Hence, the needs to adopt production systems that are environmentally friendly especially in food production, marks the bases of organic farming strategy (Bello, 2008).The use of resources available on farm is increasingly gaining importance among small scale farmers. Such resources within farm include crop residues, green manure, compost and farm yard manure. Opined with this, Livestock industry is now booming in Nigeria; with the discharge of huge amount of manures that pollutes the environment.

Recently, there has been concerted effort towards the use of organic materials for ameliorating soil fertility decline. Among these organic materials, Livestock manure remains the single most important soil amendment available on farm. Also, manure from livestock is an important source of Nitrogen for crop production in the small holder sector. It helps farmers reduce inputs of commercial fertilizer, thereby increasing the profit margin of the farmer (Ayoola and Makinde, 2008). Nutrients contained in organic manures are released more slowly and stored for a longer time in soil thus supporting better root development, leading to higher crop yields (Abouel-Magd et al. , 2005).

However, manure use is beset by several problems, including low nutrient concentration and inadequate quantities. The efficiency of manure utilization by a crop is also determined by the method of application, time of incorporation and the rate of decomposition in the soil. Hence, organic forms of nutrients must first be mineralized into plant-available forms such as nitrate (Achieng et al.,2010). Previous studies showed that improving manure management via collection, storage, handling and composting enhances nutrient concentration and fertilizer equivalency (Kihanda, et al. 2002). Generally, it is commonly recognized that composted manure has positive effects on crop production, although undesirable substances such as heavy metals may impose health hazards if edible crops are grown (Wong et al. , 1999).

This project therefore, seeks to address the problem of low nutrient concentration in livestock manures through improved management strategies. It also relates livestock manures quality with key quality indices indentified laboratory measurements. In addition, it will also quantify the differential contribution of distinct livestock manures fractions on soil properties for productivity of organically produced suwan yellow maize seeds for the Ibarapa Agro-ecological zone.

MATERIALS AND METHODS

Field trials were conducted at Oyo State College of Agriculture Igbo-ora during 2010 and 2011 cropping seasons. Igbo-ora, is in Abarapa zone; the northern part and derived Savannah Zone of Oyo State. The region has two rainy periods and had between 1000 to 1600mm of rainfall and temperature between 22^{o}C and 38^{o}C. The test crop, Suwan yellow maize variety was obtained from Oyo State Agricultural Development Programme (OYSADEP) store in Oyo town. The seeds were planted in 2010 growing season using Poultry manure to produced Organic base seeds for the experiment in 2011 growing season.

The soils of the experimental site were randomly sampled at depth 0-30cm before planting using urger. The soil samples were bulked, air-dried and sieved through 2mm mesh before physico and chemical analysis. . The parameter that was measured includes the pH taken in a 1:25 solution of 10g air-dried soil + 25ml distilled water or 1m kcl solution. Texture wwas determined by the pipette method. Samples were fractionated using Vanlauwe et al .; (1998) method. Olsen-P was measured to determine the available Phosphorus. Percentage total nitrogen was measured by the Kjeldahl digestion method while the Amato method was used to measure the percentage total soil carbon (Amato, 1983).The experiment was laid out in a randomized complete block design (RCBD) with three replicates having plot size 3 x3 m with treatments; No fertilizer (control),Compost, Poultry, Pig and Cow-dung manures all at 5t/ha. The Poultry manure(Pom) was the droppings from chicken that had been left to decompose for about five months on farm while both Cow-dung(Cod) and Pig manures(Pim) were evacuated from the College farm during daily cleaning and deposited outside the ranch.

The nutrient composition of the organic manures were analyzed before addition and presented in Table 1. All the manures were applied a week before planting to enhance nutrient use efficiency by the crop. The plots were weeded manually whenever necessary throughout the experimental period. Maize was harvested at 14WAP and was sun-dried to 14% moisture content. Growth parameter collected at 4-10WAP includes plant height (cm), number of leaves, leaf area (cm2), stem girth diameter (cm) while the yield characters considered are weight of grains sample, length of grain filled, number of seeds per cob, cob diameter, root biomass weight, Cob +husk weight and dehusk cob weight were also recorded.

The analysis of variance (ANOVA) procedure was done to evaluate the treatment effects.

Mean values were separated using the least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

Table 1: Pre soil analysis of the experimental site

Element	values
PH	6.76
Temp	28.4
OM	1.56
TN	0.11
Av P	16.920
Sand	78.4
Silt	11.6
Clay	10
K	1.14
Na	0.31
Ca	0.16
Mg	0.38

The base line result of the soil analysis reveals that the nutrient status of the soil is below critical value for N, P and K with slightly acidity and sandy textural class. The low level of nutrients, acidity and the poor structure of the soil justified the use of farm yard manures and compost to enhance nutrient balance and improve structural stability. Also, there was variation among the different treatments in terms of nutrient content. The total nitrogen content of the compost is highest (3.35%) while poultry manure had the highest values of Av.P (2146.80ppm) and K (9.80Cmol/kg) respectively. The compost had higher value of K(8.50Cmol/kg) but the pig manure gave higher values of Av. P(1528.80ppm). Compost should be expected to provide the soil and plant with higher quantity of N than other treatments, because it contains higher N than Pom, Pim and Cod. However, the ability of the compost to perform better may be due to appropriate decomposition of the composting materials and mineralization of N (Eusuf Zai et al., 2008).

Table 2: Effect of Compost and Farm yard manures on growth of Maize

Treatments	Leaf area (cm2) Weeks after planting 6	8	10	Plant height (cm) Weeksafter planting 6	8	10	Girth (cm) Weeks after planting 6	8	10
Control	271.88b	333.83d	420.83c	81.13b	121.98c	184.08b	7.37c	7.85e	12.79c
Compost	446.11a	694.83a	671.83a	118.93a	221.61a	239.02a	8.58a	11.32a	15.34a
Poultry	394.60a	550.72b	624.92ab	113.68a	198.71a	226.98a	8.54a	10.31b	14.56ab
Pigmanure	331.81ab	494.17bc	589.33ab	105.96ab	193.28ab	216.60ab	8.40ab	9.88c	14.26ab
Cowdung	331.73ab	442.17c	530.17bc	93.34ab	157.91bc	205.37ab	8.08b	9.03d	13.48bc

Levels not connected by same letter are significantly different

Table 3: Effect of Compost and Farm yard manures on Maize Yield

Treatments	Root wt. (kg).	Grain wt. ton/ha	Grains filled length(cm)	Cob diameter(cm)	Grains count/cob	Husk cob wt.(kg)	Dehusk cob wt.
Control	0.25e	4.8	11.50c	12.03c	604.33c	0.31c	0.29e
Compot	0.76a	11.8	16.37a	17.00a	845.00a	0.59a	0.56a
Poultrymanure	0.62b	9.0	15.73a	15.87ab	826.33a	0.53ab	0.48b
Pig manure	0.56c	8.4	14.87ab	15.47ab	781.67ab	0.50b	0.44c
Cowdung	0.51d	7.2	14.07b	14.38b	726.33b	0.47b	0.37d

Levels not connected by same letter are significantly different

Table 4: Proximate analysis of the Organic materials

Nutrient element	Pig manure	Maize Based Compost	Cow dung	Maize residue	Poultry manure
%TN	3.05	3.35	2.86	0.76	3.31
Av. P(PPM)	15.29	12.31	5.92	3.50	21.47
K(Cmol/kg)	5.70	8.50	5.25	4.35	9.80
PH	8.06	9.32	8.29	8.14	8.74
EC	1540	3125	1482	821	>3999
Tempt	27.2	27.2	27.4	26.8	27.1

Effect of farmyard manure and compost on growth of Maize

There were significant differences on all the growth parameters considered (leafarea, plant height, and stem girth) between 4-10WAP with the exception of leaf numbers at 4-6WAP. The

result from (Table 2) gave a significant effect on all the characters observed compared with the control . The response of the treatments on all the growth parameters observed are in the order Com>Pom>Pim>Cod>Co throughout the period of investigation.The control gave the lowest values at 10WAP leaf area (420.83cm2), Plant height (184.08cm) and girth (12.79cm) while the compost had the highest values leaf area (671.83cm2), plant height (239.02cm) and girth (15.43cm) respectively. However, at 10WAP poultry and pig manure treatments did not differ significantly when both leaf area and plant girth were considered. However, the pig manure and cowdung treatments did not differ significantly when plant height was evaluted at 6 and 10WAP respectively.

The above results indicate that composts were superior to others in almost all parameters considered. The observed result is inline with the findings of Kostov et al. ; (1995), that compost has sharp impact over manure in respect of nutrient release.

Effect of farmyard manure and compost on Maize yields

The effects of manures and compost on Maize yield are presented in (Table 3). Compared to the control, all treatments increased the maize yield. Generally, yields and performance of Maize increased in the order of Com> Pom>Pim>Cod>Co respectively. The control produced the lowest yields values for all character considered grains weight (4.8t/ha), grain filled length (11.50cm), cob diameter (12.03cm) and grain count (604) per cob. Whereas, the addition of Compost produced grain yield (11.4t/ha), grain filled length (16.37cm), cob diameter (17.00cm) and grain count (845) per cob respectively. This represented about 112.5% increase over the respective yields in the control. Maize yields following application of the manures Poultry (o.45kg), Pig (0.42kg) and Cow dung (0.35kg) per cob gave 87.5%, 75% and 45.8% respectively over the control. The poultry and Pig manure treatments did not differ significantly between them.

The yield differences among treatments could be related to N, P and K availability to crops and release patterns by the organic manures (Ayuke et al. ; 2004). Nutrients from organic materials must first undergo decomposition before they are available for crop uptake since availability depended on nutrient concentration and release in synchrony with crop needs. Compost had the highest N, higher K concentration and underwent rapid mineralization, followed by poultry with highest P and K contents, while Pig manure and Cow dung, has a low

concentration of N and K, exhibited slow mineralization and/ or immobilization during the early stages of Maize. Maize yields with compost were therefore significantly higher than other manures. The performance of compost corroborate with the findings of Oscarson, (2000) who viewed that the higher the N in fertilizer source, higher the N harvest by plant.

CONCLUSION

Mixed manure Compost of Maize plant residue with farm yard manures materials (Poultry, Pig and Cow-dung) enriched soil nutrients and increased nutrient uptake. Higher values were obtained for Compost than for any farmyard manures of similar organic materials. Despite Poultry manure having enough nutrients and with higher Average Phosphorus and Potassium contents fails to contribute satisfactorily but Compost itself was efficient and enhance nutrients release. Mixed manure Maize compost with Pom, Pim plus Cod is recommended for the restoration of soil for Maize production. Further research is required for comparative effect of substituting the maize residue with leguminous crop especially groundnut plus farmyard manures. Field trials of the leguminous compost will be helpful for proper presentation of the technology and its adoption.

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