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EVALUATION OF INTEGRATED APPLICATION OF UREA AND ANIMAL MANURES

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ABSTRACT

A study was carried out at Igboora, South-western Nigeria from 2010-2011 to examine the effect of sole use of poultry and pig manures and their fortification with N fertilizer on performance of maize. The treatments were poultry manure (P) 5 t/ha, Swine manure (S) 5 t/ha, P 2.5 t/ha + 0.2 t urea/ha, S 2.5 t/ha + 0.2 t urea/ha and control. Poultry manure was higher in nutrients than Swine manure. The manures significantly ($P<0.05$) increased growth parameters. Combined application of manure and urea gave highest values of yield components such as number of grains, grain weight, number and length of cobs, other effects were significant. The poultry manure at 2.5 t/ha + 0.2 t/ha urea gave highest values. Fortification of manures with urea enhanced crop growth. The study showed that poultry manure had an added advantage over swine manure in Soil restoration but both could effectively be used in combination with chemical fertilizers to improve soil productivity for maximum maize production in the region.

Key words: Poultry manure, Piggery manure, Urea fertilizer, Organo-mineral fertilizers, Maize.

INTRODUCTION

Sustainable agricultural system must address issues of environmental, economic and social sustainability in its approach apart from inputs consideration. Hence, the need to adopt production systems that are environmentally friendly especially in food production. The need marks the basis of organic farming strategy (Bello, 2008). In comparison with conventional farming, organic farming has potential benefit in improving food quality and safety (Hoaag *et al.,* 2004). 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 are stored for a longer time in soil thus, supporting better root development leading to higher crop yields (Abouel-Magd *et al.,* 2005).

Poultry and Swine industries are booming in developing countries; with discharge of huge amount of manures that pollute the environment. The estimated fractions of organic N mineralizable in some manures indicated a range from 0.08 - 0.52 % for Swine and 0.17 - 0.73 % for poultry (Cabrera and Gordillo, 1995). Aside supply of nutrients,

manures suppress disease by generating ammonia and or nitrous acid in the soil (Larzarovite, 2001). Although manure are also very cheap and effective as a good source of N for sustainable crop production, its availability remains an important issue due to its bulky nature, while inorganic fertilizer is no longer within the reach of poor-resource farmers due to its high cost (Rahman, 2004). Bello and Haftom (2008), clearly indicated that productivity can be improved by proper combination of manure with mineral fertilizers at reduced levels. Also, utilization of manures has environmental benefit by reducing pollution which is hazardous to human health.

The objective of this study was to compare the effect of sole use of Pig and poultry manures and fortification with urea on yellow maize in Ibarapa Agro-ecological zone, Southwest, Nigeria.

MATERIALS AND METHODS

Field trials were conducted at Oyo State College of Agriculture Igboora during 2010 and 2011 cropping seasons. Igboora, is in Ibarapa zone; the northern part and Derived savannah Zone of Oyo State. The region has two rainy periods and had between 1000 to 1600 mm 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 produce Organic base seeds for the experiment in 2011 growing season.

The soil of the experimental site was randomly sampled at depth 0-30 cm before planting using soil auger. The soil samples were bulked, air-dried and sieved through 2 mm mesh before physico and chemical analysis. The parameters measured include the pH taken in a 1:25 solution of 10 g air-dried soil + 25 ml distilled water or 1m KCl solution. Texture was 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 four replicates, each plot size being 3 x 3 m. Treatments were No fertilizer (control), Poultry manure 2.5 t/ha + 0.2 t urea, Pig manure 2.5 t/ha + 0.2 t Urea, Poultry manure 5 t/ha and Swine manure 5 t/ha. The Poultry manure was the droppings from chicken that had been left to decompose for about five months on farm while the Swine manure was evacuated from the pen during daily cleaning and deposited.

The sole organic fertilizers were applied a week before planting while Nitrogen fertilizer in the form of Urea (46 %) was applied first to plot with 2.5 t/ha of poultry and Swine as the second dose respectively. The plots were weeded manually whenever necessary throughout the experimental period. Maize was harvested at 14 WAP and was sun-dried to 14% moisture content. Maize growth parameters determined at 4-10WAP were plant height (cm), number of leaves, leaf area (cm^2), stem girth (cm) while the yield characters evaluated were weight of grains, length of cobs, length of grain filled, number of seeds per cob and number of cobs of cobs.

The analysis of variance (ANOVA) procedure was used to evaluate the treatment effects. Mean values were separated using Duncan multiple range test (DMRT) at 5 % level of probability.

RESULTS AND DISCUSSION

The test soil had organic matter content of 1.56 %, total N 0.11 %, available P 16.9 mg/kg, exchangeable K 1.14 cmol/kg; Ca 0.16 cmol/kg; Mg 0.38 cmol/kg, sand 78.4%, silt

11.6 % and clay 10.0 %. The soil is low in OM, N, and exchangeable Ca. The low level of these nutrients justified their fortification with urea. Chemical analysis of manures indicated that poultry manure had higher values of total nitrogen content (3.31 %), Av. P (21.47 ppm) and K (9.80 cmol/kg) compared with pig manure which had % TN of 3.05 %, Av. P 15.29 ppm and K 5.70 cmol/kg.

Table 1 shows that poultry and swine manures alone or used at reduced level with urea increased plant height, girth and leaf area at 4, 6 and 8 weeks after planting (WAP). Relative to sole use of the manures, integrated application of reduced levels of the manures with urea at 0.2 t/ha (200 kg/ha) increased the growth parameters significantly.

Table 1: Comparative effect of Organo- mineral fertilizers on maize growth at (4-8WAP) weeks after planting

	Plant height (cm)			Plant girth (cm)			Leaf area (cm^2)		
Treatments	4WAP	6WAP	8WAP	4WAP	6WAP	8WAP	4WAP	6WAP	8WAP
Control	67.78b	110.67e	171.00e	3.40c	3.63e	3.85e	184.36c	306.50b	316.50e
P5.0 t/ha	78.50b	168.23c	341.00c	4.80b	5.56c	6.79c	292.59b	386.77c	396.77cb
S5.0 t/ha	77.34b	164.42cd	330dc	4.66b	5.21d	5.39d	271.46b	368.76d	368.76d
S2.5 t+0.2 t urea/ ha	80.57a	170.21b	350.00b	4.48b	6.45b	7.58b	296.16ab	429.66b	449.67b
P2.5t +0.2 t urea/ha	87.57a	180.21a	373.00a	5.09a	7.58a	8.29a	344.26a	480.69a	496.60a

Means followed by the same letter in the same columns are not significantly different at 5% level of probability by DMRT

Table 2 shows the comparative effect of organo-mineral fertilizers on maize yield components i.e number of seeds per cob, grains with cob, weight of grains, number of cobs, and length of cobs. Treatment P2.5 t/ha + 0.2 t/ha urea had the highest number of seeds per cob (470.00), grains with cob (0.284 kg), weight of grains (0.260 t/ha) and length of cobs (18.31cm) respectively. The result is in line with Adediran *et al*. (1999), findings that the higher the rate of organo-mineral fertilizer application the better the economic response. It is also in accordance with John *et al*. (2004), that an integrated use of organic manure and in-organic fertilizer will support the supply of adequate quantities of plant nutrient required to sustain maximum crop production and profit while minimizing environmental impact from nutrient use.

Table 2: Comparative effect of Organo- mineral fertilizers on Yield of maize

Treatment	**Number of seeds/cob**	**Grains +Cob (kg)**	**Weight of grains (tons/ha)**	**Number of Cobs per row**	**Length of Cobs (cm)**
Control	285.25e	0.160c	0.123e	10.88e	14.00d
P5 t/ha	405.88c	0.223b	0.204c	17.00c	16.13c
S5 t/ha	367.25d	0.221b	0.189d	16.63dc	15.29cd
P2.5 t +0.2 t urea/ha	470.00a	0.284a	0.260a	19.00a	18.31a
S2.5+ 0.2 t urea/ha	428.75b	0.249ab	0.215b	17.68b	17.54ab

Means followed by the same letter in the same columns are not significantly different at 5% level of probability by DMRT

In his review work, Ojeniyi (2011), summarised advantages of integrated application of organic and inorganic fertilizers as follows:

(a) organo mineral fertilizerts (OMF) gave similar or higher crop yield compared with recommended NPK fertilizer.

(b) The OMF reduced need for both organic and inorganic fertilizers which had synergistic effect on each other.

(c) The OMF had liming effect and improved soil organic matter, nutrient content and availability of cautions compared with inorganic fertilizers. Combined use of organic and inorganic

fertilizers at reduced rates also enhanced nutrient uptake.

CONCLUSION AND RECOMMENDATION

From the result, the application of poultry manure, swine manure and their fortification with urea improved maize yield as well as agronomic parameters of maize. The fortification of poultry manure with urea fertilizer is found to be more effective source of maize plant nutrients than separate use of either poultry or swine manure. Treatment P 5.0 t/ha + 0.2t urea/ha gave the highest response throughout the period of investigation. This inferred that when manure quantities are reduced and supplemented with small fractions of fertilizers, farmers' cost of production are drastically minimized.
Therefore, the fortification of Urea fertilizer with poultry manure should be considered for maximum sustainable maize production in this environment.

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