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EFFECTS OF POULTRY MANURE AND N.P.K. FERTILIZER ON DRY MATTER YIELD AND UPTAKE OF NUTRIENTS IN MAIZE.

Modupeola, T. O[1]., Ogunrinde, J. O.[2] , Abdul-Rafiu, A.M.[1] and O. O. Idowu-Agida[1]
[1]National Horticultural Research Institute, P.M.B 5432 Idi-Ishin, Jericho. Ibadan. Oyo State. Nigeria.
[2]Dept. of Agronomy, Ladoke Akintola University of Technology Ogbomoso.

ABSTRACT
Biomass production and nutrient uptake of maize variety were investigated in a pot experiment at the Teaching and Research Farm of Ladoke Akintola University of Technology Ogbomoso, between March and June, 2006. Maize variety (TZE Composite) were treated to four levels of poultry manure (10, 20, 30 and 40t ha^{-1}) and N.P.K. (30, 60, 90 and 120kg ha^{-1}). Poultry manure at 30t ha^{-1} produced highest biomass, growth characteristics and nutrient uptake in the maize variety among the poultry manure levels. Also, N.P.K. at 120kg ha^{-1} gave the highest biomass and uptake of nutrient elements among the levels of the N.P.K. fertilizer in the maize variety. Significant difference occurred between the root dry weight of the plant with N, P, Ca, S uptake in the maize variety at 5% levels respectively. However, plant with K and Mg uptake were highly significantly correlated with root dry weight at 1% probability level. Similarly, there was significant difference between the shoot dry weight and plant with N, P, K, Ca, Mg and S uptake. Also, plant with N uptake was significantly correlated with shoot dry weight. For sustainable production of the maize variety in derived guinea savanna, poultry manure at 30t ha^{-1} and N.P.K. fertilizer at 120kg ha^{-1} could be used.

KEYWORDS: poultry manure, fertilizer, nutrient, dry matter, maize

INTRODUCTION
Zea mays belongs to the family Poacea . The usefulness of maize to man is as result of its composition of various nutrients. It is believed that inadequate and excessive consumption of the carbohydrate sources could lead to marasmus and kwashiorkor respectively (Okoruwa and Kling, 1996). Maize requires a great amount of nutrients for its growth and development. Nutrient can be supplied organically(crop residues, animals waste, municipal wastes) or inorganically(urea, N.P.K, super phosphate). It requires a large number of essential nutrients as soil fertility must be maintained to obtain maximum yield. Maize has the heaviest usage in Latin America on a per capital consumption basis. Africa follows closely in spite of it expanse of drier climate zones where sorghum and millet are better adapted. Most peasant farmers in Nigeria harvest maize at soft dough stage and eat them fresh after cooking in combination with edible leguminous crops like cowpea and bean. The grain can also be milled or boiled. Each country has its special maize dish ; Ogi or Akamu and Tuo in Nigeria, Ugali in Kenya and East Africa; Fufu to Zaire and Zambia. There are various beverages and alcohol obtained from maize. Maize is the most important of the feed to livestock as concentrates. The organic fertilizers are used to restore the organic matter level of the soil, in order to increase the capacity of the retention of nutrients in the complex clay – humic of the soil, that is, to increase the assimilation of the mineral nutrient from the reserves of the soil or incorporated through the fertilization. It increases the capacity of retention of nutrient in soil and therefore the fertility and the assimilation of the mineral nutrients. The improvement of the soil structure, permeability, aeration and porosity are among the numerous benefits . It is biological and natural product that is integrated perfectly in the environment with an important contribution of energy to the ecosystem. The objective of this study were to assess the effects of poultry manure and N.P.K (15 - 15- 15) on dry matter accumulation of maize. To assess the effect of poultry manure and N. P . K. on the uptake of nutrient elements in the maize variety.

MATERIALS AND METHODS
The pot experiment was carried out at the Teaching and Research Farm of Ladoke Akintola University of Technology Ogbomoso (LAUTECH) between March 3 and June 22, 2006. The temperature of the area ranges from 28°C to 33°C with average humidity of about 74%. Top soil obtained from the Teaching and Research Farm of LAUTECH, Ogbomoso were used for the pot experiment. The soil collected was air dried sieved with

wire mesh of 2mm composite samples and were analysed for physical and chemical properties before planting. Particle size analysis was carried out using the Bouyocous (1962) hydrometer method. Soil pH was measured using 1.1 (w/v) soil water suspension ratio. Total nitrogen was determined by the Macrokjeldahl (Bremner, 1965). Phosphorus was analysed by Bray p-1 method (Bray and Kurty, 1945). K, Ca, Mg and Na were determined by flame emission in the Perkin-Elmer 5000 spectrophotometer. Five kilograms of the sieved air dried soil samples were weighed into each polythene bag. Each bag was perforated at base to facilitate easy drainage of water. The treatments used include four levels of Poultry manure applied at the rate of 10, 20, 30 and 40t ha^{-1}, four level of N.P.K 30, 60, 90 and 120kg ha^{-1} and a control at zero level of poultry manure and N.P.K. The nine treatment combinations fitted into a complete randomized design in three replication. Four maize (TZE Composite) seeds were planted in each bag, sufficient water was added to bring the moisture content near field capacity. After emergence, the seedlings were thinned down to two per pot. Four levels of poultry manure and N.P.K. fertilizer were applied five days after planting. The plants were routinely sprayed with karate at 1.5L/ha for the control of insect pests. The growth parameters taken were plant height, Leaf counts, leaf area and stem diameter. The first set of data was collected at 2 weeks after planting (2WAP) and the subsequent ones were done on weekly basis. The plants were allowed to grow for eight weeks. After this, destructive harvesting was done. The shoot and root of each plant were separated and sun dried at first before being oven dried at 80°C to constant weight. The shoot and root were weighed using weighing balance to determine the shoot and root dry weight respectively. The plant samples were grounded, sieved and analysed for N, P, K, Ca, Mg and S contents following the established methods in IITA manual (Juo, 1981). The percentage content of each element was multiplied by the total dry weight of plant sample to obtain nutrient uptake value for each treatment. The growth and yield parameters of the maize variety were subjected to ANOVA and LSD was used to separate significant means at 5% and 1% levels. The relationship between the dry matter yield and nutrient uptake was established using correlation coefficient at 5% and 1% levels of significance.

RESULTS AND DISCUSSION

All the growth parameters considered such as plant height (Table2), number of leaves (Table 3) and leaf area (Table 4) increased with increase in the rates of application of both poultry manure and N.P.K (15-15-15) fertilizer at different weeks after planting for maize variety. The result as indicated in Table 2 shows that at 2 WAP maize plant which received 60kg ha^{-1} of N.P.K. was significantly higher than other treatment and control at 12.50cm. At 4WAP no significant differences were observed among the treatment of poultry manure at the different level while 120kg ha^{-1}, 60kg ha^{-1} and 30kg ha^{-1} of N.P.K. fertilizer had the highest plant height at 4 WAP, 5 WAP and 6 WAP (41.30cm, 59.20cm and 89.1cm) though not significantly different from the others. The reduction in the values of plant height under different levels of applied poultry manure (Table 2).Those obtained in control at 2WAP could be attributed to slow decomposition and gradual release of nutrients of poultry manure. This is consistent with the findings of Webstar and Wilson (1980). Also, maize leaf at 4WAP produces significantly more number of leaves (10) in poultry manure at 30t ha^{-1} at the interval of 5 and 6 weeks after planting compared to the other treatments (Table 3). Similarly at 4 and 5 WAP N.P.K. at 120kg ha^{-1} had the largest broad leaf (292.10,511.40) of maize leaf than the other treatments at 6WAP, No significant differences were observed among the treatment of poultry manure at different level (Table 4). The foliage production was greatly enhanced by poultry manure better than N.P.K fertilizer. This could be attributed to the release of organic matter and other nutrient elements particularly exchangeable cations to the soil upon the decomposition of poultry manure (Navarro, 1993). The dry root weight of maize with poultry manure at 30t ha^{-1} was significantly heavier (21g) than other treatment and control. Similarly, 120kg ha^{-1} of N.P.K. fertilizer had the highest shoot dry weight (143.65g) of maize while no significant differences were observed among the treatment of poultry manure at 10t ha^{-1}, 20t ha^{-1}, 30t ha^{-1} and 40t ha^{-1} respectively(Table 5). Moreover, N.P.K. fertilizer at 30kg ha^{-1} had the highest nitrogen nutrient uptake (242.65) and not significantly different from poultry manure at 30t ha^{-1} with 178.28 nitrogen uptake as revealed by table 6 P, K, Ca, Mg and S uptake with respect to N.P.K. applied at 120kg ha^{-1} had the highest (49.67, 69.85, 178.52, 465.69, 358.58) nutrient uptake compared to other treatment and control(Table 6). Generally, there was increase in nutrient uptake as the plant shoot and root weights increased. Plant N, P, K, Ca, Mg and S uptake showed significant influence in the biomass production in the maize variety. These nutrients increased in plant tissues of this maize variety as levels of treatments increased thereby confirming the findings of Koshino (1995) who reported that the fertility of any soil can be detected from the nutrients present in the tissues of the plant grown in the soil and that there is a great correlation between the nutrients in the plant tissues and nutrients extracted from such soils. It was observed that root dry weight correlated highly significantly with K and Mg uptake (0.475 and 0.534 respectively) in the maize variety (Table 7). However, root dry weight correlated significantly with N, P, Ca and S uptake (0.583, 0.340, 0.400 and 0.300 respectively). Similarly shoot dry weight correlated significantly with all the evaluated element at 5% (0.300, 0.800, 0.996, 0.800, 0.997 respectively). This assertion agrees with the findings of Koshino 1995; Agboola et al (1971). In this study, the maize variety differed greatly in terms of its nutrient uptake and growth responses to the applied poultry manure.This is consistent with the findings of Beauchamp et al (1976); Pollmer et al (1976); (Akintunde ,1992); Akintunde et al (1995).They observed that maize variety differ in its capacity to utilize fertilizer. Similarly for sustainable production of the maize variety in derived guinea savanna like Ogbomoso, Poultry manure at 30t ha^{-1} and N.P.K. fertilizer at 120kg ha^{-1} could be used. This implies that the optimum fertilizer rate depends on the variety of maize used among other factors. Pal (1991) showed that the optimum rate depends among other factors on the crop, soil type and rainfall. The recommendation of 30t ha^{-1} poultry manure for the improved maize variety also agree with the recommendation earlier made by Lombin (1987) for maize grown in derived savanna zones. N.P.K. fertilizer is also recommended at 120kg ha^{-1} . For hybrid maize in the savanna zones, IITA (1985) also recommended 120kg N.P.K. ha^{-1} as the optimum rate. The results of the study showed that poultry manure at 30t ha^{-1} enhanced better growth and dry matter yield characteristics and facilitated better uptake of nutrient elements in maize variety and at the same time N.P.K. 15-15-15 at 120kg ha^{-1} also had the similar results in the maize variety.

Table 1: PHYSICAL AND CHEMICAL PROPERTIES OF THE SOIL BEFORE PLANTING

PARAMETERS	VALUE(%)
pH(H_2O)	6.9
Total N	1.10
Available P(ppm)	5.77
Ca^{2+}	1.09
Mg^{2+}	2.55
K^+	1.12
Na^+	0.24
Particle size(%)	0.04
Sand	86.70
Silt	9.20
Clay	4.1
Textural class	Sandy loamy

TABLE 2: PLANT HEIGHT AT DIFFERENT WEEKS AFTER PLANTING.

TREATMENTS	2WAP(cm)	3WAP(cm)	4WAP(cm)	5WAP(cm)	6WAP(cm)
CONTROL	11.30	13.8	18.8	28.30	34.4
PM T1	10.60	17.20	21.2	32.30	43.20
PM T2	6.50	13.50	18.50	29.70	41.90
PM T3	9.50	16.30	23.60	43.0	66.70
PM T4	7.50	13.20	21.0	32.0	50.20
NPK T1	12.20	22.60	38.20	55.70	81.90
NPK T2	12.50	21.50	35.50	47.90	82.70
NPK T3	9.40	17.80	29.50	46.60	73.80
NPK T4	10.70	18.0	41.30	59.20	89.1
L.S.D	2.02	3.36	8.85	9.66	20.50
C.V (%)	7.0	11.90	31.4	34.20	72.7

PM T1 : Poultry manure at 10t ha^{-1} , NPK T1 : N.P.K. at 30kg ha^{-1}, PM T2 : Poultry manure at 20t ha^{-1}, NPK T2 : N.P.K. at 60kg ha^{-1}, PM T3 : Poultry manure at 30t ha^{-1}, NPK T3 : N.P.K. at 90kg ha^{-1}, PM T4 : Poultry manure at 40t ha^{-1} NPK T4 : N.P.K. at 120kg ha^{-1}

TABLE 3: NUMBERS OF LEAVES AT DIFFERENT WEEKS AFTER PLANTING.

TREATMENTS	2WAP	3WAP	4WAP	5WAP	6WAP
CONTROL	6.3	7.0	7.3	9.3	9.7
PM T1	6.67	9.0	8.3	9.7	11
PM T2	6.30	8.3	8.0	9.7	10.7
PM T3	6.0	7.7	10	12.3	12.7
PM T4	6.0	10	8.7	10.6	11.3
NPK T1	7.0	7.0	9.3	9.7	12
NPK T2	7.0	7.0	9.7	10.30	11
NPK T3	4.5	4.5	9.0	9.30	11
NPK T4	5.7	5.7	6.7	10.50	11.50
L.S.D	0.77	1.66	1.09	0.94	0.84
C.V (%)	2.7	5.9	3.9	3.3	2.9

TABLE 4: INFLUENCE OF POULTRY MANURE AND N.P.K. FERTILIZER ON MAIZE LEAF AREA.

TREATMENTS	2WAP(cm^2)	3WAP(cm^2)	4WAP(cm^2)	5WAP(cm^2)	6WAP(cm^2)
CONTROL	68.02	94.4	146.2	269.9	318.70
PM T1	65.90	111.9	190.10	338.6	359.40
PM T2	44.07	92.7	197.20	337.1	343.20
PM T3	98.0	136.90	238.3	414.70	434.60
PM T4	56.90	79.90	163.30	309.4	354.1
NPK T1	101.80	149.70	262.10	338.4	555.80
NPK T2	130.95	106.20	241.1	404.9	540.5
NPK T3	73.50	177.80	217.70	449.4	452.3
NPK T4	87.50	105.50	292.10	511.40	535.6
L.S.D	26.6	24.20	47.06	75.90	93.5
C.V(%)	9.5	8.6	16.8	27.1	33.2

TABLE 5: EFFECT OF POULTRY MANURE AND N.P.K. FERTILIZER ON ROOT AND SHOOT DRY WEIGHT OF MAIZE.

TREATMENTS	ROOT DRY WEIGHT (g)	SHOOT DRY WEIGHT (g)
CONTROL	4.15	25.43
PM T1	6.24	55.07
PM T2	12.09	81.45
PM T3	21	85.12
PM T4	16.21	75.25
NPK T1	15.6	108.20
NPK T2	16.89	121.80
NPK T3	16.32	88.18
NPK T4	11.58	143.65
L.S.D	5.73	35.09
C.V (%)	20.3	12.44

TABLE 6: EFFECTS OF POULTRY MANURE AND N.P.K. FERTILIZER ON NUTRIENT UPTAKE (N, P, K, Ca, Mg, S) IN MAIZE.

TREATMENTS	N UPTAKE	P UPTAKE	K UPTAKE	Ca Uptake	Mg Uptake	S Uptake
CONTROL	33.13	8.28	8.28	26.62	66.56	68.33
PM T1	145.92	25.14	15.94	58.25	153.28	150.12
PM T2	130.95	30.80	28.06	102.89	233.85	216.08
PM T3	178.28	31.78	33.95	137.96	278.77	273.90
PM T4	68.43	26.07	30.14	93.68	244.38	188.11
NPK T1	242.65	39.62	61.90	136.18	278.55	285.98
NPK T2	161.77	41.09	50.07	109.13	288.88	296.58
NPK T3	87.78	33.44	42.85	85.6	275.13	241.39
NPK T4	65.19	49.67	69.85	178.52	465.69	358.58
L.S.D	66.23	11.79	20.32	45.12	107.39	87.09
C.V (%)	23.4	4.15	7.18	15.94	37.95	30.77

TABLE 7: CORRELATION COEFFICIENTS BETWEEN THE SHOOT AND ROOT DRY WEIGHT ON THE NUTRIENT UPTAKE ON DRY MATTER YIELD IN MAIZE PRODUCTION

ELEMENTS UPTAKE	ROOT DRY WEIGHT(G)	SHOOT DRY WEIGHT (G)
N	0.583*	0.300*
P	0.340*	0.80*
K	0.475**	0.996*
Ca	0.400*	0.800*
Mg	0.534**	0.997*
S	0.300*	0.834*

* Significant at 5%

** Significant at 1%

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Corresponding author
Modupeola, T. O.,
National Horticultural Research Institute, P.M.B 5432 Idi-Ishin, Jericho. Ibadan. Oyo State. Nigeria
Email: atopson@yahoo.com