

The Comparative study of the effect of organic manure cow dung and inorganic fertilizer N.P.K on the growth rate of maize (*Zea Mays L*)

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Abstract

A Comparative study on the effect of organic manure (cow dung) and inorganic fertilizer (N.P.K) on the growth of maize (*Zea Mays L.*) was carried out at the University of Abuja, Biological science garden for a period of fourteen (14) weeks. A control was set up for this study. Maize plants treated with N. P.K fertilizer were significantly taller than those treated with cow dung and those of control. Mean number of leaves, stem diameter, shoot and root dry weight were higher with N.P.K fertilizer but showed no significant difference ($P>0.05$) from those grown with cow dung manure. Growth indices of maize plants to which fertilizer N.P.K was applied showed no significant ($P>0.05$) increase than the cow dung. It is recommended that cow dung manure can be used in the absence of N.P.K fertilizer considering the cost and associated environmental effect of the later.

Keywords: Inorganic fertilizer, N.P.K, Organic manure, growth.

INTRODUCTION

Maize which is botanically called (*Zea mays L*) belongs to the family gramineae. It is a cereal monoecious shrub. Most maize species grow well where the annual rainfall ranges from 400cm-900cm and temperature of 20°C to a height of 4.5m.

The range of time from planting to maturity varies between 3 to 4 months, depending on the variety use. Maize thrives best on well aerated, viable working soil rich in humus (Echinger, 1926). Maize grow successfully in northern part of Nigeria, the grain contains higher percentage of carbohydrate with little protein and fat.

Of all cereal, maize has the largest amount of oil, the average chemical composition is starch 68-70%, protein 10% and 3.6-5% (Mulvaney, 1996).

The grain also contains an appreciable quantity of calcium and iron. It prefers high open land and requires manure as it exhausts the soil (Bray and Kurtz, 1945).

Its leaves and stem form a good folder and the grain is nutrition as cereal food. Maize flourish both in hot and cold climate there are several varieties and hybrids, the visual sowing season April-May and the harvesting season July-August. Each plant usually bears seed on

cob. Maize cobs may be 15-25cm in length and the grain golden yellow, dull yellow, red or white. The grains are taken as a substitute for other cereal grains and prepared by boiling. They are also often fried. Usually they are grounded into fine flour called corn flour and also as powdered starch. The young tender grains are nutritious and may be taken raw roasted or boiled in milk (Moritsuka *et al.*, 1992).

Maize is sown at 25cm – 75cm between raw and for one plant per stand sown at 90cm between row and 40cm within row for two plant stands. To sow one hectare, 25kg of seed is required and one should make sure the space due to un-germinated seeds are replanted within one week (Schrmpt, 1965).

Seed should be treated with (apron plus 500) before planting. Maize is sown as soon as the rain begins. Maize seedlings are poorly adapted to drought stress condition, for crop to grow supplemented irrigation may be required in Sudan and Sahel Savannah. Early planting is advised with the first rain (Walter, 1973).

Maize generally required heavy fertilizer dosage a considerable amount of nutrient especially in relation to nitrogen and potassium in needed (Bray and Kurtz, 1945).

It is an exhausting crop and requires the use of fertilizers for maintaining high yield. The choices of

suitable forms of fertilizer for the proper growth of the plant are governed by local natural conditions and variations in soil and climate with regard to their suitability for maize cultivation (Thompson, 1975).

In temperate zones, maize cultivation without organic or inorganic fertilizer would hardly be thinkable and generally present no problem as maize cultivation in the regions usually maintain cattle stocks, (Walter, 1973).

Numerous tests and experience have shown that form yard manure with its long time effective nutrient is an ideal fertilizer for maize. According to Thompson, (1975), fertilizers are sources of plant nutrient that can be added to supplement soil natural fertility. They are intended to supply plant needs directly rather indirectly through modification of soil pH and structure. Great improvement on both quality and quantity of grain result when appropriate quantities are added at appropriate stages of plant growth (Thompson, 1975).

In area with negligible cattle stock or where stable manure are produced in small amount in other countries where stabling is almost non-existent, green manuring can provide available organic supplement in maize cultivation (Tani, 2004).

Mehole (1958), showed that maize react very favourable to green manuring in temperate zone. Schaffer, (1938) reported that maize make heavy demand on potash whole main significance in the maintenance of normal physiological functioning of the cell. Deficiency of potash may be observed result in retarded plant growth. He also stated that lead ash in a very good source of potash and helps to acidify the soil where necessary and that significant yield increase occurred where stable manure was immediately ploughed in, compared with field where it laid on the surface for weeks.

MATERIALS AND METHOD

Experimental Design

Maize (*Zea mays L*) was grown for 3 months during rainy season in 2010. Seed of maize were sown in May and plant samples were collected in September 2010.

Study Area

The research project work was conducted in the Biological science and Biological laboratory in the University of Abuja, between rainy season period of May and September, 2010.

Preparation of Seeds

Maize seed were selected and seed variability was tested

by floatation method, (Copeland 1976).

Loamy soil was cultivated into ridges the maize was planted in the area of cultivation. It was conducted during rainy season to ensure efficient amount for germination. Seven days after germination the plant were labeled for identification and measured, the height, weight, the numbers of leaves and the stem diameter were also measured and they were recorded weekly for 3 months and 2 weeks of sowing (Copeland 1976).

Growth and yield Analysis

The plant harvest were carefully removed and washed off to remove soil in the roots. Roots were separated from the shoots with a razor blade each replicate was replaced in separate envelops, and oven dried at temperature of 70°C in hours for dry roots and dry corn. It took 48 hours for the determination of dry weight or biomass (Copeland, 1976).

Plant Sample Analysis

Plant above ground and below ground samples were collected at the end of the experiment, above ground samples were collected from each plot and separated into corn and leaf subsamples. Roots were washed out carefully from the soil; all the corn and root were oven dried as dry biomass. The grain component was weighted to calculate grain yield (Walter, 1973).

RESULTS

Mean numbers of leaves recorded from maize fertilized with cow dung, N.P.K and the control, taken at weekly interval for four months are as shown in Table 1.

Result at one week after sowing did not show significant variation in mean number of leaves counted on maize grown from cow dung, N.P.K and on those that did not received fertilizer at all. At two weeks after sowing numbers of leaves was significantly higher in maize plants that were treated with cow dung and N.P.K than the control. Number of leaves at fourteen weeks after sowing was highest for N.P.K and lowest for the control. Maize grown with N.P.K are significantly higher number of leaves compared to the other treatments where there was also significantly higher number of leaves on maize treated with cow dung than the control, similar results was obtained at four weeks after sowing.

Mean stem diameter at one week after sowing result showed that maize was significantly thicker when fertilized with N.P.K compared to those treated with cow dung or those that were not treated at all (Table 2).

Application of cow dung also produce plant with significantly thicker diameter than those that did not

Table 1. Mean number of leaves produced by maize seedling over the period of 4 months

Fertilizer	1	2	3	4
Cow dung	13.2cm	20.52cm	27.2cm	16.66cm
N.P.K	13.88cm	21.32cm	28.4cm	17.46cm
Control	12.8cm	19.2cm	25.48cm	15.26cm
mean	13.29cm	20.35cm	27.02cm	16.46cm

Table 2. Stem diameter at monthly interval

Fertilizer	1	2	3	4
Cow dung	9.6cm	14.52cm	23.24cm	14.8cm
N.P.K	11.56cm	17.32cm	26.44cm	16.84cm
Control	6.68cm	13.2cm	16.52cm	10.02cm
Mean	9.28cm	15.0cm	22.06cm	18.89cm

Table 3. Seedling height (cm) at monthly intervals

Fertilizer	1	2	3	4
Cow dung	21.24cm	48.16cm	65.16cm	55.68cm
N.P.K	23.96cm	59.32cm	75.64cm	72.84cm
Control	6.2cm	37.52cm	51.04cm	41.02cm
Mean	17.13cm	48.33cm	63.95cm	56.51cm

Table 4. The mean value of organic and inorganic fertilizer on maize root and biomass

Fertilizer	1	2	3	4
Cow dung	21.24cm	48.16cm	65.16cm	55.68cm
N.P.K	23.96cm	59.32cm	75.64cm	72.84cm
Control	6.2cm	37.52cm	51.04cm	41.02cm
Mean	17.13cm	48.33cm	63.95cm	56.51cm

received fertilizer and the control. Result at 2-4 weeks showed mean stem diameter ranges of plant, cow dung and control. However subsequent result of 2-3 weeks was similar to those obtained at the first week, therefore stem diameter was thicker in maize grown with N.P.K compared to cow dung which was in turn significantly thicker than those recorded in unfertilized maize. In general therefore, stem diameter was significantly thicker in plant grow from N.P.K than plants grown from cow dung and the control.

Mean height of maize treated with different fertilizer cow dung, N.P.K and control for the period of fourteen weeks is as shown in Table 3. Record at one week after sowing shows that height of maize was significantly higher when N.P.K and cow dung than the height of unfertilized maize.

At two weeks after sowing shoot height of maize was higher for N.P.K than other treatment. It was followed by

cow dung which gave significantly taller plant.

At four weeks after sowing maize plants were also taller with cow dung and N.P.K than those that did not receive any fertilizer.

However, from four weeks after sowing plant grown from N.P.K were significantly taller than those grown from cow dung as the case was between the cow dung and the control.

The mean values of root shoot biomass of maize that receive NPK weight higher than those that received cow dung or the control are as shown in Table 4.

Suddenly, shoot biomass obtained from NPK weighed those treated with cow dung or unfertilized plants.

The mean values of root shoot biomass of maize that receives NPK weight higher than those that received cow dung or the control.

Suddenly, shoot biomass obtained from NPK weighed more than those treated with cow dung or unfertilized

plants.

DISCUSSION

The effect of different types of fertilizer (organic and inorganic) on some external features (height, leaves, stem diameter root and shoot dry weight) of the plants was observed. There is a significant difference in the rate of growth and development in the plant as a result of using dissimilar forms of fertilizer.

A significant increase was observed in both NPK and cow dung treated plants over the control treatment. Maize field and quality is influenced by crop nutrition, maize is responsive to fertilizer especially Nitrogen, Phosphorus and Potassium. High yielding maize require large quantities of soil nutrient in a healthy maize crop all the upper plant leaves and most of the lower leaves remain green until the crop is nearly mature as reported by Cobley and Steele (1976).

According to Mani (2002), each increase in N.P.K led to a significant increase in plant height and grain yield. Nitrogen fertilizer is primarily responsible for the increases in maize grain yields observed during the past 50 year. Among the essential nutrient required by maize Nitrogen in the most commonly deficient in tropical soil (Okeleye, 1995). Thompson (1975), reported N.P.K fertilizer is a source of plant nutrient that can be added to soil to supplement which are more easily released into the soil and that the nutrients presents in cow dung combined with organic substance can be released only when it decomposed, this take a longer period of time. He also stated that maize planted on soil with high cultivation value does not really react to the directly applied manure yield rather to the nutrient supply level of the soil. If N.P.K fertilizer is apply to maize plant there is no need of applying any organic manure.

Schaffer (1938) reported that maize makes heavy demand on potash whose main significance is the maintenance of normal physiological functioning of the cell. Deficiency of potash he observed results in retarded plant growth. However as manure is liable to significant nutrient losses through leaching and volatilization when it is stored and handled, it is not always as effective as it could be (Cooke, 1967). Farmers in the communal areas have developed complex and sophisticated soil fertility management strategies improving their soil with a variety of inputs ranging from manure and compost to leaf, soil from termitaria and fertilizer, mineral fertilizers account for 64% of the Nitrogen used, by small holders and manure 32% by (Muruira 1995).

The data recorded during the experiment revealed that

the two (2) treatments (N.P.K fertilizer and cow dung manure) resulted in increased yield of maize when compared with control plants. The highest plant height (75.64) was obtained with N.P.K. fertilizer while the control had the lowest number with 15.26 which are in line with these previous studies. The highest plant stem diameter (26.44). The highest stem and root biomass (18.33) were obtained from the plants treated with N.P.K. the control plants produced the lowest 16.52 and 8.37 respectively. It can therefore, be concluded that the use of N.P.K fertilizer produced a higher growth rate than the organic manure (cow dung) but there was no significant ($P<0.05$) difference between them. Albeit the use of cow dung gave a higher growth rate than the maize grown without fertilizer.

Based on the result of this experiment, it would be apt to recommend the use of N.P.K fertilizer for optimum growth of maize. However, in the absence of N.P.K fertilizer, the use of cow dung (organic manure) is recommended for farmers seeking a better yield of maize. The reason for this is not far-fetched the cow-dung treatment also produced a better yield than no-treatment. Hence cow dung (organic manure) is recommended because of its easy availability, environmental and cost effectiveness.

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