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Comparative Effect of Organic and Inorganic Fertilizer Treatments on the Growth and Yield of Onion (*Allium cepa L*)

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ABSTRACT

The experiment was conducted at the Teaching and Research Farm of Federal University Wukari, Taraba State Nigeria to compare the effect of poultry manure, cow dung, organic manure, NPK (15:15:15) and Urea on the growth and yield of Onion. The recommended rates of poultry (10 t/ha) cow dung (10 t/ha) organic manure (10 t/ha) NPK (400 kg/ha) and Urea (200 kgN/ha) were used as treatments with a control (0 kg/ha). These were arranged in a randomized complete block design with three replications. Measurements were taken on the growth and yield parameters and data collected were analyzed using analysis of variance (ANOVA) and significant means separated by Duncan multiple range tests at 5% probability level. The results revealed that all the treatments significantly ($P<0.05$) improved the growth and yield parameters of onion. Poultry manure produced significantly higher number of leaves (50.60), shoot weight (20.96 g) and bulb weight (50.60 g). Bulb height was significantly higher in poultry, organic manure and NPK applications. The onion bulb yield is in order of poultry > organic manure > cow dung > NPK > Urea > control. It is concluded that poultry manure application is better for the production of onion.

INTRODUCTION

Onion (*Allium cepa. L*) is an important vegetable crop produced majorly in the Northern part of Nigeria. It is also known as bulb onion which are widely cultivated and used all over the world as food, it can be served as cooked vegetable or part of a prepared savory dish, but can also be eaten raw [1,2]. They are pungent when chopped and contain certain chemical substances which irritate the eyes. It is a biennial plant but usually grown as annuals and are available in varieties of colours such as yellow, brown, white and red onions [3]. Onion has some medicinal attributes and are found applicable in the treatment of ailments such as; coughs, snakebite and hair loss. In addition, it is also used by athletes to rubbed down their muscles in order to firm it and for blood balance, as well as to facilitates bowel movement and erection in men. Fern Ken and Fern Addy stated that the pungent juice of onions has been used as insects repellant as well as dyes used in fabric industries [4,5]. In a research conducted by National Association of Onions 2 NAO, 2013, the nutrients composition of onions was given as; water (89%), sugar, (4%), protein (1%), fiber (2%) and fat (1%) (NOA, 2013). The major problem facing the production of onion crop is the poor soil condition of most farm land, which resulted from continuous cultivation of farm land without a fallow period which will allow for resuscitation of lost fertility. The only way out of this menace is the application of fertilizers either as organic or inorganic. Inorganic fertilizer when applied release nutrients to crop plant for proper growth and development at a faster rate, for example NPK, fertilizer is made up of Nitrogen, Phosphorus and Potassium which are the major nutrients required by plant in large quantity, Urea on the other side contain 46% nitrogen and when applied enhances vegetative growth of the plants [6]. Organic fertilizers releases nutrients to crop at a slower rates but do not easily leach from the soil. It also improves the soil structure and helps to build the organic matter of the soil, among many other advantages [7]. Many researchers such as Akanbi and Makinde have documented reports on the increase in yield of various crops through the application of fertilizers [8]. Among the convectional fertilizers, NPK and Urea are mostly used by farmers on Onion and other vegetables production on the other hand organic fertilizer, such as poultry, cow dung and organic manure are used. Hence there is a need to compare the effectiveness and efficacy of these fertilizers in the production of Onion. The objective of this study is to compare the effect of Mineral and Organic fertilizers on the production of Onions.

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MATERIAL AND METHODS

The experiment was carried out at the Teaching and Research Farm of Federal University Wukari, Taraba State, Nigeria, Taraba state lie between Latitude 6° 30 and 8° 30 N of the equator and between Longitude 9° and 12°E of the Greenwich meridian with a land mass of 54.426 km^2. It shared boundaries with Bauchi and Gombe State in the North, Adamawa State in the East and Cameroon Republic in the south west. The state has a tropical wet-dry climate well drained alluvial soils and has both Savannah and Rain forest vegetation. The rainfall ranges between 1000 mm to 250 mm per annum in the North with the driest and wettest seasons lasting from December to February and July to September respectively. The organic fertilizers used were collected from the Animal farm along Joota, Wukari while the organic fertilizer was purchased from the Local Government Secretariat, Dunga and the mineral fertilizers are purchased from the yam market in Wukari. The pre-soil samples were collected as well as the organic fertilizers used in this study were taken to the laboratory for chemical routine analysis **(Table 1)**.

Table 1. The soil chemical and physical analysis of the teaching and d research farm, Federal University, Wukari.

Properties	values
PH(H_2o)	5.75
Organic carbon (%)	1.36
Organic Matter (%)	2.35
Total N (%)	0.98
Available P (MgL^{-1})	0.52
Exchangeable K (mol/kg)	1.6
Exchangeable Na (mol/kg)	2.1
Exchangeable Ca (mol/kg)	3.8
Exchangeable Mg (mol/kg)	1.8
Exchangeable Acidity (mol/kg)	1.1
TEB	9.3
CEC	10.4
Base Saturation (%)	89.4
Sand (g/kg)	76.8
Clay (g/kg)	15.2
Silt(g/kg)	8
Textural Class	Sandy soil

Experimental Treatments and Design

The experiment was laid out in a randomized complete block design (RCBD) with three replications. The treatments consisted of three organic fertilizers and their rates which are: Cow dung (10 t/ha), Poultry Manure (10 t/ha) and Organic Manure (10 t/ha), two Inorganic fertilizers which are NPK 15:15:15 (400 kg/ha) Urea (200 kgN/ha) and the control (0 kg/ha) **(Table 2)**.

Table 2. The nutrient compositions of the organic fertilizers used in the study.

Treatments	P^H	%C	%N	P	K	Ca	Mg	Na
Poultry Manure	7.5	8.5	5.74	1.79	0.38	2.62	1.76	0.02
Cow Dung	7.9	8.9	5.6	0.56	3.57	3.1	1.34	0.02
Organic Manure	7.8	7.48	4.76	0.84	0.96	0.26	0.28	0.01

The seeds of the onion were planted in the nursery for a period of four weeks before transplanting. The plot size used for the experiment is 2 m × 2 m and the spacing of 10 cm by 10 cm making a total of 40 plants per plot, the total number of plots is 18. The organic fertilizers were thoroughly incorporated into the soil two weeks before transplanting while the mineral fertilizers was applied a week after transplanting.

Weeding was done manually at two weeks after transplanting and as when necessary, although severe pest infestation did not occur during the experiment but cypermethrine at the rate of 2 ml to 1 litre of water was applied two weeks after transplanting. Wood ash was also applied on the bed especially after each weeding operation.

Data Collection and Analysis

Data were collected on the growth and bulb yield of Onion at harvest and the parameter measured were: number of leaves per plant, number of dry leaves, bulb height, weight of the bulb, weight of the shoot and root weight per plant. Data measured were statistically analyzed using analysis of variance (ANOVA) where the treatment means were separated using Duncan multiple Range Test (DMRT) at 5% probability level.

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RESULTS AND DISCUSSION

The growth and development of Onion was influenced by the applications of fertilizers either as organic or inorganic and was significantly difference from the control application of 0 kg/ha. Poultry manure produced significantly the highest number of leaves followed by organic manure, NPK, Urea and cow dung which were not statistically different while the lowest from the control. The number of dry leaves also showed that plant responded differently to the treatments. Plants that received organic manure had the highest dry leaves followed by urea, cow dung and poultry manure which were not statistically different while the lowest dry leaves were from the control. Poultry manure, organic manure and NPK fertilizer produced significantly higher bulb height which is followed by Urea and cow dung application and the least from the control **(Table 3)**. The width of the onion bulb showed no significant difference but the highest mean value was from the poultry application followed by organic manure and the least from urea treatment **(Table 3)**.

Table 3. Effects of organic and inorganic fertilizers on the number of leaves, number of dry Leaves, bulb height, and bulb width of Onion at harvest.

Treatments	Number of leaves	Number of dry leaves	Bulb height (cm)	Bulb width (cm)
Poultry Manure	8.50 a	2.42 ab	7.53 a	14.85 a
Organic Manure	8.17 ab	3.42 a	7.50 a	13.55 a
Cow Dung	6.50 ab	2.75 ab	6.50 ab	12.92 a
NPK	7.42 ab	2.25 ab	7.00 a	12.99 a
Urea	7.25 ab	2.83 ab	6.10 ab	10.75 a
Control (0 kg/ha)	5.92 b	1.58 b	4.62 b	12.37 a
LSD, (5%)	2.18	1.67	1.8	4

Poultry manure application produced highest bulb weight of (50.60 g) which was significantly different from other treatments applied in the study **(Table 4)**. Shoot weight also followed the same trend with the least from the control. Root weight showed no significant different among the treatments applied. But poultry produced the highest mean of 0.44 g.

Table 4. Effects of organic and inorganic fertilizers on bulb weight shoot weight and root weight of onion at harvest.

Treatments	Bulb weight (g)	Shoot weight (g)	Root weight (g)
Poultry Manure	50.60 a	20.96 a	0.44 a
Organic Manure	41.27 ab	11.94 ab	0.38 a
Cow Dung	38.45 ab	11.45 ab	0.39 a
NPK	36.03 ab	12.38 ab	0.26 a
Urea	23.89 ab	10.52 ab	0.33 a
Control (0 kg/ha)	19.94 b	4.79 b	0.33 a
LSD, (5%)	27.02	10.71	0.27

The growth parameters of Onion were improved through the application of fertilizers. The plant height, number of leaves and bulb height were all influenced by the fertilizers treatments which are different from the control. This finding support the work of Fundas that organic fertilizer produced and supply adequate plant nutrients for proper growth and development of crop [9]. Furthermore, the incorporation of organic manure into the soil has been shown to increase the amount of soluble organic matter which is mainly organic acid that improves the available P content in the soil [10]. The yield in weight of the Onion bulb was increased through the application of poultry manure followed by organic manure, cow dung and least in urea which showed the supremacy of organic manure over inorganic fertilizers in vegetable production. This is in line with the work of Akanbi, John and Shaheen [11-13].

In conclusion, poultry manure whenever is available is better for the production of Onion in the study area.

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