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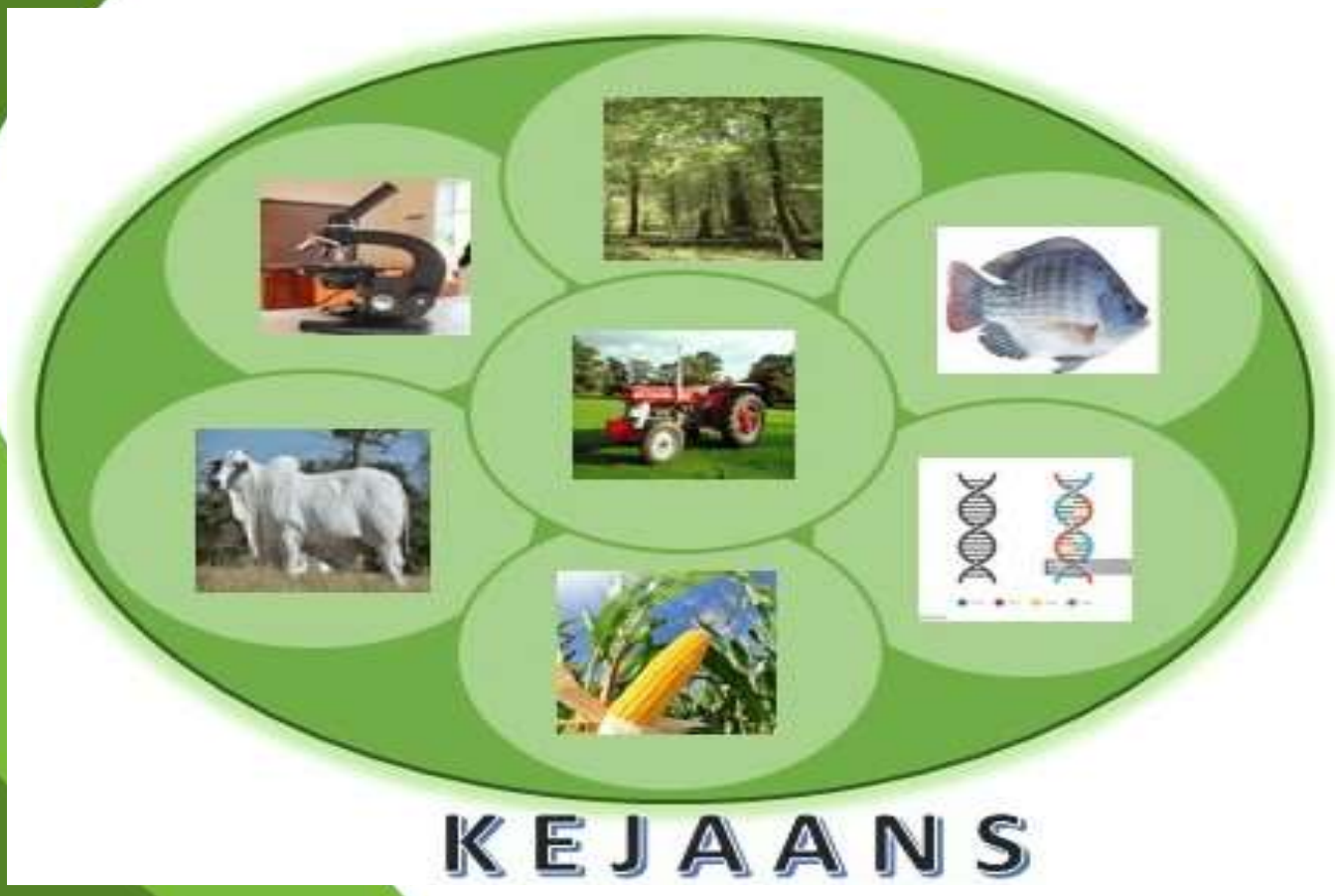

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The first page of the manuscript should contain the title of the article, which should be concise and explicit, typed with upper-case, bold, 14 font size, TNR and not more than 21 words. The surname and forenames (in full) of authors, affiliation of each author should be provided. Phone number and email address of the corresponding author (identified by an asterisk) should be provided. Superscripts should be used to relate authors to their affiliations.

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Results should be presented concisely. Only in exceptional cases will it be permissible to present the same set of results in both Table and figure. In discussion, point out the significance of the results and place the results in the context of other work and theoretical background. Results and Discussion part could be written separately if author so wish.

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Avoid the use of figures /numbers at the beginning of a sentence. Write out one through nine unless a measurement, a designator, or a range (e.g five seeds, 8cm, 3yr, 5-11 flowers)

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EFFECT OF DIFFERENT RATES OF POULTRY MANURE ON GROWTH AND YIELD OF ONION (*Allium cepa* L.) IN MAIDUGURI, BORNO, NIGERIA

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ABSTRACT

The study examined the effect of different rates of poultry manure on the growth and yield of onion (Allium cepa L.). The research was carried out at the Teaching and Research Farm, Faculty of Agriculture, University of Maiduguri located at Latitude 11.4^0 and Longitude 11.4^0 during 2017/2018 dry season under dry season. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four treatments replicated three times which comprises of T_1 (2.5 t/ha), T_2 (4.5 t/ha), T_3 (6.5 t/ha), T_4 (0 t/ha) rates of poultry manure . The parameters assessed were plant height, leaf number, bulb diameter, bulb weight, and yield per hectare. Plant height and leaf number were assessed at 3WAT, 6WAT, 9WAT while bulb diameter, bulb weight and yield per hectare were assessed at harvest. Data collected were analyzed using LSD at 5% level of probability. Results showed that the highest plant height (43 cm), highest leaf number (14.6) occurred in T_3 (6.5 t/ha) poultry manure application while the lowest plant height (29.9 cm), lowest leaf number (9.5) was observed in T_4 (0 t/ha). The highest bulb diameter (14.1 cm), highest bulb weight (9.6 kg), yield per hectare (14.7 t/ha) was recorded in T_3 (6.5 t/ha) application while the lowest bulb diameter (11.5 cm), lowest bulb weight (5 kg), lowest yield per hectare (6.6 t/ha) was recorded in T_4 (0 t/ha) application. It is therefore recommended that farmers apply 6.5 t/ha of poultry manure for maximum growth and yield in onion production.

Keywords: Onion; Allium cepa L.; poultry manure; growth; yield.

Introduction

Onion (*Allium cepa* L.) is a member of the *Alliaceae* family and its one of the most important vegetables in the world, whose utility is ranked second to tomatoes (Brice *et al*., 1997). According to Purseglove (1985), onion can be grown on a wide range of climatic conditions, but thrives best in a mild climate without excessive rainfall or extremes of temperature. It require soil with mild acid to neutral reaction (Ph 6-7) and high soil moisture content yield (Gambo *et al*, 2008). It is an important vegetable crop valued for its pungent or mild flavour and for being the essential ingredient of the cuisine of many regions (Anonymous, 1993). Onion is widely cultivated vegetable crop, produced in the second largest quantity after tomatoes (Ray *et al*. 2024). In 2022, world production of onions and shallots (as green produce) was 5.0 million

tonnes, led by China with 17% of the total, and Mali, Angola, and Japan as secondary producers (FAOSTAT, 2024).

Based on the level of consumption, daily basis (Hussaini *et al*. 2000). The bulb is used traditionally as a medicinal herb for the treatment of Measles, Pneumonia, Cold and Catarrh. Recent studies have confirmed that onion helps in fighting Osteoporosis or bone loss (Biochemist, 2005).

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. Stolton (1997), 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. Shaheen A *et.al* (2007). Many researchers such as Akanbi and Makinde have documented reports on the increase in yield of various crops through the application of fertilizers Akanbi WB, *et al.* (2007). 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.

Despite the ranking of onions as second most important vegetable in Nigeria, the present production levels do not meet the demand of the teeming populace (Gambo *et al*. 2008). Several factors are responsible for this discrepancy, among which are irrigation intervals, fertilizer application. Most farmers do not know the correct dosage of fertilizer; and when and how to apply it for optimum onion production (Magaji *et al*. 2004), The use of organic manure and inorganic manure to meet the nutrient requirement of crops would be an inevitable practice in the years to come for sustainable agriculture since organic manure generally improves the soil's physical, chemical and biological properties along with conserving the moisture-holding capacity of the soil, and thus resulting in unenhanced crop productivity. Also organic manure sustain cropping systems through better nutrient recycling and improvement in soil physical, chemical and biological properties (Ojeniyi, 2000). The use of inorganic manures has been observed to cause the destruction of soil texture and structure which often leads to soil erosion, acidity as a result of leaching effects of mineral nutrients (Ojeniyi, 2000). All these gave rise to reduce crop yields as a result of soil degradation and nutrient imbalance (Ojeniyi, 2000). The use of organic manures has been recommended for long term cropping in the tropics as slow mineralization of these manures promote crop yield for a long period of time (Gambo *et al.* 2008). The most satisfactory method of increasing crop yields is by judicious use of organic manures in combination with little portions of inorganic sources for nutrient use efficiency (Gambo *et al.* 2008). It has also been observed that organic manures increases soil water holding capacity and this means those nutrients would be made more readily available to crops where manures have been added to the soil (Dada and Fayinminmu, 2010). Magdi *et al.*, (2009) reported that the yield and quality of onion were significantly influenced by fertilizer types. The highest yield of onion bulb was

obtained by the application of poultry manure (PM) with inorganic fertilizer.

Materials and Methods

Experimental site

The experiment was carried out at the Demonstration farm of the Faculty of Agriculture, University of Maiduguri. The farm is located between latitude 11º 50'N and 13º40'N and longitude 10º14'E and altitude of 352 mm above sea level of the north-eastern Nigeria. The experiment started on 25th November, 2017 and ended on 10th March, 2018. The experiment was carried out under irrigation.

Experimental design and treatments

The experiment consisted of 4 treatments in a Randomize Complete Block Design (RCBD) which are T1 (0 t/ha), T2 (2.5 t/ha), T3 (4.5 t/ha), and T4 (6.5 t/ha), replicated 3 times. The total experimental area used was 15.5m × 4.5m. The plots were sunken bed measuring 2m × 2m with 0.5m space within rows and 1m between rows.

Source of seedling

The variety of onion (*Monguno white*) were collected at the College of Agriculture Maiduguri. It is an early maturity local variety. The seedlings were transplanted one per stand at spacing of 20 cm x 30 cm each bed consisting of 7 rows and 8 stand to give a total of 56 stands.

Cultural practices

Manure application

Poultry manure was applied to each plot two weeks before transplanting in order to enable proper decomposition of nutrients that would be released for the growth and development processes.

Irrigation

The period of the field trail was during the dry season, so there was a great need for applying water to ensure effective growth and maximum growth. Watering was done manually on daily basis at the first two weeks after transplanting and later scheduled for 2 - 3 times per week after seedling establishment.

Gap filling

At two weeks after transplanting, weaker and dead seedlings were replaced by more vigorous and healthy seedlings to ensure optimum plant population and higher yield.

Weeding

Regular weeding was carried out manually at every 2 weeks on the field in order to prevent the infestation by weeds. To reduce competition on growth resources, and also to ensure maximum growth.

Harvesting

The onion were harvested after most of the tops have fallen and the leaves turned yellow. Harvesting was done at the same time for all the 12 plots and the bulb were left on plot for 2 days before removing the leaves. This was done to ensure proper curing of the onion bulbs.

Data Collection

The parameters measured were plant height, number of leaves per plant, bulb diameter, Bulb weight and yield. Four plants were randomly tagged per plot at net plot for data collection. Data collected include;

Number of leaves per plant

Number of fully opened leaves was recorded fortnightly up to harvesting time and the means were worked out and expressed as number of leaves per plot.

Plant height (cm)

The plant height from the tagged plants were measured using a meter rule, the plant heights were measured from the base to the tips of the leaves which were taken at 3, 6, and 9 weeks after transplanting. The average result were collected and recorded.

Bulb Diameter (cm)

Diameter of four bulbs were taken at random after harvest from each treatment, measured with the help of vernier caliper and the average bulb diameter was expressed in centimeter (cm).

Bulb weight (t/ha)

The fresh weight of the sampled plant for each treatment after harvest were weighed using weighing balance calibrated in kilogram. Fresh weights of bulbs was expressed in tons per hectare

Yield

Total yield were taken from the net plot at harvest in kg /plot and later converted to tons/ha.

Data Analysis

Data obtained were subjected to statistical analysis using analysis of variance (ANOVA) after which the means were separated using fisher's least significant difference (LSD) at 5% level of probability.

Results and Discussions:

Effect of poultry manure rates on plant height

Table (1) shows the effect of poultry manure rates on plant height of onion. The result indicated that there was a significant effect among the various treatments, at 3 and 6 WAT. Treatment T4 (6.5 t /ha) and T3 (4.5 t /ha) produced the tallest plants followed by 2.5 t /ha and the least was obtained from the 0 t/ha. At 9 WAT, treatment T4 (6.5 t /ha) also produced the tallest plant followed by T3 (4.5 t/ha) and the least plant height was obtained from T1 (0 t/ha). This could to be attributed to high nutrient content of poultry manure released to crop. This findings is in line with the findings of Adekiye *et al.*, (2009) who stated that plant height, number of leaves and fibrous root length increase with increase in rate of poultry manure.

Table 1. Effect of poultry manure rates on plant height

Poultry Manure Rate	**Plant height (cm)**		
	3 WAT	**6WAT**	**9WAT**
0t/ha	11.83c	25.63b	29.53c
2.5t/ha	16.51b	25.60b	42.37a
4.5t/ha	19.23a	36.60a	36.13b
6.5t/ha	19.50a	37.37a	43.00a
Mean	16.77	31.30	37.75
$LSD_{(0.05)}$	0.89	1.178	2.573

NB. Mean values in the same column were separated using LSD at (P≤0.05%).
WAT week after transplanting

Effect of poultry manure rates on number of leave per plant of onion

Table (2) revealed the effect of poultry manure rates on number of leaves per plant at 3, 6 and 9 WAT. The result showed that there was a significant effect among the treatments. Application of 6.5 t/ha (T4) produce the highest number of leaves per plant followed by T3 (4.5t/ha), and T2 (2.5 t/ha) the least number of leaves per plant was observed from T1 (0 t/ha). This result tallies with the work of Sampathkumar (1972), who reported an increase in number of leaves per plant and increase in leaf area in onion as a rate of poultry manure increase from 5 to 20 t/ha.

Table 2. Effect of poultry manure rates on number of leave per plant

Poultry Manure Rate	Number of leaves		
	3 WAT	6WAT	9WAT
0t/ha	3.50c	6.87d	9.53d
2.5t/ha	3.80c	7.70c	10.47c
4.5t/ha	4.36b	8.00a	11.73b
6.5t/ha	5.43a	9.80b	14.60a
Mean	4.27	8.09	11.58
$LSD_{(0.05)}$	0.71	0.20	0.37

NB. Mean values in the same column were separated using LSD at (P≤0.05%).
WAT week after transplanting

Effect of poultry manure rate on bulb diameter and bulb weight

In Table 3, the effect of poultry manure on bulb diameter of showed that there is no significant difference among the treatments. However, treatment effect on bulb weight showed significant difference. Treatment T4 (6.5 t/ha) and T3 (4.5 t/ha) recorded the highest bulb weight as compared to other treatment. More so, there was no significant difference between T3 (4.5 t/ha) and T2 (2.5 t/ha). The Lowest bulb weight was recorded at T1 (0 t /ha). This findings coincides with the findings of Ayeni *et al.,* (2010) who reported that poultry manure significantly enhanced growth, yield and macro nutrient content with application at 20 and 30 t /ha which increase nutrient status and yield of onion. He further reported that poultry manure significantly increased number of leaves per plant, leaf area, plant height, bulb weight and bulb diameter per plant at 30 t /ha.

Table 3. The effect of poultry manure on bulb diameter and bulb weight

Poultry Manure Rate	Bulb diameter(cm)	Bulb weight(t/ha)
0t/ha	11.53a	5.00d
2.5t/ha	12.90a	7.75c
4.5t/ha	13.07a	8.58b
6.5t/ha	14.17a	9.68a
Mean	13.91	7.75
$LSD_{(0.05)}$	Ns	0.50

NB. Mean values in the same column were separated using LSD at (P≤0.05%).
WAT week after transplanting Ns No significant different

Effect of poultry manure rates on yield

Table 4 shows the effect of different rates of poultry manure on yield of onion. There is significant difference among the treatments obtained from onion yield at harvest. Poultry manure at rate of 6.5 t/ha (T4) gave the highest yield (14.78 t /ha) as compared to other treatments, the least yield was obtained from (T1) 0 t/ha (6.66 t/ha.).

Table 4: Effect of Poultry Manure Rates on Yield

Poultry Manure Rate	Yield (t/ha)
0t/ha	6.66d
2.5t/ha	8.54c
4.5t/ha	10.83b
6.5t/ha	14.78a
Mean	10.20
LSD	1.15

NB. Mean values in the same column were separated using LSD at (P≤0.05%).

Conclusion

The study revealed that there is significant differences among different rates of poultry manure on both growth and yield parameters. The optimum poultry manure rate for growth and yield was T4 (6.5 t/ha) for this study.

Recommendation

Based on the findings of this study, it can be recommended that onion farmers should apply 6.5 t/ha of poultry manure for optimum production in the study area.

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