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Response of Difference Rates of Cow Dung on the Growth and Yield of Onion (*Allium cepa* L.) Grown in Dadin-Kowa

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Abstract
Organic fertilizer is one of the factors that can affect the growth and yield of onion. This research aimed to determine the response of different rate of cow dung on the growth and yield of onion. The experiment was conducted in November 2020 to February 2021 at Federal College of Horticulture Research Farm, Dadin-Kowa Gombe State. Experiments using a Randomized Complete Block Design (RCBD) with a single factor, it was use of Cow dung manure at different rate in Four (4) treatment (0ton/ha, 5ton/ha, 10ton/ha and 15ton/ha) which was replicated three (3) time, with a total of 12 plots. The data collected was subjected to statistical analyses of variance (ANOVA) using Genstat, the means were separated using least significant difference (LSD) at 5% level of probability. The results showed that the application of cow dung significantly affected the growth and yield of onion. Of a given type of treatments, the 15ton/ha produced the highest (59.17cm) in plant height and was highly significant, in all the parameter that was observed, e.g Neck thickness (5.83 cm), Bulb diameter (33.30 mm), Bulb length(45.8mm) Bulb weight (64.8kg) biomass weight (62.0 g) and Bulb yield/ha (107.9kg) these were significant, therefore farmer in the study area are advised to adopt the 15 ton/ha for the high growth and yield of onion production.

Key words: *Cow dung, Growth, Onion, Yield.*

1.0 Introduction

Onion (*Allium cepa* L.) is a crucial member of the *Alliaceae* family and a vital vegetable globally, ranking second in importance after tomatoes among vegetables in Nigeria. Over five years, Nigeria's average production is 76,489 MT, accounting for about 10% of Africa's total onion production (FAO, 2018). Globally, onion production areas are increasing due to high profitability and ease of production (FAO, 2011). Onions are commonly used as flavorings or vegetables in stews and salads and are rich in flavonoids, which are associated with reduced risks of cancer, heart disease, and diabetes. They are also rich in carbohydrates, protein, vitamin C, phosphorus, and calcium and have good medicinal properties (Ramesh et al., 2017). Onions can be consumed raw, in salads, fried, boiled, roasted, or used to flavor soups and other dishes. Onion requires adequate soil moisture due to the relatively short and small root system. Onions are sensitive to photoperiod. Long days are favorable to onion production as this enhances leaf development and formation which, in turn, is directly related to bulb size. Early varieties require 13 hours for bulb initiation while late varieties require 16 hours for bulb initiation. (Gessesew, et al.,

2015). In Nigeria, onion cultivation is primarily in the northern region due to assumptions about its survival in the southern part. Cultivation is limited to the dry season when disease prevalence is lower. However, with proper irrigation and manure application, onion cultivation should be possible year-round (Rabinowitch and Currah, 2002; Falodun and Egharevba, 2018). The continuous use of inorganic fertilizers without organic manure supplementation leads to micronutrient deficiencies and unsustainable crop production (Yohannes et al., 2017). Organic material decomposition provides additional nutrients, potentially increasing nutrient uptake and yields (Shaheen et al., 2007). Proper fertility, especially from organic manure, is essential for onion production as it improves soil properties (Snyman et al., 1998). Onion production and nutritional value are limited by low soil fertility and other factors. This reduction in yields has led farmers to amend soils with organic materials to enhance growth and yield (Adepetu, 1997). According to Yai and Radav (2004), crops grown with organic manures are free from harmful chemicals, have superior nutritional quality, and are free from pollutants from inorganic fertilizers. To optimize cow dung use in onion production, evaluating the appropriate rates is essential. This study was conducted to compare response of different rates of cow dung on growth and yields of onion in Gombe State, North-East Nigeria.

2.0 Research methodology

2.1 Experimental site

The experiment was conducted at teaching and research farm of Federal College of Horticulture Dadin-kowa, Gombe state in the year 2020 dry season. The experiment site located in the Northern Guinea Savannah of Nigeria between latitude of 012^0 30^0 13.8 and 01230' 14.0 longitude of 09^0 21' 14.3 and 09" 21' 16.3" (Kowal and Knabe, 1979) the climate in the region consist of two distinct seasons, rainy season (May to October) and dry season (November to April) the annual rainfall ranges from 850mm-1000mm per annum mostly distributed between the month of May to October. Mean daily temperature ranges from 20 to 35^0C.

2.2 Treatments and experimental design

The treatments consist of a single organic manure (Cow dung) at four different rates; (0 ton/ha, 5tons/ha, 10 tons/ha and 15 tons/ha). The seed was gotten from seed dealer in Gombe market. The experiment was led out according to Randomized Complete Block Design (RCBD) with three replications. The size of each experimental unit was 3×2m, while 1m between each of the replicate and 0.5m between the plots. Distance between row-to-row and plant to plant was 35cm and 15cm respectively.

2.3 Land Preparation

The land was prepared by plowing the soil with Hoe and spade for a uniform seedbed. The field was cleared from any weeds residues, total of 12 experimental units were made. Beds of 3x2m was raised. The treatment 0 ton/ha, 5 ton/ha, 10 ton/ha and 15 tons/ha was assigned to each experimental plot accordingly, in a single dose and incorporated to the depth of 5-6cm and irrigated to stimulate the decomposition.

2.4 Transplanting of Onion seedling

The seedling was transplanted on 7th December 2020, on the prepared plots, 1 seedling per hole with 15 cm intra-row spacing (between the plants) and 35cm inter-row spacing (between the rows). The plots was irrigated before transplanting and after transplanting at regular interval as required by the crop.

2.5 Application of Organic manure (Cow Dung).

The manure was applied according to the treatment levels. Different rate of farm yard manure (cow dung) was applied to the various plots. The levels include0 ton/ha, 5 ton/ha, 10 ton/ha and 15 ton/ha and mixed with the soil and watered to be incorporated, this was done 15 days before transplanting.

2.6 Weed control

Weeding was done manually at two weeks' interval, in order to keep the experimental plot clean, to avoid competition with the crops.

2.7 Harvesting of Onions

The onions were harvested at a maturity time, within the 125 – 140 days after sowing, as the plant stunned yellow wish with necrotic leaf tips couple in the neck of the onion and fall in more than 50% plants. The plants were up rooted from the net plot of each treatment separately and the yield parameters were taken from the ten randomly selected plants.

2.8 Data measurement

Data were recorded for the following parameters i.e. Plant height (cm)**,** Numbers of leaves**,** Neck Thickness (Cm), Number of Days Maturity, Bulb Weight (g), Bulb Diameter (cm)**,** Bulb length (cm), Bulb Yield (tons/ha). All the data were recorded according to their standard methods.

Data Analyses

The data collected was subjected to statistical Analyses of Variance (ANOVA) using Genstat, the means were separated using least significant difference (LSD) at 5% level of probability.

3.0 RESULT AND DISCUSSION

3.1 Response of Different Rates of Cow Dung on Onion Height

The results in Table 1 show that there were no significant differences between the treatments in plant height at two weeks after transplanting (WAT). This may be due to the incomplete decomposition of the cow dung manure. However, at 4 WAT, the results in Table 1 indicate significant differences among the treatments. The treatment with the higher rate of cow dung resulted in greater plant height. At 6 and 8 WAT, there were highly significant differences among the treatments, with the 15 tons/ha and 10 tons/ha treatments yielding the highest plant heights. This suggests that onions grow with age and that plants receiving higher rates of cow dung were the tallest from 4 to 8 WAT. This observation aligns with Salami and Omotoso (2018), who reported that plants treated with 20 tons/ha had the tallest plants compared to the control. Similarly, Xu et al. (2003) reported that vegetables grown with higher rates of cow dung manure performed better in plant height and final yield.

3.2 Response of Different Rates of Cow Dung on the Number of Onion Leaves

Table 2 shows that there were no significant differences in the number of leaves between 2 and 4 WAT. However, from 6 to 8 WAT, significant differences were observed among the treatments, with the 15 tons/ha and 10 tons/ha treatments producing more leaves compared to the control (0 tons/ha). This indicates that manure application promotes luxuriant vegetative growth of crops. These findings are consistent with Kha et al. (2002), who reported that the number of leaves per plant was higher in plots treated with higher rates of cow dung. Amos et al. (2015) also observed a similar response.

3.3 Response of Different Rates of Cow Dung on Onion Neck Thickness

The results in Table 3 show significant differences in onion neck thickness among the treatments throughout the research period. The treatment with 15 tons/ha yielded the highest neck thickness of 5.8 cm, while the lowest neck thickness of 4.9 cm was observed in the control (0 tons/ha). This conforms with the findings of Yohanne et al. (2017), who reported that neck thickness is a critical parameter significantly influenced by the combined application of organic and inorganic fertilizers.

3.4 Response of Different Rates of Cow Dung on Onion Bulb Diameter

There were significant differences in onion bulb diameter among the treatments, as shown in Table 4. The 15 tons/ha treatment resulted in the highest bulb diameter of 33.3 mm, while the control (0 tons/ha) had a diameter of 25.93 mm. This indicates a positive impact on the growth and yield of onions. These results are in line with Negasi et al. (2017), who found that higher rates of cow dung increased onion bulb diameter. Yohannes et al. (2017) also observed similar results.

3.5 Response of Different Rates of Cow Dung on Onion Bulb Length

Table 4 shows no significant differences among the treatments regarding bulb length. However, the application of 15 tons/ha resulted in the highest bulb length of 43.5 mm, while the control (0 tons/ha) had the lowest bulb length of 38.6 mm. The higher bulb length may be due to increased photosynthetic activity resulting from adequate nitrogen supply from the higher rate of manure. Similar findings were reported by Salami and Omotoso (2018), who found that a 20 tons/ha treatment yielded the highest bulb length, accounting for an 87.4% increase over the 10 tons/ha, 5 tons/ha, and control treatments.

3.6 Response of Different Rates of Cow Dung on Onion Bulb Weight

Table 5 shows significant differences in bulb weight among the different rates of cow dung treatment. The 15 tons/ha treatment produced the highest bulb weight of 64.8 kg, followed by the 10 tons/ha treatment with 61.6 kg. The control (0 tons/ha) had the lowest bulb weight of 40.2 kg. The increase in bulb weight reflects better plant growth and development, likely due to balanced

and more available nutrients during the growing period, as reported by Salami and Omotoso (2018).

3.7 Response of Different Rates of Cow Dung on Bulb Yield/ha (kg) of Onion

Table 5 shows that total bulb yield was significantly affected by the treatments. The highest total bulb yield was obtained from the 15 tons/ha treatment with 107.9 tons/ha, followed by the 10 tons/ha treatment with 102.7 tons/ha. The lowest yield was from the control treatment (0 tons/ha), which recorded 67.0 tons/ha. These results are similar to those of Lchi et al. (2020), who reported that the highest bulb yield was obtained from the highest rates of cow dung. This could be due to the activities of nitrogen and farmyard manure in promoting physiological and metabolic processes in plants, which improve dry matter production and accumulation. The beneficial effect of organic manures on yield might also be due to the additional supply of plant nutrients and improved physical and biological properties of the soil (Datt et al., 2003).

Conclusion

The experiment results indicated that the 15 tons/ha treatment had significant differences over the other cow dung rates in various parameters observed, including plant height, number of leaves, neck thickness, bulb diameter, bulb length, bulb weight, biomass weight, and bulb yield/ha. These results were significant, and farmers in the study area are advised to adopt the 15 tons/ha rate for high growth and yield of onion production. Based on these findings, the 15 tons/ha rate demonstrated high performance in terms of growth and yield and is recommended for farmers in the study area.

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Table 1. Response of different rates of cow dung on onion height.

	Week after transplanting (WAT)			
Treatments	2	4	6	8
0 ton/ha	25.00	35.50	41.73	45.53
5 tons/ha	27.80	35.40	44.57	48.70
10 tons/ha	20.90	39.87	52.13	57.07
15 tons/ha	29.53	40.73	55.50	59.17
LS	NS	*	**	**
LSD	17.68	3.741	4.270	3.479

LSD = Least Significant Difference, WAT = Week after transplanting, NS =Not significant, LS = Level of Significant,* = Significant, ** = highly significant.

Table 2. Response of different rates of cow dung on number of leaf of onion.

	Week after transplanting (WAT)			
Treatments	2	4	6	8
0 ton/ha	4.167	9.00	12.53	13.17
5 tons/ha	4.033	9.37	13.40	15.37
10 ton/ha	4.267	9.37	15.90	18.10
15 tons/ha	4.567	9.83	17.23	17.57
LS	NS	NS	*	*
LSD	0.650	1.412	2.062	2.517

LSD = Least Significant Difference, WAT = Week after transplanting, NS =Not significant
LS = Level of Significant, * = Significant,**= highly significant.

Table 3. Response of different rates of cow dung on neck thickness of onion

	Week after transplanting (WAT)			
Treatments	2	4	6	8
0 ton/ha	3.016	4.133	4.467	4.900
5 tons/ha	3.067	3.867	4.500	5.300
10 ton/ha	3.033	3.967	5.033	5.633
15 tons/ha	3.567	4.267	5.467	5.833
LS	*	*	*	*
LSD	0.2514	0.3211	0.4264	0.6534

LSD = Least Significant Difference, WAT = Week after transplanting, NS =Not significant
LS = Level of Significant, * = Significant,** = highly significant.

Table 4. Response of different rates of cow dung on Bulb diameter (mm) and Bulb length of onion.

Treatments	Bulb Diameter (mm)	Bulb Length (cm)
0 ton/ha	25.93	38.60
5 tons/ha	29.63	40.80
10 ton/ha	32.30	40.60
15 tons/ha	33.30	43.50
LS	*	NS
LSD	6.91	8.08

LSD = Least Significant Difference, WAT = Week after transplanting, NS =Not significant
LS = Level of Significant, * = Significant,** = highly significant.

Table 5. Response of different rates of cow dung on Bulb weight (Kg), Biomass weight (g) and Bulb yield/ha (Kg) of onion.

Treatments	Bulb weight(Kg)	Biomass weight (g)	Bulb yield/ha (Kg)
0 ton/ha	40.2	33.1	67.0
5 tons/ha	51.4	43.2	85.7
10 ton/ha	61.6	53.2	102.7
15 tons/ha	64.8	62.0	107.9
LS	*	*	**
LSD	20.77	23.98	34.62

LSD = Least Significant Difference, WAT = Week after transplanting, NS =Not significant
LS = Level of Significant * = Significant,** = highly significant.