EFFECT OF DIFFERENT SOURCE OF ORGANIC MANURE ON THE GROWTH AND YIELD OF IRRIGATED ONION IN DAMATURU LOCAL GOVERNMENT AREA OF YOBE STATE, NIGERIA

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ABSTRACT

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). 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). The use of organic 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. This study was conducted during the cool dry irrigation season of 2014 at the New Research Farm (NRF) of College of Agriculture, Gujba, located in Damaturu state capital of Yobe State, Nigeria. Damaturu town is the capital of Yobe state, Nigeria. It is located on coordinates of 11° 44' 55" N, 11° 57' 50"E in the north-eastern part of Nigeria. The results showed that the different sources of manures had significantly influenced all the yield parameters of onion where F1 (cow dung) produced the heaviest (178.29g), largest (9.16 m) and highest onion tonnage 46.92 t ha^{-1} (Table 5). This was followed closely by F3 (poultry manure) that resulted in to 38.19 t ha^{-1} and then F2 (Sheep and Goat dung). Azbak red variety (V 1) equally performed significantly ($P < 0.05$) better than white variety (V 2) in terms of bulb weight, diameter and yield. The performance of the white variety consistently lagged behind that of Azbak red variety in all respects. We attributed yield differences to speed of nutrient release by the different manure to crops and genetic variations. The use of cow dung in cultivating Azbak red onion variety proved to be more beneficial. The poor performance of the "control experiment" demonstrates the soil's natural deficiency. It is therefore recommended that different onion variety should be evaluated under similar studies to assess their responses.

Keywords: Farmyard manures, onion, basin irrigation, north-eastern.

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. 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). World production of onion is estimated at over 61.6 million metric tons of bulb; and yield per hectare average 18.45 tons with Nigeria's average yield put at 14.8 tons (FAOSTAT, 2006). Based on the level of consumption onion is a major spice in diets, ranking the second (after tomatoes) most important vegetable in Nigeria. The main production period of onion in Nigeria is during the dry season between September and April. The crop is produced in dry areas in the northern parts of the country, and three crops are possible in a year, two rainfed and one irrigated (Anonymous, 1993). Farmers' production practice of onion involves complex mixture of cropping with other vegetables such as lettuce, tomato and pepper among others. Onion is consumed in different

ways by different people and forms an essential part of the traditional daily diet. It is a major spice item and ranks among the top 5 vegetables in Nigeria (NIHORT, 1986). It can be eaten raw, in salad, fried, boiled or roasted, and is also used in flavoring soups, canned food products and other savory dishes. It is used in every home virtually on 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). Onion production is a viable industry that employs plenty of labour and the bulbs are traded in large quantities within and between countries of the world (Currah and Proctor, 1990). 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 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. Therefore, this research conducted was to study the effect of different source of organic manures on the growth and yield of irrigated onion (*A. cepa*L.) in Damaturu state capital of Yobe State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted during the cool dry irrigation season of 2014 at the New Research Farm (NRF) of College of Agriculture, Gujba, located in Damaturu state capital of Yobe State, Nigeria. Damaturu town is the capital of Yobe state, Nigeria. It is located on coordinates of 11° 44' 55" N, 11° 57' 50"E in the north-eastern part of Nigeria with an area of 2,366km^{2}and a population of 88,014 based on the 2006 census. The climate regime of Yobe state is characterized by single long dry season followed by a shorter wet season. Mean annual rainfall ranges from 800 to 1000 mm. Potential evapotranspiration exceed rainfall except for few months. No rainfall was recorded during the study.Mean annual temperature is 36 ^{0}C increasing toward the Sahel zone to about 38 ^{0}C while, mean dry season temperature is 28^{o}C. Humidity was low throughout the dry season. Textural class of the soil was Clay loam.

Experimental Treatments and Field Layout

The experimental factors/treatments were four (4) sources of farm yard manure (FYM) and two (2) varieties of Onion replicated four times forming a total of 32 treatments laid in a split – plot design. Farm yard manure was allocated to the main plot while onion varieties in the sub plot. Table 1 presents the description of the treatments. Each plot was approximately 5 m^2 with a 1 m buffer space used to separate between replicates and 0.5 m space between plots. A total of 0.1 ha was used for the study. The distribution of the treatments in one replication is shown in Figure 1.

Table 1: Experimental treatments

S/No.	Treatments	Remarks
1	F_1V_1	F_1 = Cow dung
2	F_1V_2	F_2 = Sheep and Goat dung
3	F_2V_1	F_3 = Poultry manure
4	F_2V_2	F_4= (Zero manure) Control
5	F_3V_1	V_1 = White Onion
6	F_3V_2	V_1 = Red Onion
7	F_4V_1	
8	F_4V_2	

Canal	Inter Rep. Border			
	F_4V_2	F_1V_1	F_4V_1	F_2V_2
	F_3V_1	F_2V_1	F_1V_2	F_3V_2
	Inter Rep. Border			

Fig.1: One replication showing distribution of treatments

Cultural Practices

The experimental plot was initially cleared of all stubbles and other foreign matters and harrowed. Plots and replicates were then marked out in accordance with the experimental design. The plots were actually sunken beds to accommodate water. The manures were then applied in to the plots at 15 t/ha and worked in to the soil and irrigated. Four days afterwards, Onion seedlings that were previously prepared were then transplanted at about four weeks after planting into the plots at 25 cm inter- and intra-row spacing. No inorganic fertilizer was applied. Basin irrigation was adopted using 5-6 days irrigation interval. Weeds were controlled manually three times during the study. A pesticide (Permethrin 0.67%) was used to control pest attack.

Data Collection
Growth parameters

Plants' heights were measured using a meter rule from the base to the apex of the plants' leaves on 20 randomly selected Onion plants. The average was then worked out. The leaves of 20 randomly selected Onion plants were manually counted to arrive at the numbers of leaves per plant. The destructive sampling and oven drying at 72^{o}C (Ruhul Amin et. al., 2009) was adopted to obtain the crop growth rates of the plants in study.

Yield and yield parameters

At harvest, Onions per plot were manually graded using specially constructed wooden Sizer to arrive at the mean bulb diameter of the onions. In each plot, all Onion bulbs were weighed and average taken to arrive at the mean bulb weight total yield (cured yield)

Statistical analyses

The data collected were subjected to statistical analyses of variance (ANOVA) at 5% using Statistical Application of Science (SAS) and the means were separated using Duncan's Multiple Range Test (DMRT) as outline by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plants Heights

The different types of FYM and varieties had significantly affected plant heights of onion throughout the study (Table 2). In week 1 after planting (AP), significantly ($P < 0.05$) tallest plant was produced by F3 (50.75 cm), and this value is about 23% higher compared to plants obtained from application of F4. The same trend was observed in week 2 AP. But from week 3, plants that were treated with F1 were significantly ($P < 0.05$) taller but at parity with those that received F3. This is possibly due to time taken by F1 to further decompose and release nutrients to the plants. Similar trend was observed in week 4 AP. This finding is in agreement with research works of Al-Moshileh (2001) and Aliyu*et. al.*, (2007). Throughout the study it was observed Azbak red variety (V 1) was significantly ($P < 0.05$) taller than white onions. Khan*et. al*. (2002) also reported similar findings. The interactive effects of FYM and varieties did not significantly influenced plants' heights.

Table 2 Treatments (Treat) effect on plant height and number of leaves / plant

	Plant height (cm)				Number of leaves / plant			
Treat	1st WAP	2nd WAP	3rd WAP	4th WAP	1st WAP	2nd WAP	3rd WAP	4th WAP
FYM								
F1	45.5b	53.35b	62.2a	65.1a	6.52a	8.55a	10.51a	12.75
F2	48.75b	52.47	57.32b	60.12b	5.05c	7.75b	9.5b	11.51b
F3	50.75a	58.02a	60.35a	61.67b	6.15b	8.35a	9.5b	11.25b
F4	41.33c	48.83c	53.3b	52.25c	5.70b	7.33b	9.3b	10.6c
SE±	2.766	2.243	2.773	2.901	0.667	0.768	0.903	0.907
Varieties (V)								
V1	40.12a	42.12a	44.12a	46.12a	5.85a	7.25a	8.85a	13.85a
V2	37.12b	39.12b	41.12b	43.12b	5.32a	6.67b	7.21b	10.04b
SE±	1.077	1.096	1.806	1.831	0.617	0.744	0.711	0.933
Interactions								
FXV	ns	ns	nsns	ns	ns	ns	ns	

Means values in a column followed by unlike letter (s) are significantly different at 5% level using DMRT test

Number of leaves per plant (NLPP)

The differences of FYM had significantly ($P < 0.05$) affected NLPP of onions with the highest record (12.75) obtained in plants treated with F1 throughout the observation. This was followed closely by F3. This attributed to the fact in addition to other nutrients; cow dung produces more Phosphorus and Nitrogen than other FYM hence, the production of more leaves there by increasing the photosynthetic area. Khan *et. al*. (2002) who reported that number of leaves per plant was higher in plots treated with cow dung. Varietal effect was significantly ($P < 0.05$) observed withAzbak red variety (V 1) producing more NLPP than white onions (V 2). The interactive effects of FYM and varieties did not significantly influenced NLPP.

Crop growth rate (CGR)

Plots treated with poultry manure (F3) had resulted in to significantly ($P < 0.05$) higher CGR in 1st, 2nd and 3rd WAP (0.67, 0.83, and 0.99 $gm^{-2}day^{-1}$ respectively) relative to all other

treatments (Table 1). However, in 4th WAP, plants treated with cow dung (F1) significantly induced highest onion CGR (1.54 $gm^{-2}day^{-1}$). This is attributed to the early release of Nitrogen by poultry manure to plants that stimulates fast plant growth. The growth rates of onion plants triggered by F2 and F4 were statistically at parity. Similar to other observations above, Azbak red variety (V 1) grew faster than white variety (V 2) with CGR of 0.79, 0.95, 1.14, and 1.34 $gm^{-2}day^{-1}$ (Table 4). This could be attributed to their genetic properties.

Table 4: Treatments effects on crop growth rate of onion

	Crop growth rate ($gm^{-2}day^{-1}$)			
Treat.	1st WAP	2nd WAP	3rd WAP	4th WAP
FYM				
F1	0.54b	0.77b	1.02a	1.54a
F2	0.36c	0.54c	0.83b	0.98b
F3	0.67a	0.83a	0.99a	1.22b
F4	0.44c	0.67b	0.67b	0.91b
SE±	0.066	0.071	0.081	0.093
Varieties				
V1	0.79a	0.95a	1.14a	1.34a
V2	0.70b	0.81b	0.92b	1.01a
SE±	0.076	0.079	0.090	0.095
Interactions				
F X V	ns	Ns	Ns	Ns

Means values in a column followed by the unlike letter(s) are significantly different at 5% level using DMRT test

Yield and yield parameters

The different sources of manures had significantly influenced all the yield parameters of onion where F1 produced the heaviest (178.29g), largest (9.16 m) and highest onion tonnage 46.92 t ha^{-1} (Table 5). This was followed closely by F3 (poultry manure) that resulted in to 38.19 t ha^{-1} and then F2.Azbak red variety (V 1) equally performed significantly ($P < 0.05$) better than white variety (V 2) in terms of bulb weight, diameter and yield. This result is parallel to those reported by Khan *et al*. (2002).

Table 5: Treatments effects on yield parameters of onion

Treat.	Mean bulb weight (g)	Bulb diameter (cm)	Cued bulb yield (t/ha)
FYM			
F1	178.29a	9.16a	46.92a
F2	157.67b	7.54b	36.12b
F3	138.54b	8.25a	38.19b
F4	120.12c	5.21b	12.27c
SE±	5.633	0.941	2.672
Varieties			
V1	146.24a	9.25a	40.21a

V2	113.54b	6.01b	31.23b
SE±	4.741	0.883	2.011
Interaction			
F X V	*	*	*

Means values in a column followed by the unlike letter(s) are significantly different at 5% level using DMRT test

The interaction effects of sources of manure and varieties significantly ($P < 0.05$) affected bulb weight, bulb diameter and cured bulb yield (Table 6). The interactions of F1V1 generated heaviest onion bulb weights, highest bulb diameters and cured bulb yields of`119.45 g, 6.33 cm and 31.543 t ha^{-1} respectively to outperformed all other combinations (Table 5). This is followed by the performance of F3V1 that catalyzed the production of onion bulb weights, bulb diameters and cured bulb yields of 107.98 g, 6.19 cm and 30.66 t ha^{-1} respectively. F4V2 recordedleast in terms ofbulb weights, bulb diameters and cured bulb yields of 54.88g, 3.33 cm and 12.67 t ha^{-1} respectively. This implies that cultivating Onion without manure in the research area is an economically very risky venture.

Table 6: Interactive effects of FYM and Onion varieties on yield parameters of onion

Treatments	Mean bulb weight (g)	Bulb diameter (cm)	Cured bulb yield (t/ha)
Interaction			
F1V1	119.45a	6.33a	31.43a
F1V2	105.63bc	5.05d	24.2f
F2V1	92.82c	5.52c	25.58d
F2V2	80.48e	3.49g	18.22g
F3V1	107.98b	6.19b	30.66b
F3V2	88.77d	4.02f	26.95c
F4V1	67.32f	4.22e	25.54e
F4V2	54.88g	3.33g	12.67g

Means values in a column followed by the unlike letter(s) are significantly different at 5% level using DMRT test

CONCLUSION AND RECOMMENDATION

Significant effect of organic manure and variety were observed on bulb weight, diameter and yield (t ha^{-1}) during the dry season of 2014 in Damaturu of Yobe state. Interaction of cow dung and variety 1 (Azbak red) gave the best yield (31.43 t ha^{-1}) followed by poultry manure and variety 1 (Azbak red) with a yield of (30.66 t ha^{-1}). It is therefore recommended that different onion variety should be evaluated under similar studies to assess their responses.

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