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EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURES ON YIELD AND YIELD COMPONENTS OF GARLIC (*Allium sativum* L.) AT KADAWA, KANO, NIGERIA

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ABSTRACT
Effects of different types and levels of organic manures on the yield and yield components of garlic (ex- Kofa var) was investigated. Two experiments were conducted under irrigation at the Institute for Agriculture Research (I.A.R) Kadawa in the Sudan Savanna zone of Nigeria during 2007/2008 and 2008/2009 (Nov- Mar) dry seasons. The treatments consisted of five levels (0, 2.5, 5.0, 7.5 and 10.0 tons/ha) of three types of organic manures (poultry droppings (P.D), farm yard manure (FYM) and cow dung (CD) laid out in a Randomized Complete Block Design (RCBD) with four replications. Yield parameters studied included cured bulb weight , average bulb diameter, average number of cloves/bulb, average weight of cloves and cured bulb yield (kg/ha). The results showed Significant (P=0.5) effect of all organic manures with highest yield values obtained from poultry droppings, then cow dung and farmyard manure respectively. Increasing levels of all applied manures from 0-10 tons/ha significantly increased all yield parameters assessed. Thus for optimum yield of garlic at Kadawa, the use of 7.5-10 tons/ha of poultry dropping could be recommended.
Keywords: Poultry droppings (PD), Farm yard manure (FYM), Cow dung (CD), Kadawa, Sudan Savanna, Garlic, Irrigation, yield and yield components.

INTRODUCTION

Garlic is the second most widely cultivated species of the genus. "*Allium* after *Allium cepa* (Huber, 2003). It is believed to have originated from central Asia and spread to all parts of the world and is widely grown in India, Philippines, China, Ethiopia, Kenya and Rome. It is used both as staple food and medicine for several ailments (Bodnar *et al.,* 1997).

In Nigeria, the production of garlic is concentrated in the Northern Guinea and Sudan Savanna ecological zones, where it is mainly grown under irrigation in the dry seasons. Its diverse distribution can be seen by its diverse common names in different societies. It is called "Tafarnuwa" in Hausa, "Saum" in Arabic, "Aglio" in Italy, "Chesnoc" in Russia, "Lahsan in Hindi, "Ail" in French, "Ayu" in Yoruba, etc. (Aliyu, 2006).

The scope of increasing its production by bringing more areas under cultivation is very limited, because it is grown only in the dry season when other major crops occupy most of the cultivated land. Rainfall is very scanty during the dry season and frequent irrigation increases its successful production (Islami *et al.,* 2007).

Although, both manure and chemical fertilizers have a potential role in the growth and development of crops, indiscriminate use of fertilizers changes the physical, chemical and biological properties of soil, pollutes the environment and creates health hazards by its toxic residues (Borabash and Kochina, 1987). Manures supply all essential nutrients as well as improve physical, chemical and biological properties of soil and may help boost the production of garlic to peasant farmers. Moreover, despite the ranking of garlic as one of the most important medicinal crops in the world, the present production level do not meet the demand of the teeming population and there's virtually little literature available in Nigeria with reference to the effects of sole organic manure on the growth and yield of garlic *(Allium sativum* L). The objective of the study was to determine the effects of different types and levels of organic manure on the yield and yield components of Garlic (*Allium sativum* L.).

MATERIALS AND METHODS

Field experiments were conducted during the 2007/2008 and 2008/2009 dry seasons at the Institute for Agricultural Research, Irrigation Station Kadawa (11º 3a 'N, 08 02' E, 500m above Sea level) in the Sudan Savanna zone of Nigeria. The performance of a local variety of garlic (ex- Kofa) was evaluated using 3 different types of organic manure (Poultry dropping, cow dung and farm yard) applied at 0,2.5,5.0,7.5 and 10.0 tons/ha laid and out in a randomized Complete Block Design with four replications. Mature garlic bulbs were selected and split in to cloves, large and medium sized cloves were selected and soaked overnight to remove scale leaves and enhance good sprouting. The field was prepared and marked out into fifteen basins of 2×1.5m. The gross plot size was 3m having 10 rows spaced at 15cm apart, an intra-row spacing of 10cm and the net plot consist of 6 inner rows of 2cm length. Prior to planting, single doses of the three different types of organic manure used at the rate that provide 0,2.5,5.0,7.5 and 10.0 tons/ha were incorporated into the basins by broadcasting method per treatment allotted to a basing with 0 as control.

The basins were pre- irrigated a day to planting. Planting was done manually on the prepared plots. General irrigations were fallowed at weekly intervals for proper seedling establishment and stopped two weeks to harvest to allow for uniform maturity. Weeding was done manually by hand pulling and onion hoe at 3 and 6 weeks after planting (WAP).

Sample of soils were taken from the field prior to planting at 0-15 and 15-30cm depths, bulked and analyzed for physico-chemical properties using standard procedures (Table 6). Data on average cured bulb weight, average bulb diameter, number of cloves/bulb and average weight/cloves were taken using five (5) randomly sampled matured air-cured bulbs per plot after harvest. Weights of all bulbs per plot were taken and recorded in grams and subsequently converted to kilograms per hectare. Cured bulb weight/plot(bulb yield/ha) was taken and recorded per plot after harvest and air- curing for 2 weeks, expressed in grams and kilograms per hectare. Data taken were analyzed using ANOVA as described by Snedor and Cochran, (1967) and means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of Different Types of Organic Manure on Yield and Yield Components of Garlic

Application of all types of organic manure significantly increased all yield parameters assessed. Poultry droppings produced statistically the heaviest cured bulbs while no significant differences were observed between cow dung and farm yard manure in the two years of study and the combined analysis (Table 1). Larger bulb diameter was produced with the application of poultry droppings than cow dung and farm yard manure in both years and combined years (Table 2). Similarly, more number of cloves were recorded in poultry dropping treated plants as compared to cow dung and farm yard manure which were statistically at par in 2007/2008 season and combined analysis (Table3), though in 2008/2009 season , all types of applied organic manures produced statistically similar mean number of cloves. Heavier cloves were produced by poultry dropping than cow dung and farm yard manure in all seasons and combined years. However, in 2008/2009 season cow dung and farm yard manure were observed to be statistically at par (Table 4). Throughout the two-year trials and the combined analysis, poultry droppings produced statistically the highest cured bulb yield per hectare than cow dung, which as statistically superior to farm yard manure (Table 5) .Yield and yield characters observed responded positively and most of them significantly to all types of organic manures used, at P=0.05 levels. Highest bulb yield and yield characters were obtained with respect to poultry dropping manure in all seasons and combined analysis. The increase in all yield and yield parameters especially with application of poultry dropping could be due to its ability in the improvement of soil structure, increased exchange sites thus increase photosynthesis leading to greater cell division, elongation and differentiation and finally body growth as reported by Sale *et al.,* (2003). Similar results were obtained by Babaji (1996) and Miko (1999) by the application of 150kg /ha of N along with light irrigation. Akoun (2004), also confirmed that manure increases the nutrient status of a soil which leads to increase in yield.

Effect of Different Levels/ Rates of Organic Manure on Yield and Yield Components of Garlic

Application of various levels of organic manure produced positive and significant effect on yield and yield characters assessed. Maximum values of cured bulb weights ,bulb diameter, number of cloves, weight of cloves and bulb yield per hectare were recorded with the applications of 10 tons /ha of all organic manure types (Table 1,2,3,4, and 5), though there were no statistical differences between 7.5 and 10.0 tons/ha of organic manure in 2008/2009 season and the combined analysis. This implies that there's tendency for higher yield of garlic with the application of higher level of organic manure. Highest bulb characters were obtained with respect to poultry dropping manure in all seasons and combined analysis. The efficacy of organic materials depends on the source, this explains why poultry dropping outperformed the other organic manures in all the trials as it contains higher amounts of nitrogen, phosphorous, potassium beside lowering of soil pH and electrical conductivity then cow dung or farm yard manures (Table 7). Similar observations were reported by Ohallorans *et al.* (1993) and Melo and De-oliveira, (1999). Gambo *et al.* (2007) also reported that organic fertilizer or manure increased yield and yield components of onion.

The organic manure and level interaction was observed to be significant on bulb diameter (Table 2), weight of cloves (Table 4) in all seasons and combined analysis. The interaction between manure and level was also significant in 2007/2008 and combined analysis with respect to number of cloves (Table 3) and bulb yield/hectare (Table 5). However, there was no significant manure and level interaction effect on bulb weight 2008/2009 season, but significant in 2007/2008 season and combined analysis (Table 1). This implies that all types of organic manure used were effective for yield and yield components, since higher values were obtained with increase in every type of organic manure. Islami *et al.,* (2007) recorded similar results on yield of garlic in Bangladesh using fertilizer and mulches. Earlier findings of Gambo *et al.,* (2007) on *onion* also conform with these findings.

Table 1: EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURE ON AVERAGE CURED BULB WEIGHT (g) OF GARLIC AT KADAWA:

	GROWING SEASONS		
Treatment	**2007/2008**	**2008/2009**	**Combined**
Types of Organic manure			
PD	8.259a	10.265a	9.242a
CD	6.132b	9.585a	7.814b
FYM	5.662b	9.930a	7.741b
SE + -	**0.23**	**0.33**	**0.19**
Rates (tons/ha)			
0	4.470d	6.439e	5.455d
2.5	5.195c	8.463d	6.829c
5.0	7.069b	9.935c	8.502b
7.5	7.451b	11.164b	9.139b
10.0	9.234a	13.867a	11.550a
SE + -	**0.31**	**0.44**	**0.23**
Interaction			
Manure *level	*	N.S	*

Means fallowed by the same letters within same treatment group are not statistically different using Duncan's multiple range test (P=0.05). NS = Not significant
*= Significant at P= 0.05

Table 2: EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURE ON AVERAGE BULB DIAMETER (CM) OF GARLIC, AT KADAWA:

	GROWING SEASONS		
Treatment	**2007/2008**	**2008/2009**	**Combined**
Types of Organic manure			
PD	4.290a	4.500a	4.449a
CD	3.945b	4.207b	4.076b
FYM	3.825c	4.080b	3.952b
SE + -	**0.038**	**0.092**	**0.05**
Rates (tons/ha)			
0	3.391e	3.683d	3.537e
2.5	3.883c	4.233d	4.058c
5.0	3.741d	3.966cd	3.854d
7.5	4.333b	4.525b	4.429b
10.0	4.750	4.903a	4.426a
SE + -	0.050	0.12	0.06
Interaction			
Manure *level	**	*	**

Means followed by the same lettered within same treatment group are not statistically different using Duncan;s multiple range test (P=0.05). NS = Not significant
*=Significant at P=0.05.
**=Highly Significant at P=0.05

Table 3: EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURE ON AVERAGE NUMBER OF CLOVES OF GARLIC, AT KADAWA

	GROWING SEASONS		
Treatment	**2007/2008**	**2008/2009**	**Combined**
Types of Organic manure			
PD	11.665a	11.660a	11.662a
CD	9.070b	12.456a	10.720b
FYM	9.545b	12.809a	11.135ab
SE +	**0.30**	**0.46**	**0.26**
-			
Rates (tons/ha)			
0	10.066b	10.998c	10.532d
2.5	8.025c	11.691bc	9.858d
5.0	10.325b	12.058bc	11.197bc
7.5	10.333b	12.963ab	11.528b
10.0	11.716a	13.887a	12.802a
SE +	**0.403**	**0.61**	**0.31**
-			
Interaction			
Manure *level	**	NS	NS

Means followed by the same letters within same treatment group are not statistically different using Duncan's multiple range test (P= 0.05). NS= Not significant
*= Significant at P=0.05
**=Highly Significant at P=0.05

Table 4: EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURE ON AVERAGE WEIGHT OF CLOVES (g) OF GARLIC AT KADAWA:

	GROWING SEASONS		
Treatments	**2007/2008**	**2008/2009**	**Combined**
Types of Organic manure			
PD	0.702a	0.898a	0.800
CD	0.671b	0.011b	0.739
FYM	0.585c	0.787b	0.683
SE +	0.04	0.03	0.01
-			
Rates (tons/ha)			
0	0.440b	0.611d	0.525
2.5	0.646c	0.765c	0.706
5.0	0.675c	0.856b	0.706
7.5	0.720b	0.885b	0.795
10.0	0.782a	0.155a	0.919
SE +	**0.013**	**0.034**	**0.015**
-			
Interaction			
Manure *level	NS	NS	NS

Means followed by the same lettered within same treatment group are not statistically different using Duncan's multiple range test (P=0.05). NS = Not significant
* = Significant at P= 0.05

Table 5: EFFECT OF DIFFERENT TYPES AND LEVELS OF ORGANIC MANURE ON CURED BULB YIELD (kg/ha) OF GARLIC AT KADAWA:

	GROWING SEASONS		
Treatments	**2007/2008**	**2008/2009**	**Combined**
Types of Organic manure			
PD	6335.050a	5909.400a	6122.200a
CD	5659.500b	4986.400b	5331.600b
FYM	4359.850c	4195.800c	4279.900c
SE +/-	**74.050**	**288.210**	**138.770**
Rates (tons/ha)			
0	3049.300e	3408.700c	3279.000d
2.5	4185.900d	4988.200b	4547.100c
5.0	5854.900c	4899.900b	5377.400b
7.5	6875.700b	5983.000a	6469.900a
10.0	7291.500a	6104.700a	6698.400a
SE +/-	**98.730**	**348.280**	**166.520**
Interaction			
Manure * level	**	**NS**	*

Means followed by the same letters within same treatment group are not statistically different using Duncan's multiple range test (P=0.05). NS= Not significant.
*=Significant at P=0.05
**=Highly Significant at P=0.05

Table 6: Physical and chemical properties of soil on which experiments were carried out in Kadawa, Kano.

	Soil depth (Cm)	
Soil characters	0-15	15-30
pH	6.97	6.04
Organic carbon (%)	0.38	0.86
Organic matter (%)	0.48	0.10
Total Nitrogen (%)	0.02	0.06
Available phosphorus (ppm)	9.06	8.50
Exchangeable bases (meg/100g)		
Na	**0.86**	**0.60**
K	0.61	0.75
Ca	2.75	2.39
Mg	2.10	2.16
C.EC	6.32	5.19
Particle size distribution		
Sand (%)	73.00	73.00
Silt (%)	19.40	15.00
Clay (%)	8.00	12.00
Textural class	Sand Loam	Sand Loam

Table 7: Chemical composition of the three different types of manures used for the experiment at Kadawa

Types of manures	Chemical composition/ppm					
	T. Nitrogen	**A.V.P**	**Na**	**K**	**Ca**	**Mg**
CD	0.98	4.79	0.09	1.72	0.61	0.70
PD	3.80	6.25	0.35	2.96	2.36	1.32
FYM	1.08	2.56	0.07	1.41	0.95	0.65

KEY: A. V .P =Available Phosphorus

CONCLUSION

The research has shown that all the three types of organic manure used in the study significantly increased yield and yield components of garlic. Poultry droppings consistently resulted in higher values of bulb weight, bulb diameter, number of cloves, weight of cloves and bulb yield/hectare. The application of 7.5-10.0 tons/ha of organic manure (Poultry droppings) produced higher values of all yield parameters assessed. Therefore, the use of poultry droppings as organic manure at 7.5**-**10.0 tons/ha appeared optimum and could be recommended for optimum yield and yield characters of garlic in the Sudan Savanna Zone of Nigeria.

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