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Full Length Article

Growth and Yield of Watermelon (*Citrullus lanatus*) as Affected by Poultry Manure Application

S.N. DAUDA, F.A. AJAYI[1]† AND E. NDOR
College of Agriculture, P.M.B. 33, Lafia, Nasarawa State, Nigeria
†*Department of Agronomy, Nasarawa State University, Keffi, P.M.B. 135, Shabu-Lafia, Nasarawa State, Nigeria*
[1]Corresponding author's: e-mail: faajayi_dr@yahoo.com

ABSTRACT

A trial was carried out in 2005 and 2006 rainy season to study the efficacy of different levels of poultry manure (PM) at the rates of 0, 3.3, 6.6 and 9.9 t ha^{-1} on growth and yield of *Citrullus lanatus*, in Lafia, Nasarawa State, Nigeria. The experiment was carried out in a randomized complete block design, replicated three times. The results showed that application of PM significantly enhance growth parameter vigour and number of fruits during the two seasons. The average weights of the fruits in year 2006 season were significantly higher than that of 2005. In 2005, average weights of the fruits are not significantly affected by lower rates of PM (0 & 3.3 t ha^{-1}).

Key Words: Watermelon; Poultry manure; Application rates; Growth parameters; Yield

INTRODUCTION

Watermelon [C*itrullus lanatus* (Thum.) Matsum & Nakai] belongs to the family Cucurbitaceae (Schippers, 2000). Its centre of origin has been traced to both the Kalahari and Sahara deserts in Africa (Jarret *et al*., 1996) and these areas have been regarded as point of diversification to other parts of the world (Schippers, 2000). In Nigeria, though there are no official figures recorded for its production, the crop has a wide distribution as a garden crop, while as a commercial vegetable production; its cultivation is confined to the drier savanna region of the Nigeria (Anon, 2006).

In order to obtain high yield of water melon, there is need to augment the nutrient status of the soil to meet the crop's need and thereby maintaining the fertility of the soil. One of the ways of increasing the nutrient status is by boosting the soil nutrient content either with the use of organic materials such poultry manure, animal waste and use of compost or with the use of inorganic fertilizers (Dauda *et al*., 2005a). Watermelon is a heavy feeder of nitrogen and therefore required a liberal application of 200 kg. NPK compound fertilizer to be applied before sowing, followed by application of nitrogenous fertilizers at 5 weeks at intervals up to flowering stage (Rice *et al*., 1986; Schippers, 2000). Inorganic fertilizers are the most important sources of N. Adequate supply of N is associated with high photosynthetic activity, vigorous vegetative growth and a dark green colour of the leaves (John *et al*., 2004). Extensive use of inorganic fertilizer has a depressing effect on yield. This causes reduction in number of fruits, delays and reduces fruit setting, which subsequently delay ripening and leads to heavy vegetative growth (Aliyu *et al*., 1992; John *et al*., 2004).

Poultry manure is relatively resistant to microbial degradation. However, it is essential for establishing and maintaining optimum soil physical condition and important for plant growth. PM is also very cheap and effective as a good source of N for sustainable crop production, but its availability remains an important issue due to its bulky nature, while inorganic fertilizer is no longer within the reach of poor-resource farmers due to its high cost (Rahman, 2004). However, John *et al*. (2004) had advocated for an integral use of organic manure and inorganic fertilizers for the supply of adequate quantities of plant nutrients required to sustain maximum crop productivity and profitability, while minimizing environmental impact from nutrient use.

According to Beckman (1973) the use of manure application enhances soil productivity, increases the soil organic carbon content, soil micro-organisms, improves soil crumb structure, the nutrient status of the soil and enhances crop yield. The application of N a major component of poultry manure has been reported to improve the yield of egg plant (Dauda *et al*., 2005b). Aliyu (2000) reported that the use of farm yard manure (FYM) plus PM at 5 t ha^{-1} resulted in higher fruit yield of egg plant.

There is a prospect of production of the crop in Nigeria (especially, Lafia Nasarawa State, Nigeria) as indicated by the demand and the price it commands. However, there is a dearth of information relative as to the scale of production, yield potential and cultivation under

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different fertilization status in the study area. This study was therefore carried out with the aim of finding the effect of poultry manure on the production of the crop in Lafia, Nasarawa State, Nigeria.

MATERIALS AND METHODS

The study was carried out at the teaching and research farm, College of Agriculture, Lafia, Nasarawa State, Nigeria. The study area falls within the Guinea savanna zone of North central Nigeria and is located between Latitude 08.33 N and Longitude 08.32 E. The study was carried out during the wet seasons of 2005 and 2006. The treatment was poultry manure (PM) whose chemical composition is presented in Table I. Application of PM was carried out at 0, 3.3, 6.6 and 9.9 t ha^{-1} and was replicated thrice. The experiment was laid out in a randomized completed block design (RCBD). Seed bed was well prepared by ploughing and harrowing in each season and plots were marked out into 9 m^2 plot. Inter and intra spacing was 75 x 90 cm, respectively. Soil samples were taken at a depth of 0-15 cm in each season and were analyzed. The result is presented in Table II. Meteorological data during the period of study are presented in Fig. 1. Poultry manure was applied and incorporated based on treatments two weeks before sowing. The cultivar used was sugar baby, which was purchased from an Agro Allied company in Jos, Plateau State, Nigeria and it was produced and packaged by Agrinova Co-Miari, Florida. Initial germination of the seed lot was 99%.

Weeds were controlled through manual hoeing and subsequently by hand pulling as the watermelon vines spread and covered the plots to thus suppress weed growth. Labdacyalothrin (Karate^R 2.5 EC) was applied four times at the rate of 150 L ha^{-1} beginning from twelve days after sowing (DAS) to control pest infestation during the growing period of the crop. Three harvesting were carried out starting from the 80th to 103rd DAS, when it was observed that fruit tendrils were brown, the fruits became pale yellow at the spot close to the ground and when the sound of the fruit when thumbed with a knock gives a soft hollow sound instead of metallic ringing sound.

Data collection and analysis. Data regarding vine length, number of leaves and branches, fruit number and yield were recorded for both per plant and on hectare basis. Data collected were analyzed statistically as described by Snedecor and Cocharan (1967). Treatment means were compared using Duncan's Multiple Range Test (DMRT) (Duncan, 1955) at 5% probability level.

RESULTS

In 2005, PM applied at 6.6 ad 9.9 t ha^{-1} were statistically comparable and significantly higher than 3.3 and 0 t ha^{-1} of PM in promoting vine length and number of leaves. 3.3 and 6.6 t ha^{-1} PM is statistically the same when compared together in terms of number of branches produced. The two rates were significantly lower than the application rate of 9.9 t ha^{-1} and higher than 0 t ha^{-1}. Increasing PM rates in 2006 season significantly increase vine length, while 3.3, 6.6 and 9.9 t ha^{-1} of PM were not statistically different in terms of number of leaves and branches. The three rates were significantly different from 0 t ha^{-1} (Table III).

Table I. Chemical composition of the Poultry manure used during 2005 and 2006 season

% Chemical Composition	2005	2006
N	2.80	3.1
P	0.36	0.32
K	6.30	4.40
Ca	5.30	5.32
Mg	0.41	0.56
Na	0.36	0.36
OC	45.90	48.88

Table II: Physical and Chemical Properties of the research site at 0-15 cm depth for 2005 and 2006 season

Soil Composition	Values	
	2005	2006
Mechanical composition		
Clay (g kg^{-1})	8.64	9.26
Silt	26.21	26.10
Sand	65.22	64.64
Textural classification (USD)	Loamy Sand	Loamy Sand
Chemical Classification pH (H_20)	6.59	6.85
pH (0.01M $CaCl_2$)	6.24	6.57
%Organic Carbon (g kg^{-1})	0.98	1.068
Available P (mg kg^{-1})	0.826	1.008
Total N (%)	0.626	0.875
Exchangeable Cations (mol kg^{-1})		
Ca	9.26	9.94
Mg	4.46	5.92
Na	91.07	93.24
K	53.67	67.00
CEC	272	282

The response of the crop to PM application rates on yield parameters is shown in Table III. PM increase in 2005 significantly increased number of fruits per plant and per hectare. However, in 2006, PM applied at the rate of 3.3 and 9.9 t ha^{-1} were not statistically different from each other but are lower than PM rates of 6.6 t ha^{-1}. The three application rates were statistically higher than the control (0 t ha^{-1}). On average weight of the fruits produced during the two seasons, PM rates of 6.6 and 9.9 t ha^{-1} were significantly the same thus significantly increasing the average weight of the crop when compared to the rate of 3.3 and 0 t ha^{-1}, which was not statistically different from each other in 2005. Average weights recorded for 2006 season were not statistically different from all the PM rates but were statistically different from 0 t ha^{-1}.

DISCUSSION

The significant performance of watermelon in 2005

Table III. Response to poultry manure application on growth parameters at Lafia, 5 weeks after sowing

Treatment PM rate (t ha^{-1})	Vine length (cm)		Number of Leaves		Number of Branches	
	2005	2006	2005	2006	2005	2006
0	14.57c	61.90d	9.22c	13.73b	1.55c	2.08c
3.3	34.67b	75.60c	15.33b	16.23a	2.39b	3.07b
6.6	50.67a	106.20b	19.52a	16.00a	2.55b	3.33b
9.9	51.47a	121.30a	20.42a	16.67a	3.00a	3.73a
SE ±	0.98	2.50	0.46	0.46	0.10	0.28

Means within a column of a set of treatment followed by unlike letters are significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Table IV. Response to poultry manure on yield parameter produced at Lafia, Nigeria

Treatment PM rate (t ha^{-1})	Number of fruit per plant		Number of fruits (ha^{-1})		Average weight of fruit (kg)		Weight of fruit (t ha^{-1})	
	2005	2006	2005	2006	2005	2006	2005	2006
0	7.00d	5.50c	103,698.00d	814,77.01c	2.26b	2.50b	234.35b	203.69b
3.3	11.66c	10.67b	172,731.24c	158,063.38b	2.30b	4.43a	397.28b	700.24a
6.6	13.44b	14.67a	199,100.16b	217,321.38a	2.84a	4.47a	565.44a	971.47a
9.9	16.33a	11.67b	241,912.62a	172,879.38b	2.95a	4.87a	713.64a	841.92a
SE ±	0.63	0.94	6142.11	5530.40	0.11	0.29	60.20	106.80

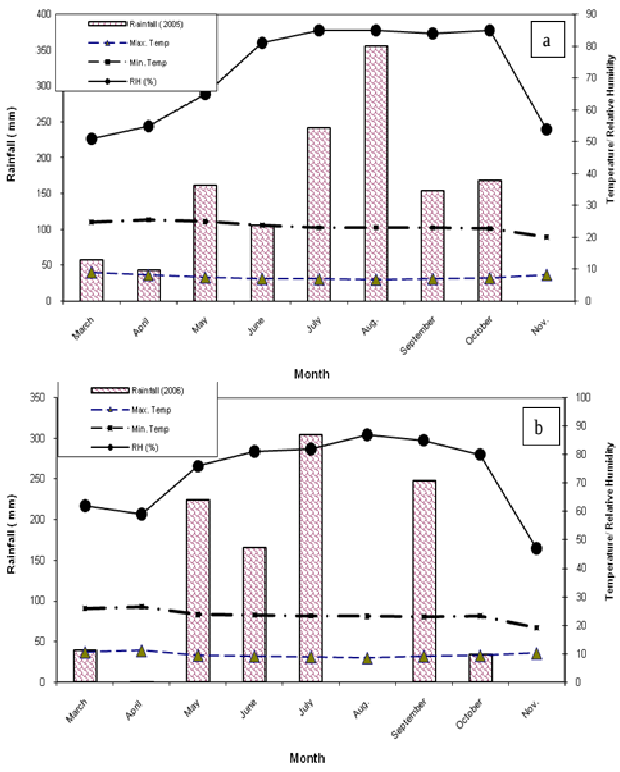
Means within a column of a set of treatment followed by unlike letter are significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

and 2006 over the control in growth parameters and yield could be due to the fact that PM contained essential nutrient elements associate with high photosynthetic activities and thus promotes roots and vegetative growth (John *et al.*, 2004). The increased in number of fruits and average weight could be attributed to the ability of PM to promote vigorous growth, increase meristematic and physiological activities in the plants due to supply of plant nutrient and improvement in the soil properties, thereby, resulting in the synthesis of more photo-assimilates, which is used in producing fruits. Gupta and Shukla (1977) reported an increase in number of fruits and size due to increase in N application.

The significant edge of 2006 season over 2005 in growth parameters could be to the quality of manure used in 2006. The increase in N as found in the PM used in 2006 has its profound effect on the vegetative development of the plant, ensure healthy and vigorous growth. This finding is in conformity with the results obtained by Aliyu (2000), Dauda *et al.* (2005b) who reported increase in growth with increased PM rates. Despite the quality of the PM used and the soil characteristics, there was more number of fruit produced in 2005 than in 2006. This could be due to low N, which resulted in poor fruit set and formation of smaller fruits (John *et al.*, 2004). Also the amount of rainfall experience in September of 2006, during the flower formation period could have caused flower droppings. Tindal (1986) had noted that higher rainfall intensity was detrimental to watermelon production.

The yield increase with an increase in PM rates suggests that PM supplies nutrients, which enhances vigorous growth, which are important indices that culminate in increase in fruit yield. This result tallies with tat of Aliyu (2002, 2003) who reported significant response in yield to different types of manure rate applications. In terms of average weight of the melon produced and fruit weight as

Fig. 1. Average Monthly Temperature, Relative Humidity and Rainfall at Lafia during 2005 (a) and 2006 (b) season



was observed in 2006, these were generally heavier than that of 2005 as could be due to better nutrient status of both the PM and soil. The proximate analyses of the fruits were however not determined.

From the results generally, it is suffice to suggest that

application of poultry manure albeit at higher application rates improves watermelon yield and production. Increasing yield and production of watermelon can thus translate in an increase in the standard of living of farmers who engaged in watermelon production. Also, there is a global trend towards organic farming, the use of poultry manure as a substitution for inorganic fertilizer will help to achieve this aim.

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