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Effect of Different Organic Manures on the Growth and Yield of Water melon (*Citrullus lanatus*)

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Authors' contributions

This work was carried out in collaboration among all authors. Authors UUE, OO, OEO and RAJ designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BOO, LG and UFY managed the analyses of the study. Authors SOO, SO and FMR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Field experimental trials were carried out at Federal College of Forestry Mechanization, Afaka. Kaduna located between latitude 10^0 35"N and longitude 07°21"E at altitude 644m above sea level to compare the effect of different application of organic manures on growth and yield of water melon *(Citrullus lanatus).* Two trials were conducted between the early onset of rain in April and post monsoon in October 2011 and the mean of the two trials were taken. The treatments were poultry manure, mixture of poultry manure plus goat/ sheep manure, goat/ sheep manure and control(no manure). The treatments were replicated four times in randomized complete block design. Data were collected on growth parameters such as plant vines length, Number of branches per plant, number of leaves and yield parameters like fruits weight, fruits diameter and number of fruits. The data were subjected to analysis of variance and the mean separated using Least Significant Difference. The results showed that there were significant differences ($P<0.05$) in plant vine length. The plots treated with poultry droppings had the highest value of plant vine length of 8.20, 137.90 and 216.30 cm at 2, 4 and 6 weeks after planting. Poultry droppings also gave the highest values for the weight of fruit (10.72 Kg) and diameter of fruit (53.25 mm). The best treatment is poultry manure which has the highest yield of 34.25% at 2.5 tonnes per hectare. Poultry manure showed positive

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effect on all the growth and yield parameters of water melon *(Citrullus lanatus)* measured. The use of poultry manure is therefore recommended for farmers in the study area in order to be able to obtain good yield of water melon.

Keywords: Effect; organic manures source; growth parameters; yield parameters; watermelon.

1. INTRODUCTION

Watermelon *(Citrullus Icinatus*) belongs to the family of cucurbitaceae Schippers, [1]. Its centre of origin has been traced to both the Kalahari and Sahara deserts in African Janet et al., [2] and these areas have been regarded as point of diversification to other part of the world Schipper, [1]. In Nigeria, though there are no official figures recorded for the production, the crop has a wide distribution as a garden crop, while as a commercial vegetable production. It cultivation is confined to drier savanna region of Nigeria Anon, [3]. In other to obtain high yield of water melon, there is need to increase the nutrient status of the soil so as to meet the crops need and thereby maintaining the fertility of the soil. One way of increasing the nutrient status is by boosting the soil nutrient content by the use of organic material such as poultry manure (PM) Dandu, [4]. Water melon is a heavy feeder of nitrogen and therefore required a liberal application of NPK compound fertilizer to be applied before sowing, followed by application of nitrogenous fertilizer at 5 weeks interval up to flowering stage Rice, [5]; Schippers, [1]. Inorganic fertilizers are the most important source of nitrogen. Adequate supply of nitrogen is associated with high photosynthetic activity, vigorous vegetative growth and a dark green colour of the leaves John, [6].

Poultry, sheep and goat manure are relatively resistant to microbial degradation. These organic manures essential for establishing and maintaining optimum soil chemical, physical and biological soil properties and important for plant growth. Poultry manure, sheep and goat manure are very cheap and effective as a good source of nitrogen for sustainable crop production, but its availability is a major constraint due to its bulky nature. On the otherhand, inorganic fertilizer is no longer within the reach of poor resource farmer due to its high cost Rahman, [7].

Organic manures are materials derived from animals, human and plants residue which contains nutrients in complex form. There are various sources of organic manure namely, cow dung, poultry droppings, goat and sheep dung, swine dung, fisheries waste product, agro industrial wastes and mix fertilizer which is a more refined form of organic manure etc. Organic manure affects the soils physical and chemical condition positively as such making the soil sustainable for the growth and yield of crops. It is a beneficial determinant of soil incrustation, water infiltration, moisture content, drainage, microbial activities and plant root penetration. Organic amendments such as livestock manures could be used as supplements and are cheap fertilizers. However, John, [6] 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, [8], 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 nitrogen, a major compound of poultry, sheep and goat manure was reported to improve the yield of water melon.

Watermelon prefers a well-tilled soil, with good drainage. It needs slow releasing fertilizer so as to increase availability for the plants and cut down the maintenance and labour cost during growing period. It needs organic manure for proper growth. A watermelon requires a full sun exposure and thrive well on a warm humid micro-climate. Watermelon thrives best on newly cleared sandy loam fertile soil rich in humus, well drained and slightly acidic with pH range of between 6.0-6.5. The optimum temperature for seed germination and growth is between 25°C to 30°C and below 20°C termination and growth is slow.

Watermelon is a vegetable crop which is of a great importance due to its high water content which is approximately 92%. It is an excellent source of vitamin C, vitamin A and Vitamin B6. It is also a good source of thiamin, potassium and magnesium. Watermelon is also a source of caroteniod antioxidant, lycopene neutralizing free radicals in the body. Watermelon seeds are rich in fat and protein, and are widely eaten as

snacks added to other dishes or used as an oilseed, specialized varieties are grown which have little watery flesh but concentrate into seed production. In China, watermelon seeds are most common snack food, in West Africa, they are pressed for oil and are popular in egusi soup and other dishes. It use as a remedy for fever to prevent the infection of tapeworm, its quench the inflammation associated with asthma, atherosclerosis, diabetes, colon cancer, and arthritis and use for the treatment of catarrh infection, bowel disorder and urinary infection.

Average crop yield of water melon in Nigeria are generally low. This is attributed to several factors, the most prominent of which is the wide spread of soil nutrient deficiency particularly nitrogen, phosphorous and potassium, inefficiency of plant micro nutrients also occurs on a lesser scale. Low availability of soil nitrogen reduces both productivity and profitability of watermelon in Savanna region of Nigeria. Nitrogen is a mobile element that can be easily lost in soil through leaching, erosion and quick mineralization. Thus, the efficient use of organic manure in combination with other improved cultural practices can be one of the most effective means of increasing productivity and output Agi, [9]. There is need to determine which organic manure is best for watermelon production. Therefore, objective of the study is to determine the effect of different organic manures on the growth and yield of watermelon.

2. MATERIALS AND METHODS

2.1 Experimental Site

The field experimental site was conducted at the Federal College of Forestry Mechanization, Afaka Kaduna. Kaduna State. The school lies between latitude 10°37'N and 10°41'N on longitude 70°47°E Otegbeye et al., [10].

2.2 Soil Sampling and Analysis

Soil sample from the experimental site was taken diagonally across the field at 0-15cm and 15-30cm respectively using hand driven soil auger. The soil was bulk and mixed thoroughly in order to have a uniform sample. The sample was analyzed in a soil laboratory for chemical and physical property.

2.3 Experimental Design and Treatment

The treatments were 2500 tones per/ha of poultry manure, 2500 tones per/ha of sheep and goat manure, 2500 tones per/ha of mixture poultry, sheep and goat, and control. Name the treatments as T1, T2, T3, T4 for better understanding. The treatments were replicated four times in randomized complete block design.

2.4 Cultural Practices

2.4.1 Land preparation

The experimental site was cleared, tilled and prepared into beds, these were done manually. The field was layout according to the experiment design.

2.4.2 Seed source

Improved variety Sugar baby was purchased from reputable seed supplier. It was treated against soil born disease using Dithane M-45.

2.4.3 Planting spacing

The planting spacing was made of gross size 60 x 30 and net plot size 2 m x 2 m. The planting spacing 60 x 30 of inter and intra row spacing.

2.4.4 Planting

Planting was carried out by digging hole at 3 cm and seed 2 seed per hole.

2.4.5 Nutrient application

The poultry and sheep/goat manure was applied according to the treatment recommendation. The poultry and sheep/goat were broadcasted on the field and incorporated into the soil.

2.4.6 Weed control

Manual hoe weeding was carried out to control weed in the experimental field when it is necessary.

2.5 Observation and Measurement of Growth Parameters

2.5.1 Plant vine length

The plant length vine was measured by the use of a meter rule at 2, 4, 6, 8, 10 and 12 weeks after planting (WAP).

2.5.2 Number of leaves

The number of leaves was determined by counting the leaves per plant tagged on each plot at 2, 4, 6, and 8 weeks after planting (WAP).

2.5.3 Number of branches

The number of branches was determined by counting the branches per plant tagged at 2, 6 and 8 weeks, after planting (WAP).

2.6 Observation and Measurement of Yield Parameters

2.6.1 Yield weight per plot at harvest

The fruits were harvested when they attained the maturity stage and were weighted and recorded from each plot.

2.6.2 Fruit diameter

The fruit diameter was taken by typing a rope round the central part of each fruit on the plot and the mean was recorded.

2.6.3 Number of fruits per Plot

The number of fruit per plot was observed, counted. and recorded.

2.7 Statistical Analysis

The data collected were subjected to statistical analysis of variance (ANOVA) as described by Schedecor and Cochran [11]. Mean separation was carried out using Duncan Multiple Range Test as suggested by Duncan [12].

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Soil analysis

The result of physical and chemical properties of soil prior to cropping is presented in Table 1. The percentage of organic carbon was 0.5% at 0-15cm soil depth compared to 0.38% at 15-30 cm; Lower organic carbon might be because of lower addition of manures, high temperature and microbial degradation. The nitrogen percentage was 0.043% at 0-15 cm latter reduced to 0.033% at 15-30 cm due to the crop planted that used the nitrogen fixing nutrients to form green pigments of the plants. The pH value was 6.40 (H_20) and 5.20 ($CaCl_2$) at 0-15 cm compared to 6.40 (H_20) and 5.40 ($CaCl_2$) at 15-30 cm which shows that the soil was slightly acidic. The value of available phosphorus, calcium, magnesium, potassium and sodium at (0.15 cm) and (15-30 cm) soil depth were 8.75 to 7.00 mg/Kg, 4.00 to 4.00 Cmol/Kg, 1.16 to 1.36 Cmol/Kg, 0 11 to 0.97 Cmol/Kg and 0.32 to 0.44 Cmol/Kg, respectively. The value of effective cation exchange capacity (ECEC) was 7.50% to 9.40%, sand was 68% to 54%, silt was 16% to 16% and clay soil was 16% to 30%. The soil was deficient therefore; application of organic manures will benefit the soil and crop planted.

3.2 Plant Vine Length (Cm)

The result of effect of different organic manure on plant vine length (cm) of water melon is shown in Table 3. The analysis of variance showed that at 2WAP, poultry manure was more significant than any treatment on the plant vine length. Treatment with the combination of poultry and sheep/goat manure and goat/sheep manure had no significant different while the control had the least effect among the treatments. At 4WAP all the treatments had no significant different, at 6WAP treatment of goat/sheep manure has the highest plant vine length, follow by poultry manure and then treatment with the combination of poultry and goat/sheep manure while the least was the control. At 8WAP, poultry manure had the highest vine length, follow by the combination of poultry and goat/sheep manure and then goat/sheep manure. Throughout the treatments control had the least effect. The result obtained agreed with the study of Agi [9].

3.3 Number of Leaves

The result of effect of different organic manure on number of leaves of water melon is shown in Table 3. The result showed that at 2 WAP, application of poultry manure and the combination poultry and goat/sheep manure has the highest number of leaves i.e there was no significant different between the two treatments. Treatment goat/sheep manure and control also had the same value which also shows that there was no significant different. At 4WAP and 6 WAP there were no significant different among the treatments. At 8 WAP treatment goat/sheep manure had the highest number of leaves, followed by the treatment with the combination of poultry and goat/sheep manure, then followed by poultry manure application while the control had the least effect. The result obtain agreed with the work of Aliyu [13].

Table 1. Physical and chemical properties of soil prior to cropping

Treatments	0-15 cm	15-30 cm
Clay %	16	30
Silt %	16	16
Sand %	68	54
Textural Class	Sandy Loam	Sandy clay loam
H_20 pH	6.40	6.00
$CaCl_2$ pH	5.20	5.40
OC%	0.50	0.38
TN %	0.043	0.033
P (Mg/Kg)	8.75	7.00
Ca (Cmol/Kg)	4.00	4.00
Mg (Cmol/Kg)	1.16	1.36
K (Cmol/Kg)	0.11	0.97
Na (Cmol/Kg)	0.32	0.44
C.E.C (Cmol/Kg)	7.60	9.40

Table 2. Effect of different organic manure on plant vine length (cm) of Water Melon (*Citrullus Lanatu)*

Treatments	Rate/Ha	2 WAP*	4 WAP	6 WAP*	8 WAP*
Poultry manure	2.5 tonnes	8.209a	137.90	223.30b	216.30a
Poultry manure and Goat/Sheep manure	2.5 tonnes	8.00b	96.80	199.90c	213.50b
Goat/Sheep manure	2.5 tonnes	8.00b	102.70	247.80a	201.80c
Control	No manure	7.00c	46.40	137.70d	148.20d
SE ±		0.53	12.5	30.24	25.74

Means with the same letter across the column are not significantly different at P = 0.05 according to LSD
WAP = Weeks after planting.

Table 3. Effect of different organic manure on number of leaves

Treatments	Rate/Ha	2 WAP*	4 WAP	6 WAP	8 WAP*
Poultry manure	2.5 tonnes	5.20a	25.30	31.10	37.20b
Poultry manure and Goat/Sheep Manure	2.5 tonnes	5:20a	25.70	34.10	40.10a
Goat/Sheep manure	2.5 tonnes	5.00b	25.80	35.70	40.30a
Control	No manure	5.00b	14.90	23.00	29.10c
SE ±		0.21	191.94	2.47	3.66

Means with the same letter across the column are not significantly different at P = 0.05 according to LSD
WAP = Weeks after planting.

3.4 Number of Branches per Plant

The result of effect of different organic manure on number of branches per plant for water melon is shown in Table 4. The result showed that at 4 WAP, 6 WAP and 8 WAP there were no significant different among all the treatment applied. All result obtained on the number of branches had no significant different. The result obtained in this study is similar to the study of Balaubramanian (1992).

How you connect number of leaves and branches with nutrient and yield. Cite with references

3.5 Weight of Fruits (kg)

The result of effect of different organic manure on fruit weight, diameter of fruit and number of fruits produced for water melon is shown in Table 5. The analysis of variance showed that there was no significant difference (P = 0.05) in the weight of fruits per plant across the treatments. However water melon plant with application of poultry manure produced the highest value (10.72 Kg) compared with control of (0.48 Kg) which has the least mean yield value. The percentage yield showed that plants with poultry manure treatment had 34.25% of total yield

weight when all the yield weight for the four treatments was combined together.

3.6 Diameter of Fruits (mm)

The result in Table 5 also revealed that there was no significant difference (P=0.05) across treatments of different organic manure application at the same level, plots with application of poultry manure had the highest mean fruit diameter value of (53.25 mm) followed by goat/sheep manure and combination of poultry manure and goat/sheep manure with fruit diameter mean values of (51.80 mm) and (51.30 mm), respectively while the least fruit diameter mean value of 10.17 mm was obtained for control treatment with no application or zero application of organic manure

3.7 Number of Fruits

There was no significant difference (P = 0.05) between the treatments in respect to number of fruits produced as shown in Table 5. Plants with application of poultry manure has the highest mean value of (28.44 fruits), followed by application of goat/sheep manure (27.04 fruits) compared with the control that had zero application that had a mean fruit number value 4.60 fruits.

3.8 Discussion

The slight increase in the plant height number of leaves and number of branches could be as a result of organic manure of different rates of available nutrient in the combination of organic manure applied, also the increase of fruit weight could be as result of uptake nutrient from the treatments applied to the crop by the root and also as result of the improvement in the soil structure, base from the literature review by Agi, [9]. The value increase in the yield due to the organic manure of different rate applied compared to the treatment. This agreed with Mulogomy and Merkx, [14] who found out that the yield in the particular cropping system as the result of the two opposing process which are the formation of fresh organic matter and the decomposition of existing of soil organic matter. According to Bredero, [15] that intensive farming with goat and poultry manure would meet the phosphate concluded that additions of organic manure into the soil to ensure that macro element are more available for uptake by the crop.

Table 4. Effect of different organic manures on the number of branches per plant

Treatments	Rate/Ha	4 WAP	6 WAP	8 WAP
Poultry manure	2.5 tonnes	25.00	5.20	5.20
Poultry manure and Goat/Sheep manure	2.5 tonnes	4.50	5.20	5.40
Goat/ Sheep manure	2.5 tonnes	3.80	5.19	5.10
Control	No manure	1.90	3.20	3.20
SE ±		0.49	0.46	0.49

Means with the same letter across the column are not significantly different at P = 0.05 according to LSD
WAP = Weeks after planting.

Table 5. Yield and yield parameters of water melon at harvest

Treatment	Rate/Ha	Weight of fruit	Diameter of Fruit	Number of fruit
Poultry manure	2.5 tonnes	10.72	53.25	28.44
Poultry manure and Goat/Sheep manure	2.5 tonnes	9.40	51.30	26.90
Goat/Sheep manure	2.5 tonnes	10.70	51.80	27.04
Control	2.5 tonnes	0.48	10.17	4.60
SE +		2.39	5.34	0.87

Means with the same letter across the column are not significantly different at P = 0.05 according to LSD
WAP = Weeks after planting.

4. CONCLUSION AND RECOMMENDATION

The study observed that the performance of poultry manure improved the yield of water melon compared to others treatments applied. Yield obtained as a result of effect of organic manure on the fruit weight showed that poultry manure has the highest percentage yield of 34.25% of the total weight of fruit obtained, followed by goat/sheep manure of 34.19 % all treatments except control are giving similar result compared to control treatment of 1.53% which is the least. The study therefore recommend that poultry manure should be adopted by farmers in this ecological zone as the source of organic manure for production of water melon *(citrullus lancitus)* in order to achieve bumper harvest.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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