GROWTH AND FRUIT YIELD OF WATER MELON (*Citrullus lanatus*) AS INFLUENCED BY COMPOST AND NPK FERTILIZER

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Abstract: The study assessed the influence of compost and NPK fertilizer rates on the growth and fruit yield of water melon in 2008 and 2009 growing seasons. There were 24 treatments combination which consisted of four different varieties of water melon: sugar baby, kaolack, crimson sweet and charlston crey), six different types of fertilizer which were: 0% NPK, 100% NPK, 100% compost, 75% NPK + 25% compost, 50% NPK + 50% compost, and 25% NPK + 75% compost The experiments was laid out in a randomized complete block design with three replications. Data were collected on the growth and yield parameters of the crop and analyzed using analysis of variance (ANOVA) at 5% level of probability. The results showed that application of compost and NPK fertilizer enhanced plant growth and fruit yield. The leaf number of Sugar baby variety is significant ($P \leq 0.05$). Sugar baby variety also produced the longest primary vine from application of 25%NPK + 75compost. Application of 50% NPK + 50% compost produced significant ($P \leq 0.05$) higher number of fruit per plant (15.0) from kaolack variety. Kaolack variety also gave the highest number of fruit (15.0) through the addition of 50% NPK + 50% Compost. Charlston crey produced the best fruit weight of (1.86 kg). Application of 50% NPK + 50% compost produced the highest fruit weight of (3.13 kg) for charlston crey variety .Therefore it was evident that application of fertilizer had effects on the growth and fruit weight of water melon in this study.

Keywords: Water melon, compost, NPK fertilizer, fruit weight.

Introduction

Water melon (*Citrullus lanatus*) is a fruit vegetable which belong to the family Curcubitacea (Wikipedia, 2013). It is widely cultivated mainly in the warmer region of the continent which is referred to as a warm season fruit vegetable (Wikipedia, 2013). It is cultivated largely for its fruits pulp which serves as a desert or be used in salad. It is also an important crop that are rich in water which help in preventing dehydration during drought period and also aid digestion of food (Sabo *et al.*, 2013). It is highly nutritious and contains thiamine water soluble B vitamin that helps the body cells converts carbohydrate into energy. It is also essentials for the functioning of the heart muscles and nervous system. (Wikipedia, 2013)

The major constraints to water melon production in this agro ecological zone include poor soil condition and insect pest infestation. Water melon like any other member of curcubitacea is associated with many insects pest and damage of melon by pests could be up to 75% to 95% total yield loss when the associated pest were not controlled (Shipper, 2000).The use of fertilizers on the other hand help to maintain adequate yield and also add one or more plant nutrient into the soil. Application of organic manure in sufficient quantities ensures the release of nutrients rather slowly and steadily over a long period and also improves the soil fertility status by activating the soil microbial biomass (Ayuso *et al.*, 1996; Belay *et al* 2001). But the use of organic manure is limited by the huge quantities required to satisfy the nutritional needs of crops and such huge quantities are obviously not obtainable and even if they were, transportation and handling costs would still constitute a major constraint. It is therefore obvious that the use of inorganic fertilizers will help to solve the problem of organic manure .But these are not usually available and always rather expensive. In other to address the bulkiness of organic materials and high cost of inorganic fertilizers a complimentary use of organic and in organic fertilizers has been recommended for sustenance of long term cropping in the tropics (Palm *et al.*, 1997; Ipinmoriti 2002). The combination rates of both fertilizers as well as optimal rate of application in water melon production however are still not highly investigated. Hence this study was conducted to assess the effects of different fertilizer combinations on the growth and yield of water melon in southern guinea savanna of Nigeria

Materials and Methods

The experiment was conducted at the Teaching and Research Farm of Ladoke Akintola University of Technology Ogbomoso, Oyo State, Nigeria in 2008 and 2009 cropping season. The site is on latitude 8^0 10' N and longitude 4'10'E at 420 m above the sea level. The experimental soil was moderately drained sandy loamy (Table 1). The vegetation of the area include weed species like wild sunflower (*Tithonia diversifolia*), tridax procumbean, guinea grass and imperata cylindrical mixed with scattered shrubs and trees notably locust bean trees (*Parkia biblobosa*) The treatments consisted of four varieties of water melon: sugar baby, (V1), kaolack, (V2), crimson sweet, (V3) and charlstoncrey, (V4) and six fertilizer treatments Which were: 0% NPK (control), 100% NPK, 100% compost, 75% NPK + 25% compost, 50% NPK + 50% compost, and 25% NPK + 75% compost. The compost treatments were applied two weeks before planting while the fertilizer was applied a week after germination. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The plot size was 3 x 3 m with 2 m margin round each plot which contain 16 plants spaced at 1m x1m.The mineral fertilizer used was NPK (15: 15: 15) while the compost manure used was made from poultry manure ,ash, maize stover, cassava peel in ratio of(1:1:3:1) sing composting procedure of Akanbi (2004). Plot were weeded using hoe fortnightly while insect pest was controlled using cypermethrin at the rate of 40 ml to 20 liter of water starting from two weeks after planting and as at when

necessary. Water melon growth parameters assessed were: number of leaves, number of secondary vine, length of primary vine and number of flower. The fruit yield parameters were: number of fruit per plant, fruit weight, fruit girth, fruit length, pulp weight, number of seeds and seed weight. The data collected were analyzed using (ANOVA) at 5% level of probability and significant different mean values were separated using LSD.

Table 1: Soil chemical and physical properties

PH	5.81
Organic carbon	2.90
Available N	0.26
Available P	7.40
Exchangeable K	0.29
Exchangeable Ca	3.11
Exchangeable Mg	0.5
% Sand	86
% Silt	7.50
% Clay	6.50

Results and Discussion

The main effect of fertilizer application on the number of leaves and length of primary vein was significant in the study. The control plot gave the highest number of leaves which was similar statistically from the plants that received 100% NPK fertilizer. The same trend was also observed for length of primary vein while the secondary vein produced no significant difference among the fertilizers applied (Table 3) Sugar baby variety produced the highest leaves number of (15.0) followed by charlstoncrey variety (14.08) while the least number of leaves was recorded from kaolack variety (11.65) (Table 3). The interactive effect of variety and fertilizer was also significant (P≤0.05). The length of the primary vine was enhanced by the application of fertilizers and sugar baby variety treated with 25% NPK + 75% compost had the longest primary vine of (29.7 m) while the least recorded from kaolack and crimsom sweet varieties having (14.73 m) and (14.30 m), respectively (Table 6). Application of 75% NPK + 25% compost to crimson sweet variety produced the best secondary vine of (2.27) which is not different statistically from sugar baby variety treated with 25% NPK + 75% compost, while the least secondary vine was from the variety kaolack treated with 75% NPK + 25% compost (Table 6). The increased in the growth parameters of water melon in the study may be due to the supply of adequate nutrients by the fertilizers for proper growth and development. This is in line with the report of John *et al.* (2004), that organic fertilizers such as compost supply essential nutrient elements associated with high photosynthetic activities and thus promote roots and vegetative growth. Also, Lawal (2000) and Agba *et al.* (2005) reported an increase in growth and yield component of watermelon in respond to increased level of fertilizer application.

Table 2: Chemical properties of matured compost

Properties	Matured compost
%N	6.60
%P	10.20
%K	1.82
%Ca	2.80
%Mg	0.56
%Fe	320.80
%Zn	98.50
%Cu	16.80

Table 3: Main effect of fertilizer types and varieties on number of leaves, length of primary vine and number of secondary vine on water melon

Treatments	No of Leaves	Length of primary vine	No of secondary vine
Fertilizer Types			
100% Compost	11.53	19.91	1.18
100% NPK	14.11	21.17	1.60
25%NPK+75%Compost	13.13	20.74	1.58
50%NPK+50% Compost	12.37	19.21	1.33
75%NPK+25% Compost	13.18	19.12	1.40
Control	15.66	23.52	1.40
S.E.D	**0.044**	**0.076**	**0.037**
L.S.D. $_{0.05}$	**0.089**	**0.152**	**0.075**
Varieties			
Sugar baby	15.06	24.54	1.66
Kaolack	11.65	19.58	1.30
Crimson sweet	12.52	18.12	1.34
Charlston crey	14.08	20.20	1.36
S.E.D	**0.036**	**0.062**	**0.031**
L.S.D. $_{0.05}$	**0.073**	**0.124**	**0.061**

Table 4: Main effect of fertilizer types and varieties on number of fruits, number of seeds, number of unfilled seeds and number of good seeds of water melon

Fertilizer Type	NF	NS	NUS	NGS
100% C	9.21	247.83	64.08	183.83
100% NPK	8.79	188.25	51.17	136.92
25%NPK+75% C	8.20	256.25	12.89	244.25
50%NPK+50% C	11.15	251.67	43.10	207.67
75%NPK+25% C	10.27	214.25	38.08	175.58
Control	8.28	209.50	29.03	180.42
S.E.D	**0.043**	**0.598**	**0.276**	**0.512**
L.S.D. $_{0.05}$	**0.087**	**1.203**	**0.556**	**1.039**
Varieties				
Sugar baby	10.23	254.67	45.50	208.83
Kaolack	12.24	221.39	18.71	203.50
Crimson sweet	5.59	220.22	58.85	160.94
Charlston crey	9.21	215.28	35.80	179.17
S.E.D	**0.035**	**0.488**	**0.226**	**0.421**
L.S.D. $_{0.05}$	**0.071**	**0.982**	**0.454**	**0.848**

C = Compost, NF= Number of fruits, NS= Number of seeds NUS= Number of unfilled seeds, NGS= Number of good seeds

Fruit yield parameters

The main effect of fertilizer on fruit yield parameters was also significant. The plot that received 50% NPK + 50% compost produced the highest number of fruits which was followed by 75% NPK + 25% compost fertilizer application (Table 4). In the same vein the plants that received 25% NPK + 75% compost gave the highest length of seed and this is followed by plants that were given 50% NPK + 50% compost and the least length of seed was recorded from the control plants. Furthermore fertilizer application of 100% compost produced the highest number of unfilled seed followed by addition of 100% NPK while the least number of unfilled seed was recorded from the plot that received 25% NPK + 75% compost (Table 4). Number of good seeds was significantly highest (P≤0.05) from the plants that received 25% NPK + 75% compost and it was followed by the application of 50% NPK + 50% compost treatment and the least number of good seeds was recorded from addition of 100% NPK. Variety effect was also significant (P≤0.05) on the fruit parameters measured in the study. Kaolack variety produced the highest number of fruits followed by the sugar baby variety. In the same vein sugar baby variety gave the highest length of seed and number of good seeds while crimson sweet variety gave the highest number of unfilled seeds (Table 4). Fertilizer main effect on fruit weight of the plant was significant (P≤0.05).

Application of fertilizer at 50% NPK + 50% compost produced the highest fruit weight of (2.56 kg) while the least fruit weight (1.46 kg) was recorded from 100% NPK .The same trend was observed with respect to fruit yield. Seed weight and pulp weight showed no significant difference among the fertilizer applied (Table 5).Variety effect was significant also on all the fruit parameters measured. Charlstoncrey variety produced the highest fruit weight (2.10 kg) followed by crimson sweet variety (2.07 kg) and the least fruit weight was recorded from sugar baby variety (1.50 kg).The same trend was also observed for pulp weight. Charlstoncrey variety produced significantly highest fruit yield in the study followed by kaolack variety and the least fruit yield from crimson sweet variety (Table 5).

Table 5: Main effect of fertilizer types and varieties on fruit weight, seed weight, pulp weight and fruit yield of water melon

Fertilizer Types	FW (kg)	SW (g)	PW (g)	FY (kg/ha)
100% C	1.61	0.33	0.94	16.01
100% NPK	1.46	0.31	1.00	13.79
25%NPK+75% C	1.94	0.45	1.03	17.98
50%NPK+50% C	2.56	0.74	1.47	31.06
75%NPK+25% C	1.67	0.53	0.95	17.47
Control	1.61	0.12	0.97	14.13
S.E.D	**0.018**	**0.057**	**0.006**	**0.029**
L.S.D. $_{0.05}$	**0.036**	**0.115**	**0.012**	**0.059**
Varieties				
Sugar baby	1.50	0.22	0.70	17.04
Kaolack	1.56	0.48	1.07	20.92
Crimson sweet	2.07	0.40	1.19	13.08
Charlston crey	2.10	0.55	1.30	22.59
S.E.D	**0.014**	**0.047**	**0.005**	**0.024**
L.S.D. $_{0.05}$	**0.029**	**0.094**	**0.010**	**0.048**

C = Compost, FW = Fruit weight, SW = Seed weight, PW = Pulp weight, FY = Fruit yield

Table 6: Effect of fertilizer types and varieties on number of leaves, length of primary vine and number of secondary vine on water melon

Fertilizer Types	Varieties	NL	LPV	NSV
100% C	Sugar baby	10.77	19.53	0.83
	Kaolack	11.60	21.60	1.23
	Crimson sweet	8.73	14.30	0.93
	Charlston crey	15.03	24.20	1.73
100% NPK	Sugar baby	17.37	26.70	1.90
	Kaolack	11.77	20.20	1.77
	Crimson sweet	11.20	16.70	1.47
	Charlston crey	16.10	21.07	1.27
25% NPK+75% C	Sugar baby	15.83	29.70	2.17
	Kaolack	10.73	18.23	1.33
	Crimson sweet	10.00	15.40	0.97
	Charlston crey	15.93	19.63	1.83
50% NPK+50% C	Sugar baby	16.13	22.03	1.63
	Kaolack	9.77	16.57	1.20
	Crimson sweet	12.37	22.70	1.60
	Charlston crey	11.20	15.53	0.90
75% NPK+25% C	Sugar baby	13.30	20.60	1.83
	Kaolack	10.57	14.73	0.70
	Crimson sweet	18.17	23.33	2.27
	Charlston crey	10.67	17.80	0.80
Control	Sugar baby	16.97	28.67	1.60
	Kaolack	15.47	26.13	1.57
	Crimson sweet	14.63	16.30	0.80
	Charlston crey	15.57	22.97	1.63
S.E.D		**0.088**	**0.151**	**0.075**
L.S.D. $_{0.05}$		**0.178**	**0.304**	**0.151**

C = Compost; NL = Number of leaves; LPV =Length of primary vine; NSV = Length of secondary vine

The interaction of fertilizer and variety showed kaolack variety fertilized with 50% NPK + 50% compost to produced the highest fruit number while the least was from crimson sweet applied with 75% NPK + 25% compost (Table 7). Charlstoncrey variety through the application of 50% NPK + 50% compost gave the highest mean value (3.13 kg) of fruit weight while the least mean value of 0.9 kg fruit weight was obtained from kaolack variety fertilized with 75% NPK + 25% compost (Table 8).The best fruit yield of water melon was obtained from charlstoncrey variety when fertilized with 50% NPK + 50% compost (38.67 ton/ha) while the least (6.27 ton/ha) was from crimson sweet variety fertilized with 25% NPK + 75% compost (Table 7). Fruit pulp weight measurement for all the varieties in this study showed charlstoncrey variety fertilized with 50% NPK + 50% compost to produced the highest pulp weight of 1.87 kg and follow by crimson sweet variety(1.69 kg) and the least pulp weight of (0.51 kg) from sugar baby variety that received 100% NPK (Table 8).Fertilizers application increased the fruits yield parameters of the crop which may be attributed to the ability of the compost and NPK fertilizer to promote vigorous growth, increased meristematic and physiological activities in the plant due to nutrients supply and improvement in the soil properties, thereby resulting in the synthesis of more photo-assimilates which is used in producing fruits (Dauda *et al.*, 2008).

Table 7: Effect of fertilizer types and varieties on number of fruits, number of seeds, number of unfilled seeds and number of good seeds on water melon

Fertilizer Types	Varieties	NF	NS	NUS	NGS
100% C	Sugar baby	10.20	260.00	80.33	178.67
	Kaolack	13.03	266.00	19.00	249.00
	Crimson sweet	5.60	221.33	114.67	105.67
	Charlston crey	8.00	244.00	42.33	202.00
100% NPK	Sugar baby	11.73	237.67	39.33	198.67
	Kaolack	12.27	125.00	25.33	100.33
	Crimson sweet	4.20	150.00	101.33	47.33
	Charlston crey	6.97	240.33	38.67	201.33
25% NPK+75%C	Sugar baby	8.60	278.67	10.33	268.00
	Kaolack	9.10	303.00	6.17	298.67
	Crimson sweet	3.03	237.00	6.07	231.67
	Charlston crey	12.07	206.33	29.00	178.67
50% NPK+50% C	Sugar baby	10.57	331.00	70.67	261.67
	Kaolack	15.00	184.00	21.23	161.33
	Crimson sweet	7.97	261.00	15.17	245.00
	Charlston crey	11.07	229.00	65.33	162.67
75% NPK+25% C	Sugar baby	10.60	176.00	30.33	144.33
	Kaolack	13.70	219.00	17.17	201.33
	Crimson sweet	7.17	321.00	90.53	231.33
	Charlston crey	9.60	141.00	14.00	125.33
Control	Sugar baby	9.67	244.67	42.00	201.67
	Kaolack	10.33	231.33	23.33	210.33
	Crimson sweet	5.57	131.00	25.33	104.67
	Charlston crey	7.57	231.00	25.47	205.00
S.E.D		**0.087**	**1.195**	**0.552**	**1.032**
L.S.D. $_{0.05}$		**0.174**	**2.406**	**1.112**	**2.077**

NF =Number of fruits, NS = number of seeds, NUS =Number of unfilled seeds, NGS = Number of good seeds, C = Compost

Seed parameters

Applied fertilizer and compost had significant influenced on the seed parameters of water melon taken. The highest number of seeds irrespective of fertilizer and compost treatments showed sugar baby variety to produced the highest values of (331) when treated with 50% NPK and 50% compost and the least seed number from kaolack variety treated with 100% NPK .This showed the genetic superiority of sugar baby variety over other varieties in the study (Table 7)

The number of good and unfilled seeds per fruit were also recorded, and kaolack variety treated with 25% NPK +

75% compost had the highest number of good seeds per fruit when compares with other variety and treatments and the addition of 100% NPK to crimson sweet gave the least number of good seeds. The highest number of unfilled seed per fruit was obtained from crimson sweet variety when it received 100% compost (Table 7) .Seed weight of the fruit was also taken and charlston crey treated with 25% NPK + 75% compost gave the best seed weight of (0.99 kg) which is significantly similar to (0.93) produced by kaolack from the addition of 100% compost (Table 8).

The number of rotten fruits per plant was also assessed in all the varieties fertilized and charlston crey produced the highest number which is similar to the value obtained with crimson sweet when treated with 100% NPK.

Conclusion

The use of NPK fertilizer and compost improved the performance of water melon when compared with unfertilized plants. All growth and yield parameters measured were positively improved by NPK and compost application which supported Smith *et al.* (1992), Ojo and Olufajo (1997) that adequate nutrient available for growing plants improves crop growth and yield parameters. Also the main and interactive effect of compost and NPK fertilizer were significant on all the parameters considered and for the most of the traits best values were obtained with the combine application of mineral and compost fertilizer especially at the rate of 50% NPK + 50% compost.

Hence application of 50% NPK + 50% compost is adequate for the production of watermelon in the study area.

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