Trends in
Agricultural
Sciences

OPEN ACCESS

Impact of Fertilizer Sources and Water Supplies on the Growth and Yield of Watermelon Varieties in Oyo State, Nigeria

[1]R.F. Asafa, [2]A.E. Ojeleye and [1]W.B. Akanbi

[1]*Department of Crop Production and Soil Sciences, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria*

[2]*Department of Agronomy, College of Agriculture, Osun State University, Osogbo, Osun State, Nigeria*

ABSTRACT

Background and Objective: The use of organic fertilizers is an agricultural practice that enhances soil fertility and plant quality. This study reported the influences of fertilizers on the yield of watermelons. **Materials and Methods:** Field experiments were conducted to assess the impacts of mineral fertilizers, organic fertilizer (Sawdust Compost, SDC) and their combinations on two varieties of watermelon during early and late raining season and under irrigation in Ogun-Osun River Basin Project Site Sepeteri, Oyo-State. Plants without mineral or organic fertilizers served as control treatments. All experiments were arranged in a Randomized Complete Block Design with three replications. Data collected, which included Crop Growth Rate (CGR), Relative Growth Rate (RGR), Net Assimilate Ratio (NAR), dry matter weight, fruit yield and plant nutrient uptake, were subjected to analysis of variance at a 5% level. **Results:** The results showed significant differences ($p<0.05$) for all the treatments tested when compared to the control. The highest value of CGR (39.86/plant) was obtained between 6-8 weeks with Kaolack variety fertilized with 13.2 t ha^{-1} SDC during the late raining season. Kaolack fertilized with 13.2 t ha^{-1} SDC during the early raining season produced the highest dry matter weight with the value of 88.81 g/plant. The highest mean fruit weight and fruit yield of 5.05 kg and 98.96 t ha^{-1} respectively were recorded with Kaolack fertilized with 13.2 t ha^{-1} SDC under irrigation. **Conclusion:** It is concluded that Kaolack watermelon variety fertilized at 13.2 t ha^{-1} SDC fertilizer under irrigation is recommended for high fruit yields.

KEYWORDS

Fertilizers, irrigation, rainfed, rates, sources, watermelon, yield

INTRODUCTION

Watermelon (*Citrillus lanatus* L.) is a member of the family Cucurbitaceae, kingdom, Plantae, order: cucurbitales, Genus: Citrullus and species: Lanatus[1,2]. It is the vine-like plant (Climber or Trailer) herb[3]. Watermelons are consumed as deserts, fresh-cut fruit and as juice[4]. It is an excellent source of vitamin A, C and vitamin E. It also provides a significant amount of vitamin B as well as, minerals such as Potassium (K), Magnesium (Mg), Iron (Fe), Manganese (Mn), Phosphorus (P), Sodium (Na) and Zinc (Zn)[5]. Cultural practices have been reported to affect fruit yield, quality and phytochemical contents of watermelon

ISSN: 2957-9449 (Online)
ISSN: 2957-9430 (Print)
https://doi.org/10.17311/tas.2022.51.64

Received: 17 Dec. 2021
Accepted: 12 Mar. 2022
Published: 01 Oct. 2022

fruits[6,7]. Among the major inputs of cultivation, watermelon responds positively to fertilizer applications[8]. The quantity applied depends on the soil type, climate and system of planting. In general, high nitrogen under high-temperature conditions promotes maleness in flowering and lowers the number of females or perfect flowers, resulting in low fruit set[9,10]. Watermelon is a heavy feeder of nitrogen[11] and therefore requires a liberal application of 200 kg N ha^{-1} [12,13]. An adequate supply of nitrogen is associated with high photosynthetic activity, vigorous vegetative growth and dark green colour of crop leaves[14]. Nitrogen has been frequently recognized as a major factor affecting watermelon yield[15]. Sabo *et al.*[16] found that nitrogen up to 120 kg ha^{-1} increased fruit yield, whereas Locascio *et al.*[17] reported that optimum yield could be achieved with nitrogen rates from 130-145 kg ha^{-1}. In the arid region, maximum yields were obtained with nitrogen application as high as 220-300 kg ha^{-1} [18]. However, excessive use of inorganic fertilizer has a depressing effect on fruit yield. This could cause excessive vegetative growth, delays in fruit set, which subsequently leads to a reduction in the number of fruits and weight of fruits produced[19].

Management of mineral fertilizers has also become increasingly critical in crop production from both an economic and environmental standpoint. The use of minerals fertilizer by farmers is limited because of scarcity, high costs and inability to substantially redress the physical fragility and chemical deterioration of the soil[20,21]. This necessitates research on the use of organic wastes that are cheap, readily available and environmentally friendly that can be used as fertilizers[22,23]. These organic materials include waste derived from city refuse, animal wastes and other plant residues. Studies have been to confirm poultry manure as an effective nutrient source for increasing yield and nutrient status of crops such as maize, amaranth, sorghum and pepper[24]. Adenawoola[25] also reported the possibility of an increase in soil nutrients with an increase in the application rate of poultry manure. In another study, the application of poultry manure was observed to improve the fruit yield of watermelon[26].

Seasonal variation is one of the significant factors that influence the growth, yield and nutrient contents of watermelon[27]. Early, steady and late rain seasons are targeted by farmers for watermelon planting. However, a major requirement in the development of an agronomic package for watermelon is to determine the most appropriate season for watermelon fruit production. Aguyoh *et al.*[28]. reported the influence of season on watermelon growth and yield performance in Kenya. They reported that the number of leaves, vine length, number of flowers aborted, number of cull fruits, number of marketable fruits and fruit yield were better in the late season than the early one. It would also be of interest to have more information that could help to understand more clearly how agronomic and environmental factors affect the growth and yield of watermelon.

This study seeks to provide sufficient information for the farmers to enhance watermelons production in Oyo-State, Nigeria.

MATERIALS AND METHODS

Study area: The field experiments were conducted on loamy sand soilin 2017 at Ogun-Osun River Basin Project Site Sepeteri, Oyo State, Nigeria. Sepeteri lies between Latitude 8°30'N and longitude 3°37'E. The region is located in the humid tropical region of the southwest within the South Guinea Savanna Zone of Nigeria. The temperature of the area ranges from 20-32°C with humidity of about 82%. Rainfall distribution is bimodal and had 618.70 and 781.1 mm of rainfall in the early and late seasons of 2017, respectively.

Sample collection: Pre-soil samples were collected randomly per block at the depth of 0-15 cm. The samples were air-dried, crushed and sieved through 2 and 0.5 mm meshes for the determination of particle size, pH, organic carbon, organic matter, total nitrogen, available phosphorus (P), exchangeable K, Na, Ca, Mg and exchangeable acidity.

The sawdust compost used was preparedfrom sawdust biomass and well-cured poultry manure. The poultry manure and sawdust biomass were sorted of non-biodegradable materials. The heap method of composting was adopted. The materials were laid out in 3:1 sawdust to poultry manure on dry weight and composted in twelve weeks. The compost heap was watered and turned once a week for the first three weeks then fortnightly until maturity. At maturity, the compost was evacuated and air-dried and samples were taken for determiningtotal nitrogen (1.1 g kg^{-1}), available phosphorus (5.22 g kg^{-1}), exchangeable K, Na, Ca, Mg and Zn with the values of 28.1, 1.8, 1.95 and 0.12 g kg^{-1} respectively.

Methodology: The treatments consisted of two varieties of watermelon (Sugar baby and Kaolack) and twelve nutrient sources and rates were: T_1 = 0 kg N ha^{-1} (Control), T_2 = 333.3 kg ha^{-1} NPK 15-15-15, T_3 = 666.6 kg ha^{-1} NPK 15-15-15, T_4 = 999.9 kg ha^{-1} NPK 15-15-15, T_5 = 1333.2 kg ha^{-1} NPK 15-15-15, T_6 = 4.4 t ha^{-1} sawdust compost (SDC), T_7 = 8.8 t ha^{-1} SDC, T_8 = 13.2 t ha^{-1}, SDC, T_9 = 17.6 t ha^{-1} SDC, T_{10} = 333.3 kg ha^{-1} NPK+4.4 t ha^{-1} SDC, 500 kg ha^{-1} NPK+6.6 t ha^{-1} SDC, 666.6 kg ha^{-1} NPK+8.8 t ha^{-1} SDC. The factorial combination of these treatments gave 24 treatments combinations arranged in a split-plot with three replicates. Plots that received compost only or its combination were uniformly applied to the soil a week before planting while plots that received mineral fertilizer were applied two weeks after sowing. Plot size of 3×3 m (9 m^2) and contained 24 plants/plot and spaced out at 1×0.75 m. Weeding was done manually as required and insect pests were controlled using Cypermethrin and Lambda-cyhalothrin at the rate of 20 mL to 18 L of water with an application at 2 weeks' interval starting from 2 weeks after sowing.

Irrigation management was done using a Centre Pivot Irrigation System (CPIS) to supply water. The overhead sprinkler gross rate of water application was approximately 10 mm at 3 days intervals for the first 6 weeks after sowing and reduced to twice a week after fruiting at 15 psi. The overhead CPIS was operated at night when the wind was at a minimum.

Data were collected on leaf area, leaf area index, crop growth rate, relative growth rate, net assimilate ratio, dry matter weight, fruit yield and plant nutrient uptake. For the determination of plant nutrient uptake three fully expanded leaves (trust leaves) were selected per plant. Sampled leaves were oven-dried at 80°C for 72 hrs to the constant weight and grounded in a Willey mill to reduce the material to a fineness suitable size. The grounded samples were stored in airtight plastic containers for chemical analysis. Total nitrogen was determined by digesting 0.5 g dry leaf samples with 68% H_2SO_4 in the Kjeldahl digestion unit until the sample was colourless and titrated with 0.1 N of H_2SO_4 using selenium and sodium as a catalyst. Total N was determined from the digest by steam distillation with excess NaOH. The P, K, Fe, Cu and Zn plant tissue contents were determined by ashing 0.2 g of the plant samples in a muffle furnace at 600°C for 3 hrs. The ash was cooled and dissolved in 1 N hydrochloric acid and the solution passed through filter paper into a 50 mL volumetric flask and was made up to the mark with distilled water. From the digest, P concentration was determined by the vanadomolybdate yellow colourimetry method using a spectrophotometer. The K was determined by using a flame photometer (Cornin Model 410 manufactured by Sherwood Scientific Ltd., Cambridge, United Kingdom) while micronutrients (Fe, Cu, Zn) were estimated with atomic absorption spectrophotometer (Perkin Elmer AAS-300 product of Agilent, Stevens Creek Blvd Santa Clara, CA 9505, United State).

Nutrient accumulation in the plant was evaluated using the method described by Ombo (1974) as:

$$\text{Nutrient uptake} = \text{Tissue nutrient content} \times \text{sample dry weight (\%)}$$

Statistical analysis: Data collected were subjected to analysis of variance for split-plot and mean were compared using least significant different at 5% probability levels.

RESULTS

The soil texture during both seasons and irrigation were loamy-sand The organic carbon was very low (<10). The total nitrogen is high (>0.2). Available phosphorus (P) was low (<10.0) and potassium was high (>0.3), sodium of early and late was of medium (0.1-0.3) while that of irrigation was high (>0.3). The calcium during the rain-fed and irrigation season was of medium (2-5). The Mg of both seasons was of medium (0.3-1) while, that of irrigation is high (>1). The soil pH of the early and late season was slightly acidic (6.49 and 6.58), respectively while that of irrigationis neutral (7.01). The result of the physicochemical soil properties showed that the experimental area is high infertility (Table 1).

The average temperature during the Irrigation cropping season (January-March) was 30.09°C which was higher than the early season (March-May) with a value of 27.33°C and lower than the late season (August-September) with the value of 31.44°C (Table 2). The compost used for the experiment had a pH of 6.7 with nitrogen contents of 1.1 g kg^{-1}. Phosphorus and Potassium contents were 5.22 and 28.1 g kg^{-1} respectively (Table 3). Calcium, Magnesium and Zinc contents were 1.8, 1.95 and 0.12 g kg^{-1}, respectively (Table 3).

Crop growth rate: The growth and yield parameters assessed were depended on the fertilizer sources and rate of application. There was a significant increment in the crop growth rate of the two varieties of watermelon assessed from 4-6 and 4-8 weeks after sowing during the three growing seasons (Table 4). In the early season, from 4-6 Weeks After Sowing (WAS), Kaolack fertilized at 1333.2 kg ha^{-1} NPK 15-15-15 had the highest (20.00 g/week) CGR when compared to Sugar baby without fertilizer which was not significantly different from Sugar baby fertilized at 333.3 kg ha^{-1} NPK 15-15-15 with the least CGR of 4.67 g/week (Table4). In late season, Kaolack fertilized with 999.9 and 1333.2 kg ha^{-1} NPK 15-15-15 had the highest (8.67 g/week) when compared with the control of both varieties. When irrigation was applied, Kaolack fertilizer with 1333.2 kg ha^{-1} NPK 15-15-15 produced the highest CGR of 21.28 and 35.86 from 4-6 and 6-8 WAS, respectively. From 6-8 WAS, Kaolack fertilized at13.2 t ha^{-1} SDC had the highest of 39.21 g/week CGR while, sugar baby without fertilizer had the least of 20.89 g/week in the early season. In the late season, Kaolack fertilized with 8.8 t ha^{-1} SDC had the highest CGR (39.21 g/week) when

Table 1: Pre-cropping physical and chemical characteristics of soil used for the study at Ogbomoso and Sepeteri

Time of planting	Early	Late	Irrigation
Properties			
pH (H_2O)	6.49	6.58	7.01
Organic carbon (%)	2.18	2.14	2.25
Organic matter (%)	3.45	3.70	3.89
Total N (g kg^{-1})	0.58	0.52	0.71
Available P (mg kg^{-1})	6.44	5.58	8.47
Exchangeable K (c mol kg^{-1})	0.56	0.75	0.83
Exchangeable Na (c mol kg^{-1})	0.25	0.22	0.43
Exchangeable Ca (c mol kg^{-1})	2.16	2.15	2.34
Exchangeable Mg (c mol kg^{-1})	0.75	0.84	1.03
Acidity (c mol kg^{-1})	0.1	0.1	0.2
Sand (%)	83.19	86.46	83.46
Silt (%)	7.00	7.00	7.00
Clay (%)	6.36	6.54	9.54
Textural class	Loamy-sand	Loamy-sand	Loamy-sand

Early season: April-June, Late season: August-November and Irrigation: January-April

Table 2: Rainfall (mm) and temperature (°C) data of the experimental sites

Months	Rainfall	Temperature
January-March	57.50	30.09
March-May	273.2	27.33
August	778.6	31.44

Source: Ogun-Osun River basin development authority, Abeokuta

Table 3: Chemical properties of compost used in the study

Properties	Values
pH	6.7
Total N (g kg^{-1})	1.1
P (g kg^{-1})	5.22
K (g kg^{-1})	28.1
Ca (g kg^{-1})	1.8
Mg (g kg^{-1})	1.95
Zn (mg kg^{-1})	0.12

All measurement was on dry weight

Table 4: Effect of fertilizers sources and rates on crop growth rate (CGR) (g/week) of watermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
CGR 4-6						
F_1	4.67	6.67	3.33	3.33	4.50	8.97
F_2	4.67	11.33	3.40	7.33	10.69	11.67
F_3	6.00	10.67	4.00	8.67	6.54	11.39
F_4	9.33	16.67	5.33	8.67	7.67	14.36
F_5	8.00	20.00	6.67	5.33	11.96	21.28
F_6	6.00	16.00	3.33	5.33	7.28	9.66
F_7	10.00	18.67	2.67	6.00	6.67	13.31
F_8	12.67	18.67	4.00	5.33	8.43	12.65
F_9	11.33	12.67	6.00	4.67	11.52	10.04
F_{10}	5.33	18.67	4.00	4.00	7.98	11.54
F_{11}	18.00	10.00	6.00	4.67	7.39	12.76
F_{12}	7.33	18.00	4.00	5.33	8.39	12.79
LSD	1.642		1.642		6.260	
CGR 6-8						
F_1	20.89	21.03	11.76	12.73	16.74	16.52
F_2	20.97	25.79	24.63	23.41	21.42	25.61
F_3	25.03	30.35	28.59	24.63	22.12	26.74
F_4	22.86	38.36	25.34	13.35	26.16	33.23
F_5	22.88	25.01	26.45	15.75	27.19	34.67
F_6	21.68	22.95	20.95	25.47	20.31	25.26
F_7	22.23	22.49	34.03	14.05	17.47	32.92
F_8	30.55	39.61	23.44	39.21	24.67	35.86
F_9	27.72	24.90	19.99	36.86	33.49	24.56
F_{10}	23.01	26.49	23.67	13.54	21.61	25.32
F_{11}	32.27	25.74	21.05	36.21	26.30	23.74
F_{12}	26.91	29.83	24.01	15.79	27.13	20.30
LSD	1.642		1.642		13.064	

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8tha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

compared with Sugar baby without fertilizer with the least of 11.76 g/week (Table 4). During irrigation, Kaolack fertilized at 13.2 t ha^{-1} SDC produced the highest CGR of 35.86 g/week when compared to 16.52 g/week produced from Kaolack without fertilizer (Table 4).

Relative growth rate (RGR): Fertilizer sources and rates significantly affected the relative growth rate (RGR) of the two watermelon varieties during the three growing seasons (Table 5). During the early season, Sugar baby sown with 13.2 t ha^{-1} SDC had the highest RGR (0.78 g/g/week) from 4-6 WAS while, Kaolack fertilizer with 13.2 t ha^{-1} SDC gave the least (0.33 g/g/week). During the late season, Kaolack fertilized with 999.9 kg ha^{-1} NPK 15-15-15 produce the highest RGR (0.72 g/g/week) while, Kaolack

Table 5: Effect of fertilizers sources and rates on relative growth rate (RGR) (g/g/week) of watermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
RGR 4-6						
F_1	0.46	0.33	0.35	0.22	0.41	0.41
F_2	0.60	0.74	0.49	0.66	0.49	0.59
F_3	0.49	0.38	0.46	0.64	0.40	0.52
F_4	0.75	0.47	0.55	0.72	0.40	0.52
F_5	0.46	0.53	0.49	0.55	0.62	0.57
F_6	0.69	0.46	0.41	0.65	0.42	0.52
F_7	0.51	0.51	0.42	0.59	0.46	0.52
F_8	0.78	0.73	0.39	0.42	0.43	0.41
F_9	0.74	0.50	0.46	0.31	0.49	0.43
F_{10}	0.55	0.53	0.49	0.31	0.43	0.47
F_{11}	0.69	0.72	0.38	0.51	0.37	0.47
F_{12}	0.77	0.51	0.49	0.42	0.45	0.47
LSD	0.0164		0.0164		0.1213	
RGR 6-8						
F_1	0.67	0.69	0.80	0.62	0.49	0.41
F_2	0.77	0.48	0.71	0.64	0.56	0.46
F_3	0.76	0.51	0.78	0.72	0.53	0.52
F_4	0.57	0.20	0.68	0.65	0.52	0.44
F_5	0.55	0.21	0.57	0.71	0.32	0.47
F_6	0.64	0.21	0.76	0.71	0.49	0.41
F_7	0.56	0.18	0.88	0.64	0.46	0.48
F_8	0.41	0.56	0.78	0.65	0.48	0.45
F_9	0.48	0.54	0.70	0.69	0.53	0.42
F_{10}	0.69	0.19	0.84	0.67	0.47	0.40
F_{11}	0.17	0.54	0.67	0.75	0.52	0.41
F_{12}	0.64	0.22	0.74	0.67	0.52	0.34
LSD	0.0164			0.0164		0.1287

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

fertilized with 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} SDC produced the least of 0.22 g/g/week. When irrigation was applied, Sugar baby fertilized with 1333.2 kg ha^{-1} NPK 15-15-15 had the highest RGR of 0.62 g/g/week (Table 5). From 6-8 WAS in the early season, Sugar babies fertilized at 333.3 kg ha^{-1} NPK 15-15-15 gave the highest RGR of 0.77 g/g/week, in the late season, Sugar babies fertilized with the application of 8.8 t ha^{-1} SDC had the highest RGR of 0.88 g/g/week while, during the irrigation, Sugar baby sowed with 333.3 kg ha^{-1} NPK 15-15-15 resulted in highest RGR of 0.56 g/g/week (Table 5). Sugar baby with the application of 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} SDC had the least of 0.17 g/g/week in the early season while, in late season, Sugar baby fertilized with 1333.2 kg ha^{-1} NPK 15-15-15 gave the least of 0.57 g/g/week and during irrigation Kaolack with the application of 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} SDC resulted to least RGR of 0.34 g/g/week (Table 5)

Net Assimilate Ratio (NAR): Net assimilate ratio (NAR) was significantly ($p<0.05$) influenced by fertilizer sources and rates of watermelon varieties during the three growing seasons (Table 6). During the early season, sugar babies sowed with 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} SDC had the highest NAR of 0.22 g/g/week when compared to the least of 0.04 g/g/week produced from Sugar babies without fertilizer from 4-6 WAS. During the late season, Kaolack fertilized with 999.9 kg ha^{-1} NPK 15-15-15 and 13.2 t ha^{-1} SDC produced the highest NAR of 0.08 g/g/week. Sugar baby with the application of 1333.2 kg ha^{-1} NPK 15-15-15 resulted in the highest NAR of 6.33 g/g/week when irrigation was applied.

Table 6: Effect of fertilizers sources and rates on net assimilate ratio (NAR) (g g^{-1}/week) of watermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
NAR 4-6						
F_1	0.04	0.06	0.03	0.05	1.34	1.96
F_2	0.05	0.09	0.03	0.10	2.47	1.18
F_3	0.07	0.10	0.04	0.07	1.04	1.75
F_4	0.10	0.14	0.06	0.08	2.34	1.26
F_5	0.08	0.17	0.06	0.05	6.33	2.40
F_6	0.05	0.18	0.03	0.06	1.39	2.58
F_7	0.10	0.17	0.02	0.06	1.24	1.53
F_8	0.14	0.07	0.05	0.08	1.40	5.07
F_9	0.11	0.10	0.06	0.05	3.11	2.01
F_{10}	0.05	0.17	0.03	0.05	1.85	1.83
F_{11}	0.22	0.11	0.05	0.04	1.20	3.48
F_{12}	0.07	0.14	0.05	0.07	1.18	2.93
LSD	0.0433			0.0257		2.9315
NAR 6-8						
F_1	0.12	0.14	0.12	0.17	3.01	2.87
F_2	0.15	0.12	0.15	0.18	2.09	2.08
F_3	0.17	0.12	0.17	0.24	2.19	2.06
F_4	0.14	0.07	0.17	0.17	1.84	2.22
F_5	0.16	0.08	0.15	0.17	3.17	1.18
F_6	0.10	0.07	0.13	0.17	2.36	2.49
F_7	0.20	0.06	0.15	0.15	2.51	2.12
F_8	0.10	0.20	0.22	0.20	1.51	4.15
F_9	0.13	0.19	0.18	0.19	2.26	1.66
F_{10}	0.11	0.06	0.18	0.15	2.65	3.71
F_{11}	0.08	0.20	0.14	0.25	1.73	3.80
F_{12}	0.14	0.07	0.22	0.20	3.02	1.71
LSD	0.037			0.0586		3.0948

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

From 6-8 WAS in the early season, sugar baby with the application of 8.8 t ha^{-1} SDC and Kaolack fertilized with 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} SDC have the highest NAR of 0.20 g/g/week while, Kaolack with the application of 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} SDC produced the least of 0.06 g/g/week (Table 6). During the late season, Kaolack with the application of 500 kg ha^{-1} NPK 15-15-15+ 6.6 t ha^{-1} SDC had the highest NAR of 0.25 g/g/week while, during the irrigation period, Kaolack fertilized with 13.2 t ha^{-1} SDC resulted in the highest NAR of 4.15 g/g/week when compared to all other treatments (Table 6).

Number of flowers and fruits: Fertilizer sources and rates significantly ($p<0.05$) influenced the number of flowers and fruits of watermelon varieties grown under rain-fed and irrigation. In the early season, Kaolack fertilized with 17.6 t ha^{-1} SDC produced the highest number of flowers per plant (10.67 flowers/plant) when compared to Kaolack without fertilizer with the least of 1.67 flowers/plant. During the late season, Kaolack with the application of 17.6t ha^{-1} SDC produced the highest of 5.00 flowers/plant while Sugar baby without fertilizer produced the least of 2.67 flowers/plant. Under irrigation, Kaolack fertilizer with 13.2 t ha^{-1} SDC produced the highest number of flowers of 21.33/plant (Table 7).

For the number of fruits, during the early season, Kaolack fertilized with 8.8 t ha^{-1} SDC produced the highest of 25.00 fruits/plot while, Sugar baby with the application of 1333.2 kg ha^{-1} NPK 15-15-15

Table 7: Effect of fertilizers sources and rates on several flowers and fruits of watermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
Number of flowers/plant						
F_1	3.33	1.67	2.67	3.33	13.33	9.33
F_2	4.00	8.33	3.67	3.33	12.33	9.33
F_3	2.67	7.33	3.00	3.67	15.33	13.67
F_4	3.33	4.00	3.67	4.00	20.00	10.00
F_5	4.00	6.00	4.67	3.67	15.33	16.67
F_6	5.67	4.00	3.33	3.67	19.33	9.00
F_7	4.67	5.67	3.00	3.67	8.33	13.33
F_8	7.00	6.00	3.00	4.00	15.33	21.33
F_9	7.00	10.67	3.67	5.00	17.00	14.33
F_{10}	7.00	6.67	4.33	4.00	13.33	13.67
F_{11}	5.00	9.00	3.67	4.67	8.00	9.00
F_{12}	6.67	8.33	3.67	4.00	9.33	11.00
LSD	3.167		1.687		8.6134	
Number of fruits/plot						
F_1	10.00	14.00	12.67	15.33	14.00	18.00
F_2	16.00	13.00	13.67	17.00	21.67	26.00
F_3	13.00	22.00	17.00	16.67	18.67	26.67
F_4	13.00	15.00	9.00	15.00	19.67	16.00
F_5	7.00	22.00	14.67	17.67	17.00	19.33
F_6	16.00	16.00	15.67	19.33	16.00	20.67
F_7	16.00	25.00	15.00	13.33	18.00	18.00
F_8	16.67	10.00	11.00	16.33	19.67	23.33
F_9	15.00	10.00	15.33	17.33	19.33	20.33
F_{10}	16.00	13.00	18.00	17.00	28.00	21.33
F_{11}	7.00	22.00	11.67	20.67	23.00	22.67
F_{12}	12.00	11.00	15.67	18.67	17.67	20.67
LSD	1.687			7.883		6.7077

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15; F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11} = 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12} = 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

produced the least number of 7.00 fruits/plot. During the late season, Kaolack fertilized with 500 kg ha^{-1} NPK 15-15-15+6.6t ha^{-1} SDC produced the highest of 20.67 fruits/plot while Sugar baby with the application of 999.9 kg ha^{-1} NPK 15-15-15 had the least of 9.00 fruits/plot. Under the irrigation, the highest number of fruits of 28.00 fruits/plot was from Sugar baby with the application of 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} Sawdust compost SDC while the least of 14.00 fruits/plot was obtained from Kaolack without fertilizer (Table 7).

Dry matter weight and nitrogen uptake: The data collected on dry matter weight and nitrogen plant uptake were significantly influenced ($p<0.05$) by fertilizer sources and rates in both seasons and under irrigation (Table 8). During the early season, Kaolack sown with the application of 13.2 t ha^{-1} SDC produced the highest dry matter weight of 88.81 and during the late season, Kalock fertilized with 999.9 kg ha^{-1} NPK 15-15-15 had the highest of 75.54 g dry matter weight when compared to the least of 42.42 and 39.34 g which were obtained from sugar baby without fertilizer application (control) (Table 8). However, when irrigation was applied, Kaolack fertilizer with 999.9 kg ha^{-1} NPK 15-15-15 had the highest dry matter yield of 48.88 g followed by application of 13.2 t ha^{-1} SDC with the value of 47.33 g when compared to a non-fertilized plant of sugar baby and Kaolack of 16.33 and 20.33 g, respectively (Table 8). The nitrogen uptake of both varieties fertilized with 13.2 t ha^{-1} SDC during the three planting times was significantly higher when compared to all other treatments used except sugar baby with the application of 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} SDC that produces the highest

Table 8: Effect of fertilizers sources and rates on total dry matter weight (TDMW) and nitrogen uptake of watermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
Total dry matter weight (g)						
F_1	42.42	51.21	39.34	44.55	16.33	20.33
F_2	46.94	57.12	41.45	53.69	24.26	32.41
F_3	54.88	57.94	47.54	62.52	30.15	31.60
F_4	56.01	61.02	46.29	75.54	43.06	48.88
F_5	59.68	69.63	50.32	49.52	40.62	34.75
F_6	43.57	61.08	41.52	45.43	17.79	32.51
F_7	57.16	63.10	40.35	46.73	22.78	43.51
F_8	76.04	88.81	60.83	59.41	29.27	47.33
F_9	53.98	82.29	52.58	51.35	41.65	32.05
F_{10}	47.5	63.31	42.51	53.73	25.05	24.06
F_{11}	60.64	82.32	65.4	49.61	30.50	29.74
F_{12}	50.01	65.68	48.37	58.75	31.23	31.42
LSD	1.642			1.642		18.262
Nitrogen (g kg^{-1})						
F_1	0.056	0.057	0.047	0.079	0.33	0.37
F_2	0.072	0.067	0.075	0.096	0.79	0.69
F_3	0.115	0.108	0.157	0.212	0.81	1.13
F_4	0.124	0.119	0.111	0.196	0.64	1.53
F_5	0.111	0.148	0.155	0.133	0.89	0.68
F_6	0.049	0.095	0.075	0.103	0.49	0.98
F_7	0.135	0.109	0.087	0.120	0.49	0.92
F_8	0.153	0.264	0.207	0.258	0.84	1.84
F_9	0.078	0.243	0.131	0.163	1.28	1.84
F_{10}	0.071	0.155	0.141	0.146	0.68	0.81
F_{11}	0.093	0.220	0.141	0.125	2.27	1.11
F_{12}	0.076	0.147	0.131	0.203	0.73	1.14
LSD	0.0033			0.0033		0.1754

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

nitrogen uptake of 2.27 g kg^{-1} under irrigation while the least uptakes were obtained from the non-fertilized plant of the two varieties during the early and late seasons and under irrigation (Table 8).

Phosphorus and potassium uptake: For the P uptake, during the early season, Sugar babies fertilized with 13.2 t ha^{-1} SDC had the highest P uptake of 28.20 g kg^{-1} while, Kaolack without fertilized gave the least of 8.22 g kg^{-1}. During the late season, Kaolack fertilized with 17.6 t ha^{-1} SDC had the highest P uptake of 15.30 g kg^{-1} while sugar baby without fertilizer gave the least of 6.00 g kg^{-1} (Table 9). When irrigation was applied, Kaolack with the application of 13.2 t ha^{-1} SDC produced the highest P uptake of 7.68 g kg^{-1} (Table 9).

For the K uptake, during the early season, Kaolack fertilized with 13.2 t ha^{-1} SDC had the highest K uptake of 21.90 g kg^{-1}meanwhile during the late season, Kaolack fertilized with 1333.2 kg ha^{-1} NPK 15-15-15 had the highest K uptake of 26.90 g kg^{-1} while during the irrigation, Kaolack with the application of 13.2 t ha^{-1} Sawdust Compost (SDC) produced the highest K uptake of 13.97 g kg^{-1}. Sugar babies without fertilization had the least K uptake during the three growing seasons (Table 9).

Mean fruit weight and fruit yield: Fertilizer sources and rates significantly influenced the mean fruit weight during the early season and when irrigation was applied but not significant during the late season. During the early season, the biggest fruit was obtained from Kaolack fertilized at 500 kg NPK 15-15-

Table 9: Effect of fertilizers sources and rates on phosphorus and potassium uptake (g kg^{-1}) of watermelon varieties grown at Sepeteri under rain-fed and irrigation

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
Phosphorus (P)						
F_1	10.12	8.22	6.00	6.40	1.55	4.27
F_2	13.06	13.16	7.12	8.10	4.27	4.53
F_3	13.23	18.90	8.64	10.12	2.02	4.82
F_4	17.20	24.71	13.24	14.28	5.48	7.19
F_5	25.71	21.07	9.44	10.28	5.12	4.79
F_6	26.02	20.10	10.23	11.46	3.94	3.57
F_7	28.20	14.16	11.48	14.21	2.80	4.20
F_8	21.60	28.18	12.29	13.38	4.33	7.68
F_9	16.10	25.16	12.42	15.30	6.44	7.00
F_{10}	17.18	21.07	7.08	9.42	2.31	2.60
F_{11}	22.24	25.21	12.67	13.02	4.55	4.49
F_{12}	27.58	25.28	10.04	11.21	4.95	4.16
LSD	1.642			1.642		0.1398
Potassium (K)						
F_1	14.30	18.80	18.00	18.40	3.85	5.23
F_2	17.70	18.10	24.60	21.60	8.68	7.79
F_3	21.20	19.80	21.90	20.90	6.24	7.79
F_4	19.90	20.30	21.30	24.10	9.36	9.65
F_5	19.10	18.10	23.90	26.90	10.60	7.61
F_6	17.90	20.80	18.50	22.40	5.97	11.42
F_7	18.20	21.70	21.60	23.70	4.34	11.41
F_8	18.60	21.90	20.30	21.20	7.61	13.97
F_9	20.40	21.30	20.10	19.20	11.00	9.67
F_{10}	21.10	21.50	18.50	20.40	7.40	7.74
F_{11}	18.70	21.20	19.80	25.60	9.85	8.04
F_{12}	18.40	19.90	20.50	22.70	9.04	6.72
LSD	1.642			1.642		0.223

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

15+6.6 t ha^{-1} SDC (3.03 kg/fruit), during the late season, a significant difference was not observed while during the irrigation, Kaolack with the application of F_8 had the biggest fruit weight of 5.05 kg/fruit (Table 10).

During the early season, Kaolack with the application of 13.2 t ha^{-1} SDC significant ($p<0.05$) increase the fruit yield with the value of 53.74 t ha^{-1} when compared to the least of 15.96 t ha^{-1} which was obtained from sugar baby without fertilizer. In the late season, Kaolack fertilized with 13.2 t ha^{-1} SDC gave the highest fruit yield of 38.15 t ha^{-1} when compared to Sugar baby with the control that gave the least of 12.22 t ha^{-1}. When irrigation was applied, the yield of 98.96 t ha^{-1} was obtained from Kaolack with the application of 13.2 t ha^{-1} SDC which was % higher than (Table 10).

DISCUSSION

The result of the soil analysis of the three growing seasons showed they were sandy loam and acidic. The available nutrients in the soil were below the nutrient requirements of the watermelon. The relatively low amount of the major nutrients required by the crop alerts the need for augmentation to enhance optimal performance. Inadequate availability of essential nutrients usually limits optimum crop performance. The results of the experiments show the superiority of fertilized plants over non-fertilized plants. These results show that NPK 15-15-15, compost and their combinations significantly influenced the growth, dry matter production and fruit yield in the three growing seasons. During the growing seasons, crop growth rate,

Table 10: Effect of fertilizers sources and rates on mean fruit weight and yield ofwatermelon varieties under rain-fed and irrigation at Sepeteri

	Early		Late		Irrigation	
Treatments	Sugar baby	Kaolack	Sugar baby	Kaolack	Sugar baby	Kaolack
Mean fruit weight (kg)						
F_1	2.15	1.99	1.00	1.13	2.14	2.50
F_2	2.58	2.59	1.10	1.15	2.47	2.80
F_3	2.54	2.08	1.20	1.22	2.19	2.74
F_4	2.73	2.14	1.23	1.40	2.80	3.55
F_5	2.97	2.19	1.27	1.18	2.50	3.58
F_6	2.76	2.14	1.23	1.47	2.70	3.72
F_7	2.86	1.93	1.06	1.16	2.38	3.31
F_8	2.19	2.22	1.40	1.28	2.50	5.05
F_9	2.04	2.07	1.20	1.46	3.10	3.29
F_{10}	2.63	2.11	1.20	1.45	2.83	3.56
F_{11}	3.03	1.96	1.30	1.50	3.09	2.96
F_{12}	2.18	2.30	1.20	1.87	3.02	4.02
LSD	0.239			0.169		0.9928
Fruit yield (t ha^{-1})						
F_1	15.96	23.00	12.22	17.11	35.33	70.85
F_2	23.78	35.59	15.59	21.00	59.04	73.37
F_3	36.59	37.33	16.56	22.59	43.70	78.89
F_4	39.44	48.96	20.63	22.41	61.19	89.19
F_5	45.78	50.96	22.67	23.52	46.81	75.93
F_6	33.30	24.04	17.11	18.04	48.00	64.89
F_7	40.37	24.67	17.56	23.00	47.11	65.44
F_8	50.74	53.74	20.89	38.15	54.63	98.96
F_9	49.07	37.93	21.26	26.67	74.59	85.19
F_{10}	23.41	28.04	16.85	27.19	63.22	79.85
F_{11}	46.96	47.93	20.44	31.52	79.11	80.89
F_{12}	29.19	30.37	24.00	34.44	59.37	92.33
LSD	1.642			1.642		33.188

F_1: Non fertilized (control), F_2: 333.3 kg ha^{-1} NPK 15-15-15, F_3: 666.6 kg ha^{-1} NPK 15-15-15, F_4: 999.9 kg ha^{-1} NPK 15-15-15, F_5: 1333.2 kg ha^{-1} NPK 15-15-15, F_6: 4.4 t ha^{-1} sawdust compost (SDC), F_7: 8.8 t ha^{-1} sawdust compost (SDC), F_8: 13.2 t ha^{-1} sawdust compost (SDC), F_9: 17.6 t ha^{-1} sawdust compost (SDC), F_{10}: 333.3 kg ha^{-1} NPK 15-15-15+4.4 t ha^{-1} sawdust compost (SDC), F_{11}: 500 kg ha^{-1} NPK 15-15-15+6.6 t ha^{-1} sawdust compost (SDC) and F_{12}: 666.6 kg ha^{-1} NPK 15-15-15+8.8 t ha^{-1} sawdust compost (SDC)

net assimilate ratio and dry matter production nitrogen uptake and fruit yield was considerably enhanced by increasing fertilizers application. These parameters were obtained with the application of 13.2 t ha^{-1} Sawdust Compost (SDC). This indicated that high dry matter production at the high level of nutrientsfavoured the development of plant parameters which culminated in better production of dry matter. When nutrient is available in the right proportion, the photosynthetic activity of the plants will be considerably favoured and conversion of photosynthetic products to yield. This result is similar to the finds of Akanbi *et al.*[29]. They reported an increase in dry matter production of Okra at a higher nitrogen rate. Liu *et al.*[30] and Ouda and Mahadeen[31] stated that the combined application of organic and inorganic fertilizers results in the vigorous vegetative growth of plants[32]. Fertilized plants showed a significant response on fruit yield when compared with the unfertilized plant. This result shows that watermelon yield could be enhanced by the application of fertilizer. This result conforms with the result of previous studies[26,33,34], who reported an increase in growth and yield component of watermelon in response to an increased level of fertilizer application.

The highest fruit yield at 13.2 t ha^{-1} SDC in the three growing seasons could be due to the availability of compost due to its slow release of nutrients and favourable nutrient mineralization of compost as a result of the influence of the mineral component on the organic content of the compost. A similar finding was reported by many scientists[29,35-37]. This result could also be attributed to the enhancement of decomposition of the organic mineral and mineralization of nutrients especially N and P by the presence of mineral fertilizer in organic compost. This supports the study of researchers[18,38] on watermelon which ensures a continuous supply of nutrients to the plants. A similar observation was reported by Ayeni*et al.*[23] whereby the yield of *Amaranthus cruentus* was affected with the application of organic and organomineral fertilizer[39] on watermelon.

This result confirms the result of the previous authors[16,40], who reported the increase in melon and watermelon growth and yield with an increase in nitrogen application. A similar report was observed with Agba and Enga[40], they reported an increase in growth and yield component of cucumber in response to an increased level of fertilizer application. The result of other study by Aguyoh *et al.*[28], also shows that as fertilization application increases, the yield of watermelon also increases.

Varietal differences were obtained to growth development in the two varieties of watermelon used in this study. From the three growing seasons and most cases, the Kaolack variety had the highest values over Sugar baby varieties. This could be attributed to differences in its genetic constitution to suitability to the agro-ecological conditions. This result is similar to the findings of Enujeke[41], who reported that the genetic constitution of crop varieties influence the growth characters. It is also in harmony with the findings of Iken and Amusa[42] that attributed the growth and yield differences among crop varieties to the right choice of the suitable agro-ecological zone. A similar observation was recorded by the previous studies[43,29,44]. They reported variability in plant genetic potential leading to differences in the observed performance. Planting Kaolack with the application of 13.2 t ha^{-1} sawdust compost under irrigation is considered as best agronomic practice towards achieving a high fruit yield.

CONCLUSION

Fertilizer sources and rates significantly influenced the growth and fruit yield of two watermelon varieties assessed during the three growing seasons. Kaolack variety produced better growth and fruit yield when compared to Sugar baby.It was observed that an increase in fertilizer resulted in better growth and fruit yield. Watermelon planted with irrigation produced better and highest fruit yield when compared to rain-fed.

SIGNIFICANCE STATEMENT

This study established the appropriate combination of organic and inorganic fertilizers and time of planting on the growth and yield of watermelon cultivated in Oyo State, Southwestern Nigeria. In addition, the study laid to rest the controversy surrounding the optimum plaining condition for an enhanced yield of watermelon in the chosen area. This information is required to guide farmers who are involved in the production of watermelon in Southwestern Nigeria.

REFERENCES

1. Garcia-Mas, J., A. Benjak, W. Sanseverino, M. Bourgeois and G. Mir *et al.*, 2012. The genome of melon (*Cucumis melo* L.). Proc. Natl. Acad. Sci., 109: 11872-11877.
2. Paris, H.S., 2015. Origin and emergence of the sweet dessert watermelon, *Citrullus lanatus*. Ann. Bot., 116: 133-148.
3. Chhaya, C., P. Rai, G.C. Majumdar, S. Dasgupta and S. De, 2008. Clarification of watermelon (*Citrullus lanatus*) juice by microfiltration. J. Food Proc. Eng., 31: 768-782.
4. Choo, W.S. and W.Y. Sin, 2012. Ascorbic acid, lycopene and antioxidant activities of red-fleshed and yellow-fleshed watermelons. Adv. Appl. Sci. Res., 3: 2779-2784.
5. Sulaiman, S.F., N.A.M. Yusoff, I.M. Eldeen, E.M. Seow, A.A.B. Sajak, Supriatno and K.L. Ooi, 2011. Correlation between total phenolic and mineral contents with antioxidant activity of eight Malaysian bananas (*Musa* sp.). J. Food Compos. Anal., 24: 1-10.
6. Kyriacou, M.C., D.I. Leskovar, G. Colla and Y. Rouphael, 2018. Watermelon and melon fruit quality: The genotypic and agro-environmental factors implicated. Sci. Hortic., 234: 393-408.

7. Rouphael, Y., M. Cardarelli, A. Bassal, C. Leonardi, F. Giuffrida and G. Colla, 2012. Vegetable quality as affected by genetic, agronomic and environmental factors. J. Food Agric. Environ., 10: 680-688.
8. Sharafzadeh, S. and K. Ordookhani, 2011. Organic and bio fertilizers as a good substitute for inorganic fertilizers in medicinal plants farming. Aust. J. Basic Appl. Sci., 5: 1330-1333.
9. Eifediyi, E.K., S.U. Remison, H.E. Ahamefule, K.O. Azeez and P.O. Fesobi, 2017. Performance of watermelon (*Citrullus lanatus* L.) in response to organic and NPK fertilizers. Acta Universitatis Sapientiae Agric. Environ., 9: 5-17.
10. Pessarakli, M., 2016. Handbook of Cucurbits: Growth, Cultural Practices, and Physiology. 1st Edn., CRC Press, Boca Raton, Florida, ISBN: 9780429170683, Pages: 594.
11. Trivedi, M.K., A. Branton, D. Trivedi, G. Nayak, M. Gangwar and S. Jana, 2016. Molecular analysis of biofield treated eggplant and watermelon crops. Adv. Crop Sci. Technol., Vol. 4. 10.4172/2329-8863.1000208.
12. Awere, S.U. and D.A. Onyeacholem, 2014. Effect of spacing and NPK 20:10:10 fertilizer on the growth and yield of watermelon (*Citrullus lanatus*) in Enugu, South Eastern Nigeria. J. Exp. Res., 2: 93-99.
13. Khan, F.A., A. Khan and M.U.R. Khattak, 2011. Evaluaion of different types of *Citrullus vulgaris* for its physical parameers and proximate composition. J. Pharm. Res., Vol. 4.
14. Mochiah, M.B., P.K. Baidoo and M. Owusu-Akyaw, 2011. Influence of different nutrient applications on insect populations and damage to cabbage. J. Appl. Biosci., 38: 2564-2572.
15. Cabello, M.J., M.T. Castellanos, F. Romojaro, C. Martinez-Madrid and F. Ribas, 2009. Yield and quality of melon grown under different irrigation and nitrogen rates. Agric. Water Manage., 96: 866-874.
16. Sabo, M.U., M.A. Wailare, M. Aliyu, S. Jari and Y.M. Shuaibu, 2013. Effect of NPK fertilizer and spacing on growth and yield of watermelon (*Citrillus lanatus* L.) in Kaltungo local government area of Gombe State, Nigeria. Scholarly J. Agric. Sci., 3: 325-330.
17. Locascio, S.J. and G.J. Hochmuth, 2002. Watermelon production as influenced by lime, gypsum, and potassium. Am. Soc. Hortic. Sci., 37: 322-324.
18. Okunlola, A.I., S.A. Adejoro and G. Fakanlu, 2011. Evaluation of some manure types for the growth and yield of watermelon in Southwestern Nigeria. Researcher, 3: 61-66.
19. Ayeni, L.S. and O.S. Ezeh, 2017. Comparative effect of NPK 20:10:10, organic and organo-mineral fertilizers on soil chemical properties, nutrient uptake and yield of tomato (*Lycopersicon esculentum*). Appl. Trop. Agric., 22: 111-116.
20. Germay, B. and A. Gedebo, 2020. Effects of organic and inorganic fertilizers on the growth, yield and yield components of maize varieties. Int. J. Agric. For., 10: 71-75.
21. Adeniyan, O.N. and S.O. Ojeniyi, 2005. Effect of poultry manure, NPK 15-15-15 and combination of their reduced levels on maize growth and soil chemical properties. Niger. J. Soil Sci., 15: 34-41.
22. Adeleye, E.O., L.S. Ayeni and S.O. Ojeniyi, 2010. Effect of poultry manure on soil physico-chemical properties, leaf nutrient contents and yield of yam (*Dioscorea rotundata*) on alfisol in Southwestern Nigeria. J. Am. Sci., 6: 871-878.
23. Ayeni, L.S., E.O. Adeleye and J.O. Adejumo, 2012. Comparative effect of organic, organomineral and mineral fertilizers on soil properties, nutrient uptake, growth and yield of maize (*Zea mays*). Int. Res. J. Agric. Sci. Soil Sci., 2: 493-497.
24. Aliyu, L., 2000. Effect of organic and mineral fertilizers on growth, yield and composition of pepper (*Capsicum annuum* L.). Biol. Agric. Hortic. Int. J. Sustainable Prod. Syst., 18: 29-36.
25. Adenawoola, A.R., 2005. Residual effects of poultry manure and NPK fertilizer residues on soil nutrient and performance of jute (*Corchorus olitorius.* L.)-Research note. Niger. J. Soil Sci., 15: 133-135.
26. Dauda, S.N., F.A. Ajayi and E. Ndor, 2008. Growth and yield of water melon (*Citrullus lanatus*) as affected by poultry manure application. J. Agric. Soc. Sci., 4: 121-124.
27. Oloyede, F.M. and O.C. Adebooye, 2005. Effect of season on growth, fruit yield and nutrient profile of two landraces of *Trichosanthes cucumerina* L. Afr. J. Biotechnol., 4: 1040-1044.
28. Aguyoh, J.N., W. Audi, M. Saidi and L. Gao-Qiong, 2010. Growth, yield and quality response of watermelon (*Citrullus lanatus* [Thunb] mansf. & nakai) cv. crimson sweet) subjected to different levels of tithonia manure. Int. J. Sci. Nat., 1: 7-11.

29. Akanbi, W.B., A.O. Togun, J.A. Adediran and E.A.O. Ilupeju, 2010. Growth, dry matter and fruit yields components of okra under organic and inorganic sources of nutrients. Am. Eurasian J. Sustainable Agric., 4: 1-13.
30. Liu, C.W., Y. Sung, B.C. Chen and H.Y. Lai, 2014. Effects of nitrogen fertilizers on the growth and nitrate content of lettuce (*Lactuca sativa* L.). Int. J. Environ. Res. Public Health, 11: 4427-4440.
31. Ouda, B.A. and A.Y. Mahadeen, 2008. Effect of fertilizers on growth, yield, yield components, quality and certain nutrient contents in broccoli (*Brassica oleracea*). Int. J. Agric. Biol., 10: 627-632.
32. Abdissa, T., N. Dechassa and Y. Alemayehu, 2012. Sweet potato growth parameters as affected by farmyard manure and phosphorus application at Adami Tulu, central rift valley of Ethiopia. Agric. Sci. Res. J., 2: 1-12.
33. Shafeek, M., A. Shaheen, E.A. El-Samad, F.A. Rizk and F.S.A. El-Al, 2015. Response of growth, yield and fruit quality of cantaloupe plants (*Cucumis melo* L.) to organic and mineral fertilization. Middle East J. Appl. Sci., 5: 76-82.
34. Adeoye, G.O., O.O. Adeoluwa, M. Oyekunle, M.K.C. Sridhar, E.A. Makinde and A.A. Olowoake, 2008. Comparative evaluation of organo-mineral fertilizer (OMF) and mineral fertilizer (NPK) on yield and quality of maize (*Zea mays* (L.)) Moench. Niger. J. Soil Sci., 18: 141-147.
35. Olowoake, A.A. and G.O. Adeoye, 2010. Comparative efficacy of NPK fertilizer and composted organic residues on growth, nutrient absorption and dry matter accumulation in maize. Int. J. Org. Agric. Rese. Dev., 2: 43-53.
36. Ainika, J., E. Amans, C. Olonitola, P. Okutu and E. Dodo, 2012. Effect of organic and inorganic fertilizer on growth and yield of *Amaranthus caudatus* L. in Northern Guinea Savanna of Nigeria. World J. Eng. Pure Appl. Sci., 2: 26-30.
37. Ojo, J A., A.A. Olowoake and A. Obembe, 2014. Efficacy of organomineral fertilizer and un-amended compost on the growth and yield of watermelon (*Citrullus lanatus* Thumb) in Ilorin Southern Guinea Savanna zone of Nigeria. Int. J. Recycl. Organ. Waste Agric., 3: 121-125.
38. Massri, M. and L. Labban, 2014. Comparison of different types of fertilizers on growth, yield and quality properties of watermelon (*Citrllus lanatus*). Agric. Sci., 5: 475-482.
39. Olaniyi, J.O. and B.A. Tella, 2011. Effects of nitrogen and potassium fertilizers on the growth, seed yield and nutritional values of egusi melon (*Citrullus lanatus* (thumb) manf.) in Ogbomoso South west Nigeria. Int. Res. J. Plant Sci., 2: 328-331.
40. Agba, O.A. and V.E. Enga, 2005. Response of cucumber (*Cucumis sativun* L.) to Nitrogen in cross river state of Nigeria. Global J. Agric. Sci., 4: 165-167.
41. Enujeke, E.C., 2013. An assessment of some growth and yield indices of six varieties of watermelon (*Citrullus lanatus* Thumb) in Asaba area of Delta State, Nigeria. Int. Res. J. Agric. Sci. Soil Sci., 3: 376-382.
42. Iken, J.E. and N.A. Amusa, 2004. Maize research and production in Nigeria. Afr. J. Biotechnol., 3: 302-307.
43. Togun, A.O. and W.B. Akanbi, 2003. Comparative effectiveness of organic-based fertilizer to mineral fertilizer on tomato growth and fruit yield. Compost. Sci. Utilization, 11: 337-342.
44. Sudre, C.P., L.S. Goncalves, R. Rodrigues, A.T. do Amaral Junior, E.M. Riva-Souza and S.B. Cdos, 2010. Genetic variability in domesticated *Capsicum* sp. as assessed by morphological and agronomic data in mixed statistical analysis. Genet. Mol. Res., 9: 283-294.