

EFFECT OF SPACING ON THE GROWTH AND YIELD OF WATERMELON (*Citrullus lanatus* L) IN RAINFOREST ZONE OF NIGERIA.

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ABSTRACT

*This study examined the effect of spacing's (50cm x 50cm, 1m x 1m, 1.5m x 1.5m and 2m x 2m 2.5m x 2.5m) on the yield of watermelon (*Citrullus lanatus* L) under the soil of Anwai in Delta State, Nigeria. Growth Parameters measured at different growth stages (2, 4, 6, 8 and 10 weeks after planting) include the main vine length (cm), number of lateral branches, number of leaves on the main vine, number of fruits per plant, fruit weight (kg) and Fruit yield. The result showed that there were significant differences among treatments for number of fruits per plant, fruit weight and fruit yield. At a spacing of 2.5m x 2.5m, the highest mean values of 24.00cm, 3684.00g and 25.00kg for fruit length, fruit weight, and fruit yield were recorded. The result of this study showed that there were significant differences among different spacing and 2.5m x 2.5m spacing performed better than others. Thus, a spacing of 2.5m x 2.5m can be recommended to the farmers who are interested in growing watermelon.*

Keywords: seed rate, fruit yield, sowing, spacing, varieties

INTRODUCTION

Water melon (*Citrullus lanatus* L) belong to the family *cucurbitaceae*, kingdom *plantae*, order *cucurbitales*, Genus: *citrullus* and species: *Lanatus*. Watermelon is believed to have originated from Kalahari and Sahara desert in Africa and there have been regarded as a point of diversification to other part of the world. (Jarret *et al.*, 2009)

Water melon is an important food for human consumption. It provide large amount of mineral vitamin and antioxidant. Water melon contain about 127 to 129kg (30 k Cal) of energy, 7.55g carbohydrate, 63g sugar, 0.4g dietary fiber, 0.15g fat and 0.61g protein per 100g and also contain about 6.2g sugar and 91.45% water by weight. Water melons are rich in water and also help in preventing dehydration potassium help in lowering high blood pressure. The mineral are said to be good at preventing condition like stroke and heart disease. (Adekunle *et al.*, 2003).

Watermelon yield worldwide ranges from about 25 t/ha, varying from 5-60 t/ha depending on the variety and cultural practice. But production of water melon is restricted to some areas in Nigeria and this restriction is mainly due to climatic condition and geographical location of these areas favoring the production (Dantata 2014). The low yield of water melon in Nigeria may be attributed to a number of reasons like cultural practice, poor knowledge about

spacing, lack or unavailability of improved varieties, improper fertilizer application, seed rate, water requirement and time of sowing (Dantata 2014). The major constraints of water melon production in Delta State are basically poor Agricultural practices and lack of appropriate information on cultivation of water melon which include knowledge of appropriate spacing for maximum fruit yield in this area. Therefore, this study is to investigate the effect of spacing on the growth and yield of water melon (*Citrullus lanatus*).

MATERIALS AND METHODOLOGY

The experiment was carried out at the Teaching and Research Farm of Agronomy Department, Asaba Campus, Delta State University, Nigeria. Asaba is located at latitude 06⁰14'N and longitude 06⁰49'E of the Equator. The annual rainfall was between 1500mm-1849.3mm with distribution as bimodal with peak in July and September and a period of precipitation in August. Asaba has a mean temperature of 37.3°C with mean relative humidity of 77.2% (NIMET, 2013).

Experimental Design and plot layout

The experiment was laid out on a Randomized Complete Block Design (RCBD). The length and width of the experimental field was 14m by 10m given a total land area of 144m² with different spacing of (50cm x 50cm, 1m x 1m, 1.5m x 1.5m and 2m x 2m 2.5m x 2.5m) the treatment was replicated three times at five different spacing. This gave total number of 15 plots in the experimental area. Agronomic practices that was carried out include clearing, tilling of the soil, complete slashing, packing of debris. Tilling of the soil is mainly done to expose larva stage of predators that hibernate in the soil which is a cultural method of controlling insect pest.

Water melon seed was obtained from International Institute of Agriculture Ibadan. The seeds were sown by direct seedling, each having a depth of 1.5cm per hole with this different spacing's (50cm x 50cm, 1m x 1m 1.5m x 1.5m 2m x 2m, and 2.5m x 2.5m). Thinning was practiced when the seedling has three true leaves. The seedlings will be thinned by keeping out one vigorous and heal their plant per hole. Weeding was done manually using hoe and pesticide was applied at 2nd 3rd 4th week after planting to protect the plant against insects such as melon fly and aphid white flies.

Data Collection

Three plants from each plot were tagged from which growth and yield parameters were recorded as follows:

Vine length (cm): Two plants from each plot were tagged from which growth of the main vine will be recorded. The main vine from the 4th, 6th, 8th and 10th week after sowing main vine length (cm) measured from the soil surface to the end tip of the plant using ruler and a lope.

Number of leaves on the main vine: Number of leaves on the main vine from two plants of each plot was counted at 4th, 6th, 8th and 10th weeks after sowing.

Number of lateral branches: Number of lateral branches was counted from the two plants of each plot at 4th, 6th, 8th and 10th weeks after sowing.

Fruit length (cm): Three fruit per plants selected in each plot were measured using meter rule.

Fruit Weight (kg): Each fruit per plot were weighed using a weighing balance.

Fruit Yield (s): Three fruit per plant were weighed using a weighing balance.

Data Analysis: Data collected were subjected to analysis of variance (ANOVA), and means were separated using LSD at 5% level of probability (SAS, 2010).

RESULTS AND DISCUSION

Effects of Spacing on Vine Length of Watermelon at Different Sampling Period.

The effects of spacing on vine length at 4th, 6th and 8th and 10th weeks after sowing is shown in Table 1. The result shown in Table 1 at 4th week after sowing showed that there were no significant difference on effect of spacing. This is due to the fact that there was no competition for nutrient, water and light at the 4th week after sowing. At 6 weeks it also showed no significant difference among treatments; however the highest vine length (1.35cm, 2.40cm, 2.85cm and 3.65cm) was recorded in 2.5m x 2.5m treatment at 5% level of probability. At 8th weeks after sowing, there were no significant differences among treatments but the treatment 2.5m x 2.5m was significantly different in vine length (2.85cm) at 5% level of probability. At 10 weeks after sowing the results showed no significant differences among treatments. Also the results shown in Table 1 showed that among the treatments, the vine length was significantly different at 10th week after sowing due to the effect of different level of spacing.

The results showed that as spacing increase, watermelon main vine length also increased due to low competition with water nutrient and light between crops.

Table 1: Effects of Spacing on Vine Length of Watermelon at Different Sampling Period

Spacing	WEEKS AFTER PLANTING			
	4	6	8	10
50cm x 50cm	1.1	1.30	1.65	2.40
1m x 1m	1.20	1.55	1.85	2.75
1.5m x 1.5m	1.30	1.60	2.40	3.25
2m x 2m	1.25	2.30	2.75	3.55
2.5m x 2.5m	1.35	2.40	2.85	3.65
LSD (0.05)	0.27	0.34	0.23	0.23

Effects of Spacing on Number of Branches of Water Melon at Different Sampling Periods

The effects of spacing on number of branches of watermelon is presented in Table 2. At 4 weeks after sowing the result showed that there were no significant differences among treatments. At 6, 8 and 10 weeks after sowing the results showed that there were no significant differences among treatments; however the treatment 2.5m x 2.5m consistently

produced the highest means number of branches at 5% level of probability. The result showed that as spacing increased, the number of lateral branches also increased, and this is due to low competition with water nutrient and light among the plants. In the same vein, the number of leaves, number of branches and vine length increased linearly with increased in spacing.

Table 2: Effects of Spacing on Number of Branches of Water Melon at Different Sampling Period

SPACING	WEEKS AFTER SOWING			
	4	6	8	10
50cm x 50cm	3.00	3.50	4.00	5.00
1m x 1m	3.00	3.50	4.00	5.00
1.5m x 1.5m	3.00	4.00	5.00	5.50
2m x 2m	3.50	4.50	5.00	6.00
2.5m x 2.5m	3.50	4.50	5.00	6.50
LSD (0.05)	1.15	1.63	0.11	1.15

Effects of Spacing on Number of Leaves of Watermelon At Different Sampling Period

The effects of spacing on watermelon number of leave is presented in Table 3. The result at 4 weeks after sowing showed no significant differences among treatments. At 6 weeks after sowing the result showed that there were no significant differences among treatment; however the highest means number of leave (29.00) was recorded in 2.5m x 2.5m treatment at 5% level of probability. At 8 and 10

weeks after sowing also showed there were no significant differences among treatments but the result showed a progressive increment in plants number of leaves from 4 to 10 weeks after sowing across treatments. At 10th week after sowing numbers of leaves was relatively more with 2.5m x 2.5m. The results showed that spacing has no significant effect on numbers of leaves and as spacing increased watermelon leaves also increased.

Table 3: Effects of Spacing on Number of Leaves of Watermelon at Different Sampling Periods

Spacing	WEEKS AFTER SOWING			
	4	6	8	10
50cm x 50cm	6.50	14.50	21.50	28.50
1mx1m	7.50	17.00	26.50	34.50
1.5mx1.5m	7.00	23.50	32.50	36.50
2mx2m	8.50	27.50	33.50	37.00
2.5mx2.5m	9.00	29.00	36.00	39.50
LSD (0.05)	1.41	2.15	2.29	1.63

Effects of Spacing on Fruit Length (cm), Fruit Weight(s), Yield (kg) of Watermelon at Different Sampling Period.

The effect of different level of spacing on fruit length is presented in Table 4. The result showed there were no significant differences between treatments. Fruit length increased relatively with the increase in spacing. A spacing of 2.5m x 2.5m (24.00cm) followed by 1m x 2m (21.3cm), 1.5m x 1.5(18.0cm), 1m x 1m(12.1cm) and the lowest 50cm x 50cm (8.67cm). The result showed that increase in spacing also leads to increase in fruit length.

The result obtained on effect of different level of spacing on fruit weight showed no significant

difference ($P>0.05$) between treatments but there was a gradual increment in fruit weight across treatments. Weight of fruit was relatively more with 2.5m x 2.5(3684g), 2m x 2m (3167g), 1.5m x 1.5m (2689.7g), 1m x 1m (2373g) and the lowest 50cm x 50cm (1925g). The result showed that by increasing spacing the fruit weight also start increasing gradually. Total yield increased as plant spacing increased from 50cm x 50cm to 2.5m x 2.5m. Thus it indicated that 2.5m x 2.5m is the best spacing for getting higher yield as compared to any other spacing.

Table 4: Effects of Spacing on Fruit Length (cm), Fruit Weight (g), Yield (kg) and yield/ha (kg/ha) of Watermelon at Different Sampling Periods.

Spacing	Fruit Length(cm)	Fruit Weight(g)	Fruit Yield(kg)	Yield(kg/ha)
1mx50cm	8.66	1925.00	11.000	763.88
1m x 1m	12.100	2373.00	16.000	1111.11
1.5m x 1.5m	18.000	2689.67	18.000	1250.00
2m x 2m	21.300	3167.00	20.667	1435.21
2.5m x 2.5m	24.000	3684.00	25.000	1666.67
LSD(0.05)	0.8764	6.2352	0.4861	6.7352

DISCUSSION

The effects of spacing on vine length at 4th, 6th and 8th and 10th weeks after sowing is shown in Table1. The result shown in Table 1 at 4th, 6th, 8th and 10th week after sowing showed there was no significant difference on spacing. This is due to the fact that there was no competition for nutrient, water and light. At 4th, 6th, 8th and 10th the highest vine length (1.35cm, 2.40cm, 2.85cm and 3.65cm) were recorded in 2.5m x 2.5m treatment at 5% level of probability. The results showed that as spacing increase,

watermelon main vine length also increase due to low competition with water nutrient and light between crops. This results agrees with the findings of Efediyi *et al.*, (2009) who reported that spacing has positive effect on plant height. This result also gets support from the work done by Ban *et al.* (2011) who observed that in row-plant spacing has a significant effect on the growth and yield of watermelon. These results is also in line with the work done by Sabo *et al.* (2013) who reported an increase in watermelon vine length was as a result to an increase in spacing.

The effects of spacing on water melon number of leave are presented in Table 3. The result at 4 weeks after sowing showed that there were no significant differences among treatments. At 6 weeks after sowing the result showed that there were no significant differences among treatment; however the highest means number of leave (29.00) was recorded in 2.5m x 2.5m treatment at 5% level of probability. At 8 and 10 weeks after sowing the results showed that there were no significant differences among treatments. The result showed a progressive increment in plants number of leaves from 4 to 10 weeks after sowing across treatments. At 10th week after sowing numbers of leaves was relatively more with 2.5m x 2.5m. The results showed that spacing has no significant effect on numbers of leaves and as spacing increased watermelon leaves also increased due to low competition with water nutrient and light between crops promoting better growth of watermelon.

These results get supported from the work done by Sabo *et al.* (2013) who reported that there is no significant difference in all the level of spacing (2.5m x 2.5m, 2m x 2m, 1.5m x 1.5) used in promoting numbers of leaves of watermelon.

These results are in agreement with the finding of Efediyiet *al.* (2009) who reported that the spacing has positive effect on number of leave. These result get support from the work done by Ban *et al.* (2011) who observed that in row-plant spacing has a significant effect on the growth and yield of watermelon. These results are supported by the work done by Sabo *et al.* (2013) who reported an increase in watermelon number of leave with an increase in spacing.

The effects of spacing on number of branches of water melon are presented in Table2. Sampling at 4, 6, 8 and 10 weeks after sowing the result showed there were no significant differences among treatments.

The effect of different level of spacing on fruit length is presented in Table 4. The result showed there were no significant difference between treatments. Fruit length was relatively more with 2.5m x 2.5m (24.00cm) followed by 2m x 2m (21.3cm), 1.5m x 1.5(18.0cm), 1m x 1m(12.1cm) and the lowest 50cm x 50cm (8.67cm). The result showed that increased in spacing also leads to increase in fruit length and it's in accordance with the findings by Goretat *al.* (2013) who reported that with increased spacing average fruit weight of watermelon and fruit size distribution shifted to large categories. The result obtained on effects of spacing on fruit weight showed no significant difference ($P>0.05$) between treatments but there was a gradual increment in fruit weight across treatments. Weight of fruit was highest with 2.5m x 2.5(3684g), 2m x 2m (3167g), 1.5m x 1.5m (2689.7g), 1m x 1m (2373g) and the lowest weight of fruit was with a spacing of 50cm x 50cm (1925g).

The result showed that by increasing spacing the fruit weight also start increasing gradually and is in line with the findings of Doneta *et al.*, (2011) who reported that with increased spacing average fruit weight of watermelon and fruit size distribution shifted to larger categories.

Total yield increased as plant spacing increased from 50cm x 50cm to 2.5m x 2.5m and also the yield per hectare also increases from 50cmx50cm to 2.5m x 2.5m. Thus it indicated that 2.5m x 2.5m is the best spacing for getting higher yield as compared to any other spacing. Similar result was also recorded by Hamide *et al.*, (2013) who reported that spacing effect was observed on yield.

CONCLUSION

The experiment was conducted to evaluate the effects of spacing on the growth and yield of watermelon (*Citrullus lanatus L.*) in Agronomy Research Farm, Delta State University, Asaba Campus. The treatment comprised of five different plant spacing (50cm x 50cm, 1m x 1m, 1.5m x 1.5m, 2m x 2m and 2.5m x 2.5m). Each treatment was replicated three times and the parameters measured were: number of leaves, number of branches, vine length fruit length, and fruit weight . The result showed that spacing at 2.5m x 2.5m significantly increased the vine length, number of leaves, number of branches, fruit length, fruit weight and fruit yield. Spacing at 2.5m x 2.5m was the adequate measurement for maximizing fruit length, weight fruit and fruit yield. Plant spacing at 50cm x 50cmconsequently gave the least values in all the yield parameters. It is recommended that watermelon producer should use the spacing 2.5m x 2.5m in raising the crop for maximum production, in the study area.

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