Assessing Watermelon Cultivars under Different Planting Distances in Bauchi North, Nigeria

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ABSTRACT---- ***The objective of this study was to evaluate the effect of planting distances and cultivars on vegetative growth and yield in watermelon. The cultivars; Sugar baby, Koalack, Royal sweet and Paradise were grown at plant distance of 25, 50, 75 and 100 cm. Results showed that vine length, number of leaves, number of fruits and fruit yield were influenced in the two seasons. Growth parameters appeared similar in all the cultivars, except in number of leaves, with cultivars (in 2009) as well as in vine length with planting distances (in 2009). Paradise (in 2008) and Royal sweet (in 2009) performed better compared with other three cultivars. Interaction between cultivars and planting distances in number of fruits was significant; planting Paradise cultivar at 50, 75 and 100 cm gave higher number of fruits. Yield was very much influenced among cultivars and planting at 100cm increased yield significantly in both years. Therefore it is recommended that for higher yields of watermelon cultivars, planting at 100cm can be adopted.***

Keywords---- Watermelon cultivars, planting distances, growth, yield, Nigeria

1. INTRODUCTION

Watermelon (*Citrullus lanatus*) is one of the world most important vegetables, as the crop is reared both for its large fruit that weigh up to 18 kg depending on variety (Ban *et al.,* 2006) and the vegetative parts which are highly nutritious (Schippers, 2000). It has been reported that watermelon production is usually more profitable when managed under different combinations of cultural practices (Clough, 1992; Robinson and Decker-Walters, 1997; Hochmuth *et al.,* 2001; Bolin and Brandenberger, 2001). Cultural practices such as irrigation, cultivation, planting distance, choice of cultivars, control of weeds, insect pests and diseases play important roles in determining yields in watermelons (Taylor *et al.,* 2003). Lu *et al.* (2003) reported that the combined effect of several cultural practices on watermelon yield was significant, producing a 100% increase in weight and number of marketable fruits per plot in two out of three years compared with production at low crop management intensity. Studies evaluating crop production management are common; most of them emphasize only one, two or more cultural practices.

Increasing watermelon plant density can increase the potential for greater yield per plot (NeSmith, 1993). There are several other information on highly variable watermelon yields among years and seasons of production due to different combinations of cultural practices (Brown, 1987; Pier and Doerge, 1995; Korkmaz and Dufault, 2001; Snyder *et al.,* 1991; Fernandez-Bayon *et al.,* 1993; Scott *et al.,* 1993; Gimeno *et al.,* 1999; Fumagalli *et al.,* 2001; Watanabe *et al.,* 2001; Lu *et al.,* 2003; Ban *et al.,* 2006). Although studies evaluating production management are common, most of them emphasize on few cultural practices. There is also paucity of information on the productivity of watermelon involving cultural practices such as the use of different crop varieties and cycles of plant spacing in Nigeria. This work therefore seeks to evaluate vegetative growth and yield in watermelon varieties using different planting distances.

2. MATERIALS AND METHODS

Two field experiments were conducted at the dry season garden of the School of Vocational and Technical Education, College of Education, Azare in Bauchi State, Nigeria between 2008 and 2009. The site of the experiment is located at 11^0 40'N, 10^0 10'E and 609.45m above sea level in the Sudan Savanna Ecological zone of Nigeria (Kowal and Knabe, 1972). Soil of the experimental site was analyzed for physico-chemical properties according to AOAC (1980) as well as the mean temperature and relative humidity of the months of experiments were recorded and results were presented in Table 1 and Table 2 respectively.

The treatments consisted of four varieties of watermelon (Sugar baby, Koalack, Royal sweet and Paradise) and four planting distances (25, 50, 75 and 100 cm) laid in a randomized complete block design (RCBD) with four replications. The land was ploughed, harrowed and made to a fine tilts. Sunken beds of $16m^2$ size were raised as plots. The plots were spaced 1m x 0.5m between and within replications. Hybrid seeds of the specified watermelon varieties were sown directly into the plots on 10^{th} January, 2008 and 2009 according to the planting distance- treatments. Four (4) seeds of each watermelon variety were sown and later thinned to one per stand at 3 weeks after sowing (WAS). Eight (8) plants from the net plot were randomly selected and tagged from which vine length, number of leaves, number of fruits and fruit yield were assessed according to standard procedures for *Cucurbits* (Dantata 2008;2010; Dantata and Babatunde, 2013; Davis *et al.,* 2008). Data collected during the studies were subjected to analysis of variance (Steel and Torrie, 1980) and, differences between means determined by Duncan's Multiple Range Test in the General Linear Model (GLM) of SPSS (1996).

3. RESULTS AND DISCUSSION

Vine lengths and number of leaves (Table 3) as well as number of fruits and fruit yield (Table 4) of watermelons were significantly affected by the planting distances in the 2- year study. The vegetative parts (vine length and number of leaves) of this horticultural crop increased significantly among cultivars and with increase in planting distances in 2008 and 2009, respectively. Paradise cultivar gave the longest vines in 2008 which was at par with Royal sweat and Kaolack cultivars. Similar trend was recorded in Royal sweet and Kaolack in 2009 season. Planting watermelons at 100 cm distance, followed by 75, 50 and 25cm distances, gave significant increases in vine lengths of watermelons in 2008 season. The same characteristic behavior was recorded with number of leaves in both seasons. Interaction of cultivars and planting distances in vine length and number of leaves was not significant (Table 3).

The performance of watermelon cultivars as in vine length and number of leaves, varied significantly due to varietal differences. This behavioural pattern of response in growth parameters exhibited by watermelon cultivars in this study, agrees with the findings of Granberry (1986) who reported various differential growth behaviour among watermelons. The authors' report on the fact that growth of watermelon cultivars varied according to year has also found expression in the current study. These pattern of response recorded among watermelon cultivars in the two seasons, could be linked to the fact that, each season might have created a distinct growing environment for the species to develop differently. This point of view concur with the report of Davis *et al.* (2008). These workers showed differential growth performance in watermelons with different environments.

The influence of planting distances in this study showed that vine length and number leaves increased significantly as planting distances gets wider. Decrease in plant population due to wider planting distances, increased shoot fresh mass which is a known vegetative components of watermelon. The increased shoot fresh mass in watermelon can also be attributed to wide variability in crop performance caused by cultivar, propagation methods, seasons and soil factors as reported by Dantata and Babatunde (2013) in cucumber a sister *Cucurbits*.

Number of watermelon fruits and the final fruit yield in 2008 and 2009 (Table4); differed significantly among treatments. Paradise cultivar produced the highest number of fruits, followed simultaneously by Kaolack, Sugar baby and Royal sweet cultivars in 2008. Royal sweet watermelon gave the highest number of fruits, followed closely by Kaolack and Sugar baby as well as Paradise in 2009. Number of fruits with different planting distances followed the order of 100 > 75 > 50 > 25 cm in both seasons (Hochmuth *et al.*, 2001; Lu *et al.*, 2003).

Final fruit yield also revealed a no statistical variation among cultivars in 2008. Whereas, in 2009, fruit yield in Royal sweet, Paradise and Kaolack varieties were statistically the same, so also, fruit yield in Paradise, Kaolack and Sugar baby cultivars. Fruit yield with different planting distances followed the order of 100 > 75 > 50 > 25 cm, in 2008 whereas in 2009 was 100 > 75 and 50> 25 cm. This result corroborates the earlier report in watermelons (Granberry, 1986; Davis *et al.*, 2008).

Interaction of cultivars and planting distances in number of fruits was significant in 2008 (Table 4). The interaction revealed that watermelons were significantly increased by different planting distances (Table 5). Paradise cultivar produced significantly higher number of fruits with wider distances of 100 and 75 cm, respectively. Followed by Kaolack, Sugar baby and Royal sweet (also at par with Paradise at 50 cm) cultivars at 100cm planting distance. However, planting the four cultivars at a distance of 25 cm as well as planting Koalack, Sugar baby and Royal sweet at 50 and 75cm, respectively gave number of fruits at par in 2008 season (Bolin and Brandenberger,2001; Ban *et al.*, 2006).

4. CONCLUSION

The results of the experiments revealed that vine length, number of leaves, number of fruits and fruit yield of watermelon cultivars were significantly increased by planting distances. These growth and yield parameters of watermelon were statistically higher among cultivars with planting distances of 100 and 75 cm. Out of the two seasons studied, interaction between cultivars and planting distances in number of fruits was significant only in one season. Number of fruits of watermelon cultivars increased with significant differences as planting distances increases from 25 to 100 cm. Therefore it is recommended that for higher yields of watermelon, these varieties can be planted at 100cm. However, planting the four cultivars at a distance of 50 and 75cm gave number of fruits in watermelon at par.

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Table 1: Physico- chemical properties of the soil at the experimental site during the 2008 and 2009 dry seasons.

Soil physico chemical properties	0 – 30 cm depth	
	2008	2009
Particle size distribution (g kg^{-1})		
Sand	715	746
Silt	190	173
Clay	95	81
Texture	Sandy Loam	Sandy Loam
Chemical composition		
Soil pH 1:2 (H_2O)	6.41	6.62
Organic carbon (g kg^{-1})	2.23	3.11
Total nitrogen (g kg^{-1})	0.58	0.66
Available phosphorus (mg kg^{-1})	5.75	5.83
CEC [C mol (+) kg^{-1}]	5.02	5.17
Exchangeable bases [C mol (+) kg^{-1}]		
Ca	4.27	4.54
Mg	0.49	0.55
K	0.53	0.59
Na	0.38	0.45

Table 2: Mean temperature and relative humidity during the months of experiments

Months	Temperature (^{0}C)		Relative humidity (%)	
	2008	2009	2008	2009
January	33.5	27.6	72.1	89.2
February	31.8	28.5	60.1	84.3
March	32.5	30.8	68.5	81.2
April	39.8	34.7	89.3	79.1
May	37.6	36.2	83.6	75.7

Source: Bauchi State Agricultural Development Project (BSADP) Northern Zone, Azare.

Table 3: Effect of cultivars and planting distances on vine length and number of leaves of watermelon during the 2008 and 2009 dry seasons

Treatment	Vine length (cm)		Number of leaves	
	2008	2009	2008	2009
Cultivars				
Sugar baby	135.6b	140.3b	148.4b	158.9c
Kaolack	145.0ab	173.2a	157.3b	193.5b
Royal sweet	148.2ab	182.2a	160.1b	209.1a
Paradise	156.8a	144.5b	191.2a	158.3c
SE±	4.1	5.2	5.5	4.1
Planting distances (cm)				
25	111.8d	136.1c	124.3d	152.6c
50	137.5c	155.6b	154.9c	174.9b
75	155.6b	165.9ab	173.9b	186.9b
100	180.7a	182.6a	203.8a	205.4a
SE±	4.1	5.2	5.5	4.1
Cv. x P. distances	NS	NS	NS	NS

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT. NS-Not significant

Table 4: Effect of cultivars and planting distances on number of fruits and fruit yield of watermelon during the 2008 and 2009 dry seasons

Treatment	Number of fruits		Fruit yield (t ha^{-1})	
	2008	2009	2008	2009
Cultivars				
Sugar baby	53.6b	64.3b	165.4	112.9b
Kaolack	58.7b	69.3b	189.1	151.5ab
Royal sweet	51.8b	79.8a	160.9	209.9a
Paradise	80.4a	51.6c	171.8	168.9ab
SE±	2.5	2.6	14.8	19.8
Planting distances (cm)				
25	24.9d	31.0d	65.5d	54.6c
50	57.9c	64.6c	152.c	141.3b
75	72.4b	75.3b	201.0b	181.4b
100	89.1a	94.0a	267.8a	266.0a
SE±	2.5	2.6	14.8	19.8
Cv. x P. distances	*	NS	NS	NS

In a column, means followed by same letter are not significantly different at 5% probability level by DMRT. *Significant NS. Not significant

Table 5: Interaction of cultivars and planting distance on number of fruits of watermelon during the 2008 dry season

Treatment	Number of fruits			
	2008			
	Planting distances (cm)			
	25	50	75	100
Cultivars				
Sugar baby	24.5f	51.8e	61.0de	77.0c
Kaolack	25.5f	57.0e	68.3d	84.0c
Royal sweet	22.5f	49.0e	60.5de	75.0cd

Paradise	27.3f	74.0cd	99.8b	120.5a
SE±		5.2		

Means followed by same letter (s) are not significantly different at 5% probability level by DMRT.