Performance of Different Varieties of Okra (*Abelmoscus esculentus* (L) Moench) Grown under Irrigation in Kashere, Gombe State.

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Abstract
Field experiment was conducted at the Teaching and Research Farm of the Faculty of Agriculture, Federal University, Kashere, Gombe State to study the Performance of Different Varieties of Okra (Abelmoscus esculentus (L) Moench) Grown under Irrigation in Kashere, Gombe State. The treatment consisted of three okra varieties (Chalawa, NHAe47 and Yarkwadon) grown at a spacing of 60cm x 45cm. The experiment was laid out in randomized complete block design and replicated three times. Data were collected on plant height, number of branches per plant, number of fruits per plant, fruit length, fruit diameter, fresh fruit weight, days to first and 50% flowering, days to first and 50% fruiting and fruit yield per plot which was converted in fruit yield per hectare. Data was analysed using ANOVA and means were separated using LSD at $p \leq 0.05$. Results obtained showed that Yarkwadon gave the highest fruit length (12.16cm), number of branches per plant (12.67), plant height (73.77cm) and number of fruits per plant (14.67) while NHe47 gave the highest fruit yield per hectare of 12.30tha-
Key Words: Okra, Yarkwadon, Irrigation, NHAe47

INTRODUCTION

Okra (*Abelmoscus esculentus* (L) Moench) is a popular vegetable crop grown in most parts of Nigeria and other tropical and sub-tropical countries. It is a member of the malvaceae family (Katung, 2007). The crop is usually grown in Nigeria for its mucilaginous content. The pods vary in length, colour and smoothness depending on the variety and it grows best in well drained rich soils. Okra is an erect annual plant that may grow up to 2m in height; the stems are green, sometimes with red traces, hairy and woody when mature. The leaves are 10- 20 cm long and broad, lobed with 5-7 lobes. The flowers are 4-8cm in diameter. Pods which contain numerous seeds are long or cylindrical and slimy when cut, their size and shape vary, pods are hairy in young stage, furrowed splitting along length when ripe (Edmond *et al*., 1999).

The crop is high in fibre and the raw fruits contain 90% water, 7% carbohydrate, 2% protein and 1% minerals (Rosa, *et al*.. 2010). Mucilaginous extract from okra is reportedly useful in curing ulcer as well as relief of dealing in sugar processing. Scheppes, (2000) noted that the tender pod contains vitamin A and C and also traces of vitamin B. Okra provides good source of calcium and other body building minerals that contributes to healthy living. Okra fruit provide numerous health benefits which are useful in treating cardiovascular, coronary heart diseases, diabetes, digestive disease, genitor urinary disorders and chronic dysentery (Peter, 2011). Okra is cultivated mainly for its immature fresh fruits which are used as vegetables in making soup or dried and milled to powder for use as flavouring (Philips *et a*l., 2010). The stems and leaves of okra are used as animal feed; the seeds are dried and ground for making coffee. World production of okra as fruit

ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
18th – 22nd November, 2018

vegetable is estimated at six million tons per year. In West Africa, it is estimated at five to six hundred thousand metric tons (500,000 to 600,000 tonnes) per year (Burkill 1997).

Okra grows best in hot summer with minimum and maximum temperatures of 18^0C (65^0 F) and 35^0C (95^0 F) respectively and need a long season with warm nights. Okra planted in late spring may remain vegetative until late summer or early fall (Sadiq *et al., 1998*). It can be grown both as rain fed and irrigated crop. () repeated. Okra is a popular vegetable in tropical and subtropical countries of the world, and it is grown for it 'Pod" (Adelakum et *al*, 2010).

Okra is a multipurpose crop due to various uses of the fresh leaves, buds, flowers, pods, and seeds (Mihretu *et al,* 2014*)*. It is currently grown mainly as a vegetable crop and has potential to be cultivated as an essential oil seed crop with (20-40%) oil content (Sorapong, 2012). Okra tolerates a wide variety of soils, but prefers a well-drained sandy loam with pH of 6-7 and soil with high organic matter content. The pod mucilage has its medicinal properties as an emollient laxative and expectorant. It also contains protein which plays a particular important role in human nutrition. Okra has been called "a perfect villagers vegetable" because of its robust nature, dietary fibre and distinct seed protein balance of both lysine and tryptophan amino acid unlike the protein of cereals and pulses. The leading world producing Okra countries are India with 483,300 tons per year while Nigeria is second with 139,000 million ton in 2.7 million hectares. Others are Sudan, Iraq and Coted`Ivore with 223,650 million tons, 132,015 and 115,867 million tons, respectively on percentage basis. India alone account for 67% of world production followed by Nigeria with 15% and Sudan with 3% while Iraq and Coted·Ivore with 2%, respectively (FAO, 2010).

Okra production in the study area is usually rainfed which consequently result to unavailability of the vegetable during the dry season. It is obvious that scarcity and high cost of okra need to be addressed through increased production under irrigation. The result of the study will determine the adaptability and yield of okra in Kashere under irrigation. This work was carried out to determine the performance of different varieties of okra under irrigation.

MATERIALS AND METHODS

Field experiment was carried out at the Teaching and Research Farm of Faculty of Agriculture, Federal University, Kashere, Gombe State. The study area is located at an elevation of 431m above sea level on latitude 9^0 46 0 and longitude 10^0 57 0 E, on the northern fringes of the Sudan savannah belt of Nigeria. The treatments consisted of three varieties of okra namely; Chalawa, NHAe47, and Yarkwadam, spaced at 60x45cm inter and intra row. Each variety was allocated to a plot measuring 16.5 m x 16.5 m, making three plots per block and was laid out in Randomized Complete Block Design (RCBD) replicated three times. Surface irrigation was used to supply the water to the crop.

Data Collection

Plant height (cm): Plant height was measured using meter rule from ground surface to the apex of the terminal bud. This was carried out at 4, 8, 12 and 16 weeks after sowing. Three plants were randomly selected from each plot and

ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
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tagged and their individual heights were measured. The mean plant height was then computed.

Number of branches per plant: Branches of the three tagged plants were counted at 12 and 16 weeks. The mean number of branches per plant was then computed.

Number of days to first and fifty percent flowering: The plots were regularly inspected and the number of days to first and fifty percent flowering were duly recorded

Number of days to first and fifty percent fruiting: These were obtained by regular observation of the plots to record the number of days the first fruit appeared and the days it took for the crops to reach fifty percent fruiting.

Number of fruit per plant: At each harvest, the fruits from each plant were counted and summed up to obtain the total number of fruit per plant.

Fresh fruit weight (g): Fresh fruit weight were measured using weighing balance at each harvest and the means recorded.

Fruit diameter (cm): Fruit diameter was measured using venier caliper and the means recorded**.**

Fresh fruit yield per hectare (kg/ha) or (t/ha): To get the fresh fruit yield per hectare, the fresh fruit yield per plot at each harvest was summed up and then converted into fresh fruit yield per hectare.

$$\text{Fresh fruit yield per hectare (t/ha)} = \frac{\text{Total Fresh fruit yield/plot (kg)}}{\text{Area of plot (m}^2\text{)}} \times 10{,}000$$

Data analysis

The data collected were subjected to analysis of variance (ANOVA) as described by Gomez and Gomez (1984), using mixed model procedure of Statistical Analysis System (SAS) (8). and significant means obtained from the analysis were separated using Least Significant Difference at ($p \leq 0.05$).

RESULTS

The result shows the performance of different varieties of okra on plant height of okra grown under irrigation which indicated that there was no significant difference among varieties on plant height at 4 and 8 WAS (Table 1). However, significant differences ($P \geq 0.05$) were observed at 12 WAS and highly significant ($p<0.01$) at 16 WAS. Yakwadom had the highest plant height (73.77 cm) followed by NHAe47 with 69.77 cm and Chalawa had the lowest plant height of 67.83cm.

There was no significant difference ($P \leq 0.05$) among the varieties in number of branches at 12WAS but significantly different at 16 WAS (Table 2). At 12 and 16 WAS, Yakwadom had the highest number of branches with values of 10.67 and 12.67, respectively while Chalawa had least values of 8.89 and 10.63, respectively.

The results indicated that days to first and 50% flowering and first and 50 % fruiting were not significantly different at $p > 0.05$ (Table 3). However, NHAe47 had the highest values (64.00, 84.00, 70.37 and 90.000 of first flowering, 50 % flowering, first fruiting and 50 % fruiting, respectively while Chalawa had the least values in all parameters.

Results showed that no significant difference was observed in fruit length, fruit diameter and fresh fruit weight at ($p < 0.05$), however, there was significant difference in fresh fruit yield per hectare where NHAe47 produced significantly higher fruits yield than both Chalawa and Yarkwadom which produced the least fruit yield per hectare (Table 4) 12.30t/ha, 8.77t/ha, and 12.07t/ha.

DISCUSSION

ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
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Table 1 showed that Yarkwadon had the highest plant height (73.77) at 16WAS. Some varieties of okra are taller in height, while others are dwarf, because of this there is variation in the plant height. Table 2,showed that there was significant difference in number of branches among the varieties. Yarkwadom had the highest number of branches (12.67) followed by NHAe47. This is in line with the work of Mogapi *et al.* (2014) who reported that okra varieties have varying branching habit. The number of branches per plant may be due to increase in number of branches and leaves, which might have contributed to increase in photosynthetic ability of the plant. This facilitated growth and increase in number of branches. Chalawa started flowering 61.00 days, NHAe47 64.00 and Yarkwadom 61.33 days after planting. It took Chalawa 79.67days, NHAe47 84.00 and Yarkwadom 82.23 respectively to reach the 50% flowering. This was in line with finding of Ekwu and Nwokwu (2012), who reported that, days to first flowering can be affected by varieties and climate. The response of okra variety on days to first and 50% flowering can be attributed to the utilization of solar radiation which usually varies in length, colour and smoothness depending on the varieties (katung, 2007). The outcome of the study revealed that days to first fruiting Chalawa started earlier than the other varieties at 66.67 days after sowing (DAS).while NHAe47 attained the days to first at 70days and Yarkwadom reached fruiting at 67.67 days. Still Chalawa was the variety that attained 50% fruiting at 90 days after sowing. The significant difference among varieties on days to first and 50% fruiting might be due to genetic makeup, environmental influence and solar radiation. The result shows that NHAe47 gave the highest fresh fruit weight (12.30t/ha), fruit diameter (3.77cm), and Yarkwadom gave the highest fruit length (12.16cm), and Number of fruit per plant (14.67). This is in line with the work of Oke (2003).

The effect on number of fruit per plant may due to increase in number of branches and leaves, which might have contributed to increase in photosynthetic ability of the plant and some of which might have been petitioned to fruits for their development (Mogapi *et al* ., 2014). The significant effect on varieties on weight of pod might be due to the excess amount of water content than the others which make their fresh pods to weight higher (Farooq *et al*., 2010).

SUMMARY

The field experiment was carried out at Teaching and Research Farm of the Department of Agriculture, Federal University of Kashere, Gombe State to determine the performance of different varieties of Okra *(Abelmoschus esculentus (L.) Moech*) under irrigation at Kashere. The experiment which was arranged in a randomized complete block design (RCBD) consisted of three Varieties Chalawa, NHAe47 and Yarkwadom, replicated three times. parameters measured were; Plant height, number of branches, number of pod per plant, fruit length, fruit diameter, fresh fruit weight, days to first and 50% flowering, Days to first and 50% fruiting. The data obtained were subjected to statistical analysis of variance (ANOVA) using which software package? .The results showed that there was no significant difference in days to first and 50% flowering, days to first and

ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
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50% fruiting. Significant effect was however, observed in plant height at 12 and 16 WAS, number of branches at 16 AWAS, number of fruit per plant and fresh fruit weight and NHe47 gave the highest (12.30 t/ha) fruit yield per hectare followed by Yarkwadom with value of 12.07 t/ha while Chalawa gave the least (8.77 t/ha) fruit yield per hectare.

CONCLUSION

Based on the finding of this study, it can be concluded that NHAe 47 had the highest yield compared to Yarkwado and Chalawa and thus could be adopted for planting under irrigation in Kashere.

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ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
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Table 1. Performance of different varieties of okra on plant height grown under irrigation in Kashere

	Plant height (cm)			
Treatment	4WAS	8WAS	12WAS	16WAS
Chalawa	2.50	5.23	18.83	67.83
NHAe47	2.36	6.03	19.77	69.77
Yarkwadom	2.60	8.06	23.77	73.77
Level of significance	N.S	N.S	*	**
LSD	NS	NS	3.01	3.85

NS: No significance, WAS: week after sowing, LSD, Least significance difference.

ISSN 978-978-54729-6-7
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Table 2. Performance of different varieties okra on number of branches of Okra in Kashere

	Number of branches	
Chalawa	8.89	10.63
NHAe47	9.53	11.53
Yarkwadom	10.67	12.67
Level of significance	N.S	*
LSD	2.562	1.652

LSD: Least Significant Difference WAS: weeks after sowing.

Table3. Performance of different varieties of okra on days to first flowering, days to 50% flowering, days to first fruiting and 50% fruiting in Kashere

Treatment	DFL	D50%FL	DFR	D50%FR
Chalawa	61.00	79.67	66.67	86.00
NHAe47	64.00	84.00	70.37	90.00
Yarkwadom	61.33	82.23	67.67	88.33
Level of significance	N.S	N.S	N.S	N.S
LSD	8.07	5.24	9.01	4.60

NS: No significance, DFL: Days to first flowering, D50%Fl: Days to 50% flowering. DFR: Days to first fruiting, D50%FR: Days to 50% fruiting.

ISSN 978-978-54729-6-7
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Table 4: Performance of different varieties of okra on yield parameters under irrigation in Kashere.

Treatment	FL(cm)	FD(cm)	NF/P	FFW(t/ha)
Chalawa	10.37	3.30	12.67	8.77
NHAe47	10.01	3.77	13.00	12.30
Yarkwadom	12.16	2.97	14.67	12.07
Level of significance	N.S	N.S	N.S	*
LSD	2.128	0.953	2.070	1.816

FL: Fruit length, FD: Fruit diameter, NF/P: Number of fruit per plant, FFW: Fresh fruit weight

ISSN 978-978-54729-6-7
THEME: "Horticulture for Improved Food Security, Sustainable Environment and National Economic Growth
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