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Growth Performance and Pod Dry Matter Yield of Some Local and an Improved Variety of Okra in Sudan Savannah Zone Nigeria

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Abstract: Field experiments were conducted during 2002 and 2003 rainy seasons to study the growth dry yield of some selected local and an improved varieties of Okra (*Abelmoschus esculentus*). The experiments were laid out in a Randomized Completed Block Design (RCBD), replicated four times. The results show that there were significant differences in growth characteristics and yield of the varieties. There were significant yield depression tons ha^{-1} by 21.8, 21.9. 49.8 and 63.4%, when Kwanab Bokodo was compared with Kwanab Magwandara, Kwanab lende, Kwanab Kwete and lady finger (control), on fresh weight basis. However on dry weight basis, reverse was the case with lady's finger significantly out-weighing (Kwanab Magwandara by 14.50%, Kwanab lende, 25.4%. Kwanab Bokodo, 34.7% and Kwaanab Kwete, 56.9%). There were also significant variations in the length of pods/plant (cm), leave area per plant (cm^2), number of leaves per plant and number of branches per plant. This implies that lady's finger with higher pod dry matter yield therefore has higher productivity and contains more nutritional components than others.

Key words: Growth and Pod dry matter yield, local and improved varieties of Okra, Sudan savannah zone Nigeria

INTRODUCTION

Okra (*Abelmoschus esculentus*) is an annual herbaceous plant of the family Malvaceae and indigenous to tropical Africa grown all over West Africa (Schippers, 2000) including Nigeria. In Nigeria, 1-2 million hectares of land are under okra production (FPDD, 1989). The crop grows to a height between 30-100 cm. Okra is grown for its pod, used as a vegetable and also as a soup thickener. The pod, which is the edible part, is between 10-15 cm in length. Numerous varieties of Okra exist. These include (both indigenous and improved varieties) Okworo Igwu ji kwanab Kwete, Kwanab Bokodo, Kwanab Magwandara and Kwanab lende while the improve varieties such as velvet, yar-balla (improved local), V38,V2, TAE 38 Jokoso NHAE 47-4 and lady's finger exits. Amongst the indigenous tribes of Zuru in Kebbi State of Nigeria, some indigenous, Okra varieties are used as soup thickener and as a condiment and/or vegetable (Grima, 2002 Personal communication). Uzuegbu (1993) made analysis of elemental composition of some soup thickeners used in Nigeria but excluded okra. This paper embodies studies on the growth characteristics of some indigenous varieties (of Zuru people in Kebbi State of Nigeria) and a well known improved variety, lady's finger. Also, it attempts to investigate the Pod Dry Matter Yield (PDMY) of some of the indigenous varieties as a basis for their nutrient content, determination.

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MATERIALS AND METHODS

The experiments were conducted in Zuru at the college of Agriculture demonstration and research farm during 2002 and 2003 wet seasons. Zuru is located in the Sudan Savanna vegetation zone of Nigeria and lies between latitude 11 degree 15 min to 11 degrees 35 min E and longitude 5 degree 47 min. The soil and climate conditions of the study area are shown on Table 1 and 2 Zuru has favourable climatic conditions for growing many crops. The soils are moderately deep, well drain, sandy-loam. The average rainfall is about 1825 mm with a mean temperature of 27°C. The wet season is from April to October. The area experiences a period of harmattan from the months of December to February (Grima, 2002).

The treatments consist of five varieties of Okro. The experimental design used was a randomized completely block design. The treatments were replicated four times. It covered a total area of 90 m^2 consisting of 20 plots.

The land was cleared of all existing shrubs stumped; stones and other debris were removed using hoe and rake. Similarly a hoe was used to prepare the seedbeds while measuring tape and rope were used in marking out the plots. A distance of 1 m was marked to separate replicates while 0.5 m was used to separate plots from one another.

The test crop varieties were Kwanab bokodo, annual, large leaves, stem, big short pod, Kwanab Magwandara sensitive to day length lobbed leaves, with notched flowers/pods, Kwanab lende-having a flower similar to cotton, that produces pods up to the Apex having large and smooth vegetative growth and sensitive to day length, Kwanab Kwete-a dark green, hairy itching pod 10-15 cm long. These varieties were planted on 27th June 2002 and 2003, respectively during the period rain has established. Native hoes were used to open holes. Two seeds were planted per hole to a depth of 2 and 60 cm between and with in rows.

Inorganic (NPK) fertilizer was applied at the rate of 50.45: 0 kg ha^{-1} using Urea and single super-phosphate at 3, 6 and 9 Weeks After Sowing (WAS).

Table 1: Physco-chemical properties of the experimental site at the college of Agriculture, Zuru demonstration and research farm during the 2002 season

Mechanical analysis	Range	$\bar{X}$%	SD
Physical			
Sand	91.5-97.3	95.82	1.19
Silt	0.9-6.6	2.35	1.46
Clay	1.8-1.9	1.82	0.97
Chemical			
Sodium (Na)	6-18 (ppm)	11.00 (ppm)	2.0
Potassium (K)	42-25	12.80	8.8
Phosphorous (P)	021-025	0.23	0.12
pH	5.7-5.9	5.80	0.12
Electrical			
Conductivity (EC)	32-52 (μs cm^{-1})	42 (μ cm^{-1})	3.20
Organic carbon	3.6-44	3.92	0.49
Organic matter	6-8	6.8	0.64

Source: Chigbundu and Ibeawuchi (2006)

Table 2: Average rainfall and relative humility data for 3 years (2000, 2001 and 2002) as recorded by the college of Agric, Zuru Meteorological station (Rainfall mm)

Years	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
2000	-	-	-	9.00	19.09	32.50	146.52	804.5	1394.05	279.50	-	-
2001	-	-	-	38.75	53.60	10.20	83.85	396.6	198.75	67.00	-	-
2002	-	-	-	25.50	19.00	10.35	59.35	262.0	262.75	67.00	-	-
Relative humidity (2002)	70	35	95	80.00	35.00	34.00	15.00	14.0	13.35	13.60	14.75	35
(2003)	71	36	89	78.00	35.00	37.00	19.00	23.0	16.00	14.00	16.00	32

Weeding, Pest, Diseases and Their Control

Weed control was carried out manually using hoe at a week's interval while pest control was carried out using insecticide, Nuvacron 40 SCW water soluble concentrate at the rate of 60 g a.i and at 9 L per hectare. No disease incidence was noticed on the crops.

Pre and post-harvest plant parameters measured included stem height (cm), using a metre rule, number a leaves per plant, leaf area (cm^2) were measured, stem diameter (cm), number of branches per plant, length of pods (cm), average weight in t ha^{-1}, on both dry and wet basis, diameter of pod and number of flowers per plant.

Harvesting and Yield Determination

Harvesting was done at 4 days interval starting from 54 Days After Sowing (DAS). Harvesting was done manually using shorp knife to cut pods from plants. Yield was determined using six randomly selected plants from each plot.

Data Analysis

Data were analyzed using Analysis of variance (ANOVA) while treatment means were separated using the Least Significant Difference (LSD) and the standard error of the mean method (Gomez and Gomez, 1994; Riley, 2001; Salako, 2004).

RESULTS AND DISCUSSION

Results in Table 3 show that the differences in plant height and leaf area among the varieties were not significant but the numbers of branches per plant, stem diameter in Kwanab kwete were significantly higher ($p = 0.05$) than the other varieties. This variety had very high mean plant height (82.75 cm), stem diameter (6.23 cm), leaf area/plant (1044.13 cm^2) at 12 WAP. Furthermore, the number of branches (7.16) was statistically higher than the mean value for other varieties used in the experiment.

Dry pod yield and number of flowers/plant did not significantly vary among the varieties, but fresh pod yield, pod length and pod diameter were significantly different ($p = 0.05$). The non-significance of the pod yield on dry weight basis as against the statistical significance of this variables on fresh weight basis is indicative of the differences in moisture content of the fruit yields, which was lowest in lady's finger (91.4%) and highest in Kwanab Bokodo (96.1%) and about 94% in other varieties. This result has implications for the culinary qualities of the varieties. In respect of plant heights, leaf area and number of branches/plant the results are in agreement with Sabatu (2002) who made the same observation when working with similar varieties in Zuru. According Harper (1983), for a meaningful consideration to be made, these parameters should be correlated with dry matter production in order to determine growth and yield and this is the case with this research.

Table 3: Average plant height (cm), stem diameter (9 cm), No. of leafs per plant, leaf area (cm^2) and No. of branches per plant determined at 12 Weeks After Sowing (WAS)

Varieties	Plant height (cm)	Stem diameter (cm)	Leaf area (cm^2)	No. of leaves per plant at (12 WAS)	No. of branches per plant
Lady's finger	78.63	4.52	366.13	9.08	1.92
Kwanab magwandara	57.39	4.71	420.79	13.04	3.78
Kwanab kwete	82.75	6.23	1044.13	17.24	7.16
Kwanab lende	71.52	4.42	378.03	10.23	2.83
Kwanab bokodo	83.31	4.33	548.96	11.98	1.69
LSD (0.05)	27.95	0.95	704.55	7.08	2.69
	NS	*	NS	*	*

NB: Average data for 2 years, * Significant at 5% probability level, NS: Not Significance at 5% probability level, LSD: Least Significant Difference

Table 4: Average pod dry weight (t ha^{-1}) pod fresh weight length of pod (cm), pod diameter (cm) and No. of flowers per plant

Varieties	Dry pod weight (t ha^{-1})	Fresh pod (t ha^{-1})	Length of pod (cm)	Pod diameter	No. of flower per plant
Lady's finger	10.09*	197.20*	9.87*	8.17	2.25
Kwanab magwandara	8.81	158.01	8.15*	10.78*	3.75
Kwanab kwete	6.43	128.54	8.45*	8.26	2.08
Kwanab lende	8.04	157.91	7.29	9.51	2.67
Kwanab bokodo	7.49	192.66*	5.17	9.37	3.62
LSD (0.05)	2.75	6.91	2.29	1.63	NS

NB: Average data for 2 years, *Significant at 5% probability level, NS: Not Significant at 5% probability level, LSD: Least Significant Difference

Results in Table 4 indicate that there were statistically significant differences among the varieties when the yield and yield components were compared. From the results obtained it could be observed that the shorter the plant, the higher the yield. Kwanab Kwete having larger leaf area (1044.13 cm^2) and also more leaves per plant had significantly lower yield (tons ha^{-1}) when compared with the control (lady's finger). The trend followed by this result was not expected since the area of leaf surface is used as an index to quantify the photosynthetic accumulations of any plant. The anomaly observed from the result of this experiment in this regard may be due to greater number of pods formed after flowering, which may have helped to, improved the plant photosynthesis. Another reason may be that the yield potential of this variety may be genetically fixed since genetic makeup of an individual affects its performance generally. Also, environmental factors may have influenced their yield since they were grown under the same environmental conditions. The assumption that all the leaves contribute to the growth and yield has been challenged (Harper, 1983) since the older the leaves, the less efficient they are in light conversion and so low photosynthetic performance. Bleasdale (1973) described a range of techniques for measuring leaf areas and indicated that calculations based on dry weight basis improved the efficiency. However, it had been noted that electrophiles are generally more efficient than planophiles in contributing to photosynthetic efficiency. Harper (1983) stressed that leaf arrangement; position and angle of presentation to incoming radiation are other factors that can make adequate contributions to photosynthetic efficiency that subsequently affect growth and yield in crop production.

CONCLUSION AND RECOMMENDATION

Yield potentials of the test crops are determined by the genenitic make up of the individual crop plant. Environmental factors may have helped to realize the yield potentials of the Lady's finger. However, with higher Pod Dry Matter Yield (PDMY) the Lady's finger contains more nutritional components than the others. It is recommended that proximate analysis of these varieties be made to determine their nutrients contents.

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