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Evaluation of okra (*Abelmoschus esculentus* L. Moench) cultivars for dry season production in the Southern Guinea Savanna ecology of Nigeria

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Abstract

Field experiments were conducted at the Teaching and Research Farm of the University of Agriculture, Makurdi during the dry seasons of 2010 and 2011 with the objective of evaluating the performance of okra cultivars in the Southern Guinea Savanna ecology of Nigeria. The experimental design was a randomised complete block design with three replications while five cultivars of okra (Guntu, Dogo and Ex-Ajia NH47 – 4 and LD 88) constituted the treatments. Highly significant variety effect was observed for all the traits (days to flowering, plant height, pod length, pod diameter, number of pods/plant, weight of fresh pods/plant and 100 – seed weight) studied, indicating that the cultivars evaluated are genetically diverse. A positive correlation was observed among the yield components of pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight, indicating the prospect of simultaneous selection for these traits. The highest values for pod length, pod diameter, number of pods/plant and 100 – seed weight observed for Ex – Ajia, NH47 – 4 and Dogo is an indication that these three varieties have the potential for good performance in the dry season and should be selected for dry season production in the southern guinea savanna ecology of Nigeria. There is need for further studies on seasonal variation across many locations within the southern guinea savanna ecology of Nigeria, with a view of selecting specific genotypes for specific season in respective locations.

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Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is an important vegetable crop in the tropical and subtropical regions of Asia and Africa (Bight and Bhat, 2006). The crop is widely grown in West Africa, particularly Nigeria, where it is consumed in all parts of the country because of its high nutritional value in diets (Smith and Ojo, 2006). The young pods are particularly rich in nutrients with 86.1% moisture content, 9.7% carbohydrates, 12.2% protein, 0.1% fibre, 0.2% fats and 0.9% ash (Ariyo and Aken'ova, 1986).

Okra is produced both as an irrigated and a rain fed crop in Nigeria, particularly in the Northern Guinea Savanna and the Sudan Savanna ecological zones of the country. However, in the rain forest and Southern Guinea Savanna agro – ecological zones of the country the production of okra is concentrated in the rainy season with abundant information on research findings (Ijoyah *et al.*2010a, 2010b; Iremiren and Oky, 1999; Smith and Ojo, 2006; Asoegwu, 1987; Ojeniyi, 1991; Melifonwu, 1999; Muoneke and Mbah, 2006; Akintoye *et al.,* 2006) for the rain fed okra farmer. The Southern Guinea Savanna ecology of Nigeria experience 6 – 7 months of rainfall from April to October each year, with a dry season period of about 5 months between November and March. Most okra farmers in the Southern Guinea Savanna therefore commence planting as soon as the rains are established and continue till September. Fresh fruits of okra are therefore abundant in the Southern Guinea Savanna ecology of Nigeria throughout the months of June to December, with a progressive decline in availability as the dry season progresses. Hence, only the okra sown by a few farmers towards the end of the rainy season and during the dry season sustain consumers in the months of December to May at exorbitant prices.

Resource input cost for dry season production of okra is higher than that of the rainy season due to the added cost of irrigation. The farmers therefore need to off-set this added cost of irrigation and maximise their profit through the use of high yielding varieties. The dearth of information on the dry season performance of okra in the Southern Guinea Savanna ecology of Nigeria necessitated this research. The objective of the study was to evaluate the performance of some varieties of okra planted during the dry season of 2010 and 2011 in the Southern Guinea Savanna ecology of Nigeria.

Materials and methods

The experiment was conducted during the dry seasons of 2010 2011 at the Teaching and Research Farm of the University of Agriculture, Makurdi, Nigeria located at Lat. 7^{o} 48' N, Long. 8^{o} 35' at an elevation of 97m above the sea level. Sunken beds measuring 5m x 4m ($20m^2$) with a 1.5m alley way between beds were constructed and used for the purpose of enhancing water retention because of the high rate of evaporation during the period of study(dry season). Five cultivars of okra (NH47 – 4, Dogo, LD 88, Ex – Ajia and Guntu) constituted the treatments in a randomised complete block design replicated four times, giving a total of twenty experimental units. Four rows of 5m length, spaced 0.5m apart were made on each bed and two seeds were sown directly into the rows at a spacing of 0.3m between hills. Planting dates were 8th February and 3rd March for the 2010 and 2011 respectively. Seedlings were thinned down to one stand/hill at two weeks after sowing and hoe - weeded immediately prior to the application of fertilizer on the next day. Compound fertilizer N P K 15 – 15 – 15 was applied by band placement at the rate of 100Kg (15KgN, 15KgP_2O_5 and 15KgK_2O).

Data was recorded on days to flowering, plant height at maturity, pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight. The data was subjected to analysis of variance according to Gomez and Gomez (1984) while means were separated using Duncan's New Multiple Range Test. Correlation coefficient among the means was carried out using SPSS V. 17.

Results and discussion

Data for the two years were combined for analysis due to homogeneity of error mean squares. Mean squares for pod yield and yield components of okra evaluated in the Southern Guinea Savannah ecology of Nigeria in the dry season of 2010 and 2011 are presented in Table 1. No significant years, rep/years and variety x years interaction effects were observed for all the traits namely, days to flowering, plant height, pod length, pod diameter, number of pods/plant, weight of fresh pods/plant and 100 – seed weight. Highly significant variety effect was however observed for all the traits studied, indicating that the varieties evaluated are genetically diverse.

Table 1. Mean squares for pod yield and yield components of okra evaluated in the southern guinea savannah ecology of Nigeria in the dry season of 2010 and 2011.

Source of variation	Df	Days to flowering	Plant height at maturity	Pod length	Pod diam-eter	Number of pods /plant	Weight of fresh pods/ Plant	100-seed weight
Years	1	0.0202	0.0640	0.0040	0.0250	0.0250	0.0003	0.0203
Reps/ Years	6	0.1903	0.1118	0.0052	0.0125	0.0865	0.0213	0.0156
Variety	4	3950.3552**	2041.3328**	68.7256**	12.2160**	783.7254**	106.1834**	2.0575**
Years x Variety	4	0.0703	0.1453	0.0009	0.0013	0.0306	0.0009	0.0128
Error	24	0.7527	0.1610	0.0114	0.0096	0.0688	0.0073	0.0074

**: significant at P < 0.01

Table 2. Character means for pod yield and yield components of okra evaluated in the southern guinea savannah ecology of Nigeria during the dry season of 2010 and 2011.

Variety	Days to flowering	Plant height at maturity (cm)	Pod length (cm)	Pod diameter (cm)	Number of pods /plant	Weight of fresh pods/ Plant(g)	100-seed weight (g)
Guntu	94.80a	92.58a	2.69e	1.71d	6.44e	7.31d	3.90e
Ex-Ajia	43.00d	60.84d	8.55b	4.25b	16.78c	13.50b	4.65b
NH47-4	45.13c	50.56e	5.45c	4.49a	18.39b	14.61a	5.18a
Dogo	42.56d	62.64c	9.31a	2.41c	32.80a	6.80e	4.41c
LD88	58.13b	73.71b	3.63d	2.41c	11.63d	8.51c	4.05d
Mean	56.72	68.07	5.93	3.06	17.21	10.15	4.44
CV (%)	1.53	0.59	1.80	3.2	1.52	0.84	1.94

Means followed with similar letter(s) in the same column are not significantly different at P< 0.05 according to Duncan's New Multiple Rang Test

Days to flowering ranged from 24.56 days for Dogo to 94.80 days for Guntu with a mean of 56.72 days (Table 2). The time of flowering in the variety Guntu coincided with the period of completion of life cycle in all the other varieties. The days to flowering observed for NH47-4 in the current work is consistent with the findings of Tairu *et al.* (2006). The variety Dogo however took longer days to flower (58) compared to 47 days recorded in the previous study (Tairu *et al.,* 2006). These conflicting results could be attributed to differences in location and season. While Tairu *et al.* (2006) carried out their studies during the rainy season in the rain forest ecology of Nigeria, the current work was carried out in the southern guinea savanna ecology of the country during the dry season.

The trend in plant followed the same pattern as the days to flowering except for the distortion caused by dwarf nature of NH47-4 (shortest variety). The range in plant height observed in the current work is in agreement with the range previously reported (Abdelmageed, 2010; Ijoyah *et al.*, 2010a). It is however contradicted by the findings of Ijoyah *et al.*

(2010b) for the same variety (NH47-4) in 2008 and 2009 at the same location (Makurdi). These differences could be attributed changes in genotypic response due to seasonal variation. Ijoyah *et al.* (2010b) carried out their studies in the rainy season while the current experiment was carried out during the dry season.

Table 3. Phenotypic correlation of genotypic means among seven characters in okra evaluated in the southern guinea savannah ecology of Nigeria during the dry season of 2010 and 2011.

Character	Plant height at maturity (cm)	Pod length (cm)	Pod diameter (cm)	Number of pods /plant	Weight of fresh pods/ Plant(g)	100-seed weight (g)
Days to flowering	0.930*	-0.787	-0.691	-0.735	-0.496	-0.711
Plant height at maturity (cm)		-0.648	-0.845	-0.629	-0.700	-0.915*
Pod length (cm)			0.421	0.852	0.194	0.460
Pod diameter (cm)				0.189	0.967**	0.917*
Number of pods /plant					-0.060	0.412
Weight of fresh pods/Plant (g)						0.846

A wide range in pod length was observed between the shortest pod of 2.69cm for Guntu and the longest pod of 9.31cm for Dogo. Only Dogo and Ex-Ajia (8.55cm) produced longer length of pods than the population mean (5.93m). The wider range in pod length in the current work compared to the previous (Ijoyah *et al.*, 2010b) could be attributed to differences in the size of population. Ijoyah *et al.*(2010b) used only one variety (NH47-4), varying the planting dates, while the current work studied five varieties during the dry season. The variety Guntu also recorded the lowest pod diameter (1.71cm), fewest number of pods/plant (6.44) and the lowest 100-seed weight (3.90g). Number of pods/plant in Guntu was very low (6.44) being only 20.7% of the outstanding number of pods produced by Dogo (32.8). The number of pods/plant observed for NH47-4 in the current work is in agreement with the findings of Tairu *et al.* (2006). The wide range (6.44 – 32.80) in the number of pods/plant in the current work is beyond the range previously reported (Abdelmageed, 2010; Ijoyah *et al.*, 2010a, 2010b; Ojeniyi and Olumilua, 2006). All the previous studies were carried out in the rainy season while the current study was conducted during the dry season. The variety Dogo recorded the lowest fresh pod weight /plant (6.80g) while NH47 – 4 recorded the highest weight (14.61g). Dry matter accumulation in seed (100 – seed weight) was also highest in NH47 – 4.

Days to flowering was positively correlated with the plant height but negatively correlated with pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight (Table 3). Similarly the plant height was negatively correlated with pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight. A positive correlation was however observed among the yield components of pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight. The positive correlation coefficient observed between pod length and yield in the current work is not consistent with the findings of Raji (2002) who observed a negative correlation between pod length and yield. The contradiction could also be attributed to differences in location and season as earlier observed. The negative correlation between days to flowering/plant height and the yield components of pod length, pod diameter, number of pods/plant, fresh weight of pods/plant and 100 – seed weight is an indication that early maturing varieties should be selected for dry season production. The highly

significant positive correlation between pod diameter and fresh weight of pods/plant and the significant positive correlation between pod diameter and 100 – seed weight is an indication that these traits are under the same genetic control and that progress in selection could be achieved by simultaneous selection for these traits.

The highest values for pod length, pod diameter, number of pods/plant and 100 – seed weight observed for Ex – Ajia, NH47 – 4 and Dogo is an indication that these three varieties have the potential for good performance in the dry season and should be selected for dry season production in the southern guinea savannah ecology of Nigeria. The variety Guntu is late maturing, with very low pod yield in terms of number and weight, but could be improved through selection. There is need for further studies on seasonal variation across many locations within the southern guinea savanna ecology of Nigeria, with a view of selecting specific genotypes for specific season in respective locations.

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