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Field Evaluation of Some Okra Varieties in a Guinea Savannah Agro-Ecology of Nigeria

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ABSTRACT

Thirty one (31) okra genotypes including ten (10) parents and twenty one (21) hybrids were evaluated for their variability study and field agronomic performance at the research farm of the Plateau State College of Agriculture, Garkawa, Nigeria during the 2020 farming season. The treatments were laid out in an Alpha Lattice Design replicated three times to determine their variation in yield performance in the study area. Data were recorded on number of primary branches / plant, number of leaves / plant, days to first flowing, days to fifty percent flowering, days to harvestable pods maturity, number of pods/plant, pod length, pod weight and one hundred seed weight. The Analysis of variance revealed a significant difference (P<0.05) among the treatments for the study traits, indicating the presence of high variability among the studied materials. Hybrids 297 x 346, 396 x 348 and Zuru x 452 stood out as the most outstanding among others based on pod yield in the study location.

INTRODUCTION

The cultivated Okra (*Abelmoschus spp*) equally known as lady's finger is a popular vegetable crop in the tropical and subtropical regions of the world (Bisht and Bhat, 2006). The crop (okra) belongs to the Malvaceae family and it was originated from Africa/Asia where it got dispatched to America, Europe and other developed countries (Mohammed *et al*, 2013). It is grown in several developed countries in the world, especially the tropical and subtropical countries (Kumar *et al*, 2010). Okra is grown on a large scale in Africa, particular Nigeria, Sudan, Egypt and Ghana, (FAOSTAT, 2008). Okra has a complete diploid set of chromosomes removed from each parent with varieties displaying immense variation in plant size, shape, fruit type and

colour (Siemonsma, 1982[a]). It is a fibrous herbaceous-semi-woody annual with an indeterminate growth habit. Okra has a deep tap root system with dense shallow roots. The stems height can grow up between 3m for dwarf varieties to 7 – 8m for the tall types. Flowers usually emerge after 35 – 60 days for early stage types and remain open from morning to early afternoon. It is mostly self-fertilized but cross pollination always occurs. Anthesis, this happened at dawn and the flower remains open throughout the morning and closes by noon or early afternoon. About 35 – 40 days are required from anthesis to seed maturity. Fruits are pale green, green or purple in color and in many cultivars are ridged (Hamon*et al*, 1991). When the fruit is mature, it turned to dark brown capsules. The mature fruit becomes fibrous and separate into five parts, showing 5 rows of seeds, with 50 – 100 seeds in a fruit (Normal, 1992). The use of Okra fruits for soups and stews thickening is because of its mucilaginous and tender-texture nature (Ijoyah and Dyer, 2012, Das *et al*, 2013). Okra fruits contain 9.7% carbohydrate, 86.1% water 1.0% fibre, 0.2% fats and 2.2% protein (Saifullah and Rabboni, 2009).

Okra unripe finger like capsules usually called pods" are normally processed and used as stews and salads, soups, sliced, boiled and fried vegetables (Akanbi*et al*, 2010, Daniela *et al*, 2012). The fruits of Okra contain digestible fibre, low calories and fat-free content (Kumar and Sreeparvathy, 2010). The fruits are also important sources of potassium, vitamins, calcium and other minerals. The improvement in plant breeding scheme leans on high genetic differences in the population and the magnitude of inheritance of favorable attributes (Olawuye *et al*, 2015). Many Okra hybrids/Varieties are being grown by farmers but best performing hybrids/varieties of Okra with desirable result to better monetary value are not available (Anusheel, 2015). Thus, inter-specific hybridization has been used mostly for the transfer of some characters from one species to another (Prabu and Warade, 2013). Artificial hybridization is a conventional breeding method that involves crossing of different genotypes in order to bring genetic variability for generating new varieties with improved qualities into lime light (Sharma, 1994). This approach is basically aimed at incorporating genes for desirable traits such as disease resistance and high yield present in one genotype into the genetic background of the other genotype to produce superior hybrids. The present study was therefore, undertaking the study of field evaluation of okra varieties in a guinea savannah agro-ecology of Nigeria (*Abelmoschus spp*).

MATERIALS AND METHODS

The research materials included eight lines (with two checks: ACH -1 and ZCH – 2 inclusive), three testers and twenty four F1 hybrids derived from a Line x Tester (8 x 3) fashion making a total of thirty five (35) entries in all.

Experimental site

This research on the assessment of parental lines, F1 hybrids and the check cultivars was carried out in the research farm of the Plateau State College of Agriculture, Garkawa ($10^0$11'N, $8^0$21'E) in the southern Guinea Agro-ecology of Nigeria.

Experimental design and field layout

The research field was manually tilled and ridged. Alpha Lattice Design with three replications was used for the study. Each plot measured 2.4 x 1.2 m (2.88m^2) consisting of four rows. A 1m and 0.5m space was allowed between each block and plot accordingly. Planting was done at 60cm and 40cm inter and intra row spacing. Three seeds were sown per hole and later thinned to one seedling per hole at two weeks after sowing to maintain 20 plants per plot. Weeding was manually done and a compound fertilizer, NPK 20:10:10 was applied at the rate of 150kg N/ha, kg$P_2$05/ha and kg $k_2$0/ha (Agba et al, 2018). Insect were controlled using two sprays of cypermetrin, 10% EC at the rate of 20g ai/ha (Oyetunde and Ariyo, 2015).

Data Collection

Five randomly selected plants excluding the border rows in the three replicates of each genotypes were tagged and used for recording the following data:

- Plant height (cm): Height of the tagged plants were measured in each plot from the ground level to the apex at the time of final harvest per plot
- Number of primary branches per plot: The total number of primary branches in each of tagged plants in each plot were counted at final harvest
- Number of leaves per plot: These were counted on all the tagged plant at final harvest per plot.
- Days to first flowering: The number of days taken from the date of sowing to the onset of first flower appearance on any plant / plot was recorded.
- Days to fifty percent: The number of days taken from the date of sowing to the day on which fifty percent of the plants in each plot flowered, were recorded.
- Days to harvestable pod: were recorded based on the numbers of days taken from anthetis to marketable pod maturity.
- Number of pods per plant: the total number of pod per tagged plant at all the harvesting were counted and recorded per plant/plot.
- Pod yield (g): the total pod harvest obtained throughout the harvesting period from each plot was summed up the average yield per plant was computed for each genotype on plot basis.

- Pod length(cm): length of pod were measured from ten randomly selected pods from each plot with the help of a measuring tape and the average computed.
- Pod girth (cm): diameter of 10 randomly selected pods were measured at the middle position in each genotype per plot with a vernier caliper and the average computed.
- Pod weights (g): weights of 10 randomly selected pod per plot were taken using a sensitive weighting balance and their means determined.
- Pod yield (kg/plant): pod harvested from all the plants in each plot on the tagged plants were weighed at each harvest. The total yield per plot were computed and extrapolated in kg/plant.
- Number of seeds per pod of the 10 randomly selected pods per plot were also determined and their mean computed.

Data Analysis

The mean values per plot of all the studied characters for each genotype were used in the statistical analysis. The characters were analysed using the analysis variance technique suggested by Panse and Sukhatme (1967).
The data collected were subjected to Analysis of Variance (ANOVA) and Least Significant Difference (LSD) was used to separate the significant treatment means.

RESULTS AND DISCUSSION

The result of analysis of variance for ten (10) studied trait of the okra genotypes is presented in Table 4.1. The analysis of variance revealed a significant difference ($P<0.05$) between treatments (both hybrid & parents) for all the studied characters. This performance exhibit the presence of sufficient variability in the genetic materials used for the study. Similar results were obtained by Medagam *et al*, 2013, who reported a wide range of variability in the okra genotypes for all the traits studied

The mean performance of the Agronomic characters studied in Garkawa is presented in Table 4.2. the result of the mean performance of the agronomic characters of the studied genotypes indicated that the number of branches per plant was highest (6.00) in genotype 303 x 348 while the least performance were exhibited by parent 303 hybrids 303 x 452, Awe x 326 and zuru x 326 and Zuru x 452 while the least were observed in genotype 304, 452 and 333 x 452 and 19.67, 21.33 and 21.00 respectively.

Genotypes Zuru and Zuru x 348 exhibited the least number of days to first flowering (48.33 and 48.00 respectively) while 304 x 326 (102.67) was highest. Similarly, Zuru (51.33), Zuru x 326 (52.67), Zuru x 348 (55.33) and Zuru x 452 (55.67) took the least number of days to fifty percent flowering as 304 (103.67) and 304 x 326 (103.67) maintained the highest number of days to fifty percent flowering. In the same vein, the number of days to harvestable pods maturity was least in Zuru (60.33) as 304 (114.33), and 304 x 326 (114.00) were the highest.

For number of pods per plant, genotypes 297 (31.33), Zuru (30.00), 304 x 326 (30.00), Zuru x 326 (32.33) and Zuru x 452 (31.33) were the most outstanding while 304 (19.67) was poorest. Pod length was highest (14.00cm) in 304 x 348 followed by 396 x 348 (13.33cm) as 452 (7.33cm) and 396 x 326 (7.67cm) were the least. For pod weight, genotypes 297 x 348 (17.00g) and 396 x 348 (17.67g) gave the highest weight while the least were represented by genotypes 396 and Awe (7.67g) respectively.

CONCLUSION

As a result of the high variability exhibited by the okra genotypes with regard to the ten (10) characters studied, representing good agronomic potentials in them, it can be concluded that hybrids 297 x 348, 396 x 348 and Zuru x 452 which exhibited highest pod yield of 17.00g, 17.67g and 17.00g respectively were the best genotypes under the Garkawa environment.

RECOMMENDATIONS

Drawing from the conclusion of this research, it is hereby recommended that hybrids 297 x 348, 396 x 348 and Zuru x 452 be adopted for cultivation in Garkawa, Mikang Local Government Area of plateau state because of their outstanding yield performance in this region.

Table 1: Analysis of variance for the various characters studied

SoV	DF	NB-P	NL-P	DFF	D50%F	DHPm	NP-P	PL	Pw	100sw
Replication	2	3.73	163.79	8.93	14.53	0.008	163.79	0.006	2.42	0.48
Treatment	30	57.97	1197.30	14218.35	13859.17	15388.73	1197.30	383.66	558.38	8.99
Error	69	44.43	526.88	636.57	897.63	634.76	526.88	65.94	82.25	15.52
Total	**104**	**106.13**	**1887.96**	**14863.85**	**14771.33**	**16023.56**	**1887.96**	**449.66**	**643.05**	**24.99**

Table 2: Mean performance of some okra genotypes in Garkawa

Genotype	NBP	NLP	DFF	D50%F	DHP	NPP	PL	PW	100SW
297	4.67	31.33	58.33	57.67	70.33	31.33	11.67	12.00	6.33
303	3.30	29.00	56.33	60.33	71.33	29.00	9.33	15.00	6.33
304	3.67	19.67	94.33	103.67	114.33	19.67	10.67	11.33	7.00
333	4.67	22.67	68.33	67.33	83.00	22.67	8.33	12.00	6.33
396	5.00	28.00	58.33	61.67	72.00	28.00	10.00	7.67	6.33
Awe	5.00	30.00	55.67	61.67	74.33	28.00	10.00	7.67	6.33
Zuru	4.33	28.33	48.33	51.33	60.33	30.00	9.33	12.67	6.33
326	5.00	23.00	64.00	73.00	80.67	28.33	11.33	16.67	6.33
348	4.00	25.00	60.67	72.00	83.00	23.00	12.00	12.67	6.67
452	4.67	21.33	58.00	64.00	76.67	25.33	7.33	11.67	6.67
297 x 326	4.67	26.00	59.33	63.33	76.67	21.33	8.67	10.67	6.67
297 x 348	4.67	28.67	57.33	65.67	78.67	26.00	10.67	17.00	6.33
297 x 452	4.33	28.00	58.67	68.00	81.00	28.67	11.67	14.67	6.00
303 x 326	3.67	29.33	57.00	61.33	70.00	28.00	10.33	15.00	6.33
303 x 348	6.00	26.67	56.00	58.33	72.00	29.33	9.00	11.33	6.67
303 x 452	3.33	30.33	55.33	60.00	68.33	26.67	8.00	14.33	6.67
304 x 326	4.33	25.33	102.67	103.67	114.00	30.33	8.33	12.33	6.33
304 x 348	5.33	28.33	88.33	88.33	107.33	25.33	14.00	12.33	6.33
304 x 452	6.00	24.00	65.67	74.33	91.33	28.33	11.67	13.00	6.67
333 x 326	5.67	26.33	64.00	70.00	78.67	24.00	16.00	14.00	6.33
333 x 348	5.00	26.33	59.67	63.67	76.00	26.33	10.33	11.33	7.00
333 x 452	4.33	21.00	64.00	66.33	80.33	26.00	11.00	16.00	6.33
396 x 326	5.00	29.00	59.33	70.67	83.00	29.00	7.67	10.67	6.33
396 x 348	3.67	22.33	50.67	58.33	70.00	22.33	13.00	17.67	6.33
396 x 452	5.67	28.67	58.00	67.00	74.67	28.67	11.00	15.00	6.00
Awe x 326	3.33	22.67	54.00	58.67	69.33	22.67	8.00	11.67	6.00
Awe x 348	5.00	23.67	55.67	62.00	73.33	23.67	8.00	11.67	7.00
Awe x 452	4.33	27.67	54.00	63.00	70.00	27.67	9.00	11.67	6.33
Zuru x 326	3.67	32.33	50.00	52.67	66.67	32.33	12.00	15.00	6.00
Zuru x 348	5.33	29.67	48.00	55.33	67.00	29.67	9.67	14.00	6.33
Zuru x 452	3.33	31.33	53.33	55.67	67.33	31.33	11.33	17.00	6.33
L.S.D	**1.13**	**4.50**	**4.95**	**5.09**	**4.94**	**3.90**	**1.40**	**1.78**	**0.77**

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