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Agronomic Attributes of Five Okra Landraces Selected for Okra Production in Oyi Local Government Area of Anambra State, Nigeria

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ABSTRACT
A research study on the agronomic attributes of five okra genotypes for Okra production were evaluated for growth and yield at the teaching and research farm of the Department of Crop Science and Horticulture, Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University (COOU) Igbariam Anambra state. The experiment was conducted using a randomized complete block design (RCBD) with 4 replications using 3m row plots. The total field size was 187 m^2 (0.00187 ha) and a plant spacing of 0.60m × 0.30m was used. There was no significant difference in the treatment means for all the parameter studied, however, result from the seedling characteristics revealed that Nkwelle Okra was the earliest to emerge (4.25 days) while Awkuzu okra was the last to emerge (6.00 days). The experiment showed that Awkuzu okra was earliest to flower at 60.30 days after planting while Nteje Okra was the last to reach 50% flowering at 70.10 days after planting. Awkuzu Okra had the highest number of pods per plant (11.80), pod weight (50.90g) and yield t/ha (0.00005t/ha) while the least was Nteje Okra for number of pods per plants (6.50), pod weight (29.60g) and yield t/ha (0.000029 t/ha). Therefore, a further genetic study was recommended for the studied genotypes to produce hybrid and synthetic cultivar for the production of okra in the study area.

Keywords: agronomic attribute; landraces; okro; oyi local government; anambra state

INTRODUCTION

Okra (*Abelmoschus esculentusL.*Moench) belongs to the plant family Malvacea which also contains various plants and fruits like the marshmallow, but it is the most common and widely cultivated crop in this family (Richard, 2017). The plant is cultivated in tropical, subtropical and warm temperate regions around the world (National Research Council, 2006). It is mostly cultivated because of its fibrous fruits or pods containing round, white seeds. Also, it is among the most heat and drought tolerant vegetable species in the world and will tolerate soils with heavy clay and intermittent moisture (Growing Okra-Department of Primary Industries and fisheries, Queensland, 2007).

In Nigeria there are two distinct seasons for okra production; the rainy and dry season. It is usually more abundant during the rainy season than the dry season due to the fact that it is mostly cultivated on a small scale by small peasant farmers who lack the funds to setup irrigation facilities for dry season production (Adenij*iet al*, 2007).

Okra serves as a major economic crop in the West African sub-region owing to its vital importance as a component of various recipes in many local delicacies. In terms of nutrition, tender green pods of okra are important sources of vitamins A, B, C and K, folic acid, potassium, magnesium, calcium and trace elements such as copper, manganese, iron, zinc, nickel, and iodine which most times is deficient in the diet of people in most developing countries. Okra has medicinal values as it contains high levels of antioxidants such as β-carotene, xanthin and lutein (lee kit *et al*, 2000). The mucilage substance gotten from okra pods has been found to have a good alkaline pH, which contributes to the cure of gastrointestinal ulcer by neutralizing the digestive acid in the stomach (Wamanda, 2007).

Despite all these economic benefits, okra is yet to reach its maximum yield potential because of several factors. They include they use of locally unimproved variety, high incidence of pests and diseases, lack of irrigation for the small peasant farmers etc. Thus, enough attention needs to be given towards selecting high yielding cultivars of okra and ways to improve their agronomic characteristics. Therefore, the objective of this work is to determine the agronomic characteristics of five landraces of okra selected for production in Oyi Local Government Area of Anambra state.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Teaching and Research farm of the Department of Crop Science and Horticulture, Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University (COOU) Igbariam, Anambra state. Igbariam falls within the derived Savannah Zone of Nigeria and is located at Latitude of 06^0 and 45^0E. The soil series are utisols and belongs to the Sandy loam textural class.

Experimental design and field layout

Okro seeds were collected from Umuobi-Awkuzu, Odumodu-Ani-Umunya, Amawa-Ogbunike, Ifite-Nkwelle, Ikenga-Nteje and evaluated using Randomized Complete Block Design (RCBD) with four replications using 3m row plots. The experimental area is 17m X 11m (187m^2) in size.

The whole area was divided into four blocks with the spacing of 1m between each block. Each block contained five treatments with an inter-row spacing of 0.60m and Intra-row spacing of 0.30m with the row 3m long. The okro was planted under rain-fed conditions.

TABLE 1: Source of Landraces

Landrace Code	Site of Collection
AWK 1	Umuobi- Awkuzu
UMU 1	Odumodu-Ani-Umunya
OGBU 1	Amawa-Ogbunike
NKWE 1	Ifite-Nkwelle
NTE 1	Ikenga-Nteje

Data collection
Data was collected on the following Parameters:

(i) ***Number of days to 50% emergence:*** This was determined by recording the number of days it took half of the plant in the plot to emerge.

(ii) ***Number of leaves:*** This was obtained as the average count of the number of leaves from four randomly selected plants per plot at 4,6,8 WAP.

(iii) ***Stem girth:*** Here the measurement of the diameter of the stem of the okra at the base was determined using Vernier caliper.

(iv) ***Number of branches per plant:*** This was obtained by counting the number of branches of four sample plant in each plot at 4, 6, 8 WAP.

(v) ***Number of days to 50% flowering:*** It will be determined by recording the number of days it took half of the okra plant in a plot to flower.

(vi) ***Plant height at 50% flowering:*** This was measured as the distance from the base of okra plants to the base of the flag leaf.

(vii) ***Number of plant at harvest:*** Data was collected on the total number of plants surviving up to the time of harvest in each plot.

(viii) ***Number of pod per plant:*** Data was collected on the number of pods on each plant per plot.

(ix) ***Pod weight (g):*** Measurement was taken as the weight in gram of all okra in each plot.

(x) ***Yield (t/ha):*** This was measured in tons per hectare of okra harvested in each plot.

Statistical analysis
The data collected were subjected to Analysis of Variance (ANOVA) using Gen. Stat Release 10.3 statistical software. The means will be compared using Fisher's least Significance Difference (F-LSD) as described by (Obi, 2002).

RESULTS
Seedling Characteristics of Okra Genotypes
From table 2 below it was observed that Nkwele Okra from Ifite-Nkwelle were the earliest in emergence at 4.25 days, emergence was recorded for Nteje Okra, Ogbunike okra, Umunya Okra, and Awkuzu Okra at 4.50, 4.50, 5.50 and 6.00 respectively. However, there was no significant difference between them in terms of days to 50% emergence (p> 0.05).

For Number of plants established, the difference was not significant as shown in table 2. Awkuzu okra from Umobi-Awkuzu had the lowest established plants (5.50), while Nkwele Okra from Ifite-Nkwelle had the highest established plants (7.25).

TABLE 2: Seedling characteristics of five okra genotypes grown in Igbariam, Southeastern Nigeria.

Landraces	Days to 50% Emergence	Number of Plants established
Awkuzu Okra	6.00	5.50
Nkwele Okra	4.25	7.25
Nteje Okra	4.50	5.75
Ogbunike Okra	4.50	6.50
Umunya Okra	5.50	5.75
LSD (0.05)	**NS**	**NS**

LSD: Least significant difference, N.S: Not significant.

Agronomic Characteristics of Okra Genotypes

Number of leaves
The results obtained in number of leaves showed that the differences in treatment means were not significant (p>0.005) as shown in table 3. The number of leaves at 4 weeks after planting revealed that Umunya Okra from Odumodu-Ani-Umunya produced the highest number of leaves (6.56) while the lowest was Nteje Okra from Ikenga-Nteje (6.00).

At 6 weeks after planting, Umunya okra also recorded the highest (14.26) while Nkwele Okra recorded the lowest (11.06). At 8 weeks after planting however, Ogbunike Okra was the highest (22.80) while Nteje Okra recorded the lowest (18.60).

TABLE 3: Number of leaves of okra genotypes at 4, 6, 8 weeks after planting

Landraces	Number of leaves 4 WAP	Number of leaves 6 WAP	Number of leaves 8 WAP
Awkuzu Okra	6.25	13.63	21.00
Nkwele Okra	6.31	11.06	20.20
Nteje Okra	6.00	11.81	18.60
Ogbunike Okra	6.50	13.19	22.80
Umunya Okra	6.56	14.26	22.10
LSD (0.05)	**NS**	**NS**	**NS**

LSD: Least significant difference, N.S: Not significant, WAP: Weeks after planting.

Stem girth
Stem Girth of a plant shows the lodging resistant of that plant to wind or other climatic factors. Table 4 revealed that there was no significant difference in the stem girth of the plants in all the studied genotypes.

At 4 weeks after planting, the genotype with the highest stem girth was Umunya Okra (2.51) while the lowest was the Awkuzu Okra from Umuobi-Awkuzu (1.13).

At 6 weeks after planting, Nkwele Okra was the highest (4.19) while Awkuzu Okra remained the lowest (3.25).

At 8 weeks after planting, Umunya Okra was also the highest (5.48) while Awkuzu Okra was the lowest (4.12).

TABLE 4: Stem girth of okra genotypes at 4, 6, and 8 weeks after planting.

Landraces	Stem Girth 4 WAP	Stem Girth 6 WAP	Stem Girth 8 WAP
Awkuzu Okra	1.13	3.25	4.12
Nkwele Okra	1.62	4.19	5.47
Nteje Okra	1.40	3.35	4.87
Ogbunike Okra	1.20	3.51	4.62
Umunya Okra	2.51	3.75	5.48
LSD (0.05)	**NS**	**NS**	**NS**

LSD: Least significant difference, N.S: Not significant, WAP: Weeks after planting.

Number of branches

Analysis of Variance (ANOVA) showed that the differences in the treatment means were not significant for the number of branches of the studied Okra genotypes (table 5). At 4 weeks after planting Ogbunike Okra from Amawa-Ogbunike had the highest number of branches (4.12) while the lowest was Umunya Okra (5.33). At 6 weeks after planting, Nkwelle-Okra recorded the highest (10.88) while the lowest was the Nteje Okra (9.31). At 8 weeks after planting, Ogbunike had the highest number of branches (15.56**)** while Nteje okra recorded the lowest number of branches (12.38).

Plant height at 50% flowering (cm)

There was no significant difference in the height of the various plants at 50% flowering table 5. However, the highest plant height was observed in Nteje okra (82.00cm) while the lowest plant height was observed in Awkuzu okra (32.70cm).

TABLE 5: Number of branches of Okra Genotypes at 4, 6, and 8 Weeks after Planting and Plant Height at Flowering.

Landraces	Number of branches 4 WAP	Number of branches 6 WAP	Number of branches 8 WAP	PH at FL (cm)
Awkuzu Okra	5.44	9.82	13.25	32.70
Nkwele Okra	5.50	10.88	14.62	79.20
Nteje Okra	5.50	9.31	12.38	82.00
Ogbunike Okra	4.12	10.06	15.56	63.20
Umunya Okra	5.33	10.70	15.51	56.30
LSD (0.05)	**NS**	**NS**	**NS**	**NS**

LSD: Least significant difference, NS: Not significant,
WAP: Weeks after Planting, PH: Plant height, FL: Flowering.

Yield characteristics of okra genotypes

Days to 50% flowering

The results in table 6 revealed that there was no significant difference (p >0.05) in the days to 50% flowering of the okra plants. Awkuzu okra was earliest in flowering (60.30) while the. ate flowering genotype among all the genotypes was Nteje (70.10).

Number of plant at harvest

There was no significant difference amongst the treatment means for the number of plants at harvest (Table 6). Nkwele okra had the highest rate of plant at harvest (7.25), while Umunya Okra and Awkuzu okra had the lowest rate of plant at harvest (5.50).

Number of pod per plant

There was no significant difference amongst the treatment means for the number of pod per plant (Table 6); however, Awkuzu Okra produced the highest number of pod per plant (11.80) while the lowest was Nteje okra (6.50).

Pod weight (g)

There was no significant difference amongst the treatment means for the pod weight (p >0.05). However, Table 6 showed that Awkuzu okra has the highest pod weight (50.90g) while the lowest pod weight was observed in Nteje okra (29.60g).

Yield (t/ha)

There was no significant difference amongst the treatment means for okra yield (p >0.05). Table 6, however, revealed that Awkuzu okra had the highest yield (0.00005t/ha) while the lowest in yield was obtained in Nteje Okra (0.000029t/ha).

TABLE 6: Mean Yield Characteristics of 5 okra genotypes grown in Ultisol of Igbariam, Anambra State, Nigeria.

Landraces	Days to 50%	NOP at Harvest	NOPD per plant	Pod Weight (g)	Yield (t/ha)
Awkuzu Okra	60.30	5.50	11.80	50.90	0.00005
Nkwele Okra	69.20	7.25	10.20	42.10	0.000042
Nteje Okra	70.10	5.75	6.50	29.60	0.000029
Ogbunike Okra	61.80	6.50	11.20	44.10	0.000044
Umunya Okra	68.20	5.50	10.50	36.20	0.000036
LSD (0.05)	**NS**	**NS**	**NS**	**NS**	**NS**

LSD: Least significant difference, NS: Not significant,
FL: Flowering, NOP: Number of plants, NOPD: Number of pod

DISCUSSION

Knowledge about germplasm diversity and relationships among diverse germplasm is useful for plant breeders because it assists them to select suitable parents for crossing (Dwivedi *et al.* 2001).

The genetic constitution of crops does not change in different environments with respect to qualitative traits. However, measurable characters which are controlled by many genes, such as yield, plant height, leaf area, etc. are affected by changes in environments (Ngwuta *et al.,* 2015). Although all the differences observed in the treatment means for the seedling, growth and yield parameters of the experiment appeared not to be significant for the five okra genotypes studied, the study is still very essential for further cross-breeding purposes.

Though ANOVA revealed that there was no significance difference among the five okra genotypes, from the tables for seedling characteristics and agronomic characteristics of the genotypes, it indicated that variability exists to allow identification of local germplasm with reasonable levels of desirable agronomic characteristics. This observation supports the earlier report of Ngwuta *et al.,* (2001) that locally available germplasm can serve as sources of hybrid maize development.

The ultimate goal of a plant breeding program is higher yield. The result from this study showed variation amongst okra genotypes for in terms of plant stand at harvest, number of pods per plant, pod weight and yield in tons per hectare.

Though this variation is not significant, the result agrees with Nwangburuka *et al* (2007) that studied twenty-nine varieties of okra for genetic variability and heritability using correlation studies. They found that the positive and significant phenotypic and genotypic correlation between plant height at maturity, fresh pod width, seeds per pod, and pods per plant, branches per plant with seed weight per plant and pod weight per plant. It was suggested that selection based on these phenotypic characters will lead to high seed and pod yield in okra.

CONCLUSION

The experiment revealed that Awkuzu okra had the highest number of yield output, followed by Ogbunike okra, genetic studies should be conducted among all the five genotypes using diallel mating to know the heterosis, combining ability, correlation coefficient of the agronomic attributes and other genetic parameters. The study revealed the days to 50% emergence and 50% flowering for the five okro landraces which is essential information for knowing when to plant each genotype for cross-breeding purposes.

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