



EFFECTS OF VARIETIES ON FRESH FRUIT YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH) IN DADIN KOWA, GOMBE STATE, NIGERIA

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ABSTRACT

Field trials were conducted during the 2021, 2022 and 2023 rainy seasons at the Teaching and Research Farm of the Federal College of Horticulture; Dadin Kowa Gombe State, Nigeria to study the effects of varieties on fresh fruit yield of okra. Treatments consisted of four (4) different okra varieties; (*Basanti 447* (V1), *Yar Chalawa* (V2), *Yar Syria* (V3) and *Yar Arba'in* (V4)). The experiment was laid out in a randomized complete block design (RCBD), replicated 4 times. Data collected were subjected to analysis of variance (ANOVA) using SAS version 9.2 (2008). Means were separated using the Least Significant Difference (LSD) at 5% probability levels. Result showed that, varietal effect was highly significant ($P \leq 0.01$) on pod weight during 2021 and 2022 rainy seasons with *Basanti 447* recording the highest pod weight (23.66 and 25.88g/plant). *Basanti 447* produced the highest yield (4.728, 4.842 and 4.27 tons per hectare). Based on the results of this research, *Basanti 447* (improved variety), gave the highest yield and yield components of okra, and can be recommended for farmers for adoption in the study area.

Keywords: Okra, Variety, Pod, Trials and Yield

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) belongs to the family (*Malvaceae*). It is an important soup condiment in Nigeria that forms part of the Nigerian curry dishes (Okon *et al.*, 2013). It is rich in vitamins, minerals and has several medicinal values. Okra is cultivated through the tropical and tempered regions of the world for its fibrous fruit content (Kabir 2010). Okra is one of the most well-known and utilized species of the family *Malvaceae*. It is also a chief vegetable crop grown for its immature pods that can be consumed as a fried or boiled vegetable or may be added to salads, soups and stews (Kashif *et al.*, 2008). Okra is important vegetable of the tropical countries and most popular in India, Nigeria, Pakistan, Cameroon, Iraq and Ghana. Though, it is virtually not grown in Europe and North America, yet, lot of people in these countries have started liking this vegetable because of good amount of vitamin A and folic acid, besides carbohydrates, phosphorus, magnesium and potassium. The world production of okra is estimated at 9.96 million tons, with India and Nigeria being the largest producers. India produces approximately 6.18 million tons, while Nigeria produces around 1.88 million tons (FAOSTAT, 2020). It is mainly grown in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Benin, Saudi Arabia, Mexico and Cameroon. Largest production is in India followed by Nigeria with the production of 6,346,370 and 2,039,500 tons respectively. Highest productivity is reported from Saudi Arabia (13.3 tons ha⁻¹) followed by Egypt (12.5 tons ha⁻¹). Although there is no complete record on production area and productivity of the crop under Ethiopian condition has high diversity in some parts of the country particularly in the South western low lands region (Zerihun, 2012).



Okra plays a significant role in human nutrition by providing carbohydrates, protein, fat, minerals and vitamins that are generally deficient in basic foods (Uwiringiyimana, *et al.*, 2024). Okra is a vegetable valued for many of its properties (Dantas, *et al.*, 2021), the fruits are used in making soup, salad and for flavoring when dried and powdered. The tender fruits contain minerals especially calcium, magnesium, iron and phosphorus, protein, vitamin A and C including riboflavin as well as high mucilage (Ndaeyo *et al.*, 2013). Mature okra seeds are good sources of protein and oil Zerihun, *et al.* (2020) and it has been known to be very important in nutritional quality. Its ripe fruit and stems contain crude fiber, which is used in the paper industry. The okra plant requires warm temperatures and is unable to withstand low temperatures for long or tolerate any threat of frost. Optimum temperature is in the range of 21 to 30°C degrees Celsius, with minimum and maximum temperatures of 18 °C and 35°C respectively (Abd El - Kader *et al.*, 2010).

Despite the increasing demand for okra (*Abelmoschus esculentus*) due to its nutritional and economic value, its production is often limited by poor agronomic practices. One of the underutilized but potentially beneficial practices is varietal selection. However, one of the farmer's low yield problem is compounded by the utilization of low yielding local varieties. Okra production and productivity is seriously affected due to the use of low yielding local varieties, sub optimal plant density, inappropriate planting date, soil fertility, heavy attack of various insect pests and weeds etc (Abdullahi, *et al.* 2020).

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at the Teaching and Research Farm of the Federal College of Horticulture; Dadinkowa situated in the Sudan savannah ecological zone of Nigeria which is located on latitude 10°20'N, longitude 11°20'E; 240 m altitude above the sea level. Data on rainfall distribution, solar radiation and atmospheric temperatures in the study area were collected from Upper Benue River Basin Development Authority Meteorology Unit, Dadinkowa.

Materials and Methods

Okra local varieties seeds were purchased locally from Kwadon market (a suburb of Gombe metropolis); the improved variety were purchase at A.A Minangi Agro-chemicals Shop, Gombe main Market.

Soil Sampling and Analysis

Composite soil sample from the study area were taken randomly from different spots at a depth of 0 – 30cm using an auger. Soil samples collected from representative field locations were used for the determination of the physical and chemical properties before sowing crop for the 2021, 2022 and 2023 rainy season, the result is presented in Table 1.

Treatments Composition and Experimental Design

Treatments consisted of four (4) different Okra varieties; (*Basanti 447* (V1), *Yar Chalawa* (V2), *Yar Syria* (V3) and *Yar Arba'in* (V4)). The experiment was laid out in a randomized complete block design (RCBD), replicated 4 times. The total land area used was 30m x 20.5m = 615m². Gross plot size was 3m x 2m (6m²), spacing between replications was 1m, between main plot was 0.5m, and between sub-plot was 0.5m.

Cultural Practices

The land was ploughed by a tractor and leveling was done manually. The seeds were sown after rainfall was well established, at 2-3 seed per hill. NPK (15:15:15) were applied at the rate of 100 kg ha⁻¹ at 2 WAS and urea rate of 100 kg ha⁻¹ at 6WAS. Thinning operation was done after emergence of seedlings when 2-3 true leaves are produced, each stand was thinned off and one vigorous plant was maintained per stand. Weeding was carried out at two weeks' interval weeded three times. Other management practices like pest and disease control were applied uniformly as required. Apart from the control, all other plant were decapitated by removing the apical bud of the main stem with sharp knife at 4 Weeks After Sowing (WAS).



Data Collection

Yield and yield components of okra

Data were collected on yield parameters of okra. Number of green pods per plant were counted at every picking day from five randomly selected and tagged plants in each plot. The total number of pods were divided to get the average number of pods per plant. Length of five green marketable pods was collected from sample plants measured and averaged.

Pod diameter of five green marketable pods was measured using Vernier caliper. Average fresh pods were weighted from five randomly taken pods from each net plot area were measured using digital balance. Yield at each harvest from the net plot area were summed up and converted to a hectare basis. Pod yield/hectare was calculated out in metric ton (MT) by converting the mean pod yield/plot using

the formula: Pod yield/hectare = $\frac{\text{pods}_{\text{plot}}^{\text{yield}} \times 10000}{\text{Area of plot}(\text{m}^2) \times 1000}$... (Ali *et al.*, 2024)

Yield at each harvest from the net plot area were summed up and converted to yield in kg/plot. The weight was then converted to yield per hectare.

Data Analysis

The data collected were subjected to analysis of variance (ANOVA) using SAS version 9.2 (2008). Means were separated using the least significant difference (LSD) at 5% probability levels for each year of study.

RESULTS AND DISCUSSIONS

Physical and Chemical Properties of the Soil at the Experimental Site for 2021, 2022 and 2023 Rainy Season

The result of the physical and chemical properties of the soil at the experimental site at the depth of 0-30cm for the year 2021, 2022 and 2023 rainy season is presented in Table 1. In 2021 the physical analysis of the soil at the experimental site gave a particle distribution of 54.8% sand 35.60% silt and 9.60% clay. The textural class was found to be sandy loam. Bulk density was 1.54gcm⁻³ total porosity 40.77%. The particle distribution of experimental site for the year 2022 and 2023 rainy seasons were statistically similar to that of 2021, given it the same textural class (sandy loam). The same trend of physical analytical result in bulk density (g cm⁻³), particle density (g cm⁻³), total porosity (%) and water holding capacity recorded in 2021 were found in 2022 and 2023. The chemical property showed pH (1:2) values of 6.76, 6.89 and 6.89 in 2021, 2022 and 2023 respectively. These indicated that soil is slightly acidic. The electric conductivity (ds/m) of the soil decreases from 0.17 in 2021 to 0.10 in 2022 and maintain its value of 0.10 in 2023. All the exchangeable bases for 2021, 2022 and 2023 shown in the table have been documented.



Table 1: Physical and Chemical Properties of the Soil in the Experimental Site for 2021, 2022 and 2023 Rainy Seasons in Dadin Kowa

Parameter	Year		
	2021	2022	2023
Physical Properties			
Sand (%)	54.8	54.8	54.8
Silt (%)	35.60	35.60	35.60
Clay (%)	9.60	9.60	9.60
Texture	Sandy loam	Sandy loam	Sandy loam
Bulk Density (g cm ⁻³)	1.54	1.54	1.54
Particle Density (g cm ⁻³)	2.60	2.60	2.60
Total Porosity (%)	40.77	40.77	40.77
Water Holding Capacity (%)	41.80	41.80	41.80
Chemical Properties			
pH (1:2)	6.76	6.76	6.76
E Conductivity (ds/m)	0.17	0.17	0.17
Organic Carbon (g/kg)	6.11	6.11	6.11
Organic Matter (g/kg)		8.37	10.98
Total Nitrogen (%)	0.09	0.14	0.14
AU Phosphorous (mg/kg)	6.65	7.80	7.80
Exchangeable Bases			
Calcium (cmol/kg)	3.94	3.70	3.70
Potassium (cmol/kg)	0.48	0.62	0.62
Magnesium (cmol/kg)	1.64	2.50	2.50
Sodium (cmol/kg)	0.45	0.39	0.39
TEB (cmol/kg)	6.54	7.21	7.21
TEA (cmol/kg)	1.85	3.10	3.10
ECEC	8.39	10.31	10.31
PBS (%)	76.76	69.92	69.92

TEA = Total Exchangeable Acidity, TEB = Total Exchangeable Bases, ECED = Effective Calcium Exchange Capacity, PBS = Percentage Base Saturation

Yield and Yield Component of Okra

Effect of varieties on Days to 50% Flowering of Okra

Varietal effect was highly significant ($P \leq 0.01$), in 2021 and 2022, Basanti447 gave the minimum number of days to 50% flowering with 43.87 and 44.10 respectively, while the maximum was observed in *Yar Syia* across all the years (54.33, 54.55 and 54.35). In 2023, *Yar Arba'in* gave the minimum days to 50% flowering with 43.91. (Table 2). This result is similar to the findings of Jamala *et al.* (2011) who reported that a significant difference was observed with days to 50% flowering V2 recorded the lowest days flowering as compared to v1 and v3.

Table 2: Effect of Verities on Days to 50% Flowering of Some Okra Varieties

Treatment	Days to 50% Flowering		
	2021	2022	2023
Variety (V)			
Basanti447	43.87	44.10	44.05
<i>Yar Chalawa</i>	53.77	53.82	54.27
<i>Yar Syia</i>	54.33	54.55	54.35
<i>Yar Arba'in</i>	44.80	44.95	43.91
P<F	<.001	<.001	<.001
LSD	0.655	0.683	0.568

Effect of Varieties on Number of Pods per Plant

Varietal effects on number of pods per plant showed significant ($P \leq 0.01$) difference throughout the rainy season as shown in Table 3. Basanti447 produced the high number of pods per



plant (14.533, 14.717 and 12.233) in 2021, 2022 and 2023 respectively, followed by *Yar Syia* with 13.30, 13.156 and 11.578 in 2021, 2022 and 2023 respectively. Low number of pods per plant was recorded in *Yar Arba'in* with 11.322, 9.983 and 9.15 in 2021, 2022 and 2023 rainy seasons respectively (Table 3). Rahman *et al.* (2012) also reported significant differences among the Okra variety for number of pods per plants and reported that the improved variety produced produce the highest pod per plant and also, that variation might be due to their genetic makeup of the variety and environmental effect.

Table 3: Effect of Varieties on Number of Pods Plant⁻¹ During 2021, 2022 and 2023 Rainy Seasons

Treatment	Number of Pods Plant ⁻¹		
	2021	2022	2023
Variety (V)			
Basanti447	14.533	14.717	12.233
<i>Yar Chalawa</i>	12.300	12.350	9.889
<i>Yar Syia</i>	13.350	13.156	11.578
<i>Yar Arba'in</i>	11.322	9.983	9.156
P<F	<.001	<.001	<.001
LSD	0.7682	1.1572	0.7539

Effects of Varieties on Length of Pods (cm) of Okra

The effects of varieties on length of pods were significant ($P \leq 0.01$) in all the three years of experiment (Table 4). In 2021, 2022 and 2023 Basanti447 produced the maximum number of pod length (15.839, 15.906 and 14.57) respectively, least value was recorded in 2021, 2022 and 2023 with mean values of 8.536, 8.569 and 9.09 respectively. Same findings were presented by Akram *et al.* (2002).

Table 4: Effects of Varieties on Length of Pods (cm) of Okra

Treatment	Length of Pod (cm)		
	2021	2022	2023
Variety (V)			
Basanti447	15.839	15.906	14.57
<i>Yar Chalawa</i>	9.244	9.528	9.33
<i>Yar Syia</i>	8.536	8.569	9.09
<i>Yar Arba'in</i>	9.461	9.282	9.65
P<F	<.001	<.001	0.004
LSD	0.4067	0.3490	2.401

Effect of Varieties on Pod Diameter (cm) of Okra

Effect of varieties was highly significant ($P \leq 0.01$) on pod diameter in 2021 and 2022 rainy season (Table 5). In 2021, *Yar Syia* produced the high number of Pod Diameter (2.161) followed by *Yar Arba'in* with mean value of 1.561. in 2022 the similar pattern was observed where *Yar Syia* recorded the high number of pod diameter (2.322), followed by *Yar Arba'in* with 2.311. This could probably be due to its genetic makeup that makes it differ from the other varieties. This finding has got support from other investigation also. Gautam *et al.* (2004) and Ram *et al.* (2013) reported that average weight of pod, diameter of pod, yield per plant were found highest with VR0-6 as compared to Arka Anamika Varsha Uphar, Parbhani Kranti and NDO-10.



Table 5: Effect of Varieties on Okra Pod Diameter (cm) During 2021, 2022 and 2023 Rainy Seasons

Treatment	Pod Diameter (cm)		
	2021	2022	2023
Variety (V)			
Basanti447	1.561	1.583	2.09
<i>Yar Chalawa</i>	2.106	2.128	2.41
<i>Yar Syia</i>	2.161	2.322	2.41
<i>Yar Arba'in</i>	2.144	2.311	2.73
P<F	<.001	<.001	0.416
LSD	0.1197	0.1115	2.388

Effect of Varieties on Pod Weight (g plant⁻¹) of Okra

Varietal effects also showed highly significant ($P \leq 0.01$) on pod weight during 2021 and 2022 rainy seasons. (Table 6). Basanti447 recorded the maximum pod weight (23.66 And 25.879 g/plant) in 2021 and 2022 respectively. Maximum weight values were recorded (19.89 g/plant in 2022) and (18.17 g/plant in 2022) at *Yar Syia* and *Yar Arba'in* in respectively. The result is similar to the findings of Omotoso *et al.*, (2015) reported that there was variety difference in terms of pod weight, improved variety 47-4 gave significant ($p < 0.05$) increase over TAE-38

Table 6: Effect of Varieties on Pod Weight (g plant⁻¹) During 2021, 2022, 2023 Rainy Season

Treatment	Pod Weight (g plant ⁻¹)		
	2021	2022	2023
Variety (V)			
Basanti447	23.66	25.87	22.0
<i>Yar Chalawa</i>	20.76	20.12	20.0
<i>Yar Syia</i>	19.89	20.35	16.9
<i>Yar Arba'in</i>	21.01	18.17	16.3
P<F	<.001	<.001	0.384
LSD	0.844	1.608	15.87

Effect of Varieties on Pod Yield per Plot (kg/plot) during 2021, 2022, 2023 Rainy Season

Effects of variety on pod yield revealed that, Basanti447 consistently outperformed other varieties, yielding 2.837 kg/plot in 2021, 2.907 kg/plot in 2022, and 2.560 kg/plot in 2023 (Table 7). The varieties *Yar Chalawa*, *Yar Syia*, and *Yar Arba'in* showed lower yields, particularly *Yar Syia*, which had the lowest yield of 1.977 kg/plot in 2023 (Table 7). The significant variation in varietal performance, with *Basanti447* consistently producing the highest yields per plot, aligns with research by Olsantan, and Salau (2008). Their work emphasized the importance of selecting high-performing varieties tailored to specific environmental conditions for optimum yields.

Table 7: Effect of Varieties on Pod yield per plot (kg/plot) During 2021, 2022, 2023 Rainy Seasons

Treatment	Pod yield per plot (kg/plot)		
	2021	2022	2023
Variety (V)			
Basanti447	2.837	2.907	2.560
<i>Yar Chalawa</i>	2.390	2.320	2.000
<i>Yar Syia</i>	2.290	2.330	1.977
<i>Yar Arba'in</i>	2.413	2.250	2.083
P<F	<.001	<.001	0.008
LSD	0.0947	0.170	0.288

Effects of Varieties on Pod Yield (tons per hectare) of Okra

Varietal effects also showed highly significant ($P \leq 0.01$) difference on pod yield in all the three years of the experiment. Basanti447 produced the highest yield when compared with the other



varieties (4.728, 4.842 and 4.27 tons per hectare) in 2021, 2022 and 2023 respectively, low yield was recorded in *Yar Syia* with mean value of 3.292 tons per hectare (Table 8). The high pod yield obtained from *Basanti 447* variety could be because it is an improved variety nature which give it the ability to produce more branches consequently more fruit. Ojo *et al.* (2012) reports similar findings.

Table 8: Effects of Varieties on Pod Yield (tons per hectare) of Some Okra Varieties

Treatment	Pod yield (t ha ⁻¹)		
	2021	2022	2023
Variety (V)			
Basanti447	4.728	4.842	4.267
<i>Yar Chalawa</i>	3.983	3.867	3.333
<i>Yar Syia</i>	3.817	3.883	3.294
<i>Yar Arba'in</i>	4.022	3.750	3.472
P<F	<.001	<.001	0.008
LSD	0.1578	0.2837	0.4791

CONCLUSION AND RECOMMENDATION

From the results of this study, the following conclusions were made: The yield parameters significantly responded to varietal effect, *Basanti 447* (improved variety) performed better on number of pods per plant, pod weight and pod yield. Thus, for the best growth and yield; Basanti447 okra variety was found to be the best. Based on the results of the study, *Basanti 447* (improved variety) was the best okra variety for its optimum productivity in the study area and is therefore recommended.

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