

Evaluation of yield and yield components of selected okra (*Abelmoschus esculentus* (L.) Moench) varieties in Ejigbo Local Government, Osun State, Nigeria

Kazeem K. Olalekan^{*1}, Micheal S. Afolabi¹, Abiola E. Ojeleye¹, Yetunde O. Alawode², Hammed L. Mohammed¹ and Ibrahim W. Arolu³

¹ Department of Agronomy, Faculty of Agricultural Production and Management, College of Agriculture, Osun State University, Osogbo, Osun State, Nigeria; ² Department of Crop and Soil Sciences, National Open University of Nigeria, Rigachikun, Kaduna State, Nigeria; ³ Department of Soil Science, College of Agriculture and Environmental Science, Kaduna State University, Kafanchan, Kaduna State, Nigeria.

ABSTRACT

Okra can contribute to food security, income generation, and human health. Its productivity is a function of variety and environmental factors. This study observed the variety that could thrive better in Ejigbo, Osun State, Nigeria. The experiment was carried out at the teaching and research farm of Osun State University, Ejigbo Campus, on three varieties of okra (Sahari F1, Madison F1 and Clemson spineless). The experiment was laid out in RCBD with three replications. Yield and agronomic characteristics were analyzed using GLM and the significantly different means were separated using DMRT at 5% level of significance. Each plot size was 1.5 m x 1.5 m, and seeds were planted at a spacing of 30 cm by 60 cm. Data collected includes: plant height, number of leaves, leaf area, number of branches, number of pod, pod length, pod diameter, days to 50% germination, total pod weight and total pod yield. Results showed that the highest yield was recorded from Sahari F1 (1.4 t ha⁻¹) though not significantly different from the yield of Madison F1 (1.17 t ha⁻¹) at 5% DMRT. Clemson spineless gave the lowest yield among the three varieties. In conclusion, Sahari F1 and Madison F1 can be recommended for growth and pod yield.

HIGHLIGHTS

- Sahari F1, Madison F1 and Clemson spineless okra evaluated for yield in Ejigbo.
- The experimental layout was RCBD with three replications.
- Sahari F1 was the top yield followed by Madison F1, difference not significant.
- Recommend Sahari F1 and Madison; more research required for low-yield Clemson.

Article History:

Available online: 21st July, 2025

Accepted: 20th June, 2025

Received: 20th March, 2025

Keywords:

Okra; Yield; Food Sufficiency; Varieties; Income

1. Introduction

Okra, *Abelmoschus esculentus* (L.) Moench is an important vegetable crop consumed worldwide. It is a member of the Malvaceae family (Chaunkhande *et al.* 2011). It is widely cultivated in the tropics and subtropics for its immature edible green fruits and consumed as a vegetable, raw, cooked or fried, as a common ingredient of soups and sauces (Chinatu *et al.* 2017; Omotoso *et al.* 2018; Komolafe *et al.* 2021). Its ability to survive different levels of moisture stress, ease of cultivation and outstanding yield makes it a chosen vegetable crop for many peasant vegetable farmers across the globe (Akpan-Idiok *et al.* 2012; Farinde *et al.* 2006). The world production was about 11.5 million tonnes, out of which India contributes 7.2 million tonnes (62.12%). Nigeria, followed closely with 1.87 million tonnes in 2022, thus, becoming the second-largest okra producing country (FAOSTAT, 2023). This crop is suitable for cultivation in many tropical and subtropical parts of the world as a garden crop as well as on large commercial farms (Omolade *et al.* 2024.) It is grown commercially in India, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan,

Pakistan, Burma, Japan, Malaysia, Brazil, Ghana, Ethiopia, Cyprus and the Southern United States.

In Nigeria, when production and consumption are considered, okra occupied the third position fruit vegetables with tomato and pepper being the first and second respectively. (Plaisier *et al.*, 2019). It can be conserved by drying or pickling and the leaves are sometimes used as a substitute for spinach. The tender fruits, leaves and succulent shoots are consumed, either in fresh or dried form (Petropoulos *et al.* 2018). The thick slimy juice of the fruit makes it a relish and a thickener of stews and contains vitamin C and some minerals such as phosphorus, calcium and potassium and has larger concentration of thiamine, riboflavin and niacin than many vegetables (Arapitsas 2008; Gopalan *et al.* 2007). It is a source of carbohydrate, dietary fibre, fat and protein. According to reports from Chittora *et al.* (2016) and Sachan *et al.* (2017), about 13 grams of vitamin C. 2-gram protein 6.5-gram carbohydrate 1.2 g of fibre, 0.7 g of minerals, and other important nutrients, could be derived from 100 grams of unripe okra. Okra seeds serve as a good substitute for coffee and contain a considerable amount of good quality oil (Calisir & Yildiz Uzowuru, 2010) Its consumption among other fruit vegetables was found beneficial in moderating

* CONTACT: Olalekan, K. K; kazeem.olalekan@uniosun.edu.ng; Dept of Agronomy, College of Agriculture, Osun State University, Osogbo, Nigeria
<https://doi.org/10.52493/j.oujas.2024.2.141>



Plate 1. Okra varieties used in the experiment.

blood pressure, fibrinogen concentration and plasma viscosity in Nigerian hypertensives (Khan *et al.* 2022; Adebawoo *et al.* 2007).

Despite the nutritive values of okra, its production is very low in most developing countries particularly in West and Central Africa regions with 2.5 tonnes/ha compared to 6.2 tonnes/ha and 8.8 tonnes/ha in East and North Africa (Muhammad *et al.* 2020). The poor yield in okra production have been linked to factors such as lack of proper agronomic practices, infrastructure, poor soils, and the use of varieties that are not location specific (Rajesh *et al.* 2018; Umeri *et al.* 2023 and Omoregie and Nwajei, 2015). In most developing countries, farmers that are involved in the cultivation of okra and other crops depend mainly on the fertility inherent in the soil and incur huge cost in labour during land preparation and weed control (Akintoye *et al.* 2011; Ibrahim and Hamma 2012), all these are with a view getting more yield. As breeding objectives change, leading to the emergence of newer varieties with better adaptations to Nigeria ecosystems, increase resistance/ tolerance to abiotic and biotic stress factors and changing farming practices, there is the possibility that the genetic base of the newer varieties may also have been altered. Such changes which may be genetic, morphological, and physiological or combination of these could have impact on certain okra traits which may affect okra fruit and other related traits. Thus, attention has gradually shifted towards improving its performance through the selection of the best variety for a specified area. The expected increase in yield through the use of improved varieties would aid food security (Adetuyi *et al.* 2011).

It therefore becomes imperative to work on improving okra productivity and nutrient composition through selection of varieties with vigorous height, fruiting branches and high yield potential. This study was therefore carried out to identify okra varieties that could thrive best under low nutrient soil and give highest yield in Ejigbo, South West Nigeria.

2. Methodology

2.1. Experimental site and location

The research was carried out during the raining season in the year 2020 at the experimental site of the Teaching and Research farm of Osun State University, Ejigbo Campus, Ejigbo, Osun State, Nigeria. (Latitude 7°, 52'28.37" N and Longitude 4°, 18'13.76" E, 426 m altitude), 29°C. Ejigbo climatic condition is a rain forest type,

having two peaks (Bimodal Rainfall) which is between 926.33-1995.17 mm per annum (Murtadha *et al.* 2023).

2.2. Planting Materials

Three (3) varieties of okra developed for pod yield and adaptation to biotic and abiotic stress factors by Agro Tech, Ibadan, Oyo State, Nigeria were used for the experiment. The varieties were Sahari F1, Madison F1 and Clemson Spineless. (Plate 1).

2.3. Experimental Layout and Field Design

The experiment was laid out in Randomized Complete Block Design with three replications. Each plot measured 1.5 m x 1.5 m with three rows per plot and planted at spacing of 30 cm by 60 cm. The blocks and unit plots were separated by 0.5 m². Three seeds were planted on a heap but were later thinned to two at 2 weeks after planting.

2.4. Land preparation

Land preparation was carried out manually using hoe and cutlass. Ridging was done after the debris was properly packed. Weeding and harvesting were also done manually.

2.5. Soil Testing

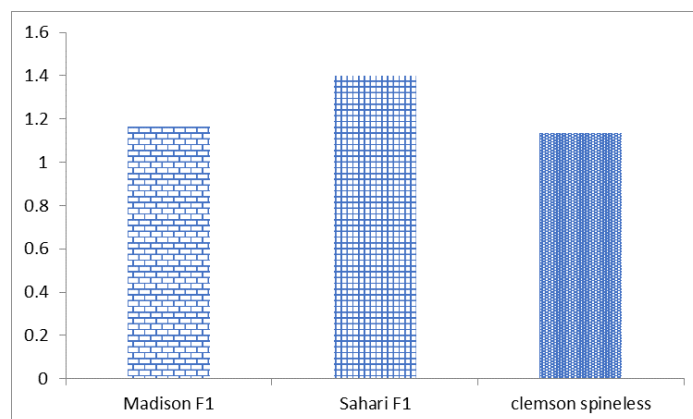
Composite sample of the experimental site was taken, air dried and sieved through 2mm sieve and analyzed for physical and chemical properties of the soil, according to the procedure described by Okalebo *et al.* (2002). The results are as shown in Table 1.

2.6. Data Collection

Data collected weekly, after two weeks of planting were Plant height (average height of plants in centimeters (cm) from the base of the plant to the apex), branches per plant, number of leaves; leaf area, number of branches, number of pod, pod length and pod diameter. The total number of harvested okro pod per plot was taken after maturity.

Table 1. Physico-chemical analysis of the soil sample

Parameter	Values
pH(H ₂ O)	6.59
% Organic Carbon	1.02
% Organic Matter	0.83
Available P(ppm)	16.00
CEC (meq/100g)	8.5
Na (Cmol/kg)	1.30
K (Cmol/kg)	1.30
Ca (Cmol/kg)	1.53
Mg (Cmol/kg)	1.50
% Nitrogen	0.256
% Sand	86.9
% Silt	10.05
% Clay	3.05
Textural class	Sand loam

**Figure 2.** Total pod yield in the okra varieties

2.7. Data Analysis

Analysis of Variance of the yield and agronomic characteristics was done using the General Linear Model (GLM) of Statistical Analysis Software 9.4 (SAS, 2018) and the significantly different means were separated using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

3. Results and Discussion

The variations in growth parameters among the three okra varieties was presented in Table 3.

Sahari F1 had the highest values in all the parameters accessed except in the days to 50% flowering (44 days). This exhibited shortest days to 50% flowering enables earlier fruiting compared to other varieties. However, the plant heights of Sahari F1 and Madison F1 (93.9cm and 91.8cm) respectively, were not significantly different from each other. Plant height (PH) is an important trait and it is positively correlated with all traits. This was same as contained in the report of Omotoso and Johson (2015) and Agba and Adiaha (2018). except in 50% days to flowering (DF) where Sahari F1 with highest plant height has the lowest days (44 days).

Variations in morphological characteristics among varieties have been earlier reported by many researchers such as Umeri *et al.* (2023) and Saleem *et al.* (2023) and Murtadha *et al.* (2023).

In almost all the yield parameters studied, Clemson spineless recorded the least values but these were not significantly different from what was recorded for Madison F1 in terms of leaf area, pod diameter, pod length, days to 50% flowering, total pod weight and pod yield (Table 3).

The choice of a preferred variety is determined by both morphological and yield characteristics and making a good choice

by the farmers would serve the ultimate purpose of food supply and income enhancement (Umeri *et al.* 2024). Among the 3 varieties under study, variations were found in both morphological and yield components. These differences could be as a result of both environmental factors and the genetic composition. In plant height, variation which may have been caused by differences in their genetic makeup and how they responded to the biotic and abiotic conditions that were prevalent.

Research has confirmed that 50 % days to flowering is an important index in determining yield component in crops. It thus remains one of the criteria that could guide selections and recommendation for farmers. (Machikowa and Laosuan, 2009; Ranga *et al.* 2021). Moreover, number of pods (NP) also has positive correlation with total pod weight (TPW) and the total pod yield (TPY), (Figure 2).

The leaf area has been linked with photosynthetic ability and therefore contributes greatly total pod yield, hence why it is often taken as an important selection criterion (Adetuyi *et al.* 2011; Sreenivasa *et al.* 2010; Uduyay *et al.* 2023). A part of okra that is of high economic value, apart from the pod is the leaf. It is prepared as a form of soup that serves medicinal and nutritional purposes in many Sub- African countries (Reseau 2022). The significant difference in total pod yield among the 3 varieties of okra. Results indicate that Sahari F1 significantly outperformed the other varieties in total pod yield in Madison F1 and Clemson spineless that though different in yield but not significantly different from each other.

Vegetative traits of okra plants have been reported to be positively correlated with yield (Omolade *et al.* 2024; Ranga *et al.* 2021) and thus traits such as plant height must be given prime attention in the selection of okra variety for production. In addition, the weight and number of pods/plant have been consistently identified as critical determinants of pod yield (Omolade *et al.* 2024). On the other hand, Agba and Adiaha (2018), cited the number of pods/plant, days to flowering and plant height as being

Table 2. Analysis of variance (ANOVA) for okra varieties for yield and yield components

SOV	df	NL	PH (cm)	LA (cm ²)	NB	NP	PD (cm)	DF	TPW (gm)	TPY (t ha ⁻¹)
Reps	2	8 ^{ns}	335.68*	15.72 ^{ns}	4.96 ^{ns}	7.27 ^{ns}	1.33 ^{ns}	6.7 ^{ns}	6.7 ^{ns}	0.09 ^{ns}
Varieties	2	2192.16**	7809.9**	294.2**	1612.5**	995.9**	31.46**	103.4**	83.4*	177. 3*
Weeks	13	808.01**	14274.5**	3700.9**	428.29**	47.38**	113.2**			
Error	82	7.95	105.8	12.31	5.67	10.19	0.80	4.2	9.61	0.02
Total	125									
CV		15.81	12.09	8.63	15.31	20.79	15.50	4.11	22.32	11.93

Key: NL= Number of leaves, PH= plant height, LA=Leaf area, NB = Number of branches, NP = Number of pods, PD = Pod diameter, DF= Days to 50% flowering, TPW= Total pod weight and TPY= Total pod yield

Table 3. Means performance for vegetative and yield-related traits among okra varieties

Varieties	NL	PH (cm)	LA (cm ²)	NB
Sahari F1	25.7 ^a	93.9 ^a	43.7 ^a	22.1 ^a
Madison F1	16.2 ^b	91.8 ^a	39.5 ^b	14.6 ^b
Clemson spineless	11.5 ^c	69.3 ^b	37.8 ^b	9.9 ^c

Key: NL: Number of Leaves; PH: Plant Height; LA: Leaf Area; NB: Number of Branches; Columns with the same superscripts are not significantly different, $p < 0.05$

the most important parameters determining yield in okra. The reports of the research work of Mohammed *et al.* (2022) and Massucato *et al.* (2020) also proved that, generally, morphological characteristics strongly influence okra yield.

The variety that gives the highest yield when planted will be preferred by the peasant farmers because it would help increase their income. The variety with high number of branches and with large leaf area also have the ability of giving high yield if worked upon by breeders. Also, the variety having least number of days to 50% germination will encourage early fruiting, which is beneficial to farmers. Furthermore, the variety having the shortest plant height, will allow easy harvest and increase in number of branches. Among the three varieties considered in this study, Sahari F1 gave the best values for both vegetative characteristics and the yield traits, it is therefore recommended for propagation in Ejigbo Area of Osun State while suggesting that further studies be carried out about its suitability as a good variety in other places through multi-location trials.

4. Conclusions

This study evaluated the yield and yield components of three okra varieties (Sahari F1, Clemson Spineless and Madison F1) in Ejigbo, Osun State, Nigeria. The results showed significant differences among the varieties in terms of yield and yield components. Sahari F1 and Madison F1 varieties outperformed Clemson Spineless in terms of vegetative parameters and pod yield. Sahari F1 and Madison F1 varieties are recommended for cultivation in Ejigbo, Osun State, due to their high vegetative growth and pod yields. Further research is needed to improve the yield and yield components of Clemson Spineless varieties. This study contributes to the knowledge of okra production in Nigeria by providing information on the yield and yield components of different varieties of okra with a view to assisting in the choice of the best variety that could aid in the breeding of improved cultivar.

CRedit authorship contribution statement

OKK: Conceptualisation, Methodology, Writing—original draft.
MHA: Field work and data collection. **MSA:** Software and statistical analysis. **OAE:** Writing—review & editing. **AYO:** Methodology, Writing—review & editing. **AIW:** Data curation, Writing—review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors acknowledge the Technologist, Mr. Hammed Owoo of the Agronomy Laboratory, College of Agriculture, Osun State University for assisting in the laboratory analysis and Mr. Yinka Ogunwale of the Teaching and Research Farm, College of Agriculture, Osun State University, Ejigbo Campus, for his assistance during the field work.

Funding

This study was completely financed by the authors.

References

- Adebawo, O. O., Salau, B. A., Adeyanju, M. M., Famodu, A. A., & Osilesi, O. (2007). Fruits and vegetables moderate blood pressure, fibrinogen concentration and plasma viscosity in Nigerian hypertensives. *African Journal of Food, Agriculture, Nutrition and Development*, 7(6). 12pp. <https://doi.org/10.18697/ajfand.17.1905>
- Adetuyi, F. O., Osagie, A. U., & Adekunle, A. T. (2011). Nutrient, antinutrient, mineral and zinc bioavailability of okra *Abelmoschus esculentus* (L) Moench Variety. *American Journal of Food and Nutrition*, 1(2), 49-54. <http://dx.doi.org/10.5251/ajfn.2011.1.2.49.54>
- Agba, O. A., & Adiaha, M. S. (2018). Effects of plant row spacing on growth and yield of curry plant (*Murraya koenigii*) in south-south Nigeria. *SPC Journal of Agricultural Sciences*, 1(1), 6-10. DOI : 10.14419/jas.v1i1.9993
- Akpan-Ikio, A. U., Udo, I. A., & Braide, E. I. (2012). The use of human urine as an organic fertilizer in the production of okra (*Abelmoschus esculentus*) in South Eastern Nigeria. *Resources, Conservation and Recycling*, 62, 14-20. <https://doi.org/10.1016/j.resconrec.2012.02.003>
- Arapitsas, P. (2008). Identification and quantification of polyphenolic compounds from okra seeds and skins. *Food chemistry*, 110(4), 1041-1045. <https://doi.org/10.1016/j.foodchem.2008.03.014>
- Calisir, S. & Yildiz, M. U. (2005). A study on some physico-chemical properties of Turkeyokra (*Hibiscus esculenta*) seeds. *Journal of Food Engineering*, 68, 73-78. <https://doi.org/10.1016/j.jfoodeng.2004.05.023>
- Chaunkhande, P., Chaunkhande P.B., & Dod, V.N., (2011). Genetic variability in Okra (*Abelmoschus esculentus* (L.) Moench). *Asian Journal of Horticulture*, 6(1):241-246. <http://www.plantarchives.org/>
- Chinatu, L. N., Okocha, P. I., Okoronkwo, C. M., & Harriman, J. C. (2017). Variability, correlation and heritability studies in

Table 4. Means performance for yield related traits among okra varieties

Varieties	NP	PD (cm)	PL (cm)	DF	TPW (gm)	TPY (t ha ⁻¹)
Sahari F1	22.1 ^a	7.0 ^a	5.0 ^a	44 ^a	19.7 ^a	1.40 ^a
Madison F1	13.3 ^b	5.3 ^b	3.3 ^b	55 ^b	12.7 ^{ab}	1.17 ^b
Clemson spineless	10.5 ^c	5.0 ^b	3.0 ^b	51 ^b	9.3 ^b	1.13 ^b

NP= Number of Pods; PD= Pod diameter; DF= Days to 50% Flowering; TPW: Total Pod Weight; TPY: Total Pod Yield. Columns with same superscripts are not significantly different, $p < 0.05$

- West African okra (*Abelmoschus caillei*). *Sky J. Agric. Res.* 6(2), 15-21. <http://www.skyjournals.org/SJAR>
- Chittora, A., Singh, N., & Singh, D. K. (2016). Production technology of okra. *Marumegh*, 1(1), 48-51.
- Farinde, A.J., Owolarafe, O.K., and Ogunbemi, O.I. (2006). Assessment of Production Processing, Marketing, and Utilization of Okra in Egbedore Local Government Area of Osun State, Nigeria. *Journal of Agronomy*, 5: 342-349. http://www.ansinet.org/c4p.php?j_id=ja
- FAOSTAT (2023). Food and Agriculture Organization Statistics. <http://www.fao.org/faostat/en/#data/QCL>, accessed on January 22, 2025
- Gemedo, H. F., Ratta, N., Haki, G. D., Woldegiorgis, A. Z., & Beyene, F. (2015). Nutritional quality and health benefits of okra (*Abelmoschus esculentus*): A review. *J Food Process Technol*, 6(458), 2. Online ISSN: 2249-4618.
- Gopalan, C., Sastri, S.B.V., & Balasubramanian, S. (2007). Nutritive value of Indian foods, National Institute of Nutrition (NIN), ICMR, India.
- Ibrahim, U., & Hamma, I. L. (2012). Influence of farmyard manure and weeding regimes on growth and yield of okra (*Abelmoschus esculentus* L. Moench) in Zaria. *World Journal of Agricultural Sciences*, 8(5), 453-458. DOI: <https://doi.org/10.5829/idosi.wjas.2012.8.5.1660>
- Komolafe, R. J., Ariyo, O. J., & Alake, C. O. (2021). Diversity in phenotypic traits and mineral elements of Okra (*Abelmoschus esculentus* L. Moench) genotypes. *International Journal of Agronomy*, 2021(1), 5528703. <https://doi.org/10.1155/2021/5528703>
- Machikowa, T., & Laosuwan, P. (2009). Effects of Extension of Days to Flowering on Yield and Other Characters of Early Maturing Soybean. *Suranaree Journal of Science & Technology*, 16(2): 15-25.
- Massucato, L. R., Nakamura, K. K., Ruas, P. M., Zeffa, D. M., Silva, D. J. H. D., & Gonçalves, L. S. A. (2019). Genetic diversity among Brazilian okra landraces detected by morphoagronomic and molecular descriptors. *Acta Scientiarum. Agronomy*, 42: 1-11. <https://doi.org/10.4025/actasciagron.v42i1.43426>
- Mohammed, J., Mohammed, W., & Shiferaw, E. (2022). Performance and genetic variability of okra (*Abelmoschus esculentus* (L.) Moench) genotypes in Ethiopia for agromorphology and biochemical traits. *Advances in Agriculture*, 2022(1), 8pp. <https://doi.org/10.1155/2022/5521151>
- Muhammad, M., Kutawa, A. B., Tadda, S. A., Muhammad, A., & Adamu, M. (2020). Productivity of okra (*Abelmoschus esculentus* L. Moench) as Influence by NPK Fertilizer and poultry manure in Northern Sudan Savanna Region of Nigeria. *International Journal of Forest, Animal and Fisheries Research* (6), 2456-8791. <https://dx.doi.org/10.22161/ijfaf.4.6.2>.
- Murtadha, M. A., Adetoro, S., & Shittu, K. A. (2023). Multivariate analysis of seed yield and morphological characters of Okra (*Abelmoschus esculentus* L. Moench) accessions. *Agricultural Science & Technology* (1313-8820), 15(2). <https://doi.org/10.15547/ast.2023.02.012>
- Murtadha, M. A., Oyetunji, A. T., & Lamidi, W. A. (2023). Evaluation of okra shoot and root systems under stress and non-stress water conditions. *Nigerian Journal of Horticultural Science*, 27(1), 29-34. <https://www.ajol.info/index.php/njhs/article/view/278557>
- Okalebo, J.R., Gathua, K.W. & P.L. Woomer (2002). Laboratory methods of soil and plant analysis. Working manual 2nd edition sacred Africa. Nairobi, Kenya. pp 22-77. <file:///C:/Users/hp/Downloads/SoilAnalysesmanual.pdf>
- Omolade, E. F., Akinbile, O. O., Elumalero, G. O., Dama, A. Z., Omojola, E. T., Akanbi, L. O., ... & Ebireri, M. U. (2024). Assessment of growth and yields components of three improved varieties of okra (*Abelmoschus esculentus* (L.) Moench). *Open Journal of Agricultural Science* (ISSN: 2734-214X), 5(2), 23-30. <https://doi.org/10.52417/ojas.v5i2.608>
- Omorie, A. U., & Nwajei, S. E. (2015). Evaluation of some varieties of millet (*Pennisetum typhoides*) in a forest-savanna transition zone of Edo State, Nigeria. In *Agriculture: The Nigerian economy beyond oil. Proceedings of the 49th Annual Conference of the Agricultural Society of Nigeria held at Delta State University, Asaba Campus, Asaba, Nigeria* (pp. 1346-1349).
- Omotoso, S.O. and Johnson, O.Y. (2015). Growth and yield of two varieties of okra (*Abelmoschus esculentus* (L.) Moench) as affected by potassium fertilizer sources. *Journal of Biology, Agriculture & Healthcare*, 5: 98-104. ISSN 2224-3208 (Paper) ISSN 2225-093X.
- Omotoso, S. O., Fawole, F. O., Aluko, M., & Kehinde-Fadare, A. F. (2018). Growth and yield of two okra (*Abelmoschus esculentus* L. Moench) varieties as affected by organic fertilizer grown on an Oxid Paleustalf in Ekiti State. *Global Advanced Research Journal of Agricultural Science*, 7(4), 137-144.
- Petropoulos, S., Fernandes, Â., Barros, L., & Ferreira, I. C. (2018). Chemical composition, nutritional value and antioxidant properties of Mediterranean okra genotypes in relation to harvest stage. *Food Chemistry*, 242, 466-474. <https://doi.org/10.1016/j.foodchem.2017.09.082>
- Plaisier, C., Dijkshoorn, Y., van Rijn, F., Bonnard, J., & Talabi, O. (2019). *The vegetable and potato sector in Nigeria: an overview of the present status*. Wageningen Economic Research. Report 2019-119. 68 pp. <https://doi.org/10.18174/504921>
- Ranga, A. D., Kumar, S. & Darvhankar, M. S. (2021). Variability among different yield and yield contributing traits of Okra (*Abelmoschus esculentus* L. Moench) genotypes. *Electronic Journal of Plant Breeding*, 12(1): 74 - 81. <https://doi.org/10.37992/21021.1201.011>
- Rajesh, J., Prasad, V. M., & Kerketta, A. (2018). Evaluation of different okra (*Abelmoschus esculentus* L. Moench) hybrids for yield and yield attributes under Allahabad agro-climatic condition. *Int. J. Pure App. Biosci*, 6(5):1343- 1346. DOI: <http://dx.doi.org/10.18782/2320-7051.7127>
- Elumalero, G. O., Amujoyegbe, B. J., Odeniran, A. F., Olawale, O. J. & Apenah, M. O. (2022). The Effect of Nutrient Sources Amendment on the Phytochemical Component of Selected Malvaceae Vegetables. *African Journal of Organic Agriculture and Ecology (AJOAE)–Volume*, 6, 2. ISSN: 2795-2223.
- Sachan, S., Singh, D., Kasera, S., Mishra, S. K., Tripathi, Y., Mishra, V., & Singh, R. K. (2017). Integrated nutrient management (INM) in Okra (*Abelmoschus esculentus* (L.) Moench) for better growth and higher yield. *Journal of Pharmacognosy and Phytochemistry*, 6(5), 1854-1856. E-ISSN: 2278-4136.
- Saleem, A. M., Ziaf, K., Amjad, M., Shakeel, A., Ghani, M. A., & Noor, A. (2023). Assessment of genetic diversity among okra genotypes through PCA and correlation analysis for fruit tenderness, and morphological and yield traits. *Pak. J.*

- Bot*, 55(2), 555-562. [https://doi.org/10.30848/PJB2023-2\(34\)](https://doi.org/10.30848/PJB2023-2(34))
- SAS Institute Inc., 2018. SAS/BASE and SAS/STATS, version 9.4. Cary: SAS Institute Inc.
- Sreenivasa, M. N., Nagaraj, M. N., & Bhat, S. N. (2010). Beejamruth: A source for beneficial bacteria. *Karnataka Journal of Agricultural Sciences*, 17(3), 72-77.
- Umeri, C., Nwajei, S. E., Moseri, H., & Bamidele, M. C. (2023). Growth and yield of seven varieties of okra (*Abelmoschus esculentus* (L) Moench) in Agbor, Delta State, Nigeria. *Journal of Agriculture and Environment*, 19(1), 135-143. ISSN: 2695-236X.

