EFFECT OF SPACING AND VARIETY ON YIELD AND GROWTH OF OKRA (*Abelmoschusesculentus*)

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Abstract

Okra belongs to the Malvacea family, genus Abelmoschus and species Abelmoschus esculentus. It is indigenous to tropical Africa and grown all over West Africa. Okra is a vegetable of nutritional essential and is cultivated and consumed in Nigeria. *An experiment was carried out in June 2022 at the Federal polytechnic Ilaro, to know the effect of spacing on growth and yield of different variety of okra. The experiment was laid out in Randomized Complete Block Design (RCBD) in a split plot arrangement, the main plot was variety,(Kirikou and Jokoso) and the subplot was spacing. The result showed that spacing was significant on the yield performance of okra. Jokoso has taller plant(40.0 cm), higher number of leaves(10.02), bigger stem girth(3.23cm) as compared to Kirikou, while Kirikou has higher leaf area per plant (98.3), higher yield per plant (32.15), higher fruit yield (kg)(627.27), higher number of pod per plant (4.51) relative to Jokoso. Okra sown at spacing of 75 x 25 cm has taller plant (38.7), higher number of leaves(12.3), higher fruit yield(905.22), while spacing at 60 x 60 cm has bigger stem girth (3.37), higher yield per plant(39.63), higher number of pods per(5.09) plant and higher leaves area per plant(125cm^2), compared to the other spacing. Based on this study, it can therefore be considered that, for optimum production of okra, Kirikou with spacing of 75 x 25 cm is recommended.*

Keyword: Okra, Spacing, Varieties, Yield

Introduction

The genus Abelmoschus and species A. esculentus of okra are members of the Malvaceae family (WIKI, 2023a; IBP, 2023). Eight species are the most often acknowledged out of the about 50 described ones (Ogunbor, 2020). It is an essential vegetable that has economic value. It is a common annual plant cultivated in the tropical and sub-tropical region of the world (Naveed*et al.*, 2009; Oyelade*et al.*, 2003; Saifullah*et al.*, 2009). Okra is believed to be native to tropical Africa, it is a vegetable crop that contains important nutrient, cultivated across West Africa ((Schipper *et al.*,2000; Njoku *et al.*,2006). Okra contains essential minerals, vitamins, protein and energy (Akande *et al.*, 2006). The immature young pods are source of Vitamin A, B, minerals like Calcium, Phosporus and Iron.

Okra as a vegetable is of great importance inculcated in many dishes, e.g soup, sauce and stew in Nigeria to improve the palatability of the food (Philp*et al.*, 2010).). It has numerous medicinal benefits such as curing dysentery, gonorrhea, urinary complication and widens the volume of the blood etc(Islam*et al.*, 2019; Gamede*et al.*, 2015).

Globally, okra production is around 9.96 million tons with India leading with 6.188 tons then Nigerian with 1.82 million tons (FAOSTAT 2020). In 2010, Okra yield in Nigeria was at its peak and since then there has been decrease in the production. This might be attributed to different factors such as complex interactions of biotic and abiotic stresses, insufficient improved varieties (Kumar *et al.*, 2010), lack of knowledge on the standard spacing that can give optimum yield, etc can lead to decrease in okra yield. This study was necessary to evaluate the impact of spacing and variety on the growth and productivity of various okra varieties.

Materials and Method

Experimental Site

The study was carried out at the Teaching and Research Farm of Department of Agricultural Technology, The Federal Polytechnic of Ilaro, Ogun State, Nigeria, from June to September in 2022.

Soil preparation and Land layout

The soil was tilled manually. The plot was thereafter marked and pegged into plot size of 3m × 3m with 0.5m margin round each plot. The total land area used was 34.5m×10m (345m^2). The trial was arranged in a split-plot fitted into Randomized Complete Block Design (RCBD) with three replicates. The main plot was variety (Jokoso, Kirikou) and sub-plot was spaced (50cm x 30cm, 60cm x 30cm, 60cm x 60cm, 70cmx30cm and 75cmx25cm). Eight treatments were randomly arranged in three replicates and each replicate has two controls (one control for each variety), given a total of 30 sub plots.

Source of Okra seed and Management

Hybrid variety of okra seed was purchased from Diekolola farms and consult, and the local variety was purchased at Ilaro (Open market). Plants were established at 2 seeds per hole with spacing varied based on the experimental design. Weeding was done manually; four plants were tagged per plot for collection of data.

Data Collected

Growth Data

Growth data were obtained for plant height, number of leaves per plant, leaf length, leaf width, number of branches per plant and stem girth.

Yield Data

Yield data was obtained for pod weight, pod length, pod width and leaf area. Fruits were harvested three times in a week when the fruit are fully matured. Leaf area was estimated using the linear model according to Musa and Usman (2016) Length x width x K, where K is the correction factor 0.62.

Statistical Analysis

Data were subjected to analysis of variance using GENSTAT Discovery Statistical package and means were separated using Least Significant Difference at 5% probability level.

Result

The experimental site used was slightly acidic, sandy loam, exchangeable potassium, total nitrogen, organic carbon, were low, exchangeable bases were from low to moderate, while the micronutrient were low (Table 1). Plant height of okra increased appropriately, i.e it got taller with time. The varietal effect was significant ($P \leq 0.05$) (1.095) only at 3rd Week after planting, although variety one (Jokoso) had the tallest height all through the period of the experiment while variety two (Kirikou) had the shortest height. The effect of spacing was not significant on plant height of okra all through the period of experiment; plant with 75x25cm had the tallest height except at 3Weeks After Planting while 50x30cm spacing had the shortest height except at 4th WAP (Table 2). The number of leaves of okra did not have significant ($P \leq 0.05$) influence on the variety and spacing, Jokoso had the highest number of leaves all through the period of experiment when compared to Kirikou. Spacing of 75x25cm had more number of leaves throughout the period, while 50x30cm spacing had the lowest number of leaves throughout the period of the experiment (Table 3). The effect of spacing on leaf area was not significant on variety and spacing of okra (Table 4). In respect to the result in table 5, the effect of spacing on yield per plant (g) was significant, although, the varietal effect was not significant. However, Kirikou had the highest yield per plant when compared to Jokoso. A spacing of 60x60cm had the highest yield per plant (39.62g), while 50x30cm spacing had the lowest yield per plant (25.85g) (Table 5). According to the results in Table 5, the effect of spacing on okra yield per hectare was significant, while the varietal effect was not significant. Kirikou had more fruit when compared to Jokoso. Spacing of 75x25cm had the highest fruit yield (kg/ha) and 50x30cm spacing had the lowest fruit yield (kg/ha) (Table 5). Effect of spacing on okra number of pod per plant was not significant all through the period of experiment, but the varietal effect was significant. However, Kirikou had the highest number of pods per plants when compared to Jokoso, while spacing of 60x30cm had the highest number of pods/plants, while 50x30cm spacing had the lowest number of pods/plants (Table 5).

Table 1: Chemical and physical analysis of the Soil

Properties	**Soil**
Org.c (g/kg)	1.88
pH	5.42
Organic matter (g/kg)	
Exchangeable. K	0.36 cmol/kg
Mg	2.89 cmol/kg
Ca	4.32 cmol/kg
Na	0.25 cmol/kg
Avg. P (mg/kg)	42.0
T.N (g/kg)	2.2
Clay (g/kg)	76.0
Mn ppm	0.8
Silt (g/kg)	54.2
Zn ppm	1.8
Sand (g/kg)	776.8
Fe ppm	3.2
H+	0.14
Cu ppm	2.5
CEC	7.96

Table 2: Plant height of Okra as affected by variety and spacing

Treatment	**Plant height (cm)**											
	Weeks after planting											
Variety	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Jokoso	9.64	10.61	13.33	16.65	20.15	24.13	27.91	31.24	33.7	37.2	38.3	40.00
Kirikou	5.66	6.25	8.24	10.16	11.76	13.28	15.97	19.46	21.33	24.6	26.1	28.00
LSD	1.095**	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Spacing												

(cm)												
50 x 30	7.41	8.24	10.17	12.48	14.54	16.27	19.39	22.12	24.26	27.9	29.3	31.3
60 x 60	7.78	7.99	11.09	14.11	16.06	18.64	21.74	25.59	27.65	31.60	32.9	35.1
60 x 30	7.51	8.45	10.63	13.26	16.04	19.21	22.42	24.57	26.76	28.5	29.70	31.00
70 x 30	7.85	8.66	10.46	13.37	16.02	18.96	22.11	26.12	27.25	31.00	31.90	33.90
75 x 25	7.72	8.81	11.59	13.79	17.10	20.43	24.02	28.35	30.08	35.70	37.3	38.7
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Table 3: Number of leaves as affected by variety and spacing.

Table 4: Effect of variety and spacing on leaf area (cm^2)

Treatments	**Number of leaves**											
	Weeks after planting											
Variety	3	4	5	6	7	8	9	10	11	12	13	14
Jokoso	5.53	5.88	5.35	5.90	5.12	5.35	5.12	7.25	7.13	10.23	10.19	10.20
Kirikou	5.10	5.62	5.20	5.65	5.37	5.79	5.38	5.38	6.89	9.52	9.64	9.88
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Spacing (cm)												
50 x 30	5.25	5.58	4.96	5.33	5.12	5.13	5.12	5.04	5.96	8.21	7.79	8.17
60 x60	5.42	5.57	5.21	6.00	5.38	5.46	5.58	6.46	7.79	11.75	11.63	11.58
60 x 30	5.12	5.50	5.21	5.29	5.00	5.38	5.25	6.04	6.03	7.83	8.46	8.42
70 x 30	5.33	5.71	5.21	6.00	5.12	6.02	5.21	7.38	6.71	9.62	9.49	9.65
75 x 25	5.46	6.21	5.79	6.25	5.58	5.88	5.08	6.67	5.58	11.96	12.23	12.38
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Treatment	Leave area (cm^2) Weeks after planting											
Variety	3	4	5	6	7	8	9	10	11	12	13	14
Jokoso	23.7	38.6	36.2	39	36.3	49.6	50.7	61.5	68.3	73.4	80.4	85.3
Kirikou	19	21.02	26.2	30.3	30.8	38.1	46	69.1	70	88.5	90.2	98.3
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Spacing												
50x30	21.1	36.1	26.3	29.9	30.3	51	46.6	54.5	60.3	73.4	72.5	83.7
60x30	19.5	24	30.7	32.7	32.7	38.7	46.7	58.3	85.1	71.9	84	75.6
60x60	23.6	44.2	35.7	38.3	40	50.7	48.8	90.1	88	113.4	112.7	125
70x30	19.9	19.7	28.5	32.6	34.4	38.1	40.4	58.7	45.9	76.6	75.1	86.4
75x25	22.6	25	34.7	39.8	30.4	40.8	50.2	65	66.6	69.5	82.1	88.3
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Table 5: Effect of variety and spacing on Okra Yield

Varieties	**Yield/plant**	**Yield (kg/ha)**	**No. of pod/plant**
Kirikou	32.15	627.27	4.51
Jokoso	26.90	558.16	3.05
SEM±	2.63	57.82	0.32
P-Value	ns	ns	0.02
Spacing			
50x30	20.85	347.5	3.21
60x30	25.35	506.97	3.22
60x60	39.63	396.15	5.09
70x30	34.74	807.75	3.74
72x25	27.06	905.22	3.58
P-Value	0.035	0.001	ns

Discussion

The soil was slightly acidic, and it is suitable for plant growth because it supplies the required nutrients (Ojo-Atere et al., 2011). This experimental research revealed that Jokoso had better vegetative performance such as; numbers of branches, number of leaves, plant height, stem girth when compared to Kirikou. The reason may be attributed to the fact, due to the presence of broader leaves which encouraged higher photosynthesis activities, and this result collaborate with the finding of Baraka*et al.*, 2019, whose stated that large leave development produce enough photosynthesis surface for rapid growth. Kirikou had better yield performance such as fruit yield (t/ha), fruit weight per pod, yield per plant, number of pod per plant when compared to Jokoso, the reason may be attributed to the fact that Kirikouf1 okra seed are reputed for their very high yield. The highest fruit yield (kg/ha) (905.2) was observed in spacing of 75x25cm followed by 70x30cm, 60x60cm, 60x30cm, and the lowest fruit yield (kg/ha) (347.5) was observed in 50x30cm spacing.

Conclusion

The result shows that Jokoso had better growth performance when compared to Kirikou, while Kirikou had better yield performance when compared to Jokoso in all the data collected all through the period of the experiment. The result of the study also shows that spacing is important in okra for optimum growth and yield. Also, in the production of okra (Abelmoschusesculentus (L.) Moench), plant spacing must be given maximum attention to obtain better yield.

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