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Effect of Seasonal Changes on Growth and Yield of Okra (*Abelmoschs esculentus*) (L) Moench

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Abstract: The effect of seasonal change on growth and yield of okra (*Abelmoschus esculentus*) was investigated using a randomized complete block experimental design. Seedling performance which include the number of leaves per plant, plant girth , number of primary branches per plant, Final plant height, number of fruit per plant, edible fruit fresh weight, edible fruit dry weight, edible fruit fresh length and proximate composition of the pods were monitored as index of growth and yield. The results of the study showed that the raining season induced the highest values for seedling performance during the two seasons. The average values of the parameters determined were significantly higher for raining season than that of dry season with values for number of leaves per plant (10.51±0.00), Final plant height (84.10±1.00), number of fruit per plant (50.10±0.00), edible fruit fresh weight (25.13±0.00) and edible fruit fresh length (8.47±1.00) as against 8.52 ±0.00, 70.00±1.00, for dry season. Higher nutritional content was also recorded in Okra planted during the raining season. However, Okra planted during the dry season matured early and produced more fruits.

Key words: seasonal changes, Okra, proximate composition, seedling, raining season, dry season

INTRODUCTION

Okra (*Abelmoschus esculentus*) belongs to the family malvaceae. Okra is an important vegetable crop commonly grown by local farmer in Nigeria[1]. Many varieties of Okra are recognized, the classification which have been based on different criteria including the time of maturity of the crop[2].

Okra has a wide usage, it is cultivated as a fresh vegetable with its fruit and the fresh leaves are used in soup preparation[3]. Okra requires a temperature of 18^0C – 30^0C and a rainfall of 100cm – 150cm per annum[3]. The crop requires a long warm growing season, it is quite susceptible to frost and will not thrive even when there is a continued cold spell. Climatic sometimes exert a direct control in the development and distribution of plant[4]. Ejieji,[5], reported that certain crops are affected by seasonal change as some plant grow best during the raining season while others thrive better during the dry season. A fairly sizeable proportion of people within the south-west part of Nigeria population are engaged in Okra production. To enhance and increase okra production in the country, improvement in the farmer's cultural practices is important. This would include appropriate season of planting. The objective of this work is to determine the changes in the season as it affects growth, seed, fruit production and nutritional content of Okra plant.

MATERIALS AND METHODS

The okra variety Tae 38 (OGEGEP) used in this study was obtained from okra farmers in Sagamu local government area of Ogun state.

The seeds were soaked in water for six hours to remove any inhibiting materials on the seed coat soluble in water[1]. The dry season and raining season planting were carried out November – January 2005 and May – July 2006 respectively. Seeds were sown in a plot of five rows at spacing of 50cm within rows and 60cm between rows. The design was a randomized complete block with three replicates. There to five seeds were sown per ridge. The plot size was 7.0x9.0cm^2. The plot was weeded regularly and the dry season plants were irrigated with water when observed to be wilting.

As a measure of growth and yield the following data and measurements were collected from growing plant for both dry and raining seasons:

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- Number of leaves per plant,
- Plant girth in cm,
- Number of primary branches per plant, and
- Final plant height in cm., others are,
- Number of fruit per plant
- Edible fruit fresh weight in grams
- Edible fruit dry weight in grams
- Edible fruit fresh length in cm

Proximate composition of fruit was determined according the method[6]. The ash content was obtained in the muffle furnace after 3 hours at 550^0C. N total was determined by the Kjedahl method. The crude protein was obtained using the conversion factor (N x 6.25) and the Soxhlet device to extract the crude fat and carbohydrate determined by the phenol sulphuric acid method[6].

Ca, Mg, Cu, Fe, Mg and Cl were determined by atomic absorption spectrophotometry, P by colometry, Na by flame photometry

Analysis of Data: Rating results in each treatment of triplicate experiments were subjected to analysis of variance (ANOVA) using general linear model option SAS. Test of significance were determined by Duncan's multiple range test at 0.5% level of probability.

RESULTS AND DISCUSSION

Data obtained showed the plant growth for both the dry and rainy season. (Table 1) It was observed that there was increase in the number of leaves, plant girth, number of primary branches per plant and plant height as cultivation time increased for both seasons. An increase in plant height was observed in dry season okra for week 2 – 4 while a higher plant girth was observed for raining season okra from week 6 – 12 when compare to dry season okra. There was an increase in the number of primary branches for dry season was (8±0.05) and that of the raining season was (12±0.05), however, a decrease in the number of the primary branches per plant for both seasons was observed progressively up to the 12th week of planting. The mean height of the plant during the study shows that the highest stem height which was 84.00± 1.00 was recorded during the dry season in week 12 (Table 1). No result was obtained for number of fruits produced, edible fruit dry and edible fruit length from week 2 to week 6. (Table1). However, week 8 recorded the highest fruit production during the dry season with a fruit production number of 100 and the highest edible fresh weight (25.13g ±0.00) and dry weight (8.47g±0.01) was recorded at week 12 respectively. (Table1).

It was observed that a higher nutritional content was recorded in pods produced during the raining season except for dry matter content which was higher in the pods produced during the dry season. (Table2). The percentage mineral content for okra pods was observed to be highest in okra pods produced during the raining season. These values were however significantly different. (Table3).

From the results it was observed that seasonal changes affect seedling performance and fruit production of okra. This finding agrees with the work of Smit *et al*.,[4]. The fact that seedling performance during the dry season recorded the highest value between the 2nd and 6th week and the least performance at later weeks is an indication that okra planted during the dry season mature and produced fruits earlier. This observation is in agreement with the findings of[8] who observed that okra planted in late season take a considerable shorter time to mature when compared to okra planted in early season. It was observed that seasonal changes affect seedling performance and fruit

Table 1: Effect of seasonal changes on seedling performance.

Weeks	No of leaves Plant Per		Plant girth in (cm)		No of pry branches per plant		Final plant height (cm)	
	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
2	4.05^a±0.03*	4.06^b±0.04	1.90a±0.01	1.88±0.02	5±0.00	6±0.00	8.75^b±0.25	15.50^a±0.50
4	7.50^a±0.01	7.05^b±0.03	2.61±0.01	2.55±0.01	7±0.00	7±0.00	26.75^a±0.25	26.00^a±0.00
6	7.50^a±0.01	7.10^b±0.00	3.52±0.01	3.54±0.01	8±0.05	10±0.05	49.75^a±0.75	45.50^a±0.50
8	8.50^b±0.00	9.51^a±0.00	4.34±0.01	4.62±0.01	8±0.05	12±0.05	70.00^b±1.00	83.50^a±1.00
10	8.50^b±0.00	10.49^a±0.00	4.91±0.00	5.21±0.00	7±0.05	9±0.05	70.00^b±1.00	84.00^a±1.00
12	8.52^b±0.00	10.51^a±0.00	4.90±0.00	5.21±0.00	6±0.05	8±0.05	70.00^b±1.00	84.10^a±1.00

Table 1: Continue

Weeks	No of leaves Plant Per		Edible fruit fresh wt (g)		Edible fruit dry wt (g)		Edible fruit length (cm)	
	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
2	NR	NR	NR	NR	NR	NR	NR	NR
4	NR	NR	NR	NR	NR	NR	NR	NR
6	NR	NR	NR	NR	NR	NR	NR	NR
8	100^{a}±1.00	9^{b}±1.00	11.84^{a}±1.00	9.26^{b}±1.00	1.80^{a}±1.00	1.50^{a}±1.00	3.12^{b}±0.50	4.3^{a}±0.75
10	21^{b}±1.00	69^{a}±1.00	7.02^{b}±1.00	14.04^{a}±1.00	1.30^{b}±1.00	2.4^{a}±1.00	6.3^{b}±1.00	8.45^{a}±1.00
12	NR	50^{b}±0.00	NR	25.13^{a}±0.00	NR	4.50^{a}±0.00	6.42^{b}±1.00	8.47^{a}±1.00

*=Mean of three replicate± standard error
NR= Not Recorded
Data represented above are means of 3 replicates. Values followed by the same letter along each horizontal column are not significantly different
by Duncan's multiple range test ($p \leq 0.05$)

Table 2: Effect of seasonal changes in percentage nutrient content of okra pod

Nutritive content	%Dry season	%Rainy season
Ash	5.82^{b}±0.01*	8.91^{a}±0.01
Dry matter	84.05^{a}±0.03	82.03^{b}±0.02
Moisture content	16.06^{b}±0.03	18.04^{a}±0.01
Crude protein	14.68^{b}±0.03	15.45^{a}±0.06
Crude fiber	31.48^{b}±0.07	33.78^{a}±0.03
Crude fat	13.84^{b}±0.07	14.78^{a}±0.01

*=Mean of three replicate± standard error
Data represented above are means of 3 replicates. Values followed by the same letter along each column are not significantly different by Duncan's multiple range test ($p \leq 0.05$)

Table 3: Effect of season changes on percentage mineral content of okra pod

Mineral content	%Dry season	%raining season
Sodium (Na^{+})	0.55^{b}±0.01*	0.63^{a}±0.01
Potassium (K^{+})	0.85^{b}±0.01	0.96^{a}±0.01
Calcium (Ca^{+})	0.30^{b}±0.01	0.43^{a}±0.01
Phosphorus (P)	0.68^{b}±0.01	0.82^{a}±0.01
Iron (Fe^{2+})	0.17^{b}±0.01	0.21^{a}±0.01
Magnesium (Mg^{2+})	0.47^{b}±0.00	0.58^{a}±0.00
Zinc (Zn) Mg^{-kg}	77.00^{b}±0.58	85.00^{a}±0.58
Copper (Cu) Mg^{-kg}	36.00^{b}±1.15	41.00^{a}±0.00

*=Mean of three replicate± standard error
Data represented above are means of 3 replicates. Values followed by the same letter along each column are not significantly different by Duncan's multiple range test ($p \leq 0.05$)

production of okra. This finding agrees with the work of[4]. The fact that seedling performance during the dry season recorded the highest value between the 2nd and 6th week and the least performance at later weeks is an indication that okra planted during the dry season mature and produced fruits earlier. This observation is in agreement with the findings of[8] who observed that okra planted in late season take a considerable shorter time to mature when compared to okra planted in early season. They require a long warm growing season, they are quite susceptible to frost and will not thrive under continue cold spell[3], reported that okra must have warm temperature to produce edible fruits. Nutritional analysis of okra pod revealed that rainy season influenced a higher nutritive level in the pods. This may be due to the ability of the pod to retain

nutritional content. This finding agrees with the observation of[11], who reported that rainy season pods had a higher mineral content compared to dry season pods.

Conclusion: In conclusion, Okra can be planted all year round depending on availability of water especially during the dry spell.

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