Evaluation of Kenaf Varieties for Growth and Yield Characteristics

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ABSTRACT

The experiment was conducted during the 2023 rainy season at two locations; Faculty of Agriculture Research Farm, Federal University Dutse and Bauchi State University, Gadau. The experiments were laid in randomized complete block design (RCBD) with three replications. The result showed that, white variety (yar fara) is superior to the other variety by having the best growth parameters such as plant height (166.6cm), number of leaves (116). White variety (yar fara) also attained 50% flowering (81 days) earlier than the other variety. Black variety (yar baka), had higher fresh weight of leaves (360g), dry weight of leaves (155.3g), fibre yield per plant (911g) and fibre yield per hectare (5.29t). For better yield of fibre, black variety (yar baka) is recommended to be cultivated.

Keywords: *Kenaf, Yield, Gadau, Fibre yield*

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INTRODUCTION

Kenaf (*Hibiscus cannabinus* L.) which is a member of the Malvaceae family is one of the most significant fibre crops in the world. According to Ezzadin *et al*. (2022), kenaf plant leaves and seeds have a number of significant uses, including culinary and therapeutic ones. The very high nutritional content of kenaf leaves leads to their usage as therapeutic herbs as well as a source of food for cooking and animal feed (Salih and Sultan, 2022). Additionally, growing kenaf plants will protect the environment from pollution by absorbing the ideal amount of carbon dioxide (CO_2), and their cultivation has an impact on agricultural sustainability. Kenaf fibres can be used for timber and other bio composite purposes (Salih *et al.,* 2022). According to Vayabari *et al*. (2023), kenaf has recently drawn a lot of attention from throughout the world as a more affordable, versatile, and controllable substitute for other fibre crops. With about 70% of the world's kenaf production, China and India are now the top producers of kenaf plants. Besides materials made from natural fibres are biodegradable, cause no harm to the environment,

renewable and cheap (Huda *et al*., 2007) compared to synthetic products. Because of the significant impact that climate change has on agricultural growing seasons, further research is required to determine the ideal varieties of kenaf. The objective of this study is to evaluate the growth and yield characteristics of kenaf varieties.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted during the 2023 cropping season at two locations; Faculty of Agriculture Research Farm, Federal University Dutse (latitude 11°70' N, and longitude 9°34' E, and 460 m above sea level) and Bauchi State University, Gadau (latitude 11° 40` 27`` N and longitude 10° 16` 30`` E, and 1200 m above sea level.

Varieties

Black variety (yar baka) which grows from 2-5 m, has an oxblood or maroon stem colour and matures in about 20 days. The *white variety (yar fara):* which grows up to 2-5 m with green or light green stem and palmate leaf structure and matures in about 120 days.

Treatments and Experimental Design

Two field experiments were carried out during 2023 rainy season at Dutse and Gadau. Seeds of two (2) kenaf varieties were selected and sown. Randomized Complete Block Design with three replicates was the field experiment design. The experimental field was cleared, ploughed, harrowed and ridged to create favourable condition for plant establishment. Plots of 3.75 m × 1.50 m dimension were marked and each plot was made up of 5 rows (0.75 m apart). The first and fifth rows were the border rows. The second and fourth rows were used as sampling rows. The third row (middle) row was used for final yield assessment (net plot). There was an alley of 1.0 m between plots and 1.5 m between replications.

Agronomic Practices

Three (3) seeds per hole were sown, at an intra-row spacing of 25 cm and inter-row spacing of 75 cm on 15th July, 2023 and 22nd July, 2023 at Dutse and Gadau respectively and thinned to 1 stand at 3WAS, first weeding was carried out manually at 3WAS and subsequent weeding was carried out as at when due (IAR&T, 2021).

Data Collection

Parameters were assessed by tagging five (5) plants randomly from the second and fourth rows. Data collected included plant height, number of leaves, and day to 50% flowering other parameters were fresh and dry leaf weight**,** fibre yield per plant and hectare.

Data Analyses

Data collected were subjected to analyses of variance using GenStat 17th edition and significant means were separated using Fisher's protected least significance difference.

RESULTS

The physico-chemical characteristics of the experimental soil during 2023 rainy season at Dutse and Gadau are shown in (Table 1). The soils at both locations had moderate amount of nitrogen and available phosphorus. Organic carbon, calcium, magnesium, potassium, sodium and cation exchange capacity were observed to be at moderate level at both locations. The pH ranged from 6.2 to 6.4 across the two locations and slightly acidic.

Plant height

There were significant differences ($P<0.05$) between the varieties across all sampling periods at Dutse. White variety (yar fara) kenaf had taller plants across all the sampling periods while kenaf at Gadau had significant difference between the varieties at 8 and 10 weeks after sowing (Table 2).

Number of Leaves per Plant

No significant differences were observed among the varieties at both location across all sampling periods (Table 3).

Number of Days to 50% Flowering

At both locations, significant differences ($P<0.001$) were found between the varieties. 50 % days to flowering were significantly higher in white variety (yar fara) (Table 4).

Fresh Weight of Leaves

There were significant differences ($p<0.05$) between the varieties at both locations, and the black variety (yar baka) produced higher fresh leaves weight (Table 5).

Dry Weight of Leaves

No significant difference was observed among varieties at both locations (Table 6).

Fibre Yield per Plant

There was significant difference ($p<0.001$) among the

Table 1: Physical and chemical of the soil 0-30cm at Dutse and Gadau during 2023 rainy season.

	Dutse	Gadau
Physical properties		
Sand (g kg-1)	74.5	80.6
Silt (g kg-1)	13.4	12.8
Clay (g kg-1)	12.1	6.6
Textural class	Sandy loam	Loamy sand
Chemical properties		
pH (H2O) 1:2:5	6.25	6.31
Acidity	5.36	5.55
Organic Carbon (g kg-1)	1.48	1.35
Phosphorus (mg/kg)	11.22	8.14
Total Nitrogen (g kg-1)	0.45	0.14
Exchangeable bases		
Ca (cmol/kg)	3.512	2.86
Mg (cmol/kg)	0.68	0.44
K (cmol/kg)	0.99	0.19
Na (cmol/kg)	0.86	0.500
ECEC (cmol/kg)	5.30	4.07

Source: Soil Science Laboratory, Federal University Dutse.

Table 2: Effect of Kenaf Varieties on Plant Height (cm) at Dutse and Gadau During 2023 Rainy Season

	Weeks after Sowing							
	Dutse				Gadau			
Treatment	**8**	**10**	**12**	**14**	**8**	**10**	**12**	**14**
Variety								
Black (yar baka)	71.4b	113.3b	130.4b	142.6b	73.0b	106.3b	120.3	127.5
White (yar fara)	84.8a	127.7a	143.1a	166.6a	82.3a	115.7a	128.8	137.6
Level of Significance	0.024	0.033	0.012	0.042	0.325	0.867	0.762	0.767
SE±	2.29	3.16	3.38	3.47	2.31	2.46	2.21	2.21

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Table 3: Effect of Kenaf Varieties on Number of Leaves at Dutse and Gadau During 2023 Rainy Season

	Weeks after Sowing							
	Dutse				Gadau			
Treatment	8	10	12	14	8	10	12	14
Variety								
Black (yar baka)	60.8	91.5	102.0	112.5	66.7	95.1	106.8	114.3
White (yar fara)	67.3	92.1	105.1	116.9	69.3	94.4	107.7	114.8
Level of Significance	0.251	0.884	0.370	0.232	0.610	0.881	0.774	0.837
SE±	4.10	2.79	2.43	2.47	3.47	3.19	2.14	1.82

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Table 4: Effect of Kenaf Varieties on Number of Days to 50% Flowering at Dutse and Gadau During 2023 Rainy Season.

	Number of Days to 50% Flowering	
	Dutse	**Gadau**
Treatment		
Variety		
Black	91.917a	94.75a
White	81.625b	87.88b
Level of Significance	<.001	<.001
SE±	0.1792	0.284

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

varieties at Dutse, and Black variety (yar baka) had higher fibre yield per plant at Dutse. No Significant difference was observed among the varieties at Gadau (Table 7).

Table 5: Effect of Kenaf Varieties on Fresh Weight of Leaves at Dutse and Gadau During 2023 Rainy Season.

	Fresh Weight of Leaves (g)	
	Dutse	**Gadau**
Treatment		
Variety		
Black (yar baka)	360.0a	357.0a
White (yar fara)	318.0b	315.0b
Level of Significance	0.003	0.027
SE±	36.7	35.5

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Table 6: Effect of Kenaf Varieties on Dry weight of leaves at Dutse and Gadau During 2023 Rainy Season.

	Dry Weight of Leaves (g)	
	Dutse	**Gadau**
Treatment		
Variety		
Black (yar baka)	155.3	157.2
White (yar fara)	125.5	130.8
Level of Significance	0.095	0.353

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Table 7: Effect of Kenaf Varieties on Fibre Yield per Plant at Dutse and Gadau During 2023 Rainy Season.

	Fibre Yield per Plant (g)	
	Dutse	Gadau
Treatment		
Variety		
Black (yar baka)	911a	825
White (yar fara)	747b	686
Level of Significance	<.001	0.278
SE±	0.334	0.843

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Table 8: Effect of Kenaf Varieties on Fibre Yield per Hectare at Dutse and Gadau During 2023 Rainy Season

	Fibre Yield per Hectare (t)	
	Dutse	**Gadau**
Treatment		
Variety		
Black (yar baka)	5.29a	4.79a
White (yar fara)	2.04b	1.68b
Level of Significance	0.002	0.473
SE±	0.176	1.744

Means followed by the same letter within column are not significantly different at 5% level of probability using Fisher's protected least significance difference.

Fibre Yield per Hectare

Significant differences ($p<0.005$) were observed among the varieties at both locations and black variety (yar baka) produced the highest fibre yield than white variety (yar fara) at both locations (Table 8).

DISCUSSION

Differences among the kenaf varieties in terms of their growth and yield components such as plant height, number of days to 50% flowering, fresh weight of leaves and fibre yield per hectare can be attributed to differences in the varieties used. This is also conforming with the study of Akinfasoye *et al.* (1997) who reported that the differences in yield parameters of crops are attributed to the cultivars used. Black variety (yar baka) produced higher fibre yield, fresh weight of leaves and reached 50% flowering in shorter days than white variety (yar fara). Apart from the variety used which plays an important role in the potential yield of the crop, the differences in the rate of

nutrient absorption of varieties and environmental variations could greatly influenced the yield of kenaf. This result agrees with the finding of Williams (2004) who observed differences in yield of kenaf varieties due to difference of these varieties; and Adeniyan *et al.* (2014) who stated that variation in characters investigated (plant height, butt diameter, wood and fibre yield) were due to genetic and environmental variations. The effect of climatic conditions (rainfall and temperature) and soil factors may affect the growth and yield characters (Mader *et al.,*2002). The result of this study is also in line with statement of Ahmed *et al.* (2018) who said Oko-ile variety exhibits efficient nutrient uptake and utilization mechanisms, particularly for essential nutrients involved in chlorophyll synthesis, such as nitrogen, phosphorus, and potassium. Genetic traits related to root morphology, nutrient transporters, and metabolic pathways contribute to enhanced nutrient uptake and utilization efficiency, leading to robust leaf development and chlorophyll accumulation.

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