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Evaluations of Genetic Divergence in Kenaf (*Hibiscus Cannabinus* L.) Genotypes Using Agro-Morphological Characteristics

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Abstract

Agro-botanical characteristics of 16 kenaf genotypes were investigated for genetic divergence using morphological analyses. The genotypes were evaluated and data analyzed across two years 2014 and 2015 in five months. Wide variation observed in the genotypes' agro-botanical characteristics proved their genetic diversification. Stems and leaves of the plants were predominantly green. Significant differences for morphological and agronomic characteristics were observed among 16 kenaf genotypes. The best height of first branching (7.58 cm) was recorded in TAINING II, while the lowest (2.53 cm) was in genotype AU-72 (4^8). In terms height, the local line consistently had the highest values across the planting months while genotype TAINING I produced the shortest plants. Also, genotype Au-75 (41^4) had the higher number of branches at the early growing stage, while the genotype V-1-400 had higher values at later growing stage. However, genotype G 452^1 consistently had the lowest number of branches in all the planting months. The values of base diameter of some Kenaf genotypes in five months over two years ranged between 0.50-13.50. The middle and top stem diameter, leaf length and width varied significantly among the genotypes in all the planting months. The number of nodes increased progressively with planting months. In all the planting months the lowest number of nodes (9.00) was obtained in genotype 2QQ (1^3) in the month of July and the highest (36.5) in ExGIWA 34^1 in the month of November. The study revealed that morphological characters could be used for identification and classification of kenaf varieties.

Keywords: Kenaf; Morphology characters; Genotypes; Crops; Nigeria

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Introduction

Kenaf (*Hibiscus Cannabinus L.)* is a short day, annual, herbaceous plant cultivated for the soft fiber in the stem. It belongs to the *Malvaceae*, a family of crops notable for both their economic and horticultural importance. The genus *hibiscus* is wide spread, and comprises over 200 annual and perennial species [1]. Kenaf is closely related to cotton (*Gossypium hirsutum L.*), Okra (*Abelmoschus esculentum)* and holly hock (*Althaca rosea L.).* Kenaf, as well as *Hibiscus sabdariffa* are classified taxonomically as *Hibiscus* [2-4]. Kenaf is one of the most important fiber crops in the world. It is composed of multiple useful components (e.g. stalk, leaves and seeds) and within each of these plant components there are various usable portions such as fibers, fiber strands, proteins, oils and allelopathic chemicals. The combined attributes of these components provide ample product diversity for its continued use and development [5-6]. In good conditions the plant can grow up to a height of five to six meters in six to eight months and produces up to 30 tons per hectare of dry stem material [7]. Conversely, kenaf is a traditional, third world crop with a lot of potentials that is capable of being propagated as an annually renewable source of industrial fibre in many countries around the world [8].

Kenaf, as plants, usually has two leaf types which are divided and entire. Kenaf plants produce simple leaves with serrated ages alternate from side to side on the stalk and branches. Cultivar and plant age affect the leaf shape. The divided (Split – leaf) cultivars have deeply lobed leaves with 3, 5, or 7 lobes per lead, the entire leaf cultivars produce leaves that are shallowly lobed, and are basically cordate (leaf shaped). The divided leaf characteristics was found to be dominant and the entire lead

shape was recessive [9-11]. At early stage, the young leaves of kenaf plant are usually simple, entire and cordate [12]. As the plant grows into maturity and additional leaves are added, the younger leaves start to differentiate into the leaf shape that is typical of the particular cultivar. Divided lead cultivars can produce 3 to 10 entire juvenile leaves prior to the production of the first divided leaf [13,14]. Each leaf also has a nectar gland on the main– vein on the underside of the leaf [15]. Kenaf has erect branches or unbranched stalks reaching a height of 1 – 4 m, and either green, red or purple prickly. Generally, the stalks of kenaf plant are round, depending on the variety, with sparsely distributed tiny thorns. It consists of two distinct fiber types: the outer- bast fibers which comprise about 35% of the stalk dry weight and the inner. Core fibers that comprise about 65% of the stalks dry weight [16].

Identification and knowledge of differences among genetic materials in plant is critical to selection of appropriate resources adapted to specific environments for successful breeding programs. In the same vein, promotion and recommendation of crops to farmers for commercial farming is proper only after a thorough research and information on such crops. This information is obtained by evaluation of the available crops genotypes. However, the crop's genotypic characteristic of kenaf in tropical country like Nigeria is still poorly understood because information on this aspect is very limited. This has made the identification of the various genotypes of the crop difficult. It has also retarded effective conservation and utilization of the numerous varieties of the crops that are available for either breeding programs or cultivation for commercial purposes [17]. Therefore, this study attempted to evaluate kenaf genotypes in order to understand their genetic divergence using agro-botanical, agronomic, flowering and yield characters.

Materials and methods

Experimental sites

The experiment was carried out in Omuiechi- Aluu Village in Ikwerre Local Government Area of Rivers State (latitude 05° 10^1 and Longitude 05° 13^1) in 2014 and 2015 cropping seasons. The climate of Rivers State is tropical rainforest with two seasons, wet and dry. There are two rainfall maxima in June and September and has a total rainfall of about 5922 mm per annum and annual temperature average of 28.5°C. The dry season which is rather not well defined and often very short lasts from late November to late February. The rainy season starts in March and lasts for over eight months in each year. The soil is described as sandy loam [18].

Source of planting materials

Sixteen (16) genotypes of kenaf (*Hibiscus cannabinus L)* used in this experiment were obtained from Jute and Fiber Crops Unit, Institute of Agricultural Research and Training (IAR&T), Moor Plantation, Ibadan, Oyo State, Nigeria.

Experimental design

A Randomized complete Block Design (RCBD) with 16 treatments and three (3) replications were used for the trial. Each plot measured 3 m by 1.5m consisting of 3 rows with planting spacing of 75 cm by 30 cm (inter- and intra- row spacing). The different kenaf genotypes were the treatments.

Agronomic practices

Planting was carried out at the beginning of June (8^{th} of June) in each year. Seeds (two seeds/hole) were sown per hole at planting depth of about 4cm and at a plant spacing of 75 cm by 30 cm between and within rows respectively [17]. Weed control was carried out manually at two weekly intervals using weeding hoe.

Measurement of Growth Parameters

These were obtained at four weeks after planting, and then other measurements were carried out subsequently on monthly basis till maturity. Data were taken from five randomly sampled plants in each plot in three replicates. The plant height was measured from the ground to the top of the plants with the aid of measuring tape on individual plant and the readings were taken or recorded. The number of branches on each plant was counted and recorded, four weeks after germination and subsequent readings were taken at monthly interval till maturity. Height at first branching was measured with meter rule in each replicate four weeks after germination. The base of the stem of each plant was measured with tape rule, firstly at four weeks after germination and subsequent measurements were taken at monthly interval and the readings were recorded. The trunk diameter of the stem of each replicate plant was measured four weeks after germination, other measurements were done at monthly interval and the readings computed. The top of the stem of each the plant was measured four weeks after germination, other measurements were done at monthly interval and the readings recorded.

The total number of leaves in each plant was counted four weeks after germination and subsequently at monthly interval till maturity. The length and width of the leaf were taken using meter rule in each of the replicates four weeks after germination and subsequently at monthly interval till maturity. This were evaluated using meter rule in each of the replicates four weeks after germination and subsequently monthly till maturity.

The number of nodes was counted four weeks after germination and subsequently at monthly interval till maturity and recorded. Also, the internodes length (distance between two nodes) was measured on each plant in all the genotypes using transparent meter rule. The number of days to flowering (50.0%) was obtained in each genotype and the values were recorded**.** The numbers of flowers on each plant was counted and recorded.

Data Analysis

The data collected were subjected to Analysis of Variance (ANOVA) using the GenStat Discovery Edition 3 (GenStat, 2007). The analysis estimated the genotype, and year effects as well as their interactions. Mean separation was done using least significant differences. Genotypic, phenotypic and error variances were estimated using the formulae of Wricke and Weber [19].

Results

Growth attributes of Kenaf

Heights of first branching, plant height and numbers of branches: The heights of first branching in some kenaf genotypes in two years are shown in **Table 1**. The best height of first branching (7.58 cm) was recorded in TAINING II, while the lowest (2.53 cm) was in genotype AU-72 (4^8). Highly significant ($p<0.001$), year effect was observed, while the genotype and year x genotype interactions were also significant ($p<0.05$). The plant height of some kenaf genotypes in five planting months over two years are shown in **Table 2**. The result revealed that the local line consistently had the highest values across the planting month while genotype TAINING I produced the shortest plants. The analysis of variance revealed that the interaction between the year and was genotype was significant ($p<0.01$). While the interactions between the year x genotype was significant ($p<0.01$) in the month of July, August and September, but was not significant in October and November (Table 2). The numbers of branches in some Kenaf genotypes in five months are shown in **Table 3**. Kenaf genotype Au-75 (41^4) had higher number of branches at the early growing stage, while the genotype V-1-400 had higher values at later growing stage. However, genotype G 452^1 consistently had the lowest number of branches in all the planting months. The analysis of variance indicated that the level of significance between the year, genotype and year and genotype interactions were at $p<0.001$, $p<0.01$ and $p<0.05$ respectively. **Base and middle stem diameter:** The values of base diameter of some Kenaf genotypes in five months over two years ranged between 0.50-13.50 **(Table 4)**. The result indicated that Taining II had the highest base diameter in each of the months. While the lowest values were observed in genotype A2-60-2826 in the months of July (0.55 cm) August (3.22 cm) and November (9.58 cm), while genotype Au 2452 (4^A) had the lowest values of 6.30cm and 6.87cm in the months of September and October respectively. The Analysis of Variance revealed that year, genotype and year x genotype interactions were highly significant ($p<0.001$). The analysis of variance of middle stem diameter in some Kenaf genotypes over two years **(Table 5)**, showed significant difference due to the effect of year ($p<0.001$), genotype ($p<0.01$), and year x genotype ($p<0.05$). In the month of July the highest values of 0.4lcm was recorded in G4521, while in August 1.53 cm was obtained in genotype V-1-400, September had 3.58cm in AU-72 (4^8) for October it was 5.37 cm In Ifekan 400 and November 7.66 cm was observed in G 4521. The lowest values of 0.23 cm; 1.08 cm and 3.10 cm were observed in AU-75 (414) in the months of July, August and September respectively. In the month of October, and November the lowest values of 4.13 cm and 6.21 cm were observed in genotype A2-60-2826 respectively [20].

Table 1 Height at First Branching in Some Kenaf Genotypes Four Weeks after Planting in2014 and 2015 Cropping Seasons.

S/N	Genotype	Height at first branching (cm)		
		2014	2015	x
1	G45 21	3.63	3.87	3.75
2	AU-72 (4^8)	2.6	2.47	2.53
3	CUBA 108	6.3	5.83	6.07
4	IFEKAN DI 400	2.5	3.27	2.88
5	TAINUNG I	6.33	6.7	6.52
6	TAININUG II	7.47	7.7	7.58
7	IFEKAN 400	4.47	6.13	5.3
8	A-60-282-5	4.03	4.27	4.15
9	V-1-400	6.27	5.8	6.03
10	EX-GIWA (34^1)	5.6	4.77	5.18
11	S108 -4-(47^8)	4.37	4.8	4.58
12	AU-75 (414)	7.03	6.23	6.63
13	A2 – 60-2826	5.8	5.87	5.83
14	AU-24S2(4^A)	4.03	4.9	4.77
15	2 QQ(1^3)	6.03	6.67	6.35
16	Local line	5.73	6.4	6.07
	Mean	**5.17**	**5.35**	
LSD0.05 Year=0.73*** Genotype=2.06* Year x Genotype=2.91*				

Top stem diameter: The top stem diameter of some Kenaf genotypes in five planting months over two years is shown in **Table 6** In July, the highest top step diameter (0.28 cm) was observed in IFEKAN-400, and lowest (0.11 cm) in AV245(4^A). In August, genotype AV-60-2826 had the highest value of 0.87 cm, and the lowest 0.53 cm observed in the local line genotype. In September, genotype A2-60-2836 had the highest value (1.60) and the lowest (1.13) was observed in Tanung I. In October, V-1-400 had the highest (2.40 cm) while AU-72 (4^8) had the lowest. In November, the highest mean value of 3.48cm was observed in A-60-282-5 and the lowest 2.58 cm in Cuba 108. Analysis of variance showed that the year, genotype and year x genotype were significant at $p<0.001$; $p<0.01$ respectively.

Leaf Length: The leaf length of some kenaf genotypes in relation to planting months and year is shown in **Table 7**. In the month of July the highest leaf length (6.50 cm) was recorded in CUBA108 and the lowest (3.93 cm) in V-1-400. In August, the highest value (8.87) was in genotype AV75 (414) and the lowest (4.45 cm) in G44521. For the month of September, genotype A-60-282-5 had the highest (9.48) and AV-72 (4^8) had the lowest value (5.97 cm). In the month of October, the local line had the highest value (12.42 cm), while the lowest (6.65cm) was in AU-72(4^8). In the months of November, the highest value (15.50 cm) was recorded in A2-60-2826 while AU-72 (4^8) had the lowest leaf length (8.90cm). The analysis of variance for the interactions of year, genotype and year x genotype indicated that they were highly significant ($p<0.01$).

Leaf Width and petiole length: The leaf width **(Table 8)**, indicated that the highest values of 4.17 cm (July), 8.35 cm (August), 9.55 cm (October); 10.55 cm (September) and 12.35 cm (November) were recorded in genotypes Cuba 100, AU-75 (414), A-60-2825; and Ex GIWA respectively. Throughout the planting months the genotype AU72 (4^8) consistently had the lowest values. Analysis of variance revealed that the interactions between the year, genotype and year x genotype were significant ($p<0.01$). The

Table 2 Plant Height (cm) of some Kenaf Genotypes in the five growing months in 2014 and 2015 cropping seasons.

S/N	Genotype	Plant Height at Different Months (cm)														
		July			August			September			October			November		
		2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x
1	G452[1]	30.7	34	32.8	72.7	72.7	72.7	121.1	125.2	123.1	181.3	181.7	181.4	228.4	230.8	229.6
2	AU-72(48)	25	23	24	80.7	79.7	80.2	116	120.6	118.3	192.3	192.4	192.3	231.3	228.4	229.9
3	Cuba108	28.7	28.4	28.8	75.7	72.3	74	119.7	118.4	119.1	182.5	175.5	179	224.3	199.1	211.7
4	IfekanDI400	26.3	25	25.6	63.7	61.3	62	100.7	100.2	100.4	169	175.5	172.2	199.3	199.1	199.2
5	Tainung I	24	24.4	24.2	61.7	60.6	61.2	101.1	101.7	101.4	160.9	159.9	160.4	198.8	197.2	198
6	Tainung II	32.7	31.3	32	79.7	78.1	78.9	126.7	125.9	126.3	187.3	186.4	186.4	263.4	258	260.7
7	Ifekan400	27	31.7	29.8	72.2	72.9	72.5	106.4	120.9	113.1	180.7	184	184.9	207.5	210.5	209
8	A-60-282-5	31.7	30	30.8	81.2	81.5	81.4	117.9	118.2	118.1	180.6	180.9	180.8	219.5	219.9	219.7
9	V-1-400	28	28	28	84	83.7	83.9	158.7	156.1	157.4	194.5	194.7	194.6	228.2	245	236.7
10	Ex-Giwa (34^{1})	32.3	31	31.6	78.6	77.9	78.2	161	162.9	161.9	184.8	185	184.9	245.5	244.9	245.2
11	S108-4-(47^{8})	29.7	28	28.8	91.6	76.7	84.2	155.5	155	155.3	189.5	189.7	189.6	225.7	244.9	235.3
12	AU-75(41^{4})	27	28.7	26.6	76.7	76.6	76.6	146.9	146.2	146.5	168.9	171.3	170.1	210.2	210.7	210.4
13	A2-60-2826	26	27.3	27.2	81.6	81.8	81.7	137.7	138.4	138	168.4	169.5	168.9	202.6	200.5	201.5
14	AU-24S2(4^{A})	27	28.7	27.8	81.2	81.5	81.4	132.5	130.7	131.6	164.4	163.4	163.9	203	204.3	203.7
15	2 QQ(1^{3})	35	35.7	35.4	90.6	90.7	90.6	149.9	149.7	149.8	181.4	182.2	181.8	227.2	226.6	226.9
16	Local line	35.3	35.3	35.3	96.7	97.2	96.9	161.6	162.4	161.9	195.9	196.8	196.4	263.5	265.8	264.7
Mean		**29.3**	**29**		**79.2**	**78.8**		**132.1**	**133.3**		**179.9**	**180.9**		**221.8**	**222.8**	
		LSD0.05 Year=0.49** Genotype=0.37** Year x Genotype=0.94**			LSD0.05 Year=1.84** Genotype=5.19** Year x Genotype=7.35*			LSD0.05 Year=2.84** Genotype=8.00** Year x Genotype=11.33*			LSD0.05 Year=3.09** Genotype=8.73** Year x Genotype=12.34ns			LSD0.05 Year=3.39** Genotype=9.57** Year x Genotype=13.53ns		

Table 3 Numbers of branches in some Kenaf genotypes in the five growing months in 2014 and 2015 cropping seasons.

Number of Branches at different months																
		July			August			September			October			November		
S/N	Genotype	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x
1	G452[1]	2	2	2	2.67	2.67	2.67	3.67	4	3.83	4.67	4.67	4.67	6	6.67	6.33
2	Au-72(48)	2.33	3	2.67	9	7	8	10.33	11	10.67	17	17.5	17.25	19.33	19.67	19.5
3	Cuba108	4	4.33	4.17	7.33	8.33	7.83	9.33	10	9.67	18.67	17	17.84	24.33	20	22.17
4	Ifekan DI400	1.33	1.33	1.33	5	6.67	5.83	13	12	12.5	17.33	17.33	17.33	20	24.67	22.33
5	Tainung I	1.33	2	1.67	3.33	5.33	4.33	8.33	10.33	9.33	16	17.33	16.67	23	20.67	21.83
6	Tainung II	2.67	2.67	2.67	6.33	5.67	6	8.33	9	8.67	20	17.33	18.67	22.67	21.33	22
7	Ifekan400	4.67	5.33	5	8.33	8	8.17	12.33	13.67	13	16.33	20	18.17	20.33	22.67	21.5
8	A-60-282-5	3.67	3.67	3.67	6.33	6.67	6.5	8.33	10.33	9.33	20	17.67	18.84	24	24.67	24.33
9	V-1-400	3	3.33	3.17	7.33	7.33	7.33	14.33	14.33	14.33	19.67	20.67	20.17	26	26.67	26.33
10	Ex-Giwa(34^{1})	1.67	2	1.83	6	6.33	6.17	8.33	9	8.67	16	15.33	15.67	17.67	24	20.83
11	Sio8-4-(47)8	1	1.67	1.33	2.33	2.33	2.33	6.67	9	7.8	17.33	16	16.67	16.67	18.33	17.5
12	Au-75(41^{4})	4.33	7	5.67	8.67	8	8.33	11.67	17.33	14.5	17.33	17.33	17.33	21	20.33	20.67
13	A2-60-2826	3.67	4.33	4	7	8	7.5	11	12.67	11.83	18	16.84	16.84	18	20.33	19.17
14	Au2452(4^{A})	4.33	3.33	3.83	6	6	6	13.67	11	12.33	17	14.67	17.83	19.33	19	19.17
15	2 QQ(1^{3})	4.33	5.33	4.83	6.33	6.33	6.33	6.33	10	8.17	18.33	15	9.33	8	12	10
16	Local line	2.33	3.33	2.83	5	5.17	5117	6.67	8	7.3	15.25	10	12.63	12.67	11.67	12.17
		2.92	**3.48**		**6.06**	**6.25**		**9.52**	**10.1**			**15.79**		**18.5**	**19.54**	
	Mean	LSD0.05 Year=0.48*** Genotype=1.35** Year x Genotype=1.90**			LSD0.05 Year=0.47*** Genotype=1.33** Year x Genotype=1.87**			LSD0.05 Year=0.63*** Genotype=1.78** Year X Genotype=2.52**			LSD0.05 Year=0.64*** Genotype=1.82** Year x Genotype=2.58**			LSD0.05 Year=0.87*** Genotype=2.47** Year x Genotype=3.49**		

Table 4 Base Diameter (cm) of Some Kenaf Genotypes in the FiveGrowing Months in 2014 and 2015 Cropping Seasons.

Genotype	Base Diameter at different months (cm)														
	July			August			October			September			November		
	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x
G452[1]	0.77	0.87	0.82	3.17	3.23	3.2	6.37	6.8	6.53	8.13	8.06	8.1	11.27	11.37	11.32
Au-72(48)	0.87	0.87	0.87	3.3	3.4	3.35	6.57	6.5	6.53	8.93	8.17	8.5	11.6	11.5	11.55
Cuba108	0.67	0.77	0.72	3.23	3.3	3.27	6.43	6.47	6.4	8.1	8.5	8.3	9.7	10	9.85
IfekanDI400	0.67	0.8	0.73	3.37	3.5	3.43	6.73	6.83	6.73	8.8	8.67	8.73	11	11.27	11.13
Tainung I	0.77	0.83	0.8	3.7	3.8	3,75	6.23	6.07	6.15	7.47	8.17	7.87	9.77	9.93	9.85
Tainung II	0.93	0.97	0.95	3.87	3.77	3.82	6.6	6.83	6.77	8.8	8.6	8.7	13	13.09	13.05
Ifekan400	0.77	0.8	0.78	3.6	3.53	3.57	5.8	5.73	5.77	8.37	9	8.63	11.83	13.13	12.48
A-60-282-5	0.53	0.57	0.55	3.33	3.1	3.22	6.23	6.27	6.25	8.37	8.77	8.57	9.83	11.17	10.88
v-1-400	0.87	0.87	0.87	3.6	3.67	3.63	6.6	6.7	6.65	8.13	8.3	8.27	11.5	9.33	10.42
Ex-Giwa(34[1])	0.8	0.87	0.83	3.67	3.67	3.67	6.87	6.93	6.9	800	7.1	7.55	11.7	11.57	11.64
Sio8-4-(47)8	0.9	0.8	0.85	3.7	3.63	3.67	6.6	6.8	6.7	8.2	8.33	8.3	11.03	11.47	11.25
Au-75(41[4])	0.7	0.7	0.7	3.13	3.3	3.22	6.93	6.67	6.8	7.3	7.3	7.3	10.77	10.9	10.84
A2-60-2826	0.53	0.7	0.61	3.27	3.5	3.38	6.33	6.5	6.47	7	7.15	7.1	10.87	10.73	10.9
Au2452(4[A])	0.67	0.7	0.68	3.2	3.3	3.25	6.3	6.4	6.35	7.2	6.7	6.9	10.07	10.93	10.05
2 QQ(1[3])	0.8	0.87	0.83	3.2	3.27	3.23	6.3	6.53	6.47	7.27	6.37	6.87	9.83	9.97	9.98
Local line	0.87	0.87	0.87	3.3	3.3	3.3	6.57	6.73	6.65	8.27	6.83	7.5	11.25	10.13	10.69
Mean	**0.75**	**0.8**		**3.42**	**3.45**		**6.47**	**6.55**		**8.01**	**7.9**		**11.34**	**11.3**	
	$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
	Year=0.13***			Year=0.21***			Year=0.21***			Year=0.11***			Year=0.18***		
	Genotype=0.36***			Genotype=0.59***			Genotype=0.59***			Genotype=0.33***			Genotype=0.53***		
	Year x Genotype=0.50***			Year x Genotype=0.84***			Year x Genotype=***			Year x Genotype=0.47***			Year x Genotype=0.74***		

Table 5 Middle Stem Diameter (cm) in Some Kenaf Genotypes in the FiveGrowing Months in 2014 and 2015 Cropping Seasons.

		Middle Stem Diameter at Different Months (cm)														
		July			August			September			October			November		
S/N	Genotype	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x
1	G452[1]	0.4	0.43	0.41	1.17	1.17	1.18	3.4	3.33	3.37	4.9	4.83	4.87	7.7	7.66	7.68
2	Au-72(48)	0.57	0.53	0.55	1.33	1.33	1.33	3.67	3.5	3.58	5.27	5.17	5.22	7.7	7.6	7.65
3	Cuba108	0.33	0.5	0.41	1.2	1.2	1.21	3.33	3.4	3.37	4.63	5.03	4.83	6.97	7.07	7.01
4	Ilekandi400	0.23	0.17	0.2	0.97	0.97	1.03	3.17	3.27	3.21	5.03	4.9	4.97	6.37	6.43	6.4
5	TAINUNG I	0.2	0.17	0.18	1.07	1.07	1.03	3.2	3.27	3.23	5	5	5	6.4	6.23	6.31
6	TAINUNG II	0.5	0.33	0.41	1.17	1.17	1.17	3.23	3.3	3.27	5.03	5.1	5.07	7.07	6.83	6.95
7	Ifekan400	0.3	0.37	0.33	1.2	1.2	1.18	3.03	3.1	3.07	5.4	5.33	5.37	7	6.77	6.88
8	A-60-282-5	0.33	0.33	0.33	0.97	0.97	1.07	3	3.1	3.05	5	4.87	4.93	6.37	6.2	6.28
9	V-1-400	0.47	0.33	0.4	1.6	1.6	1.53	3.13	3.2	3.17	5.1	5.1	5.1	7.4	7.43	7.41
10	Ex-Giwa(34[1])	0.4	0.4	0.4	01-Jul	1.07	1.07	3.13	3.3	3.21	5.13	5.2	5.17	7.23	7.33	7.28
11	Sio8-4-(47)8	0.3	0.33	0.31	1.1	1.17	1.13	3.03	3.47	3.25	4.77	4.93	4.85	6.8	6.8	6.8
12	Au-75(41[4])	0.23	0.23	0.23	1.17	1.2	1.08	3.13	3.07	3.1	4.73	4.8	4.77	6.1	6.53	6.31
13	A2-60-2826	0.23	0.3	0.27	1.1	1.07	1.18	3.17	3.17	3.17	4.03	4.23	4.13	6.17	6.27	6.21
14	Au2452(4[A])	0.27	0.3	0.28	1.2	1.43	1.31	3.07	2.98	2.98	3.97	4.03	4	6.3	6.27	6.28
15	2 QQ(1[3])	0.23	0.3	0.27	1.2	1.27	1.23	3.13	3.13	3.13	4.17	4.17	4.17	6.27	6.6	6.43
16	Local line	0.27	0.27	0.27	1.07	1.13	1.1	3	3.03	3.13	4.33	4.33	4.33	7.07	6.97	7.01
	Mean	**0.32**	**0.33**		**1.16**	**1.12**		**3.177**			**4.78**	**4.78**		**6.8**	**6.81**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.042***			Year=0.0563***			Year=0.0574***			Year=0.0816***			Year=0.0473***		
		Genotype=0.1208***			Genotype=0.59***			Genotype=0.1624**			Genotype=0.2309***			Genotype=0.1337**		
		Year x Genotype=0.1708***			Year x Genotype=0.225***			Year x Genotype 0.229**			Year x Genotype=0.3266**			Year x Genotype=0.3779**		

Table 6 Top Stem Diameter (cm) Of Some Kenaf Genotypes inthe FiveGrowing Months in 2014 and 2015 Cropping Seasons.

Top Stem Diameter at Different Months (cm)															
		July			August			September			October			November		
S/N	Genotype	2014	2015		2014	2015		2014	2015		2014	2015		2014 2015	2015	
1	G452[1]	0.17	0.13	0.15	0.73	0.7	0.72	1.5	1.4	1.45	2	2.13	2.07	3.33	3.33	3.33
2	Au-72(48)	0.2	0.2	0.2	0.6	0.6	0.6	1.5	1.43	1.47	1.9	1.67	1.78	3.03	3.2	3.11
3	Cuba108	0.23	0.2	0.22	0.6	0.5	0.55	1.37	1.4	1.38	2.37	2.1	2.23	2.03	3.13	2.58
4	Ilekandi400	0.23	0.2	0.22	0.5	0.57	0.53	1.2	1.23	1.22	2.43	2.13	2.28	2.8	2.97	2.88
5	TAINUNG I	0.13	0.13	0.13	0.57	0.63	0.6	1.67	1.13	1.4	2.17	1.93	2.05	3.23	3.2	3.21
6	TAINUNG II	0.17	0.43	0.3	0.53	0.7	0.62	1.67	1.4	1.54	2.2	1.97	2.08	3.5	3.23	3.37
7	Ifekan400	0.23	0.33	0.28	0.5	0.6	0.55	1.5	1.47	1.09	2.23	2.13	2.18	3.1	3.37	3.23
8	A-60-282-5	0.13	0.13	0.13	0.63	0.5	0.57	1.27	1.23	1.25	2.1	2.2	2.15	3.47	3.5	3.48
9	V-1-400	0.17	0.17	0.17	0.83	0.7	0.77	1.37	1.27	1.31	2.6	2.2	2.4	3.3	3.17	3.23
10	Ex-Giwa(34[1])	0.2	0.17	0.18	0.87	0.57	0.72	1.47	1.47	1.47	2.17	2.4	2.28	3.17	3.13	3.15
11	Sio8-4-(47)8	0.2	0.17	0.18	0.73	0.67	0.7	1.5	1.23	1.37	2.2	2.23	2.21	3.2	3.17	3.18
12	Au-75(41[4])	0.17	0.17	0.17	0.93	0.7	0.81	1.47	1.5	1.48	2.23	2.2	2.21	3.03	3.2	3.11
13	A2-60-2826	0.1	0.13	0.12	0.9	0.83	0.87	1.43	1.6	1.51	2.3	2.3	2.3	3.27	3.23	3.25
14	Au2452(4[A])	0.13	0.17	0.1	0.8	0.67	0.73	1.43	1.53	1.48	2.13	2.3	2.21	3.27	3.3	3.28
15	2 QQ(1[3])	0.4	0,17	0.28	0.73	0.67	0.7	1.53	1.5	1.51	2.33	2.23	2.28	3.27	3.13	3.2
16	Local line	0.17	0.13	0.15	0.47	0.6	0.53	1.47	1.4	1.43	2.13	2.37	2.26	3.27	3.13	3.2
	Mean	**0.2**	**0.2**		**0.69**	**0.66**		**1.39**	**1.38**		**2.29**	**2.16**		**3.14**	**3.21**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.05***			Year=0.04***			Year=0.05***			Year=0.06***			Year=0.07***		
		Genotype=0.139**			Genotype=1.10*			Genotype=0.15***			Genotype=0.16**			Genotype=0.20**		
		Year x Genotype=0.195*			Year x Genotype=0.15**			Year x Genotype=0.12**			Year x Genotype=0.22**			Yearxgenotype=0.27**		

Table 7 Leaf Length (cm) in Some Kenaf Genotypes in the Five Growing Months in 2014 and 2015 Cropping Seasons.

Leaf Length at Different Months (cm)																
		July			August			September			October			November		
S/N	Genotype	2014	2015		2014	2015		2014	2015		2014	2015		2014	2015	
1	G452[1]	5.13	5.1	5.12	4.43	4.47	4.45	6.17	6.2	6.18	9.23	9.27	9.25	13.57	13.53	13.55
2	Au-72(48)	5.13	5.23	5.18	5.5	5.43	5.47	5.93	6	5.97	6.57	6.73	6.65	10.47	7.33	9.13
3	Cuba108	6.4	6.6	6.5	4.7	4.57	4.63	7.53	7.23	7.38	10.77	11.07	10.92	6.07	12.87	9.47
4	Ifekan DI400	4.3	4.73	4.52	5.07	5.17	5.12	6.37	6.6	6.48	10.03	9.8	9.92	12.13	11.53	11.83
5	Tainung I	5.2	5.53	5.37	7.57	6.77	7.17	7.23	7.07	7.15	9.72	9.77	9.73	14.23	15.23	14.73
6	Tainung II	5.07	5.2	5.13	4.7	4.37	4.53	8.03	8.1	8.07	11.13	10.9	11.02	13.5	14.13	13.82
7	Ifekan400	5.03	5.33	5.18	7.07	4.93	6	8.43	8.43	8.43	10.83	10.8	10.82	13.5	14	13.75
8	A-60-282-5	6.13	6.13	6.13	7.1	6.8	6.95	9.47	9.5	9.48	11.97	12.1	12.03	13.3	14.3	13.8
9	V-1-400	3.8	4.07	3.93	6.77	6.8	6.78	5.86	6.27	6.07	9.07	9.4	9.23	13.03	13.3	13.17
10	Ex-Giwa(34[1])	5.9	5.37	5.63	9.3	8.03	8.67	7.93	7.3	7.62	9.37	9.4	9.38	12.4	13.27	12.83
11	Sio8-4-(47)8	3.72	4.33	4.02	9.2	9.23	8.22	6.27	6.33	6.3	8.97	9.23	9.1	11.6	12.37	11.98
12	Au-75(41[4])	5.1	5.23	5.17	9.27	10.47	8.87	10.9	8.17	9.53	11.57	11.1	11.33	15.23	14.57	14.9
13	A2-60-2826	5.2	5.23	5.22	6.6	8.3	7.95	7.07	9.87	7.97	11.97	12.03	12	14.97	16.07	15.52
14	Au2452(4[A])	5.23	5.3	5.27	5.73	6.33	6.03	9.2	8.77	8.98	12.17	12	12.08	14.6	14.67	14.63
15	2 QQ(1[3])	5.03	5.47	5.25	8.93	8.63	8.28	6.8	7.87	7.33	9.57	10.03	9.8	13.8	14.03	13.92
16	Local line	4.93	5.67	5.3	7.1	8.07	7.58	7.07	7.17	7.12	12.3	12.53	12.42	15.43	15.57	15.5
	Mean	**5.08**	**5.28**		**6.81**	**6.89**		**7.52**	**7.51**		**10.33**	**10.39**		**13.62**	**13.58**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.20**			Year=0.37**			Year=0.18***			Year=0.27**			Year=0.23**		
		Genotype=0.58**			Genotype=1.06*			Genotype=0.50***			Genotype= 0.77**			Genotype=0.67**		
		Year x Genotype=0.82**			Year x Genotype=1.49*			Year x Genotype=0.71**			Year x genotype=1.09**			Year x genotype=0.94**		

Table 8 Leaf Width (cm) in Some Kenaf Genotypes in the Five Growing Months in 2014 and 2015 Cropping Seasons.

Leaf Width at Different Months (cm)															
		July			August			September			October			November		
S/N	Genotype	2014	2015		2014	2015		2014	2015		2014	2015		2014	2015	
1	G452[1]	3.47	3.4	3.43	4.13	4.27	4.2	7.33	7.13	7.23	9.33	9.63	9.48	10.83	11.1	10.97
2	Au-72(48)	3.1	3.03	3.07	3.63	3.47	3.55	4.23	4.2	4.21	5.43	5.43	5.43	8.03	7.76	7.9
3	Cuba108	4.13	4.1	4.12	5.3	5	5.15	8.53	8.3	8.41	9.97	9.63	9.8	12.73	12.33	12.53
4	IfekanDI400	2.67	2.73	2.7	4.27	4.77	4.51	7.4	7.27	7.33	8.3	8.23	8.27	9.57	9.5	9.53
5	Tainung I	3.4	3.33	3.37	5.07	5.27	5.17	8.13	8.13	8.13	8.97	8.93	8.95	8.94	11.67	11.7
6	Tainung II	3.03	3.07	3.05	5.67	5.47	5.57	8.13	10.13	9.13	10.13	10.4	10.27	11.37	11.77	11.57
7	Ifekan400	4.07	3.77	3.41	5.3	5.73	5.51	8.43	10.5	9.47	10.13	10.17	10.15	11.13	11.1	11.11
8	A-60-282-5	3.07	4.07	4.07	6.37	6.47	6.41	8.43	10.67	9.55	10.57	10.53	10.55	11.57	11.67	11.67
9	v-1-400	1.4	1.63	1.51	3.7	4.47	4.08	5.8	6.6	6.2	8.83	9.63	9.23	9.8	9.97	9.88
10	Ex-Giwa(34[1])	3.07	2.37	2.72	5.33	5.53	5.43	7.13	7.13	7.13	8.63	9.87	9.25	12.5	12.2	12.35
11	Sio8-4-(47)8	1.4	1.97	1.68	4.2	4.63	4.41	6.33	6.43	6.38	8.97	9.13	9.05	9.47	9.77	9.67
12	Au-75(41[4])	3.37	2.93	3.15	8.27	5.91	8.35	9.57	7.4	8.48	7.94	9.3	10.3	12.5	10.23	11.37
13	A2-60-2826	3.2	3.43	3.31	5.3	5.47	5.38	9.37	5.93	7.65	10.27	9.13	9.7	13.1	10.06	11.58
14	Au2452(4[A])	2.57	3.03	2.8	6.97	7.07	7.07	7.97	6.88	7.4	10.2	8.13	9.17	11.4	10.53	10.97
15	2 QQ(1[3])	2.2	2.5	2.35	4.5	4.77	4.63	7.67	6.7	7.18	8.97	9.17	9.07	11.47	11.63	11.55
16	Local line	3.23	3.07	3.15	4.9	5.3	5.1	9	8.83	8.91	9.4	9.6	9.5	12.5	12.43	12.47
	Mean	**2.96**	**3.02**		**5.18**	**5.38**		**7.77**	**7.67**		**9.33**	**9.12**		**11.23**	**10.85**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.085***			Year=0.152**			Year=0.153**			Year=0.302*			Year=1.1911*		
		Genotype=0.240**			Genotype=0.430*			Genotype=0.433*			Genotype=0.856*			Genotype= 0.540**		
		Year x Genotype=0.34*			Year x Genotype=0.609*			Year x genotype=0.612*			Year x genotype=1.212*			Year x genotype=1.764*		

Table 9 Petiole Length (cm) in Some Kenaf Genotypes in the Five Growing Months in 2014 and 2015 Cropping Seasons.

Petiole Length at Different Months (cm)																
		July			August			September			October			November		
S/N	Genotype	2014	2015		2014	2015		2014	2015		2014	2015		2014	2015	
1	G452[1]	7.5	7.47	1.48	9.77	9.7	9.73	12.57	12.7	12.63	15.23	14.5	14.87	19.6	19.8	19.7
2	Au-72(48)	7.23	7.37	7.3	10.13	10.37	10.25	13.47	13.57	13.51	15.17	15.2	15.29	18.3	18.9	18.6
3	Cuba108	7.9	8	7.95	11.4	11.5	11.45	14.63	14.6	14.61	17.3	17.27	17.39	20.1	20	17.1
4	Ifekandi400	6.63	6.7	6.67	8.27	8.2	8.23	11.57	11.63	11.6	12.93	12.77	15.17	17.1	17.7	17.4
5	Tainung I	7.13	7.33	7.23	9.8	10.6	10.2	12.3	12.23	12.27	15.1	15.23	15.27	17.6	17.6	17.6
6	Tainung II	6.93	6.8	6.87	9.47	9.37	9.41	12.4	12.43	12.42	15.07	15.27	14.53	16.9	17.3	18.1
7	Ifekan400	6.97	6.9	8.93	9.13	9.3	9.21	11.7	12.3	12	14.3	14.77	14.57	17.6	18.7	18.1
8	A-60-282-5	7.73	7.43	7.58	12.1	12	12.05	16.67	16.37	16.57	14.97	14.17	14.57	22.3	21.5	21.9
9	V-1-400	7.07	6.93	7	9.5	9.2	9.35	13.1	13.93	13.51	15	16.1	15.55	17	19.3	18.1
10	ExGiwa(34[1])	7.2	6.9	7.05	9.1	9.07	9.08	14.07	14.27	14.17	15.63	16.83	16.23	17.4	18.8	18.1
11	Sio8-4-(47)8	8.13	8.03	8.08	11.4	11.07	11.23	15.07	15.07	15.07	18.97	19.13	19.05	20.4	21.1	20.8
12	Au-75(41[4])	7.23	6.97	7.1	10.47	10.47	10.47	13.73	13.9	13.87	16	16.23	16.11	18.1	18.9	18.1
13	A2-60-2826	8.3	8.27	8.28	12.37	11.87	12.11	16.07	16.4	16.23	20.47	20.47	20.47	23.2	25.3	24.3
14	Au2452(4[A])	7.43	7.73	7.58	10.43	10.67	10.55	13.13	13.3	13.27	15.03	15.37	15.2	20.6	18.9	19.7
15	2 QQ(1[3])	8.33	7.6	7.91	12.43	12.67	12.35	16.97	15.57	16.77	20.6	20.67	20.63	24.6	25.6	25.1
16	Local line	7.23	7.13	7.18	10.33	10.27	10.3	14.73	16.27	15.5	16.6	20.53	18.57	21.4	24.7	23.1
	Mean	**7.42**	**7.35**		**10.3**	**10.3**		**13.85**	**14.09**		**16.14**	**16.55**		**19.51**	**20.24**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.14**			Year=0.17*			Year=0.24**			Year=0.25**			Year=0.64**		
		Genotype=0.40**			Genotype=0.50**			Genotype=0.67**			Genotype=0.72**			Genotype=1.81*		
		Year x Genotype=0.57**			Year x Genotype=0.71**			Year x Genotype=0.96*			Year x genotype=1.02*			Year x genotype=2.57*		

petiole length of some kenaf genotype over two years is shown in **Table 9**. The genotype 2QQ (1^3) consistently had the highest value, while the lowest values were observed in Ifekandi-400 in all the months. The analysis of variance indicated a significant level ($p<0.01$) for year, genotype and year x genotype interactions.

Number of nodes and internodes length: The number of nodes increased progressively with planting months **(Table 10)**. In all the planting months the lowest number of nodes (9.00) was obtained in genotype 2QQ(1^3) in the month of July and the Highest (36.5) in ExGIWA 34^1 in the month of November. Analysis of variance indicated that the interactions between the year, genotype, and year and genotype were highly significant ($p<0.01$) in all the plating months **(Table 10)**.

The internodes lengths of some kenaf genotypes in two tears are presented in **Table 11**. Overall, The lowest (1.60 cm) internodes length was obtained in CUBA 108 in July and the highest (12.40 cm) in Ex-GIWA (3^4) in the month of November. The analysis of variance in year, genotype and year x genotype interactions were highly significant ($p<0.01$) in all the planting months **(Table 11)**.

Table 10 Number Of Nodes in Some Kenaf Genotypes in the FiveGrowing Months in 2014 and 2015 Cropping Seasons.

Number of Nodes at different months																
		July			August			October			September			November		
S/N	Genotype	2014	2015		2014	2015		2014	2015		2014	2015		2014	2015	
1	G452[1]	10.33	9.33	9.83	17.7	17.3	17.5	25	24.3	24.7	31	29	30	34.7	34.7	34.7
2	Au-72(48)	11	11	11	20.7	21	20.9	28.3	28	28.1	30.67	28	29.33	34	34	34
3	Cuba108	10.33	9	9.67	19	19.3	19.2	27.7	25.7	26.5	30.33	30	30.17	34.7	34.3	34.5
4	Ilekandi400	10	10	10	19	18.7	18.8	27.7	20	23.9	31	30	30.5	34.3	33.7	34
5	TAINUNG I	11.33	10	10.67	19	18.7	18.8	26	25.7	25.8	30.67	29.83	30	33.7	33.3	33.5
6	TAINUNG II	9.33	8.67	9	18	17.3	17.7	29.3	28.3	28.8	29.67	30.67	30.17	34.7	34.3	34.5
7	Ifekan400	11.67	11.67	11.67	20	19.3	19.7	26	25.3	25.7	28.67	31	29.84	43.7	31.7	37.7
8	A-60-282-5	15.67	15	15.33	20.3	19	19.7	28	27.7	27.8	30	29.33	29.67	33	35.3	34.8
9	V-1-400	12	12.33	12.17	21.3	20.7	21	26	29.3	27.7	28	32	30	37	38	37.5
10	Ex-Giwa(34[1])	12	11.33	11.67	17.3	18.7	18	26	25	25.5	29.33	28.33	28.83	35	36	35.5
11	Sio8-4-(47)8	13.67	12.67	13.17	19	18	18.5	28.7	26.3	27.5	30.67	29.67	30.17	34	34	34
12	Au-75(41[4])	9.67	9	9.33	17.7	17.3	17.5	23.7	23	23.3	29.67	28.67	29.17	35	33.7	34.4
13	A2-60-2826	11.33	10.33	10.83	16	17	16.5	24.3	23.7	24	29	28.67	28.83	35	34.3	34.7
14	Au2452(4[A])	9.67	9	9.33	18.3	18.7	18.5	28	28.7	28.3	30	29.33	29.67	35.7	34.7	35.2
15	2 QQ(1^3)	8.67	9.33	9	20.7	19.7	20.2	30	29.3	29.7	28.67	28.67	28.67	39.3	38.7	39
16	Local line	9.67	9.33	9.5	17.7	16.7	17.1	27	26.7	26.8	29.67	29	29.33	23.7	33.3	28
	Mean	**11.02**	**10.5**		**18.85**	**18.58**		**26.9**	**26.4**		**29.8**	**29.5**		**34.85**	**34.6**	
		$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$			$LSD_{0.05}$		
		Year=0.37**			Year=0.589**			Year=0.545**			Year=0.351**			Year=0.501**		
		Genotyp =1.06*			Genotype 1.667*			Genotype=1.541*			Genotype=0.994**			Genotype=1.417*		
		Year x Genotype=1.51*			Year x Genotype=2.357*			Year x Genotype=2.179*			Year x Genotype=1.40**			Year x Genotype=1.004*		

Table 11 Internodes Length (cm) of some Kenaf Genotypes in the five growing months in 2014 and 2015 cropping seasons.

S/N	Genotype	Internodes Length at Different Months (cm)														
		July			August			September			October			November		
		2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x	2014	2015	x
1	G45 21	1.8	1.77	1.78	2.13	2.47	2.3	3.53	4.33	3.93	4.43	4.47	4.45	7.5	7.37	7.43
2	AU-72 (4^8)	2.07	2.1	2.08	3.07	3.2	3.13	4.3	4.13	4.22	5.5	5.43	5.47	7.77	7.83	7.8
3	CUBA 108	1.6	1.6	1.6	2.07	2.07	2.07	3.7	3.6	3.65	4.7	4.57	4.63	6.07	6.27	6.17
4	IfekanDI 400	1.63	1.67	1.65	2.3	2.27	2.28	3.9	3.93	3.92	5.07	5.07	5.07	7.37	7.63	7.5
5	TAINUNG I	2.23	2.43	2.33	3.9	3.97	3.93	6.53	4.23	5.38	7.57	6.77	7.17	8.5	8.73	8.62
6	TAININNG II	1.53	1.77	1.65	2.6	2.67	2.63	3.4	3.47	3.43	4.7	4.37	4.53	5.37	5.37	5.37
7	IFEKAN 400	2.4	2.1	2.25	3.63	3.57	3.6	5.6	5.63	5.62	7.07	4.93	6	9.33	8.97	9.15
8	A-60-282-5	2.13	2.17	2.15	3.87	4.03	3.95	6.13	6.17	6.15	7.1	6.8	6.95	8.57	8.23	8.4
9	V-1-400	2.2	2.43	2.32	3.73	2.23	2.98	5.8	5.83	5.82	6.77	6.8	6.79	9.9	9.43	9.67
10	Ex-Giwa (34)	3.17	3.17	3.17	4.5	3.27	3.88	6.8	6.63	6.72	9.3	8.03	8.67	12.5	12.3	12.4
11	S108 -4-(47)8	2.7	2.77	2.73	3.4	2.37	2.89	6.73	6.63	6.68	9.2	9.23	9.22	11.4	11.4	11.4
12	AU-75 (414)	2.57	2.4	2.48	4.07	2.67	3.37	7.07	6.9	6.98	9.27	10.4	9.87	11.8	12.4	12.1

13	A2 – 60-2826	2.5	2.43	2.47	3.63	2.53	3.08	6.4	6.7	6.55	6.6	9.3	7.95	7.9	12.6	10.25
14	AU 2452 (4^{A})	2.03	2.43	2.23	2.43	2.5	2.47	3.37	3.97	3.67	5.73	6.33	6.03	6.9	8.73	7.82
15	2 QQ(1^{3})	2.57	2.53	2.55	4.13	2.63	3.38	6.77	6.83	6.8	8.93	9.63	9.28	12.23	11.43	11.83
16	Local line	2.37	2.57	2.47	3.93	2.37	3.15	6.36	6.8	6.72	7.1	8.07	7.58	8.7	10.6	9.65
Mean		**2.22**	**2.27**		**3.17**	**3.12**		**5.42**	**5.36**		**6.82**	**6.89**		**8.86**	**8.98**	
		LSD0.05 Year=0.18** Genotype=1.52* Year x Genotype=1.73*			LSD0.05 Year=0.27** Genotype 0.77** Year x Genotype=1.09*			LSD0.05 Year=0.11** Genotype=0.32** Year x genotype=0.45**			LSD0.05 Year=0.09*** Genotype=0.26** Year x Genotype=0.33**			LSD0.05 Year=0.36** Genotype=1.01* Year x genotype=1.43*		

Discussion

Analyses of genetic diversity provide for the selection of genotypes in breeding programs and provide useful genetic information [22]. In this study, high levels of genetic diversity were found for the various kenaf genotypes.The stems and leaves of the plants were predominantly green indicating presence of chlorophyll pigments and the crops affinity for nitrogen, magnesium and sulphur. Attention needs to be paid to these nutrient elements when cultivating or improving the crop. The wide variation in the botanical, as well as agro-morphological characteristics of the crop proves there is a wide genetic diversity among the genotypes. Plant breeders can, therefore, easily make choices among the germplasms for breeding programmes. Ogunniyan and Olakojo [21] found genetic variation among maize varieties using variation in their botanical characteristics. Ogunkanmi *et al.* [22] also reported variation in kenaf genotypes. Major distinctions in the characters is capable of facilitating rapid identification and classification of distinct lines during breeding programmes.

The mean of plant height, base diameter, and middle stem diameter showed significant differences among the kenaf genotypes. The result of this work indicated that the local line produced the tallest plant, while Tainung I produced the shortest among the kenaf genotypes. Generally, most of the genotypes under consideration were very tall However, Adepoju *et al.* [23] reported that short plants are preferred in breeding programmes such as rice and wheat crops, because short plants can reduce the problems of collapses and can respond to fertilizer. In spite of this, Cheng (2004) found that kenaf plants with higher main stem are stronger and do not fall easily in production levels when compared to short plants. The middle and top diameter were within the same range, this was relatively stable phenotypic trait for all the kenaf genotypes. Conversely Cheng *et al*. [24] proposed it for the identification of different kenaf genotypes.

In 2 years, plant height also increased with each succeeding harvest date from July to August in each planting year. As the plant height increased within years, the stalk biomass yields and the stalk biomass percentages also increased. These results are consistent with the report of Coetice et al. [25] who reported the same trend with full season kenaf for fiber production. The plant height growth rate, the plant height from planting to harvested divided by the number of days in the growing months, varied among years.

The leaf parameters such as leaf length, width and petiole varied significantly among different genotypes in the growing months in the two years. The analysis of variance showed that there was a statistically significant difference (0.05) between the genotypes. Leaf growth is affected by factors such as soil properties, plant's nutrition elements, temperature, and vegetation time [26]. Leaf parameters values obtained in our study are lower in most genotypes than those of some other researchers [27-29]. This might be due to genotypic differences and different climate conditions under which the trial was performed.

Conclusion

Wide variation exists in the botanical traits, thus genetic diversity, of the genotypes. The stems and leaves of the plants were predominantly green. Leaves of most genotypes were palmate, deeply lobed and had serrate margin. Most of these parameters can be used more efficiently in discriminating among kenaf genotypes. The kenaf genotypes investigated were ultra-early and early maturing. In Summary, data from this work showed a wide variation in the botanical features, as well as agro-morphological characteristics of the crop and proves there is a wide genetic diversity among the genotypes. Plant breeders can, therefore, easily make choices among the germ plasms for breeding programmes. Moreover, these genotypes performed differently and the yield over the years was affected by year of planting during field evaluation.

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