ESTIMATION OF SOME GENETIC PARAMETERS FOR YIELD AND YIELD COMPONENTS IN KENAF (*HIBISCUS CANNABINUS* L.)

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Abstract

Two field experiments were carried out at El-Gemmiza Agric. Res. Station, Gharbia Governorate, A.R.C., Egypt during the two successive seasons, 2005 and 2006, to study the variability and covariability for green stalk weight, fiber weight and their related characters through evaluation of fourteen kenaf genotypes in a randomized complete block design with three replications.

The collected data indicated that, local strain 105/2 gave the highest mean for each of green stalk yield per fed, fiber yield per fed, green stalk weight per plant, plant height, technical stem length, fiber length, fiber weight per plant, fiber percentage, fruiting zone length, stem diameter and seed weight per plant. While, the maximum seed yield per fed was recorded by S.96/20.

Mean squares due to genotypes were highly significant for all characters, revealing the variability existed among these genotypes, resulted in increasing the chance to select high yielding potential genotypes for all characters. The genotype x year variance (σ^2gy) was less than the genotypic variance (σ^2g) for all characters except fiber percentage, indicating that most of variability in most studied characters was mainly controlled by genetic factors with less influence by environmental factors. This mean that improvement of these traits could be achieved by direct selection.

The narrow range between phenotypic (PCV) and genotypic (GCV) coefficient of variability gave almost similar values, for plant height and technical stem length. Reflected the importance of selection for these traits (plant height and technical stem length), which also gave high heritability estimates.

Phenotypic (r_p) and genotypic (r_g) correlation coefficients concluded that plant height, technical stem length, fiber length, green weight per plant and fiber percentage are the major components contributing to fiber weight per plant. Therefore, selection for these traits will improve the fiber yield (weight) in kenaf.

***Key words*: Kenaf, variability, phenotypic and genotypic correlation.**

INTRODUCTION

Kenaf (*Hibiscus cannabinus)* is often touted as being a new crop, but in fact it is an ancient crop, having been domesticated in sub-Sahara in Africa more than 6000 years BC. Kenaf has been grown as a commercial crop in India for about 100 years and in other areas of Asia and in Africa, the Near East, and Latin America for a shorter time. In Egypt, Kenaf is cultivated to produce bast fiber, which used alone or mixed with jute fiber to manufacture bags, twine, ropes and other products. It would be expected as a raw material to be an alternative to wood fiber in pulp and paper industry. Moreover, kenaf seeds contains similar oil to that extracted from cotton seeds but free from gossypol (poison material) as edible for human.

Many investigators studied the differences between kenaf genotypes e.g., Osman and Momtaz, 1982, Xiao *et al.*, 1993, Webber,1993, El-Kady and El-Sweify,1995 and Abd El-Dayem, 2001. Also, the interrelationships between fiber yield or seed yield and agronomic characters were studied by several investigators (Mourad *et al.*, 1987, El-Shimy *et al.*, 1990, Bunpromma,1992, El-Farouk and El-Sweify,1998). On the other hand, the estimation of some genetic parameters in kenaf is limited. Subramanyam *et al.*, (1995) studying the heritability in eight kenaf hybrids. They found that, fiber weight per plant and green plant weight showed high heritability, indicating that selection in early generations would be effective. Abd El-Dayem (2001) found that heritability ratios in broad sense were high in all traits studied.

Before beginning any breeding program, thorough knowledge of the nature and magnitude of genetic variability and the extent of association between yield and yield components is essential. Similarly, phenotypic and genotypic variance as well as heritability estimates for fiber yield and its related characters and associations between fiber yield and other related characters are considered basic information for designing a successful breeding program to improve fiber yield in kenaf. According to Burton (1952) the genotypic coefficient of variability together with heritability estimate would give the best indication of the amount of genetic advance to be expected from selection.

Therefore, the present investigation aimed to study the phenotypic and genotypic variability as well as heritability in broad sense for green stalk yield, fiber yield and their related characters in fourteen kenaf genotypes. These parameters were used to select the best kenaf genotypes to be released as cultivars or to be incorporated in breeding program to select high yielding potential cultivars.

MATERIALS AND METHODS

Two field experiments were carried out at El-Gemmiza Agric. Res. Station, Gharbia Governorate, A.R.C., Egypt during the two successive seasons, 2005 and 2006, to study the variability and covariability of fourteen kenaf genotypes concerning green stalk yield, fiber yield and their related characters. These genotypes included one commercial cultivar (Giza3), ten promising strains and three imported varieties (Cuba, New Indian and Tianning). Pedigree, origin and released year of the fourteen kenaf genotypes used partially described in Table 1.

Table 1. Identification of 14 kenaf genotypes used, pedigree, origin, generation and year released.

Genotypes	Pedigree	Origin	Year released
1- Giza 3	Selected from farmer fields	Local cultivar	1961
2- S. 8	Selected from H.106 (G.5 x 77/68-1)	Advanced strain	1993
3- S.38	Giza 3 x 4/59-27	" " " " " " "	1976
4-S.40	4/59-28 x 18/64	" " " " " " "	1976
5- S.96/20	Giza 3 x 17/64-2	" " " " " " "	2002
6- S.103/4	Giza 4 x S.77/68-1	" " " " " " "	1995
7- S.105/2	Giza 5 x S.87/68-1	" " " " " " "	1994
8- S.108/9	Giza 3 x S.127/130	" " " " " " "	1996
9- S.116	S.4/59 x S.29/1451	" " " " " " "	1998
10-H.119	Selected from H.119 (G.4 x 16/63-2)	" " " " " " "	2000
11-S.158/4/2/5	S.105/1 x I.29	" " " " " " "	1996
12-Cuba	Selected from I. 4/29-26	Cuba	1959
13-New Indian	Selected from I. New Indian	India	1996
14-Tianning	Introduction from Nigeria	Nigeria	1995

* Year released, selected or introduced.

In two successive seasons, 2005 and 2006, the 14 kenaf genotypes were evaluated in a randomized complete block design with three replications at El-Gemmiza Agric. Res. Station, Gharbia Governorate, A.R.C., Egypt. The soil type was clay loam with organic matter of 2.03 and 2.07 %, available nitrogen 23.95 and 25.90 ppm, $CaCO_3$ of 1.59 and 1.55% and pH value of 7.95 and 7.83 in the first and second seasons, respectively. Sowing date was the first week of May in both seasons, the plot size was 3 meters length and 2 meters width (1/700 fed) and consisted of 4 rows, 50 cm apart and the distance between hills was20 cm. Thinning to two plants / hill was performed four weeks after sowing. The recommended cultural practices for kenaf production were applied. At maturity stage, five random guarded plants from each plot were taken to score the following traits:

(1) Green stalk yield (ton)/fed, (2) Fiber yield (kg) / fed, (3) Seed yield (Kg)/fed (the three characters previously mentioned were calculated from yield per plot), (4) Green weight (g)/plant, as weight in grams of kenaf stalk plant after 48 hours from harvesting, (5) Plant height (cm), measured as the distance from the two cotyledonary nodes up to uppermost capsule, (6) Technical stem length in cm, measured as the distance from the two cotyledonary nodes to the first apical branch, (7) Fiber length (cm), (8) Fiber weight (g) / plant, as the weight in grams of the air-dried fibers extracted from retted green stalk of kenaf plant, (9) Fiber percentage = (fiber weight/plant x 100 ÷ green weight/plant), (10) Fruiting zone length in cm, measured as the distance from the first apical branch to uppermost capsule, (11) Stem diameter in cm, at the middle part of technical stem length and (12) Seed weight (g)/plant.

The data obtained for each season were subjected to analysis of variance (Gomez and Gomez, 1984), therefore homogeneity test (Bartlett, test) was performed for error terms of each season. Error terms were homogeneous enabling combined analysis of variance over environments (years). Genotypic (V_g), environmental (V_e), their interaction (V_{ge}) and phenotypic (V_p) variances, as well as phenotypic (PCV) and genotypic (GCV) coefficients of variation, heritability in broad sense ($H_{b.s.}$) and phenotypic (r_p) and genetic (r_g) correlation coefficients were calculated according to Johnson *et al.,* (1955) as follows:

Sov	df	MS	Expected MS	E. Cov. Of cross product
Environments(years)	1			
Rep./Environments	4			
Genotypes (G)	13	M_1	$\sigma^2e + 3\sigma^2gy + 6\sigma^2g$	$\sigma_{e\,12} + 3\sigma_{gy\,12} + 6\,\sigma_{g\,12}$
G x Environments	13	M_2	$\sigma^2e + 3\sigma^2gy$	$\sigma_{e\,12} + 3\sigma_{gy\,12}$
Error	52	M_3	σ^2e	$\sigma_{e\,12}$

Where: (1)σ^2e, σ^2gy and σ^2g denoted environmental, genotypic x environmental and genotypic variances, respectively. (2) $\sigma_{e\,12}$, $\sigma_{gy\,12}$ and $\sigma_{g\,12}$ are the corresponding covariance components for the characters,1 and 2.

For the above table the following estimates were calculated:

σ^2_p = phenotypic variance among the variety means = M1/(2 * 3)

r_{12p} = phenotypic correlation between characters 1 and 2 = $\sigma_{12p} / (\sigma_{1p} * \sigma_{2p})$

r_{12g} = genotypic correlation = $\sigma_{12g} / (\sigma_{1g} * \sigma_{2g})$

RESULTS AND DISCUSSION

1- Variability

1-1- Mean performance:

Mean performance for green stalk yield, fiber yield and seed yield per fed as well as per plant and their related characters of fourteen kenaf genotypes averaged over two environments (years) are presented in Table (2). The local strain 105/2 gave the highest means for each of green stalk yield/fed (20.708 ton), fiber yield/fed (1.433 ton), green stalk weight/plant (669.523 g), plant height (413.232 cm), technical stem length (295.692 cm), fiber length (292.168 cm), fiber weight / plant (44.392 g), fiber percentage (6.63%), fruiting zone length (117.540 cm), stem diameter (2.027 cm) and seed weight/plant (7.342 g). While, the maximum seed yield/fed was recorded by S.96/20 (138.697 kg). On the other hand, the second highest means were recorded by each of the introduced variety Cuba for green stalk yield/fed and S.96/20 for fiber yield/fed. The introduced variety New Indian was followed by Cuba for seed yield/fed, Giza 3 for green stalk weight/plant, S.8 for each of plant height, fruiting zone length and stem diameter, S.96/20 for each of technical length, fiber weight/plant, fiber percentage and seed weight/plant. In general, the local strain 105/2 was superior than the commercial cultivar Giza 3 for most important characters, green stalk yield/fed, fiber yield/fed, technical length and fiber percentage by 13.82%, 36.35%, 12.59% and 19.68%, respectively. On the other hand, S.96/20 was superior than Giza 3 in both of seed yield/fed and fiber percentage by 15.81% and 24.37%, respectively. But the minimum mean values were obtained by S.40 for most characters under study. These results indicated that, S.105/2 was the best genotype for most traits studied and should be subjected to further test in other locations before releasing as a new commercial kenaf cultivar_for the aforementioned characters and/or to be incorporated as breeding stock in kenaf program aiming at producing high yielding lines.

Several investigators found differences among kenaf genotypes such as Osman and Momtaz,1982, El-Kady and El-Sweify,1995 and Abd El-Dayem, 2001.

2- Genetic parameters

Mean square values, variance components estimates, phenotypic (PCV) and genotypic (GCV) coefficient of variability and broad sense heritability (H%) for nine characters due to fourteen kenaf genotypes are presented in Table (3). Mean squares due to genotypes were highly significant for green stalk weight, fiber weight and their related characters, indicating that these varietal differences between kenaf genotypes are mainly due to the differences in genetic make up of studied genotypes, which reflected on yield and yield components. Also, the variability existed among these genotypes, would increase the chance to select high yielding potential genotypes for green stalk weight and fiber weight. Such variability among different kenaf genotypes in green stalk weight and fiber weight was also reported by Osman and Momtaz,1982, El-Kady and El-Sweify,1995, Abd El-Dayem, 2001 and Abo-Kaied, 2007.

The mean squares of Genotypes x Years interaction were significant for all characters except fiber percentage, fruiting zone length and stem diameter which were highly significant. Also, results indicated that magnitudes of mean squares due to genotypes for all characters studied were larger than mean squares due to G x Y interaction, which mean that most of variability in these characters were mainly controlled by genetic factors with less influence by environmental factors. This mean that improvement of these traits could be achieved by selection. Response to selection for quantitative traits is directly proportional to the function of its heritability, selection intensity and phenotypic variance. Heritability estimates enable the plant breeder to recognize the genetic differences among the traits and the genetic variance indicated the potential for the improvement of particular trait (Jarwar *et al,* 1998).

Estimates of the variance components and heritability among fourteen kenaf genotypes for green stalk weight, fiber weight and their related characters are shown in Table (3). The genotype x years variance (σ^2gy) was less than the genotypic variance (σ^2g) for all characters except fiber percentage. These results supported the previously mentioned conclusion, that the biased influence by years was small, concerning beneficial selection for most yield components. Variability among kenaf genotypes, estimated by PCV and GCV, reached maximum values of PCV for fruiting zone length (37.814) followed by seed weight/plant (32.117), fiber weight/plant (28.813) and green weight / plant (22.784). The high values of GCV were obtained for these traits, indicated the possibility to achieve further improvement by selection. The observed narrow range between PCV and GCV, which gave almost nearly similar values, for plant height and technical length reflect the importance of selection for these traits (plant height and technical length) which also, gave high heritability estimates. This conclusion may be supported by evidences that yield component traits are genetically controlled. These results indicated the possibility of using these yield component traits in selection index technique which gave more weight for plant height that had high heritability ratio (98.89%) followed by fiber weight/plant (96.38%) and technical length (92.25%). On the other hand, wide ranges were observed between PCV and GCV with moderate or low heritability for fiber percentage (PCV=7.063, GCV=4.722 and H=44.70%) and stem diameter (PCV=13.054, GCV=10.552 and H=65.34%). These results are in harmony with that reported by Abd El-Dayem (2001).

2- Correlation studies:

Phenotypic (r_p) and genotypic (r_g) correlation coefficients among green stalk weight, fiber weight/ plant and their related characters of fourteen kenaf genotypes based on data of two seasons (2005 and 2006) are shown in Table 4. Green stalk weight exhibited significant positive correlation with all characters studied except fiber percentage. Also, fiber weight/plant exhibited significant positive correlation with each of green weight/plant, plant height, fiber length and fiber percentage. These results, indicated that maximization of fiber weight/plant may be obtained via selection for these traits. Moreover, significant association was obtained between the two components, plant height and technical stem length (rp=0.883, rg=0.783) and also between fiber length and fiber percentage (rp=0.644, rg=0.773). These results indicated that plant height, technical stem length, fiber length and fiber percentage are the main components for fiber weight/plant. These results are in agreement with those obtained by Mourad *et al.*,1987, El-Shimy *et al.*,1990, Bunpromma,1992, El-Farouk and El-Sweify,1998 and Abo-Kaied, 2007.

On the other hand, phenotypic correlation coefficients between fiber weight/plant and fruiting zone length, stem diameter and seed weight / plant values were significant, while their respective genotypic correlations were negative. These findings may be partially supported by low or moderate heritability estimates obtained and gap discrepancy between the phenotypic (PCV) and genotypic (GCV) coefficients of variability for the two traits involved, fruiting zone length (H=83.23%, PCV=37.814, GVC=34.517) and stem diameter (H=65.34, PCV=13.054, GCV=10.552) Table4.

In general, it can be concluded that plant height, technical stem length, fiber length, green weight/plant and fiber percentage are the major components contributing to fiber weight/plant. Therefore, selection for these traits will improve fiber yield (weight) in kenaf.

Table 2. Mean values for green stalk, fiber and seed yields per fed as well as per plant and their related traits of 14 kenaf genotypes (combined over two seasons, 2005 and 2006).

Genotype	Green stalk yield /fed* (ton)	Fiber yield / fed (ton)	Seed yield / fed (kg)	Green stalk weight / plant (g)	Plant height (cm)	Technical stem length (cm)	Fiber length (cm)	Fiber weight / plant (g)	Fiber percentage (%)	Fruiting zone length (cm)	Stem diameter (Cm)	Seed weight / Plant (g)
1- Giza 3	18.193 bc	1.051 cd	119.760 bc	460.703 b	326.093 d	262.635 cd	255.477 bc	25.510 c	5.540 de	63.458 cd	1.760 cd	4.445 d
2- S. 8	17.913 bc	1.117 bc	98.448 e	424.012cd	371.343	248.997 de	242.915 c-e	25.302 c	5.982 b-d	122.346 a	1.942 ab	3.888 e
3- S.38	14.964 ef	0.846 f	81.208 fg	344.173f-h	293.807 f	234.358 e-g	227.450 ef	18.628 f-h	5.415 e	59.449 cd	1.415 g	3.198 f
4-S.40	12.454 h	0.742 g	77.092 gh	299.423 i	208.588 i	170.225 i	166.670 h	17.030 h	5.728 c-e	38.363 e	1.412 g	2.570 g
5- S.96/20	16.547 d	1.185 b	138.697 a	401.452 d	334.458	278.593 b	270.967 b	27.667 b	6.890 a	55.865 d	1.868 bc	6.113 b
6- S.103/4	15.408 e	0.993 de	110.558 d	373.610 e	338.998	272.518 bc	265.082 b	23.107 d	6.178 b	66.480 c	1.715 de	4.950 c
7- S.105/2	20.708 a	1.433 a	122.357 bc	669.523 a	413.232	295.692 a	292.168 a	44.392 a	6.630 a	117.540 a	2.027 a	7.342 a
8- S.108/9	13.602 g	0.787 g	86.632 f	331.378 gh	283.737	224.602 f-h	216.225 fg	18.342 gh	5.542 de	59.135 cd	1.420 g	3.397f
9- S.116	17.241 c	1.059 c	73.160 h	438.452 bc	307.717	220.893 gh	215.878 fg	25.785 c	5.907 b-d	86.824 b	1.675 de	2.523 g
10-H.119	15.609 de	0.928 ef	85.370 fg	358.700 ef	272.102	213.682 h	208.357 g	20.440 ef	5.685 c-e	58.420 cd	1.345 g	2.710 g
11-S.158/4/2/5	13.734 f	0.819 fg	116.128 cd	329.510 hi	271.605	234.413 e-g	227.122 ef	18.805 f-h	5.717 c-e	37.192 e	1.678 de	4.582 cd
12-Cuba	18.399 b	1.153 b	126.653 b	410.772 d	334.850	275.658 bc	268.275 b	24.655 c	6.005 bc	59.192 cd	1.742 cd	4.907 c
13-New Indian	15.778 de	0.974 de	138.287 a	367.925 ef	319.513	261.888 cd	253.460 bc	21.782 de	5.925 b-d	57.625 cd	1.582 ef	4.865 c
14-Tianning	15.281 e	0.899 ef	118.458 b-d	356.327 e-g	294.037 f	238.642 ef	230.357 d-f	20.120e-g	5.657 c-e	55.395 d	1.458 f	4.693 cd

* fad = 0.42 ha

Means identified by the same letter are not significantly different at 0.05 level of probability according to FLSD.

Table 3. Mean square values, variance components estimates, phenotypic (PCV) and genotypic (GCV) coefficients of variability and broad sense heritability (H%) for 9 characters of 14 kenaf genotypes based on data of two seasons (2005 and 2006).

Characters	Combined ANOVA			Variance components and some genetic parameters						
	Genotypes(G) (13)#	G x Years (Y) (13)#	Pooled error (52)#	σ^2ph	σ^2g	σ^2gy	σ^2e	H%	PCV%	GCV%
Green weight / plant (g)	49230.706**	1491.235*	743.936	8205.118	7956.579	249.100	743.936	96.97	22.784	22.436
Plant height (cm)	14385.277**	160.235*	79.020	2397.546	2370.840	27.072	79.020	98.89	15.686	15.599
Technical stem length (cm)	6388.655**	495.360*	243.434	1064.776	982.216	83.975	243.434	92.25	13.308	12.782
Fiber length (cm)	6209.108**	1095.360*	345.567	1034.851	852.291	249.931	345.567	82.36	13.482	12.236
Fiber weight / plant (g)	279.386**	10.117*	4.495	46.564	44.878	1.874	4.495	96.38	28.813	28.287
Fiber percentage (%)	1.047**	0.579**	0.220	0.175	0.078	0.120	0.220	44.70	7.063	4.722
Fruiting zone length (cm)	3845.497**	641.462**	121.217	640.916	534.006	173.415	121.217	83.32	37.814	34.517
Stem diameter (cm)	0.277**	0.096**	0.023	0.046	0.030	0.024	0.023	65.34	13.054	10.552
Seed weight / plant (g)	11.438**	0.438*	0.184	1.906	1.833	0.085	0.184	96.17	32.117	31.496

*,** = Indicate significance at the 0.05 and 0.01 levels of probability, respectively.

=Values designated the corresponding degrees of freedom .

σ^2ph, σ^2g, σ^2gy, σ^2e, phenotypic, genotypic, genotype x year plot error variances, respectively.

Table 4. Phenotypic (rp) and genotypic (rg) correlation coefficients among green stalk weight, fiber weight per plant and their components of 14 kenaf genotypes based on data of two seasons (2005 and 2006).

Characters		1	2	3	4	5	6	7	8
1-Green stalk weight / plant (g)									
2-Plant height (cm)	rp	0.821**							
	rg	0.663							
3-Technical stem length (cm)	rp	0.647*	0.883**						
	rg	0.677	0.783						
4-Fiber length (cm)	rp	0.678*	0.896**	0.998**					
	rg	0.568	0.784	0.817					
5-Fiber weight/plant (g)	rp	0.978**	0.832**	0.687*	0.719*				
	rg	0.778	0.573	0.765	0.817				
6-Fiber percentage (%)	rp	0.556	0.613*	0.626*	0.644*	0.713**			
	rg	0.442	0.547	0.743	0.773	0.817			
7-Fruiting zone length (cm)	rp	0.755**	0.796**	0.419	0.445	0.723*	0.379		
	rg	0.561	0.528	0.347	0.347	-0.274	-0.101		
8-Stem diameter (cm)	rp	0.750**	0.841**	0.745*	0.764**	0.793**	0.726*	0.667*	
	rg	0.713	0.702	0.333	0.301	-0.507	-0.249	0.703	
9-Seed weight/plant (g)	rp	0.646*	0.727*	0.869**	0.874**	0.731*	0.737**	0.287	0.713*
	rg	0.307	0.476	0.297	0.489	-0.187	0.387	0.608	0.638

*,**=Indicate significance at the 0.05 and 0.01 levels of probability, respectively.

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تقدير بعض الثوابت الوراثية للمحصول ومكوناته في التيل

حسين مصطفي حسين أبوقايد – طه عبدالمنعم ابوزيد

معهد المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة

أجريت تجربتان حقليتان خلال موسمي ٢٠٠٥ ، ٢٠٠٦ بمحطة البحوث الزراعية بالجميزة، م الغربية ، مصر. وذلك لتقييم أربعة عشر تركيبا وراثيا من التيل فيما يتعلق بمحصولي الساق الأخضر والألياف ومكوناتهما بالإضافة إلى دراسة بعض التقديرات لبعض الثوابت الوراثية (التباين الظاهري والوراثي ودرجة التوريث في المعني الواسع) ؛ وكذلك دراسة التغاير بين أزواج الصفات لتقدير معامل الارتباط الظاهري والوراثي، وكانت أهم النتائج ما يلي:

تشير النتائج إلى أن السلالة ٢/١٠٥ أعطت أعلى قيم لمحصول الساق الأخضر / فدان ومحصول الألياف / فدان ووزن الساق الأخضر / نبات ، والطول الكلي والطول الفعال وطول الألياف ووزن الألياف / نبات والنسبة المئوية للألياف وطول المنطقة الثمرية وقطر الساق ووزن البذور / نبات . بينما سجلت السلالة ٢٠/٩٦ أعلى محصول بذور / فدان .

كما أظهرت جميع التراكيب الوراثية اختلافات عالية المعنوية لكل الصفات تحت الدراسة مما يزيد من فرصة الانتخاب لتراكيب ذات قدرة محصولية عالية لهذه الصفات .

كذلك المساهمة النسبية لتباين التفاعل (σ^2gy) في التباين الكلي كان أقل من المساهمة النسبية لتباين الأصناف. مما يشير إلى أن معظم التباين لهذه الصفات يتحكم في معظمه عوامل وراثية مع تأثر قليل بالعوامل البيئية . وهذا يعني أن إمكانية التحسين لمحصول الألياف بواسطة الانتخاب المباشر لهذه الصفات.

كما أن التقارب بين معاملي الاختلاف الظاهري والوراثي لصفات الطول الكلي والطول الفعال وكذاك درجة التوريث العالية لصفتي الطول الكلي والطول الفعال تعكس أهمية هاتين الصفتين في الانتخاب .

أشارت نتائج الارتباط الظاهري والوراثي أن الطول الكلي والطول الفعال وطول الألياف والوزن الأخضر للساق والنسبة المئوية للألياف تعتبر من أهم المكونات مساهمة في محصول الألياف / النبات لذلك فان الانتخاب لهذه الصفات سوف يحسن من محصول الألياف في التيل .