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EFFECT OF DISTANCE BETWEEN HILLS ON SOME KENAF GENOTYPES AND ITS RELATION TO YIELD

M.EL-FAROUK AND A.H.H. EL-SWEIFY

Field Crops Research Institute, Agricultural Research Centre, Giza, Egypt.

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Abstract

The effect of four hill distances 10,15,20 and 25 cm. which represented the four population densities 86 666, 57 777, 43 333 and 34 666 plants/fed. respectively, on yield and some agronomic characters of three kenaf genotypes were studied. Experiments were conducted in 1995 and 1996 seasons at Ismaillia Agric. Exp. Station, Egypt. The results indicated that genotype S. 51/61-3 significantly surpassed the other genotypes in number of capsules/plant, green stalk yield, seed yield/plant and biological yield. It also produced fiber that recorded the highest highest values with regard to all the technological traits studied except fiber fineness, which was highest for cv. Giza 3. Narrow hill distance (10cm) resulted in lower yields per plant than 25 cm hill distance for the three genotypes. Stem diameter was 1.499cm for the lowest plant population and decreased to 0.987 cm for highest population. Results showed that kenaf sowing at density of 4333 plants/fed. using 15cm hill distance consistently produced greater green stalk yield as well as seed yield per fed by 11.76 and 0.223 ton, respectively. Plants sown at 10cm hill distance produced taller technical stem length with finer fibers. The maximum of fiber yield/fed. was obtained from plants planted at 15 cm hill distance (43333 plans/fed).

Correlation coefficient were computed between green stalk yield/plant and each of total length, stem diameter, fiber yield/plant, fiber %, length, fiber fineness and seed yield/plant. The results were significant and positive in traits of total length, fiber yield and seed yield/plant, and insignificant and insignificant and positive with regard to stem diameter. On the other hand, correlation was negative and significant with fiber fineness and negative and insignificat with fiber %.

INTRODUCTION

Kenaf (*Hibiscus cannabinus* L.) is a source of fiber and a potential pulp crop for paper making and related uses. It can be grown under different climatic conditions resulting in a wide range of yield. The fiber properties of kenaf enable it to be used in nearly all applications where jute is now used and it can be spun and woven on jute machinery. Kenaf in Egypt is cultivated in small areas. The main target of our plant breeding program is to develop new strains which surpass the commercial cul-

tivar. The present investigation is designed to compare kenaf yield, yield components and quality of two promising strains (51/61-3 and 567/2-1) which were released by the Fiber Crops Res. Section, Field crops Res. Institute, A.R.C., Egypt; with the commercial variety Giza 3 as affected by the hill distances in sandy soil. Several investigators recorded differences in the stalk yields and other morphological characters among some kenaf genotypes, Campbell and White (1982), in Maryland; Sij and Turner (1988) found significant differences, between two cultivars in the stem yield and total plant height. Recently, Evans and Hang (1993) and Webber (1993) noticed that kenaf cultivars differed in the yield and its components. Webber and Bledsoe (1993) evaluated six kenaf cultivars and found that Guatemala 48 was the tallest (187 cm) and produced the highest stem yield. With respect to fiber yield, Bhattacharjee et al. (1987) found that H. cannabinnus cv., HC-585 and HC-269 were superior to 4 other cvs, under study, in dry fiber yield. Bunpromma (1992), recorded that cv. N.S. 2 produced the best fiber yields in Thailand.

Many investigators studied the effect of row spacing on kenaf yield and its technological characters, Salih (1978) who revealed that the plant density at 500, 000 per hectar resulted in maximum yield. Bhangoo et al. (1986) also reached the same above mentained result, by mean that the greater population density/ha. Was more suitable for obtaining highest kenaf yield of stems. Vinent and Prieto (1988)noticed that the fiber yield ton per hectar ranged from 1.67 to 3.5 ton/ha. When kenaf plants cultivated at single and pair rows, while Nafees and Saha (1993)who confirmed the last results and illustrated that fiber yield increased with decreasing plant spacing which reached maximum magnitude at 10cm. Spacing.

MATERIALS AND METHODS

The effects of four hill distances (10, 15, 20 and 25cm.) which represented the four densities (86.7, 57.8, 43.3 and 34.6 thousand plants/fed.) on the performance of cvs. Giza 3., Strain 51/61-3 (hybried between Giza 3 cv. and S. 1/59-108) and Strain 567/2-1 (hybried between Giza 3 cv. and S.4/59-10) were studied in 1995 and 1996 seasons under sprinkler irrigation in sandy soil at Ismailia Agric. Exp. Station, Ismailia Governorate, Egypt. The experimental design was a split plot with four replications. Genotypes (G) were main plots and hill distances (D) were sub plots (7.2 m2). Kenaf seeds were sown in rows 3 m. long and 60 cm. apart. There were four hill distances in each main plot, every hill was thinned after 30 days from sowing to two plants per hill then followed by recommended fertilization.

The central two rows in each plot were harvested to determine seed, green stalk and biological yields/fed. and fiber yield after retting. The seeds of genotypes under study were obtained from Fiber Crops Research Section, A.R.C. The recommended agricultural practices for kenaf were applied at proper time. At maturity, ten guarded plant were taken from each plot to study the yield components i.e., plant height, technical length, stem diameter, green stalk yield/plant, biological yield/ plant, No. of capsules/plant, seed yield/plant. Technological characters also were recorded i.e., fiber length, fiber percentage, fiber yield/fed. and fiber fineness which were determined according to Radwan and Momtaz (1966). The data were statistically analyzed according to Snedcor and Cochran (1967). Combined analysis was performed for each character over the two growingseasons as described by Le Clerg et al. (1966). Simple correlation coefficients were computed between green stalk yield per plant and each of total length, stem diameter, fiber yield/plant, fiber %, fiber fineness, and seed yield/plant for the three genotypes under the four hill distances. (Snedcor and Cochran, 1967)

RESULTS AND DISCUSSION

A. Effect of genotypes:

The response of kenaf yield, components and fiber quality of three kenaf genotypes i.e. Giza 3 cv. in addition to the two promising strains 51/61-3 and 567/2-1 were investigated and the results are recorded in Table (1). These results showed clearly that yield component characters differed among the different genotypes. Promising strain 51/61-3 surpassed the other genotypes insignificantly with regard to total length, technical length, and stem diameter. On the other hand, it significantly outyielded them for the other component characters viz., green stalk yield/ plant as well as per feddan, no. of capsules/plant seed yield/plant as well as per feddan. Giza 3 cv. outyielded strain 567/2 in total length, technical length and stem diameter, but gave lower green stalk yield/plant as well as per faddan, number of capsules per plant and seed yield per plant as well as per faddan. It could be concluded that these varietal differences reflect variability in gnetic constitution. Varietal differences were obtained by El-Keredy et al. (1978), El-Kady (1980), Salih (1981), Osman et al. (1982). Bhangoo et al. (1986), El-Kady et al. (1990), Di-Candilo et al. (1992), Evans and Hang (1993), Webber (1993), Webber and Bledsoe (1993), El-Kady and El-Sweify (1995). Results also showed that biological yield/ plant in as well as per feddan differed significantly, and the promising strain 51/ 61-3 gave the maximum values for both traits, followed by strain 567/2-1 and

Table 1. Mean values of yield and yield compoments, and technological characters for three kenaf genotypes (combined analysis of two seasons 1995 and 1996).

Trait	Genotype			L.S.D. 5%
	Cv. Giza 3	St. 51/61-3	St. 567/2-1	
Yield				
Green stalk yield / plant (g)	97.78	104.69	102.93	1.685
Seed yield / plant (g)	9.998	12.173	11.331	0.714
Biological yield / plant (g)	107.78	116.863	114.261	0.606
Green stalk yield / fed. (ton)	8.34	8.95	8.61	0.245
Fiber yield / fed. (kg)	121.94	122.41	110.67	7.168
Seed yield / fed. (ton)	0.172	0.206	0.186	0.203
Biological yield / fed. (ton)	8.512	9.156	8.796	0.253
Yield components				
Total length (cm)	265.65	269.32	261.08	N.s.
Technical length (cm)	224.42	233.46	223.91	N.s.
Stem diameter (cm)	1.055	1.064	1.008	N.s.
No. of capsules / plant	27.14	31.77	29.59	2.579
Technological characters				
Fiber length (cm)	172.83	175.331	169.213	6.168
Fiber percentage	13.59	14.25	13.06	0.603
Fiber fineness	208.03	185.074	226.356	18.234

Giza 3 if arranged in descending order. The productive potentiality of seed yield/fed. reached about 2.02%, 2.25% and 2.11% for Giza 3, S.51/61-3 and S.567/2-1, respectively. The promising strain 51/61-3 outyielded the other genotypes in fiber yield by 122.41 kg./fed.

Fiber technology traits, responded significantly to varietal differences. Strain 51/61-3 was superior with regard to fiber length and fiber percentage. On the other hand, strain 567/2-1 produced the finest fiber while S.51/61-3 gave the coarsest fiber. It could be concluded that kenaf fiber quality depends on genetic make up of the material under test which in turn interacts with environmental condition. These results are in agreement with those obtained by El-Kady (1980), Bhattacharjee et al. (1987), El-Kady et al. (1990) and Bunpromma (1992).

B. Effect of hill distances:

Data presented in Table (2) indicate that the four hill distances 10, 15, 20 and 25 cm. significantly affected all tested traits viz, total length, technical length, stem diameter, number of capsules/plant, green stalk yield per plant as well as per fed., seed yield per plant and per feddan. Total length and technical length increased with decreasing hill distance, while the stem diameter, number of capsules/plant green and seed yields per plant were decreased. Kenaf plants achieved greater height (294.08 cm) with 10cm. between hills which equals to 86.7 thousand plants/fed. while the stem diameter was highest (1.499 cm) for 25 cm hill distance (about 34.7 thousand plants/fed.) and lowest (0.897 cm.) for the narrow hill distance (10 cm.) which meant the highest plant population (86.7 thousand plants/fed.) The same finding was obtained by El-Keredy et al. (1978), Campbell and White (1982), Bhangoo et al. (1986), and Amaducci et al. (1990). Results clearly showed that sowing Kenaf at density of 43.3 thousand plants/fed.), using 15cm hill distance consistently produced greater greater green stalk yield as well as seed yield per fed., than the other three hill distances by 11.76 and 0.223 ton, respectively; which is in agreement with Naffees and Shah (1993). Regarding biological yield/plant, plants sown at 25cm hill distance (the lowest density) gave the highest value (138.78) while the maximum biological yield/fed. was obtained by sowing at 15 cm between hills (about 43.3 thousand plants/fed.). On the contrary, sowing at 25cm obtained the lowest biological yield/fed. (7.084 tons). The maximum of fiber yield per feddan was obtained from plants sown at 15 cm. hill distance (43 333 plants/fed.). It could be concluded that planting at 15 cm. produced the highest green yield per fed. with about highest extracted fiber yield. Hill distances significantly affected all techno-

Table 2. Effect of four hill distances on yield and yield components, and technological characters of kenaf (cobined analysis of two seasons 1995 and 1996).

Trait	Hill distance				L.S.D.
	10 cm.	15 cm.	20 cm.	25 cm.	5%
Yield					
Green stalk yield / plant (g)	83.990	93.770	105.330	124.130	2.002
Seed yield / plant (g)	7.547	9.958	12.509	14.654	0.625
Biological yield / plant (g)	91.537	103.728	117.839	138.784	0.936
Green stalk yield / fed. (ton)	8.440	11.760	7.360	6.950	0.324
Fiber yield / fed. (kg)	117.910	161.340	103.920	88.470	4.762
Seed yield / fed. (ton)	0.210	0.223	0.186	0.134	0.144
Biological yield / fed. (ton)	8.650	11.983	7.546	7.084	0.309
Yield components					
Total length (cm)	294.080	270.010	257.700	242.600	21.726
Technical length (cm)	245.500	231.230	221.060	211.270	12.719
Stem diameter (cm)	0.897	0.998	1.174	1.499	0.076
No. of capsules / plant	20.050	25.860	30.590	41.500	2.243
Technological characters					
Fiber length (cm)	188.670	173.340	167.680	159.140	6.724
Fiber percentage	13.970	13.720	14.120	12.730	0.379
Fiber fineness	305.610	214.310	168.710	137.290	21.230

logical characters as shown in Table (2). The highest mean values of fiber length and fiber fineness obtained from 10 cm. hill distance were 188.66 cm. and 305.61 Nm., respectively, this may be due to narrow hill distance which produced taller technical stem length with thinner stem diameter and thus produced finer fiber. These results are in accordance with El-Keredy et al. (1978), Vinent and Prieto (1988), Vinent and Prieto (1988), Amaducci et al. (1990), Bukhtiar et al. (1990) and Nafess and Shah (1993).

C. Interaction Effects:

Data recorded in Table (3) indicated the effect of the interaction between genotypes and hill distances (G X D) on Kenaf yield, yield components and technological characters under study.The highest mean values which were obtained are presented in the same table. Results showed that the effect of G X D interaction was significant with regard to green stalk yield per plant as well as per fedd., seed yield per plant, fiber percentage, fiber yield and fiber fineness with highest mean values of 130.61 gm., 12.36 ton, 16.63 gm., 14.82%, 171.80 kg and 371.46 Nm., respectively. On the contrary, the other traits i.e., total length, technical length, stem diameter, number of capsules/plant, seed yield/fed., biological yield per plant as well as per fed. and fiber length were insignificantly affeced by (G X D) interaction. Data in Table (3) showed that the highest mean values of stem diameter, green yield per plant, biological yield per plant and fiber percentage reached 1.585 cm., 130.61 gm., 140.052 gm. and 14.82%, respectively. These averages were obtained by planting the S. 51/61-3 seeds at 25 cm. hill distance.

D. Correlation coefficients between green stalk yield and kenaf characters:

Correlation coefficient values (r) between green stalk yield/plant and the seven kenaf characters viz., total length, stem diameer, fiber yield/plant, fiber percentage, fiber length, fiber fineness and seed yield/plant for the genotypes in each of four hill distances are presented in Table (4).

There are highly significant and positive relationships between kenaf green yield/plant and each of total length, fiber yield/plant and seed yield/plat while the (r) values were significant and negative with fiber fineness trait. Results also showed insignificant and positive r estimates recorded with stem diameter and insignificant negative correlation with fiber percentage for the three kenaf genotypes under the four hill distances. Association between green stalk yield/plant and fiber

Table 3. Interaction effects of genotypes (G) and hill distances (D) on yield and yield components, and technological of kenaf (combined analysis of two seasons 1995 and 1996).

Trait	Significance	Highest values	Treatment (G X D)
Yield			
Green stalk yield / plant (g)	2.703	130.61	S. 51/61-3 X 25 cm.
Seed yield / plant (g)	0.844	16.63	S. 567/2-1 X 25 cm.
Biological yield / plant (g)	0.792	140.052	S. 51/61-3 X 25 cm.
Green stalk yield / fed. (ton)	0.324	12.36	S. 51/61-3 X 25 cm.
Fiber yield / fed. (kg)	6.431	171.8	Giza 3 X 20 cm.
Seed yield / fed. (ton)	0.265	0.265	S. 51/61-3 X 15 cm.
Biological yield / fed. (ton)	0.284	12.36	S. 51/61-3 X 15 cm.
Yiled components			
Total length (cm)	N.s.	336.5	S. 51/61-3 X 10 cm.
Technical length (cm)	N.s.	278.9	S. 51/61-3 X 10 cm.
Stem diameter (cm)	N.s.	1.585	S. 51/61-3 X 25cm.
No. of capsules / plant	N.s.	44.35	S. 51/61-3 X 25cm.
Technological characters			
Fiber length (cm)	N.s.	190.57	Giza 3 X 10 cm.
Fiber percentage	0.511	14.82	S. 51/61-3 X 25 cm.
Fiber fineness	28.669	371.46	Giza 3 X 10 cm.

Table 4. Correlation coefficient values between green stalk yield per plant and saven kenaf characters for 3 genotypes and 4 distances bewteen hills.

Genotypes	Hill distances	Characters						
		Total length (cm)	Stem diameter (cm)	Fiber yield /plant (g)	Fiber %	Fiber length (cm)	Fiber fineness (N.m.)	Seed yield / plant (g)
Giza 3 cv.	10 cm.	0.658**	0.294	0.927**	-0.469	-0.456	-0.848**	0.785**
	15 cm.	0.724**	0.241	0.843**	-0.318	-0.557*	-0.723**	0.682**
	20 cm.	0.859**	0.229	0.742**	-0.267	-0.664**	-0.671**	0.662**
	25 cm.	0.929**	0.116	0.691**	-0.211	-0.769**	-0.664**	0.562**
S. 51/61-3	10 cm.	0.510**	0.348	0.925**	-0.395	-0.288	-0.946**	0.696**
	15 cm.	0.545**	0.307	0.842**	-0.329	-0.412	-0.855**	0.659**
	20 cm.	0.638**	0.245	0.723**	-0.228	-0.514	-0.751**	0.564**
	25 cm.	0.829**	0.192	0.677**	-0.171	-0.625**	-0.673**	0.557**
S. 567/2-1	10 cm.	0.560**	0.412	0.969**	-0.397	-0.273	-0.984**	0.656**
	15 cm.	0.635**	0.367	0.827**	-0.362	-0.308	-0.909**	0.617**
	20 cm.	0.757**	0.269	0.742**	-0.235	-0.418	-0.884**	0.555**
	25 cm.	0.829**	0.161	0.693**	-0.164	-0.477	-0.775**	0.535**

*,** significant (*r*) at 5% and 1% , respectively.

Table 4. Correlation coefficient values between green stalk yield per plant and saven kenaf characters for 3 genotypes and 4 distances bewteen hills.

Genotypes	Hill distances	Characters						
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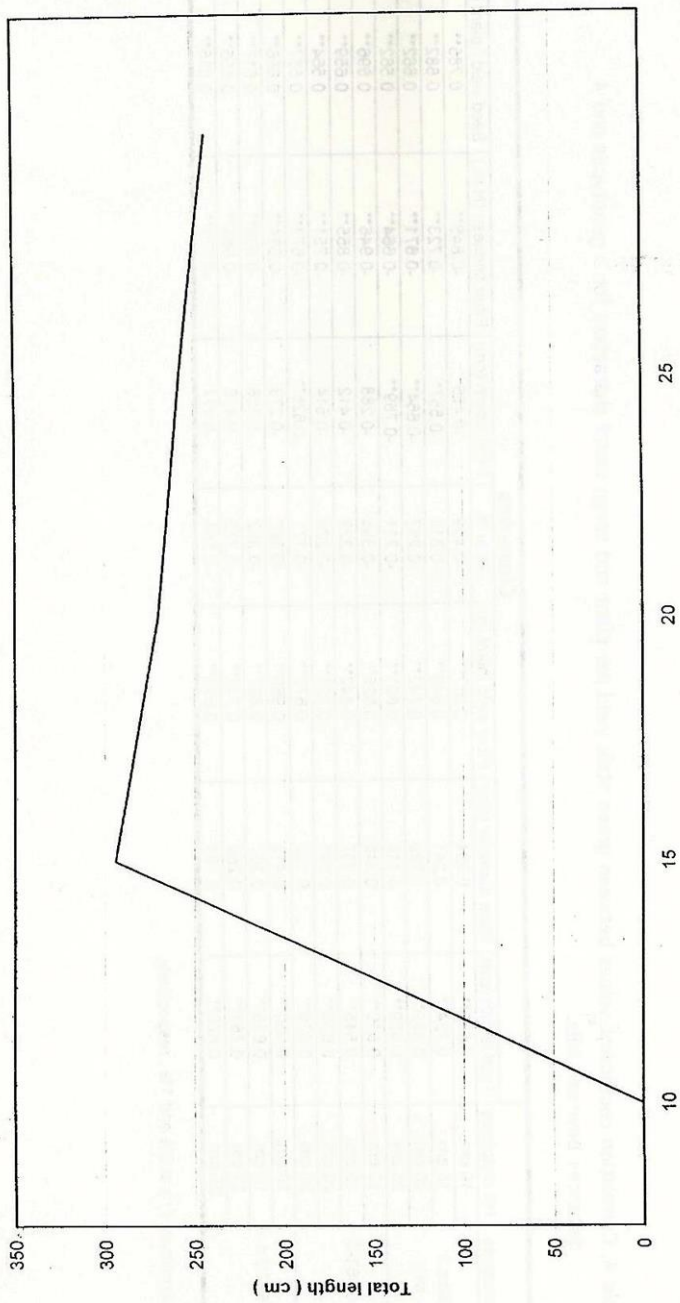

Fig. 1. Effect of hill distance on total length of kenaf plants.

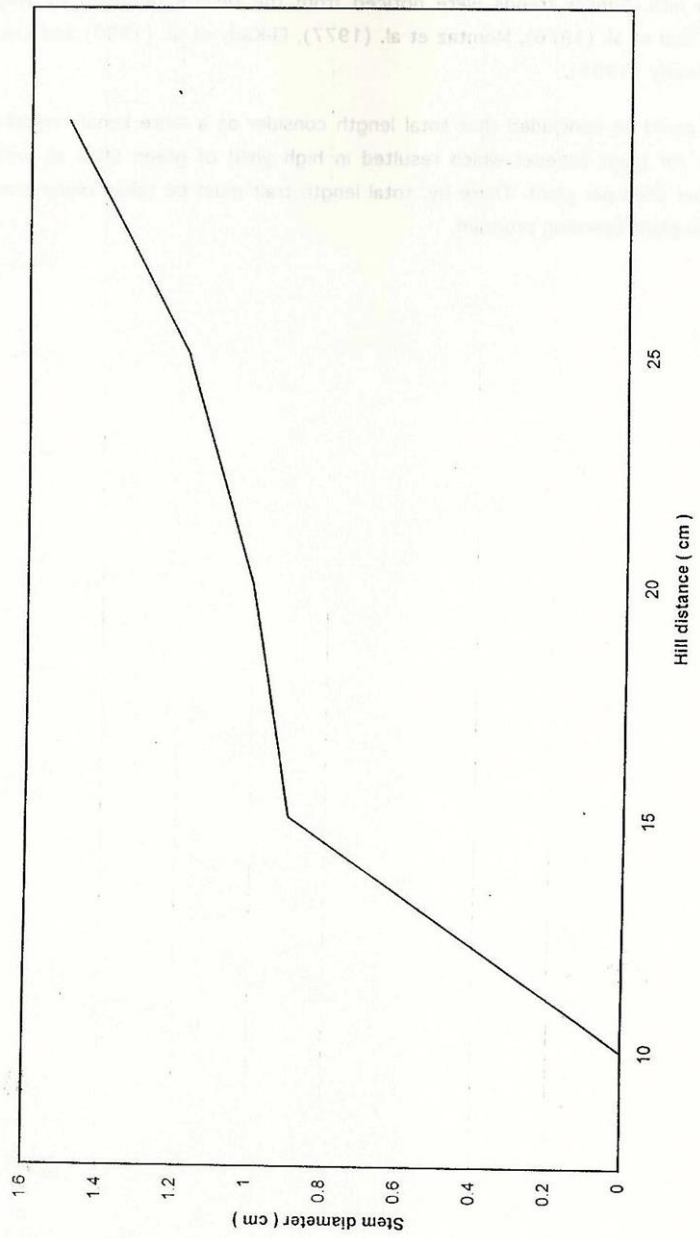

Fig. 2. Effect of hill distance on stem diameter of kenaf plants.

length was insignificant and negative except with Giza 3 cv. sown at 10 cm. between hills which appeared only insignificant and negative, while r values were highely significant and negative with highly insignificant and negative correlation coefficient between hills. Similar trends were noticed from the results obtained by Naguib (1965), Gad et al. (1976), Momtaz et al. (1977), El-Kady et al. (1990) and El-kady and El-Sweify (1995).

It could be concluded that total length consider as a more kenaf remarkable chracter for plant breeder which resulted in high yield of green stalk as well as great fiber yield per plant. There by, total length trait must be taken under consideration in plant breeding program.

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تأثير المسافة بين الجور على بعض التراكيب الوراثية في التيل وعلاقتها بالمحصول

محمد الفاروق محمود ، آمنه حافظ حسن السويفى

قسم بحوث المحاصيل الحقلية - مركز البحوث الزراعية.

أجرى هذا البحث بمحطة البحوث الزراعية بالاسماعيلية لموسمين زراعيين ١٩٩٥ ، ١٩٩٦ بهدف دراسة تأثير المسافة بين الجور (١٠ ، ١٥ ، ٢٠ ، ٢٥ سم) على صفات المحصول والجودة لثلاث تراكيب وراثية من التيل وعلاقة ذلك بالمحصول.

دلت النتائج على تفوق السلالة ٥١ / ٦١ - ٣ معنويا على الصنف التجارى جيزة ٣ والسلالة ٥٦٧ / ٢ -١ وذلك فى صفات مكونات المحصول ومحصول السيقان الخضراء والبذور للفدان. كما أعطت هذه السلالة أعلى درجة فى حالة ألياف الصنف التجارى جيزة ٣ .

أظهرت النتائج أن الزراعة على مسافات ضيقة بين الجور والتى تمثل الكثافة النباتية العالية قد أدت الى الحصول على قيم اقل بالنسبة لمكونات المحصول عن الزراعة على مسافات كبيرة بالنسبة للتراكيب الوراثية تحت الدراسة دلت النتائج أن الزراعة على مسافة ١٥سم بين الجور والتى تمثل الكثافة النباتية ٤٣٣٣٣ نبات/فدان قد أعطت أعلى محصول للسيقان الخضراء والبذور للفدان كما أنها أعطت أفضل إنتاج من الألياف أيضا بمقدار ٣٤ ، ١٦١ كجم/ف.

أظهرت دراسات الارتباط أن هناك ارتباط موجب ومعنوى بين محصول السيقان والطول الكلى ومحصول الألياف والبذور للنبات. بينما وجد ارتباط سالب ومعنوى مع نعومة الألياف.