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EVALUATION OF MEAN PERFORMANCES, GENETIC PARAMETERS AND NUTRITIVE VALUES FOR SOME SELECTED STRAINS OF FORAGE SORGHUM

Haggag, M.El-H.*; E. S. Soliman;M. M. Abdelgalil*; Z. M. Marei* and A.E. El-Shahawy*.**

*** Forage Crops Res. Sec., Field Crops Res. Inst., ARC, Egypt.**

**** Animal Production Res. Inst., ARC, Egypt.**

ABSTRACT

The shortage of green fodder for farm animal during summer has been increased in Egypt. Therefore, great efforts must be directed towards the improvement of summer forage crops. Sorghum could be provided as a solvent to this problem, since it is considered the most important forage crop during summer. This investigation is a contribution to improvement the sorghum fodder yield by selection.

Selected 17 strains from F_2 segregation generation of the superior hybrid between forage sorghum variety (Quna) and dwarf male - sterile line (Red land) were evaluated to study the genetic variability for fodder yield and its component. Also, genetic variability was determined for all studied traits.

The results showed that there are highly significant differences for all studied traits in the three cuts in two seasons and for combined analysis. The estimate of heritability in broad sense were high for all studied traits in the three cuts also. The genetic advance had considerable values in the three cuts with respect to all studied traits. In addition, there are three promising strains (No 5, 6 and 9) for total forage yield. Also these strains had a high *In situ* dry matter disappearance (ISDMD) and *In situ* organic matter disappearance (ISOMD). The DM percentages of the three strains were higher than parent (1). The OM and CP % of strains 5 and 6 were higher than parent (1). The feed intake by bucks from strains 5 and 6 were significantly ($P<0.05$) higher than strain 9 and parent (1). No significant differences among parent (1) and other strains in digestion coefficients were recorded of all nutrients except CP digestibility of strains 5 and 6 which was significantly ($P<0.05$) higher than strain 9 and parent (1). The DM yields were 5.23, 6.68, 5.57 and 4.50 ton/ fed. for parent (1), strains 5, 6 and 9, respectively. The TDN yields were 3.503, 4.586, 3.798 and 2.959 ton/ fed. for parent (1), strains 5, 6 and 9, respectively. The DCP yield was 0.389, 0.591, 0.472 and 0.317 ton/fed for parent (1), strains 5, 6 and 9, respectively. Therefore, genetically improved sorghum strains can be obtained and subsequently, these strains could be directly cultivated or hybridized to produce superior F_1 hybrids.

Keywords: Sorghum, strains, genetic variability, *in situ*, digestibility, yield.

INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is the world's fifth leading cereal and a major crop in Africa.

Sorghum is a crop with extreme genetic diversity, but overriding characteristics is its tolerance to heat and drought. Sorghum or sweet sorghum possess on abundance of sweet juice and are suited for use as silage, fodder and hay. Sudan grass is annual grass sorghum with slender stems, open heads and great tillering capacity. In Egypt, sorghum is used as one of summer forage crops, where, the reduction of green fodder is a serious problem for livestock which affects negatively on their production of meet and milk. Great efforts should be directed to improve the green yield as multi cuts forage crop necessarily needed in summer. Since several studied traits for sorghum are related to fodder quality, it seemed desirable to examine the expected progress in yield resulting selection for one of these traits. This is particularly important since yield proved to be very low heritability but at the same time correlated with other traits. It would be advantageous if these other traits are easier to measure and can thus be used for screening selections to the important indirect traits viz, fresh fodder yield segrigations (Soliman1994). Utilizing new germ plasm from different crosses is important breeding technique to improve the forage yielding ability of sorghum. Selection for forage yield and its components was highly effective method due to the considerable values of genetic gain (El-Shahawy 1978, Singh 1982, Shafey 1989 and Haggag *et al* 1993 and 1999).

There is a possibility to increase the fodder yield and its components through selection program for either plant height or number of leaves traits and number of tillers, then the selected inbred sorghum lines could be used to obtain superior (F_1) hybrids, (Haggag *et al* 1999).

The objectives of this investigation are to evaluate seventeen strains selected from advance segregation generations of the superior hybrid between forage sorghum variety (Quna) and dwarf male - sterile line (Red line) to prove that selection is an effective technique method to improve the forage yielding ability in sorghum. Besides, study the palatability and nutritive values of green forage of the best strains.

MATERIALS AND METHODS

The Genetic Materials:

The genetic materials used in this investigation included two parental varieties. The male parent was inbred line containing genetic restore fertile gene (S. sudanese Quna). The female parent was inbred line containing cytoblasmic male sterile gen (*S. bicolor*, Red line).

This investigations were carried out at El-Serw Agricultural Research Station during the growing seasons 1993 to 1999. Selection procedure following hybridization was pedigree selection method. In the growing season 1993, the two parental varieties were planted and crossed at the flowering time. The hybrid seeds were collected and sown in the growing season 1994 in bulk plot to produce the (F_1) plants which were selfed to give the first segregating generation (F_2) seeds . In 1995, the selfed seeds were spaced in rows sufficiently that individual plants may be examined. At the maturity stage, 200 superior plants in which desired characteristic of forage yield component traits were selected and selfed. In 1996, selfed seeds of 200 individual selected plants from the previous generation were planted (F_3) as seeds of individual plant per row, and selection between and with in rows were continued to obtain 17 strains of best performance as a forage crop. These strains take serial number from 2 to 18 .

In the growing seasons 1997 and 1998, strains which selected from (F_3) generation were evaluated with their forage parent (No.1) in a comparison field trial. .A randomized complete blocks design with four replications was used , each block included 18 intery , each intery was planted in one row of 4.00m long and 0.6 m wide with space planted at 0.20 m apart to insure 20 hills per row , each hill contained two plants . Agronomic field practices applied at the proper time as recommended for forage sorghum. Three cuts were taken during each growing season.

Data were recorded for the properties affecting the forage yield as plant height in centimeter (PH, cm), stem diameter in millimeter (SD, mm), number of tillers per plant (NT/ P), fifth leaf area (5^{th} LA), leaves to stem ratio (LSR %), green fodder yield in ton per feddan (GFY, ton/F) and dry yield in ton per feddan (DY, ton/F).

Nutritional evaluation:

Representative samples were taken from all strains for *in situ* dry matter disappearance (ISDMD) and *In Situ* organic matter disappearance (ISOMD) determinations. The *In Situ* was carried out according to Mehrez and Ørskov (1977) as 2 g of air dry forage milled through 2.0 mm screen was placed in each of nylon bags (6x12 cm) prepared from polyester cloth (41 µm pore size). The nylon bags were incubated for 48 h. in the rumen of two buffalo bulls fitted with permanent rumen canula. Four bags of each strains were used (two bags incubated in each bull).

The best three strains in forage yield, ISDMD and ISOMD (1, 5, 6 and 9) and parent (1) were sown in season 1999 to evaluate the feed intake, digestibility and nutritive values of the three cuts of green forage by 12 Zaraibi bucks in metabolic cages. The bucks were about 3 years old with an initial average live body weight of 40 kg. The green forage was offered for bucks as 90% from *ad libitum* level. The daily amount of feeds was weighed and offered in two portions at 9 a.m. and 4 p.m. Drinking water was available all times.

The digestibility trial lasted for 26 days of which 21 days as preliminary period followed by 5 days collection period. Chemical analysis of samples of forage and feces were carried out according to AOAC (1980).

Statistical Analyses:

The analysis of variances were made according to Cockerham (1963), and the mean values were compared by least significant difference test (L.S.D) at both 5 % and 1 % levels which can be obtained as follows:

$$LSD = t_{0.05}\ Edf \times S^{-}d$$

$$LSD = t_{0.01}\ Edf \times S^{-}d$$

$$\bar{S}d = \sqrt{\frac{EMS}{r} \times \frac{n_1 + n_2}{n_1\ n_2}}$$

where :

$t_{0.05}$ and $t_{0.01}$ Edf = Tabulated values of " t " for error degrees of freedom at 0.05 and 0.01 levels, respectively ;

EMS= Error mean squares ,

r = Number of replications ,

n1and n2= Number of genotypes involved in the first mean and in the second mean, respectively .

The estimates of genotypic and phenotypic variances were obtained from the analysis of variance. The expectation of mean squares are presented in Tables (1 and 2) .

Table (1): The form of the analyses of variance and expectation of mean squares for all genotypes in one year.

S.V.	D.F	M.S	E.M.S
Reps	r-1		
Genotypes	g-1	M_2	$\sigma^2 e + r\, \sigma^2 g$
Error	(r-1) (g-1)	M_1.	σ^2 e

Table (2): The form of the combined analyses of variance and expectation of mean squares for all genotypes over years.

S.V.	D.F	M.S	E.M.S
Years	y – 1		
Re. / Year	y (r - 1)		
Genotypes	g - 1	M_3	σ^2 e + r σ^2 9y+ryσ^2 g
Gen / Years	(y - 1) (g - 1)	M_2	σ^2 e r σ^2 gy
Error	y (r - 1) (g - 1)	M_1	$\sigma^2 e$

where

r = Number of replications, g = Number of genotypes, y = Number of years, M_1 = Error mean squares, M_2 = Genotypic mean squares in table (1) and genotypes by years mean squares in table (2) and M_3 = Genotypic mean squares in Table (2).

σ^2 g = (M_3- M_1) / ry σ^2 ph = σ^2 g + σ^2 e / ry

Genetic coefficient of variability (G.C.V.) was calculated as:

G.C.V = σ^2 g / x. 100

Phenotypic coefficient of variability (Ph.C.V.) was calculated as:

Ph.C.V = σ^2 ph / x . 100

Broad sense heritability H b^2 % calculated according to the following equation;

H^2b % = σ^2 g / σ^2 ph. 100

Genetic advance from selection (G. a.) as suggested by Johanson *et al.* (1955).

G .a. = σ^2 g / σ ph . k

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Where: σ^2 g, σ^2 ph , σ ph and k are the genotypic variance, phenotypic variance phenotypic standard deviation and k is the selection differential, respectively.

In case of 5 % selection in large samples from normally distributed population according to Hanson, et al., (1956). k = 2.06 .

Data of *In Situ,* digestibility and nutritive values were statistically analyzed according to Snedecor and Cochran (1982).

RESULTS AND DISCUSSION

Performances of genotypes:

The analysis of variances of genotypes for all traits of the three cuts in both seasons of evaluation are presented in Table 3. Tests of significance of mean squares of all genotypes indicated the presence of highly significant differences between them. The results showed highly significant differences for all studied traits for the two seasons.

The combined analysis of variance of genotypes for all studied traits in three cuts are presented in Table 4. Highly significant differences among genotype for all studied traits in three cuts except stem diameter (SD) in 3rd cut were recorded. Also, the same trend was observed for interaction genotypes by years.

The mean of all genotypes for all studied traits of the studied three cuts were obtained and are presented in Tables 5, 6 , 7 , 8 and 9 . The results in tables 5, 6 and 7 for vegetative traits of the two seasons and over all mean showed that plant height (PH) and number of tillers per plant (No.T/ P) are increased in cut-3 than cut-2 and cut-1. On the other hand, other vegetative traits decreased in cut-3 than cut-2 and cut-1. Results in Table 8 showed that green yield (GY/F) of cut-2 is higher than the other two cuts in two seasons and over all means. Strains 5, 6 and 9 had higher total green fodder yields. They were 37.41, 32.16 and 29.38 ton / fed. Respectively. Similarly, dry yield (DY/F) results in Table 9 showed similar trend. Strains 5 and 6 were exceeded than forage parent 1. Its were 6.68, 5.57 and 5.23 ton/fed., respectively. Results revealed that there are two promising selected strains through selection program for green forage yield and its components than their forage parent 1. These strains are number 5 and 6. These results are in agreement with Jon-Orn *et al*. 1976, Bakheit 1990, Soliman (1994), Kumar and Singhania (1984) and Haggag *et al* (1993 and 1999).

Genetic parameters:

Heritability (H^2b), genotypic and phenotypic of variability G.C.V and Ph.C.V. and genetic advance from selection (G.a) for the three cuts are presented in Table (10).

Heritability estimates provide information on the transmission of characters from parent to progeny. Such estimates facilitate evaluation of heredity and environmental effects in phenotypic variation and thus aid in selection. Also, it can be used to predict advance under selection, so that,

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Table (8): The means of green yield in each cut and total in the two years and over all means

G	First season				Second season				Over all means			
	1st cut	2nd cut	3rd cut	total	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
1	7.57	13.55	7.40	28.53	12.63	14.88	7.80	35.30	10.10	14.21	7.60	31.91
2	5.05	8.80	4.45	18.30	7.25	10.13	3.95	21.33	6.15	9.46	4.20	19.81
3	5.69	9.27	4.55	19.51	6.30	10.52	4.68	21.50	5.99	9.90	4.61	20.50
4	3.64	10.77	5.80	20.21	4.57	12.16	5.57	22.33	4.11	11.48	5.69	21.28
5	10.8	14.65	11.70	37.15	11.93	16.42	9.32	37.67	11.36	15.54	10.51	37.41
6	7.28	13.60	9.88	30.75	9.13	15.88	8.57	33.58	8.20	14.74	9.23	32.17
7	4.14	7.50	4.90	16.54	3.25	8.95	7.50	19.70	3.69	8.23	6.20	18.12
8	4.41	8.52	5.15	18.09	7.07	9.85	5.70	22.63	5.74	9.19	5.43	20.36
9	7.82	13.00	7.85	28.67	7.77	14.00	8.30	30.08	7.80	13.50	8.08	29.38
10	5.89	11.50	6.65	24.04	4.46	13.18	5.70	23.34	5.18	12.34	6.18	23.70
11	6.45	11.00	6.20	23.65	6.95	12.23	6.70	25.88	6.70	11.61	6.45	24.76
12	6.21	7.82	6.88	20.91	3.60	8.52	7.13	19.25	4.91	8.18	7.00	20.09
13	5.93	8.10	5.85	19.88	3.55	9.02	3.72	16.30	4.74	8.56	4.79	18.09
14	3.59	10.52	4.97	19.09	5.41	11.85	3.82	21.09	4.50	11.19	4.40	20.09
15	5.78	11.85	7.05	24.68	5.50	13.05	7.10	25.65	4.64	12.45	7.08	25.17
16	6.10	12.63	6.50	25.23	6.28	13.30	6.90	26.48	6.19	12.96	6.70	25.85
17	4.80	11.50	6.70	23.00	4.96	12.63	7.65	25.24	4.88	12.06	7.18	24.12
18	4.80	7.82	5.18	17.80	4.72	8.55	4.45	17.73	4.76	8.19	8.81	17.76
L.S.D 0.05	0.159	0.138	0.028	0.253	0.139	0.145	0.024	0.196	0.148	0.140	0.134	0.223
L.S.D 0.01	0.214	0.185	0.038	0.339	0.186	0.194	0.032	0.262	0.194	0.184	0.177	0.294

the breeder can anticipate improvement from different types and intensities of selection (Soliman 1994).

The estimates in broad sense heritability values were high for all studied traits for the three cuts all over means was over 90 % except for the two years for stem diameter (SD), which were 54.8 and 80.0 for cut 2 and cut 3, respectively. Also, high estimates of heritability were obtained for total green yield (99.8 %) and total dry yield (99.7 %) which is in agreement with Shafey (1989), Haggag *et al* (1993), Soliman (1994) and Haggag *et al*. (1999).

The differences between genotypic and phenotypic coefficient of variability were very narrow for all studied traits. So, heritabilities were very high.

Table (9): The means of dry yield in each cut and total in the two years and over all means

G	First year				Second year				Over all means			
	1st cut	2nd cut	3rd cut	total	1st cut	2nd cut	3rd cut	total	1st cut	2nd cut	3rd cut	Total
1	0.88	2.14	1.46	4.48	2.10	2.35	1.54	5.99	1.49	2.24	1.50	5.23
2	0.64	1.30	0.79	2.73	1.35	1.50	0.70	3.55	0.99	1.40	0.75	3.14
3	0.60	1.41	0.83	2.84	1.16	1.60	0.85	3.61	0.88	1.51	0.84	3.23
4	0.44	1.58	1.01	3.02	0.70	1.78	0.98	3.46	0.57	1.68	1.00	3.25
5	1.51	2.64	2.43	6.40	2.26	2.76	1.94	6.96	1.89	2.61	2.18	6.68
6	0.74	2.26	2.04	5.03	1.69	2.64	1.76	6.09	1.22	2.45	1.90	5.57
7	0.62	1.04	0.82	2.48	0.51	1.24	1.26	3.01	0.56	1.14	1.04	2.74
8	0.50	1.25	0.91	2.65	1.41	1.44	1.00	3.86	0.95	1.34	0.95	3.24
9	0.82	2.05	1.53	4.40	0.80	2.21	1.62	4.63	0.81	2.13	1.56	4.50
10	0.71	1.79	1.24	3.74	0.61	2.06	1.06	3.73	0.66	1.92	1.15	3.73
11	1.03	1.57	1.07	3.67	1.22	1.75	1.16	4.13	1.13	1.66	1.11	3.90
12	0.77	1.21	1.26	3.24	0.60	1.31	1.31	3.22	0.69	1.26	1.29	3.24
13	0.73	1.17	1.02	2.91	0.66	1.30	0.65	2.61	0.69	1.23	0.83	2.75
14	0.39	1.54	0.89	2.82	0.91	1.73	0.69	3.32	0.65	1.63	0.79	3.07
15	1.07	1.80	1.28	4.15	1.18	1.98	1.29	4.45	1.12	1.89	1.29	4.30
16	0.64	1.87	1.16	3.66	1.18	1.97	1.23	4.37	0.91	1.92	1.19	4.02
17	0.79	1.73	1.21	3.72	0.71	1.89	1.38	3.99	0.75	1.81	1.29	3.85
18	0.52	1.06	0.88	2.47	0.80	1.16	0.74	2.70	0.66	1.11	0.81	2.58
L.S.D 0.05	0.041	0.021	0.028	0.055	0.040	0.312	0.024	0.153	0.040	0.021	0.026	0.051
L.S.D 0.01	0.055	0.028	0.038	0.074	0.053	0.419	0.032	0.205	0.053	0.028	0.034	0.067

Medium values for genotypic and phenotypic coefficient of variability for green yield and dry yield in three cuts were recorded. They were (47.0, 52.3 and 47.1, 53.0), (29.5, 36.4 and 29.6, 36.4) and (37.2, 46.8 and 37.3,46.9) for cut-1, cut-2 and cut-3, respectively. The values for total green yield and dry yield, they were (33.1, 40.1 and 33.2, 40.2). On the other hand, they were low for other studied traits. It was ranged from 10.0 for stem diameter (SD) to 24.3 for leaf area (LA) for genotypic coefficient of variability (G.C.V.) and for phenotypic coefficient of variability (Ph.C.V.) ranged from 11.2 for stem diameter (SD) to 24.7 for leaf area (LA).

Genetic advance (G.a) for number of tillers per plant (No. T/P) and leaf area (LA) were high than other vegetative traits in the three cuts. On the other hand, they were high for green and dry yield in three cuts. They were ranged from 60.7 % (GFY) in cut-2 to 97.4 % for (DY) in cut-1. Also, they were 68.1 % for total green forage yield (TGY) and 82.4 % for total dry yield (TDY). These results were expected as the selected strains were grown in different years, it is expected that estimates obtained from the components of variance method would be highly inflated by genotype - year interaction , i.e. differential response of genotypes to environment (Patel *et al* 1983 and Soliman, 1994) . These results also, were in agreement with Basu (1971), El-Shahawy (1978) and Haggag *et al* (1993 and 1999).

According to Panse (1957), if the estimates of heritability (H^2b) and genetic advance (G.a) are high, they give good indication that variation is attributable to a high degree of additive effects and that selection for each traits would provide useful progress . So, results in this investigation indicate the possibility to improve either green and dry yield through leaf area (LA) and number of tillers per plant (No.T/p) traits.

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Nutritional evaluation:

The *In situ* dry matter disappearance (ISDMD) and *In Situ* organic matter disappearance (ISOMD) of the 17 strains of sorghum (from number 2 to 18) compared with parent (1) are shown in table 11. The average values of the three cuts of strains 5 and 18 were insignificantly higher than parent (1) followed by strains 9, 17 and parent (1) without significant followed by strains 6 and 7 without significant differences. However, the values of ISDMD of the best six strains (5, 6, 7, 9, 17, and 18) ranged from 60.0 to 62.7% and ISOMD ranged from 61.0 to 63.2%. However, the values of best six strains were significantly ($P<0.05$) higher than those of other strains. On the other hand, the strains 5, 6 and 9 had high green and dry yields while strains 7, 17 and 18 had low yields (Tables 8 and 9). Therefore, strains 5, 6, 9 and parent (1) were evaluated by bucks.

The chemical analysis of the best three strains (5,6 and 9) as shown in Table 12 showed that the DM% of the three strains was slightly higher than that of parent (1) in the three cuts except strain 9 which were similar with parent (1) in the 1st cut. The DM% in this study was higher than that determined by Gabr *et al.* (1999) and lower than that obtained by Gabra *et al.* (1991), Abd El-Baki *et al.* (1996) and Khinizy *et al.* (1997). The CP% of strains 5 and 6 was higher than parent (1). The CP of trains5 and 6 in this study was nearly similar with that determined by Abd El-Baki *et al.* (1996) with sorghum hybrid and Gabra *et al.*(1991)with some sorghum varieties, and it slightly higher than the CP% determined by Gabra *et al*. (1991) with some sorghum varieties, Khinizy *et al.*(1997) with sorghum hybrid, Geweifel (1997) and Gabr *et al.* (1999) with sweet sorghum. The CF% of strains 5, 6, 9 and parent (1) were nearly equal and agreed with CF % determined by Gabra *et al.* (1991) and Geweifel (1997). However, the EE and NFE lie within the data obtained by Gabra *et al*. (1991), Khinizy *et al.* (1997) and Gabr *et al.* (1999). Ash percentages of all strains were nearly similar with parent (1) and were nearly similar with those determined by Gabr *et al.* (1999), and lower than that obtained by Gabra *et al*. (1991), Abd El-Baki *et al.* (1996) and Khinizy *et al.* (1997).

Table 11: The ISDMD and ISOMD (%) of the 17 strains of sorghum (from number 2 to 18) compare with parent (1).

Strains (genotypes)	1st cut		2nd cut		3rd cut		Average	
	ISDM	ISOM	ISDM	ISOM	ISDM	ISOM	ISDM	ISOM
1	59.4	60.4	63.4	63.5	63.5	63.5	62.1^{ab}	62.5^{ab}
2	57.2	58.7	57.3	57.0	64.3	64.6	59.6^{cd}	60.1^{d}
3	54.4	55.5	59.7	59.4	63.8	64.1	59.3^{de}	59.7^{de}
4	49.4	50.5	58.8	59.0	60.9	61.0	56.4^{i}	56.8^{l}
5	57.2	58.3	62.6	62.8	68.3	68.3	62.7^{a}	63.2^{a}
6	53.3	54.6	63.7	64.1	63.7	64.1	60.2^{c}	60.9^{c}
7	52.1	54.2	63.6	64.0	64.4	64.8	60.0^{c}	61.0^{c}
8	54.8	55.5	60.7	61.4	60.8	60.9	58.8^{ef}	59.3^{ef}
9	56.2	57.4	63.3	63.7	65.6	65.8	61.7^{b}	62.3^{b}
10	54.4	55.4	58.9	59.0	65.6	65.8	59.6^{cd}	60.1^{d}
11	53.2	54.8	60.5	60.7	65.3	65.5	59.7^{cd}	60.4^{cd}
12	50.9	52.4	55.8	56.3	58.9	58.8	55.2^{j}	55.9^{j}
13	54.7	55.7	58.5	59.5	61.3	62.0	58.2^{fg}	59.1^{ef}
14	52.2	53.5	60.0	60.4	61.9	62.2	58.0^{g}	58.7^{fg}
15	53.2	54.3	59.3	59.5	59.6	60.8	57.4^{h}	58.2^{gh}
16	49.0	49.8	57.3	57.4	64.7	65.4	57.0^{hi}	57.5^{hi}
17	61.5	61.9	60.8	61.2	62.8	62.6	61.7^{b}	61.9^{b}
18	61.0	62.0	62.3	62.8	64.3	64.7	62.5^{a}	63.2^{a}

a, b, c, d, e, f, g, h, I, j Means in the same column with different superscripts differ (P<0.05).

Table 12: Chemical composition of the best three strains (5, 6 and 9) of sorghum compared with parent (1) .

Strains (Genotypes)	DM%	Chemical composition (On DM basis)					
		OM	CP	EE	CF	NFE	Ash
1st Cut							
1	13.28	91.63	9.77	2.59	30.40	48.87	8.37
5	14.67	92.09	10.74	2.36	31.61	47.38	7.91
6	15.97	92.54	10.65	2.81	32.12	46.96	7.46
9	13.26	91.26	10.35	2.70	30.2	48.01	8.74
2nd Cut							
1	14.39	91.41	10.19	4.08	31.03	46.11	8.95
5	15.08	90.61	12.09	3.63	29.65	45.24	9.36
6	15.68	91.37	11.56	3.55	31.28	44.98	8.63
9	15.92	90.40	9.03	3.95	32.15	45.27	9.60
3rd Cut							
1	14.63	89.39	14.49	2.83	25.61	46.46	10.61
5	15.92	91.29	14.94	2.34	25.07	48.94	8.71
6	16.30	90.59	14.53	2.20	26.29	47.57	9.41
9	15.96	91.32	13.48	2.31	25.53	48.00	8.68
Average							
1	14.10	90.81	11.48	3.17	29.01	47.15	9.31
5	15.23	91.33	12.59	2.78	28.78	47.19	8.66
6	15.98	91.50	12.25	2.85	29.90	46.50	8.50
9	15.05	90.99	10.95	2.99	29.29	47.09	9.01

The DM intake as g/h, % of body weight and g/kg $w^{0.75}$ fluctuated among the strains in the three cuts as shown in table 13. The DM intake from strain 6 was significantly (P<0.05) higher than other strains in the 1st cut. In the 2nd cut, the DM intake the parent (1) was significantly (P<0.05) lower than the three strains. However, no significant differences were showed recorded the three strains and parent (1) in the 3rd cut. The DM, TDN and DCP intakes of all strains could cover the maintenance requirements of goats according to NRC (1981) during the three cuts except strain 9 and parent (1) which would provide less than maintenance requirements in the 1st cut only. The DM intake from sorghum strains in this study was nearly similar to those recorded by Abd El-Baki *et al.* (1996) and Khinizy *et al.*(1997) with sheep, and lower than that recorded by Gabra *et al*. (1991) with cattle.

Table 13: Daily feed intake from the best three strains (5, 6 and 9) of sorghum compared with parent (1).

Strains (Genotypes)	Fresh intake, Kg/h	DM intake			TDN intake g/h	DCP intake g/h
		G/h	% BW	$g/kgw^{0.75}$		
1st cut						
1	5.87	780^{b}	1.90^{b}	48.15^{b}	485^{c}	46^{c}
5	5.36	786^{b}	2.02^{b}	50.38^{b}	510^{b}	52^{b}
6	5.60	894^{a}	2.29^{a}	57.31^{a}	570^{a}	58^{a}
9	5.33	707^{c}	1.72^{c}	43.64^{c}	417^{d}	44^{c}
2nd cut						
1	5.81	836^{b}	2.09^{b}	52.55^{b}	562	53^{b}
5	5.67	855^{b}	2.19^{ab}	54.81^{ab}	572	72^{a}
6	5.79	908^{a}	2.27^{a}	57.07^{a}	603	73^{a}
9	5.65	899^{a}	2.25^{a}	56.51^{a}	576	52^{b}
3rd cut						
1	6.66	975^{b}	2.44^{a}	61.28^{a}	696	104^{b}
5	6.09	970^{b}	2.49^{a}	62.18^{a}	716	118^{a}
6	6.08	991^{a}	2.48^{a}	62.29^{a}	727	117^{a}
9	5.50	978^{b}	2.45^{a}	61.47^{a}	700	102^{b}
Average						
1	6.11	864^{b}	2.14^{b}	53.99^{b}	581^{bc}	68^{b}
5	5.71	870^{b}	2.23^{ab}	55.79^{ab}	599^{b}	81^{a}
6	5.82	931^{a}	2.35^{a}	58.89^{a}	633^{a}	82^{a}
9	5.49	861^{b}	2.14^{b}	53.87^{b}	564^{c}	66^{b}

a, b , c, d, Means in the same column with different super scripts differ (P<0.05).

The differences in digestion coefficients of DM, OM, EE and CF% among the three strains and parent (1) by bucks were not significant (Table 14). The CP digestibility of strains 5 and 6 were significantly (P<0.05) higher than strain 9 and parent (1) in the 2nd and the 3rd cuts. The NFE digestibility of strain 9 was significantly (P<0.05) lower than other strains in the 2nd cut only. The results of nutrients digestibility are in harmony with the findings of Gabra *et al*. (1991) and Khinizy *et al.* (1997) except CF digestibility which was high in this study. However, the digestion coefficients of all nutrients were higher than found by Abd El-Baki *et al.* (1996). Such differences might be due to the different among animal species. No significant differences in TDN were found among the strains and parent (1) during the three cuts. The DCP of strains 5 and 6 was significantly (P<0.05) higher than strain 9 and parent (1). The high percent of DCP might be due to the high percent of CP and its digestibility in strains 5and 6.

Table 14: Digestion coefficients and nutritive values of the best three strains (5, 6 and 9) of sorghum compared with parent (1) .

Strains (Genotypes)	Digestion coefficients						Nutritive values	
	DM	OM	CP	EE	CF	NFE	TDN	DCP
1st Cut								
1	63.8	66.0	59.6	60.4	65.3	67.4	62.2	5.89^{c}
5	66.2	68.5	61.3	57.5	66.5	72.5	65.0	6.59^{a}
6	63.8	66.5	60.6	60.7	66.8	68.3	63.8	6.45^{ab}
9	63.4	65.8	60.5	63.3	61.4	68.3	59.0	6.26^{b}
2nd Cut								
1	67.0	69.9	62.4^{b}	65.3	68.6	72.8^{a}	67.2	6.35^{c}
5	68.2	70.6	69.9^{a}	66.6	67.3	73.2^{a}	66.9	8.45^{a}
6	67.3	69.6	69.5^{a}	68.1	67.7	71.2^{a}	66.4	8.03^{b}
9	64.8	66.9	64.7^{b}	70.9	65.7	68.1^{b}	64.1	5.82^{d}
3rd Cut								
1	74.3	77.1	73.9^{b}	71.7	73.6	80.7	71.4	10.7^{b}
5	76.2	77.8	81.2^{a}	65.4	73.5	81.5	73.8	12.1^{a}
6	76.7	79.1	81.4^{a}	64.3	75.4	81.3	73.3	11.8^{a}
9	74.8	81.3	77.4^{ab}	65.6	75.6	80.0	71.6	10.4^{b}
Average								
1	68.4	71.0	65.3^{b}	65.8	69.2	73.6	66.9	7.7^{b}
5	70.2	72.3	70.8^{a}	63.2	69.1	75.7	68.6	9.1^{a}
6	69.3	71.7	70.5^{a}	64.4	70.0	73.6	67.9	8.8^{a}
9	67.7	71.3	67.5^{b}	66.6	67.6	72.1	64.9	7.5^{b}

a, b, c Means in the same column with different super scripts differ (P<0.05).

Strain 5 had the highest productivity from the three cuts and consequently total yield (ton/fed) followed by strain 6 as shown in table 15. The yield of strain 5 increased than parent (1) at the rates of 17.2, 21.7, 30.9, 43.0 and 51.9% for fresh, DM, TDN, CP and DCP yields, respectively. While, the strain 6 was more with 0.8, 6.5, 8.4,16.6, and 17.6% for fresh, DM, TDN, CP and DCP yields than parent (1). On the other side, the yields of strain 9 were less than other strains and parent (1). The yields of strains 5 and 6 in this study were higher than the yield determined by Abd El-Baki *et al.* (1996), Geweifel (1997) and Khinizy *et al.*(1997).

Table 15: The yield (ton/ fed.) of the best three strains (5, 6 and 9) of sorghum compare with parent (1) .

Strains (Genotypes)	Yields (ton/ fed.) Fresh	DM	TDN	CP	DCP
1st Cut					
1	10.10	1.49	0.927	0.146	0.086
5	11.36	1.89	1.229	0.203	0.125
6	8.20	1.22	0.778	0.130	0.050
9	7.80	0.81	0.478	0.084	0.030
2nd Cut					
1	14.21	2.24	1.505	0.228	0.142
5	15.54	2.61	1.747	0.316	0.221
6	14.74	2.45	1.627	0.283	0.197
9	13.50	2.13	1.365	0.192	0.124
3rd Cut					
1	7.60	1.50	1.071	0.217	0.161
5	10.51	2.18	1.610	0.326	0.245
6	9.23	1.90	1.393	0.276	0.225
9	8.08	1.53	1.116	0.210	0.163
Total cuts					
1	31.91	5.23	3.503	0.591	0.389
5	37.41	6.68	4.586	0.845	0.591
6	32.17	5.57	3.798	0.689	0.472
9	29.38	4.50	2.959	0.486	0.317

It could be concluded that the strains 5 and 6 had the highest yields and feeding values, therefore they are promising strains as green forages in summer season. Further researches are needed for cultivating those strains directly or hybridizer to produce superior F1 hybrid in different regions and evaluating the forage by different animal species.

REFERENCES

Abd El-Baki, S. M., M. S. Nowar, F. T. Oraby, E. M. Hassona, E . S. Soliman, and K. M. El-Gindy, (1996). Nutritional evaluation of sorghum hybrid (Pioneer- 988) as green forage in Egypt. Pros. 7th Conf. Agronomy, 9-10 Sept. Fac. Agric., Mansoura Univ.

A O A C (1980) Association of Official Analytical Chemists Official Methods of Analysis. 13th Ed. Washington, D. C. USA.

Bakheit, B. R. (1990) Response of selection for forage traits in sorghum - Sudan grass hybrid (Surdan) . Assiut J. Agric. Sci., 21: 53-63.

Basu, A. K. (1971) Note on variability and heretability estimates from a winter season sorghum cross. Indian J. Agric. Sci., 41 (12) 1116-1117.

Cocherham, C. C.(1963). Estimation of genetic variances. Statistical genetic and plant breeding. NASNRC - 982, pp. 53 - 68.

El-Shahawy, A. E. (1978) Studies on forage improvement in sorghum . M.Sc. Thesis, Faculty of Agric. Tanta Univ., Egypt.

Gabra, M. A. A., E. M. Khinizy, and M. R. M. Moustafa (1991) Chemical and nutritional evaluation of some varieties of sorghum sown singly or intercropped with cowpea. J. agric. Sci. Mansoura Univ., 16 (2): 2807 - 2816.

Gabr, A.A.; A.Z. Mehrez; E.S.M. Soliman and M.E. El-Kholany (1999). Response of lactating goats to diets containing reeds grasss (*Arundo domax,* L.) versus sorghum plants. Egyptian J. of Nutr. and Feeds, 2 (Special Issue): 297-307. Proc. Of 7th Conf. on Animal Nutr., El-Arish 19-21 October.

Geweifel, H. G. M. (1997). Yield and quality of some summer forage grasses under different nitrogen levels in newly cultivated lands. Egypt. J. Appl. Sci., 12 (2): 54 - 72.

Haggag, M. El-H, S. A Shafey, G, A. Ramadan and H. E. Yassein (1993). Estimates genetic parameters of quantitative traits and correlation between traits for selected strains of forage sorghum hybrid. J. Agric. Mansoura Univ, 18 (9) : 2520 - 2531.

Haggag, M. El-H., M. M. Abd El-Maksoud and M. S. Hamad (1999). Genetic improvement of some forage sorghum traits through two cycles of selection. J. Agric. Sci. Mansoura Univ., 24 (1), 131-140.

Hanson, C.H, H.E. Robinson and R.E. Comstock (1956) . Biometerical sof yield segregating population of Koreen lespedesa. Agron..J.48: 268 - 272.

Johanson, H. W, H. F. Robinson and R.E. Comstock (1955). Estimates of genetic and enviromental variability in soybeans - Agron . J. 47: 314 - 318.

Jon-Orn, J., C. O. Gardner , and W, M. Ross (1976). Quantitative genetic studies of the Np3R sorghum random-mating population. Crop Sci., 16: 489 - 496 .

Khinizy, A. E. M., M. K. Hathout, W. H. Abd El-Malik, S. I. Hafez and P. A. Aspila (1997) Evaluation of summer forages cultivated in new reclaimed sandy soil in Egypt. J. Agric. Sci., Mansoura Univ., 22 (8): 2565 - 2573.

Kumer. S. and D. L. Singhania (1984). Genetic advance and heritability estimates for grain yield and its components .Sorghum Newsletter 27:15-16 .

Mehrez, A. Z., and E. R. Ørskov (1977). A Study of the artificial fiber bag technique for determining the digestibility of feeds in the rumen. J. Agric. Sci. Camb., 88: 645.

NRC, National Research Council (1981). Nutrient Requirements of Goats. National Academy Press. Washington. D. C. USA.

Panse, V.G. (1957). Genetics of Quantitative characters in relation to plant breeding. Indian J. Genet. & PL. breed., 17: 318 - 328.

Patel, R. H, K. B. Desai, R.T.Desai and R.K.Parikh. (1983 b). directional selection in advance generation progenies of grain sorghum. Sorghum Nnewsletter, 26: 15 - 16.

Shafey, S. A. A. (1989). Studies on sorghum breeding. Ph. D. Thesis. Fac. of Agric., Al - Azhar Univ. Egypt.

Singh, M. P. (1982). Studies on genetic variability in quantitative characters contributing to forage yield in jawar . Thesis Abstracts 8 (1): 11 - 12 (C. F.) plant breeding abst., 53 (1): 413. 1983.

Snedecor, G .W. and W. G. Cochran (1982). Statistical Methods 7th ed, Iowa State Univ. Press, Ames, Iowa, USA.

Soliman, A. M. (1994). Comparison of performance and combining ability of forage sorghum breeding lines. Ph. D. Thesis fac. of Agric. cairo Univ., Egypt.

تقييم الإنتاجية والقياسات الوراثية والقيم الغذائية لبعض السلالات المنتخبة من سورجم العلف

محمد الحسيني حجاج* ، السيد سليمان محمد سليمان ** ، محيي الدين محمد عبد الجليل * ، زغلول محمد مرعي * وعبدالشافى الدسوقى الشهاوى*

*** قسم بحوث العلف - معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية - القاهرة.**

**** معهد بحوث الانتاج الحيواني - مركز البحوث الزراعية - القاهرة 0**

يتزايد النقص في الأعلاف الخضراء صيفاً للحيوانات المزرعية في مصر 0 ولذلك يجب أن توجه الجهود لتحسين الأعلاف الصيفية 0 وأعلاف السورجم يمكن أن تمدنا بالحل الأمثل لهذه المشكلة لكونها ذات الأهمية صيفاً 0

وهذه الدراسة استمرار لتحسين الأعلاف الصيفية بالانتخاب ، حيث تم انتخاب (17) سلالة من الجيل الثالث الإنعزالي لهجين سورجم العلف الأخضر ومكوناته 0

أظهرت النتائج تفوق معنوي عالي لكل الصفات المدروسة فى الثلاث حشات في موسم الدراسة وأيضاً تحليل التباين والتفاعل بين السلالات والسنوات 0 وكانت درجة التوريث في معناها العام عالية في الثلاث حشات وأيضاً الكسب الانتخابي قد أخذ نفس الاتجاه 0

وأظهرت النتائج وجود ثلاث سلالات مبشرة لمحصول العلف ومكوناته مقارنة بالصنف قنا (الأب) وهى ارقام 5و6و9. وقد كانت معدلات الهضم الموقعى فى الكرش لهذه السلالات مرتفعة. وقد اظهر التحليل الكيماوى أن نسبة المادة الجافة فى الثلاثة سلالات المتميزة كانت مرتفعة عن الأب، كما كانت نسبة المادة العضوية والبروتين الخام والبروتين المهضوم فى السلالتين 5 و 6 مرتفعة عن الأب. وقد أظهرت تجارب تغذية تيوس ألماعز على هذه السلالات ارتفاع المأكول فى السلالتين 5 و 6 ارتفاعا معنويا عن كل من السلالة 9 والأب. كانت الاختلافات فى معاملات الهضم بين السلالات الثلاثة بعضها البعض وبينها وبين الأب غير معنوية باستثناء معامل هضم البروتين الذى كان مرتفعا معنويا فى السلالتين 5 و 6 عن السلالة 9 والأب.

أظهرت النتائج أن محصول المادة الجافة لمجموع الثلاث حشات كانت 5.23 و 6.68و 5.57 و 4.5 طن للفدان لكل من الأب والسلالات 5 و 6 و 9 على التوالى. كما كان مجموع المركبات الكلية المهضومة 3.503و 4.586و 3.798و 2.959 طن للفدان لكل من الأب والسلالات 5 و 6 و 9 على التوالى. وكان محصول البروتين المهضوم 389 و 591 و 472 و317 كجم للفدان لكل من الأب والسلالات 5 و 6 و 9 على التوالى.

وعلى هذا يمكن تحسين سورجم العلف وراثياً بالإنتخاب والسلالات المنتجة يمكن زراعتها للإنتاج مباشرة أوإدخالها في انتاج هجن متميزة خصوصا السلالتين 5 و 6.

Table (3): The analysis of variance and mean squares for all studied traits in the two years,1st year (above) and 2nd year (dawen) for all genotypes .

S.O.V		D.f	P.H	S.D	No.T/P	L.S.R	L.A	G.Y	D.Y	T.G.Y	T.D.Y
1st Cut	Rep	3	94.79 11.27	0.006 0.011	0.203 0.205	9.70 30.2	665 550	0.131 0.148	0.019 0.003		
	Geno.	17	257.2** 1247 **	0.099** 0.314**	1.165** 1.921**	465.3** 251.2**	9740** 1109**	12.19** 28.17**	0.281** 1.045**		
	Error	51	19.30 35.09	0.012 0.009	0.123 0.107	21.2 22.8	262.7 95.09	0.227 0.173	0.015 0.014		
2nd Cut	Rep	3	05.49 398.4	0.006 0.004	0.583 0.644	29.39 0.863	072.18 192.01	0.011 0.126	0.000 0.003	0.493 0.880	0.036 0.016
	Geno.	17	0234.1** 2823.7**	0.025** 0.069**	8.850** 11.81**	114.9** 191.4**	4753** 3586**	20.6** 24.4**	0.712** 0.872**	116.8** 144.5**	4.245** 5.675**
	Error	51	018.4 277.0	0.006 0.011	0.303 0.295	20.09 08.53	277.0 109.0	0.171 0.188	0.004 0.004	0.572 0.342	0.027 0.210
3rd Cut	Rep	3	22.96 47.96	0.005 0.006	0.438 0.183	4.44 9.68	374.8 252.6	0.067 0.263	0.003 0.009		
	Geno.	17	652.3** 799.5**	0.023** 0.021**	10.5** 6.02**	163.2** 131.8**	4644** 8492**	13.88** 12.04**	0.759** 0.579**		
	Error	51	36.6 10.1	0.008 0.006	0.297 0.194	4.03 3.74	318.0 182.0	0.191 0.138	0.007 0.005		

*** Sngnificant at 5 % level**
**** Sngnificant at 1 % level**

Table (4): The combined analysis of variance and mean squares of the Genotypes for all studied traits over the two years.

S.O.V		D.f	P.H	S.D	No.T/P	L.S.R	L.A	G.Y	D.Y	T.G.Y	T.D.Y
1st Cut	Year	1	9232	0.167	6.503	21525	87320	9.81	4.63		
	Rep/y	6	53.0	0.008	0.204	19.9	607.7	0.14	0.011		
	Geno.	17	997.6**	0.181**	2.008**	545.5**	7759**	33.6**	0.961**		
	Geno/y	17	506.9**	0.233**	1.078**	171.1**	3090**	6.76**	0.365**		
	Error	102	27.2	0.010	0.115	22.02	178.9	0.200	0.015		
2nd Cut	Year	1	69872	0.856	148.23	637.6	7.56	57.25	1.321	93.61	9.48
	Rep/y	6	202	0.084	00.613	15.13	132.1	0.069	0.002	0.686	0.026
	Geno.	17	1818**	0.168**	14.46**	256.3**	8185**	44.78**	1.574**	250.8**	9.51**
	Geno/y	17	1239**	0.157*	06.26**	50.04**	154.3**	0.316*	0.010**	10.68**	0.408**
	Error	102	148	0.075	00.298	14.31	193.1	0.180	0.004	0.457	0.024
3rd Cut	Year	1	14002	0.160	52.20	161.5	14380	1.051	0.049		
	Rep/y	6	35.5	0.005	0.320	07.031	313.7	0.165	0.006		
	Geno.	17	1123**	0.040	14.40**	271.9**	9252**	23.2**	1.245**		
	Geno/y	17	328.9*	0.004	2.087*	23.05*	388.4*	2.73*	0.093**		
	Error	102	23.36	0.007	0.246	03.886	249.8	0.165	0.006		

*** Sngnificant at 5 % level**
**** Sngnificant at 1 % level**

Table (5): The mean performances of vegetative traits for 1st cut in each year of cultivation and their over all means

Genotypes	First year					Second year					Over all mean				
	P.H	S.D	No.T/P	L.S.R	L.A	P.H	S.D	No.T/P	L.S.R	L.A	P.H	S.D	No.T/P	L.S.R	L.A
1	112	1.35	3.70	85.3	209	101	1.33	3.90	51.8	204	107	1.33	3.80	68.6	207
2	095	1.20	4.65	84.0	335	058	2.38	1.85	55.7	214	077	1.78	3.25	69.9	274
3	110	1.75	4.05	87.8	313	107	1.45	4.05	48.1	259	108	1.61	4.05	67.9	286
4	102	1.45	3.95	66.2	308	113	1.30	3.50	65.3	245	108	1.37	3.72	65.8	277
5	115	1.45	4.45	91.1	369	113	1.55	3.80	68.5	246	114	1.50	4.12	79.8	308
6	112	1.65	3.95	86.9	320	100	1.20	3.75	62.7	222	106	1.42	3.85	74.8	271
7	100	1.60	4.70	71.5	216	095	1.40	4.75	49.4	220	098	1.50	4.72	60.7	218
8	113	1.43	3.60	79.5	247	101	1.43	3.10	44.2	208	107	1.42	3.35	61.8	228
9	112	1.40	4.60	91.8	269	117	1.20	4.95	62.0	210	115	1.30	4.77	76.9	239
10	088	1.25	4.20	78.3	273	070	1.25	4.10	52.1	212	079	1.25	4.15	65.2	243
11	112	1.40	4.50	86.9	228	075	1.10	3.85	51.9	205	094	1.25	4.17	69.4	216
12	107	1.35	3.75	82.5	313	061	1.13	3.75	62.4	215	084	1.23	3.75	72.5	264
13	104	1.40	4.40	79.3	206	088	1.18	3.50	55.5	200	096	1.28	3.95	67.4	302
14	101	1.35	5.50	69.8	243	081	1.40	4.90	46.1	211	091	1.37	5.20	57.9	227
15	117	1.63	5.15	75.1	255	075	1.48	3.80	50.5	206	096	1.55	4.47	62.8	231
16	102	1.73	3.85	60.4	242	087	1.48	3.70	42.5	212	095	1.60	3.77	51.5	227
17	114	1.43	3.75	53.1	224	093	1.33	3.95	43.8	210	104	1.37	3.85	48.4	217
18	098	1.30	3.65	70.3	214	088	1.30	3.55	46.9	199	093	1.30	3.60	58.6	207
L.S.D 0.05	1.47	0.04	0.12	1.54	5.42	1.98	0.03	0.11	1.60	3.26	1.72	0.03	0.11	1.55	4.41
L.S.D 0.01	1.97	0.05	0.16	2.06	7.27	2.66	0.04	0.15	2.14	3.37	2.27	0.04	0.15	2.04	5.82

Table (6): The mean performances of vegetative traits for 2nd cut in each year of cultivation and their over all means

Genotypes	First year					Second year					Over all mean				
	P.H	S.D	No.T/P	L.S.R	L.A	P.H	S.D	No.T/P	L.S.R	L.A	P.H	S.D	No.T/P	L.S.R	L.A
1	135	1.05	9.30	63.4	205	196	1.15	11.5	59.2	221	166	1.10	10.4	61.3	208
2	132	1.13	9.45	55.3	223	105	1.33	07.4	49.3	203	118	1.23	07.9	52.3	213
3	130	1.00	8.90	58.5	122	141	1.05	08.7	50.2	126	136	1.03	08.8	54.3	124
4	112	1.10	8.01	55.1	205	185	1.15	10.6	52.2	206	148	1.13	09.3	53.7	206
5	153	1.00	10.6	66.3	246	216	1.15	14.5	69.6	241	184	1.07	12.6	67.9	243
6	138	1.10	10.0	60.9	208	202	1.25	12.6	66.9	206	170	1.18	11.3	63.9	207
7	129	0.95	6.28	59.8	202	175	1.02	10.0	50.6	205	152	1.00	08.1	55.2	204
8	130	1.00	6.05	50.7	132	194	1.10	11.6	52.2	130	162	1.05	08.8	51.5	131
9	138	0.90	10.0	64.0	204	198	0.93	12.0	57.9	202	169	0.92	11.0	61.0	203
10	130	1.10	6.70	55.3	176	175	1.23	09.0	53.4	185	153	1.17	07.8	54.3	181
11	129	1.02	8.65	58.4	172	173	1.13	08.0	48.8	171	152	1.08	08.3	53.6	172
12	134	1.08	5.30	46.1	198	182	1.17	09.5	48.9	193	158	1.13	07.4	47.5	196
13	133	0.85	9.30	56.3	198	171	0.85	09.0	52.5	188	152	0.85	09.2	54.4	194
14	131	1.05	8.00	59.2	171	197	1.15	10.5	49.7	178	164	1.10	09.3	54.4	175
15	130	1.10	8.90	54.1	206	157	1.27	10.7	47.1	196	143	1.19	09.8	50.6	201
16	133	1.02	7.20	56.2	167	188	1.08	09.5	45.2	173	161	1.05	08.4	50.7	171
17	127	0.93	8.90	47.9	135	162	0.90	11.1	45.8	147	145	0.92	09.9	46.9	141
18	129	1.03	9.30	52.6	137	146	1.07	10.0	44.9	153	138	1.05	09.6	48.7	146
L.S.D 0.05	1.44	0.03	0.18	1.50	4.46	5.57	0.04	0.18	0.98	3.49	4.01	0.09	0.18	1.25	4.59
L.S.D 0.01	1.93	0.04	0.25	2.01	5.57	7.47	0.05	0.24	1.31	4.68	2.29	0.12	0.24	1.64	6.04

Table (7): The mean performances of vegetative traits for 3rd cut in each year of cultivation and their over all means

Genotypes	First year					Second year					Over all mean				
	P.H	S.D	No.T/P	L.S.R	L.A	P.H	S.D	No.T/P	L.S.R	L. A	P.H	S.D	No.T/P	L.S.R	L.A
1	150	0.90	10.40	63.5	169	135	0.95	09.20	54.3	206	143	0.93	09.80	58.9	188
2	136	0.82	06.93	51.6	219	128	0.88	06.22	46.6	265	132	0.85	06.57	49.1	242
3	139	0.70	09.20	53.0	204	110	0.85	07.30	52.1	136	124	0.77	08.25	52.6	170
4	136	0.92	06.57	46.7	235	100	1.00	06.30	45.1	226	118	0.96	06.44	45.9	231
5	164	0.73	12.70	67.9	262	142	0.88	10.80	64.4	262	153	0.80	11.75	66.2	262
6	162	0.82	11.65	62.6	256	141	0.93	09.32	62.2	216	152	0.88	10.49	62.4	236
7	137	0.77	10.25	47.5	201	112	0.82	09.30	47.0	239	124	0.80	09.77	47.3	221
8	114	0.85	08.67	45.7	205	104	0.88	08.60	47.9	142	109	0.86	08.64	46.8	174
9	154	0.88	10.68	59.9	203	135	0.88	09.35	58.8	166	144	0.88	10.01	59.4	185
10	152	0.95	10.32	49.3	247	108	1.00	08.00	54.2	217	130	0.98	09.16	51.7	232
11	146	0.80	07.30	51.2	147	108	0.82	08.00	53.6	151	128	0.81	07.65	52.4	149
12	136	0.93	08.57	55.1	183	100	1.02	08.65	51.0	172	118	0.98	08.61	53.0	178
13	132	0.90	10.00	52.1	204	131	0.90	09.35	50.1	180	132	0.90	09.68	51.3	192
14	133	0.90	09.75	49.8	151	128	0.90	08.65	46.9	205	131	0.90	09.20	48.4	178
15	124	0.93	09.52	45.0	228	110	1.02	06.65	43.8	157	117	0.98	08.09	44.4	193
16	139	0.80	07.80	54.5	211	128	0.90	07.55	52.1	140	134	0.85	07.67	53.3	176
17	130	0.95	09.77	54.8	209	127	1.05	07.25	49.9	115	129	1.00	08.51	52.4	162
18	142	0.93	10.63	54.4	156	123	1.00	08.55	47.0	135	133	0.96	09.59	50.7	145
L.S.D 0.05	2.02	0.03	0.18	0.67	5.96	1.06	0.03	0.15	0.65	4.51	1.60	0.03	0.16	0.65	5.22
L.S.D 0.01	2.71	0.04	0.24	0.90	7.99	1.43	0.04	0.19	0.87	6.04	2.10	0.04	0.22	0.85	6.88

Table (10): Estimates of variance components for parental and selected families of sorghun over two years

Cut	X	σ^2g	σ^2e	σ^2PH	H^2b %	G.C.V	ph.C.V	G.a	(G.a / X) %
First cut									
P.H	98.6	242.7	027.2	249.5	97.3	15.8	16.0	031.2	31.6
S.D	1.25	0.043	0.010	0.045	95.6	16.6	17.0	0.418	33.4
NO.T/P	4.03	0.474	0.115	0.502	94.4	17.1	17.6	01.38	34.2
L.S.R	65.6	131.0	022.0	136.5	96.0	17.4	17.8	023.1	35.2
L.A	241	1895	0179	1940	97.7	18.1	18.3	088.6	36.8
G.Y	6.15	08.35	0.200	08.40	99.4	47.0	47.1	05.93	96.5
D.Y	0.924	0.236	0.015	0.240	98.2	52.3	53.0	0.992	107.4
2nd Cut									
P.H	0154	417.5	0148	454.5	91.8	13.3	13.8	40.30	26.2
S.D	01.07	0.023	0.075	0.042	54.8	14.2	19.2	0.231	21.6
NO.T/P	09.34	03.55	0.298	03.62	97.9	20.2	20.4	03.84	41.2
L.S.R	054.6	060.4	014.3	64.00	94.4	14.2	14.6	15.60	28.4
L.A	0184	1998	00193	2046	97.6	24.3	24.6	91.00	49.4
G.Y	11.32	11.18	0.180	11.22	99.6	29.5	29.6	06.88	60.7
D.Y	01.72	0.392	0.004	0.393	99.7	36.4	36.4	01.29	74.9
3rd Cut									
P.H	0131	274.9	23.40	280.8	97.9	12.6	12.8	33.80	25.8
S.D	00.89	0.008	0.007	0.010	80.0	10.0	11.2	0.165	18.5
NO.T/P	08.89	03.54	0.246	03.60	98.3	21.2	21.3	03.84	43.2
L.S.R	52.60	67.00	03.89	68.00	98.5	15.6	15.7	16.70	31.8
L.A	00195	225.0	0250	23.13	97.3	24.3	24.7	96.40	49.4
G.Y	06.45	05.76	0.165	05.80	97.8	37.2	37.3	04.93	76.4
D.Y	01.19	0.310	0.006	0.311	99.6	46.8	46.9	01.14	96.2
T.G.Y	23.9	62.6	0.457	62.80	99.8	33.1	33.2	16.30	68.1
T.D.Y	3.84	2.37	0.024	2.38	99.7	40.1	40.2	3.16	82.4