PEDIGREE SELECTION FOR YIELD IN GRAIN SORGHUM POPULATION, [*Sorghum bicolor* (L.) Moench]

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Abstract: Two cycles of pedigree selection method for grain yield/plant were conducted on a segregating population (TP24D) of grain sorghum in the F_3 generation . Selection was practiced at Shandaweel, Agric. Res. Center in 2002 and 2003 summer seasons . After the second cycle, the selected families were evaluated at Shandaweel (Sohag), Agric. Res., Station, Sohag (optimal environment) and Qena (sub-optimal environment), South Valley University Experiment Farm, Faculty of Agric. After two cycles of pedigree selection showed 5.87 and 3.72% increase in grain yield/plant over the bulk sample at Sohag and Qena, respectively, with an average of 4.98% over the two locations . Selection for grain yield/plant was accompanied by decrease in days to 50% flowering of -7.43, -6.66% and -7.03 %, increase in 1000-grain weight of 4.27, 5.70 and 4.89% over the bulk sample at Sohag, Qena and across locations, respectively .

Synergistic selection for grain yield/plant under optimal environment (Sohag) was better than the antagonistic one under sub-optimal environment (Qena). Sufficient genotypic coefficient of variability for grain yield/plant and other studied traits was observed .Phenotypic and genotypic variances expressed as pcv% and gcv% slightly decreased after the second cycle of selection in 1000-grain weight and days to 50% flowering compared to the first cycle . However, the variability in plant height was increased by selection for grain yield/plant . Family no. 6 could be considered the best selected family at Sohag, Qena and across locations which showed 44.26, 27.20 and 36.56% increase in yield, and was earlier than the bulk sample 4.44, 4.01 and 4.22% and gave heavier grains than it by 21.25, 11.30 and 16.57%, respectively . These results reflect that the direct selection for grain yield/plant was effective in improving these materials.

Key words: pedigree selection, yield, grain sorghum.

Introduction

Grain sorghum (*Sorghum bicolor* (L.) Moench) is one of the major cereal crops in the world as well as in Egypt . It is mainly grown in Upper Egypt particularly in Assiut and Sohag governorates and is consumed

in bread making, animal feeds and other uses.

Selection for yield is one of the most important and difficult challenges of plant breeding . Pedigree selection method can be used to identify superior genotypes for grain yield in a cultivar development program . Pedigree selection for grain yield/plant needs to evaluate selections under a series of environments such as different levels of water stress (Chigwe, 1984, Sankarapandian and Bangarvsamy, 1996 and Ali, 2002); different soils, locations, i.e., (Mahdy *et al*., 1999) . Dogget (1972) and Soonsuwon (1988) observed an improved yield over the base population after three cycles of selection . Menkir *et al*.(1994), Igaruta *et al*. (1996) and Mukka and Singh (1996) mentioned that selection was effective in improving grain yield, but it was associated to undesired increase in plant height and late flowering . Mahdy *et al*. (1999) and Ali (2002) acheived increased grain yield, earlier flowering, shorter plants and heavier grains after two cycles of pedigree selection for grain yield/plant in a segregating grain sorghum population .

The goal of the present study was to evaluate a random mating population carrying genetic male sterility and starting a pedigree selection program for grain yield/plant to isolate elite pure lines to use as parents for the production of commercial hybrids .

Materials and Methods

Field experiment was conducted at the Shandaweel Research Station, Agric. Res. Center, Sohag, Egypt, during the summer growing seasons of 2002 and 2003 and the selections were evaluated at two locations, Sohag (Shandaweel Res. Sta.) and Qena (Agric. Exper. Farm of the South Valley University) in 2004 summer season.

During the summer season of 2002, a random-mating population in F_3 generation (TP24D) introduced from USA was grown in a nursery in unreplicated experiment (100-rows, 4 m long, 60 cm apart, 20 cm between seeds within a row) at the Shandaweel Res. Station . After full emergence, seedlings were thinned to two plants per hill . At anthesis, 400 fertile plants were tagged for pedigree selection for grain yield/plant . At harvest, 20 heads were selected based on grain yield/plant .

The 20 selected families along with the bulk random sample (a mixture of equal number of grains from each of the 400 heads to represent the generation mean) were sown on Jun 15th 2003 at Shandaweel Res. Station . The field layout was a randomized complete block design with three replications . Each plot consisted of one row 4 m long, 60 cm apart and 20 cm between hills within a row . After full emergence, seedlings were thinned to two plants per hill . The agricultural practices were carried out as recommended for sorghum

production . Days to 50% flowering was recorded on plot mean basis as days from sowing to the day when 50% flowering. At harvest, data were collected on ten random guarded plants in each plot . Measurements were recorded on each plant for the following traits: plant height cm, grain yield/plant gm and 1000-grain weight gm . The highest plant in grain yield was selected from each of the best 10 families selected and saved to form the next season (the second cycle selection) .

In 2004 summer season, the selections along with the random bulk sample were evaluated at two locations; Sohag (optimal environment) and Qena (sub- optimal environment), because the soil type at Sohag is loamy (soil PH = 7.8, organic matter =1.15, total N (ppm) =15.0, P(ppm) = 11.0 and K(ppm) = 315.0) much more fertile than at Qena sandy loam (soil PH = 8.12, organic matter % =0.35, total N % =0.04, P(ppm) = 9.4, K(meq/100g soil = 0.19 and calcium carbonate % was 13.6) . Planting dates were Jun 16th and 18th at Shandaweel and Qena, respectively. The same experimental design and field procedures were properly applied at the two locations as those of 2003 season .

The analysis of variance and combined analysis were performed according to Gomez and Gomez (1984) after carrying out the homogeneity test. Phenotypic and genotypic correlations and heritability in broad sense were calculated as outlined by Walker (1960) .

The observed gain as the difference between a mean of the selected families and random bulk sample value and was tested using revised LSD method .

Results and Discussion

Base population

Means and ranges of all studied traits i.e., days to 50% flowering, plant height, grain yield/plant and 1000-grain weight were calculated from 400 fertile plants at Shandaweel Res. Sta. (Sohag) in 2002 season (Table 1) . Results revealed wide ranges of these traits, indicating a sizeable genetic gain from selection that could be expected from these materials .

Table(1): Means and ranges of studied traits in the base F_3 population at Sohag, in 2002 season .

Season	2002	
Traits	Means	Range
Days to 50% flowering (days)	69.83	50.00 – 90.00
Plant height (cm)	155.52	100.00 – 250.00
Grain yield/plant (g)	48.20	26.50 – 73.26
1000-grain weight (g)	18.44	14.34 – 23.70

The first cycle of selection

Highly significant differences were observed among the selected families for grain yield/plant and other correlated traits i.e., days to 50% flowering, plant height and 1000-grain weight (Table 2), reflecting the genetic variability among selected families in these traits . After one cycle of pedigree selection for grain yield/plant, the retained variability in the selection criterion was sufficient and accounted 14.81and 14.71% for phenotypic(pcv) and genotypic(gcv) coefficient of variability, respectively. Also, sizeable amount of gcv was found for days to 50% flowering (8.91%), plant height (16.96%) and 1000- grain weight (9.30%) . High estimates of heritability in broad sense were obtained for all studied traits, indicating that the environmental effects were small compared to the genetic effects . These results are in line with those reported by Kumar and Singh (1986), Mahdy *et al*. (1987) and Mohamed *et al*. (1999) .

Table(2): Mean, mean squares, phenotypic(pcv), genotypic(gcv) coefficient of variability and heritability in broad sense (H_b) of the first cycle selections evaluated at Sohag, season 2003 .

Trait	Mean		Mean squares			pcv	gcv	H_b
	F_4	Bulk	Reps	Families	Error			
Days to 50% flowering	68.75	78.00	13.55	119.47**	6.90	9.18	8.91	94.22
Plant height (cm)	167.62	181.67	48.17	2494.26**	69.93	17.20	16.96	97.20
Grain yield/plant(g)	55.86	53.89	0.51	205.45**	2.88	14.81	14.71	98.60
1000-grain weight(g)	21.71	20.86	0.20	12.95**	0.72	9.57	9.30	94.44

**, Significant at 0.01 level of probability .

Means of the 20 selected families based upon grain yield/plant in this population (Table 3) indicated that the best family in grain yield/plant; Fam. no.9 which outyielded, and was earlier and heavier in grains than the bulk by 46.04, -8.12 and 24.16%, respectively . Ten out of the 20 families outyielded significantly or highly significantly the random bulk sample by 4.53 to 46.04% .

Table(3): Mean trait values of the selected families of the first cycle of pedigree selection at Sohag season, 2003.

Family No.	Days to 50% flowering	Plant height(cm)	Grain yield/plant (g)	1000-grain weight(g)
1	79.33	235.00	60.50**	23.20**
2	76.00	146.67**	59.77**	20.27
3	71.67**	171.67	54.47	21.00
4	65.33**	123.33**	57.00*	21.73
5	64.00**	190.00	48.13	22.13*
6	73.33*	154.67**	61.40**	21.40
7	63.67**	138.33**	56.70*	27.07**
8	58.60**	138.33**	36.23	20.40
9	71.67**	221.67	78.70**	25.90**
10	71.33**	165.00**	54.67	19.53
11	57.33**	136.67**	50.67	20.53
12	66.33**	161.67**	45.13	21.77
13	72.67*	183.33	56.80*	20.23
14	62.00**	135.00**	62.87**	21.47
15	77.33	186.00	55.57	22.10*
16	67.33**	153.33**	55.23	24.07**
17	77.67	185.00	52.70	22.10*
18	66.33**	186.67	62.47**	20.87
19	66.67**	171.67	56.33*	20.17
20	67.33**	168.33*	51.93	18.30
$\bar{x}$	68.75	167.62	55.86	21.71
Bulk	78.00	181.67	53.89	20.86
Revised $LSD_{0.05}$***	3.87	12.05	2.41	1.23
Revised $LSD_{0.01}$***	5.09	15.88	3.18	1.62

*,** Significant at 0.05 and 0.01 probability levels, respectively .

***, Calculated for individual family with bulk .

These families were selected for the second cycle selection (Fam. no. 1,2,4,6,7,9,13,14,18 and 19) . Mean grain yield/plant of the 20 families also exceeded significantly the random bulk sample . It should be recalled that selection was practiced depending on grain yield/plant .

The overall mean of days to 50% flowering and plant height were highly significantly earlier and shorter than the bulk sample,

respectively . Mean 1000-grain weight was insignificantly heavier grains than the bulk sample . But, the individual family means showed that 16,11 and 7 families were significantly earlier, shorter and heavier grains than the bulk sample, respectively . The ten selected families for the second cycle based on their grain yield /plant, eight of them were significantly earlier than the bulk sample and 5 and 3 of them were significantly shorter and heavier grains than the bulk sample, respectively . Therefore, selection for grain yield/plant which include such families may affect the initial genotypic correlations among these traits .

Pedigree selection for grain yield/plant showed an observed gain of 3.66% and 4.07% over the bulk for grain yield/plant and 1000-grain weight, respectively . Furthermore, favourable decrease in plant height (-7.73%) and (-11.86%) in days to 50% flowering were obtained (Table 4). These results are in line with those reported by Chigwe (1984), Igarauta *et al.* (1996) and Mahdy *et al.* (1999) .

Table(4): Observed gain in pedigree selection measured in percentage from the bulk sample after the first cycle at Sohag, season 2003 .

Site of selection	Days to 50% flowering	Plant height	Grain yield/plant	1000-grain weight
Sohag	-11.86**	-7.73**	3.66**	4.07**

Grain yield showed low positive genotypic correlations with plant height(0.34) and 1000-grain weight (0.19). However, negative correlation between grain yield and days to 50% flowering (-0.43) were observed (Table 5) . These results are in line with those reported by Menkir *et al.* (1994) and Potdukhe *et al*. (1994) .

Table(5): Phenotypic (above) and genotypic (below diagonal) correlation among pairs of traits of the selected families of the first cycle at Sohag, season 2003 .

Traits	Days to 50% flowering	Plant height	Grain yield/plant	1000-grain weight
Days to 50% flowering	-	0.63	-0.34	-0.03
Plant height	0.54	-	0.35	0.24
Grain yield/plant	-0.43	0.34	-	0.26
1000-grain weight	-0.05	0.22	0.19	-

The second cycle of selection.

The ten selected families for grain yield/plant were evaluated in the second cycle of selection at two locations; Sohag and Qena .There were highly significant differences among selected families for grain yield/plant, days to 50% flowering, plant height and 1000-grain weight in the separate and combined analyses (Table 6) . This indicates the existence of sufficient variability for further improvement . Moreover, locations and location x families interaction were highly significant reflecting differential responses of the selected families to edaphic and climatic factors . The highly significant mean squares obtained for families vs. bulk indicated the feasibility of selection for grain yield/plant in this population . These results reflect the importance of evaluating selections under different environments .

Table(6): Mean squares of the selected families of the second cycle and bulk sample evaluated at two locations and their combined .

Location	S .O .V	df	Mean squares			
			Days to 50% flowering	Plant height	Grain yield /plant	1000-grain weight
Sohag	Reps	2	0.03	14.82	0.66	0.20
	Genotypes	10	46.36**	3221.94**	261.97**	11.76**
	Sel. families	9	28.37**	3318.06**	286.99**	11.65**
	Sel. fam.VS. bulk	1	208.23**	2356.87**	36.41**	12.74**
	Error (genotypes)	20	1.33	27.49	1.78	0.20
	Error (sel.families)	18	0.81	28.31	1.92	0.30
Qena	Reps	2	0.85	5.30	1.73	1.53
	Genotypes	10	34.90**	1420.46**	214.37**	5.21**
	Sel. families	9	29.50**	1556.39**	237.04**	2.59**
	Sel. fam.VS. bulk	1	83.53**	197.10**	10.36**	28.79**
	Error (genotypes)	20	0.82	23.64	1.27	0.29
	Error (sel.families)	18	0.69	25.90	1.40	0.31
Combined over two locations	Locations(L)	1	1088.24**	39128.02**	2597.66**	144.33**
	Reps/Loc.	4	0.44	10.06	1.20	0.86
	Genotypes(G)	10	76.85**	4363.00**	422.14**	13.92**
	Sel. families	9	63.82**	4709.34**	465.06**	11.09**
	Sel. fam.VS. bulk	1	194.15**	283.85**	35.87**	39.42**
	L x G	10	4.41**	279.34**	51.80**	3.05**
	L x Sel. families	9	5.31**	283.85**	58.97**	3.15**
	Error (G)	40	1.07	25.56	1.53	0.25
	Error(sel.families)	36	0.75	27.11	1.66	0.31

*,** Significant at 0.05 and 0.01 probability levels, respectively .

Results in (Table 7) revealed sufficient genotypic coefficient of variability among the ten selected families after two cycles of selection for grain yield which accounted for 14.82, 16.72 and 13.85% at Sohag, Qena and across locations, respectively . Comparing the PCV and GCV of the first and the second cycle selection, it could be noticed slight decrease in 1000-grain weight and days to 50% flowering. However, the variability in plant height increased by selection for grain yield/plant . Falconer (1989) stated that the loss of genetic variance should lead to a reduction in phenotypic variance. The phenotypic variance, however, is seldom declined by selection as expected; often it increases . Many increases have been found in many experiments . The possible reasons

Table(7): Means, phenotypic(PCV%), genotypic(GCV%) coefficient of variability and heritability in broad sense of the selected families after two cycles of selection .

Location	Items	Days to 50% flowering	Plant height	Grain yield/ plant	1000-grain weight
Sohag	$\bar{X}$ selected families	69.43	160.07	65.78	25.86
	PCV %	4.43	20.78	14.87	7.62
	GCV %	4.37	20.69	14.82	7.52
	Heritability %	97.15	99.15	99.33	97.42
Qena	$\bar{X}$ selected families	77.47	110.17	53.00	23.01
	PCV %	4.05	20.67	16.77	4.04
	GCV %	4.00	20.50	16.72	3.79
	Heritability %	97.66	98.33	99.42	88.37
Combined over two locations	$\bar{X}$ selected families	73.45	135.12	59.39	24.43
	PCV %	4.44	20.73	14.82	5.57
	GCV %	4.25	20.01	13.85	4.71
	Heritability %	91.64	93.97	87.32	71.35

for the phenotypic variance increase or not decrease are : First, the variance of many characters is not independent of the mean; when the mean changes under selection the variance automatically changes as well . Second, the environmental variance may increase. With approach to fixation, the homozygotes are sometimes more variable from environmental causes than are heterozygotes . And, third, the genetic variance may not decline as expected . The genotypic coefficient of variability across locations (13.85%) was smaller than that at each location . This could be due to that the genotype x location interaction is confounded in the mean squares of families in the separate analysis which inflates the p.c.v. and g.c.v. In consequence the estimates of broad sense heritability were higher in separate analysis than in combined analysis, reflecting the need to evaluate selection under a series of environments to get reliable estimates of parameters either genetic or environmental . Eckebil *et al.* (1977) Mentioned that broad sense heritability estimates for blooming date, yield and kernel weight were high in all populations . Maves and Akins (1991) found that heritability estimates for grain yield increased from C_0 to C_4 .

Mean of grain yield/plant of the selected families (Table 8) was 65.78, 53.00 and 59.39 g/plant at Sohag, Qena and across locations, respectively . The overall mean masked the great variability of individual selected families performance from location to another . For example, family no. 6 yielded 89.63 g at Sohag and 65.00 g/plant at Qena, indicating genotypes x environment interaction . Selection under the optimal environment (Sohag) resulted in five superior families (1, 4, 6, 9 and 13) which outyielded the bulk sample by 4.83, 13.94, 44.26, 5.47 and 8.32%, respectively . Also, selection at the sub-optimal environment (Qena) resulted in eight superior families; i.e., 1, 2, 4, 6, 7, 9, 18and 19 which exceeded the bulk sample by 4.83, 8.36, 22.31, 27.20, 4.76, 3.58, 4.31 and 5.42%, respectively . Selection across environments resulted in seven superior families (1, 2, 4, 6, 7, 9and 18) which outyielded the bulk sample by 4.82, 2.61, 17.71, 36.56, 2.83, 4.61and 2.44%, respectively . It is noticed that family No. 6 could be considered the best selected family at Sohag, Qena and across environments which showed 44.26, 27.20, and 36.56% increase in yield, it was earlier than the bulk sample by 4.44, 4.01 and 4.22% and was heavier in grains than it by 21.25, 11.30 and 16.57%, respectively . Highly significant improvement after two cycles of selection was obtained in days to 50% flowering towards earliness and 1000-grain weight as correlated traits compared to the bulk sample at Sohag, Qena and across locations.

Such improvement in grain yield/plant which accompanied with favourable improvements in earliness and grain weight indicates that the population have a good and favourable associations among grain yield and correlated traits .

The observed gains for grain yield/plant (Table 9) accounted for 5.87, 3.72 and 4.89% from the bulk sample when selection was practiced at Sohag, Qena and across environments . This indicates that selection under optimal environment was the best and the antagonistic selection was less one . Two cycles of pedigree selection for increasing grain yield/plant (Table 8) also increased plant height and 1000-grain weight . The increase in 1000- grain weight accounted 4.27, 5.70 and 4.89% from the bulk sample when selection was practiced at Sohag, Qena and across environments, respectively. However, respective decreases were observed for days to 50% flowering which reached –7.43, -6.66 and –7.03% . It could be concluded that pedigree selection for grain yield/plant was accompanied with favourable effects on the correlated traits; days to 50% flowering and 1000-grain weight. Unfavourable increase in plant height over the bulk sample accompanied pedigree selection for grain yield/plant at Sohag (15.72%), Qena (8.36%) and across environments(12.60%) .

Genotypic correlation coefficients over the two locations(Table 10) were increased after two cycles of selection compared to the first cycle between grain yield/plant and days to 50% flowering (-0.02 and -0.43), plant height (0.46 and 0.34) and 1000-grain weight (0.51 and 0.19), for the second and first cycle, respectively . Grain yield/plant showed positive genotypic correlation coefficients with plant height and 1000-grain weight and negative with days to 50% flowering . Mahdy *et al*. (1982) found that grain yield/plant showed positive significant genotypic and phenotypic correlations with each of 1000-kernel weight and plant height and negative with days to flowering in two years. Saadalla (1983) reported that positive and significant correlation between grain yield and 1000-kernel weight . Potdukhe et al. (1994) showed that grain yield was positively and significantly correlated with 100-grain weight .

Table(8): Mean traits of the ten selected families after two cycles of selection at Sohag, Qena and across two locations in 2004 season

Location	Family No.	Days to 50% flowering	Plant height	Grain yield/ plant	1000-grain weight
Sohag	1	76.00	222.33	65.13*	28.00**
	2	71.00**	135.00	60.83	25.77**
	4	70.67**	138.33	70.79**	25.17
	6	71.67**	215.00	89.63**	30.07**
	7	66.00**	145.00	62.90	23.03
	9	66.67**	175.00	65.53**	25.20
	13	70.00**	155.00	67.30**	25.13
	14	71.33**	155.00	51.50	24.77
	18	68.00**	128.33*	62.70	24.70
	19	63.00**	131.67	61.53	26.67**
	$\bar{x}$	69.43**	160.07	65.78**	25.86**
	Bulk	75.00	138.33	62.13	24.80
	Revised LSD $_{0.05}$	1.70	7.75	1.97	0.66
	Revised LSD $_{0.01}$	2.27	10.32	2.63	0.88
Qena	1	83.00	155.0	53.57**	24.43**
	2	77.00**	101.67	55.37**	23.97**
	4	78.00**	105.00	62.50**	22.23
	6	79.67**	145.00	65.00**	24.23**
	7	75.00**	95.00	53.53**	22.17
	9	73.00**	115.00	52.93*	23.20**
	13	76.00**	110.00	48.00	21.77
	14	80.00**	95.00	31.91	22.53
	18	79.33**	85.00**	53.30*	23.03**
	19	73.67**	95.00	53.87**	22.53
	$\bar{x}$	77.47**	110.17	53.00**	23.01**
	Bulk	83.00	101.67	51.10	21.77
	Revised LSD $_{0.05}$	1.34	7.19	1.67	0.81
	Revised LSD $_{0.01}$	1.78	9.57	2.22	1.09
Combined over two locations	1	79.50	188.67	59.35**	26.22**
	2	74.00**	118.33	58.10*	24.87**
	4	74.33**	121.67	66.65**	23.70
	6	75.67**	180.00	77.32**	27.15**
	7	70.50**	120.00	58.22*	22.60
	9	69.83**	145.00	59.23**	24.20**
	13	73.00**	132.50	57.65	23.45
	14	75.67**	125.00	41.71	23.65
	18	73.67**	106.67**	58.00*	23.87*
	19	68.33**	113.33*	57.70	24.60**
	$\bar{x}$	73.45**	135.12	59.39**	24.43**
	Bulk	79.00	120.00	56.62	23.29
	Revised LSD $_{0.05}$	1.05	5.14	1.26	0.51
	Revised LSD $_{0.01}$	1.39	6.77	1.66	0.67

*,** Significant at 0.05 and 0.01 probability levels, respectively .

Table(9): Observed gain of pedigree selection measured in percentage from the bulk sample after two cycles of selection .

Site of Evaluation	Days to 50% flowering	Plant height	Grain yield/ plant	1000-grain weight
Sohag	-7.43**	15.72**	5.87**	4.27**
Qena	-6.66**	8.36**	3.72**	5.70**
Combined Sohag and Qena	-7.03**	12.60**	4.89**	4.89**

*,** Significant at 0.05 and 0.01 probability levels, respectively .

Table(10): Phenotypic (above) and genotypic (below diagonal) correlations among pairs of traits over two locations after the second cycle of selection in 2004 season .

Traits	Days to 50% flowering	Plant height	Grain yield/ Plant	1000-grain weight
Days to 50% flowering	-	0.43	0.01	0.15
Plant height	0.42	-	0.49	0.76
Grain yield/Plant	-0.02	0.46	-	0.53
1000-grain weight	0.13	0.73	0.51	-

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الانتخاب المنسب لمحصول الحبوب في عشيرة من الذرة الرفيعة

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تم أجراء دورتين من الانتخاب المنسب لصفة محصول الحبوب للنبات الفردي في عشيرة انعزالية من الجيل الثالث إلى الجيل الخامس في ذرة الحبوب الرفيعة . تم تنفيذ الانتخاب في عامي 2002 و 2003 بمحطة البحوث الزراعية بشندويل – مركز البحوث الزراعية بسوهاج وبعد دورتين من الانتخاب تم تقييم العائلات المنتخبة عام 2004 في منطقتين هما سوهاج ومزرعة كلية الزراعة بقنا – جامعة جنوب الوادي . أظهرت دورتين من الانتخاب المنسب زيادة في وزن الحبوب للنبات الفردي قدرها 5.87 و3.72% مقارنة بالعينة العشوائية في كل من سوهاج وقنا على التوالي بينما كانت الزيادة على مستوى المنطقتين 4.98 % 0 ولقد صحب الانتخاب لمحصول الحبوب للنبات الفردي تبكيرا في التزهير بمقدار 7.43 ، 6.66 و 7.03 % وكذلك زيادة في وزن الألف حبة بمقدار 4.27، 5.70 و 4.89% لكل من سوهاج وقنا وعلى مستوى البيئتين مقارنة بالعينة العشوائية على التوالي .

وكان الانتخاب المتوافق لمحصول الحبوب للنبات الفردي تحت البيئة المثلي (سوهاج) أفضل من الانتخاب المتضاد تحت البيئة تحت المثلي (قنا) . وأشارت تقديرات معاملي الاختلاف المظهري والوراثي إلى وجود اختلافات مرضية لصفة محصول الحبوب للنبات الفردي والصفات الأخرى المدروسة . وبعد الدورة الثانية انخفض طفيفا كلا من التباين المظهري والوراثي والمعبر عنهما بمعاملي الاختلاف المظهري والوراثي لصفتي وزن الألف حبة والتزهير مقارنة بالدورة الأولى . بينما زادت هذة الاختلافات لصفة ارتفاع النبات بالانتخاب لصفة محصول الحبوب للنبات الفردي . وتعتبر العائلة رقم 6 أفضل عائلة منتخبة في كل من سوهاج وقنا وعلى مستوى الموقعين حيث أظهرت زيادة عن العينة العشوائية قدرها 44.26 ، 27.20 و36.56% فى المحصول وأبكرت عنة بمقدار 4.44 ،4.01 و 4.22% وأعطت زيادة في وزن الحبوب عن العينة العشوائية بمقدار 21.25 ،11.30 و 16.57% على التوالي . وهذه النتائج توضح أن الانتخاب المباشر لمحصول الحبوب للنبات الفردي كان فعالا في تحسين هذه العشيرة .