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PERFORMANCE OF TWO ADVANCED GENERATIONS OF FABA BEAN FOR EARLINESS AND HIGH PRODUCTIVITY

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ABSTRACT

This work was conducted during two successive winter seasons of 2009/2010 and 2010/2011 to study the response of phenotypic directional selection from the offspring of three crosses from four faba bean genotypes with variable levels of earliness and high yielding ability. The genotypes Giza-716, Giza-843, Sakha-1 and Triple-White were crossed as follows: Sakha-1 × Giza-843, Sakha-1 × Giza-716 and Giza-843 × Triple-White. In the first season, mean performances of parents and their offspring of F_4 generation for eight traits that include yield and number of days from sowing to maturity were measured in order to make the best choices of populations of both high yielding ability and earliness. In the second season, mean performances of parents and their offspring of five families of the three F_3 populations and the responded to selection were studied for eight traits. The results obtained encouraged the team work to continue the research on the three populations selected for advanced cycles of selection in order to improve the performance of faba bean plants. Five families of each of the three populations were selected to represent F_5 generation and the results revealed the superiority of the population Sakha-1 × Giza-716 that included the earliest matured family 4 reached to maturity after 141.7 days about a week earlier than bulk plants of the same population. The population Giza.843 × Triple-White which have both the tallest the shortest families and a family of the population Sakha-1 × Giza-843 attained the highest number of 3.85 branches. Two superior families obtained the highest numbers of pods/plant from the population Sakha-1 × Giza-843 which attained 30.7 pods and Giza.843 × Triple-White which had 30.23 pods. The highest number of seeds/plant was resulted from the family 5 with 84.53 seeds/plant of the population Giza-843 × Triple-White and attained the highest seed yield/plant with 80.56 grams of seeds/plant. The population Giza-843 × Triple-White attained both purpose of the research of earliness and high productivity.

Keywords: *Faba bean, Viciafaba, Selection, Earliness, Yield, Independent vascular supply*

INTRODUCTION

Faba bean (*Viciafaba* L.) is one of the most important source protein plants in Egypt. Much work has been directed to increase its productivity through traditional cultural practices and/or selection. The limited success of the breeding effects for selecting faba bean cultivars with enhanced yield and early maturity is mainly due to the difficulty to combine both earliness and high yield in the same genotype. The promising segregating populations make it possible to select lines with superior performance. Procedures making possible early detection of unpromising populations have been the target of many investigators (Singh and Urrea 1995 and Oliveira *et al* 1996).

Seed yield is a complex trait that is quantitatively inherited with low heritability value (Bond 1966, Kambal 1969 and Yassin 1973). The low heritability and consequent limited genetic advance for yield in response to selection had led many scientists to search for characters which are associated with yield but which are more highly heritable (De Pace 1979). Selection in early segregating populations gave higher results than primitive and local type varieties (Abdalla and Metwally 1983). Selection within local and exotic populations may result in improving faba bean performance (Abdalla 1976). Bakheit and Mahdy (1988) found that the family selection for two generations in Giza-2 was effective in producing some families exceeding the base population. Omar (1989) noticed that both pod and seed sets had a great influence on improving seed yield. He found that bulk method attained higher genetic variation and the number of superior families relative to other breeding methods. Ibrahim *et al* (1979), Nassib*et al* (1979) and Nassib and Khalil (1982) recommended using mass selection for improving commercial varieties. The procedure of mass selection involves single plant selection of few hundred plants every year and bulking their progenies after screening for the uniformity and yield. No significant differences were observed between traits in both the original and the selected populations of Giza-4 (El-Hosary 1981). The author found that selection under conditions of natural and self pollination gave similar results of studied traits on the Giza-4 variety. Ahmed (1987) practiced selection within segregating generations of 8 crosses for shedding and leaf minor infestation and measured the reflected gain in yield components. He also reported that the procedure used attained good chance for actual gain in yield and its components. El-Refaey and El-Keredy (1992) found that the effectiveness of selection between and within segregating generations varied from case to another. Ragheb (1994) found that the selection with Aquadolse (a *major* seed type) for two cycles of selection was effective. Breeding efforts have been employed for combining genes for adaptability and high yield from elite faba bean genotypes with those for earliness (Bekheit 2006). However, information on the genetics of earliness and high yield is scant and the nature of the genetic system involved is far from clear which might account for the rather limited number of early maturing and high yield cultivars released through breeding. The objective of this study is to develop, through selection, faba bean genotypes with increased levels of yield and earliness.

MATERIALS AND METHODS

Four recommended faba bean (*Vicia faba* L.) genotypes i.e. Sakha-1, Giza-843, Giza-716 and Triple-White were used to represent a wide range of agronomic traits as well as different high levels of yield and earliness. The brief descriptions of their important characteristics are given in Table

(1). This work was conducted at the Experimental Farm of Mallawi Agricultural Research Station, A gricultural Research Center, Egypt after making crosses in previous wint r seasons between these four faba bean genotypes to obtain F_1 and F_2 ar d in a previous work by Soliman (2006) and a field experiment was conduc ted in order to select the highest yield and earlier matured populations of F_3 families in a shared work by Bakheit*et al* (2011). Seeds from selected plant s of F_3 families were sown in 2009/2010 to get ten selected F_4 plants of e ch of the 3 crosses for evaluation along with the bulk F_4 of each populat on. In 2010/2011 growing season, seeds from plants of F_4 families were sc wn to get ten selected F_5 plants from five families of each of the 3 crosses for evaluation along with the bulk F_5 of each population each family. R esponse to selection was expressed as percentage of change in the me: n of the selected families from that of bulked plants of each population. Three populations attained this goal i.e. Sakha-1 × Giza-843, Sakha-1 × G iza-716 and Giza-843 × Triple-White. A randomized complete block desi n with three replications was used. The plots of five ridges assigned to pl nt the families of the 3 populations were planted as three ridges each famil and one ridge for bulk and one ridge for each parent in the evaluation sea ons. Each ridge was two-meter long, 60-cm wide and contained 10 plants spaced 20 cm apart. Seed yield per plant and other attributes of plant heigh t, number of branches, number of days to 50% flowering and 95% maturity number of pods and seeds per plant and weight of 100 seeds (g) were rec rded on individual plant basis throughout the different experiments. Means of each trait for selected, bulk and both parents of each population we e calculated and statistically analyzed according to the procedures outlin ed by Snedecor and Cochran (1981).

Table 1.The description of the fou r parental varieties of faba bean.

Parent	Pedigree	Seed index	Plant height	Maturity
Giza-716	461/442/83 × 503/4 53/83	90 - 95 g	140 – 145 cm	moderate
Giza-843	561/2076/85 × 461/ 45/83	60 – 65 g	150 – 160 cm	moderate
Sakha-1	716/724/83 × 620/2 3/85	85 – 89 g	150 – 155 cm	moderate
Triple-White	Mutant of individual p ant from Sudan	54 – 55 g	130 – 135 cm	Early

RESULTS and DISCUSSION

The results of the response t selection for yield and earliness from the previous work reached to choosir g the best populations of three crosses of Sakha-1 × Giza-843, Sakha-1 × Giza-716 and Giza-843 × Triple-White. Eight traits including flowering,m aturity, plant height, number of branches, pods and seeds per plant,seed yie d per plant and weight of 100 seeds were

studied with the responses to selection for both F_4 and five families of F_5 generations with their significance in the three crosses as follows:

1st Cycle of selection - F_4 generation

Number of days to flowering and maturity:

The negative values of the responses to selection for both flowering and maturity are considered to be a good index for earlier populations in the future in which two populations of Sakha-1 × Giza-716 and Giza-843 × Triple-White got negative values of responses to flowering – 0.42 and – 0.44% respectively, while Sakha-1 × Giza-843 and Sakha-1 × Giza-716 got negative values of responses for maturity – 0.68 and – 1.99%, respectively. These results revealed that the population Sakha-1 × Giza-716 has two advantages of earliness of both flowering and maturity (Table 2). The results are in agreement with those of Mahmoud (1968), El-Hosary (1981), and Khalil *et al* (1982).

Table 2.Means of days to flowering and maturity in 3 crosses of F_4 generation for selected, bulk and populations with the response to selection during 2008/2009 season.

	Days to flowering			Days to maturity		
Populations	**S-1 × G-843**	**S-1 × G-716**	**G.843 × T.W**	**S-1 × G-84**	**S-1 × G-716**	**G.843 × T.W**
Selected	**46.43**	**47.47**	**45.47**	**136.40**	**137.87**	**136.6**
Bulk	**44.67**	**47.67**	**45.67**	**137.33**	**140.67**	**134.7**
P_1	**45.33**	**44.67**	**46.67**	**141.00**	**141.33**	**140.3**
P_2	**40.33**	**45.67**	**49.00**	**142.67**	**144.33**	**134.7**
LSD 0.05	**ns**	**Ns**	**ns**	**ns**	**ns**	**ns**
Response %	**3.94%**	**-0.42%**	**-0.44%**	**-0.68%**	**-1.99%**	**1.41%**

Plant height and number of branches

The results represented in Table (3) showed positive responses to selection in plant height in two populations Sakha-1 × Giza-843 and Giza.843 × Triple-White which got values of 0.29 (not significant) and 15.83%. (highly significant) while the population Sakha-1 × Giza-716 got a highly significant negative value – 1 .04 of response to selection for this trait. Plant height of the selected F4 families varied considerably among the 3 populations that ranged from 133.2 to 140.4 cm. The most outstanding F4 selections of two crosses involved the tallest parental cultivars Saka-1 and Giza-843, namely population 1 (Sakha-1 × Giza-843), with a mean plant height of 140.0 cm and population 2 (Sakha-1 × Giza-716), with a mean of 151.2 cm. Meanwhile, the analysis also indicated that there were insignificant differences among the F4 selected families in all populations. The results are in agreement with those of Mahmoud (1968), El-Hosary (1981 and 1982), Khalil and Nassib (1982) and Khalil *et al* (1982).

Table 3.Means of plant height, number of branches, in 3 crosses of F_4 generation for selected, bulk and parents populationsduring 2008/2009 season.

Populations	Plant height (cm			Number of branches		
	S-1 × G-843	S-1 × G-716	43 × T.W	S-1 × G-843	-1 × G-716	.843 × T.W
Selected	140.40	134.50	133.2	5.06	4.38	7.97
Bulk	140.00	151.20	115.0	3.73	4.00	4.60
P_1	151.00	146.00	150.0	3.67	3.73	3.70
P_2	150.67	140.67	126.3	3.70	3.57	2.03
LSD 0.05	1.52	1.87	1.65	0.96	ns	1.08
Response %	0.29%	-11.04%	15.83%	35.66%	9.50%	42.28%

In terms of number of branches/plant, positive responses to selection were obtained in all of the 3 populations Sakha-1 × Giza-843 and Sakha-1 × Giza-716 which got values of 35.66% (significant) and 9.5% (not significant) and the population Giza.843 × Triple-White got a highly significant positive value (42.28%) of response to selection for this trait. Number of branches per plant of the selected F_4 families varied considerably among the 3 populations that ranged from 4.28 to 5.06 branches. The most outstanding F_4 selections of two crosses involved the most branched parental cultivar Giza-843, namely populations 1 (Sakha-1 × Giza-843) and 3 (Giza.843 × Triple-White) with means of 3.73 and 7.97 branches, respectively. Meanwhile, the analysis also indicated that there were significant variations among the F_4 selected families in all populations which permit further response to another cycle of selection (table 3). The results are in agreement with those of Mahmoud (1968), El-Hosary (1981, 1982, 1983 and 1984), and Khalil and Nassib (1982).

Number of pods and number of seeds/plant

The results represented in Table (4) revealed the mean values of number of pods/plant and show positive responses to selection in all of the 3 populations Sakha-1 × Giza-843, Sakha-1 × Giza-716 and Giza.843 × Triple-White which got values of 14.21%, 2.17% (not significant), and 42.66% from the population that got a highly significant positive value of response to selection for this trait that clarifying the transmission of the property of independent vascular supply of the genotype Triple-White to its offspring individuals. Number of pods of the selected F_4 families varied considerably among the 3 populations that ranged from 46.0 to 86.63 pods. The large flower and young pod drop in fababean has been attributed to physiological interactions among flowers and pods in the same raceme and the use of the IVS mutant with independent vascular supply traces to each flower has been suggested to circumvent this (Gates *etal.*, 1983). Lines with this trait are effective semi-determinates with a heavy pod set over the first

five to six flowering nodes, providing a strong sink for assimilates, which leads to the early death of the vegeta ive apex. This result in yield being limited by the ability of the plant to su pply assimilates, rather than by sink capacity, which is the usual case for fababean (McEwen, 1972). This is a less pronounced modification than w th determinates and would allow a more flexible response to favora ble environments in regard to photosynthetic area. The most outsta ding F_4 selections of two crosses involved the highest number of pods in volved two parents, Triple-White and Giza-843, namely population 1 (Sakha 1 × Giza-843), with a mean number of pods of 42.23 pods and population 3 (Giza-843 × Triple-White), with a mean of 49.67 pods. Meanwhile, the a alysis also indicated that there were significant variations among the F_4 elected families in all populations which permit for further response to se ection. The results are in agreement with those of Mahmoud (1968), El-H sary (1981, 1982, 1983 and 1984), and Khalil and Nassib (1982).

Table 4.Means of number of pods and s eds/plant in 3 crosses of F_4generation for selected, bulk and parents p pulationsduring 2008/2009 season.

	Number of pods			Number of seeds		
Populations	**S-1 × G-843**	**S-1 × G-716**	**G.843 × T.W**	**S-1 × G-843**	**S-1 × G-716**	**G.843 × T.W**
Selected	**48.23**	**46.00**	**86.6**	**128.0**	**119.7**	**236.7**
Bulk	**42.23**	**45.00**	**49.6**	**119.7**	**108.5**	**138.5**
P_1	**28.37**	**28.37**	**30.8**	**76.30**	**75.60**	**69.57**
P_2	**30.37**	**17.33**	**36.0**	**67.80**	**48.93**	**88.67**
LSD 0.05	**0.95**	**Ns**	**1.4**	**ns**	**1.72**	**1.30**
Response %	**14.21%**	**2.17%**	**42.66 %**	**6.93%**	**10.32%**	**47.48%**

For number of seeds/plant, po itive responses to selection were obtained in two populations, Sakha-1 × Giza-716 and Giza.843 × Triple-White, which got values of 10.32%, a d 47.48%. Number of seeds of the selected F_4 families varied considera bly among the 3 populations that ranged from 119.7 to 263.7 seeds. Th highest number of pods/plant was detected to the plants of F_4 selected p opulation Giza-843 × Triple-White with a mean number of seeds and po ulation. Further cycles to selection needed to improve this trait. The resu lts are in agreement with those of Mahmoud (1968), El-Hosary (1981 nd 1982), and Khalil and Nassib (1982).

Seed yield per plant and weight of 10 seeds

The results shown in Table (5) re ealed the mean values of seed yield per plant and show positive significant responses to selection in two of the three populations Sakha-1 × Giza-716 and Giza.843 × Triple-White with values of 9.77% and 26.10%, respect ively. Seed yield per plant of the

selected F_4 families varied consi lerably among the 3 populations that ranged from 71.37 to 79.20 g. The most outstanding selected F_4 population attained the highest seed yield per p ant involved parental cultivar Giza-843, namely population 1 (Sakha-1 × Giza-843), with a mean seed yield per plant. The significant variations an ong the F_4 selected families permitted for further cycles of selection. The results are in agreement with those of Mahmoud (1968), El-Hosary (1981 1982, 1983 and 1984) and Khalil *et al* (1982).

Table 5.Means of seeds yield/plant and weight of 100 seeds (seed index) in 3 crosses of F_4generation for selected, bulk and parents populationsduring 2008/2009 season.

	Weight of seeds/plant			Seed index		
Populations	S-1 × G-843	S-1 × G-716	G.843 × T.W	S-1 × G-843	S-1 × G-716	G.843 × T.W
Selected	79.20	74.97	71.37	59.80	63.03	51.90
Bulk	76.80	68.30	76.60	66.80	62.93	59.40
P_1	64.33	65.20	68.37	84.33	86.20	83.93
P_2	59.30	46.70	67.23	87.40	89.30	53.27
LSD 0.05	ns	2.10	5.31	1.1	ns	1.64
Response %	4.51%	9.77%	2.10%	-10.48%	0.16%	-12.63%

As for seed index, negative significant responses to selection were resulted from two populations of Sakha-1 × Giza-843 (- 10.48%) and population Giza.843 × Triple-White (- 12.63%). This result indicated that the higher number of seeds attained was accompanied by less seed index and it is in agreement with those of Mahmoud (1968), El-Hosary (1981), 1982, 1983 and 1984), and Khalil *et al.* (1982).

It is clear from the results obtained in this study that the effectiveness of selection between generations varied from trait to another and encouraged to continue for advanced cycles of selection in order to improve the performance of faba bean plants and have genotypes both high productivity and earliness.

2nd Cycle of selection – F_5 generation

Number of days to flowering and maturity

The results shown in Table (6) revealed the mean values of number of days to both flowering and maturity for five families selected from the three populations Sakha-1 × Giza-843, Sakha-1 × Giza-716 and Giza.843 × Triple-White and the responses to selection for both traits.

Table 6.Means of the flowering and maturity in 3 crosses of F_5 generation for 5 families selected, bulk and parents populationsduring 2009/2010 season.

Populations	Days to flowering			Days to maturity		
Selected families	S-1 × G-843	S-1 × G-716	G.843 × T.W	S-1 × G-843	S-1 × G-716	G.843 × T.W
1	43.33	43.00	46.00	144.3	143.7	139.3
2	39.67	44.33	42.00	139.3	144.7	137.3
3	42.00	46.33	41.33	146.3	142.3	143.3
4	39.67	41.33	41.67	140.3	141.7	145.3
5	43.00	41.67	43.00	139.7	142.0	144.3
Families mean	41.53	43.33	42.80	142.0	142.9	141.9
Bulk	42.67	46.50	45.00	143.8	148.7	145.0
P_1	46.00	44.33	42.33	144.3	144.3	137.7
P_2	48.33	45.67	48.33	144.0	147.3	144.0
LSD 0.05	0.91	ns	ns	1.31	ns	0.93
Response %	-2.67	-6.82	-4.89	-1.25	-3.90	-2.14

The negative values of the responses to selection for both flowering and maturity are considered to be a good index for earlier populations in the future in which all families means of the three populations Sakha-1 × Giza-843, Sakha-1 × Giza-716 and Giza.843 × Triple-White got negative values of responses to flowering – 2.67, -6.82 and – 4.89% respectively, and they also got negative values of responses to maturity – 1.25, - 3.90 and – 2.14%, respectively. The population Sakha-1 × Giza-716 was the earliest matured family that matured after 141.7 days about a week earlier than bulk plants of the same population. The results are in agreement with those of Mahmoud (1968), El-Hosary (1981), and Khalil *et al* (1982).

Plant height and number of branches

The results in Table (7) showed two non-significant positive responses to selection for plant height from the five selected families of Sakha-1 × Giza-843 and Sakha-1 × Giza-716 while a negative significant response to selection (– 7.59%) was attained from the five selected families of Giza.843 × Triple-White population. Plant height of the selected F_5 families varied considerably among the 3 populations and ranged from 97.67 to 140.7 cm. The tallest plants (140 cm) and the shortest plants (97.67 cm) were found in the selected families of Giza.843 × Triple-White population from families 4 and 1, respectively. This result gives a wide range of choice to choose which type of plants needed to solve some environmental problems.

Number of branches/plant was significantly varied among the plants of the five families selected from the three populations studied and negative responses to selection were resulted from Sakha-1 × Giza-843 and Giza.843 × Triple-White populations with values of – 2.48% and – 5.94%,

Table 7. Means of plant height, number of branches, in 3 crosses of F_5 generation for 5 families selected, bulk and parents populations during 2009/2010 season.

Populations	Plant height			Number of branches		
Selected Families	S-1 × G-843	S-1 × G-716	G.843 × T.W	S-1 × G-843	S-1 × G-716	G.843 × T.W
1	118.7	117.0	97.67	3.85	3.58	2.92
2	117.7	129.7	137.3	3.75	2.27	2.42
3	117.6	127.3	140.3	2.60	2.48	2.08
4	124.0	130.0	140.7	2.73	3.17	2.73
5	137.3	134.3	120.3	2.83	3.07	3.28
Families mean	123.1	127.7	127.3	3.15	2.91	2.69
Bulk	120.7	127.3	137.7	3.23	2.57	2.86
P_1	142.3	142.3	121.0	3.33	3.50	2.00
P_2	147.7	138.3	147.7	3.03	3.23	3.03
LSD 0.05	ns	ns	26.4	0.40	0.40	0.34
Response %	2.01	0.28	-7.59	-2.48	13.23	-5.94

respectively. However, the population Sakha-1 × Giza-716 attained a highly significant positive value (13.23%) of response to selection for branches/plant. Number of branches per plant ranged from 2.08 to 3.85 branches for family 3 of Giza.843 × Triple-White and family 1 of Sakha-1 × Giza-843 population, respectively. These results are in agreement with those of Mahmoud (1968), El-Hosary (1981 and 1982), and Khalil *et al.* (1982).

Number of pods and number of seeds/plant:

The results presented in Table (8) revealed the mean values of number of pods/plant and the population Giza.843 × Triple-White showed significant negative response to selection which attained – 6.73% while Sakha-1 × Giza-716 population attained a non-significant positive value of 0.04% of response to selection from the comparison between the mean of five families selected and the bulk. The highest numbers of pods/plant from F_5 selected families were detected to the family 1 of Sakha-1 × Giza-843 and family 5 of Giza.843 × Triple White with values of 30.7 and 30.23 pods, respectively.

A negative significant response to selection was obtained for number of seeds/plant from the population Giza-843 × Triple-White (– 2.85%) while both Sakha-1 × Giza-843 and Sakha-1 × Giza-716 populations attained positive non-significant responses. Number of seeds/plant varied considerably among the selected plants of F_5 families of the 3 populations that ranged from 58.13 to 84.53 seeds. The highest number of seeds/plant was resulted from the family 5 with 84.53 seeds/plant of the population Giza-843 × Triple-White which involved the genotype Triple-White with its property of independent vascular supply. The obtained results of number of

Table 8.Means of number of pods and seeds/plant in 3 crosses of F_5 generation for 5 families selected, bulk and parents populationsduring 2009/2010 season.

Populations	Number of pods/plant			Number of seeds/plant		
Selected Families	S-1 × G-843	S-1 × G-716	G.843 × T.W	S-1 × G-843	S-1 × G-716	G.843 × T.W
1	30.70	27.30	28.50	77.63	72.40	69.80
2	27.57	22.23	25.50	71.20	69.57	70.73
3	20.83	23.23	20.70	64.13	58.75	58.13
4	22.73	27.30	22.50	67.77	74.86	73.50
5	22.53	23.47	30.23	71.87	67.16	84.53
Families mean	24.87	24.71	25.49	70.52	68.55	71.34
Bulk	25.13	24.70	27.33	70.23	68.10	73.43
P_1	21.53	24.23	34.60	62.43	69.33	87.50
P_2	23.17	17.83	23.17	63.36	49.67	63.37
LSD 0.05	ns	ns	2.64	ns	ns	2.16
Response %	-1.03	0.04	-6.73	0.41	0.66	-2.85

pods and seeds/plant are in agreement with those of Mahmoud (1968), El-Hosary (1981 and 1982). and Khalil and Nassib (1982).

Seed yield per plant and weight of 100 seeds

The results shown in Table (9) reveal the mean values of seed yield per plant and showed a negative significant response to selection in Giza.843 × Triple-White population (- 4.03%) while the population Sakha-1 × Giza-716 attained a positive non-significant response to selection for seed yield per plant. Seed yield per plant varied considerably among the selected F_5 families of the 3 populations that ranged from 52.98 to 80.56 g indicating a wide range of variations between families. The highest seed yield/plant was also resulted from the family 5 with 80.56 grams of seeds/plant of the population Giza-843 × Triple-White that attained the highest number of seeds/plant.

As to the seed index, positive non-significant responses to selection were obtained from Sakha-1 × Giza-716 and Sakha-1 × Giza-843 populations. On the other hand, a negative non-significant response to selection was obtained from population Giza.843 × Triple-White. Seed indexof the selected F_5 families did not varied considerably among the 3 populations that ranged from 82.63 to 97.03 g of the medium seed size. The results are in agreement with those of Mahmoud (1968), El-Hosary (1981 and 1982), and Khalil and Nassib (1982). The results obtained made it possible to achieve the target of this work of developing, through selection, faba bean genotypes of high seed yield with good levels of earliness.

Table 9.Means of seed yield/plant and weight of 100 seeds in 3 crosses of F_5 generation for 5 families selected, bulk and parents populationsduring 2009/2010 season.

Populations	Weight of seeds/plan			Seed index		
Selected Families	S-1 × G-843	S-1 × G-716	G.843 × T.W	S-1 × G-843	S-1 × G-716	G.843 × T.W
1	71.95	66.64	73.32	90.67	92.17	90.77
2	68.77	64.29	71.69	95.07	92.60	87.47
3	60.40	57.02	62.98	95.83	97.03	91.13
4	62.31	65.47	69.75	91.63	87.43	94.93
5	59.37	60.53	60.56	82.63	90.27	93.00
Families mean	64.56	62.79	65.66	91.17	91.90	91.46
Bulk	64.92	62.57	68.42	89.93	91.87	93.17
P_1	57.90	60.63	65.20	91.67	87.37	51.63
P_2	60.10	43.00	60.10	89.70	86.57	89.70
LSD 0.05	ns	ns	2.52	ns	ns	ns
Response %	-0.55	0.35	-4.03	1.38	0.03	-1.84

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اداء جيلين متقدمين من الفول البلدي للتبكير والإنتجية العالية

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أجرى هذا البحث فى المزرعة البحثية لمحطة البحوث الزراعية بملوي, محافظة المنيا مصر الوسطى خلال الموسمين الشتويين المتتاليين 2008/2009 و 2009/2010 لدراسة فاعليةالإنتخاب في الجيلين الرابع والخامس لثلاثة عشائرمن الفول البلدي تحت ظروف مصر الوسطى كانت آباء هذه العشائر هي الاربعه طرز من الفول البلدي لتمثل مستويات مختلفة من التبكير و الإنتاجية العالية وهي Sakha-1Giza-716, Giza-843. و Triple-White الطراز الوراثي الأبكر في هذه الدراسة وهجنت الآباء الأربعة فيما بينها للحصول على أفضل التراكيب الوراثية منها التبكير و الإنتاجية العالية. تم حساب متوسطات اداء الآباء ونسلها في موسم الإنتخاب الاول لنباتات الجيل الرابع لصفتي التبكير و الإنتاجية لعالية الممثلين في عدد الأيام من الزراعة حتى نضج 95% من النباتات ووزن بذور النبات الفردي من العشائر الثلاثة المنتخبة (Giza-843 × Sakha-1 و Sakha-1 × Giza-716 و Giza.843 × Triple-White) وكانت النتائج المتحصل عليها بصفة عامة مشجعة للإستمرار في برنامج التربية لتحقيق الهدف المرجو وهو تأكيد ثبات صفات التبكير و الإنتاجية العالية. انتخب خمسة عائلات من كل عشيرة من العشائر الثلاثة المنتخبة وأوضحت لنتائج تفوق العائلات المنتخبة من عشيرة (Sakha-1 × Giza-716) وكانت العشيرة رقم 4 منها هي الأبكر نضجاً حيث وصلت الى النضج بعد 141.7 يوم وكانت أبكر من متوسط العشيرة بحوالي أسبوع. كانت نباتات العائلة رقم 4 من العشيرة (Giza.843 × Triple-White) أطول النباتات في حين أن نباتات العائلة رقم 1 من نفس العشيرة كانت أقصر النبات وحققت العائلة رقم 1 للعشيرة Sakha-1 × Giza-843 أكثر النباتات فروعاً . نتج اعلى عدد من القرون من نباتات العشيرتين Giza.843 × Triple-White و Sakha-1 × Giza-843 . نباتات العشيرة (Giza.843 × Triple-White) التي تضمنت للصنف Triple-White الذي يحمل طفرة الإمداد الوعائي المستقل, حيث تستخدم هذه الطفرة للتغلب على ظاهرة سقوط عدد كبير من الأزهار والقرون الصغيرة في الفول البلدي لوجود قنوات توصيل منفردة و مستقلة لأزهار العنقود الزهري على نبات الفول البلدي الحمل لهذه الطفرة مما يحقق زيادة في أعداد القرون والبذور له. تضمنت العائلة رقم 5 منها التي حققت نباتاتها أعلى عدد من البذور (84.53 بذرة) بأعلى وزن (56.80 جم من البذور) تفاريت العشائر فيما بينها في وزن 100 بذرة وقد حققت نتائج البحث الحصول على عائلات العشيرة Triple-White × Giza.843 التي جمعت بين التبكير والإنتاجية العالية.