

SAKHA 2, A NEW RELEASED FOLIAR DISEASE-RESISTANT FABA BEAN (*Vicia faba* L.) CULTIVAR

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ABSTRACT

In Egypt, almost 85% of the area cropped to faba bean is located in the Northern parts, where chocolate spot (*Botrytis fabae*) and rust (*Uromyces fabae*) diseases are prevailing. These foliar diseases severely attack the crop, causing remarkable yield losses particularly during wet seasons.

Significant progress has been made by the Legume Research Program, Field Crops Research Institute, ARC toward identifying sources of resistance and developing new high yielding genotypes that have improved levels of resistance to such dangerous diseases. As a result, a couple of foliar disease-resistant genotypes have been developed.

Accordingly, a series of advanced yield trials were conducted both at Sakha Research Station and on farmers' fields in North Delta region, to evaluate some of those new developing disease resistant genotypes regarding disease reaction and yield potential during 1995/96 through 1999/2000 seasons. One out of those genotypes, i.e. X952/1265 was found to be superior to the others in both productivity and level of resistance to chocolate spot and rust diseases.

Consequently, this genotype was promoted for further evaluation in pilot plots both at Sakha farm in 2000/2001 season and on farmers' fields in Kafr El-Shiekh governorate in 2001/2002 season. Yield increases resulting from X952/1265 genotype over Giza 461 (local check) and farmers' cultivars were 11.6 and 17%, respectively, besides it matured ten days earlier than Giza 461 cultivar. Recently X952/1265 genotype has been released as "Sakha 2", a new high yielding disease resistant faba bean cultivar. Seed of this new cultivar will be available to farmers of North Egypt in 2003/2004 season.

INTRODUCTION

Food Legumes have a great role in human nutrition as a major source of protein and they are considered an important component of farming systems. In Egypt, faba bean (*Vicia faba* L.) is the most important legume that has the potential to meet the increasing demand for food. The area cropped to faba bean reached 303,000 feddans in 2001/2002 season with an average yield of 8.5 ardeb/fed.

Almost 85% of the total faba bean acreage is located in the Northern parts of Egypt where chocolate spot (*Botrytis fabae*) and rust (*Uromyces fabae*) diseases severely attack the crop causing remarkable yield losses. Ibrahim *et al.* (1979) reported that up to 50% loss in yield caused by chocolate spot and rust diseases. Mohamed (1980) found that natural infection with leaf spots, rust and downy mildew caused yield losses ranging from 22 to 56 with an average of 39.7%. Mahmoud (1996) and Amer *et al.* (2002) reported that

seed yield of susceptible faba bean cultivars was inferior to that of resistant ones under natural infection with foliar diseases at Sakha, Kafr El-Sheikh.

During the last decade, significant progress has been made to identify sources of resistance and developing high yielding cultivars with improved levels of resistance to foliar diseases. Khalil *et al.* (1984) and Amer (1986) detected varietal differences for chocolate spot and rust resistance in faba bean. Also, Khalil *et al.* (1994) stated that a couple of faba bean breeding lines derived from the Giza 3 x ILB938 cross, from which Giza 461 cultivar was released, were less infected with foliar diseases. Moreover, the Legume Research Program has been successful in releasing some faba bean genotypes that have both resistance to foliar diseases and high yield potential (Khalil *et al.*, 1995). In this connection, Amer *et al.* (2001) reported that the new released cultivar Sakha 1 was markedly resistant to chocolate spot and rust diseases and outyielded the check cultivar Giza 461 by 17 % (average of five seasons). Therefore, the present investigation was designed to evaluate some of the faba bean genotypes that have been developed by the Legume Research Program, ARC for their yield potential and level of resistance to chocolate spot and rust diseases.

MATERIALS AND METHODS

In 1995/96, an advanced yield trial was carried out at Sakha Agricultural Research Station, Kafr El-Shiekh governorate to determine yield potential and level of resistance to chocolate spot and rust diseases for X952/1265, X952/1281 and X957 genotypes comparing with two check cultivars Giza 461 and Giza 716. The five entries were arranged in a complete block design with four replications. Each plot contains 12 ridges 7 meters long and 60 cm apart. Seed yield was estimated from the 10 middle ridges of each plot and transformed to ardabs per feddan (1 ardab = 155 kg and 1 feddan = 4200 m²). In light of the results obtained, an on farm research managed trial was conducted at each of Behiera, Kafr El-Shiekh and Dakahlia governorates during 1996/97, 1997/98, 1998/99 and 1999/2000 seasons to evaluate the promising genotype X952/1265 comparing with four new breeding lines and the recommended cultivar Giza 461 in a randomized complete block design with four replications. The harvested plot size was 42 m² (1/100 feddan) from which seed yield (ardab/feddan) was determined. All cultural practices were done as recommended. Reactions to chocolate spot and rust diseases were recorded according to Bernier *et al.* (1984). Data obtained were statistically analyzed according to Snedecor and Cochran (1971). At the last stage, in 2000/2001 season, the promising line X952/1265 was evaluated in two pilot plots one feddan each, at Sakha farm comparing with a resistant check, i.e. Giza 461 and a susceptible check to foliar diseases, i.e. G.429. In 2001/2002 season, 14 demonstration plots were carried out on farmers' fields in Kafr El-Shiekh governorate, two small plots of 42 m² were harvested from each demonstration plot and from adjacent farmer's fields to determine seed yield per feddan.

RESULTS AND DISCUSSION

I- Seed yield/feddan:

Results of the genotype evaluation experiment conducted at Sakha in 1995/96 revealed that the promising genotype X952/1265 exceeded the check cultivar Giza 461 in seed yield per feddan by 35.9% (Table 1). Data of eleven on-farm researcher managed trials conducted at the three main faba bean producing governorates in North Delta region (Behiera, Kafr El-Shiekh and Dakahlia) are presented in (Table 2). The combined data showed that yield increases obtained from the new promising genotype X952/1265 compared with the local check Giza 461 were 5.8, 15.4 and 3.9 in 1996/97, 1997/98 and 1999/2000 seasons, respectively. The average increase in seed yield per feddan over five seasons reached 11.6% for the new genotype X952/1265 compared with the check cultivar Giza 461. These results agreed with those obtained by Amer *et al.*, 2002, who stated that the new released foliar disease resistant cultivar Sakha 1 outyielded the check cultivar Giza 461 by 17%. Yield data of the pilot plots of the new genotype X952/1265 conducted at Sakha farm comparing to the resistant check Giza 461 and the susceptible one G.429 (Table 3) indicated that X952/1265 genotype surpassed the two check cultivars by 8.5% and 35.3%, respectively. Also, yield data of 14 demonstration plots carried out at Kafr El-Shiekh governorate in 2001/2002 season showed that X952/1265 genotype exceeded farmers' cultivars, on average, by 1.78 ardab/feddan (17%), Table 4.

Table 1: Seed yield, susceptibility to foliar diseases and maturity of some faba bean genotypes grown at Sakha, 1995/96 season.

Genotype	Seed yield		Susceptibility to diseases **		Days to maturity
	(Ardab/ fed)	Relative yield (%)*	Chocolate spot	Rust	
Giza 461	9.87	100.0	1.25	1.00	170
Giza 716	12.59	127.6	1.50	1.00	155
X952/1265	13.41	135.9	1.23	1.00	160
/1281	12.79	129.6	1.33	1.00	165
X957	12.97	131.4	1.33	1.00	145
LSD _{0.05}	1.01	--	Ns	Ns	--

* Relative yield was computed for each genotype as a percentage from the check cultivar Giza 461

** Chocolate spot scale 1-9, 1= highly resistant 9= highly susceptible
Rust scale 1-5, 1= highly resistant 5= highly susceptible

II- Reaction to chocolate spot and rust diseases:

Average reaction to chocolate spot (*B. fabae*) and rust (*U. fabae*) diseases measured under field conditions of Sakha and the three governorates of North Delta region in 1995/96 through 2000/2001 was given in Tables 1,2 and 3. In 1998/99 and 1999/2000 seasons the infection level with both diseases was too mild to record (Table 2).

Table 2: Seed yield, susceptibility to foliar diseases and maturity of some faba bean genotypes in North Delta region during 1996/97, 1997/98, 1998/99 and 1999/2000 seasons.

Genotype	Seed yield (ardab/fed)			Combined yield		Combined disease reaction		Days to maturity
	Behiera	Kafr El-Shiekh	Dakahlia	Ardab feddan	Relative (%)	Chocolate spot	Rust	
1996/97 season								
Giza 461	10.30	9.59	11.19	10.36	100.0	4.67	2.0	171
X952/1265	11.06	9.79	12.04	10.96	105.8	3.67	2.0	166
X952/1281	11.58	9.38	13.04	11.33	109.4	3.67	2.0	165
X957	10.33	9.78	13.79	11.30	109.1	3.33	2.0	151
X1001	10.96	10.22	12.70	11.29	109.0	3.67	2.0	168
X &Sk	10.75	11.19	11.30	11.08	106.9	3.67	2.2	170
LSD _{0.05}	0.90	0.82	0.82	Ns	--	1.13	Ns	--
1997/98 season								
Giza 461	8.64	9.76	11.25	9.88	100.0	3.76	3.48	162
X952/1265	9.47	10.99	13.75	11.40	115.4	3.00	3.11	150
X952/1281	9.12	10.83	14.91	11.62	117.6	3.30	3.48	151
X957	10.62	11.26	15.78	12.55	127.0	3.30	3.00	140
X1001	10.24	10.89	13.24	11.46	116.0	3.78	3.48	160
X &Sk	10.63	11.44	8.75	10.27	103.9	3.78	4.22	160
LSD _{0.05}	Ns	1.59	2.33	2.53	-	Ns	1.00	--
1998/99 season								
Giza 461	8.88	--	7.48	8.18	100.0	--	--	167
X952/1265	7.84	--	8.05	7.94	97.1	--	--	152
X952/1281	8.91	--	8.99	8.95	109.4	--	--	142
X957	7.47	--	6.40	6.93	84.7	--	--	161
X1001	7.73	--	6.86	7.29	89.1	--	--	162
X &Sk	7.55	--	6.72	7.13	87.2	--	--	160
LSD _{0.05}	1.35	--	1.29	0.79	--	--	--	--
1999/2000								
Giza 461	11.34	13.38	11.85	12.19	100.0	--	--	--
X952/1265	12.08	13.21	12.70	12.66	103.9	--	--	--
X952/1281	13.71	14.06	13.26	13.68	112.2	--	--	--
X957	11.18	12.08	12.42	11.89	97.5	--	--	--
X1001	8.17	13.89	11.24	11.10	91.1	--	--	--
X &Sk	10.37	13.21	12.69	12.09	99.2	--	--	--
LSD _{0.05}	1.68	1.08	0.96	0.69	--	--	--	--

Table 3. Seed yield and reaction to foliar diseases of the demonstrated X952/1265 genotype compared to the resistant check 'Giza 461' and the susceptible one Giza 429' in 2000/2001.

Genotype	Seed yield (ardab/feddan)	Disease reaction	
		Chocolate spot	Rust
X952/1265	11.5	2.0	1.5
Giza 461	10.6	2.0	2.0
Giza 429	8.5	4.0	4.0

Table 4. Seed yield of the demonstrated genotype 'X952/1265' compared to farmers' cultivars in 2001/2002 season.

Governorate	Demonstration plot (No)	Seed yield (ardab/feddan)		Yield increase	
		X952/1265	Farmers' cv.	Ardab/fed.	%
Kafr El-Shiekh	14	12.28	10.50	1.78	17

The X952/1265 new genotype recorded slightly lower infection rate with foliar diseases than the resistant check Giza 461. These findings are in accordance with those reported by Amer *et al.* (2002). Also, Khalil *et al.*, (1994) reported that Giza 461 cultivar was less infected with foliar diseases.

III- Days to maturity:

Data presented in Tables 1 and 2 indicate that although days to maturity differed from season to another for a given genotype, the new promising genotype X952/1265 reached maturity 10 days earlier than the check cultivar Giza 461 (average of five tested seasons).

Recently according to the above mentioned results, X 952/1265 genotype (Reina Blanca x Giza 461) has been released as Sakha 2, a new high yielding foliar disease resistant cultivar. Seed of this new cultivar will be available to farmers of North Egypt in 2003/2004 season.

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سحا ٢-صنف جديد من الفول البلدى مقاوم للأمراض الورقية

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تبلغ المساحة المنزرعة بالفول البلدى بمحافظة الوجه البحرى نحو ٨٥ % من جملة المساحة المنزرعة بهذا المحصول فى مصر، حيث تنتشر أمراض المجموع الخضرى واهمها التبقع البنى والصدأ التى تشد خطورتها فى المواسم التى تتوافر فيها الرطوبة مسببة خسائر كبيرة فى المحصول تصل إلى نحو ٥٠ % . لذا فقد تركزت الجهود البحثية بهدف تعريف مصادر مقاومة لهذين المرضين بغية استنباط أصناف عالية الإنتاج مقاومة لهما للنهوض بالإنتاجية. ولما كانت السلالة ١٢٦٥/٩٥٢ تعتبر من السلالات المباشرة من ناحية المقاومة للأمراض والمحصول فقد تم تقييمها فى سلسلة من التجارب البحثية فى حقل التجارب بمحطة البحوث الزراعية بسحا خلال موسم ١٩٩٦/١٩٩٥ وكذا فى حقول المزارعين بثلاث محافظات بالوجه البحرى وهى البحيرة وكفر الشيخ والدقهلية فى مواسم ١٩٩٧/١٩٩٦، ١٩٩٧/١٩٩٧، ١٩٩٨/١٩٩٨، ٢٠٠٠/١٩٩٩، واختتم التقييم بحقلين إرشاديين فى مزرعة محطة بحوث سحا موسم ٢٠٠١/٢٠٠٠ وعدد ١٤ حقل إرشادى فى محافظة كفر الشيخ موسم ٢٠٠١/٢٠٠٠ مقارنة بصنف المنطقة وأصناف المزارعين.

وقد دلت النتائج أن تلك السلالة أعطت محصولا من البذور يزيد بمقدار ١١,٦ % كمتوسط للخمسة مواسم التى أقيمت فيها الاختبارات النهائية مقارنة بالصنف جيزة ٤٦١ فى حين أعطت زيادة تقدر بنحو ١٧ % مقارنة بأصناف المزارعين المجاورة للحقول الإرشادية كما أظهرت مقاومة للأمراض الورقية أعلى من الصنف المقاوم جيزة ٤٦١ (صنف المنطقة) كما كانت أكبر فى النضج بنحو عشرة أيام عن هذا الصنف جيزة ٤٦١. وعلى ضوء هذه النتائج فقد تم تسجيل هذه السلالة كصنف جديد تحت اسم سحا ٢ الذى يمتاز بالتبكير فى النضج والمحصول العالى والمقاومة للأمراض الورقية مقارنة بصنف المنطقة جيزة ٤٦١. وستوفر تقاوى هذا الصنف الجديد لمزارعى الوجه البحرى فى موسم ٢٠٠٣/٢٠٠٤.