Evaluation of some rice quantitative characters and blast resistance under different nitrogen fertilizer levels in some promising lines.

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ABSTRACT

The main objectives of breeding program produced promising lines with high grain yield, resistant to blast and grain quality. Rice blast caused by *Pyricularia oryzae* cav is the most important rice diseases in Egypt and could cause a significant yield reduction. The present research was carried out at the farm of Rice Research and Training Center (RRTC), Sakha, Kafr EL-Sheikh, Egypt, during eight successive seasons from 2003 to 2010. Three crosses of rice; (Giza 177× HR 5824-B-3-2-3) cross1, (Sakha101 × HR 5824-B-3-2-3) cross 2, (GZ 5310-20-3-3 × Sakha101) cross 3 were evaluated in 2005. From cross 1 the expected ratio 15:1 chi-square x^2 value 0.48 with probability value 0.5 to 0.75 indicated that the presence of two pairs of complementary dominance resistance genes for blast resistance. From BC1 and BC2 the expected ratio was 3:1 indicated the presence of one pair of dominance resistance gene controlling blast resistance. From cross 2 the same trend for F2, BC1 and BC2 generations for expected ratio and dominance resistance genes. For cross 3 the expected ratio in F2, BC1 and BC2 were 1:3 and 3:13 respectively indicated the presence of different pairs of resistance genes controlling blast resistance. In 2008, 12 lines were evaluated under field conditions for some agronomic traits and blast reaction under blast nursery test and artificial inoculation with different races in greenhouse. The best promising line was PL-4-4 out from cross 1, gave the short stature 97 cm, early maturing 121 day, high yielding 10.14 t/ha, resistant to blast and good grain quality. From cross 2 the best elite was SP-5-70 which gave plant height 96 cm, late duration 140 day, high yielding more than 12

t/ha, high 1000-grain weight, good grain quality and resistant to blast disease. BY-6-20 derived from cross 3 was excellent promising line for some yield components and blast reaction. For blast resistance under different locations and artificial inoculation in greenhouse, Giza177 and GZ 5310-20-3-3 highly resistant but Sakha101 and HR 5824-B-3-2-3 were susceptible to rice blast at seedling and adult stages. In cross 1 exhibited a wide range of resistance for blast under different stages in various locations. The best line PL-4-4 was highly resistant to blast under field conditions at both seedling and adult stages. also under artificial inoculation with specific races at seedling stage. The cross 2 exhibited the most susceptible derived lines to blast under all conditions, but the best line was SP-6-70, highly resistant. For cross 3, the line BY-6-20 was highly resistant to blast under field and greenhouse conditions. Finally, in 2009 and 2010 seasons the best lines were evaluated under different nitrogen levels i.e., 0, 55, 110 and 165 Kg N/ha in split plot design for growth yield and some its components. Three promising lines; PL-4-4, SP-6-70 and BY-6-20 in addition to Sakha101 as a commercial check variety under four N levels. Significant differences were detected among the three promising lines and Sakha101 in growth, grain yield and its components in the two seasons. Sakha101 and promising lines; BY-6-20 and SP-6-70 were superior in LAI, Flag leaf area, No. of panicles/m^2, No. of filled grains/panicle and grain yield t/ha., While, BY-6-20 gave the heavier 1000-grain weight and panicle weight. Increasing nitrogen levels significantly improved growth, yield and its components. Each unit increase in nitrogen levels led to a significant increase in all these traits. The interaction between promising lines and nitrogen levels significantly affected LAI, flag leaf area, panicle number/m^2 and grain yield. Both the promising lines BY-6-20 and SP-6-70 recorded high grain yield and can be recommended with package of improved management practices for general cultivation. The promising lines BY-6-20 and SP-6-70 was superior in terms of rough rice yield at higher N levels. Its is extremely important to note that BY-6-20 and SP-6-70 matures approximately 10 days earlier than Sakha101.

Keywords: Rice, Mean performance, promising lines, Blast, *Pyricularia oryzae*, Nitrogen levels.

INTRODUCTION

Rice (Oryza sativa L.) is one of the agronomic ally and nutritionally important cereal crops. It is a major source of food for more than 2.7 billion people on a daily basis and is planted on about one-tenth of the earth's arable land. Besides its economic significance, it is rich in genetic diversity in the form of thousands of land races and progenitor species **(Nagaraju et al., 2002)**. Despite its importance, a series of biotic and a biotic stresses limits its productivity worldwide. Variety Giza 177 is the first developed in 1994 as early maturity, high yielding variety and resistant to blast until now, **Aidy et al., (2004)**. Sakha101 released in 1997 as high yielding, moderately maturing and blast-resistant variety but broken down in 2002. Both varieties were developed by Rice Research and Training Center (RRTC) Sakha, Kafr EL-Seikh, Egypt. HR 5824-B-3-2-3 produced by IRRI, International Rice Research Institute (Philippines), japonica type, very early variety, dwarf and shortness, high protein content and susceptible to blast under Egyptian conditions. GZ 5310-20-3-3 was Egyptian promising line developed in 2002 resistant to blast, moderate yield and grain quality.

Blast disease is considered as a major constraint for maximum yield production because of its high level of variability and quick spread in case of susceptible cultivars. Blast resistance has consistently been one of the most important objectives of rice breeders in Egypt. Breeding of disease resistance varieties probably is the most cost-effective and reliable method of disease management. In some instances, resistant varieties have provided effective and durable disease control but in the case of rice blast and many other important field crop diseases, success is short-lived or not easily achieved and the resistance of these cultivars breaks down in few years after release **(Marchetti and Bomman 1989 and Veillet *et al.*, 1996).**

The rice blast fungus *Pyricularia oryzae* cav., has a wide range of variability, Causes of resistance breakage are generally attributed to the capacity of the fungus to rapidly developed new pathotypes. The fungal genome is able to change, so that new recombinants or mutants can rapidly increase in frequency in the population and overcome the resistance genes present in new cultivars. The rice blast fungus is one of the highly variable genomes and consists of many physiological races, which differ in their ability to infect rice varieties **(Ou and Ayad 1968; Latterell, 1975; Bonmman *et al.*, 1987 and Zhou, 2001).** Developing blast resistant genotype has been one of the major goals in rice breeding but the resistance breaks down because of the emergence of new virulent races **(Ou, 1985).** In Egypt, this fungus recorded a breakdown for 8 cultivars during 1964-2010. As a result of high race shifting and big change in prevalence of specific races cultivar Sakha 101 was broken down in some locations and this cultivar was completely susceptible in 2005 up to 2007 seasons due to appearance of specific virulent races IG-1. The race shifting was coupled with the extension of the cultivated areas of those cultivars Sakha101 and Sakha104, whereas , these races were appeared when the cultivated area by both cultivars covered 75% of the total **EL-Shafey, (2002) and Sehly *et al.*, (2008)**. As a result of massive and wide range of variability of blast fungus, it must make a huge changes in genetic background of promising lines to induce cultivar diversity. To create a wide range of diversity in resistance to blast disease, it must use in crosses new resources of resistance cultivars, which have new resistance genes. Giza 177 was a good resource for blast resistance, whereas, it was still resistant from the year of release until now (1995-2011) under different tests for blast, **El-Refaee *et al.*, (2011)**. Broad-spectrum durable resistance against multiple rice blast pathogen populations is one of the major objectives of rice breeding programs to contain the damage caused by the rice blast fungus, **Wang *et al.*, 1994**. Resistance controlled by single genes sometimes remains effective for many years, but this is typically not durable. Because durability of resistance is essentially unpredictable, the best way to examine its mechanism is probably to examine a cultivar or genotype that has remained resistant to a highly variable pathogen for a long period. Durable resistance to *M. grisea* is also conferred by both major and minor genes **(Bonman *et al.*, 1992 and Wang *et al.*, 1994)**. In Egypt, breeding programs for blast resistance have developed numerous resistant cultivars but according to breakdown of Sakha 101, backcross-breeding strategy was used to improve and broaden their resistance and genetic background. The backcross-breeding strategy can be used to solve the breakdown problem and introgression new resistance genes **Suh *et al.*, 2009**.

Nitrogen is an essential fertilizer element to the growth and production of rice plant. Nitrogen is a constitute of all protein and non-protein components in rice. It is associated with green color of leaves, photosynthetic activity, and vegetative growth and regulates rice productivity. Nitrogen normally limits rice production because crop remove large amount of nitrogen and also, it is easily lost from soil (**Prasad., 1996**) . **Abd El-Wahab (1990)** reported that growth characters were significantly increased as nitrogen level increases up to 150 kg N/ha. Also, found that N increased grain yield and yield components. **Yadav et al.(2002) , Gautam. (2004) and Zayed *et al.* (2005**b) and **Gorgy (2010)** stated that increasing nitrogen level up to 165 or 225 kg N ha^{-1} significantly increased rice growth ;LAI , dry matter plant height ,number of tillers $plant^{-1}$ and panicle length .However , **Gorgy (2010)** clarified that continuous increase in nitrogen level significantly delayed heading date of rice crop . Increasing nitrogen rate pronounced raised the main yield components of rice;

panicle numbers plant^{-1} ,grains panicle $^{-1}$, panicle weight , 1000 -grain weight ,grain and straw yields and harvest index (**Balasubramanian .,2002 , Singh., 2002 , Meena et al., 2003 , Shivay and Singh., 2003 , Gautam., 2004 , Zayed et al., 2005b and Gorgy et al., 2011) . Meena *et al.* (2002) and Shivay and Singh.(2003)** stated that increasing nitrogen uptake with increasing nitrogen rate , while the nitrogen use efficiencies showed the opposite trend . **Subbiah *et al.* (2001)** found that ProAgro 6201 recorded higher growth ,yield attributes and yield with adding 200 kg n ha^{-1} ,while in DRRH1 and ADHR2 hybrids, increase nitrogen level over 150 kg N ha $^{-1}$ didn't increase grain yield significantly. **Gorgy (2010)**, found that the interaction between rice varieties and various grain yield and its components. The main objective of this study is to develop new promising lines with high sustainable grain yield, early maturing, high grain quality and resistant to blast disease as standby for Sakha101 and Giza 177 in the future and to determine the optimum nitrogen level for the derived promising lines before their release.

MATERIALS AND METHODS

1- Field experiment: -

The present research was carried out at the Farm of Rice Research and Training Center (RRTC), Sakha, Kafr EL-Sheikh, Egypt, during eight successive seasons from 2003 to 2010. Four parents; Giza 177, Sakha101, HR 5824-B-3-2-3 and GZ 5310-20-3-3 were used to establish the experimental materials which used in this study. In 2003 and 2004 the four rice parents were grown in two successive sowing dates at fifteen-day intervals to overcome the differences or variability in flowering time of these parents. Single seedling of each parent was transplanted 30 days after sowing in the permanent field, each in five rows. Each row was five meters long and contained 25 hills. The experiment was designed in a randomized complete block design with three replications in 2005. Each replicate comprised 20 rows of F_2 and 10 rows of Bc_1, Bc_2, F_1 and parents and each row was five meters long and contained 25 hills. In 2005, six population parents were evaluated as F_1, F_2, Bc_1 and Bc_2 generations of the four crosses. The experiment was designed in a randomize complete block design with three replications. Each replicate comprised 2o rows of F_2 and 15 of Bc_1, Bc_2, F_1 and parents, and each row was five meters long and contained 25 hills. From each replicate seventy-five plants were randomly collected from P_1, P_2, F1 and 150 plants from Bc_1 and Bc_2, and 500 plants from F_2 populations were used by chi-square x^2 test was computed as follows:

$$x^2 = \frac{(O_1-E_1)^2}{E_1} + \frac{(O_2-E_2)^2}{E_2}$$

Where: O_1 and O_2 are the observed values, and E_1 and E_2 are the expected values **(Gomez and Gomez, 1976)**.

. From 2006 to 2008, the best plants were selected according to the objectives of the breeding program. The best plants were selected from F_2, Bc_1 and Bc_2 in 2008, all families; two families were selected from F_2 and Bc_2 generation, in cross-1. Three superior families were selected from cross-2 derived from Bc_1 and one family from Bc_2. In cross-3, two best families were selected from Bc_1 and Bc_2 generation. In 2008, Some agronomic traits, i.e. Blast reaction, plant height, growth duration, flag leaf area, grain yield t/h, panicles number per plant, no. of spikelts/ panicle, 1000-grain weight, hulling, milling and head rice % were measured for all mentioned populations. In 2009 and 2010 evaluated leaf area index, flag leaf area, chlorophyll content, plant height, growth duration. Number of panicle/m2, no of filled grains/ panicle,1000-grain weight panicle weight and grain yield t/h. Three promising lines were selected and grown in the field; PL 4-4, SP

6-70 and BY-6-20, whereas PL 4-4 derived from cross-1 by BC2 generation (Giza177 × HR 5824-B-3-2-3 // HR 5824-B-3-2-3). The line SP-6-70 was out from cross-2 by BC2 (Sakha101 × HR 5824-B-3-2-3 // HR 5824-B-3-2-3) and last one was BY-6-20 from BC2 generation (GZ 5310-20-3-3 × Sakha101 // GZ 5310-20-3-3), Tables 1& 2 clarify the names, pedigree and origin of parental cultivars and scheme of this study. These lines in addition to Sakha101 were evaluated under different nitrogen levels. These data for all characters were collected according to standard evaluation system, **(IRRI 1996)**.

Table (1): The names, pedigree and origin of parental cultivars

No.	Entry	Pedigree	Origin
1	Sakha 101	Giza 176/Milyang 79	Egypt
2	GZ5310-20-3-3	GZ3707-4-2-2/GZ4069-71-1	Egypt
3	GIZA177	Giza 171/ Yumj No. 1// Pi No. 4	Egypt
4	HR 5824-B-3-2-3	Akiyudaka/suweon 310	IRRI

* IRRI = International Rice Research Institute (Philippines)

Table (2): The scheme of this study

No.	Year	Process
	2003	Crosses among 4 parents
2	2004	Crossing and make backcross
3	2005	Evaluated six populations
4	2006-2007	Selected best lines
5	2008	Selected 12 lines from three crosses
6	2009-2010	Evaluated 3 promising lines under N levels

2- Evaluation of blast resistance:

All varieties at advance generations were tested for blast disease infection under three conditions as follows:

a- Blast nursery test (seedling stage under natural infection):

Promising lines and their parents were evaluated under field conditions at three locations i.e. Sakha, Gemmiza and Zarzoura for blast resistance at seedling stage with natural infection at blast nursery test. Seedbeds were prepared during the first week of July in each season. Five rows of Giza 159 (blast spreader) were sown, then five of the considered varieties, and again one row of the spreader, with 15 cm apart. Another five varieties were sown, followed by one row of the resistant check (Giza 181). The susceptible and resistant checks were sown alternatively, surrounding five of the considered varieties. The varieties were left exposed for natural blast infection at seedling stage. About forty-days from sowing, the typical blast lesions were scored, according to the standard evaluation system using 0-9 scale (IRRI 1996) as follows:

1-2 = resistant (R)

3 = moderately resistant (MR)

4-6 = susceptible (S)

7-9 = highly susceptible (HS)

b- Greenhouse test (seedling stage under artificial inoculation) at advanced generations:-

Seeds of each variety were seeded in plastic trays (30 x 20 x15 cm.). Each tray comprised, four parents i.e Four parents; Giza 177, Sakha101, HR 5824-B-3-2-3 and GZ 5310-20-3-3 and all derived lines in addition to susceptible check (Giza 159). The trays were kept in the greenhouse at 25-30°C, and fertilized with Urea 46.5%N (5 g/tray). Seedlings were ready for inoculation at 3-4-leaf stage, about 3-4 weeks after sowing. All mentioned varieties were inoculated with 4 rice blast isolates i.e. isolate no. (403) identified to race **IB-63** which isolated from cultivar Sakha101, each **IH-1**(405) and **IB-19** (407) from Sakha104, while **IH-1** (408) isolated from Sakha101.

Rice seedlings of about 20-days old, in the trays, were inoculated by spraying with spore suspension (100 ml) adjusted to 5 x 10^4 spores/ml. Each isolate was sprayed using electrical spray gun. The inoculated seedlings were held in a moist chamber with at least 90% R.H. and 25-28 °C for 24 hr, and then moved to the greenhouse. Seven days after inoculation, blast reaction was recorded according to the standard evaluation system using 0-9 scale (**IRRI 1996**).

c- Permanent field (adult stage under natural condition):-

Four parents; Giza 177, Sakha101, HR 5824-B-3-2-3 and GZ 5310-20-3-3 and their all derived promising lines were tested for blast reaction at adult stage in three locations i.e. Sakha, Gemmiza and Zarzora.

3- Evaluation of derived promising lines from Giza177 and Sakha101 under different nitrogen fertilizers levels:

Two field experiments were conducted at the farm of Sakha Agriculture Research Station, Rice Research and Training Center, Kafr El-Sheikh, during 2009 and 2010 summer seasons. The experiments aimed to evaluate three promising lines; PL-4-4, SP-6-70 and BY-6-20 in addition to Sakha101 as a commercial check variety under four N levels i.e., 0, 55, 110 and 165 Kg N/ha to develop and release of promising varieties with high yield potential, early maturity and highly resistant to blast. The experiment was laid out in split plot design with four replications. The main plots were occupied by four rice genotypes PL -4-4, SP-6-70, BY-6-20 and Sakha101. The sub plots were assigned to four nitrogen levels, viz; 0, 55, 110, and 165 Kg N/ ha in the form of Urea (46 % N). The nitrogen fertilizer was applied in two doses; two third basal and one third top dressed at 40 days after transplanting. The sowing date was May-5 in both seasons with seedling age of 30 days. The spacing was 20 × 20 cm apart. The rest of recommendation package had been followed according to Rice

Research and Training Center (RRTC). At heading stage 5 hills were taken and transferred to lab of RRTC to determine leaf area index (LAI), flag leaf area with leaf area meter (Model Lt3000 A) and chlorophyll content using chlorophyll meter (Model-SPAD-502). At harvest, plant height was estimated, number of panicles/hill (ten hills) and then computed to number/m^2 and ten panicles characters estimate (number of filled grains/panicle, panicle weight, 1000-grain weight. Six square meter of each plot were harvested, dried and threshed to estimate the grain yield based on 14% of moisture and converted into ton/ha. The obtained data were statistically analyzed according to **Gomez and Gomez 1984**.

All varieties at advance generations were tested for blast disease infection under three conditions as mentioned. .

RESULTS AND DISCUSSIONS

1- Chi-square x^2 test at early F2, BC1 and BC2 generations in 2005:

Number of selected plants, type of blast reaction, expected ratio and qui square of blast disease for three crosses (cross-1, 2 and 3) are presented in Table (3). Five hundred plants from F2 generation, 150 plants from BC1 and BC2 were tested for blast resistance of three crosses. From cross-1, 465 plants resistant and 35 were susceptible of F2 generation representing percentage of reaction type 93 and 7%, respectively with expected ratio 15:1, qui square 0.48 with probability value 0.50 to 0.75 indicated the presence of two complementary dominance resistance genes for blast resistance. From BC1, 150 plants were evaluated for blast (120 R and 30 S) with 80 % R and 20 % S. The expected ratio 3:1 and P-value 0.1 to 0.25 which indicated into the occurrence of only one pair of dominance resistance gene controlling the blast disease resistance. Concerning BC2 in the same cross-1 gave nearly same trend. From cross-2 (Sakha x HR5824) 500 plants from F2, 150 from BC1 and BC2 were tested for blast. The data show that in F2, 217 plants (R) and 283 (S) with percentage of reaction 43% R and 57 % S with expected ratio 7:9, qui square 0.025 and P-value 0.90-0.95 which indicated the presence of two complementary resistance genes. For BC1 and BC2 the same from 21 to 28 resistant plants and susceptible from 72 -79 plants with expected ratio 1:3 which indicated into presence of one pair recessive in BC1 and BC2 populations. Concerning cross-3 (Sakha101 × GZ 5310-20-3-3) the F2 generation exhibited that 144 plants (R) and 356 are susceptible with 28.8 % (R) and 71.2 % (S), expected ratio 1:3 and P-value 0.05 to 0.025 indicated that the presence of one pair recessive gene controlling in F2 generation. On the other hand, in BC1 differ than BC2 where the BC1 gave 57 blast-resistant plants and 92 (S) with 38 and 62 % with expected ratio 1:3 these refer to presence of one pair recessive gene but in BC2 the two pair recessive gene which gave 3:13 expected ratio it can be concluded that the dominance resistance genes were found in cross-1 for all generation F2 , BC1 and BC2. On the other hand, the recessive gene controlling in the cross-2 and cross-3 for F2, BC1 and BC2 generations the contradiction among three crosses may be due to the environments conditions, same results were found in **Hammoud, 2004; EL-Wahsh and Hammoud, 2007; Sedeek *et al.*, 2007 and Hammoud *et al.*, 2009**.

2- Field experiment at advanced generations in 2008 season:

Mean performance for quantitative characters of four parents (Giza177, Sakha101, HR 5824-B-3-2-3 and GZ 5310-20-3-3) and twelve promising lines derived from three crosses by backcross method, cross-1 (Giza177 × HR 5824-B-3-2-3), cross-2 (Sakha101 × HR 5824-B-3-2-3) and cross-3 (Sakha101 × GZ 5310-20-3-3) are presented in Table (4). All crosses were evaluated for twelve traits;

Blast reaction, plant height, duration, flag leaf area, grain yield t/h, panicles number per plant, no. of spikelts/ panicle, 1000-grain weight, hulling, milling and head rice %. Results showed a wide range of variation among all crosses in most tested traits. From cross-1, four promising lines were evaluated (two selected from F2 generation, PL-5-1 and PL-5-2) and two from BC2, PL-4-3 and PL-4-4). The best promising line was PL-4-4 where gave the short stature (97 cm), early maturing (121 day), high yielding (10.14 t/h), resistant to blast and superior for all other traits compared with their two parents (Giza177 and HR 5824-B-3-2-3).

Table (3): Number of plants, reaction types, expected ratio and qui square value in 2005 season.

Entry	No. of plants	Type of reaction			Total		%		Expected Ratio	X^2	P. value
		R	MR	S	R	S	R	S			
Cross 1 (Giza 177x HR5824)											
F2 (Giza 177× HR 5824)	500	390	75	35	465	35	93	7	15:1	0.48	0.50 - 0.75
BC_1 Giza 177(Giza 177× HR 5824)	150	80	40	30	120	30	80	20	3:1	2.00	0.10 – 0.25
BC_2 Giza 177(Giza 177× HR 5824)	150	67	40	43	107	43	71	29	3:1	1.067	0.25 – 0.50
Cross 2 (Sakha 101x HR5824)											
F2 (Sakha101× HR 5824)	500	112	105	283	217	283	43	57	7:9	0.025	0.90-0.95
BC_1 Sakha101(Sakha101× HR 5824)	150	26	16	108	42	108	28	72	1:3	0.720	0.25-0.50
BC_2 HR5824(HR5824× Sakha101)	150	22	9	119	31	119	21	79	1:3	1.506	0.25-0.10
Cross3 (Sakha101xGZ5310-20-3-3)											
F2 (Sakha101x GZ5310)	500	37	107	356	144	356	29	71	1:3	3.851	0.050-0.025
BC_1 Sakha101 (Sakha101× GZ5310)	150	41	16	77	57	93	38	62	7:9	2.016	0.10-0.25
BC_2 GZ5310 (Giza 177× GZ5310)	150	10	9	131	19	131	13	87	3:13	3.645	0.05-0.10

As for cross-2, four promising lines were evaluated; SP-5-70 selected from BC2 but BY-6-28-E, BY-6-23 and BY-5-34 were out from BC1. The excellent promising lines was SP-6-70 which gave plant height 96 cm, duration 140 days, high yielding more than 12 t/h, high 1000-grain weight, good panicle characters, high grain quality (hulling, milling and head rice %) and blast resistant compared with their parents.

Table (4): Mean performance of parents and their best rice entries for agronomic traits in 2008 season.

Character / Entry	Blast reaction	Plant height (cm)	Duration days	Flag leaf area cm2	Grain yield t/h	No. of panicles/ plant	No. of spikelet/ panicle	No. of filled grains/ panicle	1000-grian weight	Hulling %	Milling %	Head Rice%
Cross-1 (P1x P2)												
P1 Giza 177	2	105	125	27.39	9.54	21	129	118	27.80	78.8	69.80	63.30
P2 HR5824-B-3-2-3	5	83	105	24.64	5.42	15	56	50	22.20	50.1	47.10	40.20
PL -5-1	2	101	122	35.19	9.22	19	121	110	28.90	80.20	71.70	60.60
PL -5-2	2	104	120	35.60	9.29	20	128	112	29.60	79.00	69.00	65.70
PL -4-3	2	100	119	30.78	8.83	20	124	104	29.70	78.00	70.90	60.40
PL -4-4	2	97	121	31.84	10.14	22	151	136	29.20	78.40	68.40	65.70
Cross-2 (P2xP3)												
P3 Sakha101	6	90	145	26.50	11.80	23	155	145	29.00	81.41	72.50	68.32
SP-6-70	1	96	140	32.32	12.08	22	162	155.60	30.82	79.36	72.65	69.34
BY-6-28-E	5	85	121	28.10	8.51	20	125	115.41	27.25	78.56	68.25	60.23
BY-6-23	2	100	125	30.34	11.21	20	135	130	27.14	80.12	70.54	66.55
BY-5-34	8	94	145	30.25	10.50	19	115	111	26.15	77.88	64.55	59.61
Cross-3 (P3xP4)												
P4 GZ5310-20-3-3	2	100	130	35.65	9.54	20	130	125	27.21	78.36	69.89	64.57
BY-6-20	2	99	127	32.25	10.52	21	134	130	27.54	79.98	70.12	65.47
BY-6-21	4	94	134	29.35	10.42	19	121	116	26.45	75.35	67.87	58.68
BY-6-29	2	91	137	33.25	10.23	20	124	115	27.11	78.21	68.57	59.87
BY-6-70	4	97	131	31.17	9.18	20	120	110	25.17	76.11	64.10	55.13
Range	1	83	105	24.64	5.42	15	56	50	22.20	50.10	47.16	40.20
	8	105	145	35.65	12.08	23	162	155	30.82	81.41	72.65	69.34

*PL = promising line.

Concerning for cross-3, tested four elites; two derived from BC1 (BY-6-21 and BY-6-29), and two from BC2 (BY-6-20 and BY-6-70). The best elite was BY-6-20 which gave plant height 99 cm, duration 127 days, yield 10.52 t/h, good panicle and good quality and resistant to blast compared with their parents.

3- Evaluation of Blast resistance at different stages under natural and artificial infection in 2008 season:

Reaction of the genotypes out from three crosses (**cross-1 (Giza177 × HR 5824-B-3-2-3)**, **cross-2 (Sakha101 × HR 5824-B-3-2-3)** and **cross-3 (Sakha101 × GZ 5310-20-3-3)** for rice blast under blast nursery test, permanent field "Sakha, Gemmiza, and Zarzora", and artificial inoculation in greenhouse, in 2008 season are presented in Table (5). Data showed that there are differences for blast reaction under field and greenhouse among four parents and twelve promising lines derived from three crosses. Giza177 (P1) was highly resistant under blast nursery, permanent field (adult stage) and artificial condition at seedling stage with four specific races i.e., IB-63 (403), IH-1 (405), IB-19 (407) and IH-1 (408). The line GZ 5310-20-3-3 (P4) was resistant under all test conditions except with artificial inoculation with race IB-63 exhibited some type 4 lesions. On the other hand, HR 5824-B-3-2-3 (P2) and Sakha101 (P3) are highly susceptible at all stage and under artificial inoculation.

In cross-1 (Giza177 × HR 5824-B-3-2-3) exhibited a wide range of resistance for blast under different stages and conditions. The best elite was PL-4-4 which derived from BC2, is highly resistant to blast under field condition at both seedling and adult stages, also under artificial inoculation with specific races at seedling stage.

In cross-2 (Sakha101 × HR 5824-B-3-2-3) exhibited that most derived lines was susceptible to blast under both field condition and artificial inoculation with all four races, but the first line SP-6-70 was highly resistant under all conditions.

In cross-3 (Sakha101 × GZ 5310-20-3-3) the line BY-6-21 was highly susceptible under field conditions at both seedling and adult stage, also under artificial inoculation at seedling with different races; IB-3(isolated from Sakha101), and IH-1and IB-19 isolated from (Sakha104). On the other hand, the two lines BY-6-29 out from (BC1) and BY-6-70 derived from (BC2) detected to be highly resistant at field condition at both seedling and adult stages, but are susceptible to all races under artificial inoculation. On the contrary, the line BY-6-20 exhibited a highly blast resistant reaction under field condition in all locations (Sakha, Gemmiza and Zarzora) at both seedling and adult stages. Also, BY-6-20 was highly resistant to all races under artificial inoculation with specific races.

From these data it can concluded that the four lines; one from cross-1, (PL-4-4), one from cross-2, (SP-6-70) and BY-6-70 derived from cross-3 can be used as standby for Giza177 and Sakha101 in the future. Use of the backcross strategy enhanced resistance of susceptible variety, in accordance with **Suh *et al.*, 2009**. The blast fungus exhibited a wide variability and the derived lines from these crosses recorded a wide diversity to resistance of *Pyricularia grisea*. Frequently, these crosses was succeeded in creation a wide genetic diversity in all agronomic traits and resistance to blast. So, from this investigation we can conclude that the cultivar Giza 177 must be crossed with other resistant parents to produce new genotypes resistant to blast disease. The obtained results in accordance with **Ou and Ayad (1968); Wu and Latterel, 1986; Bonmman et al., 1987; EL-Shafey, (2002) and Sehly *et al.*, (2008).** Giza177 still a good blast-resistance source until now, in accordance with **El-Refaee *et al.*, 2011.**

Table (5): Reaction of the genotypes out from three crosses (Giza 177×HR5824-B-3-2-3, sakha 101x HR 5824-B-3-2-3 and sakha 101x GZ 5310-20-3-3) rice blast under blast nursery test, permanent field "Sakha, Gemmiza and Zarzora and artificial inoculation in greenhouse, in 2008 season.

Variety	Blast nursery (Seedling stage)			Permanent field (adult stage)			Artificial inoculation (Seedling stage)				Generation number	Source
	Sakha	Gemmiza	Zarzora	Sakha	Gemmiza	Zarzora	(IB-63) 403	(IH-1) 405	(IB-19) 407	(IH-1) 408		
Cross-1 (P1x P2)												
P1 Giza 177	1	1	1	1	1	1	2	2	2	1	variety	CK
P2HR5824-B-3-2-3	5	4	4	5	6	5	5	2	6	1	variety	CK
PL -5-1	2	2	2	1	1	1	2	2	4	1	6	F_2
PL -5-2	2	2	2	1	1	1	3	3	4	1	6	F_2
PL -4-3	2	2	2	1	1	1	3	2	4	1	6	BC_2
PL -4-4	2	2	2	1	1	1	2	2	2	1	6	BC_2
Cross-2 (P2xP3)												
P3 Sakha101	6	7	5	7	8	5	6	2	4	5	Variety	CK
SP-6-70	1	1	1	2	2	2	2	2	2	2	6	BC_1
BY-6-28-E	6	7	5	5	7	4	5	2	7	3	6	BC_1
BY-6-23	2	2	2	3	3	2	4	5	3	2	6	BC_1
BY-5-34	7	8	6	8	8	4	6	8	7	5	6	BC_1
Cross-3 (P3xP4)												
P4 GZ5310-20-3-3	2	2	2	2	3	2	4	2	2	2	6	CK
BY-6-20	2	2	2	2	2	2	2	1	2	2	6	BC2
BY-6-21	4	6	3	5	6	4	5	4	6	3	6	BC1
BY-6-29	2	2	2	2	2	2	4	4	5	4	6	BC1
BY-6-70	2	2	2	2	2	2	4	4	4	4	6	BC2
Giza 159	7	7	6	7	6	6	6	6	3	1	4	CK
1-2 = resistant (R)	3 = moderately resistant (MR)			4-6=susceptible (S)			Sakha 101	Sakha 104	Sakha 104	Sakha 101	7-9 = highly susceptible (HS)	

* PL= promising line.

4- Evaluation of promising lines performance under different nitrogen levels in 2009 and 2010:

1- Growth characters:

Effect of N levels and three promising lines and Sakha101 cultivar and their interaction on leaf area index (LAI), flag leaf area, chlorophyll content, plant height and growth and growth duration are presented in Table (6). In both seasons, the results indicated that significant differences existed among promising lines and Sakha101 for leaf area index (LAI), flag leaf area, chlorophyll content, plant height and growth duration. In general promising line BY-6-20 significantly surpassed the other promising lines and Sakha101 in flag leaf area (cm^2) and plant height. While, promising line PL-4-4 was earlier in growth duration than Sakha101 by 15 and 16 days in 2009 and 2010 season, respectively. In the same time, PL-4-4 gave the highest values of chlorophyll content without any significant differences with Sakha101 cultivar in both seasons. Sakha101 recorded the highest LAI and may be due to more tillers /hill than other varieties. Results indicated that promising line BY-6-20 gave the highest flag leaf area (24.08 and 23.37 cm^2) in 2009 and 2010 seasons, respectively. Data in Table (6) emphasized that plant height was significantly affected by variety, where Sakha101 gave the shortest plants and promising line BY-6-20 gave the tallest ones with significant differences among other promising lines. The longest growth duration was recorded by Sakha 101 rice variety. By the way, it could be concluded that PL-4-4and BY-6-20 new rice entries could be substituted to Sakha 101 rice variety as it became blast susceptible variety Similar data have been reported by **Chandrasekhar *et al.* (2001), Singh .(2002) , Zayed .(2002) ,Gautam .(2004)and Zayed *et al.* (2005a).**

Nitrogen levels significantly influenced all growth characters of three promising lines and Sakha101 cultivar, Table (6). The measured growth parameters significantly responded to nitrogen up to 165 kg N/ha and there were progressive improvements on growth of rice. The highest values of above-mentioned traits were produced by higher nitrogen rate of 165 kg N/ha. The minimum values of growth characteristics were recorded at zero nitrogen application in both seasons, this could owe to increasing available N in soil as a result of nitrogen application. Furthermore, nitrogen application could encourage extensive root growth, large leaf area more dry matter production and considerable net photosynthesis. It was observed that increasing N level up to 165 kg N/ha significantly retarded growth duration, (Table 6). Such result could be described to the effect of N-fertilizer in enhancing rice plant vegetative growth, hence delaying flowering. Similar findings were reported by **(Abd El-Wahab, 1990**; **Meena *et al.*, 2003; Zayed *et al.*, 2005b**; **Ebaid and EL-Mowafy, 2005** and **Gorgy, 2010)**.

Considering the interaction effect, the interaction between the evaluated rice varieties and nitrogen levels had significant effects on flag leaf area and LAI in both seasons (Table 7). Regarding LAI, The best combination was applying 165 kg N/ha and Sakha101 in both seasons. Meanwhile, the worst one was none of N levels applied with promising line PL-4-4. The interaction between rice varieties and N levels a significant effect on flag leaf area in both seasons, (Table 7). Data showed that the highest value of flag leaf area (cm^2) was produced by promising line BY-6-20 when it was fertilized with 165 kg N/ha. It was recognized that the most cultivars significantly responded to nitrogen application up to 110 kg N ha^{-}.Similar findings have been reported by **Subbiah *et al.* (2001).**

Table 6: Leaf area index (LAI), Flag leaf area (cm²), chlorophyll content, plant height (cm) and growth duration (day) of some rice entries as affected by various nitrogen levels during 2009 and 2010 seasons.

Character	LAI		flag leaf area		Chlorophyll content		Plant height		Growth duration (day)	
Season	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
variety										
PL -4-4	4.43	4.38	20.90	19.71	39.33	39.29	98.86	98.86	122.69	121.56
SP-6-70	4.96	4.90	21.13	20.45	38.36	38.84	94.14	93.76	127.66	127.44
BY-6-20	4.91	4.88	24.08	23.37	39.13	39.06	101.15	101.63	124.19	124.25
Sakha101	5.32	5.26	22.22	22.22	39.31	39.11	91.65	91.11	137.25	137.56
F test	**	**	*	**	**	*	**	**	**	**
LSD0.05	0.19	0.29	2.1	1.5	0.30	0.37	1.9	1.5	1.7	2.8
N levels										
0	3.10	2.94	17.85	17.08	35.80	35.76	91.33	91.18	123.09	123.25
55	4.35	4.39	20.41	20.32	37.60	37.98	95.98	95.69	127.53	127.88
110	5.98	5.91	23.82	23.40	41.19	41.04	98.53	98.64	129.72	129.38
165 kg N/ha	6.20	6.22	25.84	24.96	41.54	41.51	99.96	99.84	131.44	130.31
F test	**	**	**	**	**	**	**	**	**	**
LSD0.05	0.28	0.20	1.4	1.1	0.41	0.76	1.6	1.3	1.2	2.3
Interaction	*	*	NS	NS	*	*	NS	NS	NS	NS

*significant at 0.05 level ** significant at 0.01 level

Table 7: Leaf area index (LAI) and flag leaf area (cm²) as affected by the interaction effect between rice entries and nitrogen level in seasons of 2009 and 2010.

character	LAI							
	2009				2010			
N levels	0	55	110	165	0	55	110	165
PL -4-4	2.80	4.03	5.35	5.54	2.60	3.96	5.34	5.64
SP-6-70	3.10	4.33	6.04	6.38	2.98	4.40	5.92	6.32
BY-6-20	3.20	4.33	5.92	6.20	2.95	4.51	5.88	6.18
Sakha101	3.29	4.72	6.60	6.68	3.23	4.69	6.50	6.72
LSD0.05	0.55				0.4			
Character	flag leaf area							
PL -4-4	17.97	20.42	21.81	23.39	16.32	19.29	20.86	22.37
SP-6-70	15.30	18.50	24.30	27.15	15.17	18.24	22.96	25.45
BY-6-20	18.96	21.00	27.09	29.36	17.86	21.94	26.23	27.45
Sakha101	19.15	21.70	22.18	23.48	18.98	21.80	23.55	24.56
LSD0.05	2.7				2.1			

2- **Grain yield and its components:**

Data documented in Tables (8 & 9) clarify that the various tested rice entries greatly varied in their yield attributing traits; panicle numbers in the second season and 1000 –grain weight as well as rice grain yield (t/ha) in both seasons. The tested genotypes didn't vary in their panicle number/m^2 in the first seasons, filled grains /panicle and unfilled grains /panicle in both seasons as well as panicle weight in both seasons. Regarding panicle number, the promising lines, SP-6-70, BY-6-20 and Sakha101 were comparable regarding panicles number/m^2 and maximum number of panicles/ m^2 were recorded by Sakha101and ranked first followed by promising line BY-6-20 where, promising line PL-4-4 gave the lowest values of this trait. Promising line BY-6-20 gave the heaviest 1000-grain weight without any significant differences with those produced by PL-4-4 promising line. The lightest 1000-grain weight was produced by Sakha101. As for grain yield, Sakha101 gave the highest values of grain yield without significant differences with two promising lines; BY-6-20 and SP-6-70 while, PL-4-4 promising line gave the lowest value of grain yield (8.26 and 8.02 t/ha) in 2009 and 2010, respectively. The varietal differences in yield and yield attributing traits has been reported by several researchers; **Patil *et al.*, 2003; Gautam, 2004; Abou Khalifa, 2005 and Gorgy, 2010.**

Regarding nitrogen levels impact, nitrogen fertilizer treatments had significant and positive impact on yield and yield component in both seasons (Tables 8 and 9). Increasing N level up to 165 kg/ha significantly increased panicles number/m^2 and grain yield. While, nitrogen rated of 110 kg/ha gave the maximum number of filled grain/panicle. Couple nitrogen rate of zero and 165 kg N/ha were comparable in unfilled grain numbers. The highest nitrogen level 165 kg N/ha increased the grain yield by about 50% over that of zero nitrogen application. The obtained improvement in the yield attribute as a result of increasing nitrogen fertilizer might be due to increased accumulation of photosynthesis from source to sink during filling as well as delaying senescence. The present findings are in good accordance with the results of **(Shima Badawi (2002), Balasubramanian, 2002; Singh, 2002; Meena *et al.*, 2003; Gautan, 2004; Zayed *et al.*, 2005a, and Gorgy, 2010)**

Table (8): Panicle numbers/m2, number of filled grains /panicle and number of unfilled grains /panicle of some rice entries as affected by various nitrogen level during 2009 and 2010 seasons.

Character	No of panicles/m^2		No of filled grains/panicle		No of unfilled grains/panicle	
Season	2009	2010	2009	2010	2009	2010
Variety						
PL -4-4	481.18	474.69	105.08	103.97	8.40	8.03
SP-6-70	496.39	490.56	111.93	109.99	7.46	7.34
BY-6-20	503.07	495.94	107.05	107.72	6.58	6.98
Sakha101	508.77	505.19	113.59	108.60	5.85	7.16
F test	NS	*	NS	NS	NS	ns
LSD0.05	NS	18	NS	NS	NS	NS
N levels						
0	338.32	342	97.83	94.20	5.67	8.22
55	525.09	517.38	110.27	107.19	6.42	6.40
110	552.75	543.63	118.60	116.63	7,56	6.99
165 kg N/ha	573.25	563.38	110.85	112.27	8.63	7.89
F test	**	**	**	**	NS	ns
LSD0.05	20.9	15.3	8.7	4.5	NS	NS
Interaction	*	*	*	*	Ns	ns

* significant at 0.05 level ** significant at 0.01 level

Table (9): 1000-grain weight g, panicle weight g and grain yield t/ha of some rice varieties as affected by various of nitrogen levels in 2008 and 2009 seasons.

Character	1000-grain weight		Panicle weight		Grain yield	
Season	2009	2010	2009	2010	2009	2010
Variety						
PL -4-4	29.00	27.96	3.19	3.21	8.26	8.02
SP-6-70	27.11	27.08	3.21	3.22	8.62	8.72
BY-6-20	29.27	28.16	3.29	3.24	8.75	8.76
Sakha101	25.38	25.53	3.14	3.14	8.83	8.80
F test	**	**	NS	NS	*	**
LSD0.05	0.29	0.48	NS	NS	0.43	0.33
N levels						
0	28.24	27.64	2.97	2.97	5.08	5.05
55	27.97	27.43	3.19	3.15	8.77	8.71
110	27.62	27.16	3.49	3.48	10.28	10.21
165 kg N/ha	26.93	26.50	3.16	3.20	10.33	10.31
F test	**	**	**	**	**	**
LSD0.05	0.38	0.36	0.27	0.17	0.34	0.24
Interaction	NS	NS	NS	NS	*	**

*significant at 0.05 level ** significant at 0.01 level

The interaction between rice entries on Sakha101 variety and nitrogen level had significant effect of panicles number/m2 and grain yield (t/ha) in both seasons (Table 10). The combination of rice entry; BY-5-20 and Sakha101 and 165 kg N/ha which gave the maximum values of panicles /m^2 without any significant differences among them. The lowest values of number of panicles /m^2 was obtained when PL-4-4 promising line was grown without N application, Table 10.

The interaction between rice entries and Sakha101 and significant effects on grain yield in both seasons, Table 10. The highest grain yield was obtained by Sakha101 when fertilized by 110 kg N/ha in the first season and the highest grain yield was obtained by promising line SP-6-70 when fertilized by the highest N level 165 kg/ha in the second season. **Gautam, 2004; Abou Khalifa, 2005 and Gorgy, 2010.**

Table (10): Panicle numbers /m2 and grain yield t/ha as affected by the interaction between rice entries and nitrogen levels in 2008 and 2009 seasons

Character	Panicle numbers /m2							
Season	2008				2009			
	0	55	110	165	0	55	110	165
Variety								
PL -4-4	320.00	506.88	537.50	560.33	323.50	492.00	537.50	545.75
SP-6-70	336.88	513.90	551.88	582.93	338.50	510.00	541.25	572.00
BY-6-20	345.65	531.48	557.90	577,25	349.50	525.75	545.50	562.75
Sakha101	350.75	548.10	563.73	572.50	356.50	541.25	550.00	573.00
LSD0.05	41.0				30.0			
Character	Grain yield t/ha							
Variety								
PL -4-4	4.84	8.41	9.76	10.03	4.54	8.09	9.59	9.88
SP-6-70	5.02	8.73	10.32	10.43	5.14	8.67	10.44	10.62
BY-6-20	5.13	8.91	10.49	10.44	5,20	9.05	10.39	10.53
Sakha101	5.31	9.01	10.55	10.43	5.31	9.03	10.47	10.23
LSD0.05	0.67				0.47			

*significant at 0.05 level ** significant at 0.01 level

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الملخص العربى

تقييم بعض الصفات الكمية لبعض سلالات الأرز المبشرة ومقاومة مرض اللفحة تحت مستويات مختلفة من التسميد الأزوتي

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أجري هذا البحث بمزرعة مركز البحوث والتدريب في الأرز سخا من موسم ٢٠٠٣ إلي موسم ٢٠١٠ وتم تقييم السلالات المستنبطة لصفات المحصول ومكوناته في سخا بينما تم تقييمها بحقل اللفحة في طور البادرة والنبات الكامل في مواقع سخا ، الجميزة وزرزورة تحت ظروف ألعدوي الطبيعية في نفس العام وتمت ألعدوي صناعيا للسلالات المبشرة بأربعة سلالات من فطر اللفحة بالصوبة الزجاجية بسخا وهى أى اتش – ١ (٤٠٨)، أى بى-١٩(٤٠٧)، أى اتش -١(٤٠٥)، أى بى -٦٣(٤٠٣) بغرض معرفة رد فعلها لتلك السلالات وكان التحليل المستخدم في دراسة الأجيال المبكرة مربع كاى عام ٢٠٠٥ والقطاعات كاملة العشوائية للأجيال المتقدمة موسم ٢٠٠٨. قيمت ١٢ سلاله ناتجة من ثلاث هجن أربعة سلالات من الهجين الأول جيزة ١٧٧ x أتش أر ٥٨٢٤-B-٣-٢-٣ وأربعة من الهجين الثاني سخا ١٠١ x أتش أر ٥٨٢٤-B-٣-٢-٣ وأربعة من الهجين الثالث سخا ١٠١ x جى زد ٥٣١٠-٢٠-٣-٣ ونتج من تلك السلالات أفضل ثلاثة سلالات وهي PL-4-4 من الهجين الأول، SP-6-70 من الهجين الثاني، BY-6-20 من الهجين الثالث وقيمت تلك السلالات تحت مستويات مختلفة من النيتروجين عام وهي صفر، ٥٥ و١١٠ ، ١٦٥ كجم /هكتار في موسمين ٢٠٠٩ و ٢٠١٠ في قطاعات منشقة لبعض صفات النمو و المحصول ومكوناته . وكانت أهم النتائج المتحصل عليها:

<u>أولا – أختبار مربع كاي في الأجيال المبكرة موسم ٢٠٠٥: -</u>

١- في الهجين الأول جيزة ١٧٧ x أتش أر ٥٨٢٤-B-٣-٢-٣ أختبرت ٥٠٠ نبات من الجيل الثاني لمرض اللفحة وكانت نسبة النباتات المقاومة إلي المصابة ٩٣ % نبات مقاوم ، ٧ % نبات مصاب بينما في الهجين الرجعي الأول أختبر ١٥٠ نبات لمرض اللفحة وكانت نسبة النباتات المقاومة إلي المصابة ٨٠ % مقاوم إلي ٢٠ % مصاب بينما في الهجين الرجعي الثاني كانت نسبة النباتات المقاومة ٧١% إلي ٢٩ % مصاب. كانت النسبة المتوقعة لمربع كاي لنباتات الجيل الثاني

بنسبة ١٥ مقاوم : ١ مصاب يدل ذلك علي وجود زوجين من الجينات السائدة المتحكمة في وراثة مرض اللفحة و كانت قيمة مربع كاي ٠,٤٨ باحتمال ٠,٥٠ – ٠,٧٥ بينما كانت النسبة المتوقعة لمربع كاي ٣:١ في كل من الجيل الرجعي الأول والثاني هذا يدل علي وجود زوج واحد من العوامل الوراثية المتحكمة في مرض اللفحة.

٢- في الهجين الثاني سخا ١٠١ x أتش أر ٥٨٢٤-B-٣-٢-٣ كانت نسبة النباتات المقاومة إلي المصابة في الجيل الثاني ٤٣ مقاوم إلي ٥٧ مصاب بينما كانت في الهجين الرجعي الأول ٢٨ مقاوم إلي ٧٢ مصاب أيضا في الهجين الرجعي الثاني كانت ٢١ مقاوم ٧٩ % مصاب هذا يدل علي أن نسبة الإصابة بالمرض أكثر من نسبة المقاومة في الأجيال وكانت النسبة المتوقعة للجينات المسئولة عن مرض اللفحة في الجيل الثاني ٧ : ٩ بينما في الهجين الرجعي الأول والثاني كان ٣ : ١ هذا يدل علي أن الجيل الثاني تتحكم فيه زوجين من العوامل الوراثية المتنحية بينما في الهجين الرجعي الأول والثاني كانت زوج واحد من العوامل الوراثية المتنحية المتحكمة في وراثة مرض اللفحة.

٣- في الهجين الثالث سخا ١٠١ x جي زد ٥٣١٠-٢٠-٣-٣ كانت نسبة النباتات المقاومة ٢٩ % إلي ٧١ % نبات مصاب بينما في الهجين الرجعي الأول ٣٨ % مصاب إلي ٦٢ % مصاب وفي الهجين الرجعي الثاني كانت ١٣ % مقاوم إلي ٨٧ % مصاب هذا يدل علي أن صفة الإصابة سائدة علي صفة المقاومة. وكانت النسبة المتوقعة للجينات المسئولة عن مرض اللفحة في الجيل الثاني ٣ :١ يدل علي وجود زوج واحد من الجينات بينما الهجين الرجعي الأول ٩ :٧ والهجين الرجعي الثاني كانت ١٣ :٣ يدل علي أن الهجين الرجعي الأول والثاني يتحكم فيه زوج من العوامل الوراثية المتنحية.

ثانيا – تقييم الأجيال المتقدمة للأباء والسلالات المنتخبة في ٢٠٠٨:

١- في الهجين الأول قيمت ٤ سلالات وكانت أفضل هذه السلالات السلالة PL-4-4 حيث تميزت بالتبكير في النضج وقصر الساق والمحصول العالي والجودة العالية والمقاومة لمرض اللفحة مقارنة بالإباء وكان الأب اتش أر ٥٨٢٤-B-٣-٢-٣ مصابا باللفحة وأقلهم في جميع الصفات المدروسة.

٢- في الهجين الثاني قيمت أربع سلالات كانت أفضل سلالة SP-6-70 كانت عالية المحصول عن الصنف سخا ١٠١ حيث أعطت أكثر من ١٢ طن / هكتار لكن كانت متأخرة نوعا عن سخا ١٠١ ومتأخر جدا عن الأب الثاني اتش أر ٥٨٢٤-B-٣-٢-٣ ولكن ذو صفات جودة عالية وصفات محصولية ممتازة ومقاوم لمرض اللفحة.

٣ – في الهجين الثالث قيمت ٤ سلالات كانت أفضل سلالة هي By-6-20 من حيث التبكير والنضج والمحصول العالي عن الأب الثاني وطول النبات وكانت عالية هي معظم الصفات خاصة الجودة والمقاومة لمرض اللفحة.

ثالثا – المقاومة لمرض اللفحة تحت ظروف الحقل والصوبة في ٢٠٠٨:

قيمت ١٢ سلالة في الهجين الأول والثاني والثالث في مرحلة البادرة والنبات البالغ في ثلاث مواقع سخا، الجميزة وزرزورة وتحت ظروف العدوي الصناعية بأربع سلالات فطرية ممرضة لمرض اللفحة وكانت النتائج كالأتي :

١- في الهجين الأول كانت السلالة PL-4-4 مقاومة في جميع مراحل النمو في البادرة والنباتات البالغة وتحت ظروف العدوي الصناعية بينما كانت السلالات الأخرى تختلف في شدة أصابتها.

٢- في الهجين الثاني كانت السلالة SP-6-70 أفضل السلالات في المقاومة لمرض اللفحة تحت ظروف الحقل في المواقع المختلفة والعدوى الصناعية مقارنة بالأبوين سخا١٠١ و اتش أر ٥٨٢٤-B-٣-٢-٣ وكذلك الثلاث سلالات الأخرى حيث تفوقت في صفات المحصول عن سخا١٠١ ولكن عمرها ١٤٠ يوم من الحبة للحبة.

٣- في الهجين الثالث كانت السلالة By-6-20 أفضل السلالات الأربعة في المقاومة لمرض اللفحة مقارنة بالإباء وقد تم انتخاب الثلاث سلالات PL-4-4، والسلالة SP-6-70 والسلالة By-6-20 وتم تقييمها في موسمي ٢٠٠٩ و ٢٠١٠ تحت مستويات مختلفة من النيتروجين.

رابعا – تقييم السلالات المبشرة تحت مستويات مختلفة من التسميد النيتروجين موسمي ٢٠٠٩ و ٢٠١٠:-

تم تقييم السلالات الثلاثة PL-4-4، SP-6-70 و والسلالة تحت مستويات تسميد نيتروجين (صفر، ٥٥ ، ١١٠ و ١٦٥ كجم نيتروجين /هكتار) في قطاعات منشقة ويمكن تلخيص النتائج كما يلي:

- تفوقت السلالة By-6-20 معنويا في مساحة ورقة العلم وطول النبات بينما كانت السلالة PL-4-4 أكثر تبكيرا من باقي السلالات وعن الصنف سخا١٠١ وبشكل عام تفوقت السلالات الثلاث تحت الدراسة من ناحية التبكير في النضج بمدة ١٠-١٥ يوم عن الصنف سخا١٠١ وأعطي الصنف سخا١٠١ أعلي القيم لدليل مساحة الورقة ولم تظهر تلك السلالات والصنف سخا١٠١ أي فروق معنوية بالنسبة لعدد الحبوب الممتلئة / دالية وعدد الحبوب الغير ممتلئة / دالية ووزن الدالية في كلي الموسمين وأيضا عدد الداليات / م^2 في الموسم الأول. ظهرت فروق معنوية بين السلالات وسخا١٠١ في صفات وزن الألف حبة ومحصول الحبوب حيث تفوقت السلالتين PL-4-4 و By-6-20 في وزن الألف حبة وأعطت أعلي القيم وسجل الصنف سخا١٠١ والسلالتين By-6-20 ، SP-6-70 أعلي محصول حبوب خلال موسمي الزراعة وبدون فروق معنوية.

- أدي زيادة التسميد النتيروجينى حتى معدل ١٦٥ كجم / هكتار إلي زيادة معظم صفات النمو كذلك زاد محصول الحبوب ومعظم مكونات المحصول بينما أنخفض وزن الألف حبة مع زيادة التسميد.
- ظهرت فروق معنوية بين السلالات المختبرة والصنف سخا١٠١ مع مستويات التسميد النيتروجين لصفتي دليل مساحة الورقة ومساحة ورقة العلم وأيضا عدد الداليان / م٢ ومحصول الحبوب وذلك خلال موسمي الزراعة.
- سجلت السلالتين SP-6-70 ، By-6-20 قدرة عالية في متوسط المحصول تتساوي تقريبا مع الصنف سخا ١٠١ والذي أصبح حساس لمرض اللفحة وقد تميزت تلك السلالات أيضا بالتبكير والنضج حوالي (١٠-١٥ يوما) . وعليه أمكن إيجاد سلالات مبشرة تتميز بالمحصول العالي والتبكير ومقاومة لمرض اللفحة ويمكن أن تحل محل الأصناف التي أصبحت قابلة للإصابة باللفحة.
- للحصول علي أعلي إنتاجية من تلك السلالات يجب زراعتها بمعدل ٤ نباتات بالجورة وعلي مسافات ٢٠ × ٢٠ سم وبمعدل تسميد النيتروجين ١٦٥ كجم نيتروجين / هكتار علي دفعتين ثلثي الكمية علي الشراقي وقبل التلويط والشتل والثلث الباقي عند بداية مرحلة تكوين السنبلة الصغيرة).