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PERFORMANCE OF SOME RICE GENOTYPES UNDER BOTH SALINITY AND WATER STRESS CONDITIONS IN EGYPT

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ABSTRACT

The present investigation was carried out at Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt, during summer seasons 2011 and 2012 as a preliminary study to breed for Egyptian super rice varieties. The objectives of the present study ware aimed to comprise 10 local and exotic rice cultivars to be tested under the two stresses, salinity and water stress in order to identify one or more genotypes could be grown under both conditions and/or to be utilized as a donor in the program to establish an Egyptian super rice varieties. Results clearly showed significant and highly significant differences between examined genotypes regarding all studied characters as affected by the different salinity levels and water stress conditions in the two seasons. Under the two conditions all of the investigated characters were decreased significantly by increasing salinity levels except sterility % increased by increasing salinity levels. The results also revealed that GZ 1368 –S-5-4 followed by Giza 179 and Giza 178 were found to be the highest tolerant rice genotypes to salinity levels beside to its significant degree of drought tolerance, these genotypes could be nominated to be grown either under salt effected soil or under water stress conditions and/or used as a donor for those types of stresses in any crossing program towards breeding for Egyptian super rice varieties. On the other hand, although, Sakha 102, Sakha 101 and Giza 182 which exhibited high yielding under normal conditions, they were found to be highly sensitive rice genotypes under both salinity and water stress conditions.

The results showed that also PCV (phenotypic coefficient of variance) in general was higher than GCV (genotypic coefficient of variation) for various characters. However the difference between GCV and PCV was low for most of the characters studied. This indicates less degree of environmental influence on manifestation of these characters. High heritability coupled with high genetic advance were recorded for number of filled grains per panicle, number of panicles/ plant and grain yield/ plant indicated the major role of additive gene action in the inheritance of these characters and these characters could be improved by selection in early segregating generations. Thus, these characters may serve as an effective selection parameter during breeding program for crop improvement.

Keywords: super rice, salinity, water stress, grain yield, genotypic and phenotypic coefficients of variability, heritability and genetic advance.

INTRODUCTION

Rice remains a staple food for majority of the world population. More than two thirds of the world relies of nutritional benefit of rice. In Egypt, rice is considered one of the most essential field crops not only as a food crop but also as a land reclamation crop and for exportation.

Rice in Egypt, although, it's the highest productivity among the world (about 10 tons/ha) still it faces many biotic and a biotic production constraints. *The biotic stresses such as* diseases and insects (blast, brown spot, stem borer..etc), while, the a biotic stresses such as salinity and drought.

Consequently, breeding for rice variety that can possess resistance to such biotic and tolerance to all a biotic stresses beside high productivity and superior grain quality is essential target in the national rice improvement program in Egypt.

CAO *et al.* (2010) stated that through the effort in research, super rice breeding in China has gained significant advance in the aspects of breeding theories, creation of breeding material and selection and promotion of the elite rice varieties. A creative super rice breeding path of the construction of harmonious plant type combined with the utilizing of heterosis was proposed. Super rice either inbreed or hybrid plays more and more important roles in rice production in Chain nowadays. Totally 71 super rice varieties have been successfully developed and released to production. These varieties have 12 t/hm^2 yield potential in on-farm demonstration field 8% to 15% higher than the check varieties. The total growing area of which reached 23.7 million hectares and rice grain production increased by 17.7 million tons from 1996 to 2009.

Accordingly, the present investigation aimed to select a lines or/and a cultivar which can be such super rice or could be used as a donor for one or more of its desirable characters in a breeding program to realize this target especially for salt and drought tolerance.

The presence of excess salts in the soil is one of the most serious problems limiting agricultural production. The threat of soil salinity looms large in the 230 million ha of the world's irrigated area (McWilliam, 1986) that produces almost half of the world's food .About 27 million ha of potential rice land in the humid tropics of Asia lies uncultivated because of salinity (Akbar and Ponnamperuma, 1980). In Egypt, about one third of rice cultivated area is affected by salinity. A sure and cost-effective means of tackling the salinity problem is use of salt tolerant varieties, but only recently have rice breeders evidenced interest in their development. Studies on genetics of salt tolerance have been limited, inhibiting the realization of breeders' goals.

In addition, 'Drought' can be defined as environmental situation where there is a decrease in soil moisture or soil moisture potentials in the rooting zone of rice crop. At present, many nations are facing second generation challenge of producing more rice at less cost in a deteriorating environment. In Egypt, rice plants are often exposed to drought conditions during one or more of their growth stages because of the shortage in irrigation water especially at the canals terminals or end tails of the canals.

The large spectrum genetic variability in segregating populations depends on the level of genetic diversity among genotypes offer better scope for selection. Estimates of GCV, PCV, heritability and genetic advance will play an important role in exploiting future research projections of rice improvement. Therefore, an attempt was made in the present study to estimate the extent of variability, heritability, genetic advance to discover the nature of gene action governing salt and drought tolerance in rice. Irrigation water especially in the terminals of the irrigation canals in the northern parts of the Nile Delta. Knowledge of the genetics of drought resistance or its component traits is important for a successful breeding program.

MATERIALS AND METHODS

The present investigation was carried out in the Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt during 2011 and 2012 seasons, to select one of two lines or/and cultivar to be utilized as an Egyptian super rice variety or as a donor for its desirable character in this respect. The present study comprised 10 local and exotic rice cultivars had well their performance under normal growing conditions to be tested under salinity and water stress in two separate experiments. Table (1) presented the origin, parentage and varietal group of these utilized cultivars under study.

Table 1: Origin, parentage and variety group of the twenty genotypes of rice used in the present investigation.

No.	Genotypes	Origin (Parentage)	Variety group
1	**Giza 178**	Egypt (Giza 175 / Milyang 49)	Indica/Japonica
2	**Sakha 101**	Egypt (Giza 176 / Milyang 79)	Japonica
3	**Sakha 102**	Egypt (Gz 4096– 7–1 / Gz 4120– 205–2)	Japonica
4	**Sakha 104**	Egypt (Gz 4096– 8– 1 / Gz 4100- 9)	Japonica
5	**Sakha 105**	Egypt (Gz 5581- 46- 3 / Gz 4316- 7- 1- 1)	Japonica
6	**Sakha 106**	Egypt (Giza 177 / Hexi 30)	Japonica
7	**Giza 179**	Egypt (Gz 6296 / Gz 1368-S-5-4)	Indica/Japonica
8	**Giza 182**	Egypt (Giza 181 / IR 39422– 161– 1– 3 // Giza 181)	Indica
9	**Gz 1368-S-5-4**	Egypt (IR 1615- 31 / BG 94- 2)	Indica
10	**IET 1444**	India (TN 1 / CO 29)	Indica

The studied characters were total duration, number of panicles/ plant, number of filled grains/ panicle, 100- grain weight (g), sterility %, Salinity tolerance index, drought tolerance index and grain yield/ plant (g) were recorded according to the standard evaluation system for rice, IRRI (1996).

1- Salinity experiment :

The effect of salinity was tested under artificial saline soil conditions for some agronomic, grain dimensions and yield traits. The Lysimeter is concrete beds (1m width x 2m length x 1 meter depth) filled with soil to 100 cm depth in three layers: 60 cm clay at surface, 20 cm sand at the middle and 20 cm gravel at bottom. Salinity, irrigation and drainage cycle were accurately controlled. The salinity levels were adjusted to 4000 ppm., 6000 ppm., and 8000 ppm. in addition, the control was kept to be irrigated by tap water. The water was artificially salinized by applying sodium chloride (Na CL) and calcium chloride (CaCL2) at the ratio of 2:1, respectively. The Lysimeter were drained are day before irrigation which applied for four days. The electrical conductivity (EC) of drainje water was measured for each plot Lysimeter and salinity levels were readjusted according to the measured EC to maintain the salinity levels constant along the season. The seeds were sown in one row, 1 meter length for each variety, in three replications, with a spacing of 15x15 cm apart between rows. These seeds were handling sown in hills 15 x 15 cm spacing at the rate of 5-10 seeds/hill and which were pulled on an individual plant after twenty five days and the recommended culture practices were applied under saline soil conditions. The plots were salinized 15 days after growing and salinization was fixed till harvest.

1- Water stress experiment

The tested aforementioned 10 genotypes were grown in a randomized complete block design with three replications. Thirty days old seedling of each genotype was individually transplanted in 10-row/replicate with spacing of 20 cm between rows and 20 cm between plants. All pre- and post-stand establishment management such as land preparation, fertilizer application, weeding, pest control and other cultural practices were done as required. Flush irrigation was used every 10 days for the water stress conditions.

Fifteen equidistance plants from each genotype in each replication were taken at maturity and data on yield traits i.e. Total duration (day), number of panicles/ plant, number of filled grains/ panicle, 100- grain weight (g), sterility %, drought tolerance index and grain yield/ plant (g) were recorded according to the standard evaluation system for rice, IRRI (1996).

Statistical analysis:

The data which obtained for each trait was statistically combined over the two seasons according to Le Clerg *et al.* (1962), then it was subjected to analysis of variance, which was used to partition the gross phenotypic variability into the components due to genetic (hereditary) and non-genetic (environmental) factors and to estimate the magnitude of these. Genotypic variance is the part of the phenotypic variance that can be attributed to genotypic differences among the phenotypes. Similarly, phenotypic variance is the total variance among phenotypes when grown over the range of environments of interest, Dudley and Moll (1969). Hence, variance components, genotypic (Vg), phenotypic (Vp) and error (Ve) variances were estimated using the formula of Wricke and Weber (1986) and Prasad *et al.* (1981) as follows:

$Vg = [MSG - MSE / r]$

$Vph = [MSG / r]$

$Ve = [MSE / r]$

Where MSG, MSE and r are the mean squares of genotypes, mean squares of error and number of replications, respectively. Phenotypic (PCV) and genotypic (GCV) coefficient of variation were evaluated according to the methods of Burton (1952), Johnson *et al.* (1955) and Kumar *et al.* (1985) as

$PCV = [\sqrt{Vp} / X] \times 100$

$GCV = [\sqrt{Vg} / X] \times 100$

Where Vp, Vg and X are the phenotypic variances, genotypic variances and grand mean per season, respectively for the traits under consideration. Broad sense heritability (h2B) expressed as the percentage of the ratio of the genotypic variance (Vg) to the phenotypic variance (Vph) was estimated on genotypic mean basis as described by Allard (1999). Genetic advance (GA) expected and GA as percent of the mean assuming selection of the superior

5% of the genotypes were estimated in accordance with the methods of illustrated by Fehr (1987) as

GA = K (S ph) h2 B

GA (as % of the mean) = (GA / x) x 100

Where k is a constant (which varies depending upon the selection intensity and, if the latter is 5%, it stands at 2.06). (S ph) is the phenotypic standard deviation ($\sqrt{Vph}$), h2B is the heritability ratio and x refers to the season mean of the trait.

RESULTS AND DISCUSSION

There was marked suppression of growth under salinity conditions as well as plant exposed to drought compared with those grown under normal conditions. The results obtained are summarized as follow.

I- Salinity experiment:

Results presented in Table 2 indicated that the differences between the salinity levels screened in the present study were significant and/or highly significant and naturally maximum effect was detected for highest salinity level comparing with the control or the other salinity levels under investigation. Moreover, it is clear from Table (2) that there were significant and highly significant differences between means of all examined genotypes regarding all studied characters as affected by different salinity levels in the two seasons of study.

This was expected because of the differences between these genotypes in respective of their genetic back ground. Sakha 102 was the earliest in total duration in both seasons, meanwhile GZ 1368 –S-5-4 was the latest one. On the basis of mean performance of grain yield and most of yield contributing traits except 100 grain weight; GZ 1368 –S-5-4 was highest yielder followed by Giza 179 in 2011 season while it was followed by Giza 179 and Giza 178 in 2012 season. Meanwhile, the lowest yield values were determined for Sakha 102 followed by Sakha101 and Giza 182 in the two seasons of study. There were superior regarding number of panicles/plant, number of filled grains/plant and grain yield/plant. The highest grain weight was determined for Giza 182 followed by Sakha 102, that were 2.62g - 2.65g and 2.47g - 2.52g for the two genotypes in the two seasons, respectively. GZ 1368 –S-5-4 was highest salinity tolerance index followed by Giza 179 and Giza 178 in the two seasons of study. Meanwhile, the lowest salinity tolerance index values were determined for Sakha 102 followed by Sakha101 and Giza 182 in the two seasons of study (Table, 2).In addition, the lowest sterility % was estimated for Giza 182 (39.40%-41.20%) followed by GZ 1386 –S-5-4 (44.00% - 45.25%) as affected by the salinity stress in both seasons. Consequently, these results indicated that under salinity stress both GZ 1368 –S-5-4 and Giza 179 proved to be tolerant to this abiotic stress and one or two of them could be utilized as a new salinity tolerant variety or as a donor for salinity tolerance in any crossing program reserving the high potentiality characters. Similar results were reported previously by Mohaiudden *et al.* (1998), El-Refaee *et al.* (2005) and Munns *et al.* (2006).

Table 2: Mean performance of grain yield and its components of some rice cultivars and lines as affected by different salinity levels during 2011 and 2012 seasons.

Factor	Total duration (days)		No. of panicles/ plant		No. of filled grains/ panicle		100- grain weight (g)		Sterility %		Salinity tolerance index		Grain yield/ plant (g)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Salinity levels (A):														
Tap water (Control)	132.63	132.50	16.33	15.53	122.9	125.3	2.68	2.66	7.17	7.15	--	--	44.25	45.25
4000 ppm.	126.70	126.48	10.53	11.50	37.00	39.50	2.05	2.03	4.45	47.50	36.62	40.33	16.25	18.25
6000 ppm.	121.97	121.65	6.70	7.33	23.00	25.30	2.00	1.98	68.41	71.30	17.17	20.66	7.60	9.35
8000 ppm.	117.70	118.23	5.16	4.75	15.40	17.50	1.87	1.90	83.46	85.90	7.25	9.52	3.21	4.31
F. test	**	**	**	*	**	**	*	*	**	**	**	**	**	**
L.S.D 0.05	4.01	4.03	3.30	3.32	6.11	5.70	0.15	0.17	2.85	2.87	1.48	1.35	2.47	2.53
L.S.D 0.01	5.97	5.99	4.92	4.94	9.10	8.49	0.23	0.25	4.25	4.28	1.97	1.93	3.68	3.75
Genotypes (B):														
Giza178	125.50	124.33	12.33	13.55	77.92	77.50	1.70	1.73	47.91	45.80	27.01	26.92	20.09	19.69
Sakha101	126.83	126.33	11.16	10.75	48.42	50.10	2.25	2.30	68.54	66.70	11.89	12.85	15.78	16.10
Sakha102	116.17	115.39	8.75	9.88	47.67	48.60	2.47	2.52	63.75	65.00	10.80	10.94	14.05	15.04
Sakha104	126.25	125.71	10.41	11.50	77.33	77.50	2.26	2.31	50.43	51.52	15.88	15.85	16.79	16.55
Sakha105	124.75	124.25	9.50	8.95	52.00	53.50	2.37	2.35	52.43	53.24	17.66	18.50	17.68	18.28
Sakha106	124.00	123.50	10.50	11.30	60.75	59.50	2.38	2.35	50.96	51.50	19.91	19.12	18.78	18.95
Giza 179	124.00	123.50	13.25	14.55	78.75	77.90	2.27	2.33	47.26	48.70	25.24	26.55	20.53	21.15
Giza 182	122.08	122.48	10.66	9.75	73.67	75.30	2.52	2.55	39.40	41.20	14.91	15.40	15.35	16.30
Gz 1368- S- 5-4	131.42	131.92	14.58	13.50	79.92	78.20	2.22	2.25	44.00	45.25	35.97	36.25	21.60	22.05
IET 1444	126.50	127.25	13.16	13.50	76.08	75.60	2.10	2.15	46.55	47.25	25.08	26.15	17.61	18.35
F. test	**	**	**	*	**	**	*	*	**	**	**	**	**	**
L.S.D 0.05	2.42	2.52	1.65	1.72	6.55	6.20	0.09	0.10	2.11	2.12	2.26	2.35	1.47	1.49
L.S.D 0.01	3.33	3.47	2.28	2.37	9.03	8.55	0.12	0.14	2.91	2.92	3.01	3.11	2.03	2.06

*,** and NS indicate significant at 0.05, 0.01 and not significant probability levels, respectively.

Table 3: Total duration as influenced by the interaction between the salinity levels and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	135.00	124.00	124.00	124.00	137.67	123.33	123.00	122.33
Sakha101	137.67	128.00	121.00	113.00	138.17	127.50	121.17	112.50
Sakha102	125.67	120.00	110.00	106.00	125.16	119.50	109.50	104.40
Sakha104	138.00	128.00	125.00	121.00	139.00	127.50	123.83	120.50
Sakha105	123.00	128.00	122.00	118.00	130.50	127.50	121.50	117.50
Sakha106	126.00	127.00	120.00	117.00	125.50	126.50	119.50	116.50
Giza 179	125.00	127.00	123.00	116.00	125.50	126.50	122.50	115.50
Giza 182	128.33	122.00	120.00	118.00	128.33	122.50	120.00	117.10
Gz 1368- S- 5-4	138.67	135.00	128.00	124.00	139.17	135.00	128.50	124.50
IET 1444	132.00	128.00	126.00	120.00	133.50	128.50	126.50	120.33
Interaction (F-test): A * B	**				**			
L.S.D 0.05	1.95				2.03			
L.S.D 0.01	2.38				2.48			

Furthermore, Table (2) revealed that the interaction between salinity levels and the investigated genotypes was highly significant regarding all studied characters. Table (3) shows total duration as influenced by the interaction between the salinity levels and genotypes during 2011 and 2012 seasons. Obviously, salinity stress caused earliness in heading which increased by increasing the salinity level in case of all genotypes. While, it was interesting to note that the tested genotypes were affected differently by salinity stress. The results showed that the most affected genotype was Sakha101 recording 24 – 23 days earliness under 8000 ppm in the tow season, respectively. Meanwhile, 10 - 11 days differences were observed for Giza 182 and Sakha104 under the same conditions. These findings prove that, in spite of most of tested genotypes are local materials, there were a wide variability was detected between these genotypes. Similar results were observed previously by Bari *et al.* (1981), Islam *et al.* (1996), El-Mowelhi *et al.* (1995) and El-Refaee *et al.* (2005).

In respect to yield contributing characters, results in table Table (4) showed that means of number of panicles/ plant as influenced by the interaction between salinity levels and genotypes during 2011 and 2012 seasons. Sharp decrease in number of panicles/plant was occurred gradually by increasing salinity levels and this decrease was maximized under 8000 ppm for all genotypes in both seasons. Similar results were exhibited previously by El-Mowelhi *et al.* (1995). and Flowers and Flowers (2005).

Table 4: Number of panicles/ plant as influenced by the interaction between the salinity levels and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	21.00	11.66	7.33	4.67	21.66	11.33	3.66	3.67
Sakha101	22.67	9.33	5.00	3.00	22.00	9.00	4.00	3.00
Sakha102	14.00	8.67	4.33	3.33	14.05	8.00	3.00	3.02
Sakha104	16.33	10.33	6.00	4.33	16.00	10.00	5.00	5.00
Sakha105	14.00	6.33	4.00	4.10	14.50	6.55	4.75	4.35
Sakha106	18.00	9.55	6.40	4.00	18.60	9.10	6.35	4.50
Giza 179	20.88	13.50	8.50	6.75	20.50	13.85	8.80	6.65
Giza 182	20.57	9.67	5.00	4.00	20.00	9.05	4.33	3.00
Gz 1368- S- 5-4	17.00	15.33	12.33	10.33	17.00	15.00	11.00	11.00
IET 1444	18.67	14.33	10.33	8.67	18.00	14.00	9.00	8.00
Interaction (F- test): A * B	**				**			
L.S.D 0.05	1.33				1.38			
L.S.D 0.01	1.63				1.70			

This decrease was optimized in case of Giza 178 and Sakha 101 with about 21 - 22.67 panicles/plant, while it was minimized to about 10 - 12 panicles /plant in case of GZ 1368 –S-5-4 and IET 1444 assuring the wide variability between the genotypes. Similar results were recorded previously by Islam *et al.* (1996), Mohaiudden *et al.* (1998) and El-Refaee *et al.* (2005).

Furthermore, number of filled grains/panicle was also decreased as it was affected by the interaction between salinity levels and genotypes during the two seasons of study. It could be noticed that sudden decrease in such character was occurred when the genotypes were faced the first level of salinity (4000 ppm). This decrease was ranged between 92.6 – 52.44% in 2011 season for Sakha 105 and GZ 1368 –S-5-4 respectively and from 93.7% to 33.7% for Sakha105 and GZ 1368 –S-5-4 in 2012 season, (Table, 5). At 8000 ppm, the decrease percentages in number of field grains/panicle were about 97.8 % to 97.4% for Sakha 101 and about 61.47% for GZ 1368 –S-5-4 in the two seasons respectively. Indicating that the number of field grains/panicle character is dramatically affected by any salinity level and this in turn clarifies the main reason of the decrease in grain yield under salinity stress. Similar results were reported previously by Mohaiudden *et al.* (1998) and Munns *et al.* (2006).

Table 5: Number of filled grains/ panicle as influenced by the interaction between salinity level and varieties during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	163.67	48.33	28.67	19.00	159.33	50.12	30.35	20.11
Sakha101	125.67	4.00	2.67	1.33	119.50	4.50	2.75	1.35
Sakha102	118.67	21.00	8.67	2.33	116.10	22.30	8.55	2.30
Sakha104	134.33	61.00	31.67	22.33	129.50	60.25	29.30	21.25
Sakha105	149.00	11.00	5.50	3.30	145.20	12.50	5.30	3.33
Sakha106	152.50	25.60	17.35	9.00	149.20	26.31	18.15	9.44
Giza 179	141.20	48.70	31.10	21.00	238.25	50.15	33.21	19.75
Giza 182	143.33	39.00	25.33	17.00	244.20	40.12	25.55	17.55
Gz 1368- S- 5-4	122.67	58.33	47.67	33.00	125.30	61.50	48.75	34.50
IET 1444	138.67	54.33	35.33	26.00	135.25	55.40	33.25	25.24
Interaction (F- test): A * B	**				**			
L.S.D 0.05	5.28				5.00			
L.S.D 0.01	6.45				6.11			

Same trend was also observed for 100-grain weight character for all tested genotypes but with different levels (Table, 6). For example, highest decrease was observed for Sakha 101 (1.40 g in the two seasons) and Sakha 102 (1.34 - 1.10 g, in the two seasons, respectively) meanwhile, the lowest decrease was detected for GZ 1368 –S-5-4 that ranged between 0.43 g in 2011 and 0.51 g in 2012 seasons. This results means that grain filling was significantly affected by salinity which causes lighter grains however this effect differ from genotype to another according to the interaction between their genetic constitution and the environment. Similar results were observed previously by Bari *et al.* (1981) and Munns *et al.* (2006).

Table 6: One hundred grain weight as influenced by the interaction between salinity levels and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	2.10	1.66	1.56	1.46	2.15	1.67	1.66	1.55
Sakha101	2.73	2.36	2.00	1.53	2.75	2.36	2.10	1.55
Sakha102	2.70	2.50	2.43	1.56	2.75	2.41	2.25	1.85
Sakha104	2.50	2.13	2.06	1.80	2.50	2.15	2.10	1.97
Sakha105	2.71	2.35	2.30	1.82	2.70	2.30	2.10	1.80
Sakha106	2.61	2.30	2.43	1.83	2.61	2.30	2.40	1.73
Giza 179	2.55	2.15	2.10	2.00	2.58	2.18	2.15	2.03
Giza 182	2.70	2.46	2.33	2.06	2.70	2.47	2.35	2.15
Gz 1368- S- 5-4	2.33	2.06	2.00	2.00	2.35	2.09	2.13	2.04
IET 1444	2.20	2.16	2.03	1.80	2.25	2.09	2.03	1.85
Interaction (F- test): A * B	**				**			
L.S.D 0.05	0.07				0.08			
L.S.D 0.01	0.09				0.10			

Further, Table (7) represents sterility % as influenced by the interaction between the salinity level and genotypes during 2011 and 2012 seasons. It is recognized that this character behaved vise verse number of filled grains /panicle character discussed earlier. Sterility % increased significantly just when genotypes were exposed to the first level of salinity (4000 ppm.) and it increased gradually by increasing salinity level and maximized under 8000 ppm. The lowest increase was computed for Giza 182 and GZ 1368 –S-5-4, meantime the highest increase was estimated for Sakha 101 and Sakha 102 in 2011 season and for Sakha 106 and Sakha 101 in the following season. These results suggested that salinity causes abortion to fertilization operation in rice plant regardless the genotype genetic background. Similar results were reported previously by Islam *et al.* (1996) and Mohaiudden *et al.* (1998).

In respect to yield contributing characters, results in Table (8) showed that salinity tolerance index as influenced by the interaction between salinity levels and genotypes during 2011 and 2012 seasons.

Table 7: Sterility % as influenced by the interaction between salinity level and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	11.15	43.27	57.25	79.98	10.50	45.30	61.20	82.30
Sakha101	7.17	70.06	95.55	96.37	6.55	65.30	87.33	92.20
Sakha102	4.25	74.94	81.17	94.62	4.33	69.50	82.31	91.35
Sakha104	6.65	44.22	64.57	86.28	7.15	45.25	61.38	83.48
Sakha105	5.23	41.80	73.20	89.50	5.80	45.35	75.50	91.30
Sakha106	6.25	38.50	67.90	91.20	5.95	40.25	71.45	93.55
Giza 179	9.95	38.50	61.70	78.90	7.85	41.30	65.70	75.55
Giza 182	10.02	31.56	48.71	67.30	9.15	35.20	51.75	66.24
Gz 1368- S- 5-4	5.81	45.10	54.40	70.68	4.85	41.30	51.20	68.35
IET 1444	2.24	26.58	77.62	76.77	5.25	28.30	67.54	73.65
Interaction (F- test): A * B	**				**			
L.S.D 0.05	1.70				1.70			
L.S.D 0.01	2.08				2.09			

Sharp decrease in salinity tolerance index was occurred gradually by increasing salinity levels and this decrease was maximized under 8000 ppm for all genotypes in both seasons. Similar results were exhibited previously by El-Mowelhi *et al.* (1995), Flowers and Flowers (2005) and Munns *et al.* (2006).

Table 8: Salinity tolerance index as influenced by the interaction between salinity level and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011			Season 2012		
	Salinity levels			Salinity levels		
	4000 ppm.	6000 ppm.	8000 ppm.	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	51.63	20.88	8.52	54.02	19.85	7.45
Sakha101	25.66	7.60	2.41	27.45	8.55	3.15
Sakha102	23.42	6.45	2.53	24.87	8.25	1.65
Sakha104	31.37	11.53	4.73	29.85	11.55	3.55
Sakha105	29.19	18.81	4.97	31.05	16.75	3.83
Sakha106	32.41	20.19	7.12	33.15	19.88	6.55
Giza 179	41.18	24.71	9.83	40.75	23.56	8.76
Giza 182	29.00	11.31	4.41	29.81	10.50	3.65
Gz 1368- S- 5-4	60.30	31.83	15.79	61.25	29.85	14.71
IET 1444	46.23	18.53	13.48	46.25	17.83	14.05
Interaction (F- test): A * B	**			**		
L.S.D 0.05	4.00			3.85		
L.S.D 0.01	5.32			5.03		

The collective results of the aforementioned results of yield component characters appear on the results of the grain yield/plant of the tested genotypes as affected by salinity levels in the two seasons of study, (Table, 9). Obviously, grain yield/plant of all tested genotypes decreased sharply under all salinity levels starting from 4000 ppm. till it maximized at 8000 ppm. level. This decrease in grain yield/plant and its yield component in general.

Table 9: Grain yield/ plant as influenced by the interaction between salinity level and genotypes during 2011 and 2012 seasons.

Genotypes	Season 2011				Season 2012			
	Salinity levels				Salinity levels			
	Tap water	4000 ppm.	6000 ppm.	8000 ppm.	Tap water	4000 ppm.	6000 ppm.	8000 ppm.
Giza178	34.41	22.91	9.28	3.78	34.41	22.90	9.28	3.78
Sakha101	36.55	11.92	3.55	1.12	36.21	12.25	3.31	1.16
Sakha102	32.45	9.92	2.75	1.08	32.88	9.25	3.08	1.11
Sakha104	35.50	14.25	5.26	2.15	35.83	13.45	5.59	2.11
Sakha105	36.25	13.50	8.70	2.30	35.55	15.25	9.10	3.30
Sakha106	37.05	15.25	9.50	3.35	37.50	16.30	8.95	3.45
Giza 179	36.75	19.25	11.55	5.60	36.55	20.10	10.50	5.23
Giza 182	32.45	12.28	4.82	1.87	32.78	11.61	5.15	1.67
Gz 1368- S- 5-4	31.58	25.02	13.25	6.56	32.25	24.35	13.58	6.68
IET 1444	29.55	15.22	7.35	5.43	28.88	18.75	7.01	5.15
Interaction (F- test): A * B	**				**			
L.S.D 0.05	1.19				1.20			
L.S.D 0.01	1.45				1.47			

The highest decrease was observed for Sakha 101 and Sakha 102, while the lowest decrease was found in case of GZ 1368 –S-5-4 and Giza 179 in the two seasons. These findings suggested that these last two genotypes possess salinity tolerance and both of them could be selected to be grown under salt effected soil and/or as a donor for salinity tolerance in salinity crossing program. Similar results were recorded previously by Bari *et al.* (1981), El-Mowelhi *et al.* (1995), Islam *et al.* (1996), El-Refaee *et al.* (2005), Flowers and Flowers (2005) and Munns *et al.* (2006).

1- Water stress experiment:

Results in Table (10) show that means of total duration (days), yield components and grain yield /plant characters of some rice genotypes as affected by two irrigation systems during 2011 and 2012 seasons. Significant and highly significant differences between means of the irrigation treatments for all tested characters in the two seasons of study. It can be observed that means of all characters were decreased, except total duration and sterility % which were increased. This in turn led to the conclusion that water stress causes delay in heading and low yield components led to low grain yield. Similar results were reported previously by Anbumozhi *et al.* (1998).

In addition, analysis of variance revealed significant and highly significant differences among genotypes for the entire tested characters, indicating the existence of high variability among the evaluated genotypes in both seasons. It is obvious to see that there are wide ranges of variability between genotypes considering all characters under water stress treatments. This could be attributed to the differences of the genetic constitution of the genotypes. Thus there is ample scope for selection of different qualitative and quantitative characters for rice improvement from drought tolerance point of view. Similar results were recorded previously by Anbumozhi *et al.* (1998), Kato *et al.* (2007) and Fitzgerald *et al.* (2010).

Furthermore, results presented in Table (10) revealed that the interaction between irrigation treatments and investigated genotypes were significant and highly significant along the two seasons of study. Results presented Table (11) water stress caused delay in heading and it was interesting to note that the tested genotypes were affected differently by this type of stress. The results showed that the most affected genotype was Sakha 101 recording 2 days delay in heading. Meanwhile, no differences were observed for Giza 182 and 3 days delay were recorded for most of the tested genotypes under the same conditions. Dramatic decrease in number of panicles/plant was occurred as affected by drought treatment for all genotypes in the two seasons of study. This decrement was optimized in case of Sakha 102 followed by Sakha 104 and Sakha 105 with about 13 - 14 panicles/plant, while it was minimized to about 5-6 panicles/plant in case of IET 1444 indicating that water stress conditions could suppressed plant growth during tellering stage and as a result the number of ear peering tillers was decreased (Table, 11). Similar results were observed previously by Zayed (1997) and Anbumozhi *et al.* (1998).

Table 10: Mean performance of total duration (days), yield components and grain yield /plant of some rice genotypes as affected by two irrigation regimes during 2011 and 2012 seasons.

Factor	Total duration (days)		No. of panicles/ plant		No. of filled grains/ panicle		100- grain weight (g)		Sterility %		Grain yield/ plant	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Drought (A)												
Normal conditions	121.37	121.35	22.83	22.10	188.60	184.00	2.91	2.83	6.07	6.65	40.42	41.20
Drought	135.97	136.57	12.60	11.70	116.85	112.95	2.48	2.44	8.41	7.06	15.79	14.32
F. test	**	*	**	**	*	*	*	**	*	*	**	**
L.S.D 0.05	2.78	12.82	0.74	0.50	15.16	1137	0.18	0.10	0.70	2.34	2.11	1.76
L.S.D 0.01	4.14	19.09	1.10	0.74	22.58	16.94	0.28	0.15	1.05	3.49	3.14	2.62
Genotypes (B)												
Giza178	136.00	135.67	17.75	17.12	181.30	175.88	2.13	2.28	6.32	5.96	30.45	29.78
Sakha101	143.00	145.00	17.28	16.62	147.80	146.75	2.70	2.60	9.01	8.04	24.79	24.76
Sakha102	126.67	125.33	14.45	13.95	126.85	123.00	3.01	2.95	9.29	8.27	22.65	22.55
Sakha104	137.17	138.67	15.12	14.95	151.70	147.50	2.80	2.71	6.84	6.27	24.23	24.10
Sakha105	123.50	124.00	17.53	16.20	128.30	126.85	3.13	3.01	5.93	5.85	22.93	22.80
Sakha106	126.17	125.00	16.37	15.87	131.20	126.23	2.85	2.73	11.50	10.60	23.58	23.56
Giza 179	124.00	125.67	21.70	20.20	186.25	180.25	2.55	2.53	6.09	5.95	33.22	32.89
Giza 182	129.00	126.00	19.53	18.37	148.75	147.30	2.50	2.50	8.05	7.56	31.42	30.78
Gz 1368- S- 5-4	137.67	138.00	20.70	20.03	146.23	140.00	2.51	2.46	5.36	5.46	31.38	30.63
IET 1444	135.50	137.17	16.70	15.70	178.55	171.39	2.61	2.61	4.01	4.33	36.40	35.72
F. test	**	**	**	**	**	*	**	**	**	**	**	**
L.S.D 0.05	1.97	2.68	1.87	1.96	12.79	14.75	0.14	0.21	0.82	1.14	1.69	1.81
L.S.D 0.01	2.72	3.69	2.57	2.71	17.63	20.33	0.20	0.28	1.13	1.57	2.34	2.49

*, ** and NS: significant at 0.05, 0.01 and not significant probability levels, respectively.

Table 11: Total duration and number of panicles/ plant as influenced by the interaction between two irrigation systems and genotypes during 2011 and 2012 seasons.

Genotypes	Total duration				No. of panicles/ plant			
	Season 2011		Season 2012		Season 2011		Season 2012	
	Normal	Drought	Normal	Drought	Normal	Drought	Normal	Drought
Giza178	136.00	143.00	135.33	142.00	22.50	13.07	21.50	12.73
Sakha101	141.00	145.00	140.67	142.33	23.50	11.07	23.17	10.05
Sakha102	123.00	130.33	122.00	131.67	21.83	7.10	21.17	6.73
Sakha104	137.67	139.67	140.00	142.33	18.83	11.40	19.17	10.73
Sakha105	121.67	131.33	122.00	133.00	24.33	10.73	22.67	9.73
Sakha106	121.33	131.00	121.00	131.33	23.00	9.73	22.33	9.40
Giza 179	121.00	139.00	123.33	140.00	25.33	18.07	23.67	16.73
Giza 182	125.00	147.00	126.67	146.33	26.00	13.05	25.00	11.73
Gz 1368- S- 5-4	134.00	141.33	135.00	142.00	24.00	17.40	23.67	16.40
IET 1444	129.00	132.00	131.67	132.67	19.00	14.40	18.67	12.73
Interaction (F-test): A * B	**		**		**		**	
L.S.D 0.05	1.59		2.16		1.50		1.58	
L.S.D 0.01	1.94		2.64		1.84		1.94	

Furthermore, results presented in Table (12) indicated that number of filled grains/panicle as the best criteria for water stress conditions was sharply decreased as it was affected by the interaction between the irrigation treatments and genotypes during the two seasons of study. It could be noticed that sudden decrease in such character was occurred when the genotypes were subjected to water stress conditions. This decrement was ranged between 94 - 93 filled grains/panicle and 29 - 33 filled grains/panicle for Sakha 105 and GZ 1368-S-5-4 in the two seasons, respectively, indicating that the number of field grains/panicle is dramatically affected by water stress conditions and this in turn clarifies the main reason of the decrease in grain yield under such stress. Similar results were exhibited previously by Anbumozhi *et al.* (1998).

Same trend was also observed for 100-grain weight character for all tested genotypes but with different levels (Table, 12). For example, the highest decrement was observed for Sakha101 (0.8 g in the two seasons) meanwhile, the lowest decrease was detected for Giza 179 that ranged between 0.17g in 2011 and 0.18g in 2012 seasons. This results means that grain filling was significantly affected by water stress conditions which causes lighter grains because of the shortage in water decrease mean of transferring the products of the photosynthesis from the green parts of the plant to the sink and as a result the grain filling decreased, however this effect differed significantly from genotype to another according to the interaction between their genetic constitution and environment. Similar results were reported previously by Anbumozhi *et al.* (1998) and Fitzgerald *et al.* (2010).

Table 12: Number of filled grains/ panicle and 100- grain weight as influenced by the interaction between two irrigation systems and genotypes during 2011 and 2012 seasons.

Genotypes	No. of filled grains/ panicle				100- grain weight (g)			
	Season 2011		Season 2012		Season 2011		Season 2012	
	Normal	Drought	Normal	Drought	Normal	Drought	Normal	Drought
Giza178	183.30	134.30	187.00	130.00	2.50	2.13	2.43	2.13
Sakha101	172.00	103.70	177.00	106.70	2.80	2.30	2.80	2.20
Sakha102	155.30	98.33	151.25	95.00	2.80	2.70	2.80	2.73
Sakha104	175.70	117.75	172.33	111.75	2.85	2.57	2.86	2.26
Sakha105	165.77	81.00	163.00	80.33	2.88	2.66	2.90	2.60
Sakha106	171.00	91.30	170.30	82.25	2.80	2.30	2.80	2.33
Giza 179	181.70	150.77	186.00	144.35	2.63	2.46	2.61	2.43
Giza 182	172.33	115.00	178.75	116.00	2.60	2.33	2.57	2.30
Gz 1368- S- 5-4	160.70	131.75	156.33	123.70	2.56	2.46	2.50	2.43
IET 1444	178.00	144.00	171.70	139.00	2.70	2.53	2.75	2.50
Interaction (F-test): A * B	**		*		**		**	
L.S.D 0.05	10.31		11.89		0.11		0.16	
L.S.D 0.01	12.60		14.53		0.14		0.20	

Further, results presented in Table (13) represent sterility % as influenced by the interaction between the irrigation treatments and genotypes during 2011 and 2012 seasons. It is recognized that this character behaved in contrary to number of filled grains/panicle character discussed earlier. Sterility % increased significantly when genotypes were exposed to drought conditions. The lowest increase was computed for Sakha 101 that differ from

0.37% to 0.48% in 2011 and 2012 seasons, respectively. In the meantime the highest increment was estimated for Giza 182 (11.70-9.07%) and Giza 178 (7.68-7.20%) in both seasons. It could be suggested that water stress conditions could cause decrease in the viability of the sexual organs of the spikelet and as a result the sterility % increased. Similar results were reported previously by Zayed (1997) and Kato *et al.* (2007).

Same trend was also observed for drought tolerance index character for all tested genotypes, the highest decrement was observed for Sakha105 (84.08 in 2011 and 84.47 in 2012 seasons) meanwhile, the lowest decrease was detected for Giza 1368 -S-5-4 that ranged between 17.19 in 2011 and 22.41 in 2012 seasons (Table 13), indicating that the drought tolerance index is dramatically affected by water stress and this in turn clarifies the main reason of the decrease in drought tolerance index under such stress. Similar results were reported previously by Anbumozhi *et al.* (1998) and Fitzgerald *et al.* (2010).

Above results of yield component characters clarify that grain yield/ plant of the tested genotypes as affected by irrigation treatment in both seasons of study, (Table, 13). Grain yield/plant of all tested genotypes decreased sharply under water stress. This decrement in grain yield/plant was expected because of the decrease in all its yield component. Highest decrease was observed for Sakha 101, Sakha 105, and Sakha 106, while the lowest decrease was found in case of GZ 1368-S-5-4 and Giza 179in the two seasons of study.

Table 13: Sterility %, drought tolerance index and grain yield/ plant as influenced by the interaction between two irrigation systems and varieties during 2011 and 2012 seasons.

Genotypes	Sterility %				Drought tolerance index		Grain yield /Plant (g)			
	Season 2011		Season 2012		Season 2011	Season 2012	Season 2011		Season 2012	
	Normal	Drought	Normal	Drought			Normal	Drought	Normal	Drought
Giza178	2.48	10.16	2.36	9.56	43.40	41.93	42.47	18.43	41.97	17.60
Sakha101	8.83	9.20	7.80	8.28	18.53	19.70	41.83	7.75	41.37	8.15
Sakha102	8.25	10.33	8.08	9.36	17.66	18.59	38.50	6.80	38.03	7.07
Sakha104	5.78	7.90	5.25	7.30	27.55	27.51	38.00	10.47	37.80	10.40
Sakha105	4.43	7.45	4.98	6.73	15.92	15.53	39.57	6.30	39.47	6.13
Sakha106	8.71	14.30	7.88	13.33	16.65	17.51	40.43	6.73	40.10	7.02
Giza 179	4.15	8.03	4.86	7.03	71.78	70.55	41.00	29.43	41.50	29.28
Giza 182	2.20	13.90	3.03	12.10	38.09	36.61	45.50	17.33	45.07	16.50
Gz 1368-S- 5-4	4.33	6.40	4.83	6.10	82.81	77.59	34.33	28.43	34.50	26.77
IET 1444	2.58	5.45	2.85	5.82	71.17	69.31	42.53	30.27	42.20	29.25
Interaction (F-test): A * B	**		**		**	**	**		**	
L.S.D 0.05	0.66		0.91		3.11	3.17	1.37		1.46	
L.S.D 0.01	0.81		1.12		4.13	4.21	1.67		1.78	

These results revealed that the last two genotypes could have drought tolerance and one of them or both could be selected to be grown under water stress conditions and/or as a donor for drought tolerance in the crossing program will be made mainly for this stress in the future. Similar results were recorded previously Anbumozhi *et al.* (1998) and Fitzgerald *et al.* (2010).

3-Estimates of component of variance; genotypic (GCV) and phenotypic (PCV) coefficients of variability, broad sense heritability (h^2B) and genetic advance for vegetative traits under saline soil and water stress conditions.

The estimates of phenotypic (Vp) and genotypic (Vg) variation were obtained for different characters and they are presented in Table 14. A wide range of phenotypic variance was observed for the characters like total duration, number of filled grains per panicle, 100 grain weight, salinity tolerance index, drought tolerance index and grain yield/plant. Whereas lower range of phenotypic variance was observed for the characters like number of panicles/plant. Genotypic variance is lower than the phenotypic variance for all yield and yield components characters studied. Estimates of phenotypic variance revealed that number of field grains/panicle exhibit highest phenotypic variance. A perusal of GCV revealed that maximum value of genetic coefficient of variation (GCV) was recorded also for the same character. These results are in confirmation to the findings of Deosarkar *et al.* (1989) and Soliman *et al.* (1993) (Table 13).

The studies on genotypic coefficient of variation and phenotypic coefficient of variation indicated that the presence of high amount of variance and role of the environment on the expression of these traits. The magnitude of phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the characters which may be due to higher degree of interaction of genotypes with the environment. These results were in agreement with Saranda and Sasikumar (1987), El-Hissewy and El-Kady (1992) and El-Abd (1995).

These values alone are not helpful in determining the heritable portion of variation (Falconer 1960). The proportion of genetic variability which is transmitted from parents to offspring is reflected by heritability (Lush 1949). In the present study high broad sense heritability was observed for traits like viz., number of panicles/plant, number of filled grains/panicle. Sterility % and grain yield/plant under saline soil condition. On the other hand, highest while lowest heritability was observed in broad sense heritability was observed for traits total duration, sterility% and grain yield/plant under water stress conditions in both seasons.

Genetic advance measures the difference between mean genotypic values of selected population and original population from which these were selected. The highest genetic advance was recorded for number of panicles/ plant followed by sterility% and grain yield/ plant under salinity condition and number of panicles/ plant followed by filled grains/panicle, drought tolerance index and grain yield/ plant under water stress conditions.

Table 14: Estimates of component of variance; genotypic (GCV) and phenotypic (PCV) coefficients of variability, broad sense heritability (h^2B) and genetic advance for grain yield and its components traits under saline soil and water stress conditions.

Characters		Grand mean		Component of variance						Genetic variability				h^2 B		Genetic advance	
				σ^2g		σ^2e		σ^2ph		PCV		GCV					
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Total duration	S	89.75	89.47	52.34	55.35	2.18	2.36	54.52	57.71	8.23	8.49	8.06	8.32	96.00	95.91	1626.9	1677.5
	D	101.17	101.37	67.00	69.90	1.45	2.68	68.45	72.58	8.18	8.40	8.09	8.25	97.88	96.31	1648.9	1667.3
No. of panicles/ plant	S	11.43	10.95	57.75	57.72	1.02	1.01	58.77	58.73	67.07	69.95	66.49	69.38	98.26	98.28	13576.6	14168.9
	D	18.62	17.80	37.08	36.38	1.30	1.44	38.38	37.82	33.27	34.55	32.70	33.89	96.61	96.19	6621.4	6846.6
No. of filled grains/ pa.	S	67.15	65.25	5624.52	5625.39	15.96	14.95	5640.48	5640.34	111.84	115.10	111.69	114.95	99.72	99.73	22974.6	23647.6
	D	152.7	148.5	1831.82	1759.04	60.81	80.81	1892.63	1839.85	28.49	28.88	28.03	28.24	96.79	95.61	5680.4	5688.9
100- grain weight (g)	S	2.26	2.31	0.160	0.155	0.003	0.004	0.163	0.159	17.87	17.28	17.71	17.06	98.16	97.49	3614.5	3469.3
	D	2.70	2.64	0.13	0.10	0.25	0.48	8.00	6.66	13.64	12.73	13.23	11.79	94.10	85.83	2643.7	2250.1
Sterility %	S	51.12	49.23	961.11	959.93	1.67	1.61	962.78	961.54	60.70	62.99	60.65	62.93	99.83	99.70	12482.0	12953.7
	D	7.24	6.88	10.95	7.91	0.25	0.48	11.20	8.39	46.23	42.11	45.71	40.89	97.77	94.28	9310.5	8178.8
Drought tolerance index	S	79.47	77.55	61.19	63.91	7.69	6.59	68.88	70.50	10.44	10.83	9.84	10.31	88.84	90.65	1911.2	2021.9
	D	61.70	60.25	1569.19	1495.50	10.25	9.75	1579.44	1505.25	64.41	64.39	64.20	64.19	99.35	99.35	13182.8	13179.3
Grain yield/ plant	S	17.83	16.88	267.25	267.11	0.81	0.75	268.06	267.86	91.83	96.96	91.69	96.82	99.70	99.72	18858.9	19917.3
	D	28.11	27.76	199.62	197.03	1.08	1.23	200.70	198.26	50.40	50.72	50.26	50.56	99.46	99.38	10326.1	10384.0

A character exhibiting high heritability may not necessarily give high genetic advance; Johnson *et al.* (1955) have showed that high heritability should be accompanied by high genetic advance to arrive at a more reliable conclusion. Therefore it should be combined with information on genetic advance. Thus a character possessing high heritability along with high genetic advance will be valuable in selection program.

High heritability coupled with high genetic advance were recorded for number of panicles/plant, number of filled grains/panicle, drought tolerance index and grain yield/plant suggesting preponderance of additive gene action in expression of these characters. Therefore, selection may be effective through these characters in segregating generation (Paramasivam *et al.* 1996).

The characters like total duration, and 100-grain weight exhibited high heritability coupled with low genetic advance suggesting preponderance on non-additive gene action in the inheritance of these traits, hence in this case selection may not be effective. Most of the above results in respect to heritability and genetic advance are in agreement with earlier reports on rice by Sawant and Patil (1995) and Sarawgi *et al.* (2000) for their potential to selection.

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سلوك بعض التراكيب الوراثية تحت كلا من اجهادات الملوحة ونقص المياه تحت الظروف المصرية

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أجريت هذة الدراسة بمزرعة مركز البحوث والتدريب فى الأرز (RRTC)، سخا، كفر الشيخ، مصر خلال المواسمين الصيفين ٢٠١١ و ٢٠١٢ لاختيار افضل الاصناف او السلالات التى تصلح كصنف فائق الانتاجية يصلح لزراعة تحت كل من الظروف الطبيعية والمعاكسه. وأشتملت الدراسة ١٠ أصناف من الأرز محلية وأجنبية والمعروفة بقدرتها على الانتاجية العالية تحت ظروف الزراعة العادية لاختبار مدى تحملها للملوحة والجفاف فى تجربتين منفصلتين وتم تنفيذ التجارب فى تصميم القطاعات الكاملة العشوائية.

أظهرت النتائج وجود إختلافات معنوية وعالية المعنوية بين قيم المتوسطات لكل التراكيب الوراثية المدروسة موضحة تأثر جميع هذه التراكيب الوراثية بمستويات الملوحة المختلفة وظروف الجفاف فى كلا موسمى الدراسة. وعرضت النتائج انخفاضا معنويا لجميع الصفات المدروسة تحت كلا الظرفين ماعدا عدد الايام حتى النضج التام التى نقصت بزيادة مستويات الملوحة.

أوضحت النتائج أن السلالتين GZ 1368 –S-5-4 و Giza 179 أفضل السلالت المدروسة في تحمل الملوحة بجانب تحمل الجفاف وبذلك واحدة من هاتين السلالتين يمكن أختيارها الزراعه تحت ظروف الطبيعيه او يمكن استغلالها فى برنامج التهجين للاستفاده منه بعض الصفات المرغوبة فى سبيل انتاج صنف ارز مصرى فائق. ومن ناحية اخرى على الرغم من ان الاصناف Sakha 102، Sakha 101 و Giza 182 كانت عالية المحصول تحت ظروف الزراعة العادية الا انها كانت عالية الحساسية تحت كلا من ظروف الملوحة والاجهاد المائى.

كما أظهرت غالبية النتائج أن معامل الأختلاف المظهرى (PCV) كان أعلى من معامل الأختلاف الوراثى (GCV) لمختلف الصفات المدروسة. وكانت الأختلافات بين معامل الأختلاف المظهرى (PCV) و معامل الأختلاف الوراثى (GCV) منخفضة لمعظم الصفات المدروسة. وهذا يدل على أقل درجة من التأثير البيئى على مظهر هذه الصفات.

كانت درجة التوريث المرتفعة مقرونة بارتفاع التحسين الوراثى المتوقع لصفات عدد السنيبلات الممتلئة/ دالية، عدد الداليات/ نبات و محصول الحبوب/ نبات موضحة الدور الرئيس للتفاعل الجينى المضيف فى وراثة هذه الصفات.

هذا وتوصى نتائج هذه الدراسة بأن هذه الصفات يمكن تحسينها بالأنتخاب فى الجيال الانعزالية. وعليه قد تخدم هذه الصفات كعلامة فى الإنتخاب الفعال أثناء برنامج التربية لتحسين المحصول.

قام بتحكيم البحث

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