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SUMMARY

The present investigation was carried out at the Experimental Farm of Rice Research and Training Center, Sakha, Kafr El-Sheikh, Egypt, during 2000 and 2001 seasons included two main experiments; i.e., experiment I (Sakha and El-Sirw) and experiment II (tap water, 4000 and 6000 ppm in the lysimeter).

The first experiment involved six rice varieties; i.e., Gaori, GZ1368-S-5-4, Giza 177, Sakha 101, Sakha 104 and Giza 182, beside their 15 F_1 's crosses. The parents and F_1 's were evaluated under two different environmental conditions (Sakha and El-Sirw) and twenty two traits; i.e. six agronomic, seven yield and its components, Na^+ , K^+ , Na/K ratio, and salinity index for studied traits and three grain quality characters, were studied. The studied traits were heading date, plant height, panicle length, straw weight/plant, flag leaf area and chlorophyll content as agronomic characters, number of panicles/plant, number of filled grains/panicle, sterility percentage, panicle weight, 1000-grain weight, grain yield/plant and harvest index as a yield and its components characters; Na^+ content, K content, Na/K ratio salinity index for number of filled grains/panicle, salinity index for 1000-grain weight and salinity index for grain yield/plant as Na^+ , K^+ , Na/K ratio, and salinity index for studied traits; grain shape, hulling percentage and milling percentage as a grain quality characters.

This experiment was executed in a R.C.B.D. with three replications and the data were analyzed according to Griffing (1956) method 2 and model 1.

The objectives are to study:

1. Heterosis relative to the better parents of the diallel crosses for the characters studied.
2. The magnitude of both general and specific combining abilities with the two conditions.
3. The phenotypic correlation coefficients among different traits.

The second experiment is concerned with the evaluation of the above mentioned parents and their F_1 crosses for the same studied traits in experiment I.

The data were analyzed also according to Griffing (1956) method 2, model 1 for the three levels of salinity; i.e. tap water, 4000 and 6000 ppm.

The obtained results were summarized as follows:

A. Experiment I (Sakha and El-Sirw):

1. The analysis of variance for all characters studied indicating highly significant mean squares for genotypes, parents and crosses for the two conditions.
2. The most desirable mean values under the two conditions were detected from the parents, Sakha 101 and the crosses, Sakha 101 x Sakha 104 for most agronomic characters studied; from Sakha 101 and Sakha 104 and the three crosses, Gaori x Sakha 104, and Sakha 101 x Sakha 104 for most yield and its components characters studied; from Gaori and the crosses, and Sakha 101 x Sakha 104 for most Na^+ , K^+ , Na/K ratio, and salinity index for studied traits and from Sakha 104 and the crosses, Sakha 101 x Sakha 104 for most grain quality characters studied.
3. The most pronounced useful heterosis effects relative to the better parents, under the two conditions (Sakha and El-Sirw) were detected in the crosses GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 for heading date; Sakha 101 x Sakha 104 for panicle length; GZ1368-S-5-4 x Sakha 104 for straw weight/plant; Gaori x Sakha 104 for flag leaf area and Sakha 101 x Sakha 104 for chlorophyll content; Sakha 101 x Sakha 104 for number of filled grains/panicle and sterility %; Sakha 101 x Sakha 104 for panicle weight; GZ1368-S-5-4 x Giza 182 for 1000-grain weight; Sakha 101 x Sakha 104 for grain yield/plant; Sakha 101 x Sakha 104 for harvest index; GZ1368-S-5-4 x Giza 182 for Na^+ content; Gaori x Sakha 101, Gaori x Sakha 104, Sakha 101 x Sakha 104 for K^+ content; Sakha 101 x Sakha 104 for Na/K ratio; Gaori x Sakha 104, and Sakha 101 x Sakha 104 for salinity index for number of filled grains/panicle; GZ1368-S-5-4 x Giza 182 for salinity index for 1000-grain weight; GZ1368-S-5-4 x Sakha 104 for salinity index for grain yield/plant; Giza 177 x Sakha 104 for grain shape; Sakha 101 x Sakha 104 for hulling % and GZ1368-S-5-4 x Giza 182 for milling %.
4. The general combining ability/specific combining ability ratios indicated that additive and additive x additive types of gene action were of greater importance in the inheritance of plant height, panicle length, chlorophyll content under the normal soil; for straw weight/plant under salinity soil, for flag leaf area under both normal and saline soil concerning agronomic characters studied. GCA/SCA ratios were found to be greater than unity for number of panicles/plant, sterility % and grain yield/plant under normal and

- saline soil; for number of filled grains/panicle, panicle weight and 1000-grain weight under normal soil; for harvest index under saline soil concerning yield and its components characters studied; for Na^+ content and K^+ content under both normal and saline soil, for salinity index in respect of grain yield/plant under saline soil.
5. The best desirable general combiners under the two conditions were Giza 177 for heading date; Gaori and Sakha 101 for plant height; Sakha 104 for panicle length; Gaori and Sakha 101 for straw weight/plant; Sakha 101 for flag leaf area; Sakha 101 for chlorophyll content; Sakha 101 and Giza 182 for number of panicles/plant, number of filled grains/panicle and sterility %; Sakha 104 for panicle weight; Sakha 101, Sakha 104 and Giza 182 for 1000-grain weight; Sakha 101 for grain yield/plant; Sakha 104 for harvest index; Gaori, GZ1368-S-5-4 and Sakha 104 for all Na^+ , K^+ , Na/K ratio, and salinity index for studied traits; Giza 182 for grain shape; Sakha 104 for hulling % and milling %.
 6. The GCA effects of parental varieties, in several cases, was associated with their mean performance, indicating that the mean performance of parental varieties gave a good criterion for their general combining ability. Hence, selection could be practiced in parents, either based on mean performance or on GCA effects with the same efficiency.
 7. The highest desirable SCA effects under the two conditions were detected from the crosses GZ1368-S-5-4 x Giza 182 for heading date; Gaori x Sakha 104 for plant height; Sakha 101 x Sakha 104 for panicle length; Sakha 101 x Giza 182 for straw weight/plant; Sakha 101 x Giza 182 for flag leaf area; Sakha 101 x Sakha 104 for number of panicles/plant; Gaori x Sakha 104, and Sakha 101 x Sakha 104 for number of filled grains/panicle; Gaori x Sakha 104 for sterility %; Sakha 101 x Sakha 104 for panicle weight; GZ1368-S-5-4 x Giza 182 for 1000-grain weight; Sakha 101 x Sakha 104 for grain yield/plant and Gaori x Sakha 104 for harvest index; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for Na^+ content; GZ1368-S-5-4 x Giza 182 for K^+ content; GZ1368-S-5-4 x Giza 182 for Na/K ratio; Gaori x Sakha 104, for salinity index in respect of number of filled grains/panicle; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for salinity index in respect of 1000-grain weight; Gaori x GZ1368-S-5-4 and Sakha 101 x Sakha 104 for salinity index concerning grain yield/plant; Gaori x GZ1368-S-5-4, GZ1368-S-5-4 x Giza 182 and Giza 177 x Giza 182 for grain shape; GZ1368-S-5-4 x Giza

B. Saline soil "El-Sirw":

B.1. Grain yield/plant was highly significantly and significantly positively correlated with 1000-grain weight, number of filled grains/panicle, number of panicles/plant, harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content (Table 26), while it was negatively correlated with sterility %, 1000-grain weight was significantly positively correlated with number of filled grains/panicle, number of panicles/plant, harvest index, panicle weight and panicle length, but it was not significant with the other traits studied.

These results, in turn, suggest that the selection for short plant height, more number of filled grains/panicle, more number of panicles/plant, heavier 1000-grain weight and heavier panicle weight lead to achieve higher yield under saline conditions.

B-2. Significant and highly significantly negatively correlations was found for Na^+ content with harvest index, panicle length and plant height, while no relationships was observed between Na^+ content and the other characters studied.

Highly significant and positively phenotypic correlation coefficients was found between grain yield/plant and K^+ content, while no relationships was observed between grain yield/plant and the other Na^+ , K^+ , Na/K ratio, and salinity index for studied traits.

These results, in turn, suggest that the selection for high levels of K^+ content and salinity index for 1000-grain weight, number of filled grains/panicle, low levels of Na^+ content and Na/K ratio lead to achieve higher yield under saline conditions.

B.3. There are highly significant and significant positive correlations between all agronomic, yield and its components characters and hulling %. While no relationships were observed between these characters and the other remaining grain quality characters studied, except the three agronomic characters; (heading date, plant height and flag leaf area). These results indicated that the selection for high percentage of milling and hulling % and medium grains lead to achieve higher quality of grains.

Experiment II "Lysimeter conditions:

The second experiment (lysimeter conditions) is connected with the evaluation the same six parents and their F_1 crosses which above mentioned in the first experiment under two levels of salinity 4000 and 6000 ppm in addition the control (tap water). The same agronomic yield and its components, chemical and grain quality characters studied in the first experiment were studied also.

The obtained results could be summarized as follows:

1. The analysis of variance for all studied characters indicated highly significant mean squares for genotypes, parents and crosses.
2. The most desirable mean values under the three treatments studied were observed from the genotypes, Sakha 104, Gaori x Sakha 104, for most agronomic characters studied; from GZ1368-S-5-4, Sakha 101, Gaori x Sakha 104 for most yield and its components characters studied; from Gaori, GZ1368-S-5-4, Sakha 104, Gaori x Sakha 104, for most chemical characters studied; from Sakha 104, Giza 182, Gaori x Sakha 104 and GZ1368-S-5-4 x Giza 182 for most grain quality characters studied.
3. The most pronounced useful heterotic effects relative to the better parents, under the three treatments tap water (control), 4000 and 6000 ppm, were detected in the crosses, Gaori x Sakha 101, Sakha 101 x Sakha 104 for heading date; Giza 177 x Giza 182 for plant height; Sakha 101 x Sakha 104 for panicle length; Giza 177 x Sakha 101 for straw weight/plant; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for flag leaf area; Gaori x Sakha 104 and Gaori x Giza 182 for chlorophyll content; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for number of panicles/plant; Gaori x Sakha 104 for number of filled grains/panicle; GZ1368-S-5-4 x Giza 182 for sterility %; Gaori x Sakha 104 for panicle weight and 1000-grain weight; Gaori x Sakha 104 for grain yield/plant; Gaori x Sakha 104 for harvest index; Gaori x Sakha 104 for Na^+ content; GZ1368-S-5-4 x Giza 182 for K^+ content; Sakha 101 x Sakha 104 for Na/K ratio; Sakha 101 x Sakha 104 Sakha 104 x Giza 182 for salinity index for number of filled grains/panicle; GZ1368-S-5-4 x Sakha 104 for salinity index for 1000-grain weight; GZ1368-S-5-4 x Giza 177 for salinity index for grain yield/plant; Gaori x Sakha 101, Gaori x Sakha 104, for grain shape; Gaori x Giza 177, Gaori x Sakha 104 and GZ1368-S-5-4 x Sakha 101 for hulling %; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for milling %.

Experiment II "Lysimeter conditions:

The second experiment "lysimeter conditions) is connected with the evaluation the same six parents and their F_1 crosses which above mentioned in the first experiment under two levels of salinity 4000 and 6000 ppm in addition the control (tap water). The same agronomic yield and its components, Na^+ , K^+ , Na/K ratio, and salinity index for studied traits and grain quality characters studied in the first experiment were studied also.

The obtained results could be summarized as follows:

1. The analysis of variance for all studied characters indicated highly significant mean squares for genotypes, parents and crosses.
2. The most desirable mean values under the three treatments studied were observed from the genotypes, Sakha 104, Gaori x Sakha 104, for most agronomic characters studied; from GZ1368-S-5-4, Sakha 101, Gaori x Sakha 104 for most yield and its components characters studied; from Gaori, GZ1368-S-5-4, Sakha 104, Gaori x Sakha 104, for most Na^+ , K^+ , Na/K ratio, and salinity index for studied traits studied; from Sakha 104, Giza 182, Gaori x Sakha 104 and GZ1368-S-5-4 x Giza 182 for most grain quality characters studied.
3. The most pronounced useful heterotic effects relative to the better parents, under the three treatments tap water (control), 4000 and 6000 ppm, were detected in the crosses, Gaori x Sakha 101, Sakha 101 x Sakha 104 for heading date; Giza 177 x Giza 182 for plant height; Sakha 101 x Sakha 104 for panicle length; Giza 177 x Sakha 101 for straw weight/plant; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for flag leaf area; Gaori x Sakha 104 and Gaori x Giza 182 for chlorophyll content; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for number of panicles/plant; Gaori x Sakha 104 for number of filled grains/panicle; GZ1368-S-5-4 x Giza 182 for sterility %; Gaori x Sakha 104 for panicle weight and 1000-grain weight; Gaori x Sakha 104 for grain yield/plant; Gaori x Sakha 104 for harvest index; Gaori x Sakha 104 for Na^+ content; GZ1368-S-5-4 x Giza 182 for K^+ content; Sakha 101 x Sakha 104 for Na/K ratio; Sakha 101 x Sakha 104 Sakha 104 x Giza 182 for salinity index for number of filled grains/panicle; GZ1368-S-5-4 x Sakha 104 for salinity index for 1000-grain weight; GZ1368-S-5-4 x Giza 177 for salinity index for grain yield/plant; Gaori x Sakha 101, Gaori x Sakha 104, for grain shape; Gaori x Giza 177, Gaori x Sakha 104 and

GZ1368-S-5-4 x Sakha 101 for hulling %; Gaori x Sakha 104 and Sakha 101 x Sakha 104 for milling %.

4. The GCA effects of some parental varieties were associated with their corresponding mean performance of certain agronomic traits studied under the three treatments (control, 4000 and 6000 ppm). These associations were concerned with the parents, Gaori and Sakha 104 for heading date; Gaori for plant height; Sakha 101 and Sakha 104 for panicle length; Giza 182 for straw weight/plant; Sakha 104 for flag leaf area and Sakha 104 for chlorophyll content.

It is note worthy to mention that, under the three treatments studied, there were association between the GCA effect and the mean performances of some parents, for certain yield and its components traits. Such association included the parents GZ1368-S-5-4 for number of panicles/plant; Giza 182 for number of filled grains/panicle; Sakha 104 for sterility %; Giza 177 for panicle weight; Giza 177 and Giza 182 for 1000-grain weight; Giza 177 and Sakha 104 for grain yield/plant.

The varieties Gaori, GZ1368-S-5-4 and Sakha 104 were the best parental varieties in general combining ability effects for Na^+ , K^+ , Na/K ratio, and salinity index for studied traits under lysimeter (conditions).

The rice varieties; Gaori, Giza 177 and Sakha 104 were the best parental varieties concerning general combining ability effects for grain quality characters studied under the three treatments.

5. The highest desirable SCA effects under the three treatments; i.e., tap water, 4000 and 6000 ppm were detected from the crosses; GZ1368-S-5-4 x Giza 182 for heading date; Gaori x Sakha 104, GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 for plant height; GZ1368-S-5-4 x Giza 177, GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 for panicle length; Giza 177 x Giza 182 for straw weight/plant; Gaori x Sakha 104, GZ1368-S-5-4 x Giza 182, GZ1368-S-5-4 x Sakha 101 and Giza 177 x Giza 182 for flag leaf area and the crosses; Gaori x Sakha 104, Gaori x Giza 182 and Sakha 101 x Sakha 104 for chlorophyll content in the three treatments studied.

The best crosses for yield and its components characters studied were, Gaori x Sakha 104, GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 under the three levels of salinity.

The best crosses for Na^+ , K^+ , Na/K ratio, and salinity index for studied traits were Gaori x Sakha 104, GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 at the three treatments under lysimeter conditions.

The best crosses for grain quality characters studied were Gaori x Sakha 104, GZ1368-S-5-4 x Giza 182 and Sakha 101 x Sakha 104 for the three treatments studied.

6. The phenotypic correlation coefficients among the traits studied under the three treatments revealed the following:

A. The control treatment (tap water):

A.1. Significant and positively correlation coefficients was found for grain yield/plant with 1000-grain weight, number of filled grains per panicle, number of panicles per plant, harvest index, panicle length and chlorophyll content. While it was negatively and highly significantly correlated with sterility %. One hundred grain weight was highly significantly and positively correlated with number of filled grains/panicle, number of panicles/plant, harvest index panicle weight, panicle length and chlorophyll content, while it was negatively and highly significantly correlated with sterility %. The number of filled grains/panicle was significantly and highly significant and correlated with number of panicles per plant, harvest index, panicle weight, panicle length, flag leaf area and chlorophyll content but it was negatively and significant correlated with sterility %. The number of panicles/plant was significantly and highly significantly correlated with harvest index, panicle weight, panicle length, flag leaf area and chlorophyll content and it was negatively and highly significantly correlated with sterility %. Sterility % was highly significant and negatively correlated with harvest index, panicle weight and panicle length, while, it was not significant with the other traits.

A.2. Na^+ content was significant and highly significant negatively correlated with grain yield/plant, number of filled grains/panicle, harvest index and plant height, but it was significantly positively correlated with panicle length.

Phenotypic correlation coefficients were found between K^+ content and the following characters; number of filled grains/panicle grain yield/plant, harvest index and chlorophyll content, Na/K ratio was significantly and positively correlated with sterility %, but it was significantly and highly significantly negatively correlated with grain yield per plant, 1000-grain weight, number of filled grains per panicle number of panicles per plant and harvest index. Salinity index for 1000-grain weight was significant positively was significant and highly significant positively correlated with harvest index and panicle weight.

- A.3. Grain shape was not significantly and negatively correlated with all agronomic, yield and its components characters studied. Milling percentage was significantly and positively correlated with straw weight/plant and chlorophyll content, while it was not significantly with the other remaining characters studied. Hulling percentage was positively and highly significant correlated with grain yield/plant, 1000-grain weight, number of filled grains/panicle, number of panicles/plant, harvest index, panicle weight, panicle length and chlorophyll content.

B. 4000 ppm treatment:

- B.1. Grain yield/plant was highly significant and significantly positively correlated with 1000-grain weight, number of filled grains/panicle, number of panicles/plant, harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content, while it was negatively correlated with sterility %. One thousand-grain weight was significantly and positively correlated with number of filled grains/panicle, number of panicles/plant, harvest index, panicle weight and panicle length, but it was not significantly with the other traits studied. The phenotypic correlation coefficients was found to be highly significantly and positively correlated between number of filled grains/panicle and panicle length. Phenotypic correlation coefficients between heading date and the number of filled grains/panicle was negatively significant. Number of panicles/plant was highly significant and significantly positively correlated with harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content. Panicle length was significantly and positively correlated with straw weight/plant, flag leaf area and chlorophyll content. Plant height was significantly and positively correlated with flag leaf area only. Straw weight/plant was positively correlated with flag leaf area. Flag

leaf area was highly significantly positively correlated with chlorophyll content. Heading date was not significant and negatively correlated with straw weight/plant, flag leaf area and chlorophyll content. Straw weight/plant was significantly and positively correlated with flat leaf area but it was not significant with chlorophyll content. Flag leaf area was highly significant and positively correlate with chlorophyll content.

C. 6000 ppm treatment:

C.1. Grain yield/plant was highly significant and significant positively correlated with 1000-grain weight, number of filled grains/panicle number of panicles/plant, harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content, while it was negatively correlated with sterility % and heading date. 1000-grain weight was significantly and highly significantly positively correlated with number of filled grains/panicle, number off panicles/plant, harvest index, panicle weight and panicle length, but it was negatively correlated with sterility % and heading date but it was not significant with the other traits studied. The phenotypic correlation coefficients was found to be significantly and positively correlated between number of filled grains/panicle and panicle length, while it was negatively correlated with heading date. Number of panicles/plat was highly significant and significantly positively correlated with harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content, while it was significantly negatively correlated with sterility % and heading date. Sterility % was highly significantly negatively correlated with harvest index, panicle weight, panicle length, straw weight/plant, flag leaf area and chlorophyll content, while it was significantly positively correlated with plant height and heading date.

C.2. Significant and highly significant negative correlations was found for Na^+ content with harvest index, panicle length and plant height, while no relationships was observed between Na^+ content and the other characters studied. Highly significant and positive phenotypic correlations coefficients was found between grain yield/plant and K^+ content, while no relationships was observed between grain yield/plant and the other Na^+ , K^+ , Na/K ratio, and salinity index for studied traits.