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Yield potentiality and photosynthetic parameters of some local and exotic elite rice genotypes

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ABSTRACT

This work aimed at studying earliness, yield and photosynthetic parameters in some local and exotic rice resources. Twelve rice entries were used in the study including two from Bangladesh, one from Madagascar, three from Egypt, two from Korea and four from IRRI. These genotypes were evaluated during 2020 and 2021 seasons in RCBD using four replications at the Faculty of Agriculture, Moshtohor Experiment Station. Significant differences were found among rice entries for all studied traits in the two growing seasons. The genotype GZ 10686-1-2-2-1 was the earliest among all studied entries, while genotype PR 78 was the shortest among all entries. Entry IRRI 142 had the highest significant value for chlorophyll content comparing to Giza 179, panicle length was highest with the genotype SAIBORO 9361. The genotype Korea 27 expressed the best mean values for panicle weight, weight of 100 grain and grain yield plant^{-1}, while genotype IRRI 152 ranked the second best for grain yield plant^{-1}. Genotype GZ 10848-1-2-2-1 was the best for number of tillers plant^{-1}. Moreover, the genotype IRRI 152 exhibited the most desirable mean values for cuvette temp. and leaf diffusive, while genotype Korea 27 was the best for quantum sensor, stomatal conductance and Co2 assimilation rate in both seasons. For transpiration rate, the genotype AC 2882 expressed the best mean value, while Korea 47 gave the lowest value for this trait with significant difference from the variety Giza 179.

Key words: Rice, yield potentiality, photosynthetic parameters.

1. INTRODUCTION

Rice (*Oryza sativa*, L.) represents the main source of food for half of the world population [1]. In Egypt, it ranks the second cereal crop after wheat with a cultivated area of 554205 ha. and produced about 4.5 million tons in ٢٠٢٠ season [2]. Our national goal is to increase the yield potentiality of rice varieties to face the demand of this crop particularly under the limited area of cultivation and scarcity of irrigation water. Therefore, many attempts are being made by rice breeders to develop and evaluate new rice genotypes with earlier maturity and high yield potentiality. Yield itself is a complicated trait and is greatly affected by environment fluctuations, therefore selection for higher yield productivity depends mainly upon screening local and exotic genotypes under different environments [3].

Adhikari [4] reported that the magnitude of variability among rice genotypes determines the success of plant breeding program towards higher productivity. Meantime, information about photosynthetic parameters in rice are helpful in selecting desirable genotypes with higher yield potentiality. **Adachi [5]** studied leaf photosynthesis in rice, and found that increasing the rate of photosynthesis caused an increase in grain yield in rice (*Oryza sativa*). **Panda [6]** found that the mean values of some photosynthetic traits in five rice varieties were significantly higher in rice landraces comparing to improved varieties. The variability among rice genotypes were studied by several researchers **[7,8,9,10, 11].** Therefore, the objectives of this work were to evaluate yield potentiality of some local and exotic rice genotypes and estimate some physiological traits as good parameters for selection program.

2. MATERIALS AND METHODS

Plant Materials:

Twelve local and exotic rice entries with high level of variability were used in this study. These entries included two from Bangladesh, one from Madagascar, three from Egypt, two from Korea and four from IRRI. The names, source and origin of these entries are presented in Table (1).

Table (1) Names, source and origin of the studied rice genotypes

NO.	Genotype name and source	Origin
1	SAILBORO 9361	Bangladesh
2	NUNCHA	Bangladesh
3	FOFIFA 161	Madagascar
4	GZ 10686-2-1-3-4	Egypt
5	GZ 10848-1-2-2-1	Egypt
6	Korea 27	Korea
7	AC 2882	IRRI
8	IRRI 142	IRRI
9	IRRI 152	IRRI
10	Korea 47	Korea
11	PR 78	IRRI
12	Giza 179	Egypt

Field Experiment:

The current investigation was undertaken during summer seasons of 2020 and 2021 at the Experiment Station of the Faculty of Agriculture, Moshtohor, Benha University. In both seasons, the twelve genotypes were planted on May 15th in the nursery and after 30 days the seedlings were transplanted into the permanent field in randomized complete block design with 4 replicates. Each entry was transplanted in 5 rows 4 meter length with 20 cm between hills. All other culture practices were done properly as recommended for the region. Data were recorded on days to 50% flowering (day), plant height (cm), chlorophyll content, number of panicle plant-1, panicle length (cm), panicle weight (g), number of tillers plant-1, weight of 100 grain, seed set %, grain yield (g) plant^{-1} and harvest index. Photosynthetic parameters, i.e., cuvette temp., quantum sensor, leaf diffusive, transpiration rate, stomatal conductance and Co2 assimilation rate were estimated using a portable porometer "steady-state porometer, LICOR, LI-1600, Lincoln, NE, USA" designed for assessing the steady-state Co2 and H2O exchange degrees of plant leaves [12]. Data were analyzed for each separate season and then the combined analysis was performed after testing homogeneity for both seasons according to Steel and Torrie [13].

Results and Discussion

The results of this work will be presented and discussed as follows:

A) Earliness and morphophysiological traits:

The statistical analyses for three traits namely, days to 50% flowering, plant height, chlorophyll content, are presented in Table 2. Mean squares due to genotypes were significant for all studied traits in both seasons. This indicated that the genotypes had great variability concerning the studied traits. These results agree with those obtained by [14,15,16, 17]. Moreover, significant variances due to the interaction between genotypes and seasons were detected for plant height, chlorophyll content. This means that the rice entries behaved somewhat differently from one season to another .

Mean values of the three traits are presented in Table 3. Regarding days to 50% flowering, the genotype GZ 10848-1-2-2-1 expressed the most desirable mean values in the 1st, 2nd seasons and combined over them recording 77.50, 78.50 and 78 days, respectively. Meantime, the entry Korea 27 ranked the second for this trait with significant difference as compared the variety Giza 179 .

The variety AC 2882 was the latest among all checked entries. Regarding plant height, the best mean performance was detected for the genotype PR 78 since it expressed the lowest and significant values in the first (75.25 cm), second season (82.75 cm) and combined analyses (82.0cm) comparing to the variety Giza 179

The highest mean of plant height was recorded with the genotype SAILBORO 9361 being 146.25 cm. For chlorophyll content, the most desirable mean values were obtained for the entry IRRI 152 recording 49.75, 49.00 and 49.38 in the first, second season and combined data, respectively. The entry Korea 27 ranked the second for this trait giving mean values of 47.88 in the combined analysis.

Table (2) Mean squares of days to 50% flowering, plant height and chlorophyll content in both seasons and combined data.

S.O.V	d.f		Days to 50% flowering			Plant height (cm)			Chlorophyll content (SPAD reading)		
	S	C	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
Seasons (S)		**1**			**1.50**			**114.84****			**14.79****
Rep/ S	**3**	**6**	**4.0**	**2.9**	**3.47**	**5.0**	**12.8**	**8.91**	**0.4**	**1.1**	**0.37**
Genotypes	**١١**	**11**	**45.0****	**42.2****	**86.06****	**1824.8***	**1987.7***	**3745.5****	**148.1****	**74.0****	**185.1****
Genotypes x S		**11**			**1.16**			**67.23***			**37.07***
Pooled error	**33**	**66**	**6.4**	**8.2**	**7.28**	**32.2**	**29.8**	**26.56**	**6.2**	**4.8**	**5.46**

* and ** significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Table (3) Mean performance of rice entries for days to 50% flowering, plant height and chlorophyll content in the first, second season and combined data.

Genotype	Days to 50% flowering			Plant height (cm)			Chlorophyll content		
	First Year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
SAILBORO 9361	**81.25**	**82.25**	**81.75**	**143.75**	**148.75**	**146.25**	**35.13**	**34.00**	**34.56**
NUNCHA	**82.75**	**83.75**	**83.25**	**143.75**	**138.25**	**141.00**	**34.98**	**36.60**	**35.79**
FOFIFA 161	**82.25**	**83.00**	**82.63**	**121.75**	**116.00**	**118.88**	**46.88**	**45.25**	**46.06**
GZ 10686-2-1-3-4	**79.75**	**79.50**	**79.63**	**89.50**	**75.00**	**82.25**	**44.53**	**44.43**	**44.48**
GZ 10848-1-2-2-1	**77.50**	**78.50**	**78.00**	**103.75**	**96.75**	**100.25**	**42.28**	**41.60**	**41.94**
Korea 27	**79.00**	**79.50**	**79.25**	**130.00**	**130.00**	**130.00**	**49.25**	**46.50**	**47.88**
AC 2882	**88.25**	**87.50**	**87.88**	**101.50**	**100.25**	**100.88**	**31.67**	**44.59**	**38.13**

IRRI 142	**87.00**	**87.75**	**87.38**	**100.00**	**101.50**	**100.75**	**47.48**	**45.63**	**46.55**
IRRI 152	**81.25**	**80.50**	**80.88**	**102.75**	**99.50**	**101.13**	**49.75**	**49.00**	**49.38**
Korea 47	**80.75**	**79.75**	**80.25**	**93.50**	**90.50**	**92.00**	**46.55**	**46.20**	**46.38**
PR 78	**78.00**	**78.75**	**78.38**	**75.25**	**82.75**	**79.00**	**46.18**	**45.30**	**45.74**
Giza 179	**84.50**	**84.50**	**84.50**	**103.00**	**103.00**	**103.00**	**40.28**	**45.25**	**42.76**
LSD 0.05	**3.51**	**3.96**	**2.64**	**7.86**	**7.57**	**5.46**	**3.44**	**3.02**	**2.29**
LSD 0.01	**4.60**	**5.19**	**3.47**	**10.31**	**9.92**	**7.15**	**4.51**	**3.96**	**3.00**

B- Yield and its components:

Analysis of variance for number of panicle plant-1, panicle length, panicle weight, number of tillers plant^{-1}, 100 grain weight, seed set %, grain yield plant^{-1} and harvest index are presented in Table 4. Highly significant mean squares for all traits were detected for all genotypes in both growing seasons and combined analysis. Such results reflect the magnitude of variability among previously mentioned rice genotypes concerning these traits. These results are in line with those mentioned by [3,11,15,18,19,20,21,22, 23].

Meantime, significant mean squares due to genotype x seasons interaction were significant for number of panicle plant^{-1}, panicle weight, number of tillers plant-1, 1000 grain weight and grain yield plant^{-1}. As a result, the previously mentioned traits behaved somewhat differently from one season to another, while other traits responded similarly to the fluctuations of the environments.

Performances of studied rice genotypes are presented in Table (5). For panicles number, the entry Korea 27 exhibited desirable mean value with significant difference from Giza 179 recording 21.75, 18.78 and 20.26 in the 1st, 2nd seasons and combined over them, respectively. The longest panicle was detected for the entry SAIBORO 9361 with mean value of 26.0, 25.50 and 25.75 in the 1st, 2nd season and combined analyses, respectively. Again, the entry Korea 27 expressed the highest and significant mean value for panicle weight recording 5.28 g in the combined analysis. In addition, the genotype GZ 10848-1-2-2-1 expressed the highest and significant mean value for number of tiller plant-1 recording 27.38. The entry IRRI 152 exhibited the most desirable values for 1000 grain weight recording 32.73, 31.63 and 32.18 g in the first, second seasons as well as combined analyses, respectively. For seed set %, the entry PR 78 recorded desirable value 97.18%, 96.33% and 96.76% for the respective cases .

Furthermore, the particular entry (Korea 27) exhibited the best mean values for grain yield plant-1 giving 60.50, 58.50 and 59.50 g in the 1st, 2nd season and overall two seasons, respectively. The entry IRRI ranked the second for grain yield plant-1 with significant difference comparing with Giza 179 (Table 5) and Fig. 1. Regarding harvest index, the Entry AC 2882 ranked the first among all genotypes giving values of 63.73, 63.75 and 63.74% in the respective three cases.

In conclusion, the two rice entries, Korea 27 and IRRI 152 seemed to be the best among all studied genotypes since they had the highest yield potentiality. These two entries are promising and could be used in productivity improvement of rice.

C- Photosynthetic parameters:

The data of cuvette temp., quantum sensor, leaf diffusive, transpiration rate, stomatal conductance and Co2 assimilation rate are presented in Table(6).

It is clear that mean squares due to genotypes were significant for all traits in both seasons revealing the predominance of variability among local and exotic rice genotype. Meanwhile, significant mean squares due to the interaction between genotypes and seasons were significant for all studied traits indicated that genotypes behaved differently in both summer growing seasons. These results are in line with those obtained by several investigators [6,8,9,10,11,24,25,26, 27].

Mean performances of rice genotypes for photosynthetic parameter in both seasons as well as combined analyses are presented in Table 7 and Figs 2-7. For cuvette sensor, the highest and significant mean values were detected for the entries PR 78 in the first season (28.16), IRRI 152 in the second season (28.33) and combined data (28.16) (Table 7). The lowest value for this trait was recorded for the entry AC 2882 in both seasons and combined data. Regarding quantum sensor, the entry Korea 27 exhibited the highest mean values recording 1725.0, 1595.0 and 1660.0 in the 1st , 2nd seasons as well as combined analysis, respectively with significant difference from Giza 179. The highest mean values for leaf diffusive were detected for the entries AC 2882 in the first season and IRRI 152 in the second season and combined data. Regarding transpiration rate, the entry AC 2882 gave the highest mean values being 28.58, 29.10 and 28.84 in the first, second season and combined data, respectively. In addition, the entry Korea 27 expressed the most desirable mean values for stomatal conductance and Co2 assimilation rate recording 0.11 and 39.16, respectively in the combined analyses (Table 7).

In conclusion, the two rice entries Korea 27 and IRRI 152 were the best among all studied genotypes since the had the most desirable mean performance for most photosynthetic traits in addition to yield potentiality and they were promising in future rice breeding program.

Table (4) Analysis of variance yield and its related traits in both seasons and combined data.

S.O.V	d.f		No. of panicle/ plant			Panicle length (cm)			Panicle weight (g)			No. of tillers/ plant		
	S	C	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
Seasons (S)		1			98.4**			29.2**			3.1*			4.2
Rep/ S	3	6	0.6	1.0	0.83	2.4	3.4	2.9	0.1	0.7	0.4	6.2	3.0	4.6
Genotypes	11	11	32.1*	25.6**	53.4**	17.3**	19.9**	36.9**	3.1**	1.5**	3.9**	46.8*	65.9**	110.3**
Genotypes x		11			4.3*			0.3			0.6*			2.4*
Pooled	33	66	2.3	1.8	2.1	2.2	1.4	1.8	0.3	0.3	0.3	9.1	7.6	8.3

* and ** significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Table (4) Cont.

S.O.V	d.f		1000 grain weight			Seed set (%)			Grain yield plant^{-1}			Harvest index(%)		
	S	C	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
Seasons (S)		1			71.93**			15.41**			9.49**			2.23
Rep/ S	3	6	4.5	3.5	3.98	2.6	2.1	2.34	20.7	62.0	41.3	24.3	26.0	25.17
Genotypes	١١	11	9.0**	16.8**	19.96**	62.3**	61.0**	123.2**	302.9**	280.3**	538.8***	281.6**	279.7**	538.6**
Genotypes x		11			5.93*			0.1			44.5*			22.7
Pooled	33	66	2.6	3.1	2.87	11.5	11.9	11.7	15.7	27.7	21.7	69.4	68.4	68.9

* and ** significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Table (5) Mean performance of rice genotypes for yield and its related traits in the first and second seasons as well as combined data.

Genotype	No. of panicle plant^{-1}			Panicle length (cm)			Panicle weight (g)			No. of tillers/ plant		
	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
SAILBORO 9361	20.50	18.75	19.63	26.00	25.50	25.75	3.23	3.55	3.39	22.00	22.25	22.13
NUNCHA	16.75	١٨.٥	١٧.٦٣	26.00	25.13	25.56	3.57	2.70	3.14	20.50	20.00	20.25
FOFIFA 161	17.75	15.75	16.75	22.93	21.78	22.35	5.22	4.13	4.67	17.50	17.75	17.63
GZ 10686-2-1-3-4	14.75	12.85	13.80	20.88	20.58	20.73	3.62	4.10	3.86	15.75	15.00	15.38
GZ 10848-1-2-2-1	21.50	18.43	19.96	23.00	21.70	22.35	4.79	3.92	4.35	26.00	28.75	27.38
Korea 27	21.75	18.78	20.26	24.50	23.20	23.85	5.93	4.63	5.28	24.00	23.00	23.50
AC 2882	21.50	17.50	19.50	21.00	19.70	20.35	3.36	3.24	3.30	23.75	22.75	23.25
IRRI 142	19.25	16.95	18.10	20.38	19.08	19.73	3.95	3.83	3.89	20.75	19.75	20.25
IRRI 152	20.25	18.88	19.56	21.50	20.20	20.85	5.01	4.59	4.80	19.25	18.25	18.75
Korea 47	12.75	11.45	12.10	21.38	20.08	20.73	3.75	3.63	3.69	14.25	13.25	13.75
PR 78	17.50	14.03	15.76	20.25	18.95	19.60	3.67	3.55	3.61	19.75	18.75	19.25
Giza 179	18.00	16.10	17.05	21.13	19.83	20.48	4.95	4.83	4.89	19.25	18.25	18.75
LSD 0.05	2.12	1.87	1.42	2.05	1.66	1.32	0.79	0.77	0.55	4.17	3.81	2.82
LSD 0.01	2.78	2.46	1.86	2.69	2.17	1.73	1.04	1.00	0.72	5.47	5.00	3.70

Table (5) Cont.

Genotype	1000 grain weight			Seed set %			Grain yield plant^{-1}			Harvest index		
	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
SAILBORO 9361	29.75	27.25	28.50	87.75	87.50	87.63	48.50	51.68	50.09	34.71	35.90	35.30
NUNCHA	28.75	31.25	30.00	88.00	87.00	87.50	52.93	49.00	50.96	49.49	48.30	48.90
FOFIFA 161	32.00	27.50	29.75	87.00	86.25	86.63	44.93	40.25	42.59	45.41	43.50	44.45
GZ 10686-2-1-3-4	28.00	26.03	27.01	94.57	93.76	94.16	37.09	40.51	38.80	44.61	55.34	49.97
GZ 10848-1-2-2-1	29.28	26.65	27.96	92.52	91.67	92.10	51.36	46.77	49.07	62.49	62.31	62.40
Korea 27	32.25	31.25	31.75	89.44	88.59	89.01	60.50	58.50	59.50	44.90	44.05	44.48
AC 2882	28.63	26.98	27.80	87.78	86.93	87.35	42.00	53.75	47.88	63.73	63.75	63.74
IRRI 142	29.88	28.05	28.96	96.87	96.02	96.45	45.50	42.75	44.13	43.66	42.73	43.20
IRRI 152	32.73	31.63	32.18	88.30	87.45	87.87	57.58	55.84	56.71	57.60	56.92	57.26
Korea 47	29.45	26.63	28.04	91.14	90.29	90.72	30.94	29.64	30.29	48.44	47.59	48.02
PR 78	29.83	26.88	28.35	97.18	96.33	96.76	39.22	37.92	38.57	54.38	53.53	53.95
Giza 179	29.88	29.55	29.71	96.47	95.62	96.04	52.86	49.24	51.05	49.45	48.60	49.02
LSD 0.05	2.24	2.45	1.66	4.69	4.78	3.35	5.48	7.29	4.56	11.54	11.46	8.13
LSD 0.01	2.94	3.21	2.18	6.16	6.27	4.39	7.19	9.56	5.98	15.14	15.03	10.67

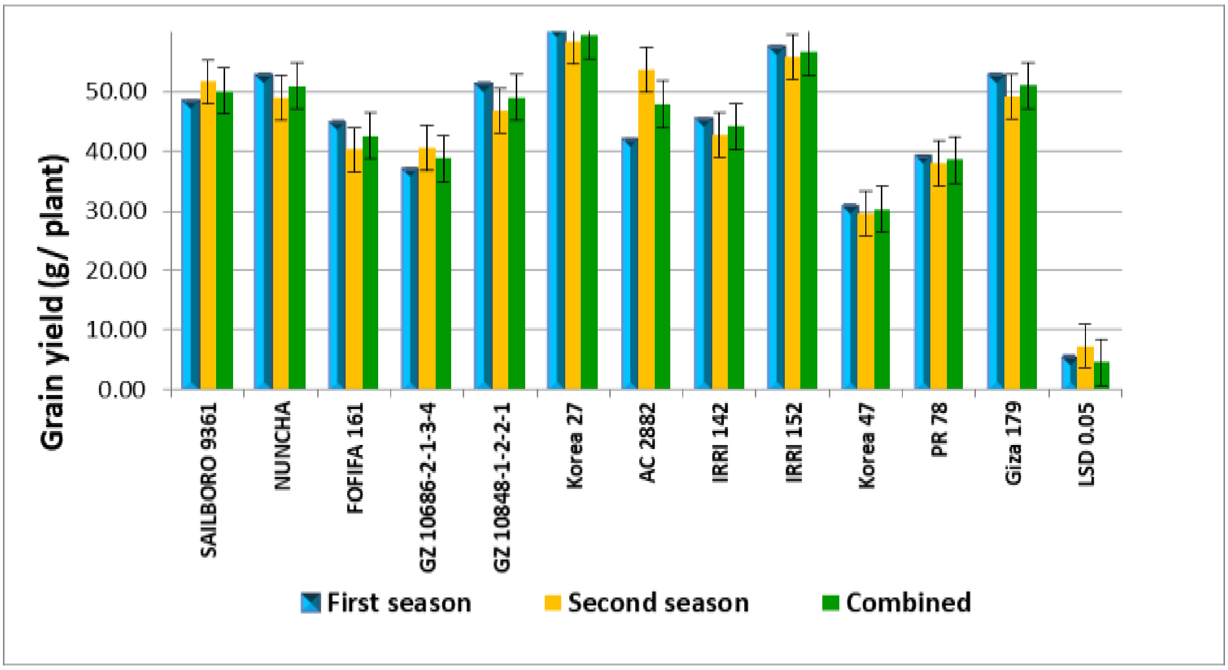

Fig. (1) Mean performance of grain yield of rice entries in all environments.

Table (6) Analysis of variance for photosynthetic traits in both seasons and combined data.

S.O.V	d.f		Cuvette sensor			Quantum sensor			Leaf diffusive		
	S	C	First Year	Second year	Comb.	First Year	Second year	Comb.	First year	Second year	Comb.
Seasons (S)		1			5.1**			138396.1*			1.24
Rep/ S	3	6	0.9	0.2	0.6	900.5	1574.3	1237.4	5.6	2.9	2.4
Genotypes	[illegible]	11	10.5**	12.4**	17.6**	80737.6*	43273.3*	99487.6**	48.5**	2.2**	5.07**
Genotypes x		11			5.3**			24523.4**			1.49*
Pooled error	3	66	0.3	0.3	0.3	1661.9	2544.0	2102.9	0.38	0.35	0.37

* and ** significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Table (6) Cont.

Genotype	Cuvette temp.			Quantum sensor			Leaf diffusive		
	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
SAILBORO 9361	27.45	28.40	27.93	1407.50	1537.50	1472.50	11.35	12.13	11.74
NUNCHA	24.58	27.33	25.95	1517.50	1565.00	1541.25	10.25	10.50	10.38
FOFIFA 161	28.30	26.70	27.50	1585.00	1465.00	1525.00	12.38	10.95	11.66
GZ 10686-2-1-3-4	25.50	24.40	24.95	1312.50	1302.50	1307.50	11.13	12.15	11.64
GZ 10848-1-2-2-1	28.15	25.70	26.93	1637.50	1380.00	1508.75	12.23	12.45	12.34
Korea 27	26.75	27.88	27.31	1725.00	1595.00	1660.00	13.13	11.63	12.38
AC 2882	23.25	22.50	22.88	1617.50	1562.50	1590.00	13.60	12.40	13.00
IRRI 142	25.70	24.68	25.19	1611.25	1425.00	1518.13	12.63	11.63	12.13
IRRI 152	28.00	28.33	28.16	1710.00	1580.00	1645.00	13.25	13.13	13.19
Korea 47	27.08	25.73	26.40	1305.00	1295.00	1300.00	12.70	12.45	12.58
PR 78	28.16	25.23	26.69	1637.50	1457.50	1547.50	10.75	11.25	11.00
Giza 179	25.70	26.23	25.96	1492.50	1482.50	1487.50	12.00	12.00	12.00
LSD 0.05	0.70	0.78	0.53	56.50	69.90	44.94	0.86	0.82	0.59
LSD 0.01	0.92	1.03	0.69	74.08	91.66	58.93	1.12	1.08	0.78

* and ** significant and highly significant at 0.05 and 0.01 levels of probability, respectively.

Table (7) Mean performance for photosynthetic traits in first, second seasons and combined data.

S.O.V	d.f		Transpiration rate			Stomatal conductance			Co2 assimilation rate		
	S	C	First year	Second year	Comb.	First Year	Second year	Comb.	First year	Second year	Comb.
Seasons (S)		1			1.08*			0.00027*			89.6**
Rep/ S	3	6	1.0	0.2	0.5	0.00001	0.00002	0.00001	6.2	3.7	4.9
Genotypes	١١	11	9.7**	13.8**	20.3**	0.00070*	0.00070*	0.00121**	41.7**	35.6**	73.5**
Genotypes x		11			3.3*			0.00013*			3.8*
Pooled error	33	66	0.5	0.5	0.5	0.00003	0.00002	0.00002	1.7	0.8	1.3

Table (7) Cont.

Genotype	Transpiration rate			Stomatal conductance			Co2 assimilation rate		
	First year	Second year	Comb.	First year	Second year	Comb.	First year	Second year	Comb.
SAILBORO 9361	24.28	27.48	25.88	0.08	0.09	0.08	38.88	35.75	37.32
NUNCHA	27.35	27.85	27.60	0.09	0.08	0.09	30.50	29.56	30.03
FOFIFA 161	27.78	27.70	27.74	0.09	0.09	0.09	30.61	28.84	29.73
GZ 10686-2-1-3-4	27.38	28.58	27.98	0.09	0.08	0.08	37.23	35.37	36.30
GZ 10848-1-2-2-1	27.60	27.35	27.48	0.08	0.07	0.08	38.00	36.63	37.31
Korea 27	26.23	26.25	26.24	0.11	0.11	0.11	40.28	38.05	39.16
AC 2882	28.58	29.10	28.84	0.08	0.08	0.08	38.30	33.48	35.89
IRRI 142	27.50	28.20	27.85	0.10	0.08	0.09	36.48	36.50	36.49
IRRI 152	25.50	26.00	25.75	0.11	0.10	0.10	39.50	37.85	38.68
Korea 47	23.50	21.98	22.74	0.07	0.07	0.07	38.88	35.82	37.35
PR 78	27.60	25.88	26.74	0.08	0.09	0.08	39.02	36.53	37.77
Giza 179	27.78	27.25	27.51	0.09	0.08	0.08	36.30	36.44	36.37
LSD 0.05	0.97	0.97	0.69	0.01	0.01	0.01	1.82	1.26	1.10
LSD 0.01	1.27	1.27	0.90	0.01	0.01	0.01	2.38	1.65	1.45

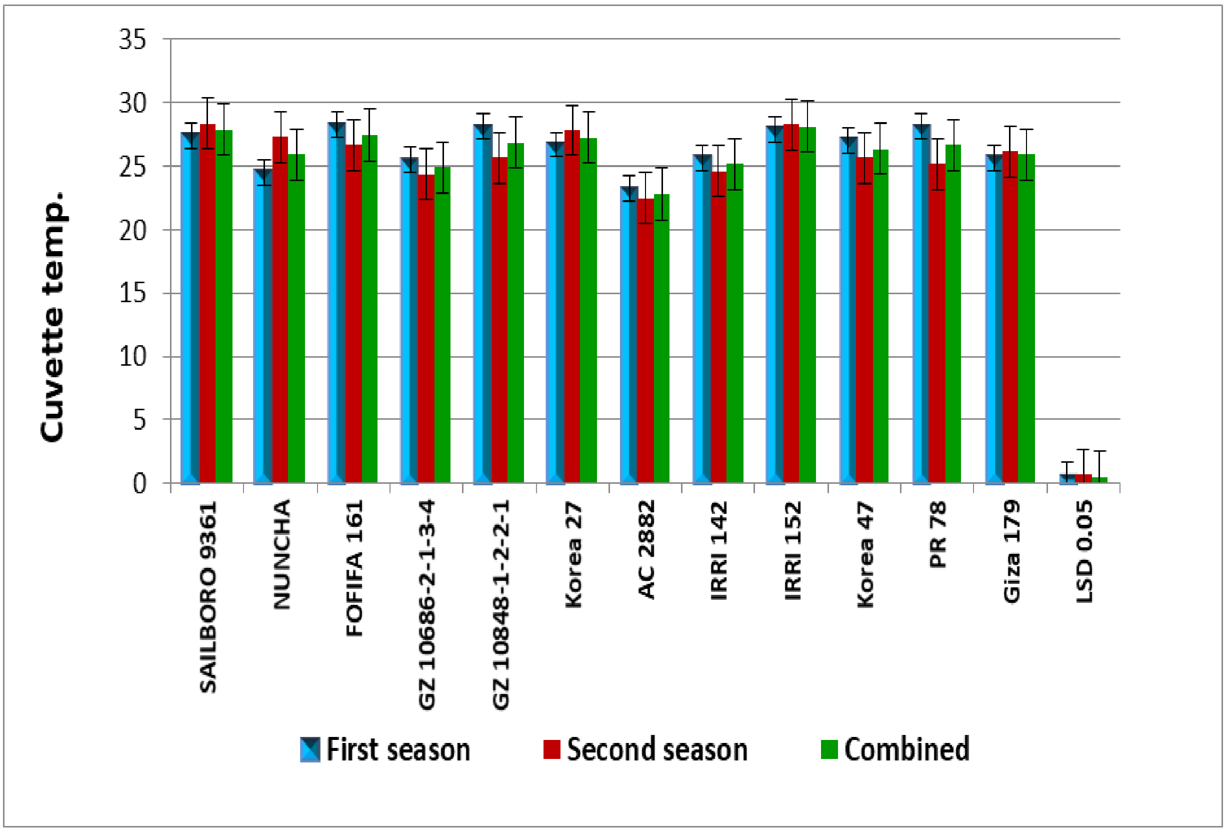

Fig. (2) Cuvette temperature of the studied rice genotypes in the first, second season and combined data.

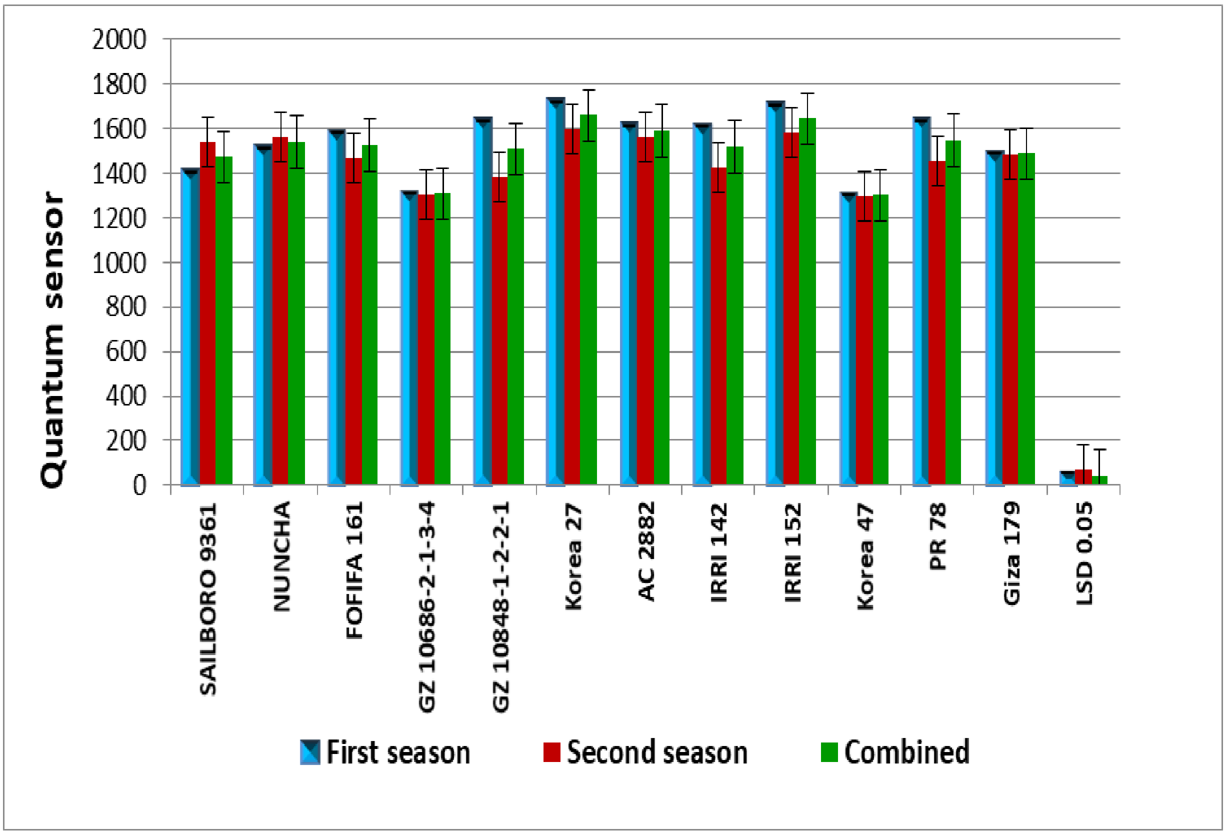

Fig. (3) Quantum sensor of the studied rice genotypes in the first, second season and combined data

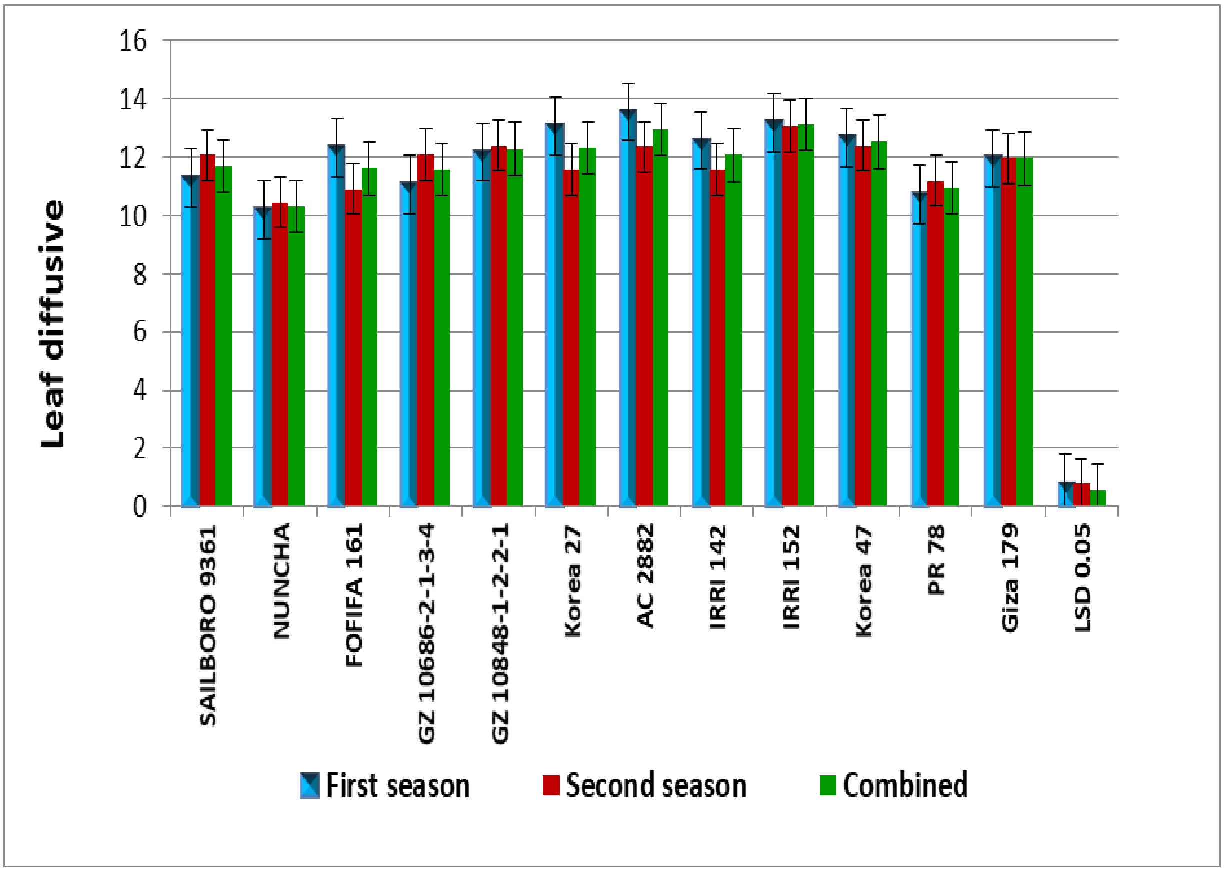

Fig. (4) Leaf diffusive of the studied rice genotypes in the first, second season and combined data

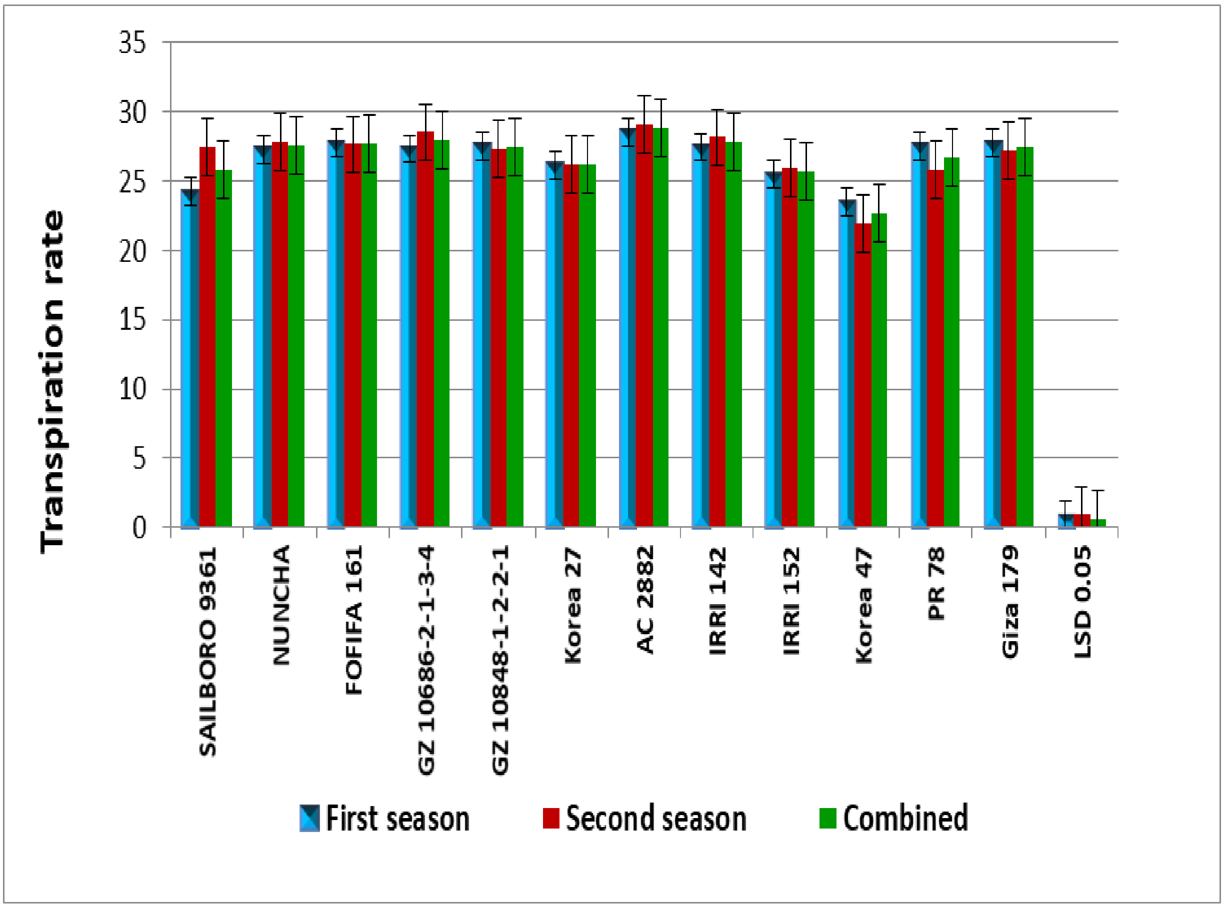

Fig (5) Transpiration rate of the studied rice genotypes in the first, second season and combined data

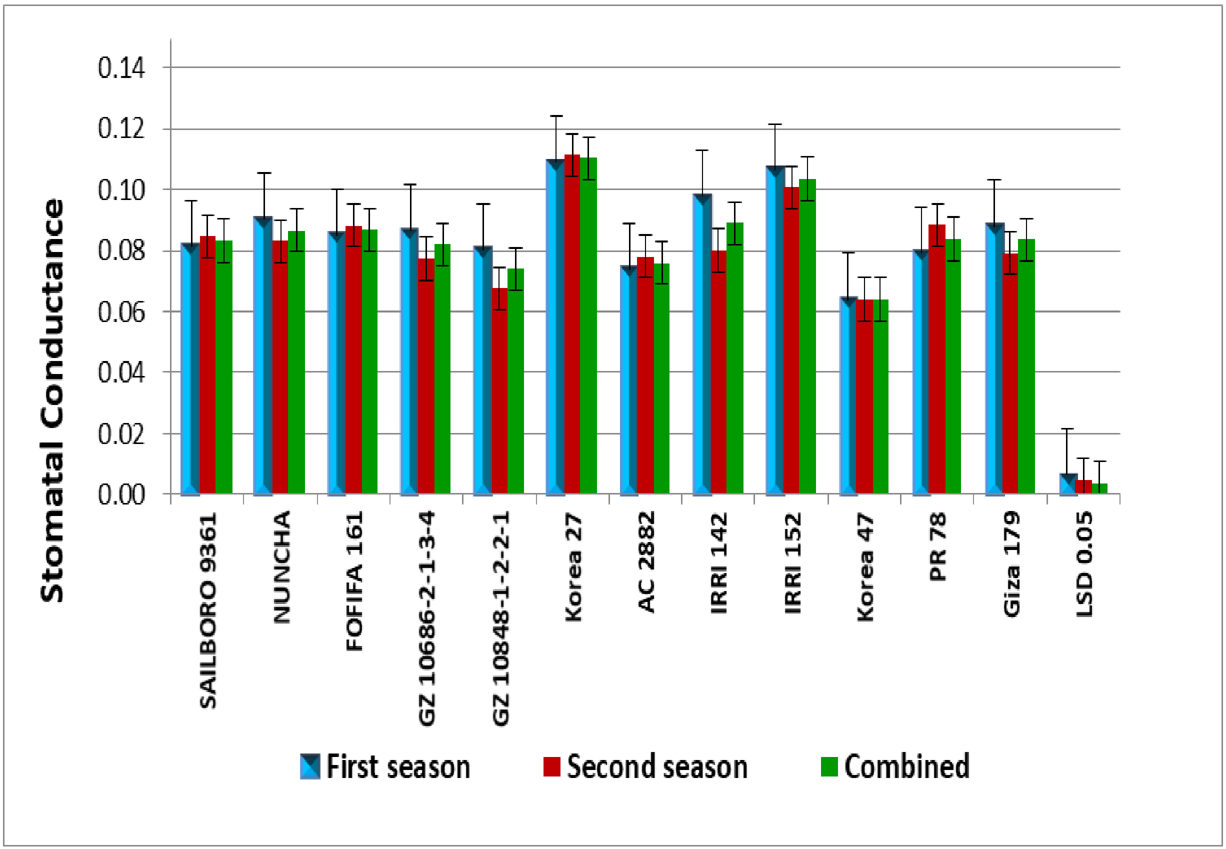

Fig. (6) Stomatal conductance of the studied rice genotypes in the first, second season and combined data

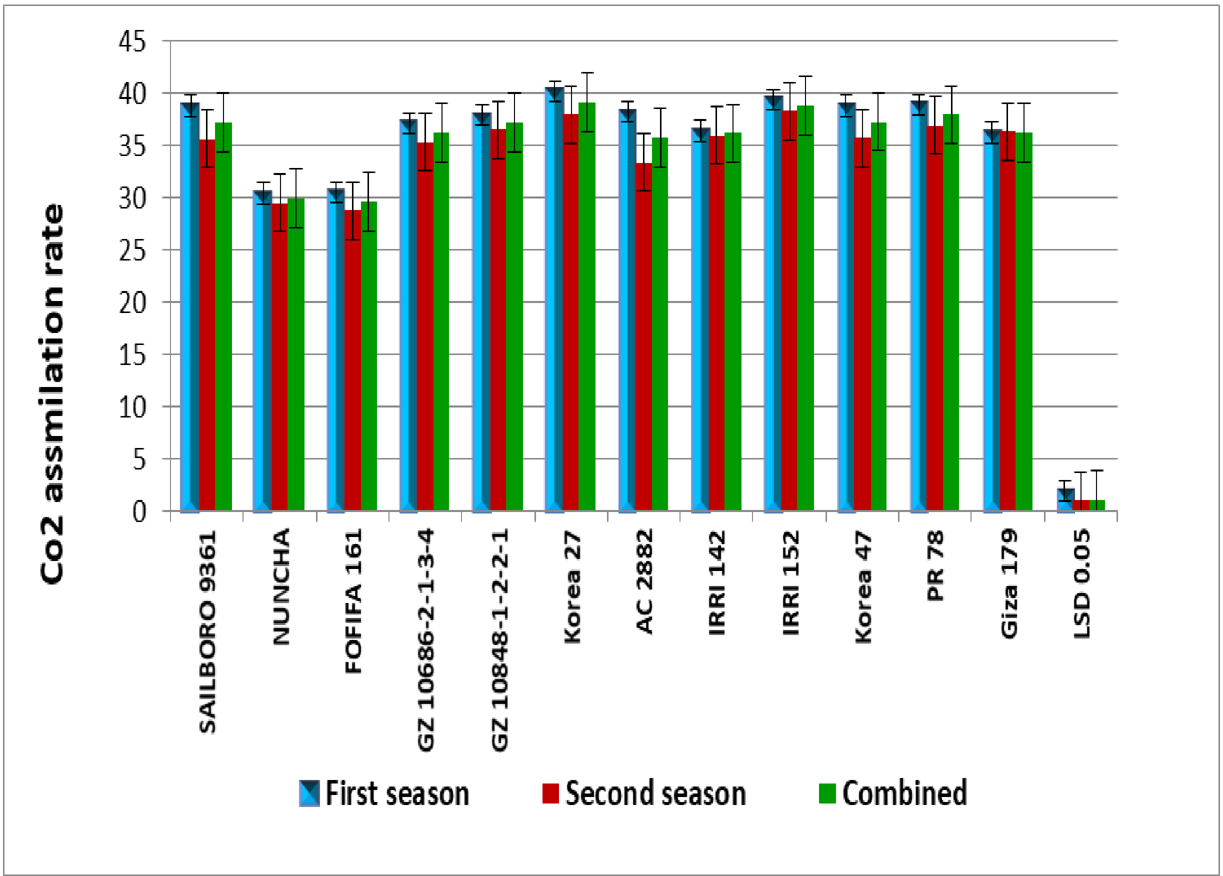

Fig. (7) Co2 assimilation rate of the studied rice genotypes in the first, second season and combined data

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