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PHENOTYPIC AND GENOTYPIC ANALYSIS OF SOME RICE VARIETIES FOR GROWTH AND YIELD TRAITS UNDER STRESS CONDITION

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ABSTRACT

Field experiments including 100 rice genotypes from different sources (selected from local and exotic materials) were carried out as a preliminary screening nursery (PSN) at two locations in Sakha Agriculture Research Station (drought conditions) and at New Valley Agriculture Research Station under heat conditions during 2007 rice growing season. Each genotype was planted in four rows, five meter long and 20 cm a part with three replications, where two the outer rows were used as borders and the two inner rows were used to record the data. The best selected genotypes, under both drought and heat conditions, according to their desirable traits, were evaluated under the same conditions during 2008 and 2009 rice growing seasons. These experiments included 18 and 20 out of 100 rice genotypes under drought and heat conditions, respectively.

The results indicated that, the vegetative characters comprising of days to heading, plant height, tillers number/plant and leaf area. Also, root characters, comprising root length, root volume, root to shoot ratio and roots number/plant, could be considered as parameters related to tolerance. These traits could be used as selection criteria since they helped the plant to maintain a favorable water balance and, hence, controlled, early stomata closure. Analysis of variance showed significant variations among the vegetative and root characters under drought conditions. Heritability estimates were higher for grain yield (0.92), plant height (0.88), leaf area (0.82), number of grains per panicle, root/shoot ratio (0.81) and days to heading (0.88). Consequently, selection for grain yield and its components could be more effective in the selected genotypes under drought and heat conditions.

INTRODUCTION

Environmental stresses, such as water deficit and high temperature are major factors limiting plant growth and productivity. Drought remains one of the oldest and most serious problem in agriculture. The shortage of irrigation water is one of the major obstacles for increasing rice production, not only in Egypt, but also worldwide. planted rice is considered sensitive to drought, although the sensitivity varies with stage of growth. For most of the commonly grown rice cultivars, their young seedlings and reproductive stage are particularly sensitive to water deficit and heat conditions. It has been established that drought stress is a very important limiting factor at the initial phase of plant growth and establishment. It affects both elongation and expansion growth (Kusaka *et al.*, 2005 and Shao *et al.*, 2008). Among the crops, rice as a submerged crop, is probably more susceptible to drought stress than most other plant species.

Also, global climate changes have an impact on yield potential and production through changed weather and atmospheric carbon dioxide concentration, affecting crop growth and development, irrigation demand and the supply of irrigation water. Analysis of the effects of climate changes, on yield potential and its consequences for yield gaps and water resource requirements, requires the application of rigorously tested and validated crop models, calibrated for key species and current varieties (Kijne, 2003).

The combination of decades of drought, desertification and overpopulation are among the causes of the conflict, because the nomads searching for water have to take their livestock further south to land, mainly occupied by farming peoples (Freeman, 2004). In 2007, higher incentives for farmers to grow non-food biofuel crops, combined with other factors (such as rising transportation costs, climate change, growing consumer demand in China and India and population growth) to cause food shortages in Asia, the Middle East, Africa and Mexico as well as rising food prices around the globe. As of December 2007, 37 countries faced food crises, and twenty had imposed some sort of food-price controls.

This investigation was carried out to evaluate some exotic and local rice varieties under heat and drought conditions. Also, the effect of heat and drought conditions was tested on rice growth and production.

MATERIALS AND METHODS

Field experiments, including 100 rice genotypes from different sources (selected from local and exotic materials) were carried out as a preliminary screening nursery (PSN) at two locations in Sakha Agriculture Research Station (drought conditions) and at New Valley Agriculture Research Station (heat conditions) during 2007 rice growing season. Each genotype was planted in four rows, five meters long and 20 cm a part, with three replications, where, the two outer rows were used as borders and the two inner rows to record the data . The best selected genotypes under both drought and heat conditions according to their desirable traits, were evaluated under the same conditions during 2008 and 2009 rice growing seasons. These experiments included 18 and 20 out of 100 rice genotypes under drought and heat conditions, respectively. Each genotype was planted in seven rows in a randomized complete back design, with three replications, by using transplanting and drilling planting methods under drought and heat conditions, respectively. Drought stress was imposed by using flush irrigation every twelve days, two weeks after transplanting to harvesting. Irrigation every five days was used under heat conditions. Fertilizers were applied at a recommended rate and time of application. All other cultural practices were applied as recommended. Agronomic and grain yield characters such as number of days to heading (day), plant height (cm), panicle length(cm), number of panicles/plant, leaf area, leaf angle(cm^2), sterility(%), 100-grain weight and grain yield (t/ha.), as well as root characters, such as root length, root volume (ml), root/shoot ratio and root numbers/plant were studied for drought experiment. Number of days to heading, plant height, number of panicles/plant, 100-grain weight, sterility (%) and grain yield (t/ha) were recorded under heat conditions. The combined analysis was conducted for each experiment of the two years (2008 and 2009 seasons). Before performing the analysis of data, the combined analysis was made to determine whether the error variances of the data were homogeneous according to Bartlett (1937) test of homogeneity which was indicated. Path coefficient analysis was made between values of grain yield and the most important characters responsible for drought tolerance, according to Dewey and Lue (1959). Some genetic parameters; i.e., phenotypic variance (PV), genotypic variance (GV) and heritability in broad sense (Hb) were computed (Lush, 1949; Burton, 1951 and Johanson *et al.*, (1955). Means of the different lines were compared with their respective parents and control, using the least significant difference test (LSD).

The evaluation of root morphology was conducted in a greenhouse experiment in pots in the Rice Research and Training Center at panicle initiation stage. such experiment used the randomized complete block design with one plant per pot (rep). Pots of 20 cm in diameter and one meter deep were lined with a plastic sleeve having two drainage holes in the bottom and filled with soil up to 10 cm of the top. After filling and before planting, plots were watered and then refilled with soil until the saturated soil level was again within 10.00-cm of the top. After 65 days from sowing, the shoot was excised from the roots near the soil surface in order to identify the maximum root length, root volume, root number, root dry weight, shoot dry weight and root to shoot ratio.

RESULTS AND DISCUSSION

One Hundred rice varieties which had been evaluated under drought and heat conditions, showed divers reactions to field in the vegetative and reproductive phases under drought and heat stress conditions.

Drought conditions:

Vegetative characters :

Eighteen genotypes were selected from 100 genotypes for screening under drought conditions, based on the traits that contributed to field drought tolerance. Mean performance for vegetative characters of the best selected varieties, under drought conditions during 2008 and 2009 seasons, are shown in Table (1).

Significant differences were observed among genotypes for number of days to heeding under drought conditions. The genotypes, Kuanchangmi, Giza 178 and Giza 182 were earlier in heading than the others under drought conditions and their values ranged from 102.00 to 103.00 days (Table 1). Significant differences for plant height, also, were detected among genotypes under drought conditions. Moreover, Kasalath, and Pinulupot1 had the tallest plants compared to the others. Their mean values ranged from 121.00 to 135.00 cm. While, the genotypes, Vandaran, Giza 175, Giza 178, and Giza 182, had the shortest plants, their values ranged from 85.2 to 97.00 cm. Significant differences, also, were detected among genotypes for panicle length. The genotypes, Kasalath, ARC 11094, Pinulupot 1, Vandaran, Tima, Kuanchangmi and Duagguanhua Luo were found to have the highest values for panicle length under drought conditions and their values ranged from 21.00 to 26.0 cm .

For number of tillers per plant, significant differences, also, were found among genotypes under drought conditions and several varieties such as Kasalath, ARC 11094, Naba, Vandaran, Kuanchangmi and Giza 178 had the desirable number of tillers per plant and their values ranged from 23.00 to 31.00 tillers per plant (Table 1).

Regarding leaf area and leaf angle, the data in Table (1) showed that most of the varieties, which gave higher yields under drought conditions had narrow leaf angles and moderate leaf area.

Table (1): Mean performance for vegetative characters of the best selected varieties under drought conditions (combined data of 2008 and 2009 seasons).

No.	Variety	No of days to heading (Days)	Plant height (cm)	Panicle length (cm)	No. of tillers /plant	Leaf area (cm)	Leaf angle
1	Kasalath	120.00	130.00	26.00	25.00	16.25	Wide
2	ARC 11094	133.00	110.00	23.00	23.00	42.00	Narrow
3	Naba	117.00	95.00	20.00	31.00	28.80	Narrow
4	Davao 1	118.00	120.00	22.00	20.00	26.18	Narrow
5	Pinulupot 1	125.00	122.00	21.00	22.00	29.59	Narrow
6	Dee geo hua luo	111.00	120.00	18.00	21.00	11.03	Narrow
7	Hong Cheuh Zai	108.00	112.00	21.00	20.00	28.00	Wide
8	Vandaran	130.00	95.00	21.00	30.00	27.70	Narrow
9	Tima	128.00	120.00	21.00	25.00	31.30	Wide
10	Nipponbare	115.00	105.00	19.00	19.00	15.78	Narrow
11	Kuanchangmi	103.00	118.00	24.00	23.00	9.40	Wide
12	Chixiandao	111.00	121.00	18.20	17.80	15.00	Narrow
13	Duagguanhua Luo	106.00	135.00	23.00	17.00	22.26	Narrow
14	Giza 14	110.00	106.00	18.00	21.00	19.70	Narrow
15	Giza 175	106.00	90.00	20.00	22.00	21.10	Narrow
16	Giza 178	102.00	97.00	19.00	25.00	17.30	Narrow
17	Giza 182	102.00	85.20	18.00	24.33	18.00	Narrow
18	Sakha 104	105.00	102.00	20.00	20.50	14.00	Narrow
	LSD at 0.05	3.50	4.80	1.50	2.00	3.20	-

In general, the genotype with desirable vegetative characters, i .e. number of days to heading, plant height, tiller numbers/plant and leaf area, could be considered as tolerant to drought stress. These traits could be used as selection criteria, since they helped the rice plant to maintain a favorable water balance and, hence, controlled early stomata closure. The analysis of variance showed significant variations among the vegetative characters, as shown in (Table 2).

Table (2): Analysis of variance for vegetative characters of the best selected varieties under drought conditions (combined data of 2008 and 2009 seasons).

S.O.V	d.f.	Mean squares				
		No of days to heading (Days)	Plant height (cm)	Panicle length (cm)	No. of tillers /plant	Leaf area
Replications	2	7311.8	3586.00	1936.80	1639.80	550.00
Genotypes	17	6387.65**	7646.60**	2997.90**	3603.68**	4342.80**
Error	34	1810.00	1238.80	3398.80	9467.80	990.80

**:significant of 0.01 level.

Root characters

The results in table (3) showed that all varieties, which gave higher grain yield (table 5) had good root system, i.e, deeper roots, higher root volume, moderate roots number and high root to shoot ratio. Such results showed that deep rooted plants, generally, survival in drought better than shallow ones because they could effectively use more stored water at deeper soil layers.

Table (3): Mean performance for root characters of the best selected varieties under drought conditions combined data of 2008 and 2009 seasons.

No.	Variety	Root length (cm)	Root volume (ml)	R: Sh ratio	Root number
1	Kasalath	28.00	60.00	0.73	190.00
2	ARC 11094	30.00	60.00	0.80	305.00
3	Naba	27.00	65.00	0.70	265.00
4	Davao 1	28.00	55.00	0.65	280.00
5	Pinulupot 1	30.00	70.00	0.85	161.00
6	Dee geo hua luo	28.00	55.00	0.72	160.00
7	Hong Cheuh Zai	35.00	70.00	0.90	230.00
8	Vandaran	40.00	55.00	0.68	154.00
9	Tima	19.00	25.00	0.40	100.00
10	Nipponbare	40.00	60.00	0.77	198.00
11	Kuanchangmi	27.00	38.00	0.66	205.00
12	Chixiandao	30.00	85.00	0.88	141.00
13	Duagguanhua Luo	27.00	28.00	0.82	181.00
14	Giza 14	23.00	22.00	0.93	165.00
15	Giza 175	19.00	24.00	0.43	125.00
16	Giza 178	30.00	35.00	0.50	250.00
17	Giza 182	33.00	40.00	0.55	285.00
18	Sakha 104	25.00	38.00	0.72	318.00
	LSD at 0.05	3.80	5.50	0.12	7.60

Drought tolerance rice varieties had fewer numbers of roots and high dry root weight, which were reported to be useful measures of drought tolerant, The results in table (3) also reported that varieties, with high root/ shoot ratios, were more drought tolerance. So, the maximum root length, root volume, moderate root number and high root/ shoot ratio could be used as good indicators of drought tolerance.

Farther more, Table (3) indicates significant differences among genotypes for root length under drought conditions. The genotypes, Vandaran, ARC 11094, Giza178, Giza 182 and Sakha 104 and others gave higher root length under drought conditions than the others and their values ranged from 25.00 to 4.00 cm (Table 3). Significant differences for root volume, also, were detected among genotypes under drought conditions.

The mean values ranged from 22.00 to 85.00 ml. Besides significant differences were detected among genotypes detected for root/shoot ratio. The genotypes Giza 14, ARC 11094, Pinulupot 1 and Hong Cheuh Zai, were found to have the highest values for root /shoot ratio under drought conditions and their values ranged from 80.0 to 93.0 (%).

Table (3) further shows Significant differences among genotypes under drought conditions for number of roots per plant. The varieties, ARC 11094, Naba, Davao 1, Sakha 104, Giza 182 and Giza 178 had the desirable number of roots per plant and their values ranged from 250.00 to 318.00 roots . In general, the genotype, with desirable root characters, comprising root length, root volume, root/shoot ratio and root number/plant, could be considered as tolerant to drought stress. These traits could be used as selection criteria, since they helped the plant to maintain a favorable water balance and, hence, controlled early stomata closure. The analysis of variance showed significant variations among the root characters, as shown in (Table 4).

Table (4): Analysis of variance for root characters of the best selected varieties under drought conditions (combined data of 2008 and 2009 seasons).

S.O.V	d.f.	Mean squares			
		Root length (cm)	Root volume (ml)	R: Sh ratio	Root number
Replications	2	0.59	0.85	0.021	1.35
Genotypes	17	99.62**	1078.64**	0.067**	12626.05**
Error	34	8.00	3.550	0.0022	7.77

**:significant of 0.01 level.

Grain yield and its components

Significant differences were found for among genotypes grain yield (t/ha) and its components under drought conditions, as shown in table (5) The genotypes, Kuanchangmi, Naba, vandran Giza 178 and Giza 182 gave the highest values of number of panicles/plant under drought conditions and their values ranged from 15.00 to 28.00 panicle per plant.

Moreover significant differences were detected for 100-grain weight among the genotypes under drought conditions. Kasalath, Pinulupot1, davao1, Chixiandao, Duagguanhua Luo and Sakha 104 genotypes, beside some others, had the highest values, compared to the others and national check variety, Giza 178.

Table (5): Mean performance for grain yield and its components of the best selected varieties under drought conditions combined data of 2008 and 2009 seasons.

No.	Variety	No. panicles /plant	100-grain weight (g)	Sterility (%)	Grain yield (t/ha)
1	Kasalath	21.00	2.55	12.00	**7.37**
2	ARC 11094	20.00	2.40	15.00	6.66
3	Naba	28.00	2.30	17.00	6.66
4	Davao 1	18.00	2.40	15.00	6.66
5	Pinulupot 1	20.00	2.40	13.00	6.66
6	Dee geo hua luo	19.00	2.60	10.00	**8.56**
7	Hong Cheuh Zai	17.00	2.50	14.00	7.14
8	Vandaran	26.00	2.30	18.00	6.42
9	Tima	22.00	2.40	17.00	6.60
10	Nipponbare	15.00	2.30	12.00	6.50
11	Kuanchangmi	28.00	2.50	8.00	**7.61**
12	Chixiandao	15.00	2.50	9.00	**7.85**
13	Duagguanhua Luo	16.00	2.50	14.00	6.50
14	Giza 14	18.00	2.35	19.00	5.52
15	Giza 175	20.00	2.30	20.00	4.80
16	Giza 178	22.00	2.22	11.00	**7.20**
17	Giza 182	23.00	2.30	9.00	7.00
18	Sakha 104	19.00	2.70	12.00	6.70
	LSD at 0.05	1.72	0.20	1.75	0.55

The mean values ranged from 2.22 to 2.70 gm. Significant differences, also, were detected among the genotypes for sterility percentage. The genotypes, Chixiandao, Kuanchangmi and Giza 182 were found to have the desirable values for sterility percentage under drought conditions and their values ranged from 8.00 to 9.00%.

This finding indicated that these genotypes could be used as donor parents to improve the fertility under drought conditions.

For grain yield (T/ha) significant differences were found among the studied genotypes under drought conditions (Table 5). The varieties, Kasalath (7.37 t/ha), Chixiandao (7.85 t/ha), Kuanchangmi (7.61 t/ha), Dee geo hua luo (8.56 t/ha) and Giza 178 (7.20 t/ha) had the desirable values of grain yield which ranged from 7.20 to 8.56 (t/ha.). The grain yield components, related to final grain yield, also were severely affected by stress conditions.. Drought had, also, been reported to delay the emergence of panicles and flowering. Production of root system, under drought, is important to above ground dry mass and the studied varieties showed great differences in the production of roots. The importance of root systems in acquiring water had long been recognized by (Abd-Allah, 2004).

In general, the genotype with desirable grain characters including the number of panicles/plant, 100-grain weight, sterility (%) and grain yield (t/ha.), could be considered as tolerant to drought stress. These traits could be used as selection criteria for tolerant genotype to drought stress. The analysis of variance showed significant variations among the grain yield (t/ha) and its components, as shown in (Table 6).

Table (6): Analysis of variance for grain yield and its components of the best released varieties under drought condition combined data of 2008 and 2009 seasons.

S.O.V	d.f.	Mean squares			
		No. of panicles/ plant	100-grain weight	Sterility (%)	Grain yield (t/ha.)
Replications	2	1.800	0.030	2.400	0.005
Genotypes	17	56.68**	0.64**	68.90**	6.54**
Error	34	5.80	0.06	6.80	0.015

** significant of 0.01 level

Phenotypic variation (Table 7) was high for grain yield per plant, number of tillers per plant, leaf area and number of days to heading in the sets of genotypes, which were selected for drought condition. While, it was the lowest for root volume, root length and root/ shoot ratio. Moreover Genotypic variation followed the same trend as for phenotypic variance, but the corresponding values were lower, thereby, implying the influence of environment on the genotypes.

Heritability estimates, in general, were higher (more than 0.80) in the selected genotypes under drought condition (Table 7). Heritability estimates were higher for grain yield (0.92), plant height (0.88), leaf area (0.82), root/shoot ratio (0.81) and number of days to heading (0.88).

Table (7): Range and mean values and some genetic parameters for different traits in some rice genotypes under drought conditions.

Character	Range	Mean	PV (%)	GV (%)	Heritability (%)	Expected genetic advance (% of mean)
Grain yield (t/h)	4.80-8.56	6.40	34.50	32.00	0.92	1.73
Plant height (cm)	102.00-133.00	110.16	17.00	15.00	0.88	3.39
Panicle length (cm)	18.00-26.00	19.77	11.50	8.20	0.71	25.17
No.of tillers/plant	17.00-31.00	22.00	24.40	16.50	0.67	30.98
Leaf area (cm^2)	9.40-42.00	22.0	27.30	22.40	0.82	40.00
Root volume (ml)	22.00-70.00	48.60	9.50	6.80	0.71	9.27
Root/shoot ratio	0.66-2.85	1.13	11.00	9.00	0.81	48.00
Root. length (cm)	19.00-40.00	28.80	17.00	13.00	0.76	22.41
No of days to heading (days)	102.00-133.00	113.80	25.00	22.00	0.88	8.00

Consequently, selection for grain yield components would be more effective in the selected genotypes under drought condition. Expected genetic advance, in general, was higher in these genotypes as they had high phenotypic variation and high heritability for different traits. It was the highest for panicle length (25.17), number of tillers per plant(30.98), leaf area(40), root/shoot ratio (48.00) and root length (22.41). However it was low for the remaining traits. It could be concluded that the genotypes, that possessed sufficient genetic variability, moderate to high heritability and appreciable genetic advance could be improved through improving grain yield by selection of these traits.

The path coefficient analysis, carried out at the phenotypic and genotypic levels showed no agreement between the path effects at two levels (Table 8). Therefore , direct and indirect influences of the component characters, only at the genotypic level, were discussed. For the best selected genotypes under drought conditions, number of days to heading had no significant direct effect on grain yield (t/ha). Number of grains per panicle had significant positive direct effect on grain yield (t/ha) ,while, panicle length, number of tillers per plant, root volume and root/shoot ratio contributed, indirectly, via number of grains per panicle. Plant height and number of tillers per plant had no significant direct effect on grain yield (t/ha), while, root length contributed, indirectly, on grain yield (t/ha), via plant height.

Table (8): Phenotypic and genotypic path coefficients of grain yield with different traits in the selected genotypes under drought condition.

Characters	No of Days to heading (day)	Plant height (cm)	Panicle length (cm)	No. tillers plant	Leaf area (cm^2)	Leaf angle	Root volume (ml)	R: shoot ratio	Root length (cm)
No of days to heading	**0.188**	0.081	0.004	-0.125	0.028	0.120	-0.077	-0.001	0.012
	0.057	0.025	0.006	-0.056	0.0118	0.180	-0.091	-0.015	0.001
Plant height	-0.004	**-0.007**	-0.002	-0.007	0.043	0.022	-0.022	-0.230	0.470
	0.082	**0.220**	-0.081	-0.008	0.052	0.031	0.058	-0.270	0.650
Panicle length	-0.044	-0.004	**-0.085**	-0.030	-0.003	0.072	0.001	0.031	0.003
	0.009	-0.003	**0.061**	0.007	0.007	0.064	0.003	0.060	0.003
No. of tillers / plant	-0.077	-0.003	0.082	**0.195**	-0.011	-0.060	0.340	0.470	-0.071
	0.002	0..03	-0.001	**-0.003**	0.002	0.001	0.520	0.660	0.053
Leaf area	0.066	-0.004	0.002	0.005	**0.015**	-0.180	0.115	0.004	0.001
	0.031	-0.007	0.008	-0.006	**-0.002**	-0.320	0.121	0.005	0.001
Leaf angle	-0.024	0.034	-0.071	-0.004	-0.031	**-0.075**	-0.001	0.024	0.036
	-0.050	0.067	-0.170	-0.018	-0.062	**0.004**	0.012	0.081	0.088
Root volume	-0.018	0.013	-0.012	-0.007	-0.004	-0.015	**0.220**	-0.001	0.002
	-0.050	-0.04	0.034	0.020	-0.001	0.050	**0.235**	-0.12	0.018
R: shoot ratio	-0.024	0.032	-0.070	-0.001	-0.018	-0.002	0.024	**-0.018**	0.051
	-0.050	0.087	-0.150	-0.012	-0.082	0.003	0.080	**-0.177**	0.118
Root length	0.118	-0.028	-0.032	-0.002	0.061	0.003	-0.008	0.061	**-0.008**
	0.219	-0.0111	0.006	-0.002	0.080	0.001	-0.071	0.080	**0.230**
Correlation with grain yield (t/ha)	-0.180	-0.350	0.280	0.730*	0.310	-0.470	0.310	0.480	0.188
	-0.220	-0.460	0.510	0.850	0.350	-0.520	0.330	0.630	0.210

On the other hand, root volume and root/ shoot ratio had indirect effect on grain yield via number of tillers/plant. An overall insight of results, obtained from path analysis, showed that number of grains per panicle was the major attribute contributing towards grain yield (t/ha) in the set of genotypes selected under drought condition.

Consequently, this serves as a reliable selection criterion for improving grain yield (t/ha)

The correlation and component analysis reveal that an ideal plant type of all genotypes should have high long panicles, high number of tillers per plant and high root/ shoot ratio in the descending order of importance under drought conditions.

Heat conditions :

Data presented in (Table 9) showed that 20 of 100 tested genotypes had desirable values for various traits. The varieties, ARC 11094, Pinulupotly, Tupa729, Shinriki and Kameji, were superior for most of the studied traits under heat conditions, especially for vegetative and grain yield characters. Thus, these genotypes proved to be good candidates for heat tolerance.

Significant differences were observed among genotypes for number of days to heading under heat conditions. The genotypes, Aikoku, Kameji and Tupa 729 were earlier in heading than the others under heat conditions and their mean values ranged from 67.00 to 77.00 days (Table 9). Besides significant differences were detected for plant height among the genotypes under heat conditions. Tupa 729, Vary Futsi and Pinulupot genotypes had the tallest plants, compared to the others. Their mean values ranged from 119.00 to 130.00 cm. While, the genotypes, Dee geo woo gen, Guizhao 2 and Giza 178, had the shortest plants, their values ranged from 68.00 to 97.00 cm.

Furthermore, Significant differences were detected among genotypes for panicle length. The genotypes, Tupa 729, Kahei and Giza 178 were found to have the highest values for panicle length under heat conditions and their values ranged from 21.00 to 23.0 cm.

For number of panicles per plant, significant differences were found among genotypes under heat conditions .The varieties Shoni, Tupa 729, Ao gou 8 and Giza 178 had the desirable number of panicles per plant and their values ranged from 22.00 to 30.00 tillers (Table 9).

Significant differences for 100-grain weight, also, were detected among genotypes under drought conditions. ARC 11094, Kahei, Ao gou 8 and Dee geo woo gen genotypes had the highest values compared to the others. Their mean values ranged from 2.24 to 3.00 g. Besides Significant differences were observed among genotypes for sterility percentage. The genotypes, Dee geo woo gen, Taichung Native 1 and Giza 178 were found to have the desirable values for sterility percentage under heat conditions and their values ranged from 10.00 to 15.0 %. This indicates that these genotype, could be used as donors to improve the fertility under heat conditions

For grain yield (t/ha.), significant differences were found among genotypes under heat conditions and the varieties, Pinulupot 1, ARC 11094, Shinriki, Kameji and Giza 178 had the desirable values of grain yield (t/ha) and their mean values ranged from 7.2 to 8.8 (t/ha.).

Table (9): Mean performance for the studied traits of the best selected varieties under heat conditions during 2008 and 2009 seasons combined.

No.	Variety	N o of Days to heading (days)	Plant height (cm)	Panicle length (cm)	No of panicles / plant	100-grain weight (g)	Sterility (%)	Grain yield/ (t/ha)
1	Kasalath	96.00	105.00	19.00	19.00	2.30	60.00	6.50
2	Shoni	105.00	103.00	14.00	30.00	2.20	65.00	7.14
3	Tupa	103.00	110.00	19.00	11.00	2.30	35.00	6.18
4	ARC 7047	108.00	98.00	19.00	16.00	2.40	30.00	6.42
5	ARC 11094	110.00	99.00	18.00	21.00	3.00	18.00	8.80
6	RyoSuisanKoumai	90.00	98.00	19.00	14.00	2.30	40.00	5.95
7	Asu	119.00	96.00	19.00	15.00	2.30	40.00	5.95
8	Vary Futsi	102.00	127.00	19.00	17.00	2.30	25.00	6.18
9	Pinulupot 1	100.00	119.00	17.00	21.00	2.30	16.00	8.09
10	Tupa 729	75.00	130.00	20.00	28.00	2.20	25.00	7.37
11	Urasan 1	100.00	106.00	19.00	16.00	2.30	28.00	7.14
12	Aikoku	67.00	85.00	17.00	19.00	2.30	18.00	7.14
13	Shinriki	97.00	105.00	18.00	24.00	2.20	35.00	7.61
14	Kameji	77.00	112.00	17.00	20.00	2.10	23.00	7.37
15	Kahei	99.00	117.00	21.00	22.00	2.80	80.00	5.42
16	Dee geo woo gen	97.00	68.00	17.00	18.00	2.40	10.00	6.66
17	Ao gou 8	101.00	92.00	18.00	27.00	2.50	34.00	7.14
18	Taichung Native 1	110.00	88.00	21.00	20.00	2.10	14.00	6.18
19	Guizhao 2	88.00	75.00	18.00	21.00	2.10	80.00	6.42
20	Giza 178	102.00	97.00	23.25	22.33	2.30	15.00	7.20
	LSD at 0.05	4.10	3.30	1.80	3.00	0.18	7.00	0.20

For some time it was hoped that a positive effect of global warming would increase filed crop agricultural yields, because of the role of carbon dioxide in photosynthesis, especially in preventing photorespiration, which is responsible for significant destruction of several crops (Mellor, 2001) . Rising atmospheric temperatures, longer droughts and side-effects of both, such as higher levels of ground-level ozone gas, are likely to bring about a substantial reduction in crop yield in the coming decades, decide were shown by large-scale experiments. Moreover, the region likely to be worst affected is Africa, because its geography makes it particularly vulnerable, and seventy per cent of the population rely on rain-fed agriculture.

The analysis of variance showed significant differences amongs the genotypes for all characters and expressed considerable range of variation Table (10).

Table (10): Analysis of variance for the studied traits of the best selected varieties under heat conditions during 2008 and 2009 seasons combined.

S.O.V	d.f.	Mean squares						
		No of days to heading (days)	Plant height (cm)	Panicle length (cm)	No. of panicles/ plant	100grain weight (g)	Sterility (%)	Grain yield/ (t/ha)
Replications	2	2.400	2.000	0.050	3.200	0.085	0.175	0.005
Genotypes	19	9132.6**	14065**	12.056	67.62**	2.77**	1333.4**	4.206**
Error	38	37.60	40.00	0.98	0.88	0.25	1.04	0.18

**:significant at 0.01 level

It was, also, observed that phenotypic and genotypic variances exhibited the same trend of variability. The maximum range of variation was observed for number of panicles per plant, followed by scope for the genetic improvement in these characters. The extent of genotypic coefficients of variation (GCV) indicated that grain yield (t/ha) (323.48), number of panicles per plant (173.69) and 100-grain weight (173.67) gave the highest values. Estimates of heritability ranged from 45.43 for plant height to 92.00 for number of days to heading (Table 11).

In general, high estimates of heritability were observed for all studied characters except for plant height (45.3%) and number of panicles/plant (56.41%). However, number of days to heading expressed the maximum heritability value (92%), followed by sterility (83.89%) and panicle length (82.14), with low genetic coefficient of variation for number of days to heading and panicle length.

Table (11): Genetic parameters of variation for grain yield and its components in the selected heat tolerant varieties.

Parameters	Mean squares						
	No of days to heading (days)	Plant height (cm)	Panicle length (cm)	No of panicles/ plant	100 - grain weight (g)	Sterility (%)	Grain yield (t/ha.)
Mean	102.00	101.04	18.58	20.42	2.23	0.30	6.85
Minimum	67.00	75.00	14.00	11.00	2.10	0.10	5.42
Maximum	119.00	127.00	23.25	30.00	3.00	0.80	8.80
Genotypic variance	27.15	94.15	1.15	1258.00	15.00	644.00	491.00
Phenotypic variance	29.45	207.20	1.40	2230.00	19.00	768.00	647.00
GCV (%)	5.10	9.60	5.79	173.69	173.67	84.59	323.48
PCV (%)	5.32	14.24	6.36	231.25	195.46	277.12	371.33
Heritability (%)	92.00	45.43	82.14	56.41	78.94	83.85	75.88
Genetic advance as (%) of mean	10.28	13.34	1.99	54.47	7.00	28.45	27.76

In the pressure investigation, it was very important to note that characters, having high heritability estimates, gave almost high values of genetic coefficient of variation, except for number of days to heading and panicle length. This maight be attributed to the varying extent of environmental components of variation involved in these traits (Table 11). Similar results of high heritability, coupled with low genetic coefficient of variation were reported by Abd-Allah, (2000). Dixit *et al.* (1970) who reported that high genetic coefficient of variation, and heritability were not always associated with high genetic advance for a character. But, to make effective selection, high heritability should be associated with high genetic advance.

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تحليل التباين المظهري والوراثي في بعض أصناف الأرز لبعض صفات النمو والمحصول تحت ظروف التقسية

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أجريت تجربة لتقييم مائة تركيب وراثي من مصادر مختلفة وذلك في موقعين مختلفين وذلك بمحطة بحوث سخا ومحطة بحوث الوادي الجديد في موسم ٢٠٠٧م . فقد تم زراعة كل تركيب وراثي في أربعة سطور طول كل سطر ٥ متر وعرض ٢٠سم في ثلاث مكررات وأعتبر السطران الخارجيان داير والسطران الداخليان لجمع البيانات .

وتم تقييم أفضل التراكيب الوراثية لصفات تحمل الجفاف والحرارة تحت نفس الظروف في موسمي ٢٠٠٨ و٢٠٠٩م . واشتملت الدراسة على، ١٨ و ٢٠ تركيبا وراثيا لتجربتي الجفاف والحرارة على الترتيب والتي تم اختيارها من مائة تركيب وراثي .

أشارت النتائج أنه يمكن استخدام الصفات الخضرية مثل عدد الأيام للتزهير وارتفاع النبات وعدد الأفرع للنبات ومساحة الورقة وصفات الجذور مثل طول الجذر وحجم الجذر ونسبة المجموع الجذرى للمجموع الخضري وعدد الجذور كدليل أنتخابى لتحمل الجفاف والحرارة حيث أنها تحافظ على توازن المحتوى المائي للنبات وتحسن التحكم في الضغط الأسموزى للخلايا في المراحل المبكرة للنبات .

وقد أظهر تحليل التباين وجود تباين معنوي للصفات الخضرية والجذور وكان المكافئ الوراثي (درجة التوريث) بالمعنى الواسع عالي القيم لكل من محصول الحبوب (طن/هكتار) (٧٦%) وارتفاع النبات (٨٨%) ومساحة الورقة (٨٢ %) وعدد الحبوب في النورة (٨٩%) وعدد الأيام للتزهير (٨٨ %). وبناءا عليه فأن الانتخاب لمحصول الحبوب طن/ هكتار ومكوناته سوف يكون أكثر فعالية في انتخاب التراكيب الوراثية تحت ظروف الجفاف والحرارة .

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