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DROUGHT TOLERANCE OF ANTHER CULTURE DERIVED RICE LINES

Abd Allah, A. A.*; M. M. Gaballah*; Aml E. A. El - Saidy and M. H. Ammar***

*** Rice Research and Training center, Field Crops Res. Institute, ARC, Giza**

**** Department of Seed Tech. Res., Field Crops Res. Institute, ARC, Giza**

ABSTRACT

Five single crosses were done between the drought tolerance genotypes and traditional varieties that have highly yielding potential. The forty anther culture derived lines obtained from five crosses viz., Giza 177 x IET 1444, Giza 177 x Yun Len 4, Sakha 101 x IRAT 112,Sakha 103 x IET 1444 and Sakha 103 x Suweon 349 . The best five of diploid lines were selected to evaluate under drought and normal conditions and their parents with IET1444 and Giza177 as drought tolerance genotype and sensitive genotype, respectively. So Field and laboratorial experiments were conducted at Sakha Farm Stations, Kafr EL-Shiekh and Seed Technology Research unit in Mansoura during 2012 and 2013 seasons. A randomized complete block design with three replications was used.

The ordinary analysis of variance indicated highly significant differences among environments, genotypes and environments x genotypes interaction for chlorophyll content, days to heading, plant height, number of panicles plant-1, grain yield plant-1, germination characters seed protein percentage, seed oil percentage and total carbohydrate percentages traits studied in both environments (normal and drought).

The results illustrated that intermediate to high estimates of genetic variance were obtained for days to heading, chlorophyll content, plant height , number of panicles plant-1 and grain yield plant-1. The phenotypic variance values indicated wide phenotypic variability among characteristics studied. Percentages of GCV were 2.18, 1.69, 5.20, 8.33, 4.70, 6.49, 3.31, 10.27, 8.47 and 28.80 % for days to heading, chlorophyll content, plant height , number of panicles plant-1 and grain yield plant-1 and 7.74, 6.83, 19.67, 19.25, 6.09 and 9.73, % for root length, shoot length and dry weight of 10 seedlings and 6.98, 8.52, 77.44, 14, 19.8, 14.16, 8.06 and 6.76, % for germination percentage, oil percentage, protein percentage and carbohydrate percentage under normal and drought environments, respectively. The heritability in all studied traits gave high percentages under normal and drought conditions.

In general, number of panicles/plant and grain yield as well as protein percentage, carbohydrate percentage and germination percentage recognized as beneficial drought tolerance indicators and may be used as selection criteria in rice breeding program. . Also, that planting the genotypes Sakha103 x IET1444, Sakha103xSuweon349 and Giza 177 x Yun Len 4 may be considered the best parents for drought recovering ability and can be crossed to produce new genotypes with desirable characters related to drought tolerance.

Keywords:Rice (*Oryza sativa* L.), germination, genotypes, drought, yield, quality, genetic variability.

INTRODUCTION

The enhancement of rice yields using various technologies has been a goal of agricultural scientists for several decades. The main limitation in rice production is a biotic stress such as salinity, drought, extreme temperature and submergence. Drought is the most important limiting factor for crop production and it is becoming an increasingly severe problem in many regions of the world. The percentage of drought affected land areas more than doubled from the 1970s to the early 2000s in the world. Drought is a world-spread problem seriously influencing grain production and quality and with increasing population and global climate change making the situation more serious. Drought is one the main limited factors that affect the growth of rice in Egypt. Anther culture becomes avery useful and powerful technique in crop improvement because of its four advantage over the convention methods as mentioned below. It can shorten the breeding cycle period, increase selection efficiency by offering the possibility of early expression of recessive gene and fixing more types of gene recombination, create variability for selection through mutations which occur during culturing and it can help to solve the problem high sterility in wide crosses.

The production of doubled haploids through anther culture in vitro is a useful technique in plant breeding to develop homozygous lines that in a short time comparing with the time required for development of new rice cultivars through conventional breeding methods, which require at least 4 - 7 years. In anther and / or isolated microspores culture technique, the immature pollen grains (haploid) are induced to divide and double their chromosome number so that the plant regenerated from them have two set of chromosomes (double haploid). Regeneration of haploid plants from cultured anthers and their subsequent diploidization, which results in fully homozygous genotypes or doubled haploids, provides an alternative route to the conventional method of inbred-line development that is usually achieved through several cycles of inbreeding. The effectiveness of the technique depends on the efficiency of haploid plant regeneration from microspores contained within the anthers, and the conversion of these haploids to doubled haploids either spontaneously during the tissue culture phase or induced thereafter. With this method, true breeding lines can be produced in the immediately succeeding generation. Therefore the technique has immense potential for developing homozygous breeding lines in relatively a short period. The first report of haploid plant production in rice through anther culture by Niizeki and Oono (1968). Many early studies have been carried out on various aspects of rice anther culture including pollen ontogeny during culture (Guha et al., 1970 and Iyer and Raina, 1972). However, due to the frequently observed variability in plant populations raised through tissue culture, it appears that, tissue culture may not be a safe method for cloning plant species, while it may be a rich and novel source of variability with great potential in crop improvement.

The goal of this study was to develop rice lines derived lines from F1 crosses tolerant to drought through anther culture technique.

MATERIALS AND METHODS

Five single crosses were done between the drought tolerant genotypes, IET1444, Yun len 4, IRAT 112 and Suweon 349 and high yielding traditional varieties, Giza177, Sakha101 and Sakha103 to incorporate the drought tolerance of drought tolerance genotypes into local high yielding varieties. F_1 progenies of crosses were grown under greenhouse conditions. Panicles from primary tillers of F_1 plants were collected on the morning when the auricle distance of the flag leaf to the next leaf around 5-9 cm. Inflorescences were collected at boot leaf stage around 9 AM at which time more microspores at mid uninucleate stage, which is the suitable stage for anther culture. The panicles were washed in tap water and wrapped in moistened paper before keeping in the incubator at 80 ^{o}c for 8 days. The middle florets of the panicles, which had anthers with uninucleate microspores were detached into 70% ethanol minute before surface sterilized with 0.1 % mercuric chloride and washed 4 to 6 times with sterile distilled water. Anthers were dissected out under aseptic conditions and held each floret with sterile forceps to tap at the edge of a vessel containing the callus induction medium to release the anthers.

Media:

The cultures were incubated in the dark at 25 ± 2 ^{o}C for callus induction. The size of calli reached to 2-3 mm transferred to regeneration media. In vitro propagated plant regeneration in MS medium with supplement of 2 mg / 1 BAP was conducted. Cluster was separated of shoot and transferred in MS medium with out phytohormones for root induction. Completely regenerated plants were acclimatized in Yoshida solution (Yoshida *et al*., 1972) for 15 days prior to individualize the plants. Media for callus induction was N_6 medium containing 0.5 mg/L 2,4-D, 1 mg/L NAA, 0.5 mg/L BAP and medium for regeneration MS medium containing 1 mg /L NAA, 1mg/L BAP, 0.2mg/Kinetin. The plants were cultivated in greenhouse for further observation and evaluation.

The forty anther culture derived lines obtained from the five crosses viz., Giza 177 x IET 1444, Giza 177 x Yun Len 4, Sakha 101 x IRAT 112,Sakha 103 x IET 1444 and Sakha 103 x Suweon 349 . The five lines only were selected based on their desirable characters that are associated with drought tolerance and their combined data. A five of diploid lines and their parents with IET1444 and Giza177 as drought tolerance genotype and sensitive genotype, respectively, were evaluated in three replications in Randomized Complete Block Design (RCBD) under normal and drought (flash irrigated every 12 days after transplanting with fifteen days) environments at Sakha Farm Stations during 2012 and 2013 seasons. Experimental plots size were 2 x 5 m, with 20 cm between and within rows. The list of crosses and their derived diploids anther cultures were shown in Table 1. Fertilizers applied as recommended doses. Nitrogen was applied in two splits the first one at land preparation and the second dose was applied at 65 days after sowing.

Table 1: Number of anther culture derived lines from the selected crosses.

No.	Crosses	No. of diploid lines
1	Giza 177 x IET1444	5
2	Giza 177 x Yun len 4	8
3	Sakha 101 x IRAT 112	8
4	Sakha 103 x IET 1444	12
5	Sakha 103 x Suweon 349	7
Total		40

Field measurements:

Chlorophyll content was determined at panicle initiation stage. Days to heading, plant height (cm), panicle length (cm), panicles plant $^{-1}$and grain yield plant^{-1} (g) were recorded at ripening stage. Seed nitrogen percentage was estimated using micro kejeldahl method of A.O.A.C. (1990). The dry weight of leaf (0.05g) was digested with sulphuric acid and hydrogen peroxide mixture distribution was carried out with 40% NaOH and ammonium was received in 4% boric acid solution. The distributes were then titrated with 0.02 N HCL using the mixed methyl red-bromocresol green indicator. Crude protein percentage was calculated by multiplying nitrogen percentage by the converting factor 5.57 (Jackson, 1967). Seed oil percentage was determined after extraction with Soxhelt's apparatus using hexan as an organic solvent according to A.O.A.C. (1990). Total carbohydrate percentages in grains were estimated based on the method of phenol sulphuric acid according to Dubois *et al*. (1956).

A laboratory experiment:

Random sample of seeds of each treatment resulted from field experiment were sown and subjected to standard germination test as the rules of International Seed Testing Association (ISTA, 1985).Germination percentage was expressed by the percentage of seed germinating normally after fourteen days. Shoot and root length (cm) were determined from 10 normal seedlings taken at random from each replicate at the end of standard germination test, then dried in a forced air oven at 105º C for 24 h to obtain seedlings dry weight and expressed as grams.

Statistical analysis:

Data collected were subjected to analysis of variance according to Gomez and Gomez (1984) and combining analysis for two seasons was done. Treatment means were compared by least significant differences test (LSD) at the level of 0.05 of probability. All statistical analysis was performed using analysis of variance technique by means of "MSTAT-C" computer soft was package. Analysis of variance was performed to check the genetic variance among the diploid lines for all traits. The broad sense heritability (H) were computed from the estimates of genetic (0/2G) and residual variance (0/2e) derived from the expected mean squares of analysis of variance as H= (0/2G)/0/2G+0/2e/K), were K the number of replications.

RESULTS

The ordinary analysis of variance Table 2 indicated highly significant differences among environments, genotypes and environments x genotype interaction for days to heading, chlorophyll content (mg/g fresh weight), plant height (cm), number of panicles plant^{-1}, grain yield plant^{-1}, Shoot length (cm), Root length (cm), dry weight of 10 seedlings (g), germination percentage, oil percentage, protein percentage and carbohydrate percentage and traits studied in both environments (normal and drought).

Table 2: Observed mean square from ordinary analysis for the studied characters in the field experiment.

Source of variance	df	Days to heading (days)	Chlorophyll content (mg/g fresh weight)	Plant height (cm)	No. of panicles plant-1	Grain yield plant-1(g)
Environment	1	7.921875**	433.201**	1,666.163**	214.208**	0.740**
Rep (environment)	4	7.307**	4.821**	4.583**	4.549**	0.049**
Genotype	6	16.666**	25.119**	32.455**	6.725**	0.079**
Environments x Genotype	6	8.446**	21.768**	139.805**	2.301**	0.066**
Error	24	0.069	7.029**	0.202	0.278	0.002

***, ** = Significant and high significant at 0.05 and 0.01 probability levels, respectively.**

Table 2: Continued.

Source of variance	df	Root length(cm)	Shoot length(cm)	Dry weight of 10-seedlings (g)
Environment	1	4.343 **	9.783 **	0.010 **
Rep (environment)	4	0.448	0.419*	0.003 **
Genotype	6	1.767 **	1.514 **	0.001 *
Environments x Genotype	6	0.551 *	1.386 **	0.002 **
Error	24	0.180	0.155	0.0001

***, ** = Significant and high significant at 0.05 and 0.01 probability levels, respectively.**

Table 2: Continued.

Source of variance	df	Germination %	Oil%	Protein %	Carbohydrate%
Environment	1	39.015*	0.062*	24.092**	92.976 **
Rep (environment)	4	15.376*	0.090**	0.392	10.689 *
Genotype	6	330.480**	0.188**	2.755**	122.288**
Environments x Genotype	6	50.909**	0.059*	7.746**	29.766**
Error	24	3.106	0.020	0.167	2.705

***, ** = Significant and high significant at 0.05 and 0.01 probability levels, respectively.**

Data in Table 3 concerned the range difference among five hybrid combinations viz., Giza177 x IET1444, Giza 177 x Yun len 4, Sakha101 x IRAT112, Sakha103 x IET1444 and Sakha103xSuweon349 for days to heading, plant height, panicle length, number of panicles/plant and grain yield/plant

Table 3:The range values for days to heading, plant height, panicle length, number of panicles plant^{-1} and grain yield plant^{-1}.

Designation	Days to heading (days)	Plant height (cm)	Panicle length(cm)	No. of panicles/ plant	Grain yield plant^{-1} (g)
Giza177 x IET1444	120-125	80-100	22-25	22-24	35-45
Giza 177 x Yun len 4	125-135	90-120	20-22	18-20	30-40
Sakha101 x IRAT112	110-130	82-110	25-28	25-30	36-48
Sakha103 x IET1444	95-110	85-120	20-25	18-23	42-44
Sakha103xSuweon349	90-120	80-100	22-24	22-26	36-40

For days to heading (Table 4) the genotypes, IET1444 and Giza177 gave the earlier values under normal conditions while, the earlier values under drought conditions obtained from Sakha101 x IRAT112.With respect to chlorophyll content, the most desirable mean values were obtained from crosses, Giza 177 x Yun len 4 and Giza177 x IET1444 under normal environment. On the other hand, the best values were 41.5 and 39.4 produced from Giza177 x IET1444 and IET1444 respectively, under drought environment. For chlorophyll content there was a significant difference between genotypes, since, the genotype Giza 177 x Yun Len 4 and Sakha103 x IET1444 recorded the highest values for normal conditions and the most desirable mean values were obtained from the crosses; Giza177 x IET1444 and Sakha103xSuweon349 under drought conditions. With respect to plant height genotypes; Giza177 x IET1444 and Sakha103 x Suweon349 gave the highest values under normal conditions on the other hand the highest values under drought conditions came from Giza 177 x Yun Len 4 and IET1444. The genotypes, Giza177 x IET1444, Sakha101 x IRAT112 and Giza177 gave the best values for number of panicles plant^{-1} under normal conditions, while, the Sakha103 x IET1444 gave the best one under drought conditions. For grain yield plant^{-1} the genotypes were Sakha103xSuweon349 and Giza 177 x IET1444 gave 39.60 and 38.00g respectively, under normal conditions wherever, the best values were obtained from Sakha103xSuweon349 (30g) and IET1444 genotypes (30g) under drought conditions.

Table 4: The genotypes mean performance for the studied characters in both normal (N) and drought conditions (D) (combined data between the two seasons).

Characters Genotypes	Days to heading (days)		Chlorophyll content (mg/ g fresh weight)		Plant height (cm)		No. of panicles/plant		Grain yield plant^{-1} (g)	
	N	D	N	D	N	D	N	D	N	D
Giza177 x IET1444	106.5	105.0	43.2	41.5	103	72.0	19.00	12.00	38.00	27.20
Giza 177 x Yun len 4	104.0	105.0	46.9	33.9	90.2	90.0	18.00	13.00	36.80	28.40
Sakha101 x IRAT112	104.5	102.0	39.1	32.1	98.0	78.0	19.00	15.00	30.80	26.80
Sakha103 x IET1444	102.5	100.0	43.3	35.0	91.4	85.0	18.00	16.00	34.40	28.40
Sakha103xSuweon349	108.5	104.0	41.9	39.1	100.0	86.0	18.40	15.00	39.60	30.00
IET1444	101.5	104.0	41.8	39.4	97.0	88.0	18.60	15.00	30.40	30.00
Giza177	102.5	104.0	42.9	37.3	97.0	88.0	19.00	14.00	36.80	27.20
LSD at 0.05	0.6	0.5	1.3	1.2	0.6	0.5	0.96	0.88	1.13	1.02

Table 4: Continued.

Characters / Genotypes	Root length (cm)		Shoot length (cm)		Dry weight of 10-seedlings (g)	
	N	D	N	D	N	D
Giza177 x IET1444	7.05	6.47	7.96	5.50	0.185	0.157
Giza 177 x Yun len 4	7.63	7.18	6.94	5.85	0.220	0.167
Sakha101 x IRAT112	8.03	6.75	7.22	5.83	0.226	0.169
Sakha103 x IET1444	7.87	7.17	6.21	6.92	0.200	0.166
Sakha103xSuweon349	7.04	6.28	6.84	5.85	0.189	0.152
IET1444	8.61	6.84	7.60	5.95	0.199	0.189
Giza177	7.03	6.67	6.02	5.65	0.202	0.155
LSD at 0.05	0.27	0.20	0.25	0.24	0.013	0.013

Table 4: Continued.

Characters / Genotypes	Germination %		Oil%		Protein %		Carbohydrate %	
	N	D	N	D	N	D	N	D
Giza177 x IET1444	76.00	73.33	2.60	2.11	5.05	9.93	74.74	75.24
Giza 177 x Yun len 4	93.33	92.00	2.01	1.99	5.20	7.00	68.50	68.66
Sakha101 x IRAT112	98.67	88.00	2.09	1.94	5.62	8.65	62.18	73.99
Sakha103 x IET1444	92.00	88.00	2.24	2.10	7.18	7.60	68.20	71.25
Sakha103xSuweon349	97.33	93.33	2.01	1.93	5.23	6.08	61.18	63.39
IET1444	97.67	93.33	2.25	2.18	7.08	7.73	72.14	77.09
Giza177	98.67	94.66	2.09	1.79	6.60	8.25	73.12	75.08
LSD at 0.05	1.12	1.12	0.09	0.09	0.26	0.27	0.48	0.48

The data in Table 4 showed that significant differences among genotypes under normal and drought environments. With respect to root length, the genotypes; Sakha101 x IRAT112 (8.03) and IET1444 (8.61) gave the highest values under normal conditions. On the other hand, the highest values under drought conditions recorded from Giza 177 x Yun Len 4(7.18 cm) and Sakha103 x IET1444 (7.17 cm). For shoot length, the genotypes were Giza177 x IET1444 and IET1444 gave 7.96 and 7.60 cm, respectively, under normal conditions. However, the best one under drought conditions obtained from genotypes were Sakha103 x IET1444 (6.92 cm) and IET1444 (5.95 cm).The genotypes, Giza177 x Yun Len 4(0.220 g) and Sakha101 x IRAT112 (0.226 g) gave the best values of dry weight of 10 seedlings under normal conditions, while, Sakha101 x IRAT112 (0.169 g) and IET1444 (189 g) gave the best one under drought conditions.

For germination percentage (Table 4), the genotype, Sakha101 x IRAT112 gave the highest values under normal conditions. While, the variety Giza 177 recorded the highest values under drought conditions. With respect to oil percentage, the genotypes Giza177 x IET1444 and IET1444 produced the highest values under normal conditions, while, the highest oil percentage values under drought conditions get from Sakha103 x IET1444, followed by IET1444.Regarding to protein percentage, the most desirable mean values were obtained from genotypes, Sakha103 x IET1444 and Giza177 under normal environment. On the other hand, the best values of protein percentage were 9.93% and 8.65% produced from Giza177 x IET1444 and sakha101 x IRAT112 respectively, under drought environment. For carbohydrate percentage were found significant differences between genotypes, where, the genotype Giza 177 and Giza177 x IET1444 recorded the highest values under normal conditions and the most desirable mean values were obtained from IET1444 and Giza177 x IET1444 under drought conditions.

Genetic parameters

Genetic variances, phenotypic variances, heritability in broad sense and expected genetic advance were estimated for all studied traits. Data in Table 5 illustrated that intermediate to high estimates of genetic variance were obtained for days to heading, chlorophyll content, plant height, number of panicles/plant and grain yield/plant. The phenotypic variance values indicated wide phenotypic variability among characteristics studied. The percentages of GCV were 2.18, 1.69, 5.20, 8.33, 4.70, 6.49, 3.31, 10.27, 8.47 and 28.80 for days to heading, chlorophyll content, plant height, number of panicles/plant and grain yield under normal and drought environments, respectively. The heritability in all studied traits in gave high percentages under normal and drought conditions. The genetic advance, indicating the possibility of selection desirable values for studied traits.

Table 5: Estimated the genotypic variance, phenotypic variance, heritability in broad sense (h^2b) and genetic advance (GA %) for the studied traits.

Entry	Days to heading (days)		Chlorophyll content (mg/g fresh weight)		Plant height (cm)		No. of panicles/plant		Grain yield plant^{-1} (g)	
	N	D	N	D	N	D	N	D	N	D
G.V	5.13	3.04	4.97	9.42	20.31	29.74	0.38	2.17	0.01	0.03
P.V	5.18	3.14	5.02	9.93	20.51	29.74	0.55	2.47	0.01	0.04
Hb	99.05	96.87	99.16	94.82	98.04	97.00	69.43	88.00	90.42	97.93
G.C.V	2.18	1.69	5.20	8.33	4.70	6.49	3.31	10.27	8.47	28.80
P.C.V	2.19	1.71	5.22	8.56	4.72	6.49	3.97	10.95	8.90	29.10
G.S	464.54	353.65	457.51	615.53	923.89	1,123.42	106.21	284.70	15.07	38.03
G.S%	446.23	342.05	1,066.36	1,671.45	963.31	1,337.40	568.47	1,984.27	1,658.23	5,870.22

Table 5: Continued.

Entry	Root length (cm)		Shoot length (cm)		Dry weight of 10-seedlings (g)	
	N	D	N	D	N	D
G.V	0.363	0.24	1.914	1.85	1.47	0.0003
P.V	0.94	0.798	2.083	2.62	4.42	0.0003
Hb	38.62	30.1	91.88	70.61	34.7	100
G.C.V	7.74	6.83	19.67	19.25	6.09	9.73
P.C.V	12.46	12.46	20.52	22.9	1056.5	9.730
G.S	77.13	55.4	273.2	235.4	309.58	642.6
G.S%	991.4	772.5	3884.1	3331.6	155567.8	360997

Table 5: continued.

Entry	Germination %		Oil%		Protein %		Carbohydrate%	
	N	D	N	D	N	D	N	D
G.V	41.71	60.5	0.025	0.084	1.725	1.18	32.09	23.4
P.V	64.31	90.8	0.125	0.20	1.77	1.28	32.24	23.6
Hb	64.9	66.63	20	42	97.7	92.2	99.5	99.15
G.C.V	6.98	8.52	7.44	14	19.8	14.16	8.06	6.76
P.C.V	8.67	10.43	16.64	0.002	20.02	14.7	8.08	6.79
G.S	1072.14	1307.9	14.56	0.39	267.7	214.9	1163.8	992.24
G.S%	1159.1	1432.1	685.5	18.71	4028.9	2800.7	1657.1	1387.2

Data in Table 5 showed that intermediate to high estimates of genetic variance were obtained for root length, shoot length and dry weight of 10-seedlings. The phenotypic variance values indicated wide phenotypic variability among characteristics studied. The percentages of GCV were 7.74, 6.83, 19.67, 19.25, 6.09 and 9.73, for root length, dry weight of 10-seedlings and shoot length under normal and drought environments, respectively. The heritability in all studied traits gave high percentages under normal and drought conditions. The genetic advance, indicating the effective of selection desirable values for studied traits .

Data in Table 5 reported that intermediate to high estimates of genetic variance were obtained for germination percentage, oil percentage, protein percentage and carbohydrate percentage. The phenotypic variance values indicated wide phenotypic variability among characteristics studied. The percentages of GCV were 6.98, 8.52 77.44, 14, 19.8, 14.16, 8.06 and 6.76 for germination percentage, oil percentage, protein percentage and carbohydrate percentage under normal and drought environments, respectively. The heritability in all studied traits produced high percentages under normal and drought conditions. The genetic advance, indicating the effective of selection desirable values for studied traits.

DISCUSSION

The decrease in plant height in all genotypes in response to drought stress may be due to decrease in relative turgidity and dehydration of protoplasm which is associated with a loss of turgor and reduced expansion of cell and cell division (Arnon, 1972). The effect of water stress during grain filling on grain may be due to reduction in rate and duration of filling processes and causing small grain size consequently reducing number of grains/panicle and grain weight. The reduction in germination parameters may be due to eventual depletion of grain moisture which produces smaller endosperm and premature seed with potentially reduced germination percentage. Similar findings were stated by Saini and Westgate, 2000. General functions such as water and water week alternating elongation of plant seeds increases resistance to stress what can be intense. The reduction in the shoot length and the root length may be due to an impediment of cell division and elongation leading to kind of tuberization. This tuberization and the lignifications of the root system allow the plant to enter a slow-down state, while waiting for the conditions to become favorable again (Fraser *et al.,* 1990).

It could be concluded that number of panicles/plant and grain yield as well as protein percentage, carbohydrate percentage and germination percentage recognized as beneficial drought tolerance indicators and may be used as selection criteria in rice breeding program. Also, that planting the genotypes Sakha103 x IET1444, Sakha103xSuweon349 and Giza 177 x Yun Len 4 may be considered the best parents for drought recovering ability and can be crossed to produce new genotypes with desirable characters related to drought tolerance.

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استنباط سلالات أرز مقاومة للجفاف من زراعة المتك

عبدالله عبدالنبي عبد الله*،محمود محمد جاب الله*،أمل الصعيدي عبد ربه الصعيديو مجاهد حلمي عمار***

*** مركز البحوث والتدريب في الأرز- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية- الجيزة**

**** قسم بحوث تكنولوجيا البذور- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية- الجيزة.**

تعتبر مشكلة نقص مياه الري أحد العوامل الرئيسية المؤثرة علي نمو وإنتاج الأرز في مصر ويستخدم تكنيك زراعة الأنسجة في الأرز في استنباط الأصناف وتحسين كفاءة الانتخاب لصفات المحصول ومكوناتة وللصفات ذات درجات التوريث المنخفضة والتي تتأثر بالعديد من الجينات . تم إجراء التهجين بين تراكيب وراثية متحملة للجفاف والأصناف التجارية المحلية التي تتميز بالمحصول العالي ثم تم استنباط أربعين سلالة باستخدام زراعة المتك من الخمسة هجن التالية : جيزة ١٧٧ x أي إي تي١٤٤٤ , جيزة ١٧٧ x يان لين ٤ , سخا ١٠١ x اي أر ايه تي ١١٢ , سخا ١٠٣ x أي إي تي١٤٤٤ و سخا ١٠٣ x سويون٣٤٩ وأبائهم أي إي تي ١٤٤٤ و جيزة ١٧٧مقاوم وحساس للجفاف على التوالى. وتم انتخاب أفضل خمسة سلالات علي اساس صفاتها المرغوبة المرتبطة بظروف الجفاف . لذلك أقيمت تجارب حقلية ومعملية تحت ظروف الري المستمر وتحت ظروف الجفاف (الري كل ١٢ يوما) بمحطة البحوث الزراعية بسخا - كفر الشيخ و وحدة بحوث تكنولوجيا البذور بالمنصورة خلال الموسمين ٢٠١٢ و ٢٠١٣ م . وصممت بنظام القطاعات الكاملة العشوائية في ثلاث مكررات.

أوضح تحليل التباين وجود اختلافات عالية المعنوية بين كل من الظروف البيئية والتراكيب الوراثية وتفاعل البيئة مع التراكيب الوراثية لصفة محتوي الأوراق من الكلوروفيل وعدد الأيام من الزراعة حتي التزهير و إرتفاع النبات وعدد الداليات/نبات و محصول الحبوب/نبات وصفات الإنبات والنسبة المئوية للبروتين والزيت و الكربوهيدرات بالحبوب تحت ظروف الري المستمر وظروف نقص المياه.

أوضحت النتائج ان قيم التباين الوراثي للصفات المدروسة وهي عدد الأيام حتى التزهير ومحتوي الأوراق من الكلوروفيل وارتفاع النبات وعدد الداليات /نبات ومحصول الحبوب/نبات كانت متوسطة إلى مرتفعة. وأظهرت قيم التباين المظهري اختلافات كبيرة بين كل الصفات المدروسة و كانت نسبة التحسين الوراثي ٢.١٨ ، ١.٦٩ ، ٥.٢٠ ، ٨.٣٣ ، ٤.٧٠ ، ٦.٤٩ ، ٣.٣١ ، ١٠.٢٧ ، ٨.٤٧، و ٢٨.٨٠ لصفات عدد الأيام حتى التزهير ومحتوي الكلوروفيل وطول النبات وعدد الداليات/ نبات ومحصول الحبوب / نبات و ٧.٧٤ ، ٦.٨٣ ، ١٩.٦٧، ١٩.٢٥ ، ٦.٠٩ و ٩.٧٣ لصفات طول الجذر و طول المجموع الخضري والوزن الجاف للبادرات و٦.٩٨، ٨.٥٢، ٧.٤٤, ١٤, ١٩.٨ , ١٤.١٦ , ٨.٠٦ و ٦.٧٦, لنسبة الإنبات ونسبة الزيت والبروتين والكربوهيدرات تحت كل من الظروف الطبيعية والجفاف علي التوالي. و أشارت النتائج أن نسبة التوريث للصفات المدروسة كانت عالية في كل من الظروف الطبيعية والجفاف.

وتوصى الدراسة بأن عدد الداليات/نبات و محصول الحبوب والنسبة المئوية للبروتين والكربوهيدرات بالحبوب والنسبة المئوية للإنبات يمكن تمييزها كدلائل مفيدة لتحمل الجفاف ويمكن استخدامها كصفات انتخاب في برنامج تربية الأرز وأيضا توصى الدراسة بزراعة التراكيب الوراثية سخا ١٠٣ x أي إي تي١٤٤٤ ، سخا ١٠٣ x سويون٣٤٩ وجيزة ١٧٧ x يان لين ٤ واستخدامها كآباء مبشرة يمكن الحصول من نسلها على نباتات أكثر تحملا للجفاف.

قام بتحكيم البحث

أ.د / عبد الرحيم عبد الرحيم ليلة	**كلية الزراعة – جامعة المنصورة**
أ.د / حمدى فتوح الموافى	**مركز البحوث الزراعية**