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**COMBINING ABILITY AND HETEROSIS FOR GRAIN
YIELD AND ITS COMPONENTS IN SOME MAIZE
INBRED LINES UNDER DROUGHT STRESS**

By

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B.Sc. Agric. Sc., (Plant Production), Fac. Agric., Ain Shams University, 2017

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ABSTRACT

Muhammed Gamal Abd-Elnaser Ali: Combining Ability and Heterosis for Grain Yield and Yield Components in Some Maize Inbreds Under Drought Conditions. Unpublished M.Sc. Thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2022.

The present study was conducted to evaluate eight white inbred lines of maize and their F_1 crosses under normal and drought stress conditions to estimate combining ability and heterosis for grain yield and associated traits. The evaluation was extended to include two transcription factor genes known to be associated with abiotic stresses in plants, namely are DREB2 and CBF4. The results showed significant mean squares (MS) of irrigation treatment were showed for the studied traits. The MS of parents, crosses, and genotypes were determined to be highly significant under both and across irrigation levels, with the exception of the anthesis-silking interval and stay green under normal irrigation, number of ears plant⁻¹ and ear diameter under both irrigation levels for parents and genotypes, and anthesis-silking interval, number of ears plant⁻¹ and ear diameter under both irrigation regimes for crosses. Grain yield and most other traits showed significant differences (MS) associated with both General combining ability (GCA) and specific combining ability (SCA) under both irrigation regimes, demonstrating the importance of both additive and non-additive genetic effects in the expression of performance traits. The drought sensitivity index indicated that the best parents were (P-53), (P-137) and (P-86), and the best crosses were (P-86×P-96), (P-53×P-96), (P-96×P-137) and (P-53×P-137) which gave the highest yield under both environments. The parental line (P-86) had positive and highly significant GCA effects. The crosses (P-17×P-96), (P-8×P-96), (P-8×P-171), (P-24×P-86), (P-86×P-96), (P-86×P-171), and (P-96×P-171), gave the highest specific combinations under both irrigation regimes for grain yield and some of the associated traits. The highest level of heterosis (heterobeltiosis) for grain yield was obtained in the crosses (P-8×P-96), (P-

8×P-137), (P-8×P-171), (P-96×P-137), and (P-96×P-171) under both irrigation regimes. The quantitative gene expression analysis of two transcription factors (DREB2 and CBF4) was successful for triplicates of four genotypes P1, P5, P5×P6, and P1×P8. Based on the obtained CT values, in contrast to CBF4, the foldchange of the DREB2 showed a significantly higher change in gene expression in the drought-tolerant genotypes versus the drought-sensitive ones. The detected change confirmed the importance of the DREB2 transcription factor in the drought tolerance mechanism, and its usefulness as a molecular marker for the detection and selection of drought-tolerant genotypes.

Key Words: Combining ability, Heterosis, White maize, Drought sensitivity index, Real-time PCR, DNA extraction and PEG⁶⁰⁰⁰

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CONTENTS

	Page
LIST OF TABLES	V
LIST OF FIGURES	X
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	3
2.1 Effect of drought stress on earliness, grain yield and its contributing traits in maize	3
2.2 Genetic parameters under drought stress condition	9
2.2.1 Heterosis estimates	9
2.2.2 Combining ability	13
2.3 Gene regulation and expression under drought stress	24
3. MATERIALS AND METHODS	28
3.1 Genetic materials and experiment layout	28
3.2 Calculations of irrigation levels	30
3.2.1 Calculate potential evapotranspiration	30
3.2.2 Obtain values of crop water consumptive	30
3.2.3 Water requirements (WR)	31
3.2.4 Irrigation requirement (IR)	31
3.2.5 Leaching requirements	31
3.2.6 The total amount of irrigation water	32
3.2.7 Environmental measurements	32
3.3 Data recorded	33
3.3.1 Earliness traits	33
3.3.1.1 Days to 50 % anthesis (DTA)	33
3.3.1.2 Days to 50 % silking (DTS)	33
3.3.1.3 Anthesis-silking interval (ASI)	33

II

3.3.2 Vegetative traits	33
3.3.2.1 Plant height (PH) in cm	33
3.3.2.2 Ear height (EH) in cm	33
3.3.2.3 Number of leaves per plant (NLP)	33
3.3.3 Physiological traits	33
3.3.3.1 Ear Leaf area (ELA) in cm ²	33
3.3.3.2 Stay green (SG)	34
3.3.4 Yield and yield components traits	34
3.3.4.1 Number of ears per plant (EPP)	34
3.3.4.2 Number of rows per ear (RPE)	34
3.3.4.3 Number of kernels per row (KPR)	34
3.3.4.4 Ear length (EL) in cm.	34
3.3.4.5 Ear diameter (ED) in cm.	34
3.3.4.6 100-kernel weight (g)	34
3.3.4.7 Grain yield per plant (g)	34
3.3.5 Drought sensitivity index (DSI)	34
3.4 Statistical procedures	35
3.4.1 Analysis of variance	35
3.4.2 Estimation of heterosis	35
3.4.3 Combining ability	36
3.5 Molecular genetics experiment	39
3.5.1 Selective PEG experiment	39
3.5.2 RNA isolation	40
3.5.3 cDNA synthesis and quantitative PCR	40
4. RESULTS AND DISCUSSION	41
4.1 Analysis of variance	41
4.2 Mean performance	51
4.2.1 Days to 50% anthesis	51

III

4.2.2 Days to 50 % silking	51
4.2.3 Anthesis-silking interval	51
4.2.4 Plant height	52
4.2.5 Ear height	52
4.2.6 Number of leaves per plant	52
4.2.7 Ear Leaf area	53
4.2.8 Stay green	53
4.2.9 Number of ears per plant	53
4.2.10 Number of rows per ear	54
4.2.11 Number of kernels per row	54
4.2.12 Ear length	54
4.2.13 Ear diameter	55
4.2.14 100-kernel weight	55
4.2.15 Grain yield per plant	55
4.2.16 Drought sensitivity index	56
4.3 Heterosis	65
4.4 Combining ability	76
4.4.1 General combining ability effects	76
4.4.2 Specific combining ability effects	85
4.5 Molecular genetics experiment	94
4.5.1 DNA and RNA isolation	94
4.5.2 PCR amplification	95
4.5.3 Real-time PCR (qPCR)	96
5. SUMMARY AND CONCLUSION	100
5.1 Results can be summarized as follows	101
5.1.1 Analysis of variance	101
5.1.2 Mean performance	102
5.1.3 Heterosis	103

IV

5.1.4 General combining ability effects	103
5.1.5 Specific combining ability effects	103
5.1.6 DNA and RNA isolation	103
5.1.7 PCR amplification	103
5.1.8 Real-time PCR (qPCR)	103
REFERENCES	104
ARABIC SUMMARY	

LIST OF TABLES

Table No.	Page
(1) Name and source of the eight inbred lines of maize used as parents in the study.	28
(2) Chemical and physical properties of soil and water irrigation.	29
(3) Seasonal irrigation quantities of maize genotypes under two irrigation levels at the farm of the higher institute for agriculture cooperation during the 2021 season.	32
(4) Average monthly climatic data of the farm of the higher institute for agriculture cooperation location during the studied season 2021.	32
(5) Analysis of variance for combining ability.	36
(6) Combined analysis of variance of method 2 giving expectations of mean squares for the assumption of model 1.	37
(7) Mean squares for days to 50 % anthesis and days to 50 % silking under normal irrigation, drought stress and their combined data in 2021 season.	43
(8) Mean squares for anthesis-silking interval and plant height under normal irrigation, drought stress and their combined data in 2021 season.	44
(9) Mean squares for ear height and number of leaves per plant under normal irrigation, drought stress and their combined data in 2021 season.	45
(10) Mean squares for ear leaf area and stay green under normal irrigation, drought stress and their combined data in 2021 season.	46

(11)	Mean squares for number of ears per plant and number of rows per ear under normal irrigation, drought stress and their combined data in 2021 season.	47
(12)	Mean squares for number of kernels per row and ear length under normal irrigation, drought stress and their combined data in 2021 season.	48
(13)	Mean squares for ear diameter and 100-kernel weight under normal irrigation, drought stress and their combined data in 2021 season.	49
(14)	Mean squares for grain yield per plant under normal irrigation, drought stress and their combined data in 2021 season.	50
(15)	Mean performance of maize genotypes for days to 50 % anthesis and days to 50 % silking under the two irrigation treatments and their combined data in 2021 season.	57
(16)	Mean performance of maize genotypes for anthesis-silking interval and plant height under the two irrigation treatments and their combined data in 2021 season.	58
(17)	Mean performance of maize genotypes for ear height and number of leaves per plant under the two irrigation treatments and their combined data in 2021 season.	59
(18)	Mean performance of maize genotypes for ear leaf area and stay green under the two irrigation treatments and their combined data in 2021 season.	60
(19)	Mean performance of maize genotypes for number of ears per plant and number of rows per ear under the two irrigation treatments and their combined data in 2021 season.	61

VII

- (20) Mean performance of maize genotypes for number of kernels per row and ear length under the two irrigation treatments and their combined data in 2021 season. **62**
- (21) Mean performance of maize genotypes for ear diameter and 100-kernel weight under the two irrigation treatments and their combined data in 2021 season. **63**
- (22) Mean performance of maize genotypes for grain yield per plant and drought sensitivity index (DSI) under the two irrigation treatments and their combined data in 2021 season. **64**
- (23) Percentages of heterosis (%) over the better parent for days to 50% anthesis, days to 50% silking and anthesis-silking interval of twenty eight F₁ under normal irrigation and drought stress in 2021 season. **70**
- (24) Percentages of heterosis (%) over the better parent for plant height, ear height and number of leaves per plant of twenty eight F₁ crosses under normal irrigation and drought stress in 2021 season. **71**
- (25) Percentages of heterosis (%) over the better parent for ear leaf area, stay green and number of ears per plant of twenty eight F₁ crosses under normal irrigation and drought stress in 2021 season. **72**
- (26) Percentages of heterosis (%) over the better parent for number of rows per ear, number of kernels per row and ear length of twenty eight F₁ crosses under normal irrigation and drought stress in 2021 season. **73**
- (27) Percentages of heterosis (%) over the better parent for ear diameter and 100-kernel weight of twenty eight F₁ crosses under normal irrigation and drought stress in 2021 season. **74**

VIII

- (28) Percentages of heterosis (%) over the better parent and over the check variety (SC-10) for grain yield per plant of twenty-eight F_1 crosses under normal irrigation and drought stress in 2021 season. **75**
- (29) Estimates of general combining ability effects for days to 50 % anthesis, days to 50 % silking and anthesis-silking interval for the eight maize parental lines under normal irrigation and drought stress in 2021 season. **80**
- (30) Estimates of general combining ability effects for plant height, ear height and number of leaves per plant for the eight maize parental lines under normal irrigation and drought stress in 2021 season. **81**
- (31) Estimates of general combining ability effects for ear leaf area, stay green and number of ears per plant for the eight maize parental lines under normal irrigation and drought stress in 2021 season. **82**
- (32) Estimates of general combining ability effects for number of rows per ear, number of kernels per row and ear length for the eight maize parental lines under normal irrigation and drought stress in 2021 season. **83**
- (33) Estimates of general combining ability effects for ear diameter, 100-kernel weight and grain yield per plant for the eight maize parental lines under normal irrigation and drought stress in 2021 season. **84**
- (34) Estimates of specific combining ability effects of twenty-eight F_1 crosses of maize for days to 50% anthesis, days to 50% silking and anthesis-silking interval under normal irrigation and drought stress in 2021 season. **89**