بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

VARIATION AMONG PEANUT GENOTYPES IN TOLERANCE OF SOME ABIOTIC STRESSES

By

MAHMOUD MOHAMED MABROUK AHMED
B.Sc. Agric. Sci. (Organic Agric.), Fac. Agric., Cairo Univ., 2013

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SUPERVISION COMMITTEE

Dr. SAIED ABD EL-RAHMAN SHRIEF
Professor of Agronomy, Fac. Agric., Cairo University

Dr. HASHIM MOHMED ABDEL-LATTIF
Assistant Professor of Agronomy, Fac. Agric., Cairo University

Dr. HAGGAG SALAH ZEIN
Assistant Professor of Genetics, Fac. Agric., Cairo University

Dr. MOHAMED SALAH ELDIN EL-SODA
Assistant Professor of Genetics, Fac. Agric., Cairo University

Dr. ASHRAF ABD EL- AALA ABD El-MOHSEN (LATE)
Professor of Agronomy, Fac. Agric., Cairo University

APPROVAL SHEET

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APPROVAL COMMITTEE

Dr. AHMED FATHY ABD-ALLAH.....
Professor of Agronomy, Fac. Agric., Al-Azhar University

Dr. MOHAMED ABD EL-MABOUD ABD EL-SHAFI.....
Professor of Agronomy, Fac. Agric., Cairo University

Dr. SAIED ABD EL-RAHMAN SHRIEF.....
Professor of Agronomy, Fac. Agric., Cairo University

Date: 17 / 6 / 2020

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my parents for all the support they lovely offered along the period of my post-graduation, as well as to my wife and my daughter Mariam for their patience and help.

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TABLE OF CONTENTS

	Page
INTRODUCTION	**1**
REVIEW OF LITERATURE	**5**
1. Water deficit and the mean performance of Groundnut	**5**
2. Genotypic variation for drought tolerance	**8**
3. Effect of water deficit on oil quality	**14**
4. The physiological and chemical traits under water deficit conditions	**18**
5. Effect of water deficit on water use efficiency	**25**
MATERIALS AND METHODS	**29**
RESULTS AND DISCUSSION	**41**
The mean performance for yield and yield components under water deficit conditions	**41**
a. Yield components	**41**
1. 100-pod weight in g	**44**
2. 100-seed weight in g (seed index)	**47**
3. Shelling %	**50**
4. Pod weight/plot in g	**53**
5. Seed yield /plot in g	**56**
6. Pod yield/ fad in kg	**59**
7. Seed yield/ fad in kg	**62**
b**. Quality traits**	**65**
1. Oil content %	**65**
2. Protein%	**69**
3. Starch %	**72**
4. Oil + Protein yield in kg	**75**
5. Starch yield in kg	**77**
c. Water use efficiency, yield vs. yield reduction	**81**
d. Drought tolerance indices	**87**
e. Physiologacl traits	**97**
SUMMARY	**125**
REFERENCES	**143**

Name of Candidate: Mahmoud Mohamed Mabrouk Ahmed
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Supervisors: Prof. Dr. Saied Abd El-Rahman Shrief
Dr. Hashim Mohmed Abdel-Lattif
Dr. Haggag Salah Zein
Dr. Mohamed Salah ElDin El-Soda
Prof. Dr. Ashraf Abd El- Aala Abd El-Mohsen (Late)
Department: Agronomy **Approval:** 17 / 6 / 2020

ABSTRACT

Water deficiency is one of the major environmental constraints, limiting agricultural productivity, and affects the distribution of plant species across different types of environments. 47 peanut mutant lines were generated by γ-radiation mutagenesis of two commercial genotypes (Giza 6 and NC-1). Yield and its components, quality traits and physiological traits of those genotypes, were evaluated in a field experiment, using split plot arranged in a randomized complete block design, with two replications. Two water regimes were applied in the main plots, and the subplots were devoted for the peanut genotypes. Significant and highly significant effects of the two water regimes and the genotypes on the agronomic traits have been detected. Water use efficiency (WUE) is estimated to determine the finest genotypes performance regarding severe water deficit. Nine genotypes (37, 12, 36, 27, 49, 42, 25, 35, 7) -sorted in ascending order- have shown superiority over the sophisticated parent (Giza 6) regarding to WUE means in stress and non-stress conditions.Stress tolerance index (STI), Stress susceptibility index (SSI), Tolerance index (TOL), Mean productivity (MP), and Geometric mean productivity (GMP) have been measured to assess the tolerance of the genotypes to water deficit. STI, GMP, and MP are high positively inter correlated. Pots experiment was conducted to estimate the concentration of chlorophyll a, b and total chlorophyll and carotenoids and some biochemical components; total sugars, total soluble phenols, total free amino acids as well as free proline. The deficit condition treatment caused an increasing in the total soluble phenols, total free amino acids, total sugar and free proline for all genotypes but with different percentage depend on the nature of the interaction between the genotypes and environmental condition.

Key words: Water Deficit, Peanut, Mutation, Drought Tolerance Indices

INTRODUCTION

Peanut (*Arachis hypogaea* L.) seeds are an excellent source for many nutrients including protein, fatty acids, vitamin E, and magnesium. In addition, peanut contain 44-56% oil and 22-30% protein on a dry seed basis (Savage and Keenan, 1994). Peanut is grown in arid and semi-arid areas where droughts can occur at any growth stage. Mid-season drought (MD) reduced nodule dry weight, fixed nitrogen and pod yield in peanut genotypes (Dinh et al., 2013). Peanut is widely cultivated in the tropics, where drought is one of the most limiting factors for production. This together with concerns about climate change and yield stability has led to increase interest in improved

Drought is considered one of the most severe abiotic stresses that restrict plant growth and crop productivity across the world. Water deficit generally has many adverse effects in the ecological, morphological, physiological, biochemical and molecular traits of plant; moreover, it can severely reduce the quantity and quality of plant growth and yield (Farooq et al 2009 [a] and Nazar et al 2015).

Water deficit perceived by the plant from its surrounding environment varies spatially and temporally at several different scales. Drought affects membrane lipids and photosynthetic responses (Lauriano et al., 2000) and yield in peanuts (Suthar and Patel, 1992). Water deficit affects thylakoid electron transport, phosphorylation, carboxylation and photosynthesis. Changes in the lipid content and composition are common in water-stress plants and this increases membrane permeability.

The WUE of crop is a widely used characteristic which most commonly accounts for the biomass produced per unit of water transpired. A number of the earlier studies of groundnut (Hebbar et al., 1994 and Wright et al., 1994) have demonstrated significant differences between varieties in this trait under both well-watered and water-limited conditions for either the whole growing season or one specific period. (Jaleel et al., 2009) added that water deficit produced changes in the ratio of chlorophyll 'a' and 'b' and carotenoids. However, they pointed out that whether drought mainly limits photosynthesis through stomatal closure or through metabolic impairment. Both stomatal and non-stomatal limitation was generally accepted to be the main determinant of reduced photosynthesis under water deficit(Farooq, et al., 2009).

The accumulation of free proline, free amino acids, total soluble phenols as well as sugar in plant roots and leaves under drought, which alter the osmotic status in plant, were confirmed by previous studied. Alobaidy, 2017 found an accumulation in total sugars, total free amino acids, total soluble phenols and free proline in cotton plants subjected to water deficit. In addition, (Neseim, et al., 2014) found an increase in total soluble phenols as well as total free amino acids in leaves and roots of sugar beet grown under water deficit. (Marur, et al. 1994) observed a sharply increase in proline in plants under water deficit. In addition, the amino acids accumulation increased in the water deficit plants 107% and 126% than control plants in the plant roots and leaves, respectively.

Breeding for drought tolerance has been an important strategy adopted by researchers to alleviate the water deficit problems and to ensure the production in environments prone to drought (Songsri et al.,

2008; Pereira et al., 2012; Santos et al., 2013). To select stable genotype according to the mean performance under favorable and water deficit conditions, many selection indices based on a mathematical relation between stress and optimum conditions has been proposed (Mursalova et al., 2015). Fischer and Maurer (1978) suggested the stress susceptibility index (SSI) for measurement of yield stability that apprehended the changes in both potential and actual yields in variable environments, Rosielle and Hamblin (1981) defined two tolerance indices, the 1st, tolerance index (TOL) as the differences in yield between stress and non-stress conditions and the 2nd, mean productivity (MP) as the average yield of genotypes under stress and non-stress conditions. Moreover, Fernandez (1992) suggest two stress tolerance indices, i.e., stress tolerance index (STI) as a useful tool for determining high yield and stress tolerance potential of genotypes, and geometric mean productivity (GMP) is often used by breeders interested in relative performance, since water deficit can vary in severity in field environments over years.

Therefore, the present work was carried out to investigate the effects of two different water regimes on 49 peanut genotypes under four main headings as follows:

- Evaluation of forty-nine peanut genotypes under water deficit conditions for yield and yield components.
- Determine the efficiency of drought tolerance indices to classify peanut genotypes into sensitive and tolerant and study interrelationships among the tolerance indices
- Evaluation of peanut genotypes reaction and water use efficiency

to water deficit.

- Evaluation of peanut genotypes for some physiological and bio-chemical traits.