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Effect of Watering Regime on Yield and its Components of *Triticum aestivum* var. el-phateah L.

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Abstract: In this study, the effects of watering regime on yield, some metabolic products as well as its components of *Triticum aestivum* var. el-phateah in two successive seasons (2004/2005) were conducted. Moreover, the addition of Halax 2 bio-fertilizers concentration was also followed. In spite of decreasing in dry weight and water contents of wheat plant by increasing field capacity, the % of germination was significantly increased (75% field capacity). Upon increasing the water regime; also the photosynthetic efficiency, root elongation, chlorophyll b as well as protein contents were raised. The addition of bio-fertilizer to wheat plants under water regime significantly enhanced shoot elongation, chlorophyll a as well as photosynthetic assimilation.

Key words: Drought, wheat cultivar, yield, Libya

INTRODUCTION

In the two last decades there were serious changes in the global climate, whose impact had been felt in our country as well. According to data provided by Manivannan *et al.* (2007), Jajarmi (2007, 2009) and Tzenova (2008) during the recent 10 years the annual amount of precipitation has dropped, where at that reduction is more strongly manifested during the warm half of the year. Water is the single most important limiting factor for Wheat production in large areas of the world. If sufficient water is not available, application of fertilizers and high yielding crop varieties are useless. Drought induces numerous changes in plant cell structure and metabolism. The stress of water deficits is a persistent threat to plant survival, yet many plants develop morphological and physiological modifications that enable them to survive in regions of inadequate rainfall and low soil moisture content (Lovatt, 1980). Damage resulting from water stress is related to the detrimental effects of desiccation on protoplasm. Removal of water leads to an increase in solute concentration as the protoplast volume shrinks, which may itself have serious structural and metabolic consequences. The integrity of membranes and protein is also affected by desiccation, which in turn leads to metabolic dysfunction (Rhodes *et al.*, 1987). One of the early effects of water deficit is a reduction in vegetative growth. Shoot growth and especially the growth of leaves is generally more sensitive than root growth in sunflower plants (Mehmet, 2003).

Photosynthesis can be affected by water stress in two ways. First, closure of stomata normally cut off access of the chloroplast to the atmospheric supply of CO_2. Second, there are direct effect of low cellular water potential on the structural integrity of the photosynthetic machinery (Abdel-Basset and Issa, 1994; Issa *et al.*, 1994). Because wheat plants are frequently subjected to drought in natural habitats, we studied effect of

watering regime on growth, yield and its components of Wheat, the main crop plants and the possibility of amelioration of negative effects of drought by pretreatment with bio-fertilizers (Halax 2).

In this investigation, the effects of watering regime on yield, some metabolic products as well as its components of *Triticum aestivum* var. el-phateah in two successive seasons (2004/2005) were conducted.

MATERIALS AND METHODS

Plant Material

Triticum aestivum L. var. el-phateah grains were sterilized by 5 min incubation in 2.6% sodium hypochlorite and washed three times with 70% ethanol. The grains were placed between 9 mm diameter sterile glass fiber filter discs (whatman GF/A). These discs were placed in 9 cm sterile petri dishes. Treatment were replicated triple and lasted for up 10 days at room temperature of about 20°C. The level of treatment were 100,75, 50, 25% field capacity. After germination the plants were transferred to pots containing soil with or without Halax 2 as bio-fertilizers (*Azotobacter* and *Azospirillum*) in. El-phateah Stations for Agricultural Researches (Libya). The irrigation system used in this experiment as follows (Table 1).

Analytical Methods

The physic-chemical of soil and water used in this experiment was determined according to AOAC (1980) and presented in Table 2. The plant height (cm), assimilatory efficiency, Photosynthetic assimilation, Chl. a, Chl. b and protein contents were adopted by AOAC (1980).

Statistical Analysis

Data of the two seasons subjected to statistical one way analysis of variance and presented at means of the three replicates with L.S.D at 5% according to Gomes and Gomes (1984).

Table 1: The treatments uses in Wheat Planting throughout the growth seasons (2004/2005)

Treatments without Halax2	Symbol	Treatments with Halax2	Symbol
Normal irrigations	NI	Normal irrigations NI+H	
Normal irrigations except at seedling stage	NIS	Normal irrigations except at seedling stage	NIS+H
Normal irrigations except at base branch stage	NIB	Normal irrigations except at base branch stage	NIB+H
Normal irrigations except at flowering stage	NIF	Normal irrigations except at flowering stage	NIF+H
Normal irrigations except at fruiting stage	NIFR	Normal irrigations except at fruiting stage	NIFR+H

Table 2: Physic-chemicals characters of soil and water uses in wheat plantations

Parameters	Soil (mg g^{-1})	Water (mg L^{-1})
Temperature	15.00	20.00
PH	8.20	7.72
Electric conductivity	0.43	1.80
NO_3^-	5.00	2.00
PO_4	4.83	1.60
SO_4	0.80	0.66
CO_3	0.00	0.40
Na^+	1.08	1.54
K^+	0.23	0.15
Ca^{++}	1.80	1.25
Mg^{++}	1.00	0.56
Fe^{+++}	1.90	1.50

RESULTS AND DISCUSSION

Current estimates indicate that 25% of the world's agricultural lands are now affected by water stress. The data in Table 2 reveal that, the Libyan soil and water irrigation plantation were characterized by low N and P and high Na, Ca and Mg.

Drought conditions of soils have wide-ranging effects on the morphological and physiological processes of Wheat plants. Numerous studies have indicated that water stress reductions in Wheat growth (Jajarmi, 2007, 2009). Increasing drought levels had deleterious effects on germination, dry weight and water contents in the flag leaves. The recorded values are presented in Table 3, the highest % of germination was recorded in 75% field capacity and the lowest one was 25% field capacity. It generally causes a decrease in cytokinin transport from root to shoot and/or an increase in leaf abscisic acid. These changes in hormone balance cause change in cell wall extensibility and therefore growth (Siddique *et al*., 2000).

Generally, the used bio-fertilizers in crop plants caused a significant increase in nitrate and total nitrogen. In Wheat plants, the Normal Irrigation (NI) with or without Halax2 as bio-fertilizers (NI+H) leads to normal growth and yield components, in caparison to other treatments (Table 3). In this respect, Abdalla *et al*. (2003) and Khaled *et al*. (2006) stated that, the inclusion of bio-fertilizers and/or organic fertilizers to improve the growth of barely and Wheat plants was recommended in the Libyan soil.

Concerning the wheat plants under water regime in seedling stage (NIS), the plant heights, Chl. a, photosynthetic assimilation and efficiency as well as the protein contents were sharply decreased (Table 4). However, these reduction was may be ameliorative by addition of Halax2(NIS+H). Drought conditions of soils have wide-ranging effects on the morphological and physiological processes of Wheat plants. Increasing drought levels had deleterious effects on germination, dry weight and water contents in the flag leaves (Jajarmi, 2007, 2009).

The water regime in the base branch stage (NIB) was less injury to Wheat plant, the reduction of growth and yields was enhanced in the pots containing Halax 2 (NIB+H) as bio-fertilizers (Table 3). The same data was recorded in other cultivars of wheat plants by EL-Kalla *et al*. (2002).

Table 3: Germination, water content and dry weight of wheat plants affected by watering regime (Field Capacity %) throughout the growth seasons (2004/2005)

Field capacity (%)	Germination (%)	Water content (%)	Dry weight (mg)
100%	80	95	86
75%	82	87	83
50%	79	81	82
25%	75	80	80
LSD at 1%	0.04	0.02	0.03

Table 4: Effect of watering regime with or without bio-fertilizers(Halax2) on growth and yield components of wheat plants throughout the growth seasons (2004/2005)

Treatments	Plant height (cm)	Chl.a	Chl.b	Chl. a/b ratio	Photosynthetic efficiency (%)	Photosynthetic assimilation	Protein content (%)
N.I	61.3	0.59	0.32	1.84	35.4	18.6	11.2
N.I+H	60.4	0.59	0.33	1.79	40.6	19.2	11.4
N.I.S	53.1	0.55	0.35	1.57	43.1	24.3	12.3
N.I.S+H	59.1	0.56	0.32	1.75	42.9	26.6	12.6
N.I.B	60.3	0.56	0.37	1.51	42.1	27.9	12.1
N.I.B+H	62.3	0.59	0.34	1.74	47.8	29.9	12.9
N.I.F	57.0	0.51	0.24	2.13	44.5	26.8	12.0
N.I.F+H	60.4	0.60	0.31	1.94	49.3	30.3	13.1
N.I.Fr	59.1	0.54	0.33	1.64	44.7	29.7	12.2
N.I.Fr+ H	63.5	0.63	0.37	1.70	51.6	31.8	13.3
LSD at 1%	0.6	0.08	0.07	1.14	0.3	2.03	0.06

CONCLUSION

The reduction of plant heights, chlorophyll a or chlorophyll a/b ratio and the contents of proteins in grains of Wheat plants in watering regime in flowering as well as in fruiting stages were undetectable and using bio-fertilizers gave the best growth ant its components, throughout the growth seasons. Drought stress condition has tremendous negative effects on the nutrient uptake by crop plant, especially at seedling and base branch stages. Nutrient uptake from soil solution is closely linked to plant root and soil water status as well as plant species and genotypes. This phenomenon needs further investigations.

REFERENCES

Abdalla, A.M., S.E. El-Kalla, A.E. Sharief, A.A. Leilah and S.A.K. El-Awami, 2003. Utilization of some agricultural Practices to improve some wheat cultivars productivity, II-Growth and protein yield. J. Agric. Sci. Mansoura Univ., 28: 7547-7555.

Abdel-Basset, R. and A.A. Issa, 1994. Membrane stabilization and survival of dehydrated *Chlorella fusca* cells induced by calcium. Biologia Plantarum, 36: 389-395.

AOAC., 1980. Official Method of Analysis of the Association of Official Analytical Chemists. 12th Edn., AOAC., Washington, DC., USA.

El-Kalla, S.E., A.E. Sharief, A.A. Leilah, A.M. Abdalla and S.A.K. El-Awami, 2002. Utilization of some agriculture Practices to improve some wheat cultivars productivityl-yield and its components. J. Agric. Sci. Mansoura Univ., 27: 6583-6597.

Gomes, K.A. and A.A. Gomes, 1984. Statistical Procedures for Agreicultural Reserch. John Wiley and Sons, Inc., New York.

Issa, A.A., M.H. Abd-Alla and A.I.S. Mahmoud, 1994. Effect of biological treatments on growth and some metabolic activities of barley plants growth in saline soil. Microbiol. Res., 149: 317-320.

Jajarmi, V., 2007. Effect of water stress on germination indices in ten rapeseed cultivars (*Brassica napus* L.) abstracts the second seminar of agriculture and environment. Islamic Azad University-Khoy branch-Iran.

Jajarmi, V., 2009. Effect of water stress on Germination indices in seven wheat cultivars. World Acad. Sci. Eng. Technol., 49: 105-106.

Khaled, A.S., M.Y. Faituri, I.H. Attitall, S.M. EL-Maraghy and A.A. Issa, 2006. Physiological responses of wheat and barley to bio-fertilization. Assiut Univ. J. Bot., 35: 215-222.

Lovatt, C.J., 1980. Stress Alters Ammonia and Arginine Metabolism. In: Polyamines and Ethylene: Biochemistry, Physiology and Interactions, Flores, H.E. and R.N. Arteca (Eds.). American Societyof Plant Physiology, Rocckville, Maryland, USA., pp:166-179.

Manivannan, P., C.A. Jaleel, B. Sankar, A. Kishorekumar, R. Somasundaram, 2007. Growth, biochemical modification and prolin metabolism in *Helianthus annuus* L. as induced by drought stress. Colloids Surf. B. Biointerfaces, 59: 141-149.

Mehmet, D., 2003. Effect of different soil and water of safflower. Turk. J. Agric. For., 26: 85-89.

Rhodes, D., S. Handa and R.A. Bressan, 1987. Metabolic Changes Associated with Adaptation of Plant Cell. In: Biochemical and Physiological Mechanisms Associated with Environmental Stress Tolerance, Cherry, J.H. (EdS.). Springer-Verlag, New York, pp: 41-46.

Siddique, M.R.B., A. Hamid and M.S. Islam, 2000. Drought stress effects on water relations of wheat. Bot. Bull. Acad. Sin., 41: 35-39.

Tzenova, V., 2008. Soil water regime in relation with some physiological indicator species. BALWOIS., 27: 1-8.