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Contribution of the Study of Physiological Disturbances of Wheat *Triticum durum* in the Presence of Nitrogen Fertilizer

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

In this work we are interested in evaluating the impact of nitrogen fertilizer urea on the roots of wheat *Triticum durum*. We followed the percentage of germination. Also biochemical parameters such as average water content, soluble sugar and average of chlorophyll content. The main results show that the presence of urea causes a significant increase in the average water content; there is also an activation of the synthesis of soluble sugars and inhibition of chlorophyll synthesis.
The most common effect of abiotic stress on plant physiology thus reducing growth.

Keywords: Urea; Triticum durum; water; soluble sugars; chlorophyll.

1. INTRODUCTION

The problem of pollution of the water without any doubt one of the most disturbing aspects of environmental degradation, this pollution causes a decrease in the availability of this irreplaceable natural resource. [1]. Chemicals that pollute water are insecticides, pesticides, fungicides and fertilizers. These products can be carried by

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runoff and pollute groundwater. Chemical fertilizers are transported into lakes or rivers by rain water and cause the degradation of the water.

The objective of this study is to evaluate the effects of nitrogen fertilizer urea on physiological parameters and on metabolic biomarkers of environmental stress (chlorophyll and average water content) in roots of *Triticum durum* wheat.

2. MATERIALS AND METHODS

2.1 Growing Seeds

The wheat seeds are grown by the method of [2], for a period of seven days; ten seeds were first randomly selected and are then placed in a Petri dish placed on blotting paper, soaked with 8 ml of distilled water at the average temperature of 20ºC.

2.2 Seed Treatment

Seed treatment is made from prepared solutions of increasing concentration based urea we selected 5 concentrations and a control medium without urea (C1=10 m Mole, C2=20 mMole, C3=30 m Mole, C4=40 m Mole and C5=50 m Mole).

2.3 Chemical Used

The chemical used is a nitrogen fertilizer; urea, the molecule comes from the unit Fertial from Annaba

2.4 Determination of the Average Water Content

The average water content of the roots and stalks of grain are determined by calculating the fresh weight (FW) of each sample before drying in an oven at 40ºC. The dry weights are then determined (DW) and the amount of water is calculated by the formula of [2].

$$\text{Rate (g)} = \frac{(FW - DW)}{FW} X\,100$$

FW: Fresh Weight
DW: Dry Weight

2.5 Determination of Chlorophyll

Chlorophyll was determined by the method of [3]: 100 mg (for each test) collected from the median third of the youngest leaves at tillering stage were ground in the presence of calcium carbonate (to neutralize the acidity of the juice vacuolar) in acetone 80% and approximately 100 mg of calcium bicarbonate (CaCO3). Milling was repeated several times to extract all chlorophyll pigments. The extract was filtered. The optical density of all filtrates was measured at 663 and 645 nm. The formula relative to the solvent, to calculate the values of chlorophylls is shown in Equation (1) and (2).

$$\text{Chl a} = 12,70.\text{DO}(663) - 2,69.\text{DO}(645) \qquad (1)$$

$$\text{Chl b} = 22,90.\text{DO}(645) - 4,60.\text{DO}(663) \qquad (2)$$

2.6 Determination of Soluble Sugars

The total soluble sugars (sucrose, glucose, fructose and their methylated derivatives polysaccharides) were measured by the method of [4], which use the anthrone reagent as in a sulfuric medium. One hundred mg of plant material was macerated for 48h in 3ml of 80% ethanol at room temperature to ensure the extraction of soluble sugars. At the time of dosing and after evaporation of the alcohol, 20 ml of distilled water were added to the extract, heated in a water bath at 70°C for 30 min and 2 ml of extract were removed for assay. The concentration of soluble sugars was determined after reading of the optical density measured with a spectrophotometer at 585 nm.

2.7 Statistical Analysis

The obtained results are represented by the average ± Standard Error. Statistical analysis of data is performed using Minitab student t-test.

3. RESULTS AND DISCUSSION

Seed Germination is one of the major aspects of plant physiology. To understand an actual development in an organism one has to go through in its life cycle. Germination is an important phenomenon will be affected by different conditions.

The present work, studied effect of the common fertilizer (Urea) on percentage of seed germination (Fig. 1). A small decrease in germination percentage can be observed particularly at a concentration of 40 m Mol (20%). Our result is in perfect agreement with the work of [5] which showed that germination was decreased with increasing nitrogen.

This disturbance observed in wheat seeds would be due to the effects of substances contained in the fertilizer on the trigger various enzymatic activities causing the start of germination process. The works of other authors [6] come support the results of our work.

The Fig. 2 shown a decrease in the average water content of stems and roots, the effect of urea on wheat does not appear that beyond

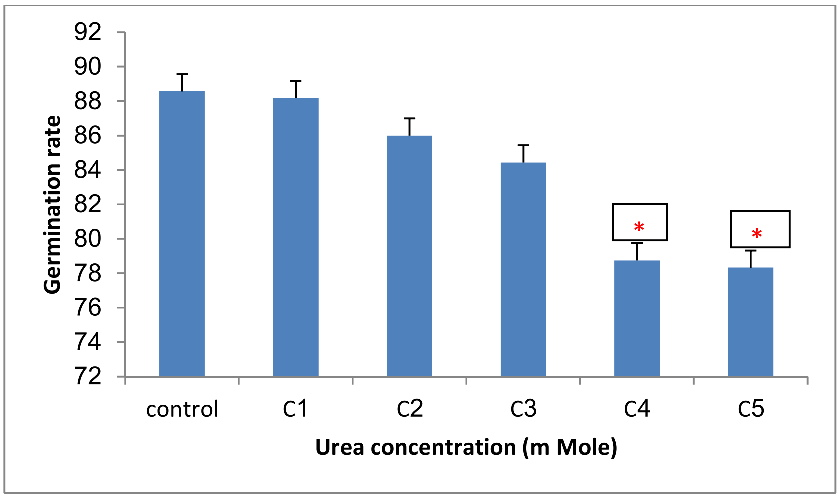

Fig. 1. Effect of different concentrations of urea on the percentage germination of wheat seeds after 7 days of treatment p=0.007

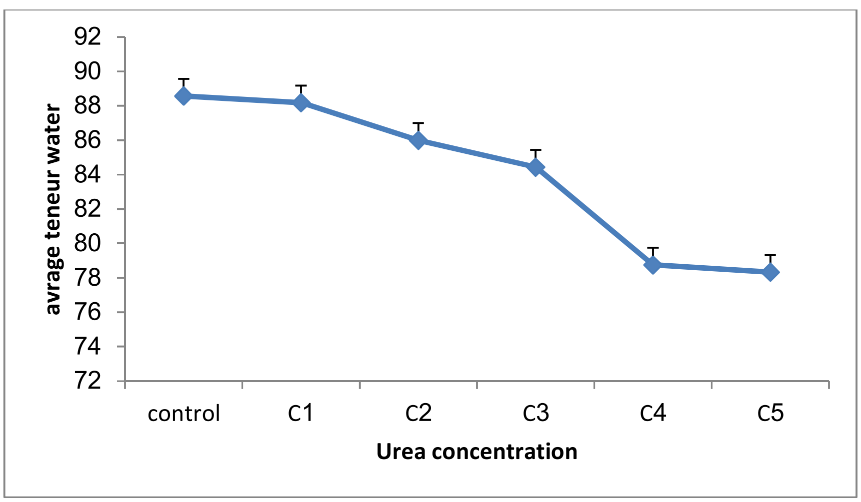

Fig. 2. Effect of different concentrations of urea in the average water content in the roots of wheat seeds after 7 days of treatment. (P>0.5)

30 m Mol urea thus confirming the results of [7]. The relative water content in the leaf is a good indicator of water status; it decreases slightly in stressed genotypes. This is especially noticeable when the plant material is subjected to 40 m Mole urea regime. These results demonstrate that urea influences this parameter decreases to prevent water loss because the absorption of water is maintained at a level sufficient to avoid dehydration of the tissues of the plant, to establish the phenomenon of succulence and to dilute the most possible osmolytes.

According to several authors a decrease in water content of the organs of the plant is most often noted in case of a metallic stress [8,9]. This is the basis of a decrease in turgor pressure and plasticity of parietal cells, responsible for a low mitotic activity therefore of reduced growth [10].

The effects of urea on the chlorophyll content (*a* and *b*) are shown in Fig. 3. The values of the probability of the analysis of variance show the existence of highly significant differences ($p \leq 0.01$) in wheat and chlorophyll (*a, b)*.

Furthermore our results showed a decrease in mean chlorophyll a, b and hence a+b. this is perfect agreement with the work of [11] as watches that nitrogen fertilization inhibits the synthesis of chlorophyll but not photosynthesis.

The effects of urea on the average content of soluble sugar are shown in Fig. 4. The sugars play a predominant role in the life of a plant; they are produced by photosynthesis, transported to the deep tissues, channeled to respiration or converted into storage compounds that are eventually degraded into their constituent carbohydrates. The accumulation of soluble sugars is a means adopted by plants under stress at the end to withstand environmental stresses. Sugars have been reported as potential osmo. They play an important role in osmotic adjustment, which is regarded as an adaptive response of plants to water deficit conditions and salt stress. They can protect the membranes and proteins against dehydration by encouraging the formation of a kind of glass at physiological temperatures. Sugars accumulated during the stress are likely to be used in the growth after the lifting of the constraint.

According to [12], the accumulation of soluble sugars can result from an increase in the hydrolysis of starch as recorded simultaneously, a decrease in the accumulation of starch and soluble sugars in stressed tissues.

The results we obtained on average levels of sugars show increasing rates for wheat. This could be due to osmotic stress in response to treatment with urea [12].

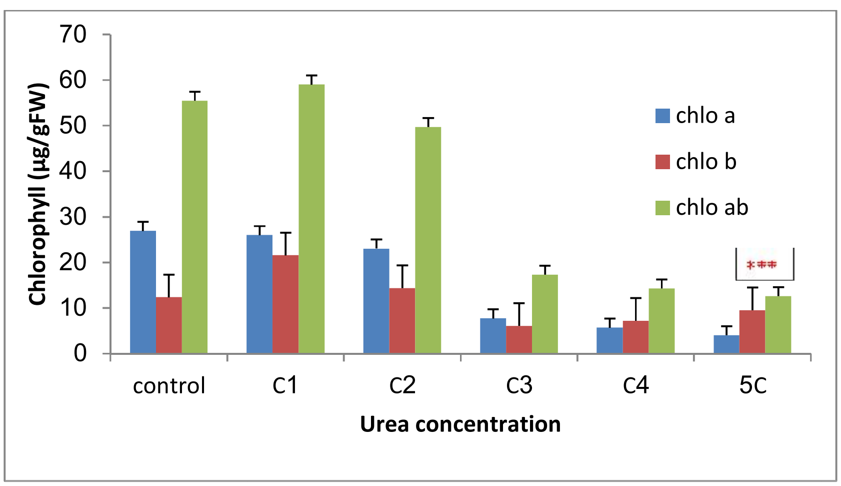

Fig. 3. Effect of different concentrations of urea on the average chlorophyll content of seedling wheat seeds after 7 days of treatment (p=0)

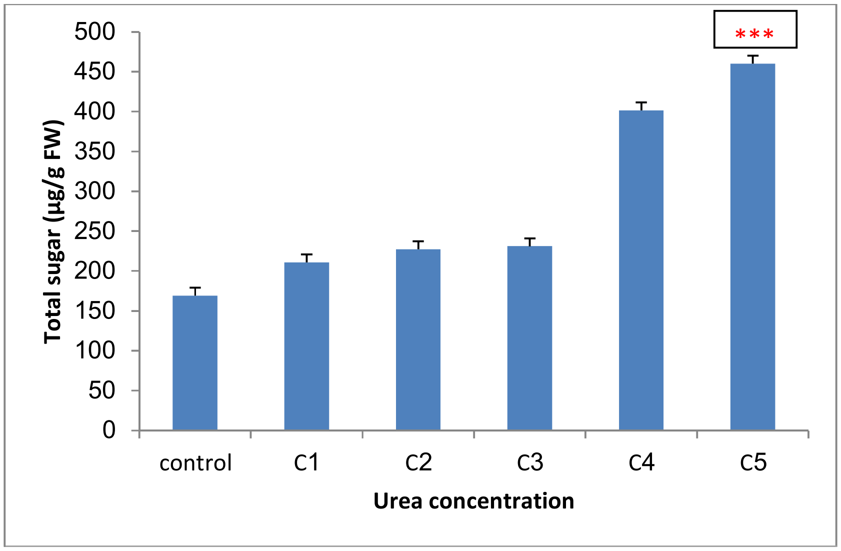

Fig. 4. Effect of different concentrations of urea on the average content of soluble sugars in roots of wheat seeds after 7 days of treatment. (p=0)

4. CONCLUSION

It could be concluded that under the conditions of the current experiment, application of nitrogen fertilizer has negative effects on chlorophyll content, germination rate and soluble sugar

The present study confirms the sensitivity of whet to pollutants, but also highlights the fact that they are also very dependent in this case on the nature of the substrate in particular (urea). Any nitrogen imbalance can bring the plant to a nutritional stress situation responsible for changes in the hormonal balance internal. Plant metabolism, growth and development may be affected by the presence of high concentration of urea.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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