RESPONSE OF WHEAT PLANT TO SELENIUM APPLICATION IN PRESENCE OF SOME ADDITIONS UNDER STRESS CONDITIONS

By

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B.Sc. Agric. Sc. (Soil Science), Ain Shams Univ. (2006)
M.Sc. Agric. Sc. (Soil Science), Ain Shams Univ. (2011)

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ABSTRACT

Mona Ibrahim Nossier: Response of Wheat Plant to Selenium Application in Presence of some Additions under Stress Conditions. Unpublished Ph.D. Thesis, Department of Soil Science, Faculty of Agriculture, Ain Shams University, 2016.

Selenium is an essential element for humans, animals and some species of microorganisms; however, in higher plants the role of selenium is still unclear. The present investigation was carried out to study the response of wheat plants to selenium application in presence of humic acid, potassium and sodium silicate and compost under salt conditions, the study included evaluation for the impact of this response on productivity of wheat plants. To achieve this goal, two germination experiments were performed in order to choose and define the more suitable concentrations of selenium and other additions.

Wheat grains were germinated on different concentrations from sodium selenite (5 – 10 - 20 - 40 - 80 µm/l) and humic acid (0.5 - 1 -2gm /1000ml), (1 -5 -10 -20 - 40gm/100 ml) compost extract (12.5 -25 -50 -75 -100%) potassium silicate (1 -2 -4 -8 16%) and sodium silicate (1 -2 -4 -8 -16%) after soaking the grains for 6 hours to select the most suitable concentrations. Wheat grains were then grown on sandy soil, under different concentrations from mixtures consisting of the best suitable concentrations of both selenium and as well as humic acid, compost and silicon under salt stress conditions. Based on the results of above preliminary experiments, field experiments were using performed saline soil.

Results showed that soaked wheat grains in different concentrations of mixtures of selenium and humic acid led to increases in the percentage of germination as well as length of both shoot and root along with their dry matter contents, were also favored content of total soluble sugars.

Results also revealed that used mixtures of selenium and humic acid in saline soil led to increases in resistance of plants to salinity conditions, therefore decreasing the content of proline compared to control, in wheat grains were also improved the proportion of protein and selenium compared to the control.

Key Words:

Wheat, Sodium selenite, Salinity, Humic acid, Compost, Silicon.

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INTRODUCTION

Selenium is one of the "essential" nutrients for human, meaning that our bodies cannot make it, and so we have to get it from our diet. Without it the heart, joints, eyes, immune system or reproductive system may suffer. Yet human only needs to eat a trace of selenium every day, about 55 micrograms or millionths of a gram **(Lauren, 2012)**.

Higher plants are thought not to require Se and to have a low tolerance to it, but there are increasing indications that Se may also have beneficial biological functions in higher plants **(Azadeh *et al* 2012)**

Selenium is a constituent of seleno-proteins, many of which have important functions, including antioxidant protection, energy metabolism and redox regulation during transcription and gene expression **(Kong *et al,* 2005)**. Selenium supplementation to plants enhances the production and quality of edible plant products, by increasing antioxidant activity of plants, as shown in tea leaves, (**Xu *et al,* 2003)**, and rice **(Xu and Hu, 2004)**. In wheat plant, nutrient uptake, under salt stress, was best when adding selenium by soaking or soaking +foliar application, but in root the results were different depending on the concerned nutrient **(Nossier, 2011)**. This effect of Se could be attributed to its ability to reduce oxygen radicals produced in the presence of salinity stress by increasing the antioxidant enzymes activities that reduce the level of accumulation of reactive oxygen species (ROS),(**Walaa *et al,* 2010)**.

Humic acid is a bio-stimulant that is derived from leonardite shale and is among the most concentrated organic materials available. Elemental analysis of humic acid has shown it to consist largely of carbon and oxygen (about 50% and 40%, respectively). It also contains hydrogen (about 5%), nitrogen (about 3%), phosphorus and sulfur (both less than 1%). Humic acid is a complex of closely related macromolecules. These molecules range in size from less than 1000 to more than 100,000 daltons, with the lower mass representing the younger material. Humic acid increases nutrient uptake, drought tolerance, and seed germination. It increases the microbial activity in the soil, making it an excellent root stimulator. Humic acid increases the availability of nutrients in applied fertilizers and those already initially existing in the soil. It helps to aerate the soil from the inside. It also helps to relatively lower the pH of the soil and flushes high levels of salts out of the root zone, all of which will help to promote better plant health and growth **(Vaqs, 2004)**. When applied to the clay soils, humic acid help breaking up compacted soils, allowing for enhanced water penetration as well as better root zone growth and development. When applied to the sandy soils, humic acid adds essential organic material necessary for water retention thus improving root growth and enhancing the sandy soil's ability to retain and not leach out vital plant nutrients **(LLC, 2013)**.

Khaled *et al, (*2011) studied the effect of different levels of humic acids on the nutrient content and plant growth, along with soil properties under conditions of salinity. They found that soil application of humus increased the N uptake by corn plants; foliar application of humic acids increased the uptake of P, K, Mg, Na, Cu and Zn. Although the effect of interaction between salt and soil humus application was found statistically significant, the interaction effect between salt and foliar humic acids treatment was not found significant. Under salt stress, the first doses of both soil and foliar application of humic substances increased the uptake of nutrients.

Compost has the unique ability to improve the properties of soils and growing media physically (structurally), chemically (nutritionally), and biologically. Although some equate the benefit of compost use to in spit of green growth, caused by plant-available nitrogen, the real benefits of using compost are long-term and related to its organic matter content. (**USCC 2001).**