EFFECT OF SOME NANO-CHEMICAL COMPOUNDS ON SALINITY TOLERANCE FOR GREEN BEAN PLANTS

By

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B. Sci. Agric. (Horticulture - Pomology), Cairo University, 2004

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ABSTRACT

Rabie Mohamed Gomaa Eid: Effect of Some Nano-Chemical Compounds On Salinity Tolerance For Green Bean Plants. Arid Land Agricultural Graduated Studies and Research Institute, Faculty of Agriculture, Ain Shams University, 2017. Unpublished M.Sc. Thesis.

Two pot experiments were carried out during the two successive autumn seasons of 2013 and 2014 in a private farm in Abou Ghalib region, Giza governorate to investigate the effects of using two different nano materials namely nano calcium and nano silicon to alleviate the effect of different salinity levels on the growth and yield of green bean plants (Phaseolus vulgaris, L.) cv. Pulista under sand soil conditions. Seeds of green bean were sowing in pots which contained sandy soil, and irrigated with saline water with EC of 500, 1000 and 1500 ppm. Nano silicon and calcium were supplied at concentrations of 1 cm3/l and 2 cm3/l for nano silicon and 0.5 g / l and 1 g / l for nano calcium respectively. Application took place at 3, 5, 7 and 9 weeks after cultivated. Data showed that all plant growth aspects such as plant height, plant fresh and dry weights, leaf area and number of leaves, were decreased under salinity level alone, but which improved under all nano calcium and nano silicon treatments in presence water saline irrigation compared to none treated plants (control). In the same trend nitrogen, phosphorus, potassium and calcium percentages in green bean leaves were declined under high salinity level (1000 and 1500 ppm) but, sodium, proline and fiber were increased under high salinity level. Yield parameters such as total pod yield and marketable pod yield improved under all nano calcium and nano silicon treatments. Among nano silicon and calcium treatments, concentration of 2 cm3/l and 1 g /l respectively recorded the highest significant effect in mitigating salinity negative effects. It could be concluded that nano silicon and calcium was more effective and efficient in mitigating salinity stress on green bean plants.

Keywords: Green bean, Salinity, Nano Silicon, Nano calcium, Total Chlorophyll, N, P, K, Total Yield.

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INTRODUCTION

The common bean is an annual legume cultured for its green pod and dry seed, both of which are eaten. In common with all other legumes it's a good source of protein **(Halterlein, 1983).** Green bean is an important crop in Egypt for local consumption as well as for exportation. This crop is growing in the open field in two main seasons i.e., spring and autumn. The total area of green beans was about 59687 feddans, which produced about 253110 tons, with an average of 4.241 tons / feddan **(FAO Statistics, 2014).**

Egypt has a significant comparative advantage in the production of horticultural commodities including green bean for export, based on its geographic position and agro-climatic conditions. It was reported that the Egyptian share in the Dutch market reached about 25% with Egypt being the main exporter of green beans to the Netherlands just ahead of Spain (24%) and Kenya (20%) **(HEIA, 2003)**. The Egyptian annual growth in the production of green beans was estimated to represent half of the world's total growth **(Wijnands, 2004)**. However, as most of the expansion of green bean cultivation is taken place in the new reclaimed lands, this expansion is constrained by some limiting factors such as salinity. Not only in the new land but also in the old valley where a considerable areas has become salt affected soils. According to **Gehad (2003)**, some 90 thousands hectares of Nile Valley and Delta region are salinity affected soil. The problem is aggregated more when over withdraw is carried out from underground water wells and/or inefficient drain system is installed in the cultivated soil. This leads either to crop failure or at least to a significant reduction in yield and quality. Many trails have been carried out in order to help the grower to overcome those negative effects and increase his alternatives in the growing patterns and quantity and quality of his production. Among those trails, modification of greenhouse climate **(Abdel-Mawgoud *et al.*, 2004)**; application of organic matter such as humate **(Abdel-Mawgoud *et al.*, 2007)**; application of specific nutrients such as amino acids or growth regulators

(El-Abd *et al*., 2005; Tantawy *et al*., 2009; 2013) and minerals i.e calcium and silicon. The latter two nutrients have been reported to alleviate salinity stress and improve plant performance and production **(Awada *et al*., 1995; Haghighi *et al*., 2012; Tantawy *et al*., 2015)**. Nano-technology can present solution to increasing the value of agricultural products and environmental problems. Nano materials because of their tiny size show unique characteristics. They can change physic–chemical properties compared to their bulk materials, they have a great surface area than bulk materials. Because of these larger surface areas, their solubility and surface reactivity was higher **(Castiglione and Cremonini 2009)**. By manufacturing the preparation ways of nano materials can change their characteristics, for example, the addition of nano particles in liquid changes their chemical, physiological and transport characteristics compared to their base fluids such as enhancement of thermal conductivity **(Ashok and Raykar 2008)**. However, by introducing nanotechnology into agriculture, many of the agricultural inputs have become more effective and its application became more efficient. This is due to the fact that nano technology makes the particles smaller in size have higher active properties.

Therefore, this study is aiming at and investigating the effect of applying nano calcium and silicon separately in different concentrations on alleviating the negative effects of salinity on green bean plants.

REVIEW OF LITERATURE

The present review of literature has involved studies on the effect of I. saline water irrigation on the growth, yield and its quality of green bean plants. II. The effect of nano calcium and silicon on salinity tolerance in green bean plants and all reviewed under the following headings:

2.1 Effect of saline water irrigation

2.1.1 Vegetative growth characteristics

2.1.1.1 Physical characteristics

2.1.1.1.1 Plant height

One of the most important plant physical attributes which have been most easily and frequently measured was plant height. Most attempts on the estimation of plant height in some vegetable crops showed a continuous depression with the increase in salinity levels. Thus, **Ramadan and Ibrahim (2006)** concluded that there was significant and gradually decrease in green bean plant height by increasing salinity level from 1000 to 2000 ppm compared by the control (250 ppm). **Also, Gama *et al.* (2007a)** indicated that plant height of five cultivars of common bean (Bassbeer, Beladi, Giza 3, HRS 516 and RO21) decreased when plants irrigated by saline water at concentration of 50 and 100 mM NaCl compared by the control (0 mM NaCl). In the same trend **Stoeva and Kaymakanova (2008)** found that reduction in plant height under salinity conditions (50 and 100 mM NaCl) were obtained in bean plants cv. Lody in both concentrations. Also on bean plants **Taffouo *et al*. (2008)** noticed that when bean plants submitted to four levels of salt stress at the roots (0, 50, 100 and 200 mM of NaCl) stem height decreased by increasing salinity level compared by the control (0.0 mM NaCl). **Ndakidemi and Makoi (2009)** illustrated that when bean plants cvs (Lyamungo 90, Jesca, Flora de Mayo and CAB 19) irrigated by saline water at NaCl concentrations (2.5, 5.0, 10.0 mM) decreased plant height in all cultivars