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Effected of N-Yttrium Oxide Y_2O_3 on Mungbean (*Phaseolus aureus Roxb.*) with Practices Enhance of Plant to Biotic Stress

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Abstract

The present study was carried out in the botanical garden / department of biology /college of science Mustansiriyah University, Baghdad. During January 2017 under natural environmental conditions in greenhouse. The aim of this study was to evaluate the activity of the N-Yttrium Oxide application to reduce salt stress in 1 and 2 g/L of NaCl on seed germination and seedling growth of Mungbean. The results reveal that N-Y_2O_3 gave the highest results in seed germinations and seedling growth trait (seedling lengths, shoot length, number of leaves, number of secondary roots and dry weight of seedling) of Mungbean than gibberellin and aqueous extract of Liquors roots under 1 and 2 g/L NaCl and has no significant difference with control treatment..

Keywords: N-Yttrium Oxide, Salinity Levels, Seed Germination, Seedling Growth.

الخلاصة

نفذت تجربة في الحديقة النباتية التابعة لقسم علوم الحياة\ كلية العلوم \ الجامعة المستنصرية, بغداد. في شهر كانون ثاني ٢٠١٧ تحت ظروف البيت الزجاجي. الهدف من التجربة تقييم فعالية مادة اوكسيد اليتيريوم النانوية في تقليل التأثير السلبي للملوحة لمادة كلوريد الصوديوم بتركيز ١و٢ غرام\لتر في انبات بذور ونمو بادرات نبات الماش. كشفت النتائج عن فعالية مادة اوكسيد اليتيريوم النانوية في تخفيف التأثير لتراكيز كلوريد الصوديوم لإنبات بذور ونمو بادرات الماش وقد اعطى اعلى نسب انبات بذور ونمو بادرات (طول البادئ, طول الرويشة, عدد الاوراق, عدد الشعيرات الجذرية والوزن الجاف). ولم تكن هناك فروق معنوية للصفات المدروسة بين هذه المعاملة ومعاملة السيطرة.

Introduction

Nowadays, salinity is became one of the most environmental problems that caused great reduction on growth of plant species. Salinity is one of the most important factors limiting plant growth also delaying seed germination (Rahman *et al*., 2000). Salinity stress affects seed germination by preventing or delaying germination (Welbaum *et al*., 1990). Seed germination is one of the critical steps for a crop subjected to salinity stress, which due to accumulation of salt in the seed planting zone (Tadav *et al*., 2011). It affects seed germination and plant growth directly the high salt concentration causes increased H_2O_2 content in both roots and leaves (Saha *et al*., 2010). Both root and shoot lengths were reduced with increased NaCl concentration, but roots were more damaged, with an increase in number of lateral roots and increase in its thickness, compared to shoots (Misra *et al*., 1996).

Recently several investigators have reported that some substances such as N- particles enhanced salt tolerance of many crop species (Al-Aghabary *et al*., 2004) and (Liang, 2005). N-materials are the group of substances in which one or several dimensions are of size 1–100 nm but N-particles are atomic or molecular aggregates with three dimensions between 1 and 100 nm (Liang, 2005). Because of their tiny size, N- materials show unique characteristics. For example, they can change physico-chemical properties compared to bulk materials. They have a great surface area, because of these larger surface areas their

solubility and surface reactivity was higher (Castiglione and Cremonini.2009).

The aim of this research is to use of N-Yttrium Oxide potential for reduce salinity stress on seed germination and seedling growth of mungbean. Yet no studies were found on the effect of N-Yttrium Oxide application to reduce salt stress damages, this is the first report on the application of N-Yttrium Oxide in this direction

Materials and Methodologies

The experiment was carried out in green house of botanical garden in biology department in college of science, Mustansiriyah University Baghdad, Iraq, in 2017. The experiment was set as a factorial and arranged in completely randomized design (CRD) in each replicate 25 seeds with five replications.

Seeds of mungbean were sterilized with sodium hypochlorite solution (10 %) for 10 minutes, and then washed three times with distilled water.

The treatment applications were:

1. N-Yttrium Oxide in concentrations of 100 ppm and 300 ppm.
2. Gibberellin in concentration 300 ppm seed germination promoter.
3. Liquors roots extract in concentrations of 5 g/L and 10 g/L as (plant extract promoter to seed germination).
4. Control treatment as distils water.

Seeds were soaking for 24 hours in 100 and 300 ppm of N-Yttrium Oxide, 300 ppm of gibberellic acid 300 ppm and 5 g/L and 10 g/L of Liquors roots extract. Distilled water was used as control treatment. The second step of the experiment, transfer the seeds of each soaked treatment to different saline solutions (0, 1 and 2 g/L NaCl) in 15 ml of sterilized Petri dishes (12 cm diameter) with double layers of filter paper, each petri dishes contain 25 seeds with five replications for each treatments. After seven days, the germination data were recorded:

$$\text{germination percentage} = \frac{\text{seeds germinated}}{\text{total seeds}} \times 100$$

Length of shoot final seedlings length, number of leaves, number of root hairs and the dry weight of the seedling. The collected data were analyzed statistically using factorial completely randomized design and analysis of variance (ANOVA) according to Statistical Analysis System (SAS 2012), to compare the calculation averages by using the least significant difference (L.S.D.) at the probability level of 0.05.

Results and Discussion

The results in Table 1 showed that the highest result seed germination % was 85.5 in 300 ppm Gibberellin followed by 84.33 in 300 ppm of N-Yttrium Oxide the lowest germination % value was 81.39 in control treatment.

Table 1: Effect of different treatments on seeds germinations and seedling grow of mung been.

Treat.	Germination (%)	Seedling lengths in (cm)	Shoot length in (cm)	No. of leaves	No. of sec. roots	Dry weight of Seedling in gm.
Control	81.39	4.4	1.3	2	4.1	0.31
N- ytt. oxide in 100 ppm	83.5	4.9	1.6	1.3	6	0.29
N-ytt. oxide 300 ppm	84.33	5.7	1.9	2	6.6	0.37
Liqurous extract 5 gm\L	81.43	4.6	1.4	1.4	4.9	0.25
Liqurous extract 10 gm\L	82.21	5	1.6	1.8	4.6	0.34
Gibberellin 300 ppm	85.5	5.8	1.3	2	7	0.38
LSD	*2.17	*0.94	*0.69	NS 0.83	*1.85	*0.088

Each number was mean of five replicate

The results also obtained that there are no significant difference between 300 ppm of N-Yttrium Oxide and plant growth regulator (Gibberellin) in all the values of seedling growth (seedling length, shoot length, number of leaves, number of secondary roots, and dry weight).

Plant growth and development starts from the germination of seeds followed by root elongation and shoot emergence as the earliest signs of growth and development.

The reported data from various studies suggested that effect of N-particles on seed germination dependent on concentrations (Siddiqui and Al-Whaibi, 2014) in this experiment the results indicated that 300 ppm of N-Yttrium Oxide was the best than 100 ppm in all studied traits. In this experiment showed that 300 ppm N-Yttrium Oxide give the highest value for mungbean seed germination % than other treatment except 300 ppm Gibberellin treatment. From these results we can suggest that 300 ppm N-Yttrium Oxide can be used to improve seed germination and seedling growth to mungbean seed. In many reports recorded that N-particles increased seed germination by providing better nutrients availability and pH and conductivity to the growing medium, (Bao-shan *et al*., 2004) and (Suriyaprabha *et al*., 2012). In another study N-particles moderate salinity stress in plants is due to reduction of osmotic potential and toxicity of Na+ ion by reducing Na+ ion absorption by plant tissues. (Raven, 1982) that mean nano practices enhances the plant growth and development by increasing gas exchange and chlorophyll fluorescence parameters, such as net photosynthetic rate (Wang *et al*., 2014)

The results in Table 2, showed that control treatment (distil water) gave the highest value in seed germination % (80.0) compare to (78.5) in 300 N-Yttrium Oxide. The results in Table 2 recorded that the same concentration 300 ppm of N-Yttrium Oxide has the highest results in seedling length 6.1 compare to control (4.4), in shoot length (1.6) compare to control (1.3), in number of secondary root gave (6.6) compare to control (5.2) and in Dry weight of seedling gave (0.41) compare to control (0.36). This treatment has the highest value than other treatments use in this experiment, except in seed germination%.

even the there was no difference present between control and 300 ppm N-Yttrium Oxide that mean N-Yttrium Oxide improving the tolerance of plants to salinity stress to Mungbean seed germination and seedling growth in 300 ppm concentration.

Table 2: Effect of different treatments on seeds germinations and seedling growth of mung been under 1gm\ L of NaCl.

Treat.	Germination (%)	Seedling lengths in (cm)	Shoot length in (cm)	No. of leaves	No. of sec. roots	Dry weight of Seedling in gm.
Control	80.0	4.4	1.3	2.0	4.1	0.36
N- ytt. oxide in 100 ppm	74.11	4.4	1. 0	2.0	5.6	0.34
N-ytt. oxide 300 ppm	78.5	6.1	1.6	2.0	6.6	0.41
Liqurous extract 5 gm\L	73.0	5.2	1.3	1.5	4.0	0.31
Liqurous extract 10 gm\L	68.76	5.5	1.4	1.0	2.0	0.29
Gibberellin 300 ppm	75.0	5.2	1.1	2.0	4.6	0.37
LSD	* 6.31	* 0.62	* 0.55	* 0.94	* 2.07	* 0.079

Each number was mean of five replicate

The results in Table 3 showed the same trends with the results in Table 2 that 300 ppm N-Yttrium Oxide gave the highest value in seed germination % and seedling growth.

Indeed our results showed that the application of 300 ppm N-Yttrium Oxide improved all plant growth aspects under 1 and 2\L NaCl concentration conditions. The possible mechanisms of N-Yttrium Oxide adjustment

the stress in plant to maintains and grows under saline conditions.

Table 3: Effect of different treatments on seeds germinations and seedling growth of mung been under 2gm\ L of NaCl.

Treat.	Germination (%)	Seedling lengths in (cm)	Shoot length in (cm)	No. of leaves	No. of sec. roots	Dry weight of Seedling in gm.
Control	81.39	5.3	1.3	2	4.1	0.31
N- ytt. oxide in 100 ppm	72.22	4.3	1.0	1.5	6.6	0.33
N-ytt. oxide 300 ppm	83.33	4.8	1.4	2.0	6	0.39
Liqurous extract 5 gm\L	75.3	3.8	1.1	1.3	0.4	0.24
Liqurous extract 10 gm\L	68.0	2.7	1.0	1.1	4.6	0.29
Gibberellin 300 ppm	77.5	4.5	1.1	2.0	5	0.36
LSD	* 6.41	* 1.05	* 0.471	* 0.94	* 1.85	* 0.088

Each number was mean of five replicate

Many reports showed that N-particles (NPs) have unique physicochemical properties, i.e., high surface area, high reactivity, tunable pore size, and particle morphology (Siddiqui *et al*., 2015). The effect of N-particles on plants depends on the composition, concentration, size, physical and chemical properties of N-particles as well as plant species (Ma *et al*. 2010). N-particles enhanced seed germination and stimulated the antioxidant system under NaCl stress. In 2009, Shah and Belozerova found in their study that some of NPs have a significant influence on lettuce seeds under salinity stress N-particles improves leaf fresh and dry weight, chlorophyll content and proline accumulation. An increase in the accumulation of proline, free amino acids, content of nutrients, and antioxidant enzymes activity due to the N-particles, thereby improving the tolerance of plants to abiotic stress (Kalteh *et al*. 2014 and Siddiqui *et al*. 2014).

Conclusions

It could be concluded that application of N-Yttrium Oxide can mitigate salt stress damages on mungbean seed germination and seedling growth in 300 ppm concentration. Many studies can be deal with other concentrations for other seed germination.

References

[1] Rahman MS, Matsumuro T, Miyake H, Takeoka Y (2000). Salinity-induced ultrastructural alternations in leaf cells of rice (Oryza sativa L.). Plant Prod Sci 3:422-429.

[2] Welbaum GE, Tissaoui T, Bradford KJ (1990). Water relations of seed development and germination in muskmelon (Cucumis melo L.) Z. Sensitivity of germination to water potential and abscisic acid during development. Plant Physiol 92:1029-1037.

[3] Tadav S.,Ifran M., Ahmad M., Hayat S. 2011. Causes salinity and plant manifestations to salt stress: a review. Journal of Environmental Biology. 32: 667-685.

[4] Rahimi R, Mohammakhani A, Roohi V,Armand N. 2012. Effects of salt stress and silicon nutrition on cholorophyll content, yield and yield components in fennel (Foeniculum vulgar MJ Agric Crop Sci; 4(21):1591-1595.

[5] Saha P., Chatterjee P., Biswas A. K. (2010). NaCl pretreatment alleviates salt stress by enhancement of antioxidant defense and osmolyte accumulation in mungbean (Vigna radiata L. Wilczek). Indian J. Exp. Biol. 48593–600.

[6] Misra N., Murmu B., Singh P., Misra M. (1996). Growth and Proline accumulation in mungbean seedlings as affected by sodium chloride. Biol. Plant. 38 531–536.

[7] Al-Aghabary K, Zhu Z, Shi QH, 2004. Infuence of silicon supply on chlorophyll content, chlorophyll fl uorescence, and antioxidative enzyme activities in tomato plants under salt stress.J Plant Nutr.;27:2101–2115.

[8] Liang YC, Zhang WH, Chen Q, Ding RX. 2005. Effects of silicon on tonoplast Hþ –ATPase and Hþ-PPase activity, fatty acid composition and fl uidity in roots of salt stressed barley (Hordeum vulgare L.).Environ Exp Bot.; 53:29–37.

[9] Castiglione Monica R, Cremonini R. 2009. Nanoparticles and higher plants. Caryologia, , 62: 161-165.

[10] SAS. 2012. Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.

[11] Siddiqui MH, Al-Whaibi MH (2014) Role of nano-SiO_2 in germination of tomato (Lycopersicum esculentum seeds Mill.). Saudi Biol Sci 21:13–17.
[12] Bao-shan L, Shao-qi D, Chun-hui L, Li-jun F, Shu-chun Q, Min Y (2004) Effect of TMS (nanostructured silicon dioxide) on growth of Changbai larch seedlings. J Forest Res 15:138–140.
[13] Suriyaprabha R, Karunakaran G, Yuvakkumar R, Rajendran V, Kannan N (2012) Silica nanoparticles for increased silic availability in maize (Zea mays L) seeds under hydroponic conditions.Curr Nanosci 8:902–908.
[14] Wang A, Zheng Y, Peng F (2014) Thickness-controllable silica coating of CdTe QDs by reverse Microemulsion method for the application in the growth of rice. J Spectrosc, http://dx.doi.org/10.1155/2014/169245
[15] Raven J.A. 1982, Transport and function of silicon in plants. Biological Reviews58, 179-207.
[16] Manzer H. Siddiqui, Mohamed H. Al-Whaibi, Mohammad Firoz and Mutahhar Y. Al-Khaishany.2015. Chapter 2 Role of Nanoparticles in Plants, http://www.springer.com/978-3-319-14501-3, pp 19 -35.
[17] Ma X, Geiser-Lee J, Deng Y, Kolmakov A (2010) Interactions between engineered nanoparticles (ENPs) and plants: phytotoxicity, uptake and accumulation. Sci Total Environ 408(16):3053–3061.
[18] Shah V, Belozerova I (2009) Influence of metal nanoparticles on the soil microbial community and germination of lettuce seeds. Water Air Soil Pollut 197:143–148.
[19] Kalteh M, Alipour ZT, Ashraf S, Aliabadi MM, Nosratabadi AF (2014) Effect of silica nanoparticles on basil (Ocimum basilicum) under salinity stress. J Chem Health Risks 4:49–55.
[20] Siddiqui MH, Al-Whaibi MH, Faisal M, Al Sahli AA (2014) Nano-silicon dioxide mitigates the adverse effects of salt stress on Cucurbita pepo L. Environ Toxicol Chem 33(11):2429– 437. doi:10.1002/etc.2697.
[21] Xie Y, Li B, Zhang Q, Zhang C, Lu K, Tao G (2011) Effects of nano-TiO2 on photosynthetic characteristics of Indocalamus barbatus. J Northeast for Univ 39:22–25.