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Effect of priming and foliar application of nanoparticles on agronomic traits of chickpea

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ABSTRACT: There is a little information about co-evaluation of seed priming and foliar application of nanoparticles on agronomic traits of chickpea. Therefore, the field assay was conducted in 2014 in the research field of Islamic Azad University of Sanandaj located in Kurdistan provinces of Iran. The experimental design was a randomized complete block design with a split-plot arrangement of treatments in three replicates. The main plots consisted of four foliar spraying of micronutrients included nano-iron chelate fertilizer, nano-zinc, nano calcium at the rates of 2g L^{-1}, and control. The subplots were the priming of chickpea seed with mentioned nanoparticles. Results showed that nano-iron chelate fertilizer, increased seed number per pod, pod number per plant, 100 seed weight and grain yield compared to control treatment 17, 48, 13 and 65% respectively. Seed priming with Zn, Fe and Ca nanoparticles improved 100 seed weight and grain yield compared to untreated treatment.

Keywords: Calsium, Iron, Legume, Zink.

INTRODUCTION

Seed priming is the process of regulating germination by managing the temperature and seed moisture content, in order to maximize the seed's potential. Several different priming methods have been reported to be used commercially, including liquid or osmotic priming and solid matrix priming. Micronutrients can use as material for seed priming. Nano priming of micronutrients is a new method for the rise of seedling vigor and development of germination percentage (Dehkourdi and Mosavi, 2013; Ghafari and Razmjoo, 2013).

This technology is particularly applied in chelate fertilizers such as zinc, calcium, and iron chelate. These micronutrients can also apply as a foliar application. Foliar application is a technique of feeding plants by applying liquid micronutrients directly to their leaves. Plants are able to take in essential nutrients through their leaves. Liu *et al.* (2005) reported that nano-fertilizers improved the yield and photosynthesis of peanut. Sheykhbaglou *et al.* (2010) showed that foliar spraying of nano fertilizers such as nano-iron oxide particles increased soybean grain yield. In other research, reported that nano zinc particles increased stem and root growth and pod yield of peanut (Prasad *et al.*, 2012).

The chickpea (*Cicer arietinum*) is a legume of the family Fabaceae, subfamily Faboideae. Because of biological nitrogen fixation, chickpea does not require the nitrogen fertilizers.

Previous studies showed that the chickpea is minimally responsive to NPK fertilizers, but the positive response of chickpea to micronutrients was reported (Mohammadi *et al.*, 2011; Namavi *et al.*, 2011). Zinc, iron and calcium take over the different roles in crop, such as formation, partitioning and utilization of photosynthesis assimilates (Sawan *et al.*, 2008). Mevada *et al.* (2005) reported that maximum grain yield of chickpea was obtained under application of chelated iron. Zinc and iron deficiency in soils could be a restricted factor of yield and extremely decrease crop yield quality. Therefore, this research was aimed to investigate the effect of priming and foliar application of Zn, Fe and Ca nano particles on grain yield, yield components and nutrient uptake of chickpea.

MATERIALS AND METHODS

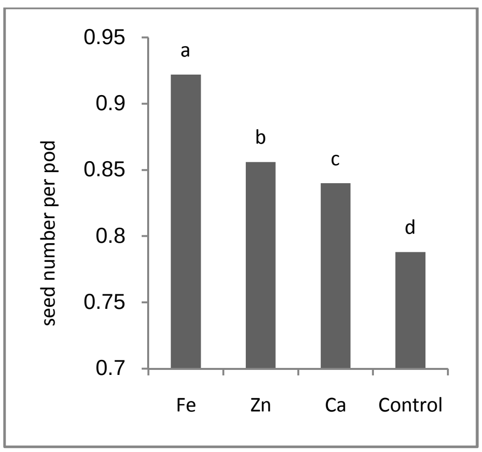
The field assay was conducted in 2014 at the research field of Islamic Azad University of Sanandaj (35° 11 lat. N; 46° 59 long. E, 1400 m above sea level) located in Kurdistan provinces of Iran. The experimental design was a randomized complete block design (RCBD) with a split-plot arrangement of treatments in three replicates. The main plots consisted of four foliar spraying of micronutrients included nano-iron chelate fertilizer, nano-zinc, nano calcium at the rates of 2g L^{-1}, and control (without fertilizers).

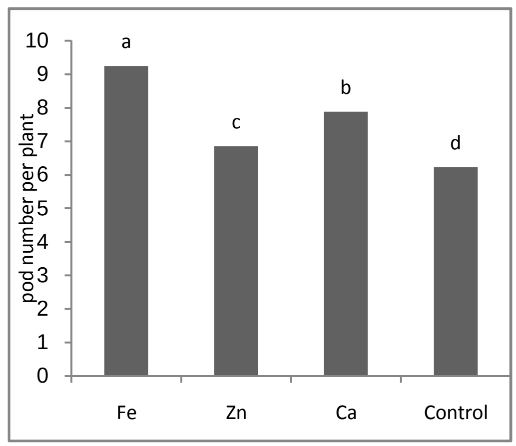
The subplots were the priming of chickpea seed with mentioned nanoparticles. Fifty percent of fertilizers were foliar sprayed at flowering stage and the rest at podding stage. The same amount of water was sprayed to the control plots each time. For priming, chickpea seeds were soaked in an aerated solution of respective osmoticum having concentration 2g L^{-1} of nanoparticles for 18 h at room temperature. Untreated dry seeds considered as the control. Some of the initial soil physicochemical properties in the surface layer (0-30 cm) were: clay-loam texture (29% sand, 41% clay and 30% silt), pH 7.36 (1:2.5 in water), 1.19% OM, 0.20% total N, 8.2 mg kg^{-1} Olsen P, and 254 mg kg^{-1} extractable K^+ (NH4Ac). Sows were carried out April 15, 2014. Main plot size was 5×25 m and spaces between main plots were two meters. All weeds were removed by hand and inter row cultivation throughout the growing season.

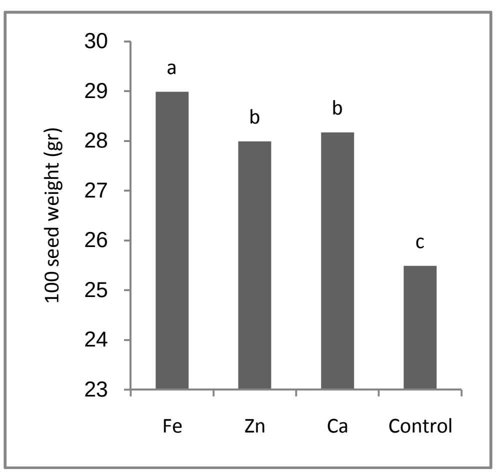
At harvest time harvest, grain yield and yield components were evaluated from an area of 2 × 2.5 m in each sub-sub plots. The data collected in this study were subjected to analysis of variance (ANOVA) and the means comparison was done through an LSD test using a SAS statistical package (SAS Institute 2002).

RESULTS AND DISCUSSION

Foliar application had a significant effect on grain yield and yield components, and seed priming had a significant effect only on 100 seed weight and grain yield. The interaction of foliar application × seed priming had no significant effect on grain yield and yield components (data not shown). Mean comparisons specified that nano-iron chelate fertilizer, increased seed number per pod, pod number per plant, 100 seed weight and grain yield compared to control treatment 17, 48, 13 and 65% respectively (Fig. 1).







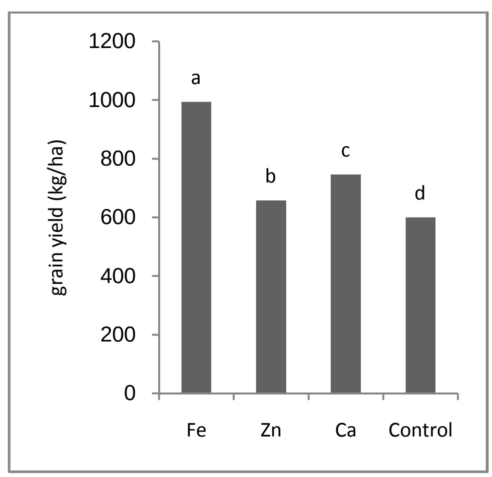
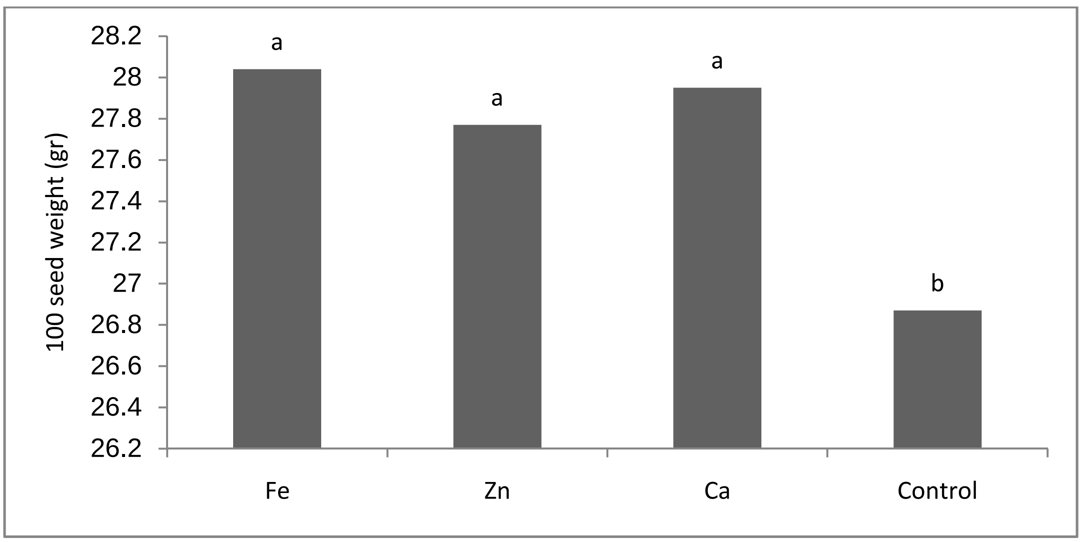


Fig. 1. Effect of foliar application of nanoparticles on grain yield and yield components.

Improvement in yield components as a result of application of nano-micronutrients might be due to the enhanced photosynthetic and other metabolic activity which leads to an increase in various plant metabolites responsible for cell division and elongation as opined by Hatwar *et al.* (2003). Iron has a great role in increasing growth characters, being a component of ferrodoxin, an electron transport protein and is associated with chloroplast. It helps in photosynthesis might have helped in better growth (Hazra *et al.*, 1987). Kumar *et al.* (2009) showed that application of iron fertilizer increased the grain yield of chickpea by 17.3% over the control. Kobraee *et al.* (2011) reported that iron foliar application increased grain yield by influencing number of seeds per plant and seed weight. Therefore, Iron deficiency could be a restricting factor of yield and extremely decrease crop yield. Seed priming with Zn, Fe and Ca nanoparticles improved 100 seed weight and grain yield compared to untreated treatment (Fig. 2). The observed increase in primed treatments, may be due to rapid and appropirate establishment of seedling (Farooq *et al.*, 2008), minimization of time between seed sowing and emergence and the synchronization of emergence (Parera and Cantliffe, 1994), their capable use of nutrient, soil moisture and solar radiation (Subedi and Ma, 2005), photosynthetic rate and stomatal conductance (Fariduddin *et al.*, 2003).



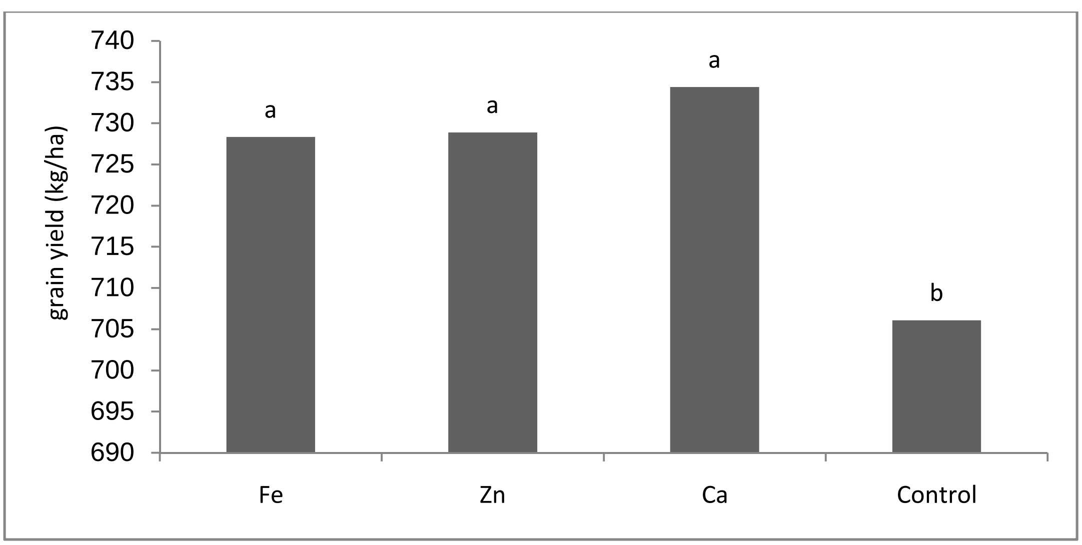


Fig. 2. Effect of seed priming with nanoparticles on grain yield and 100 seed weight.

CONCLUSION

Growth of chickpea as an important legume plant, producing protein was affected by nano iron application. It seems that the use of iron nano-particles causes increased in pod number and 100 seed weight and finally will increase total yield. Before the recommendation of these materials, additional testing is required and influence of the nano-particles in chickpea products must be evaluated.

REFERENCES

Dehkourdi, E., & Mosavi, M. (2013). Effect of anatase nanoparticles (TiO_2) on parsley seed germination (Petroselinum crispum) In Vitro. *Biological Trace Element Research.* **155**: 283-286.

Fariduddin, Q.,, Hayat S., & Ahmad, A. (2003). Salicylic acid influences net photosynthetic rate, carboxylation efficiency, nitrate reductase activity and seed yield in *Brassica juncea*. *Photosynthetica.* **41**: 281- 284.

Farooq, M., Basra, S.M.A., Rehman, H., & Saleem, B.A. (2008). Seed priming enhances the performance of wheat (*Triticum aestivum* L.) by improving chilling tolerance late sown. *Journal of Agrony and Crop Science*. **94**: 55-60.

Ghafari, H., & Razmjoo, J. (2013). Effect of foliar application of nano-iron oxidase, iron chelate and iron sulphate rates on yield and quality of wheat. *International Journal of Agronomy and Plant Production.* **4**(11): 2997-3003.

Hatwar, G.P. Gondane, S.V. Urkude, S.M., & Gahukar, O.V. (2003). Effect of micronutrients on growth and yield of chilli. *Soil and Crop.* **13**: 123-1254.

Hazra, P., Maity, T.K. & Mandal, A.R. (1987). Effect of foliar application of micronutrients on growth and yield of okra (*Abelmoschus esculentus* L). *Prog. Hort.* **19**: 219-222.

Liu, X. M., Zhang, F. D., Zhang, S. Q., He, X. S., Fang, R., Feng, Z. & Wang, S. (2005). Effects of nano-ferric oxide on the growth and nutrients absorption of peanut. *Plant Nutrition and Fertilizer Science.* **11**: 14-18.

Kobraee, S., Shamsi, K., & Rasekhi, B. (2011). Effect of micronutrients application on yield and yield components of soybean. *Annals of Biological Research.* **2**(2): 476-482.

Mevada, K.D., Patel, J.J., & Patel, K.P. (2005). Effect of micronutrients on yield of urdbean. *Indian Journal of Pulse Research.* **18**: 214-216.

Mohammadi, K., Ghalavand, A., Aghaalikhani, M., Heidari, G.R., & Sohrabi, Y. (2011). Introducing the sustainable soil fertility system for chickpea (*Cicer arietinum* L.). *African Journal of Biotechnology.* **10**(32): 6011-6020.

Namvar, A., Seyed Sharifib, R., Sedghi, M., Asghari Zakaria, R., Khandan, T., & Eskandarpour, B. (2011). Study on the effects of organic and inorganic nitrogen fertilizer on yield, yield components, and nodulation state of chickpea (*Cicer arietinum* L.). *Communications in Soil Science and Plant Analysis.* **42**(9): 1097-1109.

Parera, C.A., & Cantliffe, D.J. (1994). Pre-sowing seed priming. *Horticulture Review.* **16**: 109-141.

Prasad, T.N.V.K.V., Sudhakara, P., Sreenivasulua, Y. Lathaa, P. Munaswamya, V., Raja Reddya, K. Sreeprasadb, T. S., Sajanlalb P. R., & Pradeepb T. (2012). Effect of nanoscale zinc oxide particles on the germination, growth and yield of peanut. *Journal of Plant Nutrition.* **35**(6): 905-927.

SAS Institute. (2002). The SAS System for Microsoft Windows. Release 8.2. Cary, NC.

Sawan, Z.M, Mahmoud, M.H., & El-Guibali, A.H. (2008). Influence of potassium fertilization and foliar application of zinc and phosphorus on growth, yield components, yield and fiber properties of Egyptian cotton (*Gossypium barbadense L*.). *Journal of Plant Ecology.* **1**(4): 259-270.

Sheykhbaglou, R., Sedghi, M., Tajbakhsh shishevan, M., & Sharifi, S.R. (2010). Effects of nano-iron oxide particles on agronomic traits of soybean. *Notulae Sci Bio.* **2**: 112-113.

Subedi, K.D., & Ma, B.L. 2005. Seed priming does not improve corn yield in a humid temperate environment. *Agronomy Journal.* **97**: 211-218.