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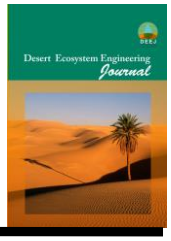

Investigating The Effect of Zeolite and Geohumus Superabsorbent on Growth Indices of *Calligonum comosum* and Some Soil Properties in Desert Regions

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Extended Abstract

Introduction: Improving the efficiency of water consumption requires the effective use of modern technologies (Jalili and Jalili, 2011). For instance, as dry and sugar-like substances with the ability to absorb and maintain aqueous solution several times their weight, superabsorbent polymers can increase the plant's height, the stem's diameter, and the leaf length, and lower the plant's water needs by one third compared to the control (Abedi-koupai *et al*., 2006). Therefore, this study sought to investigate the effect of irrigation periods and different levels of zeolite and Geohumus on a number of *Calligonum comosum's* growth characteristics under the influence of drought stress and some soil characteristics of the region.

Materials and methods: This study investigated the effect of irrigation interval (deficit-irrigation, regular irrigation) on the one hand, and the influence of zeolite mineral and Geohumus superabsorbent at three (0, 10, 15 % by weight) and four levels (0, 100, 150, 250 g per hole), respectively, on the other hand, on the vegetative properties of *Calligonum comosum* in seedling cultivation (obtained from Forests, Range and Watershed Management Organization of Yazd Province) in the field, and on some soil characteristics in March 2016. Moreover, to evaluate the effect of each factor including the irrigation, type, and level of superabsorbent addition on the studied characteristics, the data were analyzed via SPSS-22 software.

Discussion: The study's results indicate significant effects of irrigation treatments and superabsorbent application on the plant's height, large canopy crown's diameter, small crown's diameter, and collar diameter. The highest values in all of the above-mentioned features were obtained for 250 g Geohumus and 15% (w/w) zeolite. The lowest values of vegetative indices were found to belong to the deficit-irrigation control treatment. On the other hand, the reason for decreased plant yield could be attributed to insufficient irrigation as required for the seedlings. Moreover, the application of superabsorbent to the soil dramatically decreased the soil moisture fluctuations around the plant's root, decreasing the stress exerted on the plant during the irrigation or effective rainfall intervals in arid and semi-arid regions where the plant relied on precipitation (Jafarian Lahoeti, 2006). In this regard, some studies have proved that maximizing potential production is one of the main advantages of superabsorbent polymers (Shahriari *et al*., 2010).

The study's results also suggested that the above-mentioned factors increased the root's length and height and dry and wet weights, indicating that the application of superabsorbent polymers in sandy soils can help raise soil moisture storage and, therefore, carry out successful irrigation programs in arid and semi-arid areas. In this regard, Yousefian *et al*. (2018) investigated the effect of Stockosorb and zeolite on *Atriplex lentiformis* in the

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desert areas of Semnan, Iran, showing the effect of treatment on increasing the plant's height, its collar diameter, and its large and small canopy diameters. However, as the amendment material does not have a direct nutritional effect, the growth increase could be attributed to the improvement of the soil's physical condition by the polymers, increasing the root's density and raising the number of secondary roots, as a result of which the roots would have more access to available water and the plant would be less affected by drought stress.

Moreover, the study found that using superabsorbent polymers significantly reduced the soil's electrical conductivity (EC), whose highest value was observed in the control treatment. However, the lowest mean value of the soil's electrical conductivity belonged to the application of 250 g Geohumus, which did not show a significant difference compared to 150 g Geohumus. Furthermore, the soil's EC in the sample with 15% zeolite was less than that of the control treatment with a significant difference, which could be attributed to the fact that superabsorbent polymers can absorb and retain a large amount of water, and this high volume of water in the soil leads to the dilution of solute concentration and reduced electrical conductivity (Bal *et al*., 2010; Doraji *et al*., 2010). However, if the water volume in the soil is not greater than the limit and does not cause the soil to be saline, it can improve the plant's growth (Banej Shafie *et al*., 2012), which is consistent with the results found by Doraji *et al*. (2010), Zanghui Nasab *et al*. (2013), and Yousefian (2015). Moreover, according to the data analysis performed for soil bulk density, the lowest value was reported for 250 g Geohumus, in which increasing the amount of superabsorbent polymer application decreased the soil's bulk by 5.8%, suggesting that water absorption and superabsorbent re-drying had created empty pores in the soil. Also, it was found that low levels of organic matter decreased the soil's bulk density (Mohammadi Torkashvand *et al*., 2017), while Zeolite had no significant effect on the soil's bulk density. In this regard, Judy *et al* (2007), investigated the effect of zeolite, Lika, and Compost on potting soils, concluding that Zeolite had no significant effect on the soil's physical characteristics, including apparent specific weight, which is consistent with the results found by Abrisham (2014).

Conclusion: The application of superabsorbent polymer in the present study improved the *Calligonum comosum* seedling traits. Moreover, the best superabsorbent application rate performed to increase vegetative growth in the region belonged to 250 g Geohumus and 15 wt.% zeolites, and the lowest vegetative growth rate was observed in the control treatment. Therefore, it can be concluded that if the purpose of planting the seedlings in the rangeland is to restore, amend, and maintain the area's soil structure, deficit-irrigation and superabsorbent application are recommended, as they have the ability to absorb nutrients and slowly provide them for the plant. Moreover, in addition to saving the use of fertilizer and reducing costs, deficit irrigation and superabsorbent help the fertilizer to be used in the effective root zone. In fact, using these materials reduces the irrigation costs (that account for about 70% of the total costs) for biological desalination projects. However, choosing superabsorbent polymers made from natural resources, ease of use, the ratio of water absorption, proper life span, price, and environmental impacts are some important considerations to note in this regard.

Keywords: Superabsorbent, Soil, Irrigation, Growth indices.