Journal of Plant Physiology and Breeding
2023, 13(2): 249-260 ISSN: 2008-5168

Research Paper

Soil moisture variations and growth characteristics of Russian olive seedlings as affected by pumice in rainfed conditions

Reza Hassanpour[1*], Davoud Zarehaghi[2], Mohammad Ebrahim Sadeghzadeh Reyhan[3], and Pasha Gharabaghi[4]

Received: March 2, 2023 Accepted: September 23, 2023
[1]Soil and Water Research Department, East Azarbaijan Agricultural and Natural Resources Research and Education Centre, Agricultural Research, Education and Extension Organization (AREEO), Tabriz, Iran
[2]Department of Soil Science and Engineering, Faculty of Agriculture, University of Tabriz, Tabriz, Iran
[3]Soil Conservation and Watershed Management Research Department, East Azerbaijan Agricultural and Natural Resources Research and Education Centre, Agricultural Research, Education and Extension Organization (AREEO), Tabriz, Iran
[4]East Azerbaijan Organization of Agriculture Jahad, Tabriz, Iran
*Corresponding author; E-mail: reza.hassanp@gmail.com

Abstract
One of the strategies for efficiently using agricultural water resources and preserving them is to use absorbent materials such as pumice in soil. The present research aimed to evaluate the effects of different levels of pumice on soil water content and Russian olive seedling growth. For this purpose, an experiment was designed and conducted as a randomized complete block design with four treatments and three replications from 2017 to 2018 in the Khajeh Research Station. Treatments included control (no pumice), and 10%, 20%, and 30% pumice. During the experiment, the average soil moisture content was measured by TDR every 10 days. The growth characteristics of the Russian olive seedlings, including seedling height, collar diameter, and leaf area were measured. Minimum soil water content was recorded for the control treatment and then a significant increase was observed by increasing the use of pumice. In the control treatment, seedling height, collar diameter, and leaf area were 56 cm, 6.2 mm, and 108 cm^2, respectively, while in the 30% pumice treatment, the same characteristics were significantly increased to 105 cm, 11.4 mm, and 201 cm^2, respectively. So, by increasing the amount of pumice from 0 to 30%, seedling height, collar diameter, and leaf area increased by 87, 84, and 86%, respectively. Therefore, we can conclude that pumice by retaining soil water during the growing season, especially in rainfed conditions, prevents plant water-deficit stress and enhances its growth and development.

Keywords: Russian olive, soil moisture, soil porosity, superabsorbent

How to cite: Hassanpour R, Zarehaghi D, Sadeghzadeh Reyhan ME, Gharabaghi P. 2023. Soil moisture variations and growth indices of Russian olive seedling as affected by pumice in rainfed conditions. J Plant Physiol Breed. 13(2): 249-260.

Introduction

Water plays a vital and irreplaceable role in sustaining the functioning of the environment and societies. World water resources are used for agriculture, drinking, municipal needs, and several human activities. Among them, agriculture is the largest consumer of water in the world, consuming more than 70% of the available water (UNESCO 2022). Therefore, water conservation with efficient use of it in agriculture is of great importance.

One of the practical methods to retain water in the soil and prevent its loss is the use of superabsorbent polymers (SAPs) in the soil (Zheng *et al*. 2023). SAPs are hydrophilic polymer gels or hydrogels that can absorb and retain large amounts of water (Mignon *et al*. 2019). From a practical point of view, a material that can absorb at least 20 times its weight is considered a superabsorbent (Abedi Koopaee and Sohrab 2004). The amount of water absorbed by these polymers varies from about 20 to more than 2000 times their weight, depending on the formulation, impurities, and the amount of salt in the polymer (Ganji Khorramdel 2008). After absorption and due to drying of the environment, the water inside the polymer is gradually absorbed by the surrounding soil and thus the soil stays moist for a long time without the need for re-irrigation.

El-Rehim *et al.* (2004) studied the effect of cross-linked polyacrylic acid (PAA), polyvinyl alcohol, and potassium polyacrylate hydrogels on corn growth. They showed that by increasing the hydrogel amount in the soil, the average plant height, leaf width, total dry weight, and wilting time increased. They stated that the PAA and potassium polyacrylate hydrogels can improve sandy soil physical conditions for root growth, because they often absorb water about 1000 times more than their weight, reduce irrigation frequency for plants, and enhance water retention in the soil, and therefore increases the plant growth and production. Pourmeydani and Khakdaman (2005) investigated the effect of Aquasorb superabsorbent on soil water retention and olive, pine, and Atriplex growth and showed that Aquasorb has a major effect on retaining soil water and growth of the studied plants. Orikiriza *et al.* (2009) reported that the addition of hydrogel to the five soil types (sand, sandy loam, loam, silt loam, and clay) significantly increased shoot and root dry weight in eight tree species. Yang *et al.* (2014) reported that the soil with added hydrophilic polymer significantly increased water holding capacity and seed germination than the control treatment. Khodadadi Dehkordi (2017) investigated the impact of superabsorbent polymer on soil and plants on steep surfaces and showed that all Super-AB-A-200 treatments significantly improved the soil water retention capacity compared with the controls. Fernández *et al*. (2022) evaluated the effect of PAA superabsorbent on the hydrophysical soil variables and the tall fescue (*Festuca arundinacea* ssp.) growth and found that its use has a significant impact on the soil water storage and plant biomass.

Pumice is one of the superabsorbents which is a mineral with non-crystalline chemical composition of aluminum silicate with high moisture absorption properties. Pumice consists of solid particles and very fine glassy and porous particles that are very light and composed of molten or semi-molten material (Bideci *et al*. 2014). This material can be widely used in soil to increase the water-holding capacity and permeability of the soil. The consumer price is also cheaper compared to similar materials such as perlite and vermiculite. Pumice increases soil void ratio, facilitates plowing, and improves aeration and water retention in soil. Pumice is mixed with soil in various amounts, which improves soil hydraulic conductivity and aeration, and reduces the negative effects of crust formation and waterlogging in soil. This material can be used for a long period due to its stable physical and chemical properties (Alraddadi and Assaedi 2021). Sahin *et al*. (2005) showed that the addition of pumice to the soil increased soil water retention and strawberry growth, so the highest soil moisture, leaf area, and root dry matter of strawberry was obtained by 45% pumice treatment. Malekian *et al.* (2012) reported that pumice significantly increased the retention of soil water and corn growth characteristics. The maximum leaf area index, stem diameter, seed weight, and grain yield were obtained from the 30% pumice treatment. Zarehaghi *et al.* (2015) investigated the effect of pumice on soil water holding capacity, growth, and yield of spring safflower and observed that with the increase of pumice, soil water content increased significantly and the highest amount of soil water content was observed in the treatment of 30 tons pumice per hectare. This treatment caused a significant increase of 47, 14, 43, and 74% in germination rate, plant height, 1000-seed weight, and grain yield compared to the control treatment (without pumice).

Russian olive or oleaster (*Elaeagnus angustifolia* L.) belongs to the genus *Elaeagnus* of Elaeagnacea (Araliaceae) family (Sahan *et al*. 2013). There are more than 90 species of the Russian olive around the world which are mainly distributed in subtropical regions of Asia, Europe, and some parts of North America (Saboonchian *et al*. 2014). Russian olive is a long-lived tree (80–100 years) that grows rapidly up to 10 m in height and 30 cm in diameter and starts to fruit after 5–6 years (Kiseleva and Chindyaeva 2011). Different parts of the Russian olive plant have been used in a variety of medicinal formats, in perfume industries, as well as in woodwork and musical instrument production (Kiseleva and Chindyaeva 2011). This tree is tolerant to a wide range of harsh environmental conditions such as severe drought, flood, and airborne salts. Russian olive can grow in unsuitable soil conditions such as stony, sandy, and high salinity or alkalinity (Asadiar *et al*. 2013). In Iran, in most areas, this tree is found as a self-growing plant and because of that it is a forgotten species and has received little attention in research despite its beneficial characteristics. Because of its tolerance to salinity and drought, this tree may be a suitable choice for establishing vegetation and avoiding soil (or salt) erosion by wind. The minimum available rainwater should be utilized in the best possible way for the growth and development of this tree in rainfed conditions; that is, water should be stored and progressively delivered to the plant during the growing season. Therefore, this study aimed to evaluate the effect of pumice on retaining soil water and the growth of Russian olive seedlings.

Material and Methods

This research was conducted in the Khajeh Research Station, located in 30 km northeast of Tabriz, Iran. This region is located 38.09˚ north latitude and 46.39˚ east longitude, at 1550 meters above sea level (Figure 1).

The climate is cold and semiarid, the average annual temperature is 9.9$^{\circ C}$ and the average annual rainfall is 250 mm. The rainfall during the experiment is provided in Figure 2. The soils were saline.

This research was started in the 2017-2018 growing season and continued through 2018-2019. At the end of the 2018-2019 growing season, the soil and seedling characteristics were measured. The experiment was designed as a randomized complete block design with three replications in plots with dimensions of 6×6 meters. Treatments included:

Treatment A (control): without pumice
Treatment B: 10% pumice (w/w)
Treatment C: 20% pumice (w/w)
Treatment D: 30% pumice (w/w)

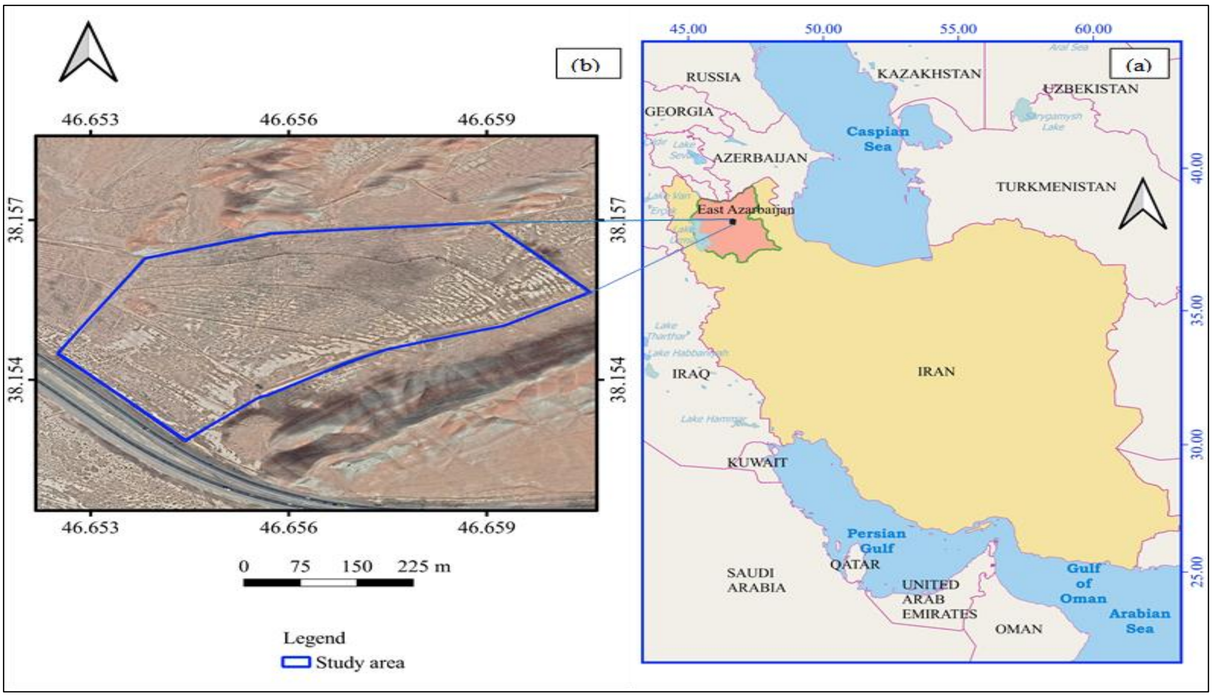

Figure 1. Location maps of the study site: (a) map of Iran, (b) map of the study area.

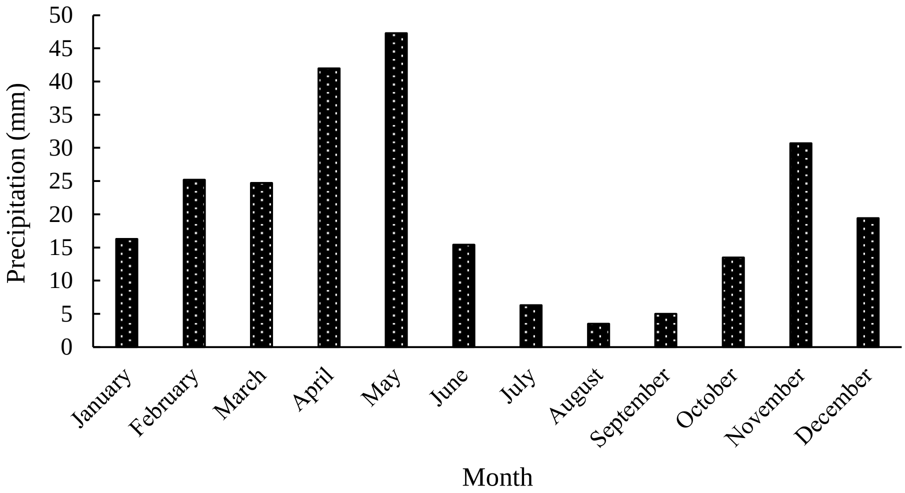

Figure 2. Precipitation amount during the experiment in the study area.

To apply the treatments, pits with a diameter and depth of 70 cm were dug for each treatment in each plot. Russian olive seedlings were planted in each pit and a pair of TDR sensors with a length of 70 cm was placed in the pits to measure the soil water content. Excavated soils from the pits were mixed with pumice and again returned to the pits. The pumice needed in this study was prepared by the Pars Pumice Factory located in Osku City, Iran. Some properties of the pumice are given in Table 1. This experiment was carried out in rainfed conditions, so the plots were not irrigated and water required by seedlings was supplied from rainfalls.

Before applying the treatments, some physical and chemical properties of the studied soil, including its texture (Gee and Bauder1979), bulk density, particle density, porosity (Hao *et al*. 2008), organic carbon (Nelson and Summers 1996), EC of the saturation extract (EC_e, Richard 1996), and soil reaction in the saturation extract (pH_e, Richard 1969) were measured (Table 2).

During the experiment, the volumetric soil moisture content in each pit was measured by TDR every 10 days. Also, seedlings' growth characteristics, including plant height, collar

Table 1. The properties of the pumice used in the experiment.

Characteristics	
Bulk density (g cm^{-3})	0.50
Particle density (g cm^{-3})	2.35
Porosity (%)	79
EC_e (dS m^{-1})	3.10
pH_e	7.8
Particle size	Equivalent to the sandy loam soil+

+76, 19, and 5 percent in size of sand, silt, and clay, respectively.

Table 2. Some physical and chemical properties of the studied soil.

Characteristics	
Sand (%)	39.6
Silt (%)	30
Clay (%)	30.4
Textural class	Clay loam
Bulk density (g cm^{-3})	1.35
Particle density (g cm^{-3})	2.65
Porosity (%)	49
Organic carbon (%)	0.68
EC_e (dS m^{-1})	3.9
pH_e	7.3

diameter, and leaf area were measured. The collar diameter was measured using a digital caliper at five points of the seedling stem. At the end of the growing season, all seedling leaves were collected and their area was determined using a leaf area meter.

Data analysis was performed using SPSS software and diagrams were drawn using Excel. Duncan's multiple-range test was used at the 1% probability level to compare the means of treatments for the measured traits.

Results and Discussion

Soil water content

The effect of pumice on soil water content was significant in all five months at the 1% probability level (Table 3). In August and September, although no rainfall occurred (Figure 2), pumice had a significant effect on the soil water content.

Figure 3 shows the volumetric soil water content in different months during the experiment for four amounts of pumice. In all five months, in the control treatment (no pumice), soil water content was the lowest and in the treatment D (30% pumice), it was the highest (Figure 3). With decreasing rainfall from May to September (Figure 2), soil water content also decreased, but in all five months, pumice treatments had higher soil water content than that of the control. In other words, adding pumice to the soil causes water retention in the soil and this retention was higher in the treatments with higher pumice. This result was consistent with the results of Malekian *et al.* (2012) and Zarehaghi *et al.*

Table 3. Analysis of variance for the effects of pumice on volumetric soil water content during the experiment

Source of variation	df	Mean squares				
		May	June	July	August	September
Block	2	3.8	3.9	2.8	1.7	0.17
Pumice	3	121.5^{**}	12.6^{**}	9.23^{**}	4.7^{**}	3.8^{**}
Experimental error	6	15.7	2.24	3.4	1.9	0.56

** Significant at the 1% probability level.

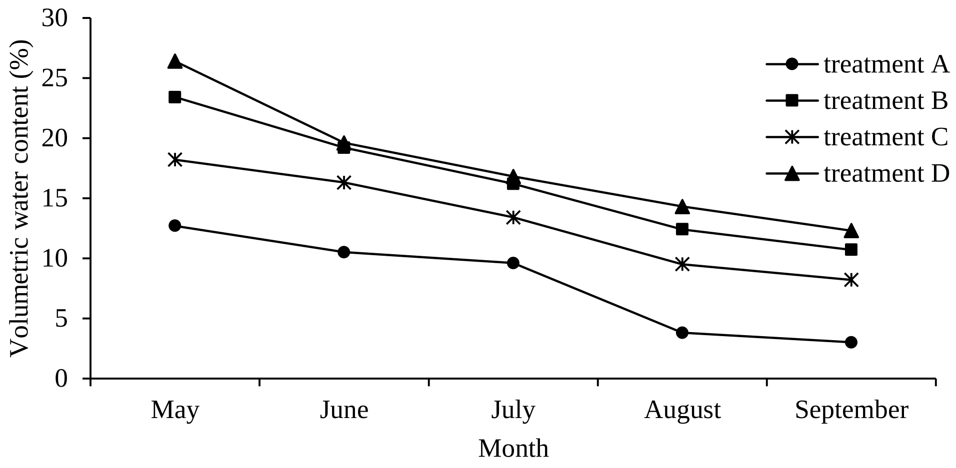

Figure 3. Variation of volumetric soil water content at different levels of pumice during the experiment. A, B, C, and D represent pumice amounts of 0, 10, 20, and 30%, respectively.

(2015). In these studies, adding pumice to the soil also increased water retention in the soil. Because of its porous structure, Pumice increases soil porosity and decreases bulk density and crust formation on the soil surface. These factors increase water infiltration in the soil and decrease surface runoff. Therefore, the water content in the mixture of soil and pumice usually is higher than in the soil without pumice (Chen *et al*. 2004; Ni *et al*. 2010; Yang *et al*. 2014).

Russian olive seedling characteristics

Table 4 shows the effect of pumice on the growth characteristics of the Russian olive seedlings. The effect of pumice on the seedling height, collar diameter, and leaf area was significant at the 1% probability level.

Figures 4, 5, and 6 show the seedling height, collar diameter, and leaf area for different amounts of pumice, respectively. With increasing the amount of pumice in the soil, all three growth characteristics increased significantly compared to the control. In the control treatment, seedling height, collar diameter, and leaf area were 56 cm, 6.2 mm, and 108 cm^2, while they were increased significantly to 105 cm, 11.4 mm, and 201 cm^2, respectively when the 30% pumice treatment was used.

These results are consistent with the results of Zangoee Nasab *et al.* (2012) and Yousefian *et al.* (2018) in Atriplex. In these studies, applying superabsorbent polymer increased the seedling height and shoot and root dry weight of Atriplex.

As mentioned above, pumice because of its porous and light texture provides appropriate physical conditions in the soil for root growth. On the other hand, it prevents water-deficit stress during the growing season by absorbing and retaining rainwater in the soil. Plants are exposed to the water deficit when there is not sufficient water in the soil. Water deficit disrupts many cellular and whole-plant functions, affecting plant growth and production (Dodd and Ryan 2016). In this research, the maximum seedling growth was obtained at the high level of pumice (30% pumice). Another possible reason is that under the proper ventilation and adequate available water conditions in the soil due to the addition of pumice, water-soluble ions with low molecular weight (e.g. nutrients) can be absorbed by pumice and enhance plant growth by gradual release.

Table 4. Analysis of variance for the effects of pumice on Russian olive seedling characteristics.

Source of variation	df	Mean squares		
		Collar diameter	Seedling height	Leaf area
Block	2	0.57	3.94	8.64
Pumice	3	25.9**	268.92**	25343**
Experimental error	6	0.57	2.44	344

**: Significant at the 1% probability level

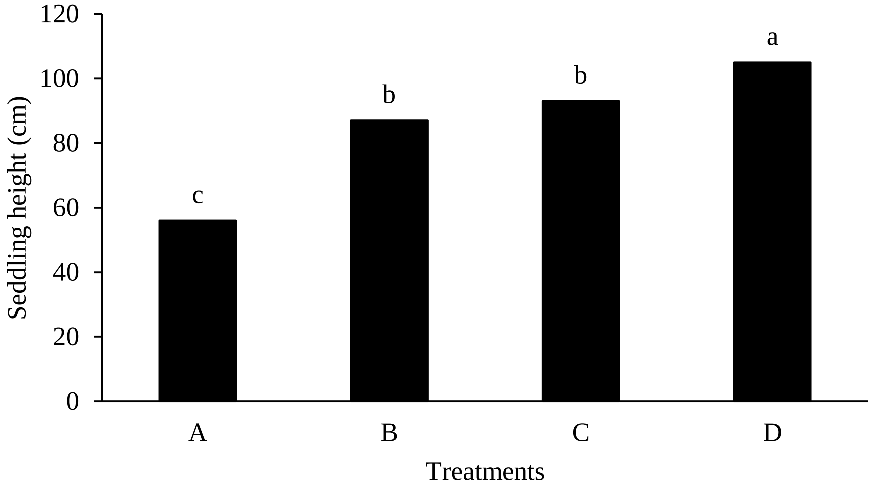

Figure 4. The seedling height of Russian olive at different amounts of pumice. A, B, C, and D represent 0, 10, 20, and 30% pumice, respectively.

Conclusion

This study confirmed that pumice plays an important role in retaining water in the soil. Adding pumice to the soil significantly increased soil water retention, plant height, collar diameter, and leaf area of olive at the 1% probability level. In the control treatment which received no pumice, the soil water content was the lowest during the growing season and by increasing the use of pumice, it showed a significant increase. In the control treatment, seedling height, collar diameter, and leaf area were 56 cm, 6.2 mm, and 108 cm^2, respectively, while 30% pumice significantly

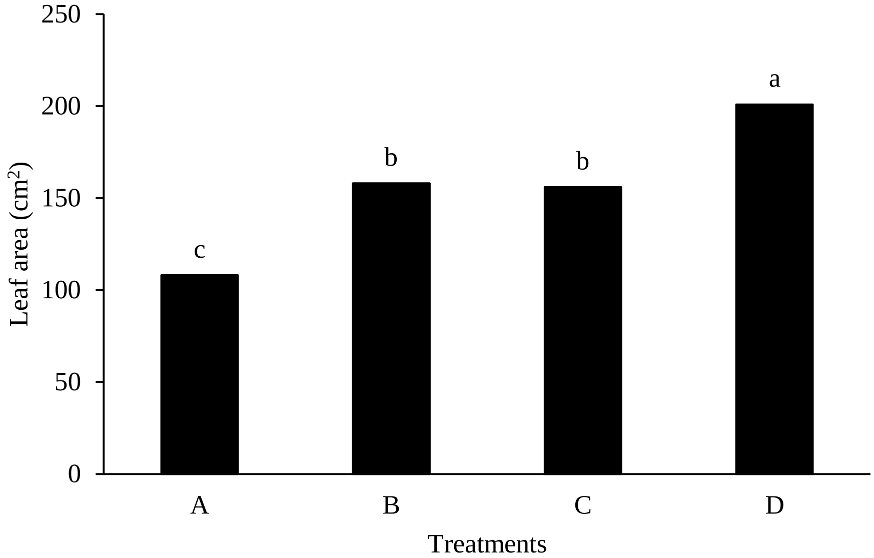

Figure 5. The leaf area of the Russian olive seedlings at different amounts of pumice. A, B, C, and D represent 0, 10, 20, and 30% pumice, respectively.

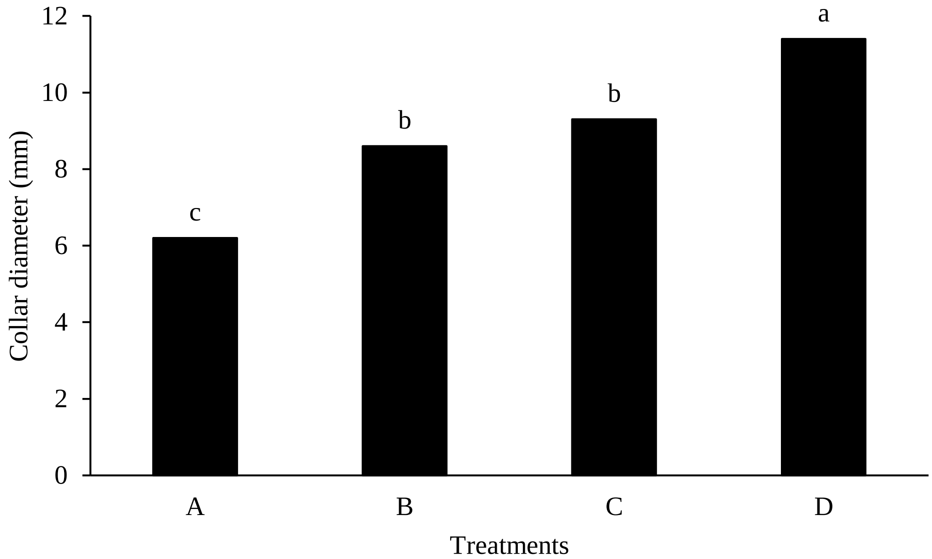

Figure 6. The collar diameter of the Russian olive seedlings at different amounts of pumice. A, B, C, and D represent 0, 10, 20, and 30% pumice, respectively.

increased the same characteristics to 105 cm, 11.4 mm, and 201 cm^2, respectively. Therefore, pumice because of its porous light texture and good water absorption properties, increases porosity, reduces bulk density and crust formation on the soil surface, and provides appropriate physical conditions for root growth. It also prevents water-deficit stress during the growing season by retaining water in the soil. Also, pumice is cost-effective compared to similar materials such as perlite and vermiculite, therefore, its use can be economical on a large scale in the rainfed conditions to promote the growth and development of Russian olive and similar plants. This study was significant because its findings were acquired over two years and in field conditions. Furthermore, it indicated the direction of future research in this field by focusing on the possibility of growing and developing a seedling tolerant to salinity and drought in rainfed conditions and in the presence of a cost-effective superabsorbent.

Conflict of interest

The authors declare that they have no competing financial interests that could have appeared to influence the work reported in this paper.

References

Abedi Koopaee J, Sohrab F. 2004. Evaluating the application of superabsorbent polymers on soil water capacity and potential on three soil textures. Iran J Polym Sci Technol. 17(3): 163-173 (In Persian with English abstract).

Alraddadi S, Assaedi H. 2021. Physical properties of mesoporous scoria and pumice volcanic rocks. J Phys Commun. 5(11): 115018.

Asadiar LS, Rahmani F, Siami A. 2103. Assessment of genetic diversity in the Russian olive (*Elaeagnus angustifolia*) based on ISSR genetic markers. Rev Cienc Agron. 44(2): 310-316.

Bideci ÖS, Bideci A, Gültekin AH, Oymael S, Yildirim H. 2014. Polymer coated pumice aggregates and their properties. Compos B Eng. 67: 239-243.

Chen P, Zhang WA, Luo W, Fang YE. 2004. Synthesis of superabsorbent polymers by irradiation and their applications in agriculture. J Appl Polym Sci. 93: 1748-1755.

Dodd IC, Ryan AC. 2016. Whole-plant physiological responses to water-deficit stress. In: eLS. Chichester: John Wiley & Sons, Ltd.

El-Rehim HAA, Hegazy EA, El-Mohdy HLA. 2004. Radiation synthesis of hydrogels to enhance sandy soils water retention and increase plant performance. J Appl Polym Sci. 93: 1360-1371.

Fernández PL, Behrends Kraemer F, Sabatté L, Guiroy J, Gutierrez Boem F. 2022. Superabsorbent polyacrylamide effects on hydrophysical soil properties and plant biomass in a sandy loam soil. Commun Soil Sci Plant Anal. 53(21): 2892-2906.

Ganji Khorramdel N. 1999. The effect of water superabsorbent (PR 3005 A) on some soil physical properties. MSc Thesis, Faculty of Agriculture, Tarbiat Modarres University, Tehran, Iran (In Persian with English abstract).

Gee GW, Bauder JW. 1979. Particle size analysis by hydrometer: a simplified method for routine textural analysis and a sensitivity test of measured parameters. Soil Sci Soc Am J. 43: 1004-1007.

Hao X, Ball BC, Culley JLB, Carter MR, Parkin GW. 2008. Soil density and porosity. In: Carter MR, Gregorich EG (eds.). Soil sampling and methods of analysis. Boca Raton, USA: CRC Press, Taylor & Francis Group. pp. 743 -759.

Khodadadi Dehkordi D. 2017. Effect of superabsorbent polymer on soil and plants on steep surfaces. Water Environ J. 32(2): 158-163.

Kiseleva TI, and Chindyaeva LN, 2011. Biology of oleaster (Elaeagnus angustifolia L.) at the northeastern limit of its range. Contemporary Problems of Ecology 4: 218-222.

Malekian A, Valizadeh E, Dastoori M, Samadi, Bayat V. 2012. Soil water retention and maize (*Zea mays L*.) growth as affected by different amounts of pumice. Aust J Crop Sci. 6(3): 450-454.
Mignon A, De Belie N, Dubruel P, van Vlierberghe S. 2019. Superabsorbent polymers: a review on the characteristics and applications of synthetic, polysaccharide-based, semi-synthetic and 'smart' derivatives. Eur Polym J.117: 165-178.
Nelson DW, Sommers LE. 1996. Total carbon, organic carbon, and organic matter. In: Page AL, Miller RH, Keeney DR (eds.). Methods of soil analysis, Part 2. Chemical and microbiological properties. Madison, WI: American Society of Agronomy. pp. 961-1010.
Ni B, Liu M, Lu S, Xie L, Zhang X, Wang Y. 2010. Novel slow-release multielement compound fertilizer with hygroscopicity and moisture preservation. Ind Eng Chem Res. 49: 4546-4552.
Orikiriza LJB, Agaba H, Tweheyo M, Eilu G, Kabasa JD, Huttermann A. 2009. Amending soils with hydrogels increases the biomass of nine tree species under nonwater stress conditions. Clean Soil Air Water 37: 615-620.
Pourmeydani A, Khakdaman H. 2005. Effect of superabsorbents on irrigation period of three species of Atriplex, Tehran pine and olive. Iran J For Poplar Res. 13(2): 175-189 (In Persian with English abstract).
Richard LA. 1969. Diagnosis and improvements of saline and alkali soils. Agriculture Handbook, No. 60. WA DC: USDA.
Saboonchian F, Jamei R, Sarghein S. 2014. Phenolic and flavonoid content of *Elaeagnus angustifolia* L. (leaf and flower). Avicenna J Phytomed. 4(4): 231-238.
Sahan Y, Dundar AN, Aydin E, Kilci A, Dulger D, Kaplan FB, Gocmen D, Celik C. 2013. Characteristics of cookies supplemented with oleaster (*Elaeagnus angustifolia* L.) flour: physicochemical, sensorial and textural properties. J Agric Sci. 5(2): 160-168.
Sahin U, Ors S, Ercisli S, Anapali, Esitken A. 2005. Effect of pumice amendment on physical soil properties and strawberry plant growth. J Cent Eur Agric. 6(3): 361-366.
UNESCO, 2022. The United Nations World Water Development Report. Division of Water Sciences, Colombella, Perugia, Italy: UNESCO.
Wang H, Zhang L, Dawes WR, Liu C, 2001. Improving water use efficiency of irrigated crops in the North China Plain – measurements and modeling. Agric Water Manag. 48: 151-167.
Yang L, Yang Y, Chen Z, Guo C, Li S. 2014. Influence of super absorbent polymer on soil water retention, seed germination and plant survivals for rocky slopes eco-engineering. Ecol Eng. 62: 27-32.
Yousefian M, Jafari M, Tavili A, Arzani H, Jafarian Z. 2018. The effects of superabsorbent polymer on *Atriplex lentiformis* growth and soil characteristics under drought stress (Case study: Desert Research Station, Semnan, Iran). J Rangel Sci. 8(1): 65-76.
Zangoee Nasab S, Emami H, Astaraei, Yari A. 2012. Effects of different amounts of super absorbent and irrigation interval on some soil physical properties and Atriplex growth indices. J Water Res Agric. 26(2): 211-223 (In Persian with English abstract).
Zarehaghi D, Neyshabouri MR, Sadeghzadeh Reyhan ME, Hassanpour R. 2015. Effect of pumice on water holding capacity in soil, growth and yield of Safflower in dryland conditions. J Soil Manag Sustain Prod. 5(3): 191-204 (In Persian with English abstract).
Zheng H, Mei P, Wang W, Yin Y, Li H, Zheng M, Ou X, Cui Z. 2023. Effects of super absorbent polymer on crop yield, water productivity and soil properties: A global meta-analysis. Agric Water Manag. 282: 108290.

تأثیر پومیس بر تغییرات رطوبت خاک و ویژگی‌های رشد نهال سنجد در شرایط دیم

رضا حسن‌پور[۱*]، داود زارع‌حقی[۲]، محمدابراهیم صادق‌زاده ریحان[۳] و پاشا قره‌باغی[۴]

۱- بخش تحقیقات خاک و آب، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی آذربایجان شرقی، سازمان تحقیقات، آموزش و ترویج کشاورزی، تبریز

۲- گروه علوم و مهندسی خاک، دانشکده کشاورزی، دانشگاه تبریز، تبریز

۳- بخش تحقیقات حفاظت خاک و آبخیزداری، مرکز تحقیقات و آموزش کشاورزی و منابع طبیعی آذربایجان شرقی، سازمان تحقیقات، آموزش و ترویج کشاورزی، تبریز

۴- سازمان جهاد کشاورزی استان آذربایجان شرقی، تبریز

*مسئول مکاتبه؛ E-mail: reza.hassanp@gmail.com

چکیده

یکی از راهکارهای استفاده بهینه از منابع آب کشاورزی و حفظ آن استفاده از مواد جاذب مانند پومیس در خاک است. پژوهش حاضر با هدف بررسی تأثیر سطوح مختلف پومیس بر مقدار آب خاک و رشد نهال سنجد انجام شد. به این منظور آزمایشی در قالب طرح بلوک‌های کامل تصادفی با چهار تیمار و سه تکرار در سال ۱۳۹۶ تا ۱۳۹۷ در ایستگاه تحقیقاتی خواجه طراحی و اجرا شد. تیمارها شامل شاهد (بدون پومیس) و ۱۰، ۲۰ و ۳۰ درصد پومیس بودند. در طول آزمایش، میانگین رطوبت خاک هر ۱۰ روز یکبار با دستگاه TDR اندازه‌گیری شد. ویژگی‌های رشد نهال سنجد شامل ارتفاع نهال، قطر یقه و سطح برگ اندازه‌گیری شد. کمترین مقدار آب خاک برای تیمار شاهد ثبت شد و سپس با افزایش استفاده از پومیس افزایش معنی‌داری در این صفات مشاهده شد. در تیمار شاهد، ارتفاع نهال، قطر یقه و سطح برگ به ترتیب ۵۶ سانتی‌متر، ۶/۲ میلی‌متر و ۱۰۸ سانتی‌متر مربع بود، در حالی که در تیمار ۳۰ درصد پومیس، همین ویژگی‌ها به ترتیب به ۱۰۵ سانتی‌متر، ۱۱/۴ میلی‌متر و ۲۰۱ سانتی‌متر مربع افزایش یافت. به طوری که با افزایش مقدار پوکه از ۰ به ۳۰ درصد، ارتفاع نهال، قطر یقه و سطح برگ به ترتیب حدود ۸۷، ۸۴ و ۸۶ درصد افزایش یافت. بنابراین، می‌توان گفت که پومیس با حفظ آب خاک در طول فصل رشد به ویژه در شرایط دیم از تنش آبی گیاه جلوگیری کرده و رشد و نمو آن را افزایش می‌دهد.

واژه‌های کلیدی: ابرجاذب، تخلخل خاک، رطوبت خاک، سنجد