



Assessment of the effect of *Piriformospora indica* symbiosis and paclobutrazol application on growth parameters in sweet basil (*Ocimum basilicum* L.) in response to salinity stress

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Abstract

Background and Objectives: Water and soil salinity are the serious and growing problem in the world, a large part of our country is also faced with this problem. Nowadays, application of symbiont microorganisms such as mycorrhiza-like fungi, *P. indica*, is one of the strategies using for improvement of growth and yield in unpleasant environmental conditions such as water and soil salinity. But beside the application of these microorganisms, today the use of materials such as paclobutrazol has also increased, which has the ability to regulate the growth and decrease the negative effects of environmental stresses. The aim of this study is to investigate the effect of these factors on the properties of basil in saline condition as well as compare the efficiency of them.

Materials and Methods: The study was conducted based on randomized complete blocks design with three replications at Sari Agricultural Sciences and Natural Resources University in 2015. Treatments included two levels of coexistence (control and inoculated with the fungus), three levels of paclobutrazol (0, 20 and 40 mg.L⁻¹) and four salinity levels (0, 3, 6 and 9 dS.m⁻¹ NaCl). In this research, we studied leaf, aerial parts and root fresh and dry weight, height, number of leaves, leaf area, root length, leaf relative water content, leaf chlorophyll content, essential oil content and essential oil yield, lipids peroxidation and hydrogen peroxide content, antioxidant enzymes activity including superoxide dismutase (SOD), catalase (CAT) and ascorbate peroxidase (APX).

Results: The findings of this study indicate that inoculation significantly increased leaf, aerial parts and root fresh and dry weight in stress condition. Paclobutrazol application although reduced leaf and plant fresh and dry weight in normal condition, it could improve them in stress condition. Symbiosis also considerably increased height, number of leaves, leaf area, root length, leaf relative water content, leaf chlorophyll content and essential oil content of basil in saline condition, as the most positive effects of fungi was observed at medium and high salinity levels. However, in similar situation paclobutrazol foliar spray had significant effect on only leaf area, root length, leaf relative water content, leaf chlorophyll content and essential oil yield. *P. indica* symbiosis and paclobutrazol application also reduced membrane lipid peroxidation as a result of stress. However, the decrease in fungal treatments was more notable than

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paclobutrazol treatments. Inoculation and paclobutrazol treatments also increased considerably the content of hydrogen peroxide and superoxide dismutase, catalase and ascorbate peroxidase activity under stress.

Conclusion: It seems that, symbiotic relationship of basil with fungi *P. indica* can improve basil growth properties by increase salt tolerance in such condition. Paclobutrazol application is also effective in mitigating the adverse effects of stress, although not as powerful as fungi inoculation.

Keywords: Antioxidant enzymes, Dry matter, Essential oil, Mycorrhiza-like fungi, Paclobutrazol, Salinity



Comparison between toxicity effects of ZnO nanoparticles and their bulk on fenugreek (*Trigonella foenum-graceum*) growth under greenhouse environment

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Abstract

Backgrounds and Objectives: Widespread use of nanoparticles increases their release to the environment. Soil may be a major sink for released nanoparticles to the environment. These nanoparticles interact with ecosystem component specially plants and their symbiosis. Therefore understanding nanoparticles behavior in the soil and plants is essential to restrict potentially toxic effects of nanoparticles. On the other hand, due to metal nanoparticle solubility, their toxicology studies are need to comparative evaluation of their toxicity with non-nanoparticles. The aim of this research was comparison between toxicity of ZnO nanoparticles and their bulk on fenugreek growth under greenhouse condition.

Materials and Methods: Thus we designed an experiment to investigate effect of different zinc oxide nanoparticles concentration (125, 250, 375 and 500 mg/kg) on fenugreek as a nitrogen-fixing plants that form symbiotic relationship with *Sinorhizobium melliloti*. For comparison between nano and bulk, the same concentrations of zinc oxide and bulk nanoparticles were applied. Control treatment for both experiment had neither zinc oxide nanoparticles and their bulk. Both experiments were conducted based on completely randomized design. Contrasts were used for comparison between nano and bulk means.

Results: Results showed that increase in zinc oxide nanoparticles and their bulk had negative effect in rhizobium nodule biomass ($P < 0.05$). Apparently, inhibition effect of zinc oxide nanoparticles on rhizobium nodule biomass was more than zinc oxide bulk ($P < 0.05$). Increase in zinc oxide particles and their bulk increased Zn concentration in the root and shoot and decreased P concentration in the root and shoot ($P < 0.05$). Nano group decreased P concentration in the root more than bulk group ($P < 0.05$). Level of 125 mg/kg zinc oxide nanoparticles increased shoot length, however level of 375 and 500 mg/kg zinc oxide nanoparticles decreased shoot length ($P < 0.05$). Shoot length decreased at all level of zinc oxide bulk compared to control. Root dry weight showed reduction at level 375 and 500 mg/kg zinc oxide nanoparticles and only at level 500 mg/kg zinc oxide bulk. Contrast between nano and bulk showed that there is no significant difference, though Zn concentration in the root was more than Zn concentration in the shoot. Shoot dry weight decreased at level up to 250 mg/kg zinc oxide nanoparticles and at all level of zinc oxide bulk. Shoot dry weight at nano group was more than that of bulk group, and Zn concentration of shoot at bulk group was more than that of nano group.

Conclusion: In summary, the phytotoxicity of zinc oxide particles was similar in the nano and bulk forms, but we find more toxicity of zinc oxide nano particles than their bulk for rhizobium nodules in the fenugreek plant and P concentration in the root, and this increase concerns about effects nanoparticles in agricultural ecosystems.

Keywords: Biomass, Nanotoxicity, Rhizobium nodule, Phytotoxicity

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Effect of different treatments of plant essential oils and silver nanoparticles on vase life of gerbera cut flower cv. Pink Power

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Abstract

Background and Objectives: Gerbera is one of the most important cut flowers in floriculture industry and has high economic value. One of the main problems in gerbera export is postharvest losses and short vase life due to the water relations disruption by the increasing of microbial population in preservative solution. During last decades awareness increased among people regarding side effect of chemicals used in agriculture and several research has been conducted to find alternative methods or materials to preserve product quality or prolong vase life. In this research, effect of different treatments of plant essential oils and silver nanoparticles was investigated on vase life of gerbera cut flower cv. Pink Power.

Materials and Methods: In this study the effect of essential oils of ajowan, lavender and eucalyptus with two concentrations (15 and 30 $\mu\text{L L}^{-1}$) and silver nanoparticles with two concentrations (40 and 80 $\mu\text{L L}^{-1}$) on vase solution uptake, membrane stability index of stem and petals, petals wilting percentage, microbial population at the end of stem and vase life of cut gerbera cv. Pink Power were investigated. A factorial experiment (the first factor was treatments and the second factor was sampling time) was conducted in a completely randomized design (CRD) with three replications and four flowers in each replication.

Results: The different treatments of plant essential oils and silver nanoparticles had not sensible effect on some of traits such as relative fresh weights of cut flowers, the changes of stem diameter in the below of flower head and end of stem and petals ion leakage. Conversely, some of traits such as the vase solution uptake, membrane stability index, stem ion leakage, microbial population at the stem end, petal wilting percentage and vase life were affected significantly. Essential oil of ajowan (15 $\mu\text{L L}^{-1}$) increased vase solution uptake and reduced microbial population, ion leakage petal, wilting percentage and, consequently, increased the vase life of gerbera. The highest vase life (11 days) was related to 15 $\mu\text{L L}^{-1}$ ajowan treatment, although there was no significant difference with compared to silver nanoparticles

Conclusion: In general, essential oil of ajowan and silver nanoparticles used in this study were able to improve the vase life of gerbera cut flowers. But, due the superiority of some measured traits of gerbera cut flowers treated with essential oil of ajowan compared to silver nanoparticles and harmful environmental effects of silver nanoparticles, can be recommended the ajowan essential oil with 15 $\mu\text{L L}^{-1}$ concentration be used for increasing the vase life of gerbera. However, since gerbera plants are highly heterozygous, further researches on other cultivars with different concentrations may be suggested.

Keywords: Essential oils, Microbial population, Gerbera, Membrane stability index, Vase life

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The study on the effect of biological and chemical fertilizers and humic acid on the growth, physiological characteristics and essential oil content of catnip (*Nepeta cataria* L.)

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Abstract

Background and Objectives: In sustainable agriculture, biological fertilizers are an alternative to chemical fertilizers that they can improve the quality and quantity of medicinal plants. Biological fertilizers are consisting of useful bacteria and fungus that each one is produced for a special purpose, for example nitrogen fixation, releasing phosphate and potassium nutrients from their insoluble compounds. These bacteria are usually existed around the roots and help plant to uptake nutrients. In addition, they can be useful to the plants to uptake other nutrients, decrease diseases, improve soil structure and consequently stimulate more plant growth and increase quantitative and qualitative yield. This research was conducted to study the effects of biological and chemical fertilizers and humic acid on growth and physiological parameters of catnip (*Nepeta cataria* L.).

Materials and Methods: A factorial layout based on randomized complete blocks design (RCBD) with and three replications was conducted at experimental farm of Shahid Chamran University of Ahvaz. The first factor was included five fertilizer (included nitrogen-fixing biofertilizer (*Azotobacter vinelandii*), Phosphate solubilizing biofertilizer (*Pseudomonas putida* and *Pantoea agglomerans*), NF+ PS, chemical fertilizer), control and the second factor was two humic acid levels (such as 0 and 20 kg.ha⁻¹). Growth parameters (such as plant height, leaf number and leaf area index, fresh and dry weights of aerial parts), photosynthetic pigments (chlorophyll a, b, total, carotenoid) and gas exchanges (net photosynthesis rate, quantum yield, transpiration rate, water use efficiency) were measured at beginning of flowering stage. The plants were harvested at full bloom stage and essential oil extraction was carried out with hydro-distillation method.

Results: The results showed that application of biological and chemical fertilizers had significant effects on the measured traits of catnip. The highest fresh and dry weights of aerial parts (203.33 and 37.44 g.plant⁻¹, respectively) and plant height (44.08 cm) were belonged to combination of biological fertilizers. The lowest above traits were observed in control. Humic acid had not significant effect on the most measured traits except leaf area index and fresh weight of aerial parts. The amounts of photosynthetic pigments and gas exchanges were also affected by fertilizer treatments. The results showed that application of combination of NF and PS had significant effect on chlorophyll a, chlorophyll b, total chlorophyll, carotenoid, net photosynthesis rate; water use efficiency and light use efficiency parameters of catnip but those

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had not significant difference with chemical fertilizer. The highest essential oil content was observed in PS treatment (1.30%) that it had not significant difference with chemical fertilizer (1.22%) and combination of biological fertilizers treatments (1.18%).

Conclusion: According to non-significant difference between chemical fertilizer and combination of biological fertilizers treatments in dry weight of aerial parts and essential oil content, an alternative combination of biological fertilizer NF and PS instead of chemical fertilizers is recommended.

Keywords: Catnip, Chlorophyll, Essential oil, Leaf area index, Photosynthesis



Studying the response of seed germination of neglected plant arugula (*Eruca sativa* Mill.) to some environmental factors

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Abstract

Background and Objectives: Arugula (*Eruca sativa* Mill.) is an annual plant of Brassicaceae family, that grows in a wide areas of Iran from Sistan and Baluchistan in southeast to coast of the Caspian Sea in north. This plant is known as a weed in some regions. However, it has attracted attentions in recent years due to various medicinal and forage uses, as well as having valuable traits such as high vegetative growth, high growth rate, excellent resistance to the biotic and abiotic stresses and high genetic diversity. Considering the importance of the successful germination and seedling establishment the survival of plants and also to achieve the optimal plant density of crops and the effect of environmental factors on it, this experiment was conducted to investigate the effect of environmental factors such as temperature, water potential, salinity, pH and planting depth on the germination and emergence in arugula.

Materials and Methods: All experiments were conducted in randomized completely design with four replications. Initial germination test revealed no dormancy of gathered seeds. In order to study the effects of temperature on germination percentage and rate, seeds were placed in cold incubators with temperatures of 2.5, 5, 10, 15, 20, 25, 30, 35, 38 and 40 °C. The effect of water potential (0, -0.2, -0.4, -0.6, -0.8, -1, -1.2, -1.6 and -1.8 MPa), salinity (0, 50, 150, 200, 250, 300, 350 and 400 Mm) and pH (3, 4, 5, 6, 7, 8 and 9) on seed germination were conducted under optimal temperature and effect of planting depth (1, 2, 3, 5 and 7 cm) on seedling emergence was carried out in a greenhouse condition.

Results and Discussion: Arugula seed germination occurred in a wide range of temperatures. Optimum temperatures for arugula seed germination were estimated 30.55 °C. Arugula showed a high tolerance to drought and salinity stresses. Drought and salinity stresses that reduces the germination of this plant to 50% were -13.36 MPa and 267.53 Mm, respectively. The maximum germination percentage (98%) was observed in pH 7 and any increase or decrease in pH resulted in decrease in germination percentage and rate. The highest emergence percentage (95%) were observed at a depth of 2 cm and further increase in seeding depth caused a decrease in emergence percentage.

Conclusions: In general, results of this study showed germination and emergence of winter rapeseed affected to different levels of temperature, water potential, salinity, acidity and placed planting depth. And these parameters can be used to predict the time to germination or emergence of arugula in normal conditions.

Keywords: Brassicaceae, Depth of planting, Drought, Emergence, Germination, pH, Salinity

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Study the effect of region on fruit fatty acids of four olive cultivars in Lorestan province

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Abstract

Background and Objectives: Olive (*Olea europaea* L.) belongs to the Oleaceae family and is an evergreen tree. The olive oil has been an important source of nutrition and medicine for centuries. Olive oil is of highly important due to presence of significant amount of mono-unsaturated fatty acid namely Oleic acid and natural antioxidants. On the other hand, natural antioxidants, Phenolic compositions, tocopherol and carotene contribute to oil resistance against oxidation. Different geographical regions with different natural conditions have been different effects on growth of plants and climate conditions can be affected synthesis of chemical matter or secondary metabolites in plants. Therefore, in this study, fatty acids of olive fruit cultivars in three regions of the Lorestan province were investigated by Gas Chromatography (GC).

Materials and Methods: This research was conducted in factorial test in based on completely randomized design with two factors: factor A included four cultivars of olive (Konservolia, Sevillana, Manzanilla and Rowghani) and factor B was three different regions of Lorestan province (including Kouhdasht, Khorramabad and Veysian) that were studied in four replication and each replication include three trees. In this study, fruit fatty acids of four olive cultivars were identified using GC. Then part of samples in standard plastic baskets as soon as possible to the laboratory for fatty acids analysis based on Primomo et al. (2002) method. Analysis of variance and mean comparison of traits was performed with Duncan test ($P < 0.05$), cluster analysis with Wards method. Also, principal component analysis was performed with Minitab software.

Results: Among the olive cultivars studied in different regions, the highest coefficient of variation was 45.88 and 33.63 percent for Gadoleic acid and Arachidic acid, respectively. Mean comparison showed that oleic acid in the studied regions had the highest value relative to other fatty acids and the highest values in the Kouhdasht, Veysian and then Khorramabad regions. Linoleic acid, Stearic acid, Palmitic acid and Palmitoleic acid in Khorramabad regions had a highest value relative to other fatty acids in the studied regions that no significant difference with other regions. The Rowghani cultivar in the Kouhdasht had a highest oleic acid (77.20 percent). In aspect Oleic acid, Manzanilla and Sevillana cultivars hadn't different with together. Correlation coefficients of fatty acids showed that the Oleic acid, had the most significant negative correlation with Linoleic acid (-0.819), palmitic acid (-0.791) and Gadoleic acid (-0.772), respectively. Cluster analysis of fatty acids distinguished two groups in 11.16 distances. Distribution diagram cultivars in different regions of the first and second components showed that the distributions of samples on the basis of two main components were consistent with cluster analysis, that samples together with the type and content of fatty acids were similar.

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Conclusions: The results showed that the quantity and quality of fatty acids in olive cultivars influenced by environmental factors and fatty acid values for each cultivar in each region were different. Finally, among the olive cultivars studied in different regions, the Sevillana in Khorramabad in terms of Linoleic acid, Palmitoleic acid and Myristic acid, the Manzanilla in Veysian in terms of Arachidic acid and Linolenic acid and the Konservolia in Kouhdasht in terms of Gadoleic acid, Stearic acid and Palmitic acid and finally the Rowghani cultivars in the Kouhdasht region in terms of Oleic acid had a highest values. Rowghani cultivar in Kouhdasht region had a highest quantity and quality of oil and fatty acid in this research, therefore it can be recommended as ideal cultivar.

Keywords: Oleic acid, Rowghani cultivar, Sevillana cultivar, Environmental conditions



The effect of five rootstocks on physical, mechanical and chemical characteristics of Yashar fruits -a new mandarin- during ripening stages

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Abstract

Background and Objectives: According to a breeding program (1989-2009) carry out in Citrus and Subtropical Fruits Research Center of Iran, Yashar mandarin was created from crossing between Minneola tangelo and Changsha mandarins. Based on previous investigations, we found that Yashar might be a late ripening variety on Sour orange. The quality of this new variety on different commercial rootstocks did not study yet, completely. Therefore, the aim of this study was to investigate the Yashar physico-chemical and mechanical characteristics on five commercial rootstocks during two years.

Materials and Methods: In this study, the effect of five rootstock (Sour orange, Poncirus, Citromelo, Citrange and Flying dragon) on Yashar fruit quality investigated for two years during ripening. Yashar fruit was sampled at last January to early of March period every two weeks (4 times). Various physico-chemical and mechanical characteristics evaluated including fruit length, width, thickness; arithmetic, geometric, equivalent and harmonic means; fruit aspect ratio, sphericity, surface area, true volume, apparent volume, volume error, density, peel and pulp firmness, peel thickness, weight, juice percentage, seed number, peel color indices (L^* , a^* , b^* , hue angle, chroma and CCI), total soluble solid (TSS), titratable acidity (TA), technological index (TI), pH, electrical conductivity (EC), total phenol, ascorbic acid and antioxidant capacity during experiment.

Results: The results showed that fruit length, width and thickness of Yashar had not significantly differences on five rootstock. Although fruit density showed an increasing trend during the harvest time but Yashar fruit density on Sour orange was lower than other rootstocks. Arithmetic and geometric means of fruits on all rootstocks were closer to equivalent mean as a really diameter. Variables such aspect ratio, sphericity (1.16), surface area, true volume and apparent volume were higher on Flying dragon than other rootstocks ($P < 0.05$). The fruit volume error was more negative (-13.22%) on Sour orange than other four rootstock. The peel and pulp firmness of fruits grown on Sour orange was higher with 9.28 and 5.29 N respectively. Yashar on Flying dragon produced difficult peeling fruit with more seed content. Yashar with juice percentage content about 50, had also the higher technological index. Based on CCI, fruits on all five rootstocks were not necessary to de-greening at harvest time. According to TSS:TA, Yashar fruit on Sour orange, Citrange and Poncirus can harvested in mid-February (6.92), half of March with 7.22 and 7.1, respectively. Antioxidant and bioactive compounds (phenol and ascorbic acid) of Yashar were increasing during ripening.

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Conclusion: Generally, in cold-risk areas such as northern of Iran, commercial widespread of Yashar not recommended on all five rootstocks. Based on juice percentage and TI data, the amount of juice with about 50% was higher than other citrus varieties. Aspect ratio of Yashar on Flying dragon was high ($P < 0.05$) that sphericity confirms it with 16.1 value. Although, the more negative volume error on Sour orange showed that this rootstock produced fruits with empty space inside the fruit skin and flesh, but peel and pulp resistance was higher on Sour orange. Moreover, Yashar had higher levels of antioxidant compounds than other varieties that reveals high nutritional value of this mandarin. Totally, citrus growers can be uses Sour orange rootstock in the western and Citrange rootstock in the eastern areas of the north of Iran.

Keywords: Harvesting time, Mandarin, Rootstock, Yashar



Effect of olive mill pomace compost on yield, oil percentage and the leaf elements content in two olive cvs Zard and Roughany

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Abstract

Background and Objectives: The use of olive mill solid waste to form of compost in olive groves, in addition to helping dispose of this by-product of the olive oil industry, also can recycle nutrients that out of the garden during the fruit harvest. The aim of this study was to replace this compost with manure of animal at the olive groves as an organic fertilizer, improvement on the nutritional status of olive trees, fruit quality, fruit yield and oil.

Materials and Methods: Olive mill waste solid was mixed with 10% wheat straw (W/W) and two percent urea. The composting process was completed after three months. 12, 24 and 36 kg olive pomace compost was given per tree. Control trees don't receive compost (first control) or 15 kg of manure (second control) instead of compost. The fruit yield, oil yield, fruit quality characteristics and leaf mineral elements content of Zard and Roughany olive cultivars were evaluated in compost treated and control over two years.

Results: The most both fruit and oil yield in the first and second year after treatment belonged to the 12 and 36 kg compost treatment in Zard cultivar that in the second year, fruit and oil yield were respectively 58 and 57 percent more than the first control in the same cultivar. In the first year, the highest oil percentage in the dry matter, belongs to the second control in the Roughany cultivar. While, two years after treatment, the trees that treated with 24 and 36 kg of compost in the Roughany cultivar had about 10 percentage of oil in dry matter more than the trees that treated with manure in the same cultivar. Fruit weight, pit weight and fruit pulp percentage in Zard cultivar was higher than Roughany cultivar over two years. In the second year after treatment, the trees that treated with 36 kg of compost in Zard cultivar had the highest fruit weight and also pulp weight and pulp to pit ratio was more than the manure treatment in the same cultivar. The highest nitrogen, in the first year after the treatment belonged to Roughany cultivar, with 24 kg compost, that was more 26 percent than the first control in the same cultivar. In the second year after treatment belonged to Roughany cultivar, with 24 kg compost, that was more 26 percent than the first control in the same cultivar. Two years after treatment, the trees were treated with 36 kg of compost had 10 percent more phosphorus than the first control. Also in this year, the Zard cultivar had nine percent more potassium than the Roughany cultivar. In the first year, Zard cultivar had more calcium and magnesium and less phosphorus and sodium than the Roughany cultivar, respectively. In the second year after treatment, calcium and magnesium in the trees that treated with 24 and 36 kg compost was at the highest level statistically. The ratio of sodium to potassium in the first and second year, in the Zard cultivar was less than Roughany cultivar.

Conclusion: It seems olive trees that fertilized with olive mill pomace compost especially with 36 kg could improve nutrition status of olive tree such as leaf N, P, Ca and Mg in leaves and consequently improve fruit and oil yield and fruit quality especially in Zard cultivar.

Keywords: Composting, Fruit quality, Oil content, Yield

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“Short Technical Report”

**A study on the development and growth of agricultural sciences
in Islamic civilization; botany and medicinal plants**

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Abstract

The historical evidences have shown that farming was the most important job in ancient civilization. With the advent of Islam, the role of Muslims in the development and expansion of agriculture was as clear as their role in other sciences. Many Muslim scholars have devoted themselves to research and compilation in the field of agriculture and have contributed greatly to the development of this knowledge in its time to this day. Agricultural science is one of the botanical sciences from the earliest knowledge that it has become common among Muslims. They had a remarkable share in the familiarity of Europeans with some types of trees and plants. So the name of some of these trees and fruits in Europe still calls the oriental principle. Muslims also played a major role in the development of pharmacy. Because they had a lot of information about the recognition of medicinal plants and considered as one of the branches of medical science. Iranians have a significant share in the modern civilization of the world, in the invention of tools and gadgets, and the supply of water and goods. They had long been specialized in the construction of aqueduct and they have written many books on how to extract groundwater and an aqueduct. In the Umayyad era, the issue of irrigation and control of current waters for the scholars of that period was very significant. Historical evidence shows that Muslims have been struggling to teach botany and book compilation. They initiated the translation of Dsvvrids and Galenus and Hindi books and then paid to research and compilation of the work in this field. For example, Mohammad bin Zakaria Razi had a deep study in her work on medicinal herbs, but also about pharmacology, as she introduces about 630 herbs in her 21st section of her book. In this paper, it has been tried to describe the impact of Islamic scholars on the dynamics of agricultural sciences, researches and innovations of Muslims in the field of botany and medicinal herbs in a descriptive and analytical way.

Keywords: Islamic civilization, Agriculture sciences, Botany

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“Short Technical Report”

**Study of seed storability and seed physiological quality of
two ecotypes of sage (*Salvia officinalis*) using accelerated ageing test**

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Abstract

Background and Objectives: Sage is a medicinal plant belonging to Lamiaceae family. Farmers propagate this plant by seed. There is no sufficient information about seed storability and suitable vigor test for sage. Therefore, current research was carried out to find storability potential and probability of using accelerated aging test in predicting field seedling emergence.

Materials and Methods: Experiment was carried out in base of completely randomized design with three replications, in 2016, at agronomy laboratory of Lorestan University, Iran. Factors were sage ecotypes (Hamedan and Esfahan) and accelerated ageing (40±2 °C and RH=100%) duration (0, 24, 48, 72 and 96 hour). Germination percentage, speed of germination, root length, shoot height, percent of abnormal seedling, speed of seedling emergence, seed vigor, electrical conductivity and K and Ca leakage were measured.

Results: Accelerated aging and ecotype affected all of studied traits. Interaction of accelerated ageing duration and ecotype was significant on percentage of abnormal seedling. In both ecotypes, germination rate and speed were decreased by increasing in accelerated ageing duration; however this decrease was more for Hamedan ecotype than Esfahan ecotype. Accelerated ageing increased K and Ca leakage and electrical conductivity. Ageing induced EC was more in Hamedan ecotype than Esfahan ecotype.

Conclusion: In general, seed of Esfahan ecotype had more storability potential than Hamedan ecotype. T test results showed that result of standard germination test is different with rate of seedling emergence in the soil. Therefore standard germination test is not a good indicator for seedling emergence in farm. Result of this research suggested applying 24 and 48 accelerated ageing before standard germination test for Hamedan and Esfahan ecotypes, respectively.

Keywords: Seed deterioration, Seed vigor, Seed storage, Seed quality

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