



Developing a Practical Mathematic Model, to Estimate Strength and Factor of Safety of Embowed Crown Trees, Against Wind Force

J. Baradaran Motie^{1*} - M. Shakeri²

Received: 29-3-2009

Accepted: 26-6-2012

Abstract

Conditional monitoring is prerequisite to prevent severe damage or falling down the trees. Problems such as trunk decays, reduces trees resistance against wind and floods. In this study, a mathematical modeling technique is being selected to determine the trees strength against such events. Finally, an applicable model for safety factor was created By having numeral (dimensions of crown and trunk, crown density, crown volume, section diameter, internal cavity diameter etc.) and mechanical (modulus of elasticity of wood, allowable stress, maximum wind speed, crown and trunk weight) parameters of tree. By using this model we may estimate the total maximum stress in critical plane of the trunk. Comparing allowable stress of trunk wood leads us to calculate the safety factor of the tree. The results indicated that the total maximum stress in trunk increases exponentially after the diameter of internal cavity exceeds 40 percent of trunk in critical plane.

Keywords: Trunk strength, Crown density, Wind speed, Factor of safety, Mathematic model

1,2- PhD Student and Lecture, Department of Agricultural Machinery, Faculty of Agriculture, Ferdowsi University of Mashhad

(* - Corresponding Author Email: Jalal_jbm@yahoo.com)

Effect of Biological Fertilizers of Biosulfur, Nitroxin and Super Absorbent Polymer on Growth, Yield and Essential Oil Content of Sweet Basil (*Ocimum basilicum* L.)

R. Shahhoseini^{1*} - R. Omidbaigi² - D. Kiani³

Received: 14-7-2010

Accepted: 22-4-2012

Abstract

Sweet Basil (*Ocimum basilicum* L.) is one of the most popular medicinal plants that containing essential oil. Essential oil of this plant has been utilized extensively in the food, pharmaceutical and cosmetics industries. In this study, a pot experiment was conducted to evaluate the effect of biological fertilizers of biosulfur, nitroxin and super absorbent polymer and their interactions on the growth and essential oil content of sweet basil (*Ocimum basilicum* L.) in the randomized complete block design (RCBD). Aerial parts of plants were harvested at full bloom and evaluated their yield index. All material were air-dried in the shade and subjected to hydrodistillation by Clevenger type apparatus. The results of this study showed that there was a significant difference among the treatments in terms of dry herbage weight at 1% level. The highest yield was obtained in (biosulfur+nitroxin+super absorbent). There was no significant difference in essential oil content according to v/w, but there was the significant difference between treatments in terms of w/w. The highest oil content (w/w) was observed in biosulfur+nitroxin treatment. These differences are probably due to variation in the constituents and specific gravity of the oils.

Keywords: Medicinal plant, Sweet basil, Biological fertilizers, Super absorbent, Yield, Essential oil

1,2- MSc Student and Professor, Department of Horticultural Science, Tarbiat Modares University

(* - Corresponding Author Email: Reza.Shahhoseini@gmail.com)

3- MSc Student, Department of Agronomy and Plant Breeding, Tarbiat Modares University

The Effects of Cultivar, Foliar Fertilization and Plant Density on Quantitative and Qualitative Traits and Vase Life of Cut of Lilium

M. Sadeghi Chrori^{1*} - A. Golchin² - S.N. Mortazavi³

Received: 16-8-2010

Accepted: 26-6-2012

Abstract

In order to study the effects of cultivar, foliar fertilization and plant density on quantitative and qualitative traits and vase life of cut lilium a split plot factorial experiment with three replications was carried out. Foliar fertilization as the first factor included different concentrations of a complete fertilizer (Foster fertilizer + Ammonium nitrate) and had four levels (0, 2000, 4000 and 6000 ppm) and was located in main plots. Cultivar and plant density each had two levels and factorial combinations of them were located in sub-plots. Cultivars used in this study were Arcolano and Coca and were planted with densities of (20×15 and 30×25 cm). At the end of growth period, traits such as bulb weight, plant height, chlorophyll content of leaf, vase life of cut flower, number of flower per plant and Macro- and micro nutrients contents of leaf were measured. The result of analysis of variance showed that the effects of foliar fertilization were significant on plant height, vase life of cut flower and N, P and K contents of leaf. Foliar fertilization of lilium with concentration of 4000 ppm created the highest vase life of cut flower. The effects of cultivar were significant on all measured traits except on vase life of cut flower and P and Zn contents of leaf. The Arcolano cultivar was superior to Coca cultivar in respects to the measured traits. The effects of plant density were significant only on K and Fe contents of leaf. But plant density of 30×25 had higher bulb and flower yield and quality. The results of this study indicate that for increasing yield and quality of cut lilium planting of Arcolano cultivar, with density of 30×25 cm and foliar fertilization of lilium plant with a complete fertilizer (Foster fertilizer + Ammonium nitrate) with concentration of 4000 ppm is recommended.

Keywords: Cultivars, Plant density, Foliar fertilization, Lilium

1- Former MSc Student of Horticulture Science Department, Islamic Azad University of Abhar Branch

2- Professor of Soil Science Department, Collage of Agriculture, Zanjan University

(*-Corresponding Author Email: agolchin2011@yahoo.com)

3- Assistant Professor of Horticulture Science Department, Collage of Agriculture, Zanjan University

Assessment of Genetic Variation of *Punica granatum* L. Genotypes from Seven Regions of Iran Using AFLP Markers

Z. Nemati^{1*} - A. Tehranifar² - M. Farsi³ - A. Mirshamsi Kakhki⁴ - S.H. Nemati⁵

Received: 13-9-2011

Accepted: 22-5-2012

Abstract

Pomegranate (*Punica granatum* L. that one Punicaceae) is one of the important economical and commercial horticultural plants cultivated in arid and semiarid parts of Iran. Also, due to the long history of pomegranate cultivation in Iran, genotypes from different regions with obvious similarities in appearance but with different names can be observed. Thus, the precise discrimination between genotypes is essential for effective management for future pomegranate breeding programs. In this study, AFLP markers based on seven primer combinations (*EcoRI/TruII*) were used to evaluate genetic variation and Phylogenetic relationship among 31 different genotypes of native pomegranate belonging to seven of Iran provinces. According to the cluster analysis, a relatively low genetic diversity was observed across the genotypes studied. Also, the results showed that the clustering of the cultivars didn't concerne to morphological traits. The derived dendrogram proved that genotypes are clustered independently from their geographical origin and their denomination. Heterozygosity index, Principal co-ordinates analysis (PCoA), Gst Index and analysis of molecular variance (AMOVA) revealed noticeable similarity among studied populations and observed variation within populations was very low and near zero. The high level of morphological traits diversity in Iranian pomegranate and low level of polymorphism in genome organization of these genotypes determined by AFLP markers may be related to the somatic propagation and also type of pomegranate pollination.

Keywords: Pomegranate, AFLP, Genetic Variation, Genotype

1,2,5- MSc Student, Associate Professor and Assistant Professor, Department Horticultural Science, Faculty of Agriculture, Ferdowsi University of Mashhad, Respectively

(* - Corresponding Author Email: zahra_nemati@ymail.com)

3,4- Professor and Assistant Professor, Department of Biotechnology, Faculty of Agriculture, Ferdowsi University of Mashhad



The Effect of Mulch on Weed Dry Weight and Soil Humidity and Temperature in Pepino (*Solanum muricatum*)

E. Mirabi^{1*} - S.H. Nemati² - Gh. Davarynejad³ - H. Aroice⁴

Received: 19-9-2010

Accepted: 1-7-2012

Abstract

Pepino (*Solanum muricatum*), a new vegetable crops, is from *Solanaceae* family and cultivated as annual crops. In order to investigate the effects of mulch on weed dry weight in pepino and soil humidity and temperature, an experiment was conducted based on randomized completely design with three replication at the Ferdowsi University of Mashhad green house, during 2009. Treatments included rice straw mulch, wood chips mulch and control. sampling was recorded at four stages. The result indicated that the effect of mulch was significant ($P<0.01$) on weed dry weights. The highest and the lowest of weed dry weight were achieved in control and woody chips, respectively. mulching caused decrease of soil temperature and increase of soil humidity and also decrease of weeds. Wood chips successfully decreased soil temperature and increased soil humidity compared to rice straw mulch and control.

Keywords: Pepino, Wood chips mulch, Rice straw mulch, Weeds

1,2,3,4- MSc Student, Assistant Professor, Associate Professor and Assistant Professor, Department of Horticulture Science, College of Agriculture, Ferdowsi University of Mashhad, Respectively

Study of Rooting, Quantitative and Anatomical Traits on Two Coleus Spices in High Level Carbon Dioxide

M. Shoor^{1*} - M. Behzadi² - M. Goldani³

Received: 28-9-2010

Accepted: 26-6-2012

Abstract

Carbon dioxide (CO₂) concentration of the global atmosphere has increased during the last decades. Increasing global atmospheric CO₂ concentrations are expected to influence on plants. Coleus is an ornamental plants, that is due to its attractive foliage are considered. In order to evolution of high CO₂ concentration effects on rooting, morphological and anatomical traits in two coleus spices (*C. scutellarioides* and *C. blumei*) a factorial experiment based on completely randomized design with 3 replications and 6 treatments were conducted at the greenhouses of Ferdowsi University of Mashhad at 2010. Treatments were two coleus spices and 3 concentration, of CO₂ 380(as a control), 700 and 1050 ppm. Leaf cuttings plants were placed under increasing CO₂ concentration during of 30 days. The number of leaves, stem diameter wet weigh, dry weight, length of stoma, width of stoma, size of stoma and stomatal density were measured. Results indicated that increasing CO₂ concentration from 380 to 1050 ppm leading to increase of 25.3, 32.4, 20.5 and 75 percentage in number of leaves, stem diameter, wet weigh and dry weight respectively. Also these results showed that with increase of CO₂ concentration decreased length of stoma, width of stoma and size of stoma, but increased of stomatal density. The highest mean density of stomatal to 30.7 per mm², which was related to the interaction of carbon dioxide concentration of 1050 ppm and *C. is scutellarioides* than other treatments showed significant differences.

Keywords: Carbon dioxide, Coleus, Rooting

1,2- Assistant Professor and MSc Student, Department of Horticulture Science, Faculty of Agriculture, Ferdowsi University of Mashhad

(*-Corresponding Author Email: shoor@ferdowsi.um.ac.ir)

3- Assistant Professor, Department of Agronomy and Plant Breeding, Faculty of Agriculture, Ferdowsi University of Mashhad

The Effect of Naphtalene Acetic Acid, Potassium Sulfate and Zinc Sulfate on Quantitative and Qualitative Characteristics of Clemantine Tangerine

H. Alinezhad Jahromi^{1*} - E. Shirani² - M. Mirzayi³ - J. Heydari⁴

Received: 19-10-2010

Accepted: 26-6-2012

Abstract

The Clemantine tangerine is one of the early cultivars of citrus which relatively wide of citrus orchards in the world and Iran has allocated to itself. This research is to find the effect of Naphtalene Acetic Acid (zero, 100 and 200 mg/l), Potassium sulfate (zero, 10 and 20 g/l), and Zinc sulfate (zero, 2 and 4 g/ l) on quantitative and qualitative characteristics fruit as factorial design randomized complete block with three replications and in the assembly of 27 treatments on 8 years old Clemantine tangerine trees stocked by lemon. Dispersing occurred on 1 July when the fruits have 15 mm diameters. The results showed the most amount of size, weight, water ratio and vitamin C can be seen in trees which were treated by 200 mg/l of NAA, 20 g/l potassium sulfate and 4 g/l zinc sulfate and there is a significant difference to control case, The most amount of total acid was found in the same treatment, but there was insignificant difference to control. Most stiffness was related to treatment of 4 g zinc and 20 grams of potassium per liter was also used and minimal stiffness related to treatment 200 mg /l NAA. There was the lowest soluble solids related to treatment of 200 mg/l NAA and highest value in the treatment 100 mg/l NAA, 20 g/l potassium sulphate and 2 g/l of zinc sulfate that was also used.

Keywords: Potassium sulfate, Zinc sulfate, Naphtalene Acetic Acid, Clemantine tangerine, Quantitative and Qualitative characteristics

1,2-Former MSc Student and MSc Student, Department of Horticultural Science, College of Agriculture, Shahrekord University

(* - Corresponding Author Email: h.alinezhad66@gmail.com)

3- Former BSc Student, Department of Plant Products, College of Agriculture Darab

4- Former MSc Student, Department of Soil Science, College of Agriculture, Shahrekord University

The Effects of Different Selenium Concentrations on some Morpho-physiological Characteristics of Spinach (*Spinacia oleracea* L.)

A. Saffar Yazdi^{1*}- M. Lahouti²- A. Ganjeali³

Received: 6-3-2011

Accepted: 22-5-2012

Abstract

Selenium is a metalloid that its antioxidant characteristics is proved for humans, animals and plants. However, some plants are known as hyper accumulators for selenium and sometimes seems to be useful for growth of some plants. In this paper, we have studied the effect of different selenium concentrations on growth and morpho-physiological characteristics of spinach. Seeds of spinach were germinated in germinator and seedlings were transferred to hydroponic cultures. The seedlings were grown in Hogland's solution with different selenium concentrations (in form of sodium selenite) of 0,1,2,4,6, and 10 mgL⁻¹ SeO₃⁻². The experiment was conducted based on a completely randomized design with four replications. Four weeks after treatments, morphophysiological characteristics including plant biomass, length of shoot and root, number of leaves, amount of chlorophyll a and b were measured. The results showed that application of different selenium concentrations had significant effect on morphological and physiological characteristics of root and shoot consisting wet and dry weight, root and shoot length and amount of chlorophyll. In this experiment, increasing selenium concentrations (except in 1 mgL⁻¹ SeO₃⁻² concentration) decreased amounts of all mentioned characters in comparison with control. Morphological symptoms of selenium toxicity on spinach was chlorosis on young leaves and significant reduction in root and shoot growth.

Keywords: Hydroponic cultures, Selenium, *Spinacia oleracea*

1,2,3- Former MSc Student, Professor and Assistant Professor, Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Respectively

(* - Corresponding Author Email: az.saffar.yazdy@gmail.com)

Investigation of the Tolerance of Pistachio Rootstocks to Sodium Bicarbonate

M. Rajabi¹- H.R. Roosta^{2*} - H.R. Karimi³- H. Hokmabadi⁴

Received: 13-3-2011

Accepted: 22-5-2012

Abstract

Considering to high lime in pistachio orchards of Iran, choosing of tolerant rootstock and cultivars to high pH is important. In order to investigate the effect of sodium bicarbonate on pistachio rootstocks factorial trail with two factors of sodium bicarbonate at 3 levels (0, 50 and 100 mM) and pistachio rootstocks at 4 levels (Atlantica, Sarakhs, Badami-e-Riz Zarand and Qazvini) carried out in hydroponic system. Bicarbonate caused growth reduction in all rootstocks. As the highest reduction in plant fresh weight was observed in Atlantica (70.39%) and Sarakhs (51.92%) at 100 mM, and the lowest reduction in Qazvini (31.54%) rootstock. Sodium bicarbonate treatments at 50 and 100 mM caused RWC reduction, proline increase and Cu and Mn reduction in shoots and roots. So that, the highest reduction of Mn and Cu concentrations was observed in Atlantica and the lowest reduction in Qazvini (31.54%) rootstock. The results of this study showed that Qazvini is a tolerant rootstock to sodium bicarbonate, Sarakhs and Badami semi-tolerant and Atlantica sensitive rootstocks.

Keywords: Hydroponic, Sodium bicarbonate, Nut, Nutrient element

1,2,3- Former MSc Student and Assistant Professors, Department of Horticulture Science, Faculty of Agriculture, Vali-e-Asr University of Rafsanjan, Iran, Respectively

(* - Corresponding Author Email: roosta_h@yahoo.com)

4- Section of Horticulture, Pistachio Research Institute of Iran, Rafsanjan, Iran

Effect of Salicylic acid and Methyl jasmonate on Quality and Vase- life of Gerbera (*Gerbera jamesonii* cv. Sazu) Cut Flower

M. Hashemi^{1*} - S.H. Mirdehghan² - H. Farahmand³ - H. Dashti⁴

Received: 13-4-2011

Accepted: 22-5-2012

Abstract

Gerbera (*Gerbera jamesonii*) cut flower has magnificent economical value in international cut flower industry. Due to sensitivity to ethylene and to gray mold, it has a short postharvest life. In this research, the effects of pulsing treatments with Salicylic Acid (100 and 200 mg/L) and Methyl jasmonate (25 and 50 mg/L) for 24h on quality and vase-life of gerbera cut flower were assessed. Distilled water + Sucrose (4%) was applied as control treatment. After treatment application, the flowers were taken out and kept in distilled water + sucrose (4%) solution at $25 \pm 2^\circ\text{C}$. The highest vase-life was obtained in salicylic acid 200 mg/L (9.91 day) followed by methyl jasmonate 25 mg/L (9.66 day), compared to control (7.49 day). Among the treatments, salicylic acid (200 mg/L) decreased flower petal wilting, preservative pH, and microorganism growth and subsequently increased the absorption of preservative solution, soluble solids, cut flower stem diameter and vase-life, therefore it can be chosen as best treatment in this experiment.

Keywords: Vascular blockage, Petal wilting, Plant growth regulators, Preservative solution, Microorganism

1,2,4- MSc Student and Assistant Professors, Department of Horticulture Science, Faculty of Agriculture, Vali-e-Asr University of Rafsanjan, Respectively

(*-Corresponding Author Email: mhashemi63@yahoo.com)

3- Assistant Professor, Department of Horticulture Science, Faculty of Agriculture, Shahid Bahonar University of Kerman

A Study of Rootstock and Low Temperature Effects on Antioxidant Reactions of Page Mandarin [(*Citrus reticulata* × *C. paradise*) × (*C. clementina*)]

Y. Tajvar^{1*} - R. Fotouhi Ghazvini² - Y. Hamidoghli³ - R. Hassan Sajedi⁴

Received:29-5-2011

Accepted:22-5-2012

Abstract

The production of reactive oxygen species (ROS) in plants under low temperature stress cause damage to plants. In order to evaluate of antioxidant responses of Page mandarin young trees (two years old) on different rootstocks under low temperatures, an experiment was conducted in a factorial plan based on completely randomized design. Treatment of temperatures were at seven levels include 9, 6, 3, 0, -3, -6 °C and 25 ± 2 °C (as control) and rootstocks were Sour orange, Citrange and Trifoliolate orange. Results showed that, low temperatures increased electrolyte leakage, lipid proxidation, antioxidant capacity, superoxide dismutase, ascorbate peroxidase, catalase and peroxidase enzyme activities (P<0.01). Due to effects of rootstocks lipid proxidation to 1.237 MDA μmol/gr leaf FW (P<0.05) reduced, while increased antioxidant capacity and catalase enzyme activity respectively to 72.87% and 0.431 IU/gr leaf FW (P<0.01). Results showed that interaction effect of factors were significant on, electrolyte leakage and APX activity (P<0.05). Therefore maximum electrolyte leakage to 86.97% and ascorbate peroxidase activity to 4.620 IU/gr leaf FW were observed in Page on sour orange in 6°C and Trifoliolate orange rootstocks in 0°C respectively. The biochemical indexes showed that Page mandarin on Trifoliolate orange compared with Sour orange and Citrange rootstocks had best tolerance to freezing stress.

Keywords: Citrus, Stress, Antioxidant

1- Assistant Professor, Department of Seed and Plant Improvement, Citrus Research Institute, Ramsar, Iran
(*-Corresponding Author Email: ytajvar@yahoo.com)

2,3- Professor and Associate Professor, Department of Horticultural Science, Faculty of Agricultural Science, University of Guilan, Rasht, Iran

4- Assistant Professor, Department of Biochemistry, Faculty of Biological Science, Tarbiat Modares University, Tehran, Iran

Effect of Mulch and Interval Irrigation on Yield and Fruit Quality of tow Cultivar Khorasan Razavi Province Melon

H. Nastari Nasrabadi^{1*} - S.H. Nemati² - A. Sobhani³ - H. Aroiee⁴

Received: 21-6-2011

Accepted: 22-5-2012

Abstract

Using mulch to decrease and optimize water use is known as a practical method. For this purpose, a split-factorial experiment based on complete block design with three replications on two melon cultivars was conducted in spring season of 2010 in Torbat-e-Jam. Interval irrigation treatments in three levels (6, 8 and 10 days) were considered as main plot and mulch (straw plus paddy rice, plastic and no mulch) and cultivar (Khatooni and Ghasri) were considered as sub plots in a factorial design. Results showed that there was a significant difference between plastic mulch and the control and also between interval irrigation treatments for fruit yield, ripening period, sugar percentage, fruit weight and number of fruits on plants. Interaction effect observed between interval irrigation and mulch for number of fruits on plants, marketable fruit, yield and ripening period traits. The shortest period of ripening was observed for the 8 and 10 day interval irrigation together with plastic mulch. Plastic mulch caused the sugar percentage of both cultivars to increase as well. Plastic mulch for 6 day interval irrigation caused yield and fruit quality to decrease, but it caused yield and fruit quality to increase for more than 8 day interval irrigation. Regarding the advantages of plastic mulch which is the decrease of water use and the improvement of yield and fruit quality, using plastic mulch is recommended for dry land.

Keywords: Melon, Irrigation interval, Mulch, Yield

1,2,4- MSc Student and Assistant Professors, Department of Horticultural Science, Faculty of Agriculture, Ferdowsi University of Mashhad, Respectively

(*-Corresponding Author Email: ho_nastari@yahoo.com)

3- Scientific Member Board of Agriculture and Natural Resources Research Center of Razavi Khorasan

Effect of Sowing Date on Yield and Physicochemical Properties of Medicinal Castor Bean Plant oil (*Ricinus communis* L.)

N. Farhadi¹- M.K. Souri^{2*}- A. Alirezalu³- H. Rabbi Angoorani⁴

Received: 9-8-2011

Accepted: 22-5-2012

Abstract

Castor oil due to extraordinary physicochemical properties has numerous applications in pharmaceutical, chemical, hygienic, biodiesel and nowadays in food industries. During plant growth and development, as well as during postharvest and processing, different factors may affect castor oil properties. This study was conducted to evaluate oil content and physicochemical properties under different sowing dates under climatic conditions of Tehran. The highest seed yield (1590.67 kg ha⁻¹) and oil yield (774.43 kg ha⁻¹) were obtained from 5th April Sowing date, that had significant difference with other sowing dates. In analyzed samples oil content were (%34.45-49/97), moisture content (%0.97-2.12), refractive index (1.470-1.473), chlorophyll content (0.26-0.40 mg Pheophytin/kg oil), acid value (0.28-0.62mg NaOH/g oil), peroxide value (0 meq O₂/kg oil), saponification value (165.62-181.34 mg KOH/g oil) and iodine value (82.43-89.22 g I₂/100 g oil). The results revealed significant differences for moisture and chlorophyll content, acid value ($p<0.05$) and saponification value ($p<0.01$), however, there was no significant difference ($p>0.05$) in samples for oil content, refractive index, iodine value and peroxide value. Results of fatty acid analysis by Gas Chromatography (GC) showed that fatty acids composition of castor oil was influenced by sowing date, as Ricinoleic acid (77.40-80.63%) was known the major oil fatty acid. Nevertheless, the highest amount of oil with best quality was obtained from 5th April sowing date.

Keyword: Castor bean, Sowing date, Oil, Physicochemical properties, Ricinoleic acid

1,2,3- MSc Student, Assistant Professor and PhD Student, Department of Horticultural Sciences, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran, Respectively

(* - Corresponding Author Email: mk.souri@modares.ac.ir)

4- MSc of Horticulture Science Department, Faculty of Agriculture, Zanjan University, Zanjan, Iran

Promotion of Seed Germination and Seedling Growth of Tomato by Magnetic Field and Hydropriming Treatments

H. Feizi^{1*} - P. Rezvani Moghaddam² - H. Sahabi³ - Sh. Amirmoradi¹

Received: 13-8-2011

Accepted: 26-6-2012

Abstract

Study of magnetic field and seed hydropriming effects on tomato seed germination was done in laboratory of Ferdowsi University of Mashhad, Iran. The experiment was as factorial experiment based on randomized completely design, which was including two level of hydropriming (use of dry seed and soaked seed in distilled water for five hours) and eight level of magnetic field (pretreatment of seeds in 15 and 25 mili Tesla magnetic field for 5, 15 and 25 minutes, permanent magnetic field with intensity 3 mT and control). Seed hydropriming significantly reduced mean germination time (MGT). Also it increased radicle length from 6.68 to 7.59 cm (14 percent) in comparison to dry seed. Seed hydropriming led to increasing shoot length, seedling length and vigour index by 7, 12 and 13 percentages in comparison to dry seed, respectively. Exposure of seeds in 3 mT permanent magnetic field and 25 mT for 5 minutes increased root length by 29 and 25 percentages in comparison to control. These treatments indicated the highest shoot length, seedling length and vigour index.

Keywords: Hydropriming, Mean germination time, Seedling length, Vigour index

1,2,4- PhD Student, Professor and PhD Student, Department, of Agronomy and Plant Breeding, Faculty of Agriculture, Ferdowsi University of Mashhad, Respectively

(* - Corresponding Author Email: hassanfeizi@yahoo.com)

3- MSc of Agronomy, Torbat Heydarieh High Education Complex, Torbat Heydarieh