



Effect of Application of *Pseudomonas fluorescent* Strains on Yield and Yield Components of Rapeseed Cultivars

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Abstract

Plant growth promoting rhizobacteria has been identified as an alternative to chemical fertilizer to enhance plant growth and yield directly and indirectly. Use of rhizosphere free living bacteria is one of the methods for crop production and leads to improvement of resources absorption. In order to study of yield, yield components and radiation use efficiency, under application of PGPR condition, an experiment was carried out in 2008 growing season at Agriculture and natural resources research station of Mashhad. The cultivars selected from three rapeseed species belong to *Brassica napus*, *Brassica rapa* and *Brassica juncea* (landrace, BP.18. Goldrush. Parkland. Hyola330. Hyola401). Experimental factorial design was randomized in complete block with three replications. Treatments included six varieties of Rapeseed and inoculations were four levels as non-inoculation, inoculation with *P. fluorescens*169, *P. putida*108 and use then together. Results showed that strains of *fluorescent pseudomonas* bacteria had greatest effects on yield and yield components cultivars. A significant difference in the number of pods per plant and 1000 seed weight observed. The cultivars were different in all treats except 1000 seed weight. Overall results indicated that application of growth stimulating bacteria in combination with different cultivars, had a positive effect growth, yield characteristics of plant varieties of rapeseed plants.

Keywords: Cultivar, Plant growth promoting bacteria, Rapeseed

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Simulation of Wild oat (*Avena ludoviciana* L.) Competition on Winter Wheat (*Triticum aestivum*) Growth and Yield. I: Model Description and Validation

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Abstract

Crop growth models could stimulate growth and development based on science principles and mathematical equations. They also able to evaluate effects of climate, soil, water and agronomic management practices on crop yield. In the present study, an eco-physiological simulation model developed to assess wild oat damage to winter wheat growth and yield. The general structure of this model is derived from LINTUL1 model which modified to wild oat competition against winter wheat. LINTUL1 model was developed for simulation of spring wheat potential production level. In this study, first, we added development stage (DVS) and vernalization to LINTUL1 for simulation of winter wheat growth and development and then the model calibrated for potential production level. Finally, we incorporate harmful effects of wild oat to winter wheat growth and yield. Weather data used as input were average daily minimum and maximum temperature ($^{\circ}\text{C}$) and daily global radiation (MJ m^{-2}) in Mashhad, Iran. Parameter values were derived from the literature. The model is written in Fortran Simulation Translator (FST) programming language and then validated based on an experiment data. For these purposes different wild oat plant densities were arranged. The data of this experiment does not use for calibration. The results showed that this model was in general able to simulate the temporal changes in DVS of winter wheat and wild oat, total dry matter (TDM) of winter wheat and wild oat and yield loss of wheat due to wild oat competition in all treatments, satisfactorily. Root mean square error (RMSE) for winter wheat DVS, wild oat DVS, average winter wheat TDM, average wild oat TDM, and yield loss of winter wheat was 10.4, 14.5, 5.8, 7.6 and 7.5, respectively.

Keywords: Crop growth model, Development stage, Weed competition modeling, Yield loss

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Evaluation of Yield and Yield Components of Two Wheat Cultivars in Different Row Cropping Patterns

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Abstract

Increasing biodiversity in wheat producing systems is a key element for improving sustainable wheat production. In order to find out the best combination of two common used wheat varieties, an experiment was conducted at Research Station, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in 2009-2010 and 2010-2011. The two wheat varieties (Falat and Orom) were sown based on a Randomized Completed Block Design with 12 treatments and three replicates. The treatments included in different row cropping patterns of Falat and Orom (100-0, 75-25, 50-50, 25-75, 0-100, 25-175, 175-25, 50-50, 150-50, 75-125, 125-75 and 100-100). Results of first year experiment showed that the highest grain and biological yield were obtained in sole cropping systems, although there were no significant differences between other cropping systems. The highest grain yield (3136 kg ha^{-1}) was obtained in cropping with the ratio of 75:25 Falat vs. Orom treatment which was 29 and 12.5 percentages more than their sole cropping. Our results revealed that row cropping of different wheat varieties can produce promised grain yield in two years.

Keywords: Flat variety, Sole cropping, Variety diversity, Yield

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Effects of Irrigation Levels on Growth Characteristics and Yield of Four Ecotypes of Sesame (*Sesamum indicum* L.)

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Abstract

In order to study the effects of irrigation levels on growth criteria, yield components and seed yield of four ecotypes of sesame (*Sesamum indicum* L.), a field experiment was conducted as factorial based on a randomized complete block design with three replications at the Agricultural Research Station, Ferdowsi University of Mashhad, during growing season 2010-2011. Three irrigation levels (2000, 3000 and 4000 m³ ha⁻¹) and four ecotypes (Darab, Sabzevar, Kashmar and Kalat) were allocated as treatments. Criteria such as leaf area index (LAI), dry matter (DM) accumulation, yield components (branch number, capsule number, seed number and 1000-seed weight), biological yield and seed yield of sesame were measured, accordingly. Results indicated that the simple effects of irrigation levels and ecotypes were significant ($p \leq 0.05$) on yield and yield components of sesame. Interaction between irrigation levels and ecotypes for yield components, biological yield and seed yield were significant ($p \leq 0.01$). By increasing water level from 2000 to 4000 m³ ha⁻¹ enhanced branch number, capsule number, seed number and 1000-seed weight up to 57, 55 and 36%, respectively. Seed yield of Kalat was higher than Darab, Sabzevar and Kashmar with 1, 7 and 11%, respectively. By enhancing irrigation from 2000 to 4000 m³.ha⁻¹ seed yield of Darab, Sabzevar and Kashmar and Kalat increased with 15, 67T 62 and 34%, respectively. There was a positive and significant relationship between yield and yield components. The highest correlation coefficient was observed for 1000-seed weight ($r=0.87^{**}$).

Keywords: Drought stress, Oil seeds, Water requirement

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The Effect of Sowing Date and Different Urea Fertilizer Levels on Quality and Quantity of Chamomile (*Matricaria recutita*, Perso genotype) in Shoushtar Climate Condition

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Abstract

A split plots experiment based on randomized complete blocks design was carried out at field research center of Islamic Azad University, Shoushtar branch during 2012 to find out the suitable sowing date and Urea fertilizer used in Chamomile (*Matricaria recutita*). Main plots including three sowing date (9, 19 and 29 February 2012) and subplots including four levels of Urea fertilizers (5, 10, 15 and 20 g urea fertilizer per m²). Delay at chamomile sowing date till 29 February decreased essential oil yield up to 50% compared 9 and 19 February sowing date. Increase of Urea fertilizer to 15 and 20 g m⁻² increased essential oil yield to 47% compared use of 5 g m⁻² Urea fertilizer. Results showed 9 and 19 February sowing date combined 15 and 20 g m⁻² Urea fertilizer increase flower dry weight, flower essential oil percentage, flower essential oil yield and chamazolene percentage. Highest flower dry weight, flower essential oil yield and chamazolene percentage were obtained at 9 February plant sowing date + 15 g m⁻² Urea fertilizer (38.4 g m⁻², 0.36 g m⁻² and 17.4% respectively) and 19 February plant sowing date + 15 g m⁻² Urea fertilizer (36.2 g m⁻², 0.34 g m⁻² and 18.1%). These data did not have any significant difference with 9 and 19 February plant sowing date + 20 g m⁻² Urea fertilizer. According to the results, the most suitable sowing date and Urea fertilizer for Chamomile in Shoushtar condition are 9 and 19 February and 15 g m⁻² (150 kg ha⁻¹) Urea fertilizer but it is advised this experiment repeat for multi years.

Keywords: Chamazolene, Essential oil yield, Flower yield, Plant height

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QTLs Mapping Controlling Phonological Traits of Barley under Normal and Drought Stress Conditions

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Abstract

In order to map QTLs controlling phonological traits of barley under normal and drought stress conditions, an experiment was conducted by 72 doubled-haploid lines and their two parents (Steptoe and Morex), at the Research Farm, College of Agriculture, University of Zabol, in 2011. The experiment was arranged in completely randomized block designs with three replications under normal irrigation and drought stress conditions. Phonological traits such as days to emergence, days to tillering, days to stem emergence, days to heading, days to flowering, days to milking, days to doughying, days to maturity and grain filing period were measured. QTL analysis was carried out with composite interval mapping (CIM) method by QTL cartographer software ver 2.5. Barley molecular marker linkage map comprised of 327 RFLP markers with 1226.3 cM length and 3.75 cM mean distance. The effect of genotype was significant ($P < 0.01$) for all studied traits. A total of forty two QTLs were detected for different studied traits. Phenotypic variances explained by these QTLs varied from 6.34% for days to flowering to 41.18% for days to milking. The highest LOD score was for days to doughying that was located on 2H chromosome. Mapped QTLs don't have necessary stability. Therefore, gain through marker-assisted selection (MAS) in this population for these traits likely would be limited. Because, the environment plays a tremendous role in the phenotypic expression of phonological traits.

Keywords: Doubled-haploid, Morex, Steptoe, Water deficit stress

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Evaluation of Cold Tolerance in Field Grown *Mentha (Mentha piperita L.)* under Laboratory Conditions by Electrolyte Leakage Test

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Abstract

In order to determine cold tolerance of field grown *Mentha (Mentha Piperita L.)* under controlled conditions, using electrolyte leakage index, an experiment was carried out at the College of Agriculture, Ferdowsi University of Mashhad, based on a completely randomized design with four replications. Experimental factors included six freezing temperatures (Zero, -4, -8, -12, -16 and -20 °C), seven harvest time (November, December, January, February, March, April and May) and four Peppermint organs (leaves, Stems, Stolons and Rhizomes). So, field grown and acclimated Peppermint was harvested from the faculty field every month. After separating the Peppermint organs, they were subjected to freezing temperatures. The membrane stability index was measured through electrolyte leakage (EL) and also lethal temperature 50 according to EL (LT_{50el}) was determined. The results showed that electrolyte leakages were affected significantly by freezing temperature. By reduction of freezing temperature electrolyte leakages percentage increased. Among different organs of peppermint, stolon and leaf were the *most cold tolerant* and the most cold sensitive according to EL and LT_{50el} , respectively. Also cold tolerance varied according to different harvest time in all organs. However, in May, all organs had lowest cold tolerance. Also leaves and stolons had the highest and the lowest LT_{50el} , respectively. For all organs the highest LT_{50el} was observed in May. According to the high correlation between electrolyte leakages percent and LT_{50el} ($r = 0.96^{**}$), it seems that using this index for evaluation of freezing tolerance injury in *Mentha piperita* could be useful.

Keywords: Acclimate, Electrolyte leakages, Freezing stress, LT_{50el}

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Effects of Plant Density and Nitrogen and Bio fertilizer on Qualitative Characteristics of Sugar beet in Mashhad and Torbat-e-jam Regions of Iran

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Abstract

Plant density and Fertilizers application especially with biological fertilizers that reduces environmental and underground water pollutions, are very important in sugar beet production in the world and Iran. In order to evaluate the effect of plant density and nitrogen and bio fertilizers on qualitative traits of sugar beet (*Beta vulgaris* L.), two field experiments were carried out in Agriculture and Natural Resources Research Center in Khorasan-E- Razavi province in Mashhad, and agricultural research farm in Torbat-jam sugar factory during 2012. Experimental factors were consisted of three crop densities (60000, 90000 and 120000 plants per hectare), three amounts of N fertilizers (0, 100 and 200 kgN ha⁻¹) and bio-fertilizers consist of *Azospirillum* and *Nitrobacter*, (with and without bio fertilizer). Experiments were laid out on the factorial design based on a completely randomized block designs with four replications. Results showed that the impurities of potassium and sodium in sugar beet root decreased with increasing plant density from 60000 to 120000 plants per hectare. Consumption of 200 kgN ha⁻¹ decreased gross sugar percent in sugar beet root. Bio-fertilizer and density of 90,000 plants per hectare with consuming 50% of N based on recommendations of soil test (100 kg ha⁻¹), impurities of sugar beet root (sodium, potassium and α -amino nitrogen) decreased and white sugar yield and gross sugar yield increased. Therefore, using bio-fertilizers in sugar beet cultivation enhanced qualitative yield and caused lower application of chemical nitrogen fertilizer.

Keywords: Azospirillum, Extractable sugar, Net sugar yield, Nitrobacter

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Effect of Nicosulfuron soil Residual on the Growth, Nodulation and Nitrogen Fixation of Chickpea (*Cicer arietinum* L.)

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Abstract

In order to study the effect of soil residues of Nicosulfuron herbicide on growth, nodulation and biological nitrogen fixation in chickpea (*Cicer arietinum* L.), two greenhouse experiment was conducted. Experimental design was completely randomized design in a factorial arrangement with three replications. The experiment was conducted in two stages. In the first experiment, treatments were, residues of Nicosulfuron in soil (Zero, 0.307, 0.769, 1.53, 3.07, 4.6, 6.14 and 9.21 $\mu\text{g kg}^{-1}$ soil) and chickpea genotypes (Hashem, ILC482, Kaka, Kermanshahi). In the first experiment, chickpea genotypes did not germinate, therefore levels of residues of herbicide modified, and the effect of five levels (0, 0.0153, 0.0307, 0.076 and 0. $\mu\text{g kg}^{-1}$ soil) of residual of Nicosulfuron herbicide were studied in other experiment on four mentioned genotypes of chickpea. Shoot biomass, root biomass, nodule biomass, number of nodules and total nitrogen of plant were measured, at the beginning of the reproductive stage of plants. The results showed that Nicosulfuron residues reduced all traits of chickpea genotypes, significantly. Based on ED₅₀, among chickpea genotypes, Hashem was the most tolerant genotypes in terms of shoot and roots biomass production to Nicosulfuron residue and ILC482 and Kermanshahi genotypes showed the most sensitivity to residues of Nicosulfuron in terms of shoot and root biomass, respectively.

Keywords: Hashem genotype, ILC482 genotype, Kaka genotype, Kermanshahi genotype, Residue of herbicide in soil

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Investigation on Some Morphophysiological Indices in *Salvia leriifolia* Benth. under Water Deficit Stress

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Abstract

In order to investigate the effect of water deficit stress on morphology and photosynthesis pigments contents of *Salvia leriifolia* Benth., an experiment was conducted in completely randomized design with three replications under greenhouse conditions. Water deficit treatments were Fully irrigated or Control (-0.035 MPa), Mild stress (-0.138 MPa), Moderate stress (-0.516 MPa) and Severe stress (-1.92 MPa). One set of stressed plants were kept constantly in different levels of matric potentials (Water deficit set) and the other (recovery set) irrigated to maximum water holding capacity after soil water was depleted in each stress levels. The results showed that transpiration, yellow leaves weight significantly decreased in mild stress but chlorophyll a, b content increased comparing control. There was no significant difference between constant and recovery stressed treatments to -0.516 MPa in all traits. Results indicated that leaf number, leaf area and also shoot and root dry weight were significantly ($P \leq 0.05$) decreased with increasing matric potential beyond -0.516 MPa. The highest SLA ($135 \text{ cm}^2 \cdot \text{g}^{-1}$) was obtained in -0.138 MPa and it had only significant difference ($P \leq 0.05$) with severe water deficit treatments. Results also showed that Root to Shoot ratio increased by 3.9- 4.3 times comparing control. Despite the chlorophyll content decreased in matric potential -1.92 MPa, but total carotenoids concentration and also the ratio of carotenoids to total chlorophyll were significantly increased compared to controls.

Keywords: *Salvia leriifolia* Benth., Water stress, Growth, Photosynthesis pigments

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Comparison of Morphological Characteristics of Roots in Genotypes of Barely (*Hordeum Vulgare*) in Vegetative Phase Using Filter Paper and Gel Chamber

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Abstract

The role of root growth on increase of yield is an important subject that is considered by plant breeders. In order to investigate root growth of 18 barley (*Hordeum vulgare*) genotypes at seedling growth stage, two separate experiments were conducted in the Faculty of Agriculture, Ferdowsi University of Mashhad in 2012. A completely randomized design with three replications was used for each experiment. After seeds germination in petri dishes, some seeds were transferred into gel chamber. The rest of germinated seeds were put into distilled water by use of rolled filter paper. The genotypes were compared by total root length, root dry weight, shoot dry weight, root diameter. Results showed that C-87-10 had highest total root length with 283 mm total root length in filter paper and 226 mm in gel chamber. Nimruz cultivar in filter paper with 139.3 mm and Sahand cultivar in gel chamber with 39 mm, produced the lowest total root length. Also Yosef, DC-85-5, C-87-10 and Nosrat genotypes had highest root dry weight and Val-fajr, Sahand and Nimruz genotypes had lowest root dry weight. in first experiment DC-85-5 and Sahand cultivar produced highest and lowest leaf length and in second experiment C-87-19 and Sahand cultivar had highest and lowest total leaf area.

Keywords: Filter paper, Gel chamber, jMicrovision software, Root

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Assessing the Effect of Planting Date on Safflower Cultivars Growth and Seed Yield in Rafsanjan Condition

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Abstract

The use of appropriate cultivar and planting date is the most important principles of agronomy; therefore, the aim of the present study was to consider the growth indices of different safflower cultivars and their relationships with seed yield. For this purpose, an experiment was conducted as factorial in randomized block design with four replicates included three planting dates (4 April, 25 April and 16 May) and four safflower cultivars (411, Sina, Local Esfahan and Sofeh). The maximum leaf area index (2.33) obtained in the first planting date that it was not significantly different with the second planting date but it decreased up to 70% in the third planting date. In the first planting date, the maximum LAI obtained for Local Esfahan and 411 cultivars. Maximum total dry matter was 124.2 g m⁻² for the first planting date that it decreased up to 31 and 78% in the second and third planting dates, respectively. In this planting date Sina and Local Esfahan cultivars had the higher dry matter. Maximum crop growth rate for the first planting date was 38.84 g m⁻²d⁻¹ that it decreased up to 41 and 66% in the second and third planting dates, respectively. In this planting date, the highest total dry matter obtained for the Local Esfahan cultivar. The results showed that the maximum value of seed yield dedicated to 411 and Local Esfahan cultivars that it had the high correlation with maximum total dry matter. In respect to the present study, it is suggested to use 411 or Local Esfahan cultivars in the first planting date.

Keywords: Crop growth rate, Leaf area index, Planting date, Safflower

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Determination of Genetic Coefficients of Some Maize (*Zea mays* L.) Cultivars of Iran for Application in Crop Simulation Models

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Abstract

A field experiment was conducted at the research field of the University of Lorestan in 2011 as a randomized complete block design with three replications to estimate genetic coefficients of some maize (*Zea mays* L.) cultivars. Treatments include six maize cultivars (T.V.C.767 and S.C.704 from late maturing group, T N.S640 and Maxima from mid-maturing group, and Koppany and D.C.370 from early maturing group). Results showed that there were significant differences among cultivars in terms of stem dry weight, maximum number of kernel per ear, thermal time from the flag leaf appearance to flowering, thermal time from flowering to maturity, phyllochron interval, grain weight, maximum plant height and minimum growth degree days during vegetative period. The highest (649.2) and lowest (350.6) maximum number of kernel per ear belonged to cultivars S.C.704 and D.C.370, respectively. Also, the highest and lowest stem dry weight, phyllochron interval and maximum plant height belonged to cultivars S.C.704 and D.C.370, respectively. Among genetic coefficients, the minimum growth degree days required for vegetative growth and the maximum number of kernel per ear had the greatest correlation with grain yield ($r=0.72$ and $r=0.84$, respectively). Overall, the results portrayed that the estimated genetic coefficients of the cultivars are not identical in different models and varied in a defined range.

Keywords: Cultivar-specific parameters, Modelling, Phenology

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Evaluation of Crops Biodiversity in Kermanshah Province During 2003-2012

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Abstract

Ecological functions of ecosystems are highly related to biodiversity at different levels. Nevertheless, ecological roles of biodiversity and its benefits are less considered in agroecosystems. Therefore, the aim of present study was to assess crops biodiversity in Kermanshah province. Data including crops and their cultivated area were collected from Ministry of Agriculture of Iran during 2003-2012. After data collection, some of important biodiversity indices such as Species richness, Shannon-Wiener diversity index and Sorensen's similarity index were calculated. The results showed that the number of cultivated species was 29. It nearly shows high biodiversity of crop species cultivated in the province. Among the cities, Kermanshah, Sahneh, Harsin had the maximum species while Paveh had the lowest species. The highest average of crops Shannon-Wiener index was related to Harsin (1.7) and the lowest average of crops Shannon-Wiener index was related to Dalahoo (1) for period of 10 years. In all cities, except Qasr-shirin, Salas-babajani and Paveh Shannon-Wiener index increased over 10 years. The crops Shannon-Wiener index of province was 1.35 in 2003 and it increased to 1.44 in 2012 (about 0.011 in each year). The trend of crops Shannon-Wiener index than all agricultural plants also improved about 0.01 in each year (from 1.25 in 2003 to 1.35 in 2012). The Sorensen's similarity index also increased in 2012 compare to 2003. The Sorensen's similarity index of Kermanshah with Eslamabad-gharb and Dalahoo with Salas-babajani were the highest for 2012 while it was the lowest for Paveh compare to other cities in both 2003 and 2012. According to our results, crops biodiversity in Kermanshah province was nearly suitable while similarity in cultivated crops between cities was almost high.

Keywords: Species richness, Species diversity, Shannon-Wiener diversity index, Sorensen's similarity index

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Evaluation of Salt Stress Effect on Chlorophyll Fluorescence in Two Sugar beet (*Beta vulgaris* L.) under Salicylate Foliar Application

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Abstract

To study of salicylic acid effect on chlorophyll fluorescence parameters under salt stress condition an experiment was conducted in Split factorial based on randomized complete block design with three replications at Shahid Chamran University of Ahwaz research farm. In 4-leaf stage after full expanded leaves, simultaneous with 150 mM NaCl salt stress applying; the leaves of salicylic acid including 0, 0.5 and 1 mM was sprayed on the leaves early morning. Two cultivars (Jolge and Sharif) of sugar beet were used at this experiment. Growth analysis was done at vegetative stage and ripening. Salinity caused significant reduction in root and shoot dry weight, stomatal conductance, SPAD value, Φ_{PSII} , qP and F_v/F_m . Also salt stress resulted in significant increase in NPQ. Treatment by salicylic acid caused significant increase of root dry weight, stomatal conductance conditions stress, SPAD value, Φ_{PSII} , qP and F_v/F_m compared to not application of salicylic acid under salt stress conditions. According to the results of the Correlation, photochemical quenching excited electron energy (qP) and root dry weight ($r = 0.56^*$) and shoot dry weight ($r = 0.68^{**}$) stress conditions showed a significant positive correlation. Therefore this attribute can be used to screen for these cultivars under the conditions foliar salicylic acid.

Keywords: NPQ, SPAD value, Stomatal conductance

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Effect of Plant Density, Rate and Split Application of Nitrogen Fertilizer on Quality Characteristics and Nitrogen Use Efficiency of Safflower under Weed Competition

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Abstract

In order to evaluation of plant density, rate and method of nitrogen fertilizer split application on quality characteristics and nitrogen use efficiency of safflower (Sofeh variety) under weed competition a field experiment was carried out in field research Yasouj University in 2013. This experiment was a factorial based on randomized complete block design with three replications. First factor was a two levels plant density (20 and 40 plants m⁻²) and second factor was nitrogen rate application on nine levels. That included; non nitrogen application and 75 and 150 kgN ha⁻¹ nitrogen application that both used with four split method. Split methods were included; S1 (%50 in pre planting stage - %50 in stem elongation stage), S2 (%25 in pre planting stage - %75 in stem elongation stage), S3 (%25 in pre planting stage - %50 in stem elongation stage - %25 in flowering stage) and S4 (%25 in pre planting stage - %25 in stem elongation stage - %25 in flowering stage). Also in this experiment, weed did not control. Results showed that whit increasing crop density, oil yield and protein grain yield increased by 20 percent and nitrogen utilization efficiency increased by 10 percent. The highest oil yield (50.25 g m⁻²) was obtained from 75 kg ha⁻¹ nitrogen with three-stage split application (S4). Finally, results showed that increasing nitrogen fertilizer application decreased nitrogen utilization efficiency but three-stage split method application increased this trait.

Keywords: Nitrogen, Oil, Protein, Safflower, Split nitrogen, Yield

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Evaluation of Biomass Production and Some Quality Characteristics of Fennel in Different Fertilizing Systems

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Abstract

To study the effect of different fertilizing systems on yield and quality characteristics of fennel Biomass, an experimental was conducted at College of Agriculture, Shahed University in 2011. The experimental design was split plot on the basis of randomized complete block design with three replications. The main factor comprised of levels of fertilizer application viz. control (no fertilizer application), Bio-fertilizer (*Azospirillum/Azotobacter*, biophosphorous fertilizer), 3. Integrated fertilizer (bio fertilizers+ 50% chemical fertilizer), and 4. Chemical fertilizer (triple super phosphate based on the soil analysis). The sub plots allocated to levels of number of cuttings (harvests) consisted of first, second, third and fourth cuttings. Results showed that the effect of fertilizer, cutting and interaction between them on measured traits was significant. The maximum fennel height, branch number per plant, dry weight and essential oil yield was obtained by applying integrated fertilizer in the first cutting. Maximum leaf/stem ratio was obtained from control treatment in the fourth cutting. The highest percentage of essential oil was obtained by applying integrated fertilizer in second cutting. According to the results, the use of integrated fertilizers can provide the highest quality food that reflects the desired effect of positive integrated fertilizer in production of medicinal forage of the environmental aspects.

Keywords: Biofertilizer, Cutting, Essential oil, Forage, Medicine

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Effect of Different Fertilizer Treatments Application on Quantitative and Qualitative Yield of Sesame (*Sesamum indicum* L.) Cultivars at Climatic Conditions of Kerman

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Abstract

In order to evaluate the effect of chemical fertilizer and farmyard manure on yield and quantitative and qualitative traits of sesame cultivars, an experiment was carried out as split plot based on a RCBD design with three replications at Kerman during growing season of 2010-2011. Fertilizer treatments including no fertilizer, 30 ton ha⁻¹ and 60 t.ha⁻¹ farmyard manure, 100 kg N (urea)+200 kg P (super phosphate) and 200 kg N (urea)+300 kg P (super phosphate) and Jiroft-13, Dashtestan, Darab-1 and Darab-14 cultivars were assigned randomly to the main and sub plots, respectively. Studied parameters were included plant height, number of lateral branches, number of capsule per plant, number of leaf per plant, 1000 seed weight, chlorophyll content, biological and seed yield, oil percent and yield. Effect of Fertilizer was significant on all traits except 1000-seed weight and harvest index. The cultivars for all traits except chlorophyll index and harvest index showed significant differences. Cultivar × fertilizer interaction only on the number of leaves, 1000-seed weight and harvest index were not significant. Results showed that responses of cultivars were different to the fertilizer treatments application. The highest seed and oil yield were obtained in the first level of fertilizer treatments and Darab -14 (1938 and 1131 kg ha⁻¹, respectively) and the same cultivar in the control treatment (787 and 468 kg ha⁻¹, respectively) was the lowest. Jiroft-13 did not respond to the fertilizer types and content (except 30 ton ha⁻¹ farmyard manure) compared to control, so fertilizer response of this cultivar is low. Dashtestan only in high level of chemical fertilizers treatment was significantly different with control, meanwhile, Darab-14 showed a better response to the low levels of chemical fertilizers and manures. Darab-1 did not show any significant responses to the amount and type of fertilizers, response of this cultivar with fertilizer application was significantly different compared to the control. Considering to appropriate responses of all cultivars to 30 ton ha⁻¹ farmyard manure and didn't show any significant differences with chemical fertilizer treatments, and to reduce the environmental problems caused by chemical fertilizers, this treatments is recommendable. Also due to the different response of cultivars to the fertilizer treatments, further investigations on the nutritional requirements of cultivars are necessary.

Keywords: Cultivar, Fertilizer, Oil yield and percent, Sesame, Yield

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The Effect Different Fertilizers, on Germination, Yield, of *Vicia vilosa* Roth

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Abstract

In order to study the interaction of germination, yield of *Vicia vilosa* Roth to use of biological fertilizer, chemical, and manure, an experiment was conducted as a randomized complete block design with three replications at Research greenhouse, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in 2013-2014 growing season. The experimental treatments was included three kinds of bio fertilizers and their integration with each other and vermicompost and chemical fertilizer as following : 1- mycorrhizaarbuscular species *Glomus mosseae*+vermicompost 2- mycorrhiza+Nitrocsin (included bacteriae *Azospirillum sp.* and *Azotobacter sp.*) 3- mycorrhiza arbuscular+ Rhizobium (*Rhizobium sp.*) 4-mycorrhiza arbuscular + Chemical fertilizer NPK 5- mycorrhizaarbuscular (*Glomus moseae*) 6-control. The results showed that, although the treatments has not significant effects on height of stem , it has significant effects on characteristics of root length colonization percent, number the root node, Root dry weight, soggy yield, yield dry and protein Percent. The results showed that the highest percent of root length colonization(76 percent), number the root node (20), Root dry weight (.94 g), soggy yield (1894.5 g m⁻²), yield dry (473.63 g m⁻²) and protein Percent (27.33 percent) was gained in integrated mycorrhiza and nitrocsine treatment. On the basis of results, the integration of mycorrhiza and biological rhizobium is suggested as the best fertilizer treatment for *Vicia vilosa* Roth.

Keywords: Mycorrhizaarbuscular, Nitrocsin, Percent of root length colonization, Rhizobium, Vermicompost

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Effects of Salinity Stress and Foliar Application of Nano-Zinc oxide on Yield per Plant and Some Morphophysiological Traits of Barley (*Hordeum vulgare* L.)

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Abstract

In order to investigate effects of salinity stress and foliar application with Nano-Zinc oxide on yield per plant and some morphophysiological traits of barley (*Hordeum vulgare* L.), a factorial experiment based on randomized complete block design with three replications was conducted under controlled conditions in 2012. Experimental factors were included soil salinity in four levels (zero, 25, 50 and 75 mM) with NaCl and foliar application of Nano-Zinc oxide at four levels (zero as control, 0.25, 0.5 and 0.75 g l⁻¹). The results showed that increasing of salinity stress decreased yield, grain filling period, chlorophyll content and stomata conductivity. It was vice versa in foliar application of Nano-Zinc oxide. Increasing of soil salinity and no foliar application increased dry matter remobilization. Maximum of dry matter remobilization from stem and aerial vegetative organs (0.445 and 0.199 g per plant respectively) was obtained in salinity of 75 Mm and no foliar application of Nano-Zinc oxide. Results showed that maximum of yield per plant (1.22 g), grain filling period (30.67 days), chlorophyll content (53.2) and stomata conductance (23.7 mmol m⁻²s⁻¹) were obtained in 0.75 g l⁻¹ of Nano-Zinc oxide and without of salinity application and minimum were obtained in no foliar application and salinity of 75 Mm. In general, the results showed that is useful foliar application of 0.75 g/lit of Nano-Zinc oxide in order to increasing of yield under salinity condition.

Keywords: Grain filling period, Growth indices, NaCl, Nano particles

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Effect of Salinity Stress on Morphological and Proline Content of Eight Landraces Fenugreek (*Trigonella foenum - graecum* L.)

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Abstract

In order to evaluate the effect of salinity on some morphological characteristics and proline content of eight fenugreek landraces and identification of the best landrace, a factorial experiment was conducted on the basis of complete randomized design with three replicates in the research field of Ferdowsi University of Mashhad in 2013. Experimental treatments were combination of eight fenugreek landrace (Isfahan, Tabriz, Hamedan, Sari, Challous, Amol, Mashhad and Yasooj) and four levels of salinity stress (0, 60, 120 and 180 Mm NaCl). The ANOVA results revealed the significant effect of salinity on plant height, number of branches/plant, number of nodes, inter nodal distance, root length, shoot length, root dry weight, shoot dry weight, fresh weight of fruit, nut and proline content. The highest level of salinity (180 mM NaCl) significantly decreased the mentioned plant characters by 16.72%, 30.44%, 18.22%, 49.45%, 11.95%, 13%, 48.44%, 57.90%, 59.56%, 54.11% compared to control respectively. Proline content in the highest salinity level (180 mM NaCl) was increased by 44.57% compared to control. The greatest amount of shoot vegetative yield was obtained from control (without salinity) and the highest rate of proline was achieved from 180 Mm treatment.

Keywords: Fenugreek, Landraces, Medicinal plant, Roline, Salinity stress

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Identification and Quantification of Cause and Effects in Symbiosis of Corn with Arbuscular Mycorrhiza Fungus using Structural Equation Modeling Approach

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Abstract

Considering to necessity and importance of determining mycorrhizal symbiosis level and its effects on crop agroecological characteristics as well as other related factors affecting this relationship, beside, the lack of an assured method for this purpose, the present study designed based on new perspectives and insights for determining cause and effects relations, latent variables using structural equation modeling (SEM) approach. A field experiment was conducted during 2 years. A split plots arrangement based on randomized complete block design (RCBD) with three replications was used. Treatments consisted four cropping systems (high, medium, and low input conventional as well as ecological system) and four inoculations (mycorrhizae fungus: *Glomus intraradices*, plant growth promoting rhizobacteria (PGPR): (*Azospirillum brasilense*, *Azotobacter paspali*, dual inoculation: (fungus plus bacteria), and no-inoculation (control), which were allocated to main plots and sub plots, respectively. At the first step, a confirmatory factor analyzing was conducted resulted to two distinguished factors, and then the variables which had the most loads (weight) on one of these two factors were determined. At the second step, considering ecophysiological basis of crops growth and development, in order to continue analyzing, the first factor (including: leaf area index (LAI), root length colonization percent (RLCP), dry matter (DM), stem diameter (D), SPAD readings) and the second factor (including: maximum photosynthesis (Amax), specific root length (SRL), canopy temperature (CT), plant height (H), soil respiration rate (SRR), variable chlorophyll fluorescence to maximum chlorophyll fluorescence (Fv/Fm), plant tissue phosphorus content (%P) determined resource capture latent construct and resource utilization latent construct, respectively. Correlation coefficients, squared multiple correlation coefficients, covariance matrices, direct and indirect path coefficients were calculated. Finally, RMSE and other validity tests applied to evaluate the model efficacy. The results showed the variables including LAI, D, DM, SPAD readings, H and CT had the most causality effect on corn yield production under field conditions associated with mycorrhizal fungus. At a glance, it seems the direct advantages of mycorrhizal symbiosis revealed by 35 percent cooperation in resource capture.

Keywords: Cause and effect relationship, Direct effect, Factor analysis, Path analysis, Path coefficient

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