



## Evaluating the Competitiveness and Productivity in a Maize-Bean Intercropping System Using some Indices

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Received: 06-07-2010

Accepted: 30-11-2011

### Abstract

Various additive and substitutive series of mixed intercropping of maize (*Zea mays* L.) with broad bean (*Phaseolus vulgaris* L.) was compared in a growing season (2007-2008) at the Agricultural Research Field of Ferdowsi University, in Mashhad, Iran. The treatments were sole maize and sole broad bean at their optimum density, and additive and substitutive series of them (%) including 50:50, 50:100, 50:150, 100:50, 100:100, 100:150, 150:50 and 150:100 (maize:bean). A randomized complete block design replicated three times was used. Mixed cropping was significant for grain yields of each crop species. The highest total grain yield, maize yield equivalent (MYE), land equivalent ratio (LER) and system productivity index (SPI) were obtained when maize plants were mixed at a rate of 150% with full and 50% seed rate of broad bean relative to their optimum densities (i.e. 150:50 and 150:100). Also, these treatments were superior in terms of relative crowding coefficient (RCC or K) compared with the others. According to the aggressivity index (A), with increasing the proportion of each component in intercropping, the aggressivity was escalated and dominance occurred. All in all, it is inferred that mixed intercropping of maize with broad bean at a density of more than 150% of the sole maize density (i.e. 150:100) may give better overall yield and income than sole culture of each crop species.

**Keywords:** Competitive indices, Efficiency, Land Equivalent Ratio

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## Evaluation the effects of organic, biological and chemical fertilizers on morphological traits, yield and yield components of Basil (*Ocimum basilicum L.*)

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Received: 08-06-2011

Accepted: 04-05-2014

### Abstract

The use of organic manure and biofertilizers containing beneficial microorganisms instead of chemical fertilizers are known to improve plant growth through supply of plant nutrients and can help sustain environmental health and soil productivity. Because of special priority of the medicinal plants production in sustainable agricultural systems and lack of studies on assessment of different sources of fertilizer on basil plants, an experiment was conducted at Research Station, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in 2009. A complete randomized block design with ten treatments, and three replications was used. The treatments were: 1) cow manure, 2) sheep manure, 3) hen manure, 4) compost, 5) vermicompost, 6) biological fertilizer nitroxin (consisting of Azotobacter and Azospirillum), 7) biological fertilizer consisting of Phosphate Solubilizing Bacteria (*Pseudomonas* and *Bacillus*), 8) mixture of biological fertilizer nitroxin and Phosphate Solubilizing Bacteria, 9) NPK fertilizers, and 10) control (no fertilizer). Results showed plant height in sheep manure was higher than other treatments. Number of branches in vermicompost and number of inflorescence in cow manure were significantly higher than other treatments. The number of whorled flowers in compost, sheep and cow manure were more than other treatments. Highest leaf and green area index was observed in nitroxin treatment and biological yield in sheep manure have significant difference with other treatments (except cow manure). The highest seed yield were obtained from plants treated with compost (1945 kg/h) and the lowest of that observed in NPK fertilizer and control treatments. In all measured traits (except number of inflorescence) NPK fertilizer and control treatment did not have any significant difference.

**Keywords:** Cow manure, Compost, Biological yield, Seed yield, Green area index

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## Evaluation of Nutrient Resource and Crop Diversity Interaction on Radiation Use Efficiency in Different Cropping Systems

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Received: 12-06-2011

Accepted: 25-12-2012

### Abstract

A growing interest to use multiple cropping was due to potential of these planting patterns for increasing yield by improved resource use efficiency such as radiation use efficiency (RUE). In order to investigate the effects of plant diversity and nutrient resource on radiation use efficiency, an experiment was conducted as split plot based on complete randomized block design with three replications at the Agricultural Research Station, Ferdowsi University of Mashhad, Iran, during 2006 and 2007. Treatments included manure and chemical fertilizers as main plots and intercropping of 3 soybean varieties (Williams, Sahar and Gorgan3), intercropping of 3 Millet species (common millet, foxtail millet and pearl millet), intercropping of millet, soybean, sesame (*Sesamum indicum*) and intercropping of millet, sesame, fenugreek (*Trigonella foenum-graecum*), ajowan (*Trachyspermum ammi*) as sub plots. Results indicated that in the manure and chemical fertilizer treatments, LAI of plants in intercropping decreased compared to monoculture. The effect of planting pattern on RUE was significant. In monocultures, common millet and soybean (Williams and Gorgan3 varieties) had highest RUE based on photosynthetic active radiation (PAR). The lowest RUE was obtained in sesame and foxtail millet monocultures. In the intercropping systems, when functional diversity increased, radiation use efficiency was increased, so that maximum of RUE ( $3.31 \text{ g.MJ}^{-1}$ ) was obtained in 4 species intercropping (common millet, sesame, fenugreek and ajowan). Minimum of RUE ( $1.96 \text{ g.MJ}^{-1}$ ) was observed in intercropping of 3 millet species. The interaction of planting pattern and nutrient resource on RUE was significant. In general, the highest RUE was observed in 4 species intercropping (common millet, sesame, fenugreek and ajowan) with manure treatment.

**Keywords:** Canopy, Intercropping, Monoculture, Photosynthetic active radiation

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## The Effects of Organic and Biological Fertilizers on Yield and Yield Components of Black Seed (*Nigella sativa* L.)

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Received: 14-06-2011

Accepted: 17-04-2013

### Abstract

In order to investigate the effects of organic and biological fertilizers, on yield and yield components of black seed (*Nigella sativa* L.), a field experiment was conducted at Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in years of 2009-2010, by using a completely randomized block design with three replications. The experimental treatments included: 1- Control (no fertilizer), 2- Nitroxin (including *Azotobacter* sp. and *Azospirillum* sp.), 3- Mycorrhizae, 4- Biosulfur (including *Thiobacillus* sp.), 5- Compost, 6- Vermicompost, 7- Nitroxin + compost, 8- Nitroxin + vermicompost, 9- Mycorrhizae + compost, 10- Mycorrhizae + vermicompost, 11- Biosulfur + compost, 12- Biosulfur + vermicompost, 13- Nitroxin + mycorrhizae, 14- Nitroxin + mycorrhizae + compost and 15- Nitroxin + mycorrhizae + vermicompost. Results showed that studied treatments had significant effects on all studied criteria; expect seed number per follicle, seed weight per follicle and 1000 seed weights of black seed. Our results revealed that studied biological fertilizers had no effect on black seed yield except biosulfur. In addition, compost + biosulfur and vermicompost + biosulfur treatments (790.83 and 790.80 kg.ha<sup>-1</sup>, respectively) had the highest seed yield in comparison to control treatment (338.83 kg.ha<sup>-1</sup>). It seems that in the alkalic soils, biosulfur plus sulfur treatments could increase black seed yield probably by decreasing soil pH.

**Keywords:** *Azotobacter*, *Azospirillum*, Mycorrhizae, *Thiobacillus*, Sulfur, Medicine plant

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## Effects of Different Fertilizer Managements on Quantitative and Qualitative Characteristics of Coriander (*Coriandrum sativum* L.) as a Medicinal Plant

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Received: 26-06-2011

Accepted: 23-05-2012

### Abstract

In order to study the effect of mycorrhiza and vermin compost on quantitative characteristics and essential oil content of seeds of Coriander, a field experiment was conducted during growing season of 2010 at Agriculture Research Station, College of Agriculture, Ferdowsi University of Mashhad, Iran. A randomized complete block design with three replications was used. Treatments included: 1) vermin compost, 2) mycorrhiza, 3) phosphorus, 4) mycorrhiza + vermicompost, 5) mycorrhiza + phosphorus, 6) vermin compost + phosphorus, 7) control (without fertilizer). Each plot was divided to two parts, in order to study green biological yield and seed production. Green biological yield harvested in two times at 5% flowering stage and harvesting seed yield was done when majority of plants got yellow. The result showed that vermin compost and control treatments had the highest and the lowest seed yield and plant height respectively. Mycorrhiza and mycorrhiza + phosphorus treatments had the highest number of umbel per plant, and the lowest number of umbel was shown in control treatment. Control and vermin compost treatments had the highest and lowest essential oil contents of seeds, respectively. In addition vermin compost and mycorrhiza treatments in the first and second cuts had the highest of green biological yield and dry weight of leaf per plant, respectively. Control treatment had the lowest biological yield and dry weight of leaf per plant, in both cuts.

**Keywords:** Essential oil, Number of umbel, Biological yield

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## Investigation Effect of Drought Stress Level of PEG 6000 on Seed Germination Principle and its Relation With Drought Tolerance Index in Promising Lines and Cultivars of Bread Wheat (*Triticum aestivum* L.)

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Received: 04-07-2011

Accepted: 23-09-2014

### Abstract

In order to investigate the effects of drought stress levels on seed germination and its related traits with drought stress indices, an experiment was conducted in two separate phases with 40 wheat genotypes under field and laboratory condition for germination stages with 4 level of the polyethylene glycol (PEG) concentrations. The experimental design was factorial based on a randomized complete block design with three replications. The measured traits were radicle length, stem length, radicle length to shoot length ratio, germination rate and germination percentage. The experiment in the field stage was conducted with 3 replications under both normal and drought stress condition. Result of the laboratory experiment indicated that effects of stress on traits were significant. Also different between genotypes were significant. The highest germination rate and percentage was measured under normal condition with 4.22 days and 79.9% respectively. Moderate level of stress (-3 bar) of drought stress had no significant effect on radical, coleoptile, stem length and dry weight, but reduced the germination rate significantly. In high level of drought stress (-6 bars) all traits were decreased significantly except radicle length and radicle length to shoot length ratio. In control condition, positive significant correlation was observed between all traits measured in (-6 bars) under laboratory condition, with grain yield and drought tolerance indices. But in slight (-3 bars) and severe stress dry weight and radicle length had positive significant correlation with grain yield. Grain yield of genotypes showed significant differences under field study in both normal and stress condition. Results of correlation between grain yield and drought stress indices showed that stress tolerance index (STI), mean productivity (MP) and geometric mean productivity (GMP) were suitable for the genotypes identification with highest seed yield in both normal and stress conditions according to correlation coefficients between seed and its related traits and grain yield such as correlation coefficients between drought stress indices and grain yield in both normal and stress conditions, revealed that the genotypes number 39 (WS-82-9), 38 (DN-11), 22 (mbul/Alamo/M-73-18) and 25 (Alvd/Aldan/las/3--) were determined as the most tolerant and number 5 (Gasspard) and 40 (Mahdavi) were detected as the most susceptible cultivars for drought stress.

**Keywords:** PEG 6000, Drought Tolerance Index, Stress, Wheat, Seed Germination Principle

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## The Effect of Shoot/Root Competition of Black night shade (*Solanum nigrum*) on Growth and Seed Yield of Mung Bean (*Vigna radiate* L.)

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Received: 09-07-2011

Accepted: 11-01-2014

### Abstract

In order to study the competition effects of *Solanum nigrum* on *Vigna radiate* yield, an additive experiment was conducted at Ferdowsi University of Mashhad experimental Greenhouse. The type of design was completely randomized block. Treatments included three density of *Solanum nigrum* (2, 4, and 6 plants m<sup>-2</sup>) and three types of competition (root, shoot and both of them) planted at constant density of *Vigna radiate* plus weed free check in each block. The results indicated that competitions had significant effects ( $P < 0.05$ ) on plant height, number of seed per plant, number of pods per plant, seed yield per plant, biological yield and harvest index. The control, treatment of root+shoot competition and 6 Plants m<sup>-2</sup> of *Solanum nigrum* densities has the highest and lowest number of seed per plant. Therefore, result of this experiment indicated that weed competition with crops can reduce the plants yield. Plant height, number of seed per plant, number of pods per plant, seed yield per plant, biological yield and harvest index were decreased, when the densities of *Solanum nigrum* were increased.

**Keywords:** Legume, Weed, Interference, Plant density

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## Investigation on the Effect of Location and Field Age on Yield and Frequency of Different Corm Weights of Saffron (*Crocus sativus* L.)

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Received: 11-08-2011

Accepted: 05-11-2013

### Abstract

In order to study the effect of location and age of farms on corm yield, tonies weight, tonies and frequency of different corm weight classes, an experiment was conducted on the basis of nested design as CRD with three replications in saffron growing areas of Torbat-e-Heidarieh, Zaveh, and Boshrooyeh. In this experiment, three replications of corms samples (each 1m<sup>2</sup>) were taken from different saffron field ages (from 1 year to 8 years old) after leaf shedding in late May. Results showed that the effect of location on corm yield was not significant, but effect of location on weight and percent of tonies were significant at 0.01 and 0.05 levels, respectively. Mean of corm yield at different location was 4.87 ton ha<sup>-1</sup> for 1 year old field and 16.09 ton ha<sup>-1</sup> for 8 years old field. The highest percent of weight (25.04%) was observed at 8 years old fields. Mean comparison of frequency of different classes of corm weight at different farm ages showed that among classes of 4.1 to 6, 6.1 to 8, 18.1 to 20, 22.1 to 24, 24.1 to 26, and >30 g were significantly different for farm ages at 0.01 level and in 14.1 to 16 g at 0.05 level. Mean of corm numbers per square meter was 55, 65, 71, 128, 152, 151, 184, and 248 for 1 year to 8 years old fields, respectively. The highest percentage of corms bigger than 8 g and more in the 3 years field which one effective in flower production was 59 percent. There was a positive correlation between corm diameter and corm weight ( $r^2=0.98$ ).

**Keywords:** Corm diameter, Corm weight, Saffron corms

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## Evaluation of Quantitative and Qualitative Characteristic of Forage Kochia (*Kochia scoparia*) in Different Salinity Levels and Time

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Received: 22-08-2012

Accepted: 02-03-2013

### Abstract

Increase salinity in soil and water resources in agricultural lands has created major challenges in crops production. Kochia can grow under saline conditions and used as fodder in dry and saline areas. Therefore, three experiments was conducted in complete randomize design with four replication, to study effects of different levels of salinity (0, 10, 20, 30, 40, 50 and 60 dS m<sup>-1</sup>) at different growth stages (planting and early seedling) and salinity application intervally. Results of applying saline water at the beginning of growth showed that kochia seedling was able to survive up to 30 dS m<sup>-1</sup> sodium chloride. The results showed that increasing salinity at planting and early seedling satge reduced plant height, branches number, shoot fresh and dry weight, and increased digestible dry matter, digestive value, and crude protein yield. On the other hand with increasing salinity digestibility of dry matter, organic matter digestibility, crude protein and ash percentage were increased. Total phenol was not significantly affected by salinity in all treatments. Application of salinity intermittenly at early seedling except of digestive value and ash percentage had no significant affect on other treats. Generally, results showed that the kochia seedlings are sensitive to salinity higher than 30 dS m<sup>-1</sup> and also kochia be able to keep biomass production with salinity application intervally.

**Keywords:** Ash, Digestibility, Digestive value, Phenol, Protein

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## Effect of Salt Stress on Growth, Photosynthesis, Gas Exchanges and Chlorophyll Fluorescence Insugar Beet(*Beta vulgaris* L.) Cultivars in the Seedling Stage under Controlled Condition

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Received: 17-10-2011

Accepted: 10-09-2014

### Abstract

According to continuing of drought phenomenon, global warming and dust storms resulted in salining increasing of arable lands, because it's necessary to know some physiological mechanisms in sugar beet under salt stress, this experiment was conducted to investigation of effect of salinity on growth characteristics, respiration, gas exchange and photosynthesis in three sugar beet cultivars (BR<sub>1</sub>, Jolgeh and Rasoul) in the 2010 growing season, in greenhouse of Shahid Chamran University as the factorial design based on randomized complete block with three replications. 35 days sugar beet seedlings were kept for eight weeks under three salinity levels including control (zero), 100, and 200 mM sodium chloride (NaCl). Salinity Stress reduced shoot and root dry matter and leaf area significantly. With increasing of salinity, the rate of photosynthesis (carbon dioxide assimilation), stomatal conductance, and leaf transpiration rate decreased, but respiratory rate, leaf temperature and SPAD value increased. The results showed that Quantum yield of PSII ( $\Phi_{PSII}$ ) decreased by increasing of salinity level, meanwhile Non-Photo Chemical Quenching (NPQ) increased. According to the results, the concentration of 200mM sodium chloride, had a high negative correlation between root dry matter ( $r = -0.95^{**}$ ) stress susceptibility index. Means any reduction in dry matter accumulation increased in stress susceptibility index. Lower levels of stress susceptibility index showing more tolerance of cultivar to salinity stress. Based on stress susceptibility index (SSI), in the concentration of 200 mM sodium chloride, cultivars Rasoul, BR<sub>1</sub> and Jolgeh are tolerant, semi-tolerant respectively and sensitive were identified. In the end, it seems that root dry weight, can be use as a criterion for salinity resistance of sugar beet cultivars.

**Keywords:** Chlorophyll fluorescence, CO<sub>2</sub> Assimilation, Salinity, Sugar beet, Transpiration

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## Effects of Sowing Time on Yield of Black Seed (*Nigella sativa* L.) Ecotypes under Mashhad Conditions

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Received: 06-10-2011

Accepted: 15-06-2014

### Abstract

Growth and yield of medicinal plants affected by planting date as an important management factor. In order to study the effects of planting dates on yield and yield components of some black seed (*Nigella sativa* L.) ecotypes, a field experiment was arranged in a randomized complete block design as a split-plot with three replications at the Agricultural Research Station of Ferdowsi University of Mashhad during growing season 2009-2010. Four planting dates (24 Feb., 16 Mar., 4 Apr. and 25 Apr.) and four black seed ecotypes (Birjand, Gonabad, Neyshabour and Sabzevar) were allocated to the main and sub plots, respectively. Results showed that there were significant differences between planting dates for number of follicles per plant, number of seeds per follicles and 1000-seed weight, seed yield, biological yield and harvest index. Maximum numbers of follicles per plant, number of seed per follicles, biological yield and seed yield were observed in first planting date, maximum 1000-seed weight was observed in fourth planting dates and maximum harvest index were recorded in the third planting date. Yield components, seed yield, biological yield and harvest index also were affected by ecotypes and interaction effects of planting dates and black cumin ecotypes. The highest and the lowest of all traits, expect 1000-seed weight were achieved in Gonabad and Neyshabour ecotypes, respectively. The maximum and minimum 1000-seed weights were obtained in Neyshabour and Gonabad ecotypes, respectively. Planting in 24 Feb., 16 Mar. and 4 Apr. have had high seed yield and there was a reduction on seed yield due to delay planting to 25 Apr. Also, Birjand ecotype in the last planting date had the highest seed yield. According to the seed yield, Gonabad and birjand ecotypes were better than from two other ecotypes in range of planting dates.

**Keywords:** Biological yield, Medicinal plant, Delay planting, Medicinal plant, Yield components

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## The Study of Morphological Characteristics of Old and New Barely Cultivars.

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Received:01-10-2012

Accepted: 21-07-2014

### Abstract

In order to comparison of morphological traits between new and old cultivars of barley roots (*Hordeum vulgare* L.) an experiment was conducted in greenhouse condition in Faculty of Agriculture, Ferdowsi University of Mashhad in 2011. The type of experiment was a completely randomized design with eight treatment and three replications. Experimental treatments were 4 new cultivars of barley includ (Nosrat , Youss of , Fajr30 and Nick) and old cultivars(Reihan , Kavir, Zarjoe and Valfajr). Seeding was occurred in plastic tubes with washed sands and sampeling was occurred with destroyed plastic bages in the end of the four stage includ 4-6 leaf stage, stem elongation stage, flowering and maturity stage. Traits includ total root length, area, diameter, volume, and root dry weight and yield and yield components were measure and compared. Resultsshowed that, there was significant difference between new and oldcultivars of barley rootsinallstages of development, specially the most prominent difference was in the late growing season. In root elongation characteristics (along the main root length, total index of root length) were superior to the old cultivars, but in other characteristics(size, surface, diameter and root dry weight) the new cultivars were better. In the new cultivars, horizontal and lateral root distribution in the soil were higher than old cultivars and old cultivar shad long itudina land vertical spread of roots. Generally, in the soils with adequate moisture and air condition like this experiment conditions, the root system of the plants growth deeply and their seminal roots as possible in the remaining active through out the growing season. For this reason increase in root traits was observed during the growing season to maturity.

**Keywords:** Diameter, Root Area, Total root length, Volume, Yield, Yield Components

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## Effects of Manganese on Yield, Yield Components, and Grain Quality of Wheat Cultivars

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Received: 04-12-2012

Accepted: 15-11-2014

### Abstract

In order to study the effects of manganese sulphate on yield, yield components, and grain quality of wheat cultivars, an experiment was conducted in a split plot layout within a randomized complete block design with four replicates in Abadeh region during 2007–2008. Main plot was manganese sulphate (0, 20 and 40 kg h<sup>-1</sup>) and subplot was winter wheat cultivar (including Marvdasht, Shiraz and Pishtaz). The results showed that increasing the manganese sulphate levels causes meaningful increasing in the total plant dry weight in stemming, pollination and physiological maturity period and also increasing number of fertile heads m<sup>-2</sup>, kernel number per fertile head, 1000-kernel weight, grain yield, and grain manganese and grain protein and decreasing infertile heads. Studied cultivars had significant differences with each other from vegetative growth and yield components and grain yield so that Marvdasht cultivar meaningfully had the highest dry matter during stemming, pollination and physiological maturity period in comparison with other cultivars and also had more vegetative growth. Also from yield components including number of fertile spike m<sup>-2</sup>, number of kernel in fertile spike and following this, Marvdasht kernel yield was the best cultivar, and had the highest grain manganese. And Pishtaz cultivar from total dry matter, yield components and grain yield was in second place after Marvdasht cultivar and had only the highest 1000-kernel weight. Shiraz cultivar had the least yielding rate from growth and yield indices and was the best cultivar from seed protein. Based on these results, it seemed appropriate to use 40 kg ha<sup>-1</sup> manganese sulphate and Marvdasht cultivar to produce wheat under conditions similar to current study.

**Keywords:** Grain manganese, Grain yield, Manganese sulphate, Protein rate

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## Effect of Organic Matter and Gypsum Powder Some Traits of Maize in a Saline-Sodic Soil

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Received: 01-01-2013

Accepted: 10-09-2014

### Abstract

Saline-sodic soils have improper physical, chemical and biological condition and the crop productivity is low in these conditions. Application of conditioners often can be a proper solution for reclamation and improving the productivity of saline-sodic soils. In order to study the effect of some conditioners on soil chemical characteristics and yield of maize (SC260 cultivar) in a saline-sodic soil, an experiment was carried out as a completely randomized design with 3 replications in a research greenhouse of Ferdowsi university of Mashhad. The studied treatments included control and 10 ton/ha of compost (MC), vermi-compost (VC), poultry manure (PM), and gypsum powder (G). The results showed that poultry manure and vermi-compost treatments increased significantly ( $p < 0.05$ ) dry weight of shoots, grain yield, weight of 1000 grains, and height of maize in relation to control. Application of studied conditioners in this research cause to increase electrical conductivity (ECe) and decrease sodium absorption ratio (SAR), significantly compared to control ( $p < 0.05$ ).

**Keywords:** Salinity, Sodicity, Soil conditioner, Plant dry weight

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## Effects of Spring Late Frost on Black Seed (*Nigella sativa* L.) under Controlled Conditions

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Received: 04-02-2013

Accepted: 10-09-2014

### Abstract

In many years plant growth strongly affected by late spring frost. In order to evaluate the effects of late frost on Black Seed plants, a factorial experiment based on completely randomized design with three replications was carried out in college of agriculture, Ferdowsi University of Mashhad and five Black Seed ecotypes (Birjand, Sabzewar, Ferdows, Gonabad and Neyshabour) after two months growth and hardening in natural environment, were exposed to seven temperatures (0, -1.5, -3, -4.5, -6, -7.5 and -9°C) in thermogradient freezer. For determining cold stress damages, Lethal Temperature (LT) for 50% of plants according to the Electrolyte Leakage percentage ( $LT_{50el}$ ), LT for 50% of plants according to the Survival percentage ( $LT_{50su}$ ), LT for 50% of plants according to the plant necrose in Test Tube ( $LT_{50tt}$ ) and Reduced Dry Matter Temperature 50 ( $RDMT_{50}$ ) were measured. Ability of plants for recovery was recorded based on leaf number and leaf area, plant dry weight and cold damage percentage of leaves. According to the  $LT_{50tt}$ ,  $LT_{50su}$  and  $RDMT_{50}$  Black Seed plants can tolerated cold stress in range between -5.7 to -9.0 °C and Sabzewar and Ferdows ecotypes had the most and the least cold tolerance, respectively. At the point of ability of plants for recovery, Ferdows ecotype had the least and Sabzewar and Neyshabour ecotypes had the best plant recovery. Moreover there were high correlations between  $LT_{50tt}$  and  $LT_{50}$  based on electrolyte leakage, survival and  $RDMT_{50}$ . Electrolyte leakage and visual scoring of cold damage in test tube are rapid methods, so for assessing cold tolerance in plants  $LT_{50el}$  and  $LT_{50tt}$  indices may be useful.

**Keywords:** Cold stress, Electrolytes leakage, Plant necrose, Recovery, Survival

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## The Effect of Different Mixture Ratio of Barley and Vicia Seeds on Their Yield in Dry Land Condition

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Received: 01-05-2013

Accepted: 24-08-2014

### Abstract

Intercropping of grass-legumes could be increase quantitative and qualitative yield per unit of dry land area. A series experiments were carried out to evaluate five treatments % (w/w) including: T1: Hurdeume 0 Vetch 100, T2: Hurdeume 25 Vetch 75, T3: Hurdeume 50 Vetch 50, T4: Hurdeume 75 Vetch 25, T5: Hurdeume 100 Vetch 0 as randomized complete blocks design during three years (from 2004 to 2007) with 3 replications at Maraghe station. Seeds were planted in 20cm row spacing in autumn. ANOVA results showed that the effects of treatments were significant ( $p \leq 1\%$ ). The results at three growth stages showed that the highest wet and dry forage yield before and after flowering and also stubble and grain yield belong to T3, T4 and T5 treatments. The lowest yield was obtained from T1 treatment. But for highly ratio present of legume in T3 this treatment recommended for dry lands. In flowering stage of vetch, gravimetric soil water content in 3 different depth (0-10, 10-20, 20-30 cm) of soil were significantly different between treatments and in each depth highest value belong to T3 respectively 23.39, 25.43 and 25.90 % .

Keywords: Soil fertility - legume - graminea and sustainable agriculture

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## Growth Analysis of Sugar Beet in Healthy and Rhizomania Infected Conditions

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Received: 15-05-2013

Accepted: 12-11-2013

### Abstract

Viral disease of Rhizomania is one of the most important diseases of sugar beet worldwide. The disease significantly reduces the yield and quality of sugar beet and imposes high economic loss to farmers. Long-term breeding programs to introduce tolerant cultivars are the only chance to avoid further yield losses. This study tried to analyze the growth of shoot and root of rhizomania tolerant and susceptible sugar beet to provide information for investigation of growth differentiations of sugar beet cultivars in infested and healthy soils. Growth indices were used for growth analyzing, quantification, and time course of sugar beet on infested and non-infested soils. A two-year experiment was conducted with four sugar beet cultivars in 2010 and 2011. The results of this study showed that under infested soils, root dry matter and leaf area index of the susceptible varieties in comparison to tolerant cultivars were lower by 57 and 24 percent respectively. In addition, crop growth rate and net assimilation rate of susceptible cultivars were affected by rhizomania and were lower than that of tolerant cultivars. On non-infested soil, difference between dry matter and growth indices of susceptible and tolerant sugar beet cultivars were not significant. Rhizomania decreased the green area and photosynthesis capacity and led to lower growth rate and dry matter production.

**Keywords:** Growth indices, Thermal time, Tolerant cultivar, ELISA test

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## Effect of Phosphate Solubilizing Bacteria and Different Levels of Mineral Phosphorous on the Growth and Seed Yield of Soybean Cultivars

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Received: 07-07-2013

Accepted: 30-09-2014

### Abstract

In order to investigate the effects of strains of *Pseudomonas* bacteria and levels of mineral phosphorous on the growth and seed yield of the soybean cultivars a study was conducted as split split plot format using the randomized complete block design with four replications. Two soybean cultivars such as Sari and Telar, three levels of phosphorous and four levels of inoculation with phosphate solubilizing bacteria were considered as sun and sub sub plots, respectively. Results showed that seed yield of the Telar cultivar ( $177.14 \text{ g m}^{-2}$ ) was significantly higher than Sari cultivar ( $143.87 \text{ g m}^{-2}$ ). The highest seed yield under the main influences of phosphorous ( $186.2 \text{ g m}^{-2}$ ) belonged to the treatment of applying  $50 \text{ kg h}^{-1}$  of phosphorous and seed yield declined at  $100 \text{ kg h}^{-1}$  of phosphorous. It was also found that when seeds were inoculated with *P. putida* and *P. fluorescens* seed yield increased, compared to the control ( $123.5 \text{ g m}^{-2}$ ), seed yield raised significantly ( $160$  and  $168.2 \text{ g m}^{-2}$ , respectively). By simultaneously inoculated with both the bacterial species maximum seed yield ( $190.3 \text{ g m}^{-2}$ ) obtained which was accompanied by the maximum number of pods on the main stem ( $40.87$ ), the highest number of pods per plant ( $99.67$ ), and the largest 100-seed weight ( $20.61 \text{ g}$ ). Under the triple interaction effects of cultivar, phosphorous application, and bacterial inoculation, the maximum seed yield ( $236.6 \text{ g m}^{-2}$ ) was obtained when seeds of the cultivar Telar were inoculated with *P. putida* and  $50 \text{ kg h}^{-1}$  of phosphorous were applied to the soil.

**Keywords:** *Pseudomonas fluorescens*, *Pseudomonas putida*, Tellar cultivar, Sari Cultivar Soybean, Phosphorous

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## The Effect of External Usage of Glycine Betaine on Corn (*Zea mays* L.) in Drought Condition

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Received: 27-07-2013

Accepted: 08-11-2014

### Abstract

Drought is one of the most important factors limiting crop growth and therefore use of practice to reduce its adverse effect is very important. In order to study the effect of glycine betaine on corn under drought condition an experiment was conducted as split-split plot in the base of randomized complete blocks design. The first factor was irrigation interval cycle (4 and 8 days) and second factor including different concentrations of glycine betaine (zero, 50 ppm, 100 ppm, 150 ppm) and third was spraying in two stages (stem elongation stage and before flowering). Analysis of variance showed that effects of three factors on all of traits except for carotenoids were significant. However, foliar application of glycine betaine reduced effect of drought stress conditions on the plant so that extent of chlorophyll (a and b), plant height, yield and 1000 grain weight increased significantly. Spraying by glycine betaine caused improving plant performance in stress conditions, so that in the concentration of 150 ppm produced the highest quality in all of traits that preference was more evident before flowering. By considering these results it could be said that spraying with 150 ppm of glycine betaine before flowering in the condition of stress and without drought stress could improve the extent of chlorophyll (a and b), plant height, yield and yield components. Eventually it could be concluded that external glycine betaine with 150 ppm concentration while spraying before flowering had great positive effects and usage of that material is affected by time of application concentration and more stress severity.

**Keywords:** Compatible solutes, Osmotic adjustment, Stress tolerance, Irrigation

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## The Interaction Effect of Salicylic Acid and High Temperature Stress on Some Physiological Characteristics of Maize (*Zea mays* L.)

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Received: 28-07-2013

Accepted: 25-05-2014

### Abstract

The present study was conducted to evaluate the effects of salicylic acid and High temperature on physiological characteristics of maize (cv. SC704). In order to, a factorial experiment based on randomized complete blocks design with three replications was carried out in Research Greenhouse of Vali-e-Asr University of Rafsanjan. The factors were included pre-treatment of concentrations of salicylic acid (0, 50, 100 and 200  $\mu$ M) and duration of 40°C (0, 8, 16 and 24 hours). Results showed that SPAD index increased significantly in levels of 50 and 100 $\mu$ M salicylic acid but it was low in control and 200 $\mu$ M salicylic acid. In level of 50 $\mu$ M salicylic acid, increase in duration of heat stress was resulted in increasing content of a and ab chlorophyll. However, it was occurred conversely in level of 200  $\mu$ M salicylic acid, i.e., content of a and ab was decreased. Levels of salicylic acid and duration of heat stress did not effect on Fv/Fm and content of soluble sugar. Use of 200  $\mu$ M salicylic acid decreased significantly relative water content, while increase in duration of heat stress caused to increase relative water content. In addition, increase in duration of heat stress resulted in increasing leaf temperature and proline content.

**Keywords:** Leaf Temperature, Maize, Chlorophyll, Relative Water Content

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## The Effect of Nano and Non-Nano Zinc Oxide Particles Foliar Application on Yield and Yield Components of Mungbean (*Vigna radiate*) Under Drought Stress

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Received: 06-08-2013

Accepted: 07-04-2014

### Abstract

This study was designed to investigate the effects of nanosized and non-nano zinc oxide foliar application on yield and yield components of mungbean under water stress in Shahrood Agricultural Research Center during 2011-2012. The experiment was arranged as split plot based on randomized complete block design with four replications. Water stress at three levels (control, cutting of irrigation in 50% flowering and 50% pod setting stages) were assigned as main plots and zinc oxide foliar application in five levels (control, 5 and 10  $\text{g l}^{-1}$  nanosized zinc oxide and 5 and 10  $\text{g l}^{-1}$  non-nano-scale zinc oxide) were randomized in sub-plots. Results showed that in comparison with full irrigation, water stress in flowering and pod setting stages decreased mungbean yield 2.2 and 4 percent respectively. Nano and non-nano zinc foliar application increased number of pod per plant, seed per pod, 1000-seed weight and total dry weight in water stress and non-water stress treatments significantly. Foliar application of 10  $\text{g l}^{-1}$  nanosized zinc oxide particles compared to control increased mungbean yield 6.6, 3.6 and 5.4 percent in non-water stress, water stress in flowering and pod setting stages treatments respectively. It can be concluded that foliar application of zinc as nano particles can enhance the yield of mungbean more than zinc oxide under water stress conditions.

**Keywords:** Water stress, Legumes, Nano- Nutrients, Micronutrients

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## Drought Tolerance of Wild and Cultivated Species of Safflower and Assessment of Morphological Variation

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Received: 10-08-2013

Accepted: 11-01-2014

### Abstract

Wild species of crop plants carry useful genes which can be used for breeding programs. This study was performed to investigate genetic variation of 46 genotypes from five *Carthamus* species and to evaluate their drought tolerance under field conditions (normal and deficit moisture environments) during 2011 at Isfahan University of Technology Research Farm. Results indicated that safflower species had different response to drought stress. Results showed that drought stress significantly reduced seed yield in *C. tinctorius* and *C. palaestinus*. The wild species of *C. palaestinus* had higher seed yield, its component and oil percent compared other species in both moisture conditions. Drought tolerance indice (STI) showed that *C. palaestinus* had the highest drought tolerance. Cluster analysis based on agro-morphological traits indicated that three species *C. tinctorius*, *C. palaestinu* and *C. oxyacanthus* had the most similarity among studied species. Finally in respect to high hybridization of two main safflower relatives *C. palaestinus* (because high STI) and *C. oxyacanthus* (because high stability under drought condition) are suitable source for transferring drought tolerance genes to cultivated species.

**Keywords:** Oilseed, Wild relatives, Drought tolerance indice

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## Study the Effect of Cadmium Stress on Morphological Traits and Cadmium Accumulation in Barley

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Received: 18-08-2013

Accepted: 16-04-2014

### Abstract

Cadmium is a toxic metal that affect human and other organism's life. In other to study the effect of Cd stress on morphological traits in 40 barley genotypes, a split plot experiment was conducted based on completely randomized design with three replications at the University of Mohaghegh Ardabili in 2011. CdCl<sub>2</sub> was used in two levels (control and 50 μmol). Seeds were cultivated in perlite and Pit moss medium, and Hogland nutrient solutions (with and without Cd) were used for irrigation. After maturity stage morphological traits were measured. Analysis of variance showed considerable variation for Cd accumulation between the genotypes. At control level, the genotypes had not accumulation of Cd. At Cd stress level, the grains of Abidar, Dasht, Sahra, GhareArpa, Yensivi, Daytonrani and Sahand varietis and some of lines had not accumulation of Cd and the line number of 18 (F-A2-11) and the Bahman varietis had highest Cd accumulation. Also, the highest accumulation of Cd in the shoot and leaves was observed in the line number of 18. Then, the lines 24, 25, 29 and Bahman variety had higher Cd accumulation in the shoot and leaves. The lines 3, 6, 7, 12, 13, 16 and 20 and Yensivi and Makoei varieties had the lowest Cd accumulation in the shoot and leaves. In total, Cd stress reduced measured traits mean in most genotypes. Cluster analysis of the genotypes based on measured traits categorized the genotypes into five groups. At control and Cd stress levels. The Gharearpa variety had higher mean for most traits and at control and stress levels located in groups that had higher traits average than other groups.

**Keywords:** Barley, Genetic diversity, Stress, Tolerance of Cultivars, Toxic metals

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## Effect of Different Irrigation Methods and Manure Application on Grain Maize cv. KSC704

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Received: 19-08-2013

Accepted: 05-07-2014

### Abstract

In order to study the effect of manure and irrigation methods on maize (*Zea mays* L. cv. KSC. 704) an experiment was conducted by using split plot in the form of randomized complete block design with four replications at Hajiabad agricultural research station in Hormozgan province in 2011 growing season. Irrigation methods in four levels: irrigation from one side of ridge until the end of the season ( $I_1$ ), irrigation from one side until  $V_{12}$  stage after two sides until the end of the season ( $I_2$ ), irrigation from one side until flower formation after two sides until end season ( $I_3$ ) and irrigation from two sides of ridge until the end of the season ( $I_4$ ) as main plots and different levels of manure as the second factor in four levels (0 (Control), 20, 40 and 60 tons/hectare) were randomized in subplots. Plant height, 1000 grain weight, ear traits and grain yield were measured. The results showed that effect of irrigation methods and organic fertilizers were significant on all traits. Results of interaction of treatments showed that the highest grain yield ( $8700 \text{ kg ha}^{-1}$ ) was obtained at irrigation from two side of ridge until the end of the season and consumption of 60 tons/hectare of manure and the lowest grain yield ( $4890 \text{ kg ha}^{-1}$ ) was obtained from one side of ridge until the end of the season and non application of manure.

**Keywords:** Irrigation methods, Ear traits, Grain yield

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## Effect of Drought Stress on Yield and Yield Components of Sesame Cultivars under Kerman Conditions (*Sesamum indicum* L.)

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Received: 21-08-2013

Accepted: 27-01-2014

### Abstract

To investigate effects of drought stress on yield and yield components of sesame in Kerman region a split-plot experiment based on complete randomized block design with three replications was carried out in 1388. Irrigation levels (Normal irrigation in all growth stages, withholding water after 50% flowering, withholding water after 50% pod setting) and different sesame landraces (Jiroft, Shiraz, Ardestan, Dezful, Shahr babak, Gorgan, Sirjan, Markazi, Birjand and Orzueieh) were considered as main plots and sub-plots, respectively. Plant height, the biggest pod length, number of grain per pod, number of pod per plant, grain weight per plant, 1000 grain weight and grain yield were measured traits. Results showed all the measured traits were significantly affected by the irrigation treatments. The effects of different landraces on all traits except number of grain per plant were significant. Irrigation  $\times$  landraces interaction affected all measured traits except the biggest pod length significantly. The highest grain yield was recorded for Markezi landrace ( $845.2 \text{ kg ha}^{-1}$ ) under normal irrigation and the lowest one was obtained from Jiroft landrace ( $104.8 \text{ kg ha}^{-1}$ ) with withholding irrigation after 50% flowering.

**Keywords:** Drought stress, Flowering stage, Pod setting stage, Number of grain per pod

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## The Effect of Different Soil Disturbance Methods and Weeds Control on Cotton (*Gossypium hirsutum* L.) Yield after Wheat

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Received: 07-09-2013

Accepted: 24-11-2013

### Abstract

To evaluate the effect of combined use of different soil tillage methods and weed control on cotton yield, a split plot experiment based on randomized complete block design was conducted at the city of Boshruyeh in 2012. Experiment factors were tillage method as Main-plots with three levels, including conventional tillage, no-till system and minimum tillage; and different methods of weed control at 5 levels (the herbicide trifloxy sulfur on sodium at 10, 15 and 20 g ha<sup>-1</sup>, as well as no weeding and hand hoeing) as sub-plots with four replications. The results showed that there were significant differences between the various methods of tillage methods, so that the cotton yield, monopidal branch length, number of monopidal and sympodial branches, plant height and number of bolls in minimum tillage and no-tillage systems were greater than conventional system. Application of 20 g ha<sup>-1</sup> of trifloxysulfuron sodium led to improved cottons yield, because Better control of weeds and eliminate their competition with cotton. The interaction effect of soil disturbance and weed control method was significant on the number of monopidal branches. The greatest number of monopidal branches were obtained from the conservation tillage and hand weeding.

**Keywords:** Fibrous plant, Conservation tillage, Envoke, No tillage, No weeding

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## Effect of Tillage Systems and Water Stress on Growth and Yield of Wheat

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Received:09-09-2013

Accepted:05-11-2014

### Abstract

Conservation tillage has been generally confirmed to improve water use efficiency, crop yield, and economic benefit. In order to evaluate the effect of tillage systems and water stress on growth and yield of wheat, a field experiment was conducted during in 2012 growing season as split plot arranged in randomized complete blocks design with four replications. The main plot includes different tillage systems (no tillage, conventional tillage and reduced tillage) and sub-plot, includes water stress at different growth stages {normal irrigation or control, cutting irrigation from stem elongation stage (severe stress), ear emergence (moderate stress) and grain filling (mild stress)}, respectively. The results showed that the most grain yield ( $6.91 \text{ ton ha}^{-1}$ ) was obtained in conventional tillage and control treatment (normal irrigation) with no significant differences with reduced tillage systems and normal irrigation ( $6.87 \text{ ton ha}^{-1}$ ), while that conservation tillage was used less (32.4%) water compared conventional tillage. In general, water stress at different growth stages significantly decreased seed yield. Cutting irrigation at stem elongation, ear emergence and grain filling stages reduced yield 55.77%, 30.35% and 23.88% compared to control, respectively. Therefore, reduced tillage system is recommended for the region with consuming less water and seed yield equal conventional tillage.

**Keywords:** Cutting irrigation, Ear emergence, Grain filling, Reduce tillage

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## Effect of Different Rates and Application Times of Nano-iron on Yield and Yield Components of Canola (*Brassica napus* L.)

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Received: 17-10-2013

Accepted: 11-06-2014

### Abstract

In order to study the effect of nano- iron fertilizer, a field experiment was conducted at 2012-13 in Agriculture Faculty of Shahid Chamran University of Ahvaz. Experimental design was factorial based of RBC with three replications. Frist factor was includ 5 different iron concentrations and second was includ 3 spraying times. Yield and yield component of canola were calculated. Our result showed that applying Iron fertilizer vs. not applying, use of nano-iron vs. regular iron and time of spraying had significant effect on yield and yield component of canola. Among treatments, applying 6 g l<sup>-1</sup> nano-iron had highest (4.13 ton ha<sup>-1</sup>) grain yield that due to both better pod per plant and 1000-grain weight. Also, earlier spraying had better effect on grain yield than delaying in spray. Iron concentration in grain improved with increasing in iron concentration in fertilizer. In conclusion, we found that canola is a sensitive crop to deficit of iron. Therefore, using nano-iron in higher concentration has a positive effect on grain yield and oil content.

**Keywords:** Micro nutrient, Iron content, Oil percent, Grain yield, Nano fertilizer

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## Effect of Water Deficit on Water Relations, Photosynthesis and Osmolytes Accumulation of *Salvia leriifolia* Benth.

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Received: 28-10-2013

Accepted: 25-05-2014

### Abstract

In order to investigate the effect of water deficit (WD) stress on water relations and some physiological characteristics of *Salvia leriifolia* Benth., a greenhouse experiment was conducted in completely randomized design with three replications. Irrigation treatments were full irrigated as 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 and the other set (Recovery treatments) irrigated to maximum water holding capacity after soil water was depleted in each stress levels. The results showed that LRWC and MSI significantly ( $P \leq 0.05$ ) decreased by 17.3% and 21% in severe stress compared to control respectively. Soluble carbohydrates content was increased with increasing WD levels. There was strong negative correlation between LRWC and proline content ( $r = -0.99^{***}$ ), therefore leaves proline content increased twice at -1.92 Mpa compared to control. Results also indicated that gas exchange parameters were not different in mild WD against control significantly. But decreasing soil matric potential to -1.92 MPa, net photosynthesis rate (A), transpiration rate and stomatal conductance ( $g_s$ ) decreased 52, 62 and 75 % compared to control respectively. In contrast WUEi and GEE increased 35 and 92% respectively. Positive and strong correlation were fitted between  $g_s$  and A ( $r^2 = 0.975^{***}$ ) with Logistic Model.

**Keywords:** *Salvia leriifolia* Benth., Water stress, Membrane stability index, Proline, Photosynthesis Gas exchange

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## Effect of Seed Inoculation with Plant Growth Promoting Rhizobacteria (PGPR) Affected by Different Levels of Nitrogen and Phosphorus Fertilizers on the Yield and Some Physiological Parameters of Barley (*Hordeum vulgare* L.)

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Received: 30-10-2013

Accepted: 01-02-2014

### Abstract

In order to investigate the effects of plant growth promoting rhizobacteria inoculation on growth criteria and yield of spring barley in different levels of nitrogen and phosphorus fertilizers, an experimental was conducted in two years at the Research Farm of Islamic Azad University, Ardabil branch during two growing seasons of 2009-2010 and 2010-2011 years. Experiment was conducted as Factorial split-plot design with three replications. The combination of nitrogen fertilizer in three levels (0, 40 and 80 kg N ha<sup>-1</sup> as urea) and phosphorus fertilizer (0, 30 and 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) were factorialy assigned to the main plots and seed inoculation with plant growth promoting rhizobacteria in four levels (no inoculation, seed inoculation with *Azotobacter chroococcum* strain 5, *Azospirillum lipoferum* strain OF and combination of *Azotobacter* + *Azospirillum*) were assigned to the subplots. The results showed that with increasing of nitrogen and phosphor rates and seed inoculation with plant growth promoting rhizobacteria, all of growth indices such as total dry matter, crop growth rate, relative growth rate and leaf area index were increased. Also, seed inoculation with both of *Azospirillum* and *Azetobacter* in all of sampling stages in growth indices was more than control (no seed inoculation). Maximum grain yield and leaf dry weight were obtained in highest rates of nitrogen and phosphor fertilizers with seed inoculation with both of *Azospirillum* and *Azetobacter* and minimum of they were obtained in no application of them.

**Keywords:** Crop growth rate, Relative Growth Rate, Leaf Area Index, Total Dry Matter and Leaf Dry Weight

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## Study on Seed Germination of Two Tomato Purified Cultivars under Salinity Stress

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Received: 10-12-2013

Accepted: 05-11-2014

### Abstract

Salinity stress at germination stage is a reliable test for evaluating of tolerance in many species. hence; this experiment was carried out to evaluate salinity tolerance of two common tomato cultivars in Khorasan province (Khorram and Mobil) during germination early seedling growth at 6 salinity levels 0, 40, 80, 120, 160 and 200 mM. Experiment was conducted as factorial based on a complete randomized design a completely randomized design with 4 replications. The results indicated two cultivars had significant different in salinity tolerance, as Khorram cultivar was more tolerant than Mobil cultivar. Khorram cultivar germinated up to 200 mM, while germination of Mobil cultivar was completely inhibited at salinity concentration over 120 mM. Salinity stress had significant effect on all studied traits in both cultivars. Mean germination time increased with increasing salinity stress (concentration), but germination percent, germination rate, and radical and plumule length were reduced.

**Keywords:** Germination percent, Germination rate, NaCl

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## Evaluation the Morphophysiological Changes in Wheat Cultivars with Application of Mycorrhiza and Azospirillum

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Received: 21-06-2014

Accepted: 20-12-2013

### Abstract

Resolution nutrient requirements in crops by non-chemical resource are new approach in production the organic crops. In order to study evaluation the morphophysiological changes in wheat cultivars from the use of Mycorrhiza and Azospirillum, an experiment was conducted in the research station of Shahid Chamran University of Ahvaz, Iran in 2012-13. The experimental design was factorial based on randomized complete blocks design with three replications. The treatments including of bacteria *Azospirillum lipoferum* in the two-level (non-inoculated seeds and inoculated seed), Mycorrhiza fungi in three levels (no use of strain and using strain *Glomus intraradices* and *Glomus mossaiae*), and wheat cultivars in three levels, (Chamran, Dena and Behrang). The results had indicated a significant and positive effect of microorganisms use on wheat cultivars for most traits. So that cooperation of Mycorrhiza 7 to 33% and associative symbiosis of Azospirillum 7 to 29% improved traits. However, concurrent use, led to increase the use of biological fertilizers effects on morphological traits of wheat. But the greatest plant height (103 cm), grain protein concentration (12.58%) and number of spikes per unit area (519 m<sup>2</sup>) was obtained from inoculation of C.V Dena seeds with *Azospirillum* and *G. mossaiae* and the highest flag leaf length (29.33 cm), days to maturity (118 days), the yield of single plant (6.96 g) and spike length (9.33 cm) was obtained from inoculation of C.V Chamran seeds with *Azospirillum* and *G. mossaiae*. Also the highest mycorrhizal dependency (32%) and Growth response (47%) was obtained from C.V Dena seeds with *G. mossaiae*. So wheat nutrition with Azospirillum and Mycorrhiza can be been suitable replacement for chemical fertilizers.

**Keywords:** Days to maturity, Flag leaf length, Grain Protein, Morphology, Mycorrhizal dependency

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## Effect of Water Potential Levels on Germination and Seedling Growth Stages of Four Canola (*Brassica napus* L.) Cultivars

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Received: 03-02-2014

Accepted: 11-01-2015

### Abstract

In order to evaluate the effects of water potential levels on germination and seedling growth of four canola cultivars, two laboratory experiments were conducted, using a factorial arrangement in a Completely Randomized Design with three replications during 2009. The factors consisted of four cultivars (Hayola, Zarfam, Okapi and Talaye) and four water potential levels (Zero, -0.2, -0.4, and -0.6 MPa). In germination experiment results showed that the effects of cultivar, water potential and their interaction on germination percentage and rate; fresh and dry weight and length of radicle and plumule was significant. With reduction of water potential, germination percentage more reduce than germination rate. Okapi and Hayola had maximum and minimum tolerance to reduce of water potential, respectively. In seedling experiment results showed that cultivars, water potential and their interaction had significant effect on length of stem and root, dry weight of stem and root, a/b chlorophyll and leaf proline content. With reduction of water potential, a/b chl. and leaf proline content were increased. In general results showed, Okapi was tolerated cultivar to water stress in germination stage, but at seedling stage, Zarfam was superior genotype, so in different growth stage tolerate to water stress don't a constant characteristic.

**Keywords:** Drought stress, Leaf chlorophyll, Percent of germination, Proline, Rate of germination

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## Investigating the Effects of Salinity Stress on Related Yield Traits in Eight Landraces of Fenugreek (*Trigonella foenum-graceum* L.)

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Received: 21-04-2014

Accepted: 12-08-2014

### Abstract

Salinity is considered as an important environmental stress and major problem in agriculture for arid and semiarid regions. Fenugreek is one of the important medicinal plant that used in the pharmaceutical industry. In order to investigate the effect of salinity stress on yield and yield components of eight landraces of fenugreek and identify the best landraces in terms of salt tolerance a factorial experiment was conducted in a completely randomized design with three replicates as potted in 2013. Experimental treatments were combination of eight fenugreek landrace (Isfahan, Tabriz, Hamedan, Sari, Challous, Amol, Mashhad and Yasooj) and three levels of salinity stress (60, 120 and 180 mMNaCl and tap water as a control). The results revealed that leaf area, plant height, number of pods per plant, number of seed per pod, number of seeds per plant, 1000-seedweight, seed yield per plant in the salinity level of 180 mM were decreased by %41.58, %16.72, %27.73, %40.44, %54.58, %8.88, %58.39 compared to control, respectively. Among the landraces, Mashhad and Challous landraces were the most resistant and Tabriz, Hamedan and Yasooj landraces were the most sensitive landraces to salinity.

**Keywords:** Height, Leaf Area, Medicinal Plants, Salt Tolerance Yield Components

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