



Studies on the Effects of Climatic Factors on Dryland Wheat Grain Yield in Maragheh Region

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Abstract

In order to study the effects of climate variables on rainfed wheat grain yield, climate data and wheat yield for 10 years (1995-2005) collected from Dryland Agricultural Research Institute (DARI) in Maragheh as the main station in cold and semi-cold areas. Collected data were analyzed by correlation coefficient, simple regression, stepwise regression and path analysis. The results showed that relationships between grain yield with average relative humidity and total rainfall of growing season was positive and significant at 5% and 1% probabilities, respectively. However, evaluation between grain yield with sunny hours and class A pan evaporation was negative and significant ($p < 0.05$). There are two-regression models between grain yield and average relative humidity and total cropping years rainfall in simple regression method. In stepwise regression method, only total cropping year's rainfall parameter had positive and significant relationship at 1% probability with grain yield. Path analysis results showed that direct effects of average temperature and total cropping year's rainfall were positive and non-significant on grain yield. In addition, indirect effect of class A pan evaporation had affected other climate parameters. It can be concluded that there was relationship between some climate parameters and Sardari dryland wheat grain yield. Also the relationships between grain yield with average temperature and total cropping year's rainfall was positive but with class A pan evaporation was negative.

Keywords: Climatic factors, Path analysis, Stepwise regression, Grain yield, Rainfed wheat

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Effects of Salinity and Drought Stresses on Germination Characteristics of Milk Thistle (*Silybum marianum*)

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Abstract

In order to study the germination and seedling growth responses of Milk Thistle as a medicinal plant to salinity and drought stresses, two separate experiments were conducted based on completely randomised design with four replications. In the first experiment, the effect of drought potential levels (0, -1, -2, -3, -4, -5, -6, -7, -10, -15 and -20 bars) due to using polyethylenglycol (PEG) 6000 and the second trial evaluated effects of salinity potential (0, 50, 100, 150, 200, 250 and 300 ml/molar) caused by NaCl were studied on germination characteristics and seedling growth. The results indicated that salinity and drought stresses showed significant effects on germination and seedling growth of milk thistle. The seeds were able to germinate in 300 ml/molar salinity potential and -20 bar drought potential conditions. The effect of both stresses on length and dry weight of seedlings were significant and with increasing salinity and drought stresses, the length and dry weight of radicles and plumules decreased. Increasing drought level, led to higher plumule length reduction compared to radicle length reduction, which shows that milk thistle plumule is more sensitive to droughtness than radicle. Dry weight of seedling at -3 bar drought potential was 50% of control plants.

Keywords: PEG, Drought stress, Sodium chloride, Milk thistle

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Quantitative and Qualitative Characters of Madder Root at Three Different Regions of Fars Province

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Abstract

Madder (*Rubia tinctorum* L.) from *Rubiaceae* family, is an important industrial (dying crop) and medicinal (anti-cancer and necrosis) crop. To investigate the cultivation method, the best harvest time and also to determine dye percent of madder root, a three-year experiment was conducted at three regions of Zargan, Sarvestan and Neiriz of Fars province. At each location two fields with different soil salinity levels (high and low EC) were selected. Two method of sowing (seed and root) were used in each experiment. The experimental layout was a complete randomized block design with four replications. Root dry weight and dye percent were determined at the end of second and third year of the experiment. Mean comparison showed that root dry weight and dye percent increased significantly at the end of third year. Furthermore, root dry weight was found to be higher from both root and seed sowing in saline soils at Neiriz and Sarvestan. Overall, these three years experiment showed that root and dye yield increased in saline soils at third year. It appeared that Sarvestan might be a suitable location for madder cultivation. Further field researchs are recommend on this important industrial and medicinal plant in marginal lands of Fars province.

Keywords: Madder (*Rubia tinctorum*), Root weight, Dye percentage, Fars province

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Studies on the Effect of Type and Solarization Period on Germination Percentage of Four Weed Species

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Abstract

In order to study the effects of soil solarization on weed control, an experiment with factorial arrangement in a randomized complete block design with four replications was conducted in a fallow farm in Daregaz in 2008. Factors included solarization duration (0, 2, 4 and 6 weeks) and soil moisture content (dry and moist). Soil seed bank was sampled (in two depth, 0-10 and 10-20 cm) prior to the experiment and immediately after applying treatments, and germination percentage of weed species were determined. Results of this study showed that seed germination percentage in 10 cm soil depth was influenced by soil moisture and solarization and their interactions, while in 20 cm soil depth only solarization period affected the weed seed germination. Germination percentage in moist soil was less than that in dry soil. Seed germination percentage declined more by increasing solarization duration, so that the greatest decline was obtained after 6 weeks solarization. Solarization decreased germination percentage in moist soil more than that in dry soil. Overall, the results of this experiment indicated that solarization of moist soil for 6 weeks was the most effective treatment in controlling common lambsquarters (*Chenopodium album*), common purslane (*Portulaca oleracea*), redroot pigweed (*Amaranthus retroflexus*), and wild mustard (*Sinapis arvensis*), while solarization of dry soil for 2 weeks was the least effective treatment for weed control.

Keywords: Solarization, Soil moisture, Seed bank

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Effect of Plant Spacing and Plant Density on Yield and Yield Components of Two White Bean (*Phaseolus vulgaris* L.) Promising Lines in Presence and Absence of Weeds

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Abstract

Crop genotype with high potential in weed competition is one of the main factors affecting competition against weeds. This experiment was conducted in a split-factorial plot design with four replications in base based on randomized complete block design in National Research Institute of Bean (Khomein) in 2004. The main plot comprised of with and without weed control and sub plot comprised of the plant densities (30, 40 and 50 plant /m² or 60, 50 and 40 cm row spacing, respectively) and two lines of the white bean (KS41105 and KS41124). The evaluated characteristics were: plant height, branches number, pod number/plant, seed number/pod, seed number/plant, 100seed weight and grain yield. Results of the this experiment showed that decrease of row spacing caused increasing of the grain yield in both weed free and weed infest conditions. The maximum grain yield in KS41105 line with and without weed control obtained in 40 and 50 cm row spacing, respectively. In KS41124 line, maximum grain yield with and without weed control obtained in 50 and 40 cm row spacing, respectively. In two lines weed infested condition caused decreasing of the pod number/plant, seed number/plant and 100seed weight, but there were not any effect on seed number/pod.

Keywords: White bean, Weeds, Row spacing, Yield components

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Effect of Density and Time of Urea Foliar Application on Yield and Yield Components of Black Cumin (*Nigella sativa L.*)

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Abstract

In order to study the effect of density and time of urea foliar application on yield and yield components of black cumin (*Nigella sativa L.*) a field experiment was conducted at Research Station of Faculty of Agriculture, Azad University of Birjand in 1387 growing season. Three urea foliar application times [1-control 2-at 8-10 leaves stage 3-at 10% flowering 4-100% flowering] and three plant densities (100, 200, 300 plant m⁻²) were compared in split plot based on complete randomized block design with three replications. Studied components were 1000 seed weight, biological yield, seed yield, harvest index, number of capsules per plant, number of seeds per capsule. Results showed that urea foliar application times had significant effects on seed number per capsule and harvest index. Density had significant effects on capsules number per plant, seed yield, biological yield and harvest index. Between all densities 200 plant m⁻² and urea application at 8-10 leaves stage had the highest seed yield (593/33 kg/ha) and 100 plant m⁻² and foliar application at 8-10 leaves stage had the lowest (243/33 kg/ha) seed yield. It seems that 300 plants m⁻² and urea application at 100% flowering is the best treatment for black cumin yield in birjand.

Keywords: Black cumin, Urea foliar application, Harvest index, Density

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Response of Winter Wheat (*Triticum Aestivum* L.) Canopy, Leaf Chlorophyll, and Yield to Nitrogen Fertilizer Application Methods

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Abstract

In order to evaluate the effect of different nitrogen application methods on wheat canopy, leaf chlorophyll, and yield, a field experiment with a split plot arrangement in complete randomized block design with four replicates was conducted in 2006. Basal dressing in three levels (with no basal dressing, strip and distributing nitrogen fertilizer) as main plot and top dressing in six levels (distributing on tillering, two distributing on tillering and before spike appearance, water soluble fertilizing with herbicide application before spike appearance, two water soluble fertilizing on tillering and before spike appearance, two application: one distributing on tillering and one water soluble fertilizing before spike appearance and finally, three water soluble fertilizing on tillering, before spike appearance and milking period) as subplot were applied. The amount of fertilizer in strip application was 2/3 of distributing method. In the compartmented application, the amount of applied fertilizer was two third of distributing fertilizer method. Leaf area index for no basal nitrogen fertilizer application treatment was 21% lower than the mean of LAI for band and broadcasting application treatments. Band and broadcasting application of basal nitrogen fertilizer caused 45.4 and 61.6% increase in leaf area per plant in comparison with no basal nitrogen treatment respectively. Light transition from canopy for no basal nitrogen fertilizer treatment was 81.1% higher than the mean of light transition for band and broadcasting nitrogen application treatment. Although there was not significant differences between band and broadcasting application method, the lowest and the highest leaf chlorophyll was belong to no basal nitrogen and broadcasting treatment respectively. Based on leaf chlorophyll, split or integrated treatments of top dressing application of nitrogen fertilizer in spite of reduction of nitrogen application, because of optimization, did not have significant difference with conventional treatment (wholly distributing of top dressing nitrogen fertilizer on tillering).

Keywords: Wheat, Nitrogen fertilizer, Basal dressing, Top dressing, Leaf chlorophyll

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The Effects of the Drought Stress on Germination and Seedling Growth of Nine Cultivars of Sub Clover (*Trifolium Subterraneum* L.)

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Abstract

In this research the response of nine cultivars of Subclover to drought stress induced by polyethylene glycol 8000 during the stage of germination and seedling growth on the levels of drought 0, -2, -4, -6 and -8 (bar) in 20 °C were studied. With increasing of drought stress the percentage and rate of germination decreased and germination in all cultivar approached 0 in the -8 bar of drought. But the sensitivity of germination rate to changes of drought stress was more than the percentage of germination. The cultivar of Denmark and York had the highest rate of germination on all levels of drought and Larisina cultivar had the least rate of germination. The length of root and shoot was also significantly decreased with increasing drought stress and the percent of decrease of the shoot length in comparison with the drought stress was more than the length of root, or the sensitivity to drought stress of shoot length was more than root length. With increasing of drought stress in all cultivar, the dry weight of seedlings decreased significantly. The percent of decreasing was different among cultivars. In most cultivars in the -4 bar level of drought, the dry weight of seedling, decreased more than 50 percent compared to control. The results of this research showed that drought stress affects on all germination parameter and seedling growth of subclover and the subclover is a sensitive plant to drought, however, the response of the studied cultivars was different. The cultivars Goss and York stand without any decrease in seedling dry weight up to -2 bar, but the dry weight of the dry seedling in Stenwart and Banch cultivars decreased from 0 drought.

Keywords: Subclover (*Trifolium subterraneum* L.), Drought stress, Germination, Seedling growth

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The Effects of Limitation of Source and Sink on Yield and Yield Components of Cumin (*Cuminum cyminum*)

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Abstract

In order to study the effect of limitation of source and sink on yield and yield components of cumin, an experiment was conducted in complete randomized block design in Research Field of Agriculture Faculty of Ferdowsi University of Mashhad during the years 2006-2007. The treatments were control, defoliation of 100% of leaves, defoliation of 50% of leaves and removing of 50% of umbrellas. The result indicated that in first sampling (10 days after treatments), dry matter and green area of plant significantly influenced by removing of leaves and umbrellas, in a way that increasing in defoliation cause reduction of dry matter accumulation and total green area of plant. In second sampling (24 days after treatments) defoliation of leaves and umbrellas imposed a significant effect on dry matter and total green area of plant. Leaf weight, stem weight and reproductive organs weight influenced by defoliation and umbrellas removing and in each three component the highest amount was observed in control treatment. In maturity stage, only the number of umbrellas per plant influenced by defoliation and umbrellas treatments. In control and defoliation of 50% of umbrellas, there was no significant difference between grain yield and biological yield. The highest grain weight and harvest index obtained at control and removing 50% of umbrellas. The lowest grain yield observed in 50% of umbrellas removing, whereas, the lowest biological yield observed in 100% defoliation. Moreover, the results indicated that when plant exposed with complete defoliation, accumulates more dry matter in reproductive organs and when exposed with half of umbrellas removing, dry matter partitioning pattern shift to vegetative organs.

Keywords: Defoliation, *Cuminum cyminum*, Yield, Yield components, Source limitation, Sink limitation

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Evaluation of Volunteer Barley Interference on Growth Indices of Some Wheat Cultivars

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Abstract

To evaluate interference effects of volunteer barley on growth indices of six wheat cultivars, a study conducted in Sabzevar region during 2007-2008 growing season. The experiment was established as randomized complete block design with factorial arrangement and three replications. The treatments were six wheat cultivars in weedy and weed free situation. The studied cultivars including: 1- Chamran 2- Gascogen 3- Mahdavi 4- Pishtaz 5- Shiraz and 6- Falat with densities of 350, 375, 375, 400, 400, 325 seed m⁻². Valfajr cultivar was used as a volunteer barley with density of 50 plant m⁻². Base on variance analyze results volunteer barley interference reduced grain yield, leaf area index, relative growth rate, crop growth rate, height and dry matter accumulation of wheat cultivars. The maximum of grain yield in monoculture and mixedculture was obtained in Shiraz and Mahdavi cultivars, respectively and the minimum values was found in Gascogen and Chamran cultivars, respectively. The maximum of leaf area index in monoculture and mixedculture were in Mahdavi cultivar, which could be caused by higher height and thus increased shading on volunteer barley and limitation on its growth. Comparison of cultivars relative growth rate in monoculture and mixedculture showed that Mahdavi cultivar had minimum reduction of relative growth rate. Moreover crop growth rate of Shiraz cultivar in monoculture and Mahdavi cultivar in mixedculture was greater than other cultivars. Results showed that yield of evaluated cultivars in volunteer barley interference situation were affected by height, leaf area index, relative growth rate, crop growth rate and accumulated dry matter, and Mahdavi cultivar showed better performance in these traits.

Keywords: Grain yield, Competition, Leaf area index, Relative growth rate, Crop growth rate, Dry matter accumulation

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The Effect of Inoculants of *Thiobacillus* and *Aspergillus* on Corn Growth

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Abstract

Phosphorus (P) is one of the essential macronutrients for growth and development of plant. Phosphorus is added to soil in the form of phosphatic fertilizers, part of which is utilized by plants and the remainder converted into insoluble fixed forms. Increasingly high cost of chemical fertilizers has been the major stimulus to search for an alternative, naturally-occurring, phosphate source. The researchers offered phosphorus rocks as a valuable alternative source for P. fertilizer. Unfortunately, rock phosphate is not plant available in soils with a pH greater than 6. One method to increase soluble form inorganic P is application of phosphate solubilizing microorganisms and sulfur oxidizing bacteria (*Thiobacillus*) with rock phosphate. A greenhouse experiment was carried out with two bio fertilizers (bio fertilizers santes in incubation condition) in a soil with low available P on corn growth. The bio fertilizers were: rock phosphate with 20% sulfur, 15% vermicompost, *Thiobacillus* bacteria and *Aspergillus* fungi (BFS20V15) at three rates: 440 kg/ha (BF1) , 880 kg/ha (BF2), 1320kg/ha (BF3), rock phosphate with 20% sulfur, 15% vermicompost, *Thiobacillus* bacteria (BFS20V15) at three rates: 440 kg/ha (B1) , 880 kg/ha (B2), 1320kg/ha (B3), triple super phosphate (TSP), and control without phosphorus. In the greenhouse experiment, shoot dry matter, p uptake in plant and available p in soil were determined. The results showed that maximum yield obtained from BF3 with the shoot dry weight 7.2 g per plant and with no significant difference in relation to the triple super phosphate (7.5g) at 5% level. Also highest rate p-uptake resulted from BF3. There was significant difference between treatment BF3 and TSP on p-uptake. Results indicated that it could be possible to substitute rock phosphate inoculated with sulfur-oxidizing bacteria and phosphorous-solublizing fungus for super phosphate.

Keywords: Uptake-p, pH Rock phosphate, Solfur, Vermicompost

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***In Vitro* Optimization of Rooting in Two Genotype of Lentil (*Lens culinaris* Medik.)**

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Abstract

Establishing of an efficient and repeatable regeneration protocol is one of the basic prerequisites for gene transformation and plant breeding. Lentil, because of rooting problems, is a recalcitrant legume in respect of whole regeneration. For this, we examined two methods *in vitro* and *in vivo* flowing *in vitro* method to induce root on regenerated shoots. *In vitro-in vivo* method was better than *in vitro* for rooting of regenerated shoots. The shoots regenerated from medium containing 2 mg/lit BAP produced higher frequency of rooting (70%) than medium containing 3, 4 mg/lit BAP that represents the inhibitory effect of cytokenins on root induction. IBA (10 mg /lit) as a overnight pretreatment, induced higher frequency of rooting than 3 days pretreatment while, NAA hormone with similar concentration as a 3 days pretreatment produced highest frequency of rooting (80%). Genotypes had no effect on percent, number and length of produced roots.

Keywords: Lentil, Rooting, Auxin, explant, *in vitro*

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The Effect of Preceding Crop, Nitrogen Fertilizer and Return of Crop Residue on Growth and Yield of Wheat

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Abstract

This study was conducted under cold temperate climate condition in Khorasan during 2006-2008 growing season to determine the suitable preceding crop, nitrogen and crop residue management for wheat. A randomized complete block design in split-split plot arrangement with three replicates was used. Main plots were rotation with five different crops including wheat-wheat, potato-wheat, silage corn-wheat, clover- wheat and sugar beet-wheat. Sub plots were N fertilizer rates in preceding crop including no N (Control), 50% lower than optimum N rate, optimum N rate and 50% more than optimum rate. The sub-sub plots were preceding crop residue return with two levels including no residue return (Control) and 50% return of crop residue. Results showed that crop rotation and N rate in preceding crop influenced grain yield, biological yield, spike per m², stem length and spike length in wheat. Interaction of crop rotation and N rate on grain yield and yield components was significant. The highest yield obtained from potato-wheat rotation and the lowest grain yield observed in continuous wheat rotation for all N rates. There was no significant difference for 1000 kernel weight and kernel per spike of wheat in all treatments. Return of crop residue had no significant effect on grain yield but was effective on biological yield, spike per m² and harvest index.

Keywords: Crop rotation, Crop residue management, Nitrogen, Wheat

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Evaluation of Agronomic Traits and Determination of Variables for Improving Yield of Rice Cultivars

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Abstract

IN order to study correlation and relations between yield and other agronomic and quantitative traits in rice, six rice cultivars were crossed in half a diallel design in 2005. In the next year, parents and their progenies were grown in a randomized complete block design with three replications in field research station of Faculty of Agricultural Sciences of the University of Guilan, Rasht, Iran and 15 traits were measured. Principal component analysis detected five components that explained 74.57 percent of the total variation. Grain yield was significantly and positively correlated to width, angle and area of flag leaf, number of panicles/plant and growth period. Correlation between 1000-grain weight and grain yield was negative. Stepwise regression analysis indicated that plant height, number of sterile grains per panicle, growth period, panicle length, 1000-grain weight and flag leaf area as effective traits to explain 76.5 percent of total grain yield variation. According to path analysis, growth period had the positively highest direct effects on grain yield; however, panicle length showed negatively highest direct effects. Factor analysis showed that 74.57 percent of total variations were determined by five independent factors. In cluster analysis studied traits and genotypes were classified into four groups based on Ward's method.

Keywords: Rice, Cluster analysis, Factor analysis, Path analysis, Yield

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Effects of Planting Date, Time and Methods of Weed Control on Weed Density and Biomass in Cumin Fields

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Abstract

Two field experiments were carried out in order to evaluate the effect of planting date, method and date of weed control on weed density and biomass in the experimental research field, Faculty of Agriculture, Ferdowsi University of Mashhad, during 2006 and 2007. Treatments included planting date (30 December, 20 January and 30 February), weeding date (first true leaf, start of branching and beginning of flowering stages) and weed control methods (hand weeding, fire treatment and control). The results showed that there were significant differences in the number of weeds between different sowing dates, weeding dates and control methods. The highest mean density and biomass of weeds were obtained on the planting date, 30 February, and when weed was controlled at the first leaf appearance stage with fire treatment. The most appropriate time for weed control was at the beginning of cumin flowering. Fire treatment reduced weed growth in the first half of growing season. However, hand weeding significantly reduced weed density and biomass in the second half of cumin growing season. The first planting date caused the lowest mean weed biomass and the highest cumin yield compared to later planting dates. Hand weeding treatment contained lower mean weed density and biomass compared to fire treatment, however, cumin yield was lower in hand weeding plots than fire treatment.

Keywords: Cultural control, *Cuminum cyminum*, Fire, Hand weeding, Control time

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Calculating and Comparison of Different Vegetation Indices by Using Landsat ETM⁺ Images to Study Vegetation Cover in Neyshabour Area

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Abstract

Understanding plant cover performance in a region is one of the most important factors in controlling soil fertility and its management. In studying plant cover by using of traditional field data collection methods are difficult and time consuming. Using of GIS data in vegetation cover studies satellite images can be helpful in reducing of time and obtaining more precise information. In this study different aspects were considered to obtain the best composite of different indices and identifying the most suitable parameters. The related bands obtained from tasseled cap, principal components analysis and the calculated indices were also used to evaluate the role and effects of different filters on Landsat ETM⁺ of Neyshabour region. Regression equation and regression coefficients of different parameters were analyzed and evaluated. Finally the most applicable indices were compared with the classes obtained from image classification. The results showed that mean filter of 3×3 has higher correlation coefficients when digital numbers were compared with field collected data. The indices of MSR, VI5, VI6, VI1, RI, BI1, SI, NDVI, TVI, NDSI, SAVI, MND, MSAVI, Complex multirato و COSRI and also PCA1 and the PCA3 obtained from principal components analyses, brightness and greenness bands received from tasseled cap conversion are providing better recognition and evaluation of plant cover in the region.

Keywords: Vegetation indices, Principal components analysis, Tasseled cap, Image classification, Landsat

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Evaluation of Drought Tolerance in Cold Hardy Lentils (*Lens culinaris medik.*) at Germination Stage

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Abstract

Germination and emergence of cold tolerant lentil genotypes sometimes experiences low temperatures and variable rainfalls in the fall planting. This study was conducted to evaluate the effects of drought stress on germination stage of lentil genotypes. Experiment was carried out with 18 lentil genotypes under five levels of water potential (0, -0.4, -0.8, -1.2, -1.6 MPa) using PEG solutions with a 5×18 factorial experiment based on a completely randomized design with three replications of 25 seeds at 13°C. Germination and normal seedling percentage, germination rate, radicle and plumule length were measured. Germination averaged over genotypes was 88% at 0 MPa whereas it was 18% at -1.6 MPa. MLC20, with 79%, MLC138 and MLC25 with 74% showed the highest germination, whereas MLC245 and MLC7 with 45% and 47% percent had the lowest germination percentage, respectively. The effects of water potentials × genotypes on all traits were significantly different ($p < 0.05$). At 0 MPa water potential 10 genotypes had higher than 90% germination, whereas in -1.6 MPa 12 genotypes had less than 30% and even at six genotypes there was not germination. ranking of genotypes for evaluated traits indicated MLC20 and MLC7 as a tolerant and a sensitive genotype to drought at germination stage, respectively.

Keywords: Water potential, Germination, Low temperature, Fall planting, Germination ranking

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Effects of Different Densities of Cotton (*Gossypium Hirsutum*) and Common Lambsquarter (*Chenopodium Album*) on Some Cotton Growth Characteristics in Birjand Condition

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Abstract

Weeds are problematic plants in agroecosystems as a competitor for crops. In order to evaluate effects of cotton (*Gossypium hirsutum*) and common lambsquarter (*Chenopodium album*) densities on some crop growth indices, a study was conducted during 2006 in Experimental Station of Faculty of Agriculture, The University of Birjand as factorial experiment based on complete randomized block design with four replications. Three densities of cotton (6, 9 and 12 Pl.m⁻²) and four weed densities (0, 6, 9 and 12 Pl.m⁻²) were used to provide different weed interference levels. Indeed, three plots in each replication were intended to cultivation of lambsquarter alone at 6, 9 or 12 Pl.m⁻². Results showed that crop growth rate (CGR) of cotton was influenced by weed density, and its relative growth rate (RGR) and net assimilation rate (NAR) indicated a declining trend as weed density increased. Dry matter accumulation of cotton also was affected negatively by weed densities, as interference of lambsquarter at 6, 9 and 12 Pl.m⁻² resulted to 35, 42 and 48 percent dry matter reduction, respectively, than weed-free treatment. Increasing of cotton density could partly compensate for negative impact of weed attendance on cotton growth. Thus, it seems higher plant densities can be used as a managing tool against weeds in cotton fields to avoid reduction of yield.

Keywords: Cotton, Density, Weed, competition, Growth analysis

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The Effects of Drought Stress at Different Phenological Stages on Morphological Traits and Yield Components of a Chickpea (*Cicer arietinum* L.) under Greenhouse Conditions

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Abstract

In order to evaluate the effect of drought stress on different phenological stages of jam chickpea (*cicer arietinum* L.) an experiment as completely randomized design with four replications was conducted at Research Greenhouse of Agriculture Faculty, Ferdowsi University of Mashhad. Drought stress was applied by no irrigation until the soil moisture reached to 20 percent of field capacity at different growth stages including the seedling, rapid growth, flowering, podding and seed filling. The traits such as plant height, node numbers, number and length of lateral branches, leaf dry matter were measured. All these traits significantly decreased by application of drought stress at different phenological stages. The maximum amount of plant seed weight and seed number, pod number, number and length of lateral branches were obtained for control and the minimum amount of these traits were for flowering stage. Results showed that the flowering stage in chickpea plant is more sensitive to drought stress. Although drought stress at seedling and rapid growth stages decreased the morphologic traits, leaf dry matter and seed number, but the seed weight in plant was similar to control and 100 seed weight was greater than control.

Keywords: Chickpea, Drought stress, Phenological stages

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Effect of Density and Different Planting Ratios on Grain and Biomass Yield of Grain Sorghum (*Sorghum bicolor* (L.) Moench) and Common Bean (*Phaseolus vulgaris* L.) in Intercropping System

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Abstract

Density and crop ratio are two important factors for evaluating traits in legume/cereal intercropping systems. For this propose the effects of density and crop ratios in row intercropping on grain and biomass yield of grain sorghum, (promising line, M5) and common bean (Talash cultivar) were investigated. This experiment was laid out in growing season of 2007 in a randomized complete block design in factorial arrangement with 3 replications using response model. Treatments included 3 densities (low: 19.2, bean & 6.3 sorghum; medium: 38.4 bean & 12.8 sorghum and high: 59.17 bean & 25.6 sorghum plant in m²) and 5 planting ratios (33:67, 50:50, 67:33, 100:0 and 0:100 sorghum: bean). The analysis of variance carried out by bivariate analysis, and approach of skew axis was used for comparison of means. The results of bivariate analysis showed that effects of density in biomass and seeds number per plant was significant ($p < 0.01$). Plant ratios had significant effects on grain yield ($p < 0.01$) but the thousand seeds weight and seed number per plant in the two crops were not significantly affected by planting ratios. Open angle between two skew axis indicated a positive correlation between two crops in grain yield affected by two sources of variation (densities and crop rates). High planting density showed the highest grain and biomass yields for both sorghum and bean, 5063.12 and 2106.26 kg/ha for grain yield and 32966.11 and 16564.22 kg/ha for biomass, respectively. Crop ratio treatment 33:67 (1 row of sorghum and 2 rows of bean) had the highest grain and biomass yield for sorghum in amount of 5435 and 34545 kg/ha respectively, whereas these amounts for bean were 2831.75 and 17282 kg/ha in 50:50 plant ratio treatment, respectively. Land equivalent ratios was more than one and maximum of this index (1.4) was obtained on high density and 67:33 plant ratio treatments.

Keywords: Row intercropping, Response model, Bivariate analysis of variance, Skew axis

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