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## Genetic diversity of rapeseed (*Brassica napus* L.) using SSR and ISJ molecular markers

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### ABSTRACT

To investigate the genetic diversity of 21 rapeseeds (*Brassica napus* L.), 20 semi-random ISJ and SSR primers were used. Primers produced a total number of 158 (81.5%) polymorphic bands (51 SSR and 107 ISJ bands). Average numbers of polymorphic bands for ISJ, SSR and combined of them were 10.7, 5.1 and 7.9, respectively. PIC values ranged from 0.0150 for specific primer O110D08 to 0.3420 for semi-random primer ET15-33. No significant differences were found between IT and ET primers with regard to polymorphic bands. According to UPGMA cluster analysis and Dice similarity matrix, rapeseed cultivars were divided in 3, 6 and 4 groups for ISJ, SSR primers and combine of them, respectively. Genetic variations don't agreed with geographic pattern and Iranian and foreign cultivars were not grouped in separate clusters, indicating presumably the proximity and kinship of Iranian and foreign genotypes. SLM096 and Licord with same origin produced separate groups and had high genetic distance with other genotypes; therefore, they can be used in the future breeding programs.

**Keywords:** genetic diversity, ISJ, rapeseed, SSR.

## **Nicosufuron+rimsulfuron (ultima) residues in maize filed by bioassay**

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### **ABSTRACT**

One of the most important adverse environmental effects of herbicide application in production systems is possible damage to non-target plants, such as crops that are grown in rotation. Nicosufuron+rimsulfuron (ultima) is a sulfonylurea herbicide that recently registered for use in maize fields in Iran. Its residues may be present more than a season in certain conditions. To measure nicosufuron+rimsulfuron residues, a greenhouse experiments were performed based on randomized complete block design in Karaj, Fasa and Moghan. At first, the sensitivity of eight plant species (wheat, barley, bean, lentil, vetch, canola, sugar beet, and cucumbers) to nicosufuron+rimsulfuron was determined using a completely randomized design. Lentil with the maximum inhibition of root length was detected as the most sensitive plants to the herbicide. Thus, it was used in bioassay trials to determine the concentration of the herbicide in the maize field. The determination of nicosufuron+rimsulfuron residues using standard regression equations showed that at the recommended dose of herbicide residues were detected up to 60 days after application. Based on the model parameters,  $x_0$  (time required for 50% dissipation of the herbicide) in Fasa was less than the other two regions, a 34.7% and 56.8% decrease compared to Karaj and Moghan, respectively. Thus, in areas where corn is rotated as a second crop and its weed are controlled by ultima, considering the suitable re-cropping interval to reduce the adverse effects of this herbicide on the next plants is necessary.

**Keywords:** herbicide dissipation, lentil, sulfonylurea.

## Relation between the increasing soluble phosphorus and nitrogen uptake and its effects on phosphorus harvest index of black seed

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### ABSTRACT

In order to evaluate the effect of increasing soil soluble phosphorus (P) and its effect on nitrogen (N) and P uptake, P uptake efficiency and P harvest index of black seed (*Nigella sativa* L.) in a calcareous soil; a field experiment was conducted as factorial layout based on a randomized complete block design with three replications at Research Station, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in year 2013. The experimental treatments were all combination of soil amendment in four levels (vermicimpost (V) + *Tiobacilus* (T), Sulfur (S) + T, V+S+T and control) and three levels of phosphorus (0, 30 and 60 kg.ha<sup>-1</sup>). Results showed that S+T and V+S+T had significant effects on reducing soil pH (by 0.94 and 0.61 units, respectively). The resources of soil amendment (V+T, S+T and S+V+T) significantly increased the P uptake by plant and P harvest index of black seed. A significant positive correlation was observed between P and N concentration of plant. However, there was a significant negative correlation between grain yield and P uptake efficiency of black seed.

**Keywords:** phosphorus uptake efficiency, phosphorus use efficiency, soil pH.

## Effect of salinity stress on some agronomic characteristics, grain yield and its components in Seri/Babax recombinant inbred lines wheat

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### ABSTRACT

To study and determine effect of salinity on relationship between agronomic characteristics and grain yield, 167 of the Seri/ Babax recombinant wheat inbred lines (RIL) together with two parents were evaluated using alpha lattice design with two replications under two conditions (salt stress and normal), in Zabol field station in 2011-12 cropping season. Fourteen traits including: some agronomic characteristics, grain yield and its components, were measured and recorded for 169 genotypes. Results of simple correlation coefficient analysis indicated a significant positive correlation between grain yield with harvest index, biological yield, the number of spike  $m^{-2}$  and the number of grain  $m^{-2}$  for both normal and stress conditions. Stepwise regression analysis showed that biological yield, harvest index, 1000 grain weight and Days to heading were of higher importance, among other grain yield components for normal condition, in determination of grain yield. Whereas in stress condition, biological yield, harvest index, plant  $m^2$  and plant height were the most important. Path analysis coefficients showed that the highest direct effects on grain yield were biological yield and harvest index for both normal and stress conditions. Factor analysis determined four and six factors under normal and salt stress conditions that accounted for 65% and 70% of total observed variations of grain yield. These factors were yield components, quality related traits and grain yield and its components. In conclusion, the results of this study identified harvest index and biological yield as important traits in selection for high yielding wheat genotypes.

**Keywords:** factor analysis, harvest index, wheat, biological yield, 1000 grain weight.

## **Evaluation the performance of some of Iran's native fennel (*Foeniculum vulgare* Mill.) accessions under drought stress condition**

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### **ABSTRACT**

In order to evaluate the effect of drought stress on grain yield and its components of fennel accessions, a field experiment was conducted as a split plot based on complete randomized block design with three replications. This experiment was conducted in research farm of Agricultural faculty of Zanjan University in 2012. In this study water stress in two levels included control and drought stress at reproductive stage were assigned to the main plots and five Iranian accessions of fennel included Zanjan, Lorestan, Esfahan, Hamedan and Kashan were assigned to the sub plots. The results showed that the effect of drought stress on grain yield and its components, biomass yield, grain essential oil percent and essential oil yield was significant ( $P \leq 0.05$ ). Also there were significant differences between Fennel populations about all studied traits. Majority of measured traits decreased under drought stress condition. So the highest grain yield (3284 kg/ha) was obtained in Zanjan accession and control conditions and the lowest amount of mentioned trait (1306 kg/ha) was obtained in Esfahan accession under drought stress condition. Kashan and Isfahan accessions had the highest and lowest essential oil yield respectively.

**Keywords:** drought stress, essential oil percentage, fennel, grain yield.

## Evaluation of some properties of Iranian wheat genotypes in normal and salt-stressed conditions using Restricted Maximum Likelihood (REML)

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### ABSTRACT

Applying an appropriate statistical analysis is complementary for conducting a robust experimental design in plant and animal breeding. In these experiments 33 Iranian bread wheat genotypes, cultivated in a randomized complete blocks design with three replications in two normal and saline conditions were evaluated at the field of National Salinity Research Center located in Yazd province, Iran. The restricted maximum likelihood (REML) was used to evaluate the different genotypic variance-covariance structures and to estimate the genotypic and phenotypic correlations of some of Iranian wheat traits under two normal and salt-stressed conditions. The Using different estimation by REML method the traits of grain yield, biological yield and harvest index had different and significant values across two conditions, this genetic variability can be used for salinity tolerance of bread wheat in breeding programs.. In addition, genotype by environment interaction for all traits was not significant, especially for grain yield as important trait for evaluation of salinity tolerance in wheat. The means comparisons of genotypes showed that the SALT22, SALT29 and SALT28 had the highest values and line No. 6, Shahpasand and line No.13 had the lowest values for grain yield, respectively. There were significantly positive genetic correlation between yield with biological yield (0.97) and harvest index (0.94) in combined analysis and negative genetic correlation for days to maturity with grain yield (-0.32) in saline condition by REML estimator. So, the selection of early maturing genotypes with higher yield in the saline condition, especially in the location of conducted experiment (Yazd) is achievable and selection can be done to improve the performance of salinity stress.

**Keywords:** mixed models, restricted maximum likelihood, salt, wheat.

## Genetic diversity and clustering of barley (*Hordeum vulgare* L.) genotypes to resistance of powdery mildew disease in seedling stage

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### ABSTRACT

This study was conducted to evaluate the resistance of 70 genotypes of barley to powdery mildew. After preparing the samples contaminated with powdery mildew, reproduction of the spores of the fungus was conducted on susceptible cultivar Afzal. The experiment was conducted with randomized block design in pot in greenhouse. Seedlings were inoculated with the spores fungus in two-leaf stage. After 12 days, the traits of the infection type and infection intensity, assessed based on 0-9 Saari and Prescott scale. After comparing the means, to obtain an overall result, ranking of genotypes were conducted based on the comparison of means with Arunachalam method. The results showed that varieties Afzal, Rihane, Goharjow, EB-88-8, 45-Motadel, EC-83-17 and Fajre 30 received the highest ranking for infection type and disease intensity and were identified as susceptible and moderately susceptible genotypes. The genotypes EB-86-6, EB 87-20, Arass, EB-88-2, EBYT-W-89-4, EB-88-13, Dasht, MB-83-14, EBYT-W-89-3, NB17, 24 Garm, EB-89-19, EBYT-W-89-15 and W-79-10 allocated lowest ranking and found as resistance genotypes. The results of cluster analysis were endorsing the results of ranked Arunachalam. According to the analysis, genotypes were divided into four groups, resistant, moderately resistant, moderately susceptible and susceptible. Considerable estimate for phenotypic and genotypic coefficient of variation and broad heritability for infection type and infection intensity indicates selection likely can be effective in improvement of resistance to powdery mildew.

**Keywords:** Arunachalam ranking, coefficient of variation, fungus, seedling resistance.

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## Effect of different levels of nano and typical potassium on yield and some Morpho-physiological characteristics of two wheat cultivars under salt stress

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### ABSTRACT

Potassium plays an important role in improving plant tolerance to abiotic stresses such as salinity stress. To evaluate the effect of potassium on salinity tolerance of two wheat cultivars, Kavir (as salt tolerant) and Qods (as salt-sensitive), a pot experiment was conducted, using a factorial experiment based on randomized complete block design with three replications in different treatments (Control, 150 mM NaCl, 150 mM NaCl with two levels of 300 and 450 mg potassium sulfate per 1kg soil and two levels 30 and 45 mg nano potassium per 1kg soil). Application of different potassium levels and sources in stress conditions led to mitigate the negative effects caused by salt stress, and hereby improved grain yield and its components, biological yield, plant height, stomatal conductance, and also reduced Na<sup>+</sup> concentrations and increased K<sup>+</sup> concentrations and the K<sup>+</sup>/Na<sup>+</sup> ratio in flag leaf. It appears that the presence of potassium under salt stress in compare with the absence of it, through competition with sodium uptake by plant can lead to reduce the adverse effects of sodium accumulation in plants and through osmotic potential adjustment and improved stomatal conductance caused to maintain photosynthesis, and hereby reduce salt effects on yield.

**Keywords:** potassium, salt tolerance, wheat.

## Genetic study of seed traits in wild and cultivated species of sainfoin

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(Received: Apr. 27, 2014 - Accepted: Nov. 12, 2014)

### ABSTRACT

In order to investigate genetic variation of traits related to seed yield, 41 genotypes from 14 wild and cultivated species were evaluated according to a randomized complete block design with three replications in Isfahan University of Technology Research Farm. The genotypes were significantly different for all of the studied traits indicating existence of considerable genetic variation in this germplasm. Comparison among sainfoin species showed that *O. viciifolia* had highest number of seed per panicle, fertility and seed yield per plant. The highest seed production was observed for *O. viciifolia* and the lowest one was belonged to *O. chorassanica*. Cluster analysis classified the genotypes in to three groups which can separate wild and cultivated species. Based on principal component analysis, the first and second components explained more than 50 percent of the total variation. The first component was related to seed yield and the second one was related to components of yield. The results showed high genetic diversity in wild species of sainfoin which could be used for genetic improvements.

**Keywords:** cluster analysis, genetic diversity, morphological traits, sainfoin, seed yield.

## Evaluation of wheat genotypes response to chilling stress at heading stage using physiological indices, yield and yield components

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### ABSTRACT

Temperature reduction since late December until late February is a dominate climate phenomena in Khuzestan which caused plant damage and subsequently yield reduction. In order to study the effect of chilling stress at heading stage on yield, yield component and some physiological traits of wheat genotypes, this research was carried-out with five genotypes (Chamran, Vee/ Nac, Star, Kharkheh *cv.* and line M-83-17) and four environmental temperatures (non-stress, and +3, 0 and -3°C) under greenhouse condition, in factorial experiment using CRD with three replications in Khuzestan Natural Resources and Agricultural Research Center in 2013. Date of physiological maturity, plant height and spike length, yield components including spikelet/spike, grain no./spike, 1000 grain weight and grain weight in main spike and  $F_o$ ,  $F_m$ , and  $F_v/F_m$  indices were evaluated. Results showed that the effect of chilling stress was significant for days from germination to physiological maturity, grain no. per spike, grain weight in main spike and  $F_v/F_m$  traits. The highest grain weight in main spike under non-stress and -3°C chilling stress was belonged to line M-83-17 and Chamran cultivar, respectively and under zero and 3°C chilling stress were obtained from Chamran *cv.* and Vee/Nac, respectively. The highest difference before and after chilling in  $F_v/F_m$  index was belonged to zero chilling stress. Differences in traits which were studied in this research indicated genetic variation in genotype response to chilling stress.

**Keywords:** genetic variation, heading, phenological, physiological, wheat.

## Effect of cryopreservation by vitrification on the growth and development indices of rice zygotic embryos

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### ABSTRACT

Because of the importance of Iranian rice germplasm and its application in the rice breeding programs and international genetic resources exchanges, some researches are necessary to preserve these valuable genetic resources. For this purpose, the cryopreservation of the biological samples in liquid nitrogen at  $-196^{\circ}\text{C}$  can be used. In this research, the cryopreservation of the zygotic embryos of seven rice indigenous and modern cultivars was investigated by vitrification method. The embryos were stored in the liquid nitrogen for 1, 7 and 30 days. After cryopreservation, the embryos were transferred at  $38-40^{\circ}\text{C}$  for 2 min and then were cultured on MS medium. There were no significant differences among the studied cultivars in the final germination percentage trait, but there were significant differences in vigor index trait in level %5 and in other studied traits in level %. In most traits, there was no significant difference among the storage times in liquid nitrogen while there was a significant decrease in the studied traits in comparison with the control. Investigation of the other cryopreservation methods and treatments on Iranian rice indigenous cultivars germplasm could be recommended.

**Keywords:** cryopreservation, rice germplasm, zygotic embryo.

## Effects of irrigation regimes on seed yield and yield components of chickpea cultivars at two autumn and spring planting seasons in Lorestan province

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(Received: Sep. 9, 2014 - Accepted: Mar. 14, 2015)

### ABSTRACT

This study was aimed to investigate the effects of planting season and irrigation regime on six chickpea genotypes in Lorestan province, west of Iran in a randomized complete block split-plot field experiment. The six chickpea varieties (i.e. Arman, Azad, Hashem, ILC-482, Greet and Nourabad) were sown in autumn and spring and were subjected to four irrigation levels (i.e. irrigation after 75, 100 and 150 mm evaporation from a Class-A Pan and non-irrigated) in two separate experiments. Autumn-sown chickpea out-performed the spring-sown chickpea by 55, 7.0, 8.5, 49.0, 44.0 and 5.7% in terms of number of fertile pods/plant, plant height, 100-seed weight, seed yield/plant, dry matter yield, grain yield and harvest index, respectively. Irrigation after 75 (2316 kg/ha), 100 (2121 kg/ha) and 150 mm evaporation (2010 kg/ha) led to 78, 63 and 54% increases in grain yield, respectively. "Greet" (2089 kg/ha) and "Hashem" (1775 kg/ha) produced the highest and lowest seed yields, respectively. It could be concluded that planting Cv. "Greet" under the 75 mm level of irrigation at autumn may lead to the greatest grain yield production. Nevertheless, planting the latter genotype at autumn with irrigation after 150 mm evaporation may lead to substantial increase in grain yield, with minimum usage of water.

**Keywords:** chickpea, drought stress, planting season.

## The effect of iron chelate on Chlorophyll content, Photochemical efficiency and some biochemical traits in Safflower under deficit irrigation condition

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### ABSTRACT

In order to study the effect of iron chelate (Fe-EDDHA) on some biochemical characteristic of safflower (*Carthamus tinctorius* L.) under two irrigation regimes, a field experiment was set up a split-plot based on randomized block design with four replication in 2011 in a research field of the faculty of Agriculture at Shahed University. In this study the main plots consisted of two levels of irrigation treatments that included: full irrigation and deficit irrigation at the flowering stage (irrigation to 50% and 75% soil moisture depletion relative to field capacity, respectively). The subplots consisted of eight levels of Fe-EDDHA, half of which were soil applications (S1:0, S2:50, S3: 100 and S4:150 kg.ha<sup>-1</sup>) and the remaining half of which were foliar applications (F1:foliar application of water, F2:1000, F3:2000 and F4:3000 mg.l<sup>-1</sup>). The results showed that in desirable condition of irrigation, using of foliar application of iron chelate led to increase the chlorophyll *a*, chlorophyll *b*, total chlorophyll and chlorophyll *a/b* ratio. Application of low amount of iron chelate in water stress condition resulted in significant increase in chlorophyll *a*, total chlorophyll and carotenoids content while use of large amount of iron chelate in soil, led to increase in chlorophyll *b* content and Fv/Fm. In the two levels of irrigation, foliar application of iron chelate at 2000 mg.l<sup>-1</sup> led to increase in chlorophyll *a/b* ratio. The results of this experiment showed that in water stress levels, with increased level of use of soil and foliar application of iron chelate, content of anthocyanins and flavonoids increased, respectively. It appears that use of iron chelate, can increase the tolerance of safflower to water deficit condition by increase in content of photosynthetic pigment.

**Keywords:** chlorophyll fluorescence, foliar application, iron, oxidative stress, photosynthetic pigment, safflower.

## Simultaneous transformation of three biphenyl dioxygenase bacterial genes into Arabidopsis plants

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### ABSTRACT

Polychlorinated biphenyls (PCBs) are chlorinated biphenyl rings that due to their properties such as heat resistance and stability were widely used in different industries from 1920s to 1980s. Due to their characteristics such as stability, resistance to decomposition and harmful effects on human health, their production was banned in 1980s. Worldwide contamination of water and soil with PCBs is one of the important environmental problems at present time. A way to reduce PCBs contamination is transformation and expression of biphenyl dioxygenase (BPDO) genes having catabolic degradation activity of polychlorinated biphenyls into plants. The aim of present study was developing a method for simultaneous transformation of bphA, bphE, and bphG genes, coding for the components of BPDO enzyme, into Arabidopsis plants. According to obtained results, three bphA, bphE, and bphG genes cloned into pGreen vector were transformed into E.coli, Agrobacterium and as well as Arabidopsis plants. There were differences in transformation efficiency of two strains LBA4404 and C58C1 of Agrobacterium, used in this study. The highest number of transgenic plants 0.85% was obtained by LBA4404 strain. The transgenic nature of Arabidopsis plantlets was confirmed by selecting fully green plants on 50 mg/l Kanamycin as well as PCR analysis. Transgenic plants were successfully transferred into soil and continued their growth.

**Keywords:** arabidopsis plant, chlorinated biphenyls enzyme, pGreen vector.

## **Selection for drought tolerance base on root characters and anti-oxidative enzymes in tall fescue**

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### **ABSTRACT**

This research was conducted to evaluate the effect of mild and intense drought stresses on root traits and some anti-oxidative enzymes and to identify drought tolerant genotypes in tall fescue. Twenty-four genotypes were assessed under three levels of moisture regime (control, mild and intense drought stresses) according to a factorial experiment based on a completely randomized design with three replications. The genotypes were clonally propagated and planted in PVC tubes (60×16 cm). Results indicated that the effect of moisture regime, genotype and their interaction were significant for all of the measured traits. Under mild and intense drought stress, the root length, root dry weight and dry forage yield decreased compared with control. Intense drought stress increased the root/shoot ratio about 25 percent. The activities of catalase and ascorbate peroxidase decreased under intense drought stress compared with control and mild drought stress, while the activity of peroxidase increased in this level of stress. Results showed that some tall fescue genotypes under drought stress had high yield productivity, desirable root and anti-oxidative systems indicating that these genotypes had drought avoidance and drought tolerance mechanisms which can be used for future breeding programs.

**Keywords:** catalase, dry forage yield, peroxidase, root length.