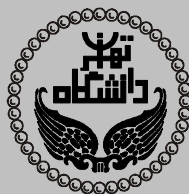


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## Agricultural Crop Management

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### Comparison of essential oil content and composition of seven populations of *Satureja sahendica* Bornm. under farm condition

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#### Abstract

*Satureja sahendica* Bornm. is an endemic medicinal plant which grows wildly in natural habitats of west and north-west regions of Iran. In this study, for domestication of *Satureja sahendica* and study of its essential oil content and composition, the seeds of seven populations were collected from natural habitats and cultivated in three replications as a complete randomized blocks design. The aerial parts of each accession were collected in full flowering stage at three consecutive years. The essential oils were obtained by hydro-distillation and analyzed by GC and GC/MS. The results showed the highest oil yields were obtained at the first year after cultivation. The major compounds in all oils were thymol, p-cymene and  $\gamma$ -terpinene with different percentages. The highest amount of thymol was found in the oils of the plants at second year. In the other words, the oils had better quality, in the second year. The percentage of  $\gamma$ -terpinene were reduced in the oils in the second year and then increased in the third year. Amount of p-cymene did not show similar changes during three studied years. Generally, it can be said annual plants had higher oil yields and two-year old plants had better oil quality.

**Keywords:** essential oils, populations, *Satureja sahendica*, thymol,  $\gamma$ -terpinene.



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### Effect of harvest time, processing type and storage condition on preservation fresh and dried pistachios nuts

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#### Abstract

To improve the quality and the possibility of fresh pistachio exports, the impact of different harvest time on storage of 'Ahmadaghahi' pistachio was investigated in 2011. Pistachios harvested at three stages of fruit ripening (40, 70 and 100 percent of hulling) in hulling fresh, fresh without hulling and dried pistachio packaged in pulpy bag and held in two-temperature storage ( $1 \pm 4$  and  $1 \pm 12^\circ\text{C}$ ) for 45 days. Data were analyzed as factorial in format of complete randomized design in three replications. The results showed expedition and delay in harvest, increases period of storage and temperature resulted to increase of endocarp spots and low fruit retention. Increase of temperature during storage resulted to diminish of taste and low fruit firmness and kernel damage, acidity, peroxide and water loss were increased. This data showed that to keep fruit fresh pistachio, harvesting in stage of 70-80 percent of ripening, processing with fresh hulling and storage at  $1 \pm 4^\circ\text{C}$  temperature, result to retention of fresh pistachio to 45 days.

**Keywords:** 'Ahmadaghahi', marketing, fresh pistachio, packaging, temperature, storage life



## Agricultural Crop Management

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### The effect of dormancy breaking treatments on seed germination of licorice (*Glycyrrhiza glabra* L.)

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Received: 15 September 2013

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#### Abstract

To evaluate the effect of different mechanical treatments (application of sulphuric acid, boiling water and flooding) on seed dormancy breaking of licorice, an experiment was carried out in randomized complete block design in 2012. Moreover, a factorial scheme in RCBD was performed to assess the application of gibberellic acid and potassium nitrate treatment as well as stratification and rotational temperature/light treatment. Treatments included different levels of gibberellic acid (zero, 100, 250 and 500 mg/l) at two time levels of two and 24 hour (along with scarification pre-treatment), concentrations of potassium nitrate (zero, 50, 100 and 150 mM) in 10 and 30 minutes (along with scarification pre-treatment), stratification temperatures treatment of -5, zero and five °C for one, two and three weeks of treatment, treatment of rotational temperature (5-15 and 10-20°C), in full light, dark and rotational light periods (eight h light and 16 h dark) and mechanical treatments of dormancy breaking. Treatment duration of two minutes in boiling water and two days water-logging treatment were the most effective treatments on germination percentage of licorice (81.33 and 53.33 percent increase in germination percentage compared to control, respectively). Application of gibberellic acid and potassium nitrate treatments and stratification had no effect on licorice dormancy. According to the licorice seed dormancy breaking in mechanical treatments and the effect of rotational temperature and light, it can be concluded that the dormancy of licorice seeds is intermittent.

**Keywords:** boiling water, flooding, licorice, seed dormancy breaking, sulphuric acid.



## Agricultural Crop Management

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### The contribution of farm slope and application of different fertilizer sources on wheat yield

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Accepted:

#### Abstract

To determine the effect of farm slopes on yield and some agronomic traits of wheat under different fertilizer treatments, an experiment was performed as split plot based on randomized complete block design with three replications in Piranshahr in 2011-2012. Treatments consisted of farm slope at four levels: (zero, three, six and 10 percent) as the main plots and combination of different fertilizer at five levels: [control, application of biofertilizer (Nitroxin), manure, chemicals (N and P) and integration of biological, manure and chemical as sub plots. Results showed that the highest (7.67 t/ha) and lowest (3.68 t/ha) seed yield obtained from farm slope zero and 10 percent, respectively. In fact, with increasing the farm slope, the yield components decreased which lead to 52 and 38 percent reduction in grain yield and total biomass of plants located on a slope of 10 percent than the control plants. Also, the applications of integrated fertilizer treatments had the most effect on morphological traits and yield components of wheat that increased 12.58 and 13.58 percent the seed yield and total biomass compared to the control plants.

**Keywords:** biofertilizer, integrated nutrition, manure, morphological traits, yield component.



## Agricultural Crop Management

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### Effect of seed deterioration and plant density on yield and yield components of hull-less barley (*Hordeum vulgare* L.)

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Received: 29 September 2013

Accepted: 12 November 2014

#### Abstract

This experiment was conducted to study the effect of seed deterioration and plant density on yield and yield components of hull-less barley at Agriculture Research Institute of Safiabad (Dezfoul) in 2012. Treatments included three levels of seed deterioration (control, 72 and 96 hours) and five plant densities (100, 150, 200, 250 and 300 plants per m<sup>2</sup>). Results showed that seed deterioration significantly affected variables of 1000 grain weight, spikes number per m<sup>2</sup>, fiber percentage, protein percentage, biological yield, grain yield and harvest index (HI) significantly. Furthermore, plant density significantly affected spike number per m<sup>2</sup>, 1000 grain weight, grain yield, harvest index, fiber percentage, protein percentage and biological yield. It can be concluded that use of high quality of seeds, in addition to the plants during growth and development, results in yield increase.

**Keywords:** deterioration, harvest index, hull-less barley, plant density, yield.



## Agricultural Crop Management

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### Effects of source limitation and post anthesis water deficiency on grain yield and gas exchange of different barley cultivars

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Received: 8 October 2013

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#### Abstract

In this study, the effects of source limitation on grain yield of twelve barley cultivars ('Aras', 'Jonub', 'Reihan', 'Zarjou', 'Sararoud', 'Sahra', 'Fajr30', 'Karoun', 'Gorgan', 'Makouei' and 'Nosrat') under post anthesis water deficiency were studied. Source limitation treatments were included control, removing of awn; leaves below flag leaf, flag leaf and spike photosynthesis. All source limitation treatments significantly reduced grain yield, 1000 grain weight and number of grains per spike. In non-water stress, the highest reduction of grain yield was seen in removing of leaves below flag leaf treatment (27.6 percent). In water deficiency, the highest and the lowest grain yield reduction were seen in removing of spike photosynthesis (32 percent) and removing of awn (18.1 percent). Flag leaf removing significantly increased photosynthesis rate in remaining leaves in non-water stress (28.8 percent) and water deficiency (10.8 percent). The evidence from this study suggests that under water deficiency after anthesis, spike photosynthesis is more important than the other current photosynthesis organs in grain yield formation in barley.

**Keywords:** awn, flag leaf, photosynthesis, spike, transpiration .



## Agricultural Crop Management

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### Effect of methyl jasmonate and salicylic acid on morphological characters and internal pigments of artichoke callus

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Received: 22 October 2013

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#### Abstract

Artichoke is one of the medicinal plants, in which its secondary metabolite production via tissue culture is expanding rapidly. The aim of present research was to study the effect of two elicitors, methyl jasmonate (MJ) and salicylic acid (SA), on the callus mass growth and the survival of in-vitro cultures of this plant. Callus cultures of artichoke were established by transferring seedling to solidified MS medium supplemented with different concentrations of salicylic acid and methyl jasmonate (zero, 25, 50, 100, 200  $\mu\text{m}$ ). Results showed that the fresh weight of callus reduced by SA application, where the dry weight increased. In contrary, MJ application did not have significant effect on fresh weight, but the dry weight decreased when MJ concentration increased. Pigments variation showed that, both in SA and MJ treatments, by increasing the concentrations of compounds from zero to 200 $\mu\text{m}$ , the chlorophyll content decreased and the carotenoids tended to increase. It seems that, although both SA and MJ as the most important elicitors increase secondary metabolite production of callus, their availability in high concentrations affect the cell grow activity, callus survival and its biomass production.

**Keywords:** artichoke, callus, methyl jasmonate, pigment, salicylic acid.





## Agricultural Crop Management

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### Effect of sodium nitroprusside application on leaf area, growth and water use efficiency of kidney bean cultivars under water deficit stress

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Received: 30 September 2012

Accepted: 17 November 2013

#### Abstract

To study sodium nitroprusside (SNP) application effect on growth indices and water use efficiency of kidney beans cultivars ('Akhtar' and 'Derakhshan') under water deficit stress, an experiment was conducted in split factorial based on randomized complete block design with three replications at Bu-Ali Sina university research field in 2012. Water stress treatments included vegetative stress, reproductive stress, vegetative + reproductive stress and non-water stress (control). Foliar application of SNP was done using three concentrations (zero, 150 and 300  $\mu\text{M}$  SNP). Reproductive stress reduced leaf area, crop growth rate and total dry weight in both cultivars. SNP foliar application (300  $\mu\text{M}$ ) increased mentioned indices 28, 26 and 20 percent in 'Akhtar' and 28, 20 and 20 percent in 'Derakhshan' in comparison to without foliar application, respectively. Water use efficiency of grain and water use efficiency of biomass in vegetative stress was more than of non-water stress. Maximum amount of water use efficiency was for 'Akhtar' cultivar with 300  $\mu\text{M}$  sodium nitroprusside foliar application and were 0.72 and 2.9 percent for grain and biomass, respectively. SNP foliar application adjusted negative effects of vegetative and reproductive stress. SNP application (300  $\mu\text{M}$ ) had more effect on growth and yield in both cultivars at all water regimes. Therefore, foliar application of SNP (300  $\mu\text{M}$ ) is desirable for kidney bean under water deficit stress.

**Keywords:** bean, drought, growth indices, seed yield, water deficit stress.



## Agricultural Crop Management

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### Investigation of the effect of phenyl-phthalamic acid and nutrition on fruit quantity and quality of plum cv. Maragheh

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Received: 19 October 2013

Accepted: 11 March 2014

#### Abstract

To obtain the sufficient yield and required yield quality we have to interfere in pollination in fruit trees. This investigation was carried out in a commercial orchard in Ashtian city, Markazi province (Iran). The effect of phenyl-phthalamic acid and nutrition on fruit quantity and quality of plum cv. 'Maragheh' was studied with the aim of increasing yield. The phenyl-phthalamic treatments (zero, 500 and 1000 mg/l) were performed at full bloom (80 percent flowering) on 29<sup>th</sup> of March. Also, nutrition was conducted on 18 May using perfect liquid fertilizer (Plant Green). As a result of this process, the yield amount was increased, when phenyl-phthalamic acid 500 and 1000 mg/l treatment were used without fertilization comparison to control. But fruit quality parameters (weight, length, and width) were decreased in comparison to control. However, treatments phenyl-phthalamic acid 500 and 1000 mg/l with fertilization not only increased fruit set but also increased fruit quality traits (weight, length, and width). According to the present results, phenyl-phthalamic acid (500-1000 mg/l) along nutrition can be used for the improvement of fruit quantity and quality of plum.

**Keywords:** Commercial orchard, Growth regulators, Pollination, Quality, Yield



## Agricultural Crop Management

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### Evaluation of some antioxidant enzymes activities and metal ion accumulation in canola inoculated with *P. fluorescens* FY32 under salinity stress

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Received: 23 Oct 2013

Accepted: 9 Feb 2014

#### Abstract

This study was designed to investigate the effect of *P. fluorescens* FY32 inoculation on the activities of some antioxidant enzymes and ion concentration of two canola cultivars ('Sarigol' and 'Hyola308') under salinity stress (150 and 300 mM NaCl) in the greenhouse condition at Department of Plant Breeding and Biotechnology, Faculty of Agriculture, University of Tabriz, in Fall 2012. The experimental design consisted of three factors replicated three times in a split-split plot design, with salinity as main factor. Data analysis showed that salt stress has significant effect on antioxidant enzymes activity (catalase, peroxidase and polyphenol oxidase). Concentration of sodium and chloride ions increased with increasing salinity, but this increase was little in the case of inoculated plants. The decrease in potassium content was smaller in inoculated plants in comparison with control. 'Hyola308' had the lowest reduction in dry matter and was tolerant cultivar in this experiment. This cultivar as a tolerant cultivar had low level of antioxidant activities and accumulation of sodium and chloride ions and also showed high concentration of potassium.

**Keywords:** Catalase, Peroxidase, PGPR bacteria, Potassium, Sodium chloride .



## Agricultural Crop Management

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### Determining the critical period of weed control in corn at Nahavand

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#### Abstract

To determine the critical period of weed control (CPWC) in corn, an experiment was conducted as a randomized complete blocks design with 14 treatments and three replications during 2013 growing season in the Nahavand climatic conditions. Two series of the treatments including weed-free and weed-infested were applied in the regular time distances of 10, 20, 30, 40, 50 and 60 days after corn emergence. Two check treatments including full and no control of weed during the whole season were also included. The nonlinear models including Logistic and Gompertz were applied to determine the start and end of critical period of weed control, respectively. Major weed species were field bindweed (*Convolvulus arvensis* L.), red root pigweed (*Amaranthus retroflexus* L.), pigweed (*Amaranthus blitoides* L.) and lambsquarters (*Chenopodium album* L.) with greater biomass and size. The results showed that periods of weed-free and weed-infested differently affected the dry weight and number of weeds in all treatments. The critical periods of weed control in corn by accepting a five percent acceptable yield loss, is necessary to control weeds in a period between 14-47 days after planting or 117-566 growth degree day (4-12 leaf stage) and by accepting a 10 percent acceptable yield loss it is necessary to control weeds in a period between 23-36 days after planting or 220-419 growth degree day (6-10 leaf stage).

**Keywords:** nonlinear equations, number of weeds, weed dry weight, weed interference, yield loss.



## Agricultural Crop Management

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### Evaluation of yield, essential oil and productivity indices in fennel and fenugreek intercropping

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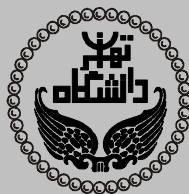
Received: 18 December 2013

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#### Abstract

To study advantages of intercropping fennel (*Foeniculum vulgare* Mill) and fenugreek (*Trigonella foenum-graecum* L.) in different ratios of intercropping and sole cropping, an experiment was conducted using replacement and additive intercropping based on randomized complete block design with three replications at Research Station of Faculty of Agriculture, University of Zanjan, Iran, during growing season in 2012. Treatments included additive intercropping in three levels (100 percent fennel + 33, 66 and 100 percent fenugreek), replacement intercropping in six levels (1:1, 1:2, 2:1, 2:2, 1:3, 3:1), sole fennel and sole fenugreek. Results showed that the highest grain yield of fenugreek was obtained in pure stand of fenugreek and the lowest mentioned trait was obtained in the 75 percent fennel + 25 percent fenugreek (3:1) replacement series. Also the highest and the lowest fennel grain yield were obtained in 100 percent fennel + 33 percent fenugreek additive series and 25 percent fennel + 75 percent fenugreek (1:3) replacement series, respectively. Yield of essential oil at 100 percent fennel + 33 percent fenugreek additive series were higher compared with sole cropping. The highest land equivalent and relative value total obtained from 100 percent fennel + 33 percent fenugreek additive series. The highest actual yield loss or gain (AYL) and intercropping advantage (IA) obtained from 25 percent fennel + 75 percent fenugreek (1:3) replacement series. Aggressiveness index revealed that in most sowing ratios fennel was dominant and fenugreek was defeated.

**Keywords:** essential oil, intercropping advantage, land equivalent ratio, relative value total, sole cropping, sowing ratio.



## Agricultural Crop Management

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### Effect of drought stress and planting method on some physiological and biochemical characteristics of two chickpea (*Cicer arietinum* L.) cultivars

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#### Abstract

To evaluate the effects of drought stress and planting methods on some physiological and biochemical characteristics of two chickpea cultivars (*Cicer arietinum* L.), an experiment was conducted at the research station of College of Agriculture, Shiraz University using a split factorial based on randomized complete block design in four replications. The main factor was stopping irrigation at different growth stages of chickpea (full irrigation= $I_1$ , flowering= $I_2$  and two weeks after emergence = $I_3$ ) and the sub-factor included a combination of pea varieties ('Arman' and 'Azad') and sowing methods (planting on ridges, furrow and basin), respectively. Results showed that under drought stress, leaf area index, stomatal conductance, photosynthetic rate, chlorophyll a and b and total chlorophyll content decreased while proline content increased. The cultivar 'Azad' had higher leaf area index, stomatal conductance, photosynthesis rate and chlorophyll than 'Arman'. The highest photosynthesis rate obtained under full irrigation treatment ( $16.09 \mu\text{mol}/\text{m}^2\text{s}$ ) and reduced to 25.79 and 14.23 percent under water stress in  $I_3$  and  $I_2$  treatments respectively. Based on these results, it can be concluded that the cultivar 'Azad' is suitable for this region and it is suggested to be planted on the ridge as has higher photosynthesis rate and lower stomatal conductance reduction leading to a higher yield.

**Keywords:** photosynthesis, proline, ridge planting, stomatal conductivity, stopping irrigation.



## Agricultural Crop Management

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### Effects of herbicide haloxifhop-R-methyl ester application and surfactant on grass weeds control, safflower yield and yield components

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#### Abstract

A field experiment was conducted to evaluate the effect of various doses of haloxifhop-R-methyl ester herbicide on grass weeds grown at different stages in 2011-2012 growing season in Research Farm of faculty of Agriculture, Shiraz University. The study was carried out as split split plot based on randomized complete block design with three replicates. Treatments were haloxifhop-R-methyl ester herbicide doses (0.6, 0.8 and 1.0 l/ha) as main factor, surfactant (with and without) as sub factor and time of herbicide application (two, six leaves and tillering of grass weeds) as sub sub factor. A check treatment (weedy) was also included. Raising the herbicide dose, decreased wild oat and foxtail dry weight at 35.7 and 12.6 gr/m<sup>2</sup>, respectively. The results showed that the delay in herbicide application and reduction of herbicide dose decreased grain yield and its components. The highest reduction in grain yield was obtained with 0.6 l/ha haloxifhop-R-methyl ester herbicide at tillering stage. Application of surfactant caused a decrease in weed dry weight compared to no surfactant and also increased grain yield significantly. In general, to achieve maximum grain yield and the best grass weed control, application of one l/ha haloxifhop-R-methyl ester with surfactant use at two-leaves in safflower field is recommended.

**Keywords:** citoveet, herbicide doses, supergallant, tillering, wild oat.



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### Effect of seed inoculation with *Rhizobium* and plant growth promoting rhizobacteria (PGPR) on yield and yield components of chickpea in irrigated and rainfed conditions

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#### Abstract

This experiment was carried out to evaluate the effect of *Rhizobium* strains and Plant Growth Promoting Rhizobacteria (PGPR) on yield and yield components of chickpea (*Cicer arietinum* L.) 'Arman' cultivar. This research was conducted as split plot based on randomized complete block design at Zanjan university research farm. Irrigation levels (optimum irrigation during season growth and no irrigation during growth period) were set as main plots and fertilizer levels (control or no application of chemical and biological fertilizers, 50kg/ha urea, seed inoculation with *Mesorhizobium ciceri* strain of SWRI-3, seed inoculation with *Mesorhizobium ciceri* strain SWRI-17, seed inoculation with PGPR, co-inoculation with rhizobium strains SWRI-3+SWRI-17 and co-inoculation with all biofertilizer, PGPR+SWRI-3+SWRI-17) were sets as subplots. The results of this study showed that drought stress reduced plant height, number of branches, number of seeds per plant, seed weight, biological yield and harvest index. Applicatin of biofertilizers because of positive effects on plant height, number of seeds per plant, seed weight, pod weight per plant and biological yield, produced more grain yield in comparison with control and nitrogen urea fertilizer in both irrigated and rainfed conditions. In addition, seed co-inoculation with all of the bio-fertilizers (PGPR+SWRI-3+SWRI-17) achieved more grain yield in comparison with separate inoculation about 18-36 percent in irrigated and 34-50 percent in rainfed conditions.

**Keywords:** biofertilizer, chickpea, *Rhizobium*, seed inoculation, yield.





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### Evaluation of qualitative and quantitative of forage yield in intercropping of barley and fennel at different levels of nitrogen

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#### Abstract

To investigate the yield and quality of forage in intercropping barley and fennel, an experiment was carried out as split plot based on a randomized complete block design with three replications at the research farm of Agriculture and Natural Resources of Ramin University during growing season of 2012-2013. Four treatments levels of nitrogen (including 0, 70, 140 and 210 kgN/ha) have been taken into account as main plots and the planting ratios in five levels [(pure culture barley and fennel), (75% barley + 25% fennel), (50% barley + 50% fennel), (25% barley + 75% fennel)] were used as the sub-plots. Results showed that the highest dry and fresh forage yield of 53380 and 8271 kg/ha were obtained from pure cultures of fennel with 210 kgN/ha and 50percent barley + 50 percent fennel with 210 kgN/ha, respectively. Morphological traits including height of barley and fennel, number of branches of fennel were positive affected by 140 kg of nitrogen. The highest crude protein with 25.7 percent was obtained from pure cultures of fennel with 210 kgN/ha. In addition, maximum crude protein yield (1528.2 kgN/ha) and land equivalent ratio (LER=1.16) were obtained from 50 percent barley + 50 percent fennel with 210 kgN/ha, respectively. The results confirmed increasing the forage yield and quality at 50 percent barley + 50 percent fennel with 210 kg N/ha.

**Keywords:** crude protein, forage yield, LER, morphological traits, planting ratios.



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### Maize (*Zea mays* L.) and Sugar beet (*Beta vulgaris* L.) intercropping

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#### Abstract

To evaluate yield and productivity indices of maize and sugar beet intercropping with different planting ratios, a field experiment was conducted in randomized complete block design with three replications at Hamedan province in Nahavand, in 2013. The planting ratios were 100:0, 75:25, 50:50, 25:75 and 0:100 (maize: sugar beet) using replacement method. Results showed that intercropping had significant effect on yield and some yield component of both crops. The root-yield, sugar sterling, melas-sugar, content purity and sugar yield of sugar beet as well as shoot height, No. row. ear<sup>-1</sup>, kernel. Row<sup>-1</sup>, 1000 kernel weight and grain yield of maize were significantly affected by different planting ratios. Calculation of land equivalent ratio (LER) revealed that planting ratio of 25:75 (LER= 1.09) and 75:25 (maize: sugar beet) (LER= 1.08) had the highest efficiency by 9% and 8%, respectively. Calculation of area time equivalent ratio (ATER) revealed that planting ratio of 25:75 (maize: sugar beet) (ATER= 1.03) had the highest efficiency. Maize in the planting ratio of 75:25 had the highest relative crowding coefficient ( $k_a= 7$ ) as dominant crop and sugar beet had the highest RCC ( $K_b= 3.88$ ) in the ratio of 25:75 (maize: sugar beet) at the dominant crop.

**Keywords:** area time equivalent ratio, competition, land equivalent ratio, relative crowding coefficient, sole cropping.



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### Seasonal Changes in Soluble Proteins, Total Phenol and Malondialdehyde Content and Their Relationship with Cold Hardiness of Some Grapevine Cultivars

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#### Abstract

In this study, cold hardiness of 15 grapevine (*Vitis vinifera* L.) cultivars were evaluated using tetrazolium stain test and post freezing budbreak assays during six months from acclimation till deacclimation stages. Moreover, seasonal changes pattern in soluble proteins, total phenol and malondialdehyde (MDA) of buds were measured during this period. Significant differences were found among cold hardiness of cultivars in all stages. 'Bidaneh Ghermez' and 'Khalili' ( $LT_{50} = -22$  and  $-22.6$  °C, respectively) were the hardiest and 'Ruby' and 'Perlette' ( $LT_{50} = -16.1$  and  $-16.9$ °C, respectively) were the least hardy cultivars in January. Soluble proteins and total phenol concentrations of buds increased during cold acclimation from November to January then decreased in March. The concentration of these compounds was higher in cold hardy cultivars such as 'Bidaneh Ghermez' and 'Khalili' than least hardy ones, indicating the positive relationship of these compounds with freezing tolerance. The measured MDA in onset and end of dormancy period was lower than its concentration in deep dormancy in January. Lower MDA concentration was found with cold hardy cultivars of 'Khalili' and 'Bidaneh Ghermez' in comparison with cold sensitive cultivars of 'Perlette' and 'Yaquti'. Our results indicated that high accumulation of soluble proteins and total phenols in cold hardy cultivars resulted in improved membrane stability and freezing tolerance.

**Keywords:** budbreak assay, cold acclimation, freezing tolerance, lipid peroxidation, tetrazolium.



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### Effect of training system and foliar spray with calcium chloride on improving quality and quantity of apple fruit (*Malus domestica*), 'Gala' and 'Delbarestival' cvs

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#### Abstract

Types of training systems and foliar spray with calcium can affect on fruits quality. In this study, the effect of foliar spray with calcium chloride (zero, 0.75, 1.5 and three g/l) during two, four and six weeks before commercial harvesting time of apple fruit cv. 'Gala' and 'Delbarestival' which trained in three different systems (V shape, HighTech and Cordon) were investigated. The results showed that types of training systems and foliar application of calcium can affect on fruits quality at harvest time. Tree yield, fruits weigh and fruit tissue firmness of 'Gala' was significantly higher than 'Delbarestival'. Furthermore, calcium spray increased fruit firmness in compared to the control and TA decrease in compare to control. Calcium treatment increased fruit skin a\* value that means more antocyanin synthesis and redness. Results generally showed that 'Gala' apple trained in HighTech and V shape systems as well as 'Delbarestival' in HighTech produced the higher fruits weight and size as well as higher quality of fruit in compare to the other systems.

**Keywords:** apple, calcium, fruit skin colour, fruit tissue firmness, training systems.



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### Evaluation of practical usability of two Iranian native grass species

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#### Abstract

Nowadays, establishment and maintenance of turfgrasses due to its high water requirements was faced with serious doubts. Hence, screening of drought resistant native grasses, and introducing them as turfgrass is not only effective in reduction of water usage but can also preserve plant gene pools of the country. In the present experiment, 'Wheat Grass' and 'Bromus' as two native grasses were compared with perennial 'Ryegrass' as control. After establishment and coverage of the pots surfaces by turfgrass outdoor, three mowing heights including two, four and six cm were applied on the species weekly. During the experiment, shoot growth, tillering, leaf color and leaf width, fresh and dry weight were measured weekly. The results of this research showed that 'Bromus' due to undesirable tissue (leaves width more than three mm) and low density is not suitable for using in landscapes. 'Wheat Grass' despite of rougher texture and less color than perennial 'Ryegrass', has higher tillering, suitable color (7.59) and good texture (leaf width about 2 mm). Also, mowing height of two cm was determined as the best for the three studied species.

**Keywords:** 'Bromus', Color, Texture, 'Ryegrass', Tillering, 'Wheat Grass'