



The effect of planting pattern and nitrogen fertilizer on yield of basil (*Ocimum basilicum* L.) and cowpea (*Vigna unguiculata* L.) intercropping under weed competition

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Abstract

Background and Objectives: Intercropping as one of the sustainable agriculture methods to improve biodiversity, reduce soil erosion and hence increase productivity, soil fertility and optimize environmental resources usage. Furthermore, this system could be a successful strategy to simultaneously increase crop productivity and suppress weeds. The present study was aimed to evaluate the intercropping of basil (*Ocimum basilicum* L.) and cowpea (*Vigna unguiculata* L.) under different levels of nitrogen and weed competition conditions.

Materials and Methods: The experiment was carried out as a split-split plot based on a randomized complete blocks design with three replications during 2010-2011 at Sari Agricultural Science and Natural Resources University. The treatments were weed control and infestation as the main plots, levels of nitrogen fertilizer (0, 50 and 100 Kg ha⁻¹) as sub plots, monocropping of cowpea and basil, and additive planting ratios of 25, 50 and 75% of basil as sub-sub plots.

Results: Results showed that the maximum yield of basil (430.37 Kg ha⁻¹) and cowpea (685.16 Kg ha⁻¹) were recorded in 100:50 intercropping which received either 100 or 50 Kg ha⁻¹ of nitrogen fertilizer under weed control conditions, respectively. In weed infested plots, however, the maximum yield of basil (138.95 Kg ha⁻¹) was obtained in 100: 25 intercropping with 100 Kg ha⁻¹ of nitrogen fertilizer. Also, the highest intercropping advantage (LA= 1.74) belonged to 100:25 intercropping with 100 Kg ha⁻¹ of nitrogen fertilizer in weed control conditions. Meanwhile, the maximum land equivalent ratio (LER=1.43) and relative value total

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(RVT= 1.88) were observed in 100:50 intercropping which fertilized with 50 or 100 Kg ha⁻¹ of nitrogen fertilizer in weed free plots, respectively. Under weed control conditions, area time equivalent ratio (ATER) was recorded more than one while under weed competition ATER was less than one except in 100:25 planting ratio combination. Also, the maximum ATER value (1.16) belonged to 100:50 (basil: cowpea) combination and application of 50 Kg ha⁻¹ of nitrogen and weed control conditions. Weed dramatically suppressed when nitrogen application was increased in intercropping where crops leaf area and biomass were improved while weeds biomass and number declined. In separate levels of nitrogen and intercropping, however, weeds number and biomass roughly decreased.

Conclusion: Results showed that in different intercropping combinations, application of 0, 50 and 100 Kg ha⁻¹ of nitrogen decreased weed number by 24, 49 and 72 %, respectively and weed biomass by 42.85, 56.67 and 78.27 %, respectively as compared those sole cropping. Generally, increasing nitrogen fertilizer caused faster canopy closure of both plant species which led to reduced weeds population and biomass and increased their competitiveness.

Keywords: Planting ratio, Density, Relative value total, Land equivalent ratio, Advantage.



Evaluation of Competitive Ability in two Sesame (*Sesamum indicum* L.) Cultivars with Cocklebur (*Xanthium strumarium* L.) in Different Crop Row Spacing

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Abstract

Background and Objectives: Weed management is necessary for the success of production in an agricultural system. Reduction of row spacing and increasing crop density per unit area is one of the practices to increase crop competitiveness. Another effective mean of integrated weed management is using high competitiveness cultivars. As cocklebur (*Xanthium strumarium* L.) is a common weed in sesame fields of Khorasan and Moghan, Iran, current study was conducted to investigate the effect of crop row spacing and cocklebur density on height, leaf area index and total dry matter of two sesame (*Sesamum indicum* L.) cultivars.

Materials and Methods: The experiment was conducted at Research Farm of University of Agricultural Sciences and Natural Resources of Gorgan, Iran, during growing season in 2010. The experiment was established in *factorial arrangement* based on randomized complete block design with three replications. The factors included different densities of cocklebur (0, 2, 4, 6 and 8 plant.m⁻²), two cultivars of sesame (Oltan, Yekta) and three sesame row spacing (35, 45 and 55 cm). Sampling was done every 14 days during the growing season to investigate the trend of growth and to determine the growth indices of sesame as well as cocklebur. In each sampling, leaf area, dry weight of stems and leaves of sesame and cocklebur was measured. Sigmoidal equation (Equation 1) was fitted to data of cumulative dry mater and leaf area index of sesame in competition with cocklebur at different row spacing.

$$W(t) = a / (1 + \exp(-b(t-m))) \quad (\text{Equation 1})$$

t: time (day after planting), a: maximum leaf area index, b: slope (increasing rate of leaf area index or cumulative dry mater), m: time required for 50% maximum of

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leaf area index. Vertical distribution of leaf area in canopy profiles of sesame and cocklebur was studied, too. For this purpose, plants were divided into segments in 20 cm interval and leaf area of each layer was measured separately.

Results: Results showed that plant height of sesame cultivars decreased by increasing cocklebur density but the effect of row spacing had not significant effect on plant height. It seems that having more height plays an important role in the ability of Oltan to tolerate the presence of weed. More ability of Oltan to capture the resources and space in the early stages of crop growth resulted in more leaf area expanding and more competitive ability of Oltan in compare with Yekta. The sigmoid equation coefficients reduced with increasing cocklebur density. The slope of this reduction in both cultivars in 35 cm row spacing was more than 45 and 55 cm row spacing. Leaf area of sesame per layer reduced with increasing the cocklebur density in all sesame row spacing. Distribution of leaf in sesame is symmetrical parabolic shape and the maximum leaf area was located in the middle layer, but leaf area distribution in the canopy of cocklebur was asymmetric and the most LAI was distributed in the upper layers of canopy resulting in advantage of the weed in competition with sesame.

Keywords: Competition, Dry biomass, Leaf area index, Weed density



Crop parameters determination of QUEFTS model for optimizing NPK nutrition in wheat

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Abstract

Background and objectives: The QUEFTS model is using for optimizing fertilizer managements in crops, but it has not been used in Iran yet. QUEFTS accounts for interactions among NPK affecting the internal use efficiency of N, P and K and allows differentiation according to different yield levels. It is necessary to determine crops parameters before application the model in the studying area. The first step of the QUEFTS model requires the estimation of the soil-supplying capacity or potential indigenous supplies of N, P and K for a given site or field. In step 2, the actual uptake of a nutrient (UN, UP, UK) is calculated as a function of the potential supply of that nutrient (SN, SP, SK). In step 3, two yield estimates are obtained for each nutrient (YND, YNA, YPD, YPA, YKD, YKA) from the UN, UP and UK estimated in step 2.

Materials and methods: For this purpose, two experiments were conducted. The first one was a survey experiment in the 45 wheat production fields. The latter was an experiment based on completely randomized block design with 36 fertilizer treatments. Before the experiments, soil samples were obtained from the farms and analysis were conducted to determine the nutrients. Grain and biological yields, NPK uptake, internal use efficiency and maximum nutrient accumulation and dilution were obtained from these two experiments.

Results: Results indicated that maximum and minimum internal use efficiency of N were 48 and 25 Kg Kg⁻¹ in the first Experiment and 46 and 17 Kg Kg⁻¹ in the second experiment. Maximum and minimum internal use efficiency of P changed

from 194 to 442 Kg Kg⁻¹ in the studying fields in the first experiment. The same results were 97 to 264 Kg Kg⁻¹ in the second experiment. Results showed that maximum and minimum internal use efficiency of K ranged from 32 to 68 Kg Kg⁻¹ in the first experiment. The same results for the second experiment were from 9 to 25 Kg Kg⁻¹. Maximum nutrient dilution for NPK were obtained 46, 415, and 56 (Kg grain/Kg nutrient uptake). Maximum nutrient accumulation for NPK were 14, 120, and 14 (Kg grain/Kg nutrient uptake).

Conclusion: There was no report on maximum nutrient dilution and accumulation of NPK for a crop in Gorgan or Iran. The presented approach using QUEFTS allows not only the estimation of nutrient requirements to achieve a certain yield; it also provides a useful tool for identifying nutritionally optimal yield. The calibration of the QUEFTS model for wheat required the estimation of the slopes of two borderlines describing the maximum accumulation (a) and dilution (d) of N, P and K in the plant in relation to grain yield.

Keywords: Internal use efficiency; Nutrient uptake; Maximum nutrient accumulation and dilution efficiency.



Effect of freezing stress on electrolyte leakage of sugar beet (*Beta vulgaris* L.) genotypes

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Abstract

Background and Objectives: Spring cultivation of sugar beet is prevalent, but nowadays because of water scarcity and also plants low water use efficiency in this time of cultivation, autumn cultivation is growing up. Several assessments also have showed that in compare with spring cultivation, autumn cultivation of sugar beet has other benefits including reducing the likelihood of plant disease and pests outbreaks as well as high radiation use efficiency and also other resources use efficiency. In contrast, in autumn cultivation several vital processes will be disturbed when sugar beet plants are exposed to chilling stress condition. Thus, it's necessary to identify chilling tolerance of sugar beet genotypes for this purpose, but because of temporal and spatial variation in chilling stress occurrences in natural environmental condition, it might be lead to uncertain results. As well as, selection processes of sugar beet chilling tolerance genotypes in the natural conditions will take long time and more cost than controlled conditions.

Materials and Methods: In order to evaluation of chilling tolerance in sugar beet (*Beta vulgaris* L.) genotypes (Jolge, Palma, Giada, Monatunno, SBS11, Super Ma and PP8) which were candidate for autumn cultivation, an experiment was performed in the Faculty of Agriculture Ferdowsi University of Mashhad as a factorial experiment in completely randomized design with three replications in 2009. In this study, sugar beet genotypes were exposed to 10 freezing temperatures (including 0, -2, -4, -6, -8, -10, -12, -14, -16 and -18°C) at controlled conditions and then amount of electrolyte leakage was measured.

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Results: Results showed that the effects of freezing temperature and genotype on electrolyte leakage were significant. Jolge, PP8 and Super Ma genotypes with 38.7 %, 38.5 % and 37.7 % had the highest amount of electrolyte leakage, respectively and the Monatunno genotype with 26 % had the lowest amount. Interaction effect of genotype and temperature on LT_{50el} was significant. Monatunno genotype with -11.1 and Palma genotype with -9.6 degree centigrade had the highest and the lowest freezing tolerance, respectively. Based on correlation between electrolyte leakage and LT_{50el} , sugar beet genotypes separated in two groups. Sensitive group including Jolge, PP8, Sbsi1 and Superma genotypes and resistant group including Monatunna, Giada and Palma genotypes. There was high significant correlation ($r=0.98^{***}$) between electrolyte leakage and LT_{50el} in the resistant group while it was low ($r=0.64$) in the sensitive group.

Conclusion: Chilling stress is one of the major limiting factors for sugar beet cultivation in the region which have moderate weather. Therefore, identifying and selecting the genotypes that are able to resist under this conditions would have high priority. As well as, based on high correlation between electrolyte leakage and LT_{50el} with plants resistance to chilling stress in several experiments, it seems that this trait could be used for assessment of high tolerant genotypes for autumn cultivation of sugar beet in the Iran.

Keywords: cold tolerance, cytoplasmic membrane, LT_{50el}



Study of yield stability of new cereal, tritipyrum, with triticales promising lines and Iranian bread wheat varieties using partitioning method of genotype \times environment interactions

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Abstract

Background and objectives: The new cereal, primary tritipyrum is a synthetic amphiploid derived from crossing between durum wheat varieties (*Triticum durum*, $2n=4x=28$, AABB) and wild coach grass species (*Thinopyrum bessarabicum*, $2n=2x=14$, E^bE^b). The results of investigation on this plant in the last two decades in Iran and England indicated its potential as a highly tolerant plant to NaCl (250 Mm). In addition to salt tolerance, perennially and keep on production tillers in growing season (5 times) it has candidate it as a forage and grain purposes in the salt affected soils and brakish water of the world. Therefore the study of interaction between genotype and environment is important in the process of releasing new lines, So that the evaluation of new lines in a series of uniform experiments is important in order to identify the degree of their adaptation to different environmental conditions. This research was conducted to investigate genotype \times environment interaction for grain yield and to identify high-yielding and adapted genotypes.

Materials and methods: In this study the genotype \times environment interaction effect containing variation in rank and value for grain yield of seventeen genotypes including eight primary and combined primary of new wheat, tritipyrum lines, five triticales lines and four Iranian wheat varieties was evaluated in a randomized completely block design with three replications in seven environment during growing seasons of 2002, 2003, 2006 and 2011 in three locations of Iran (Kerman, Sirjan, Neyriz) based on Muir method. In this method, GE interaction separated into two parts: The sum of squares of heterogeneous variance {SS (HV)_i} and the sum

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of squares of imperfect correlation $\{SS (IC)_i\}$ and the importance of each part were interpreted. Statistical analysis was performed using SAS, SPSS software and GEST program.

Results: Combined analysis of variance for grain yield showed significant differences between environments and genotype \times environment interactions. Based on Muir criterion the highest and the lowest percentage of changes in rank, were belonged to two wheat cultivars (Omid and Alvand) and two primary combined tritipyrum lines $\{(St/b)(Cr/b)-4$ and $(Ka/b)(Cr/b)-6\}$, respectively. therefore $(St/b)(Cr/b)-4$ tritipyrum line was indicated as the most stable and Omid wheat cultivar were known as the most unstable genotype. On the base of change portion in rank of sum of square for interactions (86.67%), the M45 triticales line and $(Ka/b)(Cr/b)-5$ combined primary tritipyrum line were most stable genotypes with high yield.

Conclusion: therefore, at first, with complementary agronomical experiments may release a new grain crop of triticales and new pasture line of combined primary tritipyrum for forage, at second, tritipyrum line can be used in bread wheat for producing salt tolerant wheat cultivar/s in Iran.

Keywords: Genotype \times environment interaction, Primary tritipyrum, Triticales, Bread wheat, Muir method.



Effect of nitrogen application on some characteristics of drought tolerance in spring barley

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Abstract

Background and objectives: According to the drought as the most important environmental factor that limiting agricultural products and using nitrogen as the main nutrient in farming system, In this study the effect of nitrogen on drought tolerance characteristics, including changes in total chlorophyll content, total protein content, leaf area, phosphorus and peroxidase enzyme activity under water stress on spring barley was examined.

Materials and Methods: The experiment was conducted as factorial arrangement with three replications based on completely randomized design in the Faculty of Agriculture greenhouse, University of Mohaghegh Ardabil in 2012. Water deficit imposed at three levels: 35% (Severe stress), 60% (mild stress) and 85% (control) field capacity by gravimetric method (Treatment of water deficit was applied, a week after taking the first dose of fertilizer) and three levels of nitrogen 40, 80 and 120 kg per hectare) including two million kilograms per hectare in the soil) was applied in the form of urea on EBYTW-11 spring barley genotypes.

Results: The results showed that the water stress accelerated aging of leaves and decreased the total chlorophyll content, total protein, phosphorus, leaf area and grain yield, whereas the peroxidase enzyme activity increased. Severe stress (35% of field capacity) showed the greatest impact on these parameters than mild stress (60% of field capacity) and control (85% of field capacity), So that the lowest traits (Except for peroxidase enzyme) was observed in severe stress. Nitrogen application significantly improved plant tolerance at all levels of water stress. Grain yield was 6% decreased in severe stress and 40 Kg nitrogen application per hectare than control. Nitrogen application showed severe reduction during stress than the control condition, So that in the severe stress decreased 69% yield with

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consumption of 120 Kg nitrogen per hectare. Correlation between the studied parameters showed that there was a significantly positive correlation between the grain yield and leaf area, protein, chlorophyll and phosphorus, and the highest correlation was belonged to crop yield and leaf phosphorus content ($r=0.994^*$). Correlation was a significantly negative between the peroxidase enzyme activity and other traits include protein content, phosphorus, leaf area and total chlorophyll, In other words, with reduction of these traits peroxidase enzyme activity was increased during drought stress. With increasing water stress, chlorophyll concentration and leaf area were reduced which leads to decrease the yield in plant. One of the visible effects of decline in yield is leaves area reduction. A physical and molecular implication occurs such as analysis chloroplasts, reduction in photosynthesis and protein breakdown.

Keywords: Grain yield, Leaf senescence, Peroxidase, Spring barley, Water stress.



Study of relation of the occurrence of phonological stage and morphological characteristics with the quantity and quality of sugar beet seeds

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Abstract

Background and objectives: Sugar beet plants which are produced from seeds, five to six weeks after the formation of a seed stem, flowering started and within two weeks this stage of plant growth will be completed. A significant negative correlation between the temperature received from flowering to seed maturity and the plant reproductive growth period with grain yield shows that the long plant reproductive growth period, will lead to decrease in seed yield. With the postponement of phonological stages of sugar beet plants the possibility of synchronization of plant reproductive stage with unfavorable conditions increases which leads to loss of yield. To increase the seed yield, it is necessary to investigate seed production such as improvement and farm management according to variety. In this regard, little research has been done in Iran. Therefore, this study aimed to investigate the occurrence of phonological stages and morphological characteristics and its impact on quantitative and qualitative characteristics of monogerm hybrids of sugar beet.

Materials and methods: This study was conducted based on a Completely Randomized Block Design. The experimental treatments were five promising diploid cytoplasmic male sterile (CMS) lines (7112×SB36, SB37×28874, 7112×436, 419×SB36 and 261×231) of sugar beet. Each plot consists of eight lines planting and hybrid varieties were sown in strips in female: male ratio was 6: 2. Phonological characteristics, including the emergence, bolting and flowering components, during daily visit were recorded at the time specified. For the

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evaluation of plant morphological characteristics, before harvesting five plants of each plot were randomly selected and evaluated in the laboratory.

Results: The results indicated that there were significant differences among CMS lines in respect to phenological and morphological characteristics and quantity and quality of seed. The maximum number of main branch and auxiliary branch, and plant dry weight was obtained in 7112×SB36 and SB37×28874. But, for line of 261×231, number of main branch and auxiliary branch and plant dry weight was lower than other lines, and the highest crude seed yield was observed in the 7112×SB36 and SB37×28874 and the lowest of crude seed yield was observed in 261×231. These data indicate that there is a positive correlation between phenological and morphological characteristics with the quantity and quality and negative correlation between plant heights with seed yield.

Conclusion: Considering that there is a positive correlation between phenological and morphological characteristics with the quantity and quality and negative correlation between plant heights with seed yield. Therefore, the sugar beet institutions must, prior to the introduction of CMS lines, evaluate the CMS lines on the morphological characteristics and determine fields planting density and pruning. While in Iran (Ardabil), production of sugar beet seed is done with of 50×70 planting density regardless of the morphological characteristics of crop varieties and topping of plants has never been considered for commercial seed production.

Keywords: Morphological characters, Quantitative and qualitative of seed, Phenological stages, Sugar beet seed.



Effect of the foliar application of biological, biostimulator and chemical fertilizers on growth characteristics and yield of saffron (*Crocus sativus* L.)

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Abstract

Background and objective: Saffron (*Crocus sativus* L.) is the most expensive crop in the world. In the recent years researches on this plant has been increased according to regional and national economic importance. Among the various studies on saffron the problem of nutrition is always important. This study was conducted to evaluate and compare the effect of foliar application of chemical, biological and bio-stimulator fertilizers on yield and yield components and also growth and corms characteristics of saffron.

Material and methods: An Experiment was conducted in a completely randomized block design with four replications in 3- year field of saffron in Dargaz, Khorasan Razavi province from 2010 to 2011. The first factor had 5 levels included biostimulator fertilizer Bioamino-palis, biostimulator fertilizer Aminol-forte, biological fertilizer Nitroxin, chemical fertilizer Dalfard-15, and control (without fertilizer treatment). The second factor had two levels including 1 and 2 times spraying with seven per thousands concentration of each fertilizers treatments. All fertilizer spraying concentration was 7 per thousand. The first spraying on Jun 20, 2010 and the second time after 15 days on June 24, 2011 were done. Measuring growth characteristics and properties of corm was done in the early May 2011 and measuring yield and yield components was done in the early November 2011.

Results: The results showed Aminol-forte have better effect than other fertilizers on dry weight of corm, number of corm, number of corm equal/ higher or under 8 grams, fresh weight of flower, number of flowers, fresh and dry weight of stigma and style per square meter, leaf length as well as fresh and dry weight of leaf. Bioamino-palis and Aminol-forte fertilizer treatments for number of flowers,

fresh weight of stigma and style and dry weight of stigma , did not have significant difference. Biological fertilizer Nitroxin had little positive effect on the evaluated traits. The effect of fertilizer Dalfard-15 was the intermediate of biological and biostimulator fertilizers. Two times foliar applications only reduced the number of corms weighing less than 8 g per unit area. Interaction of foliar applications levels and fertilizer types did not have significant effect on measured traits.

Conclusion: Based on the results biostimulating fertilizers, Aminol-forte and Bioamino-palis had more significant effects on growth factors, corms and performance traits of saffron compared to Dalfard-15 chemical fertilizer, and Nitroxin biological fertilizer. This can be attributed to their amino acids and growth stimulants. Aminol-forte fertilizer increased the saffron stigma yield and corms higher weight of 8 grams while bioamino-palis only increased stigma performance. Aminol Forte greater impact on corm weight was associated with a greater impact on growth. On the basis of the results of this experiment, spraying of Aminol-Forte is recommended in saffron fields once.

Keywords: Aminol-forte, Bioamino-palis, Corm, Dalfard-15, Nitroxin.



Agricultural land suitability of Aq-Qala township (Golestan province) for barley production in rainfed condition by GIS

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Abstract

Background and objectives: Unsuitable pattern of land use and changes of land use causes different environmental crisis such as pollution and deterioration of water and soil resources, expanding of desertification, soil erosion, and biological diversity reduction. Land suitability analysis can be used to identify environmental potential in different regions for achievement maximum utilization. In this research, geographical information system (GIS) and analytical hierarchy process (AHP) were applied to agricultural land suitability of Aq-Qala township for barley cultivation in rainfed condition.

Materials and methods: For this purpose, environmental requirements of barley were identified according to scientific resources. Studied environmental-components were slope, elevation, precipitation, average, minimum and maximum temperatures and some of micro and macro elements. The analytical hierarchy process (AHP) was applied to determine the weight of criteria. The digital environmental layers overlaid and integrated in GIS media in respect to AHP weights and then zoning of lands carried out in four classes (high suitable, suitable, semi-suitable and non-suitable).

Results: The results showed that 27.5% and 32.1% of these area were high suitable and suitable for barley cropping, respectively. These zones had enough rainfall and high fertility. The semi-suitable and non-suitable regions were located from the center to the northern of Aq-Qala township. In these areas, limiting factors were low precipitation, some soil variables (high pH and salinity, non-suitable texture classes, high potassium and calcium contents, low phosphate, iron, and organic matter contents) and non-suitable slope aspects.

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Conclusion: The results of this research showed that 59.6% of area is suitable for barley cropping. In general, high salinity soils ($>16 \text{ dSm}^{-1}$), low levels of precipitation and low soil fertility were introduced as limiting factors to barley cultivation in this region. Also, this research provides information at local level that could be used by farmers to select cropping patterns in accordance with suitability results.

Keywords: Land suitability, Rainfed barley, Geographical information system (GIS), Aq-Qala



Effects of planting date and plant density on yield and yield components of *Brassica nigra* under Abarkooh climatic conditions

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Abstract

Background and objectives: Black mustard (*Brassica nigra* (L.) Koch) is an annual plant belongs to *Brassicaceae*. It has a variety of uses in traditional medicine for rheumatic and neurological pain. Growth, development and production of medicinal plants like other plants are influenced by genetic and environmental factors. Selecting the most appropriate planting date and the most favorable plant density is an important factors in the success of any cultivated plant. There is optimal planting date for each crop and the delay is usually reduced its yield. Agronomists believe that the appropriate plant density at the farm is the foundation of a farming system. In appropriate density the plant can use all environmental factors and decreased competition between plants.

Materials and methods: In order to evaluate the effects of sowing date and plant density on yield and yield components of black mustard, an experiment was conducted based on RCBD with three replications at Abarkooh (Yazd Province) and the height is 1700 meters above sea level in the region during growing season in 2012. Treatments were three planting dates (30/Jan, 19/Feb and 11/March/2012) and three plant densities (33, 50 and 100 plant/m²). leaf water potential (LWP), relative water content (RWC), plant height, branch/plant, fruit/plant, seed/fruit, 1000-seed weight, seed yield, biological yield, oil percent and oil yield of black mustard were measured. Solutions from sucrose (-5, -10 and -15 bar) was used for measuring LWP. Data analyzed by MSTATC and SAS 9.2 and then means compared with LSD.

Results: Results showed there is significant difference between planting dates on RWC, plant height, branch/plant, fruit/plant, seed/fruit, 1000-seed weight, seed yield and biological yield. 30/Jan is the best date with 1474.2 Kg ha⁻¹ (seed yield),

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359.34 Kg ha⁻¹ (oil yield) and 8190 Kg ha⁻¹ (biological yield). There is no significant difference among plant densities on biological yield, seed yield and oil yield traits. The interaction effect of planting date and density on the number of silique/plant and the number of seed/silique were significantly different. The effect of plant density on seed yield did not have significant difference. In high density seed yield decreased because of decreasing of branch and silique/plant. There's no significant difference between plant densities and sowing dates on oil percent.

Conclusion: Results showed that planting dates have strong effect and selected densities have poor effect on yield, in appropriate planting date arise plants with good vegetative growth and finally high yield. In general, according to the results of mean comparison of interaction effects of density and planting date on seed yield and oil yield, 30/Jan and 100 plant/m² is recommended in the Abarkooh and similar areas.

Keywords: Black mustard, Planting date, Plant density, Seed yield, Yield components.



Study of Environmental impacts for potato Agroecosystems of Iran based on nitrogen fertilizer by using Life Cycle Assessment (LCA) methodology

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Abstract

Background and objectives: Life cycle assessment (LCA) had proven to be an appropriate assessment tool for analysis of agri-food products by identifying, quantifying and evaluating the resources consumed and emissions released into the environment. Life cycle assessment has become a widely recognized method for quantifying the environmental performances of products. Numerical scores make it possible to compare product on the aspects of climate change, ozone depletion, acidification, eutrophication, toxicity, fossil energy resource depletion and more environmental impact categories. This study was performed for evaluation the environmental impacts of potato agroecosystems based on nitrogen levels by using LCA methodology.

Materials and Methods: Tuber yield mean during 1999-2013 and applied inputs in one hectare were determined. Data used in this study including the amount of consumed chemical fertilizers, machine operation, and fossil fuel consumption for potato production collected. LCA at four steps including goal definition and scoping, inventory analysis, life cycle impact assessment (LCIA) and integration & interpretation were calculated. The system boundary included production processes, fertilizers, cow manure, herbicide, pesticides, irrigation, fuels, machinery and other materials. Therefore, this study relates all resource consumption and emissions to one ton of tuber. Then, all resources and emissions per each ton of potato tuber were quantified. Functional unit was considered as one ton of tuber. Within life cycle impact assessment, the different inputs and outputs are summarized into environmental effects. Impact categories were acidification, eutrophication and global warming. The inventory data are multiplied by characterization factors (CF) to give indicators for the so-called environmental

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impact categories. Then, to compare the indicators, they were normalized. Therefore, each normalized indicator value is multiplied by a weighting factor. Finally, an index so-called environmental index (EcoX) was calculated. Higher environmental index translates as higher burden on environment due to target production.

Results: The results revealed that the maximum aquatic and terrestrial eutrophication potentials were computed for $>400 \text{ Kg N ha}^{-1}$ with $0.72 \text{ PO}_4 \text{ equiv./t}$ tuber and $1.80 \text{ NO}_x \text{ equiv./t}$ tuber, respectively. The highest global warming potential was calculated $509.87 \text{ CO}_2 \text{ equiv./t}$ tuber for $350\text{-}400 \text{ kg N ha}^{-1}$. The maximum Eco-Index were computed for $>400 \text{ Kg N ha}^{-1}$ with 0.37 Eco-x per one tonne tuber. The highest values for impact categories such as aquatic eutrophication, terrestrial eutrophication and acidification were calculated for $>400 \text{ Kg N ha}^{-1}$ with 0.29 , 0.015 and 0.012 Eco-x per one tonne tuber, respectively.

Conclusion: It seems that system management including minimum tillage and nitrogen fixing species could be regarded to reduce problematic environmental impacts in potato production systems.

Keywords: Eutrophication, Emission of pollutants, Environmental index, Environment



Evaluation of Iranian wild *Medicago* genetic resources in order to use in agronomic systems

(Short technical report)

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Abstract

Backgrounds and objectives: Wild medics are used as forage crops in dry lands with a mean of 250 mm or more precipitation in rotations with cereals. In fall sowing, these plants can be used in the irrigated lands to produce fast and emergency forage in the March. This production is a valuable fresh forage for livestock after a long period of feeding with dry ones. This study will deal with the largest wild medics collection in the country which are kept at Iranian National Plant Gene Bank. Before this research there was not information on Agronomic-morphologic traits of these species. Outcomes of this research will provide germplasms for wild medics breeding programs.

Materials and methods: A total of 698 accessions of wild medics in 14 species were planted in the field, (each accession on 2 rows). During the growth period 14 agro-morphological traits were evaluated according to standard descriptors. Distribution and tendency center parameters of agro-morphological traits were accounted in Iranian wild medic genetic resources. Regression, Duncan and cluster analysis were used to identify relation between forage yield and other traits, the grouping species in each trait, and the comparison among species, respectively.

Results: High diversity was observed in the most of the traits. Forage yield differed from very low to very high in the collection and 200 accessions showed high forage yield. Alfalfa weevil susceptibility showed a diversity from tolerant (in 187 accessions) to susceptible (in 1 accession). There was a positive relation among forage yield and growth habit, internode length, and number of pod whorl by means of regression analysis. Based on Duncan analysis, superior species were identified in each trait. *M. rigidula* (L.) All. and *M. radiata* L. were identified as tolerant and *M. noeana* Boiss and *M. lupulina* L. as semi-tolerant to alfalfa weevil.

Cluster analysis grouped species into seven clusters based on their agronomic traits.

Conclusion: Results of this research showed that *M. noeana*, *M. rigidula*, and *M. minima* (L.) L. can be used in agronomic systems for cold temperate regions in high latitude or highlands of the country, whereas *M. turbinata* and *M. scutellata* were proposed for southern regions with mild temperate to semi-tropical conditions in low latitudes of the country. This study also provide a unique wild medic germplasms in the country that can be used in *Medicago* breeding programs

Keywords: Agronomic traits, Duncan analysis, Germplasm, *Medicago*