



Suitability assessment of wheat-grown fields using Geographic Information System, Remote Sensing and Analytical Network Process method in Qaresoo basin, Gorgan County

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Abstract

Background and objectives: In recent years, some specialized softwares have been developed for land evaluation goals that the common aspect of them is the generation of an environment to provide patterns and modeling of assessment methods. Considering the importance of wheat as a strategic crop in the human food supply, efficient use of common sources and the evaluation of wheat fields towards sustainable production, this study was aimed to agroecological assessment of winter wheat-grown fields in Qaresoo basin located in Gorgan County by Geographic Information System (GIS), Remote Sensing (RS) and Analytical Network Process (ANP) method.

Materials and methods: The wheat fields were detected using supervised method acquired by Landsat 8. In this study, environmental factors, including average, minimum and maximum temperatures, annual precipitation, slope, aspect, elevation and soil characteristics (i.e. organic matter, pH, EC and soil texture) were considered. Ecological requirements of wheat were identified from scientific literatures and variables were mapped and classified. The analytical Network process (ANP) was used to determine the weight of criteria using the questionnaires analysis sheet. Then based on a model, forenamed layers were combined and evaluated.

Results: The results of ANP questionnaire analyzing showed that the soil condition with 0.66 coefficient was in the first place in the study area. Among edaphic criteria, maximum weight was related to soil salinity and soil organic matter (0.33 and 0.16, respectively), while the lowest value belonged to soil texture (0.084). Among the climate condition rainfall with 0.097 and maximum temperature with 0.015 had the lowest coefficient. In addition, in terms of topographical criteria, the weight of elevation and aspect were the highest and lowest, respectively.

Conclusion: The results indicated that about 93.41% and 0.59% of wheat-grown fields in Qaresoo basin were high suitable and suitable for this crop, respectively. Lower elevation and lower slopes and south aspects, suitable temperature and annual precipitation, also desirable EC, soil texture and organic matter were the reasons make these regions suitable for this class. Therefore, current wheat-grown fields of Qaresoo have no limitations in terms of topographic, climatic and soil-related factors for wheat cultivation, this reveals that farmers have selected suitable areas for the cultivation of wheat. With management of limiting and reducing production factors, this region has great potential for the production of this product. But it should be noted that the continuous cultivation of wheat in recent years caused many problems in the Golestan province's agricultural system. Thus, although farmers have chosen the cultivation of this plant in the region properly, but must be replaced with introduced plants that have the same ecological requirements to prevent its frequent cultivation. Therefore, doing the same assessment on other autumn crops could be advised.

Keywords: Crop Indices, Landsat 8, Super matrix approach, Supervised Classification

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The effect of different barley (*Hordeum vulgare*) and fenugreek (*Trigonella foenum-graecum*) intercropping ratio and nitrogen fertilizer on dry matter quality and quantity

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Abstract

Background and Objectives: Intercropping is the planting of more than one plant in one land and growing season so that the plants should be the highest intimacy together in most growing season. Usually, the component species in intercropping systems occupy different niches and thereby enhance the utilization of resources. Consequently, intercropping improves the yields of the component crops. The intercropping of a cereal with a legume is a preferred system for achieving higher food supply and reduced environmental feedback. So that, one of the way to achieving to sustainability in agriculture is multiple and intercropping system.

Material and Methods: A field experiment was conducted based on randomized complete block as a factorial arrangement with three replications in experimental farm of Agricultural Faculty of Shahid Chamran University of Ahvaz at 2015-2016 growing season. The first factor was two nitrogen fertilizer application includes control (no nitrogen fertilizer) and 40 Kg ha⁻¹ nitrogen fertilizer and the second factor was eight planting patterns includes barley sole cropping, fenugreek sole cropping, fenugreek-barley intercropping ratios includes 2:1, 2:2, 3:1, 1:3, as replacement series, 100% barley+20% fenugreek as additive series and mixed intercropping. The measured traits includes: crude protein (CP), water soluble carbohydrate (WSC), ash percent, dry matter digestible (DMD), acid detergent fiber (ADF), Neutral detergent fiber (NDF), Intercropping dry matter yield, barley relative yield, fenugreek relative yield, and land equivalent ratio (LER). The plant density for barley was 375 plant m⁻² and Zehak cultivar been used. The plant density for fenugreek was 50 plant m⁻² and endemic cultivar been used. The harvest operation achieved at April in barley dough stage.

Results: The results of the experiment showed that the highest total dry matter (1277.1 g m⁻²) and LER (1.15) was obtained at 100% barley+20% fenugreek additive method. The highest crude protein, dry matter digestible (DMD) and ash percent were observed at fenugreek sole cropping treatment. The highest water soluble carbohydrate, NDF and fiber were found at barley sole cropping. Among treatments, 1:3 barley-fenugreek had the highest crude protein. Also the nitrogen fertilizer increased crude protein, water soluble carbohydrate and dry matter digestible compared to control. But in ADF and NDF treatment, the control treatment had the highest value compared to nitrogen fertilizer.

Conclusion: In general, the application of nitrogen fertilizer had significant effect on qualitative traits and with application of nitrogen fertilizer, barley crude protein, water soluble carbohydrate and dry matter digestible increased. Also, the fenugreek had the highest protein, DMD and Ash compared to barley. 100% barley-20% fenugreek had the highest (70.4%) water soluble carbohydrate. It seems that the fenugreek in intercropping caused to increased forage quality. Because with increasing in fenugreek ratio in intercropping, the crude protein increased and the ADF decreased.

Keywords: ADF, Crude protein and dry matter, Intercropping

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Effects of Humic Acid Soil and Foliar Applications on Yield, Yield Component and Oil Content of Safflower (*Carthamus Tinctorius* L.)

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Abstract

Background and Objectives: Safflower (*Carthamustinctorius* L.) is an important oil seed plant that grows throughout the semiarid regions in many parts of the world. Humic acid is the main humic substance and the important ingredient of soil organic matter (humus) which causes increase of yield and quality of crop. Aerial compost tea contains high populations of live microorganism consisting of rhizobacteria, trichoderma and pseudomonas species which increase the growth and yield of the plant. Vermiwash as the extract of vermicompost is a liquid organic fertilizer obtained from unit of vermiculture and vermicompost as drainage. It is used as a foliar spraying on the leaf. The aim of this research is evaluating the effect of humic acid and foliar application of compost tea and vermiwash on yield, yield component and oil content of safflower.

Materials and methods: In order to study the effect of granular humic acid and foliar application of compost tea and vermiwash on yield, yield component and oil content of safflower (*Carthamus tinctorius* L.), an experiment was conducted as a factorial arrangement based on randomized complete block design with three replications in agricultural research farm at Vali-e-Asr University of Rafsanjan. Treatments were included soil application of humic acid (0 (control), 500, 1000 and 1500 kg.ha⁻¹) and 4 levels of foliar application of distilled water as control, vermiwash with dilution 1:10 and 1:20 and compost tea.

Results: Results showed that the effect of different levels of humic acid on the plant height, head weight, seed number, thousand seed weight and oil percent were significant but the foliar application treatments and their interaction have no significant effect. The increase of head weight in safflower by using of humic acid could be related to the higher seed number and thousand seed weight. Stem diameter, total head number, fertile head number, oil yield and seed yield significantly affected by humic acid and foliar application treatments; however their interaction had no significant effect on them. It seems that humic acid would increase photosynthesis and plant metabolism which cause higher saving carbohydrate and decrease source limitation which translocate more sap to seed and increase thousand weight of safflower seed.

Conclusion: The results of this research showed that the highest application of humic acid (1500 Kg ha⁻¹) increased plant height, stem diameter, head weight, head number, fertile head number, seed number, thousand seed weight, oil percent, oil yield and seed yield in safflower. It is also resulted that the highest stem diameter, total head number, fertile head number, oil yield and seed yield were observed in foliar application of compost tea. It is concluded that in Rafsanjan condition and the same region climate, application of 1500 Kg ha⁻¹ humic acid and compost tea as foliar application is the best treatment for increasing seed yield, yield component and oil percentage of safflower.

Keywords: Bio-fertilizer, Compost tea, Harvest index, Vermiwash

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Evaluation of germination and key enzymatic and non-enzymatic antioxidants involved in chickpea seed ageing during natural storage and accelerate ageing

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Abstract

Background and objective: Unfavorable environmental conditions and seed storage can cause some stresses such as oxidative stress in seeds and other plant tissues by reactive oxygen species production. ROS defense network, composed of antioxidant enzymes, antioxidants and ROS-producing enzymes, is responsible for maintaining ROS levels under non-toxic tight control. In plant cells, non-enzymatic antioxidant as proline and ascorbic acid and antioxidant enzymes, such as superoxide dismutase, peroxidase, catalase, ascorbat peroxidase and glutathione reductase are considered to form a defensive team, whose combined purpose is to protect cells from oxidative damage. So this experiment laid out to study on effect of accelerate and natural ageing on enzymatic and non-enzymatic antioxidant systems in chickpea seeds.

Material and methods: The study was laid out in order to evaluate the effects of artificial ageing and natural storage on enzymatic and non-enzymatic antioxidant systems in chickpea seeds in Gorgan University of Agricultural Science and Natural Resources at 2015. The experiment was conducted in completely randomized design with four replications. Treatments were 2 and 4 year natural storage as long term storage and 1-5 day artificial aging with control. For accelerated aging the seeds were placed in polyethylene dishes, on metal sieve into water bath at 43°C, and relative humidity of 100% for 1-5 days. For natural aging seeds was stored for two and four years at natural condition. After treatments, germination and, enzymatic and non-enzymatic antioxidant activities measured. Statistical analysis was performed by SAS software.

Results: Results showed that, in accelerated ageing condition, with increasing of ageing days, germination percentage, lipid peroxidation, hydrogen peroxide production and electrolyte leakage increased. Germination percentage in accelerate ageing was lower than natural storage. In lower levels of accelerate ageing until 3 days proline accumulation was higher than natural storage but, in natural storage was higher than 4 and 5 days of accelerate ageing. With increasing of natural storage period proline production increased but ascorbic acid decreased. Ageing changed activity of catalase, peroxidase, ascorbat peroxidase, superoxide dismutase and glutathione reductase enzymes. With increasing of accelerate ageing levels until 3 days catalase, superoxide dismutase and glutathione reductase activity increased. In lower ageing levels peroxidase and ascorbat peroxidase activity increased but in high ageing levels their activity decreased. In natural storage treatments with increasing of storage period catalase activity decreased.

Conclusion: Accelerate and natural ageing comparison showed that lower accelerate ageing levels had damaging on enzymatic and non-enzymatic antioxidant systems less than natural storage treatments but in 5 days treatment reactive oxygen species accumulation over come on these systems and do not can to remove them and had more losses than natural storage treatments. In natural storage condition superoxide dismutase and glutathione reductase had more activity than 4 and 5 days accelerate aging and had more efficient than others in removing of reactive oxygen species and slowing of seed ageing. In 4 and 5 days accelerated ageing treatments catalase and peroxidase activity was more than natural storage and had an important role in this matter.

Keywords: Germination, Lipid peroxidation, Reactive oxygen species and Storage

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The effect of planting density and nitrogen fertilizer on yield and yield components of bean in Roudsar

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Abstract

Background and objectives: Pulses are rich in proteins and found to be main source of protein and second important constituent of human diet after cereals. Bean due to cultivation area and economic importance is the first among pulses in Iran. It has been reported that more distance between plants makes each plant received more light and photosynthetic activity. Nitrogen fertilizers have an important role in plant production. Therefore, the application of nitrogen fertilizer levels on each plant is very important. The purpose of this experiment was to investigate the effects of different planting intervals and nitrogen fertilizer levels on yield and yield components of beans in northern Iran.

Materials and methods: The experiment was conducted as split plot in a randomized complete block design with three replications in Rudsar in 2014. For planting seeds, a local bean cultivar (Pach baghala) was used. The cultivation was carried out on June 15th. The main factor is the fixed distance on the row of 10 cm and the spacing between the row of planting in three levels: (30, 40 and 50 cm, with plant densities of 33, 25 and 20 plants per m²), and the sub factor was nitrogen fertilizer at four levels (control, 30, 60 and 90 kg nitrogen per hectare). Yield and yield components were measured.

Results: The results showed that planting distance, different levels of nitrogen fertilizer and the interaction between planting distance and nitrogen fertilizer levels on number of pods per plant, number of seeds per plant, seed yield, plant dry weight, biological yield and harvest index were significant. Plant height was affected by different levels of nitrogen and planting distance but weight of 100 seeds was affected by different levels of nitrogen fertilizer. In different planting distances, the 40 cm spacing between rows significantly affected plant height, seed yield, plant dry weight and 40 and 50 cm spacing between row significantly affected the number of pod per plant and number of seeds per plant, while the highest biological yield was obtained at 30 cm row spacing. Application of 60 Kg N ha⁻¹ for plant height, 100 seed weight, seed yield and harvest index had a significant superiority to other nitrogen levels. The highest number of pods per plant and number of seeds per plant, plant dry weight and biological yield were obtained from treatments of 60 and 90 Kg N ha⁻¹.

Conclusion: According to results of this study the highest seed yield was obtained in the treatment with 40 cm row spacing and 60 Kg N ha⁻¹ with an average of 3448 Kg ha⁻¹ yield. To confirm these results, research should be repeated in several places and years.

Keywords: Bean, Grain Yield, Nitrogen fertilizer, Planting distances

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Evaluation of growth and physiological characteristics of wheat and barley in alley cropping systems in Saman

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Abstract

Background and objective: Plant growth involves a series of biochemical and physiological processes that interact with each other and environmental factors such as light. Evaluation of growth indices is important in analysis of factors affecting dry matter accumulation. Since more than one species grow in various farming systems such as alley cropping, so the behavior of crop next to each other could be very important. So the purpose of this study was to investigate the integration of trees and crop plants cultivated in alley-cropping System in order to maintain or even increase crop dry matter along with more efficiency of resources. It seems that multiple cropping can lead to a sustainable increase in agricultural ecosystems.

Materials and Methods: In order to evaluation of growth indices and physiological traits of wheat and barley in different cropping systems, a randomized complete block design was conducted with four replications at Saman region in 2015. Treatments were included: 4 different cultural systems (Alley cropping of wheat and barley with almond and sole cropping of them. Leaf area index, dry matter accumulation, chlorophyll (a, b and total), proline, protein content and growth indices were measured.

Results: Data showed that proline content, light absorption, crop growth rate (CGR), net assimilation rate and relative growth rate were higher in barley – almonds system. The highest dry matter accumulation per unit area (1424 g m^{-2}) also was obtained for barley – almonds system, while for the cultivation of wheat it's corresponding to 934 g m^{-2} , had no significant difference with its sole cropping. The lowest rates also found for sole cropping of barley equal to 700 g m^{-2} . It seems that barley influenced less than others with shading and competition for nutrients in this cultural system, so its dry matter accumulation will be greater compare to sole cropping and also to sole and intercropping of wheat. The highest light absorbance values obtained in this system too.

Conclusion: Alley-cropping in Chahar Mahal and Bakhtiyari province, especially in Saman as an organized cultivation system could notice as an effective way to increase productivity, land use and economic efficiency for trees and plants, such as barley. Therefore it may promote sustainable development of natural resources and the use of modern multiple cropping practices and utilization of space usage per unit of time. Barley is the best option for cultivation under almond trees among conventional cereals in the region, because of the highest dry matter in this system. Wheat cultivation in these systems although did not change dry matter accumulation, but may increase land use efficiency and productivity. So barely gain more advantages in these conditions and is more suitable option for almond trees understory.

Keywords: Alley cropping, Almond, Competition, Monoculture, Sustainable development

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Effect of irrigation cut-off and different nutritional systems on yield and yield components of spring safflower in Yasouj region

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Abstract

Background and objectives: Lack of water is one of the main factors in the reduction of agricultural production in arid and semi-arid regions of the world. Nitrogen is one of the most important nutrients and key factor in achievement to favorable yield in crops. Organic sources in combination with chemical fertilizer can lead to soil fertility and increase crop production. Thus it seems necessary investigate the effect of different nutritional systems (Organic, chemical and integrated) and irrigation cut-off on yield and yield components of safflower.

Materials and methods: The experiment was done on spring safflower (Isfahan-14 cultivar) as split-plots arranged in a randomized completed block design with three replications. The main plot were including irrigation at the four levels (S_0 : full irrigation, S_1 : irrigation cut-off at the stem elongation stage, S_2 : irrigation cut-off at the flowering and anthesis stage and S_3 : irrigation cut-off at the grain filling stage) and subplot including different nutritional systems in the six levels (N_0 : no fertilizer, N_1 : 100 kg pure nitrogen from urea, N_2 : 75 kg pure nitrogen from urea+25 kg nitrogen from organic manure, N_3 : 50 kg pure nitrogen from urea+50 kg nitrogen from organic manure, N_4 : 25 kg pure nitrogen from urea+75 kg nitrogen from organic manure and N_5 : 100 kg nitrogen from organic manure) (Organic manure was used poultry manure). This experiment was measured LAI, yield, yield components and water use efficiency.

Results: The obtained results indicated that irrigation cut-off at different growth stages had significant effect on measured traits; so at irrigation cut-off at the flowering and anthesis stage, number of fill grain per head than full irrigation treatment decreased 21.5 percent. Also yield and yield components at integrated nutritional systems were more than chemical and organic nutritional systems. The highest grain yield at S_0 , S_1 , S_2 , S_3 treatments was obtained from integrated nutritional systems of N_2 (4291.7 kg ha⁻¹), N_3 (3211.7 kg ha⁻¹), N_2 (2653.3 kg ha⁻¹) and N_2 (3603.4 kg ha⁻¹), respectively. The water use efficiency at the S_1 and S_3 treatments in the all nutritional systems was higher than S_2 treatment.

Conclusion: Use of organic manures in combined with chemical fertilizers by reducing the effects of drought stress led to improvement yield and yield components of safflower under irrigation cut-off conditions. Therefore grain yield at S_3 treatment in different nutritional systems of N_2 and N_3 was similar treatment of full irrigation and chemical nutritional system. Based on result yield reduction by irrigation cut-off at grain filling stage could be compensated by application of integrated nutritional systems.

Keywords: Irrigation cut-off, Nutritional system, Organic manure, Soil fertility, Water use efficiency

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The comparison of high tannin and zero tannin genotypes of faba bean in Gorgan climatic conditions

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Abstract

Background and objectives: There are two types of faba bean varieties, high and zero tannin. Tannins are anti-nutritive compounds that affect quality and digestion. This study was performed to evaluate the performance of genotypes zero tannins genotypes with tannin genotypes.

Materials and methods: This experiment was conducted in agricultural research station of Gorgan, in RCBD with three repetitions in growing season of 2015-2016. Eleven different faba bean genotypes (five high tannin genotypes, five zero tannin genotypes, and Barakat as control genotype) were evaluated in the terms of agronomic traits of plant height, number of pods per plant, 100-seed weight, grain yield and green pod yield, biological yield and harvest index.

Results: The results of variance analysis showed a significant difference between genotypes in terms of plant height, number of pod per plant, 100-seed weight, seed yield, biomass yield, green pod yield and harvest index. The results of mean comparisons showed that GF-311 and GF-332 both from high tannin genotypes had higher seed yield (6746 and 6426 kg ha⁻¹ respectively). The minimum seed yield (3540 Kg ha⁻¹) was referred to zero tannin (GF-98). The green sheath yield varied from 15080 to 33067 Kg ha⁻¹. The least amount was referred to GF-98 (zero tannin) and the maximum amount was referred to GF-20 (control). The yield of biomass varied from 29000 to 57333 Kg ha⁻¹. The GF-247 genotype (no tannin) had the maximum and GF-98 (zero tannin) had the minimum yield. According to mean comparisons, the maximum weight of 100-seed with 158.33 g belonged to GF-21 (tannin group) and the minimum with 102 g belonged to GF-249 (zero tannin). The results of group comparisons showed no difference between two groups of high tannin and zero tannin in terms of plant height, green pod yield and biomass yield. Generally, the high tannin genotypes based on 100-seed weight, seed yield and harvest index traits were better than zero tannin genotypes.

Conclusion: In this study, high tannin genotypes based on the most of studied traits had a significant predominance to zero tannin genotypes. As a result, if the goal of faba bean production is to obtain high yields, using high tannin genotypes in Gorgan climatic conditions is preferred. On the other hand, according to the results of this survey, the seed yield of zero tannin genotypes was similar to Barakat genotype and on the other hand zero tannin genotypes had higher quality than Barakat genotype, in case of repeating these results (similarity of performance of zero tannin and tannin genotypes) in future experiments, expansion and harvesting is justified in the region.

Keywords: Genotypes, Green pod yield, Plant height, Tannin

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Effects of potassium sulphate fertilizer rates on some of qualitative and quantitative traits of forage corn (*Zea mays* L.) in different irrigation regimes

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Abstract

Background and objectives: Drought stress reduces plant growth by affecting photosynthesis and physiological process which are related to yield. Maintaining adequate potassium (K) is critical to plant drought resistant and increased cell membrane stability, root growth and total dry mass of plants living under drought conditions and also improved water uptake and water conservation. The aim of this study was to evaluate the effect of deficit irrigation and potassium on yield of forage corn and moderating role of potassium in the face of deficit irrigation.

Materials and methods: The present research was conducted at Varamin during summer of 2011. The experiment was carried out on split plot based on randomized complete block design with six replications. The experimental factors consisted of two irrigation regimes as a main plot (full irrigation and deficit irrigation after 70 and 130 mm evaporation from class A evaporation pan, respectively) and potassium sulphate fertilizer (K_2SO_4) rates with 52% K_2O as a split plot (0, 50, 100 and 150 $Kg\ ha^{-1}$). The single cross 704 cultivar was used in this study.

Results: Deficit irrigation (irrigation after 130 mm evaporation from class A evaporation pan) reduced number of leaves, stem diameter, ear height from the ground, leaf area index and protein content, about 16, 41, 36, 33 and 5 percent by compare to full irrigation (irrigation after 70 mm evaporation from class A evaporation pan). Potassium sulphate fertilizer at the rate of 50 $kg\ ha^{-1}$ increased the protein content by 9% compared to the non-use of potassium sulphate fertilizer. The highest value of leaf area index was obtained using 150 Kg potassium sulphate ha^{-1} , which showed an increase of 8%. At the rates of 0, 50, 100 and 150 Kg potassium sulphate ha^{-1} , deficit irrigation reduced 58, 33, 29 and 27 percent of fresh forage yield and 59, 42, 39 and 28 percent of dry forage yield, compared to full irrigation conditions. In both of full irrigation and deficit irrigation conditions, the fresh (17 and 98%, respectively) and dry forage (38 and 105%, respectively) yields were increased to raise the value of potassium sulphate fertilizer from 0 to 100 $kg\ ha^{-1}$ and then significantly reduced the values of these traits. The maximum values of fresh and dry forage yields in full irrigation (78749 and 26933 $Kg\ ha^{-1}$) and deficit irrigation (55828 and 16522 $Kg\ ha^{-1}$) were gained by plants treated with 100 kg potassium sulphate fertilizer ha^{-1} . In full irrigation condition, the differences between 0 and 100 Kg potassium sulphate ha^{-1} for dry and fresh forage yield was 11449 and 27196 $Kg\ ha^{-1}$, respectively. Also, under deficit irrigation condition, the difference between 0 and 100 Kg potassium sulphate ha^{-1} treatments was 7515 and 8386 $Kg\ ha^{-1}$ for fresh and dry forage yield, respectively.

Conclusion: Results showed higher slope of increasing the fresh (6.24 and 3.67, respectively) and dry forage yields (5.61 and 14.84, respectively) by increasing the amount of potassium from zero to 100 $Kg\ ha^{-1}$ in terms of deficit irrigation stress in comparison to full irrigation. As well as a lower slope of reduction of fresh (-2.31 and -7.19, respectively) and dry forage yields (-9.99 and -10.15, respectively) by increasing the amount of potassium fertilizer from 100 to 150 $Kg\ g\ ha^{-1}$ in deficit irrigation in comparison to full irrigation condition shows the moderating role of potassium fertilizers in the face of deficit irrigation in maize.

Keywords: Drought stress, Forage maize, Irrigation, Potassium sulphate

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Evaluation of carbon allocation coefficients and net primary production for major crops in Khorasan-e Razavi Province

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Abstract

Background and objectives: Increasing CO₂ concentration in the atmosphere have prompted renewed interest in increasing the carbon soil stocks in the agroecosystems to mitigate climate change and also improve soil quality (14, 26). Predicting the changes in carbon stocks of soil, depends on reliable estimates of net primary production (NPP) and the proportion of the NPP returned to the soil. NPP defined as the increase in plant mass (biomass) and losses (such as mortality, leaf abscission, herbivory, etc.), in both above- ground and below-ground biomass per unit area of land per unit of time. The annual NPP in agroecosystems and the distribution of carbon for both above- ground and below-ground tissues of plant, is usually calculated from agricultural yield (3, 8, 17). Our purposes were to estimate a set of coefficients for calculating below-ground NPP, above- ground NPP, total annual NPP, relative coefficients of carbon allocation, allocated carbon content and annual carbon inputs to soil for major agricultural crops in Khorasan-Razavi province.

Materials and methods: Shoot and root biomasses for major agricultural crops in Khorasan-e Razavi province such as wheat, barley, corn, cotton, sugar beet, alfalfa and chickpea at plant maturity were measured during two years 2015 and 2016. The crops in all studied fields were fertilized according to local recommendations. Four sub-samples taken for shoot and root biomass measurements from 10 fields (which were subsequently averaged). Roots by using cylinders roots (below-ground biomass) were manually separated from the soil (10, 24, 30). After harvesting, shoots and root samples were separately dried to constant weight and expressed on a dry matter basis. Carbon content in each crop into four fractions including seed (C_P), shoots (C_S), roots (C_R) and extra-roots (C_E) were calculated in units of biomass carbon per unit area per unit of time (g C m⁻² yr⁻¹) (3, 9).

Results: The results showed that relative coefficients of carbon allocation to different tissues, above-ground NPP, below-ground NPP and total annual NPP were significantly affected by different crop species. The highest contents of allocated carbon to above-ground and below-ground tissues including seed (C_P), shoot (C_S), root (C_R) and extra-root (C_E) were observed for barley (4452.78 g C m⁻² yr⁻¹), alfalfa (8602.56 g C m⁻² yr⁻¹), alfalfa (2929.39 g C m⁻² yr⁻¹) and alfalfa (1904.11 g C m⁻² yr⁻¹), respectively. The maximum above-ground and below-ground NPP were calculated for barley and alfalfa with 12626.28 and 4833.5 g C m⁻² yr⁻¹, respectively.

Conclusion: Relative coefficients of carbon allocation among different tissues of each crop is a useful approach for evaluation of soil carbon changes in agricultural systems. Indeed, carbon input and NPP are the most important variables for predicting the net rate of soil carbon changes.

Keywords: Above- ground NPP, Below-ground NPP, Carbon allocation, Crop species

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The effect of integrated soil fertility management on weed population dynamics and corn silage yield

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Abstract

Background and objectives: Nowadays, environmental pollution, by herbicides and chemical fertilizer is one of the most important human issues. The application of conventional tillage and herbicide methods is costly and increase the risk of soil erosion and have negative effects on soil structure and crop yield in the long time. The present study was conducted to evaluate the effect of integrated soil fertility management on weed population dynamics and corn silage yield.

Materials and methods: This research was performed at the Agricultural Research Station of Islamic Azad University of Karaj, Iran during growing season 2013-14. The experiment was conducted as a split plot based on a randomized complete block design with four replications. Main factors included non-chemical soil fertility management treatments at 4 levels (Fallow, Manure, Perko PVH and Buko as green manure) and sub factors also included application of nitrogen fertilizer at 3 levels (120 and 240 and 360 kg ha⁻¹, utilized urea source). Perko PVH and Buko belong to Brassicaceae family. Corn Seeds (sc 704) were planted at density of 12 plants m⁻². Sampling of weeds after planting corn was conducted in primary stage of the corn canopy closure. The collected plant samples were dried in oven at 70°C for 48 hours and then were weighted. In this experiment, weed species diversity indices including Shannon-Weiner index, Margalef index and Simpson dominance index were investigated. At the end of the season, forage yield was determined. The data analyses were conducted with SAS (Version 9.1.3), and means were compared by LSD test at probability level of 5%.

Results: Variation analyses showed that the effect of non-chemical soil fertility management treatments on total weed biomass and forage yield of maize was significant (P<0.01). The highest and lowest forage yield were obtained at Perko PVH Pre-sowing treatments (78.23 ton ha⁻¹) and the manure treatment (63.71 ton ha⁻¹), respectively. The highest total weed biomass was observed at manure and fallow Pre-sowing treatments (380.03 and 364.79 g m⁻²) and the least total biomass was for the Buko and Perko PVH treatment (140.48 and 154.67 g m⁻²). The effect of nitrogen levels on total weed biomass was not significant. There was a significant difference (P<0.01) between nitrogen levels on forage yield. Interaction effect of pre-sowing treatments and nitrogen levels was significant on lambsquarter biomass, pigweed biomass, total weed density, lambsquarter density and pigweed density (P<0.01 and P<0.05); the lowest amount of these mentioned traits was obtained from Buko pre-sowing treatment by using 120 kg ha⁻¹ nitrogen. The highest total weed density (39.25 plant m⁻²) was observed in fallow by using 240 kg N ha⁻¹ and the lowest density (16.5 plant m⁻²) was obtained from the Buko treatment by using 120 kg N ha⁻¹. The effect of non-chemical soil fertility management on weed species diversity was significant (P<0.01). The highest weed species diversity were observed at fallow and manure treatments and the least diversity were for the Buko and Perko PVH treatments.

Conclusion: According to the results of this research, the combined usage of organic fertilizer with chemical nitrogen fertilizer enhances the forage yield of silage corn by reduced weed biomass, density and species diversity. Therefore, by application of the organic fertilizers could be reduced the environmental impacts meanwhile considerably reducing the use of chemical nitrogen fertilizer. In general, can be concluded that by cultivation the pre-sowing crops and return their remnants to the soil improve soil fertility and consequently the quantitative traits of corn silage and can be considered as one of the ways to achieve sustainable agriculture.

Keywords: Ecological management, Green manure, Lambsquarter, Nitrogen, Pigweed

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