Comparison of geostatistical interpolation models (kriging) to estimate soil salinity and wheat yield (a case study: Mazrae nemoneh of Aq qala)

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Abstract

Background and objective: In the past decade, data acquired from the geographical information system (GIS), Global Positioning System (GPS) and geostatistics have an important role in the study of spatial distribution of soil properties and the results often show that variation in soil properties could occur from very small distances (a few mm) to long distances (several kilometers). This study compared different methods of interpolation (kriging) to determine the best model to map soil salinity and yield variables in the field of military, AQ-Qala.

Material and methods: In order to investigate the effects of soils salinity and its variation during wheat growing season, 101 ground control points were taken in the Mazrae nemoneh, AQ-Qala, based on systematic sampling selection, and EC and pH levels were measured in two stages along with corresponded yield in harvesting stage. In order to interpolate salinity levels, ordinary, universal and disjunctive kriging in combination with five models of semivarograms were tested. For this, the field was divided to four separate sections and the models were tested separately.

Results: Final results showed that among three kriging methods and five applied models, ordinary kriging with an exponential model and the universal kriging with exponential models were the best models to estimate soil salinity and wheat yield, respectively. In this study, a significant relation was found between salinity differences for two samplings and wheat yield, as 4.5 gr yield reduction was demonstrated per salinity unit increase. Also, results of soil testing revealed that EC value for each parcel is different than others which is related to topography and parcel area, as the parcel A with the least difference between ECs had the highest yield. Results showed that EC difference had a pronounced variation which could be used to interpret yield differences among four parcels. According to estimates by interpolation methods used for predicting wheat yield in 4 studied units (A, B, C and D), unit A had the most, while unit B the least yield range. Unit A had the lowest salinity and on the other hand, only one cultivar (Koohdasht) was grown in unit A, while in the other units more than one cultivar (Line 17, Morvarid, Koohdasht and N8019) was planted.

Conclusion: In general, Overall results revealed that GIS along with available information could be used as a powerful tool for detecting the effects of abiotic factors effects (including salinity) on the agro ecosystems performance. Also, these results emphasizes on this reality that the fields are faced by widespread spatial variations of different factors which need different management options.

Keywords: Kriging, RMSE, Semivariogram, Soil Salinity, Wheat.

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Reduction of irrigated water salinity effect by foliar application of K$_2$SO$_4$ in cotton (*Gossypium hirsutum* L.)

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Abstract

Background and objective: Fresh water shortages, the need for food and availability of much saline water, enforce the farmers to use saline water. Foliar application of nutrients such as potassium has quick access to the nutrients in the plant and reduce the effects of salinity. In order to better agronomic management for achieve to higher yield, identify of varieties with high yield potential in these conditions can assist researchers to achieve high yield. Using mutant varieties as tolerant plants to salinity can be one of the solutions. Hence this study was performed to evaluate the effect of salinity of irrigated water and foliar application of potassium sulfate on some physiological characteristics, yield of two mutant cottons.

Material and methods: The experiment was laid out using of split factorial arrangement based on complete block design with four replications in Isfahan Agricultural and Natural Resources Center, Rudasht, Isfahan, Iran during 2014-2015. In this study, experimental treatments were three irrigation water [4 (as control), 8 and 12 dS m^{-1}] at main plots and three cotton genotypes (LM1673, LM1303 and Shayan) with four levels of K$_2$SO$_4$ such as 0 (as control), 2, 4 and 6 kg in 1000l/ha in sub plots. In this experiment studied traits were fiber percent, lint yield, and physiological traits such as RWC, RWL, membrane stability index and chlorophyll content.

Results: Lint yield significantly affected by irrigation with saline water, foliar application of potassium sulfate and genotype, but the interaction between experimental factors on lint yield was not statistically significant. The results showed no significant decrease in yield with increasing of salinity levels of irrigation water from 4 to 8 dS m-1, while when using 12 dS m-1 saline water for irrigation, lint cotton yield reduced as 48.5% compared to control (4 dS m-1) and fell from 4174 to 2149 Kg ha-1.Foliar application of potassium sulfate treatment at rate of 4 Kg ha-1 had the highest yield with 4425 Kg ha-1 compared to the control (2462 Kg ha-1) with 55% increasing of yield, but had not significant differences by application 2 and 6 Kg ha-1 sulfate potassium treatments. Between genotypes, LM-1303 genotype had the highest lint yield in rate of 3721 Kg ha-1 that had significant differences with Shayan genotype (3165 Kg ha-1). Highest RWC in first sampling at all foliar application of potassium sulfate treatments was obtained in 8 dS m-1 treatment at rate of 80% and in this saline treatment were not significant differences between foliar treatments. Chlorophyll content was 59 in control treatment and increasing of salinity treatment decreased it and was 54 in 12 dS m-1 treatments.

Conclusion: The results of the present study showed that in saline water treatments, LM-1303 mutant had the highest fiber percent and lint yield that in results can proposed this genotype for

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achieve to high yield in saline condition. Also, for achieve to higher yield and reducing of salinity effects can apply 4 Kg ha-1 potassium sulfate by spraying.

Salinity and drought stress effect on growth, water use efficiency and sodium and potassium concentrations of two irrigated and rain-fed spring wheat genotypes

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Abstract

Introduction: The effect of drought and salinity stress in view of water deficiency are similar to each other, but under long term-salinity stress, in addition to drought stress the plant experiences increased osmotic and high ion stress. There are different levels of salinity (more than 38% of Golestan's total land area is salt-affected) and various farming conditions (rain-fed and irrigation) in Golestan Province, Iran. The purpose of this study was to evaluate the growth, water use efficiency and sodium and potassium concentrations of plant in irrigated and rain-fed wheat genotypes (selected from the first year of the experiment).

Materials and methods: The experiment conducted under greenhouse conditions in a factorial arrangement with two irrigation regimes (5 and 75 % water lost from soil available water), four levels of soil salinity (0, 4.5, 6.5, and 8 dS/m) and two tolerant genotypes (N- 87- 20 and Karim) in a completely randomized design with three replications in the greenhouse Gorgan University of Agricultural Sciences and Natural Resources, Iran. Based on first year of the experiment at moderate salinity (9 dS/m) and under rain-fed condition N- 87- 20 and Karim were selected for moderate salinity or irrigated condition and rain fed condition, respectively. In this experiment leaf area, number of stomata, sodium and potassium concentrations for leaf and stem, total water use from sowing to maturity, water use efficiency (WUE) for grain and biomass and yield were measured.

Results: The results showed that genotype n- 87- 20 had higher leaf area but lower stomata density than those of Karim. Genotype n- 87- 20 in 25% soil available water, i.e. drier condition had similar yield (1.20 vs. 1.16 gr/plant) to Karim. In the wetter condition the yield of N- 87- 20 was higher than Karim (2.00 vs. 1.64 gr/plant). In drier condition, Karim had higher WUE than in wet condition but for N- 87- 20 genotype, it was reverse and it had higher WUE in dry than in wet condition. The sodium concentration in stem was twice as bigger than that of leaf (0.58 and 0.32%, respectively) and with increase in unit salinity of soil to 8 ds/m sodium concentration in leaf and stem increased 0.068 and 0.025 %, respectively. There was not any difference between two genotypes for Na^+/k^+ in leaf and stem but with an increase in soil salinity the Na^+/k^+ for leaf and stem decreased.

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Conclusion: N- 87- 20 was better genotype in irrigated conditions with no or moderate salinity stress and Karim was better genotype under rain-fed condition. Up to 8 ds/m of soil salinity Na^+/k^+ ratio could indicate the difference between genotypes.

Keywords: Wheat genotypes, Salinity, Rain-fed, Water use efficiency, Na^+/k^+

Effect of plant spacing on row and irrigation interval on Azivash (*Corchorus olitorius* L.) plant yield

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Abstract

Background and Purpose: Azivash is a plant which grows well in tropical zones and it has been considered in the international studies because the different parts of this plant can be used. Azivash is a plant that grows well in tropical and subtropical zones and it is an African indigenous plant that has been developed to Asia, South Africa, and South Europe. Since this plant is an agricultural plant which is used in different ways as a fresh vegetable, salad, fresh or dried vegetable in a variety of foods including soup, it is considered as a medicinal herb for its different and useful vitamins. So, this study aims to investigate the different regimes of irrigation and density effects on growth and its performance in seed time in Gorgan's climatic conditions.

Materials and method: This experiment was conducted on Azivash at four bushe densities of 20, 27, 40 and 80 mm^2 and with irrigation intervals 6, 12 and 18 days in three replications. Moreover, intervals of every row are considered as 25 cm and bush intervals on the row are determined as 5, 10, 15 and 20 cm. The plant's properties are measured in seed time. These factors included cutting energy, weight, and number of branches, bush height, and diameter.

Findings: Results showed that the maximum amount of all of measured traits except plant height observed at 20 cm plant distance and six days irrigation intervals. The maximum amount for all of factors except plant height was 20 cm plant distance and six days irrigation intervals. For instance, the maximum amount of irrigation period was every 6 days for some factors such as cutting energy, leaf weight, number of branches, stem diameter, and plant height as 1.91 MJ, 63.15 g, 63.15, 8.153 cm and 137.667, respectively, and the minimum amount of irrigation period was every 18 days as 1.6 MJ, 56.6 g, 6.408 cm and 123.58 cm, respectively.

Conclusion: Increasing irrigation intervals increased, cutting energy, the number of branches, leaf weight and stem diameter in seed ripening time decreases and plant distances increased cutting energy, leaf weight amount, the number of branches, plant height and stem diameter but the plant height decreases. It seems that increasing irrigation volume and reduction plant density have a significant effect on the plant performance and increase its quality. The most appropriate plant distance on row for Azivash was 20 cm and the most favorable irrigation interval was every six days.

Keywords: Plant distance, cutting energy, Seed ripening

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Meta-analysis of Effects Level of Nitrogen Fertilizer on Production of Industrial Plants

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Abstract

Background and Aim: Meta-analysis is a method for comparing the results of independent studies which have been focused on a specific subject. In fact, meta-analysis is a type of research is on the other researches, which could be used to re-investigate several studies on a specific topic. This approach is considered an independent research. In the meta-analysis of the statistical community, the previous research set and the research unit are each of the early and independent prior studies. Therefore, the analysis is a kind of analytical analysis. In order to assessment and continuity to results of effects of different levels of nitrogen fertilizer on some important industrial plants, this research performed using of two calculation method as effect size and logarithmic of response ratio. The first, depend on range and availability to atricles, data of effects of different levels of nitrogen fertilizer (urea based) on seed yield, node, percentage of sugar, oil and protein in some important industrial plants (sesame, sugar beet, safflower, sunflower, potato, cotton and soybean) collected which fertilizer treatments were compared with control. The effect size and logarithmic of responses ratio were estimated by Hedge method. Finally the significant of effect size and logarithmic of responses ratio tested by the range of standard error with zero.

Materials and Methods: In this research, various agricultural studies published in valid academic journals, citation databases of the Islamic world in which, depending on the scope and extent of access to articles on the effect of nitrogen fertilizer from urea source on the seed yield, tubers, sugar percentage, oil and protein are some of the most important industrial crops (sesame (16 articles), sugar beet (12 articles), safflower (20 articles), sunflower (13 articles), potato (17 articles) cotton (20 articles), soybean (10 articles), in which fertilizer treatments were compared to the control.

Finding: Results of meta-analysis released the effects of nitrogen fertilizer exception of some traits as: oil percentage of sesame, sugar percent in sugar beet (exception of 180-200 kg/ha), yield of vash and seed in cotton (50-70 kg/ha) had significant effects on yield of industrial plants. Also, the optimum level for using of nitrogen fertilizer was for soybean (200 kg/ha with 71.90% increase in yield), potato (80-100 kg/ha with 67.85% increasing in yield), safflower (90-100 kg/ha with 48.85% increasing in yield), sunflower (150 kg/ha with 43.17% increase in yield), seed yield of cotton (300 kg/ha with 28.84% and 34.76 increasing in seed yield), sugar beet (180-200 kg/ha with 35.43% increasing in root yield), seed yield of sesame (50 kg/ha with 49.63% increasing in yield), protein percentage of sesame (90-100 kg/ha with 24.47% increasing in yield).

Conclusion: The output of this results showed that the optimum level of fertilizer for achieving of maximum yield was finalized in this situation. So, using of the recommended level of nitrogen fertilizer had some benefits such as decreasing of inputting to farm, diminishing of farmer costs, obtaining of maximum yield and coming down of environmental pollution.

Keywords: Fertilizer, Optimum level, Response ratio, Size effect, Yield.

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The evaluation of Ethalfluralin, Trifluralin and Pendimethalin efficiency of different doses on controlling of potato (*Solanum tuberosum* L.) weed

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Abstract

Background and objectives: Chemical weed control is one of the most common weed control methods in potato field in the world and Iran. Herbicides which are using for potato fields include: Metribuzin, Paraquat, Pendimethalin, Rimsulfuron, EPTC, Solfosulfuron, Ethalfluralin, Trifloralin, Pendimethalin, Prosulfocarp, Metolachlor, and Oxadiargyl. In Iran, Metribuzin and Paraquat are recommended herbicides in potato field. Due to the limited number of herbicides registered, application time, number and variety of site, the objective of our research was to evaluate the efficacy of Ethalfluralin, Pendimethalin and Trifluralin for weed control and yield and component yield of potato.

Materials and methods: The experiment were conducted in Ardabil Agriculture and Natural Resources Research Station in 2013. The experiment performed as does-response based on Randomized Complete Block Design with three replications and potato's cultivar was Agria (common cultivar in Ardabil). Herbicides studied were Trifluralin (Treflan EC 48%) at 0.125, 0.25, 0.5, 1, 2 and 4 L/ ha, Etalfluralin (Sonalan EC 33%) at 0.125, 0.25, 0.5, 1, 2 and 4 L/ ha and Pendimethalin (Stomp EC 33%) at 0.25, 0.5, 1, 2, 4 and 6 L/ ha; also two treatment (with and without weeding) was considered as control. The weed sampling carried out at 20 and 60 days after treatment.

Results: Results showed that maximum reduction percent of total weed biomass at 20 days after treatment achieved by 4, 6 and 4 L/ha Ethalfluralin, Pendimethalin and Trifluralin, respectivelly and application 6, 4 and 4 Pendimethalin, Ethalfluralin and Trifluralin reduced more than 82 % at 60 days after treatment, respectivelly. The best treatment of reduction percentage of common lambsqurters biomass was 6 L/ ha Pendimethalin at 20 and 60 days after treatment that had not significant difference by 4, 4, 4 L/ha Ethalfluralin, Trifluralin and Pendimethalin, respectivelly. The maximum reduction percentage of redroot pigweed biomass was 4 L/ha Ethalfluralin. This treatment could reduce redroot pigweed biomass 97 and 91%, respectivelly. After weed free treatment the best treatment of yield per plant and total tuber yield was 4 L/ha Pendimethalin that cause to increase more than two fold.

Conclusion: This study showed application 6 and 4 L/ ha Pendimethalin and Ethalfluralin created maximum reduction percentage of weed biomass at 20 and 60 days after treatment. Application 4 L/ ha Pendimethalin increased yield per plant and total tuber yield of potato more

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than two fold. Therefore, the use of Pendimethalin and Ethalfluralin herbicides is recommended for potato weed control and increasing potato yield.

Comparison of quantity and quality indices in green and burnt harvesting sugarcane cultivars

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Abstract

Background and objectives: Increase in global warming and environmental issues, public opinion pressure, especially in urban areas near cane fields, the necessity of replacing green harvesting sugarcane (*Saccharum Officinarum*) instead of burning up is increasing. To set on fire cane fields also due to lose about 20 T ha^{-1} herbaceous (Trash blanket) remains can change to organic matter and help to soil fertility and sustainable production of sugarcane in Khuzestan.

Materials and methods: To evaluation quantity and quality indices at harvesting time in green harvesting method and comparison with burnt harvesting losses an experiment performed in 2015-2016 growing season at Imam Khomeini Agro Industry Company. The experiment design was a split plot based on complete randomized block with four replications. Three sugarcane cultivars were as main plots and five harvesting methods and ratooning after harvesting were as sub plots. In field losses such as complete cane, chopper cane, unravel cane, uncut cane, total losses, pol percent and cane yield was studied in test units. A SAS (v 9.2) software was used for accounts statistical and LSD test for means comparison.

Results: The results showed that cultivars had significant effect on all of measured characteristics. The highest and the lowest unravel cane loses was observed in cultivar of CP73-21 (2.65 t ha-1) and CP48-103 (1.23 t ha-1), respectively. Maximum total of losses belong to CP73-21 cultivar (12.14 t ha-1) and minimum (4.46 t ha-1) belong CP48 cultivar. Because of difference between sugarcane cultivars in terms of cane length, leaf numbers, maturation stage period and tolerance to logging, these characteristics have important role in field losses. The highest unravel cane losses belong whole of green harvesting methods (without significant different between themselves) with nearly (2 t ha-1) and the lowest unravel cane was observed burnt harvesting (1.35 t ha-1). Green harvesting methods had more losses than burnt harvesting method. Because leaves and top are green at harvesting time in green harvesting method so losses amount in green harvesting method is higher than burnt method. The highest pol percent belong pre and middle mature cultivar. Method harvesting had not significant different on pol percent .The highest cane yield was observed in CP69-1062 cultivar (92.87 t ha-1) and the lowest cane yield was observed in CP73-21 cultivar (65.4 t ha-1). Average yield of burnt

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harvesting was 83.19 t ha-1 and average yield of total green harvesting methods was 73.68 t ha-1. Generally, yield of green harvesting methods had yield about 11% lower than burnt harvesting methods.

Conclusion: Because researches about green harvesting sugarcane start lately in Iran and because in field losses is higher in early maturity cultivar than other cultivars and need to technical changes about sugarcane harvesters for field losses decrease, current green cane harvesting must be start with middle maturity and late maturity cultivars.

*Keywords***:** Cane yield, Choppered cane, Complete cane, Pol percent, Unravel cane

Effect of water deficit and inoculation with symbiotic micro-organisms on traits of phenological, morphological, agronomic and qualitative properties in soybean

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Abstract

Introduction: Drought stress is one of the important factors of abiotic stress that affects plant growth and yield. Soybean crops are used in most parts of the world to produce oils, vegetable proteins and forages. In sustainable agricultural systems, the use of biofertilizers is of particular importance in increasing plant production and soil fertility. Fungi improve the growth, development and function of host plants in agricultural systems by creating a symbiotic relationship with plant roots by increasing water absorption, increasing resistance to biotic (pathogenic) and abiotic (drought and salinity) stresses. Therefore, this study was conducted to investigate the effects of water deficit on important crop characteristics, grain yield and oil and protein harvest index of soybean cultivar Kosar under conditions of inoculation with arbuscular mycorrhizal and rhizobium bacteria in Urmia.

Material and Methods: Experiment was conducted as a factorial split plot based on a randomized complete block design with three replications at Research Farm of Agricultural highschool of Urmia during 2017. The main factor was three levels of irrigation (irrigation after 70 mm evaporation), moderate stress (irrigation after 110 mm evaporation) and severe drought stress (irrigation after 150 mm evaporation from class A evaporation pan), subplots were including mycorrhizal fungus in three levels of none inoculation, *Glomus mosseae, Glomus intraradices* and Risobium bacteria in two levels, none inoculationand inoculation with *Rhizobium japonicum*.

Results and Discussion:. In severe drought stress compared to optimum irrigation conditions, leaf area index, stem diameter, plant height and grain yield were significantly decreased 60, 31, 11 and 22 percent, respectively. In all irrigation conditions, inoculation with mycorrhiza *G. mosseae* and *G. intraradices* in comparison to non-inoculation, plant height, stem diameter, oil and protein harvest index, leaf area index and grain yield increased, but reduced proline. In optimum irrigation, mild and severe drought stress conditions, inoculation with bacteria in comparison to non-inoculation with bacteria, increased grain yield about 17, 19 and 17 percent, respectively. Inoculation with *G. mosseae* and *G. intraradices* in comparison to non-inoculation of mycorrhiza increased grain yield about 13% and 8%, respectively. The highest percentage of root colonization was obtained from *G. mosseae* (48.80). Inoculation with bacteria compared to non-inoculation increased the percentage of root colonization about 17%. Inoculation with bacteria compared to non-inoculation increased the nitrogen percentage about 8%. Moderate drought stress led to increase nitrogen content.

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Conclusion: Drought stress was decreased significantly phenological traits such as growth period and time to flowering, morphological traits such as stem diameter, pod length and plant height, qualitative traits such as nitrogen percentage and yield, oil harvest index, physiological traits such as leaf area index, grain yield and root colonization of Kowsar cultivar, while led to increase the proline content. Inoculation with mycorrhiza fungus especially *G. mosseae G. mosseae* and inoculation with *Rhizobium* increased the access to water and nutrients and increased all traits in this study. It also reduced proline in all three irrigation conditions and ultimately increased grain yield. Thus, soybean grain inoculation with mycorrhiza fungi, in particular *G. mosseae* and *R. japonicum* bacteria, it was possible to obtain suitable conditions for reaching maximum quantitative and qualitative yield in soybean plants under different moisture conditions and also reducing the negative effects of drought stress and chemical fertilizers.

Keywords: Bacterium, Leaf area index, Mycorhizal, Root colonization, Grain yield.

Effect of foliar application of silicon on improving the qualitative and quantitative traits of two variety of sugar beet (*Beta vulgaris* L.) grown in Torbat Heydarieh

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Abstract

Background and Objectives: Silicon is the second element in the earth's crust, which can play an important role in reducing the effects of biotic and abiotic stresses on plants. This element increases plant resistance to pests, diseases and lodging, increases the absorption of nutrients (especially N and P) and reduces water losses. Application of silicon as a fertilizer is a new idea in Agriculture. According to researchers, the use of silicon has increased root yield, Gross sugar percent and white sugar yield in sugar beet. The approaches to increase sugar beet production in Iran are based more on the use of chemical fertilizers, which has a large side effect on the environment and humans. Therefore, this experiment was conducted with the aim of investigating the effect of different concentrations of silicon fertilizer on quantitative and qualitative traits of two sugar beet varieties.

Material and Methods: The research was carried out in Torbat Heydarieh city, Khorasan Razavi in 2017. The study was done as factorial experiment based on randomized block design with three replications. The experimental factors were two sugar beet varieties (Isabella and Efesos) and silicon concentrations as 0, 0.3, 0.5, 0.7, 1.0, 1.2 and 1.5 lit/ha. Foliar application was carried out at stage of 6 leaves and repeated 5 times every 2 weeks.

Results: The results showed that the main effects of silicon and variety were significant ($P \leq 0.01$) for all measured traits except for sugar yield efficiency. However, the interaction of silicon and variety was not significant for measured traits. Efesos variety had a significant superiority to Isabella variety in terms of root yield, gross sugar percent; molasses sugar percent, white sugar content and white sugar yield. Also, in terms of impurities, this variety had lower Na and higher K and N content compared with Isabella variety ($P \leq 0.05$). With increasing of silicon concentration, root yield, gross sugar percent, white Sugar content and white sugar yield increased, and the amount of harmful Na, K and N decreased in the root pulp ($P \leq 0.05$). The root yield and white sugar yield were increased in treatment of 1.5 lit/ha silicon by 22.6 and 39.22 percent, respectively. In this treatment, root yield and white sugar yield was 89.45 and 17.5 tha^{-1} in Efesos variety and 77.65 and 14.5 t ha^{-1} in Isabella variety, respectively. The importance of white sugar yield is because the profit of the factories is ultimately calculated on the basis of this parameter.

Conclusion: It seems that application of 1.5 lit/ha silicon (CROPSIL) after five stages of foliar spraying (from 6-leaf stage, once every two weeks), was the best treatment for improvement the qualitative and quantitative traits of sugar beet, in the present research conditions.

Keywords: Silicon, White sugar yield, Root yield, Harmful nitrogen, Foliar application.

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Statistical description of soil physical and chemical criteria with yield and yield components of wheat with using stepwise regression

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Abstract

Background and objectives: Characterization of physical and chemical soil criteria is a key step in understanding the source of spatial variability in the productivity across agricultural fields (25). Crop yield variability can be caused by many factors, including spatial variability of soil texture, crop management, soil physical and chemical properties and nutrient availability (49). Understanding the spatial variability of soil physical and chemical characteristics are essential for crop management, as it is directly contributing to variability in growth and yield of crop (43, 18). Hence, understanding their spatial variability across agricultural fields is essential in optimizing the application of agricultural inputs and crop yield and it could help significantly in managing the spatial variability in the productivity of soil agroecosystems (34, 18). Therefore, the objectives of this study were: (i) evaluatation of soil physical and chemical criteria effect on yield indices of irrigated wheat and (ii) to investigate the correlation between physical and chmical soil properties and yield of irrigated wheat.

Materials and Methods: Samplings were performed based on random-systematic method from 50 fields in Khorasan-e-Razavi province during 2017 and 2018. Studied characteristics were texture, organic matter (OM), total nitrogen (TN), available P, available K, pH and C:N ratio of soil and seed yield, biological yield, number of spikes per m^2, number of seeds per spike, 1000-seed weight and harvest index (HI) of wheat. Multiple regression model was used to identify the relationship between soil parameters (as independent variables) and wheat yield indices (as dependent variables). In addition, determining the most important factors of soil physical and chemical properties which have on wheat yield criteria was done by stepwise regression analysis.
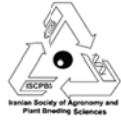
Results: The results revealed that the mean values of seed yield, biological yield, number of spikes per m^2, number of seeds per spike, 1000-seed weight and HI of irrigated wheat were observed with 3716.27 kg.ha^{-1}, 11079.07 kg.ha^{-1}, 341.91 spikes per m^2, 37.96 seeds per spike, 38.19 g and 35.72%, respectively. The highest and the lowest coeficient variances were computed for number of spikes per m^2 (0.78) and biological yield (0.13), respectively. Also, The effect of soil texture was significant (p≤0.05) on soil chemical criteria and wheat yield. The maximum OM, TN, available P, available K and pH were observed for sandy clay with 2.41%, 0.31%, 199 ppm and 7.56, respectively. The maximum seed yield and biological yield were related for clay (with 4313.83 kg.ha^{-1}) and silty clay loam (with 11924.86 kg.ha^{-1}) textures, respectively. The highest correlation coefficients were computed for OM with 1000-seed weight (r=0.935**). The most important factors influencing yield by using step by step regression were OM and available P, respectively.

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Conclusion: Longterm sustainability of agroecosystems depends on physical and chemical soil quality and especially its fertility. Poor soil management practices can lead to degraded soil and reduction in crop yields. Results suggest that novel management approaches are needed to maintain the longterm sustainability of soil resources and crop yields without seriously degrading the environment that this will help in reducing the cost of fertilization and improving soil and environmental quality without altering crop yields.

The effect of integrated management of organic and chemical fertilization on yield, oil, and essential oil of Black cumin (*Nigella sativa* L.) in different irrigation regimes

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Abstract

Background and Purpose: Lack of water is one of the main factors in the reduction of agricultural production at arid and semi-arid regions of the world. Most of the agricultural land of Iran was located in arid and semi-arid area and severe water deficit threaten the agriculture of these areas. Accordingly, any strategy to reduce the effects of drought on crop yields is necessary. Organic sourceses in combined 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 drought stress on yield and yield components of Black cumin.

Materials and Methods: This experiment was carried out as a split-plot based on randomized completely block design with three replications in Agricultural Education and Medicinal Plant Research Center of Isfahan province during 2017. Treatments included irrigation regimes at 90, 70 and 50% field capacity (FC), as the main source and fertilizer source including control (no fertilizer), vermicompost (10 t ha^{-1}), chemical fertilizer ($N_{80}P_{40}K_{30}$) and integration of vermicompost + chemical fertilizer served as the subplot. This experiment, traits were plant height, number of branches per plant, number of follicles per plant, number of seeds per follicle, 1000 seed weight, grain yield, biological yield, essential oil content, essential oil yield, oil percentage and oil yield were evaluated.

Results: The results showed that plant height, number of lateral branches, number of follicles per plant, grain yield, biological yield, essential oil yield, oil percentage and oil yield at 1% probability level, harvest index, essential oil percentage, number of seeds per follicle at the probability level of five percentages were significantly affected by different levels of drought stress. The mentioned traits showed a significant decrease with increasing drought from 90 to 50% of field capacity. The type of fertilizer had a significant effect on all traits except essential oil percentage and oil content. The highest grain yield (648.8 kg ha^{-1}), harvest index (32.72%), oil yield (177.1 kg ha^{-1}) and essential oil yield (3.8 kg ha^{-1}) in vermicompost + fertilizer combination was obtained. The results of analysis of variance of the interaction between fertilizer source and different levels of drought stress on the number of branches, grain yield, essential oil yield and oil yield were significant. The highest number of branches (44), grain yield (817.3 kg ha^{-1}), oil yield (189.3 kg ha^{-1}) and essential oil (10.3 kg ha^{-1}), using vermicompost + fertilizer combination fertilizer in Irrigation treatments with 90% FC were reduced by decreasing irrigation water by 50% FC by 25, 42, 25 and 40%, respectively. In irrigation treatments at 70 and 50% level, grain yield, essential oil yield and number of lateral branches in vermicompost alone were not significantly different with vermicompost + chemical fertilizer.

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Conclusion: In general, the results showed that the combined consumption of vermicompost + fertilizer had the most effect on the quantitative and qualitative yield of Black cumin compared to other fertilizer treatments under both stress and non-stresss conditions. Vermicompost fertilizer improves the water requirement as well as the nutritional requirements of the plant by improving the physical structure, maintaining the balance in the chemical sector, and increasing the moisture storage capacity in the soil under drought stress conditions. Also, chemical fertilizers played a major role in providing the nutritional needs of black currant to create drought resistance. However, in drought stress conditions, vermicompost fertilizer in many traits was also equal to the combination of vermicompost + chemical fertilizer. Therefore, it seems that in such a situation, the role of vermicompost fertilizer in terms of the effect on the physical structure of the soil is more important than the nutritional role of chemical fertilizers and it is recommended.