effect of irrigation and fertilization on yield and technological properties of wheat under sandy soil by using nuclear techniques

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Two field experiment were carried of Inshas Nuclear out at the experimental farm Research Center, Atomic Energy Authority, during the two growing seasons of 2004/2005 and 2005/2006 to study the effect of irrigation treatments, ascorbic acid concentrations and nitrogen rates on growth yield and yield components and chemical analysis as well as technological and rheological properties of wheat improved in sandy soil by applying to casuarinas leaves as plant residues three months before planting wheat. Each experiment included 27 treatments which were the combination of three treatments of irrigation (at 40 , 60 and 80% available soil moisture depletion) , three concentrations of ascorbic acid (without , 500 and 1000 mg/L.) and three rates pf nitrogen (60 , 80 and 100 kg N/faddan), the experimental design was a split-split plot with three replications The experimental design was split-split plots with three replications whereas, irrigation treatments were arranged in the main plots, while ascorbic acid concentrations were randomly distributed in the sub plots and nitrogen fertilizer rates were randomly allocated to the sub-sub plots. Wheat grain c.v Sakha 93 was drilled in rows at 15 cm apart in November 24th in 2004 and 2005 seasons, respectively. The characters studied: I- Growth measurements after 80 days from sowing:1-plant height (cm) 2-Number of tillers/m2 Summary -142-3-Dry weight of tillers/m2(g.)4-Flag leaf area (cm2), 5-Total chlorophyll (mg/g. D.W.). II - Yield and its components : 1-Plant height at harvest (cm.), 2-Number of spikes/m2.3-Spike length (cm), 4-Spike weight (g.), 5-Number of grains/spike.6-Weight of grains/spike (g.).7-1000-grains weight (g.).8-Grain yield (kg/fed.) from the whole sub-sub plot, 9-Straw yield (kg/fed.) from the whole sub-sub plot. III- Grains chemical characters : 1-Protein percentage, 2-Total carbohydrates percentage 3-Ash percentage, 4-Crude fiber percentage, 5-Efficiency of nitrogen and water. IV — Technological characters, 1-Hectoliter weight.2-Extraction percentages flour , fine and coarse bran, 3-Wet and dry gluten content percentage. V — Rheological properties to wheat flour by using Mixolab system, 1-Water absorption percentage, 2-Mixing time (min.)3-Stable period (min.), 4- Weakening time (Nm.), The result could be summarized as follows: A — Effect of irrigation treatments : 1-Irrigation of wheat plants at 40% depletion available soil moisture gave the tallest plant height at 80 days after planting and at harvest in both seasons, 2-Number of tillers/m2 , flag leaf area and number of spikes/m2 were significantly increased by irrigation at 40% depletion soil moisture as compared with irrigation at 60 and 80% depletion soil moisture in both seasons, 3-Irrigation of wheat plants at 60% available soil moisture depletion gave the tallest dry matter weight of shoots/m2 at 80 days after planting. The increment in dry matter reached about (59.96 and 6.71%) in the first season and (62.20 and 6.58% in the second season as compared with irrigation at 80 and 40% depletion of soil moisture, 4-Irrigation treatments had a significant effect on spike length , number and weight of grains/spike and 1000-grain weight as well as straw yield per faddan in the first and second season, 5-Irrigation of wheat plants at 40% depletion of soil moisture led to significantly surpassed the irrigation at 60 and 80% soil moisture depletion in grain yield per feddon by (10.53 and 11.00%) and (47.33 and 52.89%) in the first and second seasons, respectively, 6-Irrigation at 80% available soil moisture depletion gave the maximum total chlorophyll (16.70 and 15.80 mg/g. D.W.) and protein content in wheat grains (11.96

and 11.83%). While irrigation at 40% depletion soil moisture gave the -minimum protein content (10.48 and 10.46%) in both seasons, respectively.7-Irrigation at 60% soil moisture depletion gave the maximum nitrogen utilized percentage (34.46 and 36.95). While irrigation at 80% gave minimum nitrogen utilized (21.91 and 23.92%) in the first and second seasons, respectively, 8- the highest water use efficiency value was 1.407 and 1.448 kg grains/m3 of consumed water scored from irrigation at 60% available soil moisture depletion in the tow growing seasons respectively. It was noticed no significant differences between the two irrigation treatments of 40 and 60% in the second season, 9-Irrigation treatments had a significant effect on technological characters, whereas, hectoliter weight, extraction percentages of flour and fine bran were increased by irrigation at 40% soil moisture depletion and there is not a significant differences between irrigation at 60 and 40 % on hectoliter weight in both seasons, 10-Irrigation at 80% available soil moisture depletion gave the best coarse bran, wet and dry gluten percentage in the two growing seasons, 11-Irrigation wheat plants at 60% available soil moisture depletion gave the tallest time of mixing and stable period and the best weakening time. While, irrigation at 80% gave the highest water absorption in flour dough percentage, reached about 61.03 % and 59.92 in the first and second seasons, respectively B — Effect of ascorbic acid concentrations : 1-Plant height at 80 days after planting and at harvest, number of tillers/m2, dry matter of tillers / m2, flag leaf area and total chlorophyll were significantly increased by spraying wheat plants ascorbic acid compared to unsprayed treatment (control) and there is not significant differences between the two concentration of 500 and 1000 mg/L. on flag leaf area and total chlorophyll in both seasons.2-Application of ascorbic acid significantly increased in number of spikes /m2, spike length, spike weight, number and weight grains/spike, 1000-grain weight and straw yield /feddon compared with control treatment in both seasons, 3-There were no significant differences between the two concentrations of 500 and 1000 mg/L. on spike length, number and weight of grains/spike, 1000-grain weight and straw yield per feddon in the first season and number of spike/m2 in the second season.4-Grain yield was increased markedly by spraying ascorbic acid. Spraying wheat plants with 1000 mg/L. gave the highest average values of grain yield (2247 and 2328 kg/feddon) in the first and second seasons, respectively, and increased by about (15.00 and 16.00%) as compared with the control treatment. Also, there was no significant difference between the two concentrations 500 and 1000 mg/L. in the first season. 5-Spraying wheat plants by ascorbic acid caused a significant increase in crude protein content, ash content and crud fiber percentage in grains. While total carbohydrates percentage was decreased by increasing ascorbic acid concentration 6-There was no significant difference between the two concentrations 500 and 1000 mg/L. on crude protein content in the first season and total carbohydrates in the second season and ash percentage in both seasons, 7-The highest utilized percentage of nitrogen fertilization (31.65 and 34.22%) and water use efficiency (1.330 and 1.434 kg. grains/m3 consumed water) in the first and second seasons, respectively, by spraying wheat plants with 1000 mg/L. ascorbic acid concentration8-The hectoliter weight and coarse bran percentage were increased by increasing ascorbic acid concentration. On the contrary flour and fine bran extraction percentage were decreased in both seasons 9-Spraying wheat plants by ascorbic acid surpassed significantly in the wet and dry gluten compared with untreated in both seasons. It could be noticed no significant differences between the two concentration 500 and 1000 mg/L. on hectoliter weight , fine bran, wet and dry gluten content percentage in the first season and in both seasons on flour extraction percentage, 10-Ascorbic acid concentrations significantly affected on the Rheological properties. whereas, the best mean values of mixing time, stable period and weakening time as well as water absorption to the flour dough by application 1000 mg/L. ascorbic acid and there is not significantly differences between the two concentrations 500 and 1000 mg/L. in both seasons. C — Effect of N-rates:1-Nitrogen rates had a significant effect on plant height at 80 days after planting and harvest, number of tillers/m2 , flag leaf area and total chlorophyll in both seasons. The greatest values of above characters were recorded at the highest N-rate (100 kg. N/feddon), 2-The application of 100 kg. N/feddon significantly increased dry weight of tillere/m2 by about (17.54 and 4.49 %) in the first season and (15.02 % and 3.05%) in the second season compared with application 60 and 80 kg. N/feddon, respectively.3-The mean values of number of spikes/m2, spike length, number and weight spike, 1000- grain weight and straw yield/feddon were significantly

increased by increasing nitrogen rate up to 100 kg. N/feddon in the two growing seasons. 4-The application 100 kg. N/feddon significant increased grain yield/feddon by about (20.06 and 3.05%) in the first season and (16.84 and 2.03%) in the second season compared with application 60 and 80 kg. N/feddon, respectively. 5-The highest mean values of protein content in wheat grain (11.38 and 11.50%) resulted by using 100 kg. N/feddon in the two growing seasons, respectively.6-Total carbohydrates were significantly decreased with increasing nitrogen rate. While, ash content and crude fiber percentage increased by increasing nitrogen rate in both seasons.7-The highest nitrogen utilized percentage values was 31.34 % and 33.50% for application of 80 kg. N/feddon. While, the highest water use efficiency values was 1.361 and 1.440 kg grains/m3 of water consumed for application by 100 kg. N/feddon in the first and second seasons, respectively.8-Hectoliter weight, coarse bran, wet and dry gluten percentages were increased by in creasing nitrogen rate. On the contrary, extraction flour and fine bran percentage were increased by increasing N-rate, and there are not significant differences between the two rates of 80 and 100 kg. N/feddon.9-Application of 60 kg. N/feddon gave the highest values of extraction flour (68.85 and 68.92%) and fine bran percentage (7.33 and 6.72%) in the first and second seasons, respectively.10-Water absorption percentage was increased by about (6.36 and 2.89%) and (4.41 and 2.74%) at using rate of 100 kg. Nifeddon compared with 60 and 80 kg. N/feddon in both seasons, respectively, 11-The best values of mixing time and stable period as well as minimum value of weakening were resulted from applied 100 kg. N/feddon in two growing seasons D — interaction effect : There were a significant effect for interaction between irrigation treatments x ascorbic acid, irrigation treatments x N-rates, ascorbic acid x N-rates and the interaction between the three factors on most characters under this study in both seasons. Table (28 and 29) indicates the best response values of significant interactions and the combination of factors recording these values in both seasons, conclusionThis study could be recommended that irrigation of wheat plants at 60% available soil moisture depletion with using 500 or 1000 mg/L. ascorbic acid concentration as well as fertilization wheat with 80 kg N/faddan for improving grain yield and maximized nitrogen and water use efficiency. So, grain yield and quality were improved as a result of the application with the above-mentioned treatments in a sandy soil application with casuarina leaves as plant residues was applied three months before planting wheat , as a sandy soil ameliorate. 73.61(40° nASMD-, Without A.A.+60kg N/fed.)('foal 14001 +•ry IMm000t +catismool r1'6L 71.77 (40%ASMD+ Without LA.+60kg N/fed.)7.71 (40%ASMD+ Without A.A.+60kg Med.) 29.49 (80%ASMD +1000 mg/L AA. + 100 kg N/fed.)914 SN r.+(Sil•AASMD. 1000ing/L. 100kg N/Fed.) 2.56 (60%ASMD *1000 u AA. + 100 kg Med.) 6.31 (60%ASMD +1000 mg/ AA. + 100 kg Med.) 0.41 (60%ASMD +1000 mg/ AA. + 100 kg N/fed.)41.76 (60%ASMD +1000 mg/L AA. * 100 kg Med.) 7196(Without A.A. +60kgMed.)I (pnitektoo+ •v-v 1001111/A)) 60C11.496 ((Without I A.A. +60kgN/fed)78.89 (1000 mg/L AA. + 100 kg Med.)70.09 (Without A.A. 4604N/fed.)7.10 (Without AA. +60kght/fed.)27.74 (1000 mgil. AA. 100 kg Nifed.)31.01 (1000 mg/L AA. + 100 kg N/fed.)13.43 (1000 mg/L AA. + 100 kg N/fed.)oot + *try 'Ow 0001) W091.80 (1000 mg/L AA. + 100 kg N/fed.)3.93 (1000 mg/L AA. + 100 kg N/Ted.)0.62(1000 mg/L AA. + 100 kg N/fed.)36.02 (1000 mg/L AA. + 100 kg Med.)1.495 (1000 mg/L AA. , 100 kg N/fed.)1,041 elss3M1 Ssi 91/%01419-21.ivtoo.t/N Now 'V 1>I0ID1A1199911.394 (without Al.! 60 kg Med)78.86 (60%ASMD 100kg 19/Fed.)70.49 (40%ASMD +60kg N/Ted.)7.08 (40%A.SMD +60kg Med.)('w.1/14 340 -401NSV%08)7:9-8231.93 (80%ASMD +100kg N/fed.)SW ('foal 011001+ UPlSV%08) 09'092.49 (60%ASMD +100kg N/fed.)6.01 (60%ASMD +10014N/fed.)(RUN 231001+ OMISV%09)38.37 (60%ASMD + 80kg Med.)Vry itioquAt+ aptsmorkcii.,1.693(40%ASMD +1Mthout Art)1.458(401ASMD +Without A.A.)78.90(40%ASMD +1000mg/LAA70.42(40%ASMD +'WItitout A.A)(v-v want +apisrv.ortonrtrigiol000t+ mare/mkt:6z Irrirdm000t + atsirmootwoo yrilat0000t +answortlaezrrI/Joi000 oinsysitetsrs vyrtAat000 +aitisrmotwo rrlilitattoot+ aptsrmo9kr611.545(60%ASMD 41000mg/L.AA74.01(40%ASMD+ Without A.A.+60kg N/fed.) (TONI No9+1ry)NOtimst 4.tmstm4000c9'1 1.305 (40%ASMD+Without AA.+601cg Med.) S'N71.94 (40%ASMD+ Without A.A.+ 60kg N/fed.)8.95 (40%ASMD+ Without A.A.+60kg Med.)28.96 (80%ASMD +1000mg/L AA. + 100 kg Med.)('Pahl Sit 001 + 'VVI/301 ooet+ apisv,s09) Przw1/51 &toot + •Yv rUgui 0001+ M1191/%09f SYS ('Pal/k1 If 001 + "TV Tans OOP- CMS V%09) 80*0 40.55 (60%ASMD +1000mg/L AA. 100 kg Med.)(ixonialtoo+ -ry polott)stett 1.703 ((WithoutA.A.

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