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The Effect Of Different Levels Of Nitrogen Fertilizer On Some Growth Characteristics Of Three Cultivars Of (Sorghum) Sorghum Bicolor.L

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Abstract

A field experiment was carried out during the fall season of the year 2019-2020 in the field of experiments of the Abu Ghraib station of the Agricultural Research Department - Ministry of Agriculture, 10 km west of Baghdad within the longitude 44 ° east and north latitude 33. The research aims to find out the effect of different levels of nitrogen fertilizer on some growth characteristics of three varieties of Sorghum.it used Randomized complete Block Design (R.C.B.D) by Global experience system with three replicates. The experiment included two factors, the first factor, three levels of nitrogen (150,0 and 300) kg. ha^{-1} and symbolized by the symbol (N0, N1, N2). The second factor included three items (Kafir,Inqathe and buhooth70) and symbolized by the symbol (S1, S2, S3). The results showed that the variety (S1) of Kafir was superior in the characteristic of height by giving it the highest average of (165.23 cm), while the variety Inqathe (S2) gave the highest average in some studied traits, the number of leaves. $Plant^{-1}$, leaf area. Cm^2 and stem diameter It reached (11.44 $leaf.plan^{-1}$, 14.02 cm2 and 1.91 mm), while the cultivar buhooth70 (S3) gave the highest average in the characteristic of the number of branches. $Plant^{-1}$ (2.19 branch. $Plant^{-1}$). The nitrogen element levels showed a significant effect in all the studied traits, as the level was 300 kg. ha^{-1} (N2), the highest average in all the traits that were under the study: plant height. Cm, number of branches. $Plant^{-1}$, number of leaves. $Plant^{-1}$, leaf area.Cm^2 , The stem diameter was (164.78 cm, 2.57 branch. $Plant^{-1}$, 11.69 Leaf .$plant^{-1}$, 14.92 Cm^2 and 2.12 mm).

Keywords: Sorghum varieties , Nitrogen fertilizer, Foliar fertilization and planting method

Introduction

Sorghum bicolor L. is one of the crops of the Nigella family and it is one of the important crops that comes in fifth place after Wheat, Barley, Rice and Zea Mays (David and Poehlman, 2006) , It is grown on a large scale due to its adaptation to different environments. Sorghum bicolor grains are used in human and animal nutrition and in poor countries they are used as human food when mixed with wheat flour at 50%, In developed countries such as the United States of America, 90% of its grains enter the human food industry, such as the production of starch and its derivatives, because they contain high nutritional components, as the ratio of protein 10-12, fats 3% and carbohydrates 70%, as well as their grains contain vitamin B (Rana et al, 2013). Interest in this crop began in Iraq since 1998 through the Sorghum Development Project of the General Authority for Agricultural Research - Ministry of Agriculture, in order to distinguish it from other cereal crops by its tolerance of harsh conditions such as drought, high temperatures and salinity, as well as its wide nutritional and industrial uses (Ghasemi et al, 2012). Its grains are used as a basic material in the concentrated diets for nutrition animals,

especially poultry, due to the high protein content in them, reaching 12% with the addition of carotenoid pigment (Ottman and Olson, 2009). It was possible to overcome some of the problems facing the cultivation of this crop and to achieve an increase in the yield through good management of the soil and crop and the selection of improved varieties with high productivity with an appropriate compatibility between these varieties and the available growth factors when these factors are optimally invested, so it became necessary. Inclusion of this crop in the crop composition in the central and southern regions of Iraq, including the newly reclaimed areas in which the productivity of other crops is low (Al-Karkhi and Al-Maeeni, 2014). And because of the increase in the world population and the increase in the demand for food, there was great interest in raising production regardless of the quality, which led to an increase in the rates of use of chemical additives (N, P, K) when growing different crops, which led to the exacerbation of the harmful effects on health and the environment. , And the toxic effects of pesticides on the vegetable part that is eaten. (Osman, 2007). **The study aims to know the response of three genotypes from Sorghum to levels of nitrogen fertilizer and the extent of this effect on some growth traits and to study the interactions between varieties and levels of nitrogen fertilizer.**

Materials and working methods:

Field experiment carried out during the autumn season of the year 2020-2019 In the field of experiments at the Abu Ghraib station of the Agricultural Research Department - Ministry of Agriculture ,10 Km west of Baghdad within longitude 44 °east and north latitude33.The aim of the research is to find out the effect of different levels of nitrogen fertilizer on some growth characteristics of three varieties of Sorghum. The whole sector design work was used (RCBD) System of factor experiments and with three replications . The experiment included two factors, the first factor ,three levels of nitrogen (0,150,300) Kg. ha^{-1} And symbolized by the symbol (N0 , N1 , N2)As for the second factor, it included three varieties (Kafir, Inqa the and buhooth70) Symbolized by the symbol(S 1, S 2, S 3). The experimental land was plowed, then graded and flattened, and after that it was divided into experimental units, the dimensions of which were 2 ×3 M to become the area of the experimental unit 6 M^2 ,Contained4 Lines, the length of the line 3 M and the distance between one line and another50 Cm and the distance between its neighborhood and the other25 The planting took place on a date22/7/2019 In the autumn season it bo put 2-3 A seed in the hole, then softened to a single plant in the hole when the plants reached a height 15-20 Cm . Struggle a corn stem borer insect(Sesamia cretica) Inoculated with the granulated diazinide pesticide 10 %Active ingredient and by amount 6 Kg . ha^{-1} And in two installments . First after 20 from the germination ,and the second after 15 A day from the first batch (Al-Ali, 1980) The experiment was fertilized with phosphate fertilizer at the cultivation level and at the level of 100 Kg P.ha^{-1} from fertilizer triple super phosphate 20% P . It was also fertilized with nitrogen fertilizer to a level 200 Kg N .ha^{-1} . Urea fertilizer (46%N)(Al-Dulaimi, 2002)In four equal batches (immediately after germination , after 20 From the first batch, at the appearance of the heads and at the phase of fullness of grains and for all treatments . The irrigation experiment directly after planting and then repeated irrigation depending p for Z soil moisture and the state of the plant . herbivore land twice the experiment manually during the growing season . The following characteristics were studied : plant height cm, leaf area . cm^2 ,Number of leave . $Plant^{-1}$ ، Number of branches . $Plant^{-1}$and the diameter of the stem . Mm . And at full maturity, it is harvested 10 Plants at random from the median lines for each experimental unit to study the caricatures required .The data were analyzed statistically and the averages were compared using the least significant difference at the level 0.05 (Sahoki and Waheeb, 1990) .Using a program. Genstat .

(Table 1) Some physical and chemical properties of the soil of the experiment

properties	the value
The degree of electrical conductivity EC Desi Siemens^2	2.7
Degree of soil reaction pH	7.9
GM organic matter . Kg^{-1}	9.7
Ready-made potassium (mg . Kg^{-1})	6.5
Ready nitrogen(mg . Kg^{-1})	70
Ready phosphorous(mg . Kg^{-1})	9.8
Soil separators	
Clay(g . Kg^{-1})	260
Sand (g . Kg^{-1})	120
Silt(g . Kg^{-1})	490
Soil texture	clay loam soil

Results and discussion:

Plant height . cm

The results are shown in the table(2) The varieties significant effect on the average plant height as cultivar S1 By giving the highest average reached 165.23 Cm , while the variety is given S3 The lowest average attained 135.23 Cm . Perhaps the reason for increasing plant height when spraying nitrogen on plant to the role of this element in the biological division and plant growth in addition to the role of this element in building tryptophan, which is the main material for building growth hormone IAA (Wareaing, 1983) , Which leads to the increase in plant height and conform to its these findings with the result to e Each of (Salama , 2008 And Mohammed, 2009) who pointed to an increase in the average plant height Sorghum when you add nitrogen. The data of the same table indicated that there was a significant effect of the levels of nitrogen fertilizer added to this characteristic as it gave the fertilized plants the level N2 The highest average plant height was 164.7 8 CM and outperformed the control treatment (N0) Which gave a lower average rate of 137.8 7 Cm . To outperform plants of high level from nitrogen in the Plant height attributed the increase Readiness in the surrounding of the roots and thus increase the absorption by plant, including the nitrogen from the fast elements of movement in Then it moves to the newly formed parts that include the meristems responsible for the young growth, which leads to an increase in cell division and elongation, and thus the height of the plant increases. These results are in agreement with what was stated by both (Salama, 2008, Buah and Winkaara, 2009 Those who indicated that there was a significant effect in the characteristic of plant height when adding nitrogen fertilizer. The results of the bilateral interaction between S and N showed a significant effect on this characteristic, as the combination S1N2 gave the highest mean of 184.30 cm, while the combination S3 and the control treatment N0 gave the lowest average of 130.50 cm.

Table (2) The effect of fertilizer nitrogen levels and cultivars and overlap in the character plant height cm

Varieties	Nitrogen concentrations (kg . ha $^{1-}$)			Average **(S)**
	N0	N1	N2	
S1	142.60	168.80	184.30	165.23
S2	140.53	158.90	170.53	156.6 5
S3	130.50	135.67	139.53	135.23
Average **(N)**	137.8 7	154.4 5	164.7 8	
L . S . D 0.05		N = 1.26	S = 1.26	S * N = 2.19

The number of leaves . Plant^{-1}

This characteristic is one of the important characteristics, because increasing it means increasing the efficiency of the source in receiving the largest amount of light and intercepting it, which increases the results of photosynthesis, and the number of leaves and their size are affected by the genotype and environmental factors. By giving its the highest average of 11.44 leaf. Plant^{-1} While the genotype (S3) gave the lowest rate for this trait, which was 10.05 leaf.plant^{-1}. Although the genotype (salvage) is characterized by the fact that its plants are short in height, which indicates that it has the ability and ability to branch and form a larger leaf area, as well as due to the genetic nature of them as well as their difference in plant height and dry matter yield, which are linked positively and morally with the number Plant leaves This result is in agreement with the findings (Dayif and et al, 2002 and Faqira, 2001) who found a significant difference in the number of plant leaves between the genotypes of Sorghum . The number of leaves of the plant increased with the increase in nitrogen levels, until the plants fertilized with the high level of nitrogen gave the highest average number of leaves in the plant at the concentration N2, reaching 11.69, while the control treatment N0 gave the lowest rate of 9.54 leaf. Plant^{-1} .The reason is due to the role of nitrogen in increasing the size of cells and the speed of their division as a result of the efficiency of carbon representation and the manufacture of foodstuffs, which leads to a significant increase in the growth characteristics and that the number of leaves is a trait related to the genotype mainly, but it is affected by growth factors, especially nitrogen fertilizer and its levels. The results of (Al-Duwghji, 2001) confirmed that the higher fertilizer level of nitrogen gave the highest average number of leaves in plants. Also, the results of the bilateral interaction between the cultivars and the nitrogen fertilizer levels (S, N) indicated the presence of significant interaction, as the combination S2N2 gave the highest average of 12.27 leaf.plant^{-1}, while the combination S3N0 gave the lowest average of 9.13 leaf.plant^{-1}.

Table(3) The effect of fertilizer nitrogen levels and cultivars and overlap in the character number of leaves . Plant $^{-1}$

Varieties	Nitrogen concentrations(kg . ha^{-1})			Average **(S)**
	N0	N1	N2	
S1	9.30	11.77	11.87	10.98
S2	10.20	11.87	12.27	11.44
S3	9.13	10.10	10.93	10.05
Average **(N)**	9.54	11.24	11.69	
LS D 0.05		N = 0.32	S = 0.32	S * N = 0.56

Leaf area . cm^2

The cultivars differed significantly in the average leaf area, Table (4), as the S2 cultivar gave the highest rate of 14.02 cm^2, while the S3 variety gave the lowest average of 13.02 cm. The reason may be due to the variation in the number of days required for the stages of growth between varieties in which the length of the length of the expansion of the leaves differs, as well as in the number of leaves that differ according to the maturity of these varieties as the medium-ripened varieties possess the highest number of leaves. These results are consistent with what he reached (Ayub et al., 2010).Table (4) shows a significant effect of nitrogen concentration in the leafy area of the plant. It was observed that there was a linear increase in the leaf area with an increase in nitrogen spraying concentrations, as the percentage increase in the leaf area of N2 concentration was 14.92 cm^2 compared to the control treatment N0, which gave the lowest rate of 11.79 cm. The reason for the increase in the leaf area when spraying nitrogen is attributed to the weakness of this element and its role in increasing the division of meristematic cells, which is reflected positively on the increase in the size of the vegetative system, including the height of the plant. An important role in increasing the size of the root system of the plant, which increases the efficiency of the plant to absorb nutrients and increase the efficiency of water consumption. These results agreed with both (Sifola and xeccon, 2002 and Mohammed, 2009). The results of the bilateral interaction between S and N showed significant differences in this characteristic, as the combination S2N2 gave the highest rate outperforming the rest of the combinations by 15.87 cm^2, while the combination S3 and the control treatment N0 gave the lowest average of 11.23 cm^2.

Table (4) The effect of nitrogen fertilizer levels and varieties and their overlap on the characteristic of leaf area. Cm ^{2}

Varieties	Nitrogen concentrations (kg . ha $^{1-}$)			Average **(S)**
	N0	N1	N2	
S1	11.87	13.10	14.33	13.1 0
S2	12.27	13.93	15.87	14.02
S3	11.23	13.27	14.57	13.02
Average **(N)**	11.79	13.43	14.92	
LS D 0.05		N = 0.17	S = 0.17	S * N = 0.34

Stem Diameter. mm

The results shown in Table (5) indicated that there were significant differences between the cultivars used in the average stem diameter. S2 cultivar gave the highest average of 1.91 mm, while the S3 variety gave the lowest average of 1.38 mm. This result is in agreement with the results of (Promkhambut et al. 2011 and Ayub et al., 2010) who emphasized that the varieties of Sorghum differ according to the genotype of the stem diameter trait. This trait was significantly affected by the Compost levels used in the study, as it exceeded the N2 level when it gave the highest average for the trait was 2.12 mm, while the lowest average was at the N0 level (the comparison treatment) which reached 1.21 mm. while the lowest average was at the N0 level (the control treatment) which reached 1.21 mm. These results are in agreement with what was found by (Al- Duwghji, 2001 and Al-Hasani, 2001), where they found a difference in the characteristic of the stem diameter according to the different varieties studied, in addition to the increase in diameter by increasing the levels of nitrogen fertilizer.

Table (5) The effect of fertilizer nitrogen levels and cultivars and overlap in the character stem diameter .mm

Varieties	Nitrogen concentrations (kg . ha^{-1})			Average **(S)**
	N0	N1	N2	
S1	1.23	1.77	2.13	1.71
S2	1.37	1.87	2.50	1.91
S3	1.03	1.40	1.73	1.38

Average **(N)**	1.21	1.68	2.12	
LS D 0.05		N = 0.06	S = 0.06	S * N = 0.12

Number of branches. Plant^{1-}

The results shown in Table (6) indicated that there were significant differences between the cultivars and the nitrogen concentrations used in the study in the characteristic of the number of branches. Plant^{-1}. The S3 variety had the highest average of 2.19 branch. Plant^{-1}, while cultivar S2 gave the lowest average of 1.40 branch. Plant^{-1} The reason may be attributed to the different environmental conditions of the temperature and the amount of radiation received, as well as the ability of a certain variety to express itself under certain environmental conditions at a time when the other variety is not able to do so. These results agreed with what was stated (Al-Shehab, 2011). The results of the same table showed that there was a significant effect of nitrogen levels in this characteristic, as the compost level N2 gave the highest average of 2.57 branch. Plant^{-1}, while the control treatment N0 gave the lowest average of 1.31 branches. Plant 1-. The reason for the increase may be due to the role of the element in encouraging the meristematic tissue and the coronary region generating branches. These results are consistent with what was found (Jassim et al., 2017). The results of the binary interference showed a significant effect on this trait, as the combination S3N2 gave the highest mean of 3.30 branch. Plant^{-1}, while the combination S2N0 gave the lowest mean of 1.17 branch. Plant^{-1}.

Table (6) The effect of nitrogen fertilizer levels and varieties and their overlap on the characteristic (number of branches. Plant^{-1})

Varieties	Nitrogen concentrations (kg . ha^{-1})			Average **(S)**
	N0	N1	N2	
S1	1.30	1.53	2.67	1.83
S2	1.17	1.30	1.73	1.40
S3	1.47	1.80	3.30	2.19
Average **(N)**	1.31	1.54	2.57	
L S D 0.05		N = 0.0 9	S = 0.0 9	S * N = 0.1 8

Reference

Al- Duwghji, kifah Abdul Ridha Jassim, 2001. The response of two

types of sorghum to the date and amount of nitrogen fertilizer. Master Thesis - College of Agriculture - University of Basra. Iraq.

Al Sahuki, Medhat Majeed, Karima Waheeb. 1990 Applications in the design and analysis of experiments. Ministry of Higher Education and Scientific Research. Baghdad University. Iraq.

Al-Ali, Aziz. 1980. Handbook of Agricultural Pest Control. General Authority for Plant Protection - Department of Prevention Research - Ministry of Agriculture and Agrarian Reform - Republic of Iraq.

Al-Dulaimi, Nihad Muhammad Abboud. 2002. Productivity of several genotypes from sorghum. Master Thesis, College of Agriculture. Anbar University.

Al-Hasani, Salih Hussein Jabr. 2001. The effect of planting dates on the growth and yield of two varieties of sorghum. Master Thesis - College of Agriculture - University of Baghdad. Iraq.

Al-Karkhi, Firas Dhiab, Iyad Hussain, Ammi Al-Maeeni. 2014. The effect of tillage and agricultural systems on the growth and yield of sorghum(Sorghum bicolor L) and Mung bean (Vigna radita L) Al Furat Journal of Agricultural Sciences. 6 (1): 143--135.

Al-Shehab, Haider Abdul Latif. 2011. The effect of plant density on the branching of the grain of sorghum crop. Master Thesis - College of Agriculture - University of Baghdad Iraq.

Ayub, M, A. Muhammad, T. Muhammad , G .Abdul , A .Zeeshan and A .Muhammad .2010 . Comparative Studies on the Growth, Forage Yield and Quality of Sorghum (Sorghum Bicolor l.) Varieties under Irrigated Conditions of Faisalabad. Pak. J. life Soc. Sci. 8(2): 94-97.

Buah, S.S.J. and S. M.Winkaara. 2009. Response of sorghum to Nitrogen fertilizer and plant density in the Guinea savanna zone. J. of Agron . 8 (4) : 124-130.

David,A.S,and J.M Poehlman.2006. Breeding Field Crops. fifth edition, Blakwell puplication,pp424.

Dhaif, Abd al-Amir Miz'al, Amer Muslit Mahdi, and Qahtan Jassim Hammoud, 2002. Evaluation of some genotypes of white grain corn in the central region. ABA Journal of Agricultural Research, 12 (1): 10-1.

Faqira, Abda Bakri Ahmed, 2001. The effect of some agricultural operations on the yield and quality of fodder for millet and sorghum crops. PhD thesis - College of Agriculture - University of Baghdad. Iraq.

Ghasemi, A.;M.H.Karim and M.M.Ghasemi. 2012 . Green fodder yield performance of different varieties of sorghum grain in an arid region . Int. J.Agri.Crop Sci. 4(13): 839 – 843.

Jassim, Ali Hussain, Kazem Muhammad Hassoun and Haydar Mohsen Rashid (2017). The effect of foliar nutrient with phosphorus and potassium on the growth and yield characteristics of wheat. Karbala University Scientific Journal, Volume (5), Number (1).

Mohammed. H. A.2009. The effect of nitrogen and boron fertilizers application on the water use efficiency by sorghum. ALAnbar. J 7 (4):30-42.

Othman, Janan Youssef. 2007. Study of the effect of using organic fertilizers in potato cultivation and production as a contribution to clean organic production. Master's thesis. College of Agriculture. Orchard department. Tashrayn University. Syrian Arab Republic.

Ottman, M. J. and M. W. Olson, 2009. Growing grain sorghum in Arizona. The University of Arizona. College of Agriculture and Life Sciences. Tucson, Arizona 85721.

Promkhambut, A., A. Laureti, C. Akkasaeng and A. Younger, 2011. Growth yield and aerenchyma formation of sweet and multipurpose sorghum (sorghum bicolor L. Moench) as affected by flooding at different growth stages. Aust. J. of crop Sci. AJCS. 5(8):954-965.

Rana, D. S.; B. Singh; K. Gupta; A. K. Dhakai and S. Arya.2013. Response of Fodder Sorghum [Sorghum bicolor (L.) Moench] to zinc and iron. Forage Res., 39 (1) : 45-47.

Salama, M.A, 2008. Response of sorghum to nitrogen fertilization. Iraq. J. for desert studies. (1):11-17.

Salama, Mahmoud Abbas Abd. 2008. The response of sorghum to nitrogen fertilization, Iraqi Journal of Desert Studies, Volume (1) - No (1) .

Sifola, M. I, M. Mori and xeccon, p.2002. Biomass and nitrogen partitioning in sorghum (Sorghum bicolor L. moench) as effected by nitrogen fertilization. Ital.J.Agron. 1, 2:115- 121.

Wareaing. P. F.1983. Interaction between Nitrogen and Growth Regulaters in the Control of Plant Development. British Plant Growth Regulator Group monograph. 9:1-4.