

Effect of organic fertilizer Optimus Plus on some growth and yield characteristics of two wheat cultivars (*Triticum aestivum* L.).

R.F. AHMED¹ S.M. ZAKI² O.Gh. Abdulghafoor and M.A.Youns

¹Department of Field Crops , College of Agriculture and Forestry, University of Mosul, Iraq.
rayanobady79@uomosul.edu.iq

²University of Telafer, College of Agriculture, Department of Field Crops , Iraq.
shereen.m.zaki@uotelafer.edu.iq

³Department of Field Crops , College of Agriculture and Forestry, University of Mosul, Iraq.
omaralmzori@gmail.com

⁴University of Telafer, College of Agriculture, Department of Field Crops , Iraq.
mohisin.a.younis@uotelafer.edu.iq

Abstract

This study was conducted during winter season 2022-2023 in lathhouse of Department of Field Crops , College of Agriculture and Forestry in pots with a capacity of 7 kg of soil and seven plants per pot. The study included two cultivar of bread wheat (Wafih and Ozkan) and three levels of nano organic fertilizer optimus plus (control treatment and spraying at an average of 1.2 ml / L) using a completely randomized design (C.R.D.) with three replicates. The results indicated of Wafih cultivar excelled in traits of chlorophyll content index in leaves (48.73 spad), plant height (72.12 cm), flag leaf area (32.17 cm²), and number of tillers/plant (3.93 tillers/plant). The results also indicated the nano organic fertilizer 2 ml/L excelled in all the studied traits it achieved the highest rate in the chlorophyll content index in leaves (74.37 spad), plant height (74.37 cm), number of leaves/plant (4.96 leaves/plant), flag leaf area (32.82 cm²), and number of tillers/plant (4.10 tillers/plant). Effect of bi-interaction between the cultivars and nano organic fertilizer was significant in all the studied traits where the interaction between Wafih cultivar and nano organic fertilizer level 2 ml/L achieved the highest rate in all traits.

Keywords: Organic fertilizer, cultivars, chlorophyll content.

Introduction

Bread wheat *Triticum aestivum* L. is one of the most important cereal crops globally and locally in terms of cultivated areas and productivity. Its importance is due to its strategic role in bread production and achieving food security, as well as being one of the most important primary sources for providing the energy needed for human needs and achieving a good balance between proteins and carbohydrates in its grains. Therefore, wheat was called the king of grains (Costa et al., 2013). Due to the population increase, we have become aware of the need to cultivate good cultivar of this crop and apply modern technologies in order to improve crop

growth and increase productivity per unit area. The cultivated area of wheat in Iraq amounted to (8,573,683) million dunums for the year 2020 with an average yield of (736.1) kg / dunum, while the cultivated area in Nineveh province for the same year amounted to (2,700,326) million dunums with an average yield of (528.3 kg / dunum) (Directorate of Agricultural Statistics, 2020). This productivity is still low compared to the global production rate, so it is necessary to search for scientific and applied means to improve growth and productivity per unit area, including the use of organic fertilizers in their nano form in agriculture, which encourage

plant growth and increase its ability to withstand water stress by secreting growth-stimulating hormones and thus absorbing large amounts of nutrients and improving water relations, which in turn reduces effects of water stress (Bashan et al., 2014). It was also noted through a large number of studies that the small size of nanomaterials in organic fertilizers facilitates the absorption of large amounts of nutrient ions and their release slowly and steadily for a period of time. Thus, the nano-compositions of fertilizers ensure balanced nutrition for the plant throughout the growth period, which is reflected in the growth and production of crops (Monreal et al., 2016). Rasul et al. (2015) noted in their study of four levels of organic fertilizers (0 and 20 tons/ha of sheep manure, 20 tons/ha of cow manure, and 20 tons/ha From poultry manure) there is a significant superiority of the level of 20 tons/ha of poultry manure in the traits of plant height and the number of plant tillers, and between Al-Fatlawi and Al-Rubaiee (2020) there is a significant and gradual increase in the traits of plant height and flag leaf area when increasing the levels of organic fertilizer Humic acid from (0 to 5, 10 and 15 g/liter). It is also necessary to select improved cultivar that are suitable for the conditions of each region, which is reflected in the growth and production of crops. Fadhel (2020) indicated that the Abu Ghraib 3 excelled was significantly excelled in the traits of plant height and flag leaf area compared to the two cultivar (Tahadi and Al-Hashimiya, and Netrm et al. (2020) found a significant increase in the Sujata cultivar in the traits of plant height and number of tillers compared to the cultivar 273-GW and Kanchan. Chauhan et al. observed that PBW-343 cultivar was significantly superior to Malviya-234 and NW-1012 cultivars in the traits of plant height

and number of tillers. The research aims to evaluate the performance of two relatively new cultivar of bread wheat at different levels of organic fertilizer Optimus plus, In addition to the possibility of replacing expensive and laborious ground fertilization in the field with cheaper and more efficient foliar fertilization, and this reflected in traits studied.

Materials and methods

The experiment was conducted in one of the agricultural fields during the agricultural season 2022-2023 in the Department of Field Crops at the Faculty of Agriculture and Forestry located between lines of longitude 36.36 and latitude 43.16 to study two cultivar of bread wheat (Wafih and Ozkan) and three levels of nano organic fertilizer optimus plus (the control treatment is spraying with water only and spraying at an average of 1.2 ml / liter in some growth traits using a completely randomized design (C. R. D), if the seeds were planted on 12/1 in pots with a capacity of 7 kg of soil and a number of 10 seeds per pot, then the plants were thinned after 20 days of germination to 7 plants / pot.

The plants were treated with nano organic fertilizer by foliar spraying on the vegetative group until completely wet, with two sprays, the first spray was 60 days after germination and the second 15 days after the first spray, and based on the information on the envelopes containing the fertilizer. Nano organic fertilizer optimus plus: Optimum plus organic fertilizer manufactured using nano technology was used (Saudi origin) and produced by Nakheel Agr. at a concentration of 0, 1 and 2 ml/liter according to the manufacturer's instructions (Image 1). The size of the nanoparticles of the organic fertilizer was also measured using a scanning electron microscope to ensure that the size of these particles is within the nano range (1-100

nanometers) Image (2). Knowing that this organic fertilizer contains a group of natural

organic materials amounting to 30%, total nitrogen 5% and organic nitrogen 3%.

Table 1: Some soil characteristics for experiment site.

Clay (g.kg- 1)	Silt (g.kg- 1)	Sand (g.kg- 1)	Textural	Available N (mg.kg- 1)	Available P (mg.kg- 1)	Available K (mg.kg- 1)	Organic matter	pH	EC (dc/m)
514	385	101	Clay	37.54	11.82	147.55	23.00	7.64	0.64



Image (1): Optimus Plus organic fertilizer used in the experiment

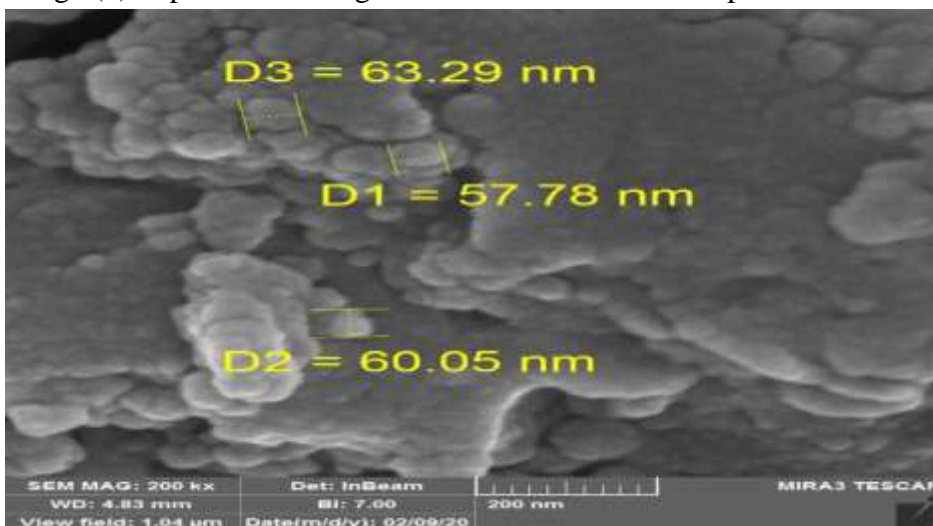


Image (2): Minutes of Optimus Plus organic fertilizer under the scanning electron microscope

Traits

studied:

Traits were studied upon completion of the flowering stage by taking 5 plants from each plant and these traits included:

1. Plant height (cm): It was measured from the base of the plant at the soil surface to the end of the spike (without peduncle), then the

average plant height was calculated for each experimental unit.

.2Number of tillers/plant: The number of tillers/plant was calculated for each experimental unit.

.3Flag leaf area (cm): It was measured using the following equation:

Flag leaf area (cm) = leaf length (cm) * maximum leaf width (cm) * 0.95

Thomas, 1975.(

.4Number of leaves/plant: It was calculated starting from the first green leaf at the soil surface to the last leaf at the top of the plant.

.5Chlorophyll content index in the leaves: It was measured for the flag leaf using the SPAD device and its trademark Optics-sciences by taking three readings from each plant.

Statistical analysis: The data of the studied traits were analyzed on the basis of a factorial experiment with two factors according to the completely randomized design (C.R.D.) with three replicates using the computer according to the statistical analysis system S.A.S (S.A.S.Institute, 2002), and the averages of the coefficients were compared using Duncan's multiple range test at the probability level of 1 and 5% as mentioned by (Al-Rawi and Khalaf Allah, 2000.(

Results and discussion

Plant height (cm : (

The results in Table (2) indicate that there are significant differences between the cultivar in the plant height trait, where the Wafih cultivar excelled recorded the highest significant rate for the trait, reaching (72.12) compared to the

Ozkan cultivar excelled, which recorded the lowest rate for the trait, reaching (69.34). The reason for Wafih cultivar excelled on the Ozkan cultivar may be due to the fact that the differences between wheat cultivar in plant height fall under the influence of genetic action to a large extent (Jadoua et al., 2017). This is consistent with what Al-Fatlawi and Al-Rubaiee ((2020 and Kumar et al. (2020) obtained. Effect of nano-organic fertilizer was significant in this trait, where the nano-organic fertilizer 2 ml/liter gave the highest rate for the trait, reaching (74.37 cm), compared to the control treatment, which gave the lowest rate for the trait, reaching (65.82 cm). This may be due to the important role of organic fertilizer in increasing the ability of the nitrogen element to divide and elongate plant cells, in addition to its entry into In the formation of the amino acid tryptophan, which is important in increasing the elongation of plant cells (Taiz and Zeiger, 2002), which was reflected in the increase in plant height. This is consistent with what Fadhil (2020) and Netam et al. (2020) found.

The bi-interaction between cultivar and nano organic fertilizer showed significant differences in this trait, where the interaction of Wafih cultivar with the level of organic fertilizer 2 ml / liter excelled and achieved the highest rate of the trait, which (75.73 cm) compared to the interaction of the Ozkan cultivar excelled with the control treatment, which achieved the lowest rate of the trait, which (64.90 cm.(

Table (2): Effect of cultivar, organic fertilizer and the interaction between them on the trait of plant height (cm.)

Organic fertilizer average	Cultivars		Optimus plus organic fertilizer ml/L
	Ozkan	Wafih	
65.82 c	64.90 d	66.73 d	control)Spraying with water only(
72.02 b	70.13 c	73.90 ab	1ml/L
74.37 a	73.00 b	75.73 a	2ml/L
	69.34 b	72.12 a	cultivars average

Identical letters within factors or interactions do not differ significantly from each other at a probability level of 1 and 5%.

Number of tillers/plant :

The results of Table (3) showed Wafih cultivar excelled in the trait of flag leaf area by giving the highest average of the trait, reaching (3.93 tillers/plant), compared to the Ozkan cultivar, which gave the lowest rate of the trait, reaching (3.70 tillers/plant). This may be due to the nature of the growth of the cultivar, which was characterized by an increase in the number of tillers in it compared to Ozkan cultivar. This result is consistent with what was found by Kumar et al. (2020) and Kumar and Niwas (2020). Effect of nano organic fertilizer was significant in this trait, as the level of nano organic fertilizer 2 ml / liter recorded the highest rate of the trait, which amounted to (4.10 tiller / plant) compared to

the control treatment, which recorded the lowest rate of the trait, which amounted to (3.58 tiller / plant). The increase in the number of plant tillers may be due to the positive effect of nano fertilizer, which encouraged the elongation of the internodes of some crown nodes located below the soil surface and their appearance above the soil surface, which was reflected in the increase in the number of plant tillers. This is consistent with what Netam et al. (2020) and Reddy et al. (2021) obtained. The bi-interaction between the cultivar and nano organic fertilizer showed significant differences in this trait, where the interaction of the Wafih excelled with the level of nano organic fertilizer 2 ml / liter achieved the highest rate of the trait, which was equal to (4.20 tiller / plant), while the interaction of the Ozkan excelled with the control treatment achieved the lowest rate of the trait, which (3.43 tiller / plant.(

Table (3): Effect of cultivar, organic fertilizer and the interaction between them on the number of tillers/plant.

Organic fertilizer average	Cultivars		Optimus plus organic fertilizer ml/L
	Ozkan	Wafih	
3.58 b	3.43 d	3.73 bcd	control)Spraying with water only(
3.77 b	3.67 cd	3.87 bc	1ml/L
4.10 a	4.00 ab	4.20 a	2ml/L
	3.70 b	3.93 a	cultivars average

Identical letters within factors or interactions are not significantly different from each other at 1 and 5% probability levels.

Flag leaf area (cm :

The results of Table (4) indicate that there are significant differences between the cultivar in this trait, as the Wafih cultivar excelled was significantly excelled by giving the highest rate for the trait, reaching (23.17 cm²), compared to Ozkan excelled which gave the lowest rate for the trait, reaching (29.00 cm²). The reason for the excelled of the Wafih excelled in this trait may be due to its excelled in the trait of number of leaves/plant, Table (5). The result agreed with what was found by Abu Al-Mikh et al. (2018) and Al-Fatlawi and Al-Rubaiee ((2020). This trait was significantly affected by the variation in the levels of nano organic fertilizer, where the

highest rate of the trait was observed at the level of nano organic fertilizer 2 ml / liter, reaching (32.82 cm²), while the lowest rate of the trait was observed in the control treatment, reaching (27.89 cm²), and this may be due to excelled in the trait of the number of leaves / plant, Table (5). The result agreed with what was obtained by Fadhil (2020) and Al-Shamary and Al-Ansari (2020.(

Bi-interaction between the cultivar and nano organic fertilizer showed significant differences in this trait, as the interaction of the Wafih excelled with the levels of nano organic fertilizer 1 and 2 ml / liter achieved the highest rate of the trait, reaching (33.05 and 34.48 cm²), respectively, compared to the interaction of the Ozkan excelled with the control treatment which reached (26.80 cm² .(

Table (4): Effect of cultivar, organic fertilizer and the interaction between them on the flag leaf area trait (cm²).

Organic fertilizer average	Cultivars		Optimus plus organic fertilizer ml/L
	Ozkan	Wafih	
27.89 c	26.80 d	28.97 c	control)Spraying with water only(
31.04 b	29.04 c	33.05 a	1ml/L
32.82 a	31.16 b	34.48 a	2ml/L
	29.00 b	32.17 a	cultivars average

Identical letters within factors or interactions are not significantly different from each other at 1 and 5% probability levels.

Number of leaves/plant:

The results in Table (5) show that there are no significant differences between the two cultivar, Wafih and Ozkan cultivar, in the trait of number of leaves/plant. This trait was significantly affected by the variation in fertilizer levels, as a significant increase in this trait was observed at the level of organic fertilizer 2 ml/liter, which reached (5.10 leaves/plant) compared to the control treatment, which recorded the lowest rate of the trait, which reached (4.72 leaves/plant).

This may be due to the nature of the nano organic fertilizer, such as the small size of its particles and its surface area, which helps it penetrate the leaf tissues and increase their absorption rate, thus stimulating plants to increase the number of leaves. Bi-interaction between the cultivar and the nano organic fertilizer led to a significant difference in this trait, as the interaction of the Wafih cultivar and the level of nano organic fertilizer 2 ml/liter recorded the highest rate of the trait, reaching (5.17 leaves/plant), compared to the interaction of the Wafih cultivar and the control treatment, which reached (4.70 leaves/plant).

Table (5): Effect of cultivar, organic fertilizer and the interaction between them on the trait of the number of leaves/plant.

Organic fertilizer average	Cultivars		Optimus plus organic fertilizer ml/L
	Ozkan	Wafih	
4.72 c	4.73 c	4.70 c	control)Spraying with water only(
4.92 b	4.83 bc	5.00 ab	1ml/L
5.10 a	5.03 ab	5.17 a	2ml/L
	4.87	4.96	cultivars average

Identical letters within factors or interactions are not significantly different from each other at 1 and 5% probability levels.

Leaf chlorophyll content index (spad:)

The results of Table (6) indicate that there are significant differences between the cultivar in this trait, where Wafih cultivar excelled significantly excelled by giving the highest rate for the trait, reaching (48.73 spad), compared to the Ozkan cultivar excelled, which gave the lowest rate for the trait, reaching (43.04 spad). This may be due to the genetic differences between the two cultivar and their ability to exploit the nutrients present in the soil. The result agreed with what Fadhil (2020) found. This trait was significantly affected by the variation in the levels of nano organic fertilizer, as the highest rate of the trait was observed at the levels of nano organic fertilizer 1 and 2 ml/L, reaching (46.41 and 47.23 spad), while the lowest rate of the trait was observed in the control treatment,

reaching (44.02 spad). The reason for this increase may be due to the ability of the organic fertilizer to provide the plant with nutrients, improve the properties of the soil, increase its ability to retain moisture, and its role in the availability of the nitrogen element, which leads to an increase in the chlorophyll content of the plant. The result agreed with what was obtained by Abu Al-Mikh et al. (2018) and Al-Fatlawi and Al-Rubaiee ((2020.(

Bi-interaction between cultivar and the nano organic fertilizer showed significant differences in this trait, where the interaction of Wafih cultivar with the level of nano organic fertilizer 2 ml / liter excelled and achieved the highest average of the trait, reaching (49.89 spad), respectively, compared to the interaction of the Ozkan cultivar excelled with the control treatment, which reached (40.60 spad.(

Table (6): Effect of cultivar, organic fertilizer and the interaction between them on the trait of the chlorophyll content index in leaves (spad.(

Organic fertilizer average	Cultivars		Optimus plus organic fertilizer ml/L
	Ozkan	Wafih	
44.02 b	40.60 d	47.43 b	control)Spraying with water only(
46.41 a	43.94 c	48.88 ab	1ml/L
47.23 a	44.58 c	49.89 a	2ml/L
	43.04 b	48.73 a	cultivars average

Identical letters within factors or interactions are not significantly different from each other at the 1 and 5% probability levels.

Conclusions:

.1The Wafih cultivar excelled on Ozkan cultivar in most of the studied traits.

.2Effectiveness of the nano organic fertilizer Optimus Plus increased with increasing spray levels for all studied traits.

.3Spraying the nano organic fertilizer Optimus Plus during different periods of the plant's life had a positive effect on all studied traits.

Recommendations:

.1We suggest replanting the cultivar Wafih and Ozkan in the same location or other

References

Al-Rawi, Khashea Mahmoud and Abdul Aziz Muhammad Khalaf Allah .2000. Design and Analysis of Agricultural Experiments - Dar

Conclusions and Recommendations

locations for more than one agricultural season to verify the stability of these two cultivars under the conditions of the agricultural area.

.2We suggest using levels higher than 2 g.L-1 of the nano organic fertilizer Optimus Plus on wheat crops or using different levels of this fertilizer on other crops due to its positive effects on the plant.

.3Comparison between soil addition and spraying methods of organic fertilizers and the possibility of compensating these nutrients with part of the traditional compound fertilizers added to the soil.

Al-Kutub for Printing and Publishing - University of Mosul. P.: 488.

- Directorate of Agricultural Statistics .2020. Central Statistical Organization, Wheat Production for the Year 2020, Iraq.
- Jadoua, Khadir Abbas and Najat Hussein Zaboun and Haider Abdul Razzaq Baqir .2017.. Effect of Branch Removal and Nitrogen Levels on Some Growth Traits of Two Cultivar of Bread Wheat. Iraqi Journal of Agricultural Sciences. 48 (1): 274 - 284.
- Al Fatlawi ,Z. H. C. and Al Rubaiee S. H. A. W. 2020. Effect of spraying different concentrations of humic acid on the growth and yield of wheat crop (ipa 99 cultivar) in different stages. Plant Archives Vol. 20, Supplement 2, pp. 1517-1521.
- Al-Shamary ,A. J. Z. and Al-Ansari A. M. S. 2022. Response of growth and productivity of wheat cultivars (*Triticum aestivum* L.) to nano-n and urea fertilizer. IOP Conf. Series: Earth and Environmental Science 1060 (2022) 012040.
- Bashan, Y.; L. E. de-Bashan; S. R. Prabhu and J. P. Hernandez .2014. Advances in plant growth-promoting bacteria linoculant technology: formulations and practical perspectives(1998-2013). Plant Soil, 378: 1-33.
- Chauhan,S. S , Singh, A. K. , Yadav, S. , Verma ,S. K. and Kum R.2020. Effect of Different Varieties and Sowing Dates on Growth, Productivity and Economics of Wheat (*Triticum aestivum* L.). International Journal of Current Microbiology and Applied Sciences , 9(2) : 2630-2639.
- Costa., R., N.Pinheiro., A.S.Almeida and C.Gomes .2013. Effect of sowing date and Seeding rate on bread wheat yield and test weight under Mediterranean conditions ..J.Food Agric.25(12):951-961.
- Fadhil ,A. H. 2020. Response of wheat cultivars of *Triticum aestivum* L to nitrogen fertilizer for growth and yield traits. Indian Journal of Ecology 47 Special Issue (10): 45-51.
- Kumar ,G. and Niwas , R. 2022. Effect of organic and inorganic fertilizers on growth and yield of wheat (*Triticum aestivum* L.). The Pharma Innovation Journal ; 11(7): 1005-1009.
- Kumar ,S., Umesha C, Surya SJV T., Mohan P J. and Sree C. N. 2020. Effect of different organic manures on growth and economics of late sown wheat (*Triticum aestivum* L.). International Journal of Chemical Studies, 8(6): 2236-2238.
- Monreal , C.M.; M. DeRosa; S.C. Mallubhotla; Bindraan P.S. and C. Dimkpa .2016. Nanotechnologies for increasing the crop use efficiency of fertilizer-micronutrients. Biol. Fertil. Soils, 52(3), 423-437.
- Netam,A. K., Nag ,U. K. and Netam C. R. 2020. Growth and yield of wheat (*Triticum aestivum* L.) cultivar as influenced by different sowing dates under bastar plateau zone of chhattisgarh. Int.J.Curr.Microbiol.App.Sci . , 9(6): 2161-2169.
- Rasul ,G. A. M., Ahmed T. S. and Ahmed, M. Q. 2015. Influence of different organic fertilizers on growth and yield of wheat. American-Eurasian J. Agric. & Environ. Sci., 15 (6): 1123-1126.
- Reddy ,J. R., Singh, R., Singh, R. K. and Singh, E. 2021. Performance of wheat (*Triticum aestivum* L.) cultivars under system of wheat intensification and conventional methods of sowing. Int.J.Curr.Microbiol. App.Sci ., 10(02): 3389-3394.
- Taiz,L.and Zeiger,E. 2002.Plant Physiology. Publisher. Sinauer Associates. Third Edition.PP:690.
- Thomas., H. 1975. The grown response to Weather of stimulated vegetative swards of a

single genotype of (*Lolium perenne*.J.). Agric. Sci. Cam. 84:330-343.

SAS Institute .2002 . The SAS system for Windows v.9.00 SAS Institute Inc. Cary , NC, USA.