Response of Wheat Variety Produced by Nanotechnology for Planting Distance under Conditions of Middle Zone of Iraq

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Abstract

A field experiment has been conducted at Al Mahaweel region (20 Km North Hilla) during the season of 2016-2017 to evaluate performance of wheat variety produced by using Nanotechnology Technique compared with (Sham 6) variety affected by row distance 15,20,25 and 30 cm. Experiment was laid out in a split plot design using randomized complete block design (R.C.B.D) with three replications. The Results showed that variety produced by Nanotechnology Technique was superior in most growth characters and yield Nano variety recorded highest grain yield (3.6 ton/ha) , but the varieties were not significant in spike height and harvest index .Results also showed no significant effect between row distances in most of above mentioned characters ,but row distant 30 cm was more significant in flag leaf area ,chlorophyll content and number of tillers .Interaction between varieties and row distant significantly affected in most growth characters and yield components.

Key Words: Variety, Row Spacing, Nanotechnology Technique and (Sham 6).

استجابة صنف الحنطة المنتج بتقانة النانو لمسافات الزراعة تحت ظروف المنطقة الوسطى من العراق

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الخلاصة

نفذت تجربة حقلية خلال العام 2016–2017 في منطقة المحاويل (20 كم شمال مدينة الحلة) لتقويم أداء صنف الحنطة المنتج بتقانة النانو بالمقارنة مع الصنف شام 6 ، ولأربعة مسافات بين خطوط الزراعة (15 و20 و25 و30 سم)، باستخدام تجربة الالواح المنشقة على وفق تصميم القطاعات الكاملة المعشاة (R.C.B.D) وبثلاثة مكررات إذ تضمنت الالواح الرئيسة الأصناف والالواح الثانوية المسافات بين الخطوط ، أظهرت النتائج تفوقاً الصنف المنتج بتقانة النانو معنوياً في معظم صفات النمو والحاصل ومكوناته ، إذ اعطى اعلى حاصل للحبوب 3.6 طن/هـ بينما لم تلحظ تأثيرات معنوية في ارتفاع السنبلة ودليل الحاصل للأصناف الاخرى وبينت عدم وجود فروق معنوية بين مسافات الخطوط في معظم الخصائص انفة الذكر ، ولكن المسافة 30 سم قد أظهرت بعض التفوق المعنوي في متوسط مساحة ورقة العلم ونسبة الكلوروفيل وعدد التفرعات ونسبة التسنبل وعدد الحبوب / لكل سنبلة واظهر التداخل بين الأصناف والمسافة بين الخطوط المختلفة فروق معنوية في معظم صفات النمو والحاصل ومكوناته.

الكلمات المفتاحية: الاصناف، مسافات الزراعة، تقانة النانو و شام 6

Introduction

The idea of using nanotechnology in crop cultivation and investment was to increase productivity and gat the same time reduce costs. Nanotechnology allows for the transformation of the agriculture sector and the whole food production chain from production, storage, processing, transportation, and even waste and water treatment (Ali and Al-Jothary, 2017). Nanotechnology has important applications in the reorganization of production to meet serious challenges associated with agriculture, including low productivity in the cultivated area, it has been producing new varieties of this technique can help reduce costs to a large extent, where the production of wheat resistant disease and insects (Nordmann, 2004).

Nanotechnology is the invention of new technologies and instruments measured in nanometers, which is a fraction of a thousandth of a micrometer, a science that studies the properties of matter at this small level, a scientific application that produces things by assembling them at the small level of their components basic atoms and molecules, so you can make something out of anything and sometimes we surprise those materials with new features that have not been known before, giving new areas for use and harnessing them for the benefit of the human being (Kasaar, 2018). The productivity of wheat varieties is still below the required level. (AL-Jabouri, *et al.,* 2001). indicated that there were significant differences between the five varieties of local wheat: Abu Ghraib, Tamuze3, IBA 95, Sham - 4 in grain yield ، number of grains / spike and the number of spikes /m^2 (Burio, *et al.,* 2004). showed a positive correlation between plant height in wheat with the number of grains / spikes, and grain yield. In the study of (Hussain, *et al.,* 2004). on four varieties of wheat, the distance exceeded 37.5 cm in the length of the spike and the number of spike /m^2, while these distances did not differ in the researchers concluded that there were significant differences in grain yield and biological yield, while there were few differences in harvest index between these cultivars when cultured under the same conditions. (Salem, 2003). The number of grains and the number of spikes/ m^2in drought resistant varieties. There were also significant differences in the number of spikes /$m^2$and the number of grains / spike and grain yield. (Qasm, *et al.,* 2008). showed that there were significant differences among the three varieties of wheat in the average number of grains. Spike and the weight of 1000 grain, while no significant difference in the number of branches and grain. (Ehsanullah, *et al.,* 2013). found differ in two varieties of wheat in the average number the number of grains / spikes, the weight of 1000 grains and the grain yield. (Pandey, *et al.,* 2013). showed the difference in the varieties of wheat Gautama and bl2800, with the superiority of the class of bl2800 in the number of forests and the grain yield was 3.53 ton/ ha^{-1} compared to the other category which gave 3.11 ton.ha^{-1} and harvest guide, which amounted to 35.8%, while Gautama superiority in length Spikes were not different in the mean number of saplings. Other practices that increase the use of different agricultural distances, which are achieved by the numerical density suitable for the exploitation of factors of production with higher efficiency and depend on the agricultural distances on the engineering arrangement of the lines The nature of the growth of varieties can be higher when the increase of the plant cover of solar radiation (Eberbach and Pala, 2005). (Malik, *et al.,* 1996) concluded by cultivating two varieties of wheat at different distances between the lines 15, 22 ,30 and 37 cm above the distance of 15 cm in the average height of the plant and the number of grains/spike and grain, weight of 1000 grain. (Eissa, *et al.,* 1995). reported that 20 cm reduction in grain yield when compared with the distance 10

and 15 cm. Sowing plants at spaced distances is more efficient in intercepting solar radiation and the influence of light on the soil surface, while growing plants at narrow distances causes shading and increased competition between plants for nutrients and water (Das and Yaduraju, 2011) (Pandey,*et al.*,2013) showed the distance between the lines 15,20 and 25 cm was significantly different in the number of spikes, The distance was 20 cm. The highest number of spike was 287 spike/ m^2, at 25 cm. The highest harvesting index was 34.6%, the mean of the spike length, the number of grains. spike, the weight of 1000 grains and the grain yield were not different (As Ehsanullah, *et al.*, 2013). showed significant differences between the distances of lines 11, 15 and 22 cm in the average number of spike, giving the distance 22 cm, the highest mean of 295 spike / m^2, and gave the distance 11 cm the highest average weight of 1000 grain at 48.6 g, The distance is 15 cm above the average grain yield of 5.0 ton/ha.

The aim of this study was to compare between the type of wheat produced by nanotechnology technique with the wheat Sham 6 in some biological characteristics in addition to studying the effect of row distance on growth and yield of wheat.

Materials and Methods

A field study was carried out at farms in Mahaweel 20 km north of Hilla City during 2016 - 2017 to assess the response of the wheat variety produced by nanotechnology technique in comparison with the Sham 6 for four distances between the planting lines 15,20,25 and 30 cm. The experiment was laid out in Randomized Complete Block Design with split plot design with three replicates. Wheat varieties were allocated to main plots and the distances between the lines to sub plots.

The code (A1) refers to the variety which is produced by nanotechnology technique. The maturity of this variety was 180-190 days, and the proportion of laboratory germination was 96%. This variety was developed by nanotechnology through nanoparticles that lead to the improve med the plants nutritional absorption leading to the increased plant growth and improved production.

The code (A2) refers to the variety which is Sham 6. The maturity of this variety was 150-160 days and the proportion of laboratory germination was 98%. This variety was obtained from the General Authority for Agricultural Research/Ministry of Agriculture-Baghdad/ Iraq.

The distances between the lines were 15, 20, 25 and 30 cm, symbolized by S1, S2, S3 and S4 respectively, random samples of soil were taken from the field of 30 cm deep for chemical and physical tests in the laboratory of the Department of Soil, College of Agriculture/Al.Qasim Green University, Babylon/Iraq. Table (1) represents these characteristics.

Table (1) Some Physical and Chemical Properties of the Experiment Soil at Depth of 30 cm.

Soil components	Value
Silt (gm /Kg soil)	381
Clay (gm /Kg soil)	182
Sand (gm /Kg soil)	437
Soil Texture	Silt-loam
Soil pH	7.2
Nitrogen (mg/Kg soil)	36
Available phosphorus (mg/Kg soil)	49
Available Potassium (mg/Kg soil)	38
Organic Matter (%)	8.4
Ec (dS/m)	2.8

The field was divided into three replicates, each containing 8 experimental units, according to the design used, with seven lines per experimental unit. The experimental unit

area was 12.5 /m^2 with a distance of 2.5 x 5 m. Nitrogen fertilizer was added at a rate of 200 Kg N (46% N) at the beginning of the study and the second addition was after 30 days of planting. Phosphate fertilizer was added at a rate of 60 Kg P_2O_5 in a superphosphate triphosphate and was added to the soil during preparing the soil (Jadoua, 1995). the experiment was Calculated randomly from the grain of each experimental unit. Grain yield was calculated by harvesting three intermediate lines of each experimental unit and then converted on the basis of ton /ha.

Biological yield ton /ha

Plant from (0.5) m^2 of each experimental unit at physiological maturity were dried in an oven at a temperature of 65 °C for three days and then was converted to tone.

The data were statistically analyzed using the SPSS statistical analysis program (R.C.B.D). The mean was compared using the least significant difference at 5% (Bashir, 2003).

Results and Discussion

Growth Characteristics

The results of Tables (2,3,4 and 5) showed significant differences between the cultivars cultivated in some growth traits. The A_1 cultivar has an average plant height of 111.8 cm and the flag leaf area reached 49.2 cm^2 and the average chlorophyll ratio of 50 spad compared to sham 6. This difference is due to the ability of the product by nanotechnology to improve the absorption of nutrients, which led to an increase in cell division, which increased vegetative growth. This is consistent with the results of (Al-jubouri, *et al.,* 2001). and (Saleem ,2003). The results in Tables (2, 3, 4 and 5) showed that there were significant differences between the distances of the lines in the average area of the flag leaf. The distance S_4 in the area of the flag leaf reached 50.9 cm^2 and the chlorophyll reached 49.2 spad. This is consistent with Das and (Yaduraju, 2011; Dukes, *et al.*, 1995) (Eberbachand Pala, 2005). and the same distance in the number of tillers was 318 /m^2. This is because increasing the distance between line not enough and the plant could take the elements easily have more ramifications and this is consistent with the results of (Ehsanullah, *et al.*, 2013).

The results of Tables (2, 3, 4 and 5) showed a significant overlap between the cultivars and the distances between the lines in the studied traits. The treatment (A_1S_2) exceeded the average height of the plant at 114.5 cm, while the treatment (A_1S_4) exceeded the average area of the flag leaf area 153.8 cm^2. Chlorophyll was 54.6. This can be attributed to the plant's ability to benefit from solar radiation and an increase in the accumulation of photosynthetic products. This treatment was also surpassed in the average number of tillers, which reached 343 tillers/m^2. This could be attributed to the nature of the specie.

Table (2) Effect of Varieties and Distances between Lines and Their Overlap in Plant Height (cm) of Wheat Crop.

Variety	Row Distance cm				Average
	(S1)	(S2)	(S3)	(S4)	
Nanotechnology (A1)	112.0	114.5	107.7	112.9	111.8
Sham 6 (A2)	85.1	86.2	88.6	79.1	84.7
Average	98.5	100.3	98.1	96.0	
LSD 5 %	Variety		Row Distance cm		Interaction
	19.7		N.S		15.1

The upper and lower averages represented 2016-2017 seasons, ^{ns}Not significant at P<0.05

Table (3) Effect of Varieties and Distances between Lines and Their Overlap inFlag Leaf Area (cm^2) of Wheat Crop.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	42.6	51.1	49.5	53.8	49.2
Sham 6 (A_2)	43.9	47.9	44.7	48.1	46.1
Average	43.2	49.5	47.1	50.9	
LSD 5 %	Variety		Row Distance cm		Interaction
	2.9		5.0		9.9

The upper and lower averages represented 2016-2017 seasons, ^{ns}Not significant at P<0.05

Table (4) Effect of Varieties and Distances between Lines and Their Overlap in Chlorophyll Content (SPAD) of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	48.7	48.7	48.0	54.6	50.0
Sham 6 (A_2)	43.7	46.2	46.1	43.8	45.0
Average	46.2	47.5	47.0	49.2	
LSD 5 %	Variety		Row Distance cm		Interaction
	1.9		2.3		5.9

The upper and lower averages represented 2016-2017 seasons, ^{ns}Not significant at P<0.05

Table (5) Effect of Varieties and Distances Between Lines and Their Overlap in Number of Tiller / m^2 of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	285	317	341	343	322
Sham 6 (A_2)	254	270	253	293	268
Average	270	294	297	318	
LSD5 %	Variety		Row Distance cm		Interaction
	41		46		67

The upper and lower averages represented 2016-2017 seasons, ^{ns}Not significant at $P<0.05$

The results indicated in Table (4) showed a significant difference in the spikes produced with A_1 being superior to 88 compared with the other. This is higher than the average number of spikelet 20.2 spiklet /spike. This is consistent with both (Al-Jubouri, *et al.*, 2001), (Saleem, 2003). (Qasm, *et al.*, 2008), (Ehsanullah, *et al.*, 2013), As shown in the tables (6 and 7) there were significant differences between the distances of planning in the distance (S_4) the highest of spikes 90.8 and the distances varied significantly in the number of spikelets, giving the distance (S_3) The spike was 19.7 spikelet / spike, which did not differ significantly with the distance (S_4), which reached 19.6 spikelet. The results in Tables (6 and 7) showed that there was a significant overlap between the varieties and the distances between the lines. The treatment (A_1S_4) gave the highest percentage of spikes (91.8%) and the average number of spikelets.

The results in Tables (8,9 and10) showed that there were significant differences between the varieties in the components of the product, the superiority of (A_1) in the number of spike / sm^2 was 285 and the average weight of 1000 grain was 43.0 gm and significantly higher in the average number of grains / spikes of 50.8 grain/ spike. This is consistent with the results of (Eissa and Alam,1995).

Tables (8, 9 and 10) showed no significant differences between planting distances in the mean weight of 1000 grains, while the difference in the mean number of grains/spikes varies significantly. The highest mean number of grains at the distance S_1 reached 50.8 grains/ spike. this corresponds to the results of both (Malik, *et, al*, 1991) and (Pandey, *et al.*, 2013). The results of Tables (8, 9 and10) showed a significant overlap between the varieties and the distances between the lines. The treatment (A_1S_2) recorded the highest at 44.4 gm

Table (6) Effect of Varieties and Distances between Lines and Their Overlap in Ratio of Spike of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	86.6	88.2	85.6	91.8	88.0
Sham 6 (A_2)	84.2	77.3	86.6	89.9	84.5
Average	85.4	82.7	86.1	90.8	
LSD5 %	Variety		Row Distance cm		Interaction
	2.7		4.8		6.1

Table (7) Effect of Varieties and Distances between Lines and Their Overlap in Number of Spiklets in Spike of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	20.2	19.8	20.4	20.6	20.2
Sham 6 (A_2)	17.5	16.9	18.9	18.7	18.0
Average	18.8	18.3	19.7	19.6	
LSD5 %	Variety		Row distance cm		Interaction
	2.1		1.3		2.4

Table (8) Effect of Varieties and Distances between Lines and Their Overlap in Number of Spike / m^2 of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	257	288	291	305	285
Sham 6 (A_2)	223	211	220	254	227
Average	240	250	256	280	
LSD5 %	Variety		Row Distance cm		Interaction
	53		N.S		78

Table (9) Effect of Varieties and Distances between Lines and Their Overlap In Number of Grain Spike / m^2 of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	53.4	47.2	48.9	53.7	50.8
Sham 6 (A_2)	47.9	48.4	43.3	44.0	45.9
Average	50.6	47.8	46.1	48.8	
LSD 5 %	Variety		Row Distance cm		Interaction
	3.9		4.3		8.1

Table (10) Effect of Varieties and Distances between Lines and Their Overlap in Weight 1000 Grain Gm of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	42.7	44.4	41.3	43.6	43.0
Sham 6 (A_2)	28.9	31.8	31.6	29.9	30.6
Average	35.8	38.1	36.5	36.7	
LSD 5 %	Variety		Row Distance cm		Interaction
	2.8		N.S		5.4

The results of Tables (11 and 12) showed that the superiority of category A1 in the average grain yield was 3.6 ton/ha-1, and the biological yield which reached 9.6 tons/ha, and the superiority of the class in the grain yield is attributed to its superiority in the average number of tillers and the number of spikes and the number of grains/spike and weight of 1000 grains and may be attributed to its superiority in the biological yield to its superiority in plant length, flag leaf area and a number of tillers m2. These results were consistent with (Saleem, 2003), (Hussain, *et al*., 2004). (Ehsanullah, *et al*., 2013). and (Pandey, *et al*., 2013). The results of Tables (11 and 12) showed a significant overlap between the varieties and the distances between the lines in the grain yield. The treatment (A1S4) was superior in the yield which reached 4.3 ton/ha. This may be due to the superiority of this treatment in the average number spikes., number of While there was no significant overlap between species and distances in the average biological yield and harvest index.

Table (11) Effect of Varieties and Distances between Lines and Their Overlap in Grain Yield Ton / Ha^{-1}of Wheat.

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	3.7	3.3	3.0	4.3	3.6
Sham 6 (A_2)	2.6	3.3	3.2	2.7	2.9
Average	3.2	3.3	3.1	3.5	
LSD5 %	Variety		Row Distance cm		Interaction
	0.5		N.S		1.1

Table (12) Effect of Varieties and Distances between Lines and Their Overlap in Biological Yield Ton / Ha^{-1}of Wheat

Variety	Row Distance cm				Average
	(S_1)	(S_2)	(S_3)	(S_4)	
Nanotechnology (A_1)	9.6	9.3	8.6	10.7	9.6
Sham 6 (A_2)	6.8	8.1	8.2	7.7	7.7
Average	8.2	8.7	8.4	9.2	
LSD5 %	Variety		Row Distance cm		Interaction
	0.6		N.S		N.S

Conclusions

The superiority of product class technology (Nano) in most qualities of growth and the sum and components. The distance between the lines did not differ significantly in most traits of growth, yield, and components, while the distance was 30 cm in the average area of paper and the proportion of chlorophyll and the number of branches. The superiority of the product (Nano) with a distance of 30 cm was in most qualities and growth and the sum and components.

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