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Response of Wheat Cultivars of *Triticum aestivum* L to Nitrogen Fertilizer for Growth and Yield Traits

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Abstract: A field factorial experiment was conducted in one of Baghdad field for the seasons 2017 and 2018. by using the Randomized Complete Block Design (R.C.B.D) with three replicates. in order to study the evaluation of some wheat cultivars (Abu Ghraib 3, Tahadi, Al Hashimiya) under the effect of nitrogen fertilizer (0, 50, 80, 100 Kg ha^{-1}) for some growth and yield traits. The results of the study showed the excelled of the genotype Abu Ghraib 3 in plant height. The flag leaf content chlorophyll for the season 2017. While in the season 2018, the genotype is no significant difference in the number of spikes and grain yield. The Tahari genotype gave the highest traits in the number of grains in the spike, the 1000 grains weight and the biological yield, The Al Hashimiya genotypes gave the highest average of traits, the flag leaf content chlorophyll and the harvesting index. The results of the study for nitrogen fertilization (100 Kg ha^{-1}) excelled in the most studied traits and for both seasons, fertilization (50 Kg ha^{-1}) excelled in 1000 grains weight and harvesting index Which gave (34.00, 34.89 g) and (37.11, 37.22 g) respectively for both seasons of agriculture, Fertilization (80 Kg ha^{-1})gave no significant differences for the studied traits except The flag leaf content chlorophyll, The interaction between the genotypes and nitrogen fertilization was significant for all traits except the number of spikes, biological yield and harvesting index in the season 2018. There were no significant differences between them. interaction between (Abu Ghraib 3 and fertilization 100 Kg ha^{-1}) gave the highest average in plant height, the flag leaf content chlorophyll and grain yield, And the interaction between (Al Hashimiya and fertilization 100 Kg ha^{-1}) gave the highest average in the flag leaf area cm, the interaction between (Al Hashimiya and fertilization 50 Kg ha^{-1}) gave the highest average in the trait of the harvest index and the interaction between (Tahadi and fertilization 100 Kg ha^{-1}) gave the highest average in the number of grain. The interaction between (Tahadi and fertilization 50 Kg ha^{-1}) gave the highest average in The 1000 grains weight. As for the number of spikes and biological yield, there is no significant effect of the interaction between genotype and nitrogen fertilization.

***Keywords*:** Wheat, Genotypes, Fertilization

Wheat (*Triticum aestivum* L) is one of the most important grain crops in the world. In terms of economy, first comes in terms of area, and third in production (FAO 2015). Wheat has been cultivated in Iraq since ancient times and an eastern hill of northern Iraq is one of the centers of origin of this crop. Iraq needs 3.25 million tons of wheat grains to feed its population and imports more than two million tons, equivalent to 60-70% of its actual need, and the average of domestic production is one million tons annually. Therefore, the gap between consumption and production appears to be significant despite the fact that this country is one of the main habitats of this crop. The decline in domestic production of wheat is due to several factors, the most important of which is not good management of the crop and the problems of salinity and drought. Nitrogen fertilization is one of the main factors to increase productivity. Wheat plants respond to nitrogen fertilizer significantly and accumulation about half of the nitrogen absorbed in grains (Diver et al 2001). It also increases nitrogen to increases cell size and speed of cell division due to efficient carbon metabolism and synthesis of metabolic compounds, increasing source efficiency and improving the size and quality of sinks. The addition of only 120 kg ha^{-1} nitrogen fertilizer resulted in a 600% increase in yield compared to non-fertilized treatment. Nitrogen fertilizer is used in large quantities in most countries of the world, including urea fertilizer, but the most prominent problems are exposed to loss in various forms, including washing and volatilization of ammonia.

MATERIAL AND METHODS

The experiment was conducted in Baghdad during the winter seasons 2017 and 2018 to observe the response of some wheat cultivars *Triticum aestivum* L. to nitrogen fertilizer. Three genotypes of wheat bread were obtained from the General Commission for Agricultural Research. The soil of the experiment was plowed by two orthogonal plows by the mold board and was then smoothed by the rotavators. The experiment was in split-plot design. The main plots included the genotypes (Abu Ghraib 3, Tahadi and Al Hashimiya). The sub plot were four nitrogen fertilizer levels (0, 50, 80, 100 Kg ha^{-1}).The plot size was of5 x 4 m containing 12 line of 3 m length and the distance between line was 15 cm. The crop was sown on November 21 and 22 for the first and second seasons, respectively. Nitrogen was added as urea (46% N) according to the treatments. Calcium superphosphate fertilizer (% 45%P_2O_5) was added at soil

preparation at an average of 100 kg P_2O_5 ha^{-1}. The irrigation was done at time of fertilizer application and recommended practices. Five random plants were selected and: plant height, flag leaf area, chlorophyll, number of spikes, number of grains per spike, 1000 grains weight grain yield, biological yield and harvest index were estimated.

RESULTS AND DISCUSSION

Plant height: There was a significant effect of genotype on plant height for two-season (Table 1). The plant height was maximum in Abu Ghraib 3 (100.33 and 99.50 cm) and AlHashimiya genotypes the minimum to (88.08 and 87.67 cm) during these two years. The nitrogenapplication significantly affected plant height. Fertilization of 80 kg $ha^{-1}$of N resulted in maximum height (99.44 and 99.22 kg ha^{-1}, respectively). This result may be due to the positive effect of nitrogen on the activity of the meristem tissue and its role in cell division, and its presence is necessary for the construction of amino acids, including (tryptophan), which is the basis for the construction of Auxin, which has a role in cell division. The interaction between the genotypes and nitrogen fertilization was significant being the maximum plant height in the genotype Abu Ghraib 3 and nitrogen fertilizer @ 80 kg ha^{-1}).

Flag leaf area: The genotypes significantly affected the flag leaf area being maximum in Al Hashimiya genotypes (36 cm^2) and lowest in Flower of Iraq genotype (75.53 and 106.52 cm^2), respectively (Table 2). The reason for difference of cultivars in the flag leaf area is due to their difference in the

Table 1. Effect of cultivars and nitrogen levels on plant height (cm)

Genotypes(G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	95.33	98.33	101.67	106	100.33
Tahadi	88	90.67	92.67	99	92.58
Al Hashimiya	84	86.33	88.67	93.33	88.08
Average	89.11	91.78	94.33	99.44	
CD (p=0.05)		G= 2.413	N= 0.767	G*N=3.653	
2018					
Abu Ghraib 3	95	97.33	99.67	106	99.5
Tahadi	88	91	92	98.33	92.33
Al Hashimiya	82	86.33	89	93.33	87.67
Average	88.33	91.56	93.56	99.22	
CD p=0.05)		G=1.731	N= 1.936	G*N=2.947	

Table 2. Effect of cultivars and nitrogen level on flag leaf (area cm^{-2})

Genotypes(G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	28.67	30.67	33.33	35.33	32
Tahadi	27.67	28.67	30.67	32.67	29.92
Al Hashimiya	31.33	34.67	38	40	36
Average	29.22	31.33	34	36	
CD (p=0.05)		G= 1.566	N= 0.855	G*N=2.417	
2018					
Abu Ghraib 3	29	31.33	34.33	36.33	32.75
Tahadi	26.67	27.67	30	33.33	29.42
Al Hashimiya	31.33	35	37.33	40.33	36
Average	29	31.33	33.89	36.67	
CD (p=0.05)		G=1.483	N= 1.302	G*N=2.401	

genetic environment and the difference of this cultivar in the period from cultivation to 100% spikes growth which falls within the period of growth and expansion of the flag leaf area and this is results agrees with observations of AlAnbari (2004) where difference of wheat cultivars in the flag leaf area are mainly due to the different genetic structure. The flag leaf area in nitrogen fertilization @ 100 kg ha^{-1} was maximum (36 and 36.67 cm^2), and lowest average with no application (29.22 and 29 cm^2), respectively. The interaction between the genotypes and nitrogen fertilization was significant difference being maximum in Al Hashimiya genotypes and fertilization 100 kg ha^{-1} (40 and 40.33 cm^2), respectively.

The flag leaf content chlorophyll: The genotypes Abu Ghraib and Al Hashimiya did not have a significant difference between them (Table 3). Nitrogen fertilization at an average of 80 and 100 kg ha^{-1} in the season 2017 did not differ significantly and gave the highest average amounted to 46 and 44.78, respectively, while the non-spray treatment gave the lowest average amounted to 39. There was no significant effect in this trait of the Nitrogen fertilization of the season 2018. The interaction between the genotypes and nitrogen fertilization showed that there were significant differences for this trait for the two seasons, where the interaction between the genotypes (Abu Ghraib 3) and fertilization 100 kg ha^{-1} gave the highest average amounted to 48.33 and 48, respectively.

Number of spikes: Abu Ghraib 3 genotype gave the highest average of the two seasons (Table 4). While in the season

Table 3. Effect of cultivars and nitrogen level on chlorophyll contents in flag leaf

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	39.33	43	46.33	48.33	44.25
Tahadi	37	40	43.33	44	41.08
Al Hashimiya	40.67	41.33	44.67	45.67	43.08
Average	39	41.44	44.78	46	
CD (p=0.05)		G= 1.331	N= 1.239	G*N=2.177	
2018					
Abu Ghraib 3	39.67	42.33	45.67	48	43.92
Tahadi	36.67	40.33	43.67	44	41.17
Al Hashimiya	41	41.67	44	44.67	42.83
Average	39.11	41.44	44.44	45.56	
CD p=0.05)		G=0.929	N= NS	G*N=2.098	

Table 4. Effect of cultivars and nitrogen Levels on number of spikes m^{-2}

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	506.7	511	515.7	527.3	515.2
Tahadi	444	446	483.3	501	468.6
Al Hashimiya	499	501	507.3	520.7	507
Average	483.2	486	502.1	516.3	
CD (p=0.05)		G= 9.43	N= 6.24	G*N= NS	
2018					
Abu Ghraib 3	522	518.3	528	532	525.1
Tahadi	444.7	466	483.7	503	474.3
Al Hashimiya	500.7	505.7	510.7	519	509
Average	489.1	496.7	507.4	518	
CD p=0.05)		G=11.78	N= 17.33	G*N= NS	

2018 there is non-significantly difference between the genotype Abu Ghraib 3 and Al Hashimiya. Tahadi genotype gave the lowest average for both seasons. The reason is due to that the Variation of the response of cultivars to climatic conditions in different seasons of agriculture in the first season. The response was different depending on the temperatures and cultivars. In the second season, the response of the cultivars varied and this caused different temperatures and lighting in the two seasons. The nitrogen fertilization was significant differences in the number of spikes, where the treatments fertilization (100 Kg ha^{-1}) and Non-spray gave the lowest average. This is due to the role of the high level of nitrogen in increasing the vegetative growth of the plant in general at different stages of growth, which is represented by increasing the total dry matter of the plant at those stages. This result agrees with the Ismail mechanism (2002). The results in Table 5 confirmed that the absence of significant differences in the interaction between the genotypes and nitrogen fertilization of the two seasons.

The number of grains in the spike (grain $spike^{-1}$): It is clear from Table 5 that there was a significant effect of the genotypes in the number of grain in the spike for the seasons 2017 and 2018, where Tahadi genotype was significantly excelled which gave the highest average amounted to 50.58 and 51.42 grain $spike^{-1}$, respectively. Table 5 showed that the nitrogen fertilization significant differences for both seasons. Fertilizer (100 Kg ha^{-1}) gave the highest average amounted to 52.78 and 54.89 grain $spike^{-1}$, respectively, while the non-spray treatment gave the lowest average amounted to 37.44 and 41.44 grain $spike^{-1}$, respectively.

Increasing the nitrogen level plays an important role in improving the fertility status of most florets, spike and It makes them more sit and form grain compared to the low level (Langer and Hanif 1973). This result agrees with Alsaidi (2002). The results in Table 5 showed that there were significant differences between the genotypes and fertilization of this trait and for the two seasons. The interaction between the genotypes (Tahadi) gave the and fertilization 100 gave the higher than the rest of the other interactions, which gave amounted to 58.33 and 59.00 grain $spike^{-1}$, respectively.

The1000 grain weight (g): Table 6 shows that there were significant differences between the genotypes in 1000 grain weight (g) for the two seasons, where the Tahadi genotypes excelled on the rest of the genotypes included in the study and gave the highest average amounted to 32.17 and 33.42 (g), respectively. Table 6 shows the presence of significant differences in the1000 grain weight (g) and for the two seasons. Fertilization 50 Kg ha^{-1} gave the highest average amounted to 34.00 and 34.89 g, respectively, compared to the control treatment which gave the lowest average amounted to 24.56 and 27.00 g, respectively. Thorn 1966 stated that the increase in one component of the yield may be led to a decrease in the other component due to the state of compensation. On the other hand, the increase in nitrogen levels led to an increase in the degree of wheat lying, which caused a blocking or impediment to the absorption of water and nutrients and thus impeded its transition to the grain. The interaction between the genotypes and fertilization, table 6 shows that there are significant differences for the same trait and for the two seasons, where the interaction between the Tahadi genotypes and fertilization 50 Kg ha^{-1} gave the highest

Table 5. Effect of cultivars and nitrogen levels and their interaction on average of the number of grains (grain $spike^{-1}$) in the spike

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	37.67	40.33	46	52.33	44.08
Tahadi	44.33	47.67	52	58.33	50.58
Al Hashimiya	30.33	36.33	42.67	47.67	39.25
Average nitrogen concentrations	37.44	41.44	46.89	52.78	
CD (p=0.05)	G= 1.253		N= 1.172	G*N=2.052	
2018					
Abu Ghraib 3	38	43.33	49	53.33	45.92
Tahadi	43.33	49	54.33	59	51.42
Al Hashimiya	43	48	52.33	52.33	48.92
Average nitrogen concentrations	41.44	46.78	51.89	54.89	
CD p=0.05)	G=1.838		N= 1.908	G*N= 3.073	

average amounted to 37.00 and 37.67 g, respectively, compared to the rest of non-spraying.

Grain yield (tonha^{-1}): Table 7 shows that there were significant differences in grain yield (ton ha^{-1}) for the seasons 2017 and 2018, where the genotype Abu Ghraib 3 was excelled to the rest of the genotypes and gave the highest average amounted to 6.190 and 6.277 ton ha^{-1}, respectively for both seasons. These results agree with Al'asil (1998) that indicated a high correlation between dry matter yield and grain yield. Table 7 shows that there are significant differences in the same trait for nitrogen fertilization and for the two seasons. Fertilization 100 gave the highest average amounted to 6.196 and 6.133 ton ha^{-1}, respectively, and compared to the non-spray treatment the lowest average in this traits 5.62 and 5.576 tonha^{-1}, respectively.

This is due to the increase in the grain of the positive and significant effects of high nitrogen levels to both the number of spikes and the number of grain per spike for the two seasons. This result agrees with Ismail (2002). The interaction between genotypes and fertilization, table 7shows that there are significant differences for the same trait and for the seasons 2017 and 2018, where the interaction between the genotype Abu Ghraib 3 and fertilization 100 gave the highest average on the rest of the other interactions amounted to 6.703 and 6.733 ton ha^{-1}, respectively.

Biological yield: The genotypes significantly effected of the biological yield with Tahadi genotypes superior to remaining

Table 6. Effect of cultivars and nitrogen levels and their interaction on average of 1000 grain weight (g)

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	24.67	34.33	30.33	27.33	29.17
Tahadi	29	37	33	29.67	32.17
Al Hashimiya	20	30.67	25.33	21	24.25
Average nitrogen concentrations	24.56	34	29.56	26	
CD (p=0.05)	G= 2.396		N= 0.972	G*N=3.650	
2018					
Abu Ghraib 3	27.67	35.33	32.33	29.67	31.25
Tahadi	30	37.67	35.33	30.67	33.42
Al Hashimiya	23.33	31.67	28.33	25.33	27.17
Average nitrogen concentrations	27	34.89	32	28.56	
CD (p=0.05)	G=2.631		N= 1.382	G*N= 4.051	

Table 7. Effect of cultivars and nitrogen levels grain yield

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
Season 2017					
Abu Ghraib 3	5.847	6.043	6.167	6.703	6.19
Tahadi	5.5	5.76	6.02	6.067	5.837
Al Hashimiya	5.513	5.603	5.77	5.817	5.676
Average	5.62	5.802	5.986	6.196	
CD (p=0.05)	G= 0.1723		N= 0.1446	G*N=0.2771	
2018					
Abu Ghraib 3	6.057	6.127	6.19	6.733	6.277
Tahadi	5.627	5.763	5.903	6.043	5.834
Al Hashimiya	5.043	5.467	5.54	5.623	5.418
Average	5.576	5.786	5.878	6.133	
CD (p=0.05)	G=0.1623		N= 0.1208	G*N= 0.2570	

Table 8. Effect of cultivars and nitrogen levels on biological yield

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	7.67	9.33	12.33	13.67	10.75
Tahadi	7.67	11	13	15.33	11.75
Al Hashimiya	7	9	10	11.33	9.33
Average nitrogen concentrations	7.44	9.78	11.78	13.44	
CD (p=0.05)	G= 1.341	N= 0.790	G*N= NS		
2018					
Abu Ghraib 3	6.33	9.67	11	14.67	10.42
Tahadi	10.33	10.67	12.33	15	12.08
Al Hashimiya	5	8.33	9.67	12	8.75
Average nitrogen concentrations	7.22	9.56	11	13.89	
CD p=0.05)	G=1.439	N= 1.157	G*N= NS		

Table 9. Effect of cultivars and nitrogen levels on harvesting index

Genotypes (G)	Nitrogen application (Kg ha^{-1})				Average
	0	50	80	100	
2017					
Abu Ghraib 3	28.33	35	31.33	30	31.17
Tahadi	30	36.33	33	31.33	32.67
Al Hashimiya	31.33	40	36	31.33	34.67
Average	29.89	37.11	33.44	30.89	
CD (p=0.05)	G= 2.075	N= 1.060	G*N=3.190		
2018					
Abu Ghraib 3	28.33	35.33	31.67	30	31.33
Tahadi	29.67	36.67	33.67	31	32.75
Al Hashimiya	31.67	39.67	35.67	31.67	34.67
Average	29.89	37.22	33.67	30.89	
CD p=0.05)	G=2.361	N= 1.569	G*N= NS		

two with average of 11.75 and 12.08, during two seasons, respectively (Table 8). Al Hashimiya genotypes gave the lowest biological yield. The nitrogen fertilization also showed the same trend. The results of the interaction between the genotypes and fertilization was not significant

Harvesting index (HI): The harvest index was significantly affected by genotypes. Al Hashimiya genotypes gave the highest HI, as compared with Abu Ghraib 3 and Tahadi (Table 9). The nitrogen fertilization @ 50 Kgha^{-1}gave the highest average HI and the no-application treatment lowest average for both the season. The interaction between the genotypes and nitrogen fertilization was significant, Al Hashimiya genotypes and fertilization @ 50 Kg ha^{-1} gave the highest HI .

CONCLUSION

Abu Ghraib genotypes gave the highest average of plant height the flag leaf content chlorophyll, number of spikes and grain yield. Tahadi genotype gave the highest average number of grains per spike, the 1000 grains weight and biological yield, while the Al Hashimiya genotypes gave the highest flag leaf area, chlorophyll and harvest index. Nitrogen fertilization (100 Kg ha^{-1}) gave the highest average for most traits except the 1000 grains weight. Therefore, recommended the genotype Abu Ghraib 3 with fertilization of 100 Kg ha^{-1}for higher productivity.

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