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EFFECT OF FOLIAR FERTILIZERS ON GROWTH AND YIELD OF THREE WHEAT VARIETIES

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Abstract

Factorial field experiment was conducted in 2016-2017 growth season in Babylon Iraq within a longitude of 32,40 and latitude 44,66 in silty-clay soil to determine the effect of spraying some foliar fertilizers (control, spraying of 2% urea, 5% humic and 1% high potash fertilizer) on growth and yield of three wheat varieties (Rashid, Al-Husein and Uruk). Randomized complete block design with three replications was used. The varieties were cultivated at 10/12/2016(in lines 20 cm apart) and harvested at 12/5/2017. The data were analyzed statistically and the average were compared by less significant difference test ($LSD_{0.05}$). The results showed that foliar fertilizers significantly increased plant height, spike length, grains no. spike^{-1}, 500 grains weight and grains yield compared to control treatment. High potash was superior in grain yield (4.249 t.ha^{-1}) compared to humic (3.904 t.ha^{-1}). Rashid and Al-Husein genotypes were superior in plant height, spike length, grains no. spike^{-1} and grains yield. Uruk variety was superior in 500 grains weight (17.3 g), but it gave the lowest grains yield (3.675 t.ha^{-1}). The interaction between foliar fertilizers and varieties caused significant effect on all traits studied, in which Rashid and Al-Husein genotypes with all foliar fertilizers were superior in all traits (except 500 grains weight) and with high potash gave highest grain yield of 4.441 and 4.455 t.ha^{-1}, while Uruk with high potash was superior in 500 grains weight (17.7 g).

Key words: high potash fertilizer, urea, humic, foliar fertilizer, wheat

Introduction

Low cereal productivity is a persistent problem and is associated with many factors that affect yield and quality of grains, including crop management and the environment in which plants grow (Coventry *et al*., 2011). Fertilizer is one of the most important management systems for crop, and excessive addition of chemical fertilizers is a problem because it leads to increase environmental pollution (Savci, 2012). Therefore, the trend started to rely on the initial addition of the codified fertilizer as soil fertilization and replace the complementary fertilizers by foliar fertilization in order to reduce the quantities of fertilizers added while ensuring the benefit of fertilizers (Haytova, 2013). The nature of most Iraqi soil is characterized as calcareous soil and the crops are deficient in most nutrients. The reason for this is not due to the total content of potassium, but to the limited availability of it (Jasim *et al*., 2016 and Al-Aidi, 2013). Therefore, studies have tended to add foliar fertilizers as a complementary process to soil fertilization to prepare the appropriate level of these essential nutrients to the plant.

Materials and Methods

Factorial experiment was carried out in Babylon, Iraq within a longitude of 32,405 and latitude 44,665, according to randomized complete block design with three replicates. The experimental unit area was 2 × 2 m. The experiment consisted of three wheat varieties (Rasheed, Al-Husein and Uruk) and 4 foliar fertilization treatments (control, spraying of 1% urea, 5% humic and 1% high potash fertilizer). The field soil was fertilized uniformly with 100 kg ha^{-1} of DAP (Di-Ammonium Phosphate). Varieties seeds were planted on 10/12/2016 in lines 20 cm apart and were followed by service operations according to the recommendations. Sprayed 1% of urea and high potash (10-10-17 of NPK) fertilizers and 5% of humic acid were done in the early morning in twice time (attiller and elongation stages). At maturity and harvest, the data were taken and analyzed and the averages were compared according to least significant difference at level of 0.05.

Results and Discussion

Plant Height (cm)

Table (1) shows that all foliar fertilizers spraying caused significant effect on l ant height compared to control (spraying water only), without significant differences between them. This was due to the effect of nutrients contained in fertilizers, especially nitrogen (in addition to other elements) in improving growth. This result was agreed with Wagan *et al*. (2017) and Arif *et al*. (2006).

The genotypes differed in plant height, where Rachid and Al-Hussain genotypes gave the highest plant height of 102.0 and 101.0 cm respectively, while Uruk genotype gave significantly lower plant height (82.0

cm). This was due to genetic differences in this cultivars (Jasim and Abood, 2018). This result was consistent with Kumar (2012) and Alam *et al*. (2004). The interaction between the factors caused significant effect.

Spike Length

Table (2) showed that foliar fertilizers caused significant effect on spike length (15.3-15.7 cm) compared to control treatment (13.7 cm). This is due to the increase in accumulation of dry matter by increasing water and nutrients absorption. This results is consistent with Wagan *et al*. (2017). Wheat genotypes differed significantly in its spike length and the longest average for the spike length obtained from Rashid and Al-husain genotypes (15.8 cm), while Uruk genotype gave less average (13.6 cm). This is due to the different genetic traits (Peymaninia *et al*., 2012), which was reflected in gene expression (Shirazi *et al*., 2015). This result was agreed with Jasim and Abood (2018) and Kumar (2012). The interaction between foliar fertilizers and genotypes significantly affected spike length, in which Rashid and Al-Hussein genotypes gave high spike length (15.6 and 15.5 cm) respectively when spraying high potash fertilizer, while Uruk genotype gave less spike length (12.9 cm) at control treatment.

Grains Per Spike

Table (3) indicate that foliar fertilizers caused significant effect on grains number spike^{-1} and spraying of urea and high potash were significantly superior compared to control. This may be due to the availability of nitrogen, which affects the increase of photosynthesis, thus reducing the competition between grains and reducing the abortion of grain. These results are consistent with Rahman *et al*. (2014).

The results indicated that the genotypes differed in the number of grains spike^{-1}, and Rashid and Al-Husein varieties gave the highest averages of 64.0 and 63.5 grains spike^{-1}compared to Uruk, which gave the lowest average of 54.0 grainsspike^{-1}. The number of grains in spike is usually positively correlated with the length of the spike. The increase in the number of grains is due to the increase in saplings number per spike, which is due to the differences in their genotype. This is in line with Al-Mammoori (2016), Kumar (2012) and Ahmad et al (2005). The interaction between the factors caused significant effect

Average Weight of 500 Grains

The results in table (4) showed that spraying high potash fertilizer only significantly increased the weight of 500 grains compared to control treatment by giving of 16.9 g compared to control treatment which gave 15.8 g without significant differences from urea and humic acid. This may be due to potassium function also on increasing division and growth cell and increasing on photosynthesis process and transferring photosynthesis material, wasting store decreasing some deal and transferring photosynthesis material to grains was causing filling grain and increasing grain size and resultant is increase of 1000&grain weigh (Hamouda *et al.*, 2015). Its role in increasing the absorption of nutrients in plant tissues, increase the activity of enzymes and nutrient transfer from source to sink (Taiz and Zeiger, 2006). This result was consistent with Hamouda *et al*. (2015) and Bahrnanyar and Ranjbar (2008). The genotypes were differed in 500 grains weight, and Uruk cultivar gave significantly the highest average of 17.3 g compared to Rashid and Al-Husein varieties (16.1 and 16.2 g respectively). This result was due to the differences in their genotype (Al-maamori, 2016), and it was consistent with Kumar (2012) and Al-Hasan (2011). The interaction between the factors caused significant effect and Uruk variety with spraying high potash fertilizer was superior (17.7 g) compare to all interactions of Rashid and Al-Husein varieties.

Grains Yield (tons ha^{-1})

Table (5) indicate that foliar fertilizers caused significant effect on grains yield compared to control (30621 t.ha^{-1}) and high potash fertilizer was significantly superior by giving 4.249 t.ha^{-1} compared to humic acid (3.904 t.ha^{-1}). This may be due to potash, which affects in increasing of nutrient absorption and photosynthesis (El-Sabbagh *et al*., 2002), then increasing grains number spike^{-1} (table 2) and grain weight (table 3) which reflected in grain yield. This result was agreed with Jasim *et al*. (2017) and Hamouda *et al*. (2015).

The results indicated that the genotypes significantly differed in grains yield, and Rashid and Al-Husein varieties gave the highest averages of 4.142 and 4.079t.ha^{-1} compared to Uruk (3.675 t.ha^{-1}). This was due to their differences in yield components (grains number.spike^{-1} and 500 grain weight as it appear in table 2 and 3). This is in line with Al- Mammoori (2016), Kumar (2012) and Al-Hasan (2011).

The interaction between the factors caused significant effect on grains yield, and Rashid and Al-Husein varieties with spraying high potash fertilizer gave high grain yield compared to all other interactions, while Uruk with control treatment gave the lowest grain yield of 3.420 t.ha^{-1}.

Table 1 : Effect of foliar fertilizers on three wheat genotypes height (cm)

Genotypes	Foliar fertilizers				Average of genotype
	Control	Urea	Humic	High potash	
Rashid	96	104	102	106	102.0
Al-Husein	97	103	100	104	101.0
Uruk	75	85	83	83	82.0
Average	89.3	97.3	95.0	97.7	
LSD $_{0.05}$	Fertilizers= 5.2		Interaction=8.9		4.5

Table 2: Effect of foliar fertilizers on spike length (cm) of wheat genotypes

Genotypes	Foliar fertilizers				Average of genotype
	control	urea	humic	High potash	
Rashid	14.2	16.4	16.1	16.6	15.8
Al-Husein	14.0	16.5	16.3	16.5	15.8
Uruk	12.9	13.9	13.6	14.1	13.6
Average	13.7	15.6	15.3	15.7	
LSD $_{0.05}$	Fertilizers= 1.12		Interaction= 1.94		0.97

Table 3 : Effect of foliar fertilizers on grain spike^{-1} of wheat genotypes

Genotypes	Foliar fertilizers				Average of genotype
	Control	Urea	Humic	High Potash	
Rashid	60	65	65	66	64.0
Al-Husein	61	64	64	65	63.5
Uruk	50	56	53	57	54.0
Average	57.0	61.7	60.7	62.7	
LSD $_{0.05}$	Fertilizers=4.1		Interaction= 7.1		3.5

Table 4 : Effect of foliar fertilizers on 500 grains weight (g) of wheat genotypes

Genotypes	Foliar Fertilizers				Average of genotype
	Control	Urea	Humic	High potash	
Rashid	15.2	16.4	16.2	16.6	16.1
Al-Husein	15.4	16.5	16.4	16.5	16.2
Uruk	16.9	17.5	17.1	17.7	17. 3
Average	15.8	16.8	16.6	16.9	
LSD $_{0.05}$	Fertilizers=1.02		interaction= 1.67		0.88

Table 5 : effect of foliar fertilizers on grains yield (t.ha^{-1}) of wheat genotypes

Genotypes	Foliar Fertilizers				Average of genotype
	Control	Urea	Humic	High potash	
Rashid	3.752	4.320	4.053	4.441	4.142
Al-Husein	3.690	4.100	4.070	4.455	4.079
Uruk	3.420	3.770	3.590	3.850	3.675
Average	3.621	4.063	3.904	4.249	
LSD $_{0.05}$	Fertilizers=0.217		Interaction= 0.367		0.188

Conclusion

From the experiment, it could be concluded that foliar fertilizers spraying improved plant growth and yield components of wheat varieties, and high potash fertilizer was superior. Rashid and Al-Husein varieties was the best in yield and yield components compared to Uruk variety.

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