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The effect of the interaction between spraying humus and chemical foliar fertilizers on the growth and yield of wheat (IPA 99 cultivar)

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Abstract: The experiment was conducted in the field of the College of Agriculture of the Department of Field Crops - Al-Qasim Green University during the agricultural season (2018-2019) to study the effect of the interaction of spraying humic acid with urea fertilizer, high-potash fertilizer and neutral fertilizer on the yield of wheat IPA 99 cultivar. The experiment included two factors, namely, the spraying of organic fertilizers represented by humic acid at two levels (without spraying and spraying), which are symbolized by (H0 and H1) respectively. The second factor is the spraying of chemical foliar fertilizers, which includes four treatments (the non-addition treatment, urea spray, high potash spray, and neutral spray). The study was conducted according to global experiments using a randomized complete block design (RCBD) with three replications. The results were as follows that spraying the H1 humus led to an increase in the area of the flag leaf by 29 cm2, an increase in the number of leaves 5.3%, the number of tillers 10.2%, the weight of 100 grains 8.4%, The spraying of chemical nutrients also led to a significant increase in most of the traits compared to the control treatment, and the types of fertilizers did not differ significantly from each other. The interaction of high potash fertilizer and humus spraying achieved the highest value in leaf area (cm^2) 20%. The number of leaves is 5.3%, the number of tillers 22%, and the weight of 100 grains 22.1%.

Keywords: humus, chemical foliar, growth, wheat

1. INTRODUCTION:

Wheat, *Triticum estivum* L., is the number one grain crop in the world and feeds more than one-third of the world's population (Jamali, 2000). In order to improve the growth and yield of wheat, the required service operations must be counted correctly. Fertilizers and plant nutrition are among the most important service operations. Given the increase in the cost of chemical fertilizers and their negative effects on the environment and humans, the trend has begun to legalize their addition and partially replace them with environmentally friendly organic fertilizers (Anonymous, 2005). The foliar fertilization method is considered more efficient than ground fertilization in compensating for the deficiency of nutrients and reducing losses due to fixation and washing, as well as reducing the quantities of added fertilizers. The flowering period and the fullness of the grain are critical growth stages in which plants are affected when nutrients are deficient. Humus is one of the most important organic fertilizers that are friendly to the environment, to humans and to animals, so the trend has begun to add it to plants. The addition of humic acid has a role in improving growth and

absorption, and it was found (Chen and Aviad, 2004) that the best concentration of humic acid spray, which showed positive effects on the growth of different plants, ranged from 50-300 mg l-1 although the low concentrations gave Positive effects too.It was shown (Hellal, 2007) that using humic acid extracted from the residues of rice straw led to improved growth and increased grain and straw in barley. (Pettit, 2003) explained that humic acid increased plant growth by activating enzymatic reactions, increasing the permeability of cell membranes, increasing cell division and elongation. Expanding the use of organic fertilizers as a partial alternative to chemical fertilizers and reducing them is important from a health and environmental point of view, taking into account the availability of nutrients necessary for the growth and production of the crop (Al-Sulaimawi, 2016). Adding humic to plants reduced the amount of fertilizer added to the soil, and thus reduced the cost and pollution of chemical fertilizers without affecting the amount of yield (Pettit, 2003). The Macronutrients NPK are one of the most important determinants of production, and nitrogen fertilizers come at the forefront, as adding appropriate levels of nitrogen fertilizer leads to an increase in growth characteristics and yield components and thus increase productivity. (Al-Abdullah, 2015).Potassium also has an important role in activating a large number of important enzymes in the plant as well as the important role of potassium in the process of photosynthesis, osmotic balance and cell growth (Sharam and Riedelsberger, 2013). Accordingly, the experiment was conducted to study the effect of spraying humus alone or intertwined with some chemical foliar fertilizers on the growth and yield of wheat.

2. MATERIALS AND METHODS:

The factorial field experiment was conducted in the field of the College of Agriculture of the Department of Field Crops - Al-Qasim Green University during the agricultural season (2018-2019) to study the effect of the interaction of humic acid spraying with urea, high-potash fertilizer, and neutral fertilizer on the yield of wheat cultivar IPA 99. The study was conducted according to Factorial experiments using a randomized complete block design (RCBD) with three replications. It included two factors: the spraying of organic fertilizers represented by humic acid at two levels (without spraying and spraying), which symbolized by (H0 and H1) sequentially, and the second factor spraying chemical foliar fertilizers, which includes four treatments (the non-addition treatment, urea spray, high potassium spray and neutral spray),The soil was fertilized with DAP fertilizer 2PO4 (NH4) at an amount of 100 kg per hectare during sowing and nitrogen fertilizer 50 kg per hectare (half of it was added in the (tillering stage and the second half in the elongation stage). The spraying process was conducted when the flowers were expelled, with a concentration of 1% on the plant and for each treatment, according to the experiments, until complete wetness, after adding washing powder in small quantities to reduce the surface tension of the water (in case of interaction spraying, humus was sprayed and after five days the other fertilizer was sprayed). The data were taken during the growing season and at harvest, and the results were statistically analyzed by analysis of variance and the averages were compared according to the least significant difference (LSD) test under the probability level of 0.05.

3. RESULTS AND DISCUSSION:

plant height (cm):

Table (1) showed that spraying humus as well as spraying foliar nutrients and the interaction between them had no significant effect on increasing plant heigh

Table (1): Effect of spraying treatments on plant height, cm

Treatments	H_0	H_1	Means
Control	81	83	82
Urea	85	87	86
High K	85	88	86
Normal	83	87	85
Means	83.5	86.25	
L.S.D	interaction = 6.5 humus = 3.25		4.6

The leaf area (cm^2):

Table (2) showed that the spraying of humus led to a significant increase in the flag leaf area compared to the control treatment, and the percentage increase between them was 4.7%.The spraying of chemical nutrients also led to a significant increase in the flag leaf area compared to the control treatment, and the types of fertilizers did not differ significantly from each other.The interaction between the two factors had a significant effect in increasing the flag leaf area and the interaction of spraying high potassium fertilizer with spraying humus achieved the highest value, while the control treatment without spraying any fertilizer gave the lowest value, and the percentage of increase between them was 20%.

Table (2) Effect of spraying treatments on flag leaf area (cm^2)

Treatment	H0	H1	Means
Control	25.00	27.00	26
Urea	28.00	30.00	29
High K	28.00	30.00	29
Normal	27.00	29.00	28
Means	27	29	
L.S.D	interaction = 2.4 humus=1.2		1.7

Number of Leaves (Leaf.plant^{-1}):

Table (3)showed that spraying humus led to a significant increase in the number of leaves per plant compared to the control treatment, and the percentage increase between them was 5.3%.The spraying of chemical nutrients also led to a significant increase in the number of leaves per plant compared to the control treatment, and the types of fertilizers did not differ significantly from each other.The interaction between the two factors had a significant effect in increasing the number of leaves in the plant, and the interaction of spraying urea and high potassium fertilizer with spraying humus achieved the highest value, while the control treatment without spraying any fertilizer gave the lowest value, and the percentage of increase between them was 15.8%.

Table (3) Effect of spraying treatments on the number of leaves of the plant Leaf.plant^{-1}

Treatment	H0	H1	Means
Control	38.00	40.00	39
Urea	40.00	44.00	42
High K	42.00	44.00	43
Normal	41.00	43.00	42
Means	40.25	42.75	
L.S.D	interaction = 3.8 humus=1.9		2.7

The number of tillers .plant^{-1}:

Table (4) shows that the spraying of humus led to a significant increase in the number of tillers in the plant compared to the control treatment, and the percentage increase between them was 10.2%. The spraying of chemical nutrients also led to a significant increase in the number of tillers per plant compared to the control treatment, and the types of fertilizers did not differ significantly from each other. The interaction between the two factors had a significant effect in increasing the number of tillers in the plant, and the interaction of humus spraying with high potash fertilizer achieved the highest value. While the control treatment without spraying any fertilizer gave the lowest value and the percentage increase between them was 22%.

Table (4): Effect of spraying treatments on the number of tillers per plant

Treatment	H_0	H_1	Means
Control	4.10	4.40	4.25
Urea	4.40	5.00	4.70
High K	4.50	4.90	4.70
Normal	4.60	5.00	4.80
Means	4.40	4.83	
L.S.D	interaction = 0.6 humus=0.3		0.42

Number of grains in the spike:

Table (5)showed that the spraying of humus had no significant effect on the number of grains in the spike. Also, spraying chemical nutrients did not have a significant effect on the number of grains per spike compared to the control treatment. The interaction between the two factors had no significant effect on the number of grains in the spike

Table (5) Effect of spraying treatments on the number of grains per spike

Treatment	H_0	H_1	Means
Control	154.00	158.00	156
Urea	162.00	160.00	161

High K	156.00	164.00	160
Normal	160.00	164.00	162
Means	158.00	161.50	
L.S.D	interaction = 11.8 humus=5.9		8.34

Weight of 100 grain(g):

Table (6)showed that the spraying of humus led to a significant increase in the weight of 100 grains compared to the control treatment, and the percentage increase between them was 8.4%.spraying of chemical nutrients also led to a significant increase in the weight of 100 grains compared to the control treatment, and the types of fertilizers did not differ significantly from each other.The interaction between the two factors had a significant effect in increasing the weight of 100 grains, and the interaction of spraying humus with high potash fertilizer achieved the highest value, while the control treatment without spraying any fertilizer gave the lowest value, and the percentage increase between them was 22.1%.

Table (6) Effect of spraying treatments on weight of 100 grain

Treatment	H_0	H_1	Means
Control	12.20	13.40	12.8
Urea	13.60	14.70	14.15
High K	13.70	14.90	14.30
Normal	13.60	14.60	14.1
Means	13.28	14.40	
L.S.D	interaction = 1.6 humus=0.8		1.13

Table 2 shows that foliar fertilization with organic and chemical fertilizers and their interaction did not have a significant effect on the plant height. This may be due to the fact that the spraying was when the spikes were expelled and the plant reached the limits of elongation. Therefore, the increases were few and did not reach significant limits.Table 3 shows that spraying with both organic and chemical fertilizers and their interaction led to an increase in the area of the flag leaf as a result of the availability of nutrients, as well as auxins and gibberellins from humus, which helped in the expansion of cells, which was reflected in the flag leaf area .This is consistent with what was found by Al-Tememe and Al-Shammari (2018). Tables 4 and 5 show that spraying with both organic and chemical fertilizers and their interaction led to an increase in the number of leaves and the number of tillers in the plant, due to the availability of nutrients and the reduction of competition between the tillers, and the arrival of the largest number of tillers to the spike, thus increasing the number of tillers , which was reflected in the increase in the total number of leaves of the plant. It is clear from Table 7 that the spraying of nutrients led to an increase in the weight of 100 grains due to the availability of nutrients and thus increasing the efficiency of photosynthesis and the net photosynthesis process, in addition to improving the efficiency of transporting nutrients to the

grains, which was reflected in the increase in the weight of the grain and this is consistent with what was found by Atab et al. 2019.

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