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Effect of Spraying with Different Levels of Salicylic and Humic Acid in Some Growth Characteristics and Yield of Wheat Triticum Aestivum

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Abstract: Field experiment carried out in Falluja /Anbar/ Iraq, during the winter season 2012-2013 to determine the effect of spraying in three concentrations of salicylic acid (37.5, 75, 112.5) mg/L and humic acid with concentrates (0, 600, 800 and 1000) gr/d in growth characteristics and yield of wheat (eebaa99) type. In this study split plots system with Randomized complete Block, Design (RCBD) has been used in the experiment, the humic acid concentrations placed in the main plots and the salicylic concentrations in the sub-plots. High concentration of humic and salicylic acid showed the most significant response to most studied traits, salicylic with a concentration of 112.5 was the best in the average area of the flag leaf, number of tillers, number of spikes 448.9 Spikes/m2, the number of grains in spike 43.26 grains/plant, yield of grains 5.13 tons/H and the highest protein contents 8.23%. Wherever, 1000 gr/ D of humic acid was the earliest one to reach 100% flowering, the average area of the flag leaf, number of tillers and number of spikes 473 Spikes/m2 but did not differ significantly with level 800 gr/ D in the number of grains in spike, the yield of grains and protein contents. The Interference between concentrations of Salicylic and humic acid significantly affected most of the properties of the yield and characteristic growth.

Keywords: Wheat, Humic acid, Salicylic acid, Spraying, Cereal

Introduction

Wheat is the world's first crop in cultivated area and productivity, as it is the main food for more than 60% of the countries. Iraq is one of the countries where wheat originated, as it has the ideal conditions for cultivation and production however, the average productivity is still below the level of ambition compared to global production where Iraq's production is estimated about 1.984 ton/h (Statisticalbrochure, 2012). Many research centers have worked in this field and have reached the adoption of a number of high-yielding varieties if appropriate conditions exist therefore, it is necessary to know the appropriate service processes of these varieties to ensure good performance and productivity, including the use of modern technologies of organic nutrition and the use of growth organizations that have a significant role in the growth and productivity of this crop (Blumenthal et al., 1995), (Zilio et al., 2018), (Kassie et al., 2018).

Organic compounds are considered complementary or alternative to chemical fertilizers and have less harm to human health and environmental pollution Gharib et al. (2011). Humic acid is an organic compound is a material that is derived from the decomposition of organic matter and contains in its composition on carbon, hydrogen, oxygen, and nitrogen. This acid plays a key role in increasing the fertility of the soil and feeding the plant when added to the plant, it helps to increase its growth through its effect to photosynthesis, respiration,

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increases the plant's resistance to harsh environmental conditions and stimulates many of the vital interactions within the plant (Jomah 2011). Salicylic acid is a non-enzymatic antioxidant that has an important role in improving the defense system of the plant during exposure to strain or environmental stress and increases the activity of some important antioxidant enzymes Saglam et al. (2011) as well as its important role in stimulating the enzymes (SOD, CAT) which work to sweep free radicals and remove the toxic effect and turn it H2O Rizhsky et al. (2003). Based on the above, this study was carried out to shed light on the role of humic and salicylic acids in the growth characteristics and yield of wheat.

Material and Method

The experiment was carried out during the winter season 2012-2013 in Fallujah /Anbar/ Iraq, objective of the study has been to determine the effect of spraying in three concentrations of salicylic acid (37.5, 75, 112.5) mg/L and humic acid with concentrates (0, 600, 800 and 1000) gr/d in growth characteristics and yield of wheat (eebaa99) type, split plots system with Randomized Complete Block Design (RCBD) was used with three replications. Organic fertilizer (humic acid) placed on the main plots with codes (H0, H1, H2, and H3), It was added to the soil in two stages, the first was at vegetative growth second at the booting stage. While secondary plots occupied the concentration of salicylic acid with codes (S1, S2, and S3). It was sprinkled on the total vegetation of wheat two times, in the vegetative growth phase and formation of spikes. Spraying was carried out early in the morning.

Soil service operations such as (tillage, smoothing, and settlement) were carried out, after that experimental land was divided into experimental units with dimensions 3*1.5 m^2, the experimental unit consisted of 10 lines with a length of 3 m and the area between the lines 15 cm, with leaved an area of 1 m between the experimental units to ensure that the fertilizer does not transfer between the experimental units. Handmade planting was carried out in the lines on 20/11/2012, the first irrigation was given immediately after planting. Fertilized the soil with triple superphosphate fertilizer with the ratio of 100 kg P_2O_5 Kg/H one time during planting, as such nitrogen fertilizer was added to level 150 Kg N. /H urea form in two batches (Ali, 2012). During the study, properties were measured days of planting up to 100% blossom, the area of the flag leaf cm^2, number of tillers m^2, number of spikes m2, number of grains in the spike, the total yield of cereal ton/ha and protein content% (Aggarwal, 2018). The data were statistically analysed by the method of variance analysis using the GENSTSTS program, the least significant difference was also used for comparing the arithmetic averages and the probability level of 0.05.

Results and Discussion

The Days of Planting to 100% Blossom

The results of Table 1 indicate a significant effect of added high concentration of salicylic acid to the early blossom, the minimum time 82 days to reach 100% blossom recorded by the concentration 112.5 SA/L, different to the other concentrations that took longer. This is due to the function of salicylic in increasing the absorption of plants of nutrients by facilitating the process of bonding with amino acids and thus increase the absorption of these important elements in the formation of flower buds of the plant to the stage of blossom, in addition to its role in increasing the proportion of carbohydrates to nitrogen and thus accelerate the arrival of plants to the stage of blossom (Verma and Verma, 2008) (Pessarakli, 2016). It was noted from the same table (1) that plants are fertilized with humic acid at a high level 1000 gr/do give the fewer time 81.67days to reach 100% blossom and did not differ significantly from the plants fertilized level 800 gr/do. While plants in control treatment the longest duration 87.56 days to reach 100% blossom. This is due to the role of humic acid in improving plant growth as well as regulating the level of plant hormones (Masciandaro et al., 2002). the table showed the Interference between sprayed plants with a concentration of 1000 mg SA-1 with the high-level fertilizer of the humic acid have minimum time to reach blossom 100% was 81.33 days

Table 1. Effect of spraying with salicylic acid and adding the humic on the number of days from planting to 100% blossom

	S1	S2	S3	
H0	92	89.00	81.67	87.56
H1	84.33	85.33	83.00	84.22
H2	83.33	81.33	82.00	82.22
H3	81.33	82.33	81.33	81.67
L.S.D 0.05		2.431		1.665
MEAN	85.25	84.05	82.00	
L.S.D 0.05		1.237		

The Area of the Flag Leaf (cm^2)

The results of (Table 2) indicated that the sprayed plants with a concentration of 112.5 mg SA / L achieved the highest mean of the flag leaf area of 37.95 cm^2 and differed significantly from the sprayed plants in the other concentrations, this is due to the direct role of salicylic in increasing cell division and expansion, especially leaf cells (Sakhabutdinova et al., 2003) which was reflected in the result of increasing the area of the flag leaf. In the same table, the results indicated the plants which fertilized with the highest level of humic acid were significantly by given highest average of area flag leaf 37.86 cm^2 and did not differ significantly from the plants fertilized at the level of 800 g/Dunum, but both exceeded the rest of the other transactions, the reason for the superiority of the high level of the humic acid is due to its positive role in the growth of the plant and stimulate enzymatic reactions and improve the cell division and elongation of cells and increase the production of plant enzymes within cells (Verma and Verma, 2008). Interference between the high concentration of humic and high-level of salicylic acid give the biggest average of area 40.63 cm^2.

Table 2. Effect of spraying with salicylic acid and adding the humic on the area of the flag leaf (cm^2)

	S1	S2	S3	
H0	15.62	17.08	17.07	16.59
H1	15.06	16.64	15.77	15.82
H2	14.77	17.52	18.33	16.87
H3	15.76	17.19	20.63	17.86
L.S.D 0.05		1.668		1.169
MEAN	15.30	17.11	17.95	
L.S.D 0.05		0.838		

Number of Tillers m2

Table 3 shows the significant effect of salicylic acid concentrations in the number of tillers. Sprayed plants with a concentration of 112.5 mg gave a mean average of 552.8 and an increase of 5.5% from a spray treatment of 37.5 mg which gave its plants a mean average of 523.8. This may be due to the role of psychedelic salicylic acid in increasing the level of plant hormones such as Auxins, Gibberellins, and cytokines (Osbourn and Lanzotti, 2009),which have a positive role in increasing the total growth of plants, including the number of tillers in the plant. Table (3) shows that the addition of high-level humic acid achieved the highest mean 561 and differed significantly from the rest of the other levels, while the comparison treatment (without adding) was given minimal average 520.8, The superiority may be attributed to the role of the acid in increasing the absorption rate of some major and minor nutrients that have a direct or indirect role in improving the growth and development of the plant, which was positively reflected in the increase in the number of tillers in the plant(25). There was no significant overlap between the two factors of this study.

Table 3. Effect of spraying with salicylic acid and adding the humic on the number of tillers m2

	S1	S2	S3	
H0	511.3	518.3	532.6	520.8
H1	531.7	532.2	552.8	538.9
H2	517.6	533.04	537.4	529.4
H3	534.8	560.0	588.3	561.0
L.S.D 0.05		NS		10.45
MEAN	523.8	536.0	552.8	
L.S.D 0.05		9.14		

Number of Spikes m2

Table 4 shows that plants sprayed with high concentration of salicylic gave the highest average of 449.9 spike/m^2, significantly higher than the plants sprayed with the other concentrations, the superiority of the addition of the high concentration of this acid in some characteristics of growth, such as the area of flag leaf and the number of tillers reflected in one way or another to increase the number of spikes/m^2.

The results of Table 4 show that the plants fertilized with 1000 g of humic acid gave the highest average number of spikes 473 spike/m^2 and differed significantly from the other treatments, while the comparison treatment gave the lowest mean of the recipe 414.4 spike/m^2. perhaps the reason for the superiority of plants fertilized with the high level of humic acid to the superiority in the overall growth attributes and this was reflected positively in increasing the spikes/m^2. The interaction between the two study factors showed a significant effect of this specification, the best average 517.3 spike/m^2 was in the plants which sprayed by the concentration of 112.5 mg and fertilizer with 1000 g.

Table 4. Effect of spraying with salicylic acid and adding the humic on the Number of spikes m2

	S1	S2	S3	
H0	403.3	416.7	423.3	414.4
H1	418.0	433.0	449	433.3
H2	446.7	430.3	406.0	427.7
H3	451.3	450.3	517.3	473.0
L.S.D 0.05		30.31		24.52
MEAN	429.8	432.6	448.9	
L.S.D 0.05		13.41		

Number of Grains in Spike

The results of Table 5 showed a significant effect sprayed plants with a concentration of 112.5 mg of salicylic acid with an average 43.26 grains/spike, it has an increase 6.84 and 10.5% if compared to other plants sprayed with concentration 75 and 37.5 mg. The reason for the superiority of the plants of high concentration of salicylic acid is due to its superiority in the average area of flag leaf and the number of tillers and the number of spikes/m2, which reflected positively in providing the largest possible amount of food for the spike, which in turn increased the proportion of fertility in flowers and thus increase the contract of grain and the lack of abortion and consequently increase the number of grains In the spike (Sakhabutdinova et al., 2003) . It is clear from the same table that the plants fertilized by 1000 g gave the highest mean 45.18 grain/spike and did not differ significantly from the plants fertilized at the level of 800 g, but both differ significantly from the other of the treatments. This may be due to the superiority of these plants in the area of flag leaf and the number of tillers and the number of spikes, in addition to the role of humic acid in increasing the absorption of some elements that have a vital role in the germination of pollen and the growth of pollen tube, which reflected on increasing the proportion of fertile flowers and then increase the number of grains spike (Nardi et al., 2002). On the same table, the high-concentration sprayed plants of 112.5 mg and high-grade fertilizers of 1000g achieved the highest mean of 48.1 grains/spike.

Table 5. Effect of spraying with salicylic acid and adding the humic on the Number of grains in spike

	S1	S2	S3	
H0	35.6	39.87	41.07	38.84
H1	38.67	32.37	37.27	36.10
H2	40.23	44.37	46.60	43.73
H3	42.07	45.37	48.1	45.18
L.S.D 0.05		2.720		2.021
MEAN	39.14	40.49	43.26	
L.S.D 0.05		1.312		

Grain Yield ton /ha

The results of Table 6 showed a significant increase in grain yield per unit area with increased concentrations of spray with salicylic acid, the high concentration of 112.5 mg given the highest mean of 5.13 tons/ha with a

significant increase of 7.5% from the concentration of 37.5 mg. The reason for the superiority of this concentration is due to its moral superiority in the components of the product and this was reflected positively in the increase in grain yield per unit area. As shown from the same table, the high level of humic acid 1000 g has achieved the highest mean of 5.69 T/ha It did not differ significantly from the level of 800g, the superiority of this level of acid is due to its superiority in the components of the product reflected in the increase in the total grain. The overlap between the two factors of the study had a significant effect on the increase the yield, the plants sprayed with a concentration of 112.5 mg and fertilizer level of 1000 g given the highest average of 5.88 tons/ha

Table 6. Effect of spraying with salicylic acid and adding the humic on the grain yield ton /ha

	S1	S2	S3	
H0	3.900	4.143	4.327	4.123
H1	4.22	4.900	5.227	4.782
H2	5.477	5.440	5.090	5.336
H3	5.467	5.727	5.883	5.692
L.S.D 0.05		0.5256		0.3911
MEAN	4.766	5.052	5.132	
L.S.D 0.05		0.2533		

Protein Content %

The results of Table 7 showed that the plants sprayed with salicylic concentration112.5 mg achieved an average of 8.23% of the protein content in the grains and differed significantly from the other treatments, the high concentration of salicylic in most of the traits of growth and outcome means the efficiency of this treatment in the conversion of materials from the leaves to grains, including protein. The results of the same table showed that the levels of humic acid significantly affected the proportion of protein as it achieved a high level of its highest protein content 8.49% while the comparison treatment achieved the lowest protein content 6.06%. The high level of humic may be attributed to its influential role in the various biological processes when it enters the plant, especially in relation to the composition of the protein. In addition, it contains elements of carbon, nitrogen, oxygen and a small amount of phosphorus and sulfur (Alshahat 2007) which have a key role in the formation of amino acids and then protein synthesis.

As for the interference between the two factors of the study, it was noted that the plants sprayed with a concentration of 112.5 mg SA and fertilizer level of 1000 g achieved the highest average of the recipe 9.20%, while the plants sprayed with concentrated 37.5 mg SA and 0 g of humic given less average 5.20%.

Table 7. Effect of spraying with salicylic acid and adding the humic on the Protein content %

	S1	S2	S3	
H1	5.200	5.467	7.520	6.062
H2	7.167	7.453	7.860	7.493
H3	8.203	7.750	8.350	8.101
H4	7.640	8.617	9.203	8.487
L.S.D 0.05		0.9601		0.7735
MEAN	7.053	7.322	8.233	
L.S.D 0.05		0.4289		

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