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Effect of Humic Acid Spraying on Growth, Yield and Viability of Seeds of Two Imported Wheat Cultivars

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Abstract :*A field experiment was conducted in one of the farmer's fields in the Albu Khatia area / located in Babylon province during the winter season 2021-2022, the experiment was applied in split plots, in a randomized complete block design (R.C.B.D), and with three replicates. The two wheat cultivars (Adana and Barcelona) occupied the main plots, while the spray concentrations of humic acid (0, 2, 4, 6) ml.L^{-1} occupied the sub plots .In order to study the effect of the stages of spraying concentrations of humic acid on the growth, yield and viability of seeds of two cultivar of imported bread wheat. As for the seed vitality tests, a practical sample was taken from the composite sample and randomly from the harvested seeds to calculate the grain yield in each experimental unit.The tests were conducted in the laboratories of the College of Agriculture, Al-Qasim Green University, and its data were analyzed according to the Completely Randomized Design (CRD), with four replicates for the two factors(the two cultivars of wheat and the spray concentrations.(The results showed the Adana cultivar excelled in each of flag leaf area, number of spikes, and number of grains. spike, weight of 1000 grains, and grain yield with averages of (36.01 cm^2, 369.37 spikes, 33.83 grains, 33.21 g, and 4.135 tons.ha^{-1}), respectively .The results of the seed vitality tests showed the Adana cultivar excelled in each of the radical length, the plumage and the dry weight of the seedling, with averages of 9.89 cm, 10.81 cm, and 0.149 mg, with the lowest average germination period of 3.764 days .As for the spray concentrations, the concentration 6 ml.L^{-1}excelled in the average of plant height, flag leaf area, yield traits and its components.It also recorded the best average for each of the percentage of germination, radical length, plumage and dry weight of the seedling (95.63 cm, 12.14 cm, 13.65 cm and 0.220 mg), and the least time for germination was 3.564 days.*

Keywords: wheat cultivars, humic acid, foliar nutrition, seed vitality

1. INTRODUCTION

Wheat, Triticum aestivum L., ranks first among grain crops in the world and Iraq in terms of importance and cultivated area. In Iraq, the total cultivated area is 9,464 thousand dunums, with a production quantity of 4,234 thousand tons, with an average yield of 447.3 kg / dunum (Directorate of Agricultural Statistics, 2021).It is an essential source of nutrition for humans and animals, and a source of essential amino acids, vitamins, minerals, dietary fiber and beneficial phytochemicals. Iraq is still suffering from a decline in the productivity of this crop, despite being one of the first places to grow it. Jadoua and Baqer (2012),This decline

may be due to not following correct management methods, such as selecting good varieties suitable for the cultivated area, or following an integrated fertilization system. Therefore, researchers constantly resort to finding other ways through which production can be raised.Among them is what appeared in recent years of interest in foliar nutrition, including spraying organic particles that do not have any harmful effect on the environment, such as Humic (1991, Senn).The viability of the seed is the main concern for future crop production, which depends to a large extent on the nutrients that are used, especially those sprayed at critical stages of crop growth, which are particularly reflected on the seed during grain filling (Paneru et al. (2017). Therefore, it is not possible to produce seeds of good quantity and quality unless the crop is supplied with the essential nutrients required for its growth. Crop productivity and resource use efficiency depend on the successful field establishment of the number of plants per unit area, which is considered the first and important stage in the growth and emergence of crop plants, on which the vegetative and reproductive stage later depends.It depends to a large extent on the good vital characteristics of the seed resulting from the mother plant, which acquires the ability to germinate gradually in order to give strong and homogeneous gestures, and this strength gradually increases until physiological maturity, which is the maximum strength for seed quality (Bewley et al. 2013).The quality of the seed is affected by several factors, including foliar nutrition, which can delay the aging of the leaf, and this gives it the necessary time to obtain carbon metabolizing materials and transfer them to the economic part of the plant, which will be reflected in its quality and vitality (Pallais et al. 1987).The foliar nutrition of the crop is one of the rapid field practices to deliver the nutrients to the plant and avoid the ground addition and the problems of soil properties, its acidity and its high degree of salinity, which exposes it to loss.Fixation and washing, thus ensuring maximum utilization of the additives sprayed on the leaves. It is also a simple, useful, easy-to-use, and low-cost technology that accumulates biologically active substances in the resulting seeds, which will be sown later to give strong seedlings (Veerappan et al. 2019).One of the basic physiological functions of humic acid is its positive effect on ionic transport by increasing the flexibility of cellular membranes, and this improves their permeability and increases their absorption of nutrients. The yield and its components, Mahdi et al. (2019).In the light of the foregoing and the absence of many studies on the role of foliar feeding and its impact on the mother plant to produce good seedlings, this study was conducted with the aim of determining the best concentration and age stage for spraying humic acid, which achieves the best growth and productivity of the wheat crop, and studying the extent of the variation in the vitality and strength of the resulting seeds of the two varieties of wheat when spraying is used with different concentrations of humic acid.

2. MATERIALS AND METHODS

A field experiment was conducted in the Albu Khatia region / Babylon province, during the agricultural season (2021-2022) in order to know the effect of spraying different concentrations of organic fertilizer (humic acid) on the growth and yield of two cultivars of bread wheat.

Ground preparation

The experimental land was prepared by tillage, smoothing and leveling, and it was divided according to the treatments into main and sub plot. The dimensions of the plot were (3×2) m2. Suitable shoulders were made to separate the panels, with a distance of 75 cm between

repeaters and 50 cm between experimental units. The total number of experimental units was 24 units, and the experiment was fertilized with DAP fertilizer (0: 46: 18), which was added in an amount of (200 kg ha-1) when preparing the soil after tillage and before smoothing. Nitrogen fertilizer was also added in the form of urea (46% N). With an amount of (180) kg (1) in two batches, the first in the middle of the branching stage and the second in the middle of the blanket stage (Jadoua, 1995).

Experiment design

The experiment was conducted according to split plot design, The Randomized Complete Block Design (RCBD), with three replicates. The two cultivars of wheat, Adana and Barcelona, occupied the main plots, which were given the symbol (V), and the concentrations of spraying with humic acid (6,4,2,0) $ml.L^{-1}$, which were taken on the secondary plots and which symbolized by (H)), and in the two spraying stages (tillering stage and flowering stage) As the same concentrations were sprayed for both phases, it was sprayed using back big sprayer with a capacity of 16 liters, with the use of a nylon piece to separate the plot from each other and prevent the volatilization of the organic fertilizer spray. In order to identify some of the physical and chemical properties of the soil before cultivation, random samples were taken from several different places in the soil of the experimental field. Tests were conducted in the laboratories of the Department of Soil and Water Resources - College of Agriculture - Al-Qasim Green University, as shown in Table (1).

Table 1. Some chemical and physical properties of field soil for the 2021-2022 season.

uints	values	traits
$g.kg^{-1}$	168	sand
$g.kg^{-1}$	485	silt
$g.kg^{-1}$	347	clay
Loam clay siltly		soil texture
$mg.kg^{-1}$	41.70	available nitrogen
$mg.kg^{-1}$	11.22	available phosphorous
$mg.kg^{-1}$	189.00	available Potassium
$DS.m^{-1}$	3.42	electrical conductivity (EC)
$Mg.m^{-3}$	1.29	bulk density
-	7.08	pH
$g.kg^{-1}$	1.34	organic matter

Cultivation

The seeds of the two cultivars of bread wheat (Adana and Barcelona) imported from abroad were sown on 11/30/2021. The seeds were sown with a seed quantity of (120 kg.ha-1) using the sowing method on lines with a distance between one line and another 15 cm.After the cultivation process, the experimental land was irrigated, and all soil and crop service operations were conducted throughout the season, and the weed control process was conducted manually. Wheat plants were harvested when they reached full maturity on (5/14/2022).

The studied traits

Plant height (cm)

Calculated as an average of ten plants randomly from each experimental unit from the soil surface level to the apex of the spike of the main branch without own.

The flag leaf area (cm^2)

It was calculated from the average of ten flag leaves of the main stems taken at random for each experimental unit according to the following equation: Flag leaf area = flag leaf length x width at the middle x 0.95. . Thomas (1975).

Number of spikes (m2)

According to the number of spikes of a group of plants harvested from an area of one meter in length from the median lines after the maturity of the crop, then converted on the basis of their number per square meter

Number of grains per spike

It was calculated as an average number of ten ears of grain taken randomly from each experimental unit.

Weight of 1000 grains (gm)

It is the average weight of 1000 grains taken randomly from the grain yield of each secondary experimental unit and weighed by the sensitive scale.

Grain yield (tons)

Calculated from the harvest of three median lines with an area of (0.45) m 2 (the area of three lines, the distance between one line and another is 15 cm) from each experimental unit and around on the basis of ($ton.ha^{-1}$) on the basis of 14% humidity.

Seed vitality test:

A practical sample was taken from the randomly combined sample of harvested wheat seeds that were sprayed with different concentrations of humic acid, in which the seed yield was calculated in each experimental unit. The tests were conducted in the laboratories of the College of Agriculture - Al-Qasim Green University.The laboratory experiment was conducted using a completely randomized design (CRD) with four replicates with two factors (the two imported wheat cultivars and the humic acid concentrations). These examinations were carried out as follows:

1- Standard laboratory germination (%).

One hundred seeds were cultured randomly from the harvested seed yield for each experimental unit, and distributed over four repetitions in sterilized Petri dishes with blotting paper inside.Then the dishes were placed in the microenvironment at a temperature of 25 ° C ± 2 and a humidity of 95%.The number of healthy seedlings was calculated after ten days (the final count) from the date of cultivation, and it was converted into percentages according to the following equation (ISTA, 2010):Natural seedling percentage = (number of natural seedlings / total number of seeds) x 100

2- The plumule and radical length of the seedling (cm) in a standard laboratory germination test

After completing the standard laboratory germination test, ten natural seedlings were randomly taken for the purpose of measuring their length (using a graduated ruler), Then, measuring the plumule and radical length separately after separating them from the point of their attachment to the seed (ISTA, 2005).

3- Seedling dry weight (mg) in a standard laboratory germination test

After completing the standard laboratory germination test, ten healthy seedlings were taken and the seed coats were removed from them. Then it was placed in perforated paper bags in an electric oven at a temperature of 60 °C for a period of 72 hours, then weighed with a sensitive electric balance and the average dry weight of the seedling was extracted (ISTA, 2005).

4- The average germination period:

Measure the average germination period according to the equation

$$MGT=\frac{\sum Dn}{\sum n}$$

Since n represents the number of germinated seeds on day D, and D is the day on which the germinated seeds were counted, Ellis and Roberts, (1981.(

Statistical analysis

Data were analyzed for all studied traits statistically according to The Randomized Complete Block Design (RCBD) for field traits and Completely Randomized Design (CRD) for seed vigor and vigor tests.Arithmetic means were compared using the Least Significant Difference (L.S.D) test at the 5% level (Steel and Torrie, 1980) using Genstat edition 7 software.

3. RESULTS AND DISCUSSION

1- plant height (cm)

Table (2) shows that there is a significant effect of the cultivar on plant height, where the Barcelona cultivar was significantly excelled in plant height and achieved an average of 88.13 cm, compared to the adana cultivar, which recorded 84.43 cm .Also, the spray concentrations of humic acid had a significant effect on this traits, where the spray concentration gave 6 ml. L-1 the best mean in this trait was 91.99 cm compared to the control treatment (spraying water only), which gave the lowest mean of 78.91 cm .The reason for increasing plant height is due to vital activity and the hormonal role of humic acid in the cytoplasm of cells and the cell wall that increases the speed of division of these cells and their elongation, causing an increase in plant height, AL-zubaidy and Al-haidary (2019 .(While we did not find significant differences between the two factors of the study in this respect.

Table 2. The effect of cultivars and concentrations of humic acid and the interaction between them on average plant height (cm).

average acid concentrations	cultivars		treatments	
	Barcelona	adana		Humic acid

78.91	**80.55**	**77.27**	**0**	**concentrations (ml.L^{-1})**
83.29	**85.12**	**81.46**	**2**	
90.94	**93.08**	**88.79**	**4**	
91.99	**93.78**	**90.19**	**6**	
	88.13	**84.43**		**Average cultivars**
L.S.D 0.05				
Interaction	**Humic acid concentrations**		**cultivars**	
N.S	**3.29**		**2.77**	

2- The flag leaf area (cm^2)

The results in table (3) showed that there was a significant effect of the cultivar on the flag leaf area (cm^2), where the adana cultivar was significantly excelled in this traits and achieved an average of 36.01 cm^2, compared to the Barcelona cultivar, which recorded 32.56 cm.Also, the spray concentrations of humic acid had a significant effect on the flag leaf area, where the spray concentration gave 6 ml. L^{-1} The best average for this traits was 38.91 cm^2. It differed significantly from the rest of the concentrations used, compared with the control treatment, which gave the lowest mean of 29.93 cm^2.it due the reason for the increase in the leaf area to the fact that humic provides the largest amount of metabolites that are transported to the leaves, and this causes the expansion of leaf cells and an increase in their area, and this agrees with the findings of AL-Fahdawi, (2017).While we did not find significant differences between the two factors of the study in this respect.

Table 3. The effect of cultivars and concentrations of humic acid and the interaction between them on the flag leaf area (cm2).

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		
29.93	**28.80**	**31.06**	**0**	**Humic acid concentrations (ml..L^{-1})**
32.30	**31.20**	**33.40**	**2**	
35.99	**34.13**	**37.84**	**4**	
38.91	**36.10**	**41.72**	**6**	
	32.56	**36.01**		**average cultivars**
L.S.D 0.05				

Interaction	humic acid concentrations	cultivars
N.S	2.98	2.12

- Number of spikes (m^2)

The data in Table (4) indicate that there is a significant effect of the varieties on the number of spikes, where the adana cultivar was significantly excelled in this traits and achieved an average of 369.37 spikes. m^2 and differed significantly from the Barcelona variety, which recorded 363.55 spikes.m^2.The spray concentrations of humic acid also had a significant effect on this trait.The spray concentration of 6 ml.L^{-1} gave the best averages in this traits, amounting to 386.75 spikes.m2, and differed significantly from the rest of the acid concentrations, in which the control treatment gave the lowest mean of 342.52 spikes.m^2.While we did not find significant differences between the two factors of the study in this respect.

Table 4. The effect of cultivars and concentrations of humic acid and the interaction between them on the average number of spikes (m^2).

average acid concentrations	cultivars		treatments	
	Barcelona	adana		Humic acid concentrations (ml..L^{-1})
342.52	339.70	345.33	0	
365.90	356.41	357.40	2	
379.67	374.83	384.50	4	
386.75	383.27	390.23	6	
	363.55	369.37		average cultivars
L.S.D 0.05				
Interaction	humic acid concentrations		cultivars	
N.S	2.56		1.87	

4- The number of grains. spike^{-1}

The results in Table (5) indicate that there is a significant effect of cultivars on the number of grains. spike, where the Adana cultivar was significantly excelled in this trait and achieved an average of 33.83 grains. The spray concentrations of humic acid also had a significant effect on this traits , where the spray concentration gave 6 ml. L^{-1} had the best average number of grains. spike^{-1} reached 37.71 grains. spike^{-1}.It differed significantly from the rest of the acid concentrations, in which the comparison treatment gave the lowest mean of 28.31 grains. spike^{-1} This is due to the role played by humic acid in reducing the effect of abortion, which occurs due to competition between grains for metabolites that are available at the right

time, and thus filling the largest number of them Hashim, (2018). While we did not find significant differences between the two factors of the study in this respect.

Table 5. The effect of cultivars and concentrations of humic acid and the interaction between them on the average number of grains. spike.

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		**Humic acid concentrations (ml..L^{-1})**
28.31	**27.48**	**29.14**	**0**	
30.70	**30.21**	**31.20**	**2**	
34.48	**33.13**	**35.83**	**4**	
37.71	**36.26**	**39.16**	**6**	
	31.77	**33.83**		**average cultivars**
L.S.D 0.05				
Interaction	**humic acid concentrations**		**cultivars**	
N.S	**3.14**		**N.S**	

5- The weight of 1000 grains (g)

The results referred to in Table (6) show that there is a significant effect of the cultivars on the weight of 1000 grains (gm), as the adana cultivar was significantly excelled in this traits and achieved an average of 33.21 gm, and differed significantly from the Barcelona cultivar, which recorded 31.56 gm.The spraying concentrations of humic acid also had a significant effect on this traits. The control treatment (spraying water only) excelled in giving the best averages for the weight of 1000 grains, which amounted to 34.73 gm, and did not differ significantly from the spraying treatment with a concentration of 2 ml. L^{-1}It differed significantly from the rest of the acid concentrations, which were given by spraying at a concentration of 6 ml. L-1 the lowest average was 29.84 gm,The reason for the superiority of the control treatment in grain weight is the result of the compensation mechanism that occurs in the small grains As the increase in the number of grains in the treatments sprayed with a high concentration of humic acid made it difficult to fill them well within a single spike, and this was confirmed by Shahryari and Mollasadeghi (2011), while we did not find significant differences between the two study factors in this traits.

Table 6. The effect of cultivars and concentrations of humic acid and the interaction between them on the average weight of 1000 grains (gm)

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		**Humic acid**

34.73	**34.03**	**35.43**	**0**	**concentrations (ml..L^{-1})**
34.04	**33.00**	**35.08**	**2**	
30.95	**30.10**	**31.79**	**4**	
29.84	**29.13**	**30.54**	**6**	
	31.56	**33.21**		**average cultivars**
L.S.D 0.05				
Interaction	**humic acid concentrations**		**cultivars**	
N.S	**1.87**		**1.19**	

6- Grain yield (ton.ha^{-1})

The results in Table (7) indicate that there is a significant effect of the cultivars on grain yield (ton.ha).The adana cultivar was significantly excelled in this trait because of its excelled in most components of the yield, 4.135 (ton.ha-1), while the Barcelona cultivar achieved the lowest average of 3.628 (ton.ha-1).The spraying concentrations of humic acid also had a significant effect on the grain yield, as the treatment was excelled on spraying with a concentration of 6 ml.L-1, the highest average of which was 4.135 (ton.ha), and it differed significantly from the rest of the spraying concentrations.While the control treatment (spraying water only) achieved the lowest average of the total grain yield, which reached 3.373 (ton.ha). The number of spikes and the number of grains increased. The spike in the spray concentration of 6 ml.L-1 is what justifies the excelled of this concentration in grain yield.As these components are considered the most influential on the grain yield, and the humic acid content of the nutrients accelerated their delivery in a timely manner, and this was reflected in the final yield of the crop, as confirmed by the results of Mahdi et al. (2019), while we did not find significant differences between cultivars and spray concentrations in this trait.

Table 7. The effect of cultivars and concentrations of humic acid and the interaction between them on average grain yield (ton.ha).

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		
3.373	**3.174**	**3.571**	**0**	**Humic acid concentrations (ml..L^{-1})**
3.738	**3.552**	**3.923**	**2**	
4.058	**3.738**	**4.378**	**4**	
4.358	**4.047**	**4.669**	**6**	
	3.628	**4.135**		**average cultivars**

L.S.D 0.05		
Interaction	**humic acid concentrations**	**cultivars**
6.640	**4.632**	**3.304**

traits of the vitality of the seed: -

1- Standard laboratory germination rate:

The results in Table (8) indicate that there are no significant differences for the seeds of the harvested cultivars in the percentage of standard germination, while spraying humic acid had a significant effect on the seeds harvested for this trait.The harvested seeds excelled from the spraying treatment with a concentration of 6 ml.L^{-1} of humic acid, recording an average of 95.63 (%).It differed significantly from the rest of the spraying concentrations, while the control treatment (water spraying only) achieved the lowest average germination rate of 86.02 (%)it due this to the fact that humic acids contain some hormones that are directly involved in the germination process, and this raises the percentage of natural seedlings. Jeyabal and Kuppuswamy (1998), While we did not find significant differences between the seeds harvested for cultivars and spray concentrations in this trait.

Table 8. The effect of cultivars and concentrations of humic acid and the interaction between them on the percentage of standard laboratory germination.

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		**Humic acid concentrations (ml..L^{-1})**
86.02	**86.37**	**85.67**	**0**	
87.94	**88.12**	**87.76**	**2**	
91.67	**91.34**	**92.00**	**4**	
95.63	**95.03**	**96.23**	**6**	
	90.22	**90.42**		**average cultivars**
L.S.D 0.05				
Interaction	**humic acid concentrations**		**cultivars**	
N.S	**3.108**		**N.S**	

1- radical length (cm):-

Table (9) shows that there is a significant effect of the harvested seeds of the two cultivars on the radical length.The seeds of the Adana cultivar excelled significantly in this trait, recording an average of 9.89 (cm), while the Barcelona cultivar achieved the lowest average of 9.12 (cm).The concentrations of spraying with humic acid also had a significant effect on

the seeds produced from plants sprayed with humic acid, where the treatment of spraying with a concentration of 6 ml.L^{-1} was excelled on the highest average of 12.14 (cm) and differed significantly from the rest of the spray concentrations. While the control treatment (spraying water only) achieved the lowest mean for this trait, which was 7.42 (cm) by Ali and Elbording (2009), while we did not find significant differences between cultivars and spray concentrations of harvested seeds in this trait.

Table 9. Effect of cultivars and concentrations of humic acid and the interaction between them on radical length (cm).

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		**Humic acid concentrations (ml..L^{-1})**
7.42	**7.10**	**7.73**	**0**	
8.40	**8.19**	**8.60**	**2**	
10.08	**9.79**	**10.36**	**4**	
12.14	**11.40**	**12.88**	**6**	
	9.12	**9.89**		**average cultivars**
L.S.D 0.05				
Interaction	**humic acid concentrations**		**cultivars**	
N.S	**1.158**		**0.848**	

2- The plumule length (cm):-

Table (10) indicates that the highest average plumule length was obtained in the seeds of the adana cultivar, which amounted to 10.81 (cm), and differed significantly from the seeds of the Barcelona cultivar, which recorded 10.13 (cm).Also, the concentrations of spraying with humic acid had a significant effect on the seeds produced from plants sprayed with humic acid.The treatment of spraying with a concentration of 6 ml.L^{-1} was excelled on the highest average length of the blade, which reached 13.65 (cm), and differed significantly from the rest of the spray concentrations. While the control treatment (spraying water only) achieved the lowest mean for this traits , which was 8.10 (cm).it also due the reason for increasing the plumule length at a concentration of 6 ml.L-1 to the content of this acid in hormones, including gibberellin, which accelerates germination and increases the biomass of plumule . This has been observed in the laboratory experiment and confirmed by MacCarthy et al. (1990), while we did not find significant differences between cultivars and spray concentrations of harvested seeds in plumule length.

Table 10. Effect of cultivars and concentrations of humic acid and the interaction between them on plumule length (cm).

average acid concentrations	**cultivars**	**treatments**

	Barcelona	adana		
8.10	8.18	8.01	0	Humic acid concentrations (ml..L^{-1})
9.24	8.94	9.54	2	
10.89	10.21	11.58	4	
13.65	13.17	14.13	6	
	10.13	10.81		average cultivars
L.S.D 0.05				
Interaction	humic acid concentrations		cultivars	
N.S	0.979		0.657	

4- Dry weight of seedlings (mg):-

The averages in Table (11) show that there are significant differences in the dry weight of the seedling, where the seeds of the cultivar recorded the highest average of 0.149 (mg). and it differed significantly from the seeds of the Barcelona cultivar, which recorded 0.128 (mg). Also, the concentrations of spraying with humic acid had a significant effect on the seeds produced from plants sprayed with humic acid.The spraying treatment with a concentration of 6 ml.L-1 excelled with the highest average dry weight of seedlings amounting to 0.220 (mg) and significantly differed from the rest of the spray concentrations compared to the control treatment, which recorded the lowest average for this traits amounting to 0.084 (mg). The nutrition of the mother plant was significantly reflected on the harvested seeds, and the increase in the dry weight of the seedling was due to the improvement of the seed weight as a result of spraying with humic acid, especially during the seed filling period. Veerappan et al. (2019)While we did not find significant differences between cultivars and spray concentrations of harvested seeds in this trait.

Table 11. The effect of cultivars and concentrations of humic acid and the interaction between them on the dry weight of seedlings (mg).

average acid concentrations	cultivars		treatments	
	Barcelona	adana		Humic acid concentrations (ml..L^{-1})
0.084	0.081	0.086	0	
0.103	0.094	0.112	2	
0.149	0.141	0.157	4	
0.220	0.197	0.243	6	
	0.128	0.149		average cultivars

L.S.D 0.05		
Interaction	**humic acid concentrations**	**cultivars**
N.S	**0.025**	**0.017**

5- germination period(day):-

The results in table (12) indicate that the seeds of the adana cultivar recorded the shortest germination period, with an average of 3.764 (days), and it differed significantly from the seeds of the Barcelona cultivars , which recorded 4.295 (days). Also, the concentrations of spraying with humic acid had a significant effect on seeds produced from plants sprayed with humic acid.The spraying treatment with a concentration of 6 ml.L-1 gave the least period to germination with an average of 3.564 (days) and was significantly different from the rest of the spraying concentrations compared to the control treatment, which recorded the highest mean for this trait amounted to 4.437 (days). it explained that the accumulation of humic acids in the seed while it is on the mother plant improves its vitality by increasing water absorption, and this reduces the necessary germination period (Micheal, 2001). While we did not find significant differences between cultivars and spray concentrations of harvested seeds in germination period.

Table 12. The effect of cultivars and concentrations of humic acid and the interaction between them on the germination period (day).

average acid concentrations	**cultivars**		**treatments**	
	Barcelona	**adana**		
4.437	**4.784**	**4.090**	**0**	**Humic acid concentrations ($ml..L^{-1}$)**
4.182	**4.430**	**3.933**	**2**	
3.934	**4.156**	**3.712**	**4**	
3.564	**3.810**	**3.317**	**6**	
	4.295	**3.764**		**average cultivars**
L.S.D 0.05				
Interaction	**humic acid concentrations**		**cultivars**	
N.S	**0.222**		**0.167**	

4. CONCLUSIONS

1- Spraying humic acid or any other foliar nutrient can improve the vegetative and reproductive growth of wheat crop.

2- Choosing the critical stages for spraying foliar fertilizer, in addition to choosing the cultivars, is necessary to raise the efficiency of the fertilizer and its reflection on the yield.
3- The need to Concentration on the vitality of the seed while it is on the mother plant, and that is through providing it with essential nutrients during the most critical stages of growth to produce a strong seed.

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