The Effect Of Potassium Supplementation And Foliar Spraying With Ascorbic Acid On The Vegetative Growth of *Triticum aestivum* L.

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Abstract

An experiment was carried out at Al-Husseiniya using plastic pots to investigate the effects of potassium fertilization and foliar spraying with ascorbic acid and their interactions on some vegetative growth characteristics of wheat (Abu Ghraib) cultivar growing in mixed sandy soil during the agricultural season 2020-2021. The experiment factors were represented by three levels of potassium fertilization (B), which are (0, 100, 200) kg k. h^{-1} Fertilization was carried out in three batches: after emergence, three leaf stage and at flowering. The second factor was represented by three concentrations of ascorbic acid (A), which are (0, 300, 600) mg. L^{-1} was sprayed in two stages, the first at the thinning stage (four-leaf stage) and the second at elongation (8-leaf stage). The experiment included 27 experimental units according to a completely randomized design (C.R.D) with three replications. the following Statistically, the results of the current study showed the following

1-Potassium fertilization" had a significant effect on the vegetative growth traits, as" these traits increased with increasing potassium levels at the level of 200 kg K. h^{-1} reflected by the plant height and the number of leaves reached 51 cm and 14.8 leaves. $Plant^{-1}$ in that order

2-Foliar spraying with ascorbic acid showed a " significant effect on some characteristics of vegetative growth at a concentration of 600 mg. L^{-1} was represented by plant height, number" of prunings, and the flag leaf area was 50 cm and 4.2 pruning. $Plant^{-1}$ and 355.4 cm^2. $Plant^{-1}$

3-Show the bilateral interaction of foliar spraying with ascorbic acid at a concentration of 600 mg. L^{-1} and potassium fertilization at the level of 200 kg k. h^{-1} showed a significant differences and rersulated the highest value for all vegetative growth characteristics, represented by plant height, number of shoots, number of leaves, and flag leaf area of 57 cm and 4.5 bushes. Plant $^{-1}$ and 15.7 leaves. $Plant^{-1}$ and 379.9 cm^2. Plant $^{-1}$ in order and it is considered the best treatment.

Key words : Potassium, Ascorbic acid, *Triticum aestivu*m.

Introduction

Wheat, *Triticum aestivum* L., is the world's most important crop in terms of total area planted and productivity. Despite the efforts of researchers and those interested in breeding and improving these crops, the rate of global production of grain crops such as wheat, barley, and rice per unit area for human nutrition has increased to nearly double what it was at the beginning of the twentieth century. Nevertheless, the gap between global production and demand still exists and is steadily widening. Noting that as of the year 2000, There were almost six billion people on the earth , with the third world accounting for two-thirds of that growth (6) (The General Corporation for Grain Trading/Iraqi Ministry of Commerce, 2004)" "Iraq requires 3.25 million tons of wheat grain to feed its population and imports more than two million tons of it, comparable to 60-70% of its real requirement, and the average domestic output is one million tons yearly. Despite the fact that this country is one of the key locations for the rise of this crop, there appears to be a significant gap between production and consumption. There are a number of reasons why local wheat output has decreased, but the most significant one is "the aggravation of salt and drought issues as well as the inability to practice appropriate crop management. Ascorbic acid is used in a variety of activities . which is crucial "physiological functions in

plants, including photoprotection, stress tolerance, secondary metabolite production, cell wall biosynthesis, cell division, and expansion. Low molecular weight describes it (1). Life requires ascorbic acid to carry out vital metabolic tasks. In addition to its involvement in the formation of root nodes, fixing atmospheric nitrogen, promoting mRNA synthesis, taking part in flowering, encouraging the growth of lateral buds, and working to increase cell expansion and elongation, the plant is like protecting the plant from oxidative damage and maintaining the continuation of photosynthesis by delaying the early aging of leaves and protecting chlorophyll. The active oxygen species (ROS) that are produced during photosynthesis are protected from the photosynthetic system by this acid, which serves crucial roles in the process (8). It was found that ascorbic acid directly affects the formation of genes associated to the pyramid, and it is an important cofactor in the biosynthesis of many plant hormones like ethylene, gibberellin, and abscisic acid. In addition, it regulates the plant's response to stress as a result of the complex sequence of biochemical reactions.(11) mentioned that the deficiency of ascorbic acid causes the phenomenon of aging in plants.

The aim of the research is to know the effect of supplied potassium and spraying with ascorbic acid on the vegetative growth characteristics of wheat plants.

Materials and methods

" A plastic pot experiment was carried out the winter season 2020-2021 according to a completely randomized design (RCD) with three replications. The experiment included two workers, the first spraying with ascorbic acid at concentrations of (0, 300, 600) mg. L^{-1} after the plant has thinned, i.e. (after 35 days from the date of cultivation) and at the elongation stage of the plant on 10/2/2021. As for the second factor, it represents ground fertilization with potassium, which is in three levels (0, 0,100, 200) kg $k.h^{-1}$.(Using potassium sulfate fertilizer (41% K_2SO_4) recommended in three batches, the first after emergence, the second when three complete leaves appear, and the third when flowering, and superphosphate fertilizer P_2O_5 (20% P) was added when planting once (10) .(Wheat seeds were sown on 1/12/2020 in pots prepared for planting, the capacity of one pot was 5 kg, at a rate of 10 plants per pot, and the plants were reduced to 3 plants in one pot. Soil samples prepared for cultivation were taken before planting, and some of their characteristics were measured (Table 1) according tom (13) . The required concentration and 0.15 $ml.L^{-1}$ of Al-Zahi was added as a dispersant material in order to cause complete wetness of the vegetative parts of the plant. The spraying operations were done out in the early morning, using a manual sprayer with a capacity of 5 liters. The comparison treatment was sprayed with distilled water only and the number of experimental units 27."

Table (1) Some chemical and physical properties of the experimental soil before planting for the season 2020-2021.

traits	the value	Unit
The degree of reaction pH	7.61	_____
Electrical conductivity EC	5.40	ds. m^{-1}
organic matter	9.1	gm kg^{-1}
Ca^{2+}	1.4	mol. kg^{-1}
Mg^{2+}	0.85	mol. kg^{-1}
Na^{1+}	1.2	mol. kg^{-1}
SO_4^{2-}	1.5	mol. kg^{-1}
HCO_3^{1-}	2.3	mol. kg^{-1}
CO_3^{2-}	1.5	mol. kg^{-1}
Cl^-	0.82	mol. kg^{-1}
$CaCo_3$	0.64	mol. kg^{-1}
ready nitrogen	48.2	gm kg^{-1}
Ready Potassium	150.2	gm kg^{-1}
ready phosphorous	7.69	gm kg^{-1}
Silt	105	gm kg^{-1}
the sand	644	gm kg^{-1}
Clay	251	gm kg^{-1}
Texture	sandy mixture	_

•The analyzes were carried out in soil analysis laboratories - Directorate of Agriculture in Karbala Governorate

The vegetative growth characteristics were measured at 100% flowering after reaching maturity

1-Average plant height (cm)

The average height of three plants grown in each pot from the soil surface level to the end of the spike was taken from Saffa (16)

The average number of cuttings, one bush/$plant^{-2}$

2-The number of cuttings was calculated at the completion of the flowering stage of the experimental unit and divided by the number.

3- Average number of leaves. $Plant^{-1}$

The leaves were counted for all the plants in one pot, and from them the average number of leaves per plant was extracted by dividing the total number of leaves per pot by the number of its plants.

4- Average area of the flag paper (cm^2) "

Calculated according to the equation described by (15) my agencies :

Flag paper area = paper length ´ maximum width x 0.95 . For three flag leaves for each experimental unit in the stage of 100% flowering**.** The data under study were analyzed according to the method of analysis of variance for the design of complete sectors using the least significant difference L.S.D for comparison between the arithmetic means at the level of probability 0.05 and using the statistical program Genstat (3) "

Results and discussion

1- Average plant height (cm)

Table (2) shows that ascorbic acid sprayed on shoots gave significant differences at a concentration of 600 mg. L^{-1} amounted to 51 cm, compared to the treatment of foliar spraying with distilled water only, it reached 40 cm. The reason is due to the role of vitamin C when used at an appropriate concentration in cell division and expansion and activation of the carbon metabolism process and the resulting substances used to increase plant height (14), while The addition of potassium to the soil gave significant differences that reached the highest value when adding potassium 200 kg k. h^{-1} is 51 cm, compared to the no-additive treatment, and the reason is due to potassium, which serves to improve metabolic process efficiency. and then increase plant growth in general and stimulate enzymes. This result was similar to the findings of (2), while the dual interaction of spraying with ascorbic acid and adding potassium gave significant differences, as the highest value of spraying with ascorbic acid concentration was 600 mg. Liter $^{-1}$ and add potassium level 200 kg k. h^{-1} It reached 57 cm compared to the comparison treatment, and the reason is due to the role of vitamin C in most of the vital activities that take place within the plant, represented by activating the carbon metabolism process and enzymes, as it accompanies the vital reactions, in addition to being a non-enzymatic antioxidant that protect the plant of ROS damage, which ensures the survival of the cells in the best condition ((5) This result is consistent with what was obtained by (7) .

Table (2) the effect of potassium addition and spraying with ascorbic acid and the interaction between them on the average plant heigh(cm)

B) add potassium kg K. h^{-1}	A) Spraying with ascorbic acid mg. l^{-1}			Addition rate
	0	300	600	
0	41	45	47	**0**
100	44	46	50	41
200	48	51	57	44
	44	47	51	48
L.S.D % 0.05	**A = 4**	**B = 4**	**A*B =12**	

regulator of the cell cycle and many of the basic processes as well as its effectiveness in cell division and expansion (4 & 12), while the addition of potassium to the soil resulted in non-significant differences For this characteristic, while the dual interaction of spraying with ascorbic acid and adding potassium gave significant differences," as the highest value of spraying with ascorbic acid concentration 600 mg.l^{-1} and adding potassium level of

2- The average number of cuttings (tillers $plant^{-1}$)

Table (3) shows that ascorbic acid sprayed on shoots gave significant differences in this trait at a concentration of 600 mg. Liter $^{-1}$ amounted to 4.2 beaches. Plant $^{-1}$ "compared to the control treatment (spraying with distilled water only) amounted to" 2.8 bushels. $Plant^{-1}$ The reason is due to the role of vitamin C when used to its role as a

ascorbic acid in increasing plant absorption of nutrients, including nitrogen, phosphorus and carbon, which is reflected in the plant (9).

200 kg N.h^{-1} reached" 4.5 seedlings.$plant^{-1}$ compared to the control treatment (spraying with water Distilled only and no potassium was supplied) amounted to 2.7 strands. $Plant^{-1}$ and is due to the role of

Table (3)The effect of supplied potassium and spraying with ascorbic acid and the interaction between them on the rate of number of shoots

B) add potassium kg K. h^{-1}	(A) Spraying with ascorbic acid mg. l^{-1}			(Addition rate $^{-1}$
	0	300	600	
0	2.7	3.1	4.1	3.3
100	2.5	3.5	4.0	3.3
200	3.2	3.1	4.5	3.6
	2.8	3.2	4.2	
L.S.D % 0.05	A=1.2	B = n.s	A*B =1.9	

3- Average number of leaves (leaf. $Plant^{-1}$)

Table (4) shows that ascorbic acid applied as a spray on the shoots gave non-significant differences for this characteristic, however the supplied of potassium to the soil gave significant differences at the level of 200 kg K. h^{-1} which amounted to 14.8 leaves. $Plant^{-1}$," compared to the control treatment (without adding potassium), amounted to 13.4 leaves. $plant^{-1}$, while the dual interaction of spraying with ascorbic acid and adding potassium gave significant differences, as it reached the highest value of spraying with ascorbic acid at a concentration of 600 mg. L^{-1} and add potassium at the level of 200 kg k. h^{-1} amounted " to 15.7 leaves. $plant^{-1}$ compared to the comparison treatment. The reason is due to the role of vitamin C when used to its role as a regulator of the cell cycle and many basic processes as well as its effectiveness in cell division and expansion (4 and 12) as well as its role in increasing plant absorption of nutrients, such as Nitrogen, phosphorus, and carbon, which effect is reflected on the plant (9), this result is consistent with what was obtained by (7) .

Table (4) The effect of supplied potassium and spraying with ascorbic acid and the interaction between them on the average number of leaves

B) add potassium kg K. h^{-1}	(A) Spraying with ascorbic acid mg. l^{-1}			(Addition rate $^{-1}$
	0	300	600	
0	12.6	13.8	13.9	13.4
100	13.6	14.9	14.2	14.2
200	14.0	14.6	15.7	14.8
	13.4	14.4	14.6	
L.S.D % 0.05	A = n. s	B = 1.3	A*B =2.5	

4-Average leaf area (cm2. plant^{-1})

Table (5) shows that ascorbic acid sprayed on shoots gave significant differences at a concentration of 600 mg. Liter^{-1} amounted to 355.4 cm^2. plant^{-1}" compared to the treatment of foliar spraying with distilled water only, with a percentage increase of " 24.87%. The reason is attributed to the role of acid in enhancing the plant's absorption of nutrients, including nitrogen, phosphorus, and carbon, which effect is reflected on the plant (9), while the addition of potassium to The soil gave non-significant differences, while the dual interaction of spraying with ascorbic acid and adding potassium gave significant differences, as the highest value of spraying with ascorbic acid concentration was 600 mg. Liter $^{-1}$ and add potassium level 200 kg k. h^{-1} reached 379.9 cm^2. Plant^{-1} compared to the control treatment, which amounted to 261.2 cm ^{2}. Plant^{-1} The reason is due to the role of vitamin C the used of the vital activities that take place inside the plant, represented by activating the process of carbon metabolism and enzymes, as it accompanies vital reactions , Furthermore, it is a non-enzymatic antioxidant that protects the plant from ROS damage . , which ensures the survival of cells in the best condition (((5) . This result is consistent with what was obtained by (7).

Table (5)The effect of supplied potassium and spraying with ascorbic acid and the interaction between them on the average surface area flag leaf (cm 2 . plant -1

B) add potassium kg K. h^{-1}	**(A) Spraying with ascorbic acid mg. l $^{-1}$**			**(Addition rate^{-1}**
	0	**300**	**600**	
0	261.2	328.6	361.2	317.0
100	252.6	311.7	325.1	296.5
200	340.1	346.2	379.9	355.4
	284.6	328.8	355.4	
L.S.D % 0.05	**A = 70.8**	**B = n. s**	**A*B = 94.2**	

Conclusions and Recommendations:

The study showed that most of the traits were significantly affected by the foliar spray with ascorbic acid and the addition of potassium fertilizer, and the best treatment was when the foliar spray was 600 mg L^{-1} and the potassium level was 200 kg .k h^{-1}. Therefore, I recommend the researchers to use this treatment to conduct field experiments and increase production.

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