The Effect of Foliar Spraying with Hydrogen Peroxide and Vitamin E (α-Tecopherol) and their Interaction with Some of the Vegetative and Physiological Characteristics in the Chickpeas *Cicer Arietinum* L. Plant

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Abstract

The experiment was carried out using pots and the complete random design method (RCBD) and during the winter agricultural season 2021-2022 to study the effect of spraying with hydrogen peroxide at concentrations 15, 20 mmol. L^{-1}, vitamin E at concentration 150, 200, 250 mg.L^{-1} and their interaction in some vegetative and physiological characteristics of chickpeas plant.The results showed a significant decrease in the average characteristic of plant height and the number of leaves and branches when treated with hydrogen peroxide, particularly concentration 20 mmol.L^{-1} while treatment with vitamin E at concentration of 250 mg. L-*1* led to a significant increase in these characteristic, however, had no significant effect when treated with hydrogen peroxide and vitamin E as well as a significant increase in the average effectiveness of the enzyme catalase, peroxidase, plant content of proline and hydrogen peroxide, especially when concentrating 20 mmol.L^{-1} of H_2O_2 and 250 mg.L^{-1} of vitamin E have had a significant effect on most of the characteristic studied.

Key Words: *Cicer Arietinum L.,* Hydrogen Peroxide, Vitamine E, Foliar Application.

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Introduction

Cicer arietinum chickpeas plant is high-value nutrition crops represented by protein, fatty and carbohydrates substances as well as water and fiber (Yadav *et al*., 2020). Chickpeas are grown in many countries of the world, including Italy, North Africa and the Levant, as they are an important food source for these countries because they contain antioxidant enzymes that play an important role in protecting the body from heart disease, cancer and kidney disease (Keyimy *et al*., 2020).H_2O_2 is a chemical compound that plays an important role in the plant's metabolism as well as its role in stimulating many biological reactions within the plant such as lignification, opening and closing stomata and regulating the plant's metabolic pathway (Checseman, 2007). Hydrogen peroxide is found in different parts of the plant, such as tissues and root hair, and mitochondria are one of the most important cellular parts in which H_2O_2 is produced through the electronic transport chain and with the presence of ubiqunon, which converts O_2 into the radicals of superoxide, which in turn into H_2O_2 with the Mn-SOD enzyme (Consention *et al*., 2015).

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H_2O_2 has a role to play in stimulating disease-defense genes as well as its role in stimulating molecular signals responsible for the formation of plant hormones (Liue *et al*., 2004). Vitamin E (α-Tocopherol) is a non-enzymatic antioxidant built in the plant, particularly in chloroplasts, because it contains the special enzymes of this vitamin (Abbasie *et al*., 2007).This vitamin is found in various plant parts, including leaves, seeds, bulbous and roots, and shikmaic acid has a role to play in synthesizing the polar part of this vitamin through the tyrosine metabolic pathway, while the non-polar part is synthesize through the Methylerythrital phosphate (MEP) (Riewe *et al*., 2012). This vitamin has a role to play in the acquisition of free radicals, including OH^- and O_2^- produced in thalikodies of chloroplast, as well as its role in interacting with the Acyl group involved in the synthesis of the fatty part of the cellular membrane (Fritsche *et al*., 2017).

Materials and Methods

The experiment was carried out using pots and according to randomize complete block design (R.C.B.D.) (Al-Sahuki and Waheeb, 1990). As a working experience (2×3) and three repeats, the experiment included the next factors:

1. Two concentrations of hydrogen peroxide are (15, 20) mmol.L^{-1}, as well as a control treatment of zero.
2. Three concentrations of vitamin E are (150, 200, 250) mg.L^{-1}, as well as a control treatment which is zero.

Each repeater included 12 pots, with 136 experimental units in the experiment (number of pots).

Chickpeas seeds (local class obtained from agricultural offices) were planted on 1/11/2021 with an average of 15 seeds per pot and a depth of 1 cm and the process of irrigating continued regularly and according to the need of the plant and when the plant reached the stage 4-5 leaves dated 25 November 2021 and then sprayed with hydrogen peroxide and vitamin E (after preparing the above concentration) in the early morning and using the pressing hand spray and until complete wetness.

Studied characteristics:

1. Morphological characterstics measured on 20 January 2022 represent:

a. Plant height (cm): The height of three random plants of each of the pots was measured using the graduates ruler and then calculated the mean.

b. Number of leaves for the main stem (leaf.plant^{-1}): The number of leaves for three random plants of each pots was calculated and then by mean.

c. Number of branches of the main stem (branch.plant^{-1}): The number of branches of the main stem of three random plants of each pots was calculated and then by mean.

d. Main stem diameter (mm): The stem diameter of three random plants of each lobe was measured using Vernier caliper and then by mean.

2. The physiological characteristics measured on 2 January 2022 include:

a. Catalase (CAT) effectiveness

Used solutions:

- Solution (A) prepared with a melting of 1.74 g of K_2HPO_4 in a quantity of distilled water and then completed the volume to 200 ml of distilled water.
- B solution, prepared with a melting of 1.36 g of K_2HPO_4 in a quantity of distilled water after completing the size to 200 ml of distilled water.
- The buffer solution, which was prepared by adding a certain size of B solution to 50 ml of solution A to 7.
- Solution (C) as it was prepared with a size of 0.3 ml of H_2O_2 (30%) and then completed the size to 100 ml using the regulated solution.

1g of soft plant leaves were crushed with 10 ml of K_2HPO_4 (0.1 M) and at pH = 7.8 and then filtered the solution and the filtrateunder went centrifuge using a centrifuge at a speed of 1000 cycles.minute^{-1} (Pitotti *et al*., 1995).

0.1 ml was taken from the sample and mixed with 1.9 ml of buffer solution and then added 1 ml of solution (C) and mixed the ingredients well after that and then read the absorption device Spectrophotometer and at wavelength 240 nm and then the change in absorption was followed every 30 seconds and for 3 minutes, but the control was prepared in the same way but without adding the sample.

$$\text{CAT effeteness (Unite.ml}^{-1}) = \frac{\Delta\ Advaice\ reding}{\frac{\Delta\ \text{Time}}{0.1 \times 0.01\text{ml}}}$$

Where:

0.1 ml = sample size taken

0.01 ml = 1 Unit of enzyme (amount of enzyme that causes increased light absorption by 0.01 units for one minute).

b. Peroxidase (POX) effectiveness

Used solutions:

- Guaiacoal solution: This solution was prepared by placing 1.3 ml of Guaiacoal in a volumetric flask and then completed the size to 250 ml with distilled water.
- H_2O_2 solution (0.1%): 0.4 ml of H_2O_2 (30%) was taken and placed in a volumetric course and then completed to 120 ml with distilled water.
- A prepared solution of mixing 1 ml of H_2O solution with 1 ml guaiacoal solution.

1 g of plant leaves were crushed and added 10 ml of cold K_2HPO_4 solution, then the samples were filtrated with medical gauze and placed with a centrifuge half an hour and at a speed of 1000 cycle.minute^{-1}, after which 0.1 ml of sample was taken and 2 added of the C solution and read the absorption of the spectrometer and at wavelength 420 nm, then the change in absorption was followed every 30 seconds and for 3 minutes as the enzyme efficiency was estimated according to Nezih (1985) method and according to the following equation:

POX effeteness (Unite.ml^{-1})=$\frac{\Delta\ Advaice\ reding}{\frac{\Delta\ \text{Time}}{0.1 \times 0.01\text{ml}}}$

c. Proline acid content (mg.g^{-1} soft weight) in plant leaves: 0.5 g of soft plant leaves were weighed and placed in a evaporating dish, 10 ml of sulphosalicylic acid (at a concentration of 3%) were added and samples were separated by the centrifuge for 10 minutes and at a speed of 1,000 cycles.minute^{-1},then taken 2 ml of this filtrate and added 2 ml of glacial acetic acid and 2 ml of ninhydrin solution and then left the mixture on low heat until the appearance of yellow color and then put the tubes in a water bath for an hour, the samples were then cooled and 4 ml of toluene were added, then 3 ml of the upper colored layer was withdrawn and measured by the Visible spectrophotometer and at wavelength of 520 nm, as the plant's proline content was estimated according to Bates *et al.* (1973) method and by equation:

Proline= $\frac{Reading \times 20}{Weight\ of\ plant\ sample} \times 1.47$

d. Hydrogen peroxide content (µmol. g^{-1} soft weight) in plant leaves.Take 1 g of soft plant leaves and add 2 ml of Trichloroacetic acid (0.14) after which samples were filtered and the centrifuge was separated at a speed of 12,000 cycles. minute^{-1} and for a quarter of an hour, the following solutions were prepared:

1. K_2HPO_4 solution (0.010m): This solution consists of a certain size of solution B+ solution A (200 ml).
2. Solution A: Prepare a melting of 0.3 g of K_2HPO_4 with 200 ml of distilled water.
3. Solution B: Prepare a melting of 0.2 g of K_2HPO_4 with 200 ml of distilled water.
4. Potassium Iodide solution (1 m): Attended by melting 33.20 g of KI with 200 ml of distilled water.
5. H_2O_2 solution (0.010m): Attended by melting 0.17 ml of H_2O_2 200 with 200 ml of distilled water.

It was took 0.5 ml of the filtrate and added 1 ml of Potassium Iodide solution and 0.5 ml of K_2HPO_4 regulator solution, the test tubes were placed with the optical spectrometer device and at wavelength 390 nm, after which he used the standard curve to calculate the amount of H_2O_2 taking 0.5 ml of the solution Diluted (0.5, 1, 3, 7, 9) µmol.ml^{-1} was added to the reaction material and measured by spectrophotometer and at wavelength 390 nm after which the standard curve of H_2O_2 was drawn and plant content from H_2O_2 was estimated according to Velikova *et al.* (2000).

Statistical analysis: The data were analyzed statistically by RCBD method to study the effect of different factors in the traits studied using the lowest LSD significant difference and at the probability level of 0.05 (SAS, 2012).

Result and Discussion

Table 1 results showed a significant decrease in the mean characteristic of plant height when treated with hydrogen peroxide solution, particularly concentration 20 mmol.L^{-1}, which gave the lowest mean of characteristic 20.25 cm and a significant decrease of 19.54% compared to the control treatment of 25.17% due to the stimulation of reactive oxygen species with H_2O_2, which have a negative effect on the process of cell division and thus prolongation and therefore on plant height and growth (Qu *et al.*, 2010).

The results of the table also indicated a significant increase in the mean characteristic when treating the plant with vitamin E, particularly concentrations 200 and 250 mg.L^{-1}, which were given the highest mean of characteristic 24.33 cm and a percentage increase of 25 15% compared to the control treatment of 19.44 cm, which is due to the effective role of vitamin E in protecting cellular parts from oxidative damage, particularly the fatty part of the cell membrane, maintaining membrane stability and cell fullness (Inoue *et al.*, 2011). This vitamin also

has a role to play in stimulating the synthesis of plant hormones, including auxins responsible for cell elongation, affecting cell division and expansion, leading to increased plant height (Cha *et al*., 2015).

The interaction between the two experimental factors also has a significant effect on the mean characteristic, particularly at concentration 0 mmol.L^{-1} of hydrogen peroxide and 250 mg.L^{-1} vitamin E, with the highest interference value of 19.00 cm compared to the lowest interference value of 18.00 cm at concentration 20 mmol.L^{-1} of hydrogen peroxide and zero mg.L^{-1}of vitamin E.

Table 1. The effect of spraying with hydrogen peroxide and vitamin E and their interaction in the height of the chickpeas plant.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	21.00	25.00	25.67	29.00	25.17
15	19.33	21.67	23.33	25.00	22.33
20	18.00	20.00	24.00	19.00	20.25
Mean Vitamin E	19.44	22.33	24.33	24.33	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	1.09	1.26	2.18		

Table 2 results indicated a significant decrease in the mean characteristic of the number of plant leaves when treating the plant with hydrogen peroxide solution, particularly concentration 20 mmol.L^{-1}, which gave the lowest mean of characteristic 15.08 leaves.plant^{-1} and a percentage decrease of 12.39% compared to the control treatment of 17.42 leaves.plant^{-1}. This is due to the fact that hydrogen peroxide when present with certain concentrations in the plant may attack cellular parts and reduce plant resistance to damage caused by environmental stresses exposed to it through its effect In the effectiveness and activity of some enzymatic and non-enzymatic antioxidants (Mohammed and Al-Ubaidy, 2020).The effect on the defense mechanisms within the plant with increased exposure to reactive oxygen species (ROS) elements of hydrogen peroxide may have a negative effect on cell growth, elongation and divisions, causing a decrease in the number of plant leaves (Que*et al*., 2010).

The results of the table also indicated a significant increase in the mean characteristic when treating the plant with vitamin E, particularly concentration 250 mg.L^{-1}, which gave the highest mean of characteristic 17.67 leaves.plant^{-1} and a percentage increase of 22.36% compared to the control treatment of 14.44 leaf.plant^{-1} for the effective role of vitamin E in regulating cellular metabolism and free radical capture through its interaction with compounds resulting from oxidation as well as its role in regulating oxidation and reduction processes, improving plant growth and maintaining the efficiency of the chromosome system (Al-Juboori and Mohammed , 2021). This is in line with Rahmawati and Damanik (2018) on the soybean plant.

The interaction between the two experimental factors also had a significant effect on the mean characteristic, giving the concentration 0 mmol.L^{-1} of hydrogen peroxide and 250 mg.L^{-1} of vitamin E the highest average of 19.00 leaf. plant^{-1} compared to the lowest average grade was 12.00 leaf.plant-1 when concentrating 20 mmol.L^{-1} of hydrogen peroxide and 0 mg.L^{-1} of vitamin E.

Table 2. The effect of spraying hydrogen peroxide and vitamin E and their interaction in the number of leaves of chickpeas.

H_2O_2 (mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	16.00	16.67	18.00	19.00	17.42
15	15.33	15.00	17.00	17.00	16.08
20	12.00	14.33	17.00	17.00	15.08
Mean Vitamin E	14.44	15.33	17.33	17.67	
L.S.D (0.05)	H_2O_2	VitaminE	Interaction		
	0.73	0.84	1.45		

Table 3 results indicated a significant decrease in the mean number of branches when treated with hydrogen peroxide, particularly concentration 20 mmol.L^{-1}, which gave the lowest mean of characteristic 5.50 branches.plant^{-1} compared to the control of 6.92 branches.plant^{-1} due to the stress conditions exposed to the plant with the presence of H_2O_2 and inhibition of the defensive mechanism in the enzymatic and non-enzymatic plant cell with increased oxidative damage by increasing ROS elements with membrane fat oxidation (Ben Amor *et al*., 2007). All of this has a negative effect on cell growth and divisions and therefore the number of branches. The table also indicated a moral increase in the mean characteristic when treating the plant with vitamin E, particularly concentrations 200, 250 mg.L^{-1}, which were given the highest average of 6.89 branches.plant^{-1} and a percentage increase of 40.89 % compared to control of 4.89 branches.plant^{-1} for the role of vitamin E in the acquisition of single

oxygen root and prevent the oxidation of cellular membrane fat, regulate oxidation, reduction and stimulation of the construction of plant growth hormones, regulate cellular metabolism processes and protect the light system from damage, thus maintaining the effectiveness of Installation of chloroplasts membranes (Zhirong *et al*., 2012).
This reflects positively on the number of plant branches. The table also showed that there was no significant effect of interaction between the two eperimental factors in the mean of this characteristic.

Table 3. The effect of spraying with hydrogen peroxide and vitamin E and their interaction in the number of branches of chickpeas plant.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	5.33	7.00	7.67	7.67	6.92
15	5.00	5.00	6.00	7.00	5.75
20	4.33	4.67	7.00	6.00	5.50
Mean vitamin E	4.89	5.56	6.89	6.89	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	0.67	0.77	N.S		

Table 4 results indicated that there was no significant effect on the meanstem diameter characteristic when treating the plant with different concentrations of hydrogen peroxide as well as vitamin E had no significant effect on the mean characteristic and the interaction between the two experimental factors also had no significant effect.

Table 4. The effect of spraying with hydrogen peroxide and vitamin E and their interaction in the diameter of the stem (mm) of the chickpeas plant.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	0.167	0.200	0.267	0.267	0.225
15	0.133	0.200	0.233	0.233	0.200
20	0.167	0.200	0.133	0.167	0.158
Mean vitamin E	0.156	0.167	0.211	0.222	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	N.S	N.S	N.S		

Table 5 results showed a significant increase in the mean effectiveness of the catalase enzyme when treating the plant with increased concentrations of hydrogen peroxide, particularly concentration 20 mmol.L^{-1}, which gave the highest mean of characteristic 44.40 units.ml^{-1} and a percentage increase of 35.20% compared to the control treatment of 32.84 units.ml^{-1} because the CAT enzyme is a defensive enzyme that protects cellular parts as an anti-oxidant agent, including super oxidized species, molecular oxygen and H_2O_2, and reaches a more stable state of the plant cell, as well as the role of this enzyme in removing the toxic effect of hydrogen peroxide by converting it to H_2O and O_2 (Baiano and Nobile, 2015).
This is in line with the findings of Al-Hayani (2015) on the mung plant. The table also indicated a significant increase in the mean characteristic when treating the plant with vitamin E, particularly concentration 250 mg.L^{-1}, which gave the highest average grade of 49.56 units.ml^{-1} with a percentage increase of 163.61% compared to the control treatment of 18.80 units.ml^{-1} for the effective role of vitamin E in eliminating the harmful effect of reactive oxygen species within the plant cell and preventing oxidation of the fatty part of the cellular membrane, maintaining the stability of cellular membranes and regulating the process of cellular metabolism through its role in the synthesis of phenolic compounds, which increases the construction of enzymatic antioxidants, including CAT enzyme (Shao *et al.*, 2008). This is in line with the findings of the Al-Kremawy (2019) on the wheat plant.
The interaction between the two experimental factors also had a significant effect, with the highest interaction of 60.32 units.ml^{-1} at concentration of 20 mmol.L^{-1} hydrogen peroxide and 250 mg.L^{-1} of vitamin E, while the lowest interaction value was 15.00 units.ml^{-1} at concentration 15 mmol.L^{-1} hydrogen peroxide and 0 mg.L^{-1} of vitamin E.

Table 5. The effect of hydrogen peroxide and vitamin E spraying and their interaction in the effectiveness of the catalase enzyme of chickpeas.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	17.70	41.81	43.61	28.26	32.84
15	15.00	31.10	42.15	60.10	37.09
20	23.69	51.19	42.41	60.32	44.40
Mean vitamin E	18.80	41.37	42.72	49.56	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	2.41	2.79	4.83		

Table 6 results showed a significant increase in the mean effectiveness of peroxidase when treating a

plant with hydrogen peroxide, particularly concentration 20 mmol.L^{-1}, which gave the highest mean of characteristic 57.92 units.ml^{-1} and a percentage increase of 21.52% compared to the control treatment of 47.66 units.ml^{-1}. This may be due to the fact that hydrogen peroxide has a role in regulating gene expression within the plant cell, further developing the cell's defense system of enzymatic antioxidants, including peroxidase, as well as its role in sending chemical signals to regulate plant growth and development and control of the anti-oxidant enzymatic defense system (Foyer and Noctor, 2000), this result in line with Al-Ghazi (2013) on the maize plant.

The table also showed a significant increase from the mean characteristic when treating the plant with vitamin E, particularly concentration 250 mg.L^{-1}, which gave the highest mean of characteristic 71.36 units.ml^{-1} and a percentage increase of 236.6% compared to the control treatment of 71.36 units.ml^{-1} and a percentage increase of 236.6% compared to the control treatment of 21.20 ml^{-1} units for the role of this vitamin in protecting cellular organelles from oxidation by providing the defense enzyme mechanism, increasing membrane stability, organizing cellular metabolic events and preventing the external oxidation of membrane fat, which increases the protection and support of cellular organs through the mechanism enzyme peroxidase (Shao *et al*., 2008).This is consistent with what Al-Kremawy(2019) on the wheat plant.

The table also showed a significant effect of interaction between the experimental factors from the mean of this characteristic, with the highest interference value of 83.00 units.ml^{-1} at concentration 20 mmol.L^{-1} hydrogen peroxide and 250 mg.L^{-1} of vitamin E is 16.11 units.ml^{-1} at concentration 20 mmol.L^{-1} hydrogen peroxide and 0 mg.L^{-1} vitamin E.

Table 6. The effect of spraying with hydrogen peroxide and vitamin E and their interaction in the effectiveness of the peroxidase enzyme of chickpeas

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	28.45	30.45	63.61	68.11	47.66
15	19.04	39.57	72.54	62.96	48.53
20	16.11	60.74	71.81	83.00	57.92
Mean vitamin E	21.20	43.59	69.32	71.36	
L.S.D (0.05)	H_2O_2	VitaminE	Interaction		
	1.11	1.28	2.22		

Table 7 results showed a significant increase in the mean content of proline acid for chickpeas when treated with hydrogen peroxide, particularly concentration 20 mmol.L^{-1}, which gave the highest mean of characteristic 75.84 µg.g^{-1} soft weight and a percentage of 34.85% compared to the control treatment of 56.24 µg.g^{-1} soft weight. This may be due to the role of H_2O_2 in inducing genes responsible for the Pyrroline carboxylate synthesis, which has a role in the synthesis of proline, as well as the fact that proline is a plant's defensive compound against oxidized roots, including hydroxyl root and single oxygen through its work in inhibiting cellular membrane oxidation and preventing protein demolition (Turkan and Demiral, 2009) in line with the findings of the Al-Ghazi (2013) on the maize plant.

The table also showed a significant increase in the mean characteristic when treating the plant with vitamin E, particularly concentration 250 mg.L^{-1}, which gave the highest mean of characteristic 73.51 µg.g^{-1} soft weight and 30.03% increase in control compared to 56.53 µg.g^{-1} soft weight, because of this vitamin acts as an antioxidant and supports the plant's defense mechanism against stressed elements and contributes to the induction of enzymatic and non-enzymatic antioxidants, including proline acid, as well as its role in increasing plant absorption of nutrients, including nitrogen necessary in the synthesis of amino acids, including proline acid (Farouk, 2011), is in line with Sadiq *et al*. (2017) on the mung plant.

The interaction between the two experimental factors is significant, with the highest interaction value of 82.42 µg.g^{-1} soft weight at concentration 20 mmol. L^{-1} of hydrogen peroxide and 0 mg.L^{-1} of vitamin E, 38.44 µg.g^{-1}soft weight less value at concentrations 15 mmol.L^{-1} and 0 mg.L^{-1} vitamin E.

Table 7. The effect of spraying with hydrogen peroxide and vitamin E and their interaction with the content of proline acid of chickpeas.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	48.74	52.79	58.46	64.96	56.24
15	38.44	52.74	57.14	77.51	56.46
20	82.40	72.11	70.79	78.07	
Mean vitamin E	56.53	59.21	62.13	73.51	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	2.75	3.18	5.51		

Table 8 results indicated a significant increase in the mean plant content of hydrogen peroxide when treated with H_2O_2, particularly concentration 20 mmol.L^{-1}, which gave the highest average of 8.47 µmol.g^{-1} soft weight and a percentage increase of 37.50% compared to control of 6.16 µmol.g^{-1}soft weight. This is due to the exposure of the plant to hydrogen peroxide stress, which has increased the level of hydrogen peroxide within the plant, as well as the role of H_2O_2 in regulating gene expression by releasing chemical signals that increase the plant's tolerance to stressful conditions, thereby increasing cell stability and stability (Nadal *et al*., 2011). This is in line with Al-Hayani (2015) on the mung plant.

The table also showed a significant increase in the mean characteristic when treating the plant with vitamin E, particularly concentration 250 mg.L^{-1}, which gave the highest average grade of 8.26 µmol.g^{-1} soft weight and a percentage increase of 24.2% compared to control of 6.65 µmol.g^{-1} soft weight because of vitamin E supports the defense mechanism within the cell and compensates for destructive cells as a non-enzymatic antioxidant induces the process of synthesis non-enzymatic antioxidants and plant content of H_2O_2 that increases the stability and constancy of the cellular membrane and regulates metabolic processes in the plant cell (Fritsche *et al*., 2017).As well asthe interaction between the two experimental factors was also significant, with the highest interaction value of 8.89 µmol.g^{-1} soft weight at concentration of 20 mmol.L^{-1} hydrogen peroxidase and 0 mg.L^{-1} vitamin E, while the lowest interaction value was 3.18 µmol.g^{-1} soft weight in control treatment.

Table 8. The effect of hydrogen peroxide and vitamin E spraying and their interaction with the content of hydrogen peroxide of chickpeas.

H_2O_2(mm.L^{-1})	Vitamin E concentrations (mg.L^{-1})				Mean H_2O_2
	0	150	200	250	
0	3.18	6.20	7.36	7.90	6.16
15	7.88	7.10	6.47	8.03	7.37
20	8.89	8.31	7.81	8.85	8.47
Mean vitamin E	6.65	7.20	7.21	8.26	
L.S.D (0.05)	H_2O_2	Vitamin E	Interaction		
	0.48	0.55	0.95		

Conclusion

The plant's exposure to hydrogen peroxide has reduced the plant's height , number of leaves and branches while raised the plant's content of catalase and peroxidase enzyme, proline and hydrogen peroxide especially at the concentration 20 mm.L^{-1}. While foliar spraying with vitamin E raised plant'sheight , number of leaves and branches , enzymatic and non-enzymatic antioxidant content to reduce the damage caused by hydrogen peroxide.

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