Plant Archives Vol. 20 Supplement 1, 2020 pp. 2569-2572 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SALTS STRESS AND VITAMIN C ON SOME GROWTH CHARACTERISTIC AND YIELD OF COWPEA *VIGNA SINENSIS*

Eman H. Al-Hayany

Department of Biology, College of Education for Pure Science (Ibn Al-Haitham),
University of Baghdad, Baghdad, Iraq

Abstract

A biological experiment was conducted in the Botanical Garden of the Department of Biology, College of Education of Pure Sciences (Ibn Al-Haitham) for the growth season 2017-2018 with the aim of studying the effect of salts stress and vitamin C in some of the characteristics of growth and the yield of the growth of the cowpea plant. The results showed that salts stress caused a decrease in dry weight, mean pod weight and number of seeds. pod^{-1} compared to the control treatment while treatment with Vitamin C caused increase in the studied characteristics.

***Key words**:* Cowpea plant, Vitamin C, NaCl salt solution.

Introduction

Cowpeas are one of the oldest crops planted by man and used as a source of food and believed to have been used since the stone age. The origin of the cowpea is not known exactly and there is much speculation about its origin, some researchers believe that Asia is the home of the cowpeas and the other part believes that South America is the origin of the cowpeas.

The cowpeas are a herbal and annual plant with a strong taproot and contains many branches in the area below the surface of the soil. These root branches also contain a root nodes that fixation of atmospheric nitrogen and the system of side roots and root nodes is formed near the surface of the soil and the nature of plant growth varies by variety, some are short stolon and others long shrubs. The seeds of the cowpeas contain a percentage of protein ranging from 19-26% and the varieties with a high percentage of protein contain a high percentage of thiamin. However, like other legumes seed crops, the cowpeas have a low sulphur-containing amino acid content, Methionin and cystine, ranging from 0.35-0.90% in most varieties (Ali *et al.*, 1999).

Salinity is one of the most important non-biotic stresses specific to plant growth and productivity (Kan and panda, 2008). As well as there is evidence of the effect of salts on photosynthesis enzymes, chlorophyll and carotenoids (Stepin and Klobus, 2006) and that exposure of plants to inappropriate environmental conditions such as salinity can increase the production of reactive oxygen species (ROS) such as OH^- and hydrogen peroxide H_2O_2 (Sairam and Tyagi, 2004) where these roots destroy chlorophyll, protein and nucleic acids (Franked, 1985) and plants throw away of those roots using enzyme and non-enzymatic antioxidant systems (Chelikani *et al.*, 2004).

Vitamins are uncomplicated organic compounds needed by the plant in small amounts and are necessary for the safety of growth and differ from carbohydrates, fats and proteins in that they are not used in the construction of tissues or power generation but are essential in the majority of metabolic processes as well as they are necessary to make the metabolism process normal, also to ensure the action of many enzymes as the addition of vitamins to the plant leads to stimulate growth by stimulating some enzymatic reactions (Kefelie, 1981). Ascorbic acid is a primary antioxidant which removes the free root directly by giving electron or hydrogen atom and secondary antioxidant, which prevents the emergence of oxidative stress by removing the oxidative catalyst factor. It also plays an important role in the synthesis of vitamin E in membranes and protein fats (Foyer and Noctor, 2005) and vitamin C is the primary

***Author for correspondence :** E-mail: emanhh1973@gmail.com

chlorplast, mytocondria and peroxisome and is considered a inhibitory force for cell membrane oxidation (Quan *et al.*, 2008).

Materials and Methods

A biological experiment was conducted using pots their capacity 5 kg and their diameter 30cm in the botanical garden of the Department of Biology, College of Education for Pure Sciences (Ibn Al-Haitham) for the growth season 2017-2018. With three creases for each transaction, ten seeds were planted in each seed on 26 March 2018.

The cowpeas were obtained from the local markets and the experiment was designed on the basis of the complete random design R.C.B.D. with three repeats for each transaction. Ten seeds were planted in each seed on 26/3/2018 and the salts concentrations were attended (0, 100, 150)m mole. The plants were irrigated with salts solution in stage 4-6 leaves then sprayed the plants after two weeks of irrigating with salts solution and vitamin C at concentrations (0.50, 100) mg.L^{-1} in the early morning until complete wetness and the plants not treated were sprayed with distilled water. The plants were harvested after the maturity of the pods on 25/5/2018.

The most important characteristics studied are:

1. The height of the plant (cm): according to the height of the plant from the base of the plant to the highest point in the stem at the harvest by taking three plants from each transaction randomly and then according to the mean using a graded ruler.
2. Dry weight (g): it was calculated by taking three plants randomly from each transaction and dried with oven at a temperature of 65°C until the weight was stable and the weight was calculated using a sensitive balance.
3. The weight of the pods (gm): it was calculated according to the weight of the pod for three pods taken randomly from each transaction and then taken the mean for it.
4. The number of seeds.Pod^{-1}: it was calculated according to the number of seeds per pod for three pods of each transaction and then according to the mean.

Statistical analysis

The analysis of the results was carried out according to the design used and with three repeats and compared means according to L.S.D. test (Litte and Hills, 1987).

Results and Discussion

The results of table 1 showed that the height of the plant increased significantly when the cowpea plant was treated with vitamin C and the concentration 150 mg.L^{-1} was gave the highest mean plant height was 31.11 cm compared to the treatment of control and may be due to the role of vitamin C in the process of photosynthesis and increase its yield being a non-enzymatic antioxidant and a cofactor for photosynthesis enzymes to synthesize many important hormones inside the plant (Gallie, 2013).

Table 1: The effect of salts stress and vitamin C in the height of the plant (cm).

NaCl concentration mmol.	Vitamin C concentration mg.L^{-1}			Mean
	0	50	100	
0	23.00	31.33	33.00	29.11
100	29.00	29.00	30.00	29.33
150	29.00	33.00	25.00	29.00
LSD 0.05 NaCl × Vitamin C	1.65			LSD 0.05 NaCl
Mean	27.00	31.11	29.33	N.S
LSD 0.05 Vitamin C	0.95			

The role of vitamin C is similar to growth regulators by providing protection to plant cells and regulating the growth and division of those cells (Zhang, 2013) as the results of the table indicated the existence of significant differences as a result of the interaction between the experimental factors. The concentration 150 mmol of NaCl and 50 mg.L^{-1} of vitamin C were gives a higher value of interaction which was 33.00 cm compared to the control transaction.

The results of the table 2, indicate that the dry weight decreased significantly and the concentration of 100m mol of NaCl gave the lowest mean of this characteristic of 3.99 gm and may be due to the fact that the salt stress directly or indirectly inhibits the cell division (Manchanda and Garge, 2008) as well as that salinity affects the form of plant cells, the appearance of the plant, the rate of respiration, carbonization and productivity of the dry material in the unit of the area. In general, the cells of the root, leaves and stems of the plant were decreased when it grows in the salt medium (Elashhookie, 2013) or maybe

Table 2: The effect of salts stress and vitamin C in dry weight (gm).

NaCl concentration mmol.	Vitamin C concentration mg.L^{-1}			Mean
	0	50	100	
0	5.36	8.69	4.47	6.17
100	3.45	3.66	4.85	3.99
150	4.57	7.95	4.68	5.73
LSD 0.05 NaCl × Vitamin C	1.30			LSD 0.05 NaCl
Mean	4.46	6.76	4.67	0.75
LSD 0.05 Vitamin C	0.75			

Table 3: The effect of salts stress and vitamin C in the weight of the pod (gm).

NaCl concentration mmol.	Vitamin C concentration mg.L^{-1}			Mean
	0	50	100	
0	1.15	2.00	1.35	1.50
100	0.71	1.17	1.60	1.16
150	1.04	1.45	1.91	1.46
LSD 0.05 NaCl × Vitamin C	0.51			LSD 0.05 NaCl
Mean	0.97	1.54	1.62	0.29
LSD 0.05 Vitamin C	0.29			

the decrease of dry weight of the vegetative total due to the decrease of water stress due to salts and imbalance caused by interacting between salt toxicity as well as ROS production(Khan *et al.*, 2010).

Also note from the results of the table there is a significant increase in the dry weight of the plant characteristic by increasing the concentration of vitamin C from 0 to 50 mg.L^{-1} which has given the highest mean dry weight of the plant reached to 6.76 gm compared to the treatment of control. The reason for the increase in dry weight when the vitamin C is added to the leaves may be due to its effect on the growth of the roots and the formation of a dense root total capable of absorbing nutrients from the soil well, which has positively reflected on the increase of dry matter in the plant (Zhwan and Khursheed, 2014).

The table also showed that there were significant differences as a result of the interaction between the experimental factors and the highest value of interaction at the concentration 150 ml of NaCl and 50 mg of vitamin C was 7.95 gm in compared of treatment of control.

The results of the table 3 showed a significant decrease in the mean weight of the pod, as the weight decreased when the concentration of NaCl increased from 0 to 150 mmol, the concentration 100 mg.L^{-1} was gave the lowest mean for this characteristic (1.16 gm) compared to the treatment of control and possibly due to the fact that salinity is one of the most important factors of abiotic stresses limited for growth and productivity affect the pressure stress of the leaf (Gamman *et al.,* 2007). It also reduces yield and increases the shoot: root ratio and reduce the size of the leaf and thus reduce grain production (Singh and Chatrath, 2001).

The table also indicated a significant increase in the mean weight of the pod (gm). As well as the weight of the pod increased when the concentration of vitamin C increased from 0 to 100 mg.L^{-1} that has been given the highest mean of 1.62 gm and may be due to the effects of vitamin C in the plant as it increases the rate of vegetative and root growth of the plant through its effect on the height of the stem, the number of leaves and their area and increase chlorophyll content. moreover it acts as a regulator for oxidative and reduction the protoplasm, a catalyst for photosynthesis and a catalyst for growth and cellular division of vegetative parts and its development also has a role in protecting plant cells from the effects of stress and increasing plant absorption of nutrients NPK (EL-Gabas, 2006; Farouk, 2010). It also has a positive role in the yield and its components of pods and seeds and increase their weight and turgidity (Osmman *et al*., 2014). The table showed the existence of a significant interaction between the experimental factors, the concentration 150 ml of salt and 100 mg.L^{-1} of vitamin C were gave the highest value of interaction amounted to 1.91 g compared to the treatment of control.

Table 4 was showed a significant decrease in the number of seeds per pod. The number of seeds in the pod decreases by increasing NaCl concentration from 0 to 150 mmol and the lowest mean at concentration 100 mmol was 5.17 seed.pod^{-1}. This may be due to the fact that salinity directly or indirectly inhibits the cellular division (Manchanda and Garge, 2008) and reduces the yield and increases the ratio of shoot: root ratio and reduces the size of the leaf and subsequently reduces the lack of grain production (Singh and Chatrath, 2001).

The table also showed a significant increase in the number of seeds on a pod when the concentration of vitamin C increased from 0 to 100 mg.L^{-1}. The concentration 50 mg.L^{-1} was gave the highest mean of 6.67 seed.pod^{-1}. This may be due to the fact that vitamin C increases the cellular growth of the plant, increases the density of the roots and their extension in the soil, thus increasing their absorption of the nutrients necessary in the photosynthesis process, which increases the amount of material accumulated in the plant (Conklin, 2001).

This is reflected positively in the turgidity of the seeds and the increase in their number as a result of the transfer

Table 4: The effect of salts stress and vitamin C in the number of seeds.pod^{-1}.

NaCl concentration mmol.	Vitamin C concentration mg.L^{-1}			Mean
	0	50	100	
0	4.00	7.50	7.50	6.33
100	5.50	6.00	4.00	5.17
150	4.00	6.50	6.00	5.50
LSD 0.05 NaCl × Vitamin C	1.14			LSD 0.05 NaCl
Mean	4.50	6.67	5.83	0.31
LSD 0.05 Vitamin C	031			

of carbohydrates from the source to the seed estuary (Akram *et al*., 2017). The table showed the existence of a significant interaction between the experimental factors and the highest value of interaction at the concentration 0 mmol of NaCl and 100 mg.L^{-1} of vitamin C was 7.50 seed.pod^{-1} compared to the control treatment.

The conclusion of this study is that the salt stress caused decrease in the studied characteristics meanwhile Vitamin C Caused increase in the studied characteristics.

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