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Effect of Ascorbic and Salicylic Acids on Faba Bean (*Vicia faba* L.) Productivity under Calcareous Soils Conditions

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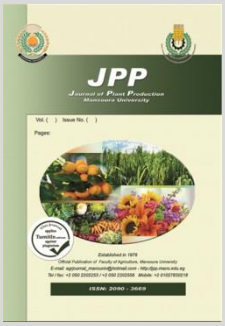

ABSTRACT

The field work was conducted at the Experimental Farm of Desert Research Center at Mariout during two winter successive seasons, 2017/2018 and 2018/2019, to study assess response to seed soaking with ascorbic acid (AS), (0, 25, 50 and 75 ppm) and foliar spraying with salicylic acid (SA) at (0, 50, 100 and 150 ppm) on yield and yield components and seed chemical composition on faba bean cv. (Mariout-2). Obtained results in this study clearly proved the role of AS and SA in increasing calcareous of faba bean plants. The highest rates from (AS) was increased significantly yield, yield components and nitrogen content in both growing seasons. Either seed soaking in AS, (25 ppm) or foliar application of SA (50 ppm) exhibited significant increments in all yield parameters compared with untreated control. Moreover, rate of AS treatment in seed soaking at (50 ppm) and foliar spray with SA at 100 ppm induced significant increases in the protein content of faba bean seed compared with the control groups. The magnitude of increments was pronounced in response to 75 ppm seed soaking of ascorbic acid and 150 ppm of SA as a foliar spray on faba bean cv. (Mariout- 2), which led to positive changes in all studied parameters.

***Keywords*:** Faba bean, Ascorbic acid, Salicylic acid, Productivity, Calcareous soils

INTRODUCTION

Faba bean (*Vicia faba* L.) is one of the most important leguminous crops in Egypt and beneficial for human nutrition perspectives because they are good source of energy, protein and dietary fiber Ma *et al*. (2005). Seed vigorous a very good indicator of the potential field performance followed by the field planting value. it is a major source of protein for human food and animal feeding and fits well to the low fertility soils of the this region and New reclaimed lands as a Mariout region which located in northern Egypt near the city of Alexandria Egypt, which was considered the calcareous soils constitute about 25-30% of the total area according to Ministry of Agriculture estimation. Calcareous soils have $CaCO_3$ in amount and forms that cause adverse effects to plant growth. Forms are including powders, nodules and crusts. According to *FAO* (1917), Tanganlli (2011), calcareous soils are relatively widespread dry regions; their potential productivity is high where adequate water and nutrients can be supplied. High calcium saturation tends to keep them in well-aggregated form and favorable physical condition. However, these soils may contain impermeable hard pans (petricalcie horizon which decrease the rhizosphere root zone of the soil). Breaking many pans by deep ploughing followed by establishment of an efficient drainage system is usually done to reclaim such soils. Furrow irrigation is usually preferred to basin irrigation for calcareous soils. On undulating lands, contour and sprinkler or drip irrigation are generally practiced. Calcareous soils generally have low organic matter content and lack nitrogen. Cultivation it presents many challenges, such as low germination rate, low water holding capacity, poor structure, low organic matter and clay content, low availability of nutrients and micronutrients,

Increasing the production of faba bean yield with high quality could be achieved be using : ascorbic acid and salicylic acid, It has been reported that presoaking of seed with optimal concentration of plant hormones and growth regulators have been used intensively for increasing salt-tolerance of plants (Plaut *et al*., 2013). Ascorbic acid (AS) is regarded as one of the most effective growth regulators against abiotic stresses especially high salinity (Batool *el al*., 2012). Azooz *et al*. (2013) showed that application of ascorbic acid through seed soaking enhanced plants growth by increasing germination percentage, root and shoot fresh and dry weights. They found that pretreatment with AS reduced salt induced adverse effects and resulted in a significant increment of growth and yield. Azooz and Al-Fredan (2009), noted that, seed soaking in ascorbic acid and spraying salicylic acid with different concentration (0, 10, and 20) improved the yield and its components. Younis *et al*., (2010) found that, ascorbic acid improved the growth of plants, seed germination and fresh weight of the vegetative and root groups.

Salicylic acid (SA) acts as potential non-enzymatic antioxidant as well as plant growth regulator some physiological processes including photosynthesis. El-Shraiy Adwi (2004), reported that acetyl salicylic acid promoted potato plant growth, plant height, and the number of leaves. Hegazi and El-Shraiy (2007), found that foliar application of salicylic acid had a positive effect on yield and vegetative parameters (plant height, leaves number, shoots and roots fresh and dry weights of bean. It also reduces Na+ and accumulation in plant tissues, improving the oxidative protection (Gunes *et al*., 2007). Therefore, SA can reduce the harmful effects of salt stress on plants by inducing their salt-tolerance (Semida *et al*., 2014). The protective effects of SA include up regulation of anti-stress processes and the recovery of growth processes after the stress is over (Sharikova *et al*., 2003). The aim of the present study was the effect of seed soaking with ascorbic acid and foliar spraying with salicylic acid on yield and yield components and seed protein content of faba bean (cv. Mariout-2) under calcareous soils conditions.

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MATERIALS AND METHODS

The field work was conducted at the Experimental Farm of Desert Research Center at Mariout during two winter successive seasons, 2017/2018 and 2018/2019. Each experiment was arranged in split plot design with three replications. Cultivar of faba bean, *(Vica faba* L.,) cv. (Mariout, 2) was used which obtained from the Desert Research Center, El-Matareya, Egypt. The seeds were pretreated with ascorbic acid by soaking for 4 hours. at open air at 0, 25, 50 or 75 ppm, and redried to original weight nearly with forced air under shade (Sundstrom *et al*., 1987), then successively washed and treated with *Rhizobium melitoti* (Okadeen), suspension before sowing for N_2-fixation (Andrew 1976). Four rates (every rate dissolved in 200 L water / fed.) of salicylic acid used as foliar spraying treatments (0, 50, 100 and 150 ppm) were applied after 60 days from sowing. Spraying treatment was allocated to main plots, while the seed soaking ones were allocated to sub-plot.

The soil is highly calcareous, loamy sand in texture with moderately salt content, pH 8.60, $CaCO_3$ 11.38 %, Available N (344.4 mg /kg), Available P (3.3 mg /kg), Available K (702.4 mg /kg) Soil electric conductivity (1.2 ds/m) and 990 ppm saline water used for surface irrigation. Plot area experiment was 3 x 3.5m size and each one containing 5 ridges, (width 60 cm and length 3.5 m), the distance between plants was 20 cm and three seeds $hill^{-1}$. Seeds were sown at rate of 50 kg / fed, on October, 29th and 7th on November in 2017 and 2018 seasons, respectively. Phosphorus levels were added before planting in the form of calcium super phosphate (15.5% P2O5). Four equal doses from ammonium nitrate (33.5 % N) (50 kg/fed) were added i.e. four weeks from planting date and every two weeks. When the plants reached 45 days from sowing date, Potassium sulfate (K2SO4 48 %) was applied. Other standard cultural practices during the growing period were adopted. When the pods mature were harvested by hand in both seasons. Recommended package of practices were followed according to Ministry of Agriculture and Land Reclamation recommendations. At harvest time, at 16th March 2018 and 3rd April 2019, parameters which taken at random from each plot by eight guarded plants with respect to yield and its attributes representing the three replications to determine i.e. plant height(cm), number of branches plant-1, number of pods plant-1, number of seed pods-1 , 100 seed weight (g), yield pods plant (g), seed yield plant-1 (g) seed yield (kg/fed.) and from 1m2 to determine biological yield (kg/fed), and protein yield (kg/fed.). Whereas, harvest index (HI) was calculated by the following formula: (Seed yield) / (biological yield) X 100. In addition to the control were subjected to chemical analysis; Percentage of nitrogen was determined by using the Micro-Kjeldahl method (A.O.A.C. 1990**);** seed protein concentration was calculated by (% N X 6.25). Statistically analysis and comparisons were done using LSD test at 5 % probability level (Snedecor and Cochran 1990).

RESULTS AND DISCUSSION

Yield and yield components and protein content

1- Effect of seed soaking

Pretreatment of seeds with ascorbic acid had essentially effect on yield, its components and protein content Table (1). An ascorbic acid only treatment of seed soaking from 25 up to 75 ppm led to increasing significantly all parameters; plant height(cm), number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seed $pods^{-1}$, 100 seed weight (g), yield pods plant (g), seed yield $plant^{-1}$ (g) seed yield (kg/fed.) except harvest index and protein content/yield were obtained with AS 25 and 50 ppm respectively in both growing seasons. Using the highest rate of ascorbic acid (AS 75 ppm) as comparing with control led to increasing percentage of attribute with: (1.21 and 0.25) for plant height/cm, (4.20 and 4.18 %) for number of branches/ plant, (16.71 and 4.50 %) for number of pods /plant, (2.03 and 1.68 %) for number of seed/ pods, (1.10 and 0.74 %) for 100 seed weight /g, (3.10 and 1.96 %) for weight of pods/ plant (g), (4.19 and 2.38 %) for weight of seeds /plant (g), (3.29 and 2.70 %) for seed yield (Kg/fed), and, (3.35 and 3.94 %) for biological yield (Kg/fed), in both seasons. Maximum harvest index and protein content/yield were obtained with AS 25 and 50 ppm with increasing percentage as comparing with control treatment were (0.28 and 0.64),(1.01 and 4.34) and (4.16 and 6.36) respectively in both growing seasons. These results are in agreement with the reports of Rasheed, (2018), who pointed out ascorbic acid significant increased (No. of pods /plant, No. of seed/ pod, seed weight (g), weight of 100 seed (g), and total seed yield ton /donum). Soaking faba bean seeds in ascorbic acid led to increase vegetative growth, number of branches , number of plant branches this increase may be due to the role of ascorbic acid in breaking capillary sovereignty by overcoming the inhibitory effect of auxin produced in the developing top of the stem Smirnoff and Wheeler, (2000).

Table 1. Effect of ascorbic acid on faba bean yield, its components and protein content in both growing seasons 2017/2018 and 2018/2019 under calcareous soils conditions.

Ascorbic (AS)	Plant height (cm)	No. of branches/ plant	No. of pods/ Plant	No. of seed / pods	100 seed weight (g)	Yield				Harvest index (%)	Protein	
						pods (g/plant	Seed (g/plant	Seed (kg/fed	Biological (kg /fed)		content (%)	Yield kg/fed
1st season												
Without	85.84	3.81	14.00	2.95	75.21	46.52	33.42	1149.2	2764.7	41.53	27.40	315.24
25	86.40	3.90	15.48	2.97	75.40	47.33	34.08	1177.5	2826.8	41.65	27.48	323.53
50	86.75	3.92	16.07	2.99	75.70	47.37	34.39	1181.8	2837.9	41.64	27.68	328.94
75	86.90	3.97	16.34	3.01	76.04	47.96	34.82	1187.7	2857.4	41.57	27.58	325.12
L S D at 5%	0.49	0.15	1.22	0.24	0.79	1.23	1.21	9.02	25.15	0.12	0.19	1.42
2nd season												
Without	89.20	3.83	16.91	2.97	80.09	47.49	35.67	1220.6	2904.9	41.74	26.89	328.23
25	89.35	3.84	17.39	3.00	80.39	48.10	36.23	1242.4	2977.1	42.01	27.41	340.41
50	89.38	3.96	17.46	3.01	80.58	48.34	36.43	1246.9	2989.0	41.73	28.11	350.53
75	89.43	3.99	17.67	3.02	80.68	48.42	36.52	1253.6	3019.4	41.54	27.43	344.05
L S D at 5%	0.16	0.11	0.55	0.15	0.45	0.89	0.75	10.22	49.21	0.22	0.31	2.31

From present investigations, it is quite clear that seeds primed with various concentrations of ascorbic acid proved to be effective in inducing salt tolerance at the yield and its components. Pretreatment with 75 ppm ascorbic acid was more effective than other treatment. (Hamad and Hamada 2005), who found that soaking of wheat grains pre-sowing for 4 hours in 100

ppm AS significantly inhibitory effects of relatively high salinity. Thus, the seed pretreatment with ascorbic acid could be applied by growers just before seeding and enable the plants to establish in calcareous soils.

2-Effect of the foliar application

Table (2), showed that plant height (cm), number of branches plant^{-1}, number of pods plant^{-1}, number of seed pods^{-1} , 100 seed weight (g), yield pods plant (g), seed yield plant^{-1} (g) seed yield (kg/fed.), harvest index and protein content/yield were increased significantly due to foliar spray of salicylic treatments (150 ppm) compared with control treatment except seed yield, harvest index and protein content were (100 ppm) in both growing seasons compared to other treatments (Table, 2). These may be due to the substantial role of SA in many metabolic and physiological processes in plants exposed to salt stress (Khan *et al*., 2003). In this respect, it can be assumed that the depressive effects of salinity on yield and other relevant physiological activities can be alleviated and/or modified, to some extent, by spraying faba bean plants by the appropriate concentrations of SA. The application of 150 ppm SA gave significantly higher biological yield of faba bean over the other foliar treatments and control in both seasons. The increasing percentages of these attribute with using the highest rate of (SA 150 ppm) as comparing with control treatment were: plant height were 4.22 and 4.31, weight pods plant^{-1}(g) were 10.32 and 8.03, biological yield were 10.73 and 10.79 in both seasons. While the heights of number of branches plant^{-1}, number of pods plant^{-1}, number of seed pods^{-1} were with foliar SA 150 ppm and the increasing percentages of these attributes as comparing with control treatment were 1.03, 12.14 and 8.78 respectively in first seasons. The recommended treatment for faba bean yield and its components i.e. 100 seed weight (g), weight of seeds plant^{-1}(g), seed yield (kg/fed), harvest index (%), protein content (%) and protein yield (kg/fed) with foliar salicylic acid (SA) 100 ppm in the first season. Increasing percentages of these attribute with using the highest rate of (SA 100 ppm) as comparing with control treatment were: 100 seed weight (g)(2.51), weight of seeds plant^{-1}(g)(9.04 and 6.01), seed yield (kg/fed) (10.46 and 8.14), harvest index (%)(1.07 and 0.40), protein content (%) (7.07) and protein yield (kg/fed) (10.74) in the first season.

Applied (SA) promoted the yield and its components of both seasons**.** However, the mode of action of salicylic acid that regulates physiological/biochemical processes in most plants that subjected to salt stress is not much available in the literature**.** Thus, the adverse effects of salt stress on faba bean plants could be mitigated by exogenous application of salicylic acid as a foliar spray and how far it regulates the plant antioxidant enzyme system. Spraying plants with salicylic acid led to significant effects on the yield and yield components, These increasing may be due to efficiency of photosynthesis by increasing the absorption of CO_2 in plastids (Tasgin *et al*., 2003) , (Jam *et al.*, 2012) ,(Khan *et al*., 2003), (Khan *et al*., 2010) and (Hayat *et al*., 2007)

Table 2. Effect of spray by salicylic acid on yield, its components and protein content in both growing seasons 2017/2018 and 2018/2019 under calcareous soils conditions.

Salicylic (SA)	Plant height (cm)	No. of branches/ plant	No. of pods/ Plant	No. of seed / pods	100 seed weight (g)	Yield				Harvest index (%)	Protein	
						pods (g/plant	Seed (g/plant	Seed (kg/fed	Biological (kg /fed)		content (%)	Yield kg/fed
						1st season						
Without	84.45	3.88	14.42	2.96	74.39	44.57	32.43	1093.09	2637.05	41.43	26.16	300.43
50	86.24	3.89	15.20	2.98	75.45	46.80	34.10	1163.59	2815.19	41.33	27.49	319.84
100	87.20	3.91	16.11	3.11	76.31	48.64	35.16	1220.91	2914.78	41.88	27.56	336.59
150	88.01	3.92	16.17	3.22	76.20	49.17	35.03	1218.71	2920.02	41.73	27.55	335.97
L S D at 5%	0.91	0.03	0.89	0.15	1.55	1.25	0.91	25.13	45.01	0.31	0.63	0.31
						2nd season						
Without	87.63	3.89	16.08	2.85	79.26	45.82	34.82	1174.72	2786.90	41.94	27.38	321.76
50	88.25	3.90	16.98	3.03	80.43	47.75	36.05	1233.47	2955.35	41.74	28.15	349.36
100	90.06	3.93	18.22	3.14	81.09	49.28	37.05	1283.66	3060.77	42.14	26.85	344.75
150	91.41	3.90	18.15	3.17	80.95	49.50	36.92	1271.91	3087.52	41.20	27.46	347.35
L S D at 5%	2.35	0.02	1.02	0.25	1.15	1.55	0.15	27.00	56.21	0.41	0.55	1.02

3-Effect of the interaction between (AS) seed soaking and (SA) foliar application

Data in Table (3) indicated that the interaction between (AS) seed soaking and (SA) foliar application was statistically significant for the yield, its components and protein content in the two growing seasons. The effective treatment on faba bean cv. Mariout 2, was seed soaking with 75 ppm and sprayed with 150 ppm (as SA foliar) which led to increasing significantly all yield parameters; plant height (cm), number of branches plant^{-1}, number of pods plant^{-1}, number of seed pods^{-1} , 100 seed weight (g), yield pods plant (g), seed yield plant^{-1} (g) except seed yield (kg/fed.), harvest index were soaking with 75 ppm and foliar with SA 150 ppm and protein content/yield was (AS at 50ppm+SA at 100 ppm) in the first growing season.

The foliar and seed soaking applications with high level gave the highest value of yield and its components this may be due to the substantial role of AS in many metabolic and physiological processes in plants exposed to salt stress Abdel Aziz, *et al.*, (2009). In addition, under saline calcareous soil conditions, increasing yield of the faba bean cultivar through the seed soaking application and SA as a foliar spraying may be explain: the induction of nutrient absorption by root system and the transportation of the nutrients essential to plant metabolism Azooz, and Al-Fredan (2009), and who found that the effect of seed soaking AS and spraying SA with different concentration (0, 10, 20) and ascorbic acid at a concentration of 100 mg L^{-1}, noted that improved the growth of plants, seed germination and fresh weight of the vegetative and root groups. AS (4 ml) led to an increase in plant growth and yield (Younis *et al*. (2010*)*. The increase in pod weight may be due to its role in increase seed weight, length of pod, number of seeds (Salih *et al*., 1993). The increase in the weight of 100 seeds of plants may be due to the role of these acids in increasing nutrients in the leaves and then mobilized to seeds, Azooz and Al-Fredan (2009), Khafaga *et al*. (2009),

Younis *et al*. (2010), Salwa *et al*. (2013), Soliman *et al*. (2016), AL-Amri and Mohammed (2017) and Thomson *et al*. (2017).

In conclusion, the obtained results in this study proved the beneficial effects of AS and SA on yield, yield components, protein content and consequently the productivity of faba bean plants under saline calcareous soil conditions. These effects may be attributed to the protective role on photosynthetic machinery against the damaging effects of salinity. Therefore, the pretreatment seed soaking with (75 ppm AS) and foliar application of SA on faba bean cv. (Mariout- 2) plants with (150 ppm) at 60 day after sowing is the most effective treatment to enhance productivity of faba bean plants under calcareous soil conditions as comparison with the control plants.

Table 3. Effect of the interaction between AS seed soaking and SA foliar spray on yield, its components and protein content of faba bean plants in the first season 2017-2018

Salicylic (SA)	Ascorbic (AS)	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seed/ pods	100 seed weight (g)	Yield				Harvest index (%)	Protein	
							pods (g/plant	Seed (g/plant	Seed (kg/fed	Biological (kg /fed)		content (%)	Yield kg/fed
						1st season							
	Without	83.86	3.85	13.33	2.90	74.23	43.31	31.20	1035.88	2567.40	40.34	26.54	275.06
	25	84.34	4.01	14.40	2.92	74.14	44.76	32.50	1105.53	2646.20	41.77	27.43	303.31
Without	50	84.71	4.03	14.83	2.94	74.42	44.82	32.76	1108.33	2656.80	41.72	27.62	317.28
	75	84.89	3.69	15.13	2.95	74.80	45.40	33.27	1122.64	2677.80	41.92	27.26	306.06
	Without	85.66	3.72	13.35	2.93	75.09	46.08	33.41	1143.55	2758.88	41.47	27.14	321.85
50	25	86.15	3.64	15.37	2.96	75.28	46.69	33.91	1160.46	2827.50	41.04	27.55	334.81
	50	86.51	3.75	15.83	3.00	75.59	46.94	34.34	1169.05	2828.50	41.33	27.71	300.67
	75	86.65	4.43	16.25	3.04	75.86	47.49	34.74	1181.33	2845.90	41.51	27.25	322.02
	Without	86.53	3.92	14.44	3.01	75.74	47.83	34.44	1201.89	2851.80	42.14	27.20	335.94
	25	87.14	4.03	16.35	2.99	76.10	48.81	35.07	1220.77	2920.30	41.80	27.76	319.49
100	50	87.49	3.93	16.72	2.97	76.51	48.61	35.35	1226.11	2935.02	41.77	28.83	338.21
	75	87.66	3.78	16.93	3.03	76.89	49.33	35.80	1234.88	2952.00	42.19	27.36	352.71
	Without	87.33	3.75	14.89	2.99	75.79	48.86	34.65	1215.52	2881.00	41.83	26.74	325.09
150	25	88.00	3.95	15.81	3.00	76.11	49.06	34.86	1223.41	2913.50	41.99	27.50	336.51
	50	88.30	3.99	16.93	3.00	76.30	49.13	35.12	1223.74	2931.50	41.74	27.65	350.60
	75	88.43	4.00	17.06	3.01	76.61	49.64	35.49	1212.18	2954.10	41.03	27.36	331.69
L S D at 5%		0.76	051	0.98	0.02	0.31	0.54	0.35	25.17	37.21	0.66	0.21	1.42

Table 4. Effect of the interaction between AS seed soaking and SA foliar spray on yield, its components and protein content of faba bean plants in the second season 2018-2019

Salicylic (SA)	Ascorbic (AS)	Plant height (cm)	No. of branches/ plant	No. of pods/ plant	No. of seed/ pods	100 seed weight (g)	Yield				Harvest index (%)	Protein	
							pods (g/plant	Seed (g/plant	Seed (kg/fed	Biological (kg /fed)		content (%)	Yield kg/fed
						2nd season							
	Without	87.60	3.81	15.38	2.85	78.84	44.71	33.81	1125.88	2705.40	41.62	26.60	299.56
	25	87.73	3.95	16.05	2.99	79.21	46.05	35.00	1181.04	2802.70	42.14	27.36	323.18
Without	50	87.81	4.04	16.33	2.99	79.46	46.22	35.15	1189.33	2801.80	42.45	28.45	338.37
	75	87.40	3.76	16.58	3.03	79.55	46.33	35.34	1202.63	2837.72	42.38	27.10	325.92
	Without	88.10	3.68	16.50	2.97	79.96	47.19	35.57	1213.55	2886.51	42.04	28.14	341.54
50	25	88.24	3.58	16.82	3.00	80.45	47.69	36.01	1230.06	2955.50	41.62	28.78	354.50
	50	88.31	3.76	17.13	3.01	80.63	48.05	36.33	1239.00	2973.50	41.67	28.61	353.16
	75	88.36	4.60	17.50	3.08	80.71	48.07	36.32	1251.28	3005.90	41.66	27.09	339.02
	Without	89.82	3.90	17.79	3.06	80.79	48.70	36.55	1272.89	2986.80	41.62	26.09	332.13
	25	90.08	3.99	18.38	3.04	80.95	49.24	37.07	1280.77	3065.30	41.78	26.04	333.58
100	50	90.14	3.96	18.22	3.02	81.23	49.48	37.24	1286.11	3083.00	41.72	26.93	346.37
	75	90.22	3.87	18.50	3.06	81.42	49.73	37.37	1294.88	3108.00	42.63	28.33	366.94
	Without	91.30	3.94	17.98	3.03	80.77	49.36	36.76	1270.22	3041.00	41.77	26.74	339.70
150	25	91.36	3.87	18.20	3.03	80.97	49.45	36.86	1278.11	3085.00	41.43	27.44	350.76
	50	91.46	4.09	18.17	3.02	81.00	49.63	37.01	1273.44	3098.00	41.11	28.47	342.61
	75	91.54	3.73	18.25	3.01	81.07	49.58	37.06	1265.88	3126.10	40.49	27.20	344.32
L S D at 5%		1.14	0.91	1.52	0.03	0.41	0.17	0.33	26.51	0.44	0.98	0.25	1.35

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تاثير حمضى الإسكوربيك والسالسيليك على إنتاجية الفول البلدى تحت ظروف الأراضى الجيرية

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أجريت تجربتان حقليتان بمحطة بحوث مريوط التابعة لمركز بحوث الصحراء بمحافظة الاسكندرية خلال موسمين زراعيين متتاليين 2018/2017 & 2019/2018 لدراسة تاثير نقع بذور الفول البلدى بحمض الاسكوربك بمعدل (بدون نقع , 25, 50, 75 جزء فى المليون) والرش بحمض الساليسليك بتركيز (50 , 100, 150 جزء فى المليون) بعد إذابة كل تركيز في 200 لتر ماء للفدان بالمقارنة بدون رش بحمض الساليسيلك وذلك بعد 60 يوم من الزراعة على محصول الفول البلدى صنف مريوط 2 تحت ظروف الاراضي الجيرية و تأثير ذلك على الإنتاجية ومحتوى البذور من البروتين. وأوضحت الدراسة النتائج آلاتية: اعطت التركيزات العالية من حمض الاسكوربك بالنقع و الرش بحمض الساليسيلك زيادة معنوية فى المحصول ومكوناتة وكذلك البروتين فى بذورالفول البلدى فى كلا الموسمين.أعطى صنف الفول البلدى مريوط 2 والتى تم نقع بذورة فى حمض الاسكوربك بمعدل 75 جزء فى المليون والمعامل بالرش الورقى بحمض ~~الاسكوربيك~~ الساليسليك بتركيز 100 جزء فى المليون أعلى إنتاجية للمحصول ومكوناتة ماعدا محتوى البروتين في البذور حيث كان عند نقع البذور بمعدل 50 جزء فى المليون والرش بحامض الساليسليك بمعدل 100 جزء فى المليون فى كلا الموسمين.اظهر البحث وجود استجابة واضحة لاستخدام حمض الاسكوربك فى الاراضى الجيرية بالنقع لبذور الفول البلدى بتركيز 75 جزء بالمليون و الرش الورقى بحامض الساليسيلك للنباتات بتركيز 150 جزء بالمليون لتجنب الاجهاد تحت ظروف الاراضى الجيرية فى هذ ة المناطق وبالتالى زيادة إنتاجية المحصول.أوصت الدراسة بأنة عند زراعة محصول الفول البلدى صنف مريوط 2 الذي يعتبر من المحاصيل الحساسة لزيادة نسبة كربونات الكالسيوم في بداية مراحل نموه يفضل معاملة بذوره بحامض الاسكوربك بالنقع بمعدل 75 جزء فى المليون و الرش الو رقى بحامض الساليسيلك (بمعدل 150 جزء فى المليون) تحت ظروف منطقة مريوط الواقعة شمال الاسكندرية بمصر لما لهم من أهمية فعالة في تحمل محصول الفول البلدى لنطاق معين في مراحل حياته الأولى تحت ظروف الأراضي الجيرية.