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Effect of Salicylic and Ascorbic acid on Growth, Green yield of two Broad bean Cultivars (*Vicia faba* L.)

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ABSTRACT

The experiment was conducted in the vegetable research farm of Horticulture Department, College of Agriculture/ University of Dohuk- Iraq, interior the plan of Broad bean crop production during the growing season of 2016-2017, to investigate the effects of two Cultivars (Aguadolce & Elisa), Salicylic acid and Ascorbic acid at concentration (0, 100 & 150 $g.L^{-1}$) on growth, green yield and green seed yield of Broad bean (*Vicia faba*.). Results showed that the cultivars had no affect on vegetative characters. The Elisa cultivar had significant increase on some majority green yield and seed yield characters (Pod Yield g. $plant^{-1}$, Total Yield ton. $donum^{-1}$, No. of seed per pod, seed weight g and weight of 100 seed g).While Aguadolce cultivar had significant increase in (pod length cm). There were no significant effect of cultivars on (No. of pods per plant $pod.plant^{-1}$, Pods weight g, No of seeds per plant, green seed yield $g.plant^{-1}$ and total seed yield ton. $donum^{-1}$). But ascorbic acid significant increased (No. of pods per plant $pod.plant^{-1}$, No. of seed per pod, seed weight g, weight of 100 seed g Green Seed yield $g.plant^{-1}$ and total seed yield ton. $donum^{-1}$)), While treating of broad bean plant with salicylic acid especially ($100g.L^{-1}$) led to significant increases (pods weight g, No. of branches per plant, Pods weight g, Pod Yield g. $plant^{-1}$, Total Yield ton. $donum^{-1}$, No. of seed per pod, seed weight g, weight of 100 seed g, Green Seed yield $g.plant^{-1}$ and total seed yield ton. $donum^{-1}$).

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1. INTRODUCTION

Legumes are the major direct source of proteins for both man and livestock, especially in poor countries where animals protein is expensive (Mohamed, 2010). Field bean (*Vicia faba* L.) is one of essential winter crops in Iraq due to its high nutritive value and high protein contents (25-42%) (Fouad *et al*.,1995). Moreover, it is a good source of nutritive minerals, such as phosphorus, potassium, calcium, sulphur and iron. Its seed produced a cheap source of protein and food of high nutritive value especially in the diet of low-income people. Its protein is a good alternative compared with expensive meat and fish protein (Chavan *et al.,* 1989).

The productivity of the plant can be increased by using some chemical compounds, including salicylic acid and ascorbic acid, ascorbic acid has an important role as an antioxidant in the plant and has a role in the protection of plants from optical oxidation (Foyer, 1993). Ascorbic acid promotes vegetative growth and emulsification and that the external addition of these compounds reduces the various stresses on the plant. It also plays an important role in controls cell growth, the elongation and division of cells, have a role in plant resistance to stress conditions such a slow and high temperature and salt stress (Smirnoff, 1996).

Salicylic acid is a plant hormone that has important physiological roles in promoting plant growth and increasing the efficiency of photosynthesis and flowering (Hayat *et al.*, 2007). The word salicylic acid (SA) was derived from Latin word Salix, meaning willow tree, it plays an important role in plant tolerance to stresses from low temperatures (Tasgin *et al*., 2003) and high heat and salinity (Khan *et al.* , 2010). Bassiouny *et al.*(2005) reported that spray the bean plants after 45 and 60 days of transplanting with ascorbic acid concentrations

of 100 or 200 or 400 mg. L^{-1} , has given a significant increase in carbohydrates, protein, potassium, phosphorus and calcium in dry seeds and the number of pods $plants^{-1}$ and the number of seeds $plant^{-1}$ and weight of 100 seeds compared to untreated plants. Burguieres *et al*. (2007) reported that the treatment of pea seeds with ascorbic acid resulted in a significant increase in germination rate and weight of vegetative, plant height and root length. Azooz and Al-Fredan (2009) found that the effect of seed soaking in ascorbic acid and spraying of bean plants in the salicylic acid with different concentration (0, 10, 20) and ascorbic acid at a concentration of 100 mg L^{-1}, noted that treatment with ascorbic acid improved the growth of plants, seed germination and fresh weight of the vegetative and root groups. Younis *et al.* (2010) found that the treatment of ascorbic acid at a concentration of 4 ml under saline conditions led to an increase in plant growth and yield.

AL-Amri (2017) showed significant increased in plant height and leaf area due to ascorbic acid application on snap bean plants. Khan *et al.,* (2003) reported that treatment with acetylsalicylic acid (10^{-5} or 10^{-4} ml/L) resulted in improved photosynthesis in soybean plant, increased sporulation, and dry leaf area and weight, but did not affect plant height. Hegazi and El-Shraiy (2007) found that when spraying the bean plants at 30 and 45 days with salicylic acid at concentrations of as above, the treatment with salicylic acid at a concentration of as above $ml.L^{-1}$ increased the height of the plant. Murtaza *et al.* (2007) that the application of SA at $10^{-4}ml.L^{-1}$ to pea plants significantly increased the yield and its components as compared to concentration $10^{-5}ml.L^{-1}$tratmenta.. El-Shraiy and Hegazi (2009) observed spraying the pea with acetylsalicylic acid with concentrations of 10 and 20 mg $.L^{-1}$, increased the vegetable growth of the

at 45 and 60 days after sowing, length of internodes and number of nodes at last picking, weight of pods per plant whereas Ascorbic acid 200 ppm has given best results for yield per plot and yield per hectare. The use of natural substances like (salicylic and ascorbic acid) has improved and increased plant growth. Due to the positive role of both salicylic acid and ascorbic acids on growth and yield of bean plants and the lack of research on their role in the growth and yield of the plant under the local conditions of Duhok reign. The present investigation aimed to study the effect of foliar applications with two antioxidants, i.e. ascorbic acid and salicylic acid on growth, green pods and yields of bean plant.

2. MATERIALS AND METHODS

150 g.L-1) in sub sub-plot and was arranged in a randomized complete block design with three replications. Each treatment included eight plants in rows. Spraying plants by two acids done three times, the first one added 45days after planting and another's one at ten day between them . A few drops of Tween 20 were added as a diffusion agent for the spray treatments. The plants were sprayed on the early morning till full wet with a 2 liter hand sprayer. The results were analyzed using the SAS, 2007 program. Means values were compared using Duncan's multiple range test at 0.05% level (AL-Rawi and Khalaf Alah, 2000). The data were taken from five plants and yield taken from ten harvesting. Data were recorded for plant high, No. of branches/plant, No. of pods per plant, pod length cm, pods weight g, pod yield g. plant^{-1} , total yield ton. donum^{-1}, No. of seeds per pod, No. of green seeds plant^{-1}, fresh seed weight (mg), weight of 100 seed (g), green seed yield plant (g), total green seed yield ton. donum^{-1}.

3. RESULTS

3.1.Vegetative Growth Characters:-

3.1.1.Plant High.

on plant length, while significant differences had been observed on plant length when sprayed with

plant, its height, number of leaves, fresh and dry weight, plant yield, pod length, number of pods per plant, number of seeds in pods. Khafaga *et al*. (2009) reported that parameters of faba bean growth (number of branches, fresh and dry weight and leaf area)were significantly increased when seeds wee soaked in salicylic acid (200 ppm) as compared with the control plants. Meanwhile, SA as foliar application significantly increase all yield and yield components (number of pods/plant, number of seeds/pod, seeds weight/plant, pods weight/plant, 100 seed weight and seed yield). Thomson *et al.* (2017) revealed that the antioxidant acetyl salicylic acid 200 ppm effectively increased the vine length of pea plant

The experiment was conducted in the Vegetable Research Farm, Horticultural Department, College of Agriculture, University of Duhok, Kurdistan region/Iraq, during the growing season of 2014-2015. To study the effect of salicylic and ascorbic acid on growth and green yield of two broad bean cultivars. The two cultivars (Elsa and Aguadolce) were planted on Nov. 14th 2015. Seed planting was achieved on both sides of ridges at 25 cm between hills and 75cm between ridges. Add urea fertilizer (46% N) at a rate of 30 kg. dunum^{-1} in a ditch way after a month of cultivation. All the agricultural processes used in the production of this crop were carried out like irrigation, weeding. Irrigation was carried out according to the need of the plant. The process of weeding was carried out by hand by hand, whenever necessary. The experiment was conducted in split split plot design the two cultivars (Aguadolce and Elisa) in main plot and the two acids in sub plots the salicylic acid and ascorbic acid and three concentration (0,100 and

Data in table (1) shows that no significant differences occurred for each cultivars and acids

differences occurred between ascorbic acids and two highest concentration (100 and 150 g. L^{-1}) reached (5.32, 5.58 cm) respectively. The triple interaction between three factors revealed that significant differences occurred and the highest value was (5.67cm) between Aguadolce cultivars, ascorbic acids and 150g. L^{-1} concentration.

concentrations the highest plant high (5.37cm) in 150 g. L^{-1} concentration. Effect of interaction between cultivars and acids had no significant differences occurred, while significant differences found between cultivars and concentration of acids the highest value obtained between Elisa cultivars and 150 g. L^{-1} concentration reached (5.52cm). The interaction between acids and concentration also significant

Table 1: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on length of broad bean(cm).

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	4.83 ab	5.1 ab	4.77 ab	4.9 a	5.12 a
	Ascorbic	5.07 ab	5.3 ab	5.67 a	5.34 a	
Elisa	Salicylic	4.4 3b	5.27 ab	5.53 a	5.08 a	5.21 a
	Ascorbic	5.2 ab	5.33 ab	5.5 a	5.34 a	
Means of Conc.		4.88 b	5.25 ab	5.37 a	Means of Acids	
Cultivars* Conc.		4.95 ab	5.2 ab	5.22 ab		
		4.82 b	5.3 ab	5.52 a	4.99 a	
Acids * Conc.		4.63 b	5.18 ab	5.1 5ab	5.34 a	
		5.13 ab	5.32 a	5.58 a		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.1.2.Number of Branch's per plants.

100 g. L^{-1}concentration. The highest no. of branches (78.80 branch.$plant^{-1}$) had been observed between salicylic acid and 100 g. L^{-1} concentration. The triple interaction between three factors had significant effects, the highest No. of branches per plant (83.73 branch.$plant^{-1}$) had been observed between Elisa, salicylic acid and 100 g. L^{-1} concentration.

Table (2) revealed that no significant differences occurred for each cultivars and acids on the No. of branch per plants, while significant differences obtained in concentrations, the highest value (77.56 branch.$plant^{-1}$) in 100 g. L^{-1}concentration. The interaction between cultivars and acids had significant effect the Aguadolce cultivar sprayed with salicylic acid had the highest value (76.63 branch.$plant^{-1}$), also the interaction between cultivars and concentration had significant effect the highest value (79.40 branch.$plant^{-1}$) when spray Elisa cultivars with

Table 2: Effect of salicylic acid, ascorbic acid,cultivars and their interaction on number of branch's per plant of broad bean.

Cultivars	Acids	Concentration g.L^{-1}(Sa*As)			Cultivars * Acids	Means of Cultivars
		0	50	100		
		0	100	150		
Aguadolce	Salicylic	64.20 d	73.87 bc	72.53 c	70.20 b	73.21 a
	Ascorbic	76.17 bc	77.57 abc	74.90 bc	76.21 a	
Elisa	Salicylic	71.63 c	83.73 a	74.53 bc	76.63 a	76.21 a
	Ascorbic	74.13 bc	75.07 bc	80.60 ab	76.60 a	
Means of Conc.		71.53 b	77.56 a	75.64 a	Means of Acids	
cultivars * Conc.		70.18 c	75.72 ab	73.72 bc		
		72.88 bc	79.40 a	77.57 ab	73.42 a	
Acids * Conc.		67.92 c	78.80 a	73.53 b	76.41 a	
		75.15 ab	76.32 ab	77.75 ab		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.2.Green Yield Characters:-

3.2.1.No. of pods per plant

3.1.3.Number of pods per plant.

highest No. of pods (18.15pod.plant^{-1}) between Aguadolce and control treatment. There were briefly significant between acid and concentration, the highest value (16.78 pod.plant^{-1}) between salisylic acid and150 g.L^{-1} concentration. The three interaction between treatments had significant effects the highest value (20.1 pod.plant^{-1}) between Aguadolce, ascorbic acid and control treatment.

Table (3) illustrated that no significant effect of cultivars on No. of pods per plant, while there were significant effects for each acids and concentrations on the No. of pods per plant, ascorbic acid and 150 g.L^{-1} had the highest value (16.24 and 16.56 pod. plant^{-1}) respectively. The dual interaction had significant effects on No. of pods per plant, the highest No. of pods (17.23 pod.plant^{-1}) was observed between Aguadolce and ascorbic acid, and

Table 3: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on No. of pods per plant (pod.plant^{-1}) of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	16.2 bc	16.17 bc	17.7 bc	16.69 ab	16.96 a
	Ascorbic	20.1 a	16.13 bc	15.47 c	17.23 a	
Elisa	Salicylic	9.63 d	15.83 bc	15.87 bc	13.78 c	14.52 a
	Ascorbic	11.37	17.17	17.23	15.26	

	d	bc	bc	bc
Means of Conc.	14.33 b	16.33 a	16.57 a	Means of Acids
Cultivars *Conc.	18.15 a	16.15 b	16.58 b	
	10.50 c	16.5 b	16.55 b	15.23 b
Acids * Conc.	12.92 b	16.00 a	16.78 a	16.24 a
	15.73 a	16.65 a	16.35 a	

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.2.2.Pod Length (cm).

observed between Aguadolce and ascorbic acid. The highest pod length between Aguadolce and100 $g.L^{-1}$ concentration had (14.37cm). The interaction between acid and concentration had significant effects the highest value (14.58cm) between ascorbic acid and 150 $g.L^{-1}$concentration. The interaction between three factors had significant effects and the interaction between Elisa cultivar, ascorbic acid and control treatments had highest value (15.07cm).

Data in table (4) shows that significant effects between cultivars on pod length, the Aguadolce cultivar (13.78cm) was superiority over the Elisa cultivar (13.24cm). No significant differences occurred for two acids on pod length. Treated plants with concentration had significant effects on pod length, the highest pods length (14.02cm) in 150 $g.L^{-1}$ concentration. The interaction between cultivars and two acids significantly affected pod length, the highest value (14.07cm)

Table 4: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on pod length (cm)of Bbroad bean.

Cultivars	Acids	Concentration $g.L^{-1}$			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	12.73 cd	14.63 ab	13.1 abc	13.49 ab	13.78 a
	Ascorbic	13.1 abc	14.1 abc	15.00 a	14.07 a	
Elisa	Salicylic	11.03 d	13.07 abc	13.8 abc	12.63 b	13.24 b
	Ascorbic	15.07 a	12.33 cd	14.17 abc	13.86 ab	
Means of Conc.		12.98 b	13.53 ab	14.02 a	Means of Acids	
Cultivars * Conc.		12.91 b	14.37 a	14.05 ab		
		13.05 ab	12.7 b	13.98 ab	13.06 a	
Acids * Conc.		11.88 b	13.85 a	13.45 a	13.96 a	
		14.08 a	13.22 a	14.58 a		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.2.3.Pods Weight (g).

significant effects on pod weight the highest value (34.42g) between Elsa cultivar and control treatment. The interaction between acids and concentration had significant effects and the highest pods weight (28.84g) between salicylic acid and 100g.L^{-1}concentration compared to the lowest value (24.45g) between ascorbic acid and control treatment. The interaction between three factors significantly affected pod weight, the highest pod weight (36.40g) between Elsa cultivar, salicylic acid and control treatment, while the lowest one (20.24g) between Aguadulce cultivar, salicylic acid and control treatment.

Table (5) illustrated no significant differences between two cultivars on pod weigh of broad bean, but spraying with two acids increased pod weight significantly the salicylic acid was superior over the ascorbic acid reached (27.84 and 26.03g) respectively. The concentration treatment had significant effects and the highest value (28.27g) in 100 g.L^{-1}concentration compared to others. As the effect of dual interaction significantly affected on pod weight, the Elsa cultivar sprayed with salicylic acid had highest value (31.04g) while the lowest value (24.35g) obtained when Aguadolce cultivar sprayed with ascorbic acid. The interactions between cultivars and concentration had

Table 5: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on pod weight (g)of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	20.24 f	28.15 cd	25.51 de	24.64 c	24.49 a
	Ascorbic	16.47 g	29.08 c	27.51 cde	24.35 c	
Elisa	Salicylic	36.40 a	29.52 bc	27.21 cde	31.04 a	29.37 a
	Ascorbic	32.44 b	26.33 cde	24.35 e	27.71 b	
Means of Conc.		26.39 b	28.27 a	26.15 b	Means of Acids	
Cultivars * Conc.		18.36 d	28.62 b	26.51 bc		
		34.42 a	27.92 bc	25.78 c	27.84 a	
Acids * Conc.		28.32 a	28.84 a	26.36 bc	26.03 b	
		24.45 c	27.70 ab	25.93 bc		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.2.4.Pod Yield (g. $plant^{-1}$).

yield per plant, the highest value (459.63 g.$plant^{-1}$) in the 100 g.L^{-1} concentration compared to others. The interaction between cultivars and acids had no significant effects on pod yield, while the interaction between cultivars and concentration had significant effects, the highest

Data in table (6) shows that the Elsa cultivar was superior over the Aguadolce cultivar on pod yield per plant (413.85 and 409.22g.$plant^{-1}$) respectively. As the effect of two acids had no significant effects on plant yield. There were significant effects of concentration on the pod

bean plants, the highest pod yield (465.83 g. plant^{-1}) between Aguadolce, ascorbic acid and 100 g.L^{-1}concentration compared to the other interaction and the lowest value was (327.90 g. plant^{-1}) between Aguadolce, salicylic acid and control treatments.

value (460.72 g.plant^{-1}) between Aguadolce and 100 g.L^{-1}concentration. The interaction between acids and concentration had significant effects the highest value (459.93and 459.32 g.plant^{-1}) between two acids and 100 g.L^{-1} concentration respectively. The interaction between three factors significantly increased pod yield of broad

Table 6: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on Pod Yield (g. plant^{-1}) of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	327.90 e	454.03 ab	451.40 ab	411.11 a	409.22 b
	Ascorbic	330.37 e	467.40 a	424.23 bc	407.33 a	
Elisa	Salicylic	350.93 de	465.83 a	429.13 bc	415.30 a	413.85 a
	Ascorbic	368.60 d	451.23 ab	417.37 c	412.40 a	
Means of Conc.		344.45 c	459.63 a	430.53 b	Means of Acids	
Cultivars * Conc.		329.13 d	460.72 a	437.82 ab		
		359.77 c	458.53 a	423.25 b	413.21 a	
Acids * Conc.		339.42 c	459.93 a	440.27 ab	409.87 a	
		349.48 c	459.32 a	420.80 b		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.2.5.Total Yield (ton. donum^{-1}).

ton.donum^{-1}) in the interaction between Aguadolce and 100 g.L^{-1}. The interaction between acids and conc. had significant effect the highest value (2.891 and 2.887 ton.donum^{-1}) between two acids and 100 g.L^{-1}recpectively.

The interaction between three factors significantly increased total yield of broad bean plants, the highest total yield (2.938 ton.donum^{-1}) had between Aguadolce, ascorbic acid and 100 g.L^{-1}concentration compared to the other interaction and the lowest value had (2.061

Table (6) shows that the Elsa cultivar was superior over the Aguadolce cultivar on total yield per plant (2.601and 2.572 ton.donum^{-1}) respectively. As the effect of two acid had no significant effect on total yield. There were significant effect of conc. on the total yield per donum and the highest value (2.889 ton.donum^{-1}) at100 g.L^{-1} concentration compared to others. The interaction between cultivars and acids had no significant effect on total yield, while the interaction between cultivars and conc. had significant effect and the highest value (2.896

and control treatments.

Table 7: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on Total Yield (ton. donum^{-1}) of broad bean plant.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	2.061 e	2.854 ab	2.837 ab	2.584 a	2.572 b
	Ascorbic	2.077 e	2.938 a	2.666 bc	2.560 a	
Elisa	Salicylic	2.206 de	2.928 a	2.697 bc	2.610 a	2.601 a
	Ascorbic	2.317 d	2.836 ab	2.623 c	2.592 a	
Means of Conc.		2.165 c	2.889 a	2.706 b	Means of Acids	
Cultivars * Conc.		2.069 d	2.896 a	2.752 ab		
		2.261 c	2.882 a	2.660 b	2.597 a	
Acids * Conc.		2.133 c	2.891 a	2.767 ab	2.576 a	
		2.197 c	2.887 a	2.645 b		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.Green Seed Yield Characters:

3.3.1.Number of Seeds per Pod.

The data in table (8) illustrated that significant effects of cultivars on No. of seeds per pod, Elsa cultivar overcome to Aguadolce cultivar reached (5.87 and 4.71 seed. pod^{-1}) respectively. Significant effects of acids had been occurred, ascorbic acid had highest value (5.61 seed.pod^{-1}) compared to salicylic acid (4.97 seed.pod^{-1}). The effects of concentration had no significant differences. The interaction between cultivars and acids had significant effects, the highest No. of seeds (6.12 seed.pod^{-1}) were recorded in interaction between Elsa and ascorbic acid. The interaction between cultivars and concentration also significantly affected on the No. of seeds and highest value (6.33.seed.pod^{-1}) between Elsa and 150g.L^{-1} concentration. There were briefly significant between acids and concentration, the highest value (5.83seed. pod^{-1}) between ascorbic acid and150 g.L^{-1} concentration.

The three interaction between treatments had significant effects, the highest value (6.73 seed.pod^{-1}) between Elisa, ascorbic acid and 100 g.L^{-1} concentration compared to other interactions and the lowest value (3.60seed.pod^{-1}) between Aguadolce, salicylic acid and control treatment.

Table (8): Effect of salicylic acid, ascorbic acid, cultivars and their interaction on number of seed per pod of broad bean.

cultivars	Acids	Concentration g.L^{-1}			cultivars * Acids	Means of cultivars
		0	100	150		
Aguadolce	Salicylic	3.60 f	4.67 e	4.67 e	4.31 c	4.71 b
	Ascorbic	5.40 cde	4.93 de	4.97 de	5.10 b	
Elisa	Salicylic	5.00 de	5.73 ab	6.13 abc	5.62 ab	5.87 a
	Ascorbic	5.10 de	6.73 a	6.53 ab	6.12 a	
Means of Conc.		4.78 b	5.52 a	5.58 a	Means of Acid	
Cultivars * Conc.		4.50 b	4.80 b	4.82 b		
		5.05 b	6.23 a	6.33 a	4.97 b	
Acids * Conc.		4.30 b	5.20 a	5.40 a	5.61 a	
		5.25 a	5.83 a	5.75 a		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.2.Number of Seeds per Plant.

value (105.23.seed.plant^{-1}) was between Elsa and 150g.L^{-1} concentration. There were briefly significant between acid and concentration and the highest value (97.49 seed. plant^{-1}) between ascorbic acid and150 g.L^{-1} concentration and the lowest value (53.30 seed.pod^{-1}) between salicylic acid and control treatment. The interaction between three studied treatments had significant effects the highest value (115.81 seed.plant^{-1}) between Elisa, ascorbic acid and 100 g.L^{-1}concentration compared to other interaction and the lowest value (48.17seed.plant^{-1}) between Elsa, salicylic acid and control treatment.

Table (9) shows that no significant differences between two cultivars on No. of seeds per plant, while significant differences between two acids had been occurred, ascorbic acid had highest value (91.84 seed.plant^{-1}) compared to salicylic acid (75.58 seed.plant^{-1}). Effects of concentration significantly increased the No. of seeds per plant, two concentration had (90.44 and 92.44 seed.plant^{-1}) respectively compared to control treatment (68.25 seed.plant^{-1}). The interaction between cultivars and acids had significant differences, the highest No. of seeds (95.50 seed.plant^{-1}) between Elsa and ascorbic acid. The interaction between cultivars and concentration significantly affected No. of seeds the highest

Table 9: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on number of seeds per plant(seed.plant^{-1}) of broad bean.

cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of cultivars
		0	100	150		
Aguadolce	Salicylic	58.44 de	75.65 cd	82.40 c	72.16 b	80.17 a

	Ascorbic	108.45 ab	79.17 cd	76.90 cd	88.17 ab	
Elisa	Salicylic	48.17 e	91.12 c	97.69 abc	78.99 ab	87.25 a
	Ascorbic	57.92 de	115.81 a	112.76 ab	95.50 a	
Means of Conc.		68.25 b	90.44 a	92.44 a	Means of Acids	
Cultivars * Conc.		83.45 b	77.41 b	79.65 b		
		53.05 c	103.46 a	105.23 a	75.58 b	
Acids * Conc.		53.30 b	83.38 a	90.05 a	91.84 a	
		83.19 a	97.49 a	94.83 a		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.3.Seed Weight (g).

interaction. The interaction between cultivars and concentration significantly affected seed weight, the interaction treatment between Elisa cultivar and 100g.L^{-1} had the highest seed weight which was (3.842g). Significant differences occurred from the interaction treatments between acids and concentration in seed weight, the interaction treatment between ascorbic acid and spraying with 100g.L^{-1} had the highest seed weight, which was (3.787g) compared to other interaction.

The interaction treatments between three factors had significant differences, spray Elisa cultivar with 100g.L^{-1} of salicylic acid had the highest weight (3.913g), while the control treatment in the same acids of Aguadolce cultivar had the lowest value (2.535g).

The Data in table (10), shows that the Elisa cultivar significantly overcomes on the Aguadolce cultivar in weight of seed, which reached (3.460g) compared to the Aguadolce cultivar which was (3.306g). The two acids revealed significant differences in seed weight, ascorbic acid produced higher seed weight (3.552mg) compared to salicylic acid (3.213g). The concentration significantly affected seed weight and the highest value (3.635g) in 100g.L^{-1}concentration as compared to control treatment (2.968g). Significant differences were observed between cultivars and acids in seed weight, the interaction treatment between Aguadolce cultivar and salicylic acid had the highest seed weight which was (3.575g) compared to other

Table 10: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on seed weight (g) of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	2.535 e	3.056 d	3.520 bc	3.037 c	3.306 b
	Ascorbic	3.535 bc	3.802 ab	3.387 cd	3.575 a	
Elisa	Salicylic	2.635 e	3.913 a	3.620 abc	3.390 b	3.460 a
	Ascorbic	3.169	3.771	3.654	3.531	

	d	ab	abc	a
Means of Conc.	2.969 b	3.635 a	3.545 a	Means of Acids
Cultivars * Conc.	3.035 c	3.429 b	3.454 b	
	2.902 c	3.842 a	3.637 ab	3.213 b
Acids * Conc.	2.585 c	3.485 b	3.570 ab	3.552 a
	3.352 b	3.787 a	3.520 b	

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.4.Weight of 100 Seed (g).

between cultivars and concentration had significantly affected weight of 100 seed, the interaction treatment between Elisa cultivar and 100g.L^{-1} had the highest weight of 100 seed which was (384.18g). Significant differences occurred from the interaction treatments between acids and concentration in weight of 100 seed, the interaction treatment between ascorbic acid and spraying with 100g.L^{-1} had the highest weight, which was (378.65g) compared to other interaction.

The interaction treatments between the three factors had significant differences, spray Elisa cultivar with 100g.L^{-1} of salicylic acid had the highest weight (391.30g), while the control treatment in the same acids of Aguadolce cultivar had the lowest value (253.53g).

The results in table (11), display that the Elisa cultivar significantly overcomes on the Aguadolce cultivar in weight of 100 seed, which reached (346.03g) compared to the Aguadolce cultivar which was (330.61g). The two acids revealed significant differences in weight of 100 seed, the ascorbic acid produced higher weight of 100 seed (355.29g) compared to salicylic acid (321.34g). The acids concentration significantly affected weight of 100 seed and the highest value (363.55g) in 100g.L^{-1}as compared to control treatment (296.87g). Significant differences were observed between cultivars and acids in weight of 100 seed, the interaction treatment between Aguadolce cultivar and salicylic acid had the highest weight of 100 seed which was (357.49g) compared to other interaction. The interaction

Table 11: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on weight of 100 seeds (g) of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	253.53 e	305.6 d	352.03 bc	303.72 c	330.61 b
	Ascorbic	353.53 bc	380.23 ab	338.7 cd	357.49 a	
Elisa	Salicylic	263.53 e	391.30 a	362.03 abc	338.96 b	346.03 a
	Ascorbic	316.87 d	377.07 ab	365.37 abc	353.10 c	
Means of Conc.		296.87 b	363.55 a	354.53 a	Means of Acids	
Cultivars * Conc.		303.53 c	342.92 b	345.37 b		
		290.2 c	384.18 a	363.70 ab	321.34 b	

Acids * Conc.	258.53 c	348.45 b	357.03 ab	355.29 a
	335.20 b	378.65 a	352.03 b	

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.5.Green Seed yield (g.plant^{-1}).[i]

Table (12) shows no significant effect of cultivars on seed yield per plant. On the other hand, the effect of acids significantly influenced plant yield, the ascorbic acid had the highest yield (329.39g plant^{-1}) compared to lowest value in salicylic acid (250.99 g.plant^{-1}). Concentration significantly affected seed yield. The plants which received 100g.L^{-1} had the highest seed yield (331.06g plant^{-1}) and the lowest yield was (210.46g. plant^{-1}) in control treatments. Significant differences were observed in yield due to cultivars with acids interaction treatments, the highest yield was recorded between Elisa cultivar and ascorbic acid (343.45g.plant^{-1}). The effect of interaction treatments between the cultivars and concentration also significantly affected yield, Elisa cultivar sprayed with 100 and 150 g.L^{-1} improved yield and reached (395.91 and 382.24 g. plant^{-1}) respectively compared to other treatments. Similarly, interaction between acids and concentration significantly affected seed yield per plant, ascorbic acid with 100g.L^{-1} had a highest seed yield (368.38g plant^{-1}) as compared to other interaction treatments. Interaction between three studies had significant effects on seed yield per plant, the maximum yield between Elisa cultivar and sprayed with 100g.L^{-1} of ascorbic acid (435.06.plant^{-1}), while the minimum yield between Aguadolce cultivar salicylic acid and control treatment (147.86g.plant^{-1}).

Table 12: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on seed yield (g.plant^{-1}) of broad bean.

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	147.86 e	230.71 cd	291.79 bc	223.45 c	269.39 a
	Ascorbic	384.369 a	301.70 bc	259.90 cd	315.32 ab	
Elisa	Salicylic	126.56 e	356.76 ab	352.24 ab	278.52 bc	310.99 a
	Ascorbic	183.04 de	435.06 a	412.25 a	343.45 a	
Means of Conc.		210.46 b	331.06 a	329.05 a	Means of Acids	
Cultivars * Conc.		266.12 b	266.20 b	275.85 b		
		154.80 c	395.91 a	382.24 a	250.99 b	
Acids * Conc.		137.21 c	293.74 b	322.01 ab	329.39 a	
		283.71 b	368.38 a	336.08 ab		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

3.3.6.Total Seed Yield (ton. donum^{-1}).

Table (13) displays that no significant differences between cultivars in the total seed yield. The two acids in total yield were accessed to significant level, especially ascorbic acid (2.070 ton.donum^{-1}) in comparison with salicylic acid (1.578 ton.donum^{-1}). the concentration significantly increased the total seed yield; 100 and 150 g.L-1 resulted in a higher total yield (2.081 and 2.068 ton.duonum-1) respectively as compared to lower value in control treatment (1.323 ton.donum-1). The interaction treatments between cultivars and acids significantly affected on total seed yield, the interaction between Elisa cultivars and ascorbic acid had higher total yield reached (2.159ton.donum-1) as compared to other interactions. The interaction effect between cultivars and concentrations also had significant effects the highest value (2.489 and 2.403ton.donum-1) recorded between Elisa cultivars and two concentration respectively. The interaction between acids and concentrations revealed significant effects on total green seed yield, the highest value (2.316ton.donum-1) between ascorbic acid and 100g.L-1 as compared to other interactions.

The three interaction had significant effects on total seed yield, the highest value (2.735 ton.donum^{-1}) between Elisa cultivar sprayed with 100g.L^{-1} ascorbic acid, while the lowest value (0.929 ton.donum^{-1}) had between Aguadolce cultivars, salicylic acid and control treatment.

Table 13: Effect of salicylic acid, ascorbic acid, cultivars and their interaction on total green seeds yield(ton.donum^{-1})

Cultivars	Acids	Concentration g.L^{-1}			Cultivars * Acids	Means of Cultivars
		0	100	150		
Aguadolce	Salicylic	0.929 e	1.450 cd	1.834 bc	1.405 c	1.693 a

	Ascorbic	2.416 a	1.896 bc	1.634 cd	1.982 ab	
Elisa	Salicylic	0.796 e	2.243 ab	2.214 ab	1.751 bc	1.955 a
	Ascorbic	1.151 de	2.735 a	2.591 a	2.159 a	
Means of Conc.		1.323 b	2.081 a	2.068 a	Means of Acids	
Cultivars * Conc.		1.673 b	1.673 b	1.734 b		
		0.973 c	2.489 a	2.403 a	1.578 b	
Acids * Conc.		0.862 c	1.846 b	2.024 ab	2.070 a	
		1.783 b	2.316 a	2.112 ab		

Means within a column, row and there interactions followed with the same letters are not significantly different from each other's according to Duncan multiple range test at 5% level.

4. DISSCUTION

It is evident from the previously mentioned results in table (6, 7, 8, 10and 11) the Elisa cultivar superior to the Aguadolce cultivar in (Pod Yield g. plant^{-1}, Total Yield ton. donum^{-1}, No. of seed per pod, seed weight g and weight of 100 seed g), which is due to the genotype differences between the two cultivars and the increase in absorption of the nutrient in the soil, may be due to the differences in root system and RCEC (Root Cation Exchange Capacity) which is differing among cultivars. These results are in harmony with those of the (Salih, 2007 and Amer *et al*., 2008), and also the differences between studied cultivars in growth habit and response of each one to environmental conditions during the growing season which are controlled by genetically factors. That may be reflected on the nodulation and N-fixation consequently growth characteristics. Similar results were obtained by (Dahmardeh *et al*., (2010); El-Masry, (2010) Osman *et al.*, (2010); Darya, (2013) and Kubure *et al*., (2016)).

Spraying broad bean plants with two concentration of salicylic and ascorbic acid (100 and 150 g.L^{-1}) significant affected on the growth and green yield of pods and seed characteristics, these results may be due to that the role of salicylic acid to its encourage cell division which increases the level of auxin and cytokinins in plant tissues that accelerate the division of cells (Shakirova *et al*., 2003), The increase in the number of branches when treated with salicylic acid may be due to its role in increasing the levels of cytokinins that play a role in increasing cell division and breaking the capillary sovereignty (Taiz and Zeiger, 1998), and increasing the efficiency of photosynthesis by increasing the absorption of CO2 in plastids (Khan *et al.,* 2003), thus providing the materials needed to build new tissues and increase vegetative growth and thus increase the number of branches. The increase in the number of plant branches when treated with ascorbic acid 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, in addition to its role in promoting cell division and growth (Smirnoff and Wheeler , 2000). The increase in the number of pods treated with both salicylic acid and ascorbic acid may be attributed to their role in increasing the number of branches per plant (Table 2).

These two compounds (acids) also play a role in reducing the impact of ABA and increasing the production of growth-promoting plant hormones such as auxin and gibberellin (Rai *et al.,* 1986; Smirnoff and Wheeler, 2000), ABA oxidation and hyper plasticity, The increase in pod weight when treated with salicylic acid and ascorbic acid may be due to its role in increasing the processed food and going to the pods and increase seed weight (Table, 10). The increase in the number of seeds in the treatment of both salicylic acid and ascorbic acid with both concentration may be attributed to the role of these substances on reduction competition between flowers and vegetative growth on photosynthesis products and thus increased fertilization. This may also be attributed to the role of these two acids in increasing the length of the pod (Table 4) and increasing the number of seeds where the number of seeds in pod was found to be increased by the length of the pod (Salih *et al*., 1993). The increase in the weight of 100 green seeds of plants treated with both salicylic acid and ascorbic acid may be due to the role of these acids in increasing nutrients in the leaves and then mobilized to seeds. Plants of both salicylic acid and ascorbic acid may be attributed to their role in increasing the number of pod. plant^{-1} (Table 3) and number of seeds in pod (Table 8) increased the superiority of salicylic acid in the weight of 100 green seeds (Table 10).The increase in the total yield of the green pod and seeds in the treatment with both salicylic acid and ascorbic acid was similar to the increase in the yield of green pod and seeds per plant (Table 6 and 12). These results is harmony with those of (Burguieres *et al*. (2007); Azooz and Al-Fredan (2009); Khafaga *et al*. (2009); Younis *et al.* (2010); AL-Amri (2017)& Thomson *et al.,* (2017) Salwa *e tal*.,(2013)).

5. CONCLUSION

The obtained results revealed that the Elisa cultivar superior over the Aguadulce cultivar in more character. Foliar spraying faba bean plants with both acids was beneficial to the crop growth and yield along with green pods and seeds. Hence, it could be suggested that the Elisa cultivar is suitable with area condition and faba bean grown under the experiment and similar growing conditions and foliar sprayed with salicylic and ascorbic to produce high quantity and good quality of some characters green pods, green yield and green seed yield suitable for marketing.

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