Plant Archives
Journal home page: www.plantarchives.org
DOI Url: https://doi.org/10.51470/PLANTARCHIVES.2021.v21.no1.206

EFFECT OF FOLIAR SPRAY WITH SOME EXOGENOUS PROTECTANTS ON YIELD AND POD QUALITY OF TWO SNAP BEAN CULTIVARS GROWN IN SALINE SOIL

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(Date of Receiving-16-01-2021; Date of Acceptance-06-04-2021)

ABSTRACT

This research was carried out at the private Farm Located at Anba Bishoy Monastry , Wadi El Natroun distract, Beheria Governorate , Egypt, during the two successive summer seasons 2017 and 2018 to study the effect of some exogenous protectants (Trehalose, Phenylalanine and proline amino acid at 0.1 ppm of each beside sprayed with water) as foliar spray on productivity and pod quality of two snap bean cultivars (Buffalo and Douglas) grown in saline soil and irrigated with drip irrigation system. Buffalo cultivar gave higher growth, yield and pod quality than Douglas cultivar under saline soil conditions. Spraying snap bean plants with Trehalose or phenylalanine increased dry weight of leaves, branches and shoot dry weight, average pod weight, average, yield/plant, total yield /fad., whereas spraying with phenylalanine increased total protein and total carbohydrates in pods. The interaction between Buffalo cultivar and spraying with Trehalose or phenylalanine increased dry weight of leaves, branches and shoot dry weight, average pod weight, yield / plant, total yield /fad., whereas the interaction between Buffalo cultivar and spraying with phenylalanine increased total protein and total carbohydrates in pods.

Keywords: Snap bean, cultivars, exogenous protectants, yield and pod quality.

INTRODUCTION

Snap bean *Phaseolus vulgaris,* L. is one of most popular Fabaceae crops for local consumption and export to European countries during the vegetable season. Snap bean also plays a significant role as a good source of carbohydrates and protein for human nutrients. In Egypt, in 2018, the cultivation of green snap bean plants was 26268 ha which produced 284299 tons with an average of 10.817 tonnes / ha. (FAO, 2019). In order to improve the production of snap bean, this can be accomplished by growing the cultivated area with the use of good cultivars for the best yield and good quality.

Some researchers showed differences between snap bean cultivars for growth (Yunsheng *et al.*, 2015 , Hamaiel *et al.*, 2016, Marzouk *et al*., 2016 and Shafeek *et al.*, 2017) , yield and its components (Masa *et al*., 2017, Abdallah, 2018 , Rahman *et al*., 2018 and Saleh *et al*., 2018) and quality (Mandour, 2014 and Beshir *et al*., 2015). They showed that there were significant differences between cultivars regarding plant growth, productivity and pod quality.

Trehalose acts as a source of energy; a stabilizer; carbohydrate storage; a protector for protein and lipid membrane structure (Lunn *et al*., 2014) and sucrose use (Schluepmann *et al*., 2003). Trehalose can accumulate in several plant species in response to abiotic stresses such as salinity, and improves plant performance (Yang *et al.*, 2014). Polyamines, one of the oldest classes of natural compounds, are present in almost all living organisms and play vital roles in many physiological processes such as cell evolution and growth, and in response to environmental stresses such as salinity. Many studies show that polyamines may serve as cellular signals involved in cross-discussion with hormonal pathways such as the control of abiotic stress response by abscisic acid (Mustafavi *et al*., 2018). Proline is an essential organic osmolyte that accumulates in a host of plant species in response to environmental stress such as drought, salinity, extreme temperatures, UV radiation, and heavy metals. Besides its role as an osmolyte for osmotic adaptation, Proline helps to maintain subcellular structures such as membranes and proteins, scavenge free radicals, and redox cell buffering capacity under stress (Hsu *et al*., 2003).

Many authors showed that spraying plants with exogenous protectants such as (Trehalose, Phenylalanine and proline amino acid) cussed increases in growth (Hanafy, 2010 on snap bean, Sadak *et al.,* 2015 on faba bean and Khater *et al.,* 2018 on cowpea) , yield and quality (Saad *et al.*, 2015 on faba bean , Ganesh *et al*., 2017 on Pigeonpea and El-Saadony *et al*., 2017 on pea and Mahmood *et al.*, 2017 on pepper).

Therefore, the object of this work was to enhance the snap bean cultivars (Buffalo and Douglas) tolerance to salinity and obtained good yield and best green pod quality by using some exogenous protectants as foliar spray.

MATERIALS AND METHODS

This research was carried out at the private Farm Located at Anba Bishoy Monastry , Wadi El Natroun distract, Beheria Governorate , Egypt, during the two successive summer seasons 2017 and 2018 to study the effect of some exogenous protectants as foliar spray on growth, productivity and pod quality of two snap bean cultivars grown in saline soil and irrigated with drip irrigation system .

Table 1: Chemical analysis of water and soil of the experimental in 2018 season

	pH	EC	Soluble anions (meq/L)				Soluble (cations meq/L)			
		(ds/m)	CO_3	HCO_3	Cl	SO4	Ca	Mg	K	Na
Water	7.61	1.60	0.40	4.60	8.80	0.02	7.61	1.60	0.32	8.48
Soil	7.56	3.61	0.40	2.60	13.00	0.19	7.56	4.61	2.30	16.15

According to reclamation and development center desert soils Cairo University

This experiment was included 8 treatments which were productivity and pod quality of two snap bean cultivars grown in saline soil and irrigated with drip irrigation system .

This experiment was included 8 treatments which were the combinations between two cultivars (Buffalo and Douglas) and some exogenous protectants (Trehalose, Phenylalanine and proline amino acid at 0.1 ppm of each beside sprayed with water).

These treatments were arranged in a split plot in a complete block design with three replications. Snap bean cultivars were randomly distributed in the main plot, while some exogenous protectants were randomly arranged in the sub plot.

Seeds of snap bean cultivars were sown in the 1st April and 17th March in the 1st and 2nd seasons, respectively.

The plot area was 7.5 m^2. Every plot consisted of three dripper lines 5 m in length and 50 cm in width and spacing at 20 cm between two hills. One dripper line was used for the samples to measure vegetative growth and the other two dripper lines were used for yield determination. Seeds of snap bean cultivars were obtained from Pop Vriend seeds (PV) company Holland.

The plants were sprayed with different exogenous protectants twice; i. e., 25 and 50 days after sowing in both seasons.

Each plot received 2 liter solutions of each concentrations using spreading agent (reflecting materials) in all treatments to improve adherence of the spray to the plant foliage for increasing exogenous protectants absorption by the plants. The untreated plants (check) were sprayed with water and spreading agent. One dripper line was left between each two experimental plots without spraying as a gourd row to avoid the overlapping of spraying salutation.

In both experiments, nitrogen, phosphorus and potassium were added at the rates of 80 kg N, 37 kg P_2O_5 and 50 kg K_2O, in the form of ammonium sulphate (20.5 % N), calcium superphosphate (15.5 % P_2O_5) and potassium sulphate (48 % K_2O) respectively. One third of all fertilizers were added at the time of soil preparation with 20 m^3/fed. FYM, but the rest were divided into 10 equal portions and were added through water irrigation system (fertigation) by 3 days intervals , beginning 15 days after sowing. The other normal agricultural treatments for growing snap bean plants were practiced.

Data Recorded

A random sample of 10 plants from each experimental unit was taken after 60 days of sowing and the following data were recorded

1. Dry weight

Different plant parts leaves and branches (shoots) were oven dried at 70 °C till constant weight, and total dry weight were recorded.

2. Proline amino acid content

It was determined in dry leaves at 60 days after sowing in both seasons according to the method described by Bates (1973).

3. Pod yield and its components

Green pods of each plot were harvested at the proper maturity stage (at 75 days after sowing) , counted and weighted in each harvest and yield / plant and total fresh pod yield (ton /fed.) were determined. Twenty pods were randomly chosen from each treatment to determine; average pod weight (g)

4. Pod quality

At harvest time, ten pods were randomly taken from each treatment and oven dried at 70°C till constant weight and the chemical constituents of pods during the two seasons

were determined Total carbohydrate (%) according to the methods as described by Dubois *et al.,* (1956).

Total protein

percentage of seed protein, total pod N was estimated, and a factor of 6.25 was used to convert total N to protein percentage (Kelly and Bliss, 1975).

Total fibers were determined in both seasons as percentage according to Maynard (1970).

Proline Amino Acid Content was determined on the basis of pod dry matter as previously mentioned in leaves in both seasons.

Statistical analysis

According to Snedecor and Cochran (1967), the data from this experiment was subject to adequate statistical analysis of variance, and the discrepancies between treatments were measured using LSD at 0.05 level.

RESULTS AND DISCUSSION

Dry weight/ plant

Effect of cultivar

Buffalo cultivar recorded higher values of and dry weight of leaves, branches and shoot dry weight/ plant compared to Douglas cultivar at 60 days after sowing in both seasons (Table 2).

The increases in dry weight/ shoots were about 23.44 and 25.20 % for Buffalo cultivar over Douglas in the 1st and 2nd seasons, respectively.

These results are agree with Yunsheng *et al.,* (2015), Hamaiel *et al.,* (2016), Marzouk *et al.,* (2016) and Shafeek *et al.,* (2017) all on snap bean they showed that there were significant differences between snap cultivars as for dry weight/ plant.

Effect of some exogenous protectants

Foliar spray of snap bean plants with Tre or Phe increased dry weight of leaves branches and shoot at 60 days after sowing in both seasons (Table 2).

In most cases, there were significant differences between spraying with Pro and control with respect to dry weight of branches in both seasons and shoot dry weight in the 2nd season.

The increases in shoot dry weight were about 21.43 and 25.71 % for Tre and 18.78 and 24.17 % for Phe over unsprayed plants in the 1st and 2nd seasons, respectively.

Trehalose reduced the inhibitory effects of salinity on growth may be through improving the water status of the plant tissues, since the relative water content of the shoot increased (Zeid, 2009). Growth reduction due to salinity stress was restored by trehalose treatments by improving water status of plant tissues, and dry weight of different plants (Sadak, 2016). Recently, Ahmed *et al.,* (2016) added that the improvement of growth due to application of trehalose combined with drought may be due to

Table 2. Effect of cultivars and some exogenous protectants on dry weight of different organs of snap bean during 2017 and 2018 seasons

Treatments	Dry weight (g)						Relative increases in TDW (%)	
	leaves		branches		Total			
Cvs	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
	Effect of cultivars							
Buffalo	8.77	9.08	6.40	6.52	15.17	15.60	123.94	125.20
Douglas	7.38	7.43	4.87	5.04	12.24	12.46	100.00	100.00
LSD at 0.05 level	**0.80**	**0.78**	**0.82**	**0.88**	**1.42**	**1.30**	--	--
	Effect of some exogenous protectants							
Control	7.49	7.45	4.92	4.92	12.41	12.37	100.00	100.00
Tre. at 0.1 ppm	8.64	9.02	6.43	6.53	15.07	15.55	121.43	125.71
Phe. at 0.1 ppm	8.51	8.84	6.24	6.53	14.74	15.36	118.78	124.17
Pro. at 0.1 ppm	7.66	7.71	4.95	5.14	12.61	12.85	101.61	103.88
LSD at 0.05 level	**0.57**	**0.56**	**0.59**	**0.63**	**1.02**	**0.93**	--	--

Tre.= Trehalose is a sugar consisting of two molecules of glucose, Phe. Phenylalanine is an essential amino acid and Pro.= Proline is a proteno genic amino acid

metabolization of T6P to usable sugars. Hence, trehalose application could improve plant growth and alleviate the harmful effects of salinity stress on plant.

Amino acids can directly or indirectly influence the physiological activities in plant growth and development such as exogenous application of amino acids have been reported to modulate the growth of tomato in plastic greenhouse (Boras *et al*., 2011).

These results agree with those reported Khater *et al.,* (2018) on cowpea plants with trehalose effect, Hanafy (2010) on snap bean and Sadak *et al.,* (2015) on faba bean regarding amino acid effect.

Effect of the interaction

The interaction between cultivar and some exogenous protectants had significant effect on dry weight of snap bean at 60 days after sowing in both seasons (Table 3).

The interaction between Buffalo cultivar and foliar spray with Tre or Phe increased dry weight of leaves, branches and shoot dry weight/ plant in both seasons.

There were no significant differences between Buffalo and Douglas cultivars in proline contents in leaf tissues in both seasons (Table 4).

Effect of some exogenous protectants

Spraying snap bean plants with Pro significantly increased the contents of proline in leaf tissues, followed by spraying with Tre, while spraying with Phe decreased proline in leaf tissues, followed by control treatment in both seasons (Table 4).

Proline has high hydrophilic characteristics, so, it plays as an osmoticum. In addition, it has compatible actions in cell cytoplasm without interfering with cellular structure and metabolism. During salinity, proline can act as a signaling molecule; modulate mitochondrial function and influence cell proliferation by triggering specific genes, which otherwise are essential for a particular plant to recover from stress (Szabados and Savoure, 2009). Accumulation of proline helps to maintain membrane integrity by reducing lipid oxidation through scavenging free radicals and protecting cellular redox potential (Ashraf and Foolad, 2007).

Table 3 . Effect of the interaction between cultivars and some exogenous protectants on dry weight of different organs of snap bean during 2017 and 2018 seasons

Treatments		Dry weight (g)						Relative increases in TDW (%)	
		leaves		Branches		Total			
Cvs	Exogenous protectants	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
Buffalo	Control	8.18	8.27	5.37	5.42	13.55	13.69	120.34	124.00
	Tre. at 0.1 ppm	9.29	9.83	7.54	7.63	16.83	17.46	149.47	158.15
	Phe. at 0.1 ppm	9.22	9.68	7.36	7.42	16.58	17.10	147.25	154.89
	Pro. at 0.1 ppm	8.38	8.53	5.33	5.61	13.71	14.14	121.76	128.08
Douglas	Control	6.79	6.62	4.47	4.42	11.26	11.04	100.00	100.00
	Tre. at 0.1 ppm	7.99	8.21	5.31	5.43	13.30	13.64	118.12	123.55
	Phe. at 0.1 ppm	7.79	7.99	5.11	5.63	12.90	13.62	114.56	123.37
	Pro. at 0.1 ppm	6.93	6.88	4.57	4.67	11.50	11.55	102.13	104.62
LSD at 0.05 level		0.81	0.80	0.84	0.89	1.45	1.32	---	--

Tre.= Trehalose is a sugar consisting of two molecules of glucose , Phe. Phenylalanine is an essential amino acid
Pro.= Proline is a proteno genic amino acid

The interaction between Douglas cultivar and control and the interaction between Douglas cultivar and Pro gave the lowest values of dry weight of leaves, branches and dry weight of shoots.

The increases in shoot dry weight were about 49.47 and 58.15 % for the interaction between Buffalo cultivar and spraying with Tre. and 47.25 and 54.89 % for the interaction between Buffalo cultivar and spraying with Phe. and 21.76 and 28.08 % for the interaction between Buffalo cultivar and spraying with Pro over the interaction between Douglas cultivar and control in the 1st and 2nd seasons, respectively.

The simulative effect of spraying Buffalo cultivar with Tre on dry weight of shoots/ plant may be due to that Tre increased number of leaves/ plant and number of branches/ plant and plant height of Buffalo cultivar (Table 3).

Proline content

Effect of cultivar

Regarding trehalose effect, Zeid (2009) stated that pre-soaking maize grains (Giza 2) with 10 mM trehalose alleviated the adverse effects of salinity stress on the metabolic activity of maize seedlings through increasing photosynthetic pigments, nucleic acids content and organic solutes e.g., sugars, soluble proteins and proline content.

Effect of the interaction

The interaction between Buffalo or Douglas cultivars and spraying with Pro or Tre increased proline contents in leaf tissues, whereas the interaction between Buffalo or Douglas and spraying with Phe decreased proline content in leaf tissues in both seasons (Table 4).

Yield and its components

Effect of cultivar

There were significant differences between Buffalo and Douglas cultivars in average pod weight, yield / plant and total yield/fad. and Buffalo cultivar gave higher values of average pod weight, yield / plant and total yield/ fad in both seasons (Table 5). The increases in total yield were about 29.49 and 27.22 % for Buffalo cultivar than Douglas cultivar in the 1st and 2nd seasons, respectively. This means that the increases in total yield for Buffalo cultivar were about 0.861 and 0.807 ton/fad. over the Douglas cultivar in the 1st and 2nd seasons, respectively.

Table 4. Effect of cultivars (C), and some exogenous protectants (EP) and their interaction (C×EP) treatments on proline amino acid (mg/mg DW) in leaves of snap bean during 2017 and 2018 seasons

Snap bean cultivars	Exogenous protectants (EP)				
	Control	Tre. at 0.1 ppm	Phe. at 0.1 ppm	Pro. at 0.1 ppm	Mean (C)
	2017 season				
Buffalo	9.97	10.10	8.64	11.02	9.93
Douglas	9.90	10.04	8.85	10.95	9.93
Mean (SA)	9.93	10.07	8.74	10.99	---
LSD at 5%	(C)= NS	(EP)= 0.24	(C×EP)= 0.35		
	2018 season				
Buffalo	9.86	10.00	8.84	10.94	9.91
Douglas	9.85	9.99	8.79	10.85	9.87
Mean (SA)	9.85	10.00	8.81	10.89	---
LSD at 5%	(C)=NS	(EP)=0.06	(C×EP)= 0.08		

Tre.= Trehalose is a sugar consisting of two molecules of glucose
Phe. Phenylalanine is an essential amino acid
Pro.= Proline is a proteno genic amino acid

The differences between snap bean cultivars could be attributed to the genetic differences between cultivars.

These findings are in line with the results of Masa *et al.,* (2017), Abdallah (2018) , Rahman *et al.,* (2018) and Saleh *et al.,* (2018) all on snap bean they fond that there were significant differences between cultivars on yield and its components.

Effect of some exogenous protectants

Spraying snap bean plants with Tre or Phe increased average pod weight, yield/plant and total yield/fad. compared to Pro and control in both seasons (Table 5).

The increases in total yield were about 22.52 and 28.26 % for Tre and 20.05 and 23.71 % for Phe. and 3.90 and 5.16 for Pro. over the control in the 1st and 2nd seasons, respectively.

Regarding the stimulatory effect of trehalose on yield, Chrominski *et al.,* (1989) found that osmoregulators decreased fruit abscission due to its role in reducing ethylene production, leading to increase fruits and seeds number per sliquie and consequently increased seed yield per plant. Moreover, application of osmoregulators may be enhancing photosynthetic pigments, leading to enhanced dry matter accumulation and increased seed yield (Umar and Bansal, 1995).

Theses results are harmony with those reported by Khater *et al.,* (2018) on cowpea plants with trehalose effect, Hanafy (2010) on snap bean , Sadak *et al.,* (2015) on faba bean and Ganesh *et al.,* (2017) on Pigeonpea regarding amino acid effect and El-Saadony *et al.,* (2017) on pea plants regarding proline effect.

Effect of the interaction

The interaction between Buffalo cultivar and spraying with Tre or Phe increased average pod weight, yield /

Table 5 . Effect of cultivars and some exogenous protectants on yield and its components of snap bean during 2017 and 2018 seasons

Treatments	Average pod weight (g)		Yield / plant (g)		Total yield /faddan* (ton)		Relative increases in total yield (%)	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
	Effect of cultivars							
Buffalo	7.19	7.28	90.40	90.25	3.781	3.772	129.49	127.22
Douglas	6.26	6.32	69.60	70.72	2.920	2.965	100.00	100.00
LSD at 0.05 level	0.28	0.28	1.09	3.22	0.248	0.310	--	--
	Effect of some exogenous protectants							
Control	6.26	6.32	71.57	70.32	3.002	2.948	100.00	100.00
Tre. at 0.1 ppm	7.15	7.27	87.73	90.27	3.678	3.781	122.52	128.26
Phe. at 0.1 ppm	6.93	7.07	85.81	87.07	3.604	3.647	120.05	123.71
Pro. at 0.1 ppm	6.58	6.55	74.90	74.29	3.119	3.100	103.90	105.16
LSD at 0.05 level	0.20	0.18	2.03	2.31	0.102	0.133	--	--

Tre.= Trehalose is a sugar consisting of two molecules of glucose
Phe. Phenylalanine is an essential amino acid and Pro.= Proline is a proteno genic amino acid
*Faddan equal 0.4 ha.

plant and total yield/fad. in both seasons (Table 6).

The increases in total yield /fad. were about 56.08 and 61.27 % for the interaction between Buffalo cultivar and spraying with Tre and 54.35 and 54.82 % for the interaction between Buffalo cultivar and spraying with Phe over the interaction between Douglas cultivar and control in the 1st and 2nd seasons, respectively.

The stimulative effect of spraying with Tre on total yield / fad. of Buffalo cultivar may be due to that Tre increased dry weight of shoots (Table 2) , average pod weight and yield / plant (Table 5).

Pod quality

Effect of cultivars

Table 6. Effect of the interaction between cultivars and some exogenous protectants on yield and its components of snap bean during 2017 and 2018 seasons

Treatments		Average pod weight (g)		Yield / plant (g)		Total yield / faddan* (ton)		Relative increases in total yield (%)	
Cvs	Exogenous protectants	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
Buffalo	Control	6.79	6.65	78.56	75.94	3.292	3.177	121.39	116.89
	Tre. at 0.1 ppm	7.57	7.88	101.14	105.20	4.233	4.397	156.08	161.77
	Phe. at 0.1 ppm	7.46	7.72	99.67	100.67	4.186	4.208	154.35	154.82
	Pro. at 0.1 ppm	6.94	6.85	82.24	79.19	3.414	3.306	125.88	121.63
Douglas	Control	5.72	5.98	64.58	64.70	2.712	2.718	100.00	100.00
	Tre. at 0.1 ppm	6.72	6.65	74.32	75.34	3.122	3.164	115.12	116.41
	Phe. at 0.1 ppm	6.39	6.41	71.95	73.46	3.022	3.085	111.43	113.50
	Pro. at 0.1 ppm	6.22	6.25	67.55	69.38	2.823	2.894	104.09	106.48
LSD at 0.05 level		0.29	0.25	2.88	3.27	0.145	0.188	--	--

Tre.= Trehalose is a sugar consisting of two molecules of glucose , Phe. Phenylalanine is an essential amino acid and Pro.= Proline is a proteno genic amino acid
*Faddan equal 0.4 ha.

Buffalo cultivar gave higher total protein and total carbohydrates in pods in both seasons, whereas Douglas cultivar gave higher total fiber I the 2nd season (Table 7). There were no significant differences between two cultivars in proline content in both seasons and total fiber in the 1st season

These results are agree with those reported by Mandour (2014), Essubalew *et al.,* (2015) , Beshir *et al* . (2015) and Saleh *et al.,* (2018) all on snap bean.

Effect of some exogenous protectants

Spraying snap bean plants with Phe increased total protein and total carbohydrates followed by spraying with Tre, whereas spraying with Tre increased proline content (Table 7). Spraying with Tre, Phe and Pro decreased total fiber in pods compared to control.

Trehalose may have an indirect effect on carbohydrate metabolism by interfering with photosynthetic capacity and utilization of other sugars (Ranwala and Miller, 2009). Trehalose may play an important role in regulating carbohydrate allocation in plants during development under stress (Eastmond and Graham, 2003). Trehalose serves as an energy source; a stabilizer; carbohydrate storage; a protector for protein and lipid membrane structure (Lunn *et al.,* 2014).

These results are in harmony agree with those reported by Khater *et al.,* (2018) showed that spraying cowpea plants with trehalose at 500 µM gave increased proline, free amino acids and carbohydrate content than unsprayed plants. Saad *et al.,* (2015) found that crude protein and total carbohydrates of seeds significantly increased with spraying faba bean plants Polyamine (Putrescine) at 50 and 100 mg/L than unsprayed plants and El-Saadony *et al.,* (2017) found that spraying pea plants with proline at (100ppm) recorded the highest values total carbohydrates in seeds than unsprayed plants.

Effect of the interaction

The interaction between Buffalo cultivar and spraying with Phe increased total protein and total carbohydrates in pods , whereas the interaction between Douglas cultivar and spraying with Pro increased proline content in pods compared to other treatments and control (Table 8).

The interaction between Buffalo or Douglas cultivars and spraying with Tre or Phe decreased total fiber in pods compared to the interaction between Buffalo or Douglas cultivar and control.

From the forgoing results, it could be concluded that

1.Buffalo cultivar gave higher growth, yield and pod quality than Douglas cultivar under saline soil conditions.

2. Spraying snap bean plants with trehalose increased plant height, number of both leaves and branches and N and P total uptake by shoots, whereas spraying with phenylalanine increased total K uptake by shoot , total protein and total carbohydrates in pods. Spraying with Trehalose or phenylalanine increased dry weight of leaves, branches and shoot dry weight, average pod weight, average number of pods/ plant, , yield / plant, total yield /fad.,

Table 7 . Effect of cultivars and some exogenous protectants on pod quality of snap bean during 2017 and 2018 seasons

Treatments	Total protein (%)		Total carbohydrates (%)		Proline amino acid (mg/ g DW)		Total fiber (%)	
	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
	Effect of cultivars							
Buffalo	17.85	18.21	59.53	59.18	5.25	5.22	6.84	6.95
Douglas	17.35	17.34	57.22	57.70	5.08	5.23	6.82	7.18
LSD at 0.05 level	0.23	0.61	1.11	1.13	NS	NS	NS	0.03
	Effect of some exogenous protectants							
Control	16.39	17.05	52.38	53.55	4.62	5.06	7.32	7.43
Tre. at 0.1 ppm	17.90	17.29	61.15	60.05	5.69	4.79	7.02	7.08
Phe. at 0.1 ppm	18.96	20.12	62.71	62.41	4.86	4.80	6.33	6.90
Pro. at 0.1 ppm	17.15	16.63	57.25	57.73	5.49	6.27	6.66	6.86
LSD at 0.05 level	0.32	0.49	0.79	0.93	0.04	0.03	0.15	0.06

Tre.= Trehalose is a sugar consisting of two molecules of glucose
Phe. Phenylalanine is an essential amino acid and Pro.= Proline is a proteno genic amino acid

Table 8. Effect of the interaction between cultivars and some exogenous protectants on yield and its components of snap bean during 2017 and 2018 seasons

Treatments		Total protein (%)		Total carbohydrates (%)		Proline amino acid (mg/ g DW)		Total fiber (%)	
Cvs	Exogenous protectants	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season	2017 season	2018 season
Buffalo	**Control**	16.47	17.68	53.58	53.65	4.66	5.10	7.39	7.41
	Tre. at 0.1 ppm	18.05	17.51	62.69	61.05	6.40	4.73	7.06	7.11
	Phe. at 0.1 ppm	19.56	20.92	64.06	64.16	5.07	4.90	6.39	6.41
	Pro. at 0.1 ppm	17.33	16.72	57.79	57.86	4.85	6.15	6.53	6.87
Douglas	**Control**	16.30	16.43	51.18	53.46	4.58	5.02	7.25	7.45
	Tre. at 0.1 ppm	17.74	17.07	59.62	59.06	4.98	4.85	6.98	7.05
	Phe. at 0.1 ppm	18.37	19.33	61.37	60.67	4.65	4.69	6.28	7.38
	Pro. at 0.1 ppm	16.97	16.53	56.71	57.60	6.13	6.39	6.79	6.85
LSD at 0.05 level		**0.46**	**0.69**	**1.12**	**1.31**	**0.05**	**0.05**	**0.21**	**0.09**

Tre.= Trehalose is a sugar consisting of two molecules of glucose , Phe. Phenylalanine is an essential amino acid and Pro.= Proline is a proteno genic amino acid.

3. The interaction between Buffalo cultivar and spraying with Trehalose or phenylalanine increased number of both leaves and branches , and dry weight of leaves, branches and shoot dry weight, average pod weight, average number of pods/ plant, yield / plant, total yield / fad. the interaction between Buffalo cultivar and spraying with Trehalose increased plant height , N and P total uptake by shoots, whereas the interaction between Buffalo cultivar and spraying with phenylalanine increased K total uptake by shoots and total protein and total carbohydrates in pods.

In general, spraying snap bean plants grown in saline soil with trehalose or with phenylalanine as exogenous protectants were the best treatments for increasing snap bean plants to saline soil under Wadi El Natron conditions.

REFERENCES

Abdallah, A. A. M. (2018). Effect of mineral, organic and bio nitrogen fertilization on growth and productivity of some snap bean cultivars. M.Sc. Thesis, Fac. Agric., Zagazig University.

Ahmed, H.E., M.A. Kord, H.A. Youssef and E.A. Qaid, (2016). Exogenous application of trehalose improves the physiological status of wheat cv. giza 168 grown under stress. *Egypt. J. Bot*., 56 (3) (Part 1):627- 646.

Ashraf, M. and M.R. Foolad, (2007). Roles of glycine betaine and proline in improving plant abiotic stress tolerance. *Environ Exp Bot*., 59:206–216.

Bates, L. S. (1973). Rapid determination of proline for water stress studies. *Plant and Soil* 39 : 205-207.

Beshir, H.M. F. L. Walley , R. Bueckert and B. Taran (2015). Response of snap bean cultivars to rhizobium inoculation under dry land agriculture in Ethiopia. *Agronomy* 5(3): 291-308.

Boras M., R. Zidan and W.Halloum (2011).Effect of amino acids on growth, production and quality of tomato in plastic greenhouse. Tishreen Univ. J Res. and Sc Studies. *Biolog Sci Series*.;33(5):229-238.

Dubois, M., R.A. Gilles, J.Hamillon, R.Rebers, and I. Smith (1956). Colorimetric method for determination of sugars and related substances. *Anal. Chem*. 28: 350.

Eastmond, P.J. and I.A. Graham, (2003). Trehalose metabolism: a regulatory role for trehalose-6-phosphate*? Curr Opin Plant Biol*. 6(3):231-235.

El-Saadony, F.M., Dalia A.S. Nawar and H.G. Zyada (2017). Effect of foliar application with salicylic acid, garlic extract and proline on growth, yield and leaf anatomy of pea (*Pisum sativum* L.) grown under drought stress. *Middle East J. Appl. Sci.,* 7(3): 633-650.

Essubalew G., A. Mohammed and A. Tesfaye (2015). Impact of sowing date and plant spacing on yield, quality and disease incidence of Snap bean (*Phaseolus vulgaris L.*) varieties at Jimma Southwestern, Ethiopia. Glo. *Adv. Res. J. Edu. Res. Rev*., 4(5) : 81-89.

FAO (2019). Statistical database food and agricultural organization of the united nations. Available at http:\\ www.faostat.fao.org

Ganesh. N. J., D. D.Rajesh, B. G.Dnyaneshwar and K. H. Chute (2017). Implant of foliar sprays of polyamine (Putrescine) and NAA On chemical and biochemical parameters and yield of pigeonpea. Bull. Env. Pharmacol. Life Sci., 6 (3): 407-412.

Hamaiel, A. F. , M. S. Hamada , M. M. B. Shokr and Eman M. M. Abd-Elrhem (2016). Response of some snap bean cultivars to foliar application with some antioxidant substances for increasing productivity and quality

under local environments at early summer season. *J. Plant Production, Mansoura Univ*. 7(11): 1221 – 1231.

Hanafy A. (2010). Effect of some simulative compounds on growth, yield and chemical composition of snap bean plants grown under calcareous soil conditions. *J. Amer. Sci*., 6(10):552-569.

Hsu S.Y., Y.T. Hsu and C.H. Kao (2003). The effect of polyethylene glycol on proline accumulation in rice leaves. *Biol Plant*.; (46):73–78.

Kelly, I.D. and F.A. Bliss (1975). Heritability estimates of percentage seed protein and available methionine and correlations with yield in dry bean. *Crop Science*, 15: 753-757.

Khater M.A., Mona G. Dawood, Mervat Sh. Sadak, Magda A. F. Shalaby, M.E. El-Awadi and Karima Gamal El-Din (2018). Enhancement the performance of cowpea plants grown under drought conditions via trehalose application. *Middle East J. Agric. Res*., 7(3): 782-800.

Lunn, J.E., I. Delorge, C.M. Figueroa, P.V. Dijck and M. Stitt, (2014).Trehalose metabolism in plants. *Plant J*., 79: 544-567.

Mahmood, N., N. A. Abbasi, I. A. Hafiz, I. Ali and S. Zakia (2017). Effect of biostimulants on growth, yield and quality of bell pepper cv. yolo wonder. *Pak. J. Agri. Sci*., Vol. 54(2), 311-317; 2017.

Mandour , M.A. (2014). Response of two snap bean cultivars to nitrogen fertilizer sources under sandy soil conditions. *Global J. Agric. Food Safety Sci.,* 1 (2):52-66 .

Marzouk N. M., R.E., Abdelraouf , S.R. Salman and M. M. H. Abd El Baky (2016). Effect of water stress on yield and quality traits of different snap bean varieties grown in an arid environment. *Middle East J. Agric. Res*., 5(4): 629-635.

Masa M., T. Tana and A. Ahmed (2017). Effect of Plant Spacing on Yield and Yield Related Traits of Common Bean (*Phaseolus vulgaris* L.) Varieties at Areka, Southern Ethiopia. *J Plant Biol Soil Health,* 4(2): 1-13.

Maynard, A.J. (1970). Methods in food analysis. Academic Press New York, London, 176 pp.

Mustafavi, S.H., H.Naghdi Badi, A. Sękara, A. Mehrafarin, T. Janda, M. Ghorbanpour and H.Rafiee, (2018). Polyamines and their possible mechanisms involved in plant physiological processes and elicitation of secondary metabolites. *Acta Physiol Plant*. 40: 102.

Rahman M. S., M. A. Kabir, B. C. Halder, E. Haque, A. Rahman (2018). Response of french bean (*Phaseolus vulgaris* L.) varieties to phosphorus levels in the active Tista Flood Plain. *Int. J. Agron. Agric. Res*., 12 (1): 20-25.

Ranwala, A.P. and W.B. Miller (2009). Comparison of the dynamics of non-structural carbohydrate pools in cut tulip stems supplied with sucrose or trehalose. *Postharvest Biology and Technology*, 52: 91-96.

Saad A. M. (2015). Growth Behavior and Productivity of Faba Bean (*Faba vulgaris,* L.) as Affected by Various Promoting Foliar Applications. *Middle East J. Appl. Sci*.., 5(3): 804-811.

Sadak M. S.H., M. T. Abdelhamid and U. Schmidhalter (2015). Effect of foliar application of amino acids on plant yield and some physiological parameters in bean plants irrigated with seawater. Acta biol. Colomb., 20(1):141-152.

Sadak M. Sh., (2016). Mitigation of drought stress on fenugreek plant by foliar application of trehalose, *Inter. J. of Chem. Tech. Res*. 9(2):147-155.

Saleh S., G. Liu , M. Liu , Y. Ji , H. He ID and N. Gruda (2018). Effect of irrigation on growth, yield, and chemical composition of two green bean cultivars. *Horticulturae* , 4 (3):1-10.

Schluepmann, H., T. Pellny, A. van Dijken, S. Smeekens and M. Paul (2003). Trehalose-6-phosphate is indispensable for carbohydrate utilization and growth in *Arabidopsis thaliana*. Pntal Acad Sci. USA, 100: 6849-6854.

Shafeek M.R., A. M. Shaheen, Magda M. Hafez, Asmaa R. Mahmoud and Aisha H. Ali. (2017). Influence of cattle manure levels on the snap bean cultivars grown in sandy soil condition*. Middle East J. Appl*. Sci., 7 (3): 430-438.

Snedecor, G.W. and W.G. Cochran (1967). Statistical Methods. 6th Ed. The Iowa State Univ. Press, Amer., Iowa, USA.

Szabados, L., and A. Savoure, (2009). Proline: a multifunctional amino acid. *Trends Plant Sci.* 15: 89–97.

Umar, S. and S.K. Bansal, (1995). Potassium requirement of mustard (*Brassica juncea* L) under moisture stress conditions. *Plant Physiol, Biochem*, New Delhi, 22(2): 130-135

Yang, L., X. Zhao, H. Zhu, M. Paul, Y. Zu and Z. Tang (2014). Exogenous trehalose largely alleviates ionic unbalance, ROS burst, and PCD occurrence induced by high salinity in Arabidopsis seedlings. Frontiers in *Plant Science and Plant Physiology*, 29; 5:570.

Yunsheng Li. , A. M. El-Bassiony, M. E. El-Awadi, and Z. F. Fawzy (2015). Effect of foliar spray of asparagine on growth, yield and quality of two snap bean varieties. *Agric. Bio. Sci. J*. 1(3): 88-94.

Zeid, I.M., (2009). Trehalose as osmoprotectant for maize under salinity-induced stress. *Res. J. Agric. Biol. Sci*. 5, 613–622.