Zagazig J. Agric. Res., Vol. 45 No. (6A) 2018 1913-1924

Plant Production Science

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

EFFECT OF SALINITY AND LITHOVIT ON GROWTH, YIELD COMPONENTS AND CHEMICAL CONSTITUENTS OF CLUSTER BEAN (*Cyamopsis tetragonoloba*, Taub.)

Alaa S.M.A. Nassar, A.A. Meawad and M.A. Abdelkader*

Hort. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 30/09/2018 ; Accepted: 21/10/2018

ABSTRACT: This work was conducted at the Nursery of Diarb Negm City Council, Sharkia Governorate, Egypt during the two consecutive seasons of 2015 and 2016 to study the effect of different soil salinity levels (0.0, 1500, 3000 and 4500 ppm), lithovit rates (0, 2, 4, 6 and 8 g/l) as foliar applications and their combination treatments on growth, yield components and some chemical constituents of cluster bean (guar) plants. The investigations were performed in a split-plot in complete randomized block design with 3 replications. The obtained results cleared that using salinity levels decreased growth parameters (plant height, number of branches /plant and dry weight of leaves/ plant), yield components (pod number and seed yield/plant), some chemical constituents (total chlorophyll content a+b) and active ingredient (galactomanan) compared to control. Moreover, the highest values in these parameters were registered by lithovit at 8 g/l treatment in both seasons, in most cases. Generally, it could conclude that lithovit at 8 g/l, showed a uniform impact in alleviating of cluster bean growth inhibition and its productivity under moderate salinity stress condition.

Key words: *Cyamopsis tetragonoloba*, salinity, lithovit, growth, yield, nitrogen, galactomanan.

INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* Taub.) which belongs to Fabaceae (Leguminaceae) family is upright, a drought-tolerant, a coarse and annual summer legume crop being planted as food for the consumption of livestock and human as well. The major producers of guar are India, Pakistan, and USA. However, smaller quantities are also grown in Africa and Australia (**Gillett, 1958; Undersander *et al.*, 2006; Dinani *et al.*, 2017**). It is a tropical legume that is drought resistant and grows during the hot summer months (**Jones and Johnson, 1983**), its drought resistance and N2-fixing ability affect profitable production (**Gerik *et al.*, 1983**). The commercial importance of guar is due to the gum (guaran or galactomanan) that is extracted from the seed and used in food processing, paper manufacturing, pharmaceuticals, and as an emulsifier in drilling muds for the petroleum industry (**Whistler and Hymowitz, 1979**). Guar is used as laxative, antibilious. Gum is hypoglycaemic, hypolipidaemic, appetite depressor, reduces glycosuria during gum supplementation. Taking guar gum orally with meals was found to lower post-prandial glucose levels in patients with type 1 diabetes (**Khare, 2007**). The fodders of guar as well as its grains are quite nutritive, rich in protein, fat and minerals.

Furthermore, Nano-fertilizers are used recently as an alternative to conventional fertilizers due to slow release and efficient use by plants. Lithovit compound particles contain calcium carbonate (80%), magnesium carbonate (4.6%) and Fe (0.75%). The beneficial effect of this compound is being contains calcium carbonate ($CaCO_3$) decomposes to calcium oxide (CaO) and carbon dioxide (CO_2) in leaves stomato, and this CO_2 increases photosynthesis intensity, leading to increased carbon uptake and assimilation, thereby increasing plant growth (**Carmen *et al.*, 2014**).

* **Corresponding author: Tel. :** +201008002904
E-mail address: mohammedahmed1980@yahoo.com

Therefore, the main objective of this study was to evaluate the role of lithovit on counteracting the deleterious impact of salinity on growth parameters, yield components, total chlorophyll content and galactomanan percentage of cluster bean plant.

MATERIALS AND METHODS

This study was conducted during the two consecutive seasons of 2015 and 2016 at the Nursery of Diarb Negm City Council, Sharkia Governorate, Egypt. This work was carried out to examine the effect of soil salinity levels (0.0, 1500, 3000 and 4500 ppm), lithovit rates (0, 2, 4, 6 and 8 g/l) as foliar applications and their interactions on growth, yield, some chemical constituents and galactomanan content of cluster bean (guar) plants. Also, guar plants were foliar sprayed with lithovit three times at 35, 50 and 65 days after sowing. The lithovit was obtained from Agrolink company as a powder.

Seeds of guar (*Cyamopsis tetragonoloba* Taub.) were obtained from Research Centre of Medicinal and Aromatic Plants, Dokky, Giza and were sown in bags 40 cm filled with 12 kg of soil on the 1st May during both seasons. The soil for the experiment was collected from the upper layer (0-15 cm) of a cultivated field. The collected soil was air-dried, crushed and sieved through a 2 mm sieve and homogeneously mixed before subjecting to different treatment. The mechanical and chemical properties of the used soil are shown in Table 1 according to **Chapman and Pratt (1978)**.

Response of guar plants to different levels of salinity was evaluated under bags culture conditions. For this purpose, experiments were conducted with varying levels of salinity. The four levels of artificial soil salinity were used by dissolving the natural salt crust of sea water in tap water then added to the soil based on its weight. The chemical analysis of salt is shown in Table 2.

Six seeds were sown per bag. The seedlings were thinned to be two plants per bag after one month from sowing date. The plot contained about 10 bags; three plants from each replication were randomly selected for observing growth, physiological and mineral analyses of guar. The mean value of each parameter was computed from 15 plants (3 plants from each replication).

The basal doses of nitrogen (N), phosphorous (P_2O_5) and potassium (K_2O) were applied in each bag at the rate of 80 mg/kg, 40 mg/kg and 30 mg/kg through ammonium sulphate, single superphosphate and sulphate of potash, respectively at the time of sowing of each crop. The statistical layout of this experiment will be split-plot design experiment between salinity level (four levels) as main plot and lithovit rate (five rates) as sub-plot in randomized complete blocks design (RCBD) with three replicates. The interaction treatments between soil salinity level and lithovit rate were consisted of 20 treatments.

Data Recorded

Growth parameters

Plant height (cm), number of branches and leaves dry weight/plant (g) were recorded after 90 days from sowing. Three plants were randomly chosen from each experimental unit in the two seasons.

Yield components

Pods of cluster bean were harvested after 150 days of seed sowing in both seasons to determined number of pods/ plant and seed yield/plant (g).

Total chlorophyll and active ingredient

Total chlorophyll content a+b (mg/g) in leaves were determined according to **Wettstein (1957)**, Also, galactomanan (guaran) percentage was determined in guar seeds according to the methods described by **Anderson (1949)**.

Statistical Analysis

Data of the present work were statically analyzed and the differences between the means of the treatments (salinity levels and lithovit rates) were considered significant when they were more than the least significant differences (LSD) at the 5% levels by using computer program of Statistix Version 9 (**Analytical Software, 2008**).

Table 1. Physical and chemical properties of experimental farm soil (average of two seasons)

						Mechanical analysis							Soil texture
Clay (%)			Silt (%)						Coarse sand (%)				Clay
49.60			28.10						22.30				
						Chemical analysis							
Time	pH	EC (dsm^{-1})	Soluble cations (m.mol/l)					Soluble anions (m.mol/l)			Available (ppm)		
			Ca^{++}	Mg^{++}	Na^{+}	Zn^{++}	Mo^{++}	Cl^{-}	HCO_3^{-}	SO_4^{--}	N	P	K
Before planting	7.70	0.58	3.80	1.80	0.40	1.80	1.72	3.40	2.12	0.84	175	68	74

Table 2. Chemical analysis of salt (water-salt extract at 5:1)

EC (mmhos/cm)	Soluble cations (m.mol/l)				Soluble anions (m.mol/l)			
	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	CO_3^{--}	SO_4^{--}	Cl^{-}
171.3	9.28	8.54	3000.0	2.80	4.86	0.0	80.76	2935.00

RESULTS AND DISCUSSION

Growth Parameters

Plant height (cm)

As shown in Table 3, using salinity treatments significantly decreased plant height of guar compared to control in both seasons. In the same time, plant height was decreased with increasing the levels of salinity to reach its minimum by using that of 4500 ppm. Furthermore, in most cases, lithovit treatments significantly increased guar plant height compared to untreated plants in the two seasons. Lithovit at 8 g/l significantly increased plant height compared to control and the other ones under study. In addition, the combination between salinity and lithovit decreased plant height comparing to control. Also, using 8 g/l lithovit increased plant height in comparison to the salinized plants under the same levels alone in the two seasons.

Number of branches per plant

The results illustrated in Table 4 reveal that, salinity treatments generally decreased guar branch number/plant compared to control. This decrease was significant with the levels of 3000 and 4500 ppm. Also, the number of branches per plant was decreased as the salinity levels increased up to 4500 ppm. All lithovit rates (except that of 2 g/l) increased branch number per guar plant compared to control in both seasons. Such increase was significant by using the rates of 6 and 8 g/l. Generally, number of branches per plant insignificantly increased by using 6 and 8 g/l lithovit under salinity levels as compared to salinity treatments alone.

Dry weight of leaves per plant

The results presented in Table 5 suggest that, using salinity treatments significantly decreased leaf dry weight per plant (except that of 1500 ppm in the first season) compared to control in both seasons. However, 4, 6 and 8 g/l of lithovit insignificantly increased dry weight of leaves per plant in the first season, while, these rates recorded significant increase in the same parameter in the second one compared to control. Also, the best combination treatments was 1500 ppm of salinity and 8 g/l of lithovit in comparison with the other combinations between salinity levels (except that of unsalinized plants) and lithovit rate under study in both seasons.

Consulting the above mentioned results which indicated that all applied salinity levels cause a decrease in plant height, number of branches per plant and leaves dry weight per guar plant compared with unsalinized plants. This result are in agreement with those obtained by **Roodbari *et al.* (2013)** on *Mentha piperita* **Khaliq *et al.* (2014)** on *Ocimum basilicum* and **Helaly *et al.* (2018)** on rosemary plant.

Table 3. Effect of soil salinity level, lithovit rate and their combinations on plant height (cm) of *Cyamopsis tetragonoloba* at 90 days from sowing during 2015 and 2016 seasons

Soil salinity (ppm) (S)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	103.00	74.00	113.00	111.67	114.66	103.27
1500	89.33	73.67	97.67	90.33	106.00	91.40
3000	65.67	71.33	81.83	66.67	100.00	77.10
4500	60.00	52.27	67.00	62.51	99.33	68.22
Means (L)	79.50	67.82	89.88	82.79	105.00	
LSD at 5%	S = 8.49		L = 9.55		SL = 19.03	
			Second season (2016)			
Control	119.00	110.67	126.00	127.33	142.33	125.07
1500	93.00	88.00	110.00	112.33	113.00	103.27
3000	87.00	73.00	98.67	100.00	108.67	93.47
4500	70.67	60.67	98.67	97.67	105.67	86.67
Means (L)	92.42	83.08	108.33	109.33	128.67	
LSD at 5%	S = 4.15		L = 10.71		SL = 19.59	

Table 4. Effect of soil salinity level, lithovit rate and their combinations on number of branches per plant of *Cyamopsis tetragonoloba* at 90 days from sowing during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	8.33	7.00	9.00	10.00	12.33	9.33
1500	6.33	6.00	7.66	8.33	9.66	7.60
3000	5.33	4.00	6.33	7.66	7.33	6.13
4500	4.33	3.66	5.00	6.00	6.66	5.13
Means (L)	6.08	5.16	7.00	8.00	9.00	
LSD at 5%	S =2.12		L =1.86		SL =3.93	
			Second season (2016)			
Control	9.00	8.66	13.33	17.00	19.66	13.53
1500	7.00	7.00	11.66	15.66	16.66	11.60
3000	6.66	6.00	9.66	11.66	14.66	9.73
4500	6.00	4.66	8.00	10.00	13.66	8.46
Means (L)	7.16	6.58	10.66	13.58	16.16	
LSD at 5%	S =2.50		L =1.86		SL =4.15	

Table 5. Effect of soil salinity level, lithovit rate and their combinations on dry weight of leaves per plant (g) of *Cyamopsis tetragonoloba* at 90 days from sowing during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	7.23	5.70	8.46	7.00	8.52	7.38
1500	6.46	4.90	7.41	6.50	7.80	6.62
3000	5.00	3.20	6.50	6.00	7.00	5.54
4500	4.70	2.94	5.00	5.48	6.40	4.90
Means (L)	5.85	4.18	6.84	6.24	7.43	
LSD at 5%	S =1.79		L = NS		SL = 3.52	
			Second season (2016)			
Control	9.90	11.00	12.60	12.63	15.36	12.30
1500	7.30	8.00	10.60	11.60	12.30	9.96
3000	6.23	6.33	7.80	9.26	10.00	7.92
4500	5.00	5.50	6.53	7.80	8.60	6.69
Means (L)	7.11	7.71	9.38	10.32	11.57	
LSD at 5%	S = 1.82		L = 1.80		SL = 3.69	

The injurious impacts of salinity on plant growth are due to the inhibition of photosynthesis, the induction of growth inhibitor, and reduction of leaf area (**Kashem *et al.*, 2000)**, leaf protein (**Farouk *et al.*, 2012)**, and reduced ability to provide and utilize assimilates/photosynthates (**Kashem *et al.*, 2000**).

As the rate of lithovit increased, all the above mentioned parameters increased throughout the range examined. The advantages of increasing lithovit on enhancing plant growth have been previously reported (**Carbonell *et al.*, 2011; Abdelkader *et al.*, 2018; Ghatas and Mohamed, 2018**). Lithovit compound particles contain calcium carbonate (80%), magnesium carbonate (4.6%) and Fe (0.75%). The beneficial effect of this compound is being contains calcium carbonate ($CaCO_3$) decomposes to calcium oxide (CaO) and carbon dioxide (CO_2) in leaves stomato, and this CO_2 increases photosynthesis intensity, leading to increase carbon uptake and assimilation, thereby increasing plant growth (**Carmen *et al.*, 2014**).

However, some treatments of lithovit especially the rates of 6 or 8 g/l, to some extent, reduced the harmful effect of salinity in abovementioned parameters of guar plant. Such effect might be due to enhancing the metabolic processes (anabolism) leading to more vegetative growth. These results are in line with those reported by **Maswada and Abd El-Rahman (2014)** on wheat plants.

Yield Components

Number of pods/plant

The results given in Table 6 indicate that, cluster bean plants planted in soil salinity up to 4500 ppm produced less number of pods per plant than control in both seasons. In the same time, salinity treatments showed significant effect in this respect. Considerable variation in pod number per guar plant was observed resulting from the different lithovit used in the two seasons. In this connection, lithovit treatments at 8 g/l followed by that of 6 g/l increased number of pods per plant compared to

Table 6. Effect of soil salinity level, lithovit rate and their combinations on number of pods per plant of *Cyamopsis tetragonoloba* during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	17.66	18.33	17.00	20.33	24.66	19.60
1500	16.66	15.33	15.66	18.00	22.00	17.53
3000	14.33	13.66	12.66	19.33	18.00	15.60
4500	10.66	8.00	11.33	16.33	18.66	13.00
Means (L)	14.83	13.83	14.16	18.50	20.83	
LSD at 5%	S = 1.80		L = 2.42		SL = 4.68	
			Second season (2016)			
Control	21.66	20.33	22.66	23.66	30.66	23.80
1500	17.33	19.66	18.33	22.00	28.00	21.06
3000	14.00	15.66	17.66	19.66	22.66	17.93
4500	12.33	10.33	11.33	18.33	21.33	14.73
Means (L)	13.33	16.50	17.50	20.91	25.66	
LSD at 5%	S = 1.90		L = 2.34		SL = 4.59	

control in the two seasons. This increase was significant during the first and second seasons. In matter of combination, it was cleared that the highest value was obtained due to either 0.0 or 1500 ppm of salinity combined with 8 g/l of lithovit in both seasons without significant difference between them. Also, there was significant decrease in this concern due to the treatments of control, 2, 4 and 6 g/l combined with salinity at 3000 and 4500 ppm if compared to control in the two seasons.

Seed yield/plant (g)

Results presented in Table 7 show that, salinity treatments decreased seed yield per guar plant compared to control in both seasons. In the mean time, salinity treatments at 3000 and 4500 ppm showed significant effect in this respect during the two seasons. All lithovit treatments caused a clear increment in seed yield per plant (except that of 2 and 4 g/l in the first season and 2 g/l in the second one) comparing with control in both seasons. However, spraying cluster bean three times with lithovit at 8 g/l rate recorded significant increase in this regard compared to control. Furthermore, using lithovit at 2 g/l under soil salinity levels at 3000 and 4500 ppm resulted in significant reduction in seed yield/ plant compared to the highest rate of lithovit combined with the same levels of soil salinity.

Concerning number of pods per plant and seed yield/plant of cluster bean, it was found that control treatment (unsalinized plants) gave the maximum values in this regard compared to soil salinity levels. Such decrease might be due to the disturbance in anabolic activities, affected by the decrease in water absorption and/or disturbance of minerals balance or absorption and utilization caused by salinity treatments (**Hamad, 1996**).

Salinity has considerable adverse impacts on plants productivity. As it was stated, the detrimental effects of high salinity on plants can be observed at the whole-plant level as the death of plants and/or decreases the productivity (**Parida and Das, 2005**). In cumin, *Ammi majus*, fennel and *Cymbopogon winterianus* increasing salt concentrations caused a significant reduction in the number of umbels, fruit yield/plant, weight of 1000 seeds and herb yield (**Nabizadeh, 2002; Ashraf *et al.*, 2004; Abd El-Wahab, 2006; Chauhan and Kumar, 2014**).

Table 7. Effect of soil salinity level, lithovit rate and their combinations on seed yield per plant of *Cyamopsis tetragonoloba* during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	9.00	9.33	9.01	10.33	11.38	9.81
1500	9.11	6.21	6.22	9.09	10.42	8.21
3000	6.83	4.86	4.09	9.14	8.85	6.75
4500	4.18	2.80	3.85	7.52	8.70	5.41
Means (L)	7.28	5.80	5.79	9.02	9.84	
LSD at 5%	S = 2.08		L = 2.00		SL = 4.13	
			Second season (2016)			
Control	11.08	11.01	11.17	12.67	19.14	13.01
1500	9.11	10.11	9.33	11.45	17.32	11.46
3000	7.32	7.63	8.14	11.08	12.38	9.31
4500	5.80	3.98	5.74	8.69	10.64	6.97
Means (L)	8.33	8.18	8.60	10.97	14.87	
LSD at 5%	S = 2.26		L = 2.09		SL = 4.35	

Obtained results in this research suggested that as lithovit rates are increased gradually the above mentioned characters are increased. In fact, Lithovit acts as a long term CO_2 reservoir supplying plants with CO_2 consequently promoting flowering and fruiting in many crops (**Kumar, 2011**). Also, lithovit has enhanced leaf area and chlorophyll content due to its stimulatory impact on photosynthetic rate caused by atmospheric CO_2 amelioration (**Del Amor, 2013**). These results are in accordance with those found by **Hamoda *et al.* (2016)** on cotton plant.

Such increase in yield components of cluster bean due to some treatments of lithovit under salinity treatments indicated that used nano-fertilizers reduced, to some extent, the harmful effect of salinity, by acting the photosynthetic rate. Also, **Sajyan *et al.* (2018)** stated that the best improvement in plant yield (76%) was obtained with lithovit at EC= 8ms cm^{-1} due to improvement in fruit number per plant. Lithovit showed superior effects under salt stress compared to the Aspirin and Glycinebtaine.

Total Chlorophyll and Active Ingredient

Total chlorophyll contents a+b (mg/g)

Results listed in Table 8 suggest that, using salinity treatment at higher level of 4500 ppm decreased total chlorophyll content in leaves as fresh weight compared to control in the two seasons. There was a decrease in total chlorophyll content in the first season and an increase in this regard in the second one by using the levels of 1500 and 3000 ppm. Total chlorophyll content was increased by using lithovit as foliar spray (except that of 2 g/l in the first season) compared to control in the two seasons. However, the highest values in this parameter were achieved with 8 g/l in the first season and 4 g/l in the second one compared with control and the other ones under study. Moreover, total chlorophyll content in guar seeds was increased as a result of the treatment of lithovit at 6 and 8 g/l combined to those of salinity at 1500 ppm in comparison to those of salinity alone (3000 and 45000 ppm) or those of the other ones of combination between lithovit and salinity in the first season. On the other

Table 8. Effect of soil salinity level, lithovit rate and their combinations on total chlorophyll content a+b (mg/g) of *Cyamopsis tetragonoloba* during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	0.824	0.823	0.906	0.846	0.955	0.871
1500	0.835	0.736	0.724	0.831	0.850	0.795
3000	0.710	0.700	0.765	0.841	0.793	0.762
4500	0.692	0.748	0.687	0.809	0.788	0.745
Means (L)	0.765	0.751	0.770	0.832	0.847	
LSD at 5%	S = 0.004		L = 0.003		SL = 0.006	
			Second season (2016)			
Control	0.903	1.173	1.047	1.057	1.123	1.061
1500	0.907	1.177	1.060	1.190	1.090	1.085
3000	1.153	1.073	1.237	1.177	0.977	1.123
4500	1.157	1.197	1.283	0.900	0.993	1.106
Means (L)	1.030	1.155	1.157	1.081	1.046	
LSD at 5%	S = 0.045		L = 0.043		SL = 0.089	

hand, the best values in this concern were achieved with the treatment of lithovit at 4 g/l combined to those of salinity at 3000 and 45000 ppm in comparison to those of salinity alone (1500 ppm) or those of the other ones of combination between lithovit and salinity in the second season.

Galactomanan percentage

Table 9 reveals that, galactomanan (pure guar gum) percentage significantly decreased by using salinity treatments, except that of 1500 ppm in the first season, compared with control in both seasons. In the other words, using salinity treatments at higher levels (3000 and 4500 ppm) recorded the lowest values in this regard in the two seasons compared to control and the other levels under study. In addition, lithovit rates generally increased galactomanan percentage of guar plants compared to control in both seasons, in most cases. Also, glactomanan percentage in cluster bean seeds was mostly decreased by using all lithovit rates under salinity treatments up to 3000 ppm level if compared with control in the two seasons. However, lithovit treatment at 6 and 8 g/l might succeed in increasing glactomanan percentage under low and moderate salinity levels (1500 and 3000 ppm) compared to those of control in both seasons.

In the present study, it was reported that the lowest values of total chlorophyll content (a+b) in leaves and glactomanan percentage of guar were recorded due to salinity treatments at 3000 and 4500 ppm, in most cases, while the best values in this connection were achieved with control ant the lowest levels of soil salinity . This result confirmed the findings reported earlier by **Hamad (1996)** and **Ramadan (1996)** on guar plant, **Cha-Um and Kirdmanee (2009)** on maize, **Ali *et al.* (2013)** on *Simmondsia chinensis* and **Nouman *et al.* (2012)** on *Moringa oleifera*.

These results may be due to salt-induced water stress reduction of chloroplast stoma volume and regeneration of reactive oxygen species in playing an important role in the inhibition of photosynthesis seen in salt stressed plants **(Price and Hendry, 1991; Allen, 1995)**.

Table 9. Effect of soil salinity level, lithovit rate and their combinations on guaran percentage of *Cyamopsis tetragonoloba* during 2015 and 2016 seasons

Salinity (S) (ppm)	Lithovit rate (L) (g/l)					
	Control	2	4	6	8	Means (S)
			First season (2015)			
Control	26.37	26.50	26.35	27.90	31.62	27.75
1500	24.08	24.32	22.76	26.77	28.00	25.18
3000	22.31	23.47	22.62	26.41	27.70	24.50
4500	21.43	21.39	19.97	23.68	25.96	22.48
Means (L)	23.55	23.92	22.92	26.19	28.32	
LSD at 5%	S = 3.23		L = 1.62		SL = 4.32	
			Second season (2016)			
Control	29.33	29.65	29.83	30.75	34.03	30.72
1500	29.43	25.86	26.21	29.45	29.42	28.07
3000	26.81	24.54	25.07	29.39	28.21	26.80
4500	24.50	20.67	24.50	27.12	28.04	24.96
Means (L)	27.52	25.18	26.40	29.18	29.92	
LSD at 5%	S = 0.45		L = 0.50		SL = 1.00	

The salinity could seriously change the photosynthetic carbon metabolize, leaf chlorophyll content as well as photosynthetic efficiency. It was observed that the high levels of salinization induced a significant decrease in the contents of pigment fractions (chlorophyll a and b) as compared with control plants (**Seeman and Critchley, 1985** and **Sharkey *et al.*, 1989**).

Concerning total chlorophyll content and galactomanan percentage, our results concluded that these parameters significantly increased with increasing lithovit rates. These results are in line with those stated by **Abdelghafar *et al.* (2016**) on onion and **Dragicevic *et al.* (2016)** and **Abd El-Aal and Eid (2018)** on soybean plants.

In addition, nano particles of $CaCO_3$ treatment reported the higher total chlorophyll content and galactomanan percentage of cluster bean plant. Adding of simulating plant growth (lithovit) treatments increased the efficiency of soil and plant potential to moderate salt stress and increase total chlorophyll and active ingredient of cluster bean plant. These results are in agreement with those stated by **Shallan *et al.* (2016)** on cotton plants.

Conclusion

From above mentioned results, it is preferable to spray *Cyamopsis tetragonoloba* plants with lithovit at 8 g/l three times a season under moderate salt stress (1500 ppm) to enhance the growth, yield components and total chlorophyll content as well as galactomanan percentage of cluster bean plant.

REFERENCES

Abd El-Aal, M.M.M. and R.S.M. Eid (2018). Effect of foliar spray with lithovit and amino acids on growth, bioconstituents, anatomical and yield features of soybean plant. 4th Int. Conf. Biotechnol. Appl. in Agric. (ICBAA), Benha Univ., Moshtohor and Hurghada, 4-7 April, Egypt.

Abdelghafar, M.S., M.T. Al-Abd, A.A. Helaly and A.M. Rashwan (2016). Foliar application of lithovit and rose water as factor for increasing onion seed production. Nat. Sci., 14 (3): 53-61.

Abdelkader, M.A.I., A.S.H. Gendy, I.A. Bardisi and H.A. Elakkad (2018). The impact of NPK fertilization level and Lithovit concentration on productivity and active ingredients of *Coriandrum sativum* plants. Middle East J. Appl. Sci., 8 (3): 827-836.

Abd El-Wahab, M.A. (2006). The efficiency of using saline and fresh water irrigation as alternating methods of irrigation on the productivity of *Foeniculum vulgare* Mill subsp. vulgare var. vulgare under North Sinai conditions. Res. J. Agric. Biol. Sci. 2 (6): 571-7.

Ali, E.F., S. Bazaid and F.A.S. Hassan (2013). Salt effects on growth and leaf chemical constituents of *Simmondsia chinensis* (Link) Schneider. J. Med. Pl. Studies, 1 (3): 22 – 34.

Allen, R.D. (1995). Dissection of oxidative stress tolerance using transgenic plants. Plant Physiol., 7:1049-1054.

Analytical Software (2008). Statistix Version 9, Analytical Software, Tallahassee, Florida, USA.

Anderson, E. (1949). Endosperm mucilagrs of legumes: occurrence and composition. Ind. Eng. Chem., 41: 2887-2890.

Ashraf, M., N. Mukhtar, S. Rehman and E.S. Rha (2004). Salt-induced changes in photosynthetic activity and growth in a potential medicinal plant Bishop's weed (*Ammi majus* L.). Photosynthetica, 442 (4): 543-50.

Carbonell, M.V., M. Florez, M.E. Martinez, R. Maqueda and J.M. Amaya (2011). Study of stationary magnetic fields on initial growth of pea (*Pisum sativum* L.) seeds. Seed Sci. and Technol., 39 (3): 673-679.

Carmen, B., R. Sumalan, S. Gadea and S. Vatca (2014). Physiological indicators study involved in productivity increasing in tomato. Pro-Environ., 7: 218 – 224.

Chapman, D.H. and R.F. Pratt (1978). Methods Analysis for Soil, Plant and Water. Univ. of California Div. Agric. Sci., 16: 38.

Chauhan, N. and D. Kumar (2014). Effect of salinity stress on growth performance of *Citronella java*. Int. J. Geol., Agric. and Environ. Sci., 2 (6): 11- 14.

Cha-Um, S. and C. Kirdmanee (2009). Effect of salt stress on proline accumulation, photosynthetic ability and growth characters in two maize cultivars. Pak. J. Bot., 41 : 87-98.

Del Amor, F.M. (2013). Variation in the leaf 13° C is correlated with salinity tolerance under elevated CO_2 concentration. J. Pl. Physiol., 170: 283-290.

Dinani, O.P., P.K. Tyagi, A.K. Shrivastav, P.K. Tyagi, A.B. Mandal and S.K. Jaiswal (2017). Effect of feeding fermented guar meal vis-à-vis toasted guar meal with or without enzyme supplementation on immune response, caeca micro flora status and blood biochemical parameters of broiler quails. Int. J. Pure App. Biosci., 5 (1): 624-630.

Dragicevic, V., B. Nikolic, H. Waisi, M. Stojiljkovic and M. Simic (2016). Increase of soybean nutritional quality with nonstandard foliar fertilizers. J. Cent. Euro. Agric., 17 (2): 356-368.

Farouk, S., S.A. Youssef and A.A. Ali (2012). Induction of systemic resistance in tomato against *Alternaria solani* by biostimulants and vitamins. Alex. J. Agric. Res., 57 (1): 117-129.

Gerik, T.J., R.E. Stafford, M.J. Norris and D.E. Kissel (1983). An assessment of guar production potential in central Texas. MP-1536. Tex Agric. Exp. Sta. Coll. Station, TX.

Ghatas, Y.A.A. and Y.F.Y. Mohamed (2018). Influence of mineral, micro-nutrients and Lithovit in growth, oil productivity and volatile oil constituents of *Cymopogen citruts* L. plants. Middle East J. Agric., 7 (1): 162-174.

Gillett, J. B. (1958). Indigofera (Microcharis) in tropical Africa with related genera *Cyamopsis* and *Rhynchotropis*, Kew bulletin additional series, 1 : 165.

Hamad, E.H.A. (1996). Effect of salinity and some growth regulators on guar plants. M.Sc. Thesis, Fac. Agric., Zagazig Univ., Egypt.

Hamoda, S.A.F., A.N.E. Attia, M.H. El-Hendi and Sh.O.S. El-Sayed (2016). Effect of nano-fertilizer (lithovit) and potassium on growth, fruiting and yield of Egyptian cotton under different planting dates. Int. J. Adv. Res. Biol. Sci., 3 (12): 29-49.

Helaly, M.N., S. Farouk, S.A. Arafa and N.B.I.A. Amhimmid (2018). Inducing salinity tolerance of rosemary (*Rosmarinus officinalis* L.) plants by chitosan or zeolite application. Asian J. Adv. Agric. Res., 5 (4): 1-20

Jones, O.R. and W.C. Johnson (1983). Cropping practices: Southern Great Plains in Dry Land. Agric. Agron. J., 23: 365-395.

Kashem, M.A., N. Sultana, T. Ikeda, H. Hori, T. Loboda and T. Mitsui (2000). Alteration of starch-sucrose transition in germinating wheat seed under sodium chloride salinity. J. Pl. Biol., 43:121-127.

Khaliq, S., Z.U. Zafar, H.R. Athar and R. Khaliq (2014). Physiological and biochemical basis of salt tolerance in *Ocimum basilicum* L. J. Med. Pl. Studies, 2 (1): 18-27.

Khare, C.P. (2007). Indian Medicinal Plants. Springer Science Business Media, LLC. New York, USA.

Kumar, P. (2011). Nanotechnology in Agriculture. Financing Agric., 34: 8-10.

Maswada, H. F. and L.A. Abd El-Rahman (2014). Inducing salinity tolerance in wheat plants by hydrogen peroxide and Lithovit "a nano-caco3 fertilizer". J. Agric. Res. Kafr El-Sheikh Univ., 40 (4): 696-719.

Nabizadeh, E. (2002). Effect of salinity on cumin growth and yield. Iranian Field Crop Res., 1: 20-29.

Nouman, W., M.T. Siddiqui, S.M.A. Basra, R.A. Khan, T. Gull, M.E. Olson and H. Munir (2012). Response of *Moringa oleifera* to saline conditions. Int. J. Agric. Biol., 14: 757–762.

Parida, A.K. and A.B. Das (2005). Salt tolerance and salinity effects on plants: a review. Ecotoxicol. Environ. Saf., 60:324-49.

Price, A.H. and G.A.F. Hendry (1991). Iron catalysed oxygen radical formation and its possible contribution to drought damage in nine native grasses and three cereals. Pl. Cell Environ., 14:477-484.

Ramadan, A.A. (1996). Effect of soil salinity and some micro-elements on guar plants. M.Sc. Thesis, Fac. Agric., Zagazig Univ., Egypt.

Roodbari, N., S. Roodbari, A. Ganjali, F.S. Nejad and M. Ansarifar (2013). The effect of salinity stress on growth parameters and essential oil percentage of peppermint (*Mentha piperita* L.). Int. J. Adv. Biol. and Biomed. Res., 1 (9): 1009-1015.

Sajyan, T.K., N. Shaban, J. Rizkallah and Y.N. Sassine (2018). Effects of Monopotassium-phosphate, Nano-calcium fertilizer, Acetyl salicylic acid and Glycinebetaine application on growth and production of tomato (*Solanum lycopersicum*) crop under salt stress. Agron. Res., 16 (3): 872-883.

Seeman, J.R. and C. Critchley (1985). Effects of salt stress on the growth, ion content, stomatal behavior and photosynthetic capacity of saltsensitive species *Phaseolus vulgaris* (L). Planta, 164: 152–162.

Shallan, M.A., H.M.M. Hassan, A.A.M. Namich and A.A. Ibrahim (2016). The influence of lithovit fertilizer on the chemical constituents and yield characteristics of cotton plant under drought stress. Int. J. Chem. Tech. Res., 9 (8): 1-11.

Sharkey, T.D., J.R. Seeman and J.A. Berry (1989). Photosynthesis in intact Leaves of C_3 Plants: Physics, physiology and rate limitations. Bot. Rev., 51: 53-105.

Undersander, D., D. Putnam, A. Kaminski, K. Kelling, J. Doll, E. Oplinger and J. Gunsolus (2006). Alternative Field Crops Manual, University of Wisconsin-Madison.

Wettstein, D.V. (1957). Chlorophyll lethal under sub mikroskoshrel der plastieden. Ex. PF Celi. Res., (12): 427-433

Whistler, R.L. and T. Hymowitz (1979). Guar: Agronomy, Production, Industrial Use, and Nutrition. Purdue Univ. Press. West Lafayette, India.

تأثير الملوحة والليثوفيت على النمو والمكونات المحصولية والمكونات الكيميائية لنبات الجوار

آلاء صلاح محمود أحمد نصار- على عبد الحميد معوض - محمد أحمد إبراهيم عبد القادر

قسم البساتين - كلية الزراعة - جامعة الزقازيق - مصر

أُجري هذا العمل في مشتل مجلس مدينة ديرب نجم، محافظة الشرقية، مصر خلال الموسمين المتتاليين لعامي ٢٠١٥ و٢٠١٦ لدراسة تأثير مستويات ملوحة التربة المختلفة (صفر، ١٥٠٠ ، ٣٠٠٠ و٤٥٠٠ جزء في المليون) ، معدلات الليثوفيت (صفر، ٢، ٤، ٦ و ٨ جم/لتر) رشاً على الأوراق ومعاملات التداخل بينهما على النمو ومكونات المحصول وبعض المكونات الكيميائية لنباتات الجوار، تم تصميم التجربة كقطع منشقة مرة واحدة في قطاعات كاملة العشوائية في ثلاث مكررات، أظهرت النتائج التي تم الحصول عليها والتي تفيد بأن استخدام مستويات الملوحة أدى إلى انخفاض صفات النمو (ارتفاع النبات، وعدد الأفرع/النبات والوزن الجاف للأوراق/نبات)، والمساهمات المحصولية (عدد القرون ومحصول البذور/نبات)، وبعض المكونات الكيميائية (محتوى الكلوروفيل الكلي أ+ ب) والمادة الفعالة (الجلكتومانان) مقارنة بالكنترول، علاوة على ذلك، تم تسجيل أعلى القيم في هذه الصدد باستخدام الليثوفيت بمعدل ٨ جرام/لتر في كلا الموسمين، في معظم الحالات، عموما، يمكن أن نستنتج أن الليثوفيت بمعدل ٨ جم/لتر، كان له تأثيراً واضحاً في التخفيف من تثبيط نمو وإنتاجيه نبات الجوار تحت ظروف الإجهاد الملحي المتوسط.

المحكمـــــون:

١- **أ.د. السيد حماد عامر حماد** أستاذ نباتات الزينة والطبية والعطرية – كلية الزراعة – جامعة الأزهر بأسيوط.

٢- **د. أحمد شاكر حسين جندي** أستاذ نباتات الزينة والطبية والعطرية المساعد – كلية الزراعة – جامعة الزقازيق