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STUDIES OF SALINITY AND DROUGHT ON COMMON BEAN

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ABSTRACT

Two pot experiments were carried out in the farm of Fac. of Agric.; Mansoura University during the two successive summer seasons of 2008 and 2009, to investigate the effect of soil salinity Proline treatments and some irrigation levels on plant growth, yield and biochemical constituents of Common bean (*Phaseolus vulgaris* L.). cv. Nebrasca.

The results obtained can be summarized as follows:-

1-Vegetative growth of common bean in term of plant height, number of leaves, fresh weight, dry weight and leaf area was reduced in case of growing on saline clay soil in both seasons.

2- Decreasing the number of irrigation gave rise to decrease vegetative growth in both seasons.

3- Proline treatment caused positive effect on the leaves.

4- The triple interaction had no significant effect on all parameters of vegetative growth in both years except leaf area in the second year.

5- Saline soil had deleterious effect on flowering parameters on both years. Likewise, decreasing irrigation number lead to injuring effect on flowering parameters while proline treatment had no obvious increase in this respect.

6- Triple interaction had no effect on flowering parameters on both years.

7- Almost NPK concentrations as well as Na, Ca, Mg were reduced in case of saline soil in both years.

8- Decreasing irrigation number decreased mineral contents of common bean leaves in both years, while proline treatment lead to increase mineral concentration in both years.

9- Saline soil had injurious effect on chlorophyll contents in both seasons. Likewise, decreasing irrigation number caused a significant decrease in pigment content in both years. Otherwise, proline treatment caused an increase in pigments content in both years.

INTRODUCTION

Salinity is one of the formidable problematic features of the agriculture soil in Egypt. Reclamation of such salt affected areas by the classic way implying drainage and leaching is often expensive and/or impractical. The inhibitory effect of salinity on growth may be due to the decrease in water absorption, metabolic processes, merestimatic activity and cell enlargement.

In general, Egypt as a country always suffers from the increasing of population and has both drought and arid climate resulting high salting in soil. Usually, tremendous losses in crop production occur annually in our nation because of soil salinity. Furthermore, much evidence has accumulated confiriming that growth, yield and metabolism of plants in saline soils are negatively influenced by slight changes in the concentration of salts in the soil.

Recently, proline is synthesized from either glutamate or ornithine. It has been demonstrated that the glutamate pathway is predominant under conditions of osmotic stress (Delauney and Verman 1993). The main step of proline biosynthesis from glutamate is catalyzed by a single bifunctional enzyme, A'-pyrroline-5-carboxylate synthetase (P5CS), which produces y-glutamyl kinase (y-GK) and glutamic acid-5 semialdehyde (GSA) dehydrogenase (or y-glutamyl phosphate reductase). The GSA produced by these reactions is spontaneously converted into pyffoline-5-carboxylate (P5C), which is then reduced by P5C reductase (P5CR) to proline (Zhang *et al.,* 1995). Plants also synthesize proline from ornithine, through ornithine--aminotransferase (OAT). If the cx-amino group of ornithine is transaminated, the product is cx-keto--aminovalerate, which cyclizes to A'-pyrroline-2-carboxylate (P2C) and is then reduced to proline. Alternatively, trans-amination of the s-amino group yields GSA, which is converted to proline via *P5C* (Delauney and Verma, 1993). The metabolism and accumulation of proline also depend on its degradation, which is catalysed by the action primarily of the mitochondrial enzyme, proline dehydrogenase (PDH) (Hare *et al.,* 1999). In present-day agriculture, a common type of stress results from extensive use of N-fertilizers (Ruiz and Romero, 1998). Rabe (1990) reviewed the influence of numerous kinds of a biotic and biotic stress on the composition of N-containing compounds in plants. The amino compounds most often accumulated in different organs of the plant as a function of stress include glutamine, asparagine, arginine, citruline, ornithine and principally proline.

The present study is planned as an attempt to minimize the detrimental effect of salinity on snap bean plants through making use of many irrigations and proline. Yield and its components as well as some physiological aspects were considered.

MATERIALS AND METHODS

Two pot experiments were carried out in the farm of Fac. of Agric.; Mansoura University during the two successive summer seasons of 2008 and 2009, to investigate the effect of soil salinity and some irrigation levels on plant growth, yield and biochemical constituents of Common bean (*Phaseolus vulgaris* L.).Nebrasca.

The experimental design:

Factorial randomized complete block design with three replicate was used in this study. Two types of soil (clay and salinity) and two proline treatments (with 1000 ppm and control) were used with foliar ways and four irrigation treatments (2, 4, 6 and 8 irrigations). The experiments included 16 treatments in three replicates, 2 treatments of salinity and 2 proline treatments and four irrigations, then the total number of pots required for each season was 48 pots.

Cultivation:

48 plastic pots; 35 cm in diameter and 40 cm height were used in each season. Each pot was filled with 15 kg air dried clay soil taken from the surface layer of soil Agric. Exp. Station, Mansoura Univ. or from the surface layer of soil Damietta farm, some physical and chemical properties of the used soil are shown in Table (2).

Table (1): Physical and chemical analysis of the experimental soils salinity and clay during 2009 and 2010 seasons.

Soil	O.M %	$CaCO_3$ %	Coarse sand%	Fine Sand%	Silt %	Clay %	Texture class	EC** dS/m	pH*
Clay	1.96	3.08	1.92	23.78	26.18	49.23	Clay	0.60	8.0
Salinity	1.89	2.10	415	22.94	27.14	48.94	Clay	2.30	7.8

Table 2:

S.p	Available (ppm)			meq/100g soil							
%	N	P	K	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{--}	Cl^{-}	SO_4^{--}	HCO_3^{--}
65	45	16.0	330	0.5	8.14	3.8	4.7	o.oo	4.74	1.08	6.75
62	50	70.0	170	3.5	12.5	18.4	5.6	o.oo	23.75	12.7	3.75

Soil suspension (1:2.5)** * Soil extraction (1:5)**

Ten seeds/pot were selected for uniformity in size and colour and were sown in each pot on 10th March (2008 and 2009) at equal distance and depth.

After 21 days from sowing, plants were thinned to the most five uniform plants per pot then the irrigation treatment of pots were alone after 21 days from sowing at 50 % of soil field capacity one irrigation every 30 days (2 irrigations) one irrigation every two weeks (4 irrigations), then one irrigation every 10 days (6 irrigations), finally one irrigation every week (8 irrigations). The compound fertilizers N:P:K (20:20:20) were added three times the first one after 21 days from sowing and the other two after 41 and 61 days from sowing, respectively.

Proline:

Proline were obtained from El-Gomhoria Co.; Mansoura, Egypt, and foliar applied at 100 ppm twice/1 after 21 days from seeding then after two weeks from the first spray and control.

Sampling date:

After 55 days from the sowing and the first picking (55 days later); 8 plants were randomly taken from each treatment to determine the following parameters:

Vegetative growth characteristics:

At full blooming stage (60) days from sowing, five plants were randomly taken from each treatment to determine:

1- Plant height (cm)
2- Number of leaves per plant.

3- Fresh weight of plant (g/plant).
4- Dry weight of plant (g/plant).

The plant samples were weighed and oven dried at 70 °C tell constant weight was reached then, dry matter calculated in expression of g/plant and the dried plants were thoroughly ground and wet digested by a sulphoric-percloric acid moisture as described by Peterburgski (1968).

Flowering parameters:

1- Number of flowers per plant.
2- Number of days required for appearance the 1st flower.
3- Number of pods per plant.
4- Fruit setting % = $\frac{\text{No of Pods / Plant}}{\text{No of Flowere /Plant}}$ x 100

Chemical constituents:

1- Chlorophyll content was determined in the upper fourth leaf substending the terminal bud at 60 days after sowing colouremetrically as described by Goodwine (1965).
2- Total N% was estimated according to the method described by Pregle (1945), using micro-kjeldahl.
3- Total P% was determined colouremitricaly using the chlorostannus reduce molybdo phosphoric blue colour method in sulphoric system Jackson (1967).
4- K% was determined in the digested plant sample using a flam photometer Black (1965).
5- Na, Ca and Mg were determined in the digested plant sample using Atomic absorption. A.O.A.C.(1970).
6- Crude protein was estimated in the digestic of the dry pods by determination of N% and multiblied in 6.25 according to A.O.A.C. (1970).
7- Prolein content in leaf extracts was determined following the procedure (Irrigoyen *et al.*, 1992) using ninhydrin reagent.

Statistical analysis:

The obtained data were subjected to statistical analysis as factorial experiment in a randomized complete block design with four replicates in both seasons. All data were statistically analyzed according to the procedure outlined by Snedecor and Cochran (1967). The treatment means were compared using LSD according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Data presented in Table (2) showed that saline clay soil negatively affects the vegetative growth of common bean plants in terms of plant height, number of leaves, fresh weight, dry weight and leaf area as compared with clay soil. However, saline soil reduced significantly vegetative growth in both seasons of study. Such deleterious effect could be due to reduction of water potential; causes imbalance or disturbance in ion homeostasis and toxicity.

This altered water levels to initial growth reduction and limitation of plant productivity (Benlloch-Gonzalez *et al.,* 2005).

It was noticed from data given in the same table that the number of irrigations had an obvious effect on vegetative growth parameters. Since, decreasing the number of irrigations gave rise to decreasing to vegetative growth in both years of study. The result is in agreement with that Allen, *et al.,* (2000) who found that water stress reduced vegetation growth of bean crop. On the other hand, proline spraying caused a significant increase in vegetative growth parameters of common mean in both years. In this direction, Solomen *et al.,* 1994 found that that proline protects enzyme against high ionic strength and restore terror. Moreover, it improves the stability of some cytoplasm and mitochondrial enzymes (Nash *et al.,* 1982).

The interaction between soil type and number of irrigations significantly affected fresh weight; dry weight and leaf area in both years, other wise plant height and number of leaves were not affected by such interaction. Furthermore, fresh weight and dry weight were affected by the interaction between soil type and proline treatment in the first year, where only leaf area was changed in the second year. However, number of leaves was affected by the interaction between number of irrigations and proline treatment in the first year, while leaf area was significantly affected in the second year.

The triple interaction had no significant effect on all tested parameters of vegetative growth in both years, except leaf area in the second season.

Table (2): Vegetative growth parameter of common bean plant as affected by irrigations levels and proline in to two soil type in the two seasons.

Treatments	1st season					2nd season				
	Plant height (cm)	No. of leaves	Fresh weight (g/plant)	Dry weight (g/plant)	Leaf area (cm^2/plant)	Plant height (cm)	No. of leaves	Fresh weight (g/plant)	Dry weight (g/plant)	Leaf area (cm^2/plant)
A- Soil type										
Clay	23.25	7.91	35.41	7.22	279.62	21.66	7.08	35.23	7.06	284.95
Salinity	21.87	5.54	28.89	5.67	254.08	20.54	5.58	28.66	5.55	255.81
LSD 5%	**0.61**	**0.61**	**0.42**	**0.11**	**3.95**	**0.68**	**0.41**	**0.57**	**0.16**	**2.81**
B- Number of irrigations										
8	26.25	9.92	43.05	7.95	309.58	25.08	9.5	42.67	7.82	311.92
6	23.25	7.41	33.74	7.18	274.66	22.33	7.42	33.51	7.09	282.33
4	21.75	5.57	30.62	5.89	263.16	19.75	5.16	30.68	5.81	264.08
2	19.21	3.83	21.18	4.76	220.00	17.25	3.25	20.93	4.51	222.00
LSD 5%	**0.65**	**0.81**	**0.58**	**0.23**	**5.02**	**0.75**	**0.69**	**0.72**	**0.26**	**3.39**
C- Proline										
With	23.15	7.37	33.32	6.82	275.33	21.50	6.83	33.22	6.67	275.92
Without	22.1	6.08	30.97	607	258.37	20.70	5.84	30.68	5.94	264.25
LSD 5%	**1.88**	**0.18**	**0.85**	**0.21**	**11.15**	**0.94**	**1.12**	**0.63**	**0.42**	**2.61**
Interaction										
A x B	**n.s**	**n.s**	***	***	***	**n.s**	**n.s**	***	***	***
A x C	**n.s**	**n.s**	*	***	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**
B x C	**n.s**	*	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**
A x B x C	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**

Data illustrated in Table (3) showed that saline soil had bad effect on flowering parameters and total yield in both years. This result is in agreement with that found by (Hamed, (1990); Goertz and Coons (1991) and Abd El-Aal (1994). Data of the same table showed that decreasing number of irrigations reduced flowering parameters (number of flowers/plant, number of pods/plant and total yield) in both years of study. But proline treatment caused a significant increase in flowering parameters and total yield/plant in both seasons. Results obtained by Allen, *et al.,* (2000) affirmed that flowering and pod full were the most sensitive periods for the bean crop. The interaction between soil type and number of irrigation significantly affects number of pods/plant and total yield per/plant in both years, otherwise, flowering parameters were not affected by the interaction between soil type and proline. However, total yield/plant was significantly affected by the interaction between number of irrigation and proline treatment in both years. While the triple interaction had no obvious effect on flowering parameters.

Table (3): Flowering parameters of common bean plant as affected by irrigation levels and proline under two soil types in the two seasons.

Treatments	1st season						2nd season					
	No. of flowers /plant	No. of pod's/ plant	Pod's dim. /plant	pod's length/ plant	Setting/ plant	Total yield/plant)	No. of flowers /plant	No. of pod's/ plant	Pod's dim. /plant	pod's length/ plant	Setting/ plant	Total yield/plant)
A- Soil type												
Clay	18.92	11.21	0.96	10.55	69.54	42.5	16.95	9.92	0.94	10.88	68.37	39.21
Salinity	16.58	8.51	0.81	10.22	65.87	3308	15.41	8.87	0.87	10.24	65.37	31.08
LSD 5%	**0.56**	**0.25**	**0.02**	**0.18**	**0.64**	**0.98**	**0.92**	**0.59**	**0.01**	**0.28**	**1.70**	**1.05**
B- Number of irrigations												
8	23.11	16.25	1.05	12.38	74.92	57.58	21.51	16.12	1.03	12.35	74.42	54.16
6	19.58	14.25	1.01	12.11	72.50	52.50	19.00	12.66	0.98	11.95	71.41	50.50
4	17.16	7.33	0.93	11.46	66.16	41.08	14.83	7.58	0.92	11.11	65.08	35.92
2	11.25	1.58	0.57	5.58	57.25	0.00	9.41	1.34	0.69	6.83	56.58	0.00
LSD 5%	**0.86**	**0.71**	**0.03**	**0.45**	**0.77**	**1.14**	**1.23**	**0.79**	**0.02**	**0.41**	**1.44**	**0.85**
C- Proline												
With	18.45	10.16	0.89	10.48	67.95	39.08	16.87	10.21	0.91	10.70	67.25	36.04
Without	17.04	9.54	0.88	10.28	67.45	36.50	15.50	8.58	0.92	10.42	66.50	34.25
LSD 5%	**0.36**	**1.35**	**0.06**	**0.56**	**2.71**	**2.28**	**1.42**	**1.07**	**0.04**	**0.75**	**3.15**	**2.24**
Interaction												
A x B	**n.s**	***	***	*	**n.s**	***	**n.s**	*	**n.s**	**n.s**	*	***
A x C	**n.s**	**n.s**	**n.s**	*	*	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**
B x C	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**	**n.s**	*	**n.s**	**n.s**	**n.s**	**
A x B x C	**n.s**	**n.s**	**n.s**	**	**n.s**	**n.s**	**n.s**	*	*	**n.s**	**n.s**	**n.s**

Data in table (4) illustrated that the nitrogen content for common bean tissues was reduced in case of saline soil in both years of studies. Data in the same table show that nitrogen concentration in common bean tissues was significantly increased by increasing number of irrigations. This result is in agreement with that Abdel-Aal (1994) who found that nitrogen and potassium contents were significantly reduced with increasing the level of salinity. The interaction between soil type and number of irrigation gave high significantl effect while foliar application of proline at 100 p.p.m resulted in an increase in N-concentration in the two seasons while the interaction between number of irrigation with foliar application of proline caused a significant effect in the two seasons when the triple interaction had no significant in the same seasons.

On the other hand, data of table (4) show that phosphorus content for common bean tissues which cultivated in soil clay was larger than the same one for saline soil. This result is in agreement with that **Yousif (2007),** on snap bean who cleared that total nitrogen and phosphorus contents were significantly decreased as the level of salinity increased. The interaction between soil type and number of irrigation had no significant effect in this respect it was noticed that foliar application of proline at (100) p-p-m in the two season caused an increase in N P K.. On the other hand, the triple interaction had no significant effect on nitrogen and phosphorus contents in both years.

Also, data in table (4) show that the average values of k - content in the leaves of common bean significantly increased in clay soil while decreased with reduced number of irrigation. The result is in agreement with that Metwally (2009) who cleared that salinity stress levels decreased N-P-K all types of interaction which significantly affected K value in the first year only.

Data in table (4) also show that sodium content in common bean leaves was reduced significantly by increasing number of irrigation and also reduced by application of proline treatments. This result is in agreement with that Chaudhuri ,K.and M.A.Chaudhuri (1998) who found that greater accumulation of Na and CL and a lower of K+ Na in the roots and shoots of C-clitoris. Data in table (4) show that interaction between soil type and number of irrigation significantly affected for N-content in two seasons. while the interaction between soil type and proline treatment had significant effect in the 1st year only otherwise significant effect for the interaction between the number of irrigation and proline treatment was noticed in the first year such as it was in the triple interaction.

Data presented in table (4) show that there was significant effect on calcium content in the two seasons. Data also show that common bean plants with decreased number of irrigation or in soil salinity was accumulated more calcium than those of soil clay or increased number of irrigation. The result is in agreement with that of Talaat (2003) on sweet pepper who found that in salt stress had positive effect on Na, CL, Ca concentrations in various plant organs (shoot, root and fruit) as compared to non-Stalinized plants. Data in table (4) illustrated the significant effect for the interaction between soil type and number of irrigation and effected with proline treatment in the two seasons. Furthermore interaction between number of irrigation and proline treatment had no significance in the first season but had effect in the second year. While causes significant reducing in the first season with triple interaction.

Data in table (4) show that magnesium content of common bean leaves had a similar trend as calcium content as mentioned previously. The result is in agreement with Farouk (2005) found that sodium chloride reduced significantly nitrogen, phosphorous, potassium, calcium, and magnesium. Data in table (4) illustrated that interaction between soil type and number of irrigation had significant effect as calcium content in the first year only while no effect between soil type and proline treatment was noticed in both years. On the other hand there was significant effect due to the interaction between number of irrigation and proline treatment in both years while, triple interaction had no obvious effect on magnesium content.

Table (4): N, P, K% and Na, Ca, Mg of common bean plant as affected by irrigation levels and proline in two soil types in the two seasons.

Treatments	N%		P%		K%		Na%		Ca%		Mg%	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Soil type												
Clay	3.35	3.28	0.38	0.36	2.51	2.49	1.40	1.43	2.53	2.47	1.43	1.42
Salinity	3.08	3.17	0.37	0.35	2.35	2.32	1.23	1.24	2.48	2.53	1.41	1.39
LSD 5%	**0.059**	**0.048**	**0.012**	**0.014**	**0.013**	**0.015**	**0.009**	**0.011**	**0.009**	**0.010**	**0.007**	**0.008**
B- Number of irrigations												
8	3.48	3.52	0.42	0.41	2.58	2.55	1.43	1.42	2.45	2.44	1.45	1.44
6	3.22	3.25	0.39	0.37	2.46	2.44	1.37	1.39	2.48	2.47	1.43	1.42
4	3.09	3.14	0.35	0.34	2.38	2.35	1.28	1.28	2.53	2.54	1.41	1.40
2	3.07	2.99	0.34	0.32	2.28	2.29	1.19	1.17	2.56	2.56	1.38	1.39
LSD 5%	**0.11**	**0.06**	**0.016**	**0.017**	**0.024**	**0.025**	**0.013**	**0.014**	**0.017**	**0.014**	**0.009**	**0.011**
C- Proline												
With	3.29	3.26	0.38	0.36	2.46	2.42	1.33	1.35	2.52	2.49	1.43	1.42
Without	3.14	3.19	0.36	0.37	2.39	2.40	1.31	1.32	2.49	2.51	1.41	1.39
LSD 5%	**0.07**	**0.11**	**0.03**	**0.01**	**0.01**	**0.03**	**0.014**	**0.019**	**0.022**	**0.012**	**0.012**	**0.018**
Interaction												
A x B	***	***	**n.s**	*	*	**n.s**	***	***	**	***	*	**n.s**
A x C	**n.s**	**n.s**	**n.s**	**n.s**	*	**n.s**	**n.s**	*	***	***	**n.s**	**n.s**
B x C	**	**	**n.s**	**n.s**	*	**n.s**	**	**n.s**	**n.s**	***	*	*
A x B x C	**n.s**	**n.s**	**n.s**	**n.s**	*	**n.s**	***	**n.s**	*	**n.s**	**n.s**	**n.s**

Data in Table (5) showed that the mean values of chl.a, chl.b in clay soil significant was increase as compared with the same values obtained from saline soil in both seasons. Salinity is one of the major factors influencing senescence and the increasing degradation of chlorophyll content. The result is in agreement with that Metwally (2009) who cleared that chlorophyll a and b in leaves of pepper plant were slightly decreased with increasing the level of salinity stress. In this direction; Yousof *et al.,* (2010) on rice found that chlorophyll a and chlorophyll b markedly decreased with increasing salinity levels.

Data of table (5) illustrated that the interaction between soil type and number of irrigation had significantly effect on chl.a, furthermore, these values were not affected by interaction between soil type and proline treatment in the two seasons, however there was significantly effect in first seasons only for interaction between proline and number of irrigation and triple interaction in the two seasons. On the other hand, chl.b in all type of interaction gave significant effect in the second seasons only. These results were in agreement with those obtained by shadded (1990). Mishra and Sharma (1994). Lovelll *et al.,* (2000). Farouk (2005). Turan *et al.,* (2007).

Data in table (5) show that the content of proline in common bean leaves at green maturity stage significantly increased with soil salinity and reduceding number of irrigation during, the two season. The accumulation of proline during water depict may assist in enzyme protection and stabilization of biological membrane and the degradation of proline may improve the energy status of cells recovering from water. This result is in agreement with Turan *et al.,* (2007) who mention that proline of bean plants was increased by high salinity. There are no significant effects in the two seasons for all type of interaction but there are significant to interaction between soil type and number of irrigation in the second season only, this result were in agreement with those obtained by Mekki and Orabi (2007) Metwally (2009) Tartoura *et al.,* (2009), Yousof *et al.,*(2010)

Table (5): Chlorophyll (mg/g F.W.), proline (Y/g F.W.) and crude protein % of common bean plant as affected by irrigation levels and proline in two soil type in the two seasons.

Treatment	Chlo. A (mg/g F.W.)		Chlo. B)mg/g F.W(.		Proline (µg/gFW)		Crude protein% (g /F.W.)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Soil type								
Clay	0.744	0.727	0.572	0.561	10.98	10.96	16.11	16.13
Salinity	0.673	0.675	0.506	0.498	11.41	10.41	15.86	15.92
LSD 5%	**0.005**	**0.021**	**0.019**	**0.003**	**0.08**	**0.05**	**0.08**	**0.04**
B- Number of irrigations								
8	0.807	0.802	0.624	0.625	10.66	10.65	16.23	16.27
6	0.761	0.748	0.583	0.572	11.12	11.05	10.07	16.05
4	0.663	0.652	0.502	0.485	11.47	11.43	15.87	15.89
2	0.606	0.602	0.444	0.437	11.53	11.61	15.79	15.69
LSD 5%	**0.011**	**0.026**	**0.030**	**0.006**	**0.18**	**0.12**	**0.13**	**0.07**
C- Proline								
With	0.731	0.724	0.557	0.552	11.20	11.21	16.04	16.06
Without	0.687	0.678	0.520	0.508	11.19	11.17	15.94	15.98
LSD 5%	**0.013**	**0.046**	**0.026**	**0.009**	**0.36**	**0.09**	**0.02**	**0.15**
Interaction								
A x B	***	*	n.s	**	n.s	**	n.s	n.s
A x C	n.s	n.s	n.s	***	n.s	n.s	*	n.s
B x C	*	n.s	n.s	***	n.s	n.s	n.s	n.s
A x B x C	*	n.s	n.s	***	n.s	n.s	n.s	n.s

Data of table (5) show significant differences in crude protein values between the two type of soil and the reduced number of irrigation gave rise to reducing values of crude protein in common bean pods at green maturity stage. That result was in agreement with Yousif (2007) on snap bean who reported that total carbohydrates and crude protein content in the green pods of snap bean plant were significantly decreased as a result of increasing soil salinity levels. It can be concluded that common bean plants grown under saline conditions tended to increase their osmotic pressure of the cells which attained by salt accumulation and inter mediate materials of organic products such as amino acids and ascorbic acid. All type of interactions had no clear effect on proline contents and crude protein in both years with some exceptions.

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" دراسة علي الملوحة والجفاف علي نبات الفاصوليا"

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أجريت تجربتان في أصص خلال عامي ٢٠٠٨، ٢٠٠٩ لدراسة تأثير ملوحة التربة وعدد الريات والرش بالبرولين علي نمو وإنتاج محصول الفاصوليا (صنف نبراسكا) وقد تم زراعة بذور الفاصوليا في تربة ملحية وأخري طينية وذلك في أصص وتم الري بمعدل ريتان وأربعة ريات و ٦ ريات و ٨ ريات في خلال فترة التزهير والعقد وتم رش النباتات بالبرولين بمعدل ١٠٠ جزء في المليون ولقد أوضحت النتائج مايلي:-

١- زراعة الفاصوليا في الأرض الملحية أدي إلي إنخفاض في النمو الخضري متمثلا في إرتفاع النبات والمجموع الخضري و الوزن الطازج والوزن الجاف والمساحة الورقية وكذلك تقليل عدد الريات أدي إلي إنخفاض ملحوظ في النمو الخضري . أما رش النباتات بالبرولين فقد أدي إلي تحسن النمو الخضري بشكل واضح. ولم يكن للتفاعل الثلاثي بين عدد الريات ونوع التربة والرش بالبرولين أي تأثير واضح علي النمو الخضري في كلا الموسمين.

٢- تبين أن للملوحة تأثير ضار واضح علي قياسات التزهير (عدد الأزهار/للنبات، عدد القرون/ للنبات الواحد، نسبة العقد) في كلا الموسمين كذلك تقليل عدد الريات أدي إلي تقليل قياسات التزهير أما الرش بالبرولين فقد أدي إلي زيادة قياسات التزهير في الفاصوليا وكذلك لم يكن للتفاعل الثلاثي تأثير واضح علي التزهير في الفاصوليا.

٣- تبين أن معظم المحتوي المعدني للأوراق قد تأثر بزراعة الفاصوليا في الأرض الملحية وكذلك محتوي الصبغات وتقليل عدد الريات أدي إلي إنخفاض في محتوي العناصر في الأوراق وكذلك إنخفاض في محتوي الصبغات النباتية. ولم يكن هناك تأثير واضح للتفاعل الثلاثي بين العوامل تحت الدراسة في كلا الموسمين.

قام بتحكيم البحث

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