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Evaluation of Alfalfa Productivity and its Response to Bio-Fertilizer, Mineral Nitrogen and Sulphur under Saline Condition in Newly Reclaimed Area

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FIELD experimental was conducted at Sahl–El–Tina location which representing new reclaimed area, during 2006/ 2007 growing season to study the effect of mineral N, bio-fertilizer, sulphur and combination treatments on reclaimed soil and alfalfa productivity under saline soil . The experiment was in complete block design . The obtained data indicated that the soil pH increased slightly after the addition of amendments. Result of EC values of soils after alfalfa harvest showed highly significant decrease specially when bio-fertilizer + sulphur +32kg N/fed were used. Regarding to macro elements N,P and K available in soil content increased in all treatments compared with treatment of mineral N- fertilizer. Concerning the increase of micro elements Fe, Mn and Zn available content in soil , also more related to the residual of bio-fertilizer + S+ 32 kg N/fed . On the other hand the forage yield, showed significant in both of treatments bio-fertilizer + S+ 32 kg N/fed. Alfalfa cuts plant high, leaf/ stem ratio, dry yield, number of branches/ plant and green yield ton/fed were significant. The results of physiological characters, revealed significant in both alfalfa cuts and mineral fertilization for leaf chlorophyll and leaf water content in all treatments.The transpiration rate showed non- significant, for leaf osmotic pressure.

Keyword : Saline soil, Reclaimed soil, Nitrogen mineral, Sulphur, Bio-fertilization, Alfalfa productivity.

In Egypt, there are urgent needs for the horizontal and vertical expansion to meet the demands of increased population. So, the agricultural applied projects of salt affected soils at Sahl El-Tina plan for Glbana village, area should be the scale efforts to bring additional new areas. To achieve this target, the driven to maximize reclamation technique in this area for reuse of agriculture drainage water for reclamation and irrigation of salt affected soils (Shaban, 2005) .

Bio-fertilizers are environment friendly , low cost agricultural input with maximum out put. These bio-fertilizers are to play an important role in enhancing crop productivity and improve of soil properties through nitrogen fixation , phosphate solubleization, plant hormone productivity, (Hedge *et al.*, 1999). Cabrera (2006) reported that the applied of bio-fertilizers efficiency become higher , which enabled plants to extract a bigger amount of N ,P, K, Ca^{+2} and Mg^{+2} so increasing yield.

The farmers in the developing countries are custommed to applying urea as nitrogen fertilizer for different crops because of its high nitrogen content and its low price.(Abbady *et al.*, 2006). (Brady, 1974) found that applied sulphur to a well- drained soil ends up in the sulfate from according to the following oxidation reactions :

$2S+ 3 O_2 +H_2O \dashrightarrow 2H_2SO_4$. The oxidation of sulphur compounds , such as sulfates (SO^{-2}_3) and sulfides (S^{-2}), can occur by strict chemical reactions. Whereas , most of the sulfur oxidation occurring in soil is thought to be biochemical in nature . Abd El-Fattah *et al.* (2005) study the effect of applied sulphur on soil pH depended on the sulphur application rate , on sandy soil and on the incubation period .

Alfalfa can be successfully grown on most soils . Alfalfa will tolerate a mount of salinity during the germination stage, but once established it will tolerate higher a mounts of salt (8 dS/m) (Sheard , 2007) . Richard (2002) found That the applications of nitrogen (N), sulfur (S), potassium (K) and phosphorus (P) are needed is important to insure adequate alfalfa yield and quality. Over-generalizations made about the occurrence of N, S, K and P deficiencies are dangerous.

Alfalfa's deep roots can recover nitrogen that has leached below the rooting depth of annual crops. In addition, alfalfa fixes its own nitrogen with the help of *Rhizobium meliloti* bacteria on its roots (Jim Bauder, 2007). Potassium is thought to aid rapid re-growth after a cut and stand decline is often associated with depleted soil potassium. In grass-alfalfa mixed stands, potassium requirements are higher because the grasses can out-compete the alfalfa for potassium (Bauder & Flaherty, 2007). Zhihui Yang and Bal Ram Singh (2007) reported that The macro aggregate sizes (>2 and 1–2 mm) contained the highest ester S, but micro aggregates (<0.106 mm) exhibited higher carbon-bonded S and residual S than other aggregates. In conclusion, the accumulation of S was dependent on fertilizer type, the rate of FYM application and aggregate sizes. Shaban & Helmy (2006) found that the application of different N – treatments was slightly increased available Fe, Mn, Zn and B contents in soil as compared to the control treatment .The highest available Fe , Mn , and Zn was obtained under applied treatment of (75 kgN/fed+ bio-fertilizer).

This work aims to evaluate the chemical properties and the content of macro and trace elements in soil salinity and to study the effect of bio-fertilizer, sulphur and mineral nitrogen on the changes in: saline soil properties , its content of some elements and the alfalfa yields .

Material and Methods

The soil properties before planting show in Table 1. Water used in irrigation was collected from El-Salam canal water . water samples were taken from the irrigation water at different times ,first planting , after first cut 1 (60 days from planting) and second cut (45 days from cut 1 and cut third (50 days from cut 2) respectively (Table 1a) .

TABLE 1. Physic-chemical properties of soil used before planting .

Depth	Particulars size distribution (%)				Texture Classes	O.M (%)	$CaCO_3$ (%)
	C.sand	F.sand	Silt	Clay			
0 - 30	24.6	42	18.6	14.8	Sand Clay	0.75	6.2
30- 60	21.1	46	20.6	12.3	Sand clay	0.41	4.5

	pH (1:2.5)	EC (dS/m)	Cations (meq/l)				Anions (meq/l)			
			Ca^{+2}	Mg^{+2}	Na^+	K^-	CO^{-}_3	HCO-3	Cl-	SO^{-}_4
0-30	8.01	10.30	8.40	9.70	85	0.23	nil	7.50	77	18.83
30-60	8.12	12.60	7.10	8.90	112	0.39	nil	4.00	120	4.39

Macro-Microelements content in soil used before planting:

	Macro elements (mg/kg)			Microelements (mg/kg)		
	N	P	K	Fe	Mn	Zn
0-30	61	5.9	80	5.2	2.27	0.75
30-60	54	4.5	75	3.0	2.29	0.43

TABLE 1a. Chemical properties of irrigation water used .

Period irrigation	pH	EC (dS/m)	Cations (meq/l)				Anions (meq/l)			
			Ca^{+2}	Mg^{+2}	Na^+	K^+	CO^{-}_3	HCO^{-}_3	Cl^-	SO^{-}_4
First Sowing	8.23	1.54	1.38	2.76	11	0.23	nil	2.11	7	6.26
After 60 days	8.14	1.36	1.45	2.41	9	0.26	nil	2.08	5	6.04
After 105 days	8.05	1.28	1.52	2.35	8	0.28	nil	2.04	6	4.11
After 160 days	8.02	1.25	1.66	2.27	8	0.32	nil	2.10	7	3.15

Period irrigation	Macronutrients (mg/l)				Micronutrients (mg/l)		
	NO_3-N	NH_4-N	P	K	Fe	Mn	Zn
First Sowing	4.36	9.12	3.59	8.97	1.23	0.79	1.45
After 60 days	5.87	9.24	3.64	10.14	1.34	0.85	1.55
After 105 days	5.91	9.35	3.69	10.92	1.44	0.89	1.59
After 160 days	9.94	11.48	3.75	11.48	1.42	0.86	1.62

Seeds of Alfalfa *(Medicago sativa* L*)* as F^1 's (F^1 first filial generation obtained from full diallel crosses and reciprocal included six alfalfa genotypes as parents ; (P1:1S , P2 Is (94) ; P3: siwa, P4 WL 605 ; P5 : Hassawi , P6 : Sr), adapted for drought and salinity tolerance) . obtained from dilled hybridization tolerated to salinity condition driven from research of breeding alfalfa for unfavorable conditions (salinity and drought resistance) (El-Sherif, 2003), seeds supplied from Forage Department Filed Crop Res Inst. Agriculture research center, at Ismailia station , seeds were sown on the 12^{th} of October, 2006. Seeds were inoculated with *Rhizobium melilot* (Salt tolerant PGPR) by coating with the bacteria strain and gum at the same time of sowing .

Liquid culture of bacterial strain was applied as soil application three times after 25 , 66 and 110 days after sowing as described by Omar *et al.* (2000). Mineral nitrogen fertilizer was applied in a rate of 50 kg urea (46 % N) /fed. Nitrogen rate was added in three equal doses after 30, 60 and 100 days from planting. Calcium super-phosphate (15.5% P_2O_5) was added in a rate of 25 kg P_2O_5 /fed during soil preparation and addition of 15.5 kg P_2O_5/fed after 45 , 85 and 130 days from planting . Potassium sulphate (48 % K_2O) in a rate of 100kg/fed was added on three doses after 45, 85 and 130 days of planting and addition of sulphaure fertilizer rate 120 kg S / fed was added 100kgS during soil preparation and three doses after 55, 95 and 145 days with rate 20kgS /fed from planting . In the experimental pilot unit was divided to four plots first one was added 100% N mineral , second plot inoculated with bio - fertilizer +75% N , third plot sulphur was added + 75% N and last ones combination between bio- fertilizer +S +75 % N. These mineral fertilizer rates were the recommended by Egyptian Ministry of Agriculture bulletin (2004). Alfalfa were harvested on the 10^{th} July, 2007 whereas of each plot was counted and weighed.

Sandy clay soil was collected from surface (0– 30) and (30– 60) cm. Soil was air – dried , passed through a 2 mm sieve and mixed thoroughly according to Piper (1950). Calcium carbonate was determined using a calcimeter and collected as $CaCO_3$ % and Organic matter was measured as described by Jackson (1967). Total soluble salts were determined in the saturated soil paste according to (Jackson , 1967). The pH was measured using a pH meter in soil suspension (1 : 2.5) soil water ratio (Richards, 1954) . Soluble cations and anions were determined in soil paste extract according to Black (1962). Available nitrogen measured according to the modified Kjeldahal method by Black (1962) . The phosphor was extracted by 0.5 N sodium bicarbonate and determined calorimetrically according to Olsen s' method Jackson (1967) . The available K was determined using the flame photometer (Soltanpour & Schwab, 1977). Available micronutrients were extracted using ammonium bicarbonate (DTP) and determined using Inductively Couped Plasma (ICP) Spectrometry model 400 , as described by Soltanpour & Schwab (1977).

Plant analysis

Yield and its components were determined as follow :

For certain growth and yield components traits, the sowing and /or cut of alfalfa , were handed clipped after 50 days of sowing and each 45 days intervals 7 cm, stubble height of the soil surface , plant biomass was measured after drying at 65 C^o for each cut, .Morpho- physiological traits of the hybrid $F^{1'}$ is of alfalfa tolerated for drought and salinity tolerance were estimated :

a)– Plant morphological and herbage yield characters :-

1- Plant height (cm) , was measured from the soil surface to the top leaves .

2- Number of branches measure the basic branches.

3- Leaf / stem ratio (%) , by applied the following equation :

$$\frac{\text{Weight of dray leaves (gm)}}{\text{Weight of dry stem (gm)}} \times 100$$

4- Fresh yield ton /fed, as green yield of each plot was weighed

5- Dry yield was calculated as ton /fed.

b)– plant Physiological characters :

The physiological features were estimated from the plants just before cutting.

1-Leaf chlorophyll content (SPAD –value) , was estimated using a recent non – destructive technique by the portable spade – 502 chlorophyll meter instrument , according to Featal & Miceli 'df (1996).

2-Transpiration rate (mg H_2O/ gm F.W/h) , measured using the rapid weighting method according to Stocker (1985) .

3- Relative water content (R.W.C. %) , 20 discs of leaf were under taken from the third leaf from the top of the treated plants and (R.W.C. %) was determined as described Schonfield *et al.* (1988) .

4- Leaf osmotic pressure (L. O. P) was detrmined using total soluble solids (T.S.S) in the leaf sap according to Gostav (1960).

Plant samples were subject to wet digested for determining the following : Nitrogen was determined by Kjedahl method (Chapman & Partt, 1961). Phosphor, Potassium and micronutrients were determined using Inductively Couped Plasma (ICP) Spectrometry model 400 according to Soltanpour & Schwab, (1977). Statistical analysis of the obtained data was done according to Snedecor & Cochran (1972).

Results and Discussion

Chemical properties of El-Salam irrigation water used

The promising areas that should be irrigated with El-Salam canal are about 400.000 faddans at Sahl El-Tina plain located of east Suez canal .

Data present in Table 1a show that the EC_{iw} values are more affected by both water source and the period of sampling , where the recorded values 1.54 , 1.36 , 1.28 and 1.25 dS/m during alfalfa planting . These values indicated that the irrigation water classified as moderate saline (Ayers & Westcot, 1985).

Moreover, the variations obtained in EC_{iw} , macro and micronutrients values during different periods of water sampling may be attributed to dilution effect for the lateral seepage of agricultural drainage water as a results of using large amounts of irrigation water at during time for alfalfa growth. These results are in harmony with those obtained by Ayers & Westcot (1985); FAO (1992) and El-Sherbieny *et al.* (1998). The concentration of NO_3-N in the El-Salam canal water used over a period during alfalfa plant varies from 4.36 to 9.94 mg/l . As for the ammonium nitrogen (NH_4-N)varies from 9.12 – 11.48 mg/l for the whole region . Whereas, the decrease of nitrate concentration in irrigation water may be due to the reversible condition that are not favorable for nitrification process mentioned before. These findings are in agreement with obtained by El-Sherbiny *et al.* (1998) and El-Sayed (2001). It is concluded that the values of NO_3-N , which ranged between < 5.0 – 30 mg/l in all the irrigation water , lay within the ranged of slight – moderate category according to Ayers & Westcot (1985).

On the other hand the concentrations of Fe, Mn and Zn in irrigation water is presented within safe or permissible limits and possible using these water irrigation in the studied soils. These obtained data are in agreement with those obtain by Farag & Mehana (2000) and Shaban & Helmy (2006).

Soil pH

Soil pH is an indication of the alkalinity or acidity of soil. It is based on the measurement of pH, which is based in turn on the activity of hydrogen ions (H^+) in a water or salt solution. Data present in Table 2 show that the initial state of soil, in general, exhibits the high pH values in soil profile layers . It is also found that soil pH tends to increase slightly after the added amendments . The data in Table 2 show that soil pH slightly decrease throughout profile layers with addition sulphur + 32 kg N/ fed. This findings are in agreement with those obtained by Brady (1974) and Abd El-Fattah *et al.* (2005). The soil of all treatments are characterized by high significant slightly to moderately alkaline conditions , where the pH values is around between 7.32 and 8.12. This findings are in agreement with those obtained by Ayras & westcot (1985) and Wahdan *et al.* (1999) .

Soil salinity (EC dS/m)

Results of the EC values of soils after alfalfa harvest , data present in Table 2 show that the EC values throughout soil profile layers, as found in all treatments the values of soil profile gave high significant decrease specially the soil with addition sulphur + Bio-fertilizer + 32 kg N/fed) value was 4.9 dS/m. The corresponding relative decreases were 29.78, 36.90 and 41.17 % for bio-fertilizer + 32 kgN/fed, S +32 kg N/fed and bio + S + 32 kg N/fed respectively, compared with soil treatment with mineral 46 kg N. This findings are in agreement with those obtained by Abd El-Fattah *et al.* (2005) .

TABLE 2. Chemical properties in soil experimental unit pilot after addition *Rhizobium melilots* and sulfur with alfalfa.

Treatments	Depth (cm)	pH (1:2.5)	EC (dS/m)	Cations	(meq/l)			Anions	(meq/l)		
				Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}
mineral 46N kg/fed	0-30	7.91	7.5	4.31	14.9	55	0.67	Nil	7.8	34.0	32.36
	30-60	7.99	9.2	4.12	16.7	67	0.59	Nil	9.1	54.0	25.32
	Mean	7.95	8.4	4.22	17.3	61	0.63	Nil	8.45	44.0	28.84
Bio-fertilizer 32 kg/N	0-30	7.65	5.7	6.53	13.9	36	0.97	Nil	5.10	19.1	33.18
	30-60	7.72	6.1	5.95	10.1	45	0.85	Nil	6.22	20.4	35.34
	Mean	7.68	5.9	6.24	12.0	41	0.91	Nil	5.66	19.7	34.26
Sulphur+ 32Nkg /fed	0-30	7.32	4.8	8.21	10.4	29	1.25	nil	4.68	12.8	32.82
	30-60	7.46	5.7	7.43	14.9	34	1.18	nil	5.41	17.3	36.71
	Mean	7.39	5.3	7.82	12.6	32	1.22	Nil	5.05	15.1	34.77
Bio +S +32 N kg/fed	0-30	7.64	4.5	8.30	9.5	25	1.54	nil	3.26	18.9	20.74
	30-60	7.72	5.2	7.49	10.6	32	1.39	nil	3.51	19.2	26.93
	Mean	7.68	4.9	7.90	10.1	29	1.47	Nil	3.40	19.1	23.84
F test		***	***	***	*	**	**	Nil	***	***	**
L.S.D .5%		0.17	1.9	0.70	3.40	20.4	0.46	Nil	1.01	12.4	5.81

It is worthily to mention that the soil treatment with Bio-fertilizer+ Sulphur + 32 kg N/fed as compared to the other treatments is more related to the occurrence of active microorganisms and organic acid . These sulphur and bio-fertilizer provided a substantial modification of soil physical properties, especially soil structure as well as soil aggregation and drainable pores This findings are in agreement with those obtained by Mantr Pukhri(2006) and Shaban & Abd El-Rhman (2007) .

Cation and anion soluble in soil study

The concentration of cations and anions in soil past extracts of the of all treatment (as profile means) under El-Salam irrigation water are presented in Table 2 . The data obtained reveal that the soluble ion contents (as profile means in meq/l) result addition amendments for Ca^{++} , Mg^{++} , Na^{+} , K^{+} HCO_3^{-} , Cl^{-} and SO_4^{-2} ion ranged between 4.22 to 7.90 ; 17.3 to 10.1 ; 61 to 29 ; 0.63 to 1.47 ; 8.45 to 3.40; 44.0 to 15.1 and 23.84 to 34.77 for treatments (N-mineral 46 kgN/fed, bio-fertilizer + 32 kg N/fed, sulpure +32 kg N/fed and Bio+S+ 32kgN/fed) respectively. The Ca^{++} and K^{+} high significant positive in all treatments . Concerning the distribution pattern of soluble ions as related to soil amendments during alfalfa cultivation , data show that they could arranged according to their amounts in the following order : Bio+ S +32kgN/fed > S + 32 kg N/fed > bio-fertilizer +32kgN/fed > mineral N 46kgN/fed for Ca^{++} and K^{+} . Mineral N 46kgN/fed > S+32 kgN/fed > bio-fertilizer +32kgN/fed > Bio+ S + 32kgN/fed, for Mg^{++}. Mineral N 46kgN/fed > bio-fertilizer +32kgN/fed > S+32 kgN/fed > Bio+ S +32kgN/fed for Na^{+} and HCO_3^{-} . Mineral N 46kgN/fed >

bio-fertilizer +32kgN/fed > Bio+ S +32kgN/fed > S+32 kgN/fed for Cl^-. S+ 32kgN/fed > bio-fertilizer+ 32kgN/fed > mineral N 46kgN/fed> Bio+ S+ 32kgN/fed , for SO^{-2}_4 .

It is worthy to mention that the noticed variations in soluble ions content may be interpreted by the dilution effect for the studied soil amendments and irrigation water during alfalfa cultivation . These results are in agreement with that obtained by Rahoma (1999) and Shaban & Abd El-Rhman(2007).

Macro elements available content in soil study

Data presented in Table 3 showed that the effect of soil amendments on N , P and K extracted content in soil . The increase of N, P and K in all treatments compares with soil treatment by mineral N- fertilizer . The data of N, P and K present in Table 3 found that an increased (profile means) from 63, 72 , 66 and 79 mg/kg soil for N; 5.6, 6.4, 7.8 and 9.3 mg/kg soil for P and 193 , 203 , 219 and 222 mg/kg soil for K of treatments soil with N- mineral fertilizer 46 kg N/ fed, bio-fertilizer + 32 kg N /fed , sulphur + 32 kgN/fed and bio + S +32 kg N /fed, respectively the corresponding relative increases available N, P and K reached 14.78 , 4.76 and 25.39 % for N; 14.28 , 39.28 and 66.07 % for P and 5.18, 13.47 and 15.03 % for K treatments of bio-fertilizer + 32 kg N /fed, sulphur + 32 kgN/fed and bio + S +32 kg N /fed, respectively compared with soil treatment with N mineral 46 kgN/fed. These results are in agreement with that obtained by Rabie (2003); El-Sebaey (2006) and Marowa (2007) .

TABLE 3. Macro-Microelements content in soil used after addition rizobium bacteria with alfalfa .

Treatment	Depth (cm)	Macro elements (ppm)			Microelements (ppm)		
		N	P	K	Fe	Mn	Zn
mineral 46 N kg/fed	0-30	65	6.4	199	5.37	3.4	0.85
	30-60	61	4.7	187	4.24	2.8	0.65
	Mean	63	5.6	193	4.81	3.1	0.75
Bio-fertilizer 32 N kg/fed	0-30	78	7.1	212	5.85	3.8	0.94
	30-60	65	5.6	193	4.78	2.9	0.70
	Mean	72	6.4	203	5.32	3.4	0.82
Sulpure+ 32kgN/fed	0-30	73	9.2	220	6.57	4.7	1.07
	30-60	58	6.4	217	5.12	3.6	0.95
	Mean	66	7.8	219	5.85	4.2	1.01
Bio +S +32N kg/fed	0-30	80	10.9	225	6.90	4.9	1.28
	30-60	77	7.6	218	5.68	3.8	1.09
	Mean	79	9.3	222	7.64	4.4	1.19
F. test		ns	ns	*	ns	ns	ns
L.S. D %5		23.43	4.13	17.16	1.92	2.20	0.34

Microelements available in the studied soils

It is evident from data present in Table 3 that pronounced increases in soil available microelement contents (Fe, Mn and Zn) were achieved as a result of El- Salam canal water. These is more related to the residual bio- fertilizer + sulphur +32 kg N/fed treatment led to released more available microelements . The relative increases of these elements in the soil experimental treated with bio-fertilizer + sulphur +32 kg N/fed compared to the other experimental pilot unit.

Concerning the experimental pilot unit relative increases for Fe , Mn and Zn reached 10.60 , 21.62 and 58.84 % ; 9.68 , 35.48 and 41.94 % and 9.33, 34.67 and 58.67 % for treatments of bio + 32 kgN/fed , sulphur +32 kg N/fed and Bio+ sulphur +32 kg N/ fed, compared with mineral N 46kg N/fed fertilizer, respectively . These results are in agreement with that obtained by Shaban & Halmy (2006) .

The values of Fe , Mn and Zn within the limits or in critical limits identical division for the others (FAO, 1992) . The effect of the used different treatments on available Fe , Mn, and Zn could be arranged in following order : Bio+ sulphur + 32kg N/fed > sulphur + 32kg N/fed > Bio +32kg N/fed > 46 kgN/fed .

Alfalfa yield component

Plant height (cm)

The results presented in Table 4, showed that F[1]'s plants different significantly . The fertilization (Bio + S +32 kg N) gave the highest values of the plant height through both of the cuts and the treatments , it is interesting to mention that plant height increasing especially in case of compound of Bio + sulphur +32kg N . The reduction of plant height associated with the reduction of fertilization and saline water irrigation could be disused on the basis that vegetative growth period were sensitive to stresses (saline water irrigation and shortage of fertilization) which was reflected in decreasing internodes length. These results were in confirm of the obtained by Penny Packer *et al.* (1991); Thomir *et al.* (1992); El- Khatib *et al.* (1993) and Moniem *et al.* (1993).

Number of branches / Plant

The results in Table 4 showed significant differences between treatments , while non significant was between cuts there is no significant, whereas, the values of corresponding relative increases were 49.35, 35.00 17.73 and 17.58% for number of branches in the treatments of 46 kgN , bio + 32 kgN , Sulphur+ 32kg N and bio + sulphur +32 kgN, respectively. These results were in confirm of the obtained by Francisco & Edna (2006) found that the nitrogen is the main nutrition for forage grass production and sulfure may be necessary when nitrogen fertilizer is applied . The interaction between nitrogen and sulfure rates was significant effects on those response variables .

TABLE 4. Morphological character and herbage yield .

Treatments	Cut	Plant height (cm)	No. of Branches/ plant	Leaf/ stem ratio	Green yield (ton/fed)	Dry yield (ton/fed)
mineral 46 N kg/fed	C1	12.88	4.60	51.30	0.880	0.201
	C2	13.20	6.50	53.20	0.950	0.222
	C3	16.40	9.50	55.30	0.980	0.250
	Mean	14.16	6.87	53.27	0.937	0.224
Bio-fertilizer 32 N kg/fed	C1	17.20	5.80	53.20	1.470	0.339
	C2	19.30	7.30	56.40	1.530	0.354
	C3	21.50	10.40	60.40	1.690	0.399
	Mean	19.33	7.83	56.67	1.563	0.364
Sulphur +32N kg/fed	C1	18.40	7.50	55.40	1.850	0.431
	C2	21.80	8.20	58.30	1.930	0.458
	C3	24.30	10.80	62.80	1.980	0.467
	Mean	21.50	8.83	58.83	1.920	0.452
Bio +S +32 N kg/fed	C1	22.50	9.50	60.11	1.880	0.442
	C2	23.50	10.50	64.20	1.980	0.642
	C3	26.80	13.50	65.30	2.120	0.505
	Mean	24.27	11.17	63.20	1.993	0.529
Cut .F. test		***	ns	*	ns	***
Fert. F. test		***	***	***	***	***
Fert Xcut .F. test		*	***	ns	ns	***
L.S.D %5 Fert		0.52	1.57	2.86	0.28	0.003
L. S. D %5 Cut		0.06	0.84	3.27	0.29	0.004

Leaf / stem ratio (L.S.R.)

The obtained results in Table 4 proved that F's plants differed significantly in L.S.R ., according to fertilization the highest values obtained from Bio+ sulphur+ 32 kg N whereas the results were 60.11, 64.20 and 65.30 in cut 1,2 and cut3 respectively, followed by sulphur +32kgN). It could be concluded that L. S. R. decreed by fertilization decrement especially in case of saline condition and increased by increasing Bio + sulphur fertilization . The results were in harmony of the obtained by Mekinimie & Dobrenz (1991) and Smith *et al.* (1994).

Green yield (ton/fed)

The data of green yield (ton /fed) presented in Table 4 showed that the fertilization treatments affected the alfalfa plants significantly, while within cuts was non significant . The corresponding relative increases values were 11.42 , 7.38 , 4.87 and 19.68 for same the 46 kgN, bio +32 kgN, Sulphur +32kg N and bio + sulphur +32 kgN respectively .

Dry yield (ton/fed)

Dry yield of F[1]'s plants showed decreasing with increasing stresses (saline condition + less dosage of fertilization) especially Bio +sulphur . The data in Table 4 indicated a significant differences in total dry yield of alfalfa 's F[1]'s due to the fertilization types, the highest values of dry yield obtained from bio+sulpure+32kg N . Its obviously that decreasing of bio and sulphur in case of saline soil and irrigation water caused a reduction of total dry yield ton/ fed . The results were confirmed by the obtained by Lugg *et al.* (1985); Pessarkil & Huber (1991) and Mehannie & Rengamy (1990).

Physiological parameters

The best option for crop production yields improvement and yield stability stresses in newly reclaimed area , is to develop stress tolerant crop varieties , well adapted for unfavorable conditions. A physiological approaches would be the most attractive way to develop new varieties rapidly, but breeding for specific sub- optimal environments involves a deeper under standing of the determining process. This is where knowledge of crop responses to water deficits may be the best put to use amendments of saline soils Siddique & Islam (2000).

Leaf chlorophyll content (SPAD value)

The values of SPAD and /or photosynthetic pigments conserve as an indicator of overall conditions of the plant it self. Healthier plants will contain more chlorophyll than less healthy ones. The presented data in Table 5 showed that values of the character differed significantly among alfalfa F[1]'s whereas the highest values of SPAD obtained from N fertilizer associated with both of sulphur and bio, results showed that the shortage of fertilization specially N, sulphur and bio-fertilizer under saline condition acts as severe stresses, of the F[1]'s alfalfa genotypes caused a reduction of chlorophyll content . The results confirmed with the reported by Kapulink & Heuer (1991) and Khan *et al.* (1994).

Transpiration rate (mg H_2O/gmfw/h)

Transpiration rate seemed to decreased as the plant stresses decreased, where, the low values revealed that plants are tolerant, the presented data (Table 5) showed that transpiration rate non significant throughout the treatments and cuts, which might be related to the F[1]'s which tolerate to stresses. The results also showed that slight increasing found between cuts in the fourth fertilizers treatments (46 kgN , bio +32 kg N , Sulphur +32kg N and bio + sulphur +32 kg N) respectively .

Kapulink & Heuer (1991), reported that transpiration rate decreased in all alfalfa cultivars under study when exposed to salinity imposed after the first cut, but in the 3 re-growth transpiration increased slightly , while Khan *et al.* (1994) , reported that salinity caused substantial reduction in transpiration rate .

TABLE 5. Physiological traits under study condition .

Treatments	Cut	Chlorophyll	Transpiration rate ($mgH_2O/gm Fw/h$)	Relative Leaf water content (%)	Leaf osmotic pressure
mineral 46 N kg/fed	C1	25.00	345.30	24.60	8.66
	C2	28.81	336.56	28.60	9.46
	C3	30.62	326.70	31.50	10.68
	Mean	28.14	336.19	28.23	9.60
Bio-fertilizer 32 N kg/fed	C1	26.08	388.70	28.90	8.24
	C2	30.61	332.50	29.20	9.15
	C3	35.55	320.80	33.60	10.50
	Mean	30.74	330.67	30.57	9.30
Sulphur+32 N kg/fed	C1	26.30	335.50	29.15	7.62
	C2	31.40	330.90	29.80	8.75
	C3	33.70	315.40	34.20	10.36
	Mean	30.47	327.27	31.05	8.91
Bio +S +32 N kg/fed	C1	28.60	330.70	29.50	7.53
	C2	33.20	327.50	30.11	8.68
	C3	35.30	312.70	35.15	10.23
	Mean	32.37	323.63	31.59	8.81
Cut .F. test		***	ns	**	ns
Fert. F. test		***	ns	**	***
Fert Xcut .F. test		ns	ns	ns	ns
L.S.D %5 Fert		1.77	51.1	1.16	0.97
L. S. D % 5 Cut		0.67	61.4	1.67	0.84

Leaf water content (%)

Leaf water content tended to gives the idea about water status of leaf tissue and tended to decrease with the increasing of the stresses which mean low fertilization accompanied with saline water irrigation and soil. The obtained data presented in Table 5, showed that highest value of leaf water content were associated with the highest dosage of fertilization especially in case of bio+S+32kgN fertilization, it is obviously that leaf water content differed between the cuts influenced by the fertilization treatments, the results indicated that decreasing in fertilization especially bio-fertilizer + sulphur increased the effect of saline condition which accompanied with decrease of leaf water content in the F1's plants , the results confirmed with the finding by Wright & Whitfield (1988) and X. U. Y.L & Yu-Sw (1992).

Leaf osmotic pressure (L . O . P)

Leaf osmotic pressure proposed as an important response to stresses and increased as stresses and salinity increasing . The presented data in Table 5 showed significantly between fertilization treatments while non significant was found between cuts , the relative increasing values showed that L.O.P., increased while decreasing when used of bio+S+32kgN fertilization. The L .O. P values were 16.99, 16.92, 12.86 and 10.85 % for the fertilization treatments (46 kgN , bio +32 kgN , Sulphur +32kg N and bio + sulphur +32 kgN), respectively, whereas , the F[1]'s irrigated with El-Slam canal . Its obviously clear that exposure of alfalfa to salinity accompanied with lees fertilization tended to noticeable increasing in L.O.P. In this connection Monje & Bugbee (1992) and Xu- YI & Yu-Sw(1992) were in the harmony of the results.

Macro – Micro nutrients content in alfalfa F[1]'s

The results obtained of soil chemical properties and fertility status positively or negatively reflected on plants growth and concentration elements (Shaban, 2005). May environmental and metabolic factors influence the ultimate composition of alfalfa . The supply of a particular nutrient obviously. The obtained data Table 6 revealed highly significant in macro and micro elements throughout both of the fertilizers treatments and cuts. The N ranged from the lowest value 2.71 (T1 C1) to 4.18 (T3 C1), it is also clear that increasing N especially with bio and sulphur treatments, associated with increasing P, K, Fe, Mn and Zn which might be return to the idea that the presence of P, K and traces elements in soil solution might be develop the elements absorption rizobium , also the micro elements encourage efficiency activate . The highest value of N, P and K were 4.18 % (as 26.13 crude protein) , 0.50 % and 3.23 % respectively , while the highest values were 5.31, 75.60 and 28 mg/kg for Fe , Mn and Zn, respectively . In this respect , many investigators have demonstrated that fertilization application particularly of N and K can have marked effect of K concentration , although other workers have suggested that K concentration of alfalfa should no be allowed to fall between 1.25 to 1.75 %. The results confirmed with the finding by Cabrera (2006) who found that the applied of bio-fertilizers efficiency become higher, which enabled plants to extract a bigger amount of N, P, K Ca^{+2} and Mg^{+2} increasing yield. Regarding to the microelements, F[1]'s plants of alfalfa differed considerably in their Fe contents and their ability to extract Fe from the soil solution , the soil pH is the most important factors gave ring each of Fe , Mn as well as Zn. It's interest to mention that plants growing in Zn deficiency were stunted and failed to produce secondary shoots , Zn bounds to a protein and an equilibrium exists show as : Zn^{+2} + protein = Zn – protein + 2 H^{+}, the equilibrium is pH sensitive and there is less binding in more acidic media.

From the previous , it is clear that minerals availability can be influenced considerably by soil type, water irrigation type as well as weather conditions positive and negative interactions between nutrient ions can occur, both in the soil , which affects availability and in the process of absorption by the plant which affects uptake. Shaban & Helmy (2006).

TABLE 6. Macro-micronutrient content in alfalfa.

Treatments	No.Cut	Macro elements (%)			Microelements (mg/kg)		
		N	P	K	Fe	Mn	Zn
mineral 46 N kg/fed	C1	3.19	0.35	2.90	4.57	70.5	18
	C2	2.35	0.31	2.60	4.50	68.3	15
	C3	2. 71	0.27	2.40	4.42	66.8	13
	Mean	2.92	0.31	2.63	4.33	68.5	23
Bio-fertilizer 32 N kg/fed	C1	3.75	0.42	3.01	4.89	65.3	24
	C2	3.62	0.40	2.89	4.82	60.5	22
	C3	3.57	0.35	2.77	4.79	58.3	19
	Mean	3.65	0.39	2.89	4.83	61.4	33
Sulphur fertilizer +32 N kg/fed	C1	3.87	0.47	3.14	5.21	76.1	25
	C2	3.77	0.41	3.10	5.12	70.9	23
	C3	3.61	0.37	3.02	5.06	65.3	20
	Mean	3.75	0.42	3.10	5.13	70.8	23
Bio +S +32 N kg/fed	C1	4.18	0.53	3.28	5.34	78.5	28
	C2	3.89	0.50	3.22	5.31	75.6	25
	C3	3.78	0.48	3.15	5.28	70.8	21
	Mean	3.95	0.50	3.22	5.31	74.9	25
Cut .F. test		***	***	***	***	***	**
Fert. F. test		***	***	***	***	***	ns
Fert Xcut .F. test		***	***	***	***	***	***
L.S.D %5 Fert		5.57	0.27	0.03	0.08	0.33	2.68
L. S. D %5 Cut		1.91	0.03	0.04	0.98	0.44	1.82

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تقييم إنتاجية واستجابة البرسيم الحجازي للتسميد بالكبريت والتسميد بالنتروجين المعدني واالحيوى تحت ظروف الملوحة في الاراضى حديثة الاستصلاح

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أقيمت تجربة بمنطقة سهل الطينة بقرية جلبانة والتي تمثل احد المناطق حديثة الاستصلاح والتي تتميز بملوحة التربة والتي تروى بمياه ترعة السلام (مياه مخلوطة بنسبة ١ :١ مياه نيل + مياه صرف زراعي) . وتمت دراسة تأثير إضافة التسميد النتروجينى المعدني في صورة يوريا ٤٦ كجم نتروجين وتسميد كبريت زراعي + ٣٢ كجم نتروجينى والتسميد الحيوي +٣٢ كجم نتروجين والتداخل بينهم على بعض صفات التربة وإنتاجية محصول البرسيم الحجازي تحت ظروف الملوحة .

وقد تم تصميم التجربة في تصميم القطاعات الكاملة العشوائية ومساحة الوحدة ٤٠م^{٢} . وأتضح من النتائج الاتى :

أ – التربة

١. انخفاض معنوي في pH للتربة حيث انخفضت من ٨,١٢ إلى ٧,٣٢ المعاملة بالكبريت والحيوي.
٢. انخفاض معنوي في نسبة ملوحة التربة وخاصة في المعاملة بالكبريت والحيوي +٣٢ كجم نتروجين وكانت القيمة ٤,٩ مليموز / سم .
٣. ازدادت نسبة العناصر الكبرى ، النتروجين والفوسفور والبوتاسيوم في التربة مع كل المعاملات وخاصة المعاملة بالكبريت والحيوي بالمقارنة بالمعاملة المسمدة بالتسميد النتروجينى فقط .
٤. ازدادت نسبة العناصر الميسرة من العناصر الصغرى ، الحديد والمنجنيز والزنك بنسبة غير معنوية في كل المعاملات.

ب – المحصول

١. أظهرت النتائج أن محصول العلف الأخضر من البرسيم ازداد بزيادة معنوية جدا إلى معنوية في كل من الحشات والمعاملات .
٢. ازداد ارتفاع النبات ونسبة الأوراق / للسيقان والمحصول الجاف. وأظهرت عدد الأفرع زيادة معنوية جدا وكذالك المحصول الأخضر داخل المعاملات.
٣. الصفات الفسيولوجية أظهرت معنوية جدا بين الحشات وداخل المعاملات لكل من الصفات والمحتوى الكلوروفيلي للورقة والمحتوى الرطوبى للورقة بينما لم تظهر صفة نسبة النتح من الورقة معنوية في جميع الحالات نظرا لتأقلم نبات الجيل الأول من البرسيم الحجازي تحت الدراسة للملوحة والجفاف وأظهرت صفة ضغط الورقة الاسموزى تأثيرا معنويا لمعاملات التسميد. ومازالت الدراسة مستمرة تحت ظروف الملوحة والإنتاجية وقليل التسميد المعدني.