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THE EFFECT OF NATURAL SOIL CONDITIONERS ON CALCAREOUS SOIL PROPERTIES AND BARLEY PRODUCTION UNDER SALINE CONDITIONS

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A field experiment was carried out with barley crop during 1999/2000 growing season at Maryout Station of Desert Research Center. The applied treatments were: control, farmyard manure (FYM) at the rates of 10, 20 and 30 tons/ha and town refuse (T.R.) rates of 10, 20 and 30 tons/ha. The experimental design was based on completely randomized blocks with four replicates. All treatments received N and P fertilizers with rates of 167.5 Kg N/ha and 37.5 P_2O_5/ha, respectively.

The results indicated that the best treatments arranged in the following order: 30 tons FYM/ha, 20 tons FYM/ha > 30 tons T.R./ha. These values were 5.31tons/ha, 5.04 tons/ha and 4.85 tons/ha, respectively. The plant content from K^+, Cu^{++} and Na^+ was the highest in case of 20 tons FYM/ha, while the highest values of Fe^{++} and Zn^{++} were in case of 30 tons T.R./ha. These are due to the high content of soil conditioners. The highest value of Mn^+ content was in case of 10 tons FYM/ha. This brought about a low yield in this treatment. EC and ESP values after harvesting were the highest in case of 20 and 30 tons T.R/ha.

Keywords : farmyard manure, town refuse, calcareous soil, barley, saline condition, micronutrient Fe, Mn, Zn and Cu; Maryout research station.

The limiting factor for horizontal extension in desert areas is available water resources. The insufficient water supplies level to use less water quality for irrigation, using such water is accompanied by salinization process which cause soil degradation. In this respect, soil conditioners application is necessary and vital to face such problem and increasing crop production. In Egypt, calcareous soils represent 25% of the new reclaimed area. Because of the limiting water supply, the need of expanding agricultural land had led to

the use of saline water in irrigation which caused soil deterioration in some areas.

Abdel-Salam *et al.* (1983) found that the yield was decreased under saline water irrigation while improved by organic manure application. The highest yield was obtained on normal soil receiving organic manure at 25 tons/ha level and irrigated with saline water (3000 ppm). Also, El-Sibaie *et al.* (1983) found that barley yield was positively affected by organic manure treatment and negatively by salinity levels. They added that, the best yield was obtained when normal soil was treated with organic manure of 25 tons/ha and irrigated with 6000 ppm saline water. Similar results on wheat were obtained by Bhapal (1989) and Raza *et al.* (1989). El-Tony *et al.*(1990) studied the effect of different organic manures, i.e. clover straw, sheep waste and town refuse on dry matter production of wheat crops. They reported that dry matter production of wheat plant was positively related with manuring and negatively with water salinity. However, they added that sheep waste and clover straw were more effective than town refuse. Under high salinity of water and calcareous soil, Khalil *et al.* (1991) reported that the increase in the grain and straw yield of wheat was accompanied with the organic wastes which improve the water use efficiency. Wassif *et al.* (1995) studied the effect of some soil amendments on production of wheat under saline irrigation water. They found that the magnitude of increase over the control treatment quantity reached 20.9, 38.4 and 27.9% for straw, grain and straw plus grain yields, respectively. Dahiya *et al.* (1987) and Jarecki *et al.* (1991) observed that the application of Farm yard manure (FYM) increased the concentration of N, P and K of maize and wheat plants. Similar trend was obtained by Sakr *et al.* (1992) on wheat under salinity condition.

Ibrahim *et al.* (1986) showed that significant increase in Fe, Mn and Zn concentrations herb and pea plants were attained with organic substances compared to unfertilized control. With respect to the electrical conductivity, Hamdi *et al.* (1968) stated that the applications of saline water containing 2 g/L of different salts decreased EC of the soil extract (Clay loam) to different degrees. Sharma and Ball (1975) showed that the effect of irrigation with saline water was more pronounced on sandy loam soil than clay loam one.

Abdel-Hamied *et al.* (1991) found that Diethyline triamine penta acidic acid (DTPA) extractable Cu and Zn ranged from 0.8-2 and 1.4-3.8 ppm, respectively, in salt affected soils.

Yousry *et al.* (1984) found that the addition of poultry manure to three soil types increased the electrical conductivity greater than 7 dS/m.

The aim of the present investigation was to study the effect of natural soil conditioners on controlling salinity hazard and barley yield as well as some soil properties after harvesting.

MATERIALS AND METHODS

The field experiment was carried out at Maryout Station of Desert Research Center. The soil analysis of the experimental sit is presented in table (1).

TABLE (1). Soil physical and chemical properties.

Soil texture	$CaCO_3$ %	pH	EC dS/m	Ca	Mg	Na	K	HCO_3	Cl	SO_4	C.EC meq/ 100g	ESP %
				meq/L								
Clay loam	27	8.04	5.86	14.79	15.79	32.6	2.05	12.0	18.0	34.0	29.27	8.52

The experiment studied the effect of natural soil conditioners on soil properties and barley yield. The applied treatments consisted of two natural soil conditioners, each type was applied at 4 levels 0, 10, 20 and 30 tons/ha. The experiment was conducted in a completely randomized block design with four replicates for each treatment. The site was divided into 42 m^2. All treatments received 167.5 Kg N/ha as NH_4NO_3 and 37.5 Kg P_2O_5/ha as superphosphate fertilizers.

Barley was sown at the rate of 100 Kg/ha in 2/12 (1999) in the experimental plots, the saline water (2000 ppm) was applied at intervals of 10 days using surface irrigation. The applied water has pH 8.22, EC 3.32 dS/m, soluble Ca^{++} 9 meq/L, Mg^{++} 9 meq/L, Na^{+} 16.08 meq/L, K^{+} 0.51 meq/L HCO_3^{-} 5 meq/L, Cl^{-} 19 meq/L and $SO_4^{=}$ 9.3 meq/L. FYM has N 1.55%, C/N 14.83, EC 34.9 dS/m and water holding capacity 180%. Town refuse has N 1.48%, C/N 12.23, EC 33.5 dS/m and water holding capacity 100%. After harvesting, surface soil samples (0-30cm) were taken from each treatment and prepared for determination of Fe^{++}, Mn^{++}, Zn^{++} and Cu^{++} in DTPA extractant. After maturity of the yield grains and straw were recorded and statistically analysed according to Snedecor and Cochran (1967). Thereafter plant samples were wet ashed with HNO_3; $HClO_4$: H_2SO_4.10: 4:1 respectively according to Van Schowenburg (1968) and determined Fe, Mn, Zn, Cu, K and Na.

RESULTS AND DISCUSSION

The values of barley yield as affected by different levels of Farmyard manure and town refuse are given in tables (2 and 3).

Regarding the FYM, all rates were significantly increased the yield of grains and straw. Apparently the best rate of FYM is 30 ton /ha, where the yield is 5.31 ton/ha and 8.89 ton/ha for grains and straw, respectively. From the economic point of view the rate of 20 tons FYM/ha was the best, where the grains and straw were 5.04 tons/fed and 8.925 tons/ha, respectively. This is owing to the enhancing of water use efficiency.

Concerning the town refuse (TR) effect, all rates were significantly increased the grains yield, while the straw yield significantly decreased compared to the control yield.

TABLE (2). The effect of natural soil conditioners on grain yield of barley (Ton/ha.)

Type of soil conditioners	FYM			T.R.		
Treat. Control	10	20	30	10	20	30
3.43	3.52	5.04	5.31	4.28	4.78	4.85

L.S.D. $_{0.05}$ = 0.70 **L.S.D.$_{0.01}$ = 0.98**

TABLE (3). The effect of natural soil conditioners on straw yield of barley (Ton/ha).

Type of soil conditioners	FYM			T.R.		
Treat. Control	10	20	30	10	20	30
7	7.41	8.93	8.89	4.91	5	5.19

L.S.D. $_{0.05}$ = 0.85 **L.S.D. $_{0.01}$ = 1.19**

Table (4) shows that the high content of Fe in barley grains was obtained from town refuse treatments. This is owing to the high content of iron in TR (table 4), while the highest value of Mn was in FYM at the rate of 10 ton/ha. This is due to the high content of Mn in FYM, also the few yield in this treatment. While this value decreased in other treatments because of the dilution effect. The zinc content in barley grains was high in different treatments as compared with control treatment. This was true for either FYM or TR. The copper content of barley-grains was high for the rate of 20 tons/ha of FYM and the rate of 30 tons/ha. It is apparently for the available of Cu. DTPA in FYM. Similar result was obtained in case of potassium and sodium content. On the other hand, these results are because of the EC which is high for FYM (34.9 dS/m) and TR (33.5 dS/m). Moreover, these values do not represent the fact because of the different acid content.

TABLE (4). Mineral content of barley grains as affected by soil conditioners.

elements / Treatments	Fe ug/g	Mn ug/g	Zn ug/g	Cu ug/g	K' mg/g	Na mg/g
Control	161	39	33	5.25	5	1.3
FYM 10 tons/ha.	176	57	42	5.50	5.9	1.4
FYM 20 tons/ha..	195	26	39	7.00	7.0	1.7
FYM 30 tons/ha..	188	30	38	6.5	5.3	1.6
T.R. 10 tons/ha.	208	35	39	3.75	5.3	1.4
T.R. 20 tons/ha.	219	30	40	5.00	5.2	1.2
T.R. 30 tons/ha.	355	49	43	4.00	5.4	1.5
FYM	3509	218	55	9	12	16.0
TR	4624	151	445	125	3.5	18.2

FYM=Farmyard manure
TR=Town refuse

Table(5) shows that the EC of soil samples after harvesting decreased through different FYM treatments relative to the initial soil EC (5.86 dS/m). In this respect, the EC values in case of FYM treatments at the rates of 10, 20 and 30 ton/ha were3.66, 4.26 and 4.28 dS/m, respectively.

TABLE (5). Soil analysis after harvesting.

Treatments	EC (dS/m)	ESP	Ex. K' (meq/100g)
Control	3.70	8.9	1.03
FYM 10 tons/ha	3.66	9.22	0.92
FYM 20 tons/ha.	4.26	9.80	1.03
FYM 30 tons/ha	4.28	9.80	0.97
TR 10 tons/ha.	4.73	11.00	1.03
TR 20 tons/ha.	6.08	14.86	0.92
TR 30 tons/ha	5.87	16.60	1.03

FYM=Farmyard manure
TR=Town refuse

TABLE (6). Available micronutrients of soil after harvesting as affected by natural soil conditioners application.

Micronutrient ppm / *Treatments*	Fe '' ug/g	Mn'' ug/g	Zn'' ug/g	Cu'' ug/g
Control	3.22	2.32	0.80	0.98
FYM 10 tons/ha	2.54	3.66	0.42	0.50
FYM 20 tons/ha	2.86	3.93	1.27	0.56
FYM 30 tons/ha	2.28	4.80	0.91	0.46
TR 10 tons/ha.	2.40	5.17	0.79	0.32
TR 20 tons/ha.	3.52	8.28	1.29	0.26
TR 30 tons/ha	3.26	6.93	0.81	0.38
FYM TR	46.4 1373	40.9 75.1	19.04 28.76	2.44 5.84

FYM=Farmyard manure
TR=Town refuse

On the other hand, TR treatments caused a slight increase in soil EC after harvesting. Generally, the FYM is better than the TR The ESP increased in case of TR more than FYM. This is owing to the high content of sodium in TR.

Table (6) showed that the highest contents of Fe, Mn, Zn and Cu were in case of Town refuse.The best treatments were FYM 20 and 30 tons/ha

concerning barley grains and straw. The low content for most elements in the case of the high yield. This fact due to the dilution effect. From the economic point of view the rate of 20 ton FYM per hectare was the best treatment.

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تأثير محسنات التربة الطبيعية على صفات الأرض الجيرية وإنتاجية محصول الشعير تحت ظروف الملوحة

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أجريت تجربة حقلية خلال موسم ١٩٩٩ /٢٠٠٠ فى محطة بحوث مريوط التابعه لمركز بحوث الصحراء واستخدم فيها نوعين من المحسنات الطبيعية هى مخلفات المزرعة ومخلفات المدن بمعدلات(٠،١٠،٢٠،٣٠ طن /هكتار) ، (١٠،٢٠،٣٠ طن /هكتار) على الترتيب فى تصميم قطاعات كاملة العشوائية مع ٤ مكررات لكل معاملة اضيف السماد النتروجينى والفوسفورى بمعدلات ١٦٧،٥ كجم ن/هكتار،٣٧،٥ كجم فو٢ أه /هكتار) .

اظهرت النتائج أن ترتيب المعاملات من حيث كفاءتها كانت كالتالى :- ٣٠طن مخلفات المزرعة > ٢٠ طن مخلفات المزرعة > ٣٠ طن مخلفات مدن وهذه القيم كانت كالتالى ٥،٣١ و٥،٠٤ و٤،٨٥٢٥ طن /هكتار على الترتيب. محتوى النبات من البوتاسيوم والنحاس والصوديوم كان الأعلى فى حاله ٢٠ طن مخلفات المزرعة للهكتار بينما كان الحديد والزنك اعلى فى حاله ٣٠طن مخلفات مدن للهكتار. والنتيجة السابقة تعزى الى محتوى المحسنات العالى من تلك العناصر ، وكانت القيمة الأعلى للمنجنيز فى حالة ١٠طن مخلفات مزرعة للهكتار وهذا يرجع إلى الإنتاجية القليلة.

أظهرت التحاليل الكيماوية للتربة بعد الحصاد أن درجة التوصيل الكهربى والنسبة المئوية للصوديوم المتبادل كانت عالية فى حاله(٢٠،٣٠ طن /هكتار) مخلفات مدن وقد أدت إضافة مخلفات المدن إلى زيادة التوصيل الكهربى والنسبة المئوية للصوديوم المتبادل بينما على العكس من ذلك أدت إضافة مخلفات المزرعة الى نقص هذه القيم فى كل معدلات الإضافة من سماد المزرعة ونستخلص من ذلك أن مخلفات المزرعة كانت الأفضل فى تأثيرها على خواص التربة الجيرية ولقد تحقق أقصى عائد صافى من معاملة(٢٠ طن/هكتار) مخلفات مزرعة وقد كانت نسبة المنفعة الى التكاليف ١،٨٤.