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EFFEECT OF DIFFERENT RATES AND METHODS OF SOME SOIL CONDITIONERS APPLICATION ON SOME PHYSICAL PROPERTIES OF SANDY SOIL AND YIELD OF PEANUT

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ABSTRACT: *A field experiment was conducted at Ismailia Research Station (Agriculture Research Center) in summer seasons, 2012 to study the effect of using tafla (bentonite), compost and farmyard manure (FYM) at the rates of 4 and 8 ton/fed, and using two methods (mixed with the 20 cm surface and buried as layer beneath 20 cm depth) on some physical properties of sandy soil and peanut yield. The studied physical properties were infiltration rate (cm/min), hydraulic conductivity (cm/min), total soil porosity (%), field capacity (%), wilting point (%) and available water (%). The studied peanut yield were grain yield (kg/fed), weight of 100 grain (gm), pod yield (kg/fed) and shoot yield (kg/fed).*

The obtained results indicated that all used conditioner type, their rates and buried, either interaction or individual, reduced the values of infiltration rate and hydraulic conductivity in significant compared to control. But, used buried compost at rate 8 ton/fed had the highest significant effect on total porosity (%), otherwise of control. The values of field capacity and wilting point in all plots increased with increasing the applied treatments compared to control. The values of available water increased being to increase the field capacity. Similar trend with total porosity and available water was noticed for grain yield, weight of 100 grain (gm), pod yield (kg/fed) and shoot yield (kg/fed) at the mentioned treatments, where compost type at 8 ton/fed which used in buried method had the highest significantly effect.

Key words: *Tafla, Compost, Farmyard manure, Peanut yield, Sandy soil*

INTRODUCTION

The major problem in cultivating sandy soils, however are their high infiltration rate and the low of water and nutrients far away from the root zone. Addition of organic matter can increase soil productivity by proving essential plant nutrient and by improving physical properties (El-Hady, 1979).

On the other hand, application of organic amendments and bio-fertilizer to soil can be an environmentally safe and economical alternative for disposal.

The addition of bentonite and/or organic manure to sandy soil increased the concentration of N, P and K in grains of wheat and soybean, consequently the yield increased. The addition of bentonite can be used for improving moisture retentivity of sandy soils (Lotfy and El-Hady 1984). El-Sebaey, (2000) found that application of rice straw, composted plant residues and cotton stalks compost to sandy soil increased and improved the availability of N, P and K in soil compared to mineral fertilizers. The use of organic fertilization and composts in agriculture are widely practiced in Egypt.

Most desert soils are sandy ones poor in their natural fertility and therefore plants grown on their soils suffer from lack in most of the nutritive elements. Further more, if these nutritive elements were applied to these soils as ordinary mineral fertilizers they will be subjected to loss with the drained water. This might cause ground water and streams to contaminated with a lot pollutants especially nitrate. Consequently, the will be a potential hazard for the human health. (Abd El Aziz, 2010).

Providing cheap and acceptable substitutes for the traditional mineral fertilizers.

Improving soil physical properties and consequently improving the soil water relationship through increasing total porosity , water holding pores and consequently , water retentively and improvement chemical and biological properties..

Ali, (2011). Said that, treating sandy soil with clay and organic matters as manures and compost in one of the options adapted to increase water and productivity with the least use of mineral fertilizers.

Besides water repellency of sandy soil can reduced by adding small increments of clay content.

Regarding the response of physical properties to bentonite application, many properties such as particle size distributions, bulk density , total porosity and moisture retention characteristics were reported to be improved . El- Halawany *et al.,* (1991) reported that bentonite application resulted in a high significant increase in soil porosity and available water content , contrary to bulk density and hydraulic conductivity where values were significant decreased.

El-Sedfy *et al.,* (2002). reported that , the maximum yield of peanut were obtained by biogas manure application the improvement of physical properties of the studies soil (bulk density, total porosity, hydraulic conductivity and soil application) as a result of using different organic amendments (compost, biogas manures and mixture of both) induced on enhancements in plant growth yield production .

Sadik *et al.,* (2004) reported that, soil amendments improved soil moisture retention in the following order : chicken manure mixed with vermiculite > chicken manure mixed with bentonite > rice straw compost mixed with bentonite > rice straw compost mixed with vermiculite . Also that the yield of peanut and carrot increased significantly by natural amendments application and the highest yield were obtained with the application of chicken manure mixed with vermiculite.

This research aimed to study the effect of different soil conditioners type and their application rate and methods on soil physical properties and yield production of peanut.

MATERIALS AND METHODS

A field experiment was conducted in Ismailia Agriculture Research Station in summer season 2012 to study the efficiency of different methods of conditioner application i.e., tafla (bentonite), compost and farm yard manure on some soil physical properties of sandy soil and yield of peanut. These conditioners were applied with two rates (4 and 8 ton/fed) and every rate applied in two methods; one of them was mixed with the surface layer (0-20 cm) (mixed), and the second was buried conditioner layer spread below 20 cm from the surface (buried). These treatments were shown in table (1), and analyses of these conditioners were tabulated in table (2). Some soil properties was measured and shown in table (3). Peanut grains (Giza 4) were seeded in summer seasons 2012. The treatments were randomized complete block design for conditioner types, with the rates as a split plot on the type and the methods as a split-split plot on the rate, with three replicates. Each plot was 1/400 feddan (3 x 3.5 m2). Recommended fertilizers were applied and drip irrigation was used.

Table (1): The studied application treatments

Conditioner types	Rates (ton/fed.)	Methods
Tafla (Bentonite)	4	Surface (Mixed)
		Subsurface (Buried)
	8	Surface (Mixed)
		Subsurface (Buried)
Compost	4	Surface (Mixed)
		Subsurface (Buried)
	8	Surface (Mixed)
		Subsurface (Buried)
Farm yard manure	4	Surface (Mixed)
		Subsurface (Buried)
	8	Surface (Mixed)
		Subsurface (Buried)

Table (2): Analyses of the used soil conditioners

	Tafla (Bentonite)	Compost	Farm yard manure
Moisture content%		32.10	18.50
pH	7.85	7.95	6.85
EC (dS/m)	1.68	2.68	2.90
Density (Kg/m^3)	83.00	280.0	312.0
Organic carbon OC (%)		36.18	40.15
Organic matter OM (%)	0.30	48.12	72.08
Total N (%)	0.65	3.25	1.38
Total P (%)	0.05	0.38	0.25
Total K (%)	0.40	0.52	0.35
C/N ratio		11.13	29.09

Table (3): Some Physical and Chemical properties of the used soil.

pH	8.09	C. sand	63.45
EC (dS/m)	0.89	F. sand	26.13
SP (%)	18.90	Silt	2.40
Soluble ions (meq/l)		Clay	8.02
Ca^{++}	2.30	Texture class	Sandy soil
Mg^{++}	0.70		
Na^{+}	3.05	CaCO3 (%)	0.68
K^{+}	0.60	OM (%)	0.40
$CO_3^{=}$	--	BD (g/m^3)	1.78
HCO_3^{-}	0.60		
Cl^{-}	2.60		
$SO_4^{=}$	3.45		

Some soil physical properties; infiltration rate (cm/min), hydraulic conductivity (cm/min), total porosity (%), field capacity (%), wilting point (%) and available water (%) were determined according Black *et al* (1982). Grain yield (kg/fed), weight of 100 grain (gm), pod yield (kg/fed) and shoot yield (kg/fed) were recorded after harvest. Soil properties and conditioners analyses were determined according to Jackson (1967). Statistical analyses were conducted according Nissen (1983).

RESULTS AND DISCUSSIONS

1). Physical Properties:

A- Effected of the studied treatments on soil infiltration rate (cm/min), hydraulic conductivity (cm/min) and total porosity (%) of sandy soil.

For infiltration rate and hydraulic conductivity statistical tri-interaction i.e., the tested treatments of tafla, compost and farmyard manure at the two rates and two methods of applications show no significant different either for infiltration rate or hydraulic conductivity. The values of bi-interaction of type-rate and rate-method were beneficial significant effect compared control. Also, the individual effects were

significant in useful trend compared control and 4 ton/fed. compost was the less effect compared to control. This behavior may be attributed to preserved moisture and minimized the bypass water when applied treatments, otherwise control.

As for total porosity, the tri-, bi-interaction and individual effects were higher significant differences. The highest value was found in the soil treated with buried compost at 8 ton/fed., whatever at tri-interaction, bi-interaction or individual effect, as they found in (Table, 4). This attributed to the applied conditioners to the sandy soils (El-Sedfy *et al.,* 2002).

B-Soil moisture constants (FC, WP and AW) :

Soil field capacity, wilting point and available water are considered the three main soil moisture constants. The values of tri-interaction of conditioner type, rates and method were no different effect between them. This means that, those had similar effects on soil moisture constants (Table, 5).

Field capacity when bi-interaction applied of type-rate, type-method and rate-method, wilting point when applied rate-method and available water when applied type-rate were higher significant differences compared control (Table, 5). Otherwise, the treatments of interaction or individual of compost at rate 8 ton/fed. which used buried beneath 20 cm depth represented the higher increase of FC, WP and AW compared to control.

This through light, that the increment of available water returned to the relatively high increments of field capacity, which had been influenced by the conditioner application. These results was agreed with (Tester, 1990; Fawy *et al.,* 2009 and El-Kommos *et al.,* 1989).

2: Effect of the studied treatments on peanut productivity :

A). Peanut grain yield (kg/fed) and weight of 100 grain (gm):

Grain yield of peanut associated by (kg/fed) as shown in table (6) revealed that buried of 8 ton/fed compost was the highest value (871.1 kg/fed) followed by mixed of 4 ton/fed compost (810.5 kg/fed), then buried 8 ton/fed FYM (772.5 kg/fed) and buried 8 ton/fed tafla (761.4 kg/fed).

Figs (1-I,II,III) showed that the highest values affected by bi-interaction of type-rate, type-method and rate-method treatments were 8 ton/fed compost, buried compost and the type average of buried of 8 ton/fed, respectively. As for individual effect of conditioner type, their rates and methods (Fig.1.IV), the highest values were compost, 8 ton/fed and buried, respectively. These results were agreed with (El-Sedfy *et al.,* 2002).

Tri-interaction effects of the treatments on weight of 100 grain (gm) (Table, 6) showed that conditioner buried of 8 ton/fed compost (76.65 gm), mixed of 8 ton/fed compost (73.59 gm), buried and mixed of 4 ton/fed FYM (76.38 & 73.40 gm) was superior effect, in significant with control. The previous values were followed by buried and mixed of 8 ton/fed tafla (69.70 & 68.85 gm). in general all values showed that the buried methods were better than the mixed ones.

Figs (2-I,II,III) showed that superior values of weight of 100 grain (gm) affected by buried (subsurface) application, either for compost or FYM at rate 8 ton/fed. were owing to different application promoting moisture content in the two layers, which would act preserve to saved water for plant demand, other than surface applications, that led to health growth and by turn to the best yield. While the drown Fig.(2.IV) showed that compost, 8 kg/fed or buried was the highest effect on weight of 100 grain (gm).

B- Pod yield and shoot yield:-

The crop was harvested at physiological maturity and yields recorded in (Table ,7) which revealed that, the plant grown under all the studied treatments compared to control. The highest values of pod yield and shoot yield were recorded when using compost followed by tafla, then farmyard manure, 8 ton/fed and buried method.

Table (4): Effects of the studied treatments on the infiltration rate (cm/min), hydraulic conductivity (cm/min) and total porosity (%) of sandy soil after harvest of peanut .

Treatments			Infiltration rate (cm/min)	Hydraulic conductivity (cm/min)	Total porosity (%)
Type	Rate	Method			
Control			4.68	0.417	32.83 H
Tafla	4	Mixed	4.20	0.383	31.69 I
		Buried	4.38	0.380	32.07 I
	8	Mixed	3.90	0.370	30.56 J
		Buried	3.78	0.367	29.81 K
Compost	4	Mixed	4.20	0.387	35.84 E
		Buried	4.38	0.370	35.84 E
	8	Mixed	3.96	0.373	37.73 C
		Buried	4.08	0.357	39.62 A
FYM	4	Mixed	4.20	0.407	35.09 F
		Buried	4.38	0.400	33.96 G
	8	Mixed	4.04	0.377	36.60 D
		Buried	4.04	0.373	38.49 B
Control			4.68 A	0.417 A	32.83 E
Tafla	4		4.29 B	0.382 C	31.88 F
	8		3.84 C	0.368 DE	30.19 G
Compost	4		4.29 B	0.378 CD	35.84 C
	8		4.02 C	0.365 E	38.67 A
FYM	4		4.29 B	0.403 B	34.53 D
	8		4.04 C	0.375 CDE	37.54 B
Control			4.68	0.417	32.83 E
Tafla		Mixed	4.05	0.377	31.13 F
		Buried	4.08	0.373	30.94 F
Compost		Mixed	4.08	0.380	36.78 B
		Buried	4.23	0.363	37.73 A
FYM		Mixed	4.12	0.392	35.85 D
		Buried	4.21	0.387	36.22 C
4		Mixed	4.32 AB	0.398	33.86 C
		Buried	4.46 A	0.392	33.67 C
8		Mixed	4.15 C	0.384	34.43 B
		Buried	4.15 BC	0.378	35.19 A
Control			4.68 A	0.417 A	32.83 C
Tafla			4.07 B	0.375 C	31.03 D
Compost			4.16 B	0.372 C	37.26 A
FYM			4.17 B	0.389 B	36.03 B
4			4.39 A	0.395 A	33.77 B
8			4.15 B	0.381 B	34.81 A
Mixed			4.23 B	0.391 A	34.15 B
Buried			4.30 A	0.385 B	34.43 A

Means followed by the same letters or have no letters in the same interaction or individual are not different at the 5% level by LSD test, while followed by different letters are significant different.

Table (5): Effect of the studied treatments on sandy soil after harvest peanut yield.

Treatments			Field capacity	Wilting point	Available water
Type	Rate	Method			
Control			7.90	2.45	5.46
Tafla	4	Mixed	8.30	2.95	5.35
		Buried	8.58	2.85	5.73
	8	Mixed	8.78	2.64	6.14
		Buried	9.65	3.25	6.20
Compost	4	Mixed	8.36	2.67	5.79
		Buried	8.75	2.87	6.41
	8	Mixed	10.65	3.10	7.55
		Buried	11.35	3.59	8.40
FYM	4	Mixed	8.25	2.95	5.30
		Buried	8.42	2.77	5.65
	8	Mixed	8.68	2.88	5.80
		Buried	9.88	3.43	6.45
Control			7.90 D	2.45	5.46 C
Tafla	4		8.44 C	2.90	5.54 C
	8		9.22 B	2.95	6.17 B
Compost	4		8.56 C	2.77	6.10 B
	8		11.00 A	3.35	7.98 A
FYM	4		8.34 C	2.86	5.48 C
	8		9.28 B	3.16	6.13 B
Control			7.90 E	2.45	5.46
Tafla		Mixed	8.54 D	2.80	5.75
		Buried	9.12 C	3.05	5.97
Compost		Mixed	9.51 B	2.88	6.67
		Buried	10.05 A	3.23	7.41
FYM		Mixed	8.47 D	2.92	5.55
		Buried	9.15 C	3.10	6.05
4		Mixed	8.20 C	2.75 B	5.48
		Buried	8.41 C	2.74 B	5.81
8		Mixed	8.00 B	2.77 B	6.24
		Buried	9.70 A	3.18 A	6.63
Control			7.90 C	2.45 B	5.46 B
Tafla			8.83 B	2.92 A	5.86 B
Compost			9.78 A	3.06 A	7.04 A
FYM			8.81 B	3.01 A	5.80 B
4			8.31 B	2.76 B	5.64 B
8			9.35 A	2.96 A	6.43 A
Mixed			8.60 B	2.76 B	5.86 B
Buried			9.05 A	2.96 A	6.22 A

Means followed by the same letters or have no letters in the same interaction or individual are not different at the 5% level by LSD test, while followed by different letters are significant different.

Table (6): Tri-interaction effects (types, rates and methods) of the treatments on Peanut yield (kg/fed) and weight of 100 grains (gm).

Treatments			Grain Yield (kg/fed)	Weight of 100 grain
Type	Rate	Method		
Control			568.1 K	61.78 E
Tafla	4	Mixed	661.7 I	60.81 E
		Buried	707.6 F	65.66 CD
	8	Mixed	724.8 E	68.85 BC
		Buried	761.4 C	69.70 B
Compost	4	Mixed	676.4 H	73.59 A
		Buried	691.5 G	65.38 CD
	8	Mixed	810.5 B	63.50 DE
		Buried	871.1 A	76.65 A
FYM	4	Mixed	739.5 D	63.99 DE
		Buried	622.3 J	64.25 DE
	8	Mixed	740.4 D	73.40 A
		Buried	772.5 C	76.38 A

Means followed by the same letters or have no letters in the same interaction or individual are not different at the 5% level by LSD test, while followed by different letters are significant different.

Table (7): Effect of the studied treatments on the peanut pod yield (kg/fed) and shoot (kg/fed) after harvest.

Treatments			Pod yield (kg/fed)	Shoot (kg/fed)
Type	Rate	Method		
Control			783	1356
Tafla	4	Mixed	933	1621
		Buried	998	1681
	8	Mixed	1000	1754
		Buried	1075	1812
Compost	4	Mixed	961	1609
		Buried	954	1649
	8	Mixed	1127	1913
		Buried	1184	2099
FYM	4	Mixed	991	1767
		Buried	878	1494
	8	Mixed	1029	1770
		Buried	1066	1823
Tafla	4		965 C	1651 C
	8		1038 B	1783 B
Compost	4		958 C	1629 C
	8		1155 A	2006 A
FYM	4		934 C	1631 C
	8		1048 B	1796 B
Tafla		Mixed	967	1688 BC
		Buried	1036	1746 BC
Compost		Mixed	1044	1761 B
		Buried	1069	1874 A
FYM		Mixed	1010	1769 B
		Buried	972	1658 C
4		Mixed	917	1588 B
		Buried	903	1545 B
8		Mixed	985	1698 A
		Buried	1027	1773 A
Tafla			1002 B	1717 AB
Compost			1056 A	1818 A
FYM			991 B	1713 B
4			910 B	1567 B
8			1006 A	1735 A
Mixed			950	1643
Buried			965	1659

Means followed by the same letters or have no letters in the same interaction or individual are not different at the 5% level by LSD test, while followed by different letters are significant different.

Fig (1): Bi- and individual effects of type, rate and method of conditioner application on peanut yield (kg/fed) and weight of 100 grain (gm).

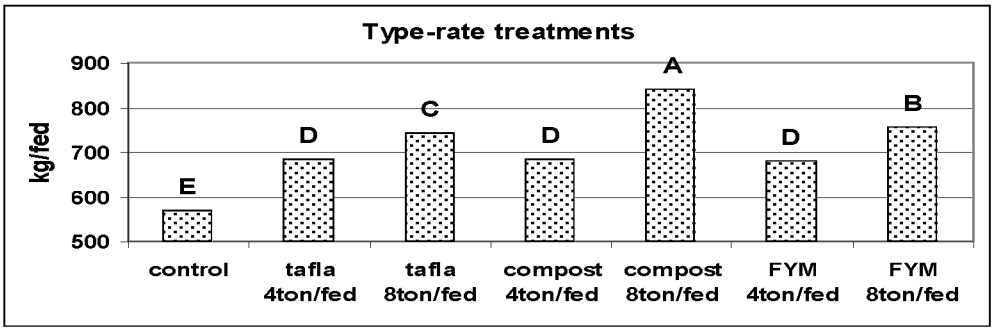

Fig (1-I): Bi-interaction effect of type and rate treatment

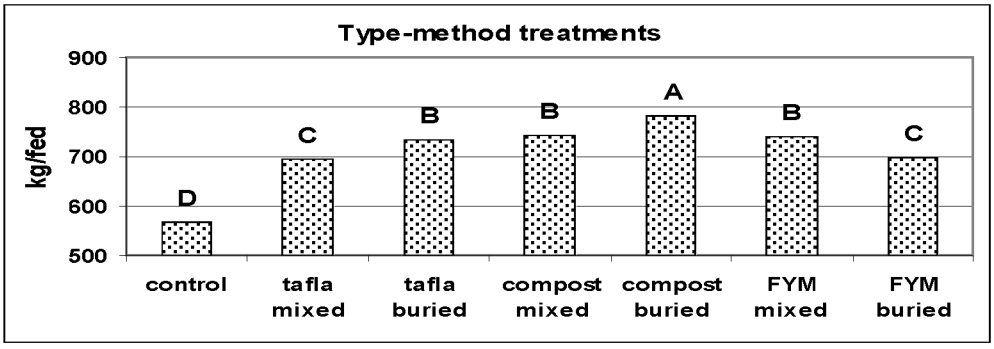

Fig (1-II): Bi-interaction effects of type and method of treatment

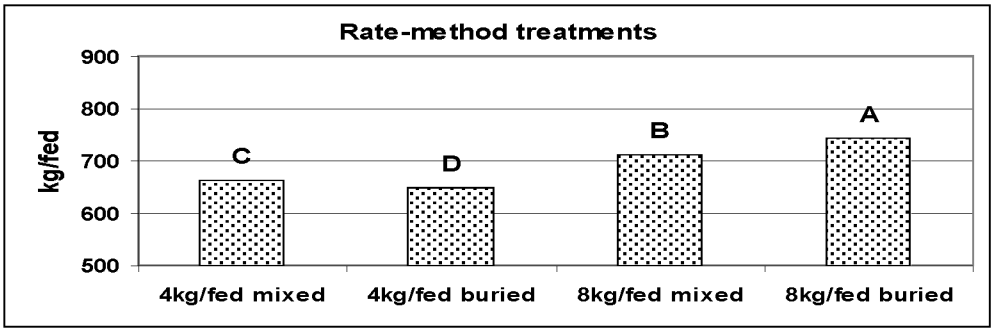

Fig (1-III): Bi-interaction effect of rate and method of treatment

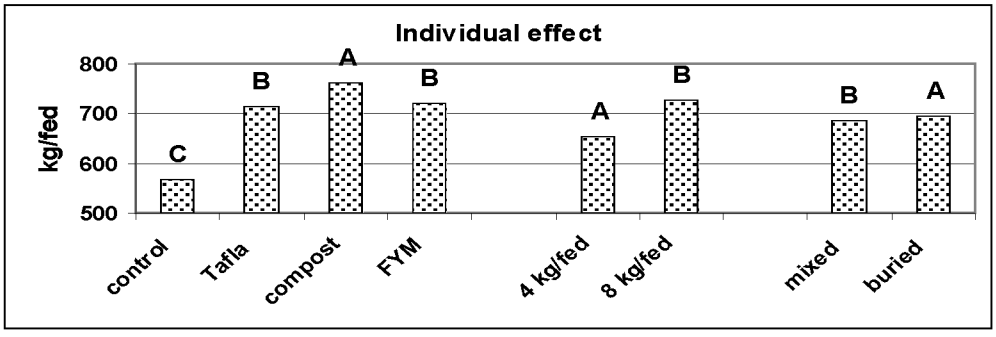

Fig (1-IV): Individual effects of type, rate and method of treatment

Columns have the same letters are not different at the 5% level by LSD test, while those have different letters are significant different.

Fig (2): Bi- and individual effects of type, rate and method of conditioner application on peanut weight of 100 grain (gm).

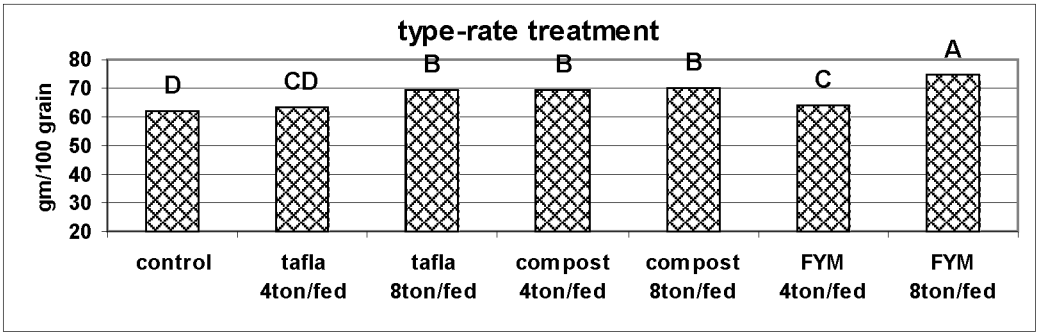

Fig (2-I): Bi-interaction effect of type and rate treatment

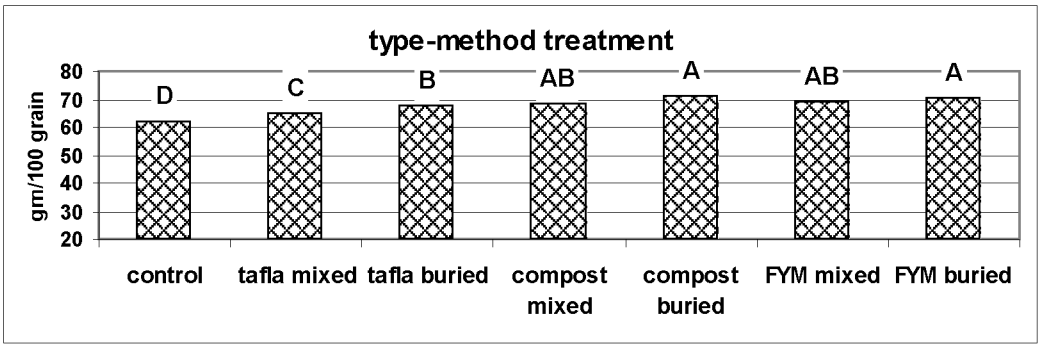

Fig (2-II): Bi-interaction effects of type and method of treatment

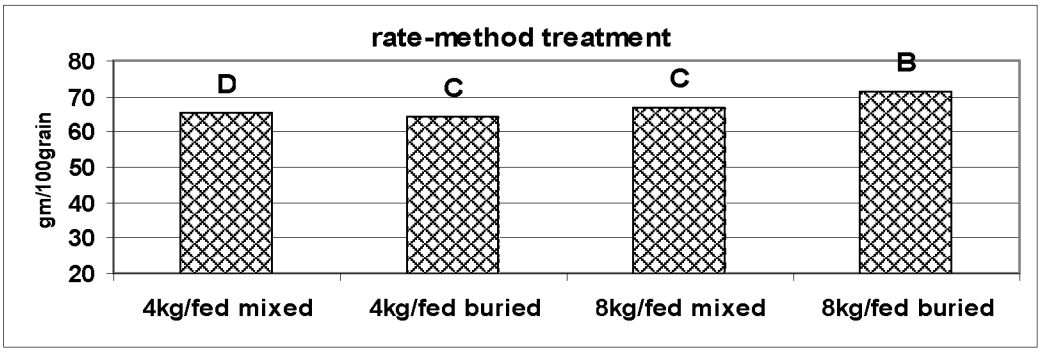

Fig (2-III): Bi-interaction effect of rate and method of treatment

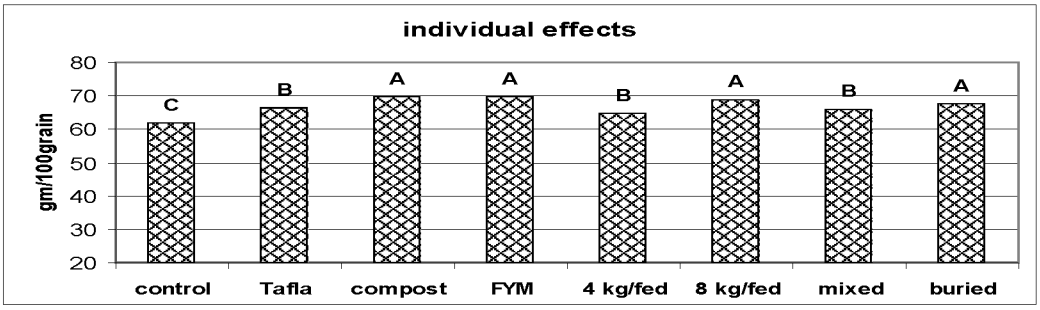

Fig (2-IV): Individual effects of type, rate and method of treatment

Columns have the same letters are not different at the 5% level by LSD test, while those have different letters are significant different.

Data in (Table,7) showed that bi-interaction of type-rate for pod yield, type-rate, type-method and rate-method of shoot yield were highly significant, which 8 ton/fed and buried for all preceded interaction represented superior effect other than others. Whereas, no significant different was found between tri-interaction effect for pod and shoot yield.

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تأثير المعدلات وطرق اضافة مختلفة لبعض محسنات التربة الطبيعية على بعض الخواص الطبيعية للاراضى الرملية وأنتاجية الفول السودانى

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الملخص العربى

أجريت تجربة حقلية فى محطة البحوث الزراعية بالاسماعيلية فى الموسم الصيفى ٢٠١٢ لدراسة تأثير استخدام كل من الطفلة (البنتونيت) – كمبوست – مخلفات المزرعة بمعدل ٤–٨ طن /فدان باستخدام طريقتى اضافة (خلط مع ٢٠ سم سطحى – اضافة تحت سطحى ٣٠ سم مع الردم) وذلك لدراسة بعض الخواص الطبيعية للاراضى الرملية وكذلك انتاجية محصول الفول السودانى . وتم دراسة بعض الخواص الطبيعية مثل معدل الرشح (سم/دقيقة) ، التوصيل الهيدروليكى (سم /دقيقة) ، المسامية الكلية (%)، السعة الحقلية (%) ، نقطة الذبول (%)، الماء الميسر (%). وايضا تم دراسة محصول حبوب الفول السودانى (كجم /فدان) ، وزن المائة حبة (جم) ، وزن القرون (كجم/فدان) ، وزن العرش (كجم/فدان).

دلت النتائج المتحصل عليها نتيجة اضافة المحسنات تأثر الخصائص الطبيعية للتربة خلال فترة التجربة كذلك التفاعل بين المعاملات .

ادى الى انخفاض قيم الرشح والتوصيل الهيدروليكى معنويا بالمقارنة بالكنترول ولكن باستخدام الكمبوست بمعدل ٨ طن /فدان (تحت سطحى) ، ادى الى زيادة اكثر تأثير معنوى ، كل نسبة المسامية بالمقارنة بالكنترول . قيم السعة الحقلية ونقطة الذبول فى كل المعاملات تزداد بزيادة معدل اضافة المحسنات الطبيعية بالمقارنة بالكنترول . قيم الماء الميسر تزداد بريادة السعة الحقلية نفس الاتجاة مع المسامية الكلية والماء الميسر لوحظ مع قيم كل من المحصول كجم/فدان ، وزن ١٠٠ حبة جم ، وزن القرون كجم/فدان ، وكذلك وزن العرش كجم/فدان لكل المعاملات بينما معاملة الكمبوست (تحت سطحى) ٨ طن /فدان ادى الى زيادة معنوية .