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EVALUATING THE EFFECTS OF APPLIED MIXTURES OF SOME ORGANIC COMPOSTS COMBINED WITH SHALE ON SOME PROPERTIES AND PRODUCTIVITY OF A SANDY SOIL

Reda, M.M.A.

Soils, Water and Environment Res. Instit., Agric. Res. Center, Giza, Egypt

ABSTRACT

The main objective of this investigation was to study the effect of applied mixtures of shale combined with some organic composts of plants residues, i.e., broad bean straw, rice straw and corn stalks at the rate of 20 tons/fed by weight in different ratios (1:3, 1:1 and 3:1), in addition to 50% of the recommended mineral N, P and K fertilizer doses, on some physical and chemical properties of a tested sandy soil at the experimental Farm of Ismailia Agriculture Res. Station as well as the productions of both wheat and maize plants during two successive seasons of 2002/2003 and 2003, as compared to the control treatment (full doses of the recommended N, P and K fertilizers).

Application of different combination ratios (1:3, 1:1 and 3:1) for shale and organic composts improved the physical properties of the tested soil, i.e. clay and silt percentage, bulk density, hydraulic conductivity, total porosity and soil moisture contents at field capacity, wilting point and available water. Also, the chemical properties i.e., pH, ECe, O.M, CEC and available N, P and K in the cultivated soil were favored, except EC as compared with the control due to applying all treatments of shale and such composts together after either wheat or corn harvestings.

The yields of both wheat and corn plants as well as the contents of N, P and K in grains of both crops were markedly improved upon the application of these soil amendments.

In general, the best treatment was a mixture of both shale and composted broad bean, particularly at ratio (1:3) as compared with the other treatments.

Key words: Shale - Composted broad bean - Composted rice straw - Composted corn stalk - Soil physical properties - Chemical properties – Wheat – Corn.

INTRODUCTION

Large areas of Egypt are marginal desert soils, so cultivation of these soils is necessary to increase our agricultural production and solve the problems of increasing population and food shortage. However, these soils are, generally, lacking factors essential for fertility; being generally characterized by a very low moisture holding capacity, poor plant nutrients and a scarcity of organic matter. Thus, introducing agricultural production of these soils requires development of both soil and water managements.

Recently, organic materials such as crop residues, i.e., broad bean straw, rice straw and corn stalks are available in abundant and tremendous amounts every year. The recycling of these materials to produce organic fertilizers (as compost) is very important for increasing the agricultural production, reducing the application rates of chemical fertilizers, and hence the prevention of environmental pollution (Saleh *et al.,* 2003). Zebarth *et al.* (1999) reported that soil water retention in sandy soil was increased and soil bulk density was reduced due to addition of 2% organic matter. The continued use of organic manures, alone or in combination with inorganic sources improved the available K (Toor and Bishmoi, 1996) and the net N and P in soils (Metwally and Khamis, 1998 and Mahmoud, 1994). El-Sharawy *et al.* (2003) reported that application of either cotton stalks or rice straw composts significantly improved bulk density, hydraulic conductivity, moisture contents, available N, P and K and grain yields of wheat and corn plants as well as concentrations of NPK in plant leaves and grains.

Shale (Tafla) is one of the natural available materials adjacent to these areas. Application of shale to these soils improves the water holding capacity and reduces the leaching of nutrients. Laila *et al.* (1998) reported that hydraulic conductivity in sandy soil was markedly decreased, while total porosity, moisture retention and wheat yield were significantly increased with increasing the amounts of applied shale; best treatment was 20 ton/fed. El-Shanawany *et al.* (1994) showed that application of tafla and organic manure in sandy soil alone or in combination increased soil total porosity and available water content as well as the yield of pods and foliage of peanut. Hamouda *et al.* (1999) added that available water, filed capacity, total aggregates, clay, wilting point, total porosity, silt, organic matter, cation exchange capacity, electrical conductivity were increased, while, bulk density and hydraulic conductivity were reduced with the successive shale additions to sandy soil. Also, the yields of peanut and wheat had highest values at the treatments of 15 and 20 ton/fed, respectively.

The current work aims to study the effect of the different ratios of the mixtures between shale and composted plant residues applications on some characteristics of a sandy soil as well as yields of wheat and maize plants. These practices would minimize the environmental pollution which resulted from the intensive application of chemical fertilization by substituting a part of it with the organic composts.

MATERILAS AND METHODS

A field experiment was conducted on a sandy soil at Ismailia Agricultural Research Station during two successive seasons 2002/2003 (winter season) and 2003 (summer season) under sprinkler irrigation system, to study the effect of applied mixtures of shale combined with different sources of compost i.e., broad bean straw, rice straw and corn stalks at the rate of 20 tons/fed, on some soil properties and the production of wheat and corn plants. Also, the comparison between inorganic fertilizers and organic manures were considered in this study. Some physical and chemical properties of the tested soil are shown in Table (1). Also, the main characteristics of the used composts and shale are shown in Tables (2 and 3).

Wheat (Giza 164) was planted at November 2002 followed by corn (Giza 2) which cultivated at May 2003.The different treatments (shale combined with different sources of compost) were mixed with the soil surface (0-20 cm layer) before planting (15 days). Each treatment was replicated three times in a randomized complete blocks design. Mineral fertilizers were applied at rate of 100% and 50% of the recommended dose for control and other treatments, respectively.

Also, the treatments of shale combined with different sources of compost were applied at ratios of 1:3, 1:1 and 3:1 for shale:compost. The following treatments were included:

Table (1): Some physical and chemical properties of the investigated soil

Soil characteristics		Value
Some physical properties:		
Particle size distribution (%)		
Coarse sand		68.01
Fine sand		30.10
Silt		1.15
Clay		0.74
Textural class		Sandy
Bulk density	(g cm^{-3})	1.70
Total porosity	(%)	39.4
Hydraulic conductivity	(cm h^{-1})	10.66
Filed capacity	(%)	8.72
Wilting point	(%)	2.64
Available water	(%)	6.08
Some chemical properties:		
pH (1:2.5 soil:water suspention)		7.67
Calcium carbonate	(%)	1.62
Organic matter	(%)	0.26
Cation Exchange Capacity (CEC)	m mol_c	2.86
ECe (soil paste extract)	(dS m^{-1})	0.56
Soluble ions		
Ca^{2+}	meq/L	1.86
Mg^{2+}	““	1.79
Na^{+}	““	1.63
K^{+}	““	0.59
$CO_3^{=}$	““	0.00
HCO_3^{-}	““	2.99
Cl^{-}	““	1.42
$SO_4^{=}$	““	1.46
Available nitrogen	mg kg^{-1} soil	22.00
Available phosphorus	mg kg^{-1} soil	3.10
Available potassium	mg kg^{-1} soil	59.0

Table (2): Some characteristics of the tested composts after maturing

Characters	Rice straw	Corn stalks	Broad bean
pH (1:10)	7.46	7.18	7.32
EC (1:10) dS/m	3.28	1.86	1.91
Organic matter (%)	48.33	47.55	59.54
Organic carbon (%)	28.1	27.6	34.6
Total nitrogen (%)	1.47	1.34	1.95
C/N ratio	19.15	20.6	17.71
Available N mg kg^{-1}	518	424	982
Available P mg kg^{-1}	325	319	296
Available K mg kg^{-1}	1154	1968	1680
Bulk density g cm^{-3}	0.44	0.40	0.48
Moisture content (%)	32.9	28.6	36.7

Table (3): some physical and chemical properties of used shale

Characteristics		Value
Particle size distribution	(%)	
Coarse sand		14.02
Fine sand		28.32
Silt		18.69
Clay		38.97
$CaCO_3$	(%)	4.86
Organic matter	(%)	0.19
pH (1:2.5)		7.80
EC	(dS m^{-1})	17.42

1- Control = Chemical fertilizer were applied at ratios of 100 kg N/fed as $(NH_4)_2SO_4$ (20% N), 30 kg P_2O_5/fed as superphosphate (15 P_2O_5) and 48 kg K_2O/fed as potassium sulphate (48% K_2O).
2- Shale : broad bean compost (1:3)
3- Shale : broad bean compost (1:1)
4- Shale : broad bean compost (3:1)
5- Shale : rice straw compost (1:3)
6- Shale : rice straw compost (1:1)
7- Shale : rice straw compost (3:1)
8- Shale : corn stalks compost (1:3)
9- Shale : corn stalks compost (1:1)
10- Shale : corn stalks compost (3:1).

All different shale and organic treatments received also 50% of the chemical recommended doses of N, P and K. Composting was conducted at Ismailia Agricultural Station, using the different three types of plant residues following the method described by Abou El-Fadl (1960).

At harvesting stage, grain and straw yields for both wheat and corn crops were recorded. Representative grains samples for both crops were taken to analyze N, P and K contents according to Cottenie *et al.* (1982).

Representative surface (0-20 cm) soil samples were collected from the treated plots after wheat and corn harvestings. The collected soil samples were air dried and prepared for physical and chemical analyses, as well as plant residues composts were determined according to the standard methods (Black *et al.*, 1965 and Jackson, 1973).

RESULTS AND DISCUSSIONS

I. Effect of applied shale combined with compost on physical properties:

1- Clay and silt:

When the different mixtures of shale and organic composts were applied to the tested soil, the percentages of clay and silt were highly affected by the successive additions after corn season than those after wheat season (Table, 4). This may be due to their contents in the applied shale (Hamouda *et al.*, 1999). The highest values for clay and silt were obtained by 15 ton shale/fed mixed with 5 ton composted broad bean/fed. Similar results were obtained by El-Shanawany *et al.* (1994) who stated that contents of clay and silt increased when sandy soil treated with (tafla+manure) treatments.

2- Bulk density and hydraulic conductivity:

The obtained results indicated that soil bulk density and hydraulic conductivity values were lower after corn season than those after wheat season particularly, (shale+composted broad bean) treatments in ratio (1:3) and (3:1) for B.D and H.C, respectively, Table (4). This could be due to the application of organic matter as compared with the control, in the corn season which reflects an accumulation of the more stable organic matter presented as humin fractions. These products

Table (4): **Effect of applied shale combined with compost treatments on some physical properties of the studied soil after harvesting of both wheat and corn**

Treatments	Mixtures ratio	Clay (%)	Silt (%)	B.D. (g cm^{-3})	T.P (%)	H.C (cm h^{-1})	F.C (%)	W.P. (%)	A.W (%)
After wheat harvesting									
Control (chemical)*		**0.84**	**1.18**	**1.75**	33.96	**13.37**	**8.76**	**2.82**	**5.94**
Shale + Broad bean compost	1 : 3	1.62	1.74	1.57	40.75	12.51	12.01	3.73	8.28
	1 : 1	1.44	1.62	1.63	38.49	10.36	11.60	3.69	7.91
	3 : 1	1.80	1.98	1.63	38.49	12.21	10.90	3.46	7.44
Mean		**1.62**	**1.78**	**1.61**	**39.25**	**12.36**	**11.50**	**3.63**	**7.88**
Shale + Rice straw compost	1 : 3	1.50	1.59	1.61	39.25	12.70	11.73	3.61	8.12
	1 : 1	1.36	1.50	1.65	37.74	12.51	11.00	3.41	7.59
	3 : 1	1.66	1.90	1.67	36.98	12.32	9.96	3.26	6.70
Mean		**1.51**	**1.66**	**1.64**	**38.11**	**12.51**	**10.90**	**3.43**	**7.47**
Shale + Corn stalks compost	1 : 3	1.41	1.52	1.64	36.98	12.78	11.44	3.60	7.84
	1 : 1	1.37	1.46	1.68	36.60	12.62	10.07	3.33	6.74
	3 : 1	1.71	1.80	1.69	36.23	12.37	9.26	3.20	6.06
Mean		**1.50**	**1.59**	**1.67**	**36.98**	**12.59**	**10.26**	**3.38**	**6.88**
After corn harvesting									
Control (chemical)*		**0.89**	**1.21**	**1.70**	**35.85**	**12.91**	**8.91**	**2.96**	**6.22**
Shale + Broad bean compost	1 : 3	1.65	1.78	1.53	42.26	10.93	12.31	3.92	8.39
	1 : 1	1.56	1.63	1.60	39.62	10.12	11.95	3.73	8.22
	3 : 1	1.89	1.99	1.61	39.25	9.93	11.70	3.59	8.11
Mean		**1.70**	**1.80**	**1.58**	**40.38**	**10.33**	**11.99**	**3.75**	**8.24**
Shale + Rice straw compost	1 : 3	1.52	1.64	1.58	40.38	11.32	12.06	3.79	8.27
	1 : 1	1.50	1.57	1.60	39.62	11.07	11.36	3.53	7.83
	3 : 1	1.79	1.95	1.63	38.49	10.80	10.16	3.46	6.70
Mean		**1.60**	**1.72**	**1.60**	**39.62**	**11.06**	**11.19**	**3.59**	**7.60**
Shale + Corn stalks compost	1 : 3	1.44	1.61	1.61	39.25	11.46	11.87	3.71	8.16
	1 : 1	1.41	1.53	1.65	37.74	11.71	10.93	3.47	7.46
	3 : 1	1.80	1.92	1.66	37.36	10.92	9.71	3.33	6.38
Mean		**1.55**	**1.69**	**1.64**	**38.11**	**11.36**	**10.84**	**3.50**	**7.33**

* Treated with the recommended doses of mineral N, P and K

improve soil physical conditions and enhance the formation of stable soil aggregates. In addition, humic substances are permanent aggregate-binding agents involved in the stabilization of soil micro-aggregates, <250 μm (N' Dayegamiye and Angers, 1993). In addition, the short-term effect of the applied shale to sandy soil showed that an improvement in both bulk density and hydraulic conductivity (Fahim *et al.*, 1994).

3- Total porosity and soil moisture:

Concerning the effect of the application of different mixtures of shale and organic compost to sandy soil on the total porosity after wheat and corn harvesting, data in Table (4) show that the values of total soil porosity were highly affected after corn season. It was increased with different ratios of shale and organic composts. Shale+broad bean compost treatments were more effective particularly, at ratio (1:3), as compared with other ratios and the control treatment. It was noticed that the lowest bulk density value was corresponded the highest total porosity one. Logan *et al.* (1996) and Borhamy (1998) obtained the same result. Clay in tafla is the main cause for increased total porosity. Also, the organic matter plays as a cementing agent and creating additional pores (El-Shanawany *et al.*, 1994).

Also, data in Table (4) show that the application of shale and organic composts increased the moisture holding capacity of sand soil, whether at the field capacity and/or at the wilting point, however, the available water was increased. The amount of available soil moisture is relatively high after the second growth season, particularly the treatment of shale+broad bean compost at ratio (1:3) as compared with the first one and the control of mineral fertilization. Abdel-Aziz *et al.* (1990) and El-Sharawy *et al.* (2003) found that organic materials and shale increased the water holding capacity of soils, due to the increase in soil micro-pores.

II. Effect of applied shale combined with compost on chemical properties:

1- Soil pH, EC, CEC and organic matter:

Table (5) indicated that application of different ratios of combined shale and organic compost materials had favorable effect on soil pH after wheat and corn harvesting. The ratio (1:3) of combined treatments was being more effective in decreasing soil pH, particularly (shale+composted broad bean) as compared with other composts materials (rice and corn) and the control treatment (chemical fertilization), mainly attained to the acidic effect of this material rather than the other materials and the soil buffering capacity (El-Sharawy *et al.,* 2003).

Concerning the effect of different treatments on ECe and CEC after wheat and corn harvesting, it could be concluded that application of the studied organic composts to shale at different ratios had ECe and CEC values higher than that of control, particularly the ratio (3:1) in (shale+composted broad bean). These results are in agreement with those obtained by Gouda (1984) who found that an increase in soil salinity by using shale or organic manure as a soil conditioner. Laila *et al.* (1993) obtained similar results upon treating sandy soil with shale. They attributed this increase due to an increase in the amount of tafla added to soil which contains soluble salts in appreciable amounts. Hamouda *et al.* (1999) added that cation exchange capacity and electrical conductivity were increased with increasing shale addition, particularly after the second season.

Results of organic matter content after harvesting of either wheat or corn, as influenced by application of different amendments treatments to soil are presented in Table (5). Generally, there are a positive relationship between the organic residues application, particularly at treatments(1:3) ratios, such increases recorded 70.4, 51.9 and 40.7% after wheat harvesting, as well as 60.0, 44.0 and 32.0% after corn harvesting by application of bean straw, rice straw and corn stalks composts, respectively as compared with the control (chemical fertilization) treatment. Soil organic matter content after corn harvesting was lower than that after wheat. This could be due to the rapid oxidation and decomposition of soil organic matter in summer season (El-Sharawy *et al.,* 2003).

2- Available N, P and K in soil:

Addition of bean straw, rice straw and corn stalks combined with shale at different ratios to sandy soil, led to an increase in the available nitrogen in soil (Table 5). After harvesting of wheat, such increase were 39.7, 31.1 and 26.9% for soil treated with shale combined with composted broad bean straw, rice straw and corn stalks in the presence of ratio (1:3), respectively as compared with inorganic fertilizer

Table (5): Effect of applied shale combined with compost treatments on some chemical properties of the studied soil after harvesting of both wheat and corn

Treatments	Mixtures ratio	pH (1:2.5)	EC (dS/m)	O.M. (%)	CEC (meq/100 g soil)	Available nutrients (mg/kg) N	P	K
After wheat harvesting								
Control (chemical)*		7.80	0.52	0.27	2.99	21.9	3.16	60.1
Shale + Broad bean compost	1 : 3	7.63	0.61	0.46	4.46	30.6	4.10	79.7
	1 : 1	7.69	0.82	0.39	4.42	27.4	3.59	73.3
	3 : 1	7.70	1.02	0.36	4.93	26.0	3.42	71.4
Mean		**7.67**	**0.82**	**0.40**	**4.60**	**28.00**	**3.77**	**74.8**
Shale + Rice straw compost	1 : 3	7.66	0.85	0.41	4.43	28.7	3.84	75.1
	1 : 1	7.72	0.96	0.35	4.36	25.4	3.35	71.2
	3 : 1	7.75	1.11	0.32	4.81	24.2	3.29	70.6
Mean		**7.71**	**0.97**	**0.36**	**4.53**	**26.1**	**3.49**	**72.3**
Shale + Corn stalks compost	1 : 3	7.70	0.73	0.38	4.40	27.8	3.50	73.3
	1 : 1	7.75	0.90	0.32	4.32	25.0	3.27	68.7
	3 : 1	7.77	1.02	0.30	4.79	24.2	3.23	66.9
Mean		**7.74**	**0.88**	**0.33**	**4.50**	**25.67**	**3.33**	**69.6**
After corn harvesting								
Control (chemical)*		7.75	0.58	0.25	3.06	22.0	3.10	60.4
Shale + Broad bean compost	1 : 3	7.60	0.69	0.40	4.69	30.1	4.21	83.1
	1 : 1	7.65	0.93	0.35	4.60	25.9	3.62	77.4
	3 : 1	7.67	1.08	0.33	5.11	23.2	3.53	75.6
Mean		**7.64**	**0.90**	**0.36**	**4.80**	**26.4**	**3.79**	**78.7**
Shale + Rice straw compost	1 : 3	7.62	0.90	0.36	4.60	27.1	4.01	80.7
	1 : 1	7.69	0.99	0.31	4.54	23.6	3.43	76.1
	3 : 1	7.70	1.12	0.30	5.01	23.0	3.35	74.3
Mean		**7.67**	**0.97**	**0.32**	**4.72**	**24.67**	**3.60**	**77.0**
Shale + Corn stalks compost	1 : 3	7.66	0.80	0.33	4.54	26.8	3.63	78.4
	1 : 1	7.70	0.93	0.30	4.50	22.9	3.39	73.7
	3 : 1	7.72	1.09	0.28	4.90	22.3	3.29	70.8
Mean		**7.69**	**0.94**	**0.30**	**4.65**	**24.0**	**3.44**	**74.3**

*** Treated with the recommended doses of mineral N, P and K.**

treatment (control). The corresponding values after corn harvesting, were 36.8, 23.2 and 21.8%, respectively. Taking into consideration the total values of N added to the cultivated soil, either in mineral or in organic forms which were equal, organic manuring plays a role for increasing N availability through microorganisms activities, beside decreasing N losses by leaching and volatilization (Metwally and Khamis, 1998). Microflora can directly assimilate significant amounts of organic N compounds from plant residues or from dead biomass (Mary *et al.,* 1996).

Data also showed that available P trend is almost similar to that of available N and the addition of composted bean straw resulted in the presence of highest amounts of available P. Such increases reach 29.7, 21.5 and 10.8% in the treatments of composted bean straw, rice straw and corn stalks after the first season, while they were 35.8, 29.4 and 17.1% after the second season, respectively, particularly at (1:3) ratio as compared with the control and other ratios. Such results could be explained accordingly to the decomposition of organic residues and subsequent release of inorganic and organic acids which enhance the solubility and availability of P. Other possibilities could be: (a) effect of organic residues on lowering the fixation of phosphorus through several mechanisms such as chelation and formation of organic complexes relatively available for plants, (b) effect of organic matter through coating the $CaCO_3$ particles as protective mechanism against precipitation and adsorption of various elements, and (c) carbon production from humus could exchange the adsorbed anions such as phosphates thus should be available (Elgala and Amberger, 1982 and El-Leboudi *et al.,* 1988). On the other hand, the increase of available P in the manured treatments may be also due to the production of CO_2, during organic residues decomposition, thus formation of H_2CO_3, which contributed to phosphate solubility (Barsoom, 1998).

Concerning the values of available K, data show a similar trend to that obtained previously for P. Generally, the application of composted broad bean straw, rice straw and corn stalks combined with shale, particularly the ratio (1:3) increased the amounts of available K as compared with the control. Shale+broad bean compost particularly, in second season, was being more effective than the other studied two composts treatments. Tan (1980) found that humic and fulvic acids are capable for dissolving very small amounts of potassium from the soil minerals by chelating, complex reaction or both with released amounts of K being increased with time.

III. Effect of applied shale combined with compost on yield and its composition:

Soil productivity is the result of the different soil characteristics as affected by different ratios of the mixtures between shale and composted plant residues applications; and its out put is the crop yield. Data in Table (6) revealed that the grain and straw yields of wheat as well as grain and stover yields of corn plants, responded to the mixtures of shale and composted plants residue treatments. The highest responses for the yield of wheat and corn plants were at 5 ton shale/fed combined with 15 ton composted broad bean/fed (1:3) treatment. These treatments were characterized by relative increases of grains and straw yields of wheat as well as grains and stover of corn plants, equivalent to 28.7, 30.0, 32.4 and 37.3% respectively, over the control (treated with recommended dose of chemical fertilizers. However, the yield of the two crops was reduced gradually with increasing the rates of the applied shale and decreasing the rates of the applied composted plant residues (1:1 and 3:1), but the products were still over the control treatment. The reduction in the yield at the higher rate of the applied shale may be due to the accumulation of salt as a result of successive addition of shale (Gouda, 1984 and Hamouda *et al.,* 1999). While, the obtained higher yields of both wheat and corn plants in sandy soil as a result of shale addition are due to the higher contents of the fine fraction in the shale which improve the physical and chemical properties of sandy soil, as well as maintenance of nutrient elements from loss by leaching. These results are in agreement with the conclusion of Abdel-Aziz *et al.* (1990) upon using shale and El-Shanawany *et al.* (1994) upon using (shale+organic manure). Other possibly increasing the yield of both plants upon increasing the application rate of composted plant residues, may be due to the decomposition of organic material and release of its nutrients in available form rather than the beneficial effects of organic matter on soil chemical, physical and biological properties (Abdel-Aziz *et al.,* 1998). Such results are also in close agreement with Gaffar *et al.* (1992) and Saleh *et al.* (2003), who indicated that the application of organic manures increased the yield of wheat and corn plants and

Table (6): Effect of applied shale combined with compost treatments on wheat and corn yield parameters

Treatments	Mixtures Ratio	Grain yield (kg/fed)	Straw yield (ton/fed)	Grain contents (%)		
				N	P	K
After wheat harvesting						
Control (chemical)*		**968**	**2.50**	**2.17**	**0.26**	**0.87**
Shale + Broad bean compost	1 : 3	1246	3.25	3.28	0.50	1.73
	1 : 1	1198	3.19	2.92	0.43	1.60
	3 : 1	1164	2.95	2.31	0.36	1.17
Mean		**1202.7**	**3.13**	**2.84**	**0.43**	**1.50**
Shale + Rice straw compost	1 : 3	1171	3.13	3.07	0.43	1.53
	1 : 1	1120	2.94	2.66	0.39	1.40
	3 : 1	1108	2.68	2.19	0.30	1.12
Mean		**1133.0**	**2.92**	**2.64**	**0.37**	**1.35**
Shale + Corn stalks compost	1 : 3	1150	2.89	3.00	0.40	1.42
	1 : 1	1090	2.73	2.41	0.36	1.33
	3 : 1	1077	2.61	2.07	0.30	1.10
Mean		**1105.7**	**2.74**	**2.49**	**0.35**	**1.28**
After corn harvesting						
		(kg/fed)	(g/plant)	(%)		
Control (chemical)*		**1189**	**284**	**1.21**	**0.28**	**1.20**
Shale + Broad bean compost	1 : 3	1574	390	2.96	0.54	1.96
	1 : 1	1428	356	2.41	0.48	1.80
	3 : 1	1389	331	2.01	0.40	1.29
Mean		**1463.7**	**359**	**2.46**	**0.47**	**1.68**
Shale + Rice straw compost	1 : 3	1487	378	2.41	0.46	1.71
	1 : 1	1370	346	2.16	0.39	1.55
	3 : 1	1336	316	1.90	0.35	1.20
Mean		**1397.7**	**347**	**2.16**	**0.40**	**1.49**
Shale + Corn stalks compost	1 : 3	1390	332	2.36	0.44	1.57
	1 : 1	1362	304	2.09	0.39	1.50
	3 : 1	1281	298	1.85	0.34	1.21
Mean		**1344.3**	**311**	**2.10**	**0.39**	**1.43**

*** Treated with the recommended doses of mineral N, P and K.**

their nutrients uptake. The increase of grain yield depends on the type and the rates of organic composts.

Regarding the effect of the studied soil treatments on chemical composition of wheat and maize plants, data also revealed that there were marked increase in the contents of N, P and K over the control by application of different ratios of mixtures (shale and composted plants residues) to sandy soil. Application of a mixture of shale+composted broad bean at a ratio (1:3) being more effective than the two other ratios and other two composed plants (rice and corn). This increase was mainly due to one or more of the following reasons: (1) increasing the availability of these elements in soil through improving its condition as a result of amendment applications as compared with the untreated one, (2) increasing CEC of the treated soil through organic manuring and shale addition, (3) improving soil chemical, biological and fertility properties and (4) the improvement of soil physical properties, which is reflected on water behaviour and decreasing nutrient losses by leaching and deep percolation (El-Sharawy *et al.*, 2003).

The results presented in this work for the field trail conducted to assess the potential benefits to wheat and corn plants from the treated sandy soil with different ratios of (shale: composted broad bean), shale: composted rice straw) and (shale: composted corn stalks) as well as chemical fertilizers revealed improving soil chemical and physical properties, as well as best yields and nutrient contents were most apparent with shale: composted broad bean at ratio (1:3).

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تقييم التأثيرات الناتجة من إضافة مخاليط بعض المكمورات العضوية مع الطفلة على خواص وإنتاجية أرض رملية

محمد رضا محمود أحمد
معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – الجيزة – مصر

الهدف الرئيسي لهذا البحث هو دراسة تأثير إضافة نسب مختلفة لمخاليط من الطفلة ومكمورات بعض البقايا النباتية على بعض الخواص الطبيعية والكيميائية لأرض رملية وإنتاجيتها من القمح والذرة خلال موسمي ٢٠٠٢ –٢٠٠٣ (الشتوي)، ٢٠٠٣ (الصيفي). لذلك صممت تجربة بمحطة البحوث الزراعية بالأسماعيلية في قطاعات كاملة العشوائية، حيث أشتملت المعاملات على إستخدام ثلاث أنواع من المخاليط (طفلة مع بقايا الفول البلدي المكمورة)، (طفلة مع بقايا الأرز المكمورة)، (طفلة مع بقايا الذرة المكمورة) بنسب مختلفة (١: ٣)، (١:١)، (٣: ١) وبمعدل ٢٠ طن/فدان لكل مخلوط. كما أضيفت الأسمدة المعدنية لكل معاملة بمعدل ٥٠% من الجرعة السمادية المقررة لكل من النيتروجين والفسفور والبوتاسيوم، بالأضافة إلى معاملة المقارنة والتي تضمنت إضافة ١٠٠% من الجرعة السمادية المقررة لكل من الأسمدة النتروجينية والفوسفاتية والبوتاسية.

وقد أتضح من النتائج ان جميع النسب المختلفة لخلطات الطفلة مع مكمورات الفول البلدي أو الأرز أو الذرة قد أدت إلى حدوث تحسناً ملحوظاً لبعض الخواص الطبيعية حيث زادت النسبة المئوية لكل من الطين والسلت والمسامية الكلية والسعة الحقلية ومعامل الذبول والماء الميسر على العكس انخفضت قيم كل من الكثافة الظاهرية والتوصيل الهيدروليكي. كما أثرت النتائج أيضاً على بعض الخواص الكيميائية فقد انخفضت قيم الـpH وزادت النسبة المئوية لكل من المادة العضوية والسعة التبادلية الكاتيونية ومحتوى التربة من النتروجين والفوسفور والبوتاسيوم الميسر وزادت أيضاً قيم ملوحة التربة نتيجة لإضافة الطفلة مقارنة بالتربة الغير معاملة (السماد المعدني فقط).

كذلك تبين من النتائج زيادة في محصول القمح والذرة وكذا زيادة في محتوى النتروجين والفسفور والبوتاسيوم في حبوب كلاً من القمح والذرة. وبصفة عامة، تم إستنتاج أن أفضل المعاملات والتي أظهرت تحسناً ملحوظاً في إنتاجية كلاً من القمح والذرة هي معاملة التربة بمخلوط الطفلة مع بقايا الفول البلدي المكمورة بمعدل ٢٠ طن/فدان وبنسبة خلط (١: ٣) على الترتيب مع إضافة ٥٠% من الجرعة السمادية المقررة للأسمدة المعدنية الثلاث عند مقارنتها بالتربة الغير معاملة عضوياً (١٠٠% من الجرعة السمادية) وبباقي معاملات الخلط (الطفلة مع بقايا أرز مكمورة)، (الطفلة مع بقايا الذرة المكمورة).