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EFFECT OF COMPOSTED PLANT RESIDUES ON NEWLY RECLAIMED SOILS PROPERTIES AND ITS PRODUCTIVITY

E. A. Abou Hussien, Y. B. El-Koumey, Fatma, S. El-Shafiey and Heba M. A. Gohar
Soil Sci Dept. Fac. of Agric. Minufiya Univ. Egypt.

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ABSTRACT: *A pot experiment was carried out in the Experimental Farm. Faculty of Agriculture, Minufiya University, Shibin El-Kom to study the effect of both application rate (0, 1 and 2% OM) and composting period (0, 2, 4 and 6 months) of either of rice or potato straw on some chemical properties of two newly reclaimed soils (sandy and calcareous) of Egypt and its content of available N, P and K. Also, the effect of those treatments on wheat (Triticum aestivum L.) plant growth and its content of N, P and K was studied.*

The obtained data show a decrease of soil pH and its content of $CaCO_3$ and increase in its EC (dSm^{-1}) and the content of OM (%) and available N, P and K (mg/kg) with the increase of added rate and composting periods of rice and potato straw in both sand, and calcareous soils. The found decrease or increase effects in the soils treated by composted potato straw were greater than those associated the treatments of rice straw. The obtained dry matter yield of wheat plants and its content of N, P and K were increased with the increase of composting period and application rate of composted rice and potato straw, where these increases resulted from the treatments of composted potato straw were higher than those found with the treatments of composted rice straw in both sandy and calcareous soils.

Key words : *Compost, Potato, Rice, Wheat, Soil properties, Nutrients uptake.*

INTRODUCTION

Wheat plant (*Triticum aestivum* L.) is considered one of the most important cereal crops (family poaceae) in the world. The mass production of wheat in Egypt (8 million ton) is about 50% lower than the consumption (14.5 million ton/year, 2008). Therefore more than six million tons must be imported annually. Most of wheat production in Egypt is coming from the fertile clay soil in the Nile Valley and Delta. The amount needed is greater than that produced. Hence, the efforts of agronomists now are directed towards increasing wheat productivity to close the large gap between wheat production and consumption by one or more of various manners. The first is increasing the cultivated area of wheat in both old and newly reclaimed soils. The second is growing resistant cultivars (plant certified must-free seed) which is considered the most economical and effective way of controlling diseases. The third is improving agriculture practices among which are the time and amount of chemical fertilization (El-Baalawy, 2010).

Most new reclaimed soils of Egypt represent high percent (%) of total area. Most of these soils may be reclaimed with low costs compared with other desertic soils. Also, these soils are more suitable to many economic crops cultivation such wheat and corn. In addition, these soils are located nearly of Wady of Nile river (Fayed, 2009).

Abdel-Aal *et al.*, (2003) confirmed that, application of organic material [viz, water hyacinth compost (HC) town refuse compost (TR) and chicken manure (Ch)] increased organic matter content, cation exchange capacity and decreased the hydraulic conductivity of the desert sandy soils. Wang and Yang (2003) indicated that application of organic materials of the plots prevented soil pH from decreasing and increased the amount of soluble salts. El-Kouny *et al.,* (2004) found that soil organic matter was significantly increased by 1.78% as a result of using biologically activated compost.

Ahmed and Ali (2005) found that, application of organic fertilizers to soil significantly increased available P in soil in both cropping season compared to control. The study of El-Ghamry *et al.,* (2005) showed that, application of compost to soil significantly increased available N (NH_4-N and NO_3-N), P and K compared to control.

Also Mekail (2006) reported that, treating sandy soils with poultry manure compost had a direct and residual positive effect on NPK content of post harvest soils of wheat as compared to NPK fertilizers treatments. In similar investigation Bashandy, Samah (2007) stated that, treating sandy soils with date palm waste compost increased the total-N, available P and K content of post harvest soils as compared with either untreated soils of NPK fertilizers treatments.

Taha (2007) found that, treating sandy soils with sesame straw composts significantly increased their available N, P and K in the treated soils after harvesting of the two successive crops as compared to control. On the other hand, all the treatments left a residual fertility of N, P and K after the second crop much higher than control or the initial soil fertility. Also Nasser (2007) reported that, soil treated with different traits addition of composted materials had high values of macro element (N, P and K) than the untreated one. The increasing of soil macro elements were related to the increase of rates of composted materials. Similarly, DTPA-extractable Fe, Mn, Zn and Cu were increased due to the application of such composts after either maize or wheat harvesting.

The present study was curried out to achieve the main objective that represented by decreasing the environmental pollution throughout utilization some used of organic wastes (rice and potato straw) which caused an Egyptian wide environmental problems as an organic fertilizer. As well as to reach the most beneficial combination from mineral and organic fertilizers for achieving the maximum yield of wheat yield grown on newly reclaimed soils (sandy and calcareous).

So different experiments were carried out: 1) To achieve the possibility of utilization some locally available biosolid wastes namely rice and potato straw to produce organic fertilizer by using compost technology of biosolid wastes in a way that can improve its nutrient content; 2) To evaluate the chemical and physical changes that may take place during composting the organic waste; 3) To study the effect of application of the composting materials on soil chemical properties and its content of available nutrients and 4) To elucidate the effect of the composted materials on yield and chemical composition of wheat plants.

MATERIALS AND METHODS

In order to a chive the objective of this study, the course of investigation consisted of the following materials and experiments which were carried out in the Soil Science Departement, Faculty of Agriculture Minoufiya University, Shibin El-Kom, Egypt.

Two surface soil samples (0-20 cm) of two different locations represented newley reclaimed soils were used in this study. The first sample which represent sandy soil was collected from Quessna region, Minoufiya Governorate, where the second sample which represent calcareous soil was collected from El-Nobariya region, Behara Governorate. The collected sample from each locetion was air-dried, ground, good mixed and sieved through a 2 mm sieve. The prepared fine soil samples were used in some chemical and physical determinations and assessment the content of some nutrients according to the methods described by Cottenie *et al.*, (1982) and Page *et al.*, (1982). The obtained data were recorded in Table (1). The residual part of these soil sample was used in the greenhouse experiments.

The used plant residues i.e. rice straw (RS) and potato straw (PS) were collected, spreaded in the open-air conditions for dryness. Then chopped into about 1-2 cm segments using rushing machine. The chemical analysis of the used plant residues was carried out and the obtained data were recorded in Table (2). The compost was prepared in polyethelen pots of 50 cm diameters, and depth of 70 cm, Each pot contained 5 kg air dried of either of rice straw or potato straw, cuts to small pieces (finely ground of the straw). For five kg of the straw an activating mixture containing of about 100 g amoium sulphate, 20 g superphosphate, 100 g finely ground $CaCO_3$, about 500 g of soil was added. Moisture content was brought to 60% of the water holding capacity. For aeriation, the composted straw was turned over and pressed every three weeks. The composting process continued for 2, 4 and 6 months. The composted materials were analyzed for pH, EC (dSm^{-1}) and the content of OM (%) and some nutrients (mg/kg) according to the methods described by Cottenie *et al.*, (1982) and Page *et al.*, (1982). The obtained data were recorded in Table (2).

Table (1): Main properties of the two used soils.

Physical properties	Soil	Partides size distribution (%)				Textural grade	WHCr %
		C. sand	F. sand	Silt	Clay		
	Sandy	90.50	4.85	2.85	1.80	Sandy	27
	Calcerous	66.45	19.50	12.55	1.50	Sandy loam	40

Soil salinity	Soil	pH (1:2.5) soil water susp	EC dSm^{-1}	Soluble ions (meq/l)							
				Cations				Anions			
				Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	HCo^-_3	CO^{2-}_3	SO^2_4
	Sandy	8.25	1.40	8.40	0.85	3.45	1.9	11.15	0.81	0.00	2.64
	Calcerous	8.05	5.46	33.10	2.70	13.65	5.15	38.15	1.80	0.00	14.65

Chemical properties	Soil	OC %	OM %	Total N (%)	C/N Ratin	$CaCO_3$ %
	Sandy	0.55	0.955	0.045	12.22	2.14
	Calcerous	0.25	0.437	0.025	10.00	34.10

Available nutrients (mg/kg)	Soil	Macronutrients			Micronutients			
		N	P	K	Fe	Mn	Zn	Cu
	Sandy	18.1	6.05	90.70	0.50	1.20	0.18	0.20
	Calcerous	14.0	5.10	60.10	0.45	0.75	0.16	0.18

WHC = Water holding capacity

Table (2): Chemical composition of the used plant residues at different composting periods.

Plant residues	Composting period (month)	OM (%)	OC (%)	Total N (%)	C/N Ratio	Total P (%)	pH	EC dSm^{-1}	Total Fe mg/kg	Total Mn mg/kg	Total Zn mg/kg
Rice straw	0	73.42	43.85	0.42	104.47	0.075	7.85	2.80	450	230	70
	2	61.92	40.65	0.75	81.30	0.090	7.80	2.95	472	240	73
	4	55.93	33.10	1.03	32.14	0.115	7.67	3.20	510	265	78
	6	49.02	28.50	1.20	23.73	0.185	7.50	3.80	580	280	85
Potato straw	0	69.06	40.15	0.70	57.60	0.088	7.70	2.90	485	242	72
	2	61.06	35.50	1.30	27.15	0.110	7.60	3.10	500	260	77
	4	51.89	30.17	1.85	16.61	0.160	7.55	3.50	545	270	80
	6	39.36	22.30	2.00	11.17	0.220	7.46	3.95	295	290	90

pH in 1 : 10 (Compost : water) Susp and EC in 1 : 10 (compost : water) extract.

Greenhouse Experiment

This experiment was carried out to study the effect of maturity degree of compost or composting periods (0, 2, 4 and 6 months) of the tested plant residues on wheat plant growth and its content of nutrients. Also, some chemical properties of the cultivated soils and its content of available nutrients were studied.

In this experiment, 144 plastic pot with 15 cm inter diameter and 20 cm depth were used. These pots were divided into two equal main groups. Each pot of the first main group was filled with 4 kg of fine sandy soil. Also 4 kg of fine calcareous soil were planed in each pot of the second main group. The pots of each main group were divided into two equal sub groups. These sub groups were treated with one of plant residues composted at periods of 0, 2, 4 and 6 months respectively. The pots of each sub group were divided into three sub sub groups (9 pots/ sub sub group) where these groups were treated with the tested composts at application rates of 0, 1 and 2% OM (organic matter) with three replicates, respectively. The pots were arranged in split split design with three replicates. Then water holding capacity (WHCr) as percentage (%) for each treatment (48 treatment) was determined.

Before sowing, all pots were fertilized with ordinary super phosphate (15.5% P_2O_5) at application rate of 200 kg/fed. (based on the area). This rate equal 0.841 g super phosphate /pot, where its good mixed with the soil. Ten grains of wheat (*Triticum aestivum* L.) were planted in each pot at 2 cm depth. The pots were irrigated with tap water at 60% of WHC for each treatment. After 15 days of sown, the plants in each pot were thinned at 5 plants per pot. After 20 days of sown, the pots were fertilized with potassium sulphate (48% K_2O) at rate of 100 kg/fed (0.42 g/pot).

Irrigation water was added every three days to keep the moisture content at 60% WHC. At flowering stage (after 70 days of sawing), wheat plants of each pot were harvested above the soil surface, washed several times by tap water followed two times by distilled water, air-dried, oven-dried at 70°C for 48 hrs, weighted, ground and kept for chemical analysis. The obtained dry matter yield were statistically amlyzed according to Snedecor and Cochran (1980). A 0.2 g of the ground oven dry plant sample was digested with 5 ml of concentrated H_2SO_4

on hot plate. Repeatedly small quantities of concentrated $HClO_4$ were added until the digest became clear and uncolored. The digest was diluted to 50 ml with distilled water, Cottenie (1980). The content of K was measured in the digest by flame photometer, according to Page (1982). Phosphorus (P) was determined in the digest using the ascorbic acid method of Murbly and Riley (1962). Nitrogen (N) was measured in digest using the conventional method of kjeldahl as described by Page *et al.,* (1982). The soil of each pot was taken, air-drid, ground, good mixed, sieved through a 2 mm sieve and kept for some chemical determinations and the content of nutrients.

RESULTS AND DISCUSSION

Effect of Organic Manures on Soil Properties.

Soil pH

The presented data in Tables (3 and 4) show that, the values of soil pH were decreased with the increase rate of the added composted plant residues compared with unmanured soil.

The obtained decreases in soil pH associated the treatments of potato straw were higher than those associated the same application rate of rice straw. These results are in harmony with the chemical composition of the used plant residues (Table, 2). At the same application rate of organic manures, the decreases in the soil pH values were increased with the increase of composting period, where the increase in this period was associated by more decomposition of the composted organic residues and due to more products of soluble acidic organic compounds (Aiad, 2010, Stevenson, 1994). In this respect, Kongchum (2005), El-Maddah *et al.,* (2007) and Aiad (2010), obtained similar results.

Table (3): Sandy soil pH, EC and the content of OM and $CaCO_3$ and its relative changes (RC,%) as affected by the studied treatments.

Organic manures treatments			pH	EC		OM		$CaCO_3$	
Type	Composting period (month)	Added rate (%)	1:2.5 soil water susp	dSm^{-1}	RC (%)	%	RC (%)	%	RC (%)
Control		0	8.26	1.46	2.74	0.35		2.14	
Rice straw	0	1	8.26	1.50	24.79	0.38	8.57	2.10	-1.87
		2	8.24	1.53	8.90	0.42	20.00	2.00	-6.54
	2	1	8.20	1.59	13.01	0.46	31.43	1.91	-10.75
		2	8.13	1.65	14.38	0.54	54.29	1.90	-11.21
	4	1	8.15	1.67	21.92	0.55	57.14	1.90	-11.21
		2	8.10	1.78	16.44	0.60	71.43	1.85	-13.55
	6	1	8.01	1.70	23.29	0.65	85.71	1.80	-15.89
		2	7.90	1.80	8.22	0.77	120.0	1.78	-16.82
Potato straw	0	1	8.02	1.58	8.22	0.40	14.29	2.10	-1.87
		2	8.21	1.65	13.01	0.45	28.57	2.00	-6.54
	2	1	8.15	1.61	10.27	0.50	42.86	1.98	-7.48
		2	8.10	1.70	16.14	0.52	48.57	1.90	-11.21
	4	1	8.10	1.65	13.01	0.62	77.14	1.90	-11.21
		2	8.02	1.80	23.29	0.70	100.0	1.80	-15.89
	6	1	7.90	1.75	19.86	0.70	100.0	1.78	-16.82
		2	7.85	1.90	30.14	0.82	134.29	1.75	-18.22

Table (4): Calcareous soil pH, EC and the content of OM and $CaCO_3$ and its relative changes (RC,%) as affected by the studied treatments.

Organic manures treatments			pH	EC		OM		$CaCO_3$	
Type	Composting period (month)	Added rate (%)	1:2.5 soil water susp	dSm^{-1}	RC (%)	%	RC (%)	%	RC (%)
Control		0	8.06	5.47		0.50		34.10	
Rice straw	0	1	8.04	5.48	0.18	0.50	0	34.10	-0.00
		2	7.96	5.53	1.09	0.52	4	34.00	-0.29
	2	1	8.00	5.50	0.55	0.55	10	33.90	-0.59
		2	7.90	5.67	3.66	0.62	24	33.82	-0.82
	4	1	7.97	5.54	1.28	0.60	20	33.80	-0.88
		2	7.90	5.80	6.03	0.65	30	33.72	-1.11
	6	1	7.88	5.60	2.38	0.68	36	33.50	-1.76
		2	7.80	5.86	1.13	0.83	66	33.20	-2.64
Potato straw	0	1	8.00	5.50	0.55	0.50	0	34.10	-0.00
		2	7.93	5.54	1.28	0.52	4	33.90	-0.59
	2	1	7.98	5.60	2.38	0.57	14	33.80	-0.80
		2	8.90	5.72	4.57	0.72	44	33.75	-1.03
	4	1	7.95	5.65	3.29	0.70	40	33.70	-1.17
		2	7.87	5.82	6.40	0.75	50	33.62	-1.41
	6	1	7.85	5.75	5.12	0.73	46	33.32	-2.29
		2	7.81	5.84	6.76	0.85	70	33.10	-2.93

The effect of the organic manures treatments on the decrease of soil pH was varied from soil to onther depending on soil physical and chemical properties, where these properties played an important role on the decomposition rate of the applied organic residues. The obtained data at the same treatment of organic manure show that the found decrease in the pH value of sandy soil was higher than that found in calcareous soil (Tables 3 and 4). Abou Hussion *et al.,* (2009); El-Fishy (2009) and Wong *et al.,* (1999) obtained similar results.

Soil salinity

The soils content of total soluble salts as EC (dSm^{-1}) presented in Tables (3 and 4) show that, EC values increased with the increase of application rate of two composted residues at different composted periods in the two soils. At the same application rate of added composted residues, the found increase of soil EC was increased with the increase of composted period. Also, the found increases of EC associated potato straw treatments were higher than those associated rice straw. The increases of soil EC were resulted from soluble salts resulted from plant residues decomposition. In addition, many compounds resulted from plant residues decomposition lead to increase the solubility of some soil compounds (Faiyad, 2009). These findings were in agreement with those obtained by Rehan *et al.,* (2004), El-Maddah *et al.,* (2007) and Aiad (2010). The found increase of sandy soil EC with different treatments of organic manures was higher than that of calcareous soil. The trends for the different effects of the studied composted residues treatments may be supported by the calculated values of relative change (RC, %) of soil EC as presented in Tables (3 and 4) which calculated from following relation.

$$RC(\%) = \frac{\text{EC value in the treated soil} - \text{EC values in the untreated soil}}{\text{EC values in the untreated soil}} \times 100$$

Soil organic matter (OM)

Regarding to the effect of different treatments of composted materials on sandy and calcareous soils content (%) of organic matter, the recorded data in Tables (3 and 4) show that, the soils content of OM increased with the increase of both application rate and composting period of the used two organic manures in the two soils. At the same treatments of the composted residues, the found increases of OM (%) in the soils treated with potato straw were higher than those treated with rice straw. Generally with different treatments of composted residues, calcareous soil content of OM was higher than that in the sandy soil. The trends of these data were become more clear through calculated values of RC (%) recorded in Tables (3 and 4). Abou Hussion *et al.,* (2009) and Follett (2001) obtained similar results.

Calcium carbonate ($CaCO_3$)

The recorded data in Tables (3 and 4) show that, the organic manures treatments decreased clearly sandy and calcareous soils content (%) of $CaCO_3$. These decreases were increased with the increase of both application rate and composting period of the used organic manures. Also, the found decrease of $CaCO_3$ content in the soil treated with potato straw was higher than that found in the soil treated with rice straw at the same application rate and composting period. Such decreases may be resulted from the effect of the produced organic acids and other compounds from the composted materials on $CaCO_3$ in the soils (Stevonson, 1994; El-Fishy, 2009), and El-Maddah *et al.,* (2007), obtained similar effect of many organic manures on the soil content of $CaCO_3$. The data of RC (%) values of $CaCO_3$ in Tables (3 and 4) show the variations in the decrease effect of the studied organic manures treatments on the soils content of $CaCO_3$. Also, RC values show that, at the same treatment of composted residues, the values of RC (%) of calcareous soil content of $CaCO_3$ were more negative comparad with that found with sandy soil.

Effect of Organic Manures on Soil Content of Available Macro-natrients

The data in Tables (5 and 6) show that, comparing with control treatment and except the uncomposted (zero time) plant residues treatments, the content (mg/kg) of available N, P and K and its RC (%) were increased with the increase of added organic manures and also with the increase of composting period. The decrease of available N, P and K with the treatments of uncomposted plant residues resulted from low content of available N, P and K in the added plant residues which consider as a major source for N in feeding of soil microorganisms. Then these micr-oorganisms depend on the available soil nutrients in its feeding (El-Fishy, 2004, Reeves and Van Kessel, 2002 and Van Kessel and Reeves, 2002). On the other hand, the increase in the soil content of available N associated the increase in the composting period of the used plant residues resulted from the increase of decomposition rate of the added plant residues followed by more release of available nutrients (El-Fishy, 2004 and Reeves and Van Kessel, 2002). So, the calculated values of RC (%) of available nutrients for the treatments of uncomposting plant residues in both soils were negative, where these values were more negative at high application rate (2%). On the other hand, RC values of available nutrients with other treatments of organic manures (composted plant residues) were positive, where it increased with the increase of both application rate and composting periods. Hassan and Mohey El-Din (2002) depite the increase in the soil content of available P followed by organic manures application to mineralization of organic matter and slow releasing minerals in an available form from organic manure or may be due to the effect of several organic acids produced during manure decomposition, which solublize the native P of the soil and partly during the formation of a coat on $CaCO_3$. Recently Aiad (2010) and El-Shouny (2011) obtained similar results with different organic manures and plant residues in some soils of Egypt.

At the same treatment (application rate and composting period) of the used composted plant residues the recorded data in Tables (5 and 6) show that, in the both soils the increases of available N, P and K and its RC values associated the treatments of composted potato straw were higher than those associated the treatments of composting rice straw. These findings were related with the chemical composition, especially the content of N, P and K of the used composted plant residues (Table, 2). Aiad (2010) and El-Fishy (2004) pointed out that, the residual content of soil available N, P and K was depending greately on the composing period and the chemical composition of the compost products, also on the cultivated soil properties and on the cultivated plant. The bicarbonate ions released from OM decomposition might also increase P availability through ion exchange pheromenon as well as displacement of phosphate by organic anions produced of OM breaking. Other studies which curried out by Bernal and Kirchman (1992) and Jedidi *et al.,* (1995) obtained similar results.

With different treatments of composting plant residues under study, the presented data in Tables (5 and 6) show that RC (%) values of available N, P and K in the sandy soil were higher than those of calcareous soil. This trend reveals that, the decomposition rate and rate of N release from composted plant residues under sandy soil conditions were higher than those under calcareous soil conditions. On the other hand, RC (%) values of available P in the calcareous soil were higher than those of sandy soil at the same treatments. This trend may be resulted from the effect of organic acids resulted from organic manures decomposition on solvent $CaCO_3$ in the soil. Also, these acids coated $CaCO_3$ and prevent its reaction with soluble P. The effect of soil properties on the rate of organic manures decomposition was studied by Aiad (2010) and El-Fishy (2004 and 2009). In both soils and at either of application rate or composting period, the contents of available N, P and K (mg/kg) in the soil treated with potato straw were higher than those in the soil treated with rice straw. The positive effect of many organic manures on different soils content of available N, P and K were reported by Aiad (2010) and El-Fishy (2004 and 2009).

Effect Of Organic Manures On Plant Growth Dry Matter Yield.

The obtained data in Table (7) show that, the found dry weights of wheat plant was significantly increased with the increase of both composting period and application rate (except the treatments of uncomposted plant residues). At zero time of composting period, the found weights were lower than those recorded with unmanured plants, where there weight at application rate 2% were lower than those found at application rate of 1%. With different treatments of either of composted rice or potato straw, the high dry weight were found with composted plant residues for six months at application rate 2%. These results may be

Table (5): Effect of the studied organic manures treatments on sandy soil content (mg/kg) of available N, P and K and its relative change (RC%).

Organic residues			N		P		K	
Type	Compost period (month)	Application rate (%)	mg/kg	RC%	mg/kg	RC%	mg/kg	RC%
0		0	17.50		6.15		90.90	
Rice straw	0	1	16.25	-7.14	5.95	-3.25	88.50	-2.64
		2	15.30	-12.57	6.10	-0.81	87.60	-3.63
	2	1	17.81	1.77	6.25	1.63	93.16	2.49
		2	18.45	5.43	6.37	3.58	96.25	5.89
	4	1	18.15	3.66	6.30	2.44	95.80	5.39
		2	19.11	9.2	6.60	7.32	101.30	11.44
	6	1	18.54	5.94	6.45	4.88	97.60	7.37
		2	19.61	12.06	6.72	9.27	108.13	18.95
Potato straw	0	1	16.40	-6.29	6.21	0.98	90.10	-0.88
		2	15.80	-9.71	6.18	0.49	89.50	-1.54
	2	1	18.10	3.43	6.51	5.85	95.62	5.19
		2	18.65	6.57	6.75	9.76	99.13	9.05
	4	1	18.50	5.71	6.68	8.62	98.22	8.05
		2	19.60	12.0	6.81	10.73	104.18	14.61
	6	1	19.10	9.14	6.75	9.76	100.33	10.37
		2	20.35	16.29	6.98	13.50	111.15	22.28

Table (6): Effect of the studied organic manures treatments on calcareous soil content (mg/kg) of available N, P and K and its relative change (RC%).

Organic residues			N		P		K	
Type	Compost period (month)	Application rate (%)	mg/kg	RC%	mg/kg	RC%	mg/kg	RC%
0		0	19.11		5.25		60.30	
Rice straw	0	1	17.55	-8.16	5.10	-2.86	60.10	-0.33
		2	16.35	-14.44	5.18	-1.33	59.54	-1.26
	2	1	19.70	3.09	5.30	0.95	61.85	2.57
		2	20.28	6.12	5.42	3.24	63.22	4.84
	4	1	19.95	4.40	5.38	2.48	62.85	4.23
		2	21.36	11.77	5.56	5.90	66.18	9.75
	6	1	20.64	8.01	5.47	4.19	64.25	6.55
		2	22.50	17.74	5.68	8.19	70.17	16.37
Potato straw	0	1	18.10	-5.29	5.22	-0.57	61.50	1.99
		2	16.75	-12.35	5.35	1.90	60.10	-0.33
	2	1	21.10	10.41	5.50	4.76	63.50	5.31
		2	24.65	28.99	5.78	10.09	67.10	11.28
	4	1	22.13	15.80	5.60	6.67	63.65	5.56
		2	28.11	47.09	5.82	10.86	71.50	18.57
	6	1	23.25	21.66	5.65	7.62	66.28	9.92
		2	25.50	33.44	6.10	16.19	72.11	19.59

attributed to the active role of decomposition products from composted plant residues such as organic and inorganic acids, growth activators and more available macro- and micro nutrients on plant growth. Also, this positive effect was resulted from the improvement occurrence in the different soil properties especially the decrease in the soil pH values and increase in the soil content of available macro- and micronutrients (Aiad, 2010 and El-Feshy, 2004 and 2009).

Data in Table (7) also showed that, the obtained dry weights of wheat plants and its relative change (RC,%) associated the treatments of composted potato straw were higher than those resulted from the treatments of composted rice straw at different composting periods and application rates. This trend revealed to high and faster decomposition rate of potato straw compared with that of rice straw. The differences in the effects of many composted plant materials on the yield of many plants were reported by Aiad (2010) and El-Feshy (2004 and 2009). These results concluded that, composted potato straw was more suitable and beneficial in the agricultural use compared with composted rice straw.

With different treatments of composted plant residues under study, dry weights of wheat grown on sandy soil were higher than those grown on calcareous soil. This trend was related with the effects of these soil properties on plant growth and nutrients availability and also revealed that, the decomposition rate of composted or uncomposted plant residues under sandy soil conditions was higher and faster than that occurred under calcareous soil conditions.

Table (7): Dry matter yield (mg/pot) of wheat plants grown on sandy and calcareous soils and its relative change (RC, %) as affect by the studied treatments .

Composting period (month) (B)	Application rate (%)	Sandy soil				Calcareous soil			
		Organic manure (A)				Organic manure (A)			
		Rice straw		Potato straw		Rice straw		Potato straw	
		g/pot	RC (%)	g/pot	RC (%)	g/pot	RC (%)	g/pot	RC (%)
Control	0	0.44		0.44		0.39		0.39	
0	1	0.41	-6.82	0.43	-2.27	0.37	-5.13	0.37	0.00
	2	0.39	-11.30	0.40	-9.09	0.36	-7.69	0.37	-5.13
2	1	0.48	9.09	0.51	15.91	0.40	2.56	0.44	12.82
	2	0.52	18.18	0.55	23.00	0.47	20.51	0.49	25.64
4	1	0.51	15.91	0.53	20.42	0.47	20.51	0.49	25.64
	2	0.56	22.22	0.60	36.36	0.53	35.90	0.59	51.28
6	1	0.55	25.00	0.67	29.55	0.51	30.78	0.53	35.00
	2	0.60	36.36	0.65	47.73	4.57	46.15	0.59	51.38
LSD at 0.05 level		A=	0.0338*	B=	0.455*	A=	0.204*	B=	0.354*
		C=	0.421*	AB=	0.442*	C=	0.160*	AB=	0.210*
		AC=	0.667*	BC=	0.015*	AC=	0.430*	BC=	0.3373*
		ABC=	0.060*			ABC=	0.573*		

Nutrients Content

Both N, P and K concentration (%) and uptake (mg/pot) were increased with the increase of the composting period compared with unmanured treatment, except the treatments of uncomposted plant residues (Tables, 8 and 9). This trend was found with both rice and potato straw in either of sandy or calcareous soil at different application rates. Also, this trend was in a good positive relations with the composting degree of the used plant residues. Other studies which carried by El-Fishy (2004) and Rabi *et al.*, (1995), pointed out that increasing of composting period of plant residues resulted in an increase of many nutrients release which become more available for uptake by plants and also the other products resulting from the composting process which improve both physical and chemical soil properties. The obtained data also show that RC (%) values of N, P and K uptake were positive and increased with the increase of composting period (except at zero composting period), but the rate of this increase decreased with the increase of this period. At zero composting period, RC values were negative and become more negative at application rate of 2%. Also, the obtained RC values show the high composting rate in the earlier composting period compared with that occurred at the latter periods (El-Fishy, 2004).

At the same composting period and except zero composting period, N, P and K concentration and uptake by wheat plants were increased with the increase of added compost (Tables, 8 and 9). These findings were recorded with both of potato and rice straw in the two used soils. These increases were resulted from the high amounts of available N, P and K released from added compost at high application rate compared with that found at low application rate. So, the high values of RC of N, P and K uptake were associated the treatments of high application rate. These results are in agreement with those obtained by Aiad (2010) and Sikora and Szmidt (2001).

Table (8): Effect of compost sources, compost period and its application rate on the content of N, P and K of wheat plants grown on sandy soil.

Compost treatments			N			P			K		
Type	Compost period (month)	Add rate (%)	Conc (%)	Uptake (mg/ pot)	RCN uptake (%)	Conc (%)	Uptake (mg/ pot)	RCP uptake (%)	Conc (%)	Uptake (mg/ pot)	RCK uptake (%)
0	0	0	1.32	5.81		0.40	1.76		1.55	6.82	
Rice straw	0	1	1.28	5.25	-9.64	0.39	1.60	-9.09	1.45	5.95	-12.76
		2	1.25	4.88	-16.01	0.35	1.37	-22.16	1.40	5.46	-19.94
	2	1	1.35	6.48	11.53	0.42	2.02	14.77	1.60	7.68	12.61
		2	1.40	7.28	25.30	0.46	2.39	35.80	1.72	8.94	31.09
	4	1	1.43	7.29	25.47	0.45	2.30	30.68	1.68	8.57	25.66
		2	1.48	8.29	42.69	0.51	2.86	62.50	1.76	9.86	44.57
	6	1	1.50	8.25	42.00	0.47	2.59	47.16	1.71	9.41	37.98
		2	1.56	9.36	61.10	0.56	3.36	90.91	1.83	10.98	61.00
Potato straw	0	1	1.28	5.50	-5.34	0.39	1.68	-4.55	1.48	6.36	-6.74
		2	1.25	5.00	-13.94	0.37	1.48	-15.91	1.45	5.80	-14.96
	2	1	1.38	7.04	21.17	0.44	2.24	27.27	1.64	8.36	22.58
		2	1.46	8.03	38.21	0.50	2.75	56.25	1.75	9.63	41.20
	4	1	1.45	7.89	35.80	0.48	2.54	44.32	1.70	9.01	32.11
		2	1.52	9.12	56.97	0.55	3.30	87.50	1.80	10.80	58.36
	6	1	1.53	8.72	50.09	0.50	2.85	61.93	1.76	10.03	47.07
		2	1.65	10.73	84.68	0.60	3.90	121.59	1.85	12.03	76.39

Table (9): Effect of compost sources, compost period and its application rate on the content of N, P and K of wheat plants grown on calcareous soil.

Compost treatments			N			P			K		
Type	Compost period (month)	Add rate (%)	Conc (%)	Uptake (mg/ pot)	RCN uptake (%)	Conc (%)	Uptake (mg/ pot)	RCP uptake (%)	Conc (%)	Uptake (mg/ pot)	RCK uptake (%)
0	0	0	1.15	4.49		0.22	0.86		1.32	5.15	
Rice straw	0	1	1.12	4.14	-7.80	0.21	0.78	-9.30	1.30	4.81	-6.60
		2	1.10	3.96	-11.80	0.20	0.72	-16.28	1.26	4.54	-11.84
	2	1	1.20	4.80	6.90	0.24	0.96	11.63	1.36	5.44	5.63
		2	1.24	5.83	29.84	0.28	1.32	53.49	1.42	6.67	29.51
	4	1	1.26	5.92	31.85	0.27	1.27	47.67	1.40	6.58	27.77
		2	1.32	7.00	55.90	0.35	1.86	116.28	1.55	8.22	59.61
	6	1	1.35	6.89	53.45	0.33	1.68	95.35	1.50	7.65	48.54
		2	1.41	8.04	79.06	0.39	2.22	158.14	1.60	9.12	77.09
Potato straw	0	1	1.14	4.56	1.56	0.21	0.84	-2.33	1.28	5.12	-0.58
		2	1.12	4.14	-7.80	0.20	0.74	-13.95	1.26	4.66	-9.51
	2	1	1.23	5.41	20.49	0.25	1.10	27.91	1.38	6.07	17.86
		2	1.29	6.32	40.76	0.30	1.47	70.93	1.50	7.35	42.72
	4	1	1.29	6.32	40.76	0.30	1.47	70.93	1.45	7.11	38.06
		2	1.35	7.97	77.51	0.40	2.36	173.42	1.57	9.26	79.81
	6	1	1.38	7.31	62.81	0.35	1.86	116.28	1.60	8.48	64.66
		2	1.48	8.73	94.43	0.42	2.48	188.37	1.65	9.74	89.13

The presented data in Tables (8 and 9) show that, in the two cultivated soils and at the same application rate and composting period, both N, P and K concentration and uptake and its RC by wheat plants manured by composted potato straw were higher than those found in the plants manured by composted rice straw. This trend reveals that, the amounts of N, P and K released from composted potato straw were greater than those released from composted rice straw. Also this trend was in harmony with the effect of added compost on soil properties and its content of available N, P and K. Such effects were reported by Heathwaite *et al.,* (2000) and Sims *et al.,* (2000), with other compost sources on some plants under different soil conditions.

Generaly and according to the recorded data in Tables (8 and 9) it may be noticed that, with the different treatments of the used composts, N, P and K concentration (%) and uptake (mg/pot) and its RC (%) in the wheat plants planted in sandy soil were higher than those found in the plants grown in the calcareous soil. The difference was related with soil properties and its content of available N, P and K and other nutrients. Similar results were obtained by Heathwaite *et al.,* (2000) and Sims *et al.,* (2000).

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تأثير بقايا النباتات المكمورة
على خواص الأراضي حديثة الاستصلاح وإنتاجيتها

الحسيني عبد الغفار أبو حسين – بدر يوسف الكومي – فاطمة سعد الشافعي –
هبه محمد عبد المقصود جوهر
قسم علوم الأراضي ــ كلية الزراعة ــ جامعة المنوفية ــ مصر

الملخص العربي

أجريت تجربة أصص في مزرعة كلية الزراعة ــ جامعة المنوفية بشبين الكوم لدراسة تأثير كل من معدل الإضافة (صفر ، ١ و ٢% مادة عضوية) وفترات الكمر (صفر ، ٢ ، ٤ و ٦ أشهر) لكل من قش الأرز وعرش البطاطس على بعض الخواص الكيميائية لأرضين حديثتي الاستصلاح (رملية وجيرية) في مصر ومحتواهما من النيتروجين والفوسفور والبوتاسيوم الميسر . كما تم دراسة تأثير هذه المعاملات على نمو نبات القمح ومحتواه من كل من النيتروجين والفوسفور والبوتاسيوم .

أوضحت النتائج نقصاً في رقم حموضة الأرض ومحتواها من كربونات الكالسيوم ، كما أوضحت زيادة في قيمة التوصيل الكهربي للأرض وكذلك محتواها من المادة العضوية والمحتوى من النيتروجين والفوسفور والبوتاسيوم الميسر في أي من الأرضين الرملية أو الجيرية. وكان تأثير النقص أو زيادة الأراضي المعاملة بعرش البطاطس المكمور أعظم من ذلك المصاحب لمعاملات قش الأرز المكمور .

أزداد محصول المادة الجافة لنبات القمح وكذلك محتواها من النيتروجين والفوسفور والبوتاسيوم بزيادة فترة الكمر ومعدل الإضافة من كل من عرش البطاطس وقش الأرز المكمورة حيث كانت هذه الزيادات الناتجة والمصاحبة لمعاملات عرش البطاطس المكمور أعلى من تلك الناتجة عن معاملات قش الأرز المكمور في كل من الأرضين الرملية والجيرية.