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EFFECT OF APPLIED GEOTEXTILE AND COMPOST ON CHEMICAL PROPERTIES OF SANDY AND CLAY SOILS AND SORGHUM PRODUCTIVITY UNDER DRAUGHT CONDITIONS

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ABSTRACT: The objective of this study is quantifying the effect of different amendments (compost and geotextiles) and their appropriate additive method and levels of irrigation on the soil chemical properties and sorghum productivity (yield and plant NPK contents) grown on two soils (sandy and clay). Sandy and clay soil samples were collected from two locations in Menofia Governorate. A pot experiment was conducted using two the soils and two types of geotextiles (cotton and polyester) plus compost. Two methods of application have been tested (layering and mixing) under different amounts of irrigation water (100, 80 and 60% of field capacity) compared to the soil received no treatments (control)

The results indicated that, all treatments resulted in reducing soil pH, where the highest decreases were recorded in the soil received compost and the lowest were resulted from polyester application. In both sandy and clay soil, EC, OM and CEC values were increased with all additives in two application methods under the three irrigation levels compared to the control treatment. The highest increases of OM and CEC were recorded in the soil treated with compost, while the polyester addition was the lowest.

Wide range of fresh and dry matter yield of sorghum plants were observed, where the highest values of both fresh and dry weights were found with compost treatment followed by cotton application. At the three irrigation levels on sandy and clay soils, the method of mixed addition resulted in high fresh and dry weights of sorghum plants compared to the the layer addition.

Sorghum plants, concentration (%) and uptake (mg/pot) of N, P and K were promoted with the three added amendments in comparison with the control treatment. The highest contents (% and mg/pot) of sorghum plants in both sandy and clay soils at the same irrigation level were found with the mixed addition of amendments in comparison with that of layer addition. Generally, application of the three amendments with the two application methods, enhanced sorghum plants contents of N, P and K, especially with increasing irrigation level from 50 to 100% of FC. The influence of added amendments on enhancinf NOK contents followed the order: compost > cotton > polyester.

Key words: Geotextile, Compost, Soil chemical properties, Sorghum Productivity, Sandy and Clay Soils.

INTRODUCTION

Drought causes deterioration of crops and consequently a decrease in agricultural production and an increase in the areas of soil prone to desertification. Therefore, water use efficiency (WUE) is mandatory, for water saving purpose. WUE is conditional on soil properties. Thus, soil texture is the critical factor affecting soil moisture (distribution, depletion and retention) and determining soil field capacity and permanent wilting point. Both sandy and clay soils have very unfavorable soil water movement, i.e., infiltration rates are extremely fast and slow in sandy and clay soils, respectively (Dagadu and Nimbalkar, 2012) so WUE is very low in these soils. Consequently, the water management is the challenge in such kind of soils. Henceforward, we decided to choose sandy and clay soils, since they are the most problematic for farmers and decision-makers in Egypt, as they cause water loss and poor distribution of water in the soil, and therefore they are of great importance to irrigation and, in general, agricultural production.

Accordingly, improving soil properties, of such critical soils, is obligatory for water

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management and agricultural production purposes. Geotextiles, which have not been fully studied and investigated. Geotextile is any natural or synthetic fabric used in soil for various purposes. Kavuru et al. (2013) defined agrotextiles, kind of geotextiles, are textiles used for their functional benefits in the agricultural field. The importance of using geotextiles came as they mean the fabrics or tissues that are used in the soil in general, and which are commonly used to stabilize the surface of loosened soils, prevent erosion and erosion by water and air, maintenance beaches, support internal roads in farms, lining irrigation channels, and wrapping perforated agricultural drainage pipes. There are very limited studies on the effect of geotextile on the physical and chemical properties of soil. One of the advantages of geotextiles is that it is cheap, easy to transport and store, and it is environmentally safe (whether it is produced from natural fabrics such as cotton or from synthetic fabrics such as polyester), and it does not emit bad odors or contain weed seeds and it does not cause infection (Omran, 2019).

On the other hand, there are soil amendments are used to improve soil properties and plant growth, reduce evaporation and leaching, increase soil water retention and conserve soil moisture for the continuation of the process of germination and growth. Subsequently, the proper amendment is the organic additives (usually compost). An organic matter (plant and/or animal residues), which has been degraded by the action of microorganism i.e., bacteria, fungi, actinomycetes etc. over a period of time is known as compost. Many types of organic matter, such as leaves, straw, fruit and vegetable peelings, and manures can be used to make compost. The degraded end product is completely different from the original organic materials, which has characteristics of dark brown color and homogeneous and without bad smell. Moreover, compost is relatively cheap and easy to prepare, so, it is an important cause for improving soil properties and crop quality. Compost allows more air into the soil improves drainage and reduces erosion. Compost helps to stop the soil from drying out in times of drought by holding more water. Compost helps in improvement of soil physio-chemical properties as it adds the nutrients to the applied soils as well as acts as a binding agent for the soil particles; thus, increase the nutrient availability for the plants (Wanas and Omran, 2006; Abou Hussien et al., 2017 and 2019).

Hariprasanna and Rakshit (2017) mentioned that sorghum (Panicoideae, cultivar) as one of the important grazing crops in feeding the livestock sector and as silage. Sorgum is also a raw material for extracting sugar, starch and cellulose and for the alcohol industry. In addition, sorghum is favorable because its tolerance to drought and its suitability in cultivation in low-fertile and new reclaimed soils.

This research was aimed to study the following points:

1- The effect of two geotextiles (cotton and polyester) from natural and artificial origin on:
  - Particular soil chemical properties of sandy and clay soils compared to compost.
  - Plant growth and N, P and K contents of sorghum plants grown in sandy and clay soils compared to compost.

2- Choose the best method to add the geotextiles (layering and mixing) to the soil.

MATERIALS AND METHODS

Soil location and sampling

This study was carried out using two soils collected from Menoufia Governorate, Egypt. Such two soils varied widely in their physical and chemical properties. The first soil was sandy soil collected from Kafour EL Ramal Quesna (Lat/Lon: 31.178045/30.5516890).

The second soil was clay soil from Experimental Farm, Faculty of Agriculture, Menoufia University, Shebin EL Kom (Lat/Lon: 30,558012/31,014420). About 300 kg of surface layer (0-30 cm) of each soil was collected. The samples at this depth were air-dried, grounded gently and passed through 2 mm sieve. The main physical and chemical soil properties were determined according to the methods described by to soil Survey Staff (2014), Cottenie et al. (1982) and Page et al. (1982) and the obtained data were recorded in Tables (1 and 2), respectively.

Table (1): Physical analysis of the experimental soils.

Studied Soils	Particle size distribution, %				Texture	Density, g/cm^3		Soil moisture constants as a percent (by weight)	
	Course Sand	Fine sand	Silt	Clay		Real	Bulk	FC	PWP
sandy	72.25	20.11	6.39	1.25	Sandy	2.85	1.77	8.89	3.89
clay	4.56	1.43	23.19	70.82	Clayey	2.67	1.25	33.04	16.78

Table (2): Chemical analysis of the experimental soils.

Soils	OM (%)	pH 1:2.5 (soil:water) Susp.	EC (ds/m) (soil:water) Extract	Soluble ions, meq/100 g soil							
				Cations				Anions			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
sandy	0.03	8.3	0.13	0.8	0.2	3.72	0.35	0.00	0.36	3	1.71
clay	1.11	8.5	0.36	1.4	0.4	5.3	0.68	0.00	0.36	2.2	5.22

Amendments (Geotextiles and Compost)

A sample of non-usable textiles, brought from garment factories at the industrial area of 6-October City, Egypt, were used in this experiment. Average values of two kind's mixtures of textile wastes were considered (Single Jersey and Single Pique) for the 100% cotton and (Mesh Pique and Interlock) for the 100% polyester.

A 2 kg sample of the compost was air dried for 3 days, then oven-dried at 70 °C for 1 day and ground in a porcelain mortar and thin by a hammer mill. Sample was stored in dry, air tight container until use.

The properties of geotextiles and compost were analyzed and presented in Tables 3 and 4.

Pot experiment

A pot experiment was conducted at green house of the Faculty of Agriculture experimental station, in Shebin El-Kom, Menoufia Governorate Egypt at October 2019. This study was carried out on two soils (sandy and clay). The soils were air- dried, grinded, sieved to 2 mm and packed in plastic pots (4 kg of soil/pot). Each pot had inner diameter and depth of 16 and 20 cm, respectively.

Spilt split plot design with three replicates was used where, the pots of each soil were divided into four main groups (18 pots/main group) representing the applied treatments i.e. compost, cotton geotextile and polyester geotextile (40 g of each pot) plus the control treatment. The pots of each main group were divided into two subgroups (9 pots/subgroup) representing two application methods of each amendment were followed (layer and mix). The first application method (layer) was carried at half (50%) of soil depth in the pots (i.e., 4.75 and 6 cm for sandy and clay soil, respectively), while in the second method (mix) was carried out by mixing each amendment with the whole soil in the pot. In the two application methods, the amendments were added before sowing.

The pots of each subgroup were divided into three sub-subgroups i.e. 100%, 75% and 50% of soil field capacity.

At the first day of June 2020, twenty seeds of sorghum (Sorghum bicolor L.) were sown in each pot. Before planting, all pots were fertilized by ordinary superphosphate (15.5% P_2O_5) at application rate of 4 g/pot and good mixed with the soil of each pot. After ten days of sowing (complete planting), the plants of each pot were thinned to 8 plants.

Table (3): Properties of cotton and polyester geotextiles

Geotextile	**100% Cotton**		**100% Polyester**	
Fabric Name	Single Jersey	Single Pique	Mesh Pique	Interlock
Fabric Type	Knitte	Knitte	Knitte	Knitte
Weight/area, g/m^2	180	200	150	135
Thickness, mm	0.34	0.35	0.25	0.19
Bulk density, g/cm^3	0.53	0.57	0.60	0.71
Hygroscopic water, %	6.8	7.1	0.8	0.5
MWHC, %	285.6	298.2	250.5	219.7

Table (4): Properties of compost

Organic matter (%)	**Moisture content (%)**	**Bulk density g/cm^3**	**pH (1.2.5)**	**EC dS/m (1:1)**	**C/N ratio**	**N (%)**	**P (%)**	**K (%)**	**Ash (%)**	**MWHC (%)**
38.1	19.3	0.77	7.17	2.9	18.7	1.11	0.73	0.95	59.2	321.1

Ammonium nitrate "NH_4NO_3" (33% N) was applied with irrigation water as N source at one rate of 6 g/pot to all pots. Likewise, all pots were fertilized by potassium sulphate" K_2SO_4" (48% K_2O) as K source at application rate of 4 g/pot. The applications of N and K were carried out in two equal doses after 20 and 40 days of planting. After 70 days of sowing, the following was done:

- The plants were harvested above the surface of the soil and weighted separately for each pot to obtain its fresh weight (FW) as g/pot. Then these plant materials were air-dried, oven-dried at 70 ^{o}C for 48 hours and weight to obtain its dry weight (DW) as g/pot. The sorghum plants were digested according to Chapman and pratt (1961) and nitrogen, phosphorus and potassium was determined according to Cottenie et al. (1982).
- Soil sample of each experimental unit was taken, separately, air-dried, ground, sieved through a 2mm sieve and analyzed for some chemical properties (EC "dSm^{-1}", pH, O.M "%" and CEC " c mole Kg^{-1} ") according to methods described by to Cottenie et al. (1982) and Page et al. (1982).

Statistical Analysis

The performed statistical analysis was three-way ANOVA in two separate groups (sandy and clay soils). The statistical analysis was performed using the STATISTICA software Ver. 12.5 (The original author is Stat-Soft and the developer is TIBCO; http://www.tibco.com/data-science-and-streaming).

RESULT AND DISCUSSION

Effect of geotextiles and compost (type and application method)

Soil Chemical Properties

Soil electrical conductivity (EC)

The found data in Table (5) show that, in both sandy and clay soil, EC values were increased significantly with all additives through the two application methods compared to the control treatments. These findings were observed with the three irrigation levels. Therefore, all RC values of EC as a result of the used mulching materials were positive. In addition, the data in Table (5) show that, the high increase of sandy and clay soils EC were occurred in the soil treated by compost followed by those received cotton treatment. This treatment was found with the two application methods under the three levels of irrigation. These increases resulted from the effect of added materials on solubilizing of some soil components. These results are in similar with those obtained before that by

Ahmed (2019) and Abou Hussin et al (2020) with compost applications.

Also, data in Table (5) display that, with the same additives material, the increase of EC in both sandy and clay soils with the mixed application method was higher than that found with application as layer. This trend was found with the three levels of irrigation. These findings may be resulted from high decomposition rate of additive materials in mixed method than that may be occurred with layer application method either of chemical and biological decomposition.

b. Soil pH

Data in Table (6) denote that, in both sandy and clay soils are a slight decrease with all studied treatments. The high decrease of soil pH was found in the soil treated by compost followed by that resulted from cotton application. The varieties in the decrease effect of some additive on soil pH was pointed out by Rabie (2019) and Abou Hussien et al. (2020).

Table (5): Effect of irrigation level (I) and amendment Type (T) and their application methods (M) on sandy and clay soils EC dS m^{-1} and it's relative changes (RC, %).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Application method (M)	Type	Sandy soil						Clay soil					
		EC	RC%	EC	RC%	EC	RC%	EC	RC%	EC	RC%	EC	RC%
Control		0.13	0	0.14	0	0.16	0	0.5	0	0.46	0	0.56	0
Layer	Polyester	0.14	7.69	0.14	0	0.17	6.25	0.42	-16	0.5	8.7	0.58	3.6
	Cotton	0.16	23.1	0.17	21.4	0.18	12.5	0.45	-10	0.5	8.7	0.6	7.1
	Compost	0.175	34.6	0.19	35.7	0.19	18.8	0.55	10	0.6	30.4	0.68	21
Mixed	Polyester	0.15	15.4	0.15	7.14	0.19	18.8	0.5	0	0.54	17.4	0.58	3.6
	Cotton	0.17	30.8	0.17	21.4	0.2	25	0.56	12	0.6	30.4	0.62	11
	Compost	0.2	53.8	0.23	64.3	0.24	50	0.65	30	0.7	52.2	0.75	34
LSD at 0.05	I	0.02428						0.0572					
	T	0.02804						0.06608					
	M	(ns)						0.0467					

Table (6): Effect of irrigation level (I) and amendment Type (T) and their application methods (M) on sandy and clay soils pH and it's relative changes "(RC, %).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Application method (M)	Type(T)	Sandy soil						Clay soil					
		pH	RC%	pH	RC%	pH	RC%	pH	RC%	pH	RC%	pH	RC%
Control		7.6	0	7.5	0	7.5	0	8.1	0	8	0	7.9	0
Layer	Polyester	7.5	-1.3	7.5	0	7.4	-1.3	7.9	-2.5	7.7	-3.8	7.5	-5.1
	cotton	7.5	-1.3	7.5	0	7.4	-1.3	7.7	-4.9	7.5	-6.3	7.5	-5.1
	Compost	7.4	-2.6	7.3	-2.7	7.2	-4	7.5	-7.4	7.5	-6.3	7.4	-6.3
Mixed	Polyester	7	-7.9	7.5	0	7.4	-1.3	7.7	-4.9	7.5	-6.3	7.5	-5.1
	cotton	7.5	-1.3	7.5	0	7.4	-1.3	7.6	-6.2	7.4	-7.5	7.4	-6.3
	Compost	7.4	-2.6	7.3	-2.7	7.4	-1.3	7.3	-9.9	7.2	-10	7.1	-10
LSD at 0.05	I	0.5804 (ns)						0.5793 (ns)					
	T	0.6702 (ns)						0.6689 (ns)					
	M	0.4739 (ns)						0.4730 (ns)					

With the same added material in both sandy and clay soil as well as at the same irrigation level, the reduction of soil pH with the mixed application method was excelled that one of layer application. Moreover, data in Table (6) display that, in both sandy and clay soils, raising level of irrigation resulted in a more decrease of soil pH. The same trend was found in both sandy and clay soils treated by the two sources of geotextile (polyester and cotton) and compost with the two application methods.

c. Percent of organic matter (OM, %) in soil

The presented data in Table (7) reveal that, with the same treatments, clay soil content of OM was higher than that of the sandy soil. Geotextile. (Polyester and cotton) as well as compost application (regardless layer or mixed application), augmented soil OM content. however their mix applications resulted in more increase of soil OM content than those of layer application. This trend may be cleared from the calculated values of RC, where these values with cotton application were higher than those for polyester applications especially with their mixed application method. Above that, more increases in the sandy and clay soils content of OM were resulted from compost applications in the two application methods with the three levels of irrigation. Therefore, RC values of soil content of OM calculated for compost applications were higher than those calculated for both cotton and polyester with the two application methods in both sandy and clay soil at the three irrigation levels. Mohamoud (2017), Rabie (2019) and Elshahry (2020) reported that these findings are in harmony with the chemical composition of the added materials and their decomposition rate and its products pointed out that, applications different sources of organic matter varied in their increases effect on soil content of OM**.**

In addition, data in Table (7) show that with the same treatment of added materials. i.e., geotextile (polyester and cotton) and compost, increasing in irrigation level from 50 to 100% FC in both sandy and clay soils were associated by increase in the soil content of OM.

Table (7): Effect of irrigation level (I) and amendment Type (T) and their application methods (M) on sandy and clay soils content of organic matter (OM, %) and active real changes (RC, %).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Application method (M)	Type	Sandy soil						Clay soil					
		OM%	RC%	OM %	RC %	OM %	RC%	OM %	RC %	OM %	RC%	OM %	RC %
Control		0.20	0	0.2	0	0.2	0	0.4	0	0.4	0	0.4	0
Layer	Polyester	0.21	5	0.24	20	0.27	35	0.4	0	0.47	18	0.48	20
	cotton	0.24	20	0.24	20	0.24	20	0.44	10	0.44	10	0.5	25
	Compost	0.27	35	0.27	35	0.3	50	0.5	25	0.56	40	0.61	53
Mixed	Polyester	0.23	15	0.24	20	0.27	35	0.44	10	0.5	25	0.52	30
	cotton	0.27	35	0.29	45	0.31	55	0.5	25	0.54	35	0.57	43
	Compost	0.33	65	0.41	105	0.47	135	0.6	50	0.67	68	0.72	80
LSD at 0.05	I	(ns)						(ns)					
	T	0.0935						0.0668					
	M	(ns)						0.0472					

d. Cation exchange capacity (CEC)

The presented data in Table (8) show that, there are slight differences within CEC (c mole kg^{-1}) values of both sandy and clay soils treated individually by cotton, polyester and compost depending on their application method, where values of CEC in both sandy and clay soils treated with the tested additives in mixed application method were higher than those found when these materials added in layer form. These differences were clearer with compost applications. Therefore, all RC values (%) of CEC with three materials in sandy and clay soils were more positive with mixed application method than these calculated for layer application method. This trend was in similar under the three levels of irrigation. Also, these findings means that, added materials (cotton, polyester and compost) to sandy and clay soils under different levels of irrigation as mixed with the soil have a high effect on soil chemical properties especially the soil content of OM as well as soil CEC.

Generally, data in Table (8) elucidate that increasing levels of irrigation from 50 to 100% FC under the same treatment of added materials caused an increase in soil CEC and OM of both sandy and clay soils. This may be attributed to that the higher moisture content of the soil enhanced the activity of the different organisms of the soil, consequently, its content from organic matter.

3.1.2. Plant growth and analysis

3.1.2.1 Fresh and dry matter yield (FW and DW)

Data in Tables (9 and 10) declare that, the determined FW and DW (g/pot) for shoots of sorghum plants were significantly promoted as a result of added the three amendments with the three levels of irrigation. This enhancing influence of the three additives followed the order: compost > cotton > polyester. The increases in FW and DW of sorghum plants in both sandy and clay soils received polyester, cotton and compost under the three irrigation levels attributed mainly to improve effect of these additives on both soils physical and chemical properties (Omran et al. 2013, Kumar 2014 and Sarker et al. 2019).

With the same added materials under the three levels of irrigation in both sandy and clay soils, application method has a clear difference in their effect on FW and DW of sorghum plants, where these applications in mixed method resulted in a more increases of FW and DW compared with these found in the addition as layer (Tables 9 and 10).

Table (8): Effect of irrigation level (I) and amendment Type (T) and their application methods (M) on CEC (c mole Kg-1) of sandy and clay soil and it's relative change (RC, %).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Application Method (M)	Type	Sandy soil						Clay soil					
		CEC	RC%	CEC	RC%	CEC	RC%	CEC	RC%	CEC	RC%	CEC	RC%
Control		11.55	0	11.55	0	11.55	0	35.4	0	35.4	0	35.4	0
Layer	Polyester	11.57	0.17	11.6	0.433	11.62	0.61	35.45	0.141	35.5	0.28	35.6	0.56
	cotton	11.55	0	11.57	0.173	11.58	0.26	35.42	0.056	35.45	0.14	35.45	0.14
	Compost	11.8	2.16	11.85	2.597	11.92	3.2	35.59	0.537	35.67	0.76	35.75	0.99
Mixed	Polyester	11.6	0.43	11.64	0.779	11.7	1.3	35.5	0.282	35.58	0.51	35.65	0.71
	cotton	11.56	0.09	11.58	0.26	11.58	0.26	35.47	0.198	35.48	0.23	35.5	0.28
	Compost	11.88	2.86	11.95	3.463	12.1	4.76	35.65	0.706	35.8	1.13	35.95	1.55
LSD at 0.05	I	(ns)						(ns)					
	T	(ns)						(ns)					
	M	(ns)						(ns)					

Table (9): Effect of irrigation level "I" (% of soil field capacity) and some additives Type (T) and their application methods (M) on bot fresh and dry matter (FMY & DMY) (g/pot) of sorghum plant grown on clay soil and it's relative changes "RC" (%).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Applicative method (m)	Type	Fresh weight (FW)(g/pot)						Dry weight (DW)(g/pot)					
		g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%
Control		44	0	45.9	0	48.3	0	4.93	0	5.1	0	5.36	0
Layer	Polyester	44.4	0.909	53.7	16.99	60.6	25.47	4.93	0	6.3	23.529	6.73	25.56
	cotton	47.61	8.205	55.5	20.92	61.8	27.95	5.29	7.3	6.16	20.784	6.86	27.985
	Compost	47.56	8.091	53.45	16.45	62.3	28.99	5.53	12.2	5.94	16.471	6.93	29.291
Mixed	Polyester	44.33	0.75	53.66	16.91	54.96	13.79	4.87	-1.2	5.96	16.863	6.1	13.806
	cotton	46.29	5.205	52.23	13.79	59.52	23.23	5.14	4.26	5.8	13.725	6.61	23.321
	Compost	49.8	13.18	54.6	18.95	64.2	32.92	5.3	7.51	6.06	18.824	7.13	33.022
LSD at 0.05	I	0.5793						0.5804					
	T	0.6689						(ns)					
	M	0.473						0.4739					

Table (10): Effect of irrigation level "I" (% of soil field capacity) and some additives Type (T) and their application methods (M) on bot fresh and dry matter (FW & DW) (g/pot) of sorghum plant grown on sandy soil and it's relative changes "RC" (%).

Additives treatment		Level of irrigation (% of soil field capacity)											
		50%		75%		100%		50%		75%		100%	
Applicative method (M)	Type	Fresh weight (FW)						Dry weight (DW)					
		g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%	g/pot	RC%
Control		15.54	0	17.46	0	26.1	0	1.06	0	1.94	0	2.9	0
Layer	Polyester	34.74	123.5521	39.6	126.8	45.44	74.1	3.86	264.151	4.4	126.8	5.16	77.931
	cotton	39.24	152.5097	44.1	152.58	44.87	71.916	4.36	311.321	4.9	11.364	5.43	87.241
	Compost	41.04	164.0927	45.36	159.79	47.34	81.379	4.56	330.189	5.04	2.8571	5.26	81.379
Mixed	Polyester	33.93	118.3398	38.7	121.65	43.65	67.241	3.77	255.66	4.3	-14.68	4.85	-7.7947
	cotton	35.82	130.5019	42.03	140.72	47.7	82.759	3.98	275.472	4.67	8.6047	5.3	9.2784
	Compost	41.13	164.6718	47.7	173.2	50.31	92.759	4.57	331.132	5.3	13.49	5.59	5.4717
LSD at 0.05	I	0.6047						0.5804					
	T	0.6982						0.6702					
	M	(ns)						(ns)					

In addition, data in Tables (9 and 10) show that there is an increase in both FW and DW of sorghum plants grown on sandy and clay soils as aresult of all treatments. However, these increases reveal that, irrigation at 100% FC obviously appeared its superiority on the other levels of irrigation in augmenting FW and DW of sorghum plants. this influence may be referred to that irrigation at 100% FC is more suitable for plant growth, nutrient uptake and decomposition rate of added materials is more suitable for plant growth, nutrients uptake and decomposition rate of added materials.

3.1.2.2. Nutrients content

a. Nitrogen (N) content

Data in Table (11) demonstrate that, there is an increase of N concentration in the plants affected by the treatments of cotton and polyester with both two application methods. More increases of N content were observed with the three levels of irrigation. On the other hand, different plants content of N was increased as a result of compost application (Abou Hussien, et al 2017, 2019 and 2020).

Also, data in Table (11) imply that, the same additive material with the same level or irrigation, N concentration (%) and uptake (mg/pot) by sorghum plants grown on both sandy and clay soil were higher with mixed application method than that exposed in the plants treated with the layer application method. The effect of irrigation levels (50, 75 and 100% of FC) on sorghum plants content (% and mg pot^{-1}) was presented in Table (11). This content with the same treatment of the added materials in each soil was enhanced with the raising the level of irrigation. These increases were recorded in both sandy and clay soils. The individual effects of all studied treatments on N uptake (mg pot^{-1}) were significantly changed compared to control treatment.

b. Phosphorus (P) content

Data in Table (12) illustrate that with all the studied treatments, sorghum plants grown on clay soil have a high content (% and mg pot^{-1}) of P compared to that determined in the plants grown on sandy soil. The same data showed also a slight increase of P concentration and its uptake by sorghum plants as a result of geotextile (cotton and polyester) application with both layer and mixed methods, however more promotion of P content (% and mg pot^{-1}) in sorghum plants was induced with compost application. The superior augmenting effect of compost on sorghum plants compared with geotextile applications resulted from high compost content of P and also to its effect on improve in most soil physical, chemical and biological properties. These findings were observed in both sandy and clay soils with either of layer or mixed application methods.

The second factor under study represented by application method of the added materials (layer and mixed), P concentration and its uptake by sorghum plants treated by the three additives added in mixed layer were higher than those found in the plants under layer method application. Generally, in clay soil, sorghum plants content of P was higher than that in the plants grown on sandy soil, where this trend was found with all treatments under study. These findings related with the initial properties of the two studied soils and behavior of the tested materials under these soil conditions.

The values of LSD at 0.05 indicated that, all treatments under this study significantly effect P uptake compared to control.

c. Potassium (k) content (%)

Data in Table (13) show that,t here is a significant increase in both K, percent (%) and uptake (mg pot^{-1}), as a result of individual applications of cotton, polyester and compost. In the two soils and in the two application methods and according to the found increase of K content, the added materials takes the order compost > cotton > polyester. This order was found at the three levels of irrigation. Therefore, RC values of K uptake were positive, where the highest RC values were found with compos treatment followed by those resulted from cotton treatment. With the same type of the tested additives in both sandy and clay soils, K concentration (%) and its

Table (11): Effect of irrigation level "I" (% of soil field capacity) and some additives type "T" and there application method "M" on sorghum plants content (% and mg/pot) and relative changes "RC" (%) of N uptake.

Additives treatment		Level of irrigation (% of soil field capacity) " L "																	
		50%			75%			100%			50%			75%			100%		
		Sandy soil									Clay soil								
Applicative method (M)		N conc %	N uptake mg/pot	RC %	N conc %	N uptake mg/pot	RC %	N conc %	N uptake mg/pot	RC %	N conc %	N uptake mg/pot	RC %	N conc %	N uptake mg/pot	RC %	N conc %	N uptake mg/pot	RC %
Control		0.57	6.04	0.00	0.59	11.52	0.00	0.64	18.56	0.00	0.71	35.00	0.00	0.82	41.82	0.00	0.88	47.17	0.00
Layer	Polyester	0.68	26.25	334.46	0.85	37.40	224.54	0.96	49.54	166.90	0.80	39.44	12.69	0.95	59.85	43.11	1.14	76.72	62.65
	Cotton	0.67	29.04	380.64	0.73	35.77	210.40	0.87	47.24	154.53	0.74	39.15	11.86	0.81	49.89	19.30	0.98	67.23	42.53
	Compost	0.72	32.83	443.36	0.95	47.88	315.48	1.16	61.23	229.88	0.86	47.56	35.89	1.05	62.37	49.14	1.47	101.87	115.96
Mixed	Polyester	0.70	26.54	339.26	0.95	40.85	254.48	1.15	55.78	200.51	0.85	41.40	18.29	1.06	63.18	51.08	1.42	86.62	83.63
	Cotton	0.68	26.90	345.22	0.89	41.47	259.86	1.08	57.24	208.41	0.82	42.15	20.43	0.96	55.68	33.14	1.29	85.27	80.77
	Compost	0.73	33.54	455.11	1.12	59.57	416.94	1.42	79.38	327.68	1.01	53.53	52.94	1.37	83.02	98.52	1.64	116.93	147.89
L.S.D at 0.05 level	I	0..399									0.573								
	T	0.461									0.662								
	M	0.326									0.468								

Table (12): Effect of irrigation level "I" (% of soil field capacity) and some additives type "T" and there application method "M" on sorghum plants content (% and mg/pot) and relative changes "RC" (%) of P uptake.

Additives treatment		Level of irrigation (% of soil field capacity) " L "																	
		50%			75%			100%			50%			75%			100%		
		Sandy soil									Clay soil								
Applicative method (M)		p conc %	p uptake mg/pot	RC %	p conc %	p uptake mg/pot	RC %	p conc %	p uptake mg/pot	RC %	p conc %	p uptake mg/pot	RC %	p conc %	p uptake mg/pot	RC %	p conc %	p uptake mg/pot	RC %
Control		0.66	7.04	0.00	0.69	13.39	0.00	0.73	21.29	0.00	0.70	34.51	0.00	0.78	39.98	0.00	0.87	46.42	0.00
Layer	Polyester	0.70	27.02	283.89	0.75	33.00	146.53	0.82	42.42	99.26	0.82	40.52	17.42	0.90	56.70	41.82	1.02	68.78	48.17
	Cotton	0.68	29.82	323.71	0.71	34.79	159.90	0.76	41.49	94.89	0.77	40.73	18.02	0.81	49.90	24.81	0.98	67.23	44.83
	Compost	0.82	37.48	432.55	0.90	45.36	238.86	1.09	57.23	168.86	0.92	51.10	48.07	1.07	63.44	58.68	1.28	88.98	91.68
Mixed	Polyester	0.72	27.30	287.80	0.80	34.23	155.70	0.89	43.07	102.33	0.87	42.37	22.78	0.98	58.65	46.70	1.11	67.71	45.86
	Cotton	0.75	29.85	324.10	0.76	35.31	163.75	0.84	44.52	109.15	0.83	42.66	23.62	0.87	50.46	26.21	1.07	70.73	52.37
	Compost	0.90	41.13	484.37	0.98	51.94	288.02	1.12	62.72	194.65	1.14	60.42	75.08	1.33	80.72	101.90	1.45	103.39	122.73
L.S.D at 0.05 level	I	1.369									2.484								
	T	1.581									2.868								
	M	1.118									2.028								

Table (13): Effect of irrigation level "I" (% of soil field capacity) and some additives type "T" and there application method "M" on sorghum plants content (% and mg/pot) and relative changes "RC" (%) of K uptake.

Additives treatment		Level of irrigation (% of soil field capacity) " L "																	
		50%			75%			100%			50%			75%			100%		
		Sandy soil									Clay soil								
Applicative method (M)		K conc %	k uptake mg/pot	RC %	K conc %	k uptake mg/pot	RC %	K conc %	k uptake mg/pot	RC %	K conc %	k uptake mg/pot	RC %	K conc %	k uptake mg/pot	RC %	K conc %	k uptake mg/pot	RC %
Control		0.84	8.90	0.00	0.88	16.99	0.00	0.90	26.10	0.00	0.89	43.88	0.00	0.96	48.96	0.00	1.01	54.14	0.00
Layer	Polyester	0.94	36.28	307.50	0.97	42.68	151.21	1.04	53.87	106.40	0.98	48.51	10.55	1.14	71.82	46.69	1.22	82.11	51.66
	Cotton	0.88	38.37	330.91	0.92	45.28	166.51	1.01	54.84	110.13	0.96	50.57	15.25	1.04	64.06	30.84	1.17	80.26	48.25
	Compost	1.12	51.07	473.58	1.22	61.59	262.51	1.28	67.33	157.96	1.18	65.25	48.70	1.25	74.25	51.65	1.38	95.63	76.63
Mixed	Polyester	0.99	37.32	319.17	1.04	44.89	164.21	1.11	53.84	106.26	1.14	55.52	26.53	1.21	72.12	47.30	1.29	78.69	45.35
	Cotton	0.96	38.05	327.32	0.98	45.77	169.39	1.06	55.97	114.44	1.07	54.79	24.86	1.17	67.86	38.60	1.22	80.64	48.95
	Compost	1.22	55.75	526.17	1.25	66.25	289.94	1.37	76.58	193.42	1.34	70.81	61.37	1.41	85.45	74.53	1.60	113.79	110.18
L.S.D at 0.05 level	I	0.423									0.629								
	T	0.489									0.726								
	M	0.346									0.513								

uptake (mg pot^{-1}) by sorghum plants with added application method in mixed with the soil were higher than those found when these materials added as layer. These findings were found in both sandy and clay soils under the three levels of irrigation. Increasing level of irrigation from 50 to 100% FC in both sandy and clay soils resulted in a significant increases of K uptake ($mgpot^{-1}$).

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تأثير الجيوتكستايل والكمبوست المضاف على الخواص الكيميائية للأراضى الرملية والطينية وإنتاجية السورجم تحت ظروف الجفاف

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الملخص العربى:

الهدف من هذه الدراسة هو قياس تأثير اضافة محسنات مختلفة (السماد العضوي والجيوتكستايل) واختيار أنسب طريقة لاضافتها ومستويات مختلفة من مياة الري على الخواص الكيميائية للتربة وإنتاجية السورجم (المحصول ومحتوي النبات) لأرضين (رملية وطينية) واستهلاك المياه بواسطة النبات. ولتحقيق هدف الدراسة تم جمع عينات من التربة الرملية والطينية من موقعين بمحافظة المنوفية. أجريت تجربة أصيص باستخدام نوعين من التربة ونوعين من الجيوتكستايل (قطن وبوليستر) بالإضافة إلى السماد العضوي والأرض الغير معاملة (الكنترول). تم تجربة طريقتين للإضافة المحسنات الأرضية (الطبقة والخلط) تحت مستويات مختلفة من مياه الري (١٠٠ ، ٨٠ و ٦٠٪ من السعة الحقلية).

أشارت النتائج إلى أن جميع المعاملات قيد الدراسة أدت إلى انخفاض في درجة حموضة التربة ، حيث لوحظ الإنخفاض الأعلى في الأرض المضاف لها كمبوست والأقل نتيجة إضافة البوليستر. في كل من التربة الرملية والطينية ، زادت قيم ال EC و OM و CEC مع جميع الإضافات في طريقتى الإضافة تحت مستويات الري الثلاثة مقارنة بمعاملة الكنترول. أعلى الزيادات في قيم ال OM و CEC وجدت في التربة المعاملة بالكمبوست ، بينما كانت هذه الزيادة أقل مع إضافات البوليستر.

ظهر تغير واسع المدي في محصول المادة الطازجة والجافة لنبات السورجم ، حيث سجلت أعلى قيم للأوزان الطازجة والجافة مع معاملة الكمبوست يليها تلك الناتجة عن إضافة القطن. تحت مستويات الري الثلاثة في التربة الرملية والطينية ، أدت طريقة الإضافة خلطاً إلى ارتفاع الأوزان الطازجة والجافة لنباتات السورجم مقارنة مع تلك المرتبطة بالإضافة كطبقة.

زاد محتوي السورجم (التركيز (٪) والامتصاص (مجم / أصيص) من ال N و P و K مع المحسنات الثلاثة المضافة مقارنة بمعاملة الكنترول. وكان تأثير المحسنات الأرضية علي زيادة NPK تبعا للترتيب التالي: الكمبوست> القطن> البوليستر. حققت طريقة الخلط قيم أفضل من طريقة الطبقة في كل من التربة الرملية والطينية عند نفس مستوى الري. بشكل عام زاد محتوي نباتات السورجم من NPK مع زيادة مستوى الري من ٥٠ إلى ١٠٠٪ من السعة الحقلية، في كلا الأرضين بعد المعاملة بالثلاثة محسنات مع طريقتى الإضافة.

الكلمات المفتاحية: الجيوتكستايل ، الكمبوست ، إنتاجية النبات ، كفاءة استخدام المياه ، التربة الرملية ، التربة الطينية.