

Effect of Organic Conditioners on some Hydro- Physical and Mechanical Properties of Sandy Soil

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ABSTRACT

Laboratory experiments were carried out to investigate the influence of various organic conditioners on some hydrophysical, mechanical properties, and evaporation from the surface layer of sandy soil collected from the Al-Bustan region, Egypt. Treatments were coffee grounds (CG), plant ash (PA) at concentrations 5% & 10% and low release humic granular (LRHG) (0.5%, 1%, 5% and 10%) based on the volume basis of sandy soil plus control treatment. Three separated laboratory experiments were done on sandy soil samples. First one was subjected to wet and dry cycles to assess how organic conditioners affect saturated hydraulic conductivity. The second experiment was conducted to follow the changes of penetration resistance (PR) after one week and two weeks from starting time. The third experiment measured evaporation from the surface layer of sandy soil at intervals of 5, 7, 10, and 14 days from the start. The results indicated that organic conditioners caused a significant decrease in saturated hydraulic conductivity values in sandy soil. Specifically, Ks values decreased by 93%, 63%, and 98% in CG, PA, and LRHG treatments, respectively, compared to the control treatment. The highest PR values observed were 2.4, 0.40, and 0.13 kg/cm² in LRHG, CG, PA, and treatments, respectively. Significant differences were observed between most of the treatments. The addition of organic conditioners retarded and reduced evaporation from surface layer of sandy soil depending on surround weather condition, type and concentration of the conditioners. The result of cumulative evaporation (E) showed that there were no significant differences between CG&PA, while it was a highly significant differences between LRHG and (CG, PA). The results appeared there were highly significant differences between the concentration of conditioners. While there was a significant difference in time period less than one week. We can conclude that it is better to make a compromise between the effect of a LRHG concentrations on mechanical and hydrophysical properties of soil to recommend a proper concentration of this conditioner as a soil amendment to obtain the best plant growth.

Keywords: Conditioners, hydraulic conductivity, penetration resistance, evaporation.

INTRODUCTION

Applying soil amendments can be a practical and effective strategy to enhance soil properties and boost crop production, thereby contributing to global food security. The incorporation of appropriate amendments

improves soil chemical, physical, and biological properties. Such amendments have been shown to enhance the sustainability of dryland agriculture in arid and semi-arid regions (Shaddox, 2004; Bhardwaj *et al.*, 2007; Mann *et al.*, 2011 and Hueso-González *et al.*, 2014). Conversely, decreasing the concentration of soil organic matter affects the mechanical strength of the soil and agricultural productivity (Eden *et al.*, 2017).

The addition of crop residues into the soil are important to ensure greater amounts of soil organic carbon (SOC) (Parmar *et al.*, 2016). Proper utilization of crop residues can enhance soil properties (Bilalis *et al.*, 2003 and Tu *et al.*, 2006).

Humic acid consists of long-chain organic compounds with high molecular weight, formed through the decomposition of organic matter. It is vital for agricultural purposes. Natural humic acid (NHA) is present in soil in minimal amounts and takes thousands of years to develop (Wang *et al.*, 2023). Humic acid occurs naturally in soil as a bioproduct of organic matter decomposition and can also be synthesized by pulverizing lignite. When dissolved in water and applied with nutrient solutions to plants, humic acid helps mitigate water stress in degraded soils (García *et al.*, 2012). Research indicates that in arid sandy soils with low clay content, humic acid enhances water availability, boosts plant productivity, and improves nutrient uptake (Turan *et al.*, 2011).

Various doses of soil organic matter (SOM) such as walnut sawdust (WS), earthworm manure (EM), and farmyard manure (FM) were applied to sandy soils to assess their impact on saturated hydraulic conductivity (Ksat). Compared to the control treatment, the SOM amendments significantly reduced the hydraulic conductivity of the sandy soils ($p < 0.01$), (Demir and Demir, 2019).

Coffee grounds (CG) improved saturated hydraulic conductivity (Ks) of sandy soil (Bedaiwy *et al.*, 2018).

Soil penetration resistance (SPR) refers to the force needed to penetrate the soil, typically measured with a pocket penetrometer. At each pit, at least ten measurements were taken using this device. SPR serves as an indicator for identifying soil compaction issues, which can mechanically impede root growth and reduce crop yields (Purwakusuma *et al.*, 2023).

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Penetration resistance increased substantially with CG addition to sandy soil (Bedaiwy *et al.*, 2019).

In arid and semi-arid regions, soil evaporation is significant, with estimates suggesting that 30% to 70% of precipitation is lost through soil evaporation, without contributing to crop production (Wallace, 1991; Jalota, 1993 and Zribi *et al.*, 2015). Therefore, in areas suffer from scarcity of rainfall; evaporation from soil may reduce crop productivity. Minimizing soil evaporation is crucial for alleviating water shortages in arid and semi-arid regions. Reducing soil evaporation is important to alleviate water shortages in arid and semi-arid regions.

Factors influencing soil evaporation include air temperature, wind speed, humidity, radiation, and soil water availability. The process of water evaporation from initially saturated soil into a steady state occurs in three distinct stages. The initial stage is termed the constant rate stage, where evaporation is primarily dictated by weather conditions and water availability is not limiting. During the second stage, known as the falling rate stage, evaporation is primarily influenced by the soil's hydraulic properties. At this phase, the rate of evaporation declines sharply as water loss becomes constrained by the rate at which water can move through the drying soil. The third stage begins once the surface layer of soil has reached a sufficiently dry state (Gardner and Hillel, 1962). Cumulative evaporation from a bare soil surface can also be affected by soil texture. Jalota and Prihar (1986) found that silt loam soil experienced greater evaporation losses compared to sandy loam and loamy sand. They attributed this difference to the higher transmission rate of silt loam in the dry range.

Water loss through evaporation and deep percolation poses significant challenges in irrigating sandy soils. Therefore, efforts are consistently aimed at reducing the evaporation rate and minimizing water loss through infiltration and deep percolation in these highly permeable soils (Saad, 2017).

Significant effects ($p < 0.05$) on evaporation rate and cumulative evaporation were observed in two sandy soils subjected to successive drying and wetting cycles due to the addition of varying rates of plant residues (Saad, 2018).

The western desert plateau region in Egypt is primarily sandy, with two distinct sandy soil areas also found in the cultivated zones of the Nile Valley and Delta. Water loss through evaporation and deep percolation presents significant challenges in irrigating sandy soils. Therefore, strategies to reduce the evaporation rate and minimize water loss through infiltration and deep percolation are consistently targeted in these highly permeable soils.

The main objective of the research was to investigate the impact of coffee grounds, crop residues,

and low-release humic granules on evaporation, as well as on various hydraulic and mechanical properties of sandy soil.

MATERIAL AND METHODS

Soil sampling and analyses:

The soil of the study area (Al-Bustan region (30°49'40"N 30°32'11"E), Egypt) was classified as *Typic torripsammments* (Labib and Khalil, 1977). Representative soil samples were collected from of the study area; air dried and sieved through a 2 mm screen. Soil pH, ECe and total organic matter values were 7.1, 0.67 dS.m⁻¹ and 0.5%, respectively. Dry bulk density was (1.67 Mg.m⁻³) determined by core method (Black and Hartge, 1986). Particle size distribution was determined by the Bouyoucos hydrometer method (Bouyoucos, 1962). The textural class was sand with 89% sand, 3% silt, and 9% clay. Total salt, pH and calcium carbonate content were determined according to Page *et al.* (1982). Soil organic matter (OM) was determined by 'Walkely- Black 'method (Nelson and Sommers, 1982).

Soil amendments used in the experiments:

a- Coffee grounds (CG): Coffee grounds were obtained from Costa coffee shop in Alexandria. Coffee grounds were dried in open air in the laboratory. Samples were mixed together in order to obtain a homogeneous mixture of CG.

b-Plant ash (PA): Plant ash were obtained from different crop wastes. Plant ash were dried in open air in the laboratory. Plant ash is the soft dry powder that remains after aerobic burning plant wastes that meant plant ash is the residue left behind when plants are heated to high temperature which is an indication of minerals absorbed by plant.

c-Low relese humic granular (LRHG): LRHG is alkalin treated granular prepared by crusting humic acid materials LRHG has active biological chemical propertied and may be applied to the soil alon or in combination with available fertilizer. LRHG has brought from Desert Research Institute.

The first laboratory experiments were conducted to determine water losses by evaporation from sandy soil treated with organic materials:

Eleven treatments were prepared [CG (0%, 5% and 10%), PA (0%, 5% and 10%), and LRHG (0%, 0.5%, 1%, 5% and 10%)] on the volume basis, mixed and corporated of sandy soil samples with three replicates. 33 Plastic trays, 15 cm in diameter and 2 cm high were used. The trays were packed to the bulk density (1.67 Mg m⁻³) and well mixed and incorporated. Subsequently, water was added to achieve the soil's field capacity (after free drainage). The soil was then

allowed to dry over successive 15-day periods. Soil samples were weighed, and evaporation was measured every 2 days using an electronic balance with a capacity of 3 kg and a sensitivity of 0.01 g.

Calculation of Soil Evaporation:

The cumulative soil evaporative capacity between 2 measurements was calculated according to Chen *et al.* (2019) as follows:

$$E = 10 \times \frac{M_2 - M_1}{\pi r^2 \rho_w}$$

Where E represents the soil evaporation over a period (mm), M1 is the initial weight (g) at the first measurement, M2 is the weight (g) at the second measurement, r denotes the inside diameter of the trays (cm), and ρ_w stands for the density of water ($\text{g}\cdot\text{cm}^{-3}$).

The second experiment "Saturated Hydraulic Conductivity Assessment of Sandy Soil amended with Organic Conditioners"

Saturated hydraulic conductivity (Ks)

Three organic wastes [caffee ground (CG) (0%, 5% and 10%), plant ash (PA) (0%, 5% and 10%), and low release humic acid (LRHG) (0%, .5%, 1%, 5% and 10%)] incorporated with sandy soil on on volume basis. Eleven PVC columns measuring 3 inches in diameter and 10 cm in height were packed at a bulk density of 1.67 Mg m^{-3} . Soil columns were saturated by capillary and subjected to six wet and dry runs. The constant head method was used to determine saturated hydraulic conductivity (Ks) for each run according to Klute and Dirksen (1986) and calculated by using Darcy's law.

The Third experiment: Analysis of Mechanical Properties of Sandy Soil Amended with Organic Waste

Penetration resistance

The penetrometer used to investigate of the effect of incorporated organic wastes on penetration resistance. The organic wastes were (CG (0%, 5% and 10%), PA (0%, 5% and 10%), and LRHG (0%, 0.5%, 1%, 5% and 10%). 33 Plastic trays with 18 cm in diameter and 2 cm high were packed at bulk density 1.67 Mg m^{-3} . The moisture content of the sand in trays at zero time was at field capacity. Penetration resistance was measured with time intervals (7, and 14days).

Data analysis

Differences among treatments were analyzed using three-way analysis of variance (ANOVA), followed by a F-test for least significant differences (LSD) at a significance level of $P < 0.05$. The experimental design employed was a three-way completely randomized design (CRD), analyzed using the CoStat software.

RESULTS AND DISCUSSION

Analysis of Selected Parameters in Natural Organic Soil Amendments:

The mean values of selected parameters (hydraulic conductivity, evaporation and penetration resistance) for coffee ground, plant ash, low release humic granularss, concentrations and time interval/ wet and drying cycles were calculated based on data from three laboratory experiments as shown in following the charts or/ and ANOVA Tables.

1- Effect organic conditioners on hydraulic conductivity:

The impact of organic conditioners on saturated hydraulic conductivity (Ks) after six runs is depicted and illustrated in Fig. (1) and Table (1). Generally, the values of Ks were approximately reached to stability after 3 to 4 runs of wet and drying cycles in all treatments. Determined values showed that Ks decreased by 92.99, 62.32 and 97.69 in CG., PA., and LRHG treatments compared to control (without conditioner), respectively. At PA., the addition of 5 % of PA was beter than 10 % as a rate of reduction, that may refer to the low organic matter and water content. Concerning to LRH the reduction in 10 % was very low where it was blocked. Therefore, we tested cocentrations (0.5% and 1%) of LRHG. To avoid the high reduction of Ks under 5 and 10% of this conditioner.

The result showed that the applied 0.5% LRHG to sandy soil reduced the Ks from 5.19 (control) to 3.19 m/day after 6 runs (38.47% reduction). Also the results refered to that 1% of LRHG obtained the same Ks values of both 5% of CG and 5% of PA as shown in Fig. (1) and Table (1).

The hydraulic conductivity of sandy soil was significantly influenced by the interaction among soil conditioners, their concentration, and the duration of application ($p < 0.05$). The inverse relationship between Ksat and soil pore size affects water flow rates, with larger pores generally allowing faster flow. Introducing fine organic materials into large soil pores can reduce Ksat (Esmaelnejad *et al.*, 2017). According to Pulat *et al.* (2018), applying a 1% bio-polymer solution to a soil sample containing 70% sand led to a significant 25-fold reduction in hydraulic conductivity. Similarly, Zhang *et al.* (2016) found that incorporating ground biochar particles into sandy soil decreased hydraulic conductivity, attributing this effect to the alteration of the soil's pore structure by the added materials.

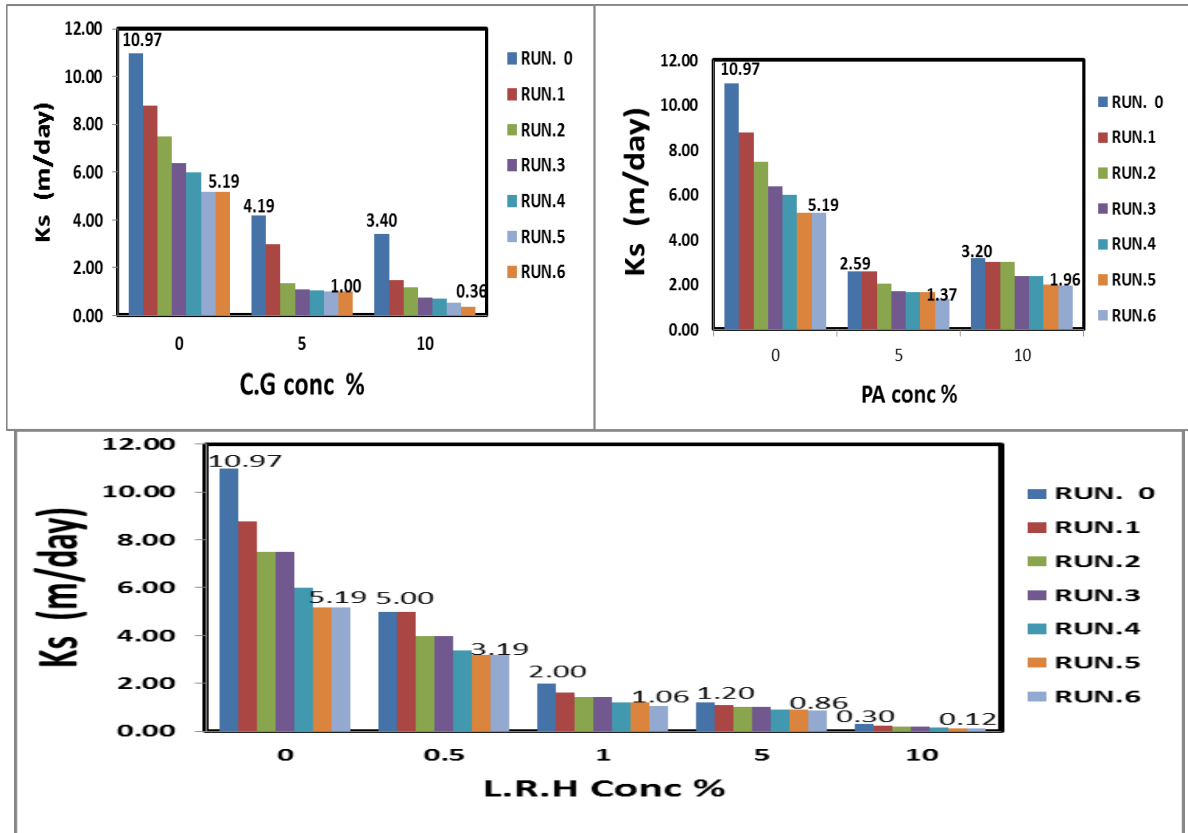


Fig. 1. Effect of organic conditioners on the saturated hydraulic conductivity (Ks) of the (CG, PA and LRHG) through six runs of wetting and drying cycles

Table 1. Reduction percentage of hydraulic conductivity values as a result of addition soil conditioners under 6 successive runs of wet and drying cycles

NO. of Runs	CG		PA		LRHG			
	5	10	5	10	0.5	1	5	10
RUN. 0	61.80	69.02	76.37	70.86	54.45	81.80	89.08	97.27
RUN.1	65.90	82.95	70.63	65.90	43.18	81.82	87.55	97.45
RUN.2	82.12	84.29	72.77	60.02	46.67	80.81	86.67	97.33
RUN.3	82.80	88.27	73.59	62.48	46.83	79.68	84.68	97.07
RUN.4	82.33	88.21	72.14	60.00	43.34	79.99	84.67	97.23
RUN.5	80.77	89.69	68.37	61.55	38.47	76.98	82.70	97.46
RUN.6	80.77	92.99	73.57	62.32	38.47	79.62	83.47	97.69

2- Effect of different organic wastes on Penetration resistance of the sandy soil:

The penetration resistance increased in all organic/soil amendments. This is a positive effect which reflect increasing the cohesion in the sandy soil.

Due to the inherently low resistance in sandy soil under usual circumstances, it was anticipated that adding organic materials (CG, PA, LRHG) would increase resistance. As the application rates of various organic substrates (CG, PA, LRHG) increased, penetration resistance markedly rose, peaking at the 10% application rate. Among the treatments, PA

exhibited the least effect, while LRHG demonstrated the most pronounced increase in resistance.

In sandy soil, this effect is highly beneficial. The naturally low resistance in sandy soil is attributed to its abundance of large pores and low cohesion. As organic substrates are incorporated, the soil begins to aggregate, forming smaller pores that enhance water retention and increase soil cohesion. This creates a more conducive environment for plant growth (Bedaiwy *et al.*, 2019).

In conclusion, organic conditioners effectively enhanced the resistance of sandy soil by increasing it. These effects are beneficial for agriculture, promoting

better conditions for seedling emergence, crop growth, and irrigation efficiency.

After 14 days the effect of the PA was approached to zero, this refers to the lower organic content and water content. After 14 days the effect of the LRHG was very high in 5% & 10% reached to consolidation, this is not a diserable effect. Thats why the concentration of 0.5% and 1% are better.

In general, the penetration resistance (PR) of sandy soil increased with increasing the concentration of different type of the conditioners and interval times. The effect of conditioners types on penetration resistance (PR) with the concentration (5%,10%) was ranked as follows: LRHG > CG > PA where PR values were 2.4,0.4,0.13 while they were 0.18, 0.4,0.13 with the concentration (0.5%,1%). The same trend obtained at time intervals 7 & 14 days with highly significant differences at $LSD=0.05$. The addition of 5 and 10% of LRHG led to the hardness of soil, hence we tested low concentrations (0.5&1%) of LRHG to avoid this problem. The result appeared that the decreasing of conditioners 10 times reduced PR values from 2.4 to 0.18 Kg/cm^2 (reduction percent about 92.5 %) as shown in Fig. (2) and Table (2).

Penetration resistance (PR) increased over time with the application of all organic conditioners. Organic matter incorporation contributes to stabilizing soil structure and increasing PR. As concentrations of PA, CG, and LRHG increased, penetration resistance substantially rose, peaking at the 10% application rate. This effect is generally favorable in sandy soil, though high concentrations of LRHG conditioner showed less favorable results.

The naturally low resistance in sandy soil stems from its abundance of large pores and low cohesion. With the addition of conditioners, the soil begins to aggregate, forming smaller pores that enhance water holding capacity and increase soil cohesion. This creates

a more favorable environment for plant growth. According to Bedaiwy *et al.* (2019), the addition of CG to sandy soil significantly increased penetration resistance.

3- Effect of organic conditioners on evaporation:

The average values of cumulative evaporation (E) as a result of mixing of soil conditioners to sandy soil were plotted as a function of time as presented in Fig. (3). Generally, organic soil amendents mixed with sandy soil decreased soil water evaporation compared to control treatment. The cumulative evaporation was in discending order under concentration 5% as follows: control, CG, PA and LRHG treatments. The average values of E were 8.8,7.9,7.6,7.2 mm for control, CG, PA and LRHG treatments, respectively. While it was ranked at 10 % as follows: control, PA, CG and LRHG. The result appeared that E values decreased with increasing the concentration of LRHG where the reduction percentages were 26,18 and 7 % in the case of addition 10 %,5%,1% of LRHG, respectively as shown in Fig. (3). The addition of organic conditioners retarded and reduced evaporation from surface layer of sandy soil depending on surround weather condition, type and concentration of the conditioners. So, this is useful under drip irrigation and greenhouses. In spite of, the high concentration (5& 10 %) of LRHG reduced evaporation by 18 to 26 % while the addition of 1% of this conditioner reduced only 7 % of evaporation as shown in Fig. (3) but as the same time After 14 days the effect of the LRHG was very high in 5% & 10% reached to consolidation as shown in Fig. (2). We can conclude should be make compromise between the effect of a LRHG concentrations on mechanical and hydro physical properties of soil to recommend a proper concentration of this conditioner as a soil amendment to obtain the best plant growth.

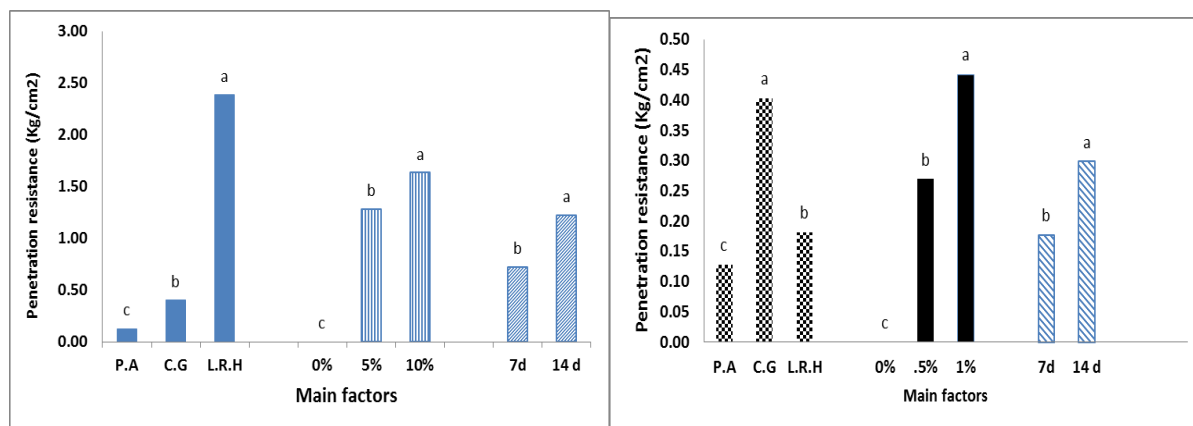


Fig. 2. Effect of Coffee grounds (CG) (A), Plant ash (PA) and Low released Humic granules (LRHG) concentrations on penetration resistance of sandy soil

Table 2. ANOVA of effect of soil amendment types, concentrations and time intervals on on penetration resistance of sandy soil

	ANOVA	F-test	ANOVA	F-test
Main Effects:			Interaction:	
Conditioner		***	Condition*Concentration	***
concentration		***	Condition *Time	***
Time		***	Concentration *Time	***
			Condition*Concentration*Time	***
LSD _{0.05}	Conditioners =0.0614	Concentration= 0.0614 (0.5, 1 %)	Duration = 0.0501	
	ANOVA	F-test	ANOVA	F-test
Main Effects:			Interaction:	
Conditioner		***	Condition*Concentration	***
concentration		***	Condition *Time	*
Time		***	Concentration *Time	***
			Condition*Concentration*Time	**
LSD _{0.05}	Conditioners ==0.0422	Concentration= 0.0422	Duration = 0.0344	

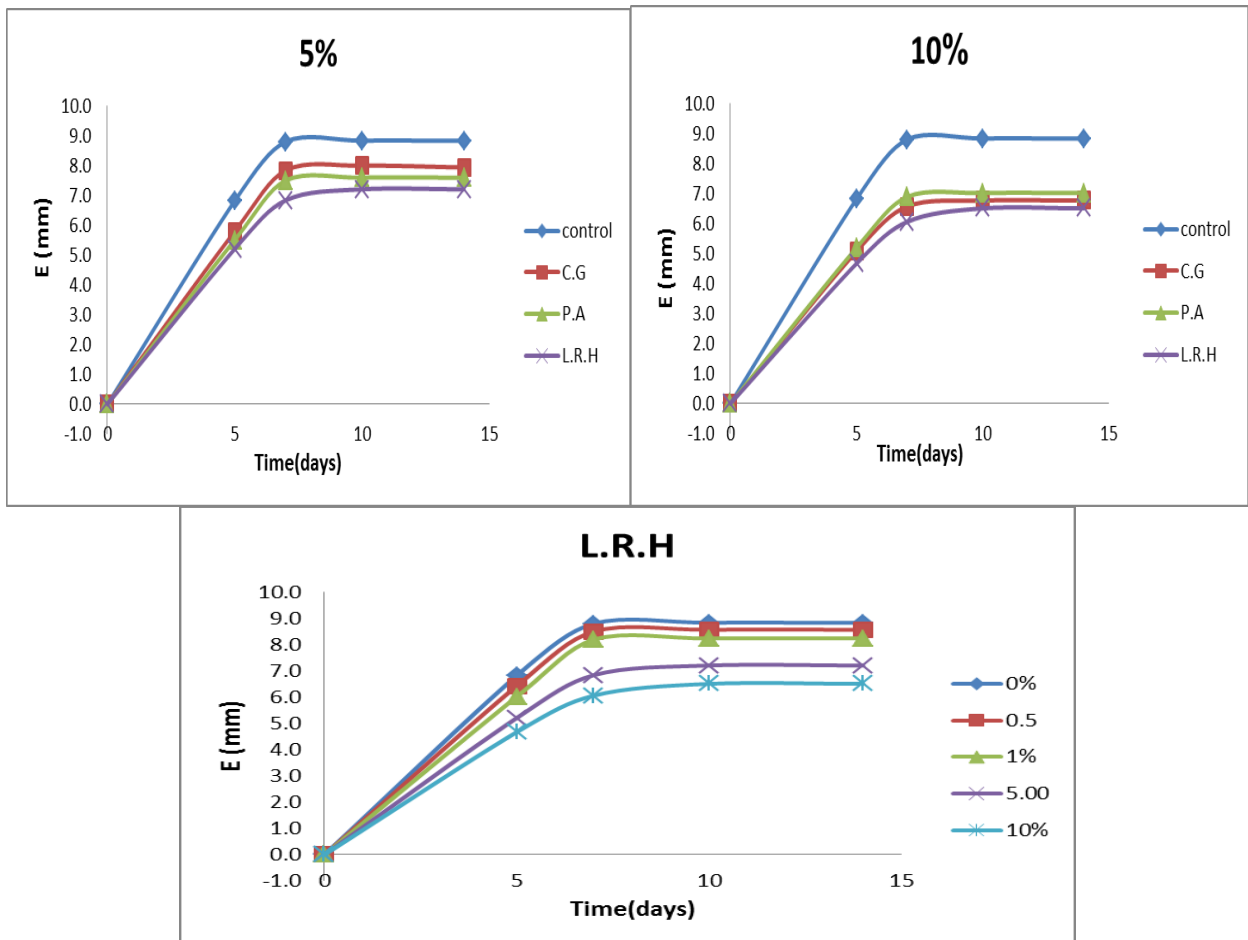


Fig. 3. Cumulative evaporation as a function of time under different concentrations of soil conditioners

The result of cumulative evaporation (E) in Fig. (4) showed that there was no significant differences between CG&PA while there was a highly significant differences between LRHG & (CG,PA).

The cumulative evaporation (E) of sandy soil decreased with increasing the concentration of different type of the conditioners. The result appeared there was a highly significant differences between the concentration of conditioners. Also the result depicted in Fig. (4) and Table (3) revealed that E increased up to 1 week then the evaporation from surface layer ceased there was no significant in E values after 10 & 14 days of starting evaporation process while there is a significant difference in period less than one week.

Organic amendments effectively decrease the evaporation rate of soil through improved soil structure, increased organic matter content, mulching effects, and enhanced microbial activity.

Mechanisms of decreased evaporation discussed as follows:

1. **Improved Soil Structure:** by increasing porosity and aggregate stability. This improved structure enhances water infiltration and retention, reducing the rate at which water is lost through evaporation.
2. **Increased Organic Matter Content:** The addition of organic matter increases the soil’s water-holding capacity. Organic matter can hold several times its weight in water, providing a reservoir that reduces the need for frequent watering and slows evaporation.
3. **Mulching Effect:** Organic amendments often act as a mulch on the soil surface, creating a physical barrier that reduces direct evaporation. This layer can also reduce soil temperature, further decreasing the rate of evaporation.

4. Enhanced Microbial Activity: Organic amendments boost microbial activity, which can enhance soil structure and organic matter decomposition. The byproducts of microbial activity, such as polysaccharides, can improve soil aggregation and water retention (Pettit, 2004; Blanco-Canqui and Lal, 2007 and Zhang *et al.*, 2019).

Zhang *et al.* (2019) observed that straw mulch significantly decreased soil surface evaporation by providing a protective layer that reduced direct exposure to sunlight and wind.

The study by Blanco-Canqui and Lal (2007) concluded that organic amendments enhance soil structure and increase organic matter content, leading to reduced evaporation.

Cumulative evaporation from a bare soil surface is influenced by soil texture. Greater evaporation losses from silt loam compared to sandy loam and loamy sand can be attributed to the higher transmission rate of water in silt loam, especially in dry conditions. Evaporation tends to increase as soil texture becomes finer in the dry range. Under higher evaporation (E) rates, a dry soil surface forms, which reduces water loss through evaporation. A loose, dry soil surface can disrupt capillary continuity in pores, thereby limiting evaporation losses. Desorptivity is a soil physics term used to describe the soil’s ability to release water through evaporation. Theoretical studies indicate that during the falling rate stage of evaporation, when water becomes scarce, the evaporation rate is proportional to the square root of time.

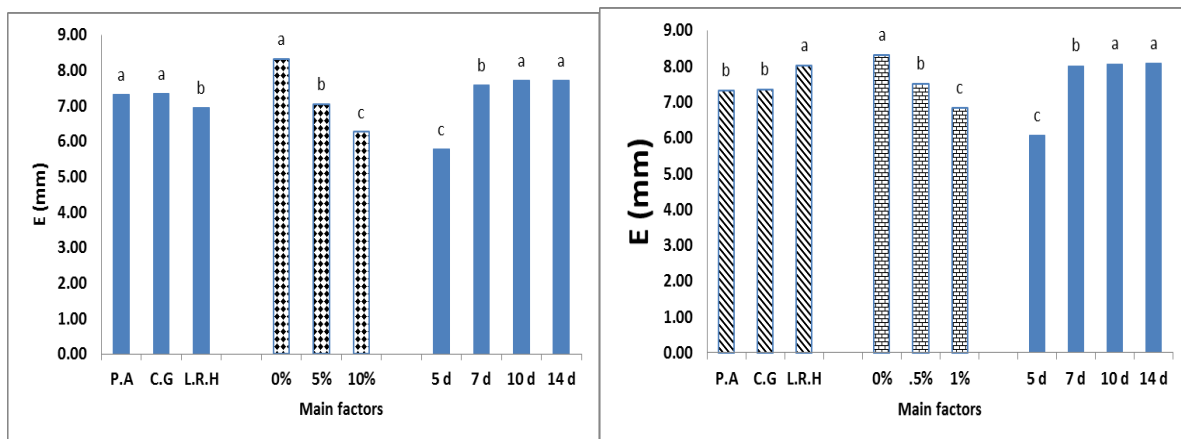


Fig. 4. Effect the type of conditioner, concentration (0,5,10) and duration on cumulative evaporation from sandy soil

Table 3. ANOVA of effect of soil amendment types, concentrations and time intervals on on cumulative evaporation of sandy soil

ANOVA		F-test	ANOVA		F-test
Main Effects:			Interaction:		
Conditioner		***	Condition*Concentration		***
concentration		***	Condition *Time		***
Time interval		***	Concentration *Time		***
			Condition*Concentration*Time		ns
LSD _{0.05}	Conditioners =0.0447	Concentration= 0.0447	Duration = 0.0516		
(0.5&1%)					
ANOVA		F-test	ANOVA		F-test
Main Effects:			Interaction:		
Conditioner		***	Condition*Concentration		***
concentration		***	Condition *Time		***
Time		***	Concentration *Time		***
			Condition*Concentration*Time		ns
LSD _{0.05}	Conditioners ==0.0399	Concentration= 0.0399	Duration = 0.0461		

CONCLUSION

This work was conducted to assess the impact of different organic conditioners on some hydraulic and mechanical properties plus evaporation of Al-Bustan sandy soil. The treatments were control (without conditioner), coffee grounds (CG), plant ash (PA) at concentrations 5% and 10%, while low-release humic granular (LRHG) treatment was at 0.5%, 1%, 5%, and 10%, relative to the volume of sandy soil.

The addition of organic conditioners decreased hydraulic conductivity in sandy soil by promoting the formation of soil micro-aggregates. For instance, applying 0.5% LRHG to sandy soil reduced Ks from 5.19 (control) to 3.19 m/day after 6 runs, representing a 38.47% reduction. Additionally, results indicated that 1% LRHG yielded similar Ks values as both 5% CG and 5% PA treatments.

The addition of 5 and 10% of LHRG led to the hardness of soil, hence we tested low concentrations (0.5 and 1%) of LRHG to avoid this problem. The result appeared that the decreasing of conditioners 10 times reduced PR values from 2.4 to 0.18 Kg/cm² (reduction percent about 92.5 %).

It is necessary to make comparison between the effect of a LRHG concentrations on mechanical and hydro physical properties of soil to recommend a proper concentration of this conditioner as a soil amendment to obtain a good media for the desired plant growth.

The results showed that the incorporation of both CG and PA with sandy soil with the concentration of 5% and 1% of LRHG obtained the reasonable of studied parameters.

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الملخص العربي

تأثير المحسنات العضوية على بعض الخواص الهيدروفيزيائية والميكانيكية للتربة الرملية

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قيم Ks إلى ٩٣% و ٦٣% و ٩٨% في كلا من معاملات CG و PA و LRHG على التوالي مقارنة بالكنترول. وكانت أعلى قيم لمقاومة التربة للاختراق (PR) هي 2.4، 0.40، 0.13 (كجم/سم^٢) في معاملات LRHG، CG، PA على التوالي. وكانت هناك اختلافات معنوية كبيرة للغاية بين المعاملات. انخفض متوسط قيم نسب الانخفاض في البخر في حالة إضافة المحسنات العضوية مخلوطة بالتربة الرملية في معاملات LRHG و PA، CG).

أظهرت نتيجة البخر التراكمي (E) عدم وجود فروق معنوية بين PA&CG في حين كانت هناك فروق معنوية عالية بين LRHG&(CG,PA). وأظهرت النتيجة وجود فروق معنوية عالية بين تركيزات المحسنات. بينما كانت هناك فروق معنوية في الفترة الأقل من أسبوع واحد.

يمكننا أن نستنتج أنه يجب إجراء مقارنة بين تأثير تركيزات LRHG على الخواص الميكانيكية والهيدروفيزيائية للتربة للتوصية بتركيز مناسب لهذا المحسن كمغذى للتربة للحصول على أفضل نمو للنبات.

أجريت تجارب معملية لفحص وتقييم تأثير المخلفات العضوية المختلفة على بعض الخواص الهيدروليكية والميكانيكية والبخرالتجمعي لتربة رملية من منطقة البستان بمصر. تم اختبار ثلاثة محسنات للتربة بتركيزات مختلفة كانت كالآتي: القهوة المطحونة (CG)، رماد النبات (PA) بتركيز ٥% و ١٠% والهيوميك الحبيبي منخفض الانطلاق (LRHG) (٥%، ١%، ٥% و ١٠%) على أساس حجم التربة الرملية بالإضافة إلى معاملة الكنترول.

هدفت الدراسة إلى تحسين بعض الخواص الهيدروليكية والميكانيكية للتربة الرملية بالإضافة إلى التبخر من الطبقة السطحية للتربة الرملية نتيجة اضافة المخلفات العضوية. تم إجراء ثلاث تجارب معملية منفصلة على عينات من التربة الرملية.

تم تعرض التجربة الأولى لدورات التجفيف والابتلال لفحص وتقييم تأثير المخلفات العضوية على التوصيل الهيدروليكي المشبع، أما التجربة الثانية والثالثة فكانت لمقاومة التربة للاختراق (PR) بعد أسبوع وأسبوعين من وقت البدء والبخر للتربة الرملية عند ٥، ٧ و ١٠ و ١٤ يوماً. أشارت النتائج إلى أن المخلفات العضوية أدت إلى انخفاض قيم التوصيل الهيدروليكي المشبع في التربة الرملية.