An attempt for ameliorating the calcareous soil behaviour and its productivity

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Abstract: A split experiment with three replicates was conducted at the farm of Nubaria Agricultural Research Station (Calcareous loamy sand soil), in a two successive winter 2013/2014 & 2014/2015 and summer 2014 & 2015 seasons on wheat (Giza168 variety) and maize planting (single cross 162 hybrid) to study the role of some different organic conditioners, as rice straw (R.S), sawdust (S.D) and compost (Comp.) under three irrigation intervals, 14 days Ir_1, 21 days Ir_2 and 28 days Ir_3) on improvement some physical-chemical soil properties, and crop productivity (wheat and maize plants) under calcareous soil conditions. The obtained results could be summarized as follows; applied of irrigation water each 21 days Ir_2 with compost application treatments were increased dry stable structure units ≥ 2mm diameter. The highest mean values for dry stable structure units≥2 mm diameter 69.47% was remarked by interaction Ir_2*Comp treatment. The superiority mean values of aggregate state and it's degree were (51% and 48.5%) obtained from the interaction of Ir_2*comp treatment. The same treatment was ascertained a highest mean values for aggregation stability index with 0.7 value as an average of two years. On the other hand, the R.S treatment was markedly the highest mean value for hydraulic conductivity with the three irrigation intervals followed by S.D treatment as an average of the two years. All treatments either irrigation intervals or the different organic conditioners and their interactions, significantly increased the soil organic content than the initial one or control. Soil pH was slight decreased significantly by the interaction of Ir_2 * comp. treatment and after two winter and summer seasons. Both of R.S and Comp. with Ir_2 were ascertained significantly increasing than the control in 1000 grain weight (g) and grain yield ton ha-1 of wheat crop during two winter seasons. On the contrary, the S.D treatment was recorded slightly significant increasing than the control in 1000 grain weight and the variation between the S.D and the control treatments in the grain yield was insignificantly at the first winter season. Concerning the maize crop the irrigation intervals treatments caused a significant decreasing from Ir_1 to Ir_3 in each of 100 grain weight (g), grain yield and dry matter (g). The mean values of relative increasing yield (R.I.Y) for both crops were achieved pronounced increasing from the first season to the second season due to applied all treatments and the superiority value was ascertained by treatment Ir_2* Comp. From all above results, it is useful to use organic conditioners, as rice straw and sawdust in improvement the hydro-physical soil properties besides increasing the respond of grain yield for two crops from first to second years. Furthermore, the interaction of Ir_2 *compost treatment was ascertained highest improving soil properties and get high productions for wheat and maize crop. It is clearly seen from the experiment that the application of composite is more useful in enhancing the tolerance of plant to drought. Moreover, addition of RS and SD gave good results for improving the physical and chemical characteristics as well as crop productivity under the condition of the experiment.
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1. Introduction

Soils play a vital role in progress the country, for necessary need to face food and dress in Egypt, most soils in the desert areas either sandy or calcareous have to be put under cultivation. Such soil characterised, i.e. by poor organic content, weak soil structure, high water retention capacities, excessive deep percolation, and causing inefficient water use, crusting, cracking that negatively effect on root penetration and low rate of infiltration (FAO, 2016). These problems adversely affect most of the physical and hydraulic properties, in addition, nutritional status of such soils (**Abd El Halim and El Baroudy, 2014**). Subsequently, the productivity of this soil was limited for these above mentioned reasons. Soil organic conditioners might be a good mean to ameliorate some of above mentioned constrains. In Egypt, fine sawdust (S.D) is considered as one of agricultural wastes, obtained from a lumber sawmills, and till now, have very few profitable uses. Sawdust may be disadvantage and desirable use as soil conditioner because of its slow rate of decomposition and on the other site, its benefits in improving the hydro- physical properties of the soil. Another important conditioners for using was rice straw (R.S). Rice straw has become a very serious problem in Egypt due to the huge production of straw of about 20 million tons year^{-1} **ToufiqIqbal (2016).** Recycling of rice straw is reported to increase the organic in soil, contains numerous elements essential for plant growth, approximately 40% of N, 30 to 35% of P, 80–85% of

K, and 40–45% of S taken up by rice remain in the straw at crop maturity. It also contains different biopolymers such as cellulose (32–37%), hemicellulose (29–37%), and lignin (5–15%) have an important role in improving soil hydro- physical properties, **Esawy et al., (2009).** Compost (Comp.) as an organic conditioner which is matured in C/N ratio and rich in nutrients needed to plant growth has a very important role to the comparison between the other previous conditioners, in order to achieve the best amelioration for soil properties and its productivity.

Due to the scarcity resources of water in Egypt, irrigation intervals must be designed to deplete the soil water to mild stress levels at the same time avoid reducing the yield production. This can be achieved by the reduction of the number of irrigation per seasons, which can allow adequate water amount per irrigation at critical growth stage, **Azza et al., (2015).**

Both of wheat and maize crops were chosen for this experiment not only for its important as economic crops for human and animals life also for its ability to tolerate the stress which may be happened due to the conditions of this experiment. Therefore, the present study aims to investigate the effect of different organic conditioners (S.D, R.S and Comp.) applied under irrigation intervals Ir_1, Ir_2 and Ir_3 to ameliorate some soil properties and enhance its production.

2. Materials and methods

A research study was conducted in two successive winter 2013/2014 & 2014/2015 and summer 2014 & 2015 seasons at the farm of Nubaria Agricultural Research Station (calcareous loam sand soil), to study the role of some different organic conditioners as, rice straw (R.S), sawdust (S.D) and compost (Comp.) under three irrigation intervals Ir_1, Ir_2 and Ir_3 on improvement some physical- chemical properties and crop productivity (wheat and maize plants) under calcareous soil conditions. Some physical and chemical properties of initial tested soil and organic conditioners were determined according to **Black et al., (1965)** and presented in Tables (1, 2 and 3).

Table (1): Some soil physical analysis of the investigated site for two experimental winter and summer Seasons.

Experimental year	Mechanical analysis			Soil texture	K_h cmhr^{-1}	Bd gcm^{-3}
	Sand%	Silt %	Clay%			
Winter2013/2014	54.49	23.21	22.30	S.L	1.85	1.23
Winter 2014/2015	55.18	22.69	22.13	S.L	1.90	1.26
Summer 2014	54.93	21.93	23.14	S.L	1.99	1.29
Summer 2015	56.59	22.02	21.39	S.L	1.96	1.27

Table (2): Some soil chemical analysis of the investigated site for two experimental winter and summer seasons.

Exp. year	Soil pH (1:2.5)	E.C (dSm^{-1})	Available macronutrients (ppm) mgkg^{-1}			Total N%	OC%	$CaCO_3$%
			N	P	K			
Winter 2013/2014	8.4	2.39	39.5	2.42	77.3	0.16	0.27	22.31
Winter 2014/2015	8.31	2.37	41.3	2.62	79.50	0.18	0.29	23.01
Summer 2014	8.34	2.49	43.1	2.60	86.22	0.12	0.25	22.30
Summer 2015	8.31	2.43	42.0	2.58	82.39	0.13	0.26	23.09

Table (3): Chemical analysis of used conditioners samples for two winter experimental seasons.

Exp. year	Conditioner type	pH 1:10	E.C (dSm^{-1})	OC%	Total N %	C/N ratio	Total P%	Total K%	C/N ratio
2013/2014	comp	7.23	2.9	23.02	1.34	17.18	0.5	1.68	17.18
2014/2015	comp	7.30	3.1	23.43	1.38	16.97	0.62	1.70	16.97
		pH 1:10	E.C (dSm^{-1})	OC%	Total N %	C/N ratio	P %	Total K%	C/N ratio
2013/2014	R.S	7.1	1.65	78.8	0.58	135.9	0.081	2.45	135.9
	S.D	4.65	0.45	99.5	0.37	269	0.006	0.08	269
2014/2015	R.S	7.09	1.66	78.8	0.59	133.6	0.08	2.42	133.6
	S.D	4.67	0.45	99.55	0.38	262	0.006	0.079	262

Experimental treatments:

➢ **Irrigation intervals (Ir)**

The irrigation intervals treatments were applied after first and second irrigation 21 days. The irrigation intervals applied as following:

- Ir_1 irrigation each 14 days,
- Ir_2 irrigation each 21 days,
- Ir_3 irrigation each 28 days.

➢ **Conditioners types (Cr)**

Three conditioners were grinded to less than 5mm and applied inequal rate of each other from O.C %**(**10 g organic carbon from each conditioner to each Kg soil) in addition to control.

- Rice Straw (R.S),
- Sawdust (S.D),
- Compost (Comp),
- Control treatment (cont. without conditioners).

Winter field experiment

The experimental design was arranged in split plot with three replicates. Irrigation intervals were tested as main plots, while the conditioners treatments were arrangement as sub-main plots. The experimental field was prepared, homogeneously mixed with the conditioners at the topsoil to approximate 30cm depth before cultivation grains of wheat (Giza 168 variety) were planted at the rateof144 Kgha^{-1} in the second week of November for each winter seasons. The experimental Plot area was 15m^2. Phosphorus fertilizer was added at rate of 108 Kg P_2O_5 ha^{-1} in form of mono-superphosphate (15.5%P_2O_5) at the land preparation. Nitrogen fertilizer at the rate of 240 kg N ha^{-1} was added as ammonia gas 82% N which was injected directly into the moderately moist soil at 15 cm depth with 30 cm spacing between points of injection before planting according to the injection technique previously used by **Farrag et al., (2011).** Potassium fertilizer in the form of potassium sulphate (48% K_2O) at the rate of 57.6 Kg K_2O ha^{-1} was added at two equal doses after 45 and 75 days from sowing. All the fertilizers were added according to the recommendation of Ministry of Agriculture.

Summer field experiment

In two summer seasons 2014 and 2015seeds of maize (single cross 162 maize hybrid) were cultivate at rate of 28.8 Kg ha-1 during the first week of May for each seasons to study the residual effect of the applied conditioners under the same irrigation intervals treatments. Each experimental plot consisted of 4 rows (5m long and 0.70 m apart) with a total area 15m^2. Recommended doses of phosphorus mineral fertilizer 108kg P_2O_5ton h^{-1}, potassium fertilizer115.2 K_2O h^{-1}and nitrogen fertilizer 288kg N h^{-1} were added as mentioned.

At harvesting stage, soil samples at depth 0-30 cm were collected in each season for determination of soil physical and chemical properties. Size distribution of stable aggregates was determined by using stability of dry aggregates according to the method of **Richards (1954).** Also, aggregates state, aggregation degree and aggregation index were calculated according to **Richards (1954),** and used particles diameters size 2mm (S1), 2-1mm (S2), 1-0.5mm (S3), 0.5- 0.25(S4) mm, 0.25-0.125mm (S5), 0.125-0.063mm (S6) and less than o.063 (S7). Undisturbed soil samples were taken using soil cores for surface layers 0-30 to determined hydraulic conductivity and soil pH measured in root zone after 90 days from planting according to **(black, et al. 1965).** Organic carbon (OC%) was determined according to Walkley and Black method as described by **Hesse (1971).**

Total yield for each plot for different seasons were weighed and converted to ton ha^{-1}. Dry weight of wheat straw ton ha^{-1}, maize stover ton ha^{-1}, 1000 wheat grain weight (g) and 100 maize grain weight (g) were estimated.

- **Aggregation state % (Agg.state)**

  = sum the diameters after dispersion X 100

- **Aggregation degree % (Agg.degree)**

$$\frac{\text{sum the diameters undispersion} - \text{sum the diameters after dispersion}}{\text{Sum the diameters undisperion}} \times 100$$

- **Aggregation stabilization index (A.S.I)**

  = (sum the diameter undispersion - sum the diameter after dispersion) X0.02(Factor) 0.02= Fixed factor

- **Relative increasing in grain yield =**

$$\frac{\text{Grain yield of treatment tonha}^{-1} - \text{grain yield of control tonha}^{-1}}{\text{Grainyield of control tonha}^{-1}} \text{X100}$$

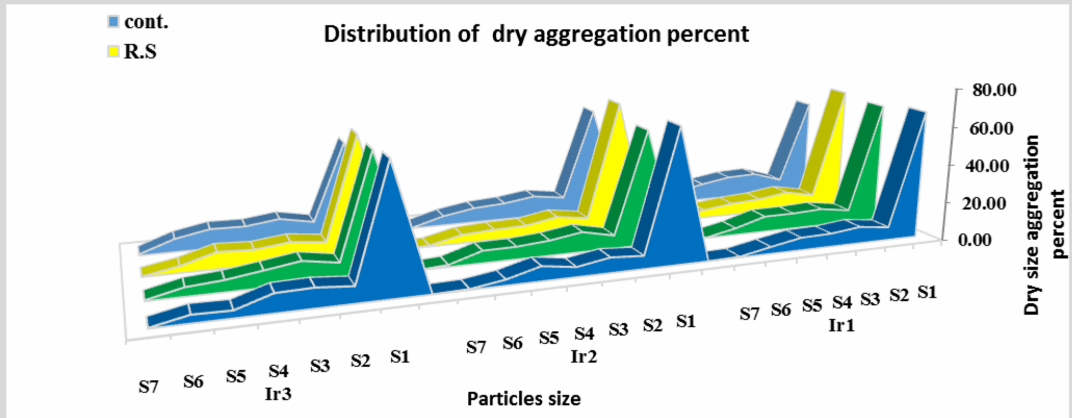
Data were subjected to statistical analysis of variance and treatment means were compared according to the Least Significant Differences (L.S.D. at 0.05). The collected data were statistically analyzed according MSTAT **(1990).**

3. Results and discussions

Effect of irrigation intervals with different conditioners on some soil physiochemical soil properties

Dry aggregation size distribution %

Fig (1) shows the effect of irrigation intervals on dry aggregate size distribution that obtained data reveal that mean values of particles size equal or more than 2mm increased with irrigation intervals Ir_2compared to Ir_1 and Ir_3 by 2.67% and 7.21%, respectively. As well as, the particles size less than 0.5mm to 0.25mm were significantly decreased with irrigation interval Ir_2compared to irrigation intervals $Ir_1$and Ir_3. Also, the variations between the particles size less than 0.25mm by irrigation intervals Ir_1, Ir_2 and Ir_3 were significantly. The lowest values were recorded to irrigation interval Ir_2.



	S1	S2	S3	S4 Ir1	S5	S6	S7		S1	S2	S3	S4 Ir2	S5	S6	S7		S1	S2	S3	S4 Ir3	S5	S6	S7
cont.	52.	7.3	12.	11.	9.2	5.8	0.4		57.	9.1	11.	9.0	7.9	5.1	0.3		50.	8.8	12.	9.9	10.	6.9	0.6
R.S	65.	6.7	9.7	7.4	6.4	4.3	0.4		67.	6.6	9.0	5.9	5.5	4.5	0.5		61.	8.0	9.9	7.9	8.6	3.5	0.2
S.D	63.	6.7	9.1	8.3	8.3	3.5	0.1		60.	6.9	10.	7.9	6.6	6.4	1.1		61.	8.2	11.	8.4	5.8	4.5	0.4
Comp.	66.	6.7	8.7	6.9	6.6	3.6	0.4		69.	6.7	7.8	5.0	7.5	2.9	0.4		64.	8.2	9.7	9.3	3.6	3.9	0.2

Fig (1): Effect treatments on dry aggregation size distribution average of two years 2014 and 2015 experiments

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Particles size	**L.S.D. 0.05**		
	Ir	**Cr**	**Ir*Cr**
≥2mm (S1)	**1.1040**	**1.2750**	**2.2080**
2-1mm (S2)	**0.2907**	**0.3356**	**0.5813**
1-0.5mm (S3)	**0.2500**	**0.2887**	**0.5000**
0.5-0.25mm (S4)	**0.2430**	**0.2806**	**0.4861**
0.25-0.125mm (S5)	**0.2344**	**0.2707**	**0.4688**
0.125-0.063mm (S6)	**0.2396**	**0.2767**	**0.4793**
<0.063mm (S7)	**0.0083**	**0.0096**	**0.0166**

Ir= irrigation intervals. Cr= organic conditioner.

On the other hand, the effect of different conditioners was illustrated at same Fig (1). Compost (comp.) treatment ascertained superiority values compared to control and other conditioners rice straw (R.S) and sawdust (S.D) for the particles size ≥ 2mm. In general, compost treatment was increased the coarse aggregates ≥2mm by 25.8%, 3.31% and 8.53 compared to control, R.S and S.D treatments, respectively. Moreover, the particles sizes ≥2mm of the conditioners were arranged in descending order as follows; compost > rise waste >sawdust>control. It was be noticed that, the dry aggregation size distribution tended to increase the coarse size equal or more than 2mm due to application of organic conditioners. As large aggregation fractions (macro-aggregate) was composed of small aggregation fraction so that associated a decrease in micro- aggregates this result is a harmony with that reported by (**Yang et al., (2007).** The highest value for the size particles ≥2mm was achieved by interaction irrigation interval Ir_2 with compost treatment which was 69.47%. On the other hand, there are a significant increasing for the same size ≥2mm by applying each of R.S and S.D and comp with all irrigation intervals compared to control treatment.

Aggregation state and their degree

Furthermore, aggregation state and its degree were considered two parameters to measure the formation and stabilization of soil aggregate. Obtained results in Fig. (2) indicated that the aggregation state were increased as a result of applying irrigation interval Ir_2 by 3.2% and 6.58% than the Ir_1 and Ir_3, respectively. At the same time, Ir_1 was increased aggregation degree by o.8%, and 3.6% than applying Ir_2 and Ir_3. It will be taken into consideration that the difference between the aggregation degree caused by applied Ir_1 and Ir_2 was insignificantly. It was also obvious, that the longest irrigation interval Ir_3 result in a perceivable decreasing of the percentage of aggregation state and their degree as compared with the shorter irrigation intervals Ir_1 and Ir_2. This may be due to the phenomenon frequently wetting and drying soil particles under short irrigation intervals as Ir_1 and Ir_2 differential swelling and shrinkage since it promotes the formation and stabilization of soil aggregations. These result are agree **El-Fayoumy and Mohamed (2001).**

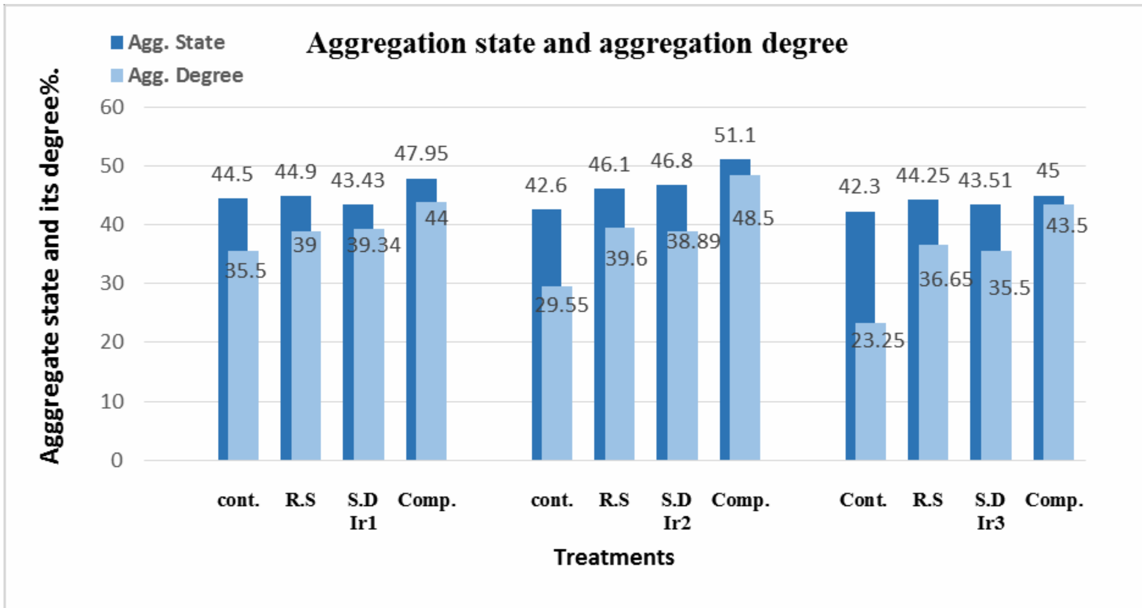

Fig (2): Effect of Treatments on aggregation state% and aggregation degree % average of two years2014 and 2015.

Items	L.S.D. 0.05		
	Ir	Cr	Ir*Cr
Aggregation state Agg. state	**0.911**	**1.052**	**1.822**
Aggregation degree Agg. degree	**0.703**	**0.813**	**1.41**

Ir= irrigation intervals. Cr= organic conditioners types

Results in Fig (2) also revealed that all different conditioners were effective on the percentage of aggregation state and their degree. Values of Agg. state and its degree were 48.02% and 45.33% by compost treatment which were superior compared to the control or R.S and S.D conditioners. While, R.S was approximately similar to S.D and both increased significantly the Agg. state and degree compared to the control treatment. From the above mentioned, the highest values for Agg. state and their degree were obtained by interaction irrigation Ir_2 with compost treatment as remarked (51.1% and 48.5%), respectively. This is may be due to the positive role of compost (matured organic residual) as release a cementing agent to form org-mineral complex and the formation of coarse aggregates due to short irrigation intervals Ir_1 and Ir_2 more than the longest one Ir_3.

Aggregation stability index A.S.I

It is worth to be mentioned that excellent aggregation index must be its value close to one **Yang et al. (2007).** Data in Fig. (3) Illustrates that the aggregation stability index (A.S.I) as a result of the interaction between all treatments. It is cleared, that the irrigation intervals were effected on the A.S.I values, the maximum mean value remarked by applied Ir_2treatment was (0.57) which considered a good A.S.I. Moreover, the difference between the Ir_1, Ir_2 and Ir_3 was slightly significant.

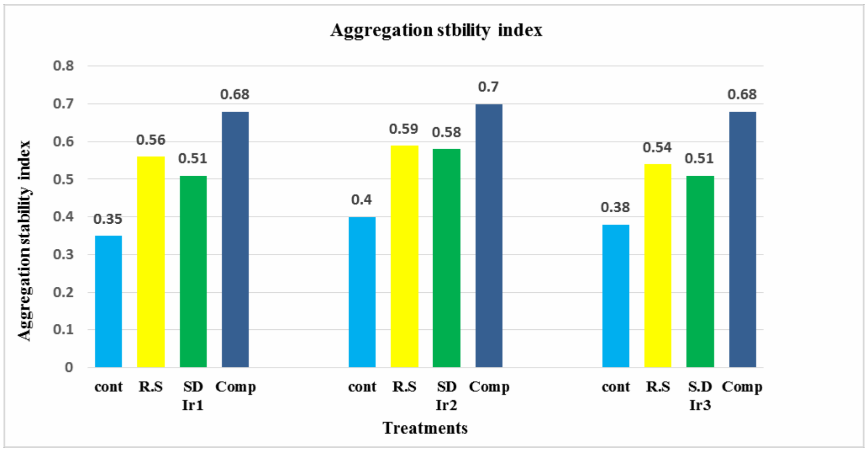

Fig (3). Effect of treatments on aggregation stability index % average two years 2014 and 2015.
L.S.D at 0.05Ir=0.371 Cr= 0.0428 Ir*Cr=0.741
Ir= irrigation intervals. Cr= of organic conditioners types.

Data in Fig (3) also showed that, the control treatment has a poor A.S.I value and the A.S.I values arranged in ascending order as following; control<S.D<R.S<comp. The R.S and S.D treatments were ascertained a good A.S.I while compost treatment remarkable a very good A.S.I mean value by approximate value (0.69).

As a general trend, the obtained result in Fig (3) revealed that, the interaction of irrigation intervals with different conditioners increased significantly A.S.I compared to the control. The variations degree of A.S.I between treatments and their interaction depend on the short and long irrigation intervals and state of conditioners decompositions. The maximum value was obtained from Ir_2 with compost treatment which it was 0.7 and considered to somewhat very good aggregation stability index A.S.I.

Hydraulic conductivity cm hr^{-1}

Fig (4) demonstrate that, the increasing irrigation intervals from Ir_1, $Ir_2$and Ir_3 was associated with a slight significant increasing in soil K_h that the mean values from 3.19,3.35to 3.39cmhr^{-1}. At the same time, data revealed that K_h values was more effective by different type of conditioners application. The mean values of K_h were arranged in the ascending order as following control< compost<sawdust < rice straw. This may be due to modification in pore size distribution, i.e., increase the drainable pores, reducing in bulk density. Therefore, the high K_h value for the R.S and S.D may be due to the mechanical action for their sizes. In this respect, the K_h value of Ir_3 combined with R.S treatment was ascertained the superiority value than all other treatments and remarked 4.49 cm hr^{-1} this results agree with (**Eusufzai and Fujii, 2012**) and (**Manukaji, 2013**).

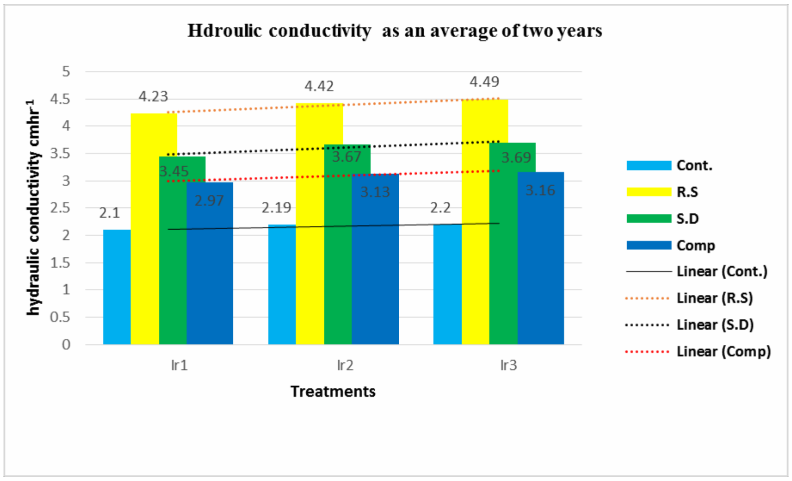

Fig (4) Effect of treatments on hydraulic conductivity cmhr^{-1}(average of two years 2014 and 2015).
L.S.D. at 5% Ir= 0.1334 Cr=0.154 Ir*Cr=0.2267
Ir= irrigation intervals. Cr= organic conditioners types. Soil OC % and pH

Soil organic matter and pH are strongly affect the soil functions and plant nutrient availability. Specifically, Soil organic matter serves multiple functions in the soil, including nutrient retention, water holding capacity, and soil aggregation and is a key indicator of soil quality. pH influences solubility and availability of plant nutrients.

Soil OC%

Data in Table (4) represents the effect of the applied irrigation intervals on soil OC% for each season. The detected changes showed that, the initial content of OC %for tested soil was very low and it increased by using irrigation intervals during winter and summer seasons compared to initial content. During the first winter season OC % mean values were significantly increased from approximate 0.27(initial OC%) to 1.13%, 1.1% and 1.o6 %for Ir_1, Ir_2 and Ir_3, respectively and same behaviour noticed in second winter season. At the same time, the OC% was associated with significant decreasing from Ir_1 to Ir_3 after first and second winter seasons.

On the other hand, there is insignificant difference in mean values of OC% in following two summer seasons between Ir_1, Ir_2 and Ir_3. Moreover, OC% value depend on the type of organic conditioners and its decomposition. In general, mean values of OC% were increased by applying the different organic conditioners as compared to the initial tested soil or the control treatment. It takes into consideration, except the first winter season OC % of compost treatment was recorded greatest mean values of soil OC% following by R.S. From that it can suppose, that the compost is more matured than R.S and S.D. treatments and more stabilized in organic mineral complex and mainly protect against chemical oxidation. This finding are in agreement with the results obtained by **Sarwar et al., (2008).**

Table (4): Effect of treatments on OC% after two winter 2013/ 2014 & and 2014/2015and two summer seasons2014 and 2015.

Treatments	OC% winter season 2013/2014				mean	OC% summer season 2014				Mean
	Cont.	R,S	S.D	Comp		Cont.	R.W	S.D	Comp.	
Ir1	0.64	1.37	1.3	1.22	1.13	0.62	1.05	0.93	1.16	0.94
Ir2	0.66	1.26	1.26	1.22	1.1	0.55	1.06	1.10	1.19	0.97
Ir3	0.63	1.2	1.26	1.16	1.06	0.52	1.06	1.12	1.09	0.95
mean	0.64	1.28	1.27	1.2		0.56	1.06	1.o5	1.15	
	L.S.D. 0.05					L.S.D. 0.05				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.026	0.03	0.052			0.29	0.033	0.057		
Treatments	OC% winter season 2014/2015				mean	OC % summer season 2015				Mean
	Cont.	R.S	S.D	Comp		Cont.	R.S	S.D	Comp	
Ir1	0.8	1.37	1.3	1.42	1.22	0.57	1.15	1.1	1.07	0.97
Ir2	0.64	1.32	1.3	1.5	1.19	0.56	1.16	1.12	1.15	1.00
Ir3	0.72	1.23	1.22	1.46	1.16	0.57	1.19	0.99	1.2	0.99
mean	o.72	1.31	1.27	1.46		0.57	1.17	1.10	1.14	
	L.S.D. 0.05					L.S.D. 0.05				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.030	0.035	0.06			N.S	0.036	0.062		

Ir = mean value of irrigation intervals. Cr= mean value of organic conditioners types

Soil pH

Regarding soil pH, the data in Table (5) indicated that, the application of all treatments recorded significant decreases in the pH values of the soil compared to the initial soil pH. The decreases in soil pH ranged between 0.2 to 0.16 units from Ir_1 to Ir_2 and Ir_3, respectively, as average two winter seasons.

Table (5): Effect of treatments on pH average two winter 2013/ 2014 & and 2014/2015 and two summer seasons 2014 and 2015.

Treatments	Two winter seasons 2013/20014 and 2014/ 2015					Two summer seasons 2014and 2015				
	Cont.	R.S	D.W	Comp	mean	Cont.	R.S	D.W	Comp	mean
	Soil pH 1:2.5									
Ir_1	8.3	8.3	8.4	7.85	8.18	8.26	8.35	8.2	8.22	8.26
Ir_2	8.1	8.0	7.98	7.85	7.98	8.25	8.3	8.25	8.12	8.23
Ir_3	8.2	7.98	7.96	7.93	8.02	8.2	8.3	8.24	8.17	8.23
mean	8.2	8.09	8.11	7.89		8.24	8.32	8.23	8.17	
	L.S.D. 0.05					L.S.D. 0.05				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.134	0.154	0.267			N.S	0.052	0.091		

Ir = mean value of irrigation intervals. Cr= mean value of organic conditioners types

While, soil pH tended to decrease by 0.03 unite from Ir_1 to Ir_2 and Ir_3 as average two summer seasons. On the other side, the minimum mean value of soil pH was obtained by applying the compost treatment after two winter and summer seasons. These results may be due to compost contain low plant residual which base forming cations so cause decreasing pH while both of RS and SD considered a large amount of plant residual (stems) in generally contain more anions so the initial decay cause pH increases this result was confirmed with **Ann. McC, at el. (2017) and Beheiry (2003).**

Effect of irrigation intervals and different conditioners applications on yield and yield components

Wheat crop

Table (6) showed the effect of treatments on yield and its components, 1000 grain yield (g) and grain yield tonh^{-1} of wheat crop were significantly increased by applying Ir_2 than the Ir_1 and Ir_3 for both winter seasons.

While the variation between Ir_1 and Ir_2 in second winter season was insignificant. The superiority mean values for 1000 grain (g) and grain yield (ton ha^{-1}) as average of two winter seasons were 38.75 and 6.97 by applying Ir_2. It was be noticed, that the straw yield tonh^{-1} was associated significantly decrease from Ir_1 to Ir_3 for both winter seasons. The variation in straw yield between Ir_1 and $Ir_2$was insignificant.

On the other side, the highest mean values for 1000 grain (g) and grain yield tonh^{-1} and straw yield tonh^{-1} were recorded by applying compost treatment. The S.D treatment was recorded the lowest mean values for 1000 grain (g), grain yield tonh^{-1} and straw yield tonh^{-1} for both winter seasons. Moreover, mean values of R.I.Y due to interaction of irrigation intervals with the different organic conditioners were 5.7 and 10.32% average of first and second winter seasons, respectively. This increasing response of relative increasing yield (R.I.Y) during two winter seasons might reflect the effects of treatments on soil properties. The magnitude of increasing or decreasing (R.I.Y) during the two winter seasons depend on the quantity of water available during physiology stage of plant growth, types of organic conditioners and their accelerate process of decomposition.

Table 6) Effect of treatments on yield and yield components of wheat crop after two winter seasons 2013/ 2014 and 2014 /2015.

Treatments	2013/2014				mean	2014/2015				Mean
	Cont.	R.S	S.D	Comp		Cont.	R.S	S.D	Comp	
	1000 grain weight (g)									
Ir_1	29.8	37.7	31.7	40.9	35.03	36.8	42.4	40.2	43.8	40.8
Ir_2	31.0	38.0	34.0	42.9	36.5	36.5	41.33	41.20	45.0	41.0
Ir_3	25.4	35.3	29.3	38.8	32.13	31.0	35.0	32.5	41.0	34.8
Mean	28.7	37.0	31.7	40.9		34.8	39.58	38.0	43.27	
	L.S.D. 0.05%					L.S.D. 0.05%				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.46	0.53	0.91			0.42	0.50	0.84		
	Grain yield ton h^{-1}									
Ir_1	6.60	6.75	6.70	7.38	6.86	6.58	7.06	6.75	7.72	7.03
Ir_2	6.43	6.96	6.69	7.72	6.95	6.39	7.01	6.74	7.73	6.99
Ir_3	5.86	5.86	5.35	6.75	5.96	5.6	5.98	5.63	6.72	5.98
Mean	6.3	6.5	6.24	7.3		6.19	6.68	6.37	7.39	
	L.S.D. 0.05%					L.S.D. 0.05%				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.27	0.29	0.50			0.22	0.26	0.41		
	Straw yield tonh^{-1}									
Ir_1	8.50	10.97	8.86	12.19	10.31	10.5	12.11	11.59	12.5	11.68
Ir_2	8.38	10.58	8.50	11.98	9.86	10.5	11.81	10.7	12.4	11.35
Ir_3	6.80	6.87	6.17	8.16	9.33	8.88	9.67	8.88	10.49	9.68
Mean	7.89	9.47	7.84	10.78		9.96	11.2	10.39	11.80	
	L.S.D. 0.05%					L.S.D. 0.05%				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.36	0.39	0.70			0.33	0.38	0.40		
	Relative increasing yield % (R.I.Y) grain yield									
Ir_1		2.27	1.52	11.82	5.2		7.29	2.58	17.33	9.07
Ir_2		8.24	4.04	20.1	10.79		9.70	5.48	20.97	12.05
Ir_3		0	-8.7	15.19	2.16		9.07	0.5	20.00	9.85
Mean		3.5	-3.1	15.7			8.69	2.85	19.43	
	L.S.D. 0.05%					L.S.D. 0.05%				
	Ir	Cr	Ir*Cr			Ir	Cr	Ir*Cr		
	0.58	0.66	1.14			0.52	0.60	1.010		

Ir = irrigation intervals. Cr = organic conditioners types.

Maize crop

Data presented in Table (7) revealed that the application of irrigation intervals were significantly affected on mean values of100 grain weight (g), grain yield ton h^{-1} and dray matter (g) for maize crop from applying Ir1 to Ir3 for two summer seasons. As well as, the difference of mean values for 100 grain weight (g), grain yield ton hr^{-1} and dry matter (g) due to applying Ir_1 and Ir_2 was insignificant for two summer seasons.

The highest mean values were recorded 40.72, 9.60 and 59.78 for 100 grain weight (g), grain yield ton h^{-1} and dry matter (g) as average of two summer seasons due to applying the compost as organic conditioners. Decreasing the mean values of 100 grain weight (g), grain yield ton h^{-1} and dry matter (g) which was caused by applying both R.W and S.D treatments than the control may be due to the microbial activity which consumed some of nutrients needs to plant growth. Concerning mean values of R.I.Y (grain yield), the interaction of Ir_2 with compost treatment were achieved pronounced increases of R.I.Y from 18.8 to 45.89% for the first and second seasons, respectively. These results may be attributed to enhance some soil physical properties and in harmony with those reported by **Ranjan at al., (2006).**

Table (7): Effect of the treatments on yield and yield components of maize crop after two summer seasons 2104 and 2015.

Treatments	2014				Mean	2015				mean
	Cont.	R.S	S.D	Comp		Cont.	R.S	S.D	Comp	
	100 grain weight (g)									
Ir_1	36.65	36.11	35.60	40.93	37.57	35.92	36.66	35.95	41.61	37.54
Ir_2	35.80	36.20	36.02	42.61	37.66	34.94	37.26	36.0	41.99	37.55
Ir_3	33.67	33.30	32.51	37.87	31.34	32.42	34.13	33.2	38.82	34.64
Mean	34.37	33.55	33.38	40.47		32.43	37.67	36.3	40.97	
	L.S.D. 0.05%					L.S.D. 0.05%				
L.S.D.5%	Ir	Cr	Ir*Cr		L.S.D.5%	Ir	Cr	Ir*Cr		
	0.09	0.12	0.20			0.16	0.18	0.35		
	Grain yield ton hr^{-1}									
Ir_1	8.54	8.24	7.74	10.05	8.64	8.15	8.33	8.06	11.26	8.95
Ir_2	7.55	7.95	7.65	8.97	8.28	7.54	7.95	7.74	11.00	8.56
Ir_3	6.44	6.3	6.05	6.97	6.44	7.35	7.65	7.50	9.66	6.67
Mean	7.51	7.5	7.15	8.66		7.68	7.98	7.77	10.64	
	L.S.D. 0.05%					L.S.D. 0.05%				
L.S.D.5%	Ir	Cr	Ir*Cr		L.S.D.5%	Ir	Cr	Ir*Cr		
	0.29	0.34	0.55			0.28	0.32	0.54		
	Dry matter (g) $plant^{-1}$									
Ir_1	55.42	54.32	53.46	61.35	56.14	59.91	58.26	55.99	62.96	59.28
Ir_2	53.16	54.2	52.81	62.11	55.57	58.11	56.91	54.29	63.13	58.11
Ir_3	50.12	47.35	46.98	52.23	49.17	53.07	54.26	52.97	56.93	54.31
Mean	52.9	51.96	51.08	58.56		57.03	56.48	54.42	61.01	
	L.S.D. 0.05%					L.S.D. 0.05%				
L.S.D.5%	Ir	Cr	Ir*Cr		L.S.D.5%	Ir	Cr	Ir*Cr		
	0.30	0.35	0.61			0.29	0.361	0.562		
	Relative increasing yield % (R.I.Y)									
Ir_1		-3.51	-9.37	17.68	1.6		2.2	-1.1	38.16	13.08
Ir_2		5.30	1.32	*18.8*	8.47		5.44	2.65	45.89	18.00
Ir_3		-2.17	-6.06	8.23	0		4.08	2.04	31.43	12.52
Mean		-0.13	-4.7	23.6			3.91	3.59	38.49	
L.S.D.5%	Ir	Cr	Ir*Cr		L.S.D.5%	Ir	Cr	Ir*Cr		
	0.53	0.58	0.996			0.56	0.65	1.13		

Ir= irrigation intervals. Cr= organic conditioners types.

The highest mean values were recorded 40.72, 9.60 and 59.78 for 100 grain weight (g), grain yield ton h^{-1} and dry matter (g) as average of two summer seasons due to applying the compost as organic conditioners. Decreasing the mean values of 100 grain weight (g), grain yield ton h^{-1} and dry matter (g) which was caused

by applying both R.W and S.D treatments than the control may be due to the microbial activity which consumed some of nutrients needs to plant growth. Concerning mean values of R.I.Y (grain yield), the interaction of Ir_2 with compost treatment were achieved pronounced increases of R.I.Y from 18.8 to 45.89% for the first and second seasons, respectively. These results may be attributed to enhance some soil physical properties and in harmony with those reported by **Ranjan at al., (2006).**

Conclusion

On the light of the present data and under the calcareous soil conditions, it seems evident that the application of compost at rate 10g OC / kg soil under irrigation every 21 days markedly enhanced some soil hydro physical properties and its wheat and maize crops production. As well as, the addition of rice straw and sawdust at 10g OC / kg soil was achieved pronounced increase in hydraulic conductivity besides respond increasing to the effect of all organic conditioners in second year. More study must be done to get more information about this different types of conditioners combining with irrigation interval and its role to improvement soil under calcareous conditions.

Reference

1. Abd El Halim A. A. and A.A. El Baroudy (2014): Influence addition of fine sawdust on the physical properties of expansive soil in the middle nile delta, egypt Journal of Soil Science and Plant Nutrition,, 2014, 14 (2), 483-490.
2. Ann McCauley; Clain Jones.; and Kathrin Olson-Rutz. (2017). Soil pH and organic matter, nutrient management module no. 8 march 4449-8.
3. Azza. R. Ahmed, Amira. A. Saleam, Kh. A. Shaban. (2015): The effect of irrigation scheduling and compost fertilizer levels on yield and water productivity of wheat crop grown on newly reclaimed loamy sand soil. Journal of American Science; 11(5).
4. Beheiry, G.G.S. (2003).Application of farmyard manure by products and their impact on the chemical properties and productivity of calcareous soil, Egyptian J. Desert Res., 53: 101-114.
5. Black, C.A.; Evans, D.D.; White, J.L.; Ensminger, L.E. and Clerk, F. E. (1965)."Methods of soil analysis". Part. 1 and 2. Amer. Soc. Agron. Manual Madison USA.
6. El-Fayoumy, M.E, and K. Mammad (2001).Calcareous soil and sesame productivity improvement in relation to organic fertilization and frequency of irrigation. J. Agric. Sci. Mansoura Univ., 26(3):3301-3315.
7. Esawy M., Mohamed, I., Paual, R, Nouraya, A, C and Mohamed, E (2009). Rice straw composting and its effect on soil properties. Compost Science & utilization, vol.17, No.3 146-156.
8. Eusufzai, M. K. and Fujii, K. (2012). Effect of organic matter amendment on hydraulic and pore characteristics of a clay loam soil. Open Journal of Soil Science, 2, 372-381.
9. FAO. (2016). FAO Soil Portal. Management of calcareous soils <http:// www.faoorg/soils.Portal.Management/ management of some problems soils/ calcareous-soils/ar/ > (accessed 01.04.16).
10. Farrag, F.R., M.F.I. Al-Akram, S.M.M. Abdou and A.A. Al-Masry, (2011). Water management of maize crop under liquid ammonia gas fertilization. Minufia J. Agric. Res., 36(4): 1133-1149.
11. Hesse, P.R. (1971).“A Text Book of Soil Chemical Analysis”. John Murry (publishers) Ltd, 50 Albermarle Street, London.
12. Manukaji, J.U. (2013). The effects of sawdust addition on the insulating characteristics of clays from the federal capital territory of Abuja. International Journal of Engineering Research and Applications. 3 (2), 6-9.
13. MSTAT-C. (1990). Micro Computer Statistical Program for Experimental Design and Analysis. Russell Freed (Ed.), MSTAT/Michigan State University, East Lansing MI.
14. Ranjan, B.; S. Chandra; R.D. Singh; S. Kundu; A.K. Srivastva and H.S. Gupta (2006). Long-term farmyard manure application effects on properties of a silty clay loam soil under irrigated wheat–soybean rotation. Soil & Tillage Research, 94: 386–396.
15. Richards, L.A. (1954). “Diagnosis and improvement of saline and alkali soils”. U.S. Dept. Agric. Hand book No 60 Gov. Print off.
16. Sarwar G, Hussain N, Schmeisky H, Muhammad S, Ibrahim M, Safdar E (2008). Improvement of soil physical and chemical properties with compost application in rice-wheat cropping system. Pak J Bot 40: 275-282.
17. Toufiq Iqbal (2016): Rice straw amendment ameliorates harmful effect of salinity and increases nitrogen availability in a saline paddy soil. Journal of the Saudi Society of Agricultural Sciences www.ksu.edu.sa.
18. Yang Z; B. R. Singh and S. Hansen (2007). Aggregate associated carbon, nitrogen and sulfur and their ratios in long-term fertilized soils, Soil and Tillage Research Volume 95, Issues 1–2, September, Pages 161–171.

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