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The Study of Some Physical and Chemical Characteristics of Soil Cultivated with Olive Trees (Olea Europaea), in Three Fields with Different Ages Under Organic and Conventional Agricultural Systems at Al-Jouf Saudi Arabia

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Abstract:- **This study was carried out at Al-Jouf region, north eastern Saudi Arabia, to investigate differences in soil physical and chemical characteristics under three olive (Olea europaea) fields (9, 17, 27 years old) under organic agricultural system (OAS), and three similar olive fields under conventional agricultural system (CAS). There were significant differences in averages of organic carbon percentage (OC%) and organic matter (OM%) under the organic and conventional agricultural systems and CAS attained the highest percentages. However, the values of other characteristics did not show significant differences between the two systems. The results indicated no significant differences between the two agricultural systems (OAS and CAS) as regared to soil pH, EC, cation exchange capacity (CEC), CaCO3. The regarding the soil macro-elements were significant differences between the two systems in soil total nitrogen content (TN) and P in which CAS dominated giving the highest soil content, with no significant difference as regard to K content. For the micro-elements (Cu, Fe, Mn, Zn) and the heavy metals (Ni, Pb, Cd) there were no significant differences between the two systems. For soil field capacity (FC) the water content under FC was significantly high in soil under organic fertilization compared to conventional system, and FC, wilting point (WP) and available water (AW) increased significantly with increase in age of fields under both systems. Due to scarcity of information regarding soil properties under the organic and conventional systems at Al-Jouf region in the Kingdom of Saudi Arabia, this study was conducted.**

Key words: Organic agricultural system, conventional agricultural system.

I. INTRODUCTION

Organic agriculture has gained its place worldwide and it expanded in recent years, as a solution of many environmental, economic and social problems that might arise from conventional management of agriculture that uses pesticides, chemical fertilizers, which lead to food and soil degradation. Though there is a lot of research examined both organic and conventional systems, the comparison between organic and conventional systems is considered to be complex and difficult. In this context, the complexity always arises from the differences in experimental conditions between published studies such as soil type, crops, climatic conditions and agricultural practices applied. Therefore, it is very difficult to compare one study to another.

There is no available information on the soil properties under the organic and conventional systems at Al-Jouf region in the Kingdom of Saudi Arabia. The agricultural systems now applied in production of crops and fruit trees are both the organic and conventional systems. Organic agricultural systems do not use chemical fertilizers but fertilizers with organic sources. And compared with conventional agricultural system they are more economic because chemical fertilizers are expensive, on the other hand yield produced by conventional agriculture is more than yield produced by organic fertilizers, but organic farming produces food which is more nutritious and they do not cause soil pollution and more friendly as environment is concerned (Reganold, et al. 2016). Organic agriculture produce high yields under drought conditions compared to conventional agricultural systems (Lotter, et al. 2003). Yield increases under organic agriculture systems compared to conventional agriculture due to the higher water-holding capacity of organically farmed soils (Siegrist, et al. 1998). It has been found that the soil under organic agriculture systems has better quality, and higher soil organic carbon and not subjected to erosion compared to conventional agricultural systems (Gattinger, et al. 2012; Lynch, et al. 2012). Also as a comparison, organic cultivation practices proved to lower down nitrate leaching, and lower down nitrous oxide and ammonia emission from the soil compared to conventional agricultural system (Tuomisto, et al. 2012). Gattinger, et al. (2012) found significant difference between organic agricultural system and conventional non-organic system regarding soil content of organic carbon, with higher value of 3.50 ± 1.08 Mg C ha−1 soil organic carbon from soil under organic agricultural system. Research concerning study of long- term impacts of organic and conventional systems on soil physical properties by (Williams, et al., 2017) showed significant increase by 10 times in cumulative water infiltration and water storage in organic farming system compared with the conventional farming system. Soil aggregates are larger and more stable improving soil water infiltration, and generally soil physical properties in the long term are improved under organic farming system compared to conventional farming system (Williams, et al. 2017). Application of organic agricultural system and comparison with conventional farming system revealed that organic farming management gave higher soil organic carbon (OC), and more available N and P, K, Fe and Zn (Herencia, 2008). The present study aims to perform a comparative soil analysis of organic and conventional agriculture systems in Al-Jouf province and quantitatively determine the differences in the soil characteristics of the two systems and provide data that could help in a comprehensive assessment of the two systems.

II. MATERIALS AND METHODS

This work was carried out in Al-Jouf province at the eastern-northern part of Saudi Arabia. The province is characterized by the cultivation of orchards, particularly olive trees (Olea europaea), peach trees (Prunus persica), date palms, stone fruits, vegetable and crops as wheat, barley, alfalfa, sorghum, tomato, potato and watermelon.

Three olive farms (9,17,27 years) each farm is about 20 ha fertilized with organic fertilizers were chosen. Density of trees was 200 trees/ha and with 8-6 m distance between the tree rows. Another three similar farms under conventional agriculture practices were selected from the adjacent farms in Al-Busaita farms, AL jouf. province.

Sample Collection

Before collecting soil samples, the surface of the soil was cleared of weeds and other debris. Then five soil sub-samples were collected from a depth of 0-20 and 20-40cm from the surface and subsurface. Every five sub-samples from one field were pooled and thoroughly mixed in a large plastic bucket. From this mixture, composite samples of approximately one Kilo gram each were packed in plastic bags, and labeled appropriately. All composite soil samples were dried before transporting them to the laboratory, for analysis.

Soil samples analysis

The collected soil samples were taken to King Saud University, College of Food and Agriculture Science, Soil Science department laboratories, sieved to pass through 2 mm sieve screen and subjected to analyses of some selected soil physical and chemical based on standard procedures as follows:

a- Soil chemical *analysis*

1. Electrical conductivity (EC) and soil pH were measured in a 1:1 soil: distilled water (w/v) suspension, where (EC) was measured according to Richards, (1954) and pH was measured according to McLean, (1982).
2. Total Nitrogen (N) titrimetrically measured after the distillation of NH_3 using the Kjeldahl digestion (Bremner and Mulvaney, 1982).
3. Exchangeable cations and the cation exchange capacity (CEC) determined by using an ammonium acetate extraction method (Thomas, 1982).
4. Available P (Olsen, 1954), K (Richards,1954) and micronutrient (Fe, Zn, Cu, Mn) in soil were determined according to Sultan pour and Schwab, (1977).
5. Heavy metals; mainly Cd, Ni, Pb were analyzed by inductively coupled plasma mass spectrometry (ICP-MS) combined with microwave digestion technique (Hossner, L.R. 1996).
6. Soil Organic Matter (SOM) was determined by the method of Walkley - Black, (1934) titration method, that it is one of the classical methods for rapid analysis of organic carbon (OC) in soils and sediments. The method is based on the oxidation of organic matter by potassium dichromate ($K_2Cr_2O_7$) - sulfuric acid mixture followed by back titration of the excessive dichromate by ferrous ammonium sulfate ($Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$). The average oxidation number for organic carbon is considered as zero and the reactions involved into the Walkley-Black, titration method.

b- Soil Physical analysis

1. Particle size distribution was carried out using the hydrometer method (Day, 1965, Gee and Bauder, 1994).
2. Bulk density (Bd): the most common method of measuring soil BD is by collecting a known volume of soil using a metal ring pressed into the soil (intact core), and determining the weight after drying (McKenzie et al. 2004).
3. Water holding capacity (WC): the amount of water held by oven dried, sieved soil under 0.33 atm of pressure field capacity and wilting point (Topp et al., 1993).

Statistical Analysis

Data were analyzed as a split – split arrangement under a randomized completed block design, with the system as the main factor, the period as a sub-main factor, and the depth as the sub-sub main factor and replicated four times. Analysis of variance and mean comparisons were carried out based on the LSD test in 5% of probability level using statistics 8.1 software (Analytical software, 2003).

III. RESULTS

Soil chemical properties

The results in Table (1) showed the differences between the studied soil chemical properties under the agriculture systems (organic and conventional) under olive trees. The soil pH value under both agricultural systems is alkaline, with no significant difference between them. There were significant differences between the two systems as regard to OM% and O.C% content in the soil, it was high under CAS compared to OAS. There were no significant differences between the two systems regarding the other soil characteristics, but the soil pH, tthe cation exchange capacity (CEC cmol/kg) and $CaCO_3$% were high in the soil of the organic agriculture system (OAS) compared to the conventional agricultural system (CAS).

TABLE (1) MEAN VALUES OF CHEMICAL PROPERTIES OF THE TWO SYSTEM IN SOIL OF OLIVE FIELDS

Chemical properties	System		LSD
	Organic Farms	Conventional Farms	
pH (1:1)	7.97	7.92	ns
EC (dS.m-1)	2.79	2.83	ns
O.C %	0.35	0.42	0.03
O.M %	0.61	0.72	0.06
CEC (cmol/kg)	9.04	8.31	ns
CaCO3 %	7.55	7.03	ns

LSD: Least significant difference. ns: not significant

Table (2) is showing the soil chemical analysis of the nutrients and heavy metals under the organic and conventional systems. There were significant differences between the two systems regarding the total nitrogen (TN) and phosphorus (P) concentrations, where they were high under OAS compared to the CAS. No significant differences between organic and conventional systems regarding the other soil element contents, but the elements K, Cu, Fe, Mn, and the heavy metals Ni, Pb, Cd were high in the OAS compared to the CAS.

TABLE (2) MEAN VALUES OF CHEMICAL PROPERTIES OF THE TWO SYSTEM IN SOIL OF OLIVE FIELDS

nutrients & Heavy metals	System		LSD
	Organic Farms	Conventional Farms	
Macro Elements (mg/kg)			
T.N.	157.71	233.58	22.2
P	8.29	11.63	1.73
K	278.14	238.01	ns
Micro Elements (mg/kg)			
Cu	0.32	0.28	ns
Fe	7.63	6.48	ns
Mn	11.22	10.07	ns
Zn	0.54	0.59	ns
Heavy Metal (mg/kg)			
Ni	42.48	39.35	ns
Pb	28.71	28.07	ns
Cd	1.48	1.41	ns

LSD: Least significant difference. ns: not significant. nd: no detected

Table (3) is illustrating the results of the soil chemical properties in the different three fields with difference ages. The results showed no significant differences between the two agricultural systems regarding these soil parameters, but it is clear that soil pH, EC, OC%, O.M% and CaCO3% were high in the farm 17 years old compared to **the** farms 9 and 27 years old under organic agriculture system while CEC was high under the 27-year-old farm. On the other hand, under conventional farming pH, CEC (cmol/kg) and CaCO3% were higher in the 17 year old field compared to the other two fields, and soil EC, O.C.% and O.M.% were higher in the oldest field 27 years old compared to the other two fields.

TABLE (3) MEAN VALUES OF SYSTEM AND TIME INTERACTION OF SOME CHEMICALS PROPERTIES IN SOIL OF OLIVE FIELDS

Chemical Properties	Organic Farms			Conventional Farms			LSD
	A1	A2	A3	A1	A2	A3	
pH (1:1)	7.95	8.24	7.71	8.08	8.16	7.53	ns
EC (dS.m-1)	1.94	3.25	3.20	0.86	3.65	3.97	ns
O.C %	0.30	0.41	0.36	0.36	0.42	0.47	ns
O.M %	0.52	0.70	0.60	0.63	0.72	0.82	ns
CEC (cmol/kg)	8.01	9.07	10.05	8.52	8.60	7.82	ns
CaCO3 %	6.24	8.81	7.61	6.95	8.30	5.83	ns

A1: 9 years. A2: 17 years. A3: 27 years. LSD: Least significant difference. ns: not significant.

Table (4) is showing the averages of macro elements and heavy metals in the soil of the three olive fields (9, 17, 27 years) under organic and conventional agricultural systems. There were no significant differences between the three different age fields under both two systems regarding concentrations of the macro elements (total N, P, K) the micro elements (Fe and Zn) and the heavy metals (Ni and Cd), except there was significant differences between these

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fields under these two systems regarding concentration of Cu, Mn and Pb. It could be seen that the soil contents of the macro-elements (T.N., P, K) under CAS were higher than that under OAS. Simultaneously there were significant differences between the differently aged three fields in both systems, with the youngest field (9 years) under OAS attaining the highest soil T.N content compared to the other two fields, the medium field (17 years) attaining the highest contents of Fe and Pb, and the oldest field (27 years) attaining the highest concentrations of K, Mn and Ni. The soil T.N. and P content was significantly higher in CAS than in OAS, while K is significantly high in OAS than in CAS in both fields (17 and 27 years). Regarding the three fields under CAS the oldest field (27 years) dominated the other two fields giving the highest concentrations in T.N., and in all the micro-elements (Cu, Fe, Mn, Zn) and in the heavy metals Pb and Cd compared to the other two fields.

TABLE (4) MEAN VALUES OF SYSTEM AND TIME INTERACTION OF SOME CHEMICALS PROPERTIES IN SOIL OF OLIVE FIELDS

nutrients &Heavy metals	Organic Farms			Conventional Farms			LSD
	A1	A2	A3	A1	A2	A3	
Macro Elements (mg/kg)							
T.N	238.50	146.63	88.00	207.50	212.13	281.13	ns
P	8.59	7.75	8.52	14.84	5.36	14.69	ns
K	198.82	304.18	331.41	196.47	263.70	253.90	ns
Micro Elements (mg/kg)							
Cu	0.35	0.32	0.29	0.17	0.26	0.43	ns
Fe	4.97	9.38	8.53	4.11	6.15	9.18	ns
Mn	7.68	12.79a	13.20	5.90	7.82	16.48	1.776
Zn	0.45	0.50	0.68	0.38	0.54	0.86	ns
Heavy Metal (mg/kg)							
Ni	39.93	42.18a	45.34	40.52	40.22	37.33	ns
Pb	27.33	30.98	27.83	28.34	26.02	29.86	1.390
Cd	1.33	1.62	1.50	1.32	1.32	1.59	ns

A1 :9 years. A2: 17years. A3:27 years. LSD: Least significant difference. ns: not significant. nd: no Significant difference detected.

Table (5) illustrates average values of the soil chemical properties (pH, EC (dS.m-1), O.C%, O.M%, CEC (cmol/kg) and CaCO3%), in the olive tree fields under OAS and CAS at two different depths. The results showed no significant differences between the soil depths under both agricultural systemsfor all the examined properties.

TABLE (5) MEAN VALUES OF SYSTEMS AND DEPTHS INTERACTION OF SOME CHEMICALS PROPERTIES IN SOIL OF OLIVE FIELDS

Chemical Properties	Organic Farms		Conventional Farms		LSD
	D1	D2	D1	D2	
pH (1:1)	7.92	8.02	7.89	7.96	ns
EC (dS.m-1)	3.44	2.14	3.44	2.21	ns
O.C %	0.42	0.29	0.48	0.35	ns
O.M %	0.72	0.50	0.83	0.61	ns
CEC (cmol/kg)	9.44	8.65	8.13	8.50	ns
CaCO3 %	7.38	7.73	6.72	7.33	ns

D1: depth 0-20cm. **D2**: depth 20-40cm. **LSD**: Least significant difference. **ns:** not significant.

The statistical analysis obtained for nutrients and heavy metals contents in the soil in relation to soil depth under both agricultural systems revealed no significance differences except in the case of the T.N. content (Table 6). But there were some significant differences between the two different soil depths where all the soil macro and micro elements and heavy metals contents were high in the first soil depth (0-20 cm) compared to D2 (20-40 cm) under both agriculture systems, and TN and P were high under conventional CAS while K was high under the organic OAS.

TABLE (6) MEAN VALUES OF SYSTEMS AND DEPTHS INTERACTION OF SOME CHEMICALS PROPERTIES IN SOIL OF OLIVE FIELDS

Chemical Properties	Organic Farms		Conventional Farms		LSD
	D1	D2	D1	D2	
Macro Elements (mg/kg)					
T.N	224.10	91.33	306.42	160.75	sd
P	11.30	5.27	13.48	9.77	ns
K	300.71	255.57	286.40	189.62	ns

Micro Elements (mg/kg)					
Cu	0.36	0.27	0.33	0.24	ns
Fe	7.73	7.53	6.32	6.64	ns
Mn	12.63	9.82	10.97	9.16	ns
Zn	0.65	0.44	0.77	0.42	ns
Heavy Metal (mg/kg)					
Ni	38.65	40.05	44.49	40.05	ns
Pb	29.51	27.91	28.24	27.90	ns
Cd	1.55	1.42	1.37	1.45	ns

D1: depth 0-20cm. D2: depth 20-40cm. LSD: Least significant difference. ns: not significant nd: not detected

Soil Physical properties

The results in table (7) illustrate that the physical properties of olive field soil of both organic and conventional farming systems, is sandy loam (SL). There was no significant differences in soil bulk density between the two agricultural systems and the high value was 1.73 g/cm3 at depth D1(0-20cm) of the 17 years old field under CAS. Generally, soil water content at field capacity (FC) was highest in the depth (20-40 cm) in the 17 years old field under OAS, and the older (27 years) field under CAS gave the lowest FC (8.25, 9.03%) in both soil depths respectively.
The soil water content at wilting point (WP) recorded the highest percentage of 6.49% at depth (20-40 cm) in the old field (27 years) of the organic farming system, while the lowest recorded WP value was 4.11% in the soil depth (0-20 cm) in the old field (27 years) under the conventional farming system.
The results concerning available water (AW) showed that the highest values (8.70%) was recorded for D1 and D2 of the younger (9 years) field under OAS, and the lowest AW (4.15%) in D1 and D2 in the old field (27 years) under the conventional farming system. It can be seen that the younger fields (9 years) under both agricultural systems dominated the the other two aged fields by having the higher AW%.

TABLE (7) MEAN OF PHYSICAL PROPERTIES IN SOIL OF THE TWO SYSTEMES

Systems	Field age year	Depths cm	%			Texture Class	Bulk density g/cm3	WC at FC %	WC at WP %	AW %
			Sand	Silt	Clay					
Organic Farms	A1	D1	67.10	15.62	17.28	SL	1.69	13.30	4.60	8.70
		D2	65.84	16.87	17.29	SL	nd	13.44	5.52	8.70
	A2	D1	65.85	14.69	19.46	SL	1.60	11.91	5.86	6.05
		D2	63.35	21.25	15.40	SL	nd	13.72	6.25	6.05
	A3	D1	73.97	7.50	18.53	SL	1.61	11.31	6.17	5.14
		D2	72.10	10.62	17.28	SL	nd	11.79	6.49	5.14
Conventional Farms	A1	D1	62.10	21.87	16.03	SL	1.66	11.38	4.26	7.12
		D2	62.72	20.00	17.28	SL	nd	12.16	5.04	7.12
	A2	D1	68.35	12.19	19.46	SL	1.73	12.33	5.69	6.64
		D2	67.10	20.31	12.59	SL	nd	13.39	5.95	6.64
	A3	D1	75.22	7.50	17.28	SL	1.56	8.25	4.11	4.15
		D2	75.85	7.50	16.65	SL	nd	9.03	4.30	4.15

T1 :9 years. T2:17 years. T3:27 years D1: depth 0-20 cm. D2: depth 20-40cm. SL: sandy loam.
SCL: sandy clay loam. WC: water content. FC: Field Capacity. WP: Wilting Point. AW: Available water

Table (8) showed significant difference between the agriculture systems (organic and conventional) as regards soil water content at FC, and no significant differences between the two systems regarding soil WP and AW. The highest soil FC was under OAS compared to CAS.

FC: Field Capacity. WP: Wilting Point. AW: Available water LSD: Least significant difference. ns: not significant

TABLE (8) MEAN VALUES OF PHYSICAL PROPERTIES OF THE TWO SYSTEM IN SOIL OF OLIVE FIELD

Physical Properties	System		LSD
	Organic Farms	Conventional Farms	
FC	12.58	11.09	0.95
WP	5.81	4.89	ns
AW	6.76	6.20	ns

Results in table (9) are showing soil FC, WP and AW average contents of the three olive fields under each of OAS and CAS. The results illustrated that the highest FC and AW% were in the younger fields (9 years) under both agricultural systems, and the lower FC, WP, AW were in the oldest fields (27 years) in both agricultural systems.

TABLE (9) MEAN VALUES OF SYSTEM AND TIME INTERACTION OF SOME PHYSICAL PROPERTIES IN SOIL OF OLIVE FIELDS

Physical Properties	Organic Farms			Conventional Farms			LSD
	A1	A2	A3	A1	A2	A3	
FC	13.37	12.81	11.55	11.77	12.86	8.64	1.46
WP	5.06	6.06	6.33	4.65	5.82	4.20	1.03
AW	8.31	6.76	5.22	7.12	7.04	4.44	1.38

T1 :9 years. T2: 17years. T3:27 years. FC: Field Capacity. WP: Wilting Point. AW: Available water LSD: Least significant difference

Result in table (10) illustrating the differences in the soil FC, WP and AW% content in the two soil depths (0-20 and 20-40 cm) under the effect of the two systems organic and conventional. The results indicate significant differences between the two agricultural systems, and also between the two soil depths concerning soil FC, WP and AW. Soil FC, WP and AW% were significantly high in depth (20-40 cm) compared to depth (0-20 cm) in both OAS and CAS.

TABLE (10) MEAN VALUES OF SYSTEMS AND DEPTHS INTERACTION OF SOME PHYSICAL PROPERTIES IN SOIL OF OLIVE AND PEACH FIELDS

Physical Properties	Organic Farms		Conventional Farms		LSD
	D1	D2	D1	D2	
FC	12.17	12.98	10.65	11.53	0.38
WP	5.54	6.09	4.69	5.10	0.24
AW	6.63	6.90	5.97	6.43	0.39

D1: (0-20 cm), D2: (20-40 cm). FC: field capacity. WP: wilting point, Aw: Available water. LSD: Least significant difference.

IV. DISCUSSION

Comparing between organic and conventional agricultural systems is not an easy job (Herencia et al., 2008, and Watson et al., 2008), due to many complexes in differences in soil type, climatic conditions, type of amendments and the amount applied. Farming practices in Al-Jouf province, Saudi Arabia depend on chemical fertilization in some farms and on organic amendments in others, especially in olive trees fields.

In this study no significant difference was found in soil pH between organic and conventional farms planted by olive trees, and pH was alkaline in both systems. This result agrees with that of (Solomou et al., 2010) who reported no significant differences in soil pH between organic fertilized olive fields and conventional ones, and does not agree with the results of Nessly., (2015), Daif et al., (2013), Freitas et al., (2011) and Sudhakaran et al., (2013) who found significant differences between soil pH values under OAS and CAS. The results showed that soil pH increases with time and then decreases, Bullock et al., (2002) found that soils under organic managements initially had a lower soil pH and over time soil pH increased to higher levels than pH in soils with conventional managements. Also, our results indicated that pH tend to be alkaline in all examined soil samples from both systems of olive, and this agrees with (Daif et al., 2013) who detected alkalinity of soils of both conventional and organic fields.

The soil electric conductivity EC (dS.m-1) recorded low value in OAS than in CAS, and with less values in younger fields compared to older fields in both organic and conventional systems. This result agrees with the finding of (Daif et al., 2013; Freitas et al., 2011) who reported that generally, EC value in organically managed field was less than its value in the conventionally managed fields. The increase of the EC in the conventionally managed soils could be due to the higher input of salts in the form of chemical fertilizers and/or pesticides (Gasparatos et al., 2011).

It is difficult to assess losses or gains in soil organic carbon (SOC) over short- and medium-term and this is partly attributed to the specific processes governing Carbon sequestration under management practices, which vary with soil type, climate, and crop rotation (Bosatta and Agren., 1994). Soil organic carbon (SOC) was significantly lower in organic system compared to conventional system, and lower in depth (20-40 cm) compared to depth (0-20 cm). But (Jiao et al., 2006) found that the annual addition of manure in amounts exceeding 30 T/ha, increased the SOC in the organic olive groves.

The results concerning soil organic matter (SOM) revealed significant increase of SOM in soil under CAS compared to OAS. This result disagrees with that obtained by (Solomou et al., 2010) who found significantly higher percentage of organic matter in the soil of the organically fertilized olive groves compared to the conventionally fertilized fields, in Magnesia Prefecture (Greece). And also disagrees with the results by (Herencia et al., 2008b) who reported significant SOM increase in organic farming systems compared to conventional systems. Some studies that compare organic and conventional farming systems on

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soils show higher OM and macronutrient content for organic farming (Edmeades 2003; Herencia et al. 2007), but at the same time other studies reported opposite results (Gosling & Shepherd 2005). No significant differences between the two systems in content of SOM in relation to the effect of time and depth.
SOM is considered the most important property of soils due to its significant impact on other biological and physicochemical soil properties, and that it showed no significant difference in the levels of SOM between the two agricultural systems, which is consistent with our results (Gasparatos et al., 2011). In addition, Gossling and Shepherd (2005) results were in parallel with our findings.
Soil cation exchange capacity (CEC cmol/kg) was just higher in the organic farming system compared to conventional farming system and in the oldest olive field in OAS compared to the younger fields. This agrees with finding of (Solomou et al., 2010) that the (CEC) of the organic olive groves was significantly higher than the conventional ones. These findings may be probably due to the fact that in the organic agriculture the increased application of manure increases the cation exchange capacity of the topsoil layers (0-30cm) due to the increase in the organic matter. In the same time, soil pH is important for CEC because as pH increases the number of negative charges on the colloids increases, thereby increasing CEC (Eghball 2002). Also (CEC) was found higher in organically managed agriculture system than in the conventional system (Freitas et al., 2011).
Soil calcium carbonate (CaCO3) percentage showed no significant difference in both organic and conventional farms. This same result was reached by (Solomou et al., 2010) who detected no significant difference between the organically fertilized olive fields and the conventional ones in concentration of CaCO3, and they attributed this to the soil texture in the two farming systems, which might have played a strong effect on the soil chemical indicators.
The total nitrogen concentration (TN) was significantly lower in the organic agriculture system than in conventional system in olive field, and also highest in the oldest field under CAS compared to the younger fields. Same result was attained by (Daif et al., 2013) who reported that TN is significantly affected by farming system and the period of organic farming practice. But different result was suggested by (Gasparatos et al., 2011) that total N did not significantly affected by the type of farming system.
Soil phosphorus (P) content was significantly high under CAS compared to OAS.
Available potassium (K) content in the soil was significantly high in soil under organic agriculture than under conventional system. This result is similar to the finding of Sudhakaran et al., (2013), they reported that the amount of potassium level was higher in organic farming than conventional farming. But, Gasparatos et al., (2011) reported that the available K in the conventionally managed soils were higher than those in the organically managed soil. Numerous studies have shown a K deficiency in organic farms due to the lower input of nutrients (Stockdale et al., 2001, Berry et al., 2002, Gossling and Shepherd, 2005).
No significant differences were obtained between the OAS and CAS regarding concentrations of Cu, Fe, Mn and Zn in the soil. These findings agree with the results of (Gasparatos et al., 2011), who found no significant differences in concentrations of Cu, Zn and some other mineral elements in olive field soil under the two agriculture management systems. But in contrast with findings of (Sharma et al., 2000), who observed that Zn, Fe, Mn, and Cu were enhanced significantly by crop residues and manure incorporation compared with chemical fertilizer application. Regarding effect of field age, Mn was significantly high under old fields (27 years) compared to younger fields.
No significant differences were observed in olive fields soil heavy metals content of Cd, Pb, Ni, related to both agriculture systems at different field ages and depths. Jia et al., (2010) found that there were no significant differences between heavy metals including nickel in soil fertilized with chemical manure and organic manure and this finding was in agreement with these results. Domagała-Świątkiewicz and Gąstoł (2012) reported no significant differences in the concentrations of, Pb between organic and conventional soils in south Poland. Domagała - Świątkiewicz and Gąstoł., (2012) reported no significant differences in the concentrations of the heavy metal, Cd between organic and conventional crop management systems.
The soil physical properties under both OAS and CAS showed that the texture is sandy loam (SL), and the highest percentage of clay was 25.48% in the second depth of the 17 years old field under the organic system.
The obtained results determined no significant differences between the two agricultural systems in relation to the soil physical properties, except for water content at FC, where it was the highest in the younger field (9 years) under OAS, and in the 17 years old field under CAS. This result agrees with that of (Williams, et al. 2017) who showed significant increase by 10 times in cumulative water infiltration and water storage in organic farming system compared with the conventional farming system. There is controversy about effect of different management systems on soil properties and according to Gosling and Shepherd (2005), the comparison of organically and conventionally managed systems is rather complicated and difficult due to the great overlap in management techniques. Also as proposed by Marinari et al. (2006) and Vakali et al., (2011), agricultural management systems could react in variable manners under different climatic regimes; thus, it is important to evaluate the effect of organic management on the soil properties under a wide range of climatic regimes.
residuals of organic matter for the improvement of relatively small soil properties.

V. CONCLUSION

There is no available information on the soil properties under the organic and conventional agricultural systems at Al-Jouf region in the Kingdom of Saudi Arabia. Therefore, this research was carried out to evaluate soil physical and chemical characteristics between organic and conventional agriculture system under olive tree fields. The organic carbon (OC%), organic matter (OM %), and total nitrogen

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(TN %), and available phosphorus (P) were found significantly high under CAS compared to OAS. And all the other soil physical and chemical characters, soil pH, EC, CEC, CaCO3, K, Cu, Fe, Mn, Zn, and heavy metals (Ni, Pb, Cd) gave no significant differences between the two agricultural systems. Soil FC, WP and AW were significantly increased with age of field, and FC was significantly high under OAS compared to CAS.

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