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EFFECT OF TWO HARROWING SYSTEMS ON DECOMPOSITION OF ORGANIC MATTER, SOME SOIL PROPERTIES, GROWTH AND PRODUCTIVITY OF SUNFLOWER (*Helianthus annuus L.*)

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Abstract

A field experiment was conducted at Abu-Ghrib during 2013- 2014 season to study the effect of harrowing systems on the decomposition and fermentation on organic matter (OM) when added and mixed with the soil under special technology, as well as its effect on the growth parameters and productivity of Sunflower (*Helianthus annuus* L). The experiment was laid out using factorial randomized complete block design (RCBD) with three replications in SCL bare soil with a percent of moisture ranged from 16–18 %. The main plots were designated to the two systems of harrowing (Rotary Harrow and Disc Harrow). The sub main plots were specified for two organic matters (Sheep manure, cow manure). Data were statistically analyzed, and LSD was used to compare means at 0.05 levels. After 90 days, the obtained results indicated that there were significant effects of harrowing systems on the rate of decomposition of organic matter and their effects on some soil and plant properties. The rotary harrows system showed significant low in bulk density, and decrease in total porosity, average of mean weight diameter (MWD), total nitrogen, and height of plant. Under constant level of OM cow manure showed superiority on sheep manure and gave a significant increase in added nutrients, rate of decomposition of OM, improving soil properties and in turn on growth and productivity of Sunflower. Also the data show there are different level with the different of the source of organic matter .

***Keywords*:** Rotary Harrow, Disc Harrow, (Sheep manure, cow manure.

Introduction

Organic agriculture is a way to create natural balance among environment of humans, plants, animals and soil, especially in recent times. So it is a dynamic agricultural system that avoids food and environmental pollution like in soil, water and vegetable crops with mineral residues and increases animal and biochemical activity to improve plants, animals, humans and the environment. At the same time, the addition of organic matter improves the physical, chemical and fertility properties of soil so as to produce organic production that does not contain any contaminants of mineral wastes of fertilizers, pesticides, vaccines or growth regulators. Great interest of the food quality and safety is increased in the recent period. The study of organic fertilizers has also increased as well as the mechanism of its use, methods of its degradation, nature of its products, its comparison with the chemical fertilizers, which used in the agricultural system, or its comparison with the synthetic additives added to soil and water (Al-Ajili *et al*., 2011). A study was carried out to investigate the effect of various agricultural operation such harrowing on the rate of decomposition and fermentation of organic matter added to the soil, and effect of its products on some physical, chemical and biological soil properties, as well as its effect on the growth and yield of *Zea may* (5018). Also to use the best harrowing systems that improve the performance of organic fertilizers in the soil and its effect on the increase in agricultural production and the minimum amount of environmental pollution. As well as aimed to create a balanced ecosystem between locally production systems and the use of organic matters and increase soil fertility, as well as creating a balance between the production of crops and the use of fertilizers and pesticides free from toxic chemicals (Al-Awadhi *et al*., 2011; Ghoneim and Alshareef, 1984). The agricultural processes effect on soil structure and the stability of its aggregates which are the basis of soil building, and it is reflected in the growth of plants in the soil and their resistance to penetration. There is relationship between the tillage and harrowing systems on the speed of decomposition of organic matter due to the compact layer called the Under Plough Layer which has direct affections dynamics of organic matter decomposition and oxidation of its products, and in turn its effect on soil properties and soil organisms. This study was conducted to investigate the relationship between the systems of harrowing used and their effect on decomposition and fermentation of organic manure from different sources (cows and sheep manure) and its effect on the soil properties studied and growth and yield of *Zea mays* L. (5018).

Organic matter is a source of many important and essential elements in plant nutrition, especially nitrogen element, because it is a stockpile of soil nitrogen. Therefore its use as fertilizer in the soil rather than chemical fertilizers has a great importance in providing soil and plants with nutrients elements which depending on the type of organic matter and speed of decomposition and fermentation in the soil and mineralization of their elements nutrients (Al-Mukhtar and Al-Mansouri, 2000; Jackson,1958). The technique of organic fertilization (animal or plant fertilizers) has been used since ancient times, especially in poor countries. But the study of the role of tillage systems or harrowing systems used in the management of soils fertilized with organic residue was considered the aim of this study. Two types of harrowing systems using in soil preparation (disc harrows (D) and rotary Harrow (R) were used to investigate the speed of decomposition and fermentation of cows and sheep manure which added to the soil (Malegoli *et al*., 2005) and its effect on products of decomposition. This technique improves soil properties such as soil structure, ventilation, soil permeability, root penetration, by influencing on porosity and bulk density and increasing cation exchange capacity (CEC) (Malegoli *et al*., 2005; Walter and Rawls, 1993). Organic fertilizer is a good source of essential nutrients for plants such as nitrogen, phosphorus and potassium, as well as containing some micro nutrients which are very important in plant life cycle such as iron, zinc and cadmium (Dugramage *et al*., 1996; Tripathi *et al*., 1989). Rand D harrowing systems were used to show their effects on the mechanism of organic fertilizer decomposition and its fermentation in the soil and the quality of their products. Another biological experiment was conducted to verify the validity of the obtained results by studying the effect of the added organic manure and the use of this technique on growth and production of maize 5018 oil cultivar, and their ability in providing nutrients.

Materials and Methods

A field experiment was carried out in the fields of the college of Agriculture - University of Baghdad, Abu Ghraib, 20 km west of Baghdad at latitudes 33° N, 44° E and 30.1 m above sea level, in spring season of 2013-2014.

New Holland 80-66S tractor (2200 RPM made in Italy)was used in the implementation of the experiment with Rotary Harrow type (Maschio) with an effective width 1.85 m, weight 365 kg and rear cover opening angle of 45°, hanging type. Disc Harrows with a smooth edge was used, type 170 (made by the State Company for Mechanical Industries, Iraq). This type of harrows has a front unit that moves the soil to the left and a rear unit behind it which is directed to the right to return the soil to its place. Each harrow contains eight discs with a diameter of 0.60 m, the distance among disks 0.23 m and with total weight of 707 kg.

The soil texture of the field was silt clay loam which classified as Typic Torrifluvent (II) group and into the MM4 series. The soil was plowed by mold board plow to a depth of (0.25 -0.30m). The organic fertilizer (sheep and cows manure) it was used at a rate of 20 ton.ha^{-1} was mixed for both types separately to the defined depth (0.25-0.3 m).

The field was smoothed and harrowed using the disc and rotary harrows and the soil was completely flooded with heavy irrigation for seven days. The field was left for three months for decomposition and fermentation of organic fertilizer as well as the weeds control have been done by hand.

The field was leveled and divided into experimental units (3 × 4) meters to determine the effect of the harrowing systems on the speed of decomposition and fermentation of the added organic matter, and their effect on the soil properties and the yield of the maize (oil cultivar 5018).

All laboratory analyzes of soil were carried out before and after the manure addition as well as during the animal manure fermentation period. The field was divided into experimental units according to Complete Randomized Blocks Design (RCBD) of 24 experimental units and three replicates.

(a) Biological experiments:

This study was conducted in the spring season 2013 using maize oil cultivar 5018. The experiment was carried out in two fields: first field was used for sheep manure and the second was used for cows manure while control treatment was left without any addition. The soil was prepared by plowing the field with mold board plow to a depth of 0.25-0.30 m. Then harrowing was conducted by two systems: disc harrows and rotary harrow.

Maize seed was planted on 7/4/2013 with a planting distance among lines of 0.75 m and 0.25 m among plants on the same line to give a plant density of 66666 plants.ha^{-1} according to the recommendations of the General Agricultural Research Department, which provided the seeds used in the study. For irrigation purpose, a channel was laid out with 1.5 m width at the beginning of the experimental unit (3X4 m), while a bed of 12m at the end. The experimental fields were fertilized with superphosphate at rate of 280 kg.ha^{-1} (as 46%P_2O_5), after tillage and before the harrowing process to ensure fertilizer mixing with soil. In addition, 460 kg.ha^{-1} of urea fertilizer 46% N was added twice. First application was added at 200 kg per hectare with phosphate fertilizers, after tillage and before harrowing, while the second application was added at 260 kg per hectare after (30 - 45 days) of planting according to the recommended of the General Dept. for Agricultural Research. Potassium fertilizer was added at rate of 160 kg.ha^{-} 1 in the form of potassium chloride by only once after 45 days of planting. The experimental fields divided according to the Complete Randomized Blocks Design (RCBD) with three replicates (Al-Ajili, Sh. S.). Three seeds were placed in each hole and the plants was thinned to one plant after four leaves. *Sesamia cretica* was controlled by using 10% of diazinon by putting the insecticide in the center of the plant after the plant reached six leaves. The process of cultivation, weeding and irrigation was carried out according to plant requirements

(b) Analyses and measurements :

1- Analysis of soil and determination of its physical , chemical proprieties before and after application of organic fertilizer and during decomposition were as follows :

- Soil pH: It was measured in soil suspension with ratio 1:1 (soil: water) using pH-Meter device model WTW pH 520. (Black, 1965)
- Soil solution ECe: It was measured in saturated soil solution which prepared according to (Page A.L. (editor), 1982.) using E.C Meter type Toa.
- $CaCO_3$ determination: It was determined in samples according to (Jackson, 1958) method.
- CEC: It was determined according to (Papanicolaou, 1976) method after determination of Ca, Mg, Cl, CO_3 and HCO_3 in extracted solution.
- Organic matter: It was determined according to modified mebius procedure described by (Page A.L. (editor), 1982.).
- Available N: It was determined according to (Page A.L. (editor), 1982.) method.
- Soil texture: It was determined by using pipette method according to (Black, 1965.).
- Particle density and porosity : porosity was determined using core sample according to the following equation : $Bd = Ms / Vtot$

Ms = weight of dried soil sample which dried in the oven (gm).

Vtot =total soil volume with its natural structure (cm^3).

While porosity was calculated according to (Awda, 1990) using the following equation:

F = (1-Pb / Ps) * 100

F= (%) total porosity.

Bb= bulk density.

Bs = particle density (Particle density was adopted as 2.65 cm^3).

The result were presented in table (1a, 1b) as following.

Table 1a : Effect of harrowing systems and type of organic matter and their interaction on bulk density

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	1.027	1.020	1.033
Sheep manure	1.040	1.040	1.040
Control treatment	1.378	1.378	
Average	1.037	1.300	

Table 1b: Effect of interaction between harrowing system and type of organic matter on total porosity %

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	54.72	56.93	55.83
Sheep manure	55.26	55.53	55.39
Control treatment	47.80		
Average	54.99	56.23	

Table 2 : Soil chemical and physical properties after addition of organic matter in each of harrowing systems.

Adjective	Before adding	After the addition			
		Cow manure		Sheep manure	
		D	R	D	R
MWD mm	0.245	1.26	1.39	0.255	0.452
% Moisture content					
Available Water	14.96	15.90	17.22	18.96	14.23
Wilt Point	13.23	12.23	15.60	13.23	10.96
Field capacity	25.19	28.19	26.15	27.18	22.20
Fragmentation organic matter% organic carbon					
Folic acid	8.20	18.25	12.45	18.60	13.40
Hydroic acid	5.46	50.22	45.12	48.40	42.20
Hyomine	3.34	31.16	42.43	33.00	44.00
C/N	11.28	11.30	13.24	13.48	11.22
C_aCO_3%	28.00	23.00	25.00	30.00	25.00
CEC cmol.kg^{-1}	22.73	25.37	36.22	29.30	23.70
ECe dc.m	2.05	3.95	4.10	2.92	2.02
pH	7.94	7.74	7.76	7.64	7.52
Available Nitrogen Mg\\$kg^{-1\ NO3}$	85.00	170.00	92.00	113.00	111.00
Mg\\$kg^{-1\ NH4}$	57.00	67.00	92.00	90.00	73.00
Available phosphorus mg.kg^{-1}	49.00	49.25	25.00	38.00	32.60
Mg.kg^{-1} Available potassium					
potassium soluble	101.66	199.20	182.22	109.60	98.20
exchangeable-potassium	40.00	42.21	34.32	48.20	48.28
Hydraulic conductivity	0.34	0.59	0.55	0.57	0.60

Results and Discussion

First: effect of studied factors on chemical and physical properties of soil:

(1) Cation exchange capacity (CEC)

The results of table (2) showed a significant differences in physical and chemical soil properties after decomposition and fermentation of the organic matter in soil. Values of CEC increased after addition of organic matter, which was different according to harrowing systems and type of organic matter. Statistical analysis showed that cows manure gave the highest value of CEC (36.22 cmol.kg^{-1}) with R system while the CEC with R by using sheep manure gave 23.70 cmol.kg^{-1} compared with control treatment of 22.73 cmol.kg^{-1}. The value of CEC with D system and cows manure gave 25.37 cmol.kg^{-1} while sheep manure with same system gave 29.30 cmol.kg^{-1}. This means that all treatments were superior compared to control treatment. This increase of CEC may be due to the increase of organic matter ratio and its content effective groups like (NH_2 , COOH, OH) which ionized to give negative charge on humus, as well as the positive ions might work as a link between humus molecules and clay metal to configure clay-humus-complex (Varadachan and Ghosh, 1991). Also one of reasons of this difference might be due to harrowing system (R) that helps in soil block fragmentation and change the porosity and bulk density (Al-Ajili, Sh. S.). This was in agreement with results of (Lax, 1991), and also was in agreement with results of organic matter fragmentation (table 2). Figure (1) shows CEC for different treatments.

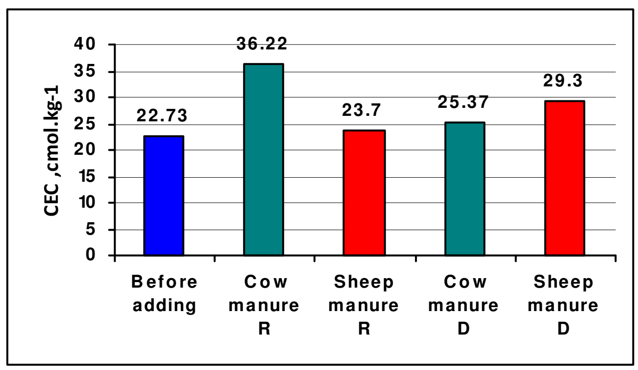

Fig. 1 : Effect of organic matter on CEC values after 90 days of fermentation process.

(2) pH of soil :

Table (2) showed effect of the added organic matter on soil pH. The addition of organic matter led to low decrease in pH values. Cows manure was most influential which gave 7.74 with R system and 7.76 with D system, while the sheep manure gave pH value of 7.64 with D and 7.52 with R compared with control treatment that gave 7.94. These differences may be due to harrowing of soil and its effect on organic matter decomposition and to the type of manure and the effect of organic acids which gave abundance of NH4 ions that reduce the pH values of soil.

The highest value of NH_4 ions in soil was 92.00 mg.kg^{-1} it was obtained from cows manure treatment with R system, while the lowest value of 67.00 mg.kg^{-1} was obtained from cows manure with D system. This reflected on soil pH compared with control treatment with value of 57.00 mg.kg-[1]. These results were in agreement with results of (2, 7, 10) in terms of effect organic matter and harrowing system and its effect that helps in biological oxidation of organic matter in soil , and in turn its effect on physical and chemical properties of soil and plant growth.

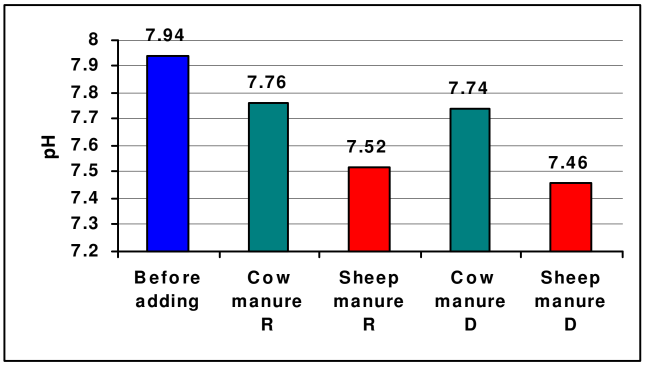

Fig. 2 : Effect of organic matter on pH values after 90 days of fermentation process.

(3) ECE of soil solution:

Table (2) showed a significant increase in the ECe values in the soil solution when organic matter was added., Cows manure with R system gave the highest value of (4.10) dS.m^{-1}, while the treatment of cows manure with D system was (3.95) dS.m^{-1}Sheep manure with R system gave 2.02 dS.m^{-1} and (2.92dS.m^{-1} at D system compared with the control treatment that gave (2.05) dS.m^{-1}. This may be due to the higher salinity in organic matter in treatment of cows manure than in sheep manure. The sheep manure contain less salinity therefore it had little effect on the soil ECe, This was in agreement with results of (7, 12). Therefore soil and agricultural mechanization should be managed well when using these manures at high levels to reduce their effect on soil salinity, and their negative impact on plant growth. Figure (3) shows the effect of the added organic matter in ECE values of soil extract after 90 days of fragmentation

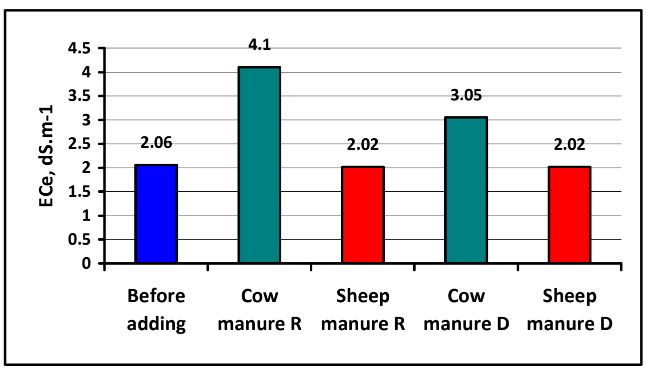

Fig. 3 : Effect of organic matter on ECe values after 90 days of fermentation process.

(4) Calcium carbonate $CaCO_3$

The results of the chemical analysis in table (2) showed that there was little change in the percentage of calcium carbonate in the soil treated with organic matter. Cows manure differed significantly from the sheep manure and control treatment. The lowest decrease in calcium carbonate was obtained from the cows treatment with D system (23%) compared with the control treatment (28%). At the treatment of sheep manure, the percentage of $CaCO_3$ was slightly increased, and it was significant (30.00%). The decrease in $CaCO_3$ may be due to the increase in partial present of carbon dioxide in treated soil solution when organic matter is decomposed (12, 13). While the increase in sheep's manure may be due to its contents of bases including calcium carbonate. Figure (4) shows the effect of organic matter on $CaCO_3$ values on soil samples.

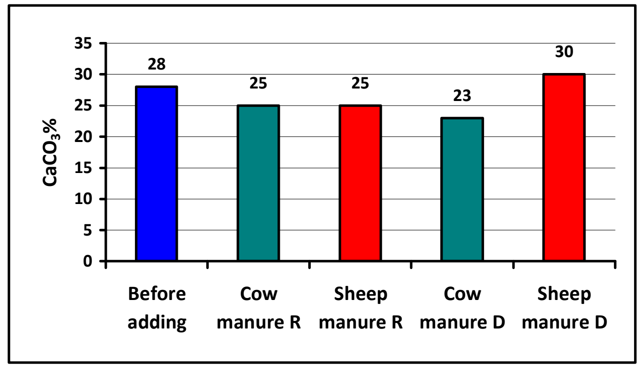

Fig. 4 : Effect of organic matter on $CaCO_3$ values after 90 days of fermentation process.

(5) Mean Weight Diameter (MWD)

The results of the statistical analysis showed that the addition of organic matter had highly significant effect on increasing soil aggregates stability in term of MWD. There was significant differences in MWD resulted from the types of organic matter and harrowing system compared with control treatment under a probability level of (0.05) and the sequence of the values was (1.39) mm (the cows manure with R system > 1.265 mm, cows manure with D system > (0.45 mm), sheep manure with R system> (0.255 mm), Sheep manure with D) (Fig. 5). This increase may be due to the effect of the interaction between the harrowing systems and type of organic matter added and to the effect of the organic matter, its degradation products and the binding effect of the biodegradation products. The value of the decomposition and fermentation products of the additive products led to formation of Ca-Humat with the presence of calcium salts especially in the soil such as Iraqi soil, which are classified globally as calcareous soil, which have a significant impact in linking soil particles with each other.

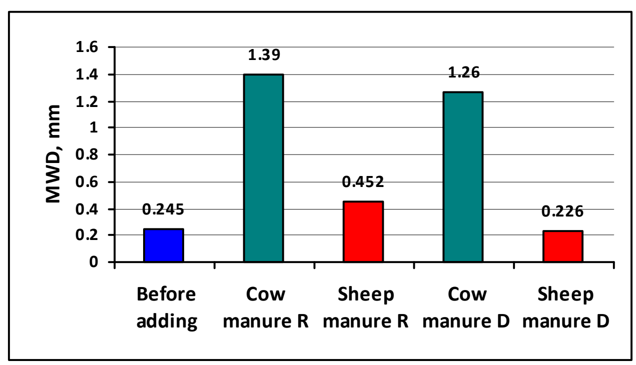

Fig. 5 : Effect of organic matter on MWD values after 90 days of fermentation process.

This is evident in terms of the effect of the products of the decomposition of cows manure in formation of this compound than it is in the case of sheep manure on the one hand. On the other hand, the effect of the R system was better than D system in both treatments compared to the control treatment. This was in agreement with results of (Dinel, 1991) that the long aliphatic group chains, which are the basic constituents of the organic matter products have significant effects, on increasing the resistance of the bonding stability. These chains were higher in cows' manure than in sheep manure with R system in both treatments, while the free ionscover soil aggregates and reduce their hydration, which led to an increase in aggregate stability.

(6) C / N ratio

The role of organic matter which is faster in decomposition has least C / N ratio than the slow decomposition organic matter, which has a high C / N ratio and the duration of the effect is shorter in the first case due to the decomposition of the same bonding material by microbiology after the energy source is exhausted. While in the second longer period of decomposition, the effect remain for longer time because it contain a high proportion of carbohydrates and protein depending on animal feed. The products of decomposition of these materials play a large role in the stability. And this finding is in consistent with results of (19), which showed that the greater proportion of these substances in the organic matter decomposing the more effective and efficient in improving the physical properties of soil. In comparison, the rate of sheep manure decomposition were greater than cows manure, also with R system was better than D system in both treatments, 11.22> 11.30> 13.24> 13.48 respectively, while the rate of decomposition of sheep manure with R>sheep manure with D>cows manure R> cows manure with D. Figure (6) shows effect of C / N values on soil samples.

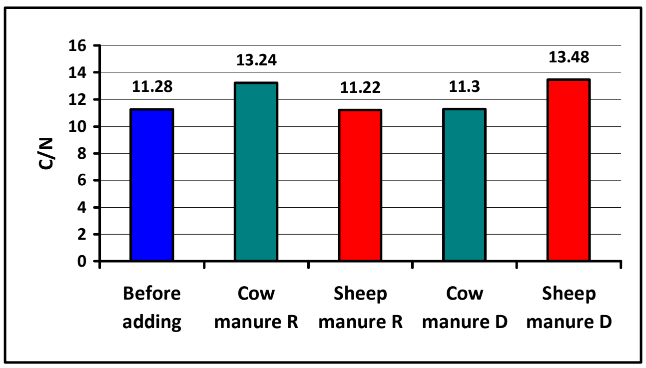

Fig. 6 : Effect of organic matter on C/N values after 90 days of fermentation process.

(7) NH_4 Value

The results of the chemical analysis in table (2) show that NH_4 is one of the important and essential organic nitrogen forms in the release of mineral nitrogen as a link through which all organic nitrogen forms pass through the soil. This led to the preparation of the mineral N element in the soil, during growth of the plant. This means that the addition of organic matter mixed with the soil with the systems of harrowing improve mineralization. The addition of organic matter in the soil is a good resource of nitrogen because most of the nitrogen in the soil is organic. The available nitrogen values inNH_4 from cows manure treatment with D system were (67.00) mg.kg^{-1} and cows manure with R system (92.00) mg.kg^{-1}, (90.00) mg.kg^{-1} in the treatment of sheep manure with D system and (73.00) mg.kg^{-1}, in the treatment of sheep manure with R compared with control treatment (57.00) mg.kg^{-1}. This showed the effective role of the interaction between the addition of organic matter to the soil and harrowing systems in the degree of decomposition, fermentation and of this material as well as the oxidation and reduction conditions within the soil system and the production of soil NH_4, Figure (7) shows the effect of organic matter on NH_4 on soil samples.

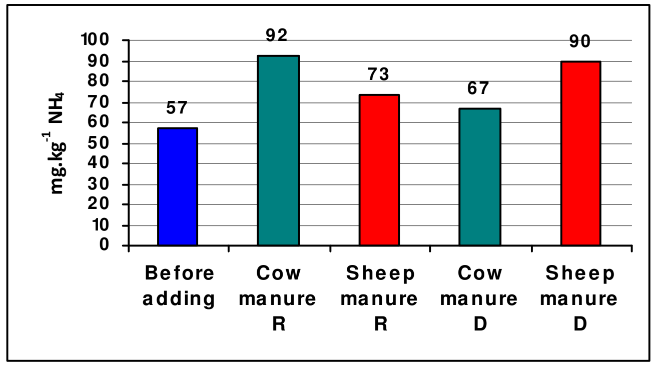

Fig. 7 : Effect of organic matter on NH_4 values after 90 days of fermentation process.

(8) Available phosphorus P value

The results of the chemical analysis in table (2) showed that this technique had an effect on the value of the available phosphorus after the process of decomposition and fermentation and under the two systems of harrowing. The values of the available phosphorus in the treatment of cows manure with D system was (49.25) mg.kg^{-1} and 25.00 mg.kg^{-1}in the treatment of cows manure with R system. While in the treatment of sheep manure with D system was (38.00) mg.kg^{-1} and at the treatment of sheep manure with R system was (32.60) mg.kg^{-1} compared with treatment of control of (49.00) mg.kg^{-1}. This was due to the loss of the phosphorus content of these organic matter , on the other hand the available phosphorus exploited by microorganism that analyzed O.M in the process of biodegradation and bio-oxidation which resulted in a decrease in P content in both treatments. The highest treatment was in the treatment of cows manure with D system and the lowest value in the treatment of R system was with cows manure. This was also due to the slow movement of phosphorus within the depth of soil where samples were taken compared to other nutrients. Figure (8) shows the results.

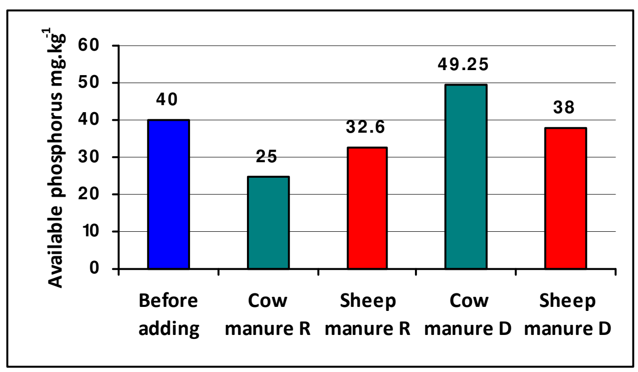

Fig. 8 : Effect of organic matter on available k values after 90 days of fermentation process.

(9) Available Potassium K value

Figure (9) showed that the best treatment was in the treatment of cows' manure with D system, which gave an exchangeable-K of (199.20) mg.kg^{-1} while the water soluble-K was (42.21) mg.kg $^{-1}$. While the lowest values were in sheep manure with R system Mg.kg^{-1} the value of exchangeable-K (98.20) mg.kg^{-1} while Water soluble-K (48.28) Mg.kg-1 compared with control treatment that gave (101.66) Mg.kg-1 as exchangeable-K and (40.00) Mg.kg-1 as water soluble-K. The increase may be due to the adsorption of part of the release of this nutrient on the soil colloid which appeared in the exchangeable form and some parts was taken by the analyzed organisms and the other part remaining in the soil as storage for the near term. Figure (9) shows the effect of organic matter on the values of available potassium k.

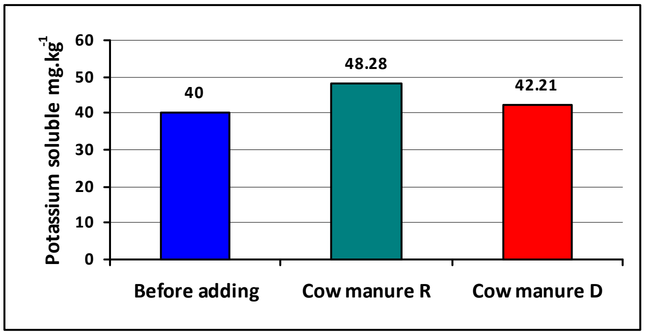

Fig. 9 : Effect of organic matter on soluble and exchangeable potassium after 90 days of fermentation process.

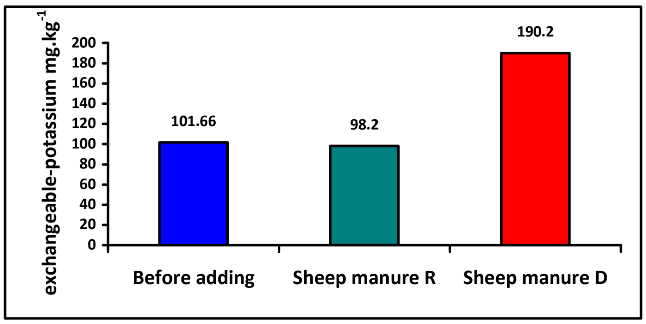

Fig. 9: Effect of organic matter on soluble and exchangeable potassium after 90 days of fermentation process .

(10) Hydraulic conductivity

Table (2) showed the effect of the harrowing and addition of organic matter on hydraulic conductivity values compared with the control treatment. The best hydraulic conductivity values obtained from the treatment of sheep manure with R system followed by the treatment of cows manure with D system and sheep manure with D system then cows manure with R system 0.60>0.59>0.57>0.55 respectively, compared with control treatment 0.34 This indicated that the harrowing systems for all condition play an effective role in increasing hydraulic conductivity values by improving their bulk density and porosity. The process of decomposition and fermentation of organic matter in addition to the systems of harrowing are very important in improving the qualities of soil, including hydraulic conductivity. These results were in agreement with results of (Al-Ajili, Sh. S). Figure (10) shows the effect organic matter on hydraulic conductivity of soil samples.

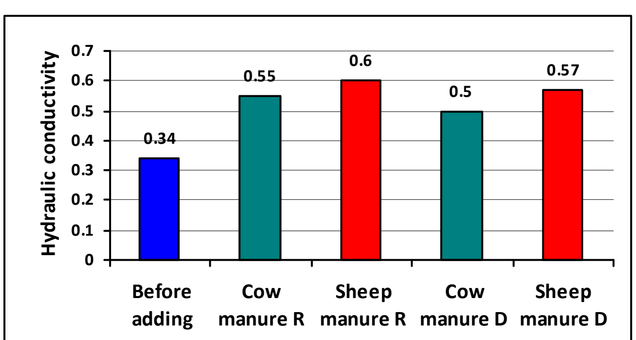

Fig. 10 : Effect of organic matter on hydraulic conductivity after 90 days of fermentation process.

Biological Experiment

(1) Plant height (cm)

Table (3) show that there were a significant differences between plant height treatments. The highest plant height (cm) was obtained from the treatment of cows manure (R) 225.30 cm followed by the treatment of cows manure (D) 219.3 cm followed by treatment of sheep manure (D) of 160.10 and finally treatment of sheep manure (R) 165.50 cm While the control treatment gave the lowest height of the plant 125.35 cm. The reason of this difference was the nature of the organic matter decomposition and their effect on the soil properties, Consequently, The effect on the height of the plant and also the results refers to slight differences due to the interaction between the systems of harrowing and the type of organic matter added and the nature of its biochemical analysis under this technique, and its impact on the soil properties. As well as the efficiency of the plant and the root mass in nitrogen uptake efficiency, which is the plant's ability to absorb nitrogen from the soil as nitrate or ammonium. The plant content of nitrogen to the added nitrogen does not exceed 50% of it (Malegoli *et al*., 2005). The organic nitrogen after conversion to mineral form due to biological shifts in the soil and the role of microorganisms will be useful for building protein within the plant tissues and is reflected on plant growth.

The fertilization recovery is the result of the balance between nitrogen uptake and immobilization by soil microbial processes, therefore, the NUE criterion is the efficiency of nitrogen absorption of the crop as a function of soil tissue, climatic conditions, soil interferences, biological processes and the nature of organic and inorganic nitrogen sources.

Table 3: Effect of the Interaction between harrowing Systems and Type of Organic Matter on plant height.

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	225.30	219.95	214.30
Sheep manure	165.50	124.35	160.10
Control treatment	129.10	125.35	123.60
Average	173.30	175.20	167.66
L.S.D. at 0.05 To : 0.05 0.173 HS : 0.054 TO x HS : 0.102			

(2) Weight of 500 seeds (gm)

The results in table (4) showed that the treatment of cows manure (R) was significantly higher than the other treatments which gave the highest value of (144.70 gm) compared with control treatment (109.22gm) while the sheep manure (R) gave (123.57 gm). The results of the same table showed that the treatment of cows manure (D) gave (132.30 gm) which is slight higher than cows manure treatment (R), sheep manure (R) and sheep manure (D) which gave 123.57 gm and 120.17 gm respectively. The increase of the weight of 500 seeds was due to the direct effect of interaction between the harrowing system and the type of organic matter, which resulted in an improvement in the physical, chemical and biological soil properties. The increase of leaf area of the plant resulted in increase of weight of 500 seeds. This was in agreement with results of (Abu Dahi *et al*., 2001; Almaamouri, 1997), which play an important role in improving the efficiency of photosynthesis, which transport their products from sources to sinks. This was consistent with the results of the chemical analysis of the nutrients after decomposition, as shown in table 2 in terms of the increase in the ratio of available nitrogen, available phosphorus and available potassium after addition of organic fertilization within this technology and its interaction with the system of mechanization of plowing and harrowing.

Table 4 : Effect of harrowing systems and type of organic matter and their interaction on the Weight of 500 seeds.

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	144.70	132.30	138.5
Sheep manure	123.57	120.17	121.87
Control treatment	109.22	115.00	112.11
Average	125.83	122.44	124.16
L.S.D. at 0.05 To : 0.273 HS: 0.032 To x HS : 0.296			

(3) Seeds yield (ton.ha^{-1})

The results in Table (5) showed that the treatments of cows manure with (R and D) systems are higher than the treatments of sheep manure with (R and D) compared with control treatment in total seeds yield. The treatment of the cows manure (R) gave the highest value of seeds yield of 6.85 ton.ha^{-1}compared with control treatment that gave lowest value of 2.25 ton.ha$^{-1.}$ All treatment were differed significantly, the cows manure (R,D) treatments differed significantly from the sheep manure (R,D) treatments which differed significantly from control treatment by the values 6.85> 5.20> 4.63> 4.10> 2.25 ton.ha^{-1}. The reason of this increase may be due to the role of nutrients as a result of the decomposition process of the organic matter under the two harrowing systems, the effect of the interaction between the additives of organic matter is the effect of the biochemical decomposition of the organic matter under the two systems of harrowing and improvement of chemical and physical soil properties, which was positively reflected in the growth and production of sunflower, the phosphorus produced by the process of decomposition works to form a good plant roots, which increases nutrient uptake coupled with the increase of the materials produced in the leaves by process of photosynthesis as a result of increasing the leaf area and the transfer of these materials and storage in the grain, and thus lead to an increase the seeds yield. This was in agreement with results of (Alfalahi, 2005, Al-Ma'ini and Ibrahim 2004.).

Table 5: Effect of harrowing systems and type of organic matter and their interaction on seeds yield

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	6.025	5.20	6.85
Sheep manure	4.63	4.10	4.36
Control treatment	2.25	2.92	2.28
Average	4.35	4.58	4.07
L.S.D. at 0.05 To : 0.304 HS: 0.031 To x HS : 0.402			

(4) Height of area (cm)

The results in table (6) showed that there were significant differences in the effect of the harrowing systems with the addition of organic matter on the area of the sunflower in both systems in the two experimental fields. Highest value of area of flower was obtained from the treatment of cows manure (R) 31.46 cm^2 followed by cows manure (D) 26.32 cm^2, followed by the treatment of sheep manure (R) 20.62 cm^2 and sheep manure (D) 20.19 cm^2 compared with the control treatment 18.75 cm^2 in the field of harrowing system (R) and 12.04 cm^2 in field of harrowing (D). This was due to the simple superiority of the soil properties and the biochemical and physical environment in the soil, the effect of the process of decomposition of organic matter under the systems of harrowing and the appropriate climate and yield response to all the treatments. This is clear through the results of table 2 and the results of soil analysis. The height value of sunflower area is one of important characters in sunflower crop. This was due to the relation between the increase in the possibility of mechanical harvesting of the sunflower and height of area value in plant and the preservation of the crop with the lowest losses (Dhaef *et al*., 2000).

Table 6: Effect of harrowing systems and type of organic matter and their interaction on the height of ear.

Type of Organic	Harrowing systems		Average
	D	R	
Cow manure	26.32	28.89	1.463
Sheep manure	20.62	20.19	20.41
Control treatment	18.75	12.4	15.39
Average	23.61	19.52	
L.S.D. at 0.05 2.17			

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