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Evaluate the Response of Sunflower Productivity to Modern Chemigation systems in New Reclaimed Lands

Sabreen Kh. Pibars* and H. A. Mansour

[1]Water Relations & Field Irrigation Department, Agric. Division, National Research Centre, Cairo, Egypt.

Abstract: Field experiments were conducted during two successive growing seasons in split split plot design at the National Research Center farm, El-Nubaria area, El-Behaira Governorate .Experiments investigated the effect of fertilization treatments: (traditional method of fertilization; fertigation technique), three levels of compost tea 30, 50 and 80 L/fed (CP1, CP2 and CP3) and three levels of humic acid 2, 3 and 4 L/fed.(HA1,HA2 and HA3)on sunflower Productivity. Data obtained indicated that FM surpassed TM in all the growth characters. Decreasing the applied organic fertilizers adversely affected the growth characters and the differences were significant at the 5% level.The main results could be summarized as follows: the highest seed yield (1450 kg/ fed.) was obtained in the treatment (FM×CP2×HA3) while the minimum one was 980 kg /fed obtained in the treatment(TM×CP1×HA1), respectively. The highest and the lowest oil yield of sunflower (630 and 280 kg oil fed-1.) were obtained with treatment FM x CP2 x HA3 and TM x CP1 x HA1, respectively.
Keywords: SunflowerProductivity, organic fertilizer, humic acid, compost tea.

Introduction

Supply of nutrients to the soil is very important for organic farmers. Soil managementin organic agriculture improves the soil fertility supplying with composted material(Willer and Yussefi 2005)[1]. Organic composts and other solid manures are great but theytake a while to break down in the soil and become available to plants. Compost tea is an increasingly popularproduct in organic agriculture largely due totestimonial support of its efficacy (Ryan et al. 2005)[2].While it has been produced and used in Europe forhundreds of years, it is a relatively new product inNorth America (Brinton et al. 2004)[3]. Compost tea isan infusion of compost in water for a period oftime, the compost is removed and the remainingsolution is the compost tea, which is then applied toplant leaves where it may confer disease resistance,provide beneficial microorganism to the plant and soil, as well as supply essential plant nutrients(Bess 2000; Scheuerell and Mahaffee2004)[4; 5]Furthermore, since compost tea is a foliarspray, it

is also claimed to be a readily availableform of compost supplying nutrients more quicklythan compost additions to soil (Bess 2000)[4].

In this concern, Sabreen et. al. (2015), Mansour et. al. (2015 a; b) [6, 7; 8].Indicated that the maineffect of compost tea on the studied traits of sunflowercould be written the following ascending order 30L/fed. <50 L/fed<70L/fed. Hussein and Hassan (2011)[9] humic acids are important soil components, they can improve nutrient availability and have impact on other important chemical, biological, and physical properties of soils. Also, Foliar application of humic acids increased the uptake of P, K, Mg, Na, Cu and Zn. Bio-fertilizers, especially those containing Nfixing bacteria, were suggested to reduce the used mineral fertilizer quantities and produce clean and healthy crops.

Humic acid application had a highly significant effect on improving soil characteristics such as aggregate size, soil pH and EC as compared with do not add humic asid treatment. (Ebtisam I. Eldardiry et. al., 2012)[10].Fertigation is a new agriculture technique which applies water and fertilizer simultaneously (Bruno, et al 2011)[11]. It can supply water and fertilizer timely and rightly and improve nutrients uptake and water use efficiency (Mahajan and Sing, 2002)[12].

Sunflower is the fourth oil grain crop grown worldwide by area (Fagundes et al., 2007)[13]. Fertilizer management is an important part of crop production. This is due in part to increasing costs for fertilizer materials, particularly nitrogen (N) fertilizer. Producers need to know how different production inputs affect crop yields so that they can choose technically efficient input combinations. They also need to know how input usage affects the profitability of their operations with varying input and crop prices. Fertilizer is an input that can easily be reduced, thus lowering input costs. However, fertilizer is a crop input that has a high return on investment if applied at the appropriate level. Prediction of optimum fertilizer rates is important because of increasing economic and environmental concerns. The economic optimum N rate was approximately 110 kg ha-1 for sunflower grown under irrigated conditions of Anatolia, Turkey (Peker and Ozer, 2005)[14].

Materials and Methods

Experiments were conducted at the Agricultural Research Station, El-Nubaria district, Egypt, National Research Centre, (latitude of 30o30\ N and longitude of 30o20\ E) during the winter season of 2012 and 2013. Field experiments were conducted in two successive growing seasons to study the effect of organic fertilization on sunflower Productivity under surface and subsurface drip irrigation in newly reclaimed soil.

Experiment Layout:

The experiments were carried out in split split plot design with three replications combined over method of irrigation. Sunflower(*Huleanthus annusL.*) was sown at 15May, in both summer seasons. The main plots were devoted to surface and subsurface drip irrigation system; sub-main plots were devoted to three levels of compost tea 20, 50 and 80 L/fed (CP_1, CP_2 and CP_3).

Table (1): Some soil physical properties of the experiment at site.

Sample depth, cm	Particle Size Distribution, %				θw (w/w)			O.M. (%)	pH (1:2.5)	EC (dSm-1)	Texture class
	Coarse Sand	Fine Sand	Clay and Silt	CaCo3 (%)	F.C	W.P	S. P				
0-20	47.76	49.75	2.49	7.02	10.1	4.7	21.0	0.65	8.7	0.35	Sandy
20-40	56.72	39.56	3.72	2.34	13.5	5.6	19.0	0.40	8.8	0.32	Sandy
40-60	36.76	59.40	3.84	4.68	12.5	4.6	22.0	0.25	9.3	0.44	Sandy

Where:
F. C : Field capacity, B.D : Bulk density, W.P : Welting point,

On the other hand, three levels of humic acid 2, 3 and 4 L/fed. In the sub-sub-plots.Fertilization treatments: (traditional method of fertilization; fertigation technique), under drip irrigation method was used. Standard drippers were spaced 30 cm apart along 40 m lateral. Dripper discharge is 4 L/h, Layout of the drip surface and the subsurface irrigation network as show in (Fig. 1).

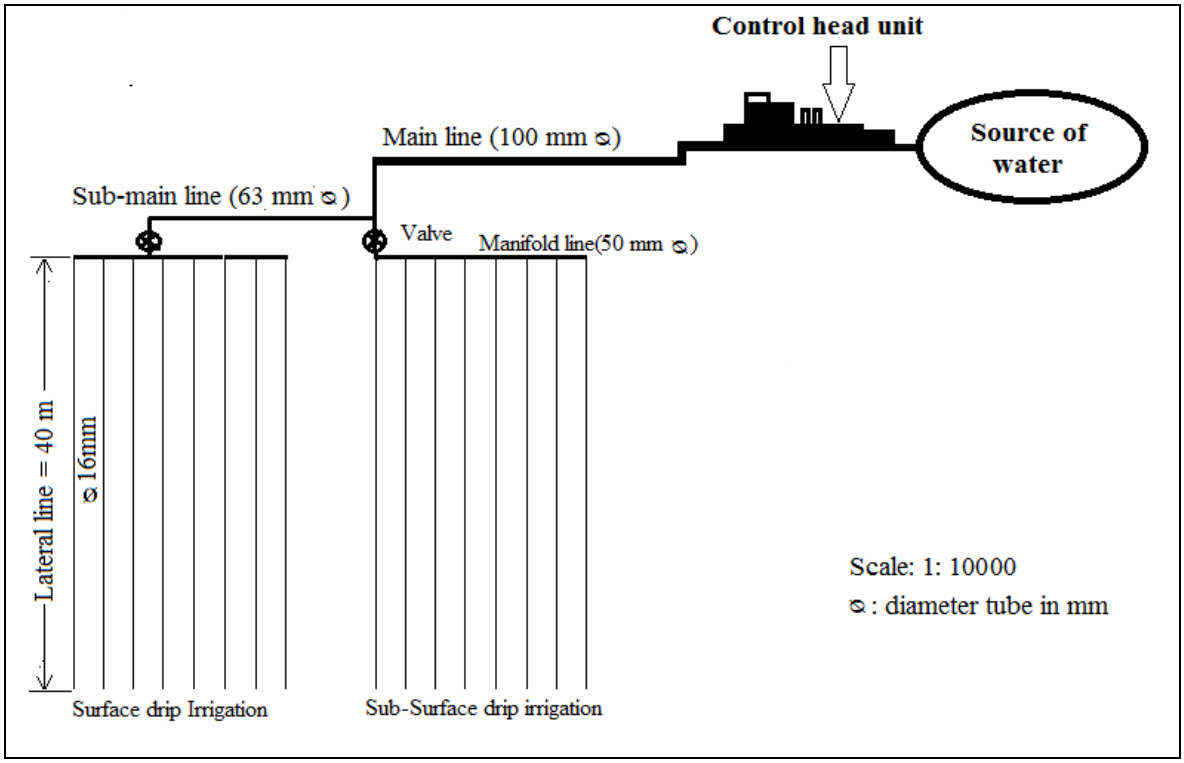

Fig (1). Layout of the drip surface and subsurface irrigation network

Total yield and some characters of plant:

The total yield of each treatment as determined using a frame 1m × 1m size. The frame was placed randomly and the sunflower plants within the frame were weighted. The recorded plant characters are: Plant height cm, Steam diameter (cm), Head diameter (cm), Seed yield (Kg/fed), Oil yield

(Kg/fed).The oil content of sunflower seeds was determined using a Soxhlet apparatus and Petroleum ether as solvent according to A.O.A.C. (1995). Oil yield kg fed-1 was estimated as following equations:-

$$\text{Oil yield kg fed}^{-1} = \text{Oil\% Seed yield fed}^{-1}/\ 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

Results and Discussion

The Main effect of irrigation system, compost tea and humic acid on growth parameters:

Main effects of irrigation method as shown in Tables (1 and 2);Figures (2and 3), the main effects of irrigation method on growth parameters, i.e. plant height (cm), steam and weight of 100 seeds. The obtained data indicated that the fertigation method exceeded the traditional method in all the studied growth and growth characters.

Table (2): Effect of Fertigated Humic Acid And Compost Tea on yield parameters under surface and subsurface drip irrigation system.

Irrigation system	Compost tea	Humic acid	Plant height (cm)	Diameter of steam, (cm)	100 seeds weight(g)
Surface irrigation system	C_1	H_1	46	1.6	2.4
		H_2	71	2.3	3.3
		H_3	83	2.6	3.3
	C_2	H_1	99	2.7	4.2
		H_2	113	3.1	4.8
		H_3	119	3.3	5.0
	C_3	H_1	92	1.8	3.6
		H_2	102	2.2	3.9
		H_3	115	2.8	4.7
Sub surface irrigation system	C_1	H_1	73	2.1	3.1
		H_2	80	2.0	3.8
		H_3	94	2.5	4.2
	C_2	H_1	116	2.7	4.9
		H_2	123	3.2	5.2
		H_3	137	3.5	5.9
	C_3	H_1	99	2.2	4.7
		H_2	105	2.7	4.7
		H_3	126	3.1	5.0
LSD 0.05			**2**	**0.1**	**0.2**

Three levels of compost tea 30, 50 and 70 L/fed (CP1, CP2 and CP3) .
Three levels of humic acid 2, 3 and 4 L/fed.(HA1,HA2 and HA3).

The main effect of compost tea on the studied traits could be written the following ascending order $CP_1<CP_3<CP_2$ i.e values of the studied characters increased with increasing the CP applied (30-50 L / fed.). This could be explained on the basis that CP is an essential major nutrient, especially forlegumes, Egyptian soil is poor in the available fertilizer.

Regardless of irrigation method and CP treatments, the data of Fig (2) demonstrated the effect of humic acid on the characters under study. Based upon the obtained values of the studied characters, humic acid could put in the following ascending order: $HA_1<HA_2<HA_3$. The differences in investigating

characters among humic acid were significant at the 5% level.The results of the present study showed that the organic media can improve plant height. This can be due to increased media moisture storage and enhanced nutrient absorption (Samei et. Al., 2005)[15].(Kamari Shahmaleki et. Al., 2010)[16] found that treatment with 20 and 50 mg/l humic acid in lettuce increased characteristics significantly.

All the values of the studied characters in the FM × CP×HA surpassed those of the TM × CP×HA. For the two irrigation systems, the depressive effects of the interaction on the obtained values of the characters could arranged in the following descending order FM × CP_2× HA_3<FM × CP_3 × HA_2< FM × CP_1× HA_1 and TM × CP_2× HA_3<FM × CP_3× HA_2< FM × CP_1× HA_1. The difference between any two interactions was significant at the 5% level.In this respect, several investigators shown that the addition of a specific amount of humic substances to plants can enhance vegetative growth parameters, i.e., plant length,number of main stems/plant, foliage fresh and dry weight/plant (Awad and EL-Ghamry, 2007; Verlinden et al., 2009)[17; 18].

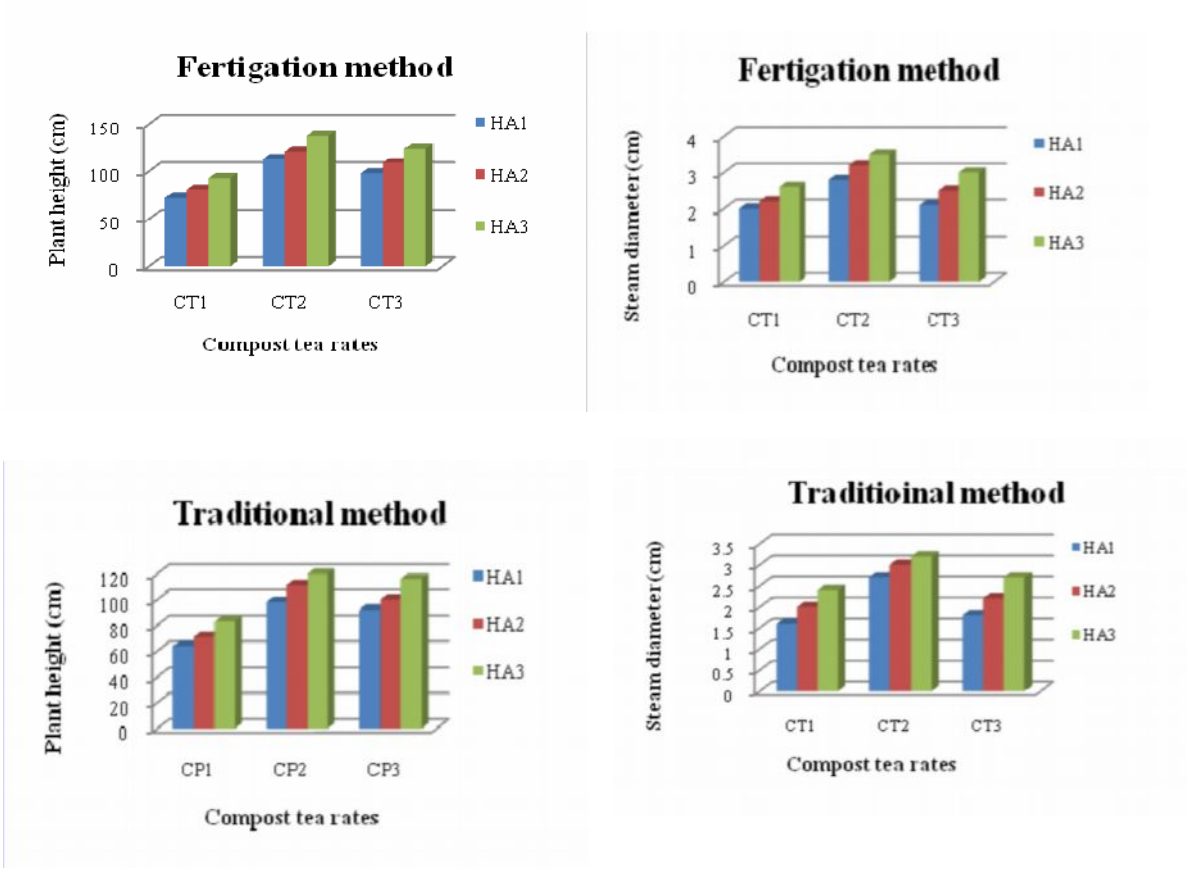

Fig (2): effect of fertilization treatments, compost tea and humic acid on growth parameters.

Table (3): Effect of Fertigated Humic Acid And Compost Tea On SunflowerProductivity under surface and subsurface drip irrigation system.

Irrigation system	Compost tea	Humic acid	Seed yield(kg/fed.)	Oil yield (kg/fed.)
Surface irrigation system	C_1	H_1	980	280
		H_2	1132	385
		H_3	1243	410
	C_2	H_1	1155	401
		H_2	1257	510
		H_3	1384	552
	C_3	H_1	1236	372
		H_2	1271	427
		H_3	1300	491
Sub surface irrigation system	C_1	H_1	1220	370
		H_2	1260	412
		H_3	1343	475
	C_2	H_1	1350	423
		H_2	1380	510
		H_3	1450	630
	C_3	H_1	1230	414
		H_2	1310	438
		H_3	1410	551
LSD 0.05			**42**	**11**

Three level of compost tea 30, 50 and 70 L/fed (CP1, CP2 and CP3) .
Three levels of humic acid 2, 3 and 4 L/fed.(HA1,HA2 and HA3).

The main effect of fertilization treatments, compost tea and humic acid on seed yield:

Data in fig (3) shows that in bothFM and TM, this interaction could be put in the following ascending order: $CP_1\times$ irrigation method$<CP_3\times$ irrigation method$<CP_2\times$ irrigation method. The difference in the studied parameters between any two interactions was significant at the 5% level. The maximum values (1450 kg/fed.) were obtained with the interaction FM $\times$ CP_2whereas the minimum ones (980 kg/fed.) with the interaction TM $\times$ CP_1 except water use efficiency.

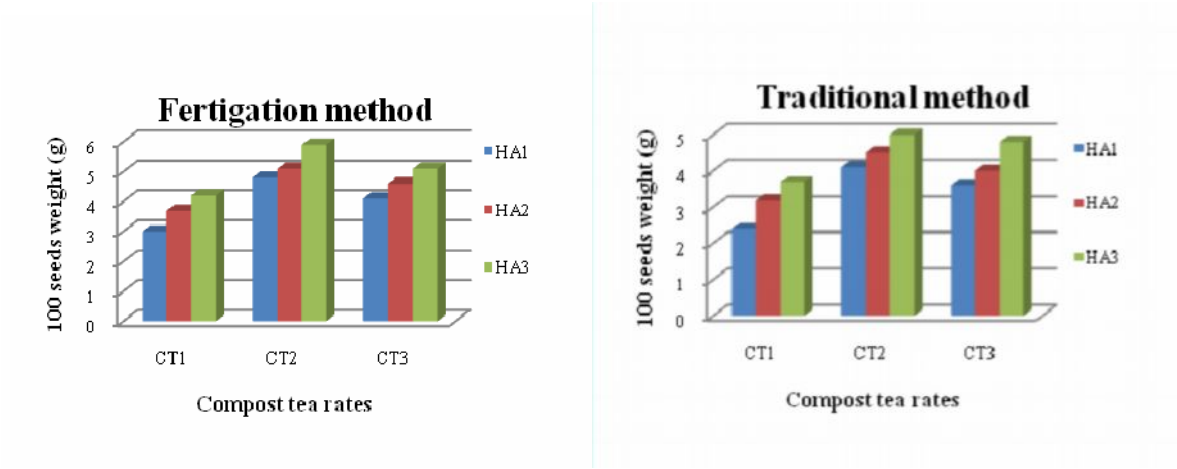

Fig (3): effect of fertilization treatments, compost tea and humic acid on growth parameters.

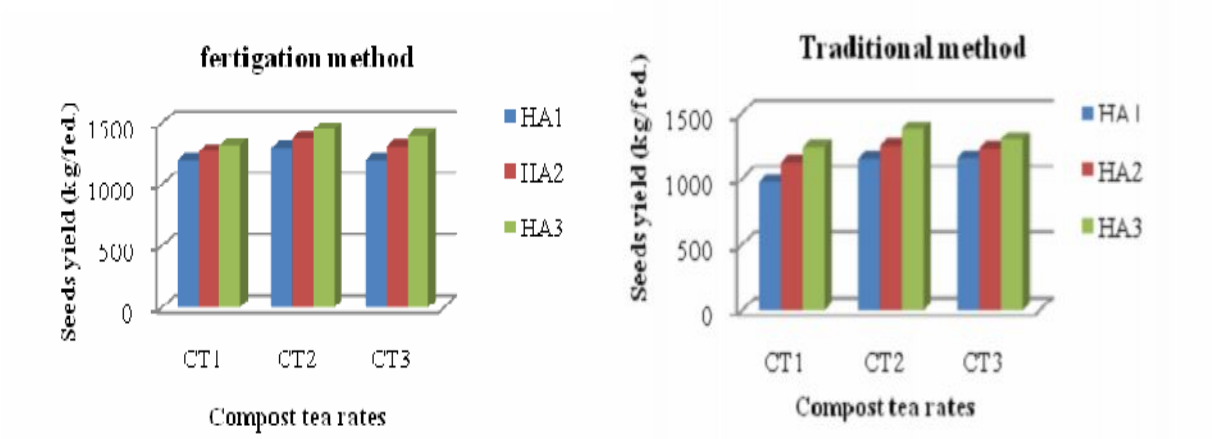

Fig (3): effect of fertilization treatments, compost tea and humic acid on seed yield.

All the interactions CP × HA led to significant differences in the investigated parameters at the 5% level. The highest values of the studied parameters and the lowest one were noticed with the interaction CP_2× HA_3 and CP_1 × HA_1, respectively. This could be attributed to one or more of the following reasons: - Soluble organic is low in the Egyptian soil and organic fertilizer is a major essential element in plant nutrition.

Humic substances have a very profound influence on the growth of plant roots. When humic acids applied to the soil, enhancement of root initiation and increased root growth may be observed(Pettit 2004)[19]. The stimulatory effects of humic substances have been directly correlated with enhanced uptake of macronutrients, such as nitrogen phosphorus and sulfur (Chen et. Al.,1990)[20] and micronutrients, that is, Fe, Zn, Cu and Mn (Chen et. Al., 1999)[21].

Effect of fertilization treatments, compost tea and humic acid on oilseed yield.

Data in Fig. (4) Show that the highest and the lowest oil yield of sunflower(630 and 280 kg oil fed-1.) was obtained with treatment FM x CP_2 x HA_3 and TM x CP_1 x HA_1, respectively.

The highest value of oil yield was achieved by using fertigation technique under 50L compost tea /fed. But the statistical analysis indicated that no significant difference was achieved between 50 and 80 L compost tea /fed., in the oil yield, this means saving 30Lfrom organic fertilizer.

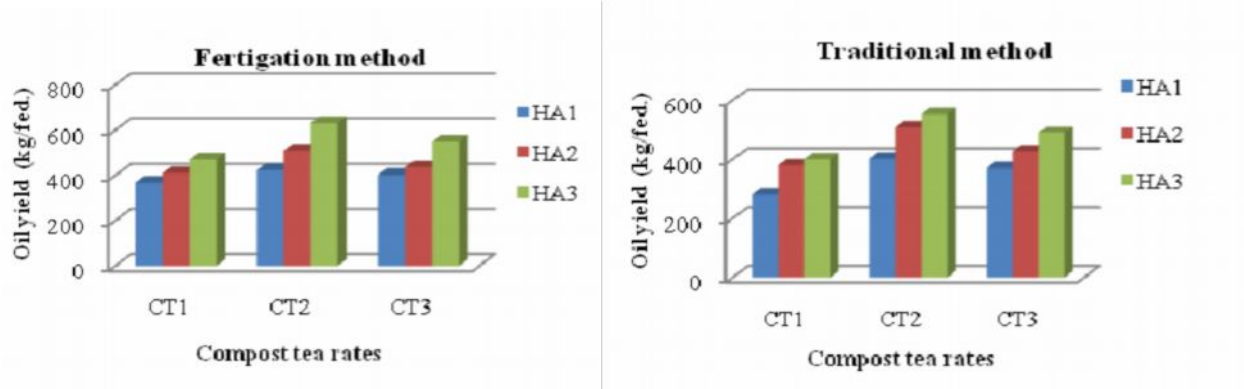

Fig (4): Effect of fertilization treatments, compost tea and humic acid on oil yield.

Conclusions:

From the above mentioned presentation, it can be concluded that:

1. The use of organic materials such as humic acid and compost tea for plant nutrition in organic production systems should be considered. Desired biochemical or physiological processes and crop quality factors could be obtained by the right choice of organic fertilizers or application rates.
2. The highest and the lowest sunflower yield (1450 and 980 kg fed-1.) was obtained with treatment FM x CP_2 x HA_3 and TM x CP_1 x HA_1, respectively.
3. The main effect of compost tea on the studied traits could be written the following ascending order $CP_1<CP_3<CP_2$.
4. The main effects of irrigation method on growth parameters, i.e. plant height (cm) , steam and weight of 100 seeds. The obtained data indicated that the subsurface drip irrigation exceeded the surface drip irrigation in all the studied growth and growth characters.
5. The highest and the lowest oil yield of sunflower (630 and 280 kg oil fed-1.) were obtained with treatment FMx CP_2 x HA_3 and SD x CP_1 x HA_1, respectively.
6. The highest value of oil yield was achieved by using fertigation technique under 50L compost tea /fed. But the statistical analysis indicated that no significant deference was achieved between 50 and 80 L compost tea /fed. , in the oil yield, this means saving 30Lfrom organic fertilizer.

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