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Alleviation of Water Stress on Photosynthesis in Oilyplants

***W.M. Shukry and E.E. Hammda**

Botany Department, Faculty of Science, Mansoura University, El Mansoura, Egypt

***Corresponding Author:** W.M.Shukry, Botany Department, Faculty of Science, Mansoura University, El Mansoura, Egypt.*

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ABSTRACT

Stressful environments such as salinity and drought was assessed on photosynthesis, the most fundamental and intricate physiological process of three oil plants canola (BrassicanapusL.), safflower (Carthamustinctorius L.) and sunflower (Helianthus annusL) grown in different sites in Egypt (Suez road; North Coastal area; El-Kantra East) , is also severely affected in all its phases by such stresses . The plants were subjected to a pot experiment in which pots contained an equal amount of each soil-type either alone or supplemented with composted plant residue (wheat straw and Eichhorniacrassipes) at three concentrations (0.25, 0.5, 1.0% v/v) as organic fertilizers and ammonium sulphate at three levels (5, 10, 15 g/pot) as inorganic fertilizer. Since the mechanism of photosynthesis involves various components, including photosynthetic pigments and photo systems, the electron transport system, and CO2 reduction pathways, any damage at any level caused by a stress may reduce the overall photosynthetic capacity of a three plants . All three soil types resulted in a decrease in photosynthetic pigments and Hill reaction as well as transpiration rate and leaf conductance for all three plants when grown in these different soil types compared to the control garden soil although these parameters improved when soils were supplemented with organic fertilizers rather than inorganic ones. In addition leaf temperature of stressed plants was increased and decreased when grown in different soil and when soil were supplemented with fertilizers respectively compared with the control.

Keywords: *Photosynthesis, canola, safflower, sunflower, stress, organic and inorganic fertilizers;*

INTRODUCTION

Although the plant growth is controlled by a multitude of physiological, biochemical, and molecular processes, photosynthesis is a key phenomenon, which contributes substantially to the plant growth and development. The chemical energy expended in a number of metabolic processes is, in fact, derived from the process of photosynthesis, which is capable of converting light energy into a usable chemical form of energy. This key process occurs in all green plants, whether lower or higher, occurring in oceans or on land as well as in photosynthetic bacteria (Taiz and Zeiger 2010, Pan *et al*. 2012). However, stressful environments, including drought, salinity, and un favourable temperatures, considerably hamper the process of photosynthesis in most plants by altering the ultra structure of the organelles and concentration of various pigments and metabolites as well as stomatal regulation .Different growth and development related processes depend on the interplay of intracellular organelles. The chloroplast is the key site for photosynthesis, in which both light and dark reactions of photosynthesis take place. However, this organelle is highly sensitive to different stressful environments such as salinity, drought, extremes of temperature, flooding, varying light intensity, and UV radiation, and it plays a premier role in the modulation of stress responses (Biswal *et al*. 2008, Saravanavel *et al*. 2011). All these stresses reduce the photosynthetic rate by stress-induced stomatal or non stomatal limitations (Saibo *et al*. 2009, Rahnama *et al*. 2010). For example, drought stress, particularly at its mild intensity, can inhibit leaf photosynthesis and stomatal conductance in most green plants (Medrano *et al*. 2002) .Stomata closure is known to have a more inhibitory effect on transpiration of water than that on CO_2 diffusion into the leaf tissues (Chaves *et al*. 2009, Sikuku *et al*. 2010). However, in contrast, under severe drought stress, dehydration of mesophyll cell stakes place causing a marked inhibition of basic metabolic processes of photosynthesis as well as a reduction of plant WUE (Damayanthi *et al*. 2010, Anjum *et al*.2011). Drought stress also reduces the efficiency of mesophyll cells to utilize the available CO_2 (Dias and Bruggemann 2010a,b).Stomata closure in response to drought and salinity stress generally occurs due to decreased leaf turgor and atmospheric vapor pressure along with root-generated chemical signals (Chaves *et al*.2009). Thus, the decrease in photosynthetic rate under stressful conditions (salinity, drought, and temperature) is normally attributed to a suppression in the mesophyll conductance and the stomata closure at moderate and severe stress (Flexas *et al*. 2004, Chaves *et al*. 2009).The effects of salinity and drought on photosynthesis are attributed directly to the stomatal limitations for diffusion of gases, which ultimately alters photosynthesis and the mesophyll metabolism (Chaves *et al*. 2009).

Significant improvement in crop growth was achieved when supplementary irrigation was provided to the crops in their three most critical growth stages under stress conditions Ghosh*et al*. (2012) and by adding organic manures. Several groups reported that the application of organic manures to salt-affected sandy soil can ameliorate their salinity and improve their physical, chemical and biological properties and consequently increase plant growth and yield of crops (El-Fakhrani 1996 and Gharib *et al*., 2008).Moreover organic manures can improve the properties of soil exposed to drought by increasing the limited moisture holding capacity (Getinet 2016).

In Egypt, considerable attention has been paid in the last few years to the subject of soil reclamation to increase agricultural production and subsequently overcome the deficiency in food requirements (Hanne, 2009) some regions of the world, such as parts of Sahara Desert of North Africa receive an average of 5 mm of rainfall or less per year. This extreme aridity is a typical of the arable land which is used for crops, as at El-Kantara and Suez sites in Egypt. Nevertheless, most of the world's agriculture is subjected to drought problems. Arid and semi-arid zones are defined as areas in which plant transpiration is about 50% or less than the transpiration that would normally occur in response to the limited water availability (El-Bassiouny and Shukry 2001; Qaderi *et al*. 2006). Incorporation of any new crop in Egyptian rotation is very difficult due to the limited cultivated area and due to the high competition from the main crops such as wheat and cotton. Hence, it is necessary to concentrate planting in newly reclaimed areas. Most of these areas have some stress problems, i.e. drought, salinity and unbalanced nutrient elements. Therefore, attempts are being made to increase crop productivity in new reclaimed soils by many ways such as through the application of organic manures (Abd-Eladl *et al*., 2016) Oil plants in general appear to be one of the most promising plants since their gamut of products range from proteins to carbohydrates to fats. In Egypt, there is a big problem concerning edible oil production. The local production satisfies only 20% of the total requirements. Canola, safflower and sunflower have thus a bright future as sources of oil in Egypt .Canola (*Brassica napus*L.) is one of the major oil crops in Asia and Europe (Qaderi *et al*. 2006). Safflower (*Carthamustinctorius*L.) has been cultivated around the world since ancient times as an important oil crop. It is one of the world's most important edible oil crops (Shukry, 2007).

The aim of the present study was to investigate the effects of water stress, whether induced by salinity or drought on photosynthesis of three oily plants canola (*Brassicanapus*L.), safflower (*Carthamustinctorius*L.) and sunflower (*Helianthus annus*L.) grown in three sites of Egyptian soils (Suez, North Coast and El-Kantara) and the effect of soil application of different levels of organic fertilizers represented by wheat straw and *Eichhorniacrassipes* and inorganic fertilizer represented by ammonium sulphate.

MATERIALS AND METHODS

Plant Material and Growth Conditions

In this study, the changes in photosynthetic activity of canola (*Brassicanapus*L.) and safflower (*Carthamustinctorius*L.) during a winter season and sunflower (*Helianthus annus*L.) plants during a summer season under the effect of organic (wheat straw and *Eichhorniacrassipes*) and inorganic fertilizers on three sites of soils (Suez, North Coast and El-Kantara). These sites suffered from either drought or salinity stress. The current investigation was carried out during winter season using local varieties of canola (*Brassicanapus*L.) and safflower (*Carthamustinctorius* L.) and during the summer season for sunflower (*Helianthus annuus*L.). All seeds were kindly supplied by the Faculty of Agriculture, Mansoura University. Three sites were selected: the North Coastal area (i.e. 249 kmnorth-west of Cairo); El-Kantara East (i.e. 180 km northeast of Cairo) and Suez road (i.e. 135 km northeast of Cairo). Soils were collected from these sites in order to study the possibility of cultivating in these desert areas.

An experiment was carried out in pots (25 cm in diameter) containing equal amounts of soil (7 kg). Pots were divided into three groups, the first and second groups were supplied by composted plant residue (wheat straw and *Eichhorniacrassipes*) as organic fertilizers at three concentration levels (0.25, 0.50, 1.0%) according to Guerif (1979) and El-Sirafy *et al.* (1989), respectively; the third group was supplied with ammonium sulphate (N = 20.5%) at three levels (5, 10 and 15 g/pot) as inorganic fertilizer (El-Sirafy *et al*. 1989). All fertilizers (wheat straw was collected from a field after the end of the wheat-growing season and prepared according to Guerif (1979) and *Eichhorniacrassipes* was collected from the Nile River and prepared according to El-Sirafy *et al*. (1989)) were applied to the soil before sowing. Each group represented one type of soil besides the control (garden soil, sand-clay 2:1).Preliminary experiments to test the vitality of seeds was carried out prior to actual experiments. Seeds of all three plants were surface- sterilized with 0.001 M $HgCl_2$ solution for three minutes and then washed thoroughly with tap water. Irrigation was carried out with tap water according to usual practices. Plants were exposed to natural day length (day length was 16 and 10 h in summer and winter, respectively) and illumination in a greenhouse at the Faculty of Science, Mansoura University. Mansoura lies on the east bank of the Damietta branch of the Nile, in the Nile Delta region. Mansoura is about 120 km northeast of Cairo. Classifies its climate as hot desert climate (BWh).

The chemical analysis of each experimental soil is shown in Table1. The geography of Egypt is diverse, ranging from the coastal areas of the Red and Mediterranean seas to the Nile Valley, the Sinai Peninsula and the Eastern and Western deserts. Egypt comprises of hills, mountains, deserts, rivers and oceans, and features different soils in different areas. Just like its many geographic regions, the soils in Egypt vary from one another, each with its own distinctive qualities and characteristics. Most of the soils are formed through flooding, soil erosion and layering. And the chemical properties of wheat straw and *E. crassipes*(organic fertilizers) are shown in Table 2.

At the time of sampling (flowering stage) the plant samples were collected from each pot for analysis. The data of different treatments were statistically analyzed and the comparison among means was carried out by calculating the least significant difference (L.S.D.) at 5% levels (Snedecor and Cochran, 1973).

Table1. *Chemical and physical data for experimental soils*

	Control	**Suez**	**North Coast**	**EL-Kantara**
Chemical analysis				
Organic carbon %	0.80	0.12	0.48	0.30
$CaCO_3$%	3.40	1.65	40.65	1.15
HCO_3%	0.06	0.07	1.20	0.051
CO_3%	-	-	-	-
Cl %	0.018	0.015	0.025	0.017
SO4 (mg100 g-1D.wt.)	0.08	0.057	0.067	0.046
NO3(mg100 g-1D.wt.)	14.5	3.300	7.200	1.460
NH4(mg100 g-1D.wt.)	4.21	0.970	0.077	0.720
iPx10-3(mg100g-1D.wt.)	0.55	0.120	1.470	5.600
Exchangeable cations				
K+x10-4 mM g-1D.wt.	19.2	15.9	15.6	14.6
Na+x10-4mMg-1D.wt.	7.8	87.8	196.0	152.0
Ca++x10-4mMg-1D.wt.	336.5	136.5	429.0	151.0
Salinity (ppm)	121.6	102.0	177.9	108.2
PH	7.40	7.43	7.54	7.36
Physical analysis				
E.C. mmohs cm -1	0.19	0.44	0.28	0.17
W.H.C. % 61.0	33.40	22.40	18.50	28.70
Mean moisture content	27.30	0.24	1.61	0.26

Table2. *Chemical data for experimental fertilizers*

	Eichhorniacrassipes	**Wheat straw**
Carbohydrate contents		
Total soluble sugar(mg glucose g^{-1}.D.wt.)	9.884	6.353
Sucrose (mg glucose g^{-1}.D.wt.)	3.081	0.598
Polysaccharides (mg glucose g^{-1}.D.wt.)	19.688	13.904
Nitrogen contents		
Total soluble nitrogen (mgNH_4-N g^{-1}.D.wt.)	9.348	4.726
Protein (mgNH_4-N g^{-1}.D.wt.)	24.024	11.162
Ionic content		
Potassium mM g^{-1}D.wt.	0.363	0.254
Sodium mM g^{-1}D.wt.	0.098	0.169
Calcium mM g^{-1}D.wt.	1.014	0.401
Hormonal content		
IAA µg g^{-1}D.wt.	750.6	645.2
GA3 µg g^{-1}D.wt.	397.4	240.1
ABAµg g^{-1}D.wt.	398.6	363.6
Cytokininsµg g^{-1}D.wt.	224.0	199.0

Determination of Photosynthetic Pigments

The photosynthetic pigments (chlorophyll “a”, chlorophyll “b” and carotenoids) were determined at different stages of plant development according to the Spectro photo metric method as recommended by Metzner *et al*. (1965).

A known fresh weight of the plant leaves was homogenized in 85% aqueous acetone for 5 minutes. The homogenate was filtered through Whattman No. 1 filter paper using suction. The filtrate was made up to volume with 85% acetone. The extract was measured against a blank of pure 85% aqueous acetone at three wave lengths of 452.5, 644 and 663 nm using Spekolspectro - colourimeter taking into consideration the dilutions made. It was possible to determine the concentrations of pigment fractions; (chlorophyll "a", chlorophyll "b" and carotenoids) as µg/ml using the following equations:

Chlorophyll "a" = 10.3 E663 – 0.918 E644 = µg/ml

Chlorophyll "b" = 19.7 E644 – 3.87 E663 = µg/ml

Carotenoids = 4.2 E452.5 – (0.0264 Chlorophyll "a" + 0.426 Chlorophyll "b") =µg/ml

Then the fractions were calculated as µg chlorophyll / g fresh weight of the differently treated plant leaves.

Determination of Photosynthetic Activity

Hill Reaction Assay

As described by Arnon (1949), 4 g of detached leaves were ground three times for 5 seconds at full speed in a chilled blender in 50 ml of 50 mM N-Tricine (N-Trishydroxylmethylglycine, pH 7.8), 0.3M-sucrose and 2 mM-MgCl2. The resulting homogenate was filtered through four layers of nylon mesh. Chloroplast pellets were obtained by centrifugation at 2000 xg for 10 minutes. The pellets were re suspended in 30 ml of 0.1 M-NaCl and then centrifuged again at 5000 xg for 5 minutes. The resulting pellets were re suspended in 1mM N-Tricine (pH 7.8), 10mM-NaCl and 10 mM-MgCl2 and then kept at 0-4°C until used for the analysis.

Photo system II activity, as indicated by the rate of 2, 6-dichlorophenolindophenol (2,6-DCPIP) photo-reduction (Trebst, 1972) was monitored at 600 nm using Spekolspectro-colourimeter. The sample cuvette was illuminated by tungsten lamp (6000 lux) using head filter ($CuSO_4$ solution). DCPIP photo reduction was monitored at 600 nm. The photo system II reaction mixture contained 200 m M-Na phosphate (pH 6.7), 2 mM-$MgCl_2$, 0.5m M-DCPIP. The chlorophyll concentration range for this experiment was 10 µg in /ml of the reaction mixture (4 ml).

Estimation of Carbohydrates

Extraction of Plant Tissue

Sugars were extracted by overnight submersion of dry tissue in 10 ml of 80% (V/V) ethanol at 25°C with periodic shaking. Total soluble sugars and sucrose were determined using modifications of the procedures of Yemm and Willis (1954) and Handel (1968) respectively.

Estimation of Total Soluble Sugars (T.S.S)

They were analyzed by reacting of 0.1 ml of the alcoholic extract with 3.0 ml freshly prepared anthrone (150 mg anthrone + 100 ml of 72% H_2SO_4) in a boiling water bath for 10 minutes and reading the cooled samples at 625 nm in a Gilford Model 240 Spectrophotometer.

Estimation of Sucrose

Sucrose content was determined by first degrading reactive sugars present in 0.1 ml extract with 0.1 ml 5.4 N KOH at 97°C for 10 minutes. Three ml of freshly prepared anthrone reagent were then added to the cooled reaction product, and the mixture was heated at 97°C for 5 minutes, cooled and read at 620 nm.

Estimation of Polysaccharides

The method used for estimation of polysaccharides in the present study was that of Thayermanavan and Sadasivam (1984).Starch is an important polysaccharides, it is the storage form of carbohydrates in plants abundantly found in roots, tubers, stems, leaves, fruits and cereals. Starch, which is a compound of several glucose molecules, is a mixture of two types of components namely amylose and amylopectin. Starch is hydrolyzed into simple sugar is measured calorimetrically.

Measurement of Total Leaf Conductance, Transpiration Rate and Leaf Temperature

Total leaf conductance, transpiration rate and leaf temperature of the second fully expanded leaf of (*Brassica napus*L., *Carthamustinctorius*, L. and *Helianthus annus*, L.) plants were measured using a Li-1600 M Steady State Porometer. The atmospheric pressure (PRES SET) and aperture area of the apparatus were adjusted to 101.3 Kpa and 1 Cm^2 respectively (Ibrahim, 1999).

Results And Discussion

Photosynthesis is one of the most promising physiological processes contributing to the plant growth and productivity of crops for food (Natr and Lawlor 2005) and it is one of the primary processes affected by salinity (Munns *et al*.2006) and drought

(Karaba *et al*. 2007).Hence, photosynthetic pigments which constitute mainly of chlorophyll a, chlorophyll b and carotenoids are of vital importance in photosynthesis.

Photosynthetic Pigments and Hill Reaction

The total amount of nutrients in the soil and content of their available forms are the major factors determining the nutrient conditions of plant and their requirements for fertilizers El-Samahy (2000).The different treatments have given varied responses in photosynthetic activity of canola (*Brassica napus*L) safflower (*Carthamustinctorius*L) and sunflower (*Helianthusannus*L) plants throughout the flowering stage of growth.

The present available results (Tables3,4&5) revealed that the changes in photosynthetic pigments and Hill reaction were drastically decreased comparing with the garden soil in canola, safflower and sunflower plants at the three sites of Egyptian soils, Munns *et al*.(2006)This may be due to reduction in mass of leaves (Hendrik *et al* ., 2009)or due to raising of elements in leaves to the toxic levels, Jia*et al*.(2008) and the net result is the inhibition in the rate of photosynthesis under stress conditions either by salinity or by drought.

Thus the data in tables 3,4 and 5 showed that stressed oily plants (canola safflower and sunflower) considerably reduced Chl a , Chl b , Chl(a+b) as well as cartenoids and total pigments in leaves of all three plants grown in different soil types (North Coastal , El-Kantara East and Suez road) comparing with those grown in control (Garden soil) .These results were in a good agreement with those obtained by (Jaleel *et al*. 2009) who reviewed that , the photosynthetic pigments , including Chl a , Chl b , total chlorophyll and cartenoids of *Withanniasomnifera* plants were found to decline , with increasing salt level .Also , the reduction in in chlorophyll content due to drought stress was in good harmony with those obtained by Chaves *et al*.(2009).

Table3. *Effect of different soil types and treatments on the photosynthetic pigments and photosynthetic activity [DCPIP] photo reduction by Brassica napus L. chloroplasts (flowering stage) in the presence of H_2O as an electron donor.The mean values are expressed as mg chlorophyll g^{-1}fresh weight; each value is the mean of 3 samples.*

Soil Type	Treatment	µM DCPIP Reduced / mg chl./hr.	Chlorophyll "a"	Chlorophyll "b"	Carotenoids	Chlorophyll "a+b"	Total Pigment
Suez Soil	Control	0.0231	319.31	236.91	252.43	556.22	808.65
	Wh.St.	0.0262*	350.40*	247.78*	297.03*	598.18*	895.21*
		0.0388	381.49	258.64*	323.21	640.13*	963.35
		0.0467	459.49	314.07	350.82	773.56	1124.38
	Eich.	0.0382	473.47	326.22	381.98	799.69	1181.67
		0.0658	670.27	444.33	512.92	1114.61	1627.53
		0.0902	800.89	670.27	644.28	1471.17	2115.45
	Amm.Sul.	0.0376	551.11	429.57	443.22	980.68	1423.90
		0.0465	791.29	722.39	557.20	1513.68	2070.87
		0.0661	961.11	779.67	738.35	1740.78	2479.13
	L.S.D. at	0.0051	60.44	46.59	47.21	107.03	154.24
North Coast Soil	Control	0.0178	282.55	190.29	251.89	472.85	724.74
	Wh.St.	0.0189*	308.13*	213.64*	254.47*	521.78*	776.24*
		0.0247	335.23	233.51	272.45*	568.74	841.19
		0.0280	350.42	283.59	306.00	634.01	940.00
	Eich.	0.0212	332.85	227.78	295.64	560.63	856.27
		0.0244	359.09	241.13	308.63	600.22	908.85
		0.0269	458.74	314.22	395.08	772.96	1168.04
	Amm.Sul.	0.0215	383.80	297.46	366.94	681.26	1048.20
		0.0377	557.84	360.21	430.90	918.05	1348.95
		0.0485	613.13	452.36	554.81	1065.49	1620.30
	L.S.D. at	0.0028	41.10	29.27	35.39	70.37	105.76
El-Kantara Soil	Control	0.0202	294.73	212.08	256.12	506.81	762.93
	Wh.St.	0.0253	316.28*	228.35*	256.70*	544.63*	801.33*
		0.0325	368.31	256.70	302.64	625.01	927.65
		0.0398	457.78	294.96	358.21	752.74	1110.95
	Eich.	0.0251	374.83	257.86	305.44	632.69	938.13
		0.0496	424.85	273.83	353.03	698.69	1051.71
		0.0684	524.91	378.05	448.19	902.96	1351.16
	Amm.Sul.	0.0306	508.04	322.59	387.98	830.64	1218.62
		0.0404	697.61	366.16	425.80	1063.77	1489.57
		0.0577	933.15	631.24	496.71	1564.39	2061.10
	L.S.D. at	0.0041	51.18	33.44	37.05	84.62	121.67
Garden Soil		0.0625	600.97	435.70	529.61	1036.67	1566.28

**Non significant L.S.D. at 5%. (Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate)*

Table4. *Effect of different soil types and treatments on the photosynthetic pigments and photosynthetic activity [DCPIP] photo reduction by Carthamustinctorius L. chloroplasts (flowering stage) in the presence of H_2O as an electron donor. The mean values are expressed as mg chlorophyll g^{-1} fresh weight, each value is the mean of 3 samples.*

Soil Type	Treatment	µM DCPIP Reduced / mg chl. /hr.	Chlorophyll "a"	Chlorophyll "b"	Carotenoids	Chlorophyll "a+b"	Total Pigment
Suez Soil	**Control**	**0.0423**	**241.63**	**210.29**	**267.09**	**451.92**	**719.01**
	Wh.St.	0.0517*	268.97*	221.01*	307.18	489.98*	797.16*
		0.0546	286.06	250.93	357.93	536.99	894.92
		0.0733	292.89	280.86	390.08	573.75	963.82
	Eich.	0.0881	316.97	249.16	299.18	566.13	833.23
		0.0947	360.46	298.82	325.81	659.28	958.46
		0.1288	408.95	319.10	328.57	728.05	1056.62
	Amm.Sul.	0.0798	339.74	262.77	285.92*	602.51	888.43
		0.0872	371.40	298.78	304.54	670.18	974.72
		0.1064	403.07	307.04	345.88	710.11	1056.00
	L.S.D.at	0.010	31.12	26.021	30.428	52.235	89.363
North Coast Soil	**Control**	**0.0327**	**194.66**	**132.95**	**115.89**	**327.62**	**443.514**
	Wh.St.	0.0351*	203.93*	143.75*	192.87	347.69*	540.56
		0.0499	219.34	149.65	209.57	368.99	578.56
		0.0598	239.26	164.78	231.44	404.04	635.48
	Eich.	0.0597	237.68	148.42*	151.24	386.09	537.33
		0.0762	260.06	157.63	193.09	417.68	610.78
		0.0990	271.65	190.82	209.91	462.47	672.38
	Amm.Sul.	0.0499	233.70	160.27	175.75	393.97	569.73
		0.0787	254.46	179.71	202.40	434.50	636.90
		0.0944	291.75	214.58	215.72	506.33	722.05
	L.S.D. at	0.009	23.555	16.099	21.874	40.85	56.55
El-Kantara Soil	**Control**	**0.0440**	**287.26**	**214.65**	**251.63**	**501.91**	**753.54**
	Wh.St.	0.0493*	305.09*	241.45*	285.98	546.55*	798.18*
		0.0562	334.52	262.71	296.12	597.23	893.35
		0.0624	387.08	280.11	340.60	667.19	1007.78
	Eich.	0.0766	353.41	297.95	263.66*	651.36	915.02
		0.0964	399.43	353.67	309.65	753.10	1062.75
		0.1375	407.60	374.25	328.54	781.85	1110.40
	Amm.Sul.	0.0740	372.26	310.77	285.98	683.03	969.01
		0.0898	407.35	351.43	312.98	758.78	1071.79
		0.1154	429.23	384.15	369.30	813.38	1182.68
	L.S.D.at	0.012	33.4	28.239	31.999	55.029	91.857
Garden Soil		**0.0539**	**393.38**	**287.93**	**282.56**	**681.31**	**963.87**

**Non significant L.S.D. at 5%, (Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate*

The effects of drought and salt stresses on photosynthesis are either direct (as the diffusion limitations through the stomata and the mesophyll and the alterations in photosynthetic metabolism) or secondary, such as the oxidative stress arising from the superimposition of multiple stresses. The carbon balance of a plant during a period of salt/water stress and recovery may depend as much on the velocity and degree of photosynthetic recovery, as it depends on the degree and velocity of photosynthesis decline during water depletion Chaves *et al.* (2009).

Moreover,(Netondo*etal.*,2004),suggested that salinity could affect chlorophyll of leaves through the inhibition of its synthesis and/ or the acceleration of its degradation or through impairment of the carboxylation capacity which in turn inhibits electron transport (Saeedipour 2009). It was clear from the recorded results in table 3 that except for plants of canola (*Brassica napus*L.) which grown in different soils (Suez, North Coast and El-Kantara) at the lowest concentration of wheat straw (0.25%) which exhibited a non-significant change in chlorophyll “a”, the other treatments of all fertilizers showed a significant increase in this photosynthetic pigment. For chlorophyll “b”, there was a significant increase at all treatments in the three soils used except for wheat straw treatment at lower concentration (0.25and 50.0%) in Suez soil and at 0.25 in both North Coast and El-Kantara soils which showed a non-significant change in chlorophyll “b”. Generally, excluding the lowest concentration of wheat straw treatment which induced a non-significant increase in chlorophyll “a+b” in the three used soils as well as at concentration 0.50% in Suez soil; there was a significant increase in chlorophyll "a+b" with the application of organic and inorganic fertilizers comparing with their respective control levels Berova and Karanatsidis (2009) studied the effect of organic fertilizers on the amount of chlorophyll pigments and rate of photosynthesis. They stated that, the application of organic fertilizers can not only enhances the synthesis and amount of chlorophylls but also increases the rate of photosynthesis. Lowest dose of inorganic fertilizer induced the highest leaf chlorophyll content, while the lowest chlorophyll content obtained by control treatment, these results agreed with the previous findings. Analysis of data for carotenoids showed a non-significant increase in canola plants treated with the concentration 0.25% of wheat straw in all types used of soil as well as with 0.50% of wheat straw in North Coast soil only, while, the other concentrations of both organic and inorganic fertilizers elicited a significant increase in carotenoids above the control values. In general, the total pigments showed a marked increase in response to all used fertilizers (organic and inorganic) as compared with the untreated ones (controls) except for the treatment of the three soils used by wheat straw at the lowest concentration.

Table5. *Effect of different soil types and treatments on the photosynthetic pigments and photosynthetic activity [DCPIP] photo reduction by Helianthus annus L. chloroplasts (flowering stage) in the presence of H_2O as an electron donor. The mean values are expressed as mg chlorophyll g-1 fresh weight, each value is the mean of 3 samples*

Soil Type	Treatment	µM DCPIP reduced/mg chl./hr.	Chlorophyll "a"	Chlorophyll "b"	Carotenoids	Chlorophyll "a+b"	Total Pigment
Suez Soil	**Control**	**0.3812**	**329.47**	**202.60**	**310.93**	**532.07**	**843.00**
	Wh. St. .25%	0.4041*	383.98*	231.15*	267.36	615.13	882.49*
	0.50%	0.4262*	506.70	237.23*	283.03	743.93	1026.96
	1.00%	0.4702	561.18	250.31	290.24	811.49	1101.73
	Eich. 0.25%	0.5958	637.08	336.96	312.98*	974.04	1287.02
	0.50%	0.7181	639.04	423.53	402.99	1062.57	1465.56
	1.00%	0.8902	672.52	541.81	419.83	1214.33	1634.16
	Amm. Sul. 5g	0.6301	618.80	325.38	279.51	944.18	1223.69
	10g	0.7806	703.92	402.43	407.35	1106.35	1513.70
	15g	0.9890	829.79	488.08	478.10	1317.87	1795.97
	L.S.D. at 5%	0.0680	67.47	43.10	25.00	80.80	136.15
North Coast Soil	**Control**	**0.3397**	**240.58**	**174.39**	**438.00**	**414.97**	**852.97**
	Wh. St. 0.25%	0.3737*	279.41*	208.38	374.87	487.79*	862.66*
	0.50%	0.3901*	316.80	238.32	404.00	555.12	959.12
	1.00%	0.4501	391.07	247.14	442.27*	638.21	1080.48
	Eich. 0.25%	0.5684	454.02	229.25	402.00	683.27	1085.27
	0.50%	0.6923	494.29	279.21	464.53*	773.50	1238.03
	1.00%	0.8562	567.17	324.76	587.80	891.93	1479.73
	Amm. Sul. 5g	0.5732	397.55	306.30	368.29	703.85	1072.14
	10g	0.7505	569.60	314.44	470.66	884.04	1354.70
	15g	0.9631	573.93	430.75	627.30	1004.68	1631.98
	L.S.D. at 5%	0.0650	49.40	38.16	32.10	86.90	103.74
El-Kantara Soil	**Control**	**0.4068**	**479.57**	**272.70**	**416.03**	**752.27**	**1168.30**
	Wh. St. 0.25%	0.4204*	542.97*	305.34*	508.75	848.30	1357.05
	0.50%	0.4357*	578.82	324.29	528.50	903.11	1431.60
	1.00%	0.486.3	633.19	355.86	532.72	989.05	1521.77
	Eich. 0.25%	0.6026	730.83	511.58	549.55	1242.41	1791.96
	0.50%	0.7019	818.56	429.02	596.22	1247.58	1843.80
	1.00%	0.9130	991.49	389.98	685.87	1381.47	2067.34
	Amm. Sul. 5g	0.6709	685.48	486.35	420.74*	1181.83	1592.56
	10g	0.8734	772.96	660.83	430.96*	1433.80	1864.75
	15g	0.9901	843.06	661.31	477.00	1504.37	1981.36
	L.S.D. at 5%	0.0710	73.56	47.04	34.30	91.50	144.71
Garden Soil		**1.1233**	**1154.60**	**950.04**	**620.90**	**2104.64**	**2725.54**

**Non significant L.S.D. at 5%. (Where, Wh. St= Wheat stra ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate).*

The effects of drought and salt stresses on photosynthesis are either direct (as the diffusion limitations through the stomata and the mesophyll and the alterations in photosynthetic metabolism) or secondary, such as the oxidative stress arising from the superimposition of multiple stresses. The carbon balance of a plant during a period of salt/water stress and recovery may depend as much on the velocity and degree of photosynthetic recovery, as it depends on the degree and velocity of photosynthesis decline during water depletion Chaves *et al.* (2009).

Table6. *Effect of different soil types and treatments on carbohydrates content in shoot of Brassica napus L. plants. Each value is the mean of 3 samples calculated as mg glucose equivalent g^{-1} dry weight.*

Soil Type	Treatment	Flowering Stage			
		T.S.S.	Sucrose	Polysac.	Total Carb.
Suez Soil	Control	**8.441**	**4.480**	**23.916**	**32.357**
	Wh. St. 0.25%	9.689*	8.246	26.531*	36.220*
	0.50%	14.163	10.942	29.619	43.781
	1.00%	20.959	17.468	30.076	51.035
	Eich. 0.25%	13.946	10.438	41.997	52.435
	0.50%	17.931	14.745	44.060	58.805
	1.00%	23.544	19.134	52.887	76.431
	Amm. Sul. 5g	25.796	10.029	39.314	65.110
	10g	30.493	11.749	40.311	70.804
	15g	37.577	15.963	51.472	89.049
	L.S.D. at 5%	2.768	1.635	5.670	7.703
North Coast Soil	**Control**	**9.136**	**5.009**	**26.314**	**35.449**
	Wh. St. 0.25%	10.217	8.157	30.464	40.681*
	0.50%	14.867	11.281	32.476	47.344
	1.00%	21.145	16.687	37.005	58.150
	Eich. 0.25%	15.813	9.909	39.124	54.937
	0.50%	22.171	13.808	41.023	63.194
	1.00%	36.103	20.657	44.508	80.611
	Amm. Sul. 5g	26.080	10.854	36.583	62.663
	10g	29.374	11.992	38.679	68.053
	15g	37.497	19.133	40.775	78.272
	L.S.D. at 5%	3.466	1.825	5.149	9.259
El-Kantara Soil	**Control**	**9.140**	**5.270**	**26.692**	**35.832**
	Wh. St. 0.25%	11.449*	8.268	29.343*	40.791*
	0.50%	12.892	9.449	31.014	43.906
	1.00%	15.480	10.630	32.871	48.351
	Eich. 0.25%	16.101	7.033	34.692	50.793
	0.50%	25.436	10.236	37.886	63.322
	1.00%	45.728	17.239	41.023	86.751
	Amm. Sul. 5g	21.377	10.033	30.329	51.706
	10g	25.436	11.395	32.528	57.964
	15g	38.195	17.647	38.364	76.559
	L.S.D. at 5%	3.337	1.402	4.091	8.288
Garden Soil		**45.822**	**32.610**	**63.653**	**109.474**

** Non significant L.S.D. at 5%.*

(Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate)

Moreover,(Netondo*etal*.,2004),suggested that salinity could affect chlorophyll of leaves through the inhibition of its synthesis and/ or the acceleration of its degradation or through impairment of the carboxylation capacity which in turn inhibits electron transport (Saeedipour 2009). It was clear from the recorded results in table 3 that except for plants of canola (*Brassica napus*L.) which grown in different soils (Suez, North Coast and El-Kantara) at the lowest concentration of wheat straw (0.25%) which exhibited a non-significant change in chlorophyll "a", the other treatments of all fertilizers showed a significant increase in this photosynthetic pigment. For chlorophyll "b", there was a significant increase at all treatments in the three soils used except for wheat straw treatment at lower concentration (0.25and 50.0%) in Suez soil and at 0.25 in both North Coast and El-Kantara soils which showed a non-significant change in chlorophyll "b". Generally, excluding the lowest concentration of wheat straw treatment which induced a non-significant increase in chlorophyll "a+b" in the three used soils as well as at concentration 0.50% in Suez soil; there was a significant increase in chlorophyll "a+b" with the application of organic and inorganic fertilizers comparing with their respective control levels Berova and Karanatsidis (2009) studied the effect of organic fertilizers on the amount of chlorophyll pigments and rate of photosynthesis. They stated that, the application of organic fertilizers can not only enhances the synthesis and amount of chlorophylls but also increases the rate of photosynthesis. Lowest dose of inorganic fertilizer induced the highest leaf chlorophyll content, while the lowest chlorophyll content obtained by control treatment, these results agreed with the previous findings. Analysis of data for carotenoids showed a non-significant increase in canola plants treated with the concentration 0.25% of wheat straw in all types used of soil as well as with 0.50% of wheat straw in North Coast soil only, while, the other concentrations of both organic and inorganic fertilizers elicited a significant increase in carotenoids above the control values. In general, the total pigments showed a marked increase in response to all used fertilizers (organic and inorganic) as compared with the untreated ones (controls) except for the treatment of the three soils used by wheat straw at the lowest concentration.

The changes in photo reduction of di chloro phenol indo phenol (DCPIP) by isolated illuminated canola chloroplasts in response to different treatments are presented in Table3. Photo reduction of DCPIP showed a non-significant change in response to wheat straw treatment at the lowest concentration (0.25%) in both Suez and North Coasts oils, mean while, there was a significant increase at higher concentrations of wheat straw(0.50 and 1.0%). It should be mentioned that the treatment of El-Kantara soil with wheat straw at its three concentrations used exhibited a significant increase. In case of using *Eichhornia* and ammonium sulphate fertilizers at concentrations 0.25, 0.50 and 1.0% and 5, 10 and 15g/pot respectively, there were a marked increase in the photo reduction of DCPIP at the three soils used as compared with the respective control values.

Table7. *Effect of different soil types and treatments on carbohydrates content in shoot of Carthamustinctorius L. plants.Each value is the mean of 3 samples calculated as mg glucose equivalent g^{-1} dry weight.*

Soil Type	Treatment	Flowering Stage			
		T.S.S.	Sucrose	Polysac.	Total Carb.
Suez Soil	Control	**8.576**	**5.754**	**38.889**	**47.465**
	Wh. St. 0.25%	11.245	10.160	40.007*	51.252*
	0.50%	13.041	12.841	50.653	63.694
	1.00%	17.705	15.575	65.821	83.526
	Eich. 0.25%	16.727	13.705	52.135	68.862
	0.50%	18.161	15.609	68.005	89.418
	1.00%	21.413	18.022	79.656	102.856
	Amm. Sul. 5g	15.899	9.102	46.792	62.691
	10g	17.119	10.379	63.887	81.006
	15g	18.161	12.547	76.213	94.374
	L.S.D. at 5%	1.686	1.390	6.210	7.782
North Coast Soil	**Control**	**7.504**	**5.115**	**26.750**	**34.254**
	Wh. St. 0.25%	9.886	7.040	31.874*	41.760
	0.50%	11.245	9.590	41.941	53.186
	1.00%	15.290	12.883	58.372	73.662
	Eich. 0.25%	11.350	7.952	42.440	53.790
	0.50%	14.696	9.590	46.909	61.605
	1.00%	15.337	10.470	67.344	82.681
	Amm. Sul. 5g	9.155	6.480	30.986*	40.141*
	10g	11.890	7.360	41.617	53.506
	15g	14.319	8.525	53.208	67.527
	L.S.D. at 5%	1.609	1.274	5.678	6.695
El-Kantara Soil	**Control**	**9.282**	**6.280**	**40.613**	**49.896**
	Wh. St. 0.25%	11.869	6.880*	42.659*	54.528*
	0.50%	16.432	7.440	49.522	65.954
	1.00%	18.685	8.960	58.490	77.175
	Eich. 0.25%	15.399	9.280	56.931	72.330
	0.50%	17.559	12.000	67.624	85.183
	1.00%	23.201	15.760	87.312	110.512
	Amm. Sul. 5g	13.709	8.720	47.104	60.813
	10g	17.160	11.320	66.182	83.342
	15g	20.986	14.360	81.305	102.291
	L.S.D. at 5%	1.710	1.105	6.425	7.890
Garden Soil		**20.000**	**16.160**	**65.137**	**85.137**

**Non significant L.S.D. at 5%.*

(Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate)

The rate of transformation of soluble photo synthates to the insoluble ones and Hill activity were drastically reduced in salinity stress plants grown on the soil was collected from North coast than the other soil (Suez and El-Kantara). This inhibition of photosynthesis may be due to the decline in Chl content. In addition salinity inhibits photosynthesis either by inducing stomatal closure, accompying with the decrease in the rate of transpiration as clear in table 9, or by directly affecting the photosynthetic machinery at the mesophyll and chloroplast level as well as chloroplast number. Furthermore, Naidoo *et al*.(2011)stated CO2 exchange and intrinsic photochemical efficiency of PSII were significantly lower in tress of mangrove , *Avicennia marina* under hypersalinity conditions.

Table8. *Effect of different soil types and treatments on carbohydrates content in shoot of Helianthusannus L. Plants. Each value is the mean of 3 samples calculated as mg glucose equivalent g^{-1} dry weight.*

Soil Type	Treatment	Flowering Stage			
		T.S.S.	Sucrose	Polysac.	Total Carb.
Suez Soil	Control	**8.441**	**4.480**	**26.314**	**34.755**
	Wh. St. 0.25%	9.689*	8.246	30.464*	40.153*
	0.50%	14.163	10.942	32.476	46.639
	1.00%	20.959	17.468	37.005	57.964
	Eich. 0.25%	13.946	10.438	41.997	55.943
	0.50%	17.931	14.745	44.060	61.991
	1.00%	23.544	19.134	52.887	76.431
	Amm. Sul. 5g	25.796	10.029	39.314	65.110
	10g	30.493	11.749	40.311	70.804
	15g	37.577	15.963	51.472	89.049
	L.S.D. at 5%	2.768	1.635	5.670	9.259
North Coast Soil	**Control**	**9.136**	**5.009**	**23.916**	**33.052**
	Wh. St. 0.25%	10.217*	8.157	26.531*	36.748*
	0.50%	14.867	11.281	29.619	44.486
	1.00%	21.145	16.687	30.076	51.221
	Eich. 0.25%	15.813	9.909	34.692	50.505
	0.50%	22.171	13.808	37.886	60.057
	1.00%	36.103	20.657	41.023	77.126
	Amm. Sul. 5g	26.080	10.854	30.329	56.409
	10g	29.374	11.992	32.528	61.902
	15g	37.497	19.133	38.364	75.861
	L.S.D. at 5%	3.466	1.825	4.091	7.703
El-Kantara Soil	**Control**	**9.140**	**5.270**	**26.692**	**35.832**
	Wh. St. 0.25%	11.449*	8.268	29.343*	40.792*
	0.50%	12.892	9.449	31.014*	43.906
	1.00%	15.480	10.630	32.871	48.351
	Eich. 0.25%	16.101	7.033	39.124	55.225
	0.50%	25.436	10.236	41.023	66.459
	1.00%	45.728	17.239	44.508	90.236
	Amm. Sul. 5g	21.377	10.033	36.583	57.960
	10g	25.436	11.395	38.679	64.115
	15g	38.195	17.647	40.775	78.970
	L.S.D. at 5%	3.337	1.402	5.149	8.288
Garden Soil		**45.822**	**32.610**	**63.653**	**109.475**

**Non significant L.S.D. at 5%.*

(Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= AmmoniumSulphate).

The changes in pigment contents in response to organic (wheat straw and *E.crassipus* at concentrations 0.25, 0.50 and 1.0%) and inorganic fertilizers (ammonium sulphate at concentrations 5, 10 and 15 g/pot) for safflower (*Carthamustinctorius* L.) are given in table 4. Except for wheat straw treatment at concentration 0.25% in all types used of soil when chlorophyll “a” and chlorophyll “b” were non-significantly affected, all treatments (wheat straw, *E.crassipus* and ammonium sulphate) markedly increased chlorophyll “a” and chlorophyll “b” above the control levels in all types of soil. Consequently, the pattern of change in chlorophyll “a+b” was similar to that of chlorophyll “a”. In addition, a significant increase was observed in carotenoids content in response to all treatments except for 5gm/pot ammonium sulphate in Suez soil and 0.25% *E.crassipus*in El-Kantarasoil. In total pigments, except for wheat straw treatment at concentration 0.25% in Suez and El-Kantara soils when a non-significant effect was observed, the various treatments (wheat straw, *E.crassipus* and ammonium sulphate) in Suez, North Coast and El-Kantara soils increased markedly the total pigments above the control levels. Except for wheat straw treatment at the lowest concentration (0.25%) in the three soils used which non-significantly affected the reduction of Photo reduction of dichlorophenolindophenol (DCPIP), all treatments (wheat straw, *E.crassipus* and ammonium sulphate) significantly increased the reduction of DCPIP above the control values in all sites (Suez, North Coast and El-Kantara).

Table9. *Effect of different soil types and treatments on transpiration rate (m mol m^{-2} s^{-1}),leaf conductance (m mol $m^{-2}s^{-1}$) and leaf temperature (C°) of sBrassica napus L. plants during flowering stage.Each value is the mean of 3 samples*

Soil Type	Treatment	Transpiration Rate	Leaf Conductance	Leaf Temperature
Suez Soil	*Control*	**5.400**	**161.5**	**39.2**
	Wh.St.	5.800*	213.9	37.8
		8.895	258.0	36.0
		13.530	350.5	35.1
	Eich.	6.105*	243.5	38.8
		9.625	270.0	38.0
		15.250	386.0	36.8
	Amm. Sul. 5g	9.760	260.0	38.0
	10g	11.500	319.0	37.3
	15g	13.870	394.0	36.3
	L.S.D. at 5%	1.048	29.94	1.855
North Coast Soil	**Control**	**3.858**	**118.0**	**35.0**
	Wh. St.	4.707	122.5*	35.7*
		8.904	145.0	34.5*
		9.200	251.0	34.0*
	Eich.	7.850	186.0	34.9*
		8.160	272.0	34.6*
		12.720	336.5	34.6*
	Amm. Sul. 5g	6.106	181.5	35.7*
	10g	8.784	215.5	35.5*
	15g	9.550	271.5	34.8*
	L.S.D. at 5%	0.844	22.02	1.753
El-KantaraSoil	**Control**	**6.040**	**157.0**	**35.3**
	Wh. St.	8.840	214.0	37.9
		11.095	218.0	37.2
		14.100	256.5	36.3*
	Eich.	9.185	241.0	37.9
		11.035	298.0	36.7*
		14.100	372.0	36.7*
	Amm. Sul. 5g	7.346	259.5	38.3
	10g	9.563	264.0	37.4
	15g	11.048	284.0	36.6*
	L.S.D. at 5%	1.070	26.74	1.861
Garden Soil		**10.160**	**252.0**	**36.7**

** Non significant L.S.D. at 5%.*

(Where, Wh. St.= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= Ammonium Sulphate)

It was clear from the results given in table 5 that, except for sunflower plants which grown in different soils (Suez, North Coast and El-Kantara) at the lowest concentration of wheat straw (0.25%) which elicited a non-significant change in chlorophyll “a”, the other treatments with all fertilizers showed a significant increase in this photosynthetic pigment. For chlorophyll “b”, there was a significant increase with all treatments at the three used soils except at Suez site treated with wheat straw at lower concentrations (0.25 and 0.50%) and El-Kantara site treated with the concentration 0.25% wheat straw which showed a non-significant change in chlorophyll “b”. Generally, there was a significant increase in chlorophyll “a+b” under organic and inorganic fertilizers at the three sites. Analysis of data for carotenoids showed that in Suez soil, there was a significant decrease in wheat straw treatment at all concentrations used (0.25, 0.50 and 1.0%) and at the lowest concentration of ammonium sulphate (5g/pot); while, there was a non-significant change at the lowest concentration of *E.crassipus* (0.25%). On the other hand, a high significant increase in carotenoids was elicited at higher concentrations of *E.crassipus*(0.50 and 1.0%) and at concentrations 10 and 15g/pot of ammonium sulphate in Suez soil. At North Coast soil, there was a non-significant change in carotenoids of sunflower plants treated with the concentration 1.0% of wheat straw and 0.50% of *E.crassipus*, a significant decrease at lower concentrations of wheat straw as well as at the lowest concentration of *E.crassipus* and ammonium sulphate comparing with the control value. At El-Kantara site, a non-significant change was observed in ammonium sulphate at lower concentrations (5, 10g/pot). On the other hand, a significant increase was recorded in the treatment by organic fertilizers (wheat straw and *E.crassipus*) at all used concentrations and by the highest concentration of ammonium sulphate.

Table10. *Effect of different soil types and treatments on transpiration rate (mmol $m^{-2}s^{-1}$),leaf conductance (m mol $m^{-2}s^{-1}$) and leaf temperature (C °)of Carthamustinctorius L plants during flowering stage. Each value is the mean of 3 samples.*

Soil Type	Treatment	Transpiration Rate	Leaf Conductance	Leaf Temperature
Suez Soil	Control	**0.868**	**91.000**	**20.0**
	Wh.St.0.25%	1.230	100.000*	19.3*
	0.50%	1.618	134.500	19.0*
	1.00%	1.946	172.000	19.0*
	Eich. 0.25%	0.918*	111.000	19.3*
	0.50%	1.273	151.000	18.8*
	1.00%	2.091	159.000	18.7*
	Amm. Sul. 5g	1.410	106.000	19.4*
	10g	1.492	116.067	19.3*
	15g	2.071	156.500	19.3*
	L.S.D. at 5%	0.126	11.98	3.010
North Coast Soil	**Control**	**0.865**	**70.800**	**18.3**
	Wh.St. 0.25%	0.889*	72.600*	20.0*
	0.50%	0.924*	77.700	19.2*
	1.00%	1.004	83.500	19.1*
	Eich. 0.25%	0.955*	70.800*	18.5*
	0.50%	1.124	94.900	18.4*
	1.00%	1.329	96.500	18.3*
	Amm. Sul. 5g	0.999	77.600	18.6*
	10g	1.112	93.200	18.6*
	15g	1.239	108.000	18.4*
	L.S.D. at 5%	0.118	6.077	2.527
El-Kantara Soil	**Control**	**0.868**	**75.033**	**22.1**
	Wh. St. 0.25%	0.941*	77.300*	20.2*
	0.50%	1.075	83.600	20.1*
	1.00%	1.237	102.500	19.2
	Eich. 0.25%	1.091	94.150	20.4*
	0.50%	1.153	108.000	20.3*
	1.00%	1.471	110.500	19.1
	Amm. Sul. 5g	1.082	85.500	21.8*
	10g	1.372	103.067	21.3*
	15g	1.430	110.000	20.6*
	L.S.D. at 5%	0.110	8.203	2.625
Garden Soil		**1.200**	**156.000**	**18.000**

As has been explained, the total pigments in general showed a significant increase in response to all organic and inorganic fertilizers as compared with untreated soils (control) except for the treatment by wheat straw at the lowest concentration (0.25%) in Suez and North Coast soils. The changes in photo reduction of dichlorophenolindophenol (DCPIP) by isolated illuminated sunflower chloroplasts of sunflower in response to different treatments are presented in table 5. Photo reduction of DCPIP showed a non-significant change in response to wheat straw treatment at lower concentrations used (0.25 and 0.50%) in different types of soil

(Suez, North Coast and El-Kantara), meanwhile there was a significant increase at the highest concentration (1.0%) of wheat straw. In case of using *E.crassipus* and ammonium sulphate at the three levels of concentrations, there was a significant increase in photo reduction of DCPIP at the three used soils (Suez, North Coast and El-Kantara).In this connection, Li*et al*. (2017) stated that, the interaction between high light which induce high leaf temperature(Mlinarić *et al*.,2016)as shown in tables 9, 10 and 11 and other environmental stresses such as drought (at Suez and El-Kantara) and salinity (at North Coast) lead to photo inhibitory processes (Shukry, 2001).

Table11. *Effect of different soil types and treatments on transpiration rate (m mol m-2 s-1),leaf conductance (m mol m-2s-1) and leaf temperature (C°) of Helianthus annus L. plants during flowering stage. Each value is the mean of 3 samples.*

Soil Type	Treatment	Transpiration Rate	Leaf Conductance	Leaf Temperature
Suez Soil	Control	**2.895**	**96.700**	**35.1**
	Wh.St. 0.25%	4.135	102.033*	32.4
	0.50%	6.114	164.000	32.3
	1.00%	8.116	217.500	32.0
	Eich. 0.25%	6.039	197.333	34.7
	0.50%	8.698	248.333	32.9
	1.00%	9.207	323.333	31.9
	Amm. Sul. 5g	4.359	132.667	35.3*
	10g	7.644	205.333	34.8*
	15g	8.678	287.000	34.4
	L.S.D. at 5%	1.030	30.797	0.303
North Coast Soil	**Control**	**2.677**	**79.567**	**33.4**
	Wh.St. 0.25%	3.065*	99.067*	31.9
	0.50%	3.700	113.500	31.7
	1.00%	4.420	143.533	31.7
	Eich. 0.25%	5.578	184.667	32.0
	0.50%	6.183	209.333	31.8
	1.00%	6.433	216.000	31.8
	Amm. Sul. 5g	3.706	115.533	32.6
	10g	6.198	142.200	33.1*
	15g	7.268	220.667	33.1*
	L.S.D. at 5%	0.749	23.289	0.401
El-Kantara Soil	**Control**	**5.502**	**188.500**	**32.1**
	Wh.St. 0.25%	6.083*	199.000	33.7
	0.50%	6.496*	214.500	33.6
	1.00%	9.234	285.500	33.6*
	Eich. 0.25%	7.216	211.000	32.2*
	0.50%	7.950	276.333	31.9*
	1.00%	9.907	327.333	31.9*
	Amm. Sul. 5g	6.371*	232.000	31.9*
	10g	8.060	264.667	31.9*
	15g	9.510	313.000	31.6*
	L.S.D. at 5%	1.229	38.732	0.502
Garden Soil		**7.575**	**185.633**	**31.7**

** Non significant L.S.D. at 5%. (Where, Wh. St= Wheat straw ; Eich. = Eichhornia and Amm. Sul.= AmmoniumSulphate*

The supplementation of soil by wheat straw and E.crassipus would improve both the photosynthetic pigments and Hill reaction. This influence was ranged between non-significant (low wheat straw concentration) to significant increase (high concentration of wheat straw and all *E.crassipus treatments*). This in conformity with Mengel and Kirk by (1987) and Marschner (1995)who stated that using *E.crassipus*as soil additives before sowing could improve the nutrient concentration in the plant tissues which in turn improved formation of the photo synthesates in the leaves. This may be due to the fact that, organic fertilizers would increase the organic compounds of the soil and consequently its fertility Karanatsidis and Beravo (2009). However, several investigators observed that, the application of organic substances stimulate plant photosynthesis, Al-Tarawneh (2005) .In the present study (Tables 3,4 and 5 it was appeared that canola, safflower and sunflower plants grown at the three Egyptian sites treated with inorganic fertilizer (ammonium sulphate) increased the total pigments content. The magnitude of increase was more pronounced at the higher level of ammonium sulphate (15 g/pot). This may be due to the increasing in nitrogen increased number and size of active leaves during growth and this stimulates the increase in photosynthetic surface which in turn raised plant capacity in building up metabolites. These results are confirmed with those obtained by Hanshal (2014) who reported that, there were a significant increase effect due to soil application of urea and/or ammonium sulphate on some physiological aspects and biochemical composition of pearl millet (*Pennisetumglaucum*) plants. The parameters analyzed were dry weight, water content, polysaccharides, total carbohydrates, phosphorus content, nitrogenous content and proline in roots and shoots as well as photosynthetic pigments content in the leaves. Also, Bybordi (2012) stated that, salinity significantly decreased wet and dry weight, leaf area, relative water content, photosynthesis and respiration ratio and leaf potassium content of canola plants, mean while, all these parameters were improved with nitrate and ammonium treatments in 50:50 ratios. El Mantawy (2017) using sunflower plant found that Different sources of nitrogen fertilizers have an important effect on accumulation of chlorophyll pigments in plants with the application of ammonium sulfate fertilizers; this may be due to the role of sulfur element in synthesis of proteins, oils, vitamins, and flavoured compounds in plants. Also, it is a constituent of three amino acids Methionine (21% S), Cysteine (26% S) and Cystine (27% S), which are the building blocks of protein. These results are in harmony with Patra*et al*. (2013).

Carbohydrates content

The present available results revealed that the pattern of change in carbohydrates is consistent with the compulsory role of water stress not only on synthesis, mobilization and partition of photosynthesates, has been presented in tables 6, 7 and 8 for canola, safflower and sunflower respectively .These observations led to the conclusion that, the stress might have inhibited the photosynthetic activity and/or increased partial utilization of carbohydrates for some kinds of metabolism. In this connection, Ashraf and Harris (2013) authenticated that the overall reduction of long term growth, is probably due to higher sensitivity of photo system II, decrease of CO2 in the intercellular spaces of stomata, reduction in photochemical quantum efficiency of CO2 uptake, low level of oxygen evolution and low levels of 3-photosphoglycerate. This reflects the reduction in carbon allocation to new leaves and longer term potential photosynthetic capacity; resulting in reduction of photon yield of CO2 assimilation and consequently limit starch synthesis in water-stressed plants. In this respect, Mohamed (2011) showed that the changes in proportions of sugars and polysaccharides are presumably related to the changes in enzyme activity. Thus Seemann and Critchley (1985), working on bean, noted a reduction in ribulosebiphosphate carboxylase in vivo under salinity stress. Also, Stiborova *et al*. (1987) using barely and maize found that, stress induced decreases in chlorophyll content and in ribulose-1,5-biphosphate carboxylase activity in barley as well as decreases in phosphoenol pyruvate carboxylase and NADP-dependent malate dehydrogenase in maize.Thus the present observed results, showed that, the supplementation of the three sites of soils with either organic (wheat straw and *E.crassipus*) or inorganic fertilizers (ammonium sulphate) would increase significantly the total soluble sugars, sucrose, polysaccharides and total carbohydrates during the growth of canola, safflower and sunflower in response to increase the levels of all used fertilizers or non-significantly increased at 0.25% wheat straw. This led us to conclude that the photosynthetic efficiency was increased leading to enhanced biosynthesis of carbohydrates which are utilized in the growth. However, the application of organic fertilizers (either wheat straw or *E.crassipus*) to poor soils resulted in a significant increase in carbohydrates and consequently the growth compared to the control, these increments are greater in *E.crassipus* than in wheat straw (Metwally and Khamis, 1998). This is due to the fact that *E.crassipus* contains a high amount from hormones than in wheat straw as presented in table 2. El-Bassiouny and Shukry (2001) stated that total soluble sugars were increased in response to IAA in cowpea plants grown under drought conditions. These results were similar to those obtained by Dogra*et al*. (1994), who stated that, IAA increased the water soluble and acid soluble sugar content of wheat. These increases were a response to the drought-induced water deficit, using osmotic adjustment to achieve the active accumulation of solutes within the cellular compartments of the plants, where this is usually followed by a reduction of the osmotic component of the water potential. This mechanism helped the cell to maintain turgor above the critical levels, preventing excessive water loss and the negative effects of drought on the physiological activity of the plant (Peltler and Marigo, 1999 and Rodriguez *et al.*, 1999).Concerning the effect of hormones on polysaccharides and total carbohydrate values of cowpea leaves there were significant increments. The maximum increment was achieved by higher concentrations. These results showed that hormones induced a stimulatory effect on the carbohydrates synthesis; similar results were obtained by Hathout*et al*. (1993). However, water stress is often accompanied; particularly under Mediterranean conditions; by other limiting factors such as high temperature, leaf-to-air vapour pressure deficit, nutrient depletion and irradiance. It has been demonstrated that the combination of these factors favours photo inhibtion which limits photosynthetic capacity of plants (Valladars and Pearcy, 1997) and these consequently was reflected on carbohydrates. Also it is evident that the application of organic fertilizers increased all of carbohydrate fractions in shoots. These results are expected since, application of organic fertilizers increases leaf area, chlorophyll content and stimulate photosynthesis Chinthapalli *et al*. (2015) .Treatments of the three sites of Egyptian soils with ammonium sulphate, in general, increased all of carbohydrate fractions in shoots of canola, safflower and sunflower plants (see Tables 6, 7 and 8). The magnitude of increase was most pronounced with the highest ammonium sulphate concentration (15g/pot). The obtained data are in harmony with those obtained by Braun *et al*. (2016) who found that total soluble sugars and total sugars were increased with nitrogen fertilizers.

Transpiration rate, leaf conductance and leaf temperature

Characterization of water status and its availability in plant tissues assumes importance in studies where water becomes limiting .The importance of the internal water balance in plant water relations is generally accepted because of the close relationship between this balance and turgidity, to the rate of physiological processes that control the quality and quantity of growth (Aldesuquy and Ibrahim, 2000). Measurements of electrical conductance of leaf surfaces have been used in the past to investigate the leaf wetness status Li *et al* (2017) the leaf water content or the transport processes of ions through the cuticle Li *et al* (2017)observed a close relationship between leaf surface current and stomatal conductance. Data in tables 9, 10 and 11 for canola, safflower and sunflower plants showed that, leaf conductance, transpiration rate and leaf temperature were increased above the garden soil value, however, the leaf temperature in the three soils was in the following order: Suez > El-Kantara> North Coast for canola plant, El-Kantara> Suez > North Coast for safflower plant and Suez > North Coast >El-Kantara for sunflower plant. In this respect,. Hasanuzzaman *et al.* (2017) stated that high transpiration would cause stomatal closure by increasing water potential gradient between the guard cells and other epidermal cells or by lowering leaf water potential either of which could directly decrease the turgor pressure of guard cells relative to other epidermal cells or affect hormonal distribution. For canola, safflower and sunflower plants at the three sites of Egyptian soils, it was apparent that, the supplementation of the soil either by wheat straw, *E.crassipes* or ammonium sulphate fertilizers at all levels, showed a significant increase in transpiration rate, leaf conductance and a decrease in leaf temperature with increasing the concentration of fertilizers (organic and inorganic). In this regard, El-Samahy (2000) reported that application of cattle manure increases transpiration rate and leaf conductance, but leaf temperature have the opposite effect, this may be due to application of cattle manure increased plant transpirational water loss, leaf conductance and consequently decreased leaf temperature by promoting plant growth through its effect on nutrients and water availability. Several investigators concluded that application of organic manure increased the water holding capacity of the soil (Chaterjee*et al*., 2005).Moreover; Shahin *et al*. (2000) stated that increased of N rate led to slight increases in daily and seasonal evapotranspiration rate of rapeseed.

Conclusion and Future Prospects

It is now evident that stresses lead to the considerable reduction in photosynthetic performance mediated through stress-induced stomatal or non stomatal limitations (Athar and Ashraf 2005; Rahnama *et al*. 2010 and Taiz and Zeiger 2010). However, it is not easy to discriminate between the effects of these limitations on overall photosynthetic capacity of a plant. Certainly, it depends on the species to what extent the process of photosynthesis under stress conditions is controlled by stomatalorn on stomatal factors. Nevertheless, knowledge of the proportion of the stomatal and non stomatal factors controlling the process of photosynthesis is vital for appointing the future research on photosynthesis.

Final conclusion for this study stated that, the three oily plants can be cultivated with a high performance on photosynthesis in three different soils with additive high concentrations from fertilizers as follow:

For canola in seuz soil with $(NH_4)_2SO4$; in North coast soil with wheat straw and in El-Kantra soil with $(NH_4)_2SO_4$. For safflower in seuz soil with $(NH_4)_2SO4$; in North coast soil with E. crassipes and in El-Kantra soil with$(NH_4)_2SO4$.For sunflower in seuz soil ; in North coast and in El-Kantra soil with$(NH_4)_2SO4$ comparing with the control.

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