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OIL AND PROTEIN CONTENTS AND QUALITY CHARACTERISTICS OF SUNFLOWER SEEDS "SAKHA 53" PLANTED IN NEW RECLAIMED LAND

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ABSTRACT

Field and laboratory studies were conducted in the two successive summer growing seasons of 2005 and 2006 in Klabshu Research station and in Oils and Fats Res. Dept., Food Technology Research Institute to evaluate: 1] the effect of micronutrients mixture and N-levels (30, 60, 90 and 120 Kg N/Fed) on growth, yield and yield components and quality parameters of sunflower variety namely Sakha 53 in sandy soil under drip irrigation system; 2] the productivity of the new variety of sunflower in the Egyptian reclaimed lands and 3]the effect of micronutrients and N-levels on oil, protein and phenols contents of sunflower seeds and their physicochemical characteristics; refractive index at 25°C (RI), viscosity at 25°C (RI), %free fatty acids (FFA), peroxide (PV), iodine values (IV) and unsaponifiable matter% (UNSAP). Fatty acids profile of sunflower seeds oil and their oxidative stability were also examined.

The obtained results revealed that: Increasing nitrogen fertilizer from 30 up to 120 N Kg / Fed increased significantly plant height, leaf area / plant, specific leaf weight, stem diameter, head diameter, 100-seed weight, seed yield/plant and seed yield / Fed. Foliar spray method with micronutrients mixture of Fe, Zn and Mn increased significantly plant height, leaf area / plant while there were no significant variations concerning the other characters.

The interaction between foliar spray of micronutrient mixture and nitrogen fertilization showed no statistical effect on all characters under investigation. The results also showed that Sakha 53 variety proved its high productivity as a new variety, characterized with its high content of oil which reached up to 47.51%, in the Egyptian lands. Sakha 53 had high protein content (25.9%) in both seasons. Physical and chemical characteristics (RI, Visc. at 25°C, IV and UNSAP%) were almost the same. Sunflower oil had low %FFA and PV(0.19-0.24% and 0.54-0.93meq/Kg oil), respectively.

Fatty acids profile of Sakha 53 showed that, the predominant saturated fatty acids were palmitic and stearic ,while the predominant unsaturated fatty acids were oleic and linoleic. The oxidative stability of oils was varying in propotional to their fatty acids content. Total phenols as mg/Kg caffeic acid of the seeds was ranged from 618-944 mg/Kg seeds regardless the harvesting seasons and nitrogen treatments. HPLC analysis of phenols revealed that, the major phenol fractions of Sakha 53 seeds were chlorogenic, caffeic acids followed by protocatechic and vanillic acids.

It could be concluded that Sakha 53 may be contributed in the shortage of oil production gape due to its high content of oil and high productivity in the Egyptian land. Also, results indicated that, coating sunflower seeds with micronutrients mixture (Fe + Zn + Mn) with adding 120 Kg N/Fed may be gave the highest productivity of Sakha 53 variety.

INTRODUCTION

Egypt is one of the world's fastest growing vegetable oil markets for several years. Over the previous five or six years, total consumption of vegetable oils and fats increased from 800.000 to about 1.3 M tonne, almost three times the world average growth rate. (Buckley, 2005)

Sunflower (Helianthus annus) L. is an important source of high quality edible oil. It's considered to be the most important oil seed crop of the world due to its wide range adaptability and highest oil (40 – 50%) seed contents (Nawaz et al., 2003). Sunflower oil, regained some of its popularity in 2005/06 after the Egyptian government changed the mix on its ration card scheme for cooking oil from 80/20 to 50/50 soy/sunflower. Under this programme, poorer consumers get

oil and margarine at subsidized prices, which should boost sunflower oil consumption further. (Buckley, 2005)

However, the shortage in oil crops production and huge gape between the oil production and consumption which reached almost 90 % and the lake of the Egyptian cultivated land that urged the government to expand and reclaimed large areas in the desert. In the newly reclaimed sandy soils, micronutrients and nitrogen fertilizers are playing a great role to obtain high yield per area unit. Nitrogen is the most important limiting nutrient and frequently deficient in the Egyptian soils, especially in newly reclaimed lands. Hefni et al. (1985) found that, application of 30 and 60KgN/Fed on sunflower plant increased head diameter, 100-seed weight, seed yield /plant (El-Ahmer et al. ,1990). Metwally (1995) showed that, adding N fertilizer at the rate of 45Kg N/Fed significantly increased plant height and stem diameter of sunflower. Singh et al. (1995) reported that, various growth attributes of sunflower; i.e., plant height, stem and head diameter increased linearly with addition of nitrogen up to 80KgN/ha. Hermati (1993) reported that, sunflower hybrids were given 0-150Kg N, 0-150Kg P_2O_5 and 0-180Kg K_2O/ ha. Increasing nitrogen application rates slightly increased yield.

The present study was conducted with the objectives to study the effect of NPK levels on yield and yield components of sunflower, and to select the best treatments in increasing the sunflower seed oil percentage with maintaining the best quality characteristics, of its physicochemical properties.

MATERIALS AND METHODS

Experimental:

The study was carried out at Klabshu Agricultural Research station, Dakahlia Governorate during the two growing seasons of 2005 and 2006 to study the response of sunflower to micronutrients mixture Fe, Zn and Mn applied as foliar spray with four different levels of nitrogen fertilization.

The experiment was laid out in RCB designs with four replications. The main plots were devoted to applying micronutrients while the subplots included the nitrogen fertilizer levels as following:

Main plots (200 ppm Fe + 30 ppm Zn + 200 ppm Mn)
Subplots (Nitrogen fertilization levels): 30, 60, 90 and120 Kg N/Fed

Micronutrients were added in the form of EDTA. The experimental basic unit area included five ridges, each of 60 cm width and 3.5m length occupying an area of 10.5m^2 sunflower seeds "Sakha 53" were planted on 20/5/2005 and 25/5/2006 in the first and second seasons, respectively. All the plant protection measures and cultural practices were performed as usual.

Some physical and chemical properties of the experimental site are shown in Table 1.

Table 1: Some physical and chemical properties of the experimental soil site

Mechanical analysis		Chemical analysis
Clay %		pH (1:1) : 8.22
Silet %		EC (1:1) (mm hos) : 0.65
Sand %	68.3 %	Ca Co $_3$ % 18.20
		oM : 0.08
Texture	Sandy Loam	Total nitrogen % 0.017
		P (ppm) 3.50
		Exchangeable K meq / 100g soil: 0.30

At harvest a random sample of ten guarded plants per plot were taken to measure, plant height (cm), stem diameter (cm), head diameter (cm), seed yield / plant (g) and 100-seed weight (g). The seed yields were recorded on a plot basis then transferred, to seed yield in Kg/ Fed. Data were statistically analyzed according to Steel and Torrie (1980).

Laboratory analysis

Determination of oil percentage of sunflower seeds: oil percentage was conducted using Soxhlet apparatus for 16 h according to the AOAC (2000) methods.

Determination of protein content of sunflower seeds

protein content was determined according to the AOAC (2000) methods.

Oil extraction : oil was extracted from sunflower seeds after soaking twice in hexane. The collected solvents were evaporated under vacuum and the obtained oils were kept at -4°C in dark bottles till analysis.

Determination of the physical and chemical characteristics of sunflower seeds oil

Refractive index (RI) at 25°C, free fatty acids, peroxide and iodine values of the extracted oils were determined according to the AOAC (2000) methods. Sunflower seeds oil viscosity was measured using the Viscometer Brook-field RVDV1+C/P (cone/plate Viscometer, CP 41) connected to a water bath Brookfield TC 500. Viscosity was carried out at 25° ± 0.01°C according to the method described by Howard (1991).

Determination of fatty acids content : Fatty acids content of extracted oil were determined using Agilent 6890 GC.

Fatty acids content of the oils were converted into methyl esters using diazomethane and identified by gas liquid chromatography according to the methods of Leth et al. (1998). Fatty acids composition was achieved by gas Liquid chromatography fitted with flame ionization detector, column (1.5m x 4mm) packed with diatomate C (100-120 mesh) and coated with 10% polyethylene glycol adipate (PEGA). Temperature program was from 70° to 190°C at 8°C / min, then isothermally at this temperature for 20 min. Nitrogen flow rate was 30 ml/min. Detector, injection temperatures, hydrogen and air-flow rates and chart speed were 300°C, 250°C, 33 ml/min, 330 ml/min, respectively. Fatty acids were identified according to an authentic sample of fatty acids chromatographer internal standard.

Determination of the extracted oils susceptibility to oxidation with the Rancimat method:

Five grams of sunflower seed oils were accurately weight into each of the reaction vessels, and the following procedure was carried out according to the method described by Mendez, et al. (1996). The Metrohm Rancimat 679 was switched on until the temperature of the oil batch reached 100°C. Then 60 cm^3 of distilled water was placed into each of the six conductivity cells, and the air flow was set at 20 L / hr. The temperature was checked to ensure that it had a constant

value. The air supply was connected to the tubes containing the oil samples, and the chart recorded was started. The determination continued automatically until the conductivity reached the maximum value and the induction period was read.

Extraction of total phenols:

20g of defatted sunflower seeds, collected from the harvested plant (2005, 2006 seasons) treated with 30,60,90 and 120 Kg N/Fed, were extracted using 200 ml methanol for 24 h at room temperature according to the method described by Duh, et al. (1992). The extracts were filtered, and the residue was re-extracted using the same conditions and the collected solvents were evaporated under vacuum to 5ml at 40°C and complete dryness was achieved in vacuum and kept at - 4°C till analysis.

Determination of total phenols

Total phenols content was determined spectrophotometrically using Folin-Ciocattean reagent according to the method described by Duh, et al. (1992). The methanolic extracts (0.1 ml) of samples in a volumetric flask were diluted with glass-distilled water (75 ml). Folin-Ciocalteau reagent (5 ml) was added and the content of the flask mixed thoroughly. After 3 min., Sodium Carbonate (Na_2 Co_3) Solution (10 ml, 10% w/v) was added and finally quantified to 100 ml glass-distilled water and then the mixture was allowed to stand for 30 min. with intermittent shaking. The blue colour was measured with a UV-Vis Spectrophotometer. The concentration of total phenolic compounds in samples, mg/kg of dry product, were determined as caffeic acid.

Identification of phenols

Phenols of sunflower seeds, were identified by Hewlett-Packard HPLC. Identification of phenols was achieved at 280 nm by internal standard method of Evangelisti, et al. (1997).

RESULTS AND DISCUSSION

Growth characters :

a- Effect of micronutrients mixture:

Data in Table 2 show that micronutrients mixture significantly affected plant height and stem diameter, whereas head diameter recorded insignificant effect. These results could be explained on the basis that micronutrients must be presented during vegetative stage to get the normal growth of plant roots specially under sandy soil condition. (Osawa, 1973).

b- Effect of nitrogen fertilization :

Results showed that, in both seasons and combined increasing nitrogen fertilizer from 30 up to 120 KgN/Fed significantly increased plant height, leaf area/plant, specific leaf weight, stem diameter and head diameter (Table 2). Such results emphasized the function of N in plant metabolism. In this respect, Haron and salah (1991) reported that, increasing nitrogen application from 0 to 60 KgN/fed markedly increased plant height, stem diameter, leaf area index and head diameter.

c- Interaction effect between applying micronutrients mixture and nitrogen fertilization :

The data in Table 2 revealed that, the interaction effect recorded insignificant effect between the two factors on all studies growth characters indicating that each factor had an independent effect.

Yield components:

Data in Table 3 reveal that seed yield / plant was significantly affected by applying of micronutrients (Fe + Zn + Mn), while 100-seed weight recorded insignificant effect. Concerning the effect of nitrogen fertilization, 100-seed weight and seed yield / plant increased significantly with increasing nitrogen fertilizer level from 30 up to 120 Kg / Fed, but 100 seed weight recorded insignificant effect between 90 and 120 Kg N/Fed levels. In this respect, Anton et al. (1995) reported that, the addition of nitrogen fertilizer up to 90 Kg N/Fed increased insignificantly seed index of sunflower plants.

The interaction effect between micronutrients mixture (Fe+Zn+Mn) and nitrogen levels, showed no statistical effect on 100 – seed weight and seed yield / plant in the two seasons.

Table 2: Effect of foliar spray of micronutrients mixture and different nitrogen fertilization on yield growth character of Sakha 53 Variety during 2005 and 2006 seasons

	Nitrogen levels	Plant height (cm)			Leaf area / plant (cm^2)			Specific leaf Area (mg / cm^2)			Stem diameter (cm)			Head diameter (cm)		
Foliar Spray of (Fe + Mn + Zn)	Kg/Fed	2005	2006	Comb.	2005	2006	Comb.	2005	2006	Comb.	2005	2006	Comb.	2005	2006	Comb.
	30	114.2	115.3	114.8	618.6	622.5	620.6	3.85	3.68	3.77	0.82	0.84	0.83	10.0	10.2	10.1
	60	120.7	124.2	122.5	605.7	659.8	632.8	3.98	3.82	3.90	0.91	0.94	0.93	10.9	11.5	11.2
	90	132.7	136.0	134.4	739.5	693.7	716.6	3.96	4.09	4.03	1.01	1.04	1.02	11.9	11.9	11.9
	120	139.5	133.4	136.5	759.4	737.6	737.6	4.56	4.31	4.44	1.03	1.09	1.06	12.2	12.4	12.3
Mean		126.7	127.2	126.9	680.8	673.0	676.9	4.09	3.98	4.04	0.94	0.98	0.96	11.3	11.5	11.4
L.S.D 5% (N)		7.53	5.58	4.39	4.39	68.4	36.7	35.7	0.33	0.31	0.21	0.07	0.05	1.19	1.21	0.78
L.S.D 5% FS		S	NS	S	S	S	S	NS	NS	S	NS	NS	S	NS	NS	NS
NXFS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	N.S	N.S	N.S

Table 3: Effect of foliar spray of micronutrients mixture and different levels of nitrogen fertilizer on and its components of Sakha 53 variety during 2005 and 2006 seasons

Foliar spray	Nitrogen levels Kg / Fed	100 – Seed weight (g)			Seed yield / Plant (g)			Seed yield / Fed (Kg)		
		2005	2006	Comb.	2005	2006	Comb.	2005	2006	Comb.
	30	3.63	3.77	3.70	12.11	13.24	12.68	528.0	555.6	541.8
	60	3.97	4.15	4.06	13.83	14.80	14.32	623.6	632.8	628.2
	90	4.42	4.68	4.55	18.25	19.33	18.79	736.8	753.2	745.0
	120	4.72	4.84	4.78	21.14	22.55	21.85	766.4	844.8	805.6
Mean		4.19	4.36	4.27	16.33	17.49	16.91	663.7	696.6	680.2
L.S.D. 5% (FS)		N.S	N.S	N.S	S	N.S	S	S	S	S
L.S.D. 5%		0.60	0.40	0.35	1.80	2.21	1.35	51.4	42.0	29.9
(N) FSXN		NS	NS	NS	NS	NS	NS	NS	NS	NS

Seed yield :

Table 3 shows that, seed yield was insignificantly affected by spraying sunflower plants with the micronutrients mixture (Fe +Zn+Mn). These results are in harmony with those obtained by El-Yamany et al. (1993) who concluded that, seed coating with (Fe + Zn + Mn) increased significantly seed yield of sunflower compared with foliar spray of the same micronutrients.

Increasing nitrogen levels from 30 Kg N /Fed up to 120 Kg N/Fed increased significantly sunflower seed yield (Table 3). Such results reveal the important role of nitrogen in increasing sunflower production under sandy soil conditions. In this respect, Awad and Griesh (1992) pointed out that, application of 120 Kg N / Fed to sunflower plant increased seed yield / Fed under sandy soil conditions. Regarding the interaction effect between foliar spray of micronutrients in combination with nitrogen fertilizer levels, it is clear that such interaction had insignificant effect on seed yield per plants as well as seed yield / Fed in both seasons.

Physicochemical characteristics of sunflower seeds oil

Effect of nitrogen fertilization on oil content in sunflower seeds samples was determined and results are presented in Table 4. Results revealed that increasing nitrogen fertilizer from 30 up to 120 KgN/Fed significantly increased oil content in seeds from 33.12, 34.58 to 46.09, 47.51% in both seasons, respectively. El-Ahmer, et al. (1990) reported that, oil content of sunflower seeds planted in Egypt was 29.67%. Nawaz et al. (2003) also mentioned a high oil percentage of sunflower seeds.

Table 4 also reveals that protein content depend on nitrogen fertilization level, which means that the highest protein content was found in sunflower seeds treated with 120Kg N/Fed.

Refractive index at 25°C and viscosity at 25°C ranged from 1.4710 to 1.4750 and from 48.20 to 55.00 cP, respectively compared with 1.4726 and 85.50 cP, respectively of Rizk, et al. (2006).

Table 4: Effect of nitrogen fertilization on oil, protein contents and physicochemical characteristics of sunflower seeds oils.

	N 30		N 60		N 90		N 120		Sunflower oil
	2005	2006	2005	2006	2005	2006	2005	2006	
% oil	33.12	34.58	34.29	35.5	38.94	40.82	46.09	47.51	29.67*
% Protein	16.3	16.1	19.8	18.9	25.0	24.9	25.4	25.9	--
RI (25°C)	1.4718	1.4720	1.4712	1.4750	1.4750	1.4710	1.4736	1.4740	1.4726**
Visc.cP (25°C)	51.19	50.30	53.80	55.00	54.30	52.70	50.90	48.20	85.50**
% FFA	0.22	0.21	0.24	0.19	0.17	0.19	0.2	0.15	0.04**
PV	0.64	0.79	0.54	0.63	0.72	0.76	0.93	0.62	0.80**
IV	112.45	118.00	120.92	119.12	125.32	117.96	132.10	132.84	130.00**
UNSAP%	1.08	0.96	1.61	1.91	0.94	0.60	1.85	1.98	--

* Results are reported by El-Ahmer, et al. (1990)
** Results are reported by Rizk, et al. (2006)

Free fatty acids (%FFA) and peroxide value (PV) showed low values in both seasons, may be due to the freshness of seeds and extracted oils. Iodine values (IV) of the extracted oils indicated that all sunflower seeds samples were semi-drying oils and that is because of their iodine values were laying between 112-130 gI_2 / Kg oil (Table 4). The obtained data of %FFA, PV and IV were almost the same as those reported by Rizk, et al. (2006).

Unsaponifiable matter % ranged from 0.6 to 1.98 % in seed oils in both seasons with slight variations between treatments.

Results in Table 4 ascertained that, increasing nitrogen level had no significant effect on physicochemical characteristics of the extracted oils from seeds harvested from the two seasons.

Fatty acids profile of sunflower seeds oils

Fatty acids profile of sunflower seeds oil (Table 5) showed that, oils extracted in the two seasons were almost similar in their fatty acids profile except oleic and linoleic acids percentages, were only similar in samples fertilized with 30, 60Kg N/Fed, (40, 50%), respectively, and differed with higher nitrogen concentration (90, 120 Kg N/Fed).

Table 5: Effect of nitrogen fertilization on fatty acids profile of sunflower seed oils

Fatty Acids	N 30		N 60		N 90		N 120		Sun. oil*
	2005	2006	2005	2006	2005	2006	2005	2006	
16:0	5.16	5.76	4.82	5.15	4.73	4.91	5.23	5.51	6.67
16:1	0.12	0.16	0.14	0.17	0.15	0.13	0.15	0.09	--
18:0	3.25	3.36	2.78	3.01	3.52	3.28	3.25	2.48	4.10
18:1	42.19	39.82	41.72	39.97	49.83	52.73	23.65	26.74	15.95
18:2	49.26	50.74	50.18	51.59	41.73	38.91	67.65	65.06	73.28
18:3	0.12	0.16	0.18	0.09	0.05	0.05	0.07	0.12	--

*Results are reported by Samah and Mohamed (2002)

Oleic acid increased and linoleic acid decreased in samples treated with 90 Kg N/ Fed (49.83, 52.73 and 41.73, 38.91%), respectively in both seasons. Controversy, oleic acid was decreased sharply with the highest nitrogen fertilization (120 Kg N/ Fed), 23.65, 26.74%, while linoleic acid was greatly increased to 67.65, 65.06%,

respectively in both seasons. The present data of fatty acids profile are comparable with those reported by Samah and Mohamed (2002).

Oxidative stability of oils extracted from sunflower seeds

The oxidative stability of oils extracted from sunflower seeds determined by the Rancimat methods and expressed as induction period (h) at 100°C are shown in Table 6. Highest oxidative stability was obtained in oil extracted from sunflower seeds treated with 90kgN/Fed, while the lowest was with 120 Kg N/Fed. The obtained data are higher than those reported by Rizk, et al. (2006).

The results also reveled that nitrogen fertilization had no significant effect on the oxidative stability of oils and these variations in oil oxidative stability may be attributed to the oleic and linoleic acids content.

Table 6: Oxidative stability of oils extracted from sunflower seeds

Treatments	N30		N60		N90		N120		Sunflower oil*
Years	2005	2006	2005	2006	2005	2006	2005	2006	
Induction period at 100°C (h)	4.3	4.0	4.2	4.0	4.7	4.9	3.3	3.1	2.62

*Results are reported by Rizk, et al. (2006)

Total phenols

Total phenols of sunflower seeds were determined by the Folin-ciocalteu method and results are presented in Table 7. Total phenols ranged from 618 to 967 mg/kg of dry sample as caffeic acid regardless to nitrogen concentrations and harvested seasons. These findings were in agreement with those reported by Samah and Amany (2002). The highest concentration of phenol compounds was obtained with 90 kg/Fed. N treatment

Phenols fractions

The HPLC analysis of phenols fractions of the methanolic extracts of sunflower seeds treated with different concentrations of nitrogen fertilizer; 30, 60, 90 and 120 KgN/Fed are presented in Table 8 compared with those reported by Samah and Amany (2002).

Results revealed that major phenolic fraction was chlorogenic acid (41.0%) followed by caffeic acid (36.7%). Other phenols like protocatechic acid and vanillic acid were present in 9.2 and 8.4% respectively.

Table 7: Total phenols (mg/Kg as caffeic acid) of methanolic extracts from sunflower seeds

Treatments	N30		N60		N90		N120		Sunflower cake*
Years	2005	2006	2005	2006	2005	2006	2005	2006	
Total phenols	752	714	646	618	967	944	717	711	714

*Results are reported by Samah and Amany (2002)

Table 8: Total phenols fractions as a percentage of sunflower seeds extracts

Treatments	N30		N60		N90		N120		Sun. cake*
Years	2005	2006	2005	2006	2005	2006	2005	2006	
Unknown (1)	7.4	6.8	7.3	7.9	6.8	7.1	7.6	7.4	7.30
Unknown (2)	1.3	1.7	2.5	2.0	0.6	1.2	0.9	0.2	0.67
Chlorogenic acid	38.9	39.0	39.0	38.8	39.6	38.4	40.8	41.0	40.11
Caffeic acid	36.1	36.7	36.4	34.8	35.9	36.0	35.1	36.0	35.11
Protocatechic acid	7.9	8.2	6.9	8.3	8.8	9.2	8.5	8.4	8.30
Vanillic acid	8.4	7.6	7.9	8.2	8.3	8.1	7.1	7.0	8.51

*Results are reported by Samah and Amany (2002)

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Composition characteristics of sunflower seeds

محتوى الزيت والبروتين وخصائص الجودة لبذور عباد الشمس "سخا ٥٣" المنزرعة في الأراضي المستصلحة الجديدة

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دراسات حقلية ومعملية تم إجرائها خلال موسمي ٢٠٠٥، ٢٠٠٦ في محطة بحوث كلابشو بمحافظة الدقهلية وقسم بحوث الزيوت والدهون بمعهد بحوث تكنولوجيا الأغذية بمركز البحوث الزراعية بالجيزة وكان الهدف من الدراسة تقييم صنف جديد من عباد الشمس هو سخا ٥٣عند أربع مستويات مختلفة من النيتروجين وكذلك رشه بمخلوط من العناصر لمعرفة خصائص النمو والمحصول. كما تم اجراء هذه الدراسة لتقييم مدي إنتاجية هذا الصنف للزراعة في الاراضي المصرية المستصلحة. وكذلك دراسة تأثير هذه المعاملات على محتوى البذور من الزيت والبروتين والفينولات الكلية والخصائص الطبيعية والكيميائية (معامل الانكسار ، اللزوجة، الاحماض الدهنية الحره، رقم البيروكسيد والرقم اليودي كذلك المحتوي من المواد غير القابلة للتصبن) للزيت الناتج وأيضاً دراسة تركيب الأحماض الدهنية لهذا الزيت للتعرف على خصائصه الغذائية والتكنولوجية وثباته الأكسيدي باستخدام جهاز الرانسيمات.

كما تم دراسة محتوى بذور عباد الشمس من الفينولات الكلية مع عمل تقدير لهذه الفينولات باستخدام جهاز HPLC .

وأوضحت النتائج الآتي :-

أدت زيادة التسميد النيتروجيني من ٣٠ إلى ١٢٠ كجم نيتروجين للفدان إلى زيادة معنوية في طول النبات ، مساحة الأوراق / نبات ، الوزن النوعي للأوراق ، قطر الساق ، قطر القرص ، وزن ١٠٠ بذرة ومحصول البذور / نبات ومحصول البذور / فدان.

استخدام طريقة الرش بالنسبة للعناصر أدت إلى زيادة معنوية في كـلاً مـن ارتفـاع النبات، مساحة الأوراق بينما لم يكن هناك فرق معنوي بالنسبة لبقية الصفات.

كان تأثير التفاعل بين الرش بالعناصر الصغرى والتسميد النيتروجيني غيـر معنـوي على جميع الصفات تحت الدراسة.

أثبتت النتائج أن صنف سخا ٥٣ له كفاءه عالية، كصنف جديد يتميز بمحتواه العالي من الزيت تصل الي ٤٧,٥١%، للزراعة في الأراضي المصرية المستصلحة.

كما أثبتت ارتفاع محتواه من البروتين والذي يصل الي ٢٥,٩% وتشابه الخصائص الطبيعية والكيميائية للزيت المستخلص من البذور (معامـل الانكـسار، اللزوجـة، الـرقم اليودي، نسبة المواد غير القابلة للتصبن) خلال موسمي الزراعـة. كمـا يتميـز الزيـت بانخفاض محتواه من الأحماض المنفرده ورقم البيروكـسيد (٠,١٩-٠,٢٤% ، ٠,٥٤-٠,٩٣ ملليمكافئ/كجم زيت).

أظهر تركيب الاحماض الدهنية لزيت عباد الشمس "سخا ٥٣" أن الاحماض الدهنيـة المشبعة السائده هي البالميتيك والاستياريك والاحماض الدهنية غير المشبعة السائدة هـي الاوليك واللينوليك. وأن الثبات الاكسيدي للزيوت يختلف بـإختلاف محتواهـا مـن هـذه الاحماض.

يتراوح محتوي المستخلص الميثـانولي لهـذه البـذور (مقـدراً كمللـيجم حمـض كافييك/كجم بذرة) من ٦١٨-٩٤٤ ملليجم / كجم بذرة بغض النظر عن موسـم الحـصاد والمعاملة بالنيتروجين.

كما أظهر التحليل الكروماتوجرافي عالي الكفاءة أن الفينولات السائدة هي حمـضي الكلوروجينيك والكافييك ويتبعهم حمضي البروكاتشيك والفانيليك.

توصي الدراسة باستخدام الصنف سخا ٥٣ في الزراعة كمحصول زيتي عـالي فـي نسبة الزيت للمساهمه في سد الفجوة الغذائية في الزيوت النباتية.

وأن طريقة استخدام العناصر الصغري بالنسبة للنبات ربما يكون أفضل لـو تـم استخدام طريقة التغليف عن استخدام الرش مع إضافة النيتروجين بمعدل ١٢٠ كجم/فـدان مما يعطي أعلى انتاجية من نباتات عباد الشمس من محصول البذرة / فدان.