Economic Evaluation of some Safflower (*Carthamus tinctorius*, L.) Genotypes under Upper Egypt Conditions

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ABSTRACT

Safflower is commercially cultivated for vegetable oil extracted from its seeds. In this study, the economic and production importance of 14 genotypes and varieties of safflower cultivated at Shandaweel Research Station in Sohag Governorate (Egypt) were investigated. A comparison between the new lines (genotypes) of safflower and known varieties was done for two seasons 2012/2013 and 2013/2014 to estimate the impact on the safflower production and oil content. Data for plant height, seed yield/plant, 100-seed weight, seed yield/feddan, and seed oil percentage were collected. The results showed that, among varieties and genotypes of safflower, Kharega 1and Kharega 2 were the best for the most investigated parameters during season 2012-2013. At the same time, line 8, Giza 1 and Line 9 were in the third place after Kharega1 and Kharega 2 in the parameters plant height ,weight seed yield/plant, 100-seed weight, and seed yield/feddan. While, the oil percentage, was found higher in Line 9, Line 5 and Giza 1.

On the other hand, it was found that Kharega 1, Kharega 2 and Line 8 were higher in plant height during the 2013l2014 season. In this study, mean comparison for the seed yield/plant within all the safflower genotypes and varieties were made using Fisher's Least Significant Difference Test. The data showed that the varieties (Kharga1, Kharga1, Line11, Line 4 and Giza 1) occupied from the first order up to the fifth order, respectively. Also the differences between all studied genotypes and varieties of safflower were very significant in case of weight seed yield/plant, seed yield/feddan, and oil percentage, while kharga1 and line 5 were the best for yield/feddan and seed weight, and line 9 was the best for oil percentage.

Key words: Safflower, genotypes, varieties, yield, oil content and economic.

INTRODUCTION

Safflower (*Carthamus tinctorius L.*) is a temperate zone plant grown in arid and semiarid regions of the world. The crop is grown for dyes production, for food, fabric and for medicinal uses, but it is currently cultivated for edible oil and birdseed (McPherson, Allen, Keith, Topinka and Linda, 2004). Around the world, safflower is mainly grown for its edible oil, for cooking, salad and margarine. Research linking health and diet has increased the demand for the oil, which has the highest high polyunsaturated/saturated ratios of any oil available. It is nutritionally similar to olive oil, with high levels of linoleic or oleic acid, but much less costly. Polyunsaturated fats are associated with lowering of blood cholesterol (Weiss, 2000). Development of oil seeds cultivation has an important role to provide the requisite edible oils for human beings (Eslam, 2004). The germplasm resources of safflower have so far been characterized entirely on the basis of morphological traits, agronomic characters, biotic and /or biotic stress and /or biochemical characters (Han & Li, 1992); (Aslam&Hazara, 1993); (Fernandez-Martinez; Rio and Haro, 1993); (Deharo; Del,. Lopez; Garcia; Palomares and Fernandes Martines, 1997), in a study of 199 safflower genotypes collected from 37 different countries, showed that the oil percent varied by genotype and environmental conditions. Paramus (Parameshwarappa & Meghannavar, 2001) showed that the number of heads, seed weight, and seed oil content varies considerably in the safflower population.

Safflower genotypes varied significantly in seed yield and its attributes, oil percent and oil yield per unit area (El-Gayar; Abd El-Gawad and Barsoum, 1990); (Mundel; Huang and Braun, 1999); (Camas; Ctrakand Esendal, 2007); (Omidi, 2006) evaluated safflower genotypes under 3 different environmental conditions, in Karaj, Isfahan, and Drab in Iran, and indicated significant differences among genotypes in seed and oil yield.

Concerning correlation coefficient, (Bagavan & Ravikumar, 2001) reported a positive correlation between number of heads per plant and grain yield. (Johnson; Ghorpade and Bradley, 2001) indicated

that the grain yield was positively correlated with seed weight and plant height. The number of capitulate in a plant was positively correlated with seed and oil yields. Positive correlations between seed oil and seed yields were obtained (Eslam; Monirifar and Ghassemi, 2010).

In recent years, there has been a proliferation of safflower cultivars, and many excellent genotypes with superior properties are now available. This demonstrates a need for additional research examining the agronomic performances of newly released safflower genotypes in diverse regions. This study was initiated to economically evaluate the agronomic performance of new safflower genotypes under arid conditions in Upper Egypt, Sohag Governorate.

MATERIALS AND METHODS

A field study of 14 safflower genotypes and varieties was conducted at the experimental farm of the Shandaweel Research Station at Sohag Governorate in the period of 2012/2013 and 2013/2014. The experimental design was Randomized Complete Block with three replications with 5 rows, 60 cm apart and 4 m length, the distance between plants was 15 cm. Amount of seeds used per feddan was 12 kg.

Genotypes' seeds were sown manually on November 4th in the first season and on November 7th in the second season. The source of the seeds of all the studied genotypes and varieties was shown in Table (1).

Nitrogen fertilizer was applied at rate of 60 kg/feddan in the form of urea (46.5%) as top dressing or broad casting in equal doses 21 and 45 days after sowing. Phosphorus fertilizer was applied at a level of 150 kg/feddan as supper phosphate (15.5 %) before sowing in all treatments. Hand harvesting was performed about 155 days after sowing. Ten guarded were randomly taken from each plot and plant height (cm), seed yield/plant (g), 100-seed weight (g), seed yield/feddan (kg) were determined for each plot. Seed oil percentage was measured using the modified Soxhelt methods that uses petroleum ether (60-80), according to the standard method of A.O.A.C. (1990).

Mean comparison for all parameters within all the safflower genotypes and varieties were made using Fisher's Least Significant Difference Test at $P \leq 0.05$.

RESULTS AND DISCUSSION

1. Season (2012 – 2013)

Data in the table (2) showed that highly significant varieties and genotypes of safflower of the Plant height during the season (2012-2013), it was found that the most important varieties and genotypes of safflower of the Plant height in this study are found in Kharega1, Kharega 2 and Line 8 variety.

The results of the analysis of variance for the means of plant height (cm) for genotypes and varieties safflower during the season (2012 - 2013) showed that the Kharega 1, Kharega 2 and Line 8 variety occupied the centers of the first to third in this study of plant height, which amounted to about 213.33, 205.00, and 200.00 (cm),

and significant differences excel the rest of the varieties that have been cultivated in this season, and followed by Lin 11 and the Giza1 variety,

Table 1: The origin of safflower genotypes

No.	Origin	Number	Genotypes
1	Cyprus	1697	Line 1
2	Ethiopia	1699	Line 2
3	India	152	Line 3
4	Ethiopia	1667	Line 4
5	Ethiopia	1675	Line 5
6	India	154	Line 6
7	Cyprus	1671	Line 7
8	Cyprus	1668	Line 8
9	India	147	Line 9
10	Cyprus	1682	Line 10
11	India	146	Line 11
12	Egypt	--	Varity
13	Egypt	--	Varity
14	Egypt	--	Varity

Table 2: The results for analysis of variance to effect plant height (cm) on safflower genotypes and varieties during the season (2012 - 2013)

Source of var.	*d.f*	S. dev. sum	S. d. av. sum	*f*
Bet., genotypes	13	5908.31	454.49	9.01**
Wit. genotypes	28	1412.67	50.45	

with means plant height (cm) to them about 195.67% and 194.33 (cm), where these varieties and genotypes outperform the rest of the varieties cultivated in this season of the plant height, while the Line6 is non-significant, as shown in Table (3).These results concur with the results of others (El-Gayar, Abd El-Gawad and Barsoum, 1990); (Pascual-Villalobos & Alburquerque 1996); (Koutroubas; Papakosta and Doitsinis, 2004) documenting that safflower genotypes differed in plant height. Lower plant heights in the current study were probably caused by high altitude. This agrees with the study of (Kofidis; Bosabalidis and Moustakas, 2003), who found that oregano plants grown at high altitude were shorter than those grown at low altitude.

The results of the analysis of variance for the effect of the weight seed yield/ plant (g) of the safflower genotypes and varieties during the season (2012 - 2013) as shown in Table (4).

Data in the table (4) showed that the means of weight seed yield/plant (g) in this study during the season (2012-2013) were the most important varieties of safflower plant, where the means of weight yield/plant found in some varieties under study.

The results of the analysis of variance for the means of the weight seed yield /plant (g) of these varieties and genotypes of safflower during the season (2013-2014), to the varieties of Kharega1, Kharega 2 and Giza 1 variety one occupying the centers of the first to third in study of the means weight seed yield/plant, which amounted to about 46.30 and 44.10 and 39.37 (g) of plant and significant differences outperform the rest of the varieties that have been cultivated in this season.

Followed by items from Line 4 to Line 10 at about 38.80 and 36.90 (g) of the plant, while the rest of safflower genotypes in this study non-significant. As shown in Table (5).

Table 3: Results of the LSD for the means Plant height (cm) of safflower genotypes and varieties during the season (2012-2013)

Phenomenon (in descending order)	In ascending order according to the average plant height in cm													
	Average (%)	line 9 23.03	line 3 26.17	line 6 26.60	line 5 29.50	line 1 31.07	line 7 31.97	line 11 32.27	line 8 33.97	line 2 36.80	line 10 36.90	line 4 38.80	Giza (1) 39.37	Kharega (2) 44.10
Kharega 1	213.33	41.67*	41.33*	35.67*	31.67*	31.00*	31.00*	30.00*	20.33*	20.00*	19.00*	17.67*	13.33*	8.33
Kharega 2	205.00	33.33*	33.00*	27.33*	23.33*	22.67*	22.67*	21.67*	12.00*	11.67	10.67	9.33	5.00	
line 8	200.00	28.33*	28.00*	22.33*	18.33*	17.67*	17.67*	16.67*	7.00	6.67	5.67	4.33		
line 11	195.67	24.00*	23.67*	18.00*	14.00*	13.33*	13.33*	12.33*	2.67	2.33	1.33			
Giza 1	194.33	22.67*	22.33*	16.67*	12.67*	12.00*	12.00*	11.00	1.33	1.00				
line 3	193.33	21.67*	21.33*	15.67*	11.67	11.00	11.00	10.00	0.33					
line 7	193.00	21.33*	21.00*	15.33*	11.33*	10.67	10.67	9.67						
line 6	183.33	11.67	11.33	5.67	1.67	1.00	1.00							
line 10	182.33	10.67	10.33	4.67	0.67	0.00								
line 5	182.33	10.67	10.33	4.67	0.67									
line 2	181.67	10.00	9.67	4.00										
line 9	177.67	6.00	5.67											
line 4	172.00	0.33												

Data in parentheses indicated that a value less significant difference probability of 95%.

Table 4: Analysis of variance for the effect of the weight seed yield /plant(g) of safflower genotypes and varieties during the season (2012-2013)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*f*
Bet., genotypes	13	1781.18	137.01	15.16**
Wit. genotypes	28	253.07	9.04	

Table 5: Results of the LSD for the means weight seed yield /plant (g) and its effect on safflower genotypes and varieties during the season (2012-2013)

Phenomenon (in descending order)	In ascending order according to the average seed yield per plant in gm													
	Average (%)	line 9 23.03	line 3 26.17	line 6 26.60	line 5 29.50	line 1 31.07	line 7 31.97	line 11 32.27	line 8 33.97	line 2 36.80	line 10 36.90	line 4 38.80	Giza (1) 39.37	Kharega (2) 44.10
Kharega 1	46.30	23.27*	20.13*	19.70*	16.80*	15.23*	14.33*	14.03*	12.33*	9.50*	9.40*	7.50*	6.93*	2.20
Kharega 2	44.10	21.07*	17.93*	17.50*	14.60*	13.03*	12.13*	11.83*	10.13*	7.30*	7.20*	5.30*	4.73	
Giza 1	39.37	16.33*	13.20*	12.77*	9.87*	8.30*	7.40*	7.10*	5.40*	2.57	2.47	0.57		
line 4	38.80	15.77*	12.63*	12.20*	9.30*	7.73*	6.83*	6.53*	**4.83**	**2.00**	**1.90**			
line 10	36.90	13.87*	10.73*	10.30*	7.40*	5.83*	4.93	4.63	**2.93**	**0.10**				
line 2	36.80	13.77*	10.63*	10.20*	7.30*	5.73*	4.83	4.53	**2.83**					
line 8	33.97	10.93*	7.80*	7.37*	4.47	2.90	2.00	1.70						
line 11	32.27	9.23*	6.10*	5.67*	2.77	1.20	0.30							
line 7	31.97	8.93*	5.80*	5.37*	2.47	0.90								
line 1	31.07	8.03*	4.90	4.47	1.57									
line 5	29.50	6.47*	3.33	2.90										
line 6	26.60	3.57	0.43											
line 3	26.17	3.13												

Data in parentheses indicated that a value less significant difference probability of 95%.

The results are supported by the findings of (Narkhede & Patil, 1990) and (Mane; Jadhav and Powar, 1990), may have reported varietal differences in their respective studies.

The results of analysis of variance of the effect of the100-seed weight (g) of the safflower genotypes and varieties during the season (2012-2013) as shown in Table (6).The results of analysis of variance for the means of the 100-seed weight (g) to these varieties and genotypes of safflower during the season (2013-2014), in the varieties of Kharega1, Kharega 2 and Line 9 variety one occupying the centers of the first to third in study of the means 100-seed weight, which amounted to about 6.95 and 6.70and 6.33 (g) of plant and significant differences outperform the rest of the varieties that have been cultivated in this season, followed by items from Line 5 and Line 3 at about 6.33 and 6.02 (g) of the plant, while the rest of safflower genotypes in this study non-significant, as shown in Table (7).Variation in 100-seed weight between genotypes of safflower has reported by (Narkhede & Patil, 1990); (Mane, Jadhav and Powar, 1990); (Mahasi; Pathak; Wachira; Riungu and Kamundia, 2005). Result was found in a previous study in Kenya evaluating 36 exotic safflower accessions for agro-morphological characters such as yield per plant (Mahasi; Pathak; Wachira; Riungu and Kamundia, 2005).

Data in the table (8) to found that high significant varieties and genotypes of safflower of the oil percentage during the season (2012-2013), it was found that the most important varieties and genotypes of safflower of the oil percentage in this study are found in Line 9, Line 5 and Giza 1 variety.

The results of analysis of variance for the means of oil percentage of genotypes and varieties safflower during the season (2012 - 2013), in the Line 9, Line 5 and Giza 1 variety occupied the centers of the first to third in this study of oil percentage, which amounted to about 34 .85 ,34.77 and 34.60 %, and significant differences excel the rest of the varieties that have been cultivated in this season, and followed by Kharega 2 variety and the Line 2, with an average oil percentage to them about 33.65 and 33.45 %, where these varieties and genotypes outperform the rest of the varieties cultivated in this season in the oil percentage, also occupied genotypes from 7 to 3 centers from the Line6 to the Line11of moral superiority and the average oil percentage, which amounted to about 32.87, 32.73, 31.97, 31.71, 31.43, 31.12 and 29.53% for these varieties, respectively, while the Line6 is non-significant, as shown in Table (9). Similar results were reported by (Narkhede & Patil, 1990); (Camas, Ctrak and Esendal, 2007) and (Abd El-Lattief; Seedek and Rehab, 2009).

Table 6: Analysis of variance for the effect of the 100-seed weight (g) of safflower genotypes and varieties during the season (2012-2013)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*f*
Bet., genotypes	13	17.11	1.31	13.97**
Wit. genotypes	28	2.64	0.09	

Table 7: Results of the LSD for the means of 100- seed weight (g) and its effect on safflower genotypes and varieties during the season (2012-2013)

Phenomenon (in descending order)	In ascending order according to the average100- seed weight in Gm													
	Average (%)	line 4 4.85	line 6 5.02	line 1 5.05	line 8 5.12	line 11 5.15	line 2 5.20	Giza (1) 5.62	line 7 5.65	line 10 5.68	line 3 6.02	line 5 6.22	line 9 6.22	Kharega (2) 6.70
Kharega 1	6.95	2.10*	1.93*	1.90*	1.83*	1.80*	1.75*	1.33*	1.30	1.27*	0.93*	0.73*	0.73*	0.25
Kharega 2	6.70	1.85*	1.68*	1.65*	1.58*	1.55*	1.50*	1.08*	1.05*	1.02*	0.68*	0.48	0.48	
line 9	6.22	1.37*	1.20*	1.17*	1.10*	1.07*	1.02*	0.60*	0.57*	0.53*	0.20	0.00		
line 5	6.22	1.36*	1.20*	1.17*	1.10*	1.07*	1.02*	0.60*	0.57*	0.53*	0.20			
line 3	6.02	1.17*	1.00*	0.97*	0.90*	0.87*	0.82*	0.40	0.37	0.33				
line 10	5.68	0.83*	0.67*	0.63*	0.57*	0.53*	0.48*	0.07	0.03					
line 7	5.65	0.80*	0.63*	0.60*	0.53*	0.50	0.45	0.03						
Giza 1	5.62	0.77*	0.60*	0.57*	0.50	0.47	0.42							
line 2	5.20	0.35	0.18	0.15	0.08	0.05								
line 11	5.15	0.30	0.13	0.10	0.03									
line 8	5.12	0.27	0.10	0.07										
line 1	5.05	0.20	0.03											
line 6	5.02	0.17												

Data in parentheses indicated that a value less significant difference probability of 95%.

Table 8: the results for analysis of variance of effect the oil percentage% on safflower genotypes and varieties during the season (2012 - 2013)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*f*
Bet., genotypes	13	200.76	15.44	10.21**
Wit. genotypes	28	42.36	1.51	

Table 9: Results of LSD for the mean oil percentage of safflower genotypes and varieties during the season (2012-2013).

Phenomenon (in descending order)	In ascending order according to the average oil percentage												
	Average (%)	Line 8 27.20	Line 6 29.17	Line 3 29.53	Line 4 31.12	Line 10 31.43	Line 11 31.71	Line 1 31.97	Kharega (1) 32.73	Line 7 32.87	Line 2 33.45	Kharega (2) 33.65	Giza (1) 34.60	Line 5 34.77
Line 9	34.85	7.65*	5.68*	5.32*	3.73*	3.42*	3.14*	2.88*	2.12*	1.98	1.40	1.20	0.25	0.08
Line 5	34.77	7.57*	5.60*	5.23*	3.65*	3.34*	3.06*	2.80*	2.03	1.90	1.32	1.12	0.17	
Giza 1	34.60	7.40*	5.43*	5.07*	3.48*	3.17*	2.89*	2.63*	1.87	1.73	1.15	0.95		
Kharega 2	33.65	6.45*	4.48*	4.12*	2.53*	2.22*	1.94	1.68	0.92	0.78	0.20			
line 2	33.45	6.25*	4.28*	3.92*	2.33*	2.02	1.74	1.48	0.72	0.58				
line 7	32.87	5.67*	3.70*	3.33*	1.75	1.44	1.16	0.90	0.13					
Kharega 1	32.73	5.53*	3.57*	3.20*	1.62*	1.30	1.03	0.77						
Line 1	31.97	4.77*	2.80*	2.43*	0.85	0.54	0.26							
Line 11	31.71	4.51*	2.54*	2.17*	0.59	0.28								
Lline 10	31.43	4.23*	2.26*	1.90	0.31									
Line 4	31.12	3.92*	1.95	1.58										
Line 3	29.53	2.33*	0.37											
Line 6	29.17	1.97												

Data in parentheses indicated that a value less significant difference probability of 95%.

The results are supported by the findings of (El-Gayar, Abd El-Gawad and Barsoum, 1990); (Narkhede & Patil, 1990); (Mundel, Huang and Braun, 1999); (Mahasi; Pathak; Wachira; Riungu and Kamundia, 2005); (Omidi Tabrizi, 2006); (Camas; Ctrak and Esendal, 2007); (Abd El-Lattief, Seedek and Rehab, 2009) and (Eslam, Monirifar and Ghassemi, 2010), may have reported varietal differences in their respective studies. The data in the table (10) showed that high significance for means to seed yield/feddan. During the season (2012-2013), it was found that the most important varieties and genotypes of safflower for the seed yield/feddan in this study are found in Kharega 1, Line 9 and Kharega 2 varieties.

The results of the analysis of variance for the means of seed yield/feddan for these genotypes and varieties during the season (2012-2013) overlap in the order of varieties and genotypes of different safflower, due to the non-significant of these varieties under study, as in Table (11). The same results reported by (Omidi, 2006); (Bagavan & Ravikumar, 2001); (Johnson, Ghorpade and Bradley, 2001) and (Eslam, Monirifar and Ghassemi, 2010).

Table 10: the results for analysis of variance of the seed yield / feddan (tons) effect on safflower genotypes and varieties during the season (2012 - 2013)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*f*
Bet., genotypes	13	2.10	0.16	58.64**
Wit. Genotypes	28	0.08	0.003	

Table 11: Results of LSD for the means seed yield / feddan (tons) of safflower genotypes and varieties during the season (2012-2013)

Phenomenon (in descending order)	In ascending order according to the average seed yield / feddan (tons)													
	Average (%)	line 6 0.92	line 4 0.93	line 8 0.94	line 1 0.96	line 10 1.01	line 7 1.03	line 2 1.09	line 3 1.18	line 11 1.31	Giza (1) 1.36	line 5 1.39	Kharega 2 1.40	line 9 1.47
Kharega 1	1.61	0.96*	0.68*	0.67*	0.65*	0.60*	0.58*	0.52*	0.43*	0.30*	0.26*	0.23*	0.21*	0.14*
line 9	1.47	0.55*	0.53*	0.53*	0.51*	0.46*	0.44*	0.38*	0.29*	0.16*	0.11*	0.08	0.07	
Kharega 2	1.40	0.48*	0.47*	0.46*	0.44*	0.39*	0.37*	0.31*	0.22*	0.09	0.05	0.02		
line 5	1.39	0.47*	0.45*	0.45*	0.42*	0.38*	0.36*	0.29*	0.21*	0.07	0.03			
Giza 1	1.36	0.44*	0.42*	0.42*	0.39*	0.35*	0.33*	0.26*	0.18*	0.04				
line 11	1.31	0.39*	0.38*	0.38*	0.35*	0.31*	0.28*	0.22*	0.13*					
line 3	1.18	0.26*	0.24*	0.24*	0.22*	0.17*	0.15*	0.08						
line 2	1.09	0.17*	0.16*	0.16*	0.13*	0.09	0.07							
line 7	1.03	0.11*	0.09*	0.09*	0.07	0.02								
line 10	1.01	0.09	0.07	0.07	0.05									
line 1	0.96	0.04	0.03	0.03										
line 8	0.94	0.02	0.01											
line 4	0.93	0.02												

Data in parentheses indicated that a value less significant difference probability of 95%.

2. Season (2013-2014)

Data in the table (12) showed high significance means of plant height (cm) during the season (2013-2014).

It was found that the most important genotypes and varieties of safflower the means of plant height in this study are in varieties Kharega 1 and Kharega 2 and Line 8.

The results of the analysis of variance for the means of plant height of these varieties and genotypes during the season (2013-2014), to the varieties of Kharega 1, Kharega 2and the Line 8 occupy the centers of the first to third in this study of the means of plant height (cm), which amounted to about 214.33, 207.00 and 204.00 (cm) and significant differences outperform the rest of the varieties that have been cultivated in this season.

Followed by the Lines of the line 4 until the line 7 with an average of about 198.33, 195.00, 193.97 and 191.67 (cm), then lines 9 and 10, the line 1 and 4 means amounting to about 191.33 and 187.33 and 177.67 and 175.67 (cm). The rest of varieties and genotypes were non-significant, as shown in table (13).

Data in table (14) shows the means of seed yield/plant (g) during the season (2013-2014). It was found that the most important varieties and genotypes of safflower plant, where the means of weight yield/plant found in some varieties under study.

The results of the analysis of variance for the means of the weight seed yield /plant (g) during the season (2013-2014), in the varieties of Kharega1 to Giza 1 variety occupying the centers of the first to five in this study of the means seed yield/plant (g), which amounted to about 48.08, 45.43, 40.46, 40.23 and 39.43 (g) of plant and significant differences outperform the rest of the varieties that have been cultivated in this season, followed by items from sixth to seventh at about 38.33 and 38.13 (g) of the plant, while the rest of the items were non-significant, showed in table (15).

Data in table (16) showed that significant to the means of 100-seed weight of the safflower genotypes and varieties in this study during the season (2013-2014) which indicates the lack of significant differences between different varieties of safflower under study.

Data in table (17) showed that high significance for means of seed yield/feddan during the season (2013-2014). It was found that the most important varieties of safflower of the seed yield/ feddan in this study were in Kharega 1 and Line 5 in this study.

The results of analysis of variance for the means seed yield/feddan (tons) of safflower genotypes during the season (2013-2014). The varieties of Kharega 1 from Giza 1 variety occupied the centers of the first to sixth in the study of the means of seed yield/feddan (tons), which amounted to about 1.77, 1.75, 1.58, 1.53, 1.52 and 1.48 tons/feddan and significant differences outperform the rest of the varieties that have been cultivated in the season, followed by the genotypes of the Line 7, the Line 2 and Line 5 of about 1.23, 1.22 and 1.18 (tons), while the rest of the genotypes were non-significant showed that in table (18).

The data in table (19) showed that high significance for varieties and genotypes of safflower crop of the oil percentage during the season (2013-2014). It was found that the most important varieties and genotypes of safflower of the oil percentage in this study is the Line 9, Line 11 and Giza 1varitey.

The results of the analysis of variance for the means oil percentage of genotypes and varieties safflower crop by estimating the LSD during the season (2013-2014). Line 9, Line 11 and Giza1 variety occupied the centers of the first to third in the study of means oil percentage, which amounted to about 34.52, 34.37 and 34.33 %, and significant differences excel the rest of the varieties that have been cultivated in this season.

Followed by a second varieties and genotypes Line 2, Kharega 2 and Line 7 with an average oil percentage to them about 34.05, 33.91 and 32.83 %, where these varieties outperform the rest of the varieties cultivated in this season in this study of the oil percentage. It also occupies the genotypes and varieties from the other centers were significant and the means oil percentage which amounted to about 32.45%, 32.43%, 32.43%, 32.35%, 32.35%, 32.01% and 30.62% for these genotypes and varieties under study, as shown in table (20).

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Table 12: The results of analysis of variance for plant height effect on safflower genotypes and varieties during the season (2013 - 2014)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*F*
Bet., genotypes	13	5784.48	444.96	5.39**
Wit. genotypes	28	2312.00	82.57	

Table 13: Results of LSD for the average plant height (cm) of safflower genotypes and varieties during the season (2013-2014)

Phenomenon in descending order	In ascending order according to the average plant height in cm													
	Average (%)	Line 2 172.00	Line 4 175.67	Line 1 177.67	Line 5 182.67	Line 6 186.00	Line 9 187.33	Line 10 191.33	Line 7 191.67	Line 3 193.67	Giza (1) 195.00	line 11 198.33	Line 8 204.00	Kharega (2) 207.00
Kharega 1	214.33	42.33*	38.67*	36.67*	31.67*	28.33*	27.00*	23.00*	22.67*	20.67*	19.33*	16.00*	10.33	7.33
Kharega 2	207.00	35.00*	31.33*	29.33*	24.33*	21.00*	19.67*	15.67*	15.33*	13.33	12.00	8.67	3.00	
Line 8	204.00	32.00*	28.33*	26.33*	21.33*	18.00*	16.67*	12.67*	12.33	10.33	9.00	5.67		
Line 11	198.33	26.33*	22.67*	20.67*	15.67*	12.33	11.00	7.00	6.67	4.67	3.33			
Giza 1	195.00	23.00*	19.33*	17.33*	12.33	9.00	7.67	3.67	3.33	1.33				
Line 3	193.67	21.67*	18.00*	16.00*	11.00	7.67	6.33	2.33	2.00					
Line 7	191.67	19.67*	16.00*	14.00	9.00	5.67	4.33	0.33						
Line 10	191.33	19.33*	15.67*	13.67	8.67	5.33	4.00							
Line 9	187.33	15.33*	11.67	9.67	4.67	1.33								
Line 6	186.00	14.00	10.33	8.33	3.33									
Line 5	182.67	10.67	7.00	5.00										
Line 1	177.67	5.67*	2.00											
Line 4	175.67	3.67*												

Data in parentheses indicated that a value less significant difference probability of 95%.

Table 14: Analysis of variance for the effect of the Seed yield / plant (g) of the safflower genotypes and varieties during the season (2013 - 2014)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*F*
Bet., genotypes	13	1555.63	119.66	7. 47**
Wit.genotypes	28	448.48	16.02	

Table 15: Results of the LSD test for the means seed yield /plant and its effect on safflower genotypes and varieties during the season (2013-2014)

Phenomenon in descending order	In ascending order according to the average seed yield per plant in gm													
	Means (%)	Line 6 28,30	Line 9 28,38	Line 3 28,40	Line 5 29,83	Line 1 33,43	Line 7 33,63	Line 8 35,71	Line 2 38,13	Line 10 38,23	Line 14 39,43	Line 4 40,23	Line 11 40,46	Kharega (2) 45,43
Kharega 1	48,08	19,78*	19,70	19,68*	18,25*	14,64*	14,44*	12,36*	9,94*	9,84*	8,65*	7,84*	7,61*	2,64
Kharega 2	45,43	17,14*	17,06*	17,03*	15,60*	12,00*	11,80*	9,72*	7,30*	7,20*	6,01*	5,20	4,97	
Line 11	40,46	12,17*	12,09*	12,06	10,63*	7,03*	6,83*	4,75*	2,33	2,23	1,04	0,23		
Line 4	40,23	11,94*	11,86*	11,83*	10,40*	6,80*	6,60	4,52	2,10	2,00	0,81			
Giza 1	39,43	11,13*	11,05*	11,03	9,60*	5,99	5,79	3,71	1,29	1,19				
Line 10	38,23	9,94*	9,86*	9,83*	8,40*	4,80	4,60	2,52	0,10					
Line 2	38,13	9,84*	9,76*	9,73*	8,30*	4,70	4,50	2,42						
Line 8	35,71	7,42*	7,34*	7,31*	5,88	2,28	2,08							
Line 7	33,63	5,34	5,26	5,23	3,80	0,20								
Line 1	33,43	5,14	5,06	5,03	3,60									
Line 5	29,83	1,53	1,45	1,43										
Line 3	28,40	0,10	0,02											
Line 6	28,38	0,08												

Data in parentheses indicated that a value less significant difference probability of 95%.

Table 16: Analysis of variance to test the effect of the 100- seed weight of the safflower genotypes and varieties in this study during the season (2013-2014)

Source of vari.	*d.f*	S.dev.sum	S. d.av. sum	F
Bet., genotypes	13	1595.87	122.76	1.06**
Wit. genotypes	28	3240.59	115.74	

Table 17: Analysis of variance for the effect the seed yield / feddan (tons) on the safflower genotypes and varieties during the season (2013-2014)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*F*
Bet., genotypes	13	3.14	0.24	25.26**
Wit.genotypes	28	0.27	0.01	

Table 18: results to LSD to the means seed yield/feddan (tons) of safflower genotypes and varieties during the season (2013-2014)

Phenomenon in descending order	Ascending order according to seed yield/ feddan (tons)												
	Average %	Line 6 0,98	Line 1 1,02	Line 8 1,02	Line 4 1,04	Line 10 1,06	Line 2 1,18	Line 3 1,22	Line 7 1,23	Giza 1 1,48	Line 11 1,52	Line 9 1,53	Kharga 2 1,58	Line 5 1,75
Kharga 1	1,77	0,79*	0,75*	0,75*	0,73*	0,72*	0,59*	0,55*	0,54*	0,29*	0,25*	0,24*	0,19*	**0,02**
Line 5	1,75	0,77*	0,73*	0,72*	0,71*	0,69*	0,57*	0,53*	0,51*	0,27*	0,23*	0,22*	0,17*	
Kharga 2	1,58	0,60*	0,56*	0,56*	0,54*	0,52*	0,40*	0,36*	0,35*	0,1	0,06	0,05		
Line 9	1,53	0,56*	0,51*	0,51*	0,49*	0,48*	0,35*	0,31*	0,30*	0,05	0,01			
Line 11	1,52	0,54*	0,50*	0,50*	0,48*	0,47*	0,34*	0,30*	0,29*	0,04				
Giza 1	1,48	0,50*	0,46*	0,45*	0,44*	0,42*	0,30*	0,26*	0,25*					
Line 7	1,23	0,26*	0,22*	0,21*	0,19*	0,18*	0,05	0,01						
Line 3	1,22	0,24*	0,20*	0,20*	0,18*	0,16*	0,04							
Line 2	1,18	0,21*	0,16*	0,15	0,14	0,13								
Line 10	1,06	0,08	0,04	0,03	0,02									
Line 4	1,04	0,06	0,02	0,02										
Line 8	1,02	0,05	0,01											
Line 1	1,02	0,04												

Data in parentheses indicates the value of LSD probability level of 95%.

Table 19: the results for analysis of variance of the effect oil percentage on safflower genotypes and varieties during the season (2013 - 2014)

Source of var.	*d.f*	S.dev.sum	S. d.av. sum	*F*
Bet., genotypes	13	160.93	12.38	9.31**
Wit. Genotypes	28	37.24	1.33	

Table 20: Results of LSD for the average oil percentage of safflower genotypes and varieties during the season (2013-2014).

Phenomenon (in descending order)	In ascending order according to the average oil percentage													
	Average (%)	Line 8 26.63	Line 6 30.62	Line 3 32.01	Kharega (1) 32.35	Line 1 32.35	Line 10 32.43	Line 5 32.43	Line 4 32.45	line 7 32.83	Kharega (2) 33.91	Line 2 34.05	Giza (1) 34.33	Line 11 34.37
Line 9	34.52	7.88*	3.90*	2.51*	2.16*	2.16*	2.09*	2.08*	2.07*	1.69*	0.61	0.47	0.19	0.14
Line 11	34.37	7.74*	3.75*	2.36*	2.02*	2.02*	1.94*	1.94*	1.92	1.54	0.46	0.33	0.05	
Giza 1	34.33	7.69*	3.71*	2.32*	1.97*	1.97*	1.90	1.90	1.88	1.50	0.42	0.28		
Line 2	34.05	7.41*	3.43*	2.04*	1.69	1.69	1.62	1.62	1.60	1.22	0.14			
Kharega 2	33.91	7.28*	3.29*	1.90	1.56	1.56	1.48	1.48	1.46	1.08				
Line 7	32.83	6.20*	2.21*	0.82	0.48	0.48	0.40	0.40	0.38					
Line 4	32.45	5.82*	1.83	0.44	0.10	0.10	0.02	0.02						
Line 5	32.43	5.80*	1.81	0.42	0.08	0.08	0.00							
Line 10	32.43	5.80*	1.81	0.42	0.08	0.08								
Line 1	32.35	5.72*	1.73	0.34	0.00									
Kharega 1	32.35	5.72*	1.73	0.34										
Line 3	32.01	5.38*	1.39											
Line 6	30.62	3.99*												

Data in parentheses

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الملخص العربى

التقييم الاقتصادى لبعض التراكيب الوراثية للقرطم تحت ظروف صعيد مصر

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يعتبر محصول القرطم من أهم وأقدم المحاصيل المزروعة ، حيث تحتوي بذور القرطم علي زيت ثابت يعرف بزيت القرطم وهو من الزيوت الجافة ويستعمل في العديد من الصناعات مثل صناعة السمن الصناعي والصابون، كما يساعد علي خفض الكوليسترول في الدم ، لذا يهدف هذا البحث إلي تقدير الأهمية الاقتصادية لأربعة عشر تركيبة وراثية وصنف قرطم منزرع فى محطة بحوث شندويل بمحافظة سوهاج بمصر، وعمل مقارنة بين أصناف القرطم الجديدة والتقليدية خلال موسمى 2013/2012 و2014/2013 وذلك لدراسة تأثير هذه الأصناف على إنتاج محصول القرطم وكذلك نسبة الزيت فيه. وتتمثل الخصائص التي تم دراستها في طول النبات، وزن النبات الفردى، وزن المائة بذرة، محصول الفدان وكذلك النسبة المئوية للزيت فى البذرة.

وتحقيقاً للهدف البحثي اعتمد البحث علي أساليب التحليل الإحصائي الاقتصادي الوصفي والاستدلالي في التقدير الإحصائي للاتجاهات الخاصة بمتغيرات الدراسة بالإضافة إلي استخدام بعض الأساليب والنماذج الإحصائية مثل تحليل التباين وأقل فرق معنوي L.S.D لتحديد أهم هذه الأصناف تفوقاً معنويا من حيث الإنتاجية.

وقد توصل البحث إلي مجموعة من النتائج لعل من أهمها:

١- أن كل من الأصناف خارجة ١ وخارجة ٢ خلال موسم ٢٠١٣/٢٠١٢ أعطت أفضل نتائج فى معظم الصفات المدروسة بين كل الأصناف والتراكيب الوراثية التى تم دراستها وفى نفس الوقت وجد أن الصنف الثامن وجيزة ١ والصنف التاسع قد شغلوا الترتيب الثالث بعد خارجة 1وخارجة 2 فى كل من صفات طول النبات ووزن النبات الفردى ووزن المائة حبة ومحصول الفدان على التوالى، أما بالنسبة لنسبة الزيت فقد وجد أن أفضل الأصناف والتراكيب الوراثية المدروسة كانت الصنف التاسع والخامس وجيزة ١ على التوالي.

٢- أما خلال موسم ٢٠١٤/٢٠١٣ وجد أن أفضل الأصناف والتراكيب الوراثية للقرطم لمتوسطات طول النبات كانت هى خارجة ١ وخارجة ٢ والصنف الثامن لذلك فانه لا يوجد اختلاف بين الموسمين فى هذه الصفة ،أما بالنسبة لصفة وزن النبات الفردى والتى تم تقديرها بواسطة إختبار أقل فرق معنوي LSD فقد وجد ان الأصناف من خارجة ١ إلى جيزة ١ قد شغلت المراكز من الأول إلى الخامس فى هذه الدراسة.

٣- كما اتضح معنوية كل من الأصناف والتراكيب الوراثية بالنسبة لكل من صفات وزن النبات الفردى ، ومحصول الفدان وكذلك نسبة الزيت فى هذا الموسم وقد كانت كل من خارجة ١ والصنف الخامس أفضل المدروس فى صفة محصول الفدان ووزن النبات الفردى بينما كان الصنف التاسع هو أفضل الأصناف بالنسبة لنسبة الزيت.

الكلمات الدليلية: القرطم، التراكيب الوراثية، الأصناف، الناتج، محتوى الزيت، اقتصاديات