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INFLUENCE OF FILTER MUD CAKE FERTILIZATION UNDER LOW LEVELS OF NITROGEN ON YIELD AND ITS COMPONENTS FOR TWO SUNFLOWER CULTIVARS

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ABSTRACT

Two field experiments were conducted at the Agricultural Exp. Farm of El-Azhar Univ. at Assiut, during 2008 and 2009 seasons to study the response of two cultivars of sunflower (Sakha-53 & Giza-102), to the application of different nitrogen rates (15, 30 and 45 kg /fed) and Filter Mud Cake (FMC) (0.0, 0.5, 1.0 and 1.5 ton/fed.). The experiments were performed in a split-split plot design with three replicates where, sunflower cultivars were assigned to the main plot, while nitrogen and filter mud cake rates were distributed randomly in the sub and sub-sub plot, respectively. The combined analysis was conducted across the two seasons.

The obtained results indicated that sunflower cultivars exhibited significant differences in all studied traits except harvest index. Plants of Sakha-53 were superior significantly than Giza-102 in all studied traits i.e., head weight and diameter, shelling %, no. of seeds/head, seed index, seed yield/plant, oil and protein percentage as well as seed and oil yields/fed.

Increasing the level of nitrogen applications up to 45 kg N/fed. caused highly significant increases in all traits under study except no. of seeds/head and shelling % which did not reach the level of significance. On the contrary, harvest index and seed oil percentage decreased significantly by increasing N levels up to 45 kg N/fed.

The application of FMC to sunflower plants exerted a significant influence on all traits under study except no. of seeds/head and harvest index which did not reach the level of significance. In general, head characters, seed yield/plant, seed index and protein % as well as seed and oil yields/fed. increased by increasing the rate of FMC applications while oil % decreased with increasing the rate of FMC applications.

In general, the highest yield/fed (seed & oil) was recorded by Sakha-53 (2336.43 and 1014.59 kg/fed.) when these plants received 45 kg N/fed. and 1.0 ton FMC/fed.

INTRODUCTION

Sunflower (*Helianthus annuus*, L.) is one of the four important annual crops in the world for edible oil. Its seeds contain 24-49 % of oil and the cake contains 25-35 % of protein which is mostly feeded to livestock because of its high biological value. Furthermore, sunflower seeds are eaten as salted whole seeds as roasted nut meats. Moreover, sunflower oil is characterized by its high content of unsaturated fatty acids such as oleic and lenoleic which represent 90 % of total fatty acids of sunflower oil (Saleh *et al.* 2004). Abou-Ghazala *et al.* (2001) recorded a significant difference between ten hybrids (Eruflower, Macao, Vidoc, Alamo, Malabar, H-44, H-112, H-102, H-14 and H-94) for all the studied characters except RGR.. Abou-Khadra *et al*. (2002) reported that sunflower hybrids (Vidoc, Alamo, Eruflower and Malabar) differed significantly in their growth, yield and its attributing characteristics.

Saleh *et al.* (2004) revealed that cultivars (Maik, Vidoc and Eruflower) significantly differed in all characters (yield and yield components) under study. El- Mohandes *et al.* (2005) showed that sunflower hybrids exerted a highly significant influence on all traits (Vegetative growth traits, seed yield and yield component) in the tow growing seasons. Where, Hybrid-102 surpassed Hybrid-20 in all traits except oil %. Awad and Ghrib (2009) indicated that sunflower genotypes exhibited significant differences in all studied traits. Sakha-53 cultivar and Pop.770 were among those having great head diameter, seed yield / fed., and seed oil yield /fed.. The commercial cultivar Sakha-53 surpassed all other genotypes in 100-seed weight. On the other hand, Pop.770 exceeded all other genotypes in seed oil content. Sakha-53 cultivar and Pop.770 outyielded all other genotypes in oil yield / fed..

Nitrogen fertilization is one of the most important factors affecting the yield of all field crops and it plays an important role in plant growth. It is considered the indispensable element for several vital functions in the plant. Toaima and Saleh (2003), Mohamed (2003) and El-Keredy *et al*. (2004) reported that increasing nitrogen levels significantly increased head diameter, 100-seed weight, seed yield/plant, seed yield/fed. and oil yield /fed. in both seasons whereas, seed oil content was significantly decreased by increasing nitrogen rate. El-Sadek *et al*. (2004) showed that increasing nitrogen fertilization up to 80 kg N/fed. gave the highest values of yield attributes and oil yield/fed. whereas, the highest value of oil % was obtained by using 40 kg N/fed.. Harvest index reached to the maximum by using 60 kg N/fed. Fatih (2004) revealed that nitrogen levels had significantly affected on the total number of seeds/head, seed yield/head, 1000–seeds weight, seed and oil yield of oilseed and confection sunflowers. Al-Thabet (2006) and Abd El-Zaher *et al.* (2009) reported that nitrogen application markedly enhanced growth and yield, but resulted in sharp decrease in seed oil percentage. Mohamed *et al*. (2007) revealed that increasing N application level up to 120 kg/fed. significantly increased each of head diameter, head dry weight/plant, 100-seed weight, seed weight /plant, seed, and oil yields/fed., but decreased harvest index, seed oil content responded to N addition up to 90 kg N/fed.. Azouz and Amal (2007), Eman (2007), Khalil *et al*. (2008) and Awad and Ghrib (2009) indicated that head diameter, seed weight/plant and 100-seed weight tended to increase as nitrogen increased during the two growing seasons. Babaiy *et al*. (2009) revealed that significant effect of different levels of N on most studied traits. Seed yield, head diameters, thousand seed weight, and number of seeds/head were increased at 200 kg/ha nitrogen treatment, but the oil percentage was decreased. The highest oil percent was obtained at 100 kg/ha N fertilizer level.

In sugar can mill Filter mud cake is a by-product and generally collected and applied directly to agricultural fields as a soil fertilizer, due to its mineral content. Sugar industry is one of greatest industries in Egypt. The high production of sugar coming mainly from sugarcane crop generates great amounts of wastes of sugar industry (filter mud cake, vinasse, bagasse and ash). Nowadays, the utilization of filter mud cake is considered by many researchers as a promising alternative fertilizer, particularly for developing

countries (El-Gharably 2002). Attia (2001) reported that filter mud cake, a local by-product of sugar cane industry, is considered a natural waste product. It can supply plants with both essential nutrients and organic matter such as N, P, K, Fe, Mn, Zn and probably others. Application of filter mud cake significantly enhanced the yield, dry matter and total contents of N in onion bulbs. The highest values occurred when 5.0 ton filter mud cake/fed. were added. Mohamed *et al*. (2007) revealed that addition of 3 ton compost/fed. to sunflower plants brought a significant increase in each of head diameter, head dry weight/plant, 100-seed weight, seed weight/plant, seed yield/fad., harvest index, crop and oil yield/fed.. Whereas, seed oil content was not significantly affected by compost application. Ahmad and Jabeen (2009) showed that application of only biogas slurry or vermicompost enhanced the vegetative and reproductive yield of sunflower but the highest yield was recorded in combined treatment of the both. Hence this study revealed that application of biogas slurry and vermicompost could be undertaken to replace chemical fertilizers in organic farming for cultivation of sunflower. Muhammad and Khattak (2009) studied the effects of pressmud (PM) on maize growth in two saline-sodic soils indicated that increasing levels of PM enhanced maize plant height, shoots and roots biomass in both soils. Ossom *et al.* (2009) showed that filter mud cake had advantages on agronomic characteristics in cassava production. The greatest plant height was observed in the treatments with the inorganic fertilizer, followed by the 60 kg/ha filter cake treatments. This work was designed to investigate the response of sunflower cultivars to organic fertilization and mineral nitrogen fertilization to improve sunflower productivity.

MATERIALS AND METHODS

Two field experiments were conducted at the Agricultural Exp. Farm of El-Azhar University at Assiut, during 2008 and 2009 seasons to study the response of two cultivars of sunflower (Sakha-53 & Giza-102), to the application of different nitrogen rates (15, 30 and 45 kg /fed.) in the form of Urea 46% and filter mud cake FMC (0.0, 0.5, 1.0 and 1.5 ton/fed.).

Seeds were sown on 3rd and 8th of May in 2008 and 2009 seasons, respectively, using seeds obtained from the Agriculture Research Center, in hills 25 cm apart, on ridges 60 cm apart and 3.5 meter long, leaving one plant /hill at thinning time (21 days after sowing), with a plot area of 10.5 m^2.

The physical and chemical analyses of the experimental site are presented in Table (1). Some chemical properties of filter mud cake are presented in Table (2).

Table (1): The physical and chemical analysis of soil field experiments.

Characteristics / **Physical analysis**	**2008**	**2009**	**Characteristics** / **Chemical analysis**	**2008**	**2009**
Sand (%)	25.50	24.00	Organic matter (%)	1.03	0.98
Silt (%)	39.50	39.00	Available N (ppm)	76.40	78.38
Clay (%)	35.00	37.00	Available P(ppm)	10.13	11.12
Soil texture	Clay loam		Exchangble K (ppm)	358.06	366.10
			Ph (sp. m^{-1})	7.80	7.87
			E.C. (ds. m^{-1})	1.17	1.18
			Total $CaCo_3$ (%)	2.81	2.62

Table (2): Some chemical properties of filter mud cake (FMC) used at the experimental ratio.

Material	PH(1: 5)	EC(1:2.5,dS/m)	N (%)	P (%)	K (%)	OM (%)
Filter Mud Cake	6.92	1.47	2.17	1.50	0.95	31.60

The split-split plot design was applied in three replicates where sunflower cultivars were assigned to the main plot, while nitrogen and filter mud cake rates were distributed randomly in the sub and sub-sub plot, respectively. Different nitrogen rates were added in two split doses, where the first one was added after thinning time and before irrigation, while, the second dose was added before the second irrigation. The preceding crop was *Vicia faba* L. in both seasons. Other cultural practices were carried out as usual for sunflower production under Assiut conditions.

At heading, the heads of two central rows, heads of five plants were chosen at random from external ridges of each plot and bagged at early seed development (by using magazine paper) to avoid bird's damage until maturity. The sunflower plants were hand-harvested at the stage of physiological maturation when the back of the head has turned from green to yellow and the bracts are turning brown.

At harvest, samples of five bagged plants were taken and the following traits were recorded:

1. Head diameter (cm).
2. Head weight (gm): Average head weight was obtained from 5 guarded plants sample /plot.
3. Shelling percentage: It was calculated using the following formula:

$$\text{Shelling \%} = \frac{\text{Seed weight/plant}}{\text{Head weight/plant}} \times 100$$

4. Number of seeds/head: It was calculated using the following equation:

$$\text{Number of seeds/head} = \frac{\text{Seed weight /plant}}{\text{Seed index}} \times 100$$

5. Seed weight/ plant (gm): Average seed weight was obtained from a five guarded plants sample per plot.
6. Seed index (gm): the average weight, in grams, of two random 100-seed samples per plot.
7. Harvest index: It was calculated using the following equation:

$$\text{Harvest index} = \frac{\text{Seed weight/plant}}{\text{Biological yield/plant}} \times 100$$

8. Seed yield/fed; Heads of two bagged inner ridges of each plot were harvested and left two weeks until fully air dried and seed yield was used to estimate yield kg /fed.
9. Oil percentage in seed was estimated according to the Official Method A. O. A. C. (1980) by Soxhlet apparatus using petroleum ether (bp 40-60 ^{0}C) as a solvent.

Oil yield /fed (kg) was calculated by multiplying oil percentage in seed by seed yield kg /fed.

10. Total nitrogen in seeds was determined by Kjeldahl method according to A.O.A.C.(1980). Protein % was calculated by multiplying the N by the converting factor 6.25 (Hymowitz *et al.* 1972).

All obtained data were subjected to statistical analysis according to Gomez and Gomez (1984) and mean comparisons were done using least significant differences (L. S. D. at 5%).

RESULTS AND DISCUSSION

1. Head characters:

The combined results as shown in Tables (3 and 4) show that Sakha-53 cv. outyielded significantly Giza-102 cultivar in all head characters, i.e., head diameter, head weight, shelling %, and no. of seeds /head by 18.15, 63.48, 2.64 and 36.60 %, respectively. This mainly due to differences in genetic make up between cultivars. These results are in accordance to those obtained by Abou-Khadra *et al*.(2002), Saleh *et al.* (2004). El- Mohandes *et al.* (2005), Eman (2007) and Awad and Ghrib (2009) who concluded that there were differences between sunflower cultivars in head characters.

The results reveal that the application of nitrogen fertilizer to sunflower plants exerted a significant influence on head weight and head diameter, whereas the response of no. of seeds/head as well as shelling % to nitrogen fertilizer levels did not reach the level of significance. It is clear from these data that head weight and diameter increased by increasing nitrogen level from 15 to 30 or 45 kg N/fed., where the maximum values were obtained when N was applied at its highest level (45 kg N /fed.). The increase in head weight of plants treated with 30 and 45 kg N /fed. were 4.24 and 8.34 %, respectively, while the increase in head diameter were 5.23 and 11.31 % for the same respective N levels over those plants received 15 kg N /fed. This is due to the fact that increasing nitrogen levels increased vegetative growth by stimulation photosynthetic activity in sunflower plants and consequently produced wider and heavier heads. These results are in line with those obtained by Saleh *et al.* (2004), Al-Thabet (2006), Mohamed *et al*. (2007), Khalil *et al*. (2008) and Babaiy *et al*. (2009) who reported that head characters increased by increasing nitrogen rates.

The combined data show that the application of FMC to sunflower plants exerted a significant influence on all head characters except no. of seeds/head. It is clear from these results that head weight and diameter as well as shelling % increased by increasing FMC rate from 0.0 to 0.5, 1.0 or 1.5 ton/fed.. The maximum values of head weight and diameter were obtained when FMC was applied at its highest rate (1.5 ton/fed.) while, the maximum value of shelling % was obtained when FMC was applied at a rate of 1.0 ton/fed.. The increase in head weight of plants treated with 0.5, 1.0 and 1.5 ton FMC/fed. over 0.0 ton/fed (control) were 4.87, 6.11 and 7.76 %, respectively. While the increase in head diameter was 1.87, 3.42 and 4.51 %, respectively for the same respective FMC rates over the control. The

increases in shelling % were 1.15, 3.25 and 3.08 %, respectively for the same respective FMC rates over the control. These mean that the application of FMC was more active in increasing traits in comparison to the control (0.0 ton/fed.). The application of FMC to sunflower plants may increase the activity of the plants by increasing synthesis of more metabolites and consequently increase vegetative and reproductive growth and also increase the number of sound seeds. The previous results are in accordance with those reported by Attia (2001) and Mohamed and Ayman (2009).

The results show that all head characters did not exert any significant affected by all possible interactions.

Table (3): Effect of different nitrogen levels and rates of filter mud cake (FMC) on head weight /plant (g.), head diameter (cm) and shelling % of two sunflower cultivars. (combined analysis of the two growing seasons).

Parameters / Treatments		Head weight /plant (g.)	Head diameter (cm)	shelling %
Cultivars	Sakha-53	126.04	21.42	65.81
	Giza-102	77.10	18.13	63.17
F. test		*	*	*
N levels (kg/fed.)	15	97.49	18.74	64.20
	30	101.62	19.72	64.03
	45	105.62	20.86	65.26
F. test		*	*	N.S
L. S. D. $_{0.05}$		2.81	0.47	-
FMC (ton/fed.)	0.0	97.03	19.30	63.31
	0.5	101.76	19.66	64.04
	1.0	102.96	19.96	65.37
	1.5	104.56	20.17	65.26
F. test		*	*	*
L. S. D. $_{0.05}$		3.48	0.32	1.47
Interaction	C x N	N.S	N.S	N.S
	C × F	N.S	N.S	N.S
	N × F	N.S	N.S	N.S
	C × N × F	N.S	N.S	N.S

2. Seed index (g):

The results in Table (4) show that there was a significant variation between the two tested cultivars, where Sakha-53 cv. surpassed significantly Giza-102 cv. in seed index. Seed index of Sakha-53 cv. was higher than Giza-102 cv. by 24.46 %. This mainly due to that Sakha-53 cv. had better vegetative growth and photosynthetic area which led to more carbohydrate which was translocated from source (leaves and stem) to the sink (seeds). The results of improving Sakha-53 cultivar might be due to genetic factor which make up the superiority. These results are in line to those reported by Ibrahim *et al*. (2003), El-Keredy *et al*. (2004), Eman (2007) and Awad and Ghrib (2009) who found differences between cultivars in seed index.

The applications of nitrogen to sunflower plants exert a significant influence on seed index. It is clear from these data that seed index increased gradually by increasing nitrogen level from 15 to 30 or 45 kg N/fed. by 6.55 and 12.05%, respectively. This mean that increasing nitrogen application may

increase synthesis of more metabolites as a result of increasing photosynthesis activity and consequently produced heavy and more sound seeds. These results are in agreement with those obtained by Ibrahim *et al*. (2003), Saleh *et al.* (2004), Al-Thabet (2006), Mohamed *et al*. (2007), Khalil *et al*. (2008), and Abd El-Zaher *et al.* (2009) who concluded that seed index increased by increasing nitrogen levels.

The combined data show that the application of FMC to sunflower plants exerted a significant influence on seed index. Seed index increased gradually by increasing FMC rates compared to the control. The increase in seed index of plants supplied with 0.5, 1.0 and 1.5 ton FMC/fed. over the control were 3.40, 6.06 and 7.25 %, respectively. The previous results are in accordance with those reported by Attia (2001), Ahmed and Osman (2003) and Mohamed and Ayman (2009). Seed index was not significantly affected by all possible interactions.

3. Seed yield /plant (g):

The results in Table (4) show that there was a significant variation between the two tested cultivars. Sakha-53 cv. significantly surpassed Giza-102 cv. in seed weight/plant. Seed weight/plant of Sakha-53 cv. was higher than Giza-102 cv. by 70.21 %.These results are similar to those reported by Saleh *et al.* (2004), El- Mohandes *et al.* (2005), Eman (2007) and Awad and Ghrib (2009) who found significant differences between sunflower cultivars in seed yield/plant.

The application of nitrogen fertilizer to sunflower plants exerts a significant influence on seed yield/plant**.** In general, increasing nitrogen levels increased seed yield/plant where, the maximum value (69.20 g) was obtained when nitrogen was applied at 45 kg/fed. The increase in seed weight/plant of plants received 30 and 45 kg N/fed. over those received 15 kg N/fed. were 3.55 and 9.60 %, respectively. The increase in seed weight/plant when nitrogen was applied at higher levels is due to the increase in number of seed/head and seed index. These results are in agreement with those reported by Toaima and Saleh (2003), El-Keredy *et al*. (2004), Azouz and Amal (2007), Khalil *et al*. (2008), Babaiy *et al*. (2009) and Awad and Ghrib (2009) who reported that seed weight/plant increased by increasing nitrogen rates.

The combined data show that the application of FMC to sunflower plants exerted a significant influence on seed weight/plant**.** Seed weight/plant increased gradually by increasing FMC rates, the increase of plants supplied with 0.5, 1.0 and 1.5 ton FMC/fed. compared to control were 6.04, 9.74 and 10.93 %, respectively. The increase in such trait may be due to the increase in shelling % and seed index. The previous results are in accordance with those reported by Attia (2001), and Ahmed and Osman (2003) who reported that seed weight/plant increased by increasing the rate of FMC. Seed weight/plant was not significantly affected by all possible interactions

Table (4): Effect of different nitrogen levels and rates of filter mud cake (FMC) on no. of seeds/head, seed yield/plant (g.) and seed index (g) of two sunflower cultivars. (combined analysis of the two growing seasons).

Parameters / Treatments		No. of seeds /head	Seed yield/plant (g.)	Seed index (g.)
Cultivars	Sakha-53	1063.80	83.03	7.836
	Giza-102	778.75	48.78	6.296
F. test		*	*	*
N levels (kg/fed.)	15	934.68	63.14	6.653
	30	911.66	65.38	7.089
	45	917.49	69.20	7.455
F. test		N.S	*	*
L. S. D. $_{0.05}$		-	1.99	0.197
FMC (ton/fed.)	0.0	899.81	61.78	6.782
	0.5	924.28	65.51	7.014
	1.0	929.38	67.80	7.193
	1.5	931.64	68.53	7.274
F. test		N.S	*	*
L. S. D. $_{0.05}$		-	2.84	0.219
Interaction	C x N	N.S	N.S	N.S
	C × F	N.S	N.S	N.S
	N × F	N.S	N.S	N.S
	C × N × F	N.S	N.S	N.S

4. Harvest index (%):

The results in Table (5) reveal that differences between the two tested cultivars was not significant. The application of nitrogen to sunflower plants had significant effect on harvest index which decreased by increasing nitrogen levels from 15 up to 30 or 45 kg N/fed. where, the highest value of harvest index (33.67%) was obtained when N at level of 15 kg N/fed. was applied. Mohamed *et al*. (2007) and El-Sadek *et al*. (2004) who reported that harvest index decreased with increasing nitrogen levels.

The combined data show that the application of FMC to sunflower plants did not exert any significant influence on harvest index. Moreover, the data reveal that harvest index was not significantly affected by all possible interactions.

5. Seed yield/fed (kg):

The combined data (Table 5) show that seed yield/fed was significantly affected by sunflower cultivars. Seed yield/fed. of Sakha-53 cv. was higher than Giza-102 cv. by 63.96 %. The increase in Sakha-53 cv. yield may be due to the increase in seed weight /plant as well as harvest index. Abou-Khadra *et al*.(2002), Saleh *et al.* (2004), El- Mohandes *et al.* (2005), Eman (2007) and Awad and Ghrib (2009) who concluded that there were differences between sunflower cultivars in seed yield/fed.

The combined data reveal that seed yield/fed. was significantly affected by the application of nitrogen. Seed yield/fed. and increased gradually by increasing N levels from 15 to 30 or 45 kg N /fed. The increases in seed yield/fed. as result of the application of 30 and 45 kg N/fed. over those of 15 kg N/fed. were 9.87 and 14.74 %, respectively. This means that sunflower plants responded positively to the increase in nitrogen levels, this increase

may be due to the beneficial effect of nitrogen on producing more vegetative growth by enhancing the photosynthesis activity and the formation of more metabolites for formation of more sound seed with a heavy weight. These results are in agreement with those reported by Al-Thabet (2006), Mohamed *et al*. (2007), Khalil *et al*. (2008), and Abd El-Zaher *et al.* (2009) who concluded seed yield/fed. increased by increasing nitrogen levels.

Table (5): Effect of different nitrogen levels and rates of filter mud cake (FMC) on harvest index and seed yield/fed. (kg/fed.) of two sunflower cultivars. (combined analysis of the two growing seasons).

Parameters / Treatments		harvest index	seed yield/fed. (kg/fed.)
Cultivars	**Sakha-53**	31.37	2149.19
	Giza-102	31.79	1310.81
F. test		**N.S**	*
N levels (kg/fed.)	**15**	33.67	1598.82
	30	31.24	1756.66
	45	29.83	1834.52
F. test		*	*
L. S. D. $_{0.05}$		**1.18**	**43.75**
FMC (ton/fed.)	**0.0**	31.27	1651.88
	0.5	31.72	1714.90
	1.0	31.68	1753.59
	1.5	31.65	1799.63
F. test		**N.S**	*
L. S. D. $_{0.05}$		-	**54.22**
Interaction	**C x N**	**N.S**	**N.S**
	C × F	**N.S**	**N.S**
	N × F	**N.S**	**N.S**
	C × N × F	**N.S**	**N.S**

The combined results show that the application of FMC to sunflower plants exerted a significant influence on seed yield/fed. In general, seed yield /fed. increased gradually by increasing FMC rates. The increase of plants supplied with 0.5, 1.0 and 1.5 ton FMC/fed. over the control were 3.81, 6.16 and 8.94 %, respectively. The increase in seed yield /fed. as result of FMC application, may be due to the increase in seed index, number of seeds /head and seed yield/plant. This is due to stimulation effect on plant growth of treated plants and increases the ability of such plant to form more metabolites required for building more plant organs. These results are in line with those obtained by Attia (2001) and Ahmed and Osman (2003).

In general, seed yield/fed. was not significantly affected by all possible interactions. However, the highest seed yield/fed. (2336.43 kg) was obtained from Sakha-53 cv. plants when received 45 kg N/fed. and 1.0 ton FMC/fed..

6. Protein percentage:

The combined data in Table (6) reveal that protein % of seed was significantly affected by sunflower cultivars. Protein % of Sakha-53 cv. was higher than Giza-102 cv. by 1.08 %. This is mainly due to differences in genetic make up between cultivars.

The application of nitrogen to sunflower plants exerted a significant influence on protein %. Seed protein content increased gradually by increasing N levels from 15 to 30 or 45 kg N /fed.. The highest value (19.49 %) was obtained from the highest N level (45 kg N/fed.). This means that protein content of sunflower seed responded positively to the increase in nitrogen levels. This increase may be due to the fact that increasing nitrogen supply to the plants stimulates the biosynthesis of more amino acids and consequently, more protein. These results are in agreement with those obtained by Mohamed (2003), El-Keredy *et al*. (2004) and Helmy, and Ramadan (2008).

It is clear from these data that the application of FMC to sunflower plants exerted a significant influence on protein %. Seed protein content increased by increasing FMC rates, where the highest value (18.45 %) was obtained when plants supplied with 1.0 ton FMC/fed.. This due to the fact that these may be enhance the formation of more amino acids and consequently, more protein. These results are in line with those reported by Ahmed and Osman (2003) and Helmy and Ramadan (2008).

The data reveal that protein content of seed was not significantly affected by all possible interactions.

7. Oil percentage:

The combined data in Table (6) reveal that oil % was significantly affected by sunflower cultivars. Oil % of Sakha-53 cv. was higher than Giza-102 cv. by 8.27 %. This is mainly due to differences in genetic make up between cultivars. These results are in line to those reported by Eman (2007) and Awad and Ghrib (2009) who found a difference between cultivars in oil %.

The application of nitrogen to sunflower plants exerted a significant influence on oil %. The reduction in oil content in seeds was recorded by increasing nitrogen levels from 15 to 30 or 45 kg N/fed. where the highest value (40.25 %) was obtained from the lowest N level (15 kg N/fed.). The reduction in oil content in N treated plants may be due to the fact that increasing nitrogen supply to the plants stimulate the biosynthesis of more amino acids and consequently, more protein or by other way the pathway of fatty acids formation inhibited by increasing nitrogen levels. These results are in agreement with those obtained by Mohamed (2003), El-Keredy *et al*. (2004), Al-Thabet (2006), Mohamed, *et al*. (2007), Khalil *et al*. (2008), and Abd El-Zaher *et al.* (2009) who concluded that oil % decreased by increasing nitrogen levels.

It is clear from these data that the application of FMC to sunflower plants exerted a significant influence on oil %. The increase of FMC rates decreased oil content in seeds as compared to the control, especially those plants supplied with 1.5 ton FMC/fed., where the lowest value (39.10 %) was obtained. This due to the fact that these may be enhance the formation of more protein and inhibit the biosynthesis of fatty acids. These results are in line with those reported by Attia (2001) and Ahmed and Osman (2003)

The data reveal that oil content of seed was not significantly affect by all possible interactions.

Table (6): Effect of different nitrogen levels and filter mud cake (FMC) rates on oil yield (kg/fed.) protein and oil percentage of two sunflower cultivars. (combined analysis of the two growing seasons).

Parameters / Treatments		Oil yield (kg/fed.)	Protein%	Oil%
Cultivars	Sakha-53	935.22	18.45	43.55
	Giza-102	461.43	17.37	35.28
F. test		*	*	*
N levels (kg/fed.)	15	658.29	16.14	40.25
	30	711.05	18.09	39.46
	45	725.64	19.49	38.54
F. test		*	*	*
L. S. D. $_{0.05}$		22.40	1.02	0.61
FMC (ton/fed.)	0.0	674.04	17.07	39.77
	0.5	690.74	17.77	39.38
	1.0	708.30	18.45	39.41
	1.5	720.23	18.37	39.10
F. test		*	*	*
L. S. D. $_{0.05}$		22.30	0.79	0.54
Interaction	C x N	N.S	N.S	N.S
	C × F	N.S	N.S	N.S
	N × F	N.S	N.S	N.S
	C × N × F	N.S	N.S	N.S

8. Oil yield/fed (kg):

The combined data in Table (6) reveal that oil yield/fed. was significantly affected by sunflower cultivars. Oil yield/fed. of Sakha-53 cv. was higher than Giza-102 cv. by 102.68 %. The significant influence of cultivars on oil yield/fed. may be due to the high significant effect of cultivars on seed yield/fed. as well as oil %. These results are in agreement with those obtained by El- Mohandes *et al.* (2005), Eman (2007) and Awad and Ghrib (2009) who concluded that there were differences between sunflower cultivars in oil yield/fed.

The results reveal that oil yield was significantly affected by different nitrogen levels. Oil yield/fed. increased gradually by increasing N levels from 15 to 30 or 45 kg N /fed. The increases in oil yield/fed. as result of the application of 30 and 45 kg N/fed. over those of 15 kg N/fed. were 8.01 and 10.23 %, respectively. It is clear from these data that oil yield/fed. increased as a result of increasing seed yield /fed.. These results are in agreement with those obtained by Al-Thabet (2006), Mohamed *et al*. (2007), Khalil *et al*. (2008), and Abd El-Zaher *et al.* (2009) who concluded seed yield/fed. increased by increasing nitrogen levels.

The combined results show that the application of FMC to sunflower plants exerted a significant influence on oil yield/fed. In general, seed yield /fed. increased gradually by increasing FMC rates. The increase of plants supplied with 0.5, 1.0 and 1.5 ton FMC/fed. compared to control were 2.48, 5.08 and 6.85 %, respectively. The increase in oil yield /fed. as result of FMC application, may be due to the increase in seed yield/fed.. These results are in line with those reported by Attia (2001) and Ahmed and Osman (2003).

The data reveal that oil yield/fed. was not significantly affected by all possible interactions. However, the highest oil yield/fed. (1014.59 kg) was obtained from Sakha-53 cv. plants when received 45 kg N/fed and 1.0 ton FMC/fed.

It could be concluded that maximum sunflower yield could be obtained by pluming Sakha-53 cultivar under application of 45 kg N/fed together with 1 ton/fed of filter mud cake.

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تأثير التسميد بطينة المرشحات تحت مستويات منخفضة من الآزوت علي المحصول ومكوناته لصنفين من زهرة الشمس

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أجريت تجربتان حقليتان بالمزرعة البحثية لكلية الزراعة - جامعة الأزهر بأسيوط خلال موسمي 2008 و 2009 ، لدراسة استجابة صنفين من عباد الشمس (سخا-53 & جيزة-102) لمعدلات مختلفة من الآزوت (15، 30 و 45 كجم ن/فدان) وطينة المرشحات (0.0 ، 0.5 ، 1.0 و 1.5 طن/فدان) وقد استخدم تصميم القطعاعات المنشقة مرتين في ثلاث مكررات ، حيث وزعت الأصناف في القطع الرئيسية، بينما وزعت معدلات التسميد الازوتي و طينة المرشحات عشوائيا علي القطع المنشقة و المنشقة مرتين علي الترتيب. أجري تحليل تجميعي للموسمين معا.

أظهرت النتائج المتحصل عليها اختلافات معنوية بين أصناف زهرة الشمس في كل الصفات المدروسة فيما عدا معامل الحصاد حيث تفوقت نباتات الصنف سخا-53 على جيزة-102 في كل الصفات المدروسة مثل وزن وقطر القرص، عدد بذور القرص، التفريط %، دليل معامل البذرة، محصول البذور للنبات والنسبة المئوية للزيت و البروتين و كذلك محصول البذور والزيت للفدان.

أدت زيادة معدلات الآزوت من 15 إلي 30 أو 45 كجم ن /فدان إلي زيادة معنوية في كل الصفات المدروسة فيما عدا عدد بذور القرص و التقريط % التي لم تصل إلي مستوي المعنوية. وعلي العكس نقص معامل الحصاد و النسبة المئوية للزيت في البذور معنويا بزيادة معدلات الازوت حتي 45 كجم ن /فدان.

إظهر استعمال طينة المرشحات تأثيرا معنويا علي كل الصفات تحت الدراسة فيما عدا عدد بذور القرص و دليل الحصاد التي لم تصل إلي مستوي المعنوية. وعموما ، أدت زيادة معدلات استخدام طينة المرشحات إلي زيادة صفات القرص، محصول البذور للنبات، دليل معامل البذرة، البروتين % وكذلك محصول البذور و الزيت للفدان بينما نقصت النسبة المئوية للزيت بزيادة معدل استخدام طينة المرشحات.

وبصفة عامة، نتج أعلي محصول (البذور و الزيت) للفدان من الصنف سخا- 53 (2336.43و1014.59 كجم/فدان) من البذور والزيت، عند إضافة 45 كجم ن/فدان و 1.0 طن من طينة المرشحات للفدان.

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