EFFECT OF RATES AND APPLICATION TREATMENTS OF NITROGEN FERTILIZER ON SUNFLOWER (Helianthus annuus, L.). 1- Growth characters.

BY

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ABSTRACT

Two field experiments were conducted at the Extension Field near Mit Ghmr, Dakahlia Governorate to evaluate effects of rates and application treatments of the fertilizer N on growth and productivity of sunflower in 1987 and 1988 seasons. Rates were 0, 20, 40 and 60 kg N/fad. Application treatments were six dose-time combinations. Results obtained showed that N significantly affected at least six growth characters out of nine. These were mid-flowering date, plant height, number of green leaves/plant, number of dry leaves/plant, stem diameter and leaf area (LA). N had unfavourable effects on percentages of lodged and broken plants, which were both increased by N rates. No significant differences were detected among rates except for plant height in favour of 60 kg/fad. and the number of dry leaves/plant in favor of 20 kg N/fad. in one season only. LA increased significantly with 60 kg N/fad in both seasons. Results obtained suggest that the rate equals to 20 kg N/fad. could be considered sufficient for supporting good growth of sunflower in that niche. Dose-time combinations were about equal in their effects. In addition, no significant interaction of rate dose-time combination was detected indicating the independence of both factors in effect.

INTRODUCTION

Still more effort has to be directed to sunflower crop to narrow the oil gap in Egypt because of the adaptability of the crop to a range of environmental conditions. Both N fertilizer rate and application treatment are important factors in upgrading the productivity of the crop. El-Ahmer et al (1980) and Diab (1981) found that the rate of 30 kg N/fad. resulted in increasing plant height and stem diameter significantly but had no effect on flowering time Nour El-Din et al (1983) found that rates of 30 and 40 kg N/fad. affected leaf area index significantly, but plant height and number of leaves/plant were not affected. Similarly, El-Mohandes (1984) found that applying rates from 30-60

kg/fad increased plant height stem diameter and leaf area/plant. Hefni et al (1985) reported that N did not affect mid-flowering date, however, the number of leaves/plant significantly decreased by N. On the other hand, plant height, stem diameter and leaf area/plant were significantly increased by rates. This study was intended to investigate the effects of N fertilization, rates and application treatments on sunflower at Mit-Ghamr with particular interest in the application treatment.

MATERIALS AND METHODS

Two field experiments were carried out at the Extension fields at Mit-Ghamr, Dakahlia Governorate. Soil is clay-loamy alluvial, fertile, well drained of normal pH 8 and poor in organic matter (<2%). The experiments were run as randomized complete block design with four replications each. Plot size was 21 m^2 (1/200 fad.) of 10 rows 3.5 m/ long and 60 cm wide. Sunflower variety Florida 328 (introduction from USA) was sown on the 14 th and the 29 th of June in the first and the second season, respectively. Hill spacings were 30 cm within the ridge. Before planting all experimental units were given the same amount of superphosphate. (P_2O_5 15.5 %). Plants were thinned to one plant/hill after 19 days from sowing time and before the first irrigation. In both seasons the preceding crop was wheat.

Each experiment included 24 treatments. These were the four N rates: 0. (control), 20, 40 and 60 kg N/fad. applied in six dose-time combinations as follows:

1- The rate was applied in a single dose before sowing (T_1).
2- The rate was applied in a single dose before the first irrigation (T_2)
3- The rate was applied in a single dose before the second irrigation (T_3).
4- The rate was applied in two separate doses, one before sowing and the second before the first irrigation (T_4).
5- The rate was applied in two separate doses, one before sowing and the second before the second irrigation (T_5).
6- The rate was applied in two separate doses. one before the first irrigation and the second before the second irrigation (T_6).

Data recorded and analysis:

1- Mid-flowering date, determined by the number of days from sowing to the flowering of 50 % of plants in plots.

2- Plant height (cm), number of green leaves/plant, number of dry leaves/plant number of total leaves/plant and stem diameter (mm).
3- Leaf area of the fourth leaf in cm^2 determined according to Schneiter (1978).
The previous two categories were determined on 10-plant samples taken at random from each plot.
4- Percentages of lodged and broken plants were determined on whole plot basis.

All data were statistically analysed using the ordinary ANOVA according to Sendecor and Cochran (1967). F.L.S.D. at the 5 % and 1 % levels of probability were used to compare among mean.

RESULTS AND DISCUSSION

Effect of nitrogen rates:

Mean performance of growth characters are presented in Tables (1 and 2) for the first and the second season, respectively.

Results on mid-flowering date show in general that the application of N fertilizer hastened the flowering of plants in both season in comparison with the unfertilized control. However differences among the three utilized rates were not significant. The results show that N fertilization has some beneficial effect on advancing the flowering date of sunflower plants. Other investigators, however, did not report beneficial effect for N on mid-flowering date of sunflower, El-Ahmer et al (1980), Liab (1981) and Hefni et al (1985).

The plant height was significantly increased in one season only by the application of N in comparison with the control treatment. The effect of the two rates 20 and 40 kg N/fad. was about the same on plant height. The greatest difference in plant height was between the two rates 40 and 60 kg/N. The role of N on enhancing plant height of sunflower was reported by El-Sayed et al (1984) and Kamel et al (1985) who showed that the effect of N was that of increasing the number and length of the internodes or via enhancing dry matter production.

In both seasons, plants fertilized with N maintained significantly more green leaves/plant and significantly less dry leaves/plant in comparison with the control treatment. There are no apparent differences among the other three rates. The average number of leaves/plant did not vary

Table (1): Growth characters of sunflower plants as affected by N-rates, 1987 season.

N rates		Mid Flowering date	Plant height	Green leaves/ plant	Dry leaves/ plant	Total leaves/ plant	Stem diameter	Leaf area	Lodged plants	Broken plants
		days	(cm)		No.		(mm)	(cm^2)	%	
0.0 kg		55.33	145.50	6.50	25.13	31.63	16.77	127.80	0.70	1.01
20 kg		53.44	166.60	7.31	23.15	30.45	22.05	243.10	0.96	1.35
40 kg		53.66	165.20	7.47	22.31	29.77	22.16	270.90	1.07	1.07
60 kg		53.33	171.20	7.39	21.20	28.58	23.01	299.30	0.93	1.27
L.S.D.	5%	0.75	5.86	0.70	1.12	N.S.	1.12	31.69	0.25	N.S.
	1%	0.99	7.81	0.81	1.63	N.S.	1.50	42.26	N.S.	N.S.

Table (2): Growth charaters of sunflower plants as affected by N-rates, 1988 season.

N rates	Mid flowering date	Plant height	Green leaves/ plant	Dry leaves/ plant	Total leaves/ plant	Stem diameter	Leaf area	Lodged plants	Broken plants
	days	(cm)	---------- No. ----------			(mm)	(cm^2)	------ % ------	
00 kg.	55.00	173.20	6.78	27.16	33.94	21.73	140.90	2.50	1.92
20 kg.	54.77	179.50	7.35	25.11	32.45	24.64	236.60	3.74	2.52
40 kg.	54.55	183.90	7.23	24.42	31.79	25.47	292.20	4.16	2.36
60 kg.	54.60	178.90	7.30	24.07	31.36	25.44	301.10	5.13	2.77
L.S.D. 5%	N.S.	N.S.	0.41	1.53	N.S.	0.93	32.89	1.78	0.49
1%	N.S.	N.S.	N.S.	2.03	N.S.	1.24	N.S.	N.S.	N.S.

significantly among the four N rates and the means were more or less constant over all rates. Therefor, increasing the rate over 20 kg N/fad. did not give improvement in any of the three leaf counts. Obviously, the effect of N was such that of delaying the senescence of leaves but not encouraging the intiation of more leaf primordia.

Stem diameter significantly increased by N in both seasons in comparison with the control. The highest difference in stem diameter was that between the control and the rate of 20 kg N/fad. Differences among the three rates are trivial in a sense that increasing the rate over 20 kg N/fad. is wasteful. Hegab et al (1937) and Singh et al (1987) reported somewhat similar results.

Leaf area (LA) was drastically increased by fertilization with N in both seasons. Unlike other characters, the increase in LA was progressive with N rate The LA resulting from N was about twice that resulting from the control and this was the largest increase in area among N rates. The second highest leaf area was obtained by increasing the rate from 20 to 60 kg N/fad. The difference in leaf area between the two rates 20 and 60 kg N/fad. was significant in the second season only whereas between 40 and 60 kg/fad. was not significant in both seasons. Hefni et al (1985) and Simon (1986) reported similar results.

The percentage of lodged plants was increased significantly by the application of N over the untreated control in both seasons. No significant difference could be detected among the three rates of N in percent lodged plants. Such result could be attributed to the effect of N on increasing the shoot/root ratio, thus increasing the tendency of plants to lodging. Percentage of broken plants was significant in the second season only. Results of this season showed an increase in percent broken plants due to the application of N with no apparent differences among N rates. Similar results were reported by Hussein et al (1980).

Effect of dose-time combination treatment:

Data presented in Tables (3 and 4) show that dose-time combination did not affect significantly the mid-flowering date, number of green leaves, number of dry leaves, total number of leaves, both percentages of lodged and broken plants and leaf area (LA). However, dose-time combination treatments had significant effects on plant height and stem diameter. With both characters applying the rate of N in

Table (3): Growth characters of sunflower as affected by N-application treatment, season 1987.

Treatments of application (dose-time)	Flowering date	Plant height	Green leaves/ plant	Dry leaves/ plant	Total leaves/ plant	Stem diameter	Leaf area	Lodged plants	Broken plants
	days	(cm)	No.			(mm)	(cm^2)	%	
T_1	53.66	162.80	7.08	23.33	30.40	21.50	222.60	0.78	1.27
T_2	53.99	159.80	7.13	22.58	29.71	20.56	237.50	0.89	0.89
T_3	54.50	154.20	7.30	22.37	29.66	19.73	228.10	0.78	0.97
T_4	53.83	159.70	7.41	23.18	30.58	20.70	224.60	1.06	1.09
T_5	53.99	169.60	7.30	23.18	30.47	22.01	227.20	0.94	1.51
T_6	53.66	166.60	6.79	23.06	29.84	21.84	271.60	1.04	1.38
L.S.D. 5%	N.S.	7.173	N.S.	N.S.	N.S.	1.374	N.S.	N.S.	N.S.
1%	N.S.	9.565	N.S.	N.S.	N.S.	1.832	N.S.	N.S.	N.S.

Table (4): Growth characters of sunflower as affected by N-application treatment, season 1988.

Treatment of application (dose-time)	Flowering date	Plant height	Green leaves/ plant	Dry leaves/ plant	Total leaves/ plant	Stem diameter	Leaf area	Lodged plants	Broken plants
	days	(cm)	No.			(mm)	(cm^2)	%	
T_1	55.08	183.30	7.20	25.63	33.02	24.83	244.60	4.16	2.56
T_2	54.41	175.60	7.04	24.83	31.86	24.20	234.30	4.16	2.27
T_3	54.83	176.10	7.20	25.38	32.57	23.77	254.40	3.54	2.31
T_4	54.66	182.10	7.27	25.03	32.29	24.55	246.50	3.54	2.54
T_5	54.66	178.50	6.92	25.31	32.22	24.40	246.40	4.37	2.44
T_6	54.74	177.50	7.36	24.98	32.33	24.17	230.20	3.67	2.25
L.S.D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

two split doses (50 % at sowing and 50 % before the second irrigation) was better than other combinations. Such result may establish the importance of applying half of the N rate early in the season, that is, at sowing as a stimulatory dose, and the second dose before the second irrigation to endorse the plants thereafter.

In conclusion, results show in general that under the conditions of this study, increasing the rate of N fertilizer over 20 kg N/fad. is not justifiable. As for the dose-time combination, no difference of great importance was detected to justify any recommendation for or against any one of them. Thus, the variety of application treatments of N fertilizer used in this study encourages the sunflower grower, to use either one according to his own convenience.

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تأثير معدلات
النيتـــــــــــروجينى وكيفية الاضافة على نمو عباد الشمس

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اقيمت تجربتان حقليتان بالعقول الارشاديه التابعة لوزارة الزراعة بمركـــز ميت غمر – محافظة الدقهليه خلال موسمى ١٩٨٧، ١٩٨٨ – لدراسة أثر معدل تسميـــد النيتروجين وكيفيه الاضافة على نمو محصول عباد الشمس (الصنف فلوريدا ٣٠٢).
وكانت المعاملات كالاتـــى:-

أولا: معدلات السماد النيتروجينى فى صورة يوريا ٤٦٪ ن .
١- دون سماد نيتروجيـــــنى.
٢- ٢٠ كجم / فـــــــدان .
٣- ٤٠ كجم / فـــــــدان .
٤- ٦٠ كجم / فـــــــدان .

ثانيا: كيفيه الاضافة :-
١- اضيف المعدل فى جرعة واحده قبل الزراعـــــة .
٢- اضيف المعدل فى جرعة واحده قبل الريه الاولى.
٣- اضيف المعدل فى جرعة واحده قبل الرية الثانيه.
٤- أضيف المعدل فى جرعتين واحده ٥٠٪ قبل الزراعة + ٥٠٪ قبل الرية الاولى.
٥- اضيف المعدل فى جرعتين ٥٠٪ قبل الزراعـــة + ٥٠٪ قبل الرية الثانيـــه.
٦- اضيف المعدل فى جرعتين ٥٠٪ قبل الريه الاولى + ٥٠٪ قبل الريه الثانيـــه.

وتتلخص أهم النتائج المتحصل عليها فى النقاط التاليـــــــه :-
١- كان لمعدل السماد ٢٠ كجم / فدان اثرا معنويا على موعد التزهير فى الموسم الاول حيث بكرت النباتات فى التزهير .
٢- كان لمعدل السماد ٢٠ كجم / فدان أثرا معنويا على ارتفاع النباتات فى الموسم الاول فقط حيث زاد ارتفاع النبات على بقية المعدلات .
٣- زادت عدد الاوزاق الخضراء / نبات ونقص عدد الاوراق الجافة / نبات معنويـــــا فى موسمى الزراعة باستعمال المعدل ٢٠كجم / نبات على بقية المعدلات . ولـــم يتأثر العدد الاجمالى للاوراق / نبات بأى من المعدلات المستعملة.
٤- أدى معدل التسميد ٢٠ كجم / فدان على زيادة سمك اللبات معنويا خلال موسمـــى التجربـــــــــه .
٥- أدى التسميد النيتروجينى الى زيادة مساحة الورقة الرابعه خلال موسمى التجربـــــة معنويا حتى ٦٠ كجم / فدان .
٦- زادت نسبة النباتات الراقده معنويا عند معدلى ٤٠ كجم ، ٦٠ كجم فى موسمـــــى الزراعة ١٩٨٧ ، ١٩٨٨ على الترتيب .
٧- زادت نسبة النباتات المكسورة معنويا فى الموسم التالى فقط عند المعدل ٢٠ كجـــم/ فـــــدان .
٨- لم يكن لكيفية الاضافة تأثيرا معنويا على الصفات السابقة باستثناء صفة سمـــك الساق حيث أدت الاضافة على دفعتين ٥٠ ٪ قبل الزراعة + ٥٠٪ قبل الرية الثانيـــة الى زيادة معنويه فى سمك الساق مقارنة بالمعاملات الاخرى .