J. Agric. Sci. Mansoura Univ., 27(10): 6557 - 6566, 2002

THE INFLUENCE OF TWO APPLYING METHODS OF MICRONUTRIENTS MIXTURE WITH DIFFERENT LEVELS OF NITROGEN FERTILIZATION ON SUNFLOWER PLANTS GROWN UNDER SANDY SOIL CONDITIONS.

Abdo, Fatma A. ; N.A. Anton and Fardoas R. Hana
Crops Physiology Res. Sec., Field Crops Res. Inst., Agric. Res. Center , Giza , Egypt .

ABSTRACT

Field experiments were conducted at Ismailia Agric. Res. Station during the two successive seasons of 1999 and 2000 to study the effect of applying methods of micronutrients mixture (Fe + Zn +Mn) as coating seeds or foliar spray in combination with four different levels of nitrogen fertilizer ; *i.e.* , 30 , 60 , 90 and 120 kg N/fed on sunflower plant 'Euroflower hybrid' under sandy soil conditions . The results revealed that :

1- Coating sunflower seeds by micronutrients mixture (Fe +Zn + Mn) increased significantly plant height, leaf area / plant , specific leaf weight , stem diameter , seed yield / plant and seed yield /fed compared to foliar spary method with micronutrtients mixture of Fe, Zn and Mn . Also, coating method increased oil content , protein content , oil and protein yields /fed compared with foliar application one .
2- Increasing nitrogen fertilizer from 30 up to 120 kg N/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 Also , protein content , oil and protein yields / fed increased with raising nitrogen levels. While , oil content decreased with raising nitrogen levels .
3- The interaction between applying methods of micronutrients mixture and nitrogen fertilization showed no statistical effect on all characters under investigation .

It could be concluded that coating sunflower seeds with micronutrients mixture (Fe + Zn + Mn) with adding 120 kg N/fed gave the highest productivity of sunflower plants ; *i.e*, seed yield /fed , oil and protein yields.

Keywords : Micronutrients – Nitrogen – Sandy soil – Sunflower.

INTRODUCTION

Interest in sunflower (*Helianthus annus* , L.) as an oil seed crop has continuously increased recently in Egypt . The importance of this crop is due to increases in domestic consumption of vegetable oils . Sunflower could be one of the main oil crops to solve edible vegetable oil shortage in the country.

In newly reclaimed sandy soils, micronutrients and nitrogen fertilizers are playing a great role to realize high yield per area unit . Micronutrients application in the form of coating or foliar spray is undoubtedly of great importance to improve sunflower production in sandy soil conditions .

Foliar application and seed treatments with micronutrients gave a higher seed yield compared with the control (Lungu and Toma , 1988 ; Aman – Ullah and Niaz – Hussain , 1989 ; kene *et al.*, 1990 and Stoyanov *et al* ., 1990) . El – Yamany *et al.* (1993) found that coating application of sunflower seeds

with, Fe , Zn and Mn increased head diameter , seed and oil yields significantly . Ashoub *et al.*(1998) indicated that using grain coating method with micronutrients in maize caused significant increments in plant height , dry weight of plant and protein content in grains as compared with foliar spraying method .

Nitrogen is the most important limiting nutrient and frequently deficient in the Egyptian soils , especially in newly reclaimed soils . Hefni *et al.* (1985) found that application of 30 and 60 kg N/fed on sunflower plant increased head diameter , 100-seed weight , seed yield / plant and oil yield / fed El - Ahmer *et al* . (1990) reported that the application of 60 kg N/fed on sunflower plant gave significant effect on plant height , stem diameter , head diameter and 100 – seed weight . Metwally (1995) showed that adding N fertilizer at the rate of 45 kg 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 80 Kg N/ha.

The objective of this study is to evaluate the response of sunflower plant to different levels of nitrogen fertilization with micronutrients mixture in two different methods of application , foliar spray or coating seeds, under sandy soil conditions .

MATERIALS AND METHODS

The present investigation was conducted at Ismailia Agricultural Research Station, Ismailia Governorate during the two growing seasons of 1999 and 2000 to study the response of sunflower to micronutrients mixture; *i.e,* Fe, Zn and Mn applied as foliar spray or as coating seeds with four different levels of nitrogen fertilization .

The experiment was conducted under surface irrigation system in split plot design with four replicates . The main plots were deveoted to applying methods of micronutrients while the sub- plots included the nitrogen fertilzer levels . The details of treatments were as follows:

I. Main plots (micrountrients applying methods) :

A-Coating seeds with 0.3 g /kg seeds for each Fe, Zn and Mn.

B- Foliar spray with (200 ppm Fe + 300 ppm Zn + 200 ppm Mn).

II . Sub - plots (nitrogen fertilization levels) :-

1- 30 kg N/fed .

2- 60 kg N/fed.

3- 90 kg N/fed.

4- 120 kg N/fed .

Coating seeds with micronutrients mixture took place before sowing while foliar spray with micronutrients mixture were sprayed twice (25 and 40 days after sowing) . Micronutrients were added in the form of EDTA. The experimental basic unit area included five ridges, each of 60 cm width and 3.5 m length occupying an area of 10.5 m^2 (1/400 fed). The preceding winter crop was barley in the first season , whereas it was wheat in the second season . Sunflower seeds 'Euroflower hybrid' were sown on 18/5/1999 and 25/5/2000 in

the first and second seasons ; respectively . Cultural practices were completed according to the usual methods being adopted for sunflower crop.

Nitrogen fertilizer treatments were applied in the form of ammonium nitrate (33.5 % N) split into three equal doses, the first one was added after thinning (20 days after sowing) while the other two doses were applied at 10 days intervals from the first one . As a basic dressing calcium superphosphate (15 % P_2O_5) at the rate of 30 kg P_2O_5 / fed and potassium sulphate (48 % K_2O) at the rate of 48 Kg K_2O / fed were divided into two equal doses , the first one was added immediately after thinning (20 days after sowing) and the second 10 days later . Some physical and chemical properties of the experimental site are shown in Table 1 and were done according to Ryan *et al.* (1996) .

Table 1 : Some physical and chemical properties of the experimental site during the two growing seasons .

Properties	Seasons	
	1999	2000
Particle size distribution		
Coars sand %	83.15	82.86
Fine sand %	10.35	10.64
Slit %	1.40	1.50
Caly %	5.10	5.00
Texture class	Sand	Sand
Organic mater %	0.65	0.63
Ca Co_3 %	0.46	0.48
PH (soil paste)	7.50	7.70
Ec (mmhos / cm at 25 °C)	0.10	0.13
Available nutrients (ppm)		
N	27.40	35.20
P	6.20	8.30
K	70.50	83.00
Fe	1.98	2.07
Zn	0.7	0.8
Mn	1.63	1.78

At 75 days after sowing five plants were taken from the outer ridges of the four replications to determine some growth characters; *i.e.* , leaf area / plant (cm^2) and specific leaf weight (mg / cm^2) .

Harvest took place on 8/10/1999 and 19/10/2000 in the first and second seasons , respectively .

At harvest , ten plants were taken from each sub-plot for recording the following characters :

1- Plant height (cm) .
2- Stem diameter (cm) .
3- Head diameter (cm) .
4- 100- seed weight (g) .

5- Seed yield /plant (g) .
6- Seed yield kg / fed . At harvest time , sunflower plants in two ridges of each experimental unit (sub-plot) were collected and seed weighted in kg.

Mature sunflower seeds of the second season were subjected to chemical analysis for the determination of oil and crude protein contents according to A.O.A.C. (1975) .

The collected data were analyzed statistically according to Steel and Torrie (1980) in each season as well as the combined analysis of both seasons . The discussion was held on the mean of the two growing seasons except chemical analysis (second season only) .

RESULTS AND DISCUSSION

1. Growth characters:

a. Effect of applying methods of micronutrients mixture :

Table 2 represents the effect of two applying methods of micronutrients mixture (Fe + Zn + Mn); *i.e.* , coating or foliar on some growth measurements of sunflower . Such growth behavior is expressed as plant height , leaf area / plant after 75 days , specific leaf weight after 75 days ,stem diameter and head diameter . Combined analysis of both seasons in Table 2 indicate that coating method of micronutrients mixture (Fe + Zn + Mn) was more effective treatment for increasing such growth characters compared with foliar spray method for the same elements . In other words coating method of micronutrients mixture (Fe + Zn + Mn) increased significantly plant height , leaf area / plant , specific leaf weight and stem diameter compared with foliar spray method of the same elements . Whereas , head diameter was recorded insignificantly 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 . Where manganese regulates the oxidation reduction system of iron . Also , zinc plays an important role in tryptophan synthesis which is a precursor of I.A.A. In addition it was reported that the ratio between micronutrients in plant tissues was very important for the accumulation of many nutrients in plant (Osawa , 1973) . In comparison , spraying method gave a less increases of sunflower growth characters . These data discussed on the basis that spraying method had a direct effect on the vegetative parts of plant while the coating method affected the root proliferation through the soil from germination and lead the plants to absorb more nutrients for normal and well growth (Sarkar and Sasmal , 1989 and Stoyanov *et al* ., 1990).

b. Effect of nitrogen fertilization :

The effect of nitrogen fertilization on growth characters of sunflower plants are presented in Table 2 . Results show that increasing nitrogen fertilizer from 30 up to 120 kg N/fed significantly increased plant height , leaf area / plant specific leaf weight , stem diameter and head diameter (in both seasons and combined) .

Table 2 : Effect of two applying methods with micronutrients mixture and different levels of nitrogen fertilizer on growth character of sunflower during 1999 and 2000 seasons

Applying Methods Of Mecro-Nutrients	Nitrogen levels kg/fed.	Plant height (cm)			Leaf area/plant after 75 days (cm^2)			Specific leaf weight after 75 days (mg/cm^2)			Stem diameter (cm)			Head diameter (cm)		
		1999	2000	combi.	1999	2000	combi.	1999	2000	combi.	1999	2000	combi.	1999	2000	combi.
Coating of (Fe+Zn+Mn)	30	119.10	121.73	120.42	670.40	679.55	674.98	3.92	3.81	3.87	0.87	0.92	0.90	10.25	10.46	10.36
	60	125.80	128.60	127.20	725.53	721.70	723.61	4.09	3.97	4.03	0.96	1.01	0.99	11.15	11.37	11.26
	90	135.70	139.23	137.47	785.30	759.60	772.45	4.35	4.23	4.29	1.04	1.07	1.06	12.54	12.59	12.57
	120	145.50	142.85	144.18	841.75	772.12	806.95	4.79	4.56	4.68	1.09	1.10	1.10	12.73	13.28	13.01
Mean		131.53	133.10	132.32	755.75	733.24	744.50	4.29	4.14	4.22	0.99	1.03	1.01	11.67	11.93	11.80
Foliar spray of (Fe+Zn+Mn)	30	114.15	115.24	114.70	618.63	622.65	620.64	3.85	3.68	3.77	0.81	0.85	0.83	10.00	10.19	10.10
	60	120.55	124.45	122.50	605.75	659.80	632.78	3.98	3.82	3.90	0.93	0.94	0.94	10.87	11.45	11.16
	90	132.85	136.05	134.45	739.45	693.73	716.59	3.96	4.09	4.03	1.00	1.03	1.02	11.91	11.94	11.93
	120	139.38	133.15	136.27	759.35	715.85	737.60	4.56	4.31	4.44	1.03	1.09	1.06	12.23	12.35	12.29
Mean		126.73	127.22	126.98	680.80	673.01	676.90	4.09	3.98	4.04	0.94	0.98	0.96	11.25	11.48	11.37
General mean of N-levels	30	116.63	118.49	117.56	644.52	651.10	647.81	3.89	3.75	3.82	0.84	0.89	0.87	10.13	10.33	10.23
	60	123.18	126.53	124.85	665.64	690.75	678.20	4.04	3.90	3.97	0.95	0.98	0.97	11.01	11.41	11.21
	90	134.28	137.64	135.96	762.38	726.67	744.52	4.16	4.16	4.16	1.02	1.05	1.04	12.23	12.27	12.25
	120	142.44	138.00	140.23	800.55	743.99	772.28	4.68	4.44	4.56	1.06	1.10	1.08	12.48	12.82	12.65
LSD. 5%	A.M.	S	N.S	S	S	S	S	N.S	N.S	S	N.S	N.S	S	N.S	N.S	N.S
	N	7.53	5.58	4.39	68.35	36.70	35.71	0.33	0.31	0.21	0.07	0.05	0.04	1.19	1.21	0.78
	A.M. x N	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Such results can be ascribed to the function of N in plant metaboilism ; *i.e.*, constituent of amino and nucleic acids , many cofactors and cellular compounds . In this respect ,Haron and Salah (1991) reported that application of nitrogen from 0 to 60 kg N/fed markedly increased plant height , stem diameter , leaf area index and head diameter . Also , Anton *et al* . (1995) found that the addition of nitrogen fertilizer from 30 up to 90 kg/fed increased significantly stem and head diameter . It is worthy to mention that the significant increase in specific leaf weight when sunflower plants received 120 kg N fed compared with control , could be attributed to the accumulation of dry matter or photosynthesiate compounds seemed to be more in proportion to leaf area expansion . They added that plant height , leaf area / plant and head diameter recorded insignificant effect between the treatments of 90 and 120 kg N/fed . Whereas , specific leaf weight recorded insignificant effect between treatments received 30 and 60 kg N/fed .

C. Interaction effect between applying methods of micronutrients mixture and nitrogen fertilization

Data presented in Table 2 show that the interaction effect recorded insignificant effect between the two factors under study on all studies growth characters indicating, the reby , that each factor affected independently .

2. Yield components :

Different yield components of sunflower plants as affected by applying methods of micronutrients mixture (Fe + Zn + Mn) are presented in Table 3 . Results clearly show that seed yield / plant was significantly affected by applying method of micronutrients of (Fe + Zn + Mn) , where coating method increased significantly compared with foliar spray method for the same elements.While , 100- seed weight recorded insignificant effect when plants were treated with two methods of application ; *i.e.* , coating or foliar spray method .

Concerning the effect of nitrogen fertilization, data in Table 3 reveal that 100 – seed weight and seed yield / plant increased significantly with raising nitrogen fertilizer from 30 up to 120 kg N/fed , except 100-seed weight which was recorded insignificant effect between the two levels ; *i.e.* , 90 and 120 kg N/fed In this respect, Anton *et al.* (1995) showed that the addition of nitrogen fertilizer up to 90 Kg N/fed increased significantly seed index of sunflower plants.

Regarding the interaction effect between applying methods of micronutrients mixture (Fe + Zn + Mn) in combination with nitrogen levels , such interaction showed no statistical effect on 100 – seed yield and seed yield /plant in any of the two seasons and combined under the local conditions of the present investigation .

3. Seed yield

The data presented in Table 3 show that coating sunflower seeds with mixture of (Fe + Zn + Mn) increased significantly seed yield per plant and consequently seed yield / fed compared with spraying sunflower plants with the same mixture (Fe + Zn + Mn) . Such results may be due to the superior of growth and yield components with using coating method of micronutrients mixture which reflected on seed yield - These results are in full agreement with

Table 3: Effect of two applying methods with micronutrients mixture and different levels of nitrogen fertilizer on yield and its components of sunflower during 1999 and 2000 seasons as well as oil and protein contents of sunflower seeds in the second season

Applying methods of micro-nutrients (A.M.)	Nitrogen levels kg/fed.	100- seed weight (g)			Seed yield/ plant (g)			Seed yield/ Fed (kg)			Oil content (%)	Protein content (%)	Seed oil yield (kg/fed)	Seed protein yield (kg/fed)
		1999	2000	combi.	1999	2000	combi.	1999	2000	combi.	2000	2000	2000	2000
Coating of (Fe+Zn+Mn)	30	3.81	4.02	3.92	13.26	14.46	13.86	584.80	604.40	594.60	45.88	19.69	277.30	119.01
	60	4.16	4.35	4.26	15.19	16.92	16.06	679.60	688.00	683.80	45.45	20.75	312.70	142.76
	90	4.70	4.82	4.76	20.31	21.78	21.05	786.00	806.80	796.40	45.40	21.56	366.29	173.95
	120	4.85	5.10	4.98	22.42	23.33	22.88	844.00	882.00	863.00	45.25	22.75	399.11	200.66
Mean		4.38	4.57	4.48	17.80	19.12	18.46	723.60	745.30	734.45	45.50	21.19	338.85	159.10
Foliar Sprayof (Fe+Zn+Mn)	30	3.63	3.77	3.70	12.10	13.25	12.68	528.00	555.60	541.80	45.81	19.38	254.52	107.68
	60	3.97	4.15	4.06	13.81	14.83	14.32	623.60	632.80	628.20	44.98	19.69	284.63	124.60
	90	4.42	4.68	4.55	18.27	19.31	18.79	736.80	753.20	745.00	44.25	20.50	333.29	154.41
	120	4.72	4.84	4.78	21.14	22.55	21.85	766.40	844.80	805.60	43.89	21.63	370.78	182.73
Mean		4.19	4.36	4.27	16.33	17.49	16.91	663.70	696.60	680.15	44.73	20.30	310.81	142.36
General mean of N-levels	30	3.72	3.90	3.81	12.68	13.86	13.27	556.40	580.00	568.20	45.85	19.54	265.91	113.35
	60	4.07	4.25	4.16	14.50	15.88	15.19	651.60	660.40	656.00	45.22	20.22	298.67	133.68
	90	4.56	4.75	4.66	19.29	20.55	19.92	761.40	780.00	770.70	44.83	21.03	349.79	164.18
	120	4.79	4.97	4.88	21.78	22.94	22.37	805.20	863.40	834.30	44.57	22.19	384.95	191.69
LSD. 5%	A.M.	N.S	N.S	N.S	S	N.S	S	S	S	S				
	N	0.60	0.40	0.35	1.80	2.21	1.35	51.44	42.00	29.92				
	A.M. x N	NS	NS	NS	NS	NS	NS	NS	NS	NS				

those reported 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.

Concerning the effect of nitrogen fertilization , data presented in Table 3 show that increasing nitrogen levels from 30 kg N/fed up to 120 kg N/fed increased significantly sunflower seed yield . Such results may prove that nitrogen play an important role to increase sunflower production under sandy soil conditions . In this connection Awad and Griesh (1992) pointed out that application of 120 kg N/fed to sunflower plant increased seed yield /fed under sand soil conditions.

Regarding the interaction effect between applying methods of micronutrients mixture (Fe + Zn + Mn) in combination with nitrogen fertilizer levels , it is clear that such interaction had insignificant effect on seed yield per plant as well as seed yield /fed in both seasons .

4. Chemical composition of seeds

a- Oil content (%) and oil yield

Data in Table 3 show that coating sunflower seeds with micronutrients mixture (Fe + Zn + Mn) increased slightly oil percentage and oil yield / fed than spraying method with the same micronutrients used . This results could be attributed to the effect of micronutrients on enhancing oil accumulation in seeds and the highest productivity of sunflower seed yield . In this respect El-Yamany *et al* . (1993) reported that coating method with Fe , Zn and Mn increasing sunflower seed oil yield .

Regarding the effect of nitrogen fertilization , results in Table 3 indicate that increasing nitrogen levels from 30 up to 120 kg N/fed decreased oil percentage whereas , oil yield /fed was increased . Such increase may be attributed to the increase in seed yield / fed with raising nitrogen rates . In this connection, Awad and Griesh (1992) reported that sunflower seed oil yield increased while seed oil content decreased by increasing nitrogen fertilizer . Also , Singh *et al* (1995) pointed out that oil content in sunflower seeds reduced as the nitrogen dose increased from 40 to 80 kg N/ha .

b- Protein content (%) and protein yield :

Results in Table 3 indicate that coating sunflower seeds with micronutrients mixture (Fe + Zn + Mn) increased protein percentage and seed protein yield/fed compared with foliar spray method of the same micronutrients. Such finding may due to the role of micronutrients on enhancing the enzymes which help in protein formation process (Ghaly *et al*., 1992) .

Concerning the effect of nitrogen fertilization (Table 3) , data show that increasing nitrogen rates from 30 up to 120 kg N/fed increased linearly protein percentage and seed protein yield /fed . Such results can be ascribed to the role of nitrogen in plant metabolism ;*i.e.* , constituent of amino and nucleic acids . It is worthy to mention that , nitrogen application seemed to improve the nutritive value of sunflower seeds especially under sandy soil conditions . These results are in harmony with those reported by Loubser and Grimeek (1985) who concluded that the increase of nitrogen fertilizer up to 150 kg N/ha increased protein percentage of sunflower seeds .

It could be concluded that coating sunflower seeds with micronutrients mixture (Fe + Zn + Mn) with adding 120 kg N/fed gave the highest productivity of sunflower plants ; *i.e*, seed yield /fed, oil and protein yields.

REFERENCES

Aman - Ullah and Niza - Hussain (1989). Effect of pre- sowing seed treatments on seed and oil yields of sunflower (*Helianthus annus,* L.) J. of Agric. Res .27 (3) : 217 - 222 (C.F. Field Crop Abst ., 44 (10), 1991)

Anton,N.A. ; M.M. Basseim ; S.A.M Attia and W. Kadry(1995). Response of sunflower plant to some growth regulators and different levels of nitrogen fertilizer under sandy soil conditions. Annals of Agric – Sci – Moshtohor 33 (3) : 921 – 932 .

A.O.A.C. (1975) . Association of official Agricultural Chemists ., Washington , D.C. USA.

Ashoub,M.A.; A.M. Esmail ; A.O. Osman and A.S. Osman (1998) . Effect of some microelements application methods under irrigation regime on growth and yield of maize . Arab Univ. J. Agric . Sci., Ain Shams Univ. Cairo , 6 (1) : 183 – 192 .

Awad , A. and M.H.M. Griesh (1992) . Manure and inorganic fertilizer effects on growth and yield of some sunflower cultivars . Annals of Agric . Sc. Moshtohor 30 (1) : 127 – 144 .

El-Ahmer , B.A. ; S.K . El – Saied ; S.A. M. Attia and N. R. Giurgius (1990). Effect of NPK levels on some economic characters of sunflower. Conf. of soil fertility and foliar fertilization SWRI. ARC .Giza, Egypt 14-15 Jan . 1990 .

El-Yamany ; S.M. , S.A.M. Attia and F.H.El-Gendy (1993). Response of sunflower yield to nitrogen application rates under different methods of micronutrients application on Sandy soils. Annals of Agric . Sc., Moshtohor 31(3) : 1381 - 1391.

Ghaly, S.; A.O. Osman and I.M. Abd El-Aziz (1992) . The interaction of some micronutrients and rhizobia on lentil yield grown on sandy soils . Egypt.J.Agric.Res.,70 (4) : 1025 – 1035.

Haron, M.M.E. and A.H.A. Salah (1991). Effect of nitrogen , phosphorus and potassium fertilizer levels on sunflower . Annals of Agric . Sci . Moshtohor 29(1):77-86.

Hefni , S.H.M. ; El – Sayed Shokr; B.A. El – Ahmer ; R.A. El-Deepah and A.M. Emam (1985) . Effect of P and N fertilizers on yield and its components of sunflower under Noubaria conditions . Zagazig J.Agric . Res., 12(1) : 157 – 181.

Kene , H.K; S.T. Wankhade and B.N. Sagare (1990). Influence of nutrients spray on yield and oil content of sunflower. Ann. Plant physi., 4 (2) : 246 - 248 . (C.F. Field Crop Abst . 44 (6),1991)

Loubser , H.L. and C.L. Grimeek (1985) . Influence of fertilization on the oil concentration and oil quality of sunflower seed. South African J. of plant and soil 2(4) : 211 – 214 .

Lungu , V.I. and S.I. Toma (1988).The yield of simple sunflower hybrids in relation to application of trace elements. Izvestiya Akademi Nauk Moldavskoi SSR. Seriya . 4 : 64 – 67 . (C.F. Field Crop Abst . 43 (3), 1990)

Metwally, S.Q. (1995).Fertilization of sunflower (*Helianthus annus* , L.) M.Sc. Thesis , Fac . of Agric ., Mansoura univ., Egypt .

Osawa , T. (1973) . Heavy metal toxicities in vegetable crops . The effect of iron concentration in the nutrient solution on zinc toxicities in vegetable crops . Hort Abst., 44- 8480 .

Ryan , J. ; S. Garabet ; K.Harmsen and A. Rashid (1996) . A soil and Plant Analysis . Manual Adopted for the West Asia and North Africa Region . ICARDA , Aleppo , Syria , pp. 140 .

Sarkar , R.K. and T.K. Sasmal (1989) . Response of sunflower to application of micronutrients on rice fallow Gangetic alluvial soil . Indian j. Agric . 33 , 39 - 44 . (C.F. Field Crop Abst ., 34 (9) , 1990).

Singh , V. ; S.K. Sharma and B.L. Verma (1995) . Response of rainy season sunflower (*Helianthus annus* , L.) to irrigation and nitrogen under North - Western Rajasthan. Indian J.Agron ., 40 (2): 239 – 242 .

Steel , R.G.D. and J.H. Torrie (1980) . Principles and Procedures of Statistics . Mc. Graw Hill Book Company , New York , 2th. Ed.

Stoyanov, D.;B. Sedlarsks and S. Stratieva (1990) . Effect of zinc and boron on sunflower grown on a leached chenozem soil . Pochvoznanie Agrokhimuya 25 (1) : 3 – 8 (C.F. Field Crop Abst ., 49 (8) , 1991) .

تأثير طريقتين لإضافة مخلوط العناصر الصغرى مع مستويات مختلفة للتسميد النيتروجينى على نباتات عباد الشمس النامية تحت ظروف الأراضى الرملية .

فاطمة عبد المنصف عبده ، ناجى عبده أنطون ، فردوس رياض حنا

قسم بحوث فسيولوجى المحاصيل – معهد بحوث المحاصيل الحقلية

مركز البحوث الزراعية – الجيزة – مصر .

أقيمت تجربتان حقليتان بمحطة بحوث الإسماعيلية خلال موسمى ١٩٩٩، ٢٠٠٠ لدراسة استجابة نباتات عباد الشمس لطريقتين لإضافة العناصر الصغرى وهى تغليف البذور بمخلوط (حديد + زنك + منجنيز) بتركز ٠,٣ جم / كجم بذور لكل عنصر وكذلك الرش الورقى بمخلوط العناصر الصغرى المكونه من (٢٠٠ جزء فى المليون حديد + ٣٠٠ جزء فى المليون زنك + ٢٠٠ جزء فى المليون منجنيز) وكذلك إضافة السماد النيتروجينى بمعدلات ٣٠ ، ٦٠ ، ٩٠ ، ١٢٠ كجم / نيتروجين / فدان .

وقد أوضحت النتائج الآتى :-

١- أدى تغليف البذور بمخلوط العناصر الصغرى (حديد + زنك + منجنيز) إلى زيادة معنوية فى طول النبات ، مساحة الأوراق / نبات، الوزن النوعى للأوراق ، قطر الساق ، وزن البذور / نبات ومحصول البذور / فدان وذلك بالمقارنة بطريقة الرش الورقى لمخلوط العناصر الصغرى .وكذلك ازدادت النسبة المئوية للزيت والبروتين وأيضاً محصول الزيت والبروتين للفدان .

٢- أدت زيادة التسميد النيتروجينى من ٣٠ إلى ١٢٠ كجم نيتروجين للفدان إلى زيادة معنوية فى طول النبات ، مساحة الأوراق / نبات ، الوزن النوعى للأوراق ، قطر الساق ، قطر القرص ، وزن الـ ١٠٠ بذرة و محصول البذور / نبات و محصول البذور / فدان . وكذلك ازدادت النسبة المئوية للبروتين بالبذور وأيضاً محصول الزيت والبروتين للفدان . بينما نقصت النسبة المئوية للزيت بالبذور .

٣-كان تأثير التفاعل بين طرق إضافة العناصر الصغرى والتسميد النيتروجينى غير معنوى على جميع الصفات تحت الدراسة .

وتوصى الدراسة بأن طريقة تغليف بذور عباد الشمس بمخلوط العناصر الصغرى (حديد + زنك + منجنيز) مع إضافة النيتروجين بمعدل ١٢٠ كجم / فدان يعطى أقصى إنتاج لنباتات عباد الشمس من محصول البذور للفدان بالإضافة إلى محصول الزيت والبروتين .