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EFFECT OF NANOMETRIC NITROGEN AND MICRO ELEMENTS FERTILIZERS ON YIELD AND ITS COMPONENT OF CANOLA (*Brassica napus*, L.)

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ABSTRACT

Two field experiments were carried out during 2017/2018 and 2018/2019 seasons at Al –Hussein Society of Reclaiming and Cultivating Land, 64 km Cairo Alexandria desert road, Giza Governorate, Egypt, to study the effect of nitrogen with nano metric fertilizer rates and some micro elements on Productivity and quality of canola c.v. Serw4. The experimental design used was a split plot design with three replications. Each replicate included 20 concentrates which were the combinations between five nitrogen fertilizer rates, i.e., 10 kg N (mineral) +20% from recommended nitrogen as nano. N / fed., 20 kg (mineral) +20% nano, 30 kg N +20% nano, 40 kg N (mineral) +20% nano. N, 50 kg N(mineral) +20% nano. N. were allocated in the main plots, and four micro elements rates used as nano metric fertilizers, Control (sprayed plants with recommended of Iron+ manganese), spraying plants with Fe + Mn at concentrations 100, 200, and 300 ppm concentrates, while micro elements were distributed randomly in the sub plots. while 50kgN+20% nano/fed rate gave the maxmum for plant height and number of branches/plant in the two seasons.

The obtained results showed that nitrogen fertilizer rates significantly affected yield of canola and growth characters in both seasons. Application nitrogen fertilizer with rate (40 kg N +20% nano. N/ fed) gave the highest seed yield and 1000seed weight. The obtained results indicated that spraying canola plants with Fe + Mn at concentrations 300 ppm increased yield and growth characters in both seasons as compared with the control. However, the obtained results indicate that to obtain higher characters for canola, it is recommended that application nitrogen fertilizer with rate 40 kg N +20% nano. N/ fed and applying spraying plants with Fe + Mn at concentrations 300 ppm under drip-irrigated and experiment soil condition.

INTRODUCTION

Oil Crops are important strategic crops in Egypt or in countries around the world, it considered a major source of food in terms of human consumed in different ways in the diet is also important food commodities which the food gap, where up Self-sufficiency ratio of crop oils in the range of 10% from 13% despite the multiplicity of oil crops that can be grown in Egypt, but the limited space of this crop does not exceed 3% of the cropped area in Egypt, The problem despite an increase in domestic production, but there is still a gap between the production and consumption of oil crops, which form a burden on the Egyptian trade balance so it is necessary to increase the local production of crop oils, by expanding the cultivation of oil crops to produce oilseeds by increasing the cultivated areas with new oil crops do not compete with the main crops, which can be extracted from its seeds to meet the increasing consumption and who leads in fluctuation its domestic prices.

Canola (*Brassica napus* L.) belongs to Brassicaceae group of oilseed crops and considered one of the prime sources for edible vegetable oil for human consumption due to its higher quality associated with a lower level of saturated fat (40-45%) and protein (36-40%) in the seed (**Alberta Agriculture, 1984**). Currently, it cultivated on an area of 36 million hectares annually with a total production of 72 million tons worldwide (**FAOSTAT, 2014**).Europe, China and Canada are leading producers of rapeseed with higher area under cultivations and production (**Commodity Research Bureau, 2005**). Its seed is enriched with 40% oil content and meal have 35-40% crude protein. Currently canola oil is considered as acceptable alternative to soya bean oil (**Muhammad, *et al*., 2007**). Canola is tolerant to moderate to extreme environmental conditions and can be successfully grown under arid land conditions (**Qaderi *et al.*, 2012**). To ameliorate this environment stress plant need some support from external sources that may be suitable planting date which favors plant to timely complete its life cycle or nutrients adjustment for better growth and performance (**Khaliq *et al.*, 2013**).

Nitrogen (N) is an essential nutrient for plant growth and is a key limiting factor in agro-ecosystems. Nitrogen is a constituent of amino acids, which are required to synthesize proteins and other related compounds. It plays a role in almost all plant metabolic processes (**Hopkins & Hunter, 2004**). Canola yield and yield components, the number of pods and flowers per plant, the total plant weight and harvest index in some varieties of canola have been found to improve with higher rates of nitrogen (**Al-Solaimani *et al.*, 2015**). The highest rates of fertilizer application were found to give significantly higher total dry matter than the lowest rate of fertilizer application (**Kumar *et al*., 1997**).

Micro-elements are of high importance in plant nutrition and they should not be neglected although they are needed in minor quantities. Recent research has shown that a small amount of nutrients, especially Fe, and Mn that have been applied by foliar spraying have significantly increased crop yields (**Sarkar, *et. al*. 2007, Wissuwa, *et. al*. 2008**). Foliar application of microelements is more beneficial than soil application. Since application rates are lesser as compared to soil application, same application could be obtained easily and crop reacts to nutrient application immediately (**Zayed, *et. al*. 2011**). Foliar application of micronutrients like iron and manganese significantly increased 1000-kernel weight and seed yield of canola *Brassica napus* L. (**Bahrani and Pourreza 2014**).

MATERIALS AND METHODS

Two field experiments were carried out at Al –Hussein Society for Reclaiming and Cultivating Land,64 km Cairo Alexandria desert road, Giza Governorate, Egypt, during two successive agricultural winter seasons 2017\ 2018 and 2018\ 2019, to study the effect of nitrogen with nano metric fertilizer rates and some micro elements on Productivity and quality of canola c.v. Serw4.

The experiment concentrates were five nitrogen rates 10 kg N (mineral) +20% from recommended nitrogen as nano. N / fed., 20 kg (mineral) +20% nano, 30 kg N(mineral) +20% nano, 40 kg N(mineral) +20% nano. N and 50 kg N(mineral) +20% nano. N. and four micro elements used as nano metric fertilizers, control (sprayed plants with recommended of Iron + manganese), spraying plants with Fe + Mn at concentrations 100, 200, and 300 ppm.

The experiment was laid out in split –plot design with three replications. The main plots were assigned to nitrogen fertilizer rates, sub- plots were assigned to Iron+ manganese fertilizer rates. The area of each sub plot was 10.5m^2 (3m width x 3.5m length).

Mechanical and chemical analysis of soil at the experimental site according to standard methods of **Page *et al*. (1982)** and **Arnold (1986)** are presented in Table (1).

Nitrogen fertilizer (mineral) rates studied (ammonium nitrate 33.5%) were splitting into three parts, after 15, 30 and 60 days from sowing, Nano nitrogen was added as foliar application on two equal dos after 50 and 65 days from sowing. Nano Iron+ manganese was added as foliar application on two equal dos after 55 and 70 days from sowing.

Table (1). Physical and chemical of the experimental soil, the standard method according to Page *et al* (1982).

Parameters	2017/2018 season	2018/2019 season
Mechanical analysis		
Sand %	84.72	86.54
Silt%	10.00	8.34
Clay %	5.28	5.12
Soil textural class	Sandy	Sandy
Chemical analysis		
pH soil	8.5	8.2
Ec(mmhos/cm)	8.3	8
Caco3 %	2.7	2.9
Available N (ppm)	30	32
Available P (ppm)	10	8
Available K (ppm)	72	68
Fe	0.42	0.44
Cu	0.26	0.24
Zn	0.31	0.33
Mn	0.76	0.74

At 15 November in both 2017/2018 and 2018/2019 seasons seeds of canola were hand sown on rows apart 50cm and 30cm between hills, two plants were leaved in every hill .The preceding crop was sugar beet at two seasons the soil was without sowing (fallow soil) in the summer. The experiment was laid out under drip irrigation system. All other recommended practices for canola production were done according to Egyptian minister of agriculture recommendation. Oil content (%) in the seeds was determined and petroleum ether as aslovent methods of Association of Official Agriculture Chemists **(A.O.A C, 1980)**.

Data recorded:

1- Growth traits: Ten plants were at random carefully from the middle ridge of each plot in both seasons to measure the following traits.
   a) Plant height (cm) was measured from soil surface to the top of stem.
   b) Number of branches

2-Yeild components:
   1) 1000 seeds weight (g)
   2) Seeds yield per feddan (kg).
   3) Oil content % in seeds
   4) Oil yield per fed (kg).

Statistical Analysis

All data of different traits for both seasons were collected and subjected to analysis of variance according to **Steel *et al*.** (**1997)** to sort out significant differences among concentrates. Difference among means was compared using LSD at 5% probability level.

RESULTS AND DISCUSSION

1- Plant height (cm)

Average canola Plant height at harvest time as affected by nitrogen fertilizer rates and spraying with nano Fe + Mn as well as their interaction on Plant height at harvest of canola c.v. Serw4 under drip irrigation system in 2017/2018 and 2018/2019 seasons are presented in Tables (2) and (3).

Tables (2) and (3) indicate that canola Plant height was significantly affected by rates of nitrogen fertilizer in both seasons. The results show that the highest nitrogen fertilizer rates gave the Plant height 170.17cm and 173.25 cm in 2017/ 2018 and 2018/ 2019 seasons, respectively. The highest N level, i.e. 20 kg N nano + 50 kg N mineral/ fed concentrate gave 27.23%, 20.32, 14.66 and 12.09% increase in canola Plant height over those of nitrogen fertilizer 10, 20, 30 and 40 kg N mineral/ fed concentrates, respectively, in 2017/ 2018 season. The respective values in 2018\2019 season. These results are in agreement with those of **Rathnayaka, *et. al*. (2018)**.

The obtained data (Tables 2 and 3) show that spraying canola plants with Fe + Mn significantly affected plant height in both seasons, the highest Plant height values (123.53 and 147.54 cm) were obtained with concentrate of Fe + Mn 300 ppm, in 2017/ 2018 and 2018/ 2019 seasons, respectively, as compared with the other spraying concentrates. In 2017/ 2018 season, this concentrate gave 17.53%, 16.73% and 6.74% increase in Plant height over those of the control, Fe + Mn 100 ppm and Fe + Mn 200 ppm concentrates, respectively. Results in 2018/ 2019 season followed similar trend. These results are in agreement with those of **Sultana, *et. al*. (2001)**.

Table 2. Effect of nano metric nitrogen and micro element fertilizer on some characters of canola c.v. Serw4 on 2017/2018 season.

Nitrogen	Fe+Mn	Plant height	Number of branches	1000seed weight	Seed yield
10kg N mineral+ 20 nano	Control	115.67	6.00	1.9	887.80
	100ppm	114.67	5.33	2.1	1113.20
	200ppm	129.67	7.67	2.37	1163.60
	300ppm	135.33	8.33	2.73	1232.20
	Mean	123.84	6.83	2.28	1099.20
20kg N mineral+ 20 nano	Control	128.67	5.67	2.	1251.80
	100ppm	125.67	5.00	2.23	1333.00
	200ppm	139.67	6.67	2.63	1401.60
	300ppm	148.33	7.67	2.9	1436.60
	Mean	135.59	6.25	2.44	1355.75
30kg N mineral+ 20 nano	Control	130.33	8.67	2.23	1278.40
	100ppm	136.33	8.00	2.47	1254.60
	200ppm	148.00	10.33	2.83	1401.60
	300ppm	166.67	12.33	3.10	1471.60
	Mean	145.33	9.83	2.66	1351.55
40kg N mineral+ 20 nano	Control	134.67	8.77	2.23	1529.00
	100ppm	137.67	7.01	2.57	1445.00
	200ppm	158.67	12.33	3.10	1557.00
	300ppm	167.33	13.33	3.37	1755.80
	Mean	149.59	10.36	2.82	1571.7
50kg N mineral+ 20 nano	Control	162.33	8.33	2.00	1398.80
	100ppm	157.33	8.33	2.43	1386.20
	200ppm	178.33	13.33	2.90	1555.60
	300ppm	182.67	14.23	3.13	1492.60
	Mean	170.17	11.06	2.62	1458.30
Ovear all means	Control	101.87	5.80	2.05	989.40
	100ppm	102.87	5.26	2.36	1029.16
	200ppm	115.20	7.40	2.77	1104.67
	300ppm	123.53	8.33	3.05	1179.24
	Mean	110.87	6.70	2.56	1075.62

L.S.D at 5% level for:	Plant height	Number of branches	1000seed weight	Seed yield
Nitrogen fertilizer (N)	5.05	0.21	0.10	61.63
Fe+ Mn nano (F)	3.78	0.11	0.08	57.43
Interaction (N)x(F)	N.S.	N.S.	0.18	128.43

Table 3. Effect of nano metric nitrogen and micro element fertilizer on some characters of canola c.v. Serw4 on 2018/2019 season.

Nitrogen	Fe+ Mn	Plant height	Number of branches	1000seed weight	Seed yield
10kg N mineral+ 20 nano	Control	113.00	4.33	2.03	931.20
	100ppm	115.00	4.33	2.23	1113.20
	200ppm	127.67	6.33	2.33	1186.00
	300ppm	134.00	7.33	2.77	1214.00
	Mean	122.41	5.58	2.34	1111.10
20kg N mineral+ 20 nano	Control	123.67	5.00	2.03	1272.80
	100ppm	124.00	5.67	2.23	1305.00
	200ppm	134.67	7.33	2.77	1404.40
	300ppm	144.67	7.67	2.93	1421.20
	Mean	131. 75	6.41	2.49	1350.85
30kg N mineral+ 20 nano	Control	129.67	6.67	2.04	1222.40
	100ppm	132.00	7.00	2.27	1306.40
	200ppm	145.00	7.93	2.93	1412.80
	300ppm	158.67	9.33	3.03	1489.80
	Mean	141.33	7.73	2.56	1357.85
40kg N mineral+ 20 nano	Control	133.33	7.00	2.07	1537.40
	100ppm	147.00	7.00	2.63	1393.20
	200ppm	153.67	8.33	2.93	1558.40
	300ppm	163.67	9.33	3.23	1751.60
	Mean	149.41	7.91	2.71	1560.15
50kg N mineral+ 20 nano	Control	165.33	7.67	1.87	1456.20
	100ppm	166.00	8.67	2.50	1372.20
	200ppm	176.67	9.67	2.80	1545.80
	300ppm	185.00	12.00	3.17	1176.20
	Mean	173.25	9.50	2.58	1387.60
Ovear all means	Control	137.50	6.33	2.16	1295.43
	100ppm	133.40	6.13	2.08	1284.00
	200ppm	136.80	6.53	2.37	1298.00
	300ppm	147.54	8.00	2.75	1421.48
	Mean	138.81	6.74	2.34	1324.72
L.S.D at 5% level for:					
Nitrogen fertilizer (N)		2.27	0.61	0.09	17.23
Fe+Mn nano (F)		5.57	N.S.	0.23	42.21
Interaction (N)x(F)		4.47	N.S.	0.12	18.93

Data recorded in Tables (2) and (3) indicate that the interaction between nitrogen fertilizer and foliar spraying with Fe + Mn on canola plant height was significant in 2018/2019 season. However, the highest plant height value 182.67cm and 185.00cm were obtained under the application of nitrogen fertilizer at concentrate 20 kg N nano + 50 kg N mineral/ fed with foliar spraying with Fe + Mn 300ppm in 2017/ 2018 and 2018/ 2019 seasons, respectively. **Wissuwa, *et. al*. 2008** results agreed the similar data.

2- Number of branches /plant

Tables (2) and (3) show the influence of nitrogen fertilizer rates and spraying with nano Fe + Mn different concentrations as well as their interaction on number of branches per canola c.v. Serw4 under drip irrigation system in 2017/ 2018 and 2018/ 2019 seasons.

Obtained results indicate that nitrogen fertilizer concentrates significantly affected number of branches in both seasons. However, 20 kg N nano + 50 N mineral/ fed concentrate gave the highest number of branches as compared with 10, 20, 30 and 40 kg N mineral + 20kg N nano/ fed concentrates in both seasons. That concentrate increased the number of branches by 38.25%, 43.49%, 11.12% and 6.33% over those of 10, 20, 30 and 40 kg N mineral + 20 kg N nano/ fed concentrates, respectively. Results in 2018/ 2019 season followed similar trend. These results are in agreement with those of **Rathnayaka, *et. al.* (2018)**.

The results recorded in Tables (2) and (3) showed that the highest number of branches/plant was achieved from plants received nano Fe + Mn at the concentrate of 300 ppm as a foliar application as compared with all other foliar Fe + Mn spraying concentrates in both 2017/ 2018 and 2018/ 2019 seasons. For example, in 2017/ 2018 season, Fe + Mn at concentrate 300 ppm increased the number of branches by 30.37%, 36.86% and 11.17% over those of control plants, Fe + Mn 100 ppm and Fe + Mn 200 ppm concentrations, respectively. **Mirzapour and Khoshgoftar (2006)** found similar results.

The statistical analysis revealed insignificant effect of the interaction between of nitrogen fertilizer rates and spraying with Fe + Mn concentrations on number of branches in both 2017/ 2018 and 2018/ 2019 seasons as shown in Tables (2) and (3). However, the highest number of branches (14.23 and 12.00) was recorded at the application of nitrogen fertilizer rate (20 kg N mineral + 50 kg N nano/ fed) and spraying with Fe + Mn at concentrate of 300 ppm concentrate, in 2017/ 2018 and 2018/ 2019 seasons, respectively. **Sarkar, *et. al*. 2007** agreed that results.

3- 1000-seed weight (g)

The 1000- seed weight of canola c.v. Serw4 as affected by nitrogen fertilizer, nano metric fertilizers Fe + Mn and their interaction under drip irrigation system in 2017/2018 and 2018\2019 seasons are presented in Tables (2) and (3).

Tables (2) and (3) indicate that 1000- seed weight was affected by nitrogen fertilizer rates, nano metric fertilizers Fe + Mn in both seasons. Concerning nitrogen fertilizer, the results show that 40 kg N (mineral) + 20 (nano)/ fed concentrate gave the heaviest 1000- seed weight as compared with those of 10, 20, 30 and 50 kg N (mineral + 20 kg nano/ fed in both seasons. This concentrate gave 19.15%, 13.48%, 5.67% and

7.63% increase in 1000- seed weight over those of 10, 20, 30 and 50 kg N (mineral + 20 kg nano/ fed. concentrates, respectively, in 2017/ 2018 season. The respective values in 2018\ 2019 season were 8.56%, 3.89%, 0.78 and 3.89%. This explanation is are in agreement with those of **Bahrani and Pourreza 2014** and **Rathnayaka,** ***et. al.*** **(2018)**.

The obtained results (Tables 2 and 3) showed that spraying nano metric fertilizers Fe + Mn significantly affected 1000-seed weight of canola c.v. Serw4 in both seasons. However, the highest 1000-seed weight was achieved at spraying nano metric fertilizers Fe + Mn at the concentrate of 300 ppm in both seasons. In 2018/ 2019 season, this concentrate (spraying nano metric fertilizers Fe + Mn at concentrate of 300 ppm) gave 21.46%, 24.36% and 13.82% increase in 1000-seed weight over those of control, nano metric fertilizers Fe + Mn at the 100 and 200 ppm concentrates, respectively. The same trend was true in 2017/ 2018 season. These findings are in agreement with those of **Bakhtiari,** ***et. al*****. (2015)** who reported that foliar application of Fe and manganese compounds with the technology of Nano may be a solution to the problem.

Data recorded in Tables (2) and (3) indicate that the interaction between nitrogen fertilizer rates and nano metric fertilizers Fe + Mn at concentrate of 300 ppm foliar application had significant effect on 1000-seed weight in both the experimental seasons. However, in 2017/ 2018 season, the heaviest 1000-seed weight (3.37 g) was achieved from applying nitrogen fertilizer rate 40kg mineral+ 20kg nano and applying of nano metric fertilizers Fe + Mn at concentrate of 300ppm. Results in 2018/ 2019 followed similar trend. That result were in agreement with **Zayed,** ***et. al*****. 2011.**

4- Seed yield (kg/ fed)

Seed yield of canola c.v. Serw4as affected by nitrogen fertilizer rates and foliar spraying with Fe + Mn under drip irrigation system in 2017/ 2018 and 2018/ 2019 seasons, is shown in Tables (2) and (3).

Results presented in Tables (2) and (3) show that nitrogen fertilizer rates significantly affected the seed yield per feddan of canola c.v. Serw4 in both seasons. However, the nitrogen fertilizer rates (20 kg N nano + 40kg mineral/ fed) concentrate gave the highest seed yield per feddan as compared with the all other concentrates in both seasons. This concentrate gave 30.06%, 13.74%, 14.01% and 7.22% increase in seed yield over those of 10, 20, 30 and 50 kg N mineral + 20 kg N nano/ fed concentrates, respectively in 2017/ 2018season. Results in 2018\ 2019 season followed similar trend. These results are in agreement with those of **Rathnayaka,** ***et. al.*** **(2018)**.

Data recorded in Tables (2) and (3) show that spraying canola c.v. Serw4 with Fe + Mn concentrations under drip irrigation system significantly affected seed yield per feddan in both seasons. However, the highest seed yield per feddan was obtained under applying Fe + Mn at concentrate 300pm in both seasons. This concentrate gave 16.10%, 12.73% and 6.32% increase in seed yield over those of control, spraying canola plants with Fe + Mm 100 and 200ppm concentrates, respectively in 2017/ 2018 season. The respective values in 2018/ 2019 season were 8.87%, 9.67% and 8.69%. The highest seed yield under this concentrate, i. e, Fe + Mn 300ppm might be attributed to that its significant increasing in 1000-seed weight as shown in Tables (2) and (3). Similar results have also been reported by **Wissuwa, *et. al*., (2008)**.

Data presented in Tables (2) and (3) show that interaction effects between the nitrogen fertilizer levels, and foliar application of Fe + Mn concentrations on seed yield was significant in 2017/ 2018 and 2018/ 2019 seasons, the highest seed yield (1755.80 kg/ fed) and (1751.60 kg/ fed) in 2017/ 2018 and 2018/ 2019 seasons, was obtained respectively at application of nitrogen fertilizer with concentrate 20 kg nano + 40 kg N mineral as soil amendment with the foliar application with Fe + Mn concentration of 300ppm in both seasons. **Sarkar, *et. al*. (2007)** and **Wissuwa, *et. al*. (2008)** come to the same results.

5- Oil content % in seeds

The oil content % of seed canola c.v. Serw4 as affected by nitrogen fertilizer, nano metric fertilizers Fe + Mn and their interaction under drip irrigation system in 2017/2018 and 2018\2019 seasons are presented in Table (4).

Table (4) indicate that oil content % was significant affected by nitrogen fertilizer rates, nano metric fertilizers Fe + Mn in both seasons. Concerning nitrogen fertilizer, the results show that 40 kg N (mineral) + 20 (nano)/ fed concentrate had the heaviest oil content % as compared with those of 10, 20, 30 and 50 kg N (mineral + 20 kg nano/ fed in both seasons. This concentrate gave 9.08%, 3.35%, 8.31% and 10.64% increase in oil content % over those of 10, 20, 30 and 50 kg N (mineral + 20 kg nano/ fed. concentrate, respectively, in 2017/ 2018 season. The respective values in 2018\ 2019 season were 8.56%, 3.89%, 0.78 and 3.89%. This explanation is are in agreement with those of **Muhammad, *et al*., (2007**).

The obtained results (Table 4) showed that spraying nano metric fertilizers Fe + Mn significantly affected oil content % of seed canola c.v. Serw4 in both seasons. However, the highest oil content % was achieved at spraying nano metric fertilizers Fe + Mn at concentrate 300 ppm in both seasons. In 2017/ 2018 season, this concentrate (spraying nano metric fertilizers Fe + Mn at concentrate 300 ppm) gave 8.87%, 13.56% and 8.73% increase in oil content % over those of control, nano metric fertilizers Fe + Mn at concentrate 100 and 200 ppm concentrates, respectively. The same trend was true in 2018/ 2019 season. These findings are in agreement with those of **Sarkar, *et. al*. 2007, Wissuwa, *et. al*. 2008** shown that a small amount of nutrients, especially Fe, and Mn that have been applied by foliar spraying have significantly increased crop yields.

Table 4. Effect of nano metric nitrogen rates and micro element fertilizer on Oil content inseeds and Oil yield of canola c.v. Serw4 on 2017/2018 and 2018/2019 seasons.

Nitrogen	Fe+ Mn	Oil content %	Oil content %	Oil yield	Oil yield
		2017/2018	2018/2019	2017/2018	2018/2019
10kg N mineral+ 20 nano	Control	29.03	32.66	257.73	304.13
	100ppm	28.20	31.80	313.92	354.00
	200ppm	31.43	32.40	365.72	384.26
	300ppm	35.15	35.73	433.12	433.76
	Mean	30.95	33.15	342.62	369.03
20kg N mineral+ 20 nano	Control	33.65	33.10	421.23	421.30
	100ppm	31.81	30.17	424.03	393.72
	200ppm	32.01	37.37	448.65	524.82
	300ppm	34.14	38.21	490.46	543.04
	Mean	32.90	34.71	446.09	470.72
30kg N mineral+ 20 nano	Control	31.79	36.10	406.40	441.29
	100ppm	29.00	33.21	363.83	433.86
	200ppm	29.97	34.27	420.06	484.17
	300ppm	34.06	37.42	501.23	557.48
	Mean	31.21	35.25	422.88	479.20
40kg N mineral+ 20 nano	Control	32.10	38.43	490.81	590.82
	100ppm	31.45	35.47	454.45	494.17
	200ppm	34.25	34.38	533.27	535.78
	300ppm	38.36	39.82	673.52	697.49
	Mean	34.04	37.03	538.01	579.56
50kg N mineral+ 20 nano	Control	31.08	36.27	434.75	528.16
	100ppm	29.09	36.06	403.25	494.82
	200ppm	30.22	37.10	470.10	573.49
	300ppm	31.29	38.07	467.03	447.78
	Mean	30.42	36.88	443.78	511.06
Ovear all means	Control	31.53	35.31	311.96	457.42
	100ppm	29.91	33.34	307.82	428.09
	200ppm	31.58	35.10	348.85	455.60
	300ppm	34.60	37.85	408.02	538.03
	Mean	31.90	35.40	344.16	469.78
L.S.D at 5% level for:					
Nitrogen fertilizer (N)		**2.95**	**2.85**	**28.57**	**27.60**
Fe+ Mn nano	**(F)**	**1.63**	**1.62**	**16.61**	**16.44**
Interaction	**(N)x(F)**	**N.S.**	**N.S.**	**N.S.**	**N.S.**

The statistical analysis revealed insignificant effect of the interaction between of nitrogen fertilizer rates and spraying with Fe + Mn concentrations on number of branches in both 2017/ 2018 and 2018/ 2019 seasons as shown in Table (4). However, the highest oil content % inseeds (38.36% and 39.82) was recorded at the application of nitrogen fertilizer rate (20 kg N mineral + 40 kg N nano/ fed) and spraying with Fe + Mn at concentrate 300 ppm concentrate, in 2017/ 2018 and 2018/ 2019 seasons, respectively.

6- Oil yield (kg) /fed

Oil yield of canola c.v. Serw4as affected by nitrogen fertilizer rates and foliar spraying with Fe + Mn under drip irrigation system in 2017/ 2018 and 2018/ 2019 seasons, is shown in Table (4).

Results presented in Table (4) show that nitrogen fertilizer rates significantly affected the oil yield per feddan of canola c.v. Serw4 in both seasons. However, the nitrogen fertilizer rate (20 kg N nano + 40kg mineral/ fed) concentrate gave the highest oil yield per feddan as compared with the all other concentrates in both seasons. This concentrate gave 36.41%, 16.63%, 21.16% and 17.08% increase in oil yield over those of 10, 20, 30 and 50 kg N mineral + 20 kg N nano/ fed concentrates, respectively in 2017/ 2018 season. Results in 2018\ 2019 season followed similar trend. These results are in agreement with those of **Muhammad, *et al*., (2007**).

Data recorded in Table (4) show that spraying canola c.v. Serw4 with Fe + Mn applied under drip irrigation system significantly affected oil yield per feddan in both seasons. However, the highest oil yield per feddan was obtained at applying Fe + Mn at concentrate 300pm concentrate in both seasons. This concentrate gave 23.54%, 24.56% and 14.50% increase in seed yield over those of control, spraying canola plants with Fe + Mm 100 and 200ppm concentrates, respectively in 2017/ 2018 season. The respective values in 2018/ 2019 season were 14.98%, 20.43% and 15.32%. The highest oil yield under this concentrate, i. e, Fe + Mn 300ppm might be attributed to that its significant increasing in oil content % and seed yield as shown in Tables 2, 3 and 4. Similar results have also been reported by **Sarkar, *et. al*. 2007**.

The statistical analysis revealed insignificant effect of the interaction between nitrogen fertilizer rates and spraying with Fe + Mn on oil yield in both 2017/ 2018 and 2018/ 2019 seasons as shown in Table (4). However, the highest.

Nitrogen (N) management in canola growing is a key factor of achieving high yield and oil level. In crop rotation, canola growth following cereal crops, so the soil needs a balanced N fertilization. canola is not suitable crop to grow in monoculture cropping systems. Balanced nutrient budget in soil for canola production is a very important for N fertilization program. Therefore, the total N rate can be assessed based on the yield potential of canola variety and estimated soil nutrient supply during canola growing season in soil. Nitrogen requirement of canola plant can be estimated from the expected potential yield. Using high levels of N fertilization can increase seed protein rate and cause to reduce the oil content. However, oil content of canola crop may decrease for getting high seed yield from per ha. Using large amount of N fertilizer during canola growing season can decrease the oil content of the harvested crop. Unbalanced nitrogen fertilization in canola growing season may change harvested seed fatty acid profile and glucosinolate contents **(Süzer 2010).** According to the limitations of soil usage of micro-nutrients (such as consolidation and residual effects) foliar spraying or leaf feeding is one of the effective ways in resolve plants food requirement to micronutrients **(Wang *et al*., 2004).** High phosphorus in the soil, high pH, high lime, high soil moisture, cold temperatures and large amounts of HCO3 in root environment are the causes of Fe and Mn deficiency in the soil **(Sun *et al*., 2007).** If adequate and absorbable amounts of Fe are not available for the plant chlorophyll production in leaf decreases and the leaves become pale. It should be noted that not only Fe deficiency results in yellowish leaf, but also in some cases deficiency of nitrogen and some other nutrients, some pests and diseases and low light lead to pale leaf **(Singh, 2001).** Nano fertilizers are the most important function of nanotechnology in the production phase of agriculture.

Application of nano fertilizers instead of common fertilizers, nutrients are provided to plants gradually and in a controlled manner. The nanotechnology increases the application efficiency of fertilizers, reduces soil pollution and environmental risks of chemical fertilizers (**Naderi *et al*., 2011**). Nano materials are much smaller and lighter; they interact better in the environment and may be a solution for the problem of iron nutrition in saline and lime soils. Iron and manganese Nano oxide is smaller than the common iron and manganese oxides and forms more complexes and makes the Fe and Mn more available to plants (Mazaherinia *et al*., 2010). Fe and manganese deficiency is a widespread nutritional problem in plants growing mainly in high pH and calcareous soils. Foliar application of Fe and manganese compounds with the technology of Nano may be a solution to the problem (**Bakhtiari *et al*., 2015)**.

CONCLUSIONS

Nitrogen, iron and manganese uptake are controlled by the two major factors, availability of these elements in the soil and the ability of plants to acquire them. Application methods of N and micronutrients are very important to attain the best absorption. Sometimes response of the plants is different to application methods of fertilizers, for example in calcareous soil Fe and Mn are not available for plants, in this times, foliar application is a useful method for nourish of the plants. The results of this study demonstrated that, N, Fe and Mn used as a nanometric fertilizers had positive effect on yield and quality of canola oil. In addition to this, we also recommend that plants treated with 40 kg N +20% nano. N/ fed and sprayed with Fe + Mn at concentrations 300 ppm gave the best quality and quantity in canola production.

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تأثير السماد النانوي بالنيتروجين والعناصر الصغرى على المحصول ومكوناته في الكانولا

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اجريت تجربتان حقليتان خلال موسمي الزراعة 2018/2017 م و 2019/2018 م في جمعية الحسين لاستصلاح وزراعة الأراضي – الكيلو 64 طريق القاهرة الإسكندرية الصحراوي – محافظة الجيزة – مصر، لدراسة تأثير خمس معدلات من السماد النانوي النيتروجينى تكامليا مع السماد المعدنى التجارى وهى 10 كجم نيتروجين (معدني) + 20٪ من النيتروجين الموصي به في صورة سماد نانومتري (ن/فدان) ، 20 كجم (معدني) + 20٪ نانومتري ، 30 كجم (معدني) + 20٪ نانومتري ، 40 كجم (معدني) + 20٪ نانومتري و 50 كجم (معدني) + 20٪ نانومتري واربع معدلات من العناصر الصغرى وهى كنترول (رش النباتات بالموصي به بالحديد + المنغنيز) ، ورش النباتات بالحديد + المنغنيز في صورة أسمدة نانو مترية بتركيزات 100 ، 200 و 300 جزء في المليون ، على المحصول ومكوناته فى الكانولا صنف سرو4 ويمكن تلخيص اهم النتائج المتحصل عليها فيما يلى:

1- اظهرت النتائج تاثيرا معنويا لمعدلات السماد النيتروجينى على صفات المحصول ومكوناته فى كلا الموسمين كما اظهرت النتائج ان اضافة المعدل 40 كجم ن معدنى+ 20% نانومترى قد اعطى اعلى قيم لوزن ال1000بذرة ومحصول البذور/فدان بينما اعطى المعدل 50 كجم ن معدنى+ 20% نانومترى اعلى قيم لصفتى ارتفاع النبات وعدد الافرع /النبات فى كلا الموسمين
2- كمااظهرت النتائج ايضا تاثيرا معنويا موجبا لتركيزات العناصر الصغرى (الحديد+المنجنيز) على كل الصفات المدروسة فى موسمى النمو. واعطى الرش بالحديد+المنجنيز بتركيز300 جزء فى المليون اعلى قيم لكل الصفات المدروسة مقارنة باالكنترول فى موسمى النمو
3- كان للتفاعل بين معدلات السماد النيتروجينى (المعدنى+ النانومترى) وتركيزات العناصر الصغرى تاثيرا غير معنوى لمعظم الصفات المدروسة باستثناء صفتى وزن ال1000بذرة ومحصول البذور/ فدان فى كلا الموسمين وارتفاع النبات فى الموسم الثانى فقط . من النتائج السابقة يتضح ان استخدام السماد النيتروجينى تكامليا بمعدل 40 كجم ن معدنى+ 20% نانومترى مع الرش بالعناصر الصغرى(الحديد+المنجنيز) بتركيز 300 جزء فى المليون فى الصورة النانومترية قد ادى الى زيادة المحصول ومكوناته لمحصول الكانولا صنف سرو4 تحت ظروف ارض التجربة