J. Agric. Sci. Mansoura Univ. 28 (4): 3215 - 3226, 2003

EFFECT OF ORGANIC FERTILIZER (FYM) AND/OR SOME PERCENTAGES OF NPK FERTILIZER ON FENNEL PLANTS.

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ABSTRACT

An experimental field was conducted during two successive seasons 1999/2000 and 2000/2001 to evaluate organic fertilizer (FYM) at the rates of 0,6,12 and 18t/fed.alone or in combination with some percentages of (NPK) at 60%, 40% and 20%, respectively on fennel plants, where NPK (Ammonium sulfate 150kg+super phosphate 90kg+potassium sulfate kg) alone was considered as control. Plant height and branches number cleared insignificant increment with all of applied fertilizer levels, in comparison with control (NPK). The maximum values of two previously parameters were noticed when (FYM) 18t+20% NPK was applied during both seasons. Seed index and seed yield per plant and feddan were increased significantly as a result to all fertilization dosages, with the exception of the lowest FYM level (6t/fed.) which decreased them, compared to control. FYM at 18t+20%NPK/fed. revealed the highest quantities of three previously yield parameters too.

Total sugars was increased gradually with increasing of FYM levels, and reached to its highest value (56.07%) with FYM at the rate of 18t/fed., but the superior one (65.32%) was resulted with application of FYM18t+20% NPK/fed. comparing with control (51.67%). Insoluble sugars content resulted its highest one with FYM at 18t/fed. (48.23%), but the lowest level of FYM (6t/fed.) decreased it to 39.11%, compared to control (40.07%). Treatment of FYM at the rate of 12t/fed. gave greatest content of soluble sugars, which was increased according to all of applied doses. Total protein cleared a variation affect, it was decreased wit the lowest dose of FYM (6t/fed.), and was increased with other treatments. Regarding to essential oil percentage found that all used fertilization doses increased it significantly in comparison to control. Essential oil yield/plant showed the same trend of essential oil percentage, with the exception of FYM (6t/fed.) that decreased it. According to all of applied treatments N, P and K contents were increased expected of FYM that decreased nitrogen only. Micronutrients such as Fe, Mn and Zn contents were gradually increased with increasing of FYM levels, the other treatments increased them also. Meanwhile, Mg content had a variation affect, it was decreased with FYM at 12t/fed. when used as alone or combined with 40% NPK, but other doses increased it, in comparison with control.

Anethole is the main component of fennel seed volatile oil was gradually increased with increasing FYM levels, when applied as alone, and reached to its greatest value (84.06%) with highest FYM level (18t/fed.), but the superior content (84.58%) was resulted when FYM 18t+20% NPK/fed.was applied, with comparison to control (78.47%).

Keywords: Fennel, FYM, fertilizer, essential oil, chemical composition, anethole. organic fertilizer.

INTRODUCTION

There are many events that FYM as organic fertilizer plays an important act in the production of the crops. It is noticed that using of natural fertilizer such as FYM lead to clean products, which will be more safely on human

healthy. Besides the improving of soil structure, Gupta *et al.* (1983), Bharadwaj and Omanwar (1992), who reported that farmyard manure increased water-holding capacity of soil. In addition El-Kassas (1999) in a field experiment, illustrated that farmyard manure decreased the soil contents of lead, cadmium and nickel, he added that soil organic matter content was increased with increasing organic manure application. Zaniewicz (2000) studied the residual effect of farmyard application in a long term after treatment in field trials, he found that cadmium and lead contents in lettuce and available forms of cadmium in soil were decreased in the third year after organic fertilization.

Fennel plants are known by fennel, it has an old Egyptian name is *Foeniculum vulgare* L. Its cultivation widely too in European countries such as Germany and south France, and it is cultivated also in Rusha, Japan, America and India. The ripe fruits are used for extracting essential oil that contains two important compound anethole and fenshone, it also contains phellandrene, β -pinene, camphene and farnesol. Fennel fruits are used for treating diseases like cholera bile disturbances, nervous disordered, constipation, dysentery and diarrahoea (Leung and Foster, 1996). Also fennel fruits are widely used in the preparation of various dishes like soups, sauces, pastries, confectioneries, pickles and meat dishes etc. (Bhati *et al.*, 1988). It is still widely used in traditional Arabian medicine as diuretic appetizer and digestive (Karnick, 1994).

The aim of present work is to evaluate the effect of organic fertilizer (FYM) as alone or in combination with some percentages of NPK on the yield, seed chemical constituents, essential oil and volatile oil components of fennel plants.

MATERIALS AND METHODS

Two field experiments were coducted during two successive seasons 1999-2000 and 2000-2001 at the experimental station of NRC at Shalakan, Kalubia Governorate. Farmyard manure was added to the soil at rates of 0, 6, 12 and18 ton/feddan before sowing by two weeks. Fennel (*Foeniculum vulgare* L.) seeds were obtained from Hort. Dep., Ministry of Agriculture, and sown 25 cm. Apart on rows between 35 cm at 17th October during both seasons. After one month the seedlings were thinned and the healthy plant was left. Recommended NPK dose (ammonium sulfate 140kg+ super phosphate 90kg + potassium sulfate 50kg)/fed.which considered as control was divided in two equal portions, the first one was added one month after sowing, and the second half was done one month later. In the same previously time of NPK addition 60%, 40% and 20% of NPK were added to treatments of 6, 12 and 18t /fed., respectively in combination with FYM.

Seven treatments of the applied fertilization were arranged in a complete randomized block design with three replicates, plot area was 10 m^2 (5.0 m in length and 2.0 m in width), with five rows. Mechanical and chemical analyses of soil under investigation and FYM analysis were shown in Table (A).

Table (A): Analyses of soil and farmyard manure (average of two seasons).

Characters	Soil properties %	Soluble anions and cations(mg/L)	Avialable Nutrients (ppm)
Clay	63.9	-	-
Silt	25.8	-	-
Sand	10.3	-	-
Texture	Clay loam	-	-
PH	8.75	-	-
E.C (m.mhos/cm)	1.07	-	-
Ca^{++}	-	0.97	-
Mg^{++}	-	1.73	-
Na^{+}	-	3.14	-
K^{+}	-	1.16	-
P^{-}	-	-	0.05
Mn	-	-	3.85
Zn	-	-	2.16
Fe	-	-	7.35
N	-	-	0.45
Farmyard manure analysis :			
Characters	**Soil properties %**	**Soluble nutrients %**	**Available nutrients (ppm)**
Ash	46.59	-	-
Organic carbon	32.35	-	-
Organic matter	54.79	-	-
C/N ratio	22.31	-	-
PH	7.69	-	-
E.C(m.mhos/cm)	5.31	-	-
K	-	0.57	2789
P	-	0.51	563
N	-	1.45	907

At the harvest date 15th May, plant height, branches number, seed index (100 seed weight) and seed yield per plant and feddan were estimated in both seasons. Chemical analysis of both seasons were conducted to determine sugars contents (Dubois *et al.*, 1956), essential oil (Guenther, 1961), total nitrogen (modified Micro-Kjeldhal method according to A.O.A.C., 1980), phosphorus (Chapman and Pratt, 1978), potassium (Cottenie *et al.*, 1982) and microelements Fe, Mg, Mn, and Zn (A.O.A.C., 1990). Total protein percentages were calculated as total nitrogen fixed in 6.25.

The collected samples of volatile oil from each treatment (both seasons mixture) was dehydrated with sodium sulfate anhydrous, then subjected to GLC analysis with Varian VISIS 6000 FID model. The separation was carried out with 2m x1/8 U stainless steel, 3% OV-101 column. The flow rate of carrier gas (nitrogen) was maintained at 50 L/min. The column temperature was programmed from 80-2000c/min. at the rate of 40c/min. The injection part temperature was maintained at 180 °C and detected at 240 °C. The relative percent of the different compounds was determined with Varian 4270 integrator, and identification of the separated compounds was achieved by

matching the retention times of these compounds with those of standard compounds under the same conditions.

The data were subjected to statistical analyses according to Snedecor and Cochran (1990). The L.S.D values were assessed when ever values at 0.05 levels were significant.

RESULTS AND DISCUSSION

Yield parameters:

Data tabulated in Tables (1) and (2) showed that all treatments had no significant effect on plant height as well as branches number, while most of these treatments increased significantly seed index, seed yield/plant and seed yield/feddan. The lowest level of FYM (6t/fed.) depressed the content of all previously parameters, compared with control (NPK100%) fertilization. The combination treatment of 12 and18t/fed.levels FYM gave the same trend on yield parameters. The maximum values of plant height, branches number, 100seeds wt.and seed yield per plant and fed.were recorded when dose of FYM 18t+20% NPK/fed.was applied, (117.8 cm, 8.5, 1.43gm, 62.53gm and 1125.59kg) respectively, compared with control (104.3cm, 7.3, 1.05gm, 49.35gm and888.30kg) respectively, in first season.

Table (1): Effect of FYM and/or with some percentages of NPK on yield parameters of fennel plants (First season).

Characters / Treatments	Plant height (cm)	Number of branches	Seed Index (gm)	Seed Yield/ plant (gm)	Seed Yield/ fed. (kg)
(NPK) control	104.3	7.3	1.054	49.35	888.30
(FYM) 6t/fed.	100.1	6.9	0.97	47.14	848.52
(FYM)6t+60%NPK/fed.	110.7	7.7	1.12	55.91	1006.38
(FYM) 12t/fed.	113.5	7.9	1.23	56.36	1014.48
(FYM)12t+40%NPK/fed.	114.2	8.2	1.29	56.74	1021.32
(FYM) 18t/fed.	116.1	8.4	1.35	60.47	1088.46
(FYM)18t+20%NPK/fed.	117.8	8.5	1.43	62.53	1125.59
LSD at 5%	N.S	N.S	0.30	2.69	8.11

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

Regarding to Table (2), it is found that the data of the second season gave the same trend as described for first season, but there were very slight differences in the contents of yield parameters.

The presented results were in harmony with those obtained by Kopanski and Kawecki (1994) on strawberry, they cited that farmyard manure at 40t/ha plus N at 30kg/ha, increased plant height and yield/ha. Mallanagouda *et al.* (1995) with chilli, they found that FYM with recommended NPK, gave highest DW/fruit of *Capsicum annum*, and so on the number of fruits. Sreenivas *et al.* (1998), applied FYM at 15t/ha as alone or combined with NPK at the recommended rate on *Callistephus chinensis*,

and reported that plant height and numbers of leaves and flowers/plant were greatest with FYM+ NPK at the recommended rate. Gawande *et al.* (1998), they recorded that (NPK) at the recommended rate + 50kg FYM/tree of sapota, produced the highest number of fruits per tree and the highest average weight of fruits too. They added that fruit length, diameter and TSS content were also greatest.

Table (2): Effect of FYM and/or with some percentages of NPK on yield parameters of fennel plants (Second season).

Characters / Treatments	Plant height (cm)	Number of branches	Seed Index (gm)	Seed Yield/ plant (gm)	Seed Yield/ fed. (kg)
(NPK) control	103.7	7.2	1.10	50.13	902.34
(FYM) 6t/fed.	101.4	7.0	1.03	48.31	869.58
(FYM)6t+60%NPK/fed.	109.8	7.8	1.14	55.79	1007.46
(FYM) 12t/fed.	114.3	7.9	1.33	56.45	1016.10
(FYM)12t+40%NPK/fed.	115.1	8.3	1.39	56.93	1024.74
(FYM) 18t/fed.	115.9	8.1	1.41	60.51	1089.18
(FYM)18t+20%NPK/fed.	117.5	8.7	1.51	62.75	1129.50
LSD at 5%	N.S	N.S	0.33	2.71	8.23

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

Maheswarappa *et al.* (1999) reprinted that farmyard manure combined with NPK resulted the highest rhizome yield of galangal (*Kaempperia galangal*). Jablonska *et al.* (2000), they published that cultivation of cabbage after farmyard manure and field peas showed the highest content of dry matter. Finely Eneji *et al.* (2001), they cleared that cattle manure increased significantly rice grain yield and 100 grains weight.

From the above results it could be noticed that adding NPK to FYM, resulted more affect comparing with FYM alone. In this respect NPK application stimulates physiological processes and induce more cell division and enlargement more vegetative growth and heavier dry matter (Devlin, 1975).

Seed chemical composition:

Looking to Table (3) it was noticed that all of applied fertilization doses enhanced total sugars significantly, compared to control (NPK). The maximum content of total sugars (65.32%) was observed as a result of FYM 18t plus 20% NPK/fed., followed by FYM at the rate of 18t/fed.which gave 65.07% in comparison with control (51.67%). Increasing of FYM levels increased total sugars values when applied as alone. Meanwhile soluble sugars content were increased significantly too, but the highest content 19.73% was cleared with FYM at 12t/fed.,and followed by FYM 18t/fed.+20%NPK/fed.(19.42%),compared with control (11.40%). Insoluble sugars content showed an increment according to all treatments, excepted with the dose of FYM (6t/fed.), which decreased it. Crude protein cleared a resemble

effect of insoluble sugars, but the highest one was resulted by FYM 18t+20%NPK/fed. (23.50%), followed by 22.25%, rebacked to the dose of FYM 12t plus 40%NPK/fed.,compared with control 18.69%. Essential oil percentages showed a significant increment as a result of treatments. It is noticed that this increment was gradually increased with the increasing of FYM levels. The highest essential oil percentage was resulted when FYM 18t+20%NPK/fed.was applied. Essential oil yield/plant was enhanced significantly according to all of applied treatments, with the exception of FYM at 6t/fed.which decreased it. In this connection FYM at 18t/fed.gave higher content than that of 12t/fed. The greatest quantity (1.394ml)/plant was resulted with the highest level FYM (18t/fed.), when combined with 20%NPK/fed.,compared with control (1.017ml). Previously results of first season were in agreement with those obtained in the second one, which were arranged in Table (4).

Table (3): Effect of FYM and/or with some percentages of NPK on some chemical constituents fennel seed (First season).

Characters / Treatments	Total sugars %	Insoluble sugars %	Soluble sugars %	Crude protein %	Essential oil %	Essential oil yield/ plant (ml)
(NPK) control	51.67	40.07	11.40	18.69	2.06	1.017
(FYM) 6t/fed.	58.36	39.11	19.25	18.25	2.09	0.985
(FYM)6t+60%NPK/fed.	59.98	47.30	12.68	19.06	2.20	1.230
(FYM) 12t/fed.	63.62	43.89	19.73	18.94	2.19	1.234
(FYM)12t+40%NPK/fed.	64.67	46.53	18.14	22.25	2.18	1.237
(FYM) 18t/fed.	65.07	48.23	16.84	21.75	2.21	1.336
(FYM)18t+20%NPK/fed.	65.32	45.980	19.42	23.50	2.23	1.394
LSD at 5%	2.03	2.13	0.09	0.87	0.008	0.31

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

Table (4): Effect of FYM and/or with some percentages of NPK on some chemical constituents fennel seed (Second season).

Characters / Treatments	Total sugars %	Insoluble sugars %	Soluble sugars %	Crude protein %	Essential oil %	Essential oil yield/ plant (ml)
(NPK) control	51.93	40.13	11.80	18.50	205	1.028
(FYM) 6t/fed.	58.46	39.31	19.15	17.94	2.10	1.015
(FYM)6t+60%NPK/fed.	60.01	47.35	12.66	19.13	2.19	1.226
(FYM) 12t/fed.	63.72	43.97	19.75	19.00	2.21	1.248
(FYM)12t+40%NPK/fed.	64.87	46.74	18.13	22.31	2.19	1.247
(FYM) 18t/fed.	65.19	48.09	17.10	21.81	2.20	1.210
(FYM)18t+20%NPK/fed.	65.53	45.78	19.75	23.44	2.22	1.393
LSD at 5%	2.05	2.19	0.11	0.89	0.009	0.34

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

The obvious results are in agreement with those obtained by many investigators, such as Kopanski and Kaweski (1994), who recorded

increasing in total sugars of strawberries by application FYM plus N fertilization, and Jablonska *et al.* (2000), on cabbage and they illustrated that farmyard manure resulted the highest content of monosuccharides. Rao *et al.* (1997) showed that application of FYM at the rates of 15 and 30 ton/ha.to davana plants resulted increments in essential oil. Khan *et al.* (1999) added that N and P fertilizer when used as soil or foliar caused increments in essential content of fennel. The increment of oil yield/plant or/fed. may be due to the increment of seed yield/plant or/and essential oil content (%). Moreover, El-Desuki *et al* (2001) on sweet fennel and El-Khawwas (2002) on black cumin retrieved such findings.

Macro and microelements:

It appears from Table (5), that N, P and K contents were increased according to application of farmyard manure with the exception of dose (6t/fed.) which decreased N content only compared with control. The greatest value of N content was noticed (3.76%0) with the combined treatment of FYM 18t plus 20%NPK/fed.,followed by (3.56%) at FYM 12t plus 40% NPK/fed.,in comparison with control (2.99%). The maximum content of P mean value (0.099%), was appeared when the treatment of FYM at dose (12t/fed.) was applied, compared with control (0.090%). The highest increase of K content (2.35%) was observed, when FYM 18t+ 20%NPK/fed.was applied compared to control 1.96%. It is noticed that the contents of P were very nearly with this obtained of control. Table (6), showed that results of second season were in the same trend of first one of Table (5).

Table (5): Effect of FYM and/or with some percentages of NPK on minerals of fennel seeds. (First season).

Characters Treatments	N %	P %	K %	Fe %	Mg %	Mn %	Zn %
(NPK) control	2.99	0.090	1.96	0.040	0.560	0.495	0.279
(FYM) 6t/fed.	2.92	0.092	1.98	0.045	0.691	0.499	0.315
(FYM)6t+60%NPK/fed.	3.05	0.093	1.99	0.055	0.681	0.521	0.329
(FYM) 12t/fed.	3.03	0.094	2.19	0.058	0.513	0.543	0.357
(FYM)12t+40%NPK/fed.	3.56	0.096	2.09	0.063	0.533	0.579	0.385
(FYM) 18t/fed.	3.48	0.097	2.08	0.068	0.578	0.589	0.391
(FYM)18t+20%NPK/fed.	3.76	0.099	2.35	0.075	0.628	0.614	0.423

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

Previously results are in harmony with those published by Patel *et al.* (1991), they cited that application of FYM at dose of 25t/ha produced significant increase in NPK contents of chicory leaves and roots. Rao *et al.* (1997) on davana plants and El- Tapey (2002) on maize, they indicated that FYM as alone or combined with inorganic fertilizer increased uptake of NPK. Tables (5) and (6), showed the results of microelements of fennel seed during both seasons, as affected by FYM as alone or in combination with some percentages of inorganic fertilizer. Fe content was increased gradually by

increasing FYM levels, the maximum level of FYM 18t in combined with 20%NPK/fed., resulted the greatest quantity of Fe, meanwhile Mg content resulted its highest value with applied dose of FYM at rate 6t/fed., but rate of FYM at 12t/fed.when applied as alone or in combination with 40%NPK depressed Mg content. On the other hand both of Mn and Zn contents revealed the same trend of Fe, and it is noticed that the highest contents of Mn and Zn were produced with the same treatment which gave the highest content of Fe too.

Table (6): Effect of FYM and/or with some percentages of NPK on minerals of fennel seeds. (Second season).

Characters / Treatments	N %	P %	K %	Fe %	Mg %	Mn %	Zn %
(NPK) control	2.96	0.091	1.99	0.041	0.563	0.497	0.2873
(FYM) 6t/fed.	2.87	0.093	2.01	0.044	0.692	0.519	0.314
(FYM)6t+60%NPK/fed.	3.06	0.094	2.03	0.053	0.679	0.503	0.331
(FYM) 12t/fed.	3.04	0.095	2.20	0.059	0.517	0.539	0.353
(FYM)12t+40%NPK/fed.	3.57	0.097	2.11	0.061	0.541	0.581	0.391
(FYM) 18t/fed.	3.49	0.099	2.06	0.067	0.583	0.593	0.402
(FYM)18t+20%NPK/fed.	3.75	0.103	2.29	0.078	0.632	0.623	0.419

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

Many investigators recorded harmony results with those obtained in presented work. Doran and Kaya (1998) on loquat) *Eriobotrya jaonica* L.), they established that FYM increased Fe content of leaves, Eneji *et al.* (2001) showed that cattle manure increased the extractable micronutrients (Fe, Mn, Zn and Cu) when applied on rice plants.

Essential oil components:

Table (7) indicated that essential oil components of seed fennel consisted of β -pinene, phellandrene, camphene, fenshone, anethole and farnesole according to GLC analysis. Presnted results are in agreement with those obtained by Eisa *et al.* (1992), they cited that GLC analysis of seed fennel essential oil resulted the same arrangement of previously components, and added the following quantities, 5.46%, 4.70%, 3.39%, 6.64%, 76.85% and 3.89% for the arranged components, respectively. Presented results showed that all of applied doses increased β -pinene, but it is noticed that the increasing of FYM as alone depressed this increase gradually. Phellandrene, fenshone and farnesole were decreased with all of fertilization treatments in comparison to control, but dose of FYM 18t plus 20% NPK/fed. revealed the highly depression of three previously components (2.21%, 2.96% and 0.79%), respectively, compared to control that had the amounts of 4.31%, 6.97% and 2.73%, respectively.

Camphene content was increased as a result of all applied doses, with the exception of FYM at the rate 12t/fed. which decreased it. Anethole showed increasing with all applied treatments, this increase was gradually

increased with the increasing of FYM levels as alone or in combination with the used percentages of NPK. The greatest quantity of anethole (84.58%0 was obtained when FYM 18t + 20%NPK/fed. was applied, compared to control (78.47%). From previously illustrated results, it is cleared that anethole (phenylpropanoid) content was increased on the expense of phellandrene, fenshone and farnesole compounds.

Presented results are in agreement with those obtained by Khan *et al.* (1999), who illustrated that soil and foliar levels of N and P enhanced aethole content and decreased both of phellandrene and fenshone contents of fennel essential oil, when analyzed by GLC.

Table (7): Effect of (FYM) and/or with some percentages of NPK on essential oil components of fennel sed.

Treatments / Compounds	Control NPK	(FYM) 6t/fed.	(FYM) 6t+60 %NPK	(FYM) 12t/fed. %NPK	(FYM) 12t+40 %NPK	(FYM) 18t/fed.	(FYM) 18t+20 %NPK
β- pinene	4.07	6.486.48	6.73	6:24	5.05	4.87	5.11
Phellandrene	4.31	3.20	3.22	3.21	2.23	2.27	2.21
Camphene	3.45	4.24	3.99	3.05	4.51	4.55	4.35
Fenshone	6.97	3.35	3.20	2.47	2.97	3.22	2.96
Anethole	78.47	80.82	81.10	83.77	83.89	84.06	84.58
Farnesole	2.73	1.91	1.76	1.26	1.35	1.03	0.79

Control (NPK)= Ammonium sulfate 150kg + super phosphate 90kg + potassium sulfate 50kg.

CONCLUSION

The increments of fennel yield parameters and seed chemical composition may be return to FYM (organic fertilizer) that could increase water holding capacity and cations exchange. It also added structure, stability and permeability to soils which high in clay. Organic matter is a source of nutrients that usually slow released as son as it decomposed. It is also a buffer against pH change, protects against plant diseases, heavy metals and salt toxicity, detoxifies pesticides and prevents their leaching. In addition, it promotes microbial breakdown of toxic substances and supports microorganisms that recycle nutrient and soil formation (Varanini and Pinton, 1995). The previously properties indicated that organic fertilizers are possible for successful growth of most plants.

Presented results recommended the use of farmyard manure at the rate of 18ton/feddan as alternative to mineral fertilizer for fennel plants, because of that dose produced highly values of seed production, chemical constituents, macro and micronutrients and essential oil. Beside it had the greatest value of anethole content that considered the main component of volatile oil. In addition the previously level of FYM cleared very closed results to its application in combined with 20% of recommended mineral fertilizer for fennel plants.

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تأثير السماد العضوى(مخلفات حيوانات المزرعة) إما منفردا أو مجتمعا مع بعض النسب من السماد المعدنى(ن، فو، بو) على نباتات الشمر

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فى تجربة حقلية خلال موسمين متتاليين ١٩٩٩/٢٠٠٠، ٢٠٠٠/٢٠٠١ تم تقييم السماد العضوى بنسب(٠، ٦، ١٢ و١٨طن/فدان) إما منفردا أو مجتمعا مع بعض نسب السماد المعدني(ن،فو،بو) كالتالى (٦٠%،٤٠%و٢٠%) على التوالي ، مع استخدام السماد المعدنى الموصى به (١٥٠كجم سلفات أمونيوم، ٩٠كجم سوبر فوسفات ،٥٠كجم سلفات بوتاسيوم) كاكونترول. وقد أظهرت النتائج زيادة فى أطوال النباتات والأفرع زيادة غير معنوية مع جميع المعاملات السمادية المستخدمة، وكانت أعلى قيم لهاتين الصفتين تبعا للمعاملة١٨ طن (FYM) + ٢٠ % من السماد المعدنى /فدان والمستخدم ككونترول وذلك خلال الموسمين. وقد زاد كلا من وزن المائة بذرة وكذلك إنتاج البذور للنبات والفدان زيادة معنوية تبعا لجميع المعاملات فيما عدا المعاملة ٦طن/فدان من السماد العضوى والتى أدت إلى نقص محتوى هذه الصفات السابقة الذكر ، وذلك مقارنة بالكونترول. كما أعطى المستوى ١٨ طن (FYM)+ ٢٠% NPK أعلى القيم لهذه الصفات.

وقد زاد محتوى السكريات الكلية بالبذور تدريجيا مع زيادة مستوى التسميد العضوى ، كما زاد أيضا مع باقى المعاملات المستخدمة حتى وصل لأعلى قيمة له مع نفس المعاملة التى أعطت أعلى قيم للإنتاج. كم أدت أيضا جميع المعاملات إلى زيادة محتوى السكرات الذائبة بالبذور، والذى أظهر أعلى زيادة له عند تطبيق المستوى ١٢ طن/فدان من السماد العضوى. كما أدت أيضا جميع مستويات التسميد المستخدمة بالتجربة إلى زيادة محتوى السكرات الغير ذائبة ، باستثناء المستوى٦ طن/فدان (FYM) والذى أدى إلى نقص محتواه وذلك مقارنة بالكونترول. أظهر محتوى البروتين الكلى للبذور تأثرا مختلفا تبعا للمعاملات التسميدية المختلفة، حيث أظهر زيادة فى مستواه إلا مع المعاملة ٦طن/فدان من السماد العضوى والذى أدى إلى نقص محتوى البروتين الكلى بالبذور.

وقد أدت جميع المعاملات إلى زيادة نسبة الزيت العطرى للبذور زيادة معنوية. وكذلك أظهر إنتاج النبات من الزيت العطرى نفس تأثير النسبة المئوية له فيما عدا المعاملة ٦طن/فدان (FYM) والتى أدت إلى نقص إنتاج الزيت العطرى للنبات، وذلك عند المقارنة بالكونترولNPK . زادت جميع المعاملات أيضا من محتوىNPK بالبذور فيما عدا المعاملة ٦طن/فدان من السماد العضوى التى أدت إلى نقص محتوى النتروجين. أما بالنسبة لمحتوى البذور من العناصر الصغرى (حديد، منجنيز، زنك) فقد زاد محتواها تدريجيا مع زيادة مستوى التسميد العضوى، وكذلك أيضا أدت جميع المعاملات المجتمعة من السماد العضوى والمعدنى إلى زيادة محتواها بالبذور مقارنة بالكونترول. فى حين زاد محتوى الماغنسيوم تبعا لجميع المعاملات ، فيما عدا مستوى التسميد العضوى ٦طن/فدان إما منفردا أو مجتمعا مع ٤٠% من السماد المعدنى/فدان والذى أدى إلى نقص محتواه.

زاد الأنيثول (المكون الرئيسى) للزيت العطرى للشمر زيادة تدريجية مع زيادة مستويات التسميد العضوى منفردا حتى وصل أعلى قيمة له (٦٠و٨٤%) مع أعلى مستوى من التسميد العضوى (١٨طن/فدان). بينما كان أعلى محتوى للأنيثول (٥٨و٨٤%) عند تطبيق المعاملة السمادية ١٨طن (FYM) + ٢٠% (NPK) /فدان مع المقارنة بالكونترول والذى أعطى ٤٧و٧٨%من الأنيثول.