Australian Journal of Basic and Applied Sciences, 4(5): 948-956, 2010
ISSN 1991-8178

The Enhancement of Plant Growth, Yield and Some Chemical Constituents of Dill (*Anethum Graveolens*, L.) Plants by Filter Mud Cake and Potassin Treatments

[1]Hassan, E.A., [2]Ali, E.F, and [1]Ali, A.F,

[1]Hort .Dept.Fac.Agric.Al-Azhar Univ. Assiut
[2]Hort .Dept.Fac.Agric. Univ. Assiut

Abstract:A field experiment was conducted during two successive seasons 2007/2008 and 2008/2009 to determine the influence of filter mud cake; 4, 8 and 12 m^3/fed and potassin; 3, 6 and 9 ml/L and their combinations on vegetative growth, yield, volatile oil (percentage & yield), nitrogen, phosphorus and potassium (percentages & content) of *Anethum graveolens* plants. The obtained data showed that plant height, branch number, herb dry weight, umbels number, seed yield/plant and per fed., volatile oil (percentage & yield), N, P and K (percentages & contents), were generally increased as a result of applying filter mud cake. The highest values of the previous parameters were observed due to applying the high rate of filter mud cake (12 m^3/fed.). In regard to potassin treatments, it was noticed that all of concentrations used led to a significant increase in plant height, branch number, herb dry weight, umbels number, seed yield (plant & fed.) volatile oil (percentage & yield per plant and per fed.), N, P and K (percentages & content). The highest values of the previous characteristics were obtained with potassin at high concentration. Generally, the combined effect among filter mud cake and potassin treatments on *Anethum graveolens,* L. plants parameters were statistically significant. In most cases, the addition of high rate of filter mud cake plus high concentration of potassin was the most effective treatments in increasing these parameters.

Key words: filter mud cake, potassin, dill and *Anethum graveolens*

INTRODUCTION

Anethum graveolens, L., is believed to have its beginnings in the Mediterranean region. The plant has a long and ancient history in many countries as a culinary and medicinal herb. The earliest known record of dill as a medicinal herb was found in Egypt 5,000 years ago when the plant was referred to as a "soothing medicine." Gladiators were fed meals covered with dill because it was hoped that the herb would grant them valor and courage. Dill seeds are often called "meetinghouse seeds" because they were chewed during long church services to keep members awake or kids quiet. The seeds were also chewed in order to fresh the breath and quiet noisy stomachs. Dill was believed to provide protection from witchcraft, most likely because of its strong smell. Charms were often made from sprigs of dill to provide protection from witchcraft; they were hung around the house or worn on the clothing. Dill was often added to love potions and aphrodisiacs to make them more effective. Plant essential oils are potential source of antimicrobials of natural origin (Valero & Giner, 2006). Essential oil plants include a wide range of plant species, mainly used in the preparation of perfumes, cosmetics, beverages, medicinal foods, disinfectants, insecticides, fungicides, smoking, chewing, tobacco and condiments.Essential oils are extracted from aromatic plants of many genera, which are distributed worldwide. These oils are found in various parts (seeds, leaves, fruits barks & roots) of aromatic plants. English people name *Anethum graveolens* as dill and in subcontinent it is called as sowa. It is used as flavoring and preservative agent. Its medicinal uses are as an antispasmodic, carminative, diuretic, stimulant and stomachic (Simon *et al.,* 1984). Some of the earlier studies had shown the antimicrobial activity of *Anethum graveolens* against *Saccharomyces cerevisia* and *Listeria monocytogenes* (Pascal *et al.,* 2002). Keeping in view this fact it was hypothesized that *Anethum graveolens* can have antimicrobial activity against other microbes.

Sugar-cane filter mud is considered as one of the residue which is produced in great amounts (by product obtained from the clarification of cane juice in the sugar industries). It makes about 3-4 % of total sugar cane yield, with an estimated amount of about 380.000 ton/year, coming from 10795000 ton sugar can/year

Corresponding Author: Hassan, E.A.,Hort .Dept.Fac.Agric.Al-Azhar Univ. Assiut
E-mail: essamaly1973@yahoo.co.uk

(statistical year book of A.R.E, 1994). These residues represent a problem in getting disposed. Therefore, it is necessary to try to use it as an organic fertilizer and soil amendment, because it contains a considerable amounts of N, P, K and micronutrients; Charles (1991), Arafat *et al* ., (1992), Zaid and Kriem (1992), Ahmed *et al*., (1996), Mansour and Ahmed (1998) and Ali *et al*., (2002).

As filter mud contains about 1% by weight of phosphate (P_2O_5), it has been used especially since the turn of the century, as fertilizer. Agricultural researchers have always presumed that the material acted primarily as a source of phosphate and that in addition the nitrogen content (about 1%) could be to some extent of benefit in the growing of cane. Mohamed and Ahmed (2002) applied filter mud cake at 5, 7.5 and 10 ton/fed. and they pointed out that these treatments led to a significant increase in plant height, leaves number, plant fresh weight, nitrogen, phosphorus and potassium contents in sweet fennel bulbs. Shalan (2001) investigated the effect of nitrobein, nitrogen fertilizer; 40 or 60 kg N/fed. combined with potassin (foliage spray) or potassium sulfate; 50 or 100 kg/fed.) on roselle plants. He demonstrated that nitrogen and potassium at different levels increased plant height, number of branches, number of fruit/plant, sepal weight (fresh & dry), anthocyanin, sugars and protein contents of sepals. Potassin as a source of potassium resulted in a high significant increases in most parameters; branch number, fruit number/plant, acidity, as well as anthocyanin, sugars and protein contents.

Yanishevskii and Dzhaparidze (1990) revealed that receiving the plants potassium fertilizer gave the highest average of leaves (18.6 kg/ha) compared to control plants. Amin (1997) studied the effect of NPK fertilizer (300 kg ammonium sulfate + 100 kg calcium superphosphate + 100 kg potassium sulfate) on the growth of coriander (*Coriandrum sativum*), fennel (*Foeniculum vulgare*) and caraway (*Carum carvi*). He reported that plant height, number of branches, number of umbels and seed yield per plant. The highest values for yield parameters in all three crops were obtained with the full dose of inorganic fertilizer. A similar trend was observed for oil percentages in seeds of all three crops. Bhuvaneshwari *et. al.,* (2003) assessed the influence of two levels of potassium (30 and 60 kg/ha) on the growth of anise and cleared that there are significant differences as a result of using potassium treatments with respect to growth characters like plant height, number of leaves and essential oil yield.

Yanishevskii and Dzhaparidze (1990) two container trials and one field trial were carried out over 2 years with K in 5 different forms applied at 100 mg/kg soil. In all the trials, receiving the plants potassium gave the highest average leaf yield.

Also, concerning potassium fertilization, other researchers reported that, potassium fertilization increased most vegetative parameters, fruit yield, oil yield, as well as chemical constituents in fruits and leaves especially K content in fennel and other umbillefiree plants; Kandil *et. al., (*2001), Abdou *et. al.,* (2004) and Menaria and Maliwal (2007).

MATERIALS AND METHODS

The present investigation was carried out at the Floriculture Experimental Farm of Faculty of Agriculture, Al-Azhar University, Assiut, Egypt during the two successive seasons of 2007/2008 and 2008/2009. The objectives of this work aimed to study the responses of *Anethum graveolens* plants to filter mud cake and potassin which may affect its growth and/or yield as well as chemical constituents. A spite plot design with four replicates was followed in this study, filter mud cake treatments; F1 = 4 F2 = 8 and F3 = 12 m3/fed. were the main plots, while potassin; (KO2 30%) 3, 6 and 9 ml/L were accepted the sub plots. On 30th October, fruits of dill were sown in experimental units, each was 3.6 × 3.2 square meter including 6 rows with 60 cm apart and each row contained five hills at 40 cm distance in one side. After eight weeks, the thinning was done leaving one seedling/hill. All treatments received calcium suberphosphate (300 kg/fed.) as a basal dressing. Physical and chemical properties of the experimental soil and filter mud cake are shown in Tables (1&2). All agricultural practices were performed as usual. At the end of the experiment, (April 15th and April 7th for the first and second seasons, respectively.) The following data were recorded: plant height, number of branches/plant, herb dry weight (g)/plant, number of umbels/plant, seed yield (g)/plant and the seed yield/fed. was calculated.

Data Were Recorded as Follows:

Vegetative characteristics. were plants height (cm), number of branches, dry weights of herb (g/plant), umbels number, fruit yield / plant and per fed.was calculated.

Volatile oil in the seeds was determined according to Guenther (1961). Oil yield (ml/plant) was calculated by multiplying the oil percentage by the fruit yield per plant, them a yield / fed. Was calculated

Determination of Some Nutrient Content:

The sample (0.5g) was performed to determine nutrient content according to Jackson (1978). Nitrogen percentage in leaves, and fruits was determined in the digestion using the micro-Kjeldhl method (Black *et. al*., 1965). Phosphorus percentage was determined calorimetrically using the stannous chloride phosphomolibdic-sulforic acid system and measured at 660 nm wavelength according to Jackson (1978).Potassium percentage was determined using a flame photometer as described by Jackson (1978).The obtained data were statistically analyzed according to Snedecor and Cochran (1973).

Table 1: Physico-chemical properties of the used soil.

Texture	pH	E.C.(ds/m)	$CaCO_3$%	Available nutrients (ppm)			Water soluble Ions (meq/L) in the soil paste				
				N	P	K	Ca	Mg	CO_3 + HCO_3	CL	SO_4
Loamy	7.9	1.2	2.7	62.4	9.2	356	3.4	1.9	2.9	2.2	6.6

Table 2: Chemical analysis of filter mud cake (F. M. C.)

O.M.	C%	N%	P%	K%	C/N ratio	Zn ppm	Fe ppm	Mn ppm	Cu ppm	PH
75.43	46.16	2.04	0.38	0.58	22.77	193.05	4315.5	275.4	20.99	6.05

RESULTS AND DISCUSSION

Vegetative Growth:

Plant Height:

Data presented in Table (3) revealed that plant height of *Anethum graveolens* was significantly influenced by filter mud cake treatments in the two experimental seasons. From the obtained results it could be noticed that by increasing the rates of filter mud used, the plant height was augmented therefore, the tallest plants were obtained due to receiving the plants high rate of filter mud cake which increased the plant height by 16.15 and 18.32 % over the check treatment in the first and second seasons, respectively. The role of filter mud on increasing plant height was previously mentioned by Ali *et al* (2002) and Mohamed and Ahmed (2002).

As for potassin treatments, data in Table (3) showed that all of them caused a significant increase in plant height of *Anethum graveolens* in both seasons. Foliar spray with potassin at high concentration gave the best results of plant height in comparison with untreated ones in the two consecutive seasons. This above concentration used reached 8.63 and 9.13 % over the control plants in the two growing seasons, respectively.

Concerning the interaction effect between filter mud and potassin treatments, it was significant on plant height of *Anethum graveolens* in the two successive seasons. It seems that the most effective treatments of plant height were observed when fertilizing the plants with Filter mud at the high rate plus spraying the plants with potassin at high concentration followed by medium concentration compared to other combination treatments in the first and the second seasons, as clearly declare in Table (3).

Number of Branches:

Table (3) indicate that supplying *Anethum graveolens* plants with filter mud cake at all rates led to a significant augment in branch number for the two seasons. It is clear that number of branch were significantly increased by increasing the rates of filter mud used. Therefore, utilizing of the high rate of filter mud recorded highest number of branches ranged 91.92 and 93.42 % than two experimental seasons, respectively.

In regard to potassin treatments data in Table (3) pointed out that branch number of *Anethum graveolans* was significantly influenced by all concentrations used of potassin in the two growing seasons. The data reveal that adding of high concentration of potassin gave maximum number of branches which increased it by 25.96 and by 28.86 % over the control treatment in the first and the second seasons, respectively.

The combined effect between the two factors on branch number of *Anethum graveolans* had significant for the obtained results , it is noted that treating the plants with filter mud at the high concentration of potassin recorded better results of branch number of *Anethum graveolens* in comparison with other treatments in both seasons, as clearly shown in Table (3).

Herb Dry Weight:

Herb dry weight of *Anethum graveolens* was significantly affected by utilizing of filter mud in the two seasons. The obtained data indicate that by increasing the rates of filter mud the herb dry weight was significant augmented in the two consecutive seasons. Therefore, receiving *Anethum graveolans* the high rate of filter mud produced heaviest herb dry weight and ranged 35.19 and 38.20 % over the check treatment in the two growing seasons, respectively, as clearly reveal in Table (3).The promoting effect of filter of filter mud on enhancing plant growth was reported by Ali *et al* (2002) and Mohamed and Ahmed (2002).

Data illustrated in Table (3) shows that all potassin concentrations significantly augmented herb dry weight of *Anethum graveolans* in the two seasons. It was found that the highest herb dry weight was obtained due to spraying the plants with the high concentration of potassin as increased it by 25.03 and by 24.95 % over untreated ones in both seasons, respectively.

With respect to the interaction between filter mud and potassin treatments on herb dry weight of *Anethum graveolens* was significant effect for the two successive seasons. It is clear that the most effective treatments was observed when fertilizing the plants with filter mud at the high rate and potassin at the high concentration in comparison with other combination treatments in the two experimental seasons, as shown in Table (3)

Fruit Parameters:

Umbels Number/plant:

Data recorded in Table (4) indicate that the main effect of filter mud treatments on umbels number of *Anethum graveolens* was statistically significant in the two growing seasons. From the obtained results it could be noticed that by increasing the rates of filter mud the umbels number was significantly augmented. Therefore, the maximum value of umbels number was observed when receiving the plants high rate of filter mud as ranged 52.58 and 50.83 than the check treatment in the first and second seasons, respectively.

It is worthy that all potassin concentrations led to a significant increase in umbels number in the two consecutive seasons. It was found that the highest value of umbels number was detected due to treating *Anethum graveolans* plants with potassin at the high rate which increased it over unsprayed control by 31.67 and by 29.42 % in the two seasons, respectively, as clearly reveal in Table (4).

The interaction effect between the two factors on umbels number of *Anethum graveolans* was significant for the two experimental seasons. The most effective treatment was obtained when receiving the plants the high rate of filter mud plus potassin at the high concentration compared to other treatments in the two seasons, as clearly illustrated in Table (4)

Fruit Yield (Plant / Fed.):

Obtained data in Table (4) shows that fruit yield /plant and per fed. of *Anethum graveolens* was significantly affected by filter mud treatments in the two experimental seasons. It is obvious that fruit yield ((plant / fed.) was significantly augmented by increasing the use of filter mud cake of rates i.e the .maximum value of fruit yield (plant / fed.) was noticed when fertilizing *Anethum graveolans* plants with filter mud at the high rate which increased it by 24.90 and 28.49 % over untreated control in both seasons, respectively. This previous treatment produced 642.88 and 614.74 kg/fed. fruit while, the control gave 514.59 and 478.41 kg/fed. fruit in both seasons, respectively.

Concerning the influence of potassin treatments, it was significant effect on fruit yield/plant and per fed. in the two growing seasons. The data shows that all concentrations used led to a significant increase in fruit yield (plant / fed.) in both seasons. Furthermore, spraying *Anethum graveolans* with potassin at the high concentration gave the highest values of fruit yield/plant and per fed. as increased it by 26.36 and by 26.27 % over the control plants in the two seasons, respectively. This treatment produced 631.51and 611.14 kg/fed. fruit meanwhile unsprayed control recorded 502.47 and 484.02 kg/fed. Fruit in the two seasons, respectively, as clearly shown in the two seasons in Table (4).

As for the combined effect between filter mud and potassin treatments on fruit yield/plant and per fed. had significant in the in the two consecutive seasons. From the obtained results, supplying *Anethum graveolans* plants with filter mud at the high concentration produced maximum values of fruit yield (plant / fed.) in comparison with other combination treatments in the two growing seasons. However this treatment gave 703.59 and 672.03kg fed. fruit while, the check treatment amounted 450.98 and 422.76 kg fed. fruit in the two experimental seasons, respectively as clearly illustrated in Table (4).

Chemical Constituents:

Volatile Oil Percentage:

Data presented in Table (4) reveal that filter mud treatments significantly influenced on volatile oil percentage of *Anethum graveolens* in the two experimental seasons. It is appear that all rates of filter mud led to a significant increase in volatile oil percentage in both seasons. However, the maximum value of volatile oil percentage was obtained due to addition of filter mud at the high rate as ranged 19.06 and 22.74 % over untreated ones in the first and the second seasons, respectively

Regarding potassin treatments, data in Table (4) shows that it was significant effect on volatile oil percentage of *Anethum graveolens* in the two consecutive seasons. Foliar spray of potassin by using high concentration of it gave maximum value of volatile oil percentage as ranged 12.32 and 13.78 %than the control in the two successive seasons, respectively.

According to the interaction between the two factors on volatile oil percentage of *Anethum graveolens* had significant effect in the two experimental seasons. The most effective treatments was detected due to treating the plants with filter mud at the high rate in combination with potassin at the high concentration compared to other treatments in the two seasons, as clearly reveal in Table (4).

Table 3: Vegetative growth parameters of *Anethum graveolens*, L. plants as affected by F.M.C. and Potassin during 2007/2008 and 2008/2009 seasons.

F.M.C (A)	Potassin (B)									
	Plant height (cm)									
	First season					Second season				
	Cont.	P1	P2	P3	Mean	Cont.	P1	P2	P3	Mean
Cont.	90.67	93.00	94.67	97.00	93.84	88.33	89.33	91.67	92.67	90.50
F1	98.00	101.33	105.33	108.33	103.25	93.00	98.33	101.33	104.33	99.25
F2	101.00	104.33	108.33	111.00	106.17	98.33	103.00	106.00	108.33	103.92
F3	103.67	108.33	111.00	113.00	109.00	102.67	107.33	108.33	110.00	107.08
Mean	98.35	101.75	104.83	107.33		95.58	99.50	101.83	103.83	
L.S.D.0.05	A: 0.40		B: 0.28		AB: 0.56	A: 0.28		B: 0.23		AB: 0.56
	Branch number /plant									
Cont.	4.43	4.70	5.20	5.47	4.95	4.17	4.43	5.03	5.20	4.71
F1	6.57	7.50	7.87	8.27	7.55	6.27	7.07	7.70	8.00	7.26
F2	7.57	8.40	8.70	9.63	8.58	7.10	8.00	8.40	9.30	8.20
F3	8.53	8.83	8.83	10.80	9.50	8.10	8.40	9.40	10.53	9.11
Mean	6.78	7.36	7.90	8.54		6.41	6.98	7.63	8.26	
L.S.D.0.05	A: 0.10		B: 0.08		AB: 0.16	A: 0.12		B: 0.07		AB: 0.13
	Herb dry weight (gm)									
Cont.	15.07	15.40	16.18	17.37	16.00	14.07	15.20	15.60	16.80	15.42
F1	16.27	17.40	19.03	19.90	18.15	15.73	17.00	19.00	19.17	17..73
F2	17.43	19.00	20.80	22.60	19.96	17.10	18.67	20.60	22.00	19.59
F3	18.50	21.00	22.80	24.23	21.63	18.33	20.97	22.37	23.57	21.31
Mean	16.82	17.95	19.70	21.03		16.31	17.96	19.39	20.38	
L.S.D0.05	A: 0.22		B: 0.13		AB:0.26	A: 0.22		B: 0.18		AB:0.37

Table 4: Yield of *Anethum graveolens*, L plants of *Anethum graveolens*, L plants as affected by F.M.C. and Potassin during 2007/2008 and 2008/2009 seasons.

F.M.C (A)	Potassin (B)									
	umbels number/plant									
	First season					Second season				
	Cont.	P1	P2	P3	Mean	Cont.	P1	P2	P3	Mean
Cont.	14.50	15.93	16.60	17.07	16.03	14.27	15.60	16.13	16.80	15.70
F1	15.70	20.13	21.70	23.60	20.28	15.43	19.67	21.13	23.07	19.83
F2	19.03	22.13	24.47	25.13	22.69	18.97	22.00	23.33	24.27	22.14
F3	21.50	23.33	25.70	27.30	24.46	21.10	23.10	24.40	26.13	23.68
Mean	17.68	20.38	22.12	23.28		17.44	20.09	21.25	22.57	
L.S.D.0.05	A: 0.58		B: 0.25		AB: 0.50	A: 0.44		B: 0.19		AB: 0.37
	Fruit yield/plant (gm)									
Cont.	27.06	28.65	32.88	34.92	30.88	25.37	26.67	30.25	32.54	28.71
F1	29.98	31.62	34.94	37.28	33.46	28.18	29.72	33.72	35.55	31.79
F2	31.29	33.87	38.33	40.48	36.00	30.05	32.25	36.77	38.27	34.33
F3	34.27	37.41	40.40	42.22	38.57	32.57	36.05	38.60	40.32	36.89
Mean	30.65	32.89	36.64	38.73		29.04	31.17	34.83	36.67	
L.S.D.0.05	A: 0.57		B: 0.48		AB: 0.96	A: 1.48		B: 1.31		AB: 2.62
	Fruit yield/fed. (kg)									
Cont.	450.98	477.43	548.03	581.92	514.59	422.76	444.48	504.48	542.26	478.41
F1	466.31	527.03	582.37	621.31	549.26	469.70	495.26	561.92	592.53	529.85
F2	521.48	564.54	638.86	674.70	599.89	500.81	537.48	612.76	637.75	572.20
F3	571.09	623.53	673.31	703.59	642.88	542.81	600.81	643.31	672.03	614.74
Mean	502.47	548.13	610.64	631.51		484.02	519.51	580.53	611.14	
L.S.D.0.05	A: 23.26		B: 25.24		AB: N.S	A: 14.79		B: 12.70		AB: N.S

Volatile Oil Yield (Plant & Fed.):

Data listed in Table (5) declare that filter mud treatments significantly affected on volatile oil yield/plant and per fed. of *Anethum graveolens* in the two experimental seasons. It is obvious that by increasing filter mud rates the volatile yield/plant and per fed. was significantly augmented in the two seasons. Therefore, the maximum volatile oil yield/plant and per fed. was obtained when fertilizing the plants with filter mud at the high rate which increased it by 48..11 and by 56.99 % over the control plants in both seasons, respectively. This above mentioned treatment produced 26.18 and 24.25 liter/fed volatile oil meanwhile the control recorded 17.63 and 16.12 liter/fed volatile oil in the two seasons, respectively.

In regard to potassin treatments, data in Table (5) reveal that volatile oil yield/ plant and per fed was significantly influenced by these treatments in both seasons. From the recorded data, it was found that volatile oil yield/plant and per fed was significantly augmented by increasing potassin concentrations used in the two seasons. Therefore the maximum volatile oil yield/plant and per fed was detected due to treating *Anethum graveolens* plants with potassin at the high concentration which increased it by 41.82 and 46.00 % over unsprayed plants in the two seasons, respectively. This treatment produced 25.97 and 23.81 liter/fed volatile oil while, the control gave 18.32 and 16.68 liter/fed volatile oil in the two seasons, respectively, as clearly shown in Table (5).

Concerning the combined effect between the two factors on volatile oil yield/plant and per fed. had significant in both seasons. The most effective treatment was filter mud at the high rate plus potassin at the high concentration in comparison with other combination treatments. From the obtained data, this previous combination treatment yielded 29.78 and 27.55 liter/fed. volatile oil meanwhile, the check treatment recorded 14.11 and 12.33 liter/fed. volatile oil in the first and the second seasons, respectively, as clearly shown in Table (5).

Table 5: Volatile oil percentage, yield/plant(ml) and yield/fed(L) of *Anethum graveolens*, L plants of *Anethum graveolens*, L plants as affected by F. M. C. and Potassin during 2007/2008 and 2008/2009 seasons.

F.M.C (A)	Potassin (B)									
	Volatile oil percentage									
	First season					Second season				
	Cont.	P1	P2	P3	Mean	Cont.	P1	P2	P3	Mean
Cont.	3.13	3.35	3.53	3.61	3.41	2.87	3.14	3.36	3.48	3.21
F1	3.51	3.67	3.80	4.02	3.75	3.37	3.54	3.67	3.91	3.62
F2	3.77	3.86	4.05	4.15	3.96	3.65	3.75	3.93	4.01	3.84
F3	3.86	4.01	4.15	4.24	4.06	3.74	3.87	4.03	4.12	3.94
Mean	3.57	3.72	3.88	4.01		3.41	3.58	3.75	3.88	
L.S.D.0.05	A: 0.04		B: 0.02		AB: 0.04	A: 0.06		B: 0.01		AB: 0.03
	Volatile oil yield/plant(ml)									
Cont.	0.85	0.96	1.16	1.26	1.06	0.74	0.84	1.02	1.33	0.93
F1	1.05	1.20	1.33	1.50	1.27	0.95	1.05	1.24	1.39	1.16
F2	1.18	1.31	1.56	1.69	1.43	1.10	1.21	1.45	1.54	1.32
F3	1.32	1.50	1.67	1.79	1.57	1.22	1.40	1.55	1.65	1.46
Mean	1.10	1.24	1.43	1.56		1.00	1.12	1.31	1.46	
L.S.D.0.05	A: 0.02		B: 0.02		AB: 0.04	A: 0.02		B: 0.02		AB: 0.03
	Volatile oil yield/fed(L)									
Cont.	14.11	16.00	19.39	21.00	17.63	12.33	15.28	18.00	18.89	16.12
F1	17.56	20.06	22.17	25.00	21.20	15.83	17.56	21.28	23.17	19.46
F2	19.61	21.83	25.83	28.11	23.85	18.28	20.17	24.11	25.61	22.04
F3	22.00	25.05	27.89	29.78	26.18	20.28	23.28	25.89	27.55	24.25
Mean	18.32	20.74	23.82	25.97		16.68	19.07	22.32	23.81	
L.S.D.0.05	A: 0.34		B: 0.36		AB: 0.71	A: 0.97		B: 0.66		AB: 1.32

Nitrogen, Phosphorus and Potassium Percentages:

Data recorded in Table (6) reveal that nitrogen, phosphorus and potassium percentages of *Anethum graveolens* was significantly affected by filter mud treatments in the two experimental seasons. It is obvious that all rats of filter mud significantly augmented nitrogen, phosphorus and potassium percentages in the two seasons. However, the maximum values of the three elements (N,P and K) percentages was obtained due to receiving the plants filter mud at the high rate in the two seasons. This above rate of filter mud increased nitrogen percentage by 20.15 and by 18.56 %, also increased phosphorus percentage by 56.49 and by 56.29 % and increased potassium percentage by 16.26 and by 17.64 over untreated ones in the two seasons, respectively.

As for potassin treatments, data in Table (6) shows that nitrogen, phosphorus and potassium percentage of *Anethum graveolens* was significantly affected by these treatments in both seasons. From the obtained results, it could be noticed that all of them significantly augmented the three elements (N, P and K) percentages, except potassin at the low concentration in the first season concerning nitrogen percentage and the same treatment in the second season concerning phosphorus percentage. The maximum value of nitrogen, phosphorus and potassium percentages was observed due to spraying *Anethum graveolens* with the high concentration of potassin in the two seasons. This concentration increased nitrogen percentage by 7.06 and by 6.78 % and increased phosphorus percentage by 9.31 and by 8.46 % while increased potassium percentage by 11.01 and by 12.86 % over the control in the two seasons, respectively.

The interaction effect between filter mud and potassin treatments on the three elements (N, P and K) percentages had significant in both seasons, except in the first season concerning nitrogen percentage. The most effective treatment of the three elements (N, P and K) percentages was detected due to treating *Anethum graveolens* with filter mud at the high rate and potassin at the high concentration in comparison with other combination treatments in the two experimental seasons, as clearly reveal in Table (6).

Table 6: N, P and K % of *Anethum graveolens*, L plants as affected by F.M.C. and Potassin during 2007/2008 and 2008/2009 seasons.

F.M.C (A)	Potassin (B)									
	N%									
	First season					Second season				
	Cont.	P1	P2	P3	Mean	Cont.	P1	P2	P3	Mean
Cont.	1.867	1.900	1.933	2.00	1.925	1.843	1.860	1.930	1.930	1.891
F1	2.050	2.100	2.140	2.167	2.182	1.987	2.023	2.067	2.087	2.041
F2	2.150	2.197	2.250	2.273	2.218	2.070	2.0120	2.163	2.200	2.138
F3	2.023	2.293	2.340	2.413	2.313	2.123	2.223	2.270	2.350	2.242
Mean	2.067	2.123	2.233	2.213		2.006	2.057	2.107	2.142	
L.S.D.0.05	A:0.120		B:0.099		AB: N.S	A:0.008		B: 0.008		AB: 0.016
					P %					
Cont.	0.150	0.153	0.155	0.158	0.154	0.148	0.150	0.151	0.154	0.151
F1	0.208	0.212	0.231	0.241	0.223	0.206	0.209	0.224	0.235	0.217
F2	0.225	0.233	0.240	0.244	0.235	0.222	0.223	0.232	0.237	0.229
F3	0.233	0.236	0.245	0.250	0.241	0.230	0.231	0.238	0.246	0.236
Mean	0.204	0.209	0.218	0.223		0.201	0.202	0.211	0.218	
L.S.D.0.05	A:0.001		B:0.002		AB:0.004	A:0.002		B:0.002		AB:0.004
K %										
Cont.	2.447	2.500	2.563	2.603	2.528	2.407	2.443	2.520	2.533	2.476
F1	2.510	2.607	2.640	2.753	2.627	2.453	2.553	2.583	2.710	2.575
F2	2.630	2.687	2.773	2.840	2.733	2.563	2.647	2.710	2.770	2.672
F3	2.660	2.863	3.053	3.180	2.939	2.610	2.867	3.020	3.157	2.913
Mean	2.562	2.664	2.757	2.844		2.508	2.627	2.708	2.792	
L.S.D.0.05	A:0.011		B:0.007		AB:0.014	A:0.010		B:0.010		AB:0.019

Nitrogen, Phosphorus and Potassium Content:

Data illustrated in Table (7) shows that filter mud treatments significantly influenced on nitrogen, phosphorus and potassium content of *Anethum graveolens* in the two experimental seasons. By increasing filter mud rates the uptake of the three elements (N, P and K) was significantly augmented in the two seasons. Therefore, the maximum values of nitrogen, phosphorus and potassium content was obtained when receiving the plants the high rate of filter mud amounted 0.501, 0.481g while the check treatment gave 0.308 and 0.290 g/nitrogen content in the two seasons, respectively, also gave 0.052 and 0.051g but the control recorded 0.025 and 0.023 g/phosphorus content and amounted 0.641 and 0.625g, meanwhile, untreated ones amounted 0.407 and 0.382g/potassium content in the first and the second seasons, respectively. The stimulatory effect of filter mud on increasing N, P and K contents has been studied by Ali *et al* and Mohamed and Ahmed (2002).

In regard to potassin treatments, it was significant effect on the content of the three elements (N, P and K) for the two seasons. It was found that unitizing of all concentrations of potassin led to a significant increase in the three elements (N, P and K) content in both seasons. However the use of high concentration of potassin gave the maximum values of nitrogen, phosphorus and potassium uptake of *Anethum graveolens* which amounted 0.469 and 0.442g meanwhile, the control gave 0.350 and 0.330g/nitrogen content, 0.048 and 0.045g but the control recorded 0.035 and 0.033g/phosphorus content and 0.605 and 0.574g but unsprayed plants amounted 0.432 and 0.412g/ potassium content in the two growing seasons, respectively, as clearly shown in Table (7).

The combined effect between the two factors on the three elements (N, P and K) content of *Anethum graveolens* had significant in the two seasons. The most effective treatments was filter mud at the high concentration which amounted 0.583 and 0.557g while, the check treatment gave 0.280 and 0.260g /nitrogen uptake and amounted 0.060 and 0.058g but the control recorded 0.023 and 0.021g/phosphorus uptake also gave 0.773 and 0.743g meanwhile untreated plants amounted 0.373 and 0.340g / potassium content in both seasons, respectively, as clearly shown in Table (7).

These results could be discussed as follows; the increment in plant growth, fruit yield, oil production and N, P and K percentages as well as contents of the treated *Anethum graveolens* plants may be due to the influenced of filter mud cake on augmenting these charactericts. Some merit claimed for organic fertilizers ore N and P % is not watering soluble, when the fertilizer decays in the soil. The nutrients may be released slowly which matches the uptake by the plants. The organic fertilizer decays protect the nutrients from leaching and it acts an important role in chemical behaviors of several metals in soils through its active groups (fluvic and humic acids) that have ability to retain the metals, in complex and chelate forms (Cook, 1972).

The beneficial effect of potassin on increasing vegetative growth, fruit yield, chemical constituents of *Anethum graveolens* may be due to the positive effect of K on regulating water absorption, biosynthesis and carbohydrates translocation (Yagodin, 1982). The organic matter could be a main source of N, P 50.60 %, S 80 % and high content of boron and molybdenum (Bohn *et al*, 1985), in addition, it is a main source of energy for Azotobacter growth which fixes N.

Table 7: N, P, and K content of *Anethum graveolens*, L. plants of *Anethum graveolens*, L plants as affected by F.M.C. and Potassin during 2007/2008 and 2008/2009 seasons.

F.M.C (A)	Potassin (B)									
	N content (g)									
	First season					Second season				
	Cont.	P1	P2	P3	Mean	Cont.	P1	P2	P3	Mean
Cont.	0.280	0.293	0.313	0.347	0.308	0.260	0.283	0.293	0.323	0.290
F1	0.333	0.367	0.407	0.430	0.384	0.313	0.343	0.393	0.400	0.363
F2	0.377	0.417	0.470	0.517	0.445	0.357	0.397	0.447	0.487	0.422
F3	0.410	0.480	0.530	0.583	0.501	0.390	0.467	0.510	0.557	0.481
Mean	0.350	0.389	0.430	0.469		0.330	0.373	0.411	0.442	
L.S.D.0.05	A: 0.008		B:0.004		AB:0.009	A:0.005		B:0.006		AB:0.012
	P Content (g)									
Cont.	0.023	0.023	0.025	0.027	0.025	0.021	0.023	0.024	0.026	0.023
F1	0.034	0.035	0.044	0.048	0.040	0.032	0.036	0.043	0.045	0.039
F2	0.039	0.044	0.050	0.055	0.047	0.038	0.042	0.048	0.052	0.045
F3	0.043	0.050	0.056	0.060	0.052	0.042	0.049	0.058	0.058	0.051
Mean	0.035	0.038	0.044	0.048		0.033	0.037	0.042	0.045	
L.S.D.0.05	A:0.001		B: 0.001		AB: 0.002	A: 0.002		B: 0.001		AB: 0.002
	K Content (g)									
Cont.	0.373	0.387	0.413	0.453	0.407	0.340	0.373	0.390	0.427	0.382
F1	0.407	0.427	0.503	0.550	0.472	0.387	0.433	0.490	0.517	0.457
F2	0.457	0.510	0.577	0.643	0.547	0.440	0.493	0.543	0.610	0.522
F3	0.493	0.600	0.697	0.773	0.641	0.480	0.600	0.677	0.743	0.625
Mean	0.4320	0.481	0.548	0.605		0.412	0.475	0.525	0.574	
L.S.D.0.05	A:0.010		B:0.011		AB:0.021	A:0.011		B:0.008		AB:0.016

REFERENCES

A.O.A.C., 1980. Official Methods of Analysis of the Association of Official Agricultural Chemists (A.O.A.C.) 12th Ed. Washington. D.C.

Abdou, M.A.H., A.A. El-Sayed, F.S. Badran R.S. and El-Deen, 2004. Effect of planting density and chemical and biofertilization on vegetative growth, yield and chemical composition of fennel (*Foeniculum vulgare*, Miller): II-Effect of NPK chemical fertilization and biofertilization treatments. Annals of Agricultural Science, 42(4): 1923-1937.

Ahmed, F.F., M.A. Ragab and A.E. Mansour, 1996. A comparative study on the effect of farmyard manure and filter mud for red roomy grapevines (*Vitis vinifera,* L.). The First Egyptian Hungarian Hort. Conf., Kafr El Sheikh, Egypt, 15-17 Sept.

Ali, A.F., A.A. Ahmed and M.R. Mahmoud, 2002. Response of *Populus nigra* seedlings grown in sandy calcareous soil to some organic fertilizer and nitrogen levels treatments. The 1st Conf. For Agric. & Environ. Sci., Minia, Egypt, pp: 25-28.

Amin, I.S., 1997. Effect of bio- and chemical fertilization on growth and production of *Cariandrum sativum*, *Feoniculum vulgare* and *Carum carvi*, L. plants. Annals of Agricultural Science, 35(4): 2327-2334.

Arafat, S.M., M. Abou Seeda, M.A. Sherif and M. Rashed, 1992. Beneficial effect of filter mud on agrochemical characteristics of sandy soil. Zagazig J. Agric. Res., 19(4): 1957-1965.

Bhuvaneshwari, A.A. B.S. Farooqi, Sreeramu and K.N. Srinivasappa, 2003. Influence of nitrogen, phosphorus and potassium levels on growth, seed yield and essential oil content in anise (*Pimpinella anisum* L.). Journal of Spices and Aromatic Crops, 11(2): 112-117.

Black, C.A., D.D. Evans and L.E. Ensminger, 1965. Methods of soil analysis. Agronomy J. Amer. Soc. Agron. Inc. Publ., Madison, Wisconsin, U.S.A.

Bohn, H.L., B.L. Mcneal and O.G.A. Connor, 1985.. Soil chemistry 2 nd ed. A, Wiley-Interscience publication .John Wiley &Sons New York Toronto, Singapore.

Charles, R.O., 1991. Improving the quantity and quality of soil organic matter in the topics through the use of organic materials. 2nd African Soil Sci. Soc. Conference on soil and water management for sustainable productivity. November 4-10., Cairo, Egypt.

Cooke, G.W., 1972. Fertilizing for Maximum Yield. Richard Clay (The Chauer press) LTD. Bungary. Suffok, Great Britain pp: 457.

Guenther, E., 1961. The Essential Oils, Vol.1 Van Nostr and Comp. Inc. New York, Phenolic and Phenolic glycosides, p: 357.

Jackson, M.L., 1978. *Soil Chemical Analysis*. Fall Indian Private. Ltd. New Delhi.

Kandeel, Y.R., E.S. Nofal, F.A. Menesi, K.A. Reda, M.N. Taher and Z.T. Zaki, 2001. Effect of some cultural practices on growth and chemical composition of *Foeniculum vulgarae,* Mill. Proc. Proc. 5th Arabian Hort. Conf., Ismailia, Egypt, 24-28: 61-72.

Mansour, A.E. and F.F. Ahmed, 1998. Productivity of *Hindy Bissinara* Mangoes as influenced with the application of filter mud and farmyard manure. Egypt. J. Hort. 25(2): 179.

Menaria, B.L. and P.L. Maliwal, 2007. Quality of fennel as influenced by plant density, fertilization and plant growth regulators. Indian Journal of Plant Physiology. Indian Society for Plant Physiology, New Delhi, India, 12(1): 57-62.

Mohamed, A.A. and M.E. Ahmed, 2002. A comparative study on the effect of sugar cane filter mud, sheep and chicken manures used for fertilization of sweet fennel crop (*Foeniclum vulgare,* L.). Minia J. of Agric. Res & Develop., 22(3): 221-234.

Pascal, J.D., K. Stanich, B. Girard and G. Mazza, 2002. Antimicrobial activity of individual and mixed fractions of dill, cilantro, coriander and eucalyptus essential oils. Int. J. Food Microbiol., 74: 101-9.

Shalan, M.N. T.A. Abd El-Latif, S.G. Soliman, E.O. El-Gawwas, 2001. Effect of some chemical and biofertilizer treatments on roselle plants *Hibiscus sabdariffa*, L. Egyptian Journal of Agricultural Research, 79(2): 587- 606.

Simon, J.E., A.F. Chadwick and L.E. Craker, 1984. Herbs: An Indexed Bibliography, 1971-1980, The Scientific Literature on Selected Herbs and Aromatic and Medicinal Plants of the Temperate Zone, p: 770. Archon Books, Hamden, CT, The Shoe String Press, Inc., USA

Snedecor, G.W. and W.G. Cochran, 1973. Statistical Methods. 6th ed., Iowa State Univ., Press, Ames., Iowa, USA.

Valero, M. and M.J. Giner, 2006. Effects of antimicrobial components of essential oils on growth of *Bacillus cereus* INRA L2104 and the sensory qualities of carrot broth. Int. J. Food Microbiol., 106: 90-4.

Yagodin, B.A.(ed.), 1982. Agricultural Chemistry. Part 1 Mir Publishers, Moscow,USSR.

Yanishevskii, F.V. and N.M. Dzhaparidze, 1990. The effect of potassium fertilizer form on *Catharanthus roseus*. Subtropicheskie Kul'tury., (2): 131-135.

Zaid, M.S. and H.M. Kriem, 1992. Effect of sugar-cane wastes and Sulphur on some soil properties and nutrient uptake by *Zea maiz* plants in sandy soils. J. Agric. Sci. Mansoura Univ., 17(1): 151-188.

Zhneg, N., 1998. Potassium supplying capacity and high efficiency use of potassium fertilizer in upland soils of Hunan province. Better Crops International, 12(1): 16-19.