

EFFECT OF FYM AND PLANTING SPACE ON THE VEGETATIVE GROWTH, ACTIVE INGREDIENT AND CHEMICAL COMPOSITION OF *Ammi visnaga*, L.

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ABSTRACT

An experimental trial was carried out at the Experimental Farm of Sakha Agric. Res. Station during two seasons (1999/2000 and 2000/01) to study the effect of FYM and planting space on *Ammi visnaga* L. plants. FYM was used at the rate of 15, 20 and 25 m³/fed. Which were added before planting and during the preparation of the experimental field and planting spaces were at 20, 25 and 30 cm.

The data showed that, using 25 m³/fed. FYM significantly increased vegetative growth, and by increasing planting spaces up to 30 cm apart vegetative growth significantly increased.

Treating plants with different rates of FYM increased seed weight per plant and plot, these increments were statistically insignificant while, planting space up to 30 cm significantly increased seed weight.

Active ingredient of *Ammi visnaga* (Visnagin & khellin) significantly increased by increasing both the rate of FYM and planting spaces.

Nitrogen, phosphorous and potassium content of the aerial parts of plant significantly increased by increasing the rate of organic manure and planting spaces.

INTRODUCTION

Ammi visnaga L. is one of the important pharmaceutical plants of the umbelliferae. The fruits contain two main chromones, khellin and visnagin, they used as diuretic and antispasmodic in case of ureteral stones. Khellin is now commercially available in the tablets and injections. The cultivation of *Ammi visnaga* L. in Egypt does not hold desired position although the environmental conditions are most suitable for such cultivation and production (Menesi, 1995).

Organic-fertilization of horticultural crops had drawn the attention of research workers and had become in the last few decades a positive alternative to chemical fertilizers. Organic-fertilizers are reasonably more safe to the environment if compared with chemical fertilizers.

Cattle manure increased the growth of *Ocimum basilicum* plants as mentioned by Raniv *et al.* 1998 and Aflatuni *et al.* (1993) who found that, the organic manure increased the dry matter yield of marjoram and peppermint plants.

Hammam (1996) on *Pimpinella anisum* showed that FYM at 40 m³/fed. affected positively on stem length, dry weight, while not quite clear on the number of branches and umbles as well as FYM at the rate of (20-40 m³) / fed. significantly increased the essential oil.

Yousef (2002) on *Matricaria chamomilla* L. found that poultry manure at 30 or 40 m³ / fed. resulted in significant increase for vegetative and flowering characters and chemical composition of the plant.

Abd El-Latif (2002) on Caraway plants found that using 9 m³ /fed. organic manure and biofertilizer (phosphorene and nitrobin 1 kg/fed.) gave the highest values of the vegetative growth, seed yield and oil percentage.

Zhang *et al.* (1993) stated that application of pig and cattle manure increased all P fractions in soil. The availability of P manures increased after incubation because of the transfer of moderately labeled and resistant P fractions into labelled P fraction.

Patiram (1994) found that application of goat manure increased organic matter content, pH, EC, potential K, buffering capacity and exchangeable K, Ca and Mg, which decrease exchangeable all surface samples of acidic.

As for planting distances, Shalaby *et al.* (1983) sowed *Ammi visnaga* plants on different distances between planting hill (20, 40 and 60 cm.), they found that, the distance of 40 cm gave the highest number of umbels / plant with comparison to other distances (20 and 60 cm.). Fruit yield / plant increased by increasing the distance to more than 20 cm, the fruit yield / fed. was higher when plants were at 20 cm. than the wider distances. Also, they mentioned that, there was no significant effect on plant height due to variation of spaces between hills as well as the percentage of total chromone (khellin and visnagin).

Ibrahem (2000) and Nofal *et al.* (2001) on *Ammi visnaga*, L. found that decreasing spacing between plants to 30 cm. increased plant height and seed yield/fed., while spacing at 50 cm. increased the number of umbels as well as seed yield/hill, the percentage of nitrogen, phosphorus and potassium and total chromones (khellin and visnagin) increased by increasing the planting space.

MATERIALS AND METHODS

This study was carried out during 1999/2000 and 2000/01 seasons in the Experimental Farm of Sakha Agric. Res. Station to assess the effect of FYM (cattle manure) and planting space on the vegetative growth, seed yield, khellin & visnagin content and chemical composition of aerial parts of *Ammi visnaga* plant.

FYM was added at the rate of 15, 20 and 25 m³ / fed. during the preparation of the soil. Seeds were sown on 25th October during two seasons with three spaces 20, 25 and 30 cm, with 60 cm row width. The plot area was 3.5 x 3 m.

The design of this experiment was split plot with three replicates, the main plot was FYM and sowing space was subplot. The plants were thinned (one plant in every hill).

The chemical and physical analysis of the experimental soil were determined according to Jackson (1967) in Table (1) and Table (2) showed the analysis of the FYM. All the agricultural practices processes were done. At flowering stage, plant height, number of umbels, fresh and dry weight of the aerial parts of plant were recorded during two seasons.

Table (1): Physical and chemical analysis of experimental soil.

Physical and chemical analysis:	1999/2000			2000/01		
	Depth (cm)					
	0-30	31-60	61-90	0-30	31-60	61-90
a). Physical analysis:						
Sand %	18.78	18.66	14.94	21.2	18.4	16.3
Silt%	32.75	33.14	37.15	30.4	33.4	36.2
Clay%	48.4	50.2	47.86	48.4	48.2	47.5
Soil texture	Clay	Clay	Clay	Clay	Clay	Clay
b). Chemical analysis:						
E.C in soil paste, (dS/m)	2.1	2.5	2.8	1.65	1.94	2.1
Soluble cations (meq / L [*])						
Na ⁺	14.07	17.75	19.88	11.06	13.00	14.07
K ⁺	0.4	1.4	2.4	0.4	0.4	0.4
Ca ⁺⁺	4.62	5.50	6.16	3.63	4.27	4.62
Mg ⁺⁺	3.99	4.75	5.32	3.14	3.69	3.99
Soluble anions (meq / L)						
CO ₃ ⁻	0.0	0.0	0.0	0.0	0.0	0.0
HCO ₃ ⁻	5.5	10.5	6.5	5.5	5.5	5.5
Cl ⁻	7.1	15.3	17.1	7.1	7.1	7.1
SO ₄ ⁻	10.48	3.65	10.18	5.62	8.75	10.48
Sodium adsorption ratio (SAR)	6.7812	7.8406	8.2978	6.0109	6.5178	6.7812

Table (2): Chemical properties of FYM.

Properties	Dimension	First season	Second season
pH in 1:2.5 suspension	dS m ⁻¹	6.87	6.89
E.C (Saturated extract at 25°C)	-	12.73	12.24
Saturation percentage (SP)	-	84.57	82.45
Total soluble salts (TSS)	-	0.69	0.65
Total organ carbon (C)	-	1.80	1.81
Organic matter (OM)	-	3.10	3.12
Total nitrogen (N)	-	0.38	0.24
Molecular CN ratio.	-	5.55	14.4
Available macro nutrients:			
Available N (K. sulphate extractable)	mg kg ⁻¹ soil	58.32	52.25
Available P (Na HCO ₃ extractable)	-	132.91	109.5
Available K (Ammonium acetate)	-	385.0	302.00
Available micro nutrients:			
DTPA extractable - Fe	-	4.98	3.32
DTPA extractable - Zn	-	2.38	2.18
DTPA extractable - Mn	-	58.22	54.28
Soluble cations (Saturated extract)			
Ca ⁺⁺	meq L ⁻¹	34.0	27.00
Mg ⁺⁺	-	12.56	10.13
Na ⁺	-	77.25	80.65
K ⁺	-	3.55	3.25
Soluble anions (Saturated extract)			
HCO ₃ ⁻	-	30.00	22.50
Cl ⁻	-	60.05	74.7
SO ₄ ⁻	-	37.34	25.0

Seed yield per plant and plot were also recorded at harvesting stage. Nitrogen content of dry leaves (at 60 °C) were determined by micro Kjeldahl method, phosphorus content was colorometrically determined according to A.O.A.C. (1990), and potassium was estimated by using the Flame photometer according to Willium (1984). The ripe dry fruit of khella plant were analyzed to determine the total chromones (khellin and visnagin) according to Egyptian Pharmacopoeia (1984) with Memphis modification.

The statistical analysis of data was carried out according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1- Effect of FYM & planting space on the vegetative growth of *Ammi visnaga* plant:

Data in Table (3) showed the effect of FYM and planting space on plant height and number of umbles. It was obvious that, using different quantities of organic manure had a positive effect on plant height. This character increased by increasing the batches of organic manure. This increase was significant in the first season, when both the medium and high quantities were compared with the lowest one. The pre mentioned trend was not clear in the second season and the differences were insignificant.

Table (3): Effect of FYM and planting space on vegetative growth of *Ammi visnaga* L. plant during 1999/2000 and 2000/01 seasons.

FYM (m ³)	Spacing (cm)	Plant height (cm)		No. of umbles / plant		Fresh weight / plant (g)		Dry weight / plant (g)	
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
FYM									
15		108.11	108.04	22.72	21.29	495.21	463.65	198.09	185.48
20		113.72	105.73	24.54	22.99	516.04	484.31	206.92	193.73
25		115.14	105.75	24.82	23.49	514.27	486.68	205.71	194.67
L.S.D _{5%}		1.70	n.s	1.68	1.61	14.81	10.85	5.92	4.34
Spacing									
	20	117.64	111.50	22.55	21.19	486.93	458.40	194.77	183.36
	25	112.43	105.85	23.39	21.92	507.34	476.28	202.94	190.51
	30	106.91	102.17	26.2	24.66	531.24	499.96	212.50	199.99
L.S.D _{5%}		1.76	1.70	1.5	1.47	8.83	7.03	3.54	2.81
FYM x spacing									
15	20	115.30	113.95	21.33	19.94	471.85	441.00	188.74	176.40
	25	108.32	107.36	22.1	20.46	498.86	461.08	199.56	184.45
	30	100.72	102.82	24.72	23.46	514.90	488.76	205.98	195.50
20	20	118.32	109.72	23.1	21.78	488.95	462.40	195.58	184.97
	25	113.69	104.86	23.86	22.30	517.15	483.50	208.86	193.40
	30	109.14	102.60	26.66	24.90	542.03	507.03	216.82	202.81
25	20	119.30	110.83	23.22	21.66	500.00	471.80	200.00	188.72
	25	115.27	105.33	24.20	23.01	508.00	484.15	202.40	193.66
	30	110.88	101.10	27.33	25.61	536.80	504.10	214.72	201.64
L.S.D _{5%}		n.s	n.s	n.s	n.s	n.s	n.s	3.54	n.s

The data also indicated that, plant height significantly decreased by increasing planting space. The least height was with 30 cm when the 20 and 25 cm were compared. This was true in the two seasons. However, the tallest ones (119.3 cm) were of those receiving FYM at 25 m³ and spaced at 20 cm in the first season. Dealing with the interaction of the factors under study data showed that it was insignificant.

Data in Table (3) indicated that number of umbles significantly increased with increasing the rate of FYM. In addition planting spaces significantly increased number of umbles and the highest value was at 30 cm. apart. The interaction had insignificant effect in this concern in the two seasons.

It was shown in the same table that FYM significantly increased fresh and dry weights of *Ammi visnaga* as well as plant spaces, which took the same trend. The treatment with (25 m³ and 30 cm. space) gave the highest values of fresh and dry weight of the aerial parts of the plant in the two seasons in most cases.

II-Effect of FYM and planting space on seed yield of *Ammi visnaga*, L. plant:

Data in Table (4) showed that, seed yield/plant increased by increasing the FYM. However, this increase was insignificant in the first season, while it was significant in the second one.

As for planting space, data also showed that, seed yield / plant significantly increased by increasing plant space up to 30 cm. While, increase of plant density led to increase seed yield / plot in both seasons. The interaction showed insignificant differences as affected by the two factors.

III- Effect of FYM and planting space on the active Ingredient of *Ammi visnaga*, L. plant:

Data presented in Table (4) indicates that both FYM and planting space significantly increased khellin content in the seeds in the second season only. Data also, indicated that by increasing the rate of FYM or planting space this content significantly increased. The interaction between two factors was statistically significant in both seasons. The highest value was obtained at 25 m³ FYM with 25 cm space.

Table (4) also indicated that visnagin content in the seeds significantly increased by increasing the rate of organic manure up to 25 m³, planting space as increased took the same trend. Concerning the interaction, data showed insignificant effect in the first season and significant effect in the second one.

Data in Table (4) show that, khellin and visnagin content (Chromones) significantly increased by increasing the batches of FYM. As for planting space the data indicated that, these contents significantly increased by increasing planting space. The interaction between FYM and planting space significantly increased and the highest value was obtained at the highest batch of FYM (25 m³/fad.) and widest planting space 30 cm.

These results were on harmony with those obtained by Ibrahem (2000) and Noffal et al.(2001).

Table (4): Effect of FYM and planting space on seed yield and active ingredient of *Ammi visnaga* L. Plant during 1999/2000 and 2000/01 seasons.

FYM (m ³)	Spacing (cm)	Seed weight /plant (g)		Seed weight /plot (kg)		Khellin (%)		Visnagin (%)		Total chromones (%)	
		1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
		season	season	season	season	season	season	season	season	season	season
FYM											
15		54.37	50.38	1.640	1.550	1.68	1.52	0.81	0.85	2.27	2.17
20		57.58	55.14	1.735	1.859	1.82	1.59	0.72	0.75	2.38	2.34
25		58.80	55.43	1.782	1.663	1.65	1.67	0.82	0.76	2.46	2.43
L.S.D _{5%}		n.s	4.18	n.s	n.s	0.02	0.04	0.04	0.03	0.13	0.09
Spacing											
	20	54.15	50.33	2.274	2.148	1.80	1.52	0.65	0.65	2.29	2.17
	25	54.85	52.12	1.221	1.208	1.68	1.60	0.71	0.72	2.38	2.32
	30	61.55	58.44	1.661	1.813	1.78	1.66	0.78	0.78	2.45	2.45
L.S.D _{5%}		3.27	3.48	0.099	0.143	0.01	0.04	0.04	0.04	0.06	0.06
FYM x spacing											
15	20	52.04	47.51	2.186	2.093	1.63	1.37	0.57	0.61	2.20	1.98
	25	52.51	48.11	1.155	1.058	1.65	1.44	0.61	0.68	2.26	2.12
	30	58.55	55.47	1.581	1.498	1.72	1.79	0.65	0.66	2.36	2.40
20	20	54.68	51.86	2.296	2.178	1.56	1.50	0.71	0.70	2.27	2.20
	25	55.78	53.31	1.227	1.173	1.68	1.63	0.74	0.75	2.40	2.38
	30	62.29	60.24	1.682	1.626	1.65	1.64	0.81	0.80	2.46	2.44
25	20	55.72	51.62	2.340	2.188	1.62	1.68	0.78	0.65	2.40	2.33
	25	56.26	54.93	1.282	1.208	1.67	1.73	0.8	0.73	2.47	2.46
	30	63.80	59.75	1.723	1.813	1.65	1.61	0.87	0.98	2.52	2.50
L.S.D _{5%}		n.s	n.s	n.s	n.s	0.02	0.06	n.s	0.07	n.s	0.10

VI- Effect of FYM and planting space on the chemical composition of *Ammi visnaga* plant.

Data in Table (5) indicated that, FYM and planting space showed significant effect on nitrogen content. And the interaction between the two factors showed insignificant effect in the two seasons.

Data in the same table indicated that, using FYM significantly increased phosphorus content by increasing the batches up to 25 m³ /fad., different treatments of planting space took the same trend. The interaction showed significant effect between the two factors in the first season. However, the statistical analysis showed significant effect in this concern.

The data also showed that FYM significantly increased potassium percentage in the aerial parts of plant by increasing the batches of FYM up to 25 m³. Data also indicated that planting space significantly increased by increasing plant space up to 30 cm. Treating plants with 25 m³/ fad. of FYM and planting space 30 cm apart showed significant increase in potassium content in the first season while it was insignificant in the second one.

This might be attributed to the keen competition between plants for light, minerals, aeration and water which reflected on less accumulation of minerals (N, P and K).

These results were in agreement with those obtained by the Zhang et al. (1993) and Paliram (1994).

Table (5): Effect of FYM and planting space on chemical composition (N,P and K%) of aerial parts of *Ammi visnaga* plant during 1999/2000 and 2000/01 seasons.

FYM (m ³)	Spacing (cm)	N (%)		P (%)		K (%)	
		1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
FYM							
15		2.47	2.46	0.241	0.219	1.59	1.56
20		2.28	2.28	0.256	0.235	1.70	1.64
25		2.27	2.59	0.251	0.243	1.85	1.64
L.S.D _{5%}		0.07	0.06	0.007	n.s	0.04	0.02
Spacing							
	20	2.43	2.44	0.237	0.228	1.67	1.55
	25	2.53	2.53	0.248	0.239	1.74	1.60
	30	2.65	2.66	0.258	0.230	1.74	1.69
L.S.D _{5%}		0.05	0.04	0.007	0.005	0.04	0.03
FYM x spacing							
15	20	2.36	2.34	0.229	0.217	1.52	1.49
	25	2.49	2.44	0.244	0.217	1.63	1.55
	30	2.57	2.60	0.251	0.222	1.61	1.65
20	20	2.44	2.47	0.239	0.237	1.65	1.56
	25	2.58	2.57	0.252	0.241	1.75	1.63
	30	2.70	2.70	0.260	0.228	1.70	1.71
25	20	2.50	2.51	0.243	0.231	1.84	1.60
	25	2.53	2.58	0.247	0.259	1.81	1.62
	30	2.69	2.68	0.262	0.239	1.90	1.70
L.S.D _{5%}		n.s	n.s	n.s	0.009	0.07	n.s

FYM enhanced the vegetative growth, seed yield and active ingredients because the application of FYM on the soil moisture, organic manure hold moisture maintains sufficient pore spaces to permit good air circulation and drainage of the excessive water produced and composts from plant residues and animal depositing are one type of humus which contributes to the soil fertility (Schachtschable 1979).

Fallik and Okon (1996) and Awad (1998) reported that bacterial strains were highly efficient on promotion of nitrogen fixation, CO₂ evaluation and ammonification resulting in adjustment of pH media than using each of them in single application.

It may be recommended to use FYM at the rate of 30 m³ /fad. and planting *Ammi visnaga* plant at 30 cm.

Moreover, it may be recommended to use FYM at the rate of 30 m³/fad. and planting *Ammi visnaga* plant at 30 cm distance to give the highest values of vegetative growth, seed yield and active ingredients.

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تأثير التسميد العضوي ومسافات الزراعة على النمو الخضري والمواد الفعالة والمحتوى الكيماوي لنبات الخلة البلدي

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** قسم بحوث النباتات الطبية والعطرية - معهد بحوث البساتين

اجري هذا البحث في مزرعة محطة بحوث سخا موسمي ١٩٩٩/٢٠٠٠ و ٢٠٠٠/٢٠٠١ ويهدف إلى دراسة تأثير معدلات مختلفة من سماد المزرعة FYM (١٥، ٢٠، ٢٥ م^٢/ف) وكذلك مسافات الزراعة (٢٠، ٢٥، ٣٠ سم بين النباتات) على النمو الخضري والثماري والمواد الفعالة (الخلين والفيزناجين) والتركيب الكيماوي لنبات الخلة البلدي. وكلا لوضحت الدراسة النتائج التالية:

أولاً: النمو الخضري:

- ١- كان للمعدلات المختلفة من السماد العضوي تأثيراً معنوياً على طول النبات، عدد النورات، الوزن الطازج والجاف للأجزاء الهوائية للنبات، أي أنه بزيادة معدلات التسميد حدثت زيادة معنوية في المقاييس الخضريّة السابقة حتى ٢٥ م^٢/ف خلال الموسمين.
- ٢- حدثت زيادة معنوية في طول النبات، عدد النورات، الوزن الطازج والجاف للأجزاء الهوائية للنبات بزيادة مسافات الزراعة.
- ٣- بالنسبة للتفاعل بين التسميد العضوي ومسافات الزراعة تبين أن هناك زيادة لكنها في معظم المقاييس غير معنوية في كلا الموسمين.

ثانياً: محصول البذرة:

- ١- بالنسبة لتأثير المعدلات المختلفة من السماد العضوي على وزن البذرة للنبات أو للقطعة التجريبية، فقد اتضح حدوث زيادة في الوزن بزيادة معدلات التسميد إلا أنها غير معنوية خلال الموسمين.
- ٢- حدثت زيادة معنوية في وزن البذرة للنبات بزيادة مسافات الزراعة، بينما كانت الزيادة مع الكثافة الأعلى على مستوى القطعة التجريبية.
- ٣- بالنسبة للتفاعل بين التسميد العضوي ومسافات الزراعة تبين أن هناك زيادة في وزن البذرة لكنها غير معنوية في كلا الموسمين.

ثالثاً: المواد الفعالة:

- أثبتت الدراسة أنه حدثت زيادة معنوية في النسبة المئوية للخلين والفيزناجين والكرومومون بزيادة معدلات التسميد العضوي وكذلك بزيادة مسافة الزراعة وكذلك التفاعل بينهما.
- رابعاً: التركيب الكيماوي للأجزاء الهوائية:
- ١- أوضحت الدراسة أن زيادة معدلات التسميد العضوي أدت إلى زيادة معنوية في النسبة المئوية للنيتروجين والفسفور والبوتاسيوم لأجزاء النبات الجافة على ٦٠ درجة مئوية.
 - ٢- كان لمسافات الزراعة تأثيراً واضحاً على هذه النسبة فقد حدثت زيادة معنوية بزيادة مسافة الزراعة.
 - ٣- كان للتفاعل بين العاملين تأثيراً واضحاً في زيادة النسبة المئوية للنيتروجين والفسفور والبوتاسيوم.
- ويوصى الباحثين بزراعة نبات الخلة البلدي على مسافة ٣٠ سم بين النباتات الأخر مع استعمال سماد المزرعة بمعدل ٢٥ متر مكعب للفدان.