Egyptian J. Desert Res., 55, No.2, 317-332 (2005)

RESPONSE OF *AMMI VISNAGA* PLANTS TO MINERAL AND BIOFERTILIZERS IN DESERT SOIL

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A field experiment was carried out in Maryout Agricultural experimental station, Desert Research Center, Alexandria, to study the response of *Ammi visnaga* plants to mineral fertilizer namely crystal Nasser (Te+20+20+20) at two rates (1kg/fed, F_1 and 2kg/fed, F_2) singly or in combination with locally isolated Bio_1 sezasiem {*Azotobacter chroococcum* + *Pseudomonas flurescens* + *Rhizobium spp.* + *Bacillus megaterium* (phosphate dissolver) + important macro- and micro-nutrients activating the bacterial strains} and Bio_2 (*Saccharomyces cervisiae*), as foliar application. Soil microbiological properties, uptake of nutrients and total carbohydrates were detected. The achieved results could be summarized as follows:

1- Bio_1 + F_2 as combined treatment caused significant effects in plant height (cm), number, diameter of umbels/plant and seed yield/fed.
2- The uptake of the important nutrients N, P, K, Na, Fe, Mn and Zn are improved in varying degrees. The application of biofertilizer proved high productivity than other sources.
3- Biofertilizatizers (Bio_1 + Bio_2) improve soil fertility and properties of the rhizospheric microorganisms of the medicinal plant.
4- The highest microbial growth was obtained with Bio_1 crystal Nasser (F_2>F_1) as individual and chemical fertilizers Bio_1+Bio_2 as a combination at flowering stage of plant growth.
5- Bio_1 biofertilizer energized the effect of F_2 , F_1 and yeast.

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Keywords: sezasiem, yeast, crystal Nasser, biofertilizers, *Ammi visnaga*, calcareous soil

Ammi visnagna (Khella) is considered one of the most important medicinal plants in the world. Fruits of Khella produce khellin and visnagin which act as stimulant, carminative, diuretic, vasodilator, antispasmodic and the dry mature umbel rays is useful as toothpicks (Franchi *et al.*, 1987; El-Fiky *et al.*, 1989; Andrew, 1996).

Calcareous soils of the western coastal zone of Egypt comprise an essential part of the overall extension of newly cultivated land. On the other hand, the intensive use of mineral fertilizers in recent years led to environmental pollution problems, decreased the potential activity of micro flora and the stability of soil organic matter (Pakorna, 1984).

Biofertilizers are useful for recycling elements, reserving natural resources and for protection from increasing pollution due to intensive use of mineral fertilizers (Yassen, 1993; Abd El-Ghany, 1996). Therefore, the present work aims to evaluate the effect of different types of fertilizers at local condition of Maryout calcareous soil in order to ameliorate growth parameters, uptake of nutrients and carbohydrates of *Ammi visnaga* crop.

MATERIALS AND METHODS

Two field experiments were carried out in the Maryout experimental station, Desert Research Center, west of Alexandria, north western coastal zone of Egypt during 2000/2001 and 2001/2002, on 1st October to study the response of *Ammi visnaga* plants to fertilizer sources under calcareous soil. Chemical and physical analyses of the experimental soil were carried out according to Black *et al.* (1985). The obtained results are presented in table (1).

The experimental layout was completely randomize block design with three replicates. The plot area was 2x3m containing rows of 60cm apart. The seeds were dipped at a distance of 30cm. Irrigation was regular at 7 days intervals with water having salt concentration of around 4000ppm. Number of treatments was six with three replication each giving of 18 plots. The use of highly saline water for irrigation was due to the local water in the area. The used water is a mixture of fresh and drainage water.

Fertilization

Crystal Nasser Te+20+20+20 recorded at the Ministry of Agriculture at number (1423) for year 1998 contains (20%N), (45.61% P_2O_5), (24% K_2O), (140ppm Zn), chelating form of Fe (700ppm), Mn(420ppm), Cu(100ppm), Mo(140ppm) and Boron (3ppm). Crystal Nasser was applied in a liquid form by a foliar method at three times (30, 60, 90 days after planting) at two rates (F_1 = 1kg/fed and F_2 = 2kg/fed)

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TABLE (1). Physical and chemical analyses of Maryout soil.

a- Mechanical analysis							
Particle size distribution (%)				Textural class			
Coarse sand	Fine sand	Silt	Clay				
3.30	28.10	30.89	37.71	Clay loam			
b- Chemical analysis							
EC dS/m paste	pH paste	Soluble cations and anions (meq/L)					
		Na^+	Ca^{++}	Mg^{++}	K^+	Cl^-	HCO_3^-	SO_4^-
5.56	8.1	26.2	22.8	9.4	1.1	31.2	8.0	20.3
$CaCO_3$ %	Organic carbon (%)	Total N (%)		C/N ratio		OM %	
37.0	0.51	0.09		6.0		0.9	

The microbiological treatments were applied as foliar after 30, 60, 90 days from sowing. The microbiological treatments comprised of control, Bio_1 (sezasiem) as bioactivation and Bio_2 yeast (*Saccharomyces cervicia*), obtained from the Company of Starch and Yeast in Kafr Al Zayat, Egypt. Yeast was used as suspension of 0.5kg yeast +0.5kg molasses in 50L (200L/fed) of water.

Sezasiem (Bio_1) is a biofertilizer used as foliar spray (kg/200 L water/fed). This biofertilizer contains 30 different bacterial strains {*Azotobacter chroococcum* (10 strains) + *Pseudomonas fluerescens* (5 strains) + *Rhizobium spp.* (10 strains) + *Bacillus megaterium* (phosphate dissolver, 5 strains)}. It contains some important macro and micronutrients useful for the bacterial strains in forcing them for exudation of different hormones important for activating plant growth.

Yeast as one of the richest sources of high quality protein contains the essential amino acids like lysine, tryptophan, ... etc. It also contains the essential minerals and trace elements namely calcium, cobalt, iron, ... etc., and the best source of the B-complex vitamins such as B_1, B_2, B_6 and B_{12}.

Microbiological Determination

Rhizospheric samples of plants were taken at three growth stages and subjected to microbiological determinations. Total microbial counts on soil extract agar (Page *et al.*, 1982), phosphate dissolving bacteria on Bunt and Rovira agar medium after modification by Taha *et al.* (1969), *Azotobacter* counts on modified Ashby's medium (Abd El Malek and Ishac, 1968), *Pseudomonas fluerescens* count (King *et al.*, 1954), using the dilution frequency method while yeast count was determined according to Difco Mannual (1977) using the decimal plate count technique.

Plant Measurements

Yield and growth characters such as plant height, number and diameter of umbels/plant were recorded. Random representative samples of 10-bordered plants were taken from the middle of every plot from the three replicates (Sexana and Singho, 1965) for analysis.

Total NPK in *Ammi visnaga* plant shoots at harvest were determined. Total N content was determined according to Jackson and Erle (1972), total

potassium (Gough, 1981), total phosphorus was calorimetrically determined according to APHA (1989).

Plant contents of Fe, Mn, Zn and Cu were determined at harvest according to Black *et al*. (1985). Total carbohydrates and sugars were determined according to Chaplin and Kennedy (1994). Data obtained were analyzed using Duncan's multiple range tests as described by Snedecor and Cochran (1984).

RESULTS AND DISCUSSION

The obtained results were discussed under the items of vegetative growth, yield of seeds, carbohydrates, mineral composition of plant and microbiological parameters.

1- Effect of Fertilizer Sources on the Microbial Counts

1-1- Total microbial counts

Table (2) showed that the initial total counts in the soil before cultivation was found to be 25×10^6 cfu/gm dry soils. Generally, counts tended to increase significantly towards flowering then decreased towards harvesting. Nevertheless, counts at plant harvesting were higher than those at vegetative plant growth. In addition, counts were affected by treatments whatever individuals or combined. For individual treatments, the highest counts scored with Bio_1 biofertilizer > (F_2>F_1) chemical fertilizer > control. Bio_1+Bio_2 treatment recorded the highest counts being 352 followed in descending order by Bio_1+F_2 being 325 > Bio_1+F_1 being 310×10^6 cfu/gm dry soil at flowering stage of plant growth. This result is in agreement with the statement of Subba Rao (1988), El Kased *et al*. (1996) and Migahed *et al*. (2004) that biofertilization improved soil fertility to be the most convenient ones for the growth of different medicinal plants and their rhizospheric microorganisms.

TABLE (2). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on total microbial counts during different growth stages of *Ammi visnaga* (counts $\times 10^6$ cfu/gm dry soil). (Means of two seasons)

Treatments	Stages of growth								
	Vegetating			Flowering			Harvesting		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	28	110	32	53	296	92	26	132	52
F_1	36	120	70	99	310	200	45	144	95
F_2	56	125	80	116	325	210	60	147	99
Bio_1	110	110	135	296	296	352	132	132	168

(counts $\times 10^6$ cfu/gm dry soil). c.f.u.= colony forming unit
Initial counts 10×10^6 cfu/gm dry soil.
Bio_1=sezasiem, Bio_2=yeast,
F_1= Crystal Nasser (1kg/fed), F_2=Crystal Nasser (2kg/fed)

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1-2- Phosphate dissolving bacteria (PDB)

Data presented in table (3) show that the counts of PDB significantly increased at flowering if compared with harvesting and vegetating growth of *Ammi visnaga* plant. The highest counts were recorded with Bio_1+Bio_2 being 155 followed in descending order by Bio_1+F_2 being 135×10^4 cfu/gm dry soil as combined treatments. These counts increased as much as 4-3 folds comparing with the control (37×10^4 cfu/gm dry soil) at flowering stage of *Ammi visnaga* plant. Phosphate dissolving rhizobacteria possess the ability of solubilizing phosphates in soil by producing organic acids (Saber, 1982).

TABLE (3). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on phosphate dissolving bacteria (counts $\times10^4$ cfu/gm dry soil). (Means of two seasons)

Treatments	Stages of growth								
	Vegetating			Flowering			Harvesting		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	12	44	32	37	110	91	18	55	49
F_1	22	51	33	60	120	98	35	71	52
F_2	25	55	38	65	135	102	38	78	58
Bio_1	44	44	70	110	110	155	55	55	88

Initial counts 5×10^4 cfu/gm dry soil, Bio_1= sezasiem.
cfu= Colony forming unit. Bio_2=yeast.
F_1= Crystal Nasser (1 kg/fed), F_2=Crystal Nasser(2 kg/fed)

1-3- Azotobacters

In table (4), the highest azotobacters densities recorded at flowering stage for Bio_1 treatment was 225×10^5 cells/gm dry soil as individual treatment followed in descending order by F_2 being 138×10^5 cells/gm dry soil. The counts increased as much as 5-3 folds comparing with the control (45×10^5 cells/gm dry soil) at flowering stage of *Ammi visnaga* plant.

For combined treatments, the highest increase was recorded with Bio_1+Bio_2 being 398×10^5 cells/gm dry soil which was 8 folds comparing with the control at flowering stage of the plant. This means that *Saccharomyces cerviceia* is very important for increasing the efficiency of Bio_1 as biofertilizer because it was the source of essential amino acids, minerals and trace elements and the B-complex vitamins.

The beneficial effects of *Azotobacter* spp. on plant development can be attributed not only to N-fixation, but also to the production of growth promoting substances as well as successful competition as well as against pathogenic microorganisms (Mikovachi and Millic, 2001; Arafa *et al.*, 2003).

1-4- Pseudomonas fluresecnce densities

It is clear from the data presented in table (5) that the remarkable increase was reached at flowering compared with vegetative and harvest stages of *Ammi visnaga* plant. The highest increase was recorded with Bio_1+Bio_2 being 175×10^2 cells/gm dry soil followed in descending order by

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F_2+Bio_1 being 129×10^2 cells/gm dry soil and the least one was recorded with F_1 being 51×10^2 cells/gm dry soil. These treatments increased densities as much as 10, 7, 3 folds comparing with the control treatment (17×10^2 cells/gm dry soil) at flowering stage of the plant. Some bacterial strains produce antibiotic that promote plant growth directly by producing metabolites which stimulate plant growth independent of native soil microflora (Brown and Burlington, 1968; Abd El-Ghany *et al.*, 1997).

TABLE (4). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on *Azotobacters* (counts $\times10^5$ cells/gm dry soil). (Means of two seasons)

Treatments	Stages of growth								
	Vegetating			Flowering			Harvesting		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	18	70	32	45	225	109	30	99	75
F_1	42	80	79	110	255	211	75	170	111
F_2	48	89	88	138	269	221	85	180	125
Bio_1	70	70	99	225	225	398	99	99	195

Initial densities 10×10^5 cells/gm dry soil, Bio_1= sezasiem,
cfu= colony forming unit. Bio_2=yeast.
F_1= Crystal Nasser (1 kg/fed). F_2=Crystal Nasser(2 kg/fed).

TABLE (5). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on *Pseudomonas fluorescence* (counts $\times10^2$ cells/gm dry soil). (Means of two seasons)

Treatments	Stages of growth								
	Vegetating			Flowering			Harvesting		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	9	35	25	17	99	80	13	65	45
F_1	19	48	29	51	117	78	33	81	48
F_2	22	54	29	65	129	83	38	88	53
Bio_1	35	35	65	99	99	175	65	65	99

Initial densities 2×10^2 cells/gm dry soil, Bio_1= sezasiem,
cfu= colony forming unit. Bio_2=yeast,
F_1= Crystal Nasser (1 kg/fed). F_2=Crystal Nasser(2 kg/fed)

1-5- Yeast counts

It is obvious from the data in table (6) that counts of yeast were affected by stages of *Ammi visnaga* plant growth, and types and source of fertilizer. With respect to stage of plant growth count recorded was at flowering and at harvesting were significantly higher than those at vegetating plant growth stage. Also, concerning fertilizer types and sources, the highest counts was obtained with Bio_1+Bio_2 treatment being 87×10^2 cfu/gm dry soil and the least counts was recorded with F_1 being 38×10^2 cfu/gm dry soil at flowering of plant. These treatments increased counts as much as 3 and one folds compared with the control (28×10^2 cfu/gm dry soil) at flowering stage of the plant (Abd El-Ghany *et al.*, 1997).

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TABLE (6). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on yeast (counts $\times 10^2$ cfu/gm dry soil).

Treatments	Stages of growth								
	Vegetating			Flowering			Harvesting		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	8	22	30	28	57	58	12	28	35
F_1	15	30	35	38	62	70	20	35	43
F_2	20	32	40	42	68	78	25	38	49
Bio_1	22	22	45	57	57	87	28	28	62

Initial counts 1×10^2 cfu/gm dry soil, Bio_1= sezasiem,
cfu= colony forming unit, Bio_2=yeast,
F_1= Crystal Nasser (1 kg/fed), F_2=Crystal Nasser(2 kg/fed).

It could be concluded from the above discussion that the application of the bioactivation increased the total microbial counts phosphate, dissolving bacteria, *Azotobacter* and pseudomonas densities. This was reflected on plant growth and yield. The application of other treatments increase the respective elements supplied and improved the out yield. In addition, soil fertility status increased by increasing the solubility and thus the availability of fixed nutrients in the soil such as N, P, K, Fe, Mn and Zn.

2- Effect of Fertilizer Sources on the Growth of *Ammi visnaga*

2-1- Plant height

Data presented in table (7) show that all chemical fertilizers and biofertilizers caused a significant increase in plant height when compared with the control (no fertilizer application) in both seasons. It is very clear that plant height increased as Crystal Nasser levels increased in the two seasons. The rates of increase by Crystal were 77.04 and 74.21% in the first season, 79.10 and 76.60% in the second season for the F_1 and F_2 dose of Crystal, respectively. The effect of Crystal Nasser as a commercial fertilizer may be attributed not only to the expected balance between a number of essential elements but also to the quantities of each nutrient. Similar results were obtained by Migahed (1998) on *Anethum graveolens*, Migahed and El-Kassed (1998) on *Foeniculum vulgre* and Migahed *et al.* (2004) on *Apium graveolens*.

The plant height significantly increased with Bio_1, Bio_2 and combined treatments. Bio_1 and Bio_2 treatments increases were 82.28, 86.81% and 84.17, 87.14% in the first and second seasons, respectively. Plant height significantly increased in combined treatments Bio_1 F_1, 57.84%, 59.11%, Bio_1 F_2, 54.42%, 56.37%, Bio_2 F_1, 61.14%, 62.78%, and Bio_2 F_2, 58.59%, 59.32% in the first and second season, respectively (Table 7). This may be attributed to the increase in soil available N and consequently formation of metabolites which encourage plant vegetative growth also formation of growth regulators by inoculation (El-Sawy *et al.*, 1998).

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TABLE (7).Effect of Crystal Nasser fertilizer, biofertilizer and their combination on vegetative growth of *Ammi visnaga* during 2000 and 2001 seasons.

Treatments	2000 season			2001 season		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
	Plant height (cm)					
Control	70.51	85.18	81.22	73.66	87.54	84.53
F_1	91.52	121.90	115.33	93.12	124.61	117.32
F_2	95.01	129.57	120.35	96.16	130.67	124.18
Bio_1	85.18	85.18	118.22	87.51	87.51	121.62
LSD 5%	3.35			3.50		
	No of umbels / plant					
Control	19.29	30.73	30.09	21.06	34.45	31.02
F_1	32.72	35.61	37.62	33.77	38.03	39.45
F_2	35.66	39.68	38.65	40.12	42.12	40.77
Bio_1	30.72	30.72	36.15	39.45	39.45	39.22
LSD 5%	2.20			2.80		
	Diameter of umbels					
Control	13.26	17.46	16.03	15.03	18.88	17.12
F_1	18.69	20.13	19.45	19.30	21.42	20.25
F_2	22.71	22.62	20.63	25.40	28.25	21.20
Bio_1	17.41	17.41	19.95	18.80	18.80	22.50
LSD 5%	1.20			1.50		

F_1= Crystal Nasser (1kg/fed). Bio_1= sezasiem.
F_2= Crystal Nasser (2kg/fed). Bio_2= yeast.

2-2- Number of umbels per plant

Number of umbels per plant increased in all treatments compared with the control in the two seasons. Number of umbels per plant increased in the two experiments in response to commercial fertilizer, biofertilization and combined treatments. Commercial fertilizer was more effective with biofertilization in this respect.

Number of umbels ranged from 19.29 to 42.12 umbels per plant in the two experiments (Table7). Commercial fertilizer + biofertilization were more effective than commercial fertilizer and biofertilizer each above in increasing the number of umbel/plant. In a similar investigation, Migahed (1998) and Migahed and El-Kassed (1998) reported that Granzit fertilizer significantly increased number of umbels per plants on *Anethum graveolens* and *Foeniculum vulgre*. Similar findings were reported by Migahed *et al.* (2004) on *Apium graveolens* plants.

2-3- Diameter of umbels (cm)

Diameter of umbels ranged from 13.26 to 22.71cm in the first experiment and 15.03 to 28.25cm in the second experiment (Table7). Diameter of umbels as a function in plant height and number of umbel followed the same trend in both of them. In general, Ibrahim *et al.* (1984) on *Ammi visnaga* found that the vegetative mass were significantly increased by nitrogen application up to 60kg/ha according to Menesi (1995) on *Ammi visnaga*. Ibrahim (2000) on *Ammi visnaga* found that *Azotobacter* +

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Azospirillum in the presence of full dose of NPK gave the highest number and the best growth of umbels per hill compared with other treatments in the two seasons.

2-4- Yield of seeds

Obtained results in table (8) revealed that combined treatments recorded the highest weight of seeds in comparison with individual treatments and control which gave the lowest in the two seasons. Yield of seeds increased progressively in combined treatments, F_2+Bio_1 from 745.1 to 774.0 kg/fed. While F_2+Bio_2 increased seed yield from 681.2 to 713.3 kg/fed in the first and second seasons, respectively.

It could be summarized that application of commercial fertilizer (Crystal Nasser), biofertilizer (sezasiems or yeast) and combined treatments increased the plant height, number of umbels per plant, diameter of umbels and yield of seeds. In this experiment, the application of F_2+Bio_1 gave the highest response.

These differences in seed yield may be attributed to the effect of the amount of mineral fertilization in addition to inoculation on the enzymatic systems which are responsible for the biosynthesis of stored foods and this may be reflected on the average weight of the seed yield (Wange, 1996 on Carrot; Mohamed ,1997 on *Cuminum Cyminum* and *Nigella;* Migahed *et al*., 2004 on *Apium graveolens* plants).

TABLE (8). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on seed yield (kg/fed) of *Ammi visnaga* during 2000 and 2001 seasons.

Treatments	2000			2001		
	Control	Bio_1	Bio_2	Control	Bio_1	Bio_2
Control	408.9	608.6	565.4	452.2	668.4	583.3
F_1	645.2	659.7	650.5	678.8	694.4	672.7
F_2	694.3	745.1	681.2	719.6	774.0	713.3
Bio_1	608.6	608.6	640.5	668.4	668.4	695.7
LSD 5%	22.5			32.9		

Bio_1=sezasiem, Bio_2=yeast.
F_1=crystal Nasser (1kg/fed), F_2=crystal Nasser(2kg/fed).

2-5- Uptake of nutrients

Data presented in table (9) showed that application of all fertilizer sources had significant effect on the uptake of N, P, K, Na, Fe, Mn and Zn. Biofertilizers effectively decreased the soil pH which may increase the subtly and utilization of phosphorus, Fe, Mn and Zn. Potassium was less affected. Nitrogen fixed by bacteria encouraged plant growth and consequently the plant demand of other nutrients which is normally reflected on their highest uptake by plants. The highest figures were obtained when F_2+sezasiem was applied. Similar results were obtained by Ahmed (2000).

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It could be concluded that the uptake of the nutrients N, P, K, Na, Fe, Mn and Zn were improved by varying degrees. Such improvement in the chemical composition had an impact on their nutritive value for human. However, the application of biofertilizers proved superior compared with other sources. This might be attributed to increase in the capacity of *Ammi visnaga* plant to absorb nutrients as coincides with Sprenat (1990) who found that the solubilization of minerals, synthesis of vitamins, amino acids, auxins and gibberallins, which stimulate plant growth came because of inoculation. These results are in harmony with those obtained by Govedarica *et al.* (1996) on pepper, Migahed and El-Kassed *et al.* (1998) on fennel, Ali (1998) on henna. Ibrahim (2000) stated that the highest nitrogen percent in leaves resulted on *Ammi visnaga* plant from inoculation with *Azotobacter* + *Azospirillum* in the presence of full dose of NPK. While the highest P% resulted from inoculation with *Azotobacter* + *Azospirillum* in the presence of 3/4 the dose of NPK. However, the full dose of NPK only gave the highest K% in both seasons.

The above discussion highlighted the effect of bioactivities and mineral fertilizers on the growth and yield of *Ammi Visnaga* which seemed to be obvious. This result drew the attention to the effect of such fertilizers on the microbial counts and the availability of same important nutrients to plants and finally on the fertility status of the soil in general and particularly on calcareous soils.

TABLE (9). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on the mineral composition of *Ammi visnaga* plants during 2000 and 2001 seasons.

Treatments	Mineral composition of herbage													
	N%		P%		K%		Na%		Fe ppm		Mn ppm		Zn ppm	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Control.	0.54	0.61	0.20	0.27	1.90	1.98	0.40	0.43	110.1	110.9	9.0	9.9	80	94
F_1	1.65	1.73	0.96	0.51	3.25	3.30	0.45	0.47	160.0	163.5	13.0	14.2	150	165
F_2	1.80	1.91	0.55	0.59	3.50	3.70	0.48	0.50	182.0	190.0	15.0	16.5	140	215
Bio_1	1.01	1.08	0.45	0.47	2.71	2.95	0.44	0.49	130.0	136.0	11.5	12.0	130	141
Bio_2	0.95	0.99	0.30	0.35	3.01	3.07	0.46	0.48	120.5	123.0	10.0	10.5	117	126
F_1+Bio_1	2.07	2.12	0.50	0.56	3.32	3.36	0.51	0.53	171.0	176.0	13.5	14.6	184	195
F_1+Bio_2	2.20	2.25	0.57	0.59	3.40	3.45	0.54	0.56	189.0	193.0	15.5	16.8	220	215
F_2+Bio_1	1.65	1.75	0.40	0.44	3.70	3.76	0.42	0.46	169.0	170.5	13.2	14.5	166	175
F_2+Bio_2	1.80	1.86	0.57	0.56	3.82	3.88	0.45	0.48	171.0	179.5	14.8	15.1	202	210
Bio_1+Bio_2	1.43	1.55	0.48	0.50	3.15	3.28	0.41	0.47	140.0	145.0	12.5	13.3	140	146
L.S.D (5%)	0.9	0.10	0.2	0.1	0.14	0.12	0.02	0.03	14.0	16.0	9.0	7.0	0.9	0.8

Bio_1=sezasiem, Bio_2=yeast,
F_1=Crystal Nasser(1kg/fed), F_2=Crystal Nasser(2kg/fed).

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2-6- Effect on carbohydrate content

Tables (10 and 11) indicate that the commercial fertilizer or biofertilizers slightly increased the carbohydrate content, soluble and insoluble sugars. The highest increases were recorded in F_2+Bio_1. This treatments although increased the amount of the soluble sugars and insoluble sugars, but their relative percentage to the total carbohydrate was about the half in comparison with the other treatments.

The result concerning the effect of Crystal Nasser fertilizer, biofertilizer and their combination on the carbohydrate content may throw the light on responses of vegetation growth and yield of seeds. These results are in agreement with those obtained by Abou Dahab *et al.* (1984) on *Coriandrum sativum*, Abd El-Salam (1994) on *Pimpinella anisum* and Ali (1998) on henna. Ibrahim (2000) found that the highest total carbohydrate content in leaves resulted from inoculation with *Azotobacter* + *Azospirillum* in the presence of high dose of NPK on *Ammi visnaga*.

TABLE (10). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on total carbohydrate content and soluble, (unsoluble) sugars percentage of *Ammi visnaga* plant during 2000 and 2001 seasons.

Treatments	Total carbohydrate %						Soluble sugars %						Unsoluble sugars %					
	2000			2001			2000			2001			2000			2001		
	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2
Control	10.75	13.7	12.30	11.20	14.2	13.5	1.90	2.77	2.50	2.10	2.86	2.60	8.85	10.93	9.80	9.00	11.34	10.90
F_1	15.10	16.2	15.90	16.30	17.1	16.6	2.85	2.96	2.87	2.94	2.99	2.96	12.25	13.24	13.03	13.36	14.11	13.64
F_2	18.20	19.3	18.88	18.50	19.8	18.9	3.17	3.89	3.30	3.25	3.90	3.50	15.03	15.61	15.50	15.25	15.90	15.40
Bio_1	13.70	13.7	14.20	14.20	14.2	15.11	2.77	2.77	2.80	2.86	2.86	2.71	10.93	10.93	11.30	11.34	11.34	12.19
L.S.D (5%)	0.8			0.89			0.14			0.16			2.3			4.5		

Bio_1=Sezasiem, Bio_2=yeast, Cont.=Control.
F_1=Crystal Nasser(1kg/fed.), F_2=Crystal Nasser(2kg/fed).

TABLE (11). Effect of Crystal Nasser fertilizer, biofertilizer and their combination on relation between carbohydrate content, soluble sugars and unsoluble sugars percentage of *Ammi visnaga* plant during 2000 and 2001 seasons.

Treatments	Relation S.S/T.C %						Relation Un-S.S/T.C %					
	200			2001			2000			2001		
	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2	Cont.	Bio_1	Bio_2
Control	17.67	20.22	20.92	18.92	20.14	19.26	82.23	79.78	72.60	81.08	79.86	80.74
F_1	18.87	18.27	18.05	18.04	17.49	17.83	81.12	81.73	81.95	81.97	82.51	82.17
F_2	17.42	19.42	17.48	17.57	19.69	18.52	82.58	80.75	82.09	82.43	80.30	81.48
Bio_1	20.22	20.22	19.85	20.14	20.14	20.63	79.78	79.78	79.57	79.85	79.85	80.72
L.S.D (5%)	1.2			1.8			2.1			2.3		

T.C= Total carbohydrate%, S.S= Soluble sugars%,
Uns= Unsoluble sugars% = T.C-S.S, Bio_1= sezasiem, Bio_2= yeast,
F_1= crystal Nasser(1kg/fed), F_2= crystal Nasser(2kg/fed).

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Received: 08/08/2005
Accepted: 03/11/2005

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استجابة نبات الخلة للتسميد المعدنى والحيوى فى الأراضى الصحراوية

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أجريت التجربة الحقلية بمحطة بحوث مريوط التابعة لمركز بحوث الصحراء بالإسكندرية خلال موسمى ٢٠٠/٢٠٠١ ، ٢٠٠١/٢٠٠٢ وذلك لدراسة استجابة نبات الخلة للتسميد المعدنى بمركب كريستال نصر (Te+ ٢٠+٢٠+٢٠) والمستخدم بمعدلين هما F_1(١كجم/فدان) ، F_2(٢كجم/فدان) ، ونوعين من التسميد الحيوى هما السيزاريم (Bio_1) ازوتوباكتر كروكوكم+ سيدوموناس فلوريسنس+ريزوبيا+باسيلس ميجاثيربم+ بعض العناصر الصغرى والكبرى المنشطة للسلالات Bio_2 (سكارومايسس سيرفيسيا) ، وتم استخدام التسميد المعدنى والحيوى رشا على النباتات تحت الظروف البيئية للمنطقة ويمكن تلخيص النتائج كالآتى:

١- وجد أن استخدام Bio_1+F_2 بالرش لهما تأثيرات ملحوظة بالنسبة لارتفاع النبات وقطر النورات وعدد النورات فى النبات. كما وجد أن المعاملة Bio_1+F_2 أعطت أعلى محصول من البذور للفدان مقارنه بالمعاملات الأخرى ومجموعة المقارنة.

٢- لوحظ أن استخدام التسميد المعدنى والحيوى رشا على النباتات أدى إلى زيادة فى محتوى العناصر الصغرى والكبرى فى النبات وكذلك محتوى النبات من الكربوهيدرات الكلية والسكريات الذائبة والسكريات الغير ذائبة بدرجات متفاوتة.

٣- حسن التسميد الحيوى (Bio_1, Bio_2) خصوبة التربة وخواص ميكروبات الريزوسفير لنبات الخلة.

٤- تحقق أعلى نمو ميكروبى مع Bio_1 كتسميد حيوى وكريستال نصر ($F_1 < F_2$) كتسميد معدنى كمفردات ، (Bio_1+Bio_2) كمخلوط فى مرحلة الإزهار للنبات.

٥- نشط Bio_1 كمحفز حيوى تأثير F_1, F_2 وأيضا للخميرة.

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