J. Agric. Sci. Mansoura Univ., 29(5): 2713 - 2725, 2004

INFLEUNCE OF NITROGEN LEVELS AND NO_3: NH_4 RATIOS ON VEGETATIVE GROWTH, YIELD AND CHEMICAL COMPOSITION OF CUCUMBER

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture, Suez Canal University during the two successive seasons of 2001 and 2002 to investigate the effect of nitrogen levels (30, 60 and 90 kg N/fed) and NO_3 : NH_4 ratios on vegetative growth, yield and elemental status of cucumber (*Cucumis sativus*, L.)

Results indicated that increasing the applied nitrogen levels from 30 up to 90 kg N/fed. increased all the vegetative growth parameters (No. of leaves, plant height, shoot fresh and dry weights and leaves area /plant). Conceming the N-form ratio, the results declared that the ratio of 2:1 NO_3 : NH_4 gave the highest values of all parameters followed by 3:0 ,1:1, 1:2 and the lowest values were obtained when NH_4 was the sole source of nitrogen.

Yield components, No. of fruits/plant, total yield/ plant and yield/ *fed.* were increased significantly with increasing nitrogen level, however the average of fruit weight and the early yield /plant were higher with 60 kg N/fed. than with other two rates. Regarding the NO_3: NH_4 ratios, results showed that the average number of fruits/ plant were higher with the ratio of 1:2 than 1:1 or 3: 0 . However, the average fruit weight was higher with the ratios of 2:1 and 1:1 than the other ratios. The highest early and total yield/ plant and total yield/ fed. were found with ratio of 1:2 followed by 1:1and the lowest values were observed with the ratio of 3:0.

Total nitrogen, phosphorus and potassium contents of the leaves increased with increasing nitrogen applied levels from 30 to 90 kg N./fed. Both N and P contents in the leaves increased corresponding to the increase of NH_4-N proportion in the mixture. However, the lowest K contents were found with the NH_4- N fed plants and increased with increasing the NO_3: NH_4 ratios.

INTRODUCTION

The growth and yield of cucumber and other cucurbits depend much on the supply of nitrogen and are generally increased by the application of. nitrogen fertilizers.

Ammonium and nitrate represent the major and available inorganic forms of nitrogen, taken up by the roots of higher plants (Devlin and Witham, 1983).

As ammonium or nitrate comprise about 80% of the total cations and anions taken up by plants, the form of nitrogen supply has a strong but inverse impact on the uptake of other cations and anions (Marschner, 1995). The preference of either ammonium or nitrate as sole source of nitrogen for plant growth and yield formation depends on plant species and for many a mixture is much better (Kirkby, 1981).

Species susceptible to ammonium nutrition such as cucumber and pea grow without toxicity symptoms if the concentration of ammonium is moderate and the pH in the growth medium is maintained near neutrality. Unfavorably high concentrations of ammonium nitrogen in the soil or in the nutrient solution may, however, lead to NH_4 toxicity which is considered to be the sult of effects such as ammonium- induced mineral nutrient deficiency

caused by impaired uptake of ions, acidification of the rhizosphere, alterations in the osmotic balance, or modified phytohormone metabolism (Gerendas *et al.* 1997).

The high demand of carbon skeletons for ammonium assimilation is reflected on the doubling of the rates of O_2 consumption per unit root weight compared with nitrate-fed plant (Matsumoto and Tamura, 1981). As a result sugar content of those supplied with ammonium is lower in the root than with those fed by nitrate plants. Accordingly, plant growth, is poor in ammonium fed plants when ammonium concentration or root zone temperature is high.

The relative advantage of both forms of nitrogen on plant growth also strongly depends on the external concentrations. At low concentrations the growth differences between ammonium and nitrate supply are small but it depend on plant species. However, with increasing external concentration, the advantage of nitrate as sole source of nitrogen increases and relative depression by sole ammonium supply become distinct. Highest growth rates are achieved with mixed supply of both forms of nitrogen, the optimal proportion depend strongly on the total concentrations supplied (Gerendas and Sattelmacher,1990).

Researches indicated that the highest crop yields are generally obtained with a mixture of NO_3 and NH_4 than with either form alone (Barker and Mills, 1980; Hagin *et al.* 1990). The effects of mixed systems differ with species, physiological stage of growth and the ratio of NH_4 to NO_3 supplied (Errebhi and Wilcox, 1990).

Most nitrogen fertilization studies on cucumber focus on rate, kind, method and time of application, however, the changes in NO_3: NH_4- ratios received less attention.

The aim of this study is to investigate the effect of both N levels and NO_3: NH_4 ratios on vegetative growth and yield of cucumber.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture Suez Canal University during the two successive seasons of 2001 and 2002 to investigate the influence of nitrogen levels (30, 60 and 90 kg N/fed) and NO_3 : NH_4 ratios (3:0, 2:1, 1.:1, 1:2 and 0:3), for each level of nitrogen,respectively, on the growth , yield and its components and elemental status of cucumber.

The experiments were carried out on sandy soil in texture with 95.2 and 95.4 sand, 3.0 and 2.6 silt, 1.8 and 2.0 clay, 0.92 and 0.84 organic matter, pH 7.98 and 8.01, total N (g/kg) 0.11 and 0.08, P (g/kg) 5.74 and 5.63, K (meq/L) 0.51 and 0.48, $CaCO_3$ (%) 0.68 and 0.75 in the first and second seasons, respectively.

A split-plot system in randomized blocks with four replicates was used. Nitrogen levels were arranged in main plot and the sub plot was devoted to the NO_3: NH_4 ratios. Seeds of cucumber cv. Medina were sown at first and third of April for the first and second seasons, respectively, in hills, 50 cm apart on one side of the ridges one meter width. Two plants were left per hill. The area of the sub plot was $21m^2$ (1/200 of fed). Nitrogen supply was divided to three equal portions. One-third was added during soil preparation and the

other two thirds were equally added every two weeks. The sources of N were ammonium sulphate (20.5%) and calcium nitrate (15.5%). Farmyard manure was added at soil preparation at the rate of 30 M^3/fed., other fertilizers and all recommended agricultural practices for commercial cucumber production under sandy soil conditions.were applied.

After 55 days of planting, three plants from each sub-plot were randomly taken to measure the vegetative growth parameters expressed as plant height (cm), number of leave/plant, shoot fresh weight/plant (gm). Shoots dry weight/plant were determined after they oven dried at 70°C for 72 hours. Leaves area (m^2)/plant was calculated according to the following equation

. Leaves area/plant = $\frac{\text{Fresh weight of leaves /plant x Area of the disks}}{\text{Fresh weight of disks}}$

At the beginning of harvest season fruits from each treatment were picked at two to three days intervals up to the end of harvesting season. The average number and weight of fruits/ plant, early yield and total yield g /plant as well as yield as ton / feddan were calculated.

Leaf mineral contents as percentage of dry weight of N. P and K were determined as follow;

- Total nitrogen in leaves as described by A.O.A.C.(1975).
- Phosphorous was determined according to Jackson (1967).
- Potassium was determined using flame photometer as described by Jackson (1967).
- Statistical analysis. The obtained data were subjected to statistical analysis according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSIONS

1- Vegetative growth.

1.a. Effect of nitrogen levels.

Data presented in Table (1) show the significant effect of the levels of nitrogen 30, 60 and 90 kgN/fed on vegetative growth parameters. Results declared that number of leaves/plant, plant height, both fresh and dry weight of shoot as well as the area of leaves per plant increased with increasing nitrogen level from 30 up to 90 kg.N/fed. This was evident in the two seasons of the study. The obtained results were in agreement with those of Abo-Sedera (1990); Mohamed (1999) on cucumber; Feleafel *et al.*(2000) on pumpkin and Tartoura (2001) on pea. The increment in plant growth parameters reflect the vital importance role of nitrogen as a plant nutrient, since it is an integral part of the chlorophyll molecule, nucleic acids, proteins, and other important substances (Devlin and Witham, 1983). Nitrogen stimulates the meristimatic activity for producing more tissues and organs. Abd-El-Fattah and Sorial (2000) ensured that increasing nitrogen levels increased of CYT and GA which enhance cell division and cell enlargement and thus increased vegetative growth of squash.

1.b. Effect of N-form ratio.

Concerning the influence of N form ratio on the vegetative growth of cucumber, it is clear from the results of Table (1) that the lowest values of all parameters were obtained when NH_4-N applied as sole source of N. The increase in the ratio of NO_3: NH_4 led to corresponding increase in number of

Table (1): Effect of nitrogen levels and NO_3 : NH_4 ratios on number of leaves/ plant, plant height, shoot fresh and dry weight and Leaves area of cucumber plants during 2001 and 2002 seasons.

Nitrogen levels (kg/fed)	No. of Leaves/ plant	Plant height (cm)	Shoot fr. Wt. (gm)	Shoot dry wt (gm)	Leaves area (m^2)	No .of leaves/ plant	Plant height (cm)	Shoot fr .wt. (gm)	Shoot dry wt. (gm)	Leave area (m^2)
	2001					2002				
30	17.60 c	72.15 c	227.47 c	20.35 c	21.26 c	20.22 b	67.80 c	210.20 c	22.36 b	16.88 c
60	24.81 b	101.07 b	249.41 b	23.55 b	26.24 b	22.28 a	88.64 b	234.49 b	22.66 b	20.63 b
90	26.90 a	108.74 a	258.16 a	25.67 a	30.64 a	20.05 b	91.43 a	241.81 a	23.66 a	22.75 a
					NO_3:NH_4 Ratios					
3:0	25.78 b	100.60 b	255.64 b	23.88 c	28.29 a	21.94 a	88.97 a	231.77 c	24.09 a	21.56 a
2:1	27.30 a	102.91 a	264.92 a	26.47 a	28.03 a	22.12 a	86.73 b	238.99 b	24.22 a	20.98 a
1:1	25.98 b	98.83 c	256.39 b	24.92 b	27.97 b	22.41 a	84.98 c	240.25 a	24.13 a	21.11 a
1:2	22.76 c	87.64 d	228.30 c	21.11 d	23.83 c	21.06 b	78.16 d	221.17 d	20.94 b	19.06 b
0:3	21.41 d	79.94 e	219.82 d	19.58 e	21.97 d	20.05 c	74.58 e	211.99 e	19.42 c	17.73 c

leaves/ plant, plant height, the fresh and dry weight of shoots and leaves area per plant. Generally, the ratio of 2:1 gave the best values followed 3:0,1. :1 then 1:2, respectively. The beneficial effect of mixed sources of N was also reported by Osman and Wilcox.(1986) on muskmelon, Alan (1989) on cucumber, Gameily *et al.*(1991) on onion, Ansary (1998) on spinach; William *et al.* (1999) on squash. The optimal growth of most plants grown with mixed supply of NO_3 and NH_4 explained by (Raven, 1985; Allen *et al.*1988) as when both NO_3 andNH_4 are supplied, pH stat may be achieved by similar rates of H^+ production (NH_4 assimilation) and H^+ consumption (NO_3 assimilation) and thus a very low energy requirement. Also, the mixture may enhanced the plant roots to grow and increased the production of CYT which export to the shoots (Wang and below, 1996). The rapid assimilation of ammonia cause the depletion of carbohydrate supply to plants utilize NH4 as sole source to a low point which in turn cause growth reduction of the plants (Devlin and Witham, 1983).

1.c. Effect of interaction.

Data in Table (2) show that NO_3: NH_4 ratios affected all vegetative growth parameters of cucumber. With 30 kg N. *fed* the greatest values of plant height and leaves area were obtained with the ratio of 30:0 NO_3: NH_4 followed by the ratios of 20: 10, 15: 15, 10: 20 and 0: 30,respectively. Concerning the number of leaves, fresh and dry weight of shoots, the ratio of 20: 10 gave the highest values followed by those of 15: 15, 30: 0 and the lower values of all parameters were obtained with the ratios of 10: 20 and 0: 30.

Results also show that with the level of 60 kg N/*fed.* the ratio of 40: 20 gave the highest values for all parameters, followed by 30: 30 for No. of leaves, dry weight of shoots and 60: 0 for plant height and fresh weight. However leaves area had no significant differences between the ratios 40: 20 or 60:0. Generally, plants fed with NH_4 alone had the lowest vegetative growth values followed by those grown with the ratio of 20 : 40 NO_3 : NH_4.

Plants received nitrogen fertilizer at rate of 90 kg N/*fed* had also the highest growth parameter values with the ratio of 60:30 followed by the ratio of 45:45 , 90:0, 30 :60 NO_3: NH_4 and the lowest values were gained when NH_4 was the only source of nitrogen. Matsumoto and Tamura (1981) stated that the demand of carbon skeleton for ammonium assimilation is reflected on the doubling of the rate of O_2 consumption per unit root weight compared to nitrate-fed plant as a result sugar content well be lower, and the plant growth is poor in ammonium fed plants specially when the concentration is high. The relative advantage of both forms of N on plant growth strongly depends on the external concentrations, and the highest growth rate achieved with mixed supply of both forms of nitrogen (Gerendas and Sattelmacher, 1990).

2. Yield and its components.

2.a. Effect of nitrogen levels.

Results of Table (3) show that number of fruits, yield /plant and total yield / *fed* were significantly increased as the applied N levels increased from 30 up to 90 kg N ./ *fed* in the two seasons. Regarding the fresh weight of fruits and early yield/ plant, the highest recorded values were obtained with N level

of 60 kg N/fed. over those of 30 or 90 kg N/fed. The proportional of early to total yield/ plant were 45%, 44% ;38% ,44 % and 43% 40% for those 30, 60 and 90 kg N/*fed* in the first and second season, respectively. These results were in harmony with Abo-Sedera(1990) and Mohamed (1999) on cucumber. Abd-El-Fattah and Sorial (2000) on squash stated that increasing the yield by the application of nitrogen levels may be due to the enhancement effect of nitrogen. to vegetative growth and leaves area /plant which create a large surface available for photosynthesis and thus in tum increased the weight of ruits and total yield. Besides, nitrogen is an important constituent of chlorophyll, which increase photosynthesis.

2.b. Effect of N-form ratio.

Data in Table (3) show that average number of fruits/ plant was higher with the ratio of 1:2 than the ratios of 1:1 or 3:0. The results indicated that number of fruits tend to increase with increasing NH_4 over NO_3 fertilizer although the differences between most ratios of NO_3: NH_4 were not significant. Average fruit weight also was higher with the ratio of 2:1 and 1:1 than the other ratios. This was evident in the two seasons of the study.

Concerning early and total yield/plant and total yield/feddan results also revealed significant differences between the ratios. The highest recorded values were obtained with the ratio of 1:2 followed by 1:1 and the lowest values were observed when NO_3 was the sole source of N. Similar results were obtained by William *et al.*(1999) who stated that the highest fruit biomass of squash plants receiving the ratio of 1:1 treatment indicated more carbon skeletons available for fruit production. As most of the photosynthetic energy was used for NO_3 uptake and assimilation, smaller proportion was allocated to fruit production. Hartmen et al.(1986) found that the vegetative growth of tomato shown to increase just before fruit set when 25% of the N was supplied as NH_4.The obtained results were in agreement to some extent with those of Osman and Wilcox (1986) on muskmelon and Gamiely *et al.*(1991) on onion

2.c. Effect of interaction.

Number of fruits/ plant increased with increasing N level from 30 up to 90 kg N/*fed*. With 30 kg N/fed the highest fruit was observed with the ratio of 1:2 followed by 1:1,2:1, 0:3 and the lowest number of fruits were with ratio of 3:0. The trend of the results was similar with 60 and 90 kg N/fed. however, most differences between the ratios were not significant (Table 4).

Concerning the average weight of fruits such data show that the highest weight of fruits with N level of 30 Kg was observed with the ratio of 3:0 followed by 2:1, 1:1, 1:2 and 0:3, respectively. With the N level of 60 kg/ *fed* it is clear from the results that the ratio of 1:1 gave the highest fresh weight of the fruits followed by 2:1 and 1:2 allthough most differences did not reach the value of significance. With N. level of 90 kg, such data showed that the ratio of 1:2 gave the highest fruit weight in the first and second seasons of the study.

Concerning the early and total yield/ plant or yield / *fed.*, data in the two seasons indicated that the highest values with three N levels were obtained with the ratio of 1:2 followed by the ratio of 1:1 and the lowest yield were found when plants fed with $Ca(NO_3)_2$ alone.

Table (2): Interaction effect of nitrogen levels and NO_3 : NH_4 ratios on number of leaves/plant, plant height, shoot fresh and dry weight and Leaves area of cucumber plants during 2001 and 2002 seasons.

N. levels Kg/ fed	NO_3:NH_4	No. of leaves/ plant	Plant height (cm)	Shoot fr. wt. (gm)	Shoot dry wt (gm)	Leaves area (m^2)	No. of leaves/ plant	Plant height (cm)	Shoot fr. wt. (gm)	Shoot dry wt .(gm)	Leaves area (m^2)
		2001					2002				
30	30 : 0	22.92	78.11	230.92	20.11	23.12	20.00	74.46	211.22	22.38	17.67
	20 : 10	24.11	76.14	242.77	24.33	22.05	20.77	71.20	217.36	22.83	17.24
	15 :15	23.18	72.69	232.22	22.13	22.53	21.22	70.19	221.11	22.90	18.49
	10 : 20	20.79	69.46	218.17	18.14	20.02	19.86	62.68	203.62	20.11	15.91
	0 : 30	20.17	64.33	213.26	17.06	18.60	19.24	61.36	197.70	18.60	15.11
60	60 : 0	25.42	112.22	262.69	24.39	28.36	23.36	95.26	235.71	24.91	22.89
	40 :20	28.11	114.37	270.26	25.97	28.22	22.80	91.80	246.18	24.36	21.77
	30 : 30	26.70	103.64	261.77	25.72	27.11	22.91	91.37	244.27	24.10	21.23
	20 : 40	22.81	91.74	230.55	22.11	24.47	21.63	83.62	228.61	20.82	19.31
	0 : 60	21.00	86.36	221.80	19.57	22.80	20.71	81.17	217.68	19.11	17.93
90	90:0	28.07	120.17	275.18	26.91	34.27	22.47	97.20	248.39	24.98	24.11
	60:30	29.67	116.22	281.74	29.11	33.82	22.80	97.19	253.43	25.47	23.94
	45:45	29.00	111.46	273.31	27.13	33.38	23.11	93.39	255.36	25.39	23.61
	30:60	24.69	101.72	236.17	23.07	27.00	21.70	88.17	231.28	21.89	21.96
	90 : 0	22.77	89.12	224.39	22.11	24.51	20.19	81.22	220.60	20.55	20.14
F test		NS	**	**	NS	*	NS	**	NS	NS	NS

Table (3): Effect of nitrogen levels and NO_3 : NH_4 ratios on number of fruits /plant, average of fruit weight / plant, early yield plant, total yield/ plant and total yield / fed.of cucumber plants during 2001 and 2002 seasons.

Nitrogen levels (kg/fed)	No. of Fruits / plant	Average fruit wt.(gm)	Early yield/ plant (gm)	Total yield / plant (gm)	Total yield (ton/fed)	No. of fruits/ plant	Average fruit wt.(gm)	Early yield/ plant (gm)	Total yield / plant (gm)	Total yield (ton/ fed)
	2001					2002				
30	7.27 c	82.40 c	281.07 c	626.54 c	5.25 c	6.54 c	83.09 c	238.33 c	542.62 c	4.81 c
60	9.01 b	100.73 a	400.16 a	908.01 b	7.64 b	8.35 b	96.43 a	349.18 a	805.37 b	7.66 a
90	10.74 a	90.61 b	378.94 b	973.01 a	8.19 a	9.33 a	92.20 b	346.35 b	860.65 a	7.54 b
					NO_3:NH_4 ratios					
3:0	8.34 b	90.04 d	301.95 e	741.26 e	6.30 b	7.28 d	88.60 e	267.76 d	645.62 d	5.71 c
2:1	8.79 b	96.19 a	341.74 d	848.59 c	7.21 a	7.94 c	92.03 a	307.02 c	733.86 c	6.37 b
1:1	9.28 a	94.24 b	374.44 b	876.76 b	7.36 a	8.47 b	91.06 c	332.69 b	775.51 b	6.81 a
1:2	9.70 a	92.17 c	384.45 a	898.77 a	7.49 a	8.68 a	91.56 b	342.56 a	800.47 a	7.03 a
0:3	8.92 b	88.36 e	350.05 c	793.90 d	6.50 b	7.99 c	89.60 d	306.40 c	725.27 c	6.33 b

Table (4): Interaction effect of nitrogen levels and NO_3 : NH_4 ratios on number of fruit /plants, average of fruit weight / plant, early yield / plant, total yield/ plant and total yield(ton / fed) of cucumber plants during 2001 and 2002 seasons.

N. levels Kg /fed.	NO_3:NH_4	No. of fruits/ plant	Average fruit wt (gm)	Early yield/ plant (gm)	Total yield /plant (gm)	Total yield (ton/ fed)	No. of fruits/ plant	Average fruit wt.(gm)	Early yield/ plant (gm)	Total yield/ plant (gm)	Total Yield (ton / fed)
		2001					2002				
30	30 : 0	5.97	90.92	222.69	542.79	4.55	5.40	85.33	198.32	460.78	4.07
	20 : 10	7.33	90.02	293.33	659.85	5.69	6.71	84.88	248.36	569.54	4.89
	15 : 15	7.91	87.22	302.11	689.91	5.84	7.20	82.79	264.19	596.09	5.33
	10 : 20	8.30	83.09	314.79	689.65	5.66	7.49	81.62	269.29	611.33	5.46
	0 : 30	6.83	80.60	251.43	550.50	4.50	5.88	80.84	211.51	475.34	4.29
60	60 : 0	8.22	99.78	348.81	820.20	6.97	7.31	94.34	295.76	689.63	5.94
	40 : 20	8.71	101.85	372.53	887.11	7.50	7.89	97.72	330.67	771.01	6.76
	30 : 30	9.11	102.88	430.49	937.26	7.96	8.61	98.19	369.38	845.42	7.40
	20 : 40	9.80	100.86	432.36	988.43	8.20	9.11	97.88	391.18	891.69	7.66
	0 : 60	9.23	98.27	416.61	907.04	7.56	8.81	94.00	358.89	828.14	7.21
90	90 : 0	10.84	79.41	334.36	860.80	7.37	8.13	86.14	309.19	786.46	7.11
	60 : 30	10.33	96.69	359.35	998.77	8.43	9.21	93.49	342.07	861.04	7.46
	45 : 45	10.83	92.62	390.71	1003.11	8.28	9.60	92.19	364.49	885.02	7.69
	30 : 60	11.00	92.57	406.19	1018.22	8.62	9.44	95.17	367.22	898.40	7.98
	0 : 90	10.72	86.21	382.11	924.17	7.63	9.28	94.00	348.79	872.32	7.48
F test		N.S	N.S	**	**	N.S	N.S	N.S	*	*	N.S

3. NPK contents.

3.a Effect of N. levels and N-form ratios:

Total N, P and K contents in the leaves of cucumber were increased corresponding to the increase of applied levels of nitrogen from 30 up to 90 Kg N/fed (Table 5). Obtained results are in harmony with the findings of Abo-Sedera (1991) on cucumber, Abd-El Fattah and Sorial (2000) on squash and Feleafel *et al.*(2000) on pumpkin. The highest concentration of N was found when NH_4-N was the only source of N. Increasing the proportions of NO_3-N in the mixture were tied with a corresponding decrease in N contents and the lowest concentration obtained in the leaves of NO_3-N fed plants.

Table (5): Effect of nitrogen levels and NO_3: NH_4 ratios on total nitrogen, phosphorus and potassium contents as a percentage of dry weight in the leaves of cucumber during 2001and 2002 seasons

N levels (kg/fed)	Nitrogen %	Phosphorus %	Potassium %	Nitrogen %	Phosphorus %	Potassium %
	2001			2002		
30	2.98 c	0.189 c	3.77 c	2.72 c	0.175 c	3.75 c
60	3.10 b	0.196 b	4.03 b	2.86 b	0.191 b	4.20 b
90	3.28 a	0.203 a	4.42 a	2.99 a	0.204 a	4.45 a
NO3 : NH4 Ratios						
3:0	2.90 e	0.190 d	4.80 a	2.58 e	0.184 c	4.59 a
2:1	3.01 d	0.194 c	4.59 b	2.74 d	0.186 c	4.46 b
1:1	3.14 c	0.195 c	4.35 c	2.90 c	0.187 c	4.19 c
1:2	3.23 b	0.199 b	3.50 d	2.97 b	0.193 b	3.81 d
0:3	3.32 a	0.202 a	3.12 e	3.09 a	0.199 a	3.62 e

The leaf contents of P showed a trend very similar to nitrogen with *all* N-form ratios. On the other hand K contents were highest when the ratio of NO_3: NH_4 was 3:0 followed by 2: 1, 1:1 and 1:2, respectively, and the lowest contents were found with the ratio of 0:3. Results held well in the two seasons. Our results coincided with those of Osman and Wilcox (1986) on muskmelon, Alan (1989) on cucumber, Ansary (1998) on spinach; William *et al.*(1999) on squash and contradicted with El-Nemr *et al.*(2002) on green bean.

3.b. Effect of interaction.

Data in Table (6) indicated that nitrogen, phosphorus and potassium contents in the leaves increased as the level of N increased from 30 up to 90-kg N/ *fed.* N and P increased as the ratio of NO_3 :NH_4 decreased to reach the highest content with the ratio of 0:3 with all levels of nitrogen. However, K content decreased corresponding to the increase of NH_4-N in mixture also with all the applied nitrogen levels. The trend was similar in both seasons.

Table (6): Interaction effect of nitrogen levels and NO_3: NH_4 ratios on total nitrogen, phosphorus and potassium contents as a percentage of dry weight in the leaves of cucumber during 2001and 2002 seasons

N. levels kg/fed	NO3:NH4 %	Nitrogen %	Phosphorus %	Potassium %	Nitrogen %	Phosphorus %	Potassium %
		2001			2002		
30	30 : 0	2.71	0.184	4.71	2.49	0.169	4.47
	20 : 10	2.90	0.188	4.38	2.62	0.171	4.28
	15 :15	3.01	0.188	3.96	2.71	0.173	3.84
	10 : 20	3.11	0.191	2.96	2.83	0.178	3.21
	0 : 30	3.18	0.193	2.82	2.94	0.182	2.93
60	60 : 0	2.87	0.191	4.82	2.56	0.186	4.52
	40 :20	2.96	0.194	4.56	2.74	0.186	4.41
	30 : 30	3.13	0.195	4.35	2.92	0.188	4.17
	20 : 40	3.22	0.197	3.48	2.96	0.194	3.99
	0 : 60	3.31	0.201	2.92	3.11	0.203	3.93
90	90:0	3.11	0.195	4.88	2.68	0.197	4.79
	60: 30	3.18	0.199	4.62	2.86	0.201	4.68
	45 : 45	3.28	0.203	4.74	3.06	0.201	4.56
	30 : 60	3.37	0.208	4.06	3.11	0.206	4.22
	0 : 90	3.48	0.211	3.61	3.22	0.213	4.01
F test		**	NS	*	**	NS	**

REFERENCES

A.O.A.C.(1975). (Association of Official Agricultural Chemists) Official Methods analysis, 12 th Ed., Published by A.O.A.C., Washington, D.C.

Abd El-Fattah, M.A,. and Mervat E. Sorial, (2000). Sex expression and productivity responses of summer squash to biofertiler application under different nitrogen levels. Zagazg J. Agric. Res. 27 (2): 255- 281.

Abo-Sedera, F.A., (1990). The response of cucumber plants to planting date and nitrogen fertilization. Annals of Agric. Sci., Moshtohor,28 (1): 601-617.

Alan, R. (1989). The effect of nitrogen nutrition on growth, chemical composition and response of cucumbers (*Cucumis sativus L.*) to nitrogen forms in solution culture. Journal of Horticultural. Science, 64 (4): 467- 474.

Allen, S., J. A Raven and J. I Sprent. (1988). The role of long-distance transport in intracellular pH regulation in *Phaseolus vulgaris* grown with ammonium or nitrate as nitrogen source, or nodulated. J. Exp. Bot. 39, 513-528.

Ansary, E.M. (1998). Effects of nitrification inhibitors and NH_4-N/ NO_3-N ratios on vegetative growth, physiological behavior, and hazardous compounds in spinach and lettuce plants. J. Agric. Sci. Mansoura Univ., 23 (12): 5939- 5954.

Barker, A.V., and H.A. Mills (1980). Ammonium and nitrate nutrition of horticultural crops. Hort. Rev. 2: 395- 423.

Devlin, R.M., and F.H. Witham (1983). Nitrogen metabolism. In plant Physiology, fourth Ed., Willard Grant Press, Boston pp150.

El-Nemr, M.A., U.A. El-Behairy, Omima M. Sawan, and A.F. Aou-Hadid (2002). The effect of N source on chemical analysis of green bean grown under different water levels. Egypt. J. Hort. 29 (2) : 333- 346.

Errebhi, M,. and G.E. Wilcox (1990). Plant species response to ammonium/ nitrate concentration ratios. J. Plant Nutr. 13: 1017- 1029.

Feleafel, M.N., S.M. Gabr, and I.M. Ghoneim (2000). Effect of nitrogen and potassium fertilization on growth, flowering and yield of pumpkin (Cucurbita pepo L.). J. Agrgic. Sci. Mansoura Univ., 25 (11): 7067- 7077.

Gameily, S., W.M. Randle, H.A. Mills, D.A. Smittle, and G.I. Banna (1991). Onion plant growth, bulb quality, and water uptake following ammonium and nitrate nutrition. Hortscience 26 (8: 1061: 1063.

Gerendas J., Z. Zhu, R. Bendixen, and B. Sattlemacher (1997). Physiological and biochemical processes related to ammonium toxicity in higher plants. Z. Pflanzenernahr. Bodenk 160, 239-251. [In Plant and Soil 208: 95-102 (1999].

Gerendas, J., and B. Sattelmacher (1990). Influence of nitrogen form and concentration on growth and ionic balance of tomato (Lycopersicon esculentum) and potato (Solanum tuberosum). In plant Nutrition- Physiology and Application' (M.L. van Beusichem, ed.), pp.33-37. Kluwer Academic, Dordrecht.

Hagin, J., S.R. Olsen, and A. Shaviv (1990). Review of interaction of ammonium/ nitrate nutrition of crops. J. Plant Nutr. 13: 1211- 1226.

Hartmen, P.L. , H.A. Mills, and J.B. Jones (1986). The influence of nitrate : ammonium ratios on growth, fruit development, and element concentration in ' Floradel' tomato plant. J. Amer. Soc. Hort. Sci. 111: 487- 490.

Jackson, M.L(1967). Soil chemical analysis. Prentic-Hall, India, pp. 144-197.

Kirkby, E.A.(1981). Plant growth in relation to nitrogen supply. In 'Mineral nutrition in higher plants. Second Ed.Academic Press Limited. Pp247.

Marschner,H. (1995). Mineral nutrition in higher plants. Second Ed. Academic Press Limited. PP 247.

Matsumoto, H. and K. Tamura (1981). Respiratory stress in cucumber roots treated with ammonium or nitrate nitrogen. Plant Soil 60 : 195-204.

Mohamed M.H. (1999). Effect of planting date, hybrid and level of nitrogen fertilizer on the production of cucumber under plastic house. Annals of Agric. Sci. Moshtohor 37 (1): 391: 406.

Osman, M. E. and G.E. Wilcox (1986). Nitrogen form ratio infleunce on muskmelon growth, compositio, and manganese toxicity. J. Amer. Soc. Hort. Sci. 111(3) : 320-322.

Raven, J.A.1985. Regulation of pH and generation of osmolarity in vascular land plants: costs and benefits in relation to efficiency of use of water, energy and nitrogen. New Phytol.101: 25:77. In Mineral nutrition in higher plants. Second Ed. pp 50.

Snedecor, G.W. and W.G. Cochran (1989). "Statistical methods".Iowa state Univ.Press, Ame., USA, 8th Ed.

Tartoura, E.A.A. (2001). Response of pea plants to yeast extract and two sources of N- fertilizers. J. Agric.Sci. Mansoura Univ., 26(12) : 7887-7901.

Wang, W. and F.E.Below (1996). Cytokinins enhanced growth and tillering of wheat induced by mixed nitrogen source. Crop Sci. 36: 121-126.

William, O.C. , C.S. Zana and A.M. Harry (1999). Effect of nitrogen form during te flowering period on zucchini squash growth and nutrient element uptake.J. Plant Nutr. 22(3) : 597-607.

تأثير مستوي التسميد النيتروجيني و نسبة النترات إلـى الأمونيـوم علـي المـو الخضري و المحصول و المحتوي الكيماوي في الخيار

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أجريت تجربتان حقليتان في أرض رملية بمزرعة بحوث التجارب بكلية الزراعة جامعـة قنـاة السويس بالإسماعيلية خلال موسمي ٢٠٠١و ٢٠٠٢ ٤٠ بهدف دراسة تأثير مستويات مختلفة مـن السـماد النيتروجيني تختلف في نسبة النترات إلى الأمونيوم علي كل من النمو الخضري و المحصـول الكلـي و مكوناته و المحتوي الكيماوي لنباتات الخيار صنف مدينة.

و يمكن تلخيص النتائج المتحصل عليها فيما يأتي:

١.إن زيادة معدل السماد الأزوتي من ٣٠ إلى ٩٠ كجم آزوت للفدان أدت إلى زيادة النمو الخضري متمثـلا في عدد الأوراق،وارتفاع النبات والوزن الطازج والجاف للمجموع الخضري والمساحة الورقية.

٢.أوضحت الدراسة أن نسبة النترات إلى الأمونيوم في مخلوط السماد كان لها تأثيرها حيث أعطـت نسـبة ١:٢ أعلى قيم لجميع قياسات النمو الخضري تليها النسبة ٣:صفر ثم ١:١ ثم ٢:١ بينما ظهر اقل معـدل نمو خضري في النباتات التي تم تسميدها بالامونيا فقط كمصدر للأزوت .

٣.زاد وزن المحصول ومعظم مكوناته (عدد الثمار على النباتات- محصول النبات و محصول الفدان) مـع زيادة معدل الأزوت المضاف إلا أن وزن الثمرة ووزن المحصول المبكر كان أكبر مع المعدل ٦٠ كجـم آزوت/للفدان عنه في المعدلين ٣٠ ،٩٠ كجم آزوت /فدان .

٤ عدد الثمار على النبات كان اكبر عندما كانتنسبة النترات اليي الامونيا في مخلوط السماد ٢:١ بينمـا وزن الثمرة كان الأعلى مع النسب ١:٢، ١:١ عنه في النسب الأخرى.

٥. أعطت النسبة ٢:١ أعلى محصول سواء المبكر أو المحصول الكلي.

٦. زاد محتوى الأوراق من النيتروجين والفوسفور مع زيادة معدل السماد الأزوتي المضـاف مـن ٣٠-٩٠ كجم آزوت /فدان وكان أعلى مستوى في أوراق النباتات التي تم تسميدها بالامونيا فقط كمصدر للأزوت.

٧.محتوى الأوراق من البوتاسيوم زاد أيضا مع زيادة مستوى الأزوت المضاف إلا أن هذا العنصر نقص مـع زيادة نسبة الامونيا في مخلوط السماد.