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GROWTH AND CHEMICAL COMPOSITION OF SQUASH PLANTS AS AFFECTED BY ADDING MINERAL NITROGEN WITH OR WITHOUT ORGANIC MANURES AND AZOTOBACTER STRAINS

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ABSTRACT

Field experiments were conducted to study effect of adding mineral nitrogen as Ammonium nitrate compared with or without two types of organic manuals e.g. Chechen and sheep manuals in presence or absence of inoculums of two strains of *Aztobacter vinelandii* on the growth and chemical composition of squash plants. Obtained date revealed that all treatment led to significant increase in all growth parameter i.e. plant height, number of level per plant and dry weight.

Chemical analysis also show significant increase in percentage of nitrogen in treated plants compared with control treatment. Also N up take (gm/ plant) was increased in all treatments. Clear variations among different treatments were detected. The highest values in growth permeates or plant chemical composition were obtained when 45 kg of mineral N combined with 7 tons of Chechen manure in presence of *Azotobacter* isolate T 26. Data also show that *Azotobacter* isolate T 26 showed more effect on promoting growth compare with isolate T 16. Adding Chechen manure increased all parameters under test compare with sheep manure. Positive correlation between increase mineral nitrogen and growth parameter under test when mineral nitrogen was added alone. On the contrary when mineral nitrogen was compared with any other treatment a clear negative relation between increase the N dose from 45 to 60 and most parameter under test.

INTRODUCTION

Squash (*Cucurbita pepo L*.) is one of the most important vegetable crops in Egypt. The “Eskandrany” is the main cultivar of squash grown as a summer and autumn crop near cities where most of the crop is used for local consumption as well as for export. The total area devoted by this crop was estimated by 37000 ha., and their yields were 17798 kg / ha ., FAO (2001). Many investigator studied the effects of chemical nitrogen, organic fertilizer and /or biofertilizers on growth characters and chemical composition on several vegetables. Such as on squash Abd El-Fattah and Sorial (2000), Chaurasia and Singh (1993); Almazov and Kholuyako (1994); and on pumpkin by Feleafel, (2000). Omori and ogura (1977); indicated that chicken manure increased plant height and number of leaves / plant on cucumber also on squash by Shehata, (2001). Increasing plant height with inoculation of biofertilizers agreed with those obtained on tomato and potato by Barea and Brown (1974), also on potato by El-Gamal, (1996), Sidorenko *et al*, (1996), Ibrahim and Ali (1999), and Fatma and Ali (2001), and on tomato, potato and carrot by Dakhly and Abd-El-Mageed (1997). Huett and Dettmann (1991) and on cucumber by Eissa (1996). Increasing dry weight with biofertilizer

inoculation are in agreement with those obtained on squash Hassan *et al.* (2000) on potato by El-Gamal (1996), Hammad and Abdel-Ati (1998), Ibrahim and Ali (1999), and Fatma and Ali (2001), also, on tomato by Barakat and Gabr (1998) and on cucumber by Alphonse and Saad (2000a). Hussain and Iqbal Ehan, (1973), Monib *et al.*, (1990); and on potato by, El-Gamal (1996), and Ibrahim and Aly (1999); and on squash by Abd-El-Fattah and Sorial (2000) reported increasing N-concentration with biofertilizer inoculation agreed with that obtained on tomato also Jenkins and Nelson (1992), Almazov and Kholuyako (1994). Organic manure and biofertilizer increased N-uptake on squash as reported by Shehata (2001), on tomato Saber and Gomaa, (1993). by Kheir, *et al*., (1991) and on potato Chaurasia and Singh (1993). Organic manure increased P-concentration on cucumber by Alphonse and Saad (2000); and on squash by Shehata, (2001) and with inoculation biofertilizer Monib *et al*., (1990); and on potato by Ibrahim and Aly (1999) Kheir, (1991), Chaurasia and Singh (1993), and Ciecko *et al.*, (1993). Organic manure and/or biofertilizers increased K-concentration on cucumber by Alphonse and Saad (2000); and on squash by Shehata (2001) and Ibrahim and Aly (1999) .

MATERIALS AND METHODS

All experiment were carried out at the farm of Agriculture Research Center (ARC). The experiments were conducted during the two successive autumn seasons of 2003 and 2004. The purpose of this study was to investigate the effects of chemical-N, organic or / and bio- fertilizers on growth and chemical composition of squash. Soil samples were randomly taken from the experimental field before planting at depth 0 - 30 cm. The mechanical and chemical analysis of the soil were determined according to Page (1982) results are presented in Table (1).

Table (1): Means of the mechanical and chemical analysis of the soil before squash planting in the autumn seasons of 2003 and 2004.

Soil Constituents	Physical properties				E.C* m.mhos /cm	Organic matter %	Available N %	Available P. (ppm)	Available K..mg/ 100g. soil
	Sand	Silt	Clay	Texture Grade					
First season	13.75	46.14	40.11	Silt clay	0.60	1.33	0.08	8.00	0.64
Second season	13.76	46.12	40.12	Silt clay	0.71	2.01	0.12	20.00	1.12

The experimental field was ploughed and pulverized. Then, the soil was ridged into rows one-meter width and divided to plots. Each plot consisted of four rows, each row 3.5 m long and the plot area was 4.0 x 1.0 x 3.5 =14 m2 (1/300 fed.). Seeds were sown on Sept. 9th in the two seasons on one side of the rows in hills 40 cm apart within the row. After germination, plants were thinned leaving two plants per hill. Treatments were consisted of three factors i.e.; chemical-N, organic manure or / and bio-fertilizers and conducted using split-split plots system in a randomized complete block

design with four replicates. The main plots were allocated for chemical N-fertilizer rates. The sub- plots were devoted for the organic manure source. The sub-sub-plots were occupied by bio-fertilizer sources. The treatments were applied as follows:

1- Chemical N-fertilizer: -

Four nitrogen fertilizer levels were used i.e.; 0.0, 30.0, 45.0 or 60.0 kg N / fed., in the form of ammonium nitrate (NH4NO3 - 33.5 % N). Each N-level was divided to three equal doses, and applied during field preparation, after 20 and 40 days from sowing.

2- Organic manure:-

Three treatments were used, control (without organic manure and donated P0), chicken manure at the rate of 7.5 ton / fed., and donated (P1) and sheep manure at the rate of 7.5 ton / fed., and donated (P2).

Organic manures were added 30 days before planting at depth of 30 cm and covered with soil. At the meantime, the soil was irrigated. The chemical analysis of the chicken and sheep manures is presented in Table (2).

Table (2) : The chemical analysis of the chicken and sheep manures applied in 2003 & 2004 autumn seasons .

Chemical analysis	Chicken manure		Sheep manure	
	First season	Second season	First season	Second season
Total N %	2.90	3.40	1.85	2.02
Total P %	0.84	1.01	0.62	0.74
Total K %	2.12	2.31	2.25	2.00
E.C. (mmoh/cm)	7.40	7.63	15.0	10.30

E.C., = Electric conductivity.

3- Bio- fertilizer: -

1- Strains: -

Two identified *Azotobacter vinelandii* strains kindly obtained from Genetic Department by Abdel-Rahem *et al*., (1995).

2- Media: -

Complete medium (CM) was used for *Azotobacter vinelandii* culturing (Standberg and Wilson, 1968).

The two isolates were previously tested by Dakhly and Abd-Mageed, 1997, were used in the present work. These strains were; Transforments Number 16 and 26. Inoculation was done after crude inoculums was perpetrated as reported by (Dakhly, 1993). The crude inoculation was diluted with irrigated water when used. Seeds were immersed in diluted inoculums for one hour before planting, and ample amounts of diluted inoculums was sprayed around the growing plants. The control was treated with a culture medium only.

All experimental plots were fertilized with P (30 kg P2O5 / fed. in the form of triple superphosphate 45 % P2O5) and K at the rate of 48 kg K2O /fed. in the form of potassium sulphate (48 % K2O) . P-fertilizer was applied

once during soil preparation, whereas K-fertilizer was divided into two equal doses, one-half was applied during soil preparation and the other one-half after 20 days from sowing. The other common recommended culture practices for the commercial production of squash were carried out, wherever they were needed.

At full blooming stage, data were recorded for the average plant height (cm), average number of leaves / plant and average dry weight (g) / plant. Five plants from each replicate were randomly pulled up with the roots and washed thoroughly with distilled water. Then, oven dried at 70 C^o until a constant weight. The dry tissues were weighted and used for chemical analysis. Total N % was measured by micro-Kjeldah procedure and total N uptake/plant was calculated. Phosphorus (ppm) was determined calorimetrically by the ammonium molybdate stannous chloride method, A. O. A. C. (1990), and P uptake was calculated. Potassium % was measured by atomic absorption spectrophotometer Chapman and Pratt (1961) , and K uptake was calculated .

Data were subjected to analysis of variance procedures and means were compared using L. S. D. test (according to Snedecor and Cochroni, 1973).

RESULTS AND DISCUSSION

In the present work, studies were carried out to study the effects of chemical nitrogen rates, organic manure or / and bio-fertilizers on growth and yield characters of squash plants.

1- Vegetative growth characters:-

1-1- Plant height: -

Data in Tables (3, 3a,b&c) indicated that plant height (cm) were significantly increased with application of chemical N rates, organic manures or / and biofertilizers, in both seasons. Among the various chemical N rates, application of 45 kg N / fed. showed the highest values (117.00 and 113.94 cm). Whereas chicken manure surpassed sheep manure in this character (119.68 and117.5 cm versus101.38 and 99.26 cm). Among biofertilizers sources, T26 resulted in higher values than T16 (119.87 and 117.87versus 97.30 and 95.50 cm) for the first and second seasons, respectively. However, these values indicate that quite similar response in this character due to these treatments were obtained. Increasing plant height with increasing N chemical fertilizer rates agreed with that obtained on squash Cv., “Eskandrany” as reported by Abd El-Fattah and Sorial (2000), also on pumpkin by Feleafel, (2000). Application of chicken manure increased plant height these, results are in line with those obtained on cucumber by Omori *et al*., (1977); and on squash by Shehata, (2001). Increasing plant height with inoculation of biofertilizers agreed with those obtained on tomato and potato by Barea and Brown (1974), also on potato by El-Gamal, (1996), Sidorenko *et al*, (1996), Ibrahim and Ali (1999), and Fatma and Ali (2001), and on tomato, potato and carrot by Dakhly and Abd-El-Mageed (1997) also, on squash Cv. “Eskandrany ” by AbdEl-Fattah and Sorial (2000).

Regarding the interactions between A x B, significant increases in plant height (cm) were obtained, in both seasons. The highest values of plant height were observed from the application of 45 kg N / fed., x chicken manure i.e.; 142.23 and 139.27 cm, in the first and second seasons, respectively

Meanwhile, the interactions between A x C resulted in significant increase in this character, in both seasons. Application of 45 kg N / fed., x T26 showed the highest values (150.59 and 147.31 cm) for the first and second seasons, respectively. These results are in agreement with those obtained on potato by El-Gamal (1996) and Fatma and Ali (2001); also, on squash by Abd-El-Fattah and Sorial (2000).

Also, significant increase was gained from the interaction between B x C, in both seasons. Plant height (cm) from the interaction of chicken manure x T26 showed the highest values (146.83 and 143.85 cm). It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment.

Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of plant height (cm) were obtained from chemical N at 45 kg / fed., x chicken manure x T26 i.e.; 185.0 and 181.8 cm for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

1-2- Number of leaves / plant: -

Data in Tables (4,4a,b&c) showed that number of leaves per plant was significantly affected by chemical N rate, organic manure or / and biofertilizer treatments, in both seasons. Among the various chemical N rates, application of 45 kg / fed., showed the highest values (39.71 and 37.09), whereas chicken manure surpassed
sheep manure in this character (36.78 and 34.98 versus 32.94 and 31.87) and T26 resulted in higher values than T16 (34.01 and 32.96 versus 32.66 and 32.07) for the first and second seasons, respectively. However, these values indicated that quite similar response in this character due to these treatments were obtained. Increasing number of leaves / plant with increasing N chemical fertilizers rates agreed with that obtained on squash as reported by Abd–El-Fattah and Sorial (2000), and on pumpkin by Feleafel, (2000). Application of chicken manure increased number of leaves / plant these result are in agreement with those obtained on squash Cv. “Eskandrany” by Shehata, (2001). Inoculated plants with biofertilizers showed increase in number of leaves / plant which agreed with those reported on potato by Dakhly and Abd-El-Mageed (1997) , and Fatma and Ali (2001); also , the same result on squash Cv. “ Eskandrany ” by Abd-El-Fattah and Sorial (2000),

In general, the interactions between A x B, significantly increased number of leaves per plant, in both seasons. The highest values were observed from the application of 45 kg / fed., x chicken manure (43.24 and 40.70).

On the other hand, the interactions between A x C resulted in significant increase in this character, in both seasons. Application of 45 kg / fed., x T26 showed the highest value (41.30 and 39.77) for the first and second season, respectively. These results are quite similar with those obtained on squash by Abd-El-Fattah and Sorial (2000), and on potato by Fatma and Ali (2001).Also, significant increase was obtained from the interaction between B x C, in both seasons. The interaction of chicken manure x T26 showed the highest values on number of leaves per plant (41.30 and 38.71). It should be mentioned that the values obtained from each two interactions surpassed those obtained from single treatment.

In general, the interactions among the three factors showed significant effect in both seasons. The highest values on number of leaves per plant were obtained from application of chemical N at 45 kg / fed., x chicken manure x T26 i.e.; 46.0 and 44.20 in the first and second seasons , respectively .However, the three interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

Table (3): Effects of N-chemical rates / fed., organic manure source or / and biofertilizer inoculums on plant height (cm) of squash plants the two autumn seasons.

Table (3 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	49.41	96.440	73.650
	30.0	76.50	114.45	100.44
	45.0	85.69	142.23	123.08
	60.0	88.45	125.60	108.33
Second season	0.0	47.50	94.797	72.393
	30.0	75.68	112.13	99.94
	45.0	83.29	139.27	119.27
	60.0	86.35	123.81	105.42

Table (3 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	60.48	72.090	86.930
	30.0	75.29	101.50	114.61
	45.0	89.91	110.51	150.59
	60.0	89.91	105.13	127.34
Second season	0.0	57.013	72.467	85.21
	30.0	74.72	100.08	112.96
	45.0	87.51	107.02	147.31
	60.0	88.32	102.45	124.8

Table (3 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C"					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	64.875	76.135	84.033	62.28	74.76	82.57
Chicken	92.060	120.16	146.83	91.28	117.37	143.85
Sheep	79.770	95.610	128.75	77.11	94.38	126.28

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	6.899	6.239	3.074	12.48	6.148	10.81	21.61
	Second season	5.186	5.165	2.327	10.55	5.012	9.735	18.840

Table (4): Effects of N-chemical rates / fed., organic manure source or / and biofertilizer inoculums on number of leaves / plant of squash plants during the two autumn seasons.

Table (4 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source "B"		
		0.0	Chicken	Sheep
First season	0.0	17.88	25.99	24.29
	30.0	27.25	37.84	35.00
	45.0	34.96	43.24	40.93
	60.0	31.33	41.98	38.02
Second season	0.0	17.50	23.97	21.75
	30.0	26.28	35.36	32.07
	45.0	32.82	41.03	39.44
	60.0	29.20	39.89	35.54

Table (4 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C"		
		0.0	T16	T26
First season	0.0	18.11	23.60	26.46
	30.0	27.45	35.10	37.54
	45.0	36.98	40.85	41.30
	60.0	34.73	38.07	38.53
Second season	0.0	18.16	21.19	23.87
	30.0s	26.22	33.20	34.29
	45.0	35.34	38.18	39.77
	60.0	33.00	35.72	35.92

Table (4 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C "					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	26.26	28.60	28.70	25.48	26.76	27.11
Chicken	31.60	38.90	41.30	30.14	36.34	38.71
Sheep	30.10	33.22	34.75	28.92	33.12	34.57

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	2.283	2.446	1.430	4.893	2.860	4.237	8.475
	Second season	2.997	1.338	1.956	2.677	3.913	2.318	4.637

Table (5): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on dry weight / plant (gm) of squash plants during the two autumn seasons.

Table (5 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	40.15	53.08	43.84
	30.0	42.13	59.12	52.95
	45.0	44.82	63.65	53.20
	60.0	45.02	65.52	55.91
Second season	0.0	38.11	50.38	41.61
	30.0	41.28	57.58	52.14
	45.0	43.36	63.48	51.58
	60.0	46.58	64.46	55.07

Table (5 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	41.17	45.39	50.52
	30.0	44.66	50.58	58.96
	45.0	47.22	52.40	62.04
	60.0	49.08	60.38	56.98
Second season	0.0	39.14	42.42	48.54
	30.0	43.61	49.29	58.10
	45.0	47.05	50.20	61.18
	60.0	51.16	59.36	55.59

Table (5 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C"					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	39.43	43.74	45.91	40.60	41.73	44.67
Chicken	52.08	62.74	66.21	51.01	60.87	65.05
Sheep	45.08	50.09	59.26	44.12	48.36	57.83

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	3.70	2.53	2.78	5.06	5.56	4.38	8.76
	Second season	2.034	1.44	1.710	2.88	3.42	2.50	4.99

1-3 Dry weight / plant (gm): -

Data in Tables (5,5a,b&c) indicated that dry weight per plant was significantly increased with application of chemical-N rates, organic manures or biofertilizers in both seasons. The various chemical-N rates, application of 60 kg N / fed., showed the highest values (55.48 and 55.37 gm), in both seasons .However, insignificant difference was obtained between the mean value of this parameter of 45 and 60 kg N / fed., in the first season . In the meantime chicken manure surpassed sheep manure in this character (60.34 and 58.98 versus 51.48 and 50.10 gm). Application of biofertilizer showed that T26 resulted in higher values than T16 (57.13 and 55.85 gm versus 52.19 and 50.32 gm) for the first and second seasons, respectively. Increasing dry weight / plant with increasing N chemical fertilizer rates agreed with that obtained on squash as reported by Huett and Dettmann (1991) and Abd-El-Fattah and Sorial (2000).

Application of chicken manure resulted in higher dry weight, which agreed with that obtained on cucumber by Eissa (1996). Increasing dry weight with biofertilizer inoculation are in agreement with those obtained on squash Hassan *et al.* (2000) on potato by El-Gamal (1996), Hammad and Abdel-Ati (1998), Ibrahim and Ali (1999), and Fatma and Ali (2001), also, on tomato by Barakat and Gabr (1998).

Regarding the interactions between A x B, significant increase in dry weight of plant was obtained, in both seasons. The highest values were observed from the application of 60 kg N / fed., x chicken manure (65.52 and 64.46 gm). However, insignificant differences were obtained between the mean dry weight / plant of the interaction of 45 kg N / f ed., x chicken manure and that obtained from the interaction of 60 kg N / fed. x chicken manure, in both seasons . With regard to the interaction between A x C, significant increase in this character was obtained, in both seasons. Application of 45 kg N / fed., x T26 showed the highest value (62.04 and 61.18 gm) for the first and second season, respectively. These results are in line with those obtained on potato by Fatma and Ali (2001). Significant increase was gained from the interaction between B x C, in both seasons. Dry weight per plants obtained from the interaction of chicken manure x T26 showed the highest values (66.21 and 65.05 gm). It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment.

Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of dry weight per plant were obtained from chemical N at 45 kg / fed., x chicken manure x T26 (73.53 and 73.10 gm) for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers. Significant increase was found from the interaction between B x C, in both seasons. Dry weight per plants obtained from the interaction of chicken manure x T26 showed the highest values (66.21 and 65.05 gm). It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment. Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of dry weight per plant were obtained from chemical N at 45 kg / fed., x chicken manure x T26 (73.53 and 73.10 gm) for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

2- Plant analysis: -

2-1- N concentrations (%): -

Data illustrated in Tables (6,6a,b&c) showed that N-concentration in plant tissues of squash was significantly increased with application of fertilizers i.e.; chemical N rates, organic manure or biofertilizers, in both seasons. Among the various chemical-N rates, application of 60 kg N / fed., showed the highest values (3.969 and 4.548 %), whereas chicken manure surpassed sheep manure in this character (3.889 and 4.115 versus 2.802 and 3.231) and T26 resulted in higher values than T16 (3.487 and 3.831 versus 3.183 and 3.421) for the first and second seasons, respectively. However, these results indicate that application of chicken manure resulted in highest N % quite similar to that obtained from 60.0 kg N / fed., meanwhile sheep manure showed the lowest value and was quite similar to that obtained from T26, in both seasons. Increasing N concentration with increasing chemical N fertilizer rates agreed with that obtained on potato as reported by Chaurasia and Singh (1993); Almazov and Kholuyako (1994); on squash Cv. “Eskandrany” by Abd-El-Fattah and Sorial (2000); and on pumpkin by Feleafel, (2000). Application of organic manure increased N-concentration; these results are in agreement with those obtained on cucumber by Alphonse and Saad (2000a); and on squash by Shehata (2001). Increasing N-concentration with biofertilizer inoculation agreed with that obtained on tomato as reported by Hussain and Iqbal Ehan, (1973), Monib *et al.*, (1990); and on potato by, El-Gamal (1996), and Ibrahim and Aly (1999); and on squash by Abd-El-Fattah and Sorial (2000). Regarding the interactions between A x B, significant increase in N-percentage were obtained, in both seasons. The highest values were observed from the application of 60 kg N / fed., x chicken manure (5.062 and 5.342). With respect to the interactions between A x C, significant increase in this character was observed, in both seasons. Application of 60 kg N / fed., x T26 showed the highest value (4.457 and 5.008 %) for the first and second seasons, respectively . These results are in line with those obtained on potato by Ibrahim and Aly (1999); and on squash by Abd-El-Fattah and Sorial (2000).

For the interaction between B x C, significant increase was gained, in both seasons. N-percentage from the interaction of chicken manure x T26 showed the highest values (4.662 and 4.115 %).

Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of N-percentage was obtained from chemical N at 60 kg N / fed., x chicken manure x T26 i.e.; 6.05 and 6.122 % for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

2-2- N uptake (gm / plant): -

Data in Tables (7,7a,b&c) showed that N uptake per plant were significantly increased with application of chemical N rates, organic manures or biofertilizers, in both seasons. Between the various chemical N rates, application of 60 kg N / fed., gave the highest values (2.277 and 2.574 gm), whereas chicken manure showed greater increases in this character (2.427 and 2.449 gm) and T26 resulted in higher values than T16 (2.087 and 2.167 gm versus 1.746 and 1.785 gm) for the first and second seasons, respectively. Increasing N uptake with increasing chemical N fertilizers rates agreed with that obtained on potato as reported by Jenkins and Nelson (1992), Almazov and Kholuyako (1994). Application of organic manure increased N-uptake agreed with that obtained on squash as reported by Shehata (2001). Increasing N-uptake with inoculation biofertilizer agreed with that obtained on tomato as reported by Saber and Gomaa, (1993).

On the other hand, the interaction between A x B, showed significant increases in N-uptake / plant, in both seasons. The highest values were observed from the application of 60 kg N /fed., x chicken manure (3.333 and 3.449 gm). Concerning the interaction between A x C, significant increase in this character was obtained, in both seasons. Application of 60 kg N / fed., x T26 showed the highest value (2.623 and 2.862 gm) in the first and second seasons, respectively. With regard to the interaction between B x C, significant increase was gained in both seasons. N-uptake per plant from the interaction of chicken manure x T26 showed the highest values (3.119 and 2.988 gm) for both seasons. It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment.

In general, the interactions of the three factors had significant effect, in both seasons. Among these interactions, the highest values N- uptake per plant were obtained from chemical N at 60 kg N / fed., x chicken manure x T26 i.e.; 3.97 and 3.993 gm for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from the application of two sorts or one sort of fertilizers.

Table (6): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on N-concentration (%) of squash plants during the two autumn seasons.

Table (6 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	1.047	2.799	1.930
	30.0	2.359	3.415	2.553
	45.0	2.659	4.283	3.077
	60.0	3.197	5.062	3.650
Second season	0.0	1.497	3.073	2.128
	30.0	2.435	3.623	2.740
	45.0	3.093	4.420	3.390
	60.0	3.638	5.342	4.665

Table (6 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	1.403	2.136	2.237
	30.0	1.903	3.081	3.343
	45.0	2.584	3.523	3.911
	60.0	3.460	3.990	4.457
Second season	0.0	1.806	2.288	2.585
	30.0	2.078	3.155	3.566
	45.0	2.948	3.794	4.166
	60.0	4.190	4.447	5.008

Table (6 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C "					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	*2.026*	*2.434*	*2.486*	2.257	2.678	3.048
Chicken	*2.992*	*4.015*	*4.662*	3.439	4.128	4.779
Sheep	*1.995*	*3.100*	*3.312*	2.569	3.456	3.667

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.075	0.089	0.066	0.179	0.131	0.114	0.227
	Second season	0.058	0.058	0.076	0.115	0.152	0.099	0.199

Table (7): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on on N-uptake gm / plant of squash plants during the two autumn seasons.

Table (7 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	0.425	1.502	0.861
	30.0	1.000	2.060	1.399
	45.0	1.193	2.813	1.681
	60.0	1.441	3.333	2.056
Second season	0.0	0.724	1.557	0.895
	30.0	0.743	1.922	1.472
	45.0	1.348	2.869	1.778
	60.0	1.693	3.449	2.579

Table (7 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	0.606	1.006	1.176
	30.0	0.867	1.573	2.019
	45.0	1.227	1.930	2.529
	60.0	1.734	2.474	2.623
Second season	0.0	0.737	1.155	1.284
	30.0	0.921	1.308	1.907
	45.0	1.392	1.988	2.615
	60.0	2.173	2.686	2.862

Table (7 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C "					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	0.817	1.084	1.144	0.957	1.060	1.363
Chicken	1.588	2.574	3.119	1.789	2.571	2.988
Sheep	0.920	1.581	1.998	1.170	1.723	2.150

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.052	0.049	0.067	0.102	0.129	0.900	0.179
	Second season	0.056	0.053	0.061	0.106	0.133	0.092	0.184

2-3- P- concentration (%) : -

Data in Tables (8,8a,b&c) indicated that P-concentration were significantly increased with application of chemical N rates in the second season whereas organic manures or biofertilizers showed significant increase, in both seasons. Among the various chemical N rates, application of 60 kg N / fed., showed the highest values in P-concentration (0.396 % and 0.420 %), whereas chicken manure surpassed sheep manure in this character (0.537 % and 0.568 % versus 0.462 % and 0.504 %), and T26 resulted in higher values than T16 (0.431 and 0.458 versus 0.385 and 0.412) . Increasing P-concentration with increasing chemical N rates disagreed with that obtained on spinach as reported by Kheir, (1991); but agreed with that obtained on potato as reported by Chaurasia and Singh (1993); and on pumpkin where P-concentration did not affect as reported by Feleafel, (2000). Application of organic manure increased P-concentration agreed with that obtained on cucumber by Alphonse and Saad (2000); and on squash by Shehata, (2001). Increasing P-concentration with inoculation biofertilizer agreed with that obtained on tomato by Monib et al., (1990); and on potato by Ibrahim and Aly (1999).Regarding the interactions between A x B, significant increase in this character were obtained, in both seasons. The highest values were observed from the application of 60 kg N / fed., x chicken manure (0.555 % and 0.588 %) for the first and second seasons, respectively. The interactions between A x C, resulted in significant increase in this character, in both seasons. Application of 45 kg N / fed., x T26 showed the highest value (0.445 % and 0.47 %) for the first and second seasons, respectively. These results are in disagreement with those results obtained on potato as reported by Ibrahim and Aly (1999); and agreed with that obtained on squash as reported by Abd-El-Fattah and Sorial (2000).Significant increase was gained from the interaction between B x C, in both seasons. P-percentage from the interaction of chicken manure x T26 showed the highest values (0.602 % and 0.633 %). It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment.Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of this character were obtained from chemical N at 45 kg N / fed., x chicken manure x T26 i.e.; 0.633 % and 0.659 % for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

2-4- P-uptake (gm / plant) :-

Data in Tables (9,9a,b&c) showed that P-uptake were significantly responded positively to the chemical N-fertilizers rates, organic manures or biofertilizers, in both seasons. Among the various chemical N-rates, application of 60 kg N / fed., showed the highest values (0.235 and 0.248 gm / plant), whereas chicken manure surpassed sheep manure in this character (0.324 and 0.337 versus 0.241 and 0.255 gm / plant) for the first and the second seasons, respectively. T26 resulted in higher values than T16 (0.257 and 0.271 gm / plant versus 0.214 and 0.221 gm / plant). However, organic manures were more effective in this character than the other two sorts of fertilizers as shown in Tables (9,9a,b&c). Regarding the interaction between

A x B, significant increase in this character were obtained, in both seasons. The highest values were observed from the application of 60 kg N / fed., x chicken manure (0.365 and 0.380 gm / plant). The interactions between A x C resulted in significant increase in this character, in both seasons. Application of 45 kg N / fed., x T26 showed the highest values (0.280 and 0.296 gm) for the first and second seasons, respectively. These results are in line with those obtained on tomato by Saber and Gomaa, (1993).

Table (8): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on P-concentration (%) of squash plants during the two autumn seasons.

Table (8 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	0.145	0.527	0.447
	30.0	0.150	0.516	0.456
	45.0	0.148	0.551	0.457
	60.0	0.144	0.555	0.487
Second season	0.0	0.151	0.539	0.487
	30.0	0.157	0.564	0.511
	45.0	0.152	0.582	0.497
	60.0	0.152	0.588	0.520

Table (8 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	0.316	0.369	0.433
	30.0	0.319	0.385	0.417
	45.0	0.330	0.381	0.445
	60.0	0.352	0.406	0.429
Second season	0.0	0.332	0.385	0.500
	30.0	0.366	0.412	0.453
	45.0	0.354	0.411	0.467
	60.0	0.373	0.434	0.453

Table (8 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C"					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	0.125	0.141	0.174	0.128	0.150	0.181
Chicken	0.459	0.551	0.602	0.491	0.581	0.633
Sheep	0.403	0.464	0.517	0.449	0.501	0.561

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.029	0.026	0.022	0.051	0.0450	0.0450	0.089
	Second season	0.008	0.005	0.007	0.010	0.013	0.009	0.0173

Table (9): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on P-uptake gm / plant of squash plants during the two autumn seasons.

Table (9 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source "B"		
		0.0	Chicken	Sheep
First season	0.0	0.059	0.282	0.197
	30.0	0.063	0.309	0.245
	45.0	0.063	0.339	0.247
	60.0	0.065	0.365	0.274
Second season	0.0	0.058	0.275	0.203
	30.0	0.065	0.328	0.269
	45.0	0.067	0.364	0.260
	60.0	0.075	0.380	0.288

Table (9 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C"		
		0.0	T16	T26
First season	0.0	0.137	0.174	0.228
	30.0	0147	0.208	0.263
	45.0	0.159	0.214	0.280
	60.0	0.186	0.259	0.259
Second season	0.0	0.137	0.170	0.229
	30.0	0.163	0.216	0.282
	45.0	0.171	0.223	0.296
	60.0	0.197	0.273	0.273

Table (9 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C "					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	0.049	0.062	0.079	0.052	0.063	0.084
Chicken	0.240	0.347	0.386	0.252	0.355	0.404
Sheep	0.182	0.234	0.307	0.197	0.244	0.324

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.008	0.007	0.005	0.013	0.01	0.012	0.023
	Second season	0.008	0.008	0.004	0.015	0.008	0.013	0.026

Significant increase was observed from the interaction between B x C, in both seasons. P-uptake (gm / plant) from the interaction of chicken manure x T26 showed the highest values (0.386 and 0.404 gm / plant).

Concerning the interactions of the three factors, significant effect was obtained, in both seasons. Among these interactions, the highest values of this character were obtained from chemical N at 45 kg N / fed., x chicken manure x T26 (0.415 and 0.448 gm / plant) for the first and second seasons , respectively.

2-5- K-concentrations (%): -

Data in Tables (10,10a,b&c) indicated that K-percentage were significantly affected with application of chemical-N rates, organic manures or biofertilizers, in both seasons. Among the various chemical N rates, application of 60 kg N / fed., showed significant reduction in this character as compared with those which didn't receive chemical N, in both seasons. Whereas plants received 30 or 45 kg N did not show any significant response as compared with control or plant received 60 kg N, in both seasons. On the contrary, organic manure showed significant increase where chicken manure surpassed sheep manure in this character (4.203 and 4.256 versus 3.773 and 3.925 %) in the first and second seasons, respectively. Also, biofertilizer resulted in significant increase where T26 resulted in higher values than T16 (3.644 and 3.787 versus 3.462 and 3.548 %) for the first and second seasons, respectively. However, these values indicated that organic manures showed the highest values which may be due to its high content of K. Decreasing K-concentrations with increasing N fertilizer rates disagreed with that obtained on spinach by Kheir, (1991); and agreed with that obtained on potato by Chaurasia and Singh (1993), and Ciecko *et al.*, (1993). Application of organic manure increased K-concentration agreed with that obtained on cucumber by Alphonse and Saad (2000); and on squash by Shehata (2001). Increasing K-concentrations with inoculation biofertilizers agreed with that obtained on potato by Ibrahim and Aly (1999) .

Regarding the interactions between A x B, significant increase in K. content were obtained, in both seasons. The highest values were observed from the application of 45 kg N / fed., x chicken manure (4.264 and 4.360 %).

Concerning the interactions between A x C, results showed significant increase in this character, in both seasons. Plant which did not receive any N-chemical fertilizer x T26 showed the highest value (3.816 and

3.991 %) for the first and second seasons, respectively. A comparison between the interactions of various N- rates with either T16 or T26 showed that increasing N rate reduced the value of this parameter, in both seasons. These results are in line with those obtained on squash by Abd-El-Fattah and Sorial (2000). With regard to the interaction between B x C, in both seasons. K-content from the interaction of chicken manure x T26 showed the highest values (4.428 and 4.509 %).

Table (10): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on K-concentrations (%) of squash plants during the two autumn seasons.

Table (10 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	2.050	4.221	3.912
	30.0	1.988	4.152	3.886
	45.0	1.881	4.264	3.765
	60.0	1.896	4.173	3.530
Second season	0.0	2.173	4.152	4.021
	30.0	2.065	4.220	3.954
	45.0	1.953	4.360	3.937
	60.0	1.961	4.292	3.787

Table (10 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	2.782	3.586	3.816
	30.0	2.771	3.584	3.671
	45.0	2.936	3.347	3.627
	60.0	2.805	3.333	3.462
Second season	0.0	2.725	3.631	3.991
	30.0	2.821	3.661	3.758
	45.0	3.067	3.481	3.702
	60.0	2.925	3.420	3.695

Table (10 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C"					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	1.199	2.220	2.443	1.259	2.306	2.549
Chicken	3.849	4.331	4.428	3.875	4.385	4.509
Sheep	3.422	3.836	4.061	3.518	3.954	4.302

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.176	0.165	0.141	0.282	0.330	0.244	0.488
	Second season	0.072	0.058	0.072	0.115	0.145	0.100	0.200

Concerning the interactions of the three factors significant effect was obtained, in both seasons. Among these interaction, the highest values of this character were obtained from chemical N at 0.0 kg N / fed., x chicken manure x T26 i.e.; 4.468 and 4.600 for the first and second seasons, respectively. Insignificant differences were obtained between the mean value of this parameter as result of the interactions of 0.0 kg N / fed., or 45.0 kg N / fed., x chicken manure x T26 , in both seasons.

2-6- K - uptake (gm / plant): -

Results on the effects of chemical N rates, organic manures and biofertilizers on K-uptake gm / plant are presented in Tables (11,11a,b&c). Application of chemical N rates significantly increased K-uptake. Application of 45 kg N / fed., increased K-uptake from 1.61 to 1.868 and from 1.55 to 2.001 gm / plant for the first and second seasons, respectively . Whereas chicken manure markedly increased K- uptake than sheep manure (2.551 and 2.529 versus 1.953 and 2.052 gm / plant) in the first and second seasons, respectively. Among the biofertilizers, T26 resulted in higher values than T16 (2.152 and 2.184 versus 1.865 and 1.834 gm / plant) for the first and second seasons, respectively. However, these values indicate that K-uptake by plants treated with N rates did not follow the results obtained from K-concentration this may be due to more plant growth and hence more dry weight / plant which had a dilution effect on K- concentration in plants that had received higher N- rates.

On the other hand, the interactions between A x B showed significant increase in K- uptake, in both seasons. The highest values were observed from the application of 45 or 60 kg N / fed., x chicken manure with insignificant difference between their eans, in both seasons. Regarding the interactions between A x C, significant increase in this character was gained, in both seasons. Application of 45 kg N / fed., x T26 showed the highest value (2.353 and 2.369 gm / plant) for the first and second season, respectively.

Also, significant increase was gained from the interaction between B x C, in both seasons. K-uptake from the interaction of chicken manure x T26 showed the highest values (2.931 and 2.931 gm / plant). It should be mentioned that the values obtained from each interaction surpassed those obtained from single treatment. These results are in line with those obtained on potato by Ibrahim and Aly (1999). In general, the interactions of the

three factors had significant effect on this parameter, in both seasons. Among these interactions, the highest values of K-uptake were obtained from 45 Kg N / fed., x chicken manure x T26 (3.279 and 2.286 gm / plant) for the first and second seasons, respectively. Again, the triple interactions were more effective in this character than that obtained from one or two sorts of fertilizers.

Table (11): Effects of N - chemical rates / fed., organic manure source or / and biofertilizer inoculums on K - uptake (gm / plant) of squash plants during the two autumn seasons.

Table (11 - a) the interaction between AxB

	Chemical N-rate/ fed., "A"	Organic manure source " B "		
		0.0	Chicken	Sheep
First season	0.0	0.854	2.248	1.727
	30.0	0.845	2.479	2.082
	45.0	0.844	2.733	2.027
	60.0	0.877	2.742	1.977
Second season	0.0	0.861	2.109	1.680
	30.0	0.860	2.453	2.092
	45.0	0.845	2.778	2.381
	60.0	0.911	2.774	2.056

Table (11 - b) the interaction between AxC

	Chemical N-rate/ fed., "A"	Applied inoculate "C "		
		0.0	T16	T26
First season	0.0	1.211	1.659	1.960
	30.0	1.274	1.878	2.255
	45.0	1.410	1.841	2.353
	60.0	1.471	2.084	2.041
Second season	0.0	1.115	1.576	1.959
	30.0	1.264	1.865	2.275
	45.0	1.807	1.829	2.369
	60.0	1.544	2.066	2.131

Table (11 - c) the interaction between BxC

Organic manure source "B"	Applied inoculate "C"					
	First season			Second season		
	0.0	T16	T26	0.0	T16	T26
0.0	0.475	0.970	1.121	0.150	0.961	1.137
Chicken	2.005	2.716	2.931	1.986	2.669	2.931
Sheep	1.544	1.910	2.405	1.801	1.873	2.483

		A	B	C	AxB	AxC	BxC	AxBxC
L. S. D. at 5 %	First season	0.097	0.083	0.090	0.167	0.181	0.144	0.289
	Second season	0.097	0.081	0.067	0.163	0.133	0.141	0.282

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تـأثير التسـميد المعـدني مـع أو بـدون إضـافة السـماد العضـوي وسـلالات مـن الأزوتوباكتر على صفات النمو والتركيب الكيميائي لنباتات الكوسة

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أجريت هذه الدراسة لمدة موسمين متتاليين بمزرعة محطة البحوث الزراعية بمركز ملوي محافظة المنيا وذلك في العروة الخريفية لموسمي الدراسة 2003- 2004 . شملت هذه الدراسة تأثير معدلات السماد النيتروجين المعدني (بدون معاملة ، ٣٠ ، ٤٥ ، ٦٠ كجم ن / ف) ، والمعاملة بالسماد العضوي (بدون معاملة ، مخلفات الأغنام ، زرق الدواجن) ، المعاملة بالسماد الحيوي (بدون معاملة ، T_{16} ، T_{26}) وذلك على النمو في الكوسة صنف "الاسكندرانى" . وكانت أهم النتائج المتحصل عليها :

أولا : بالنسبة للنمو الخضري :

أظهرت المعاملات الفردية بمعدلات التسميد النيتروجين المعدني أو العضوي أو الحيوي استجابة معنوية عالية لطول النبات حيث أعطت المعاملة الحيوية بالعزلة T26 أطول النباتات (١١٧.٥٧ و١١٩,٨٧سم) في كل من الموسمين . اظهر التفاعل بين المعاملات استجابة معنوية لطول النبات. اظهر التفاعل الثلاثي بين المعاملات تأثيرات ايجابية عالية المعنوية لطول النبات (سم) وكانت أفضل المعاملات الثلاثية هي المعاملة ٤٥ كجم ن / ف x زرق الدواجن x T26 والتي أظهرت القيم التالية (١٨٥,٠ و ١٨١,٨ سم) في كلا الموسمين.

بالنسبة لعدد الأوراق على النبات و الوزن الجاف (جم) / النبات أظهرت المعاملة بمعدل ٤٥ كجم ن / ف استجابة عالية المعنوية لصفة عدد الأوراق / النبات والتي كانت (٣٩,٧١ و٣٧,٦٧) واقل القيم للوزن الجاف للنبات (٥٣,٩١ و ٥٢,٥١ جم) ، في حين إن المعاملة بزرق الدواجن جاءت في المرتبة الثانية حيث حققت قيما متوسطة لصفة عدد الأوراق على النبات (٣٦,٧٨ و ٣٤,٩٨) واعلي قيمة للوزن الجاف / النبات (٦٠,٣٤ و ٥٨,٩٨ جم). واظهر التفاعل الثنائي بين المعاملات استجابة معنوية لعدد الأوراق على النبات والوزن الجاف (جم) / النبات . أعطى التفاعل الثلاثي بين المعاملات استجابة معنوية لكل من عدد الأوراق على النبات والوزن الجاف للنبات كانت أفضل المعاملات هي المعاملة بمعدل ٤٥ كجم ن / ف x زرق الدواجن x T26 حيث عدد الأوراق على النبات (٤٦,٠٠ و ٤٤,٢٠) والوزن الجاف للنبات (٧٣,٥٣ و ٧٣,١٠ جم) وذلك في كلا الموسمين.

ثانيا : التحليلات الكيميائية أظهرت النتائج استجابة معنوية لتركيز النيتروجين والنيتروجين الممتص حيث أدت زيادة معدلات التسميد النيتروجين إلى زيادة تركيز النيتروجين بالنبات حتى معدل ٦٠ كجم ن / ف (٣,٩٦٩ و ٤,٥٤٨ %) , وقد تلتها المعاملة بزرق الدواجن حيث أعطت قيما متوسطة لهذه الصفة , فى حين أن زرق الدواجن تفوق على المعاملة بمعدل ٦٠ كجم ن / ف معطيا اعلي القيم للنيتروجين الممتص / النبات. أظهرت نتائج الدراسة كذلك وجود تأثير واضح للتفاعل الثلاثي على تركيز النيتروجين بالنبات والنيتروجين الممتص / النبات وأمكن الحصول على اعلي القيم (٦,٠٥ و ٦,١٢٢ % و ٣,٩٧٠ و ٣,٩٩٣ جم) عند المعاملة بمعدل ٦٠ كجم ن / ف x زرق الدواجن x T26 في كلا الموسمين على التوالي

أما تركيز الفسفور والفسفور الممتص (مجم / النبات) فكل المعاملات أظهرت زيادة معنوية. أظهر زرق الدواجن أعلى قيمة لتركيز الفسفور بالنبات (٠,٥٣٧ و ٠,٥٦٨) وكذلك الفسفور الممتص (٠,٣٢٤ و ٠,٣٣٧ مجم / النبات) , بينما أظهرت المعاملة بالسماد النيتروجين المعدني بمعدل ٦٠ كجم ن / ف أقل القيم لتركيز الفسفور بالنبات (٠,٣٩٥ و ٠,٤٢٠ %) , وكذلك الفسفور الممتص (٠,٢٣٥ و٠,٢٤٨ مجم / النبات).

أما بالنسبة لتركيز البوتاسيوم وكذا البوتاسيوم الممتص (جم / النبات) فكانت كل المعاملات وتفاعلاتها الثنائية والثلاثية أظهرت استجابة معنوية لتركيز البوتاسيوم وكذا البوتاسيوم الممتص (جم/النبات). أدت المعاملة بزرق الدواجن إلى الحصول على اعلي القيم لتركيز البوتاسيوم (٣,٦٤٤ و ٣,٧٨٧ %) وكذلك البوتاسيوم الممتص (٢,٥٥١ و ٢,٥٢٩ جم/النبات) , حيث انه بزيادة مستويات التسميد النيتروجين انخفض البوتاسيوم وكذا البوتاسيوم الممتص (جم/النبات) في كلا الموسمين على التوالي . أظهر التفاعل الثلاثي تأثير فعال وايجابي لتركيز البوتاسيوم (٤,٤٦٠ و ٤,٤٩٥ %) وكذا البوتاسيوم الممتص (٣,٢٧٩ و ٣,٢٨٦ جم/النبات) في كلا الموسمين على التوالي .