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EFFECT OF NITROGEN, ORGANIC AND BIOFERTILIZATION ON PRODUCTIVITY OF LETTUCE (CV. ROMAINE) IN SANDY SOIL UNDER ASSIUT CONDITIONS

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ABSTRACT:

The present investigation was conducted during the two seasons of 2006/2007 and 2007/2008 at Arab El-Awammer Research Station (A.R.C.); Assiut, Egypt to study the effect of N application, compost and bio-fertilization on soil and nitrate concentration of leaves of Romaine cv. grown in sandy soil. The results indicated the effectiveness of N application 120 N level and 6 ton of organic fertilizer in all studied characters. There are significant differences between uses of bio-fertilization in all studied characters. The interactions results showed that in there was no significant difference between 120 N when mixed with 3 or 6 ton organic fertilizer while treated plant with bio-fertilization lead to decrease N level to 90 N with organic fertilization levels in plant height, leaf height, leaf diameter, head diameter and also total plant weight characters. On the other hand in yield character there was no significant differences between N level 60, 90 and 120 with mixed with bio and organic fertilizer. Nitrate content in lettuce leaves decreased with added organic and bio-fertilizer.

INTRODUCTION:

Lettuce (*Lactuca sativa* L.) is the most popular among the salad crops. It is rich in vitamins and minerals Choudhury (1967).Also, lettuce grown in Egypt for local consumption and export. The total area in Egypt was 13.567 fed. and the total yield was 136.008 ton/fed. (Ministry of Agriculture & Land reclamation, Agricultural statistics, second part, 2005). It is well known that nitrogen fertilizers are important factors for higher yield and average head weight of lettuce. Nitrogen is one of essential elements for growth and development of plants. Plants absorb nitrogen from soil in the form of nitrates, which are then converted into proteins and other nitrogen-containing substances (Cash *et al*., 2002). Nitrate content in plant represents a dynamic balance between rate of absorption, assimilation and translocation (Maynard *et al*., 1976). Many investigations present the effect of nitrogen on lettuce plants such as increasing nitrogen rate increased plant height and number of leaves/plant (Awny and Moursy, 1992), fresh weight/plant and total yield (Shafshank and Abo-Sedera,1990; Awny and Moursy, 1992; Moussa *et al*., 1993; Gawish, 1997; Cameria *et al*., 2000), nitrate contents in leaves (El-Hassan

1990; Shafshank and Abo-Sedera,1990; Awny and Moursy, 1992; Bakr and Gawish 1997). Also, there were many researches showed the effect of nitrogen on grown the lettuce plants such as Abdel- Razik and Barakat 1990, Soundy and Smith 1992, Moussa *et al*., 1993, Abdel-Razik 1996.

Test of nitrate accumulation in Egyptian vegetables showed considerable high values as compared to those found in vegetables grown in several European countries (Blom-Zandstra, 1989 and Kheir *et al*., 1991). Also, increase in N fertilizer led to increase in nitrate content of the crop tissues without significant increase in yield (Custic *et al*., 1994). Also, increasing the use of chemical fertilizer led to high cost in vegetable production and creates pollution of their agricultural environment as well as affects the soil fertility, therefore it has become essential to use untraditional fertilizers as supplements or substitutes for chemical nitrogen fertilizer. Both bio-fertilization and organic fertilizer may be the solution of decreased pollution and high cost of chemical fertilizer to increases in our exporter. Many investigations presented the effect of untraditional fertilizers on grown lettuce such as Bakr and Gawish (1997) who showed that Farmyard manure at high rate of nitrogen was associated with low nitrate concentration in lettuce. Ahmed *et al.,* (2000) found that lettuce plant treating with nitrobien as a biofertilizer resulted in significant increases in shoot height number of leaves and fresh weight. While there were significant decreases when treated with microbien. Significant decrease in nitrate accumulation when the plant treated with all studied biofertilizers, specially those plants treated with nitrobien, biogien and rizobactrein. Also, the effect of organic fertilizer presented in workers (Smith and Hadley 1989, El-Shinawy *et al*., 1999, Valšíková and Viteková.2006 and Georgios *et al*., 2007). The benefit of bio-fertilizer on grown lettuce were presented by many searches such as (Ruiz Lazano *et al.,* 1995, Azcon *et al*., 1996, Chabot *et al*., 1996 and Noel *et al*., 1996).

The present study was undertaken to investigate the effect of bio-fertilizer and organic fertilizer in single or combined applications to reduce the application of mineral N fertilization on lettuce plant in reclaimed land.

MATERIALS AND METHODS:

The present work was carried out at Arab El-Awammer Research Station (A.R.C.); Assiut, Egypt, during two seasons i.e. 2006/2007 and 2007/2008 to study the effect of bio-fertilizers and organic fertilizer under different nitrogen levels on growth and yield of lettuce cv. Romaine in sandy soil to minimize the use of inorganic N fertilizer. Five levels of N fertilizer i.e., 0, 30, 60, 90 and 120 Kg/fed. were applied in the form of ammonium nitrate (33.5% N) in 6 equal doses during both seasons of study, Biogen (*Azotobacter sp*.) as a bio-fertilizer and three levels of organic N (Composted Farm Wastes) i.e., 0, 3 ton and 6 ton/Fadden. The compost used in this work had the following chemical composition: Organic matter (%)= 48.58, Organic carbon (%)=28.18, Total N (%)= 1.011, Total P(%) =0.403, Total K (%)=1.643, Na (%)=1.070, Fe (ppm) 6474, Mn (ppm)=164, Zn (ppm)=54 and Cu (ppm)=11. Compost was applied at soil preparation before cultivation. Roots of lettuce transplanted were dipped into the bio-fertilizer solution immediately before transplanting. In addition 2 Kg/fed. of bio-fertilizer were mixed with 25 Kg soil and added at two week after transplanting. These treatments were randomized in a split-split-design with three replicates where N levels contributed as the main plots, while organic fertilizer and bio-fertilizer were distributed in

the sub-and sub-sub plots, respectively. Physical and chemical analysis of the experimental soil is shown in Table (1). Lettuce seeds were sown on 10 Oct. in both seasons. The seedlings were transplanted to the field 40 days after sowing and spacing was 25 cm between plants within rows. The plot size was 3x3.5 m. (1/400/fed.) with four rows per plot. All common agricultural practices were followed as recommended.

Ten lettuce plants were randomly taken from each sub-plot and the following measurements were recorded:

1-Plant height (cm). 2-Leaf length (cm).
3-Leaf width (cm). 4-Head diameter (cm).
5-Total plant weight (g).
6-Total yield/plot (Kg).
7-Nitrate contents (NO_3) concentration according to the procedure described by Keeney and Nelson (1982).

Soil samples were taken from surface layers (0-30 cm) at harvesting each plot and prepared to analysis according to the procedures described by Jackson (1958). All obtained data were statistically analyzed; and treatment means were compared using revised L.S.D. test according to the procedure outlined by Snedecor and Cochran (1972).

Table (1): Some physical and chemical properties of a representative soil sample used in the experimental site

Season	pH 1:1 suspention	EC (1:1 extract) dsm^{-1}	$CaCO_3$ (%)	Soluble cations meq/100 g soil				Soluble anions meq/100g soil	
				Ca^{+2}	Mg^{+2}	Na^{+1}	K^{+1}	CO_3+ HCO_3	Cl
2006/2007	8.21	0.59	27.33	0.30	0.24	0.11	0.01	0.32	0.28
2007/2008	8.43	0.77	32.15	0.33	0.28	0.15	0.03	0.38	0.22
Season	available nutrients			Mechanical analysis %			Soil texture		
	N %	P ppm	K meq/100 g soil	Sand	Silt	Clay			
2006/2007	0.06	3.14	0.14	85.4	8.7	5.9	Sandy		
2007/2008	0.04	2.88	0.12	87.2	7.2	5.6			

RESULTS AND DISSCSION:

Plant height (cm):

The effect of chemical, bio-fertilizer and organic fertilizer on plant height of lettuce plants in sandy soil is presented in Tables (2& 3) for without or with using Biogen as a Bio-fertilization respectively. The results indicated that there were significant differences due to using the five levels of nitrogen fertilizer in both seasons. The increase in plant height corresponded the increased N levels. The plants when received 120 N units were the tallest. Also, the effect of organic fertilizer obvious when plant received the 6 ton of organic fertilizer diving plants significantly taller than these received 3 ton of organic in both seasons even plant were grown with or without bio-fertilization. The interactions in between N application and three levels of organic fertilizer are presented in Tables (2&3). There were significantly differences among the interactions without or with used bio-fertilization. The results indicated that the interaction between level 120 N with 3 or 6 ton organic were significantly higher than other interactions and gave the tallest lettuce plants in both season for without using bio-fertilizer (Tables 2&3). While, when bio-fertilizer was applied to the lettuce plants the application of 120 N with both 3 and 6 ton organic gave the tallest plants but in the second season the application of 120 N with

three levels of organic and also 90 N with both 3 and 6 ton organic did not significant differ from each other in giving the tallest plant. The results are in harmony with those reported by Shafshak and Abo-Sedera (1990) on lettuce with respect to plant height. The increase in plant growth may be attributed to the beneficial effects of N on stimulating the meristmatic activity for producing more tissues and organs and N play major roles in structural proteins and other several macromolecules related with growth plants (Marschner, 1986). The improvement when using used bio-fertilization with lettuce plant led to increase in plant growth was presented by many workers such as; Brown (1974); Agwah and Shahaby (1993); Carletti *et al.,* (1996) and Lazaroving and Nowak (1997). Also, the improving in plant growth associated with decrease in N level. The decrease of N application with used organic or bio-fertilizer was reported in many investigation such as Agwash and Shahaby (1993) and El-Gmal (1996).

Leaf length (cm):

Data in Tables 2 and 3 showed significant differences in leaf length as affected by N applications in both studied seasons. Leaf length in lettuce plant significantly increased with increasing nitrogen fertilizer. Also, the same effect of increasing leaf height was previous with added more levels of organic fertilization in both studied seasons. The interactions between N fertilizer and organic without or with bio-fertilizer are presented also in Tables (2&3). Data indicated that there were significantly differences among the interactions in both studied seasons. When plants did not receive Biogen the highest values were obtained from application of (120 N x 6 ton organic) in first season and from application of 120 N with 3 and 6 ton organic in second season. When lettuce plants were treated with Biogen as a bio-fertilizer the results indicated that the combinations of (120 N x 6 ton organic), (120 N x 3 ton organic) and (90 N x 6 ton organic) gave the highest values for leaf height in first season. In the second season the interactions (120 N x 3 ton organic); (120 N x 6 ton organic); (120 N x 0 organic), (90 N x 6 ton organic) and (90 N x 3 ton organic) were significantly higher than other interactions and gave the highest value of leaf length. The results are agree with Gardener and Pew 1974 who presented that leaves formation depending on N supply. Ahmed *et al.,* (2000) found that lettuce plant when treated with nitrobien as a bio-fertilizer there are significant increases in shoot height, number of leaves and fresh weight. While there are decreases significant when treated with microbien.

Leaf width (cm):

The same trend in this character agrees with that found for leaf length character for N application and organic fertilizer (Tables 2&3). When plants were not treated with Biogen the interactions between N application and organic fertilizer presented that the highest values were obtained from interactions (120 N x 6 ton organic) in first season while both interactions 120 N with 3 and 6 ton organic and (90 N x 6 ton organic) in second season. On the other hand when Biogen was applied, the interactions (120 N x 3 ton organic); (120 N x 6 ton organic) and (90 N x 6 ton organic) gave the highest value of leaf width in first season. While, in the second season four interactions were significantly higher than other interactions in gaving the highest value of leaf width i.e; (120 N x 3 ton organic); (120 N x 6 ton organic); (90 N x 6 ton organic) and (60 N x 6 ton organic).

Head diameter (cm):

There were significant differences for the five levels of nitrogen and three levels of organic fertilizer for head diameter character in both studied seasons (Tables 4 & 5). Head diameter in lettuce plant increased with increasing the N application or increasing organic fertilizer levels. The highest in this respect was applying 120 Kg N and 6 ton of organic fertilizer whether Biogen was applied or not. Also, there were significant interaction between N application and organic fertilizer in both studied seasons for without or with treated plant by Biogen as a bio-fertilizer. Three interactions gave the largest heads in lettuce plant in first and second season i.e, 120 N with both 0, 3 and 6 ton organic fertilizer for plant without bio-fertilizer treatment. On the other hand, for plants treated with Biogen the same later interactions with (90 N x 6 ton organic) in both seasons. The present results, in general are in agreement with those obtained by Pew *et al*., (1983), Abdel-Razik and Barakat (1990), Walworth *et al.,* (1992) and Moussa *et al*., (1993).

Total plant weight (g):

Data in Tables (4 & 5) indicated that there were significant differences among the five level of N application and the highest level 120 N gave the highest value of total plant weight. Also, the total plant weight increase by increasing the added of organic fertilizer and 6 ton organic gave the highest value for this trait. This was true in both seasons whether Biogen was applied or not. There are significant between using and don't using the Biogen as a bio-fertilizer. The interactions between chemical and organic fertilizer on total plant weight presented in Table (3) without Biogen and when plant treated with Biogen. The results demonstrated that the interaction (120 N x 6 ton organic) was significantly higher than other interaction in both seasons. When plant were treated with Biogen there were no significant between both interactions (120 N x 6 ton organic) and (90 N x 6 ton organic) in giving the highest plants. That main adding the bio-fertilizer decrease using the N level. Obtained results are in agreement with those reported by Zhong *et al*., (1989) and Shashak and Abo-Sedera (1990). Also, the effect of bio-fertilizer on increase the plant weight and decrease the N application are in harmony with Carletti *et al*., (1996) and Ahmed *et al*., (2000).

Total yield (Kg/plot.):

The effect of chemical, bio-fertilizer and organic fertilizer on total yield of lettuce plants in sandy soil are presented in Tables 4 and 5 for without treated or with treated the plant by Biogen as a bio-fertilization respectively. The results presented that there was significantly differences among each of N application levels and organic fertilizer treatments in this trait. The highest total yield was obtained when plant received 120 N for N application as an average of treated organic fertilizer treatments or 6 ton organic fertilizer as an average of all tested N levels in both seasons of study (Table 3). The interactions between chemical and organic fertilizers indicated that the best interactions for total yield were obtained when plant received 120 N with 6 ton organic without Biogen treatment. When lettuce plant were treated with Biogen there were no significant differences between level 120 N and 90 N with all organic level in both seasons. Similar results also, were reported by many investigations with respect to the reduction of N fertilization through the use of bio-fertilizer inoculation such as Kumaraswamy and Madalaggeri (1990) and El-Gamal (1996). There are many investigation presented the increases in lattuce yield due to N application (Richard *et al*., 1985; Sanchez *et al.*,

1989 and Custic *et al*., 1994). Pandy and Kumar (1989) reported that the increases in yield in lettuce plants related to bio-fertilizer due to the beneficial effects of the bacterial not only due to their N fixation capacity, but also because of their ability to produce antibacterial and antifungal compounds, growth hormones and siderophores. Also, there are many workers presented the increases in yield obtained as a results of different biofertilizers inoculation such as Azcon *et al*., (1996) on lettuce; El-Gamal (1996) on potatoes and Wange (1996) on carrot.

Nitrate contents in leaves (mg/Kg):

Data in Table (6) indicated that there were significant differences among the five level of N application and the highest value of NO_3 was obtained when plant received the 120 N level in both seasons for lettuce plant which treated or no treated by Biogen. Also, in the three levels of organic fertilizer the results showed that there are decreased in NO_3 by increasing organic level in both seasons. The interaction between N application and organic fertilizer are presented in Table (4) showed that the increase in NO_3 was obtained when plant received 120 N without organic fertilizer and with increasing the organic fertilizer the NO_3 content decreased in lettuce plant. Ahmed *et al.,* (2000) found that significant decreases in nitrate accumulation when the lettuce plant treated with all studied bio-fertilizers, specially those plants treated with nitrobien, biogien and rizobactrein. Williams (2002) reported lower nitrate content in organically fertilized crops, particulary leafy vegetables and Vogtmann *et al.,* (1993) showed lower nitrate concentration in cabbage with organic fertilization compared with mineral fertilized crops. Hajslova *et al.,* (2005) and Malmauret *et al.,* (2002) reported lower nitrate concentration in organic potato and tomato, compared with mineral fertilized crops. Maynard *et al.,* (1976) showed that low nitrate content in edible part of the plants is very important for human health, due to its potential transformation to nitrites which have the highest possibility to interact with hemoglobin and affect blood oxygen transportation (Causeret 1984). The same results were confirmed by Ahmed *et al*.,(1997) who reported that biofertilizer treatments can lower nitrate concentration in Jew's mallow and radish plants while sugars, amino acids and several lower nutrient concentrations were higher.

Effect of treatmenting soil fertility:

Tables (7&8) show the effect of treatments on total N and available P in the soil after harvesting lettuce plants.

Total-N:

Total-N in the soil significantly increased with increasing mineral-N fertilizer rate. Moreover, the most increase in soil N content was observed with compost and bio-compost. The highest N-content in the soil was obtained with the high rate of N-fertilizer and bio-compost. Compost and bio-compost as organic and bio fertilizer plays an important role in maintaining soil fertility with releasing nutrients in the soil. Several investigators reported about the positive effect of applying organic fertilizer on the soil. El Etr (2004). Maftoun *et al* (2004) Mohamed and Hussein (2005), Elsharawy *et al* (2003), and El bordiny *et al.* (2003). They ascribed to the mineralization of N from compost during its composition and might be the biological fixation of atmospheric N and its reflection on soil fertility.

Phosphorous:

Available P in the soil followed the same trend as N content. Available-P significantly increased with increasing either N fertilizer rate or compost either without or with Biogen. The highest value of available P was obtained with the application of 120 kg N/fed and bio-compost.

Increasing P soil content due to the application of organic fertilizers might be a result of its decomposition and producing organic acids, which increases the nutrients availability in the soil. It might also, be due to the additions of these nutrients after the composition of the organic fertilizers (Mahmoud, 2000) and preventing fixation of P and probably other nutrients (Ahmed and Osman, 2003). This is in agreement with what have been reported by several researchers (Ahmed, 1997; Ahmed, 2001 and Ahmed & Ali, 2005).

It can be concluded that use of both organic and bio-fertilizer gave a good results for yielding of lettuce in sandy soil and also, reduce the N fertilizer without reduce the yielding. In addition, the use of organic and bio-fertilizer reduce the N accumulation in leaves which a good results for human health and reduce the soil pollution.

Table (2): Vegetative characters for lettuce plants without treated by Biogenas effected by different nitrogen levels and organic treatments and their interactions in seasons 2006/2007 and 2007/2008

Treatments		Plant height (cm) without Biogen		Leaf length (cm)		Leaf width (cm)	
N level (Kg/fed.)	Organic	1st Season	2nd season	1st Season	2nd Season	1st Season	2nd season
0		20.18 e	20.77 e	15.64 e	20.11 e	7.67 e	7.40 e
30		30.22 d	30.79 d	23.81 d	27.34 d	9.80 d	9.15 d
60		37.26 c	37.80 c	28.37 c	31.60 c	12.51 c	11.98 c
90		43.53 b	44.30 b	32.32 b	33.86 b	13.22 b	12.98 b
120		46.44 a	47.00 a	34.07 a	34.39 a	13.71 a	13.50 a
	0	31.47 c	32.11c	23.54 c	26.52 c	10.27 c	9.85 c
	3	35.84 b	36.42 b	26.85 b	29.69 b	11.47 b	11.24 b
	6	39.27 a	39.87 a	30.13 a	32.17 a	12.41 a	12.13 a
	0	16.55 m	17.00 m	12.52 m	15.88 m	6.25 i	6.00 k
0	3	19.55 l	20.00 l	14.65 l	18.70 l	7.65 h	7.25 j
	6	24.45 j	25.33 j	19.75 j	2575 j	9.12 g	8.95 h
	0	23.55 k	24.20 k	18.00 k	21.90 k	7.85 h	7.57 i
30	3	30.55 i	31.02i	23.75 h	27.75 h	9.82 f	9.67 g
	6	36.55 h	37.15 g	29.67 f	32.38 g	11.75 d	11.30 e
	0	31.08 i	31.65 h	23.38 i	27.23 i	11.27 e	10.25 f
60	3	37.95 g	38.45 f	28.88 g	33.60 e	12.68 c	12.45 c
	6	42.75 e	43.30 d	32.85 d	33.97 d	13.57 b	13.25 b
	0	40.25 f	41.25 e	29.97 e	33.38 f	12.45 c	12.15 d
90	3	44.70 d	45.60 c	32.92 d	34.00 cd	13.55 b	13.27 b
	6	45.65 c	46.05bc	34.05 b	34.20 bc	13.65 b	13.50 a
	0	45.92 bc	46.45 b	33.83 c	34.25 b	13.52 b	13.30 b
120	3	46.45 ab	47.05 a	34.08 b	34.40 ab	13.65 b	13.55 a
	6	46.95 a	47.50 a	34.30 a	34.53 a	13.95 a	13.65 a

Values marked with same alphabetical letter(s), within a comparable group of means, do not significantly differ, using revised LSD test at 0.05 level.

Table (3): Vegetative characters for lettuce plants with treated by Biogenas effected by different nitrogen levels and organic treatments and their interactions in seasons 2006/2007 and 2007/2008

Treatments		Plant height (cm)		Leaf length (cm)		Leaf width (cm)	
N level (Kg/fed.)	Organic	1st Season	2nd season	1st Season	2nd season	1st Season	2nd season
0		26.12 d	26.62 d	20.79 e	15.49 e	9.10 e	9.50 e
30		36.47 c	37.27 c	28.11 d	24.44 d	11.32 d	11.56 d
60		42.13 b	42.78 b	31.90 c	28.95 c	12.57 c	12.76 c
90		46.27 a	46.46 a	33.97 b	32.78 b	13.38 b	13.57 b
120		46.57 a	46.87 a	34.47 a	34.56 a	13.58 a	13.82 a
	0	35.23 c	35.97 c	26.81 c	23.97 c	10.90 c	11.18 c
	3	39.83 b	40.55 b	30.10 b	27.47 b	12.21 b	12.44 b
	6	43.48 a	43.47 a	32.63 a	30.30 a	12.86 a	13.12 a
	0	21.00 j	21.48 j	16.30 l	12.63 f	7.97 j	7.50 i
0	3	24.67 i	25.25 i	19.42 k	15.38 e	9.55 i	9.15 h
	6	32.67 g	33.13 g	26.65 i	18.48 d	11.00 h	10.65
	0	28.45 h	29.05 h	22.42 j	18.67 d	9.67 i	9.25 h
30	3	37.30 f	38.00 e	28.67 g	24.50 c	12.00 f	11.75 e
	6	43.67 e	44.75 d	33.22 f	30.15 b	13.00 e	12.95 d
	0	36.03 f	36.70 f	27.52 h	23.73 c	11.38 g	11.15 f
60	3	44.72 cde	45.63 cd	33.95 d	29.58 b	13.25 d	13.02 cd
	6	45.65 bcd	46.03 bc	34.22 c	33.55 a	13.65 bc	13.55 ab
	0	44.53 de	46.00 bc	33.50 e	30.50 b	13.20 de	13.15 c
90	3	46.00 bcd	46.72 ab	33.90 d	33.30 a	13.57 c	13.45 b
	6	48.28 a	46.65 ab	34.50 ab	34.53 a	13.95 a	13.52 ab
	0	46.15 bc	46.65 ab	34.30 bc	34.33 a	13.65 bc	13.45 b
120	3	46.89 ab	47.15 a	34.55 a	34.58 a	13.80 ab	13.65 a
	6	47.13 ab	46.80 ab	34.58 a	34.78 a	14.00 a	13.65 a

Table (4): Yield characters for lettuce plant treated without by Biogen as effected by different nitrogen levels and organic treatments and their interactions in seasons 2006/2007 and 2007/2008

Treatments		Head diameter (cm) without Biogen		Total plant weight (g) without Biogen		Total yield/plot (kg) without Biogen	
N level (Kg/fed.)	Organic	1st Season	2nd season	1st Season	2nd season	1st Season	2nd season
0		7.64 e	7.62 e	138.3 e	144.9 e	7.63 e	13.66 e
30		11.07 d	11.00 d	263.5 d	272.8 d	14.38 d	25.67 d
60		15.07 c	15.00 c	398.3 c	410.5 c	22.16 c	32.36 c
90		19.12 b	19.10 b	553.3 b	569.9 b	31.02 b	37.41 b
120		21.56 a	21.53 a	681.9 a	687.8 a	38.13 a	39.26 a
	0	13.09 c	13.00 c	316.1 c	328.6 c	17.75 c	25.46 c
	3	14.39 b	14.35 b	404.0 b	412.0 b	22.34 b	28.56 b
	6	17.19 a	17.13 a	501.0 a	511.0 a	27.91 a	34.99 a
	0	5.40 g	5.42 g	59.75 o	65.25 n	3.18 o	9.78 m
0	3	6.65 g	6.69 g	121.5 n	127.5 m	6.43 n	8.01 n
	6	10.88 e	10.90 e	233.5 l	242.0 k	13.30 l	23.20 k
	0	8.92 f	9.00 f	156.3 m	167.5 l	8.55 m	17.25 l
30	3	10.73 e	10.69 e	262.0 k	268.5 j	14.23 k	24.42 j
	6	13.55 d	13.50 d	372.3 i	382.3 h	20.35 i	35.35 f
	0	13.23 d	13.21 d	276.3 j	286.5 i	15.25 j	26.92 i
60	3	13.68 d	13.69 d	394.3 h	407.5 g	22.08 h	32.72 h
	6	18.30 b	18.28 b	524.3 f	537.5 e	29.15 f	37.42 e
	0	16.63 c	16.61 c	422.8 g	451.5f i	24.60 g	34.97 g
90	3	19.35 b	19.36 b	562.0 e	569.5 d	30.73 e	38.13 d
	6	21.38 a	21.39 a	675.0 c	688.8 b	37.75 c	39.13 c
	0	21.29 a	21.30 a	665.5 d	672.5 c	37.17 d	38.38 d
120	3	21.52 a	21.55 a	680.5 b	686.8 b	38.22 b	39.52 b
	6	21.88 a	21.85 a	699.8 a	704.3 a	39.00 a	39.88 a

Values marked with same alphabetical letter(s), within a comparable group of means, do not significantly differ, using revised LSD test at 0.05 level.

Table (5): Yield characters for lettuce plant treated with by Biogen as effected by different nitrogen levels and organic treatments and their interactions in seasons 2006/2007 and 2007/2008

Treatments		Head diameter (cm)		Total plant weight (g)		Total yield/plot (kg)	
N level (Kg/fed.)	Organic	1st Season	2nd season	1st Season	2nd season	1st Season	2nd season
0		12.04 e	12.10 e	286.8 e	294.0 e	9.02 d	15.07 c
30		15.38 d	15.40 d	463.3 d	474.8 d	15.32 c	26.66 b
60		19.23 c	20.1 c	583.7 c	591.7 c	23.43 b	33.87 a
90		21.22 b	21.30 b	667.9 b	679.5 b	32.33 a	38.32 a
120		22.07 a	22.10 a	692.5 a	700.3 a	34.12 a	33.83 a
	0	16.07 c	16.10 c	456.6 c	4.66.5 c	21.27 b	27.75 c
	3	18.02 b	18.10 b	529.8 b	538.5 b	21.28 b	30.66 b
	6	19.88 a	20.00 a	630.1 a	639.0 a	25.97 a	32.63 a
	0	8.8 h	9.0 h	181.0 l	187.0 m	8.98 g	13.88 d
0	3	12.23 g	12.30 g	264.3 k	270.0 l	9.92 g	14.57 d
	6	15.09 f	15.20 f	415.0 i	425.0 j	12.16 fg	21.77 bcd
	0	12.41 g	12.55 g	301.3 j	316.5 k	13.27 efg	23.67 bcd
30	3	14.93 f	15.00 f	441.3 h	449.3 i	12.83 efg	23.58 bcd
	6	18.80 d	18.90 d	647.5 d	658.5 e	19.85 def	32.72 ab
	0	17.26 e	17.33 e	481.8 g	488.5 h	20.31c def	32.35 ab
60	3	19.00 d	19.10 d	581.3 f	590.5 g	21.63 cde	32.20 ab
	6	21.42 b	21.50 b	688.0 b	696.0 bc	28.35 bcd	37.05 a
	0	19.85 c	20.00 c	631.5 e	647.3 f	29.23 abc	37.38 a
90	3	21.85 a	21.90 a	672.3 c	683.3 d	31.20 ab	37.80 a
	6	21.96 a	22.00 a	700.0 a	708.0 a	36.55 ab	39.78 a
	0	22.00 a	22.00 a	687.5 b	693.5 c	38.03 a	39.03 a
120	3	22.10 a	22.15 a	690.0 b	699.5 b	31.40 ab	30.63 abc
	6	22.11a	22.20 a	700.0 a	707.8 a	32.92 ab	31.82 abc

Table (6): Nitrate contents in lettuce leaves effected by different nitrogen levels, organic and bio-fertilizer treatments and their interactions in seasons 2006/2007 and 2007/2008

Treatments		NO_3 Contents (mg/Kg) without Biogen		NO_3 Contents (mg/Kg) with Biogen	
N level (Kg/fed.)	Organic	1st Season	2nd season	1st Season	2nd Season
0		132.6 e	131.2 e	136.3 e	139.3 e
30		163.3 d	162.1d	179.9 d	186.7 d
60		238.8 c	237.2 c	244.3 c	250.3 c
90		354.9 b	350.5 b	351.1 b	359.3 b
120		469.1 a	460.0 a	435.7 a	446.3 a
	0	286.8 a	280.2 a	292.4 c	299.3 c
	3	269.9 b	267.1 b	267.0 b	273.2 b
	6	258.6 c	256.9 c	249.0 a	256.7 a
	0	133.0 n	132.1 n	138.0 n	141.0 n
0	3	132.0 m	131.0 m	136.0 m	139.0 m
	6	131.8 o	130.8 o	135.0 o	138.0 o
	0	178.8 j	182.0 j	200.0 j	210.0 j
30	3	161.2 k	159.1k	179.0 k	184.0 k
	6	152.0 l	145.1 l	160.8 l	166.0 l
	0	252.6 g	249.1 g	275.8 g	281.0 g
60	3	240.0 h	236.4 h	237.8 h	245.3 h
	6	224.6 i	226.5 i	219.3 i	224.8 i
	0	369.8 d	364.2 d	380.0 d	388.0 d
90	3	354.2 c	351.1 c	345.0 e	353.8 e
	6	341.8 f	340.8 f	328.3 f	336.3 f
	0	499.2 a	482.5 a	468.3 a	476.3 a
120	3	462.5 b	458.2 b	437.0 b	444.0 b
	6	446.8 c	441.8 c	401.8 c	418.5 c

Values marked with same alphabetical letter(s), within a comparable group of means, do not significantly differ, using revised LSD test at 0.05 level.

Table (7): Main effect of mineral N, compost and bio-fertilizer and their interaction on total N content in the soil after harvesting in 2008 season.

N rates	Organic and bio fertilizer							
	2008 with Biogen				2008 without Biogen			
	Cont.	Comp. 3 ton	Comp. 6 ton	Mean	Cont.	Comp. 3 ton	Comp. 6 ton	Mean
Cont.	0.027	0.037	0.041	0.035	0.034	0.043	0.055	0.044
30 kg N	0.035	0.043	0.056	0.045	0.038	0.049	0.060	0.049
60 kg N	0.041	0.061	0.068	0.057	0.045	0.067	0.069	0.060
90 kg N	0.044	0.062	0.065	0.057	0.041	0.068	0.068	0.059
120 kg N	0.041	0.071	0.072	0.061	0.043	0.069	0.071	0.061
Mean	0.038	0.055	0.060		0.040	0.059	0.065	
LSD 0.05 for N	0.003				0.003			
LSD 0.05 O.M	0.003				0.003			
LSD0.05NX O.M	0.006				0.006			

Table (8): Main effect of mineral N, compost and bio-compost and their interaction on soil available P in the soil after harvesting in 2008 season

N rates	Organic and bio fertilizer							
	2008 with Biogen				2008 without Biogen			
	Cont.	Comp. 3 ton	Comp. 6 ton	Mean	Cont.	Comp. 3 ton	Comp. 6 ton	Mean
Cont.	8.13	8.61	8.97	8.57	910	10.79	11.40	10.43
30 kg N	8.50	9.58	10.37	948	9.42	11.28	12.09	10.93
60 kg N	8.39	10.45	11.28	10.04	9.10	11.81	12.87	11.26
90 kg N	8.64	11.55	12.10	10.76	8.98	12.44	13.78	11.73
120 kg N	10.77	12.16	12.66	11.86	9.89	13.35	14.01	12.42
Mean	8.88	10.47	11.07		9.30	11.94	12.83	
LSD 0.05 for N	0.4				0.2			
LSD 0.05 O.M	0.3				0.3			
LSD0.05NX O.M	0.7				0.6			

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تأثير التسميد النيتروجينى والعضوى والحيوى على إنتاجية الخس(صنف الرومين) فى الأراضى الرملية تحت ظروف أسيوط

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****معهد بحوث الأراضى والمياه والبيئة – مركز البحوث الزراعية**

أجرى هذا البحث خلال موسمى الزراعة 2007/2006، 2008/2007 بمحطة مركز البحوث الزراعية بعرب العوامر، لدراسة تأثير إضافة النتروجين وكلا من التسميد العضوى والحيوى ونسبة تركيز النيتريت فى أوراق الخس للصنف الرومين، والذى ينمو فى الأراضى الرملية. وقد تم استخدام خمسة مستويات من التسميد النتروجينى هى (صفر، 30، 60، 90، 120 كجم) على صورة نترات الامونيوم 33.5%. كما استخدم أيضا ثلاثة مستويات من التسميد العضوى بمعدلات (صفر، 3، 6 طن/فدان) بالإضافة إلى المعاملة البيوجين كمصدر للتسميد الحيوى.

وقد أظهرت نتائج الدراسة:

1- فاعلية التركيز 120 كيلوجرام نتروجين على معظم الصفات المدروسة. وكذلك فاعلية التركيز 6 طن سماد للفدان فى حالة التسميد بالسماد العضوى.

2- وجود اختلافات واضحة فى حالة التسميد الحيوى فى كل الصفات المدروسة.

3- التفاعل بين التسميد الكيميائى (النيتروجينى) والعضوى، وتبين عدم وجود اختلافات معنوية بين التركيز 120 كجم وإضافة 3 أو 6 طن فى معظم الصفات المدروسة.

4- أن معاملة النباتات بالتسميد الحيوى أدت إلى إمكانيه خفض الحاجة إلى التسميد الكيميائى (النتروجينى) لمستوى 90 كجم دون حدوث اختلاف بينها وبين المستوى 120 كجم فى صفات طول النبات وطول الورقة وعرض الورقة،وأيضاً فى صفة الوزن الكلى للنبات.

5- لا توجد فروق معنوية فى حالة استخدام مستويات من السماد النتروجينى 60، 90، 120 كجم فى صفة المحصول فى حالة المعاملة للنباتات بالسماد الحيوى (البيوجين). كما قلت نسبة النترات فى أوراق نبات الخس بإضافة التسميد العضوى أو الحيوى.

ومن ذلك ينصح باستخدام الأسمدة العضوية والحيوية رخيصة الثمن، والتى تكون أيضاً غير ضارة بالصحة لتقليل استخدام الأسمدة الكيميائية فى إنتاج محاصيل الخضر.