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EFFECT OF DIFFERENT LEVELS AND SOURCES OF NITROGEN ON GROWTH, YIELD AND QUALITY OF POTATOES GROWN UNDER SANDY SOIL CONDITIONS.

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ABSTRACT

Two field experiments were carried out during the two successive summer seasons of 1999 and 2000 at the Experimental Farm of the South Tahrir Governorate Behara- Egypt Station, Horticulture Research Institute, Agric. Res. Center to investigate the effect of nitrogen fertilization levels i.e., 120, 150 or 180 kg N/fed. either in a mineral form or half of the tested level as organic form (chicken manure) and the other half in the mineral form on vegetative growth, tuber yield and its components as well as chemical composition for plant foliage and tubers for cv. Spunta grown under sandy soil conditions. The experiment was set out in compete randomized block design with four replicates in both seasons. The obtained results could be summarized as follows:

1- Increasing nitrogen level from 120 up to 180 kg N/fed. In the form of ammonium nitrate only or half of used level as a mineral form and the other used half as organic manure (chicken manure) increased all the studied growth aspects, i.e., plant height, number of leaves and stems per plant, fresh and dry weight of plant foliage during the two seasons of study.
2- Chemical constituents of plant foliage and produced tubers (N, P and K, crud protein reducing and total sugars as well as starch content of tubers). Were increased with increasing nitrogen levels up to the highest used one (180 kg N/fed.).
3- Total tubers yield fed. As well as physical quality of produced tubers were higher in case of the highest used level either as a mineral form or half of used level as a mineral and the other half as organic form (chicken manure).
4- Using the highest level of nitrogen fertilizer (180 kg N/fed.) reflected the highest yield of medium and large size tubers compared with other used levels.

INTRODUCTION

Potato *(Solanum tuberosum L.)* is one of the most important and favorite vegetables crop grown in Egypt. It is also considered as a leading vegetable crop for export, therefore in the last decades a great attentions were directed for increasing the total produced yield and its quality. Fertilization either with mineral or organic fertilizers considered the most important agricultural treatment, which affect the growing period of plant foliage and tuber formation as well as the quality of produced yield. In this regard, Abou-Hussein, (1995), Abdel-Ati (1998), Arisha and Bardisi (1999) and Hassandokhat and Kashi (2000)

mentioned that application of organic manure either in the form of chicken manure or farmyard manure at different studied levels affected greatly the vegetative growth, K content for plant foliage and produced tubers.

As for the effect of nitrogen fertilization, many researchers found that using nitrogen in fertilization of potato increased the vegetative growth, (El-Gamal, 1985a and b, Arish, 1994 and Gabr *et al.* 2001), total tuber yield and its quality (Shehata and Abo-Sedera 1994; Joern and Vitosh 1995, Kumar *et al.*, 1996: Belanger *et al.*, 2002 and Singh *et al.*, 2002).

MATERIAL AND METHODS

Two field Experiments were carried out at the Experiment Farm of the South Tahrir Station of Horticulture during the two successive summer seasons of 1999 and 2000 to investigate the effect of nitrogen fertilization level as a chicken manure and mineral form on growth, chemical composition and tuber yield as well as quality of produced tuber for potato cv. Spunta under sandy soil conditions. The soil of the experimental field was sandy in texture with pH 7.83, the chemical analysis of soil samples and used organic manure (chicken manure) was carried out at laboratories of soil and water Res. Inst. Agric. Res. Center according to the methods described by Jakson (1965) and the results of those analysis were presented in Tables (1 & 2).

Table (1): Chemical characteristics of the experimental soil.

pH	EC (dsm)	Anions (meq.L^{-1})			Cations (mqe.L^{-1})				Mineral nutrients (ppm)		
		HCO^{3-}	Cl^{-}	SO_4^{-2}	Mg^{2+}	Na^{+}	Ca^{2+}	K^{+}	N	P	K
7.83	1.49	11.8	7.0	7.55	6.26	6.90	10.89	2.3	10	12	60

Table (2): Chemical analysis of the chicken manure.

pH	EC (dsm)	N (%)	P (%)	K (%)	S (%)	CN ratio	Moister	Ash	O.M	O.C
8.83	6.77	1.12	0.46	0.24	66.6	33.5:1	33.3	35.2	64.7	37.6

Potato seeds (tubers) cv. Spunta (obtained from Society of potatoes producing at Cairo) were planted on February 17th and 23rd for summer planting. A complete randomized block design with four replicates was adopted. Each experimental plot included three rows each 50 m length and 75 cm in width with an area 37.5 m^2. The fertilization treatments of organic and inorganic fertilization either in a single form or in combination were conducted as follows:

1. 60 kg N/ fed in the form of organic manure (chicken) plus 60 kg N/fed as ammonium nitrate (33.5 %)
2. 75 Kg N/fed. in the form of chicken manure plus 75 kg N/fed as ammonium nitrate (33.5%)
3. 90 kg N/fed. as chicken manure plus 90 kg N/fed. as ammonium nitrate (33.5%).
4. 120 kg N/fed. as ammonium nitrate (33.5 %)
5. 150 kg N/fed. as ammonium nitrate (33.5 %)
6. 180 kg N/fed. as ammonium nitrate (33.5 %).

The amounts of chicken manure were added once during the soil preparation at both autumn and summer planting, while the amounts of ammonium nitrate fertilizers was divided into 26 equal doses and added through the irrigation water (fertigation) three times week. Phosphorus fertilizer at a rats of 75 kg P_2O_5 fed. in the form of calcium super phosphate (15.5 % P_2O_5) was added once during soil preparation, while potassium fertilizers was applied at the rate of 80 kg K_2O/ fed. through the irrigation water during the same times of nitrogen fertilizer treatments. Other agricultural practices required for potato production were carried out as commonly followed in the district.

Data recorded:

a- **Vegetative growth characteristics:** A random sample consists of 5 plants were taken from each experimental plot during both seasons (95 days from planting) and the plant height, number of leaves and number of main stems per plant, fresh and dry weight of plant foliage as well as dry weight of tubers per plant were recorded .

b- **Total tuber yield and its components:** At harvest (120 days after planting) all plants in each experimental plot were pulled and tuber were collected and weighted to calculate, number and weight of tuber / plant, total tuber yield. (ton/fed), weight of large (>55 mm) medium (35-55 mm) and small size of tubers (< 35 mm) were recorded.

c- **Chemical constituents:** Total nitrogen, phosphorus and potassium content in different plant parts (foliage and tubers) were assayed in dry matter for both plant foliage and tubers according to the methods described by Pregl (1945), Murphy and Riely (1962) as modified by John (1990) and Brown and Lilleland (1946) for N, P and K, respectively. Total and reducing sugars were determined in plant foliage and tubers while starch content was measured in tubers only according to the methods described in A.O.A.C. (1990). Total protein was calculated by using conversion factor (N X 6.25) as described by Pregl (1945).

All the collected data were subjected to statistical analysis according to Gomes and Gomes (1984).

RESULTS AND DISCUSSION

4-1-Vegetative growth characteristics:

Data presented in Table (3) show the effect of different levels of nitrogen fertilization and sources on morphological characteristics of potato plant in 1999 and 2000 growth seasons.

Such data indicated that increasing the level of nitrogen fertilizer from 120 up to 180 kg N/fed. either as a mineral form or half of the used dose as mineral form and the second half as organic source (chicken manure) significantly affected all the measured morphological growth aspects i.e. plant height, number of leaves and stems per plant as well as fresh and dry weight of whole plant foliage during the two seasons of study. In this regard, application of nitrogen at 180 kg N/fed. in a mineral form reflected the highest and significant increases in all aforementioned growth traits during both seasons of growth. In this connection, the increments in vegetative growth parameters with increasing the nitrogen levels my be due to the main role of nitrogen element as a constituents of protoplasmic substance necessary for cell division and

cell elongation, photosynthetic pigments constitution and consequently increased the vegetative growth rate. Furthermore, the superiority of mineral nitrogen levels my be attributed to the presence of nitrogen element in available form for direct absorption by plant roots. Moreover, replacement half of used mineral nitrogen level with nitrogen as an organic manure did not show any significant increase in all the studied growth parameters compared with using all nitrogen amount in a mineral form. Obtained results my be due to the slow rate of decomposition for organic manure and slow release of nitrogen in a suitable form for absorptions by plant compared with more suitable mineral form. Obtained results are in the same trend with those reported by Arisha (1994), Abo-Sedera and Shehata (1994), Shehata and Bakeer (1995), Abu-Hussein (1995), Abdel-Ati (1998), Ashour and Sarhan (1998), Arisha and Bardisi (1999) and Gabr et al. (2001) all working on potato. They mentioned that, the vegetative growth aspects i.e. plant height, number of leaves and stems per plant as well as fresh and dry weight of leaves and stems per plant were positively affected with increasing nitrogen application level either in a mineral form or combination with the organic manure. Contra results were obtained by El-Banna and Abd El-Salam (2000) who revealed that numbers of main stems per plant, foliage fresh and dry weights per plant were not significantly affected by organic manure and mineral fertilization in both seasons, while plant height increased at both seasons by application of mineral fertilization.

Table (3): Effect of nitrogen fertilizer levels on vegetative growth characteristics of potato plants during summer season of 1999 and 2000.

Treatments N kg /fed.	Plant height (cm)	Number of leaves /plant	Number of stems / plant	Fresh weight of plant foliage (g)	Dry weight of plant foliage (g)
			1999		
60 (c) + 60 (a)	29.1	29.1	5.13	102.12	27.41
75 (c) + 75 (a)	30.5	33.4	5.07	118.74	29.77
90 (c) + 90 (a)	34.5	36.9	6.16	134.74	32.58
120 (a)	31.1	32.5	5.03	143.40	29.63
150 (a)	40.0	39.5	6.00	113.74	33.53
180 (a)	49.3	44.7	6.87	143.40	35.49
Mean	35.79	36.1	5.71	129.11	31.47
L.S.D at 0.05	3.81	5.2	0.84	8.58	2.87
			2000		
60 (c) + 60 (a)	30.2	36.1	4.00	100.29	27.49
75 (c) + 75 (a)	35.8	38.0	4.30	114.50	30.40
90 (c) + 90 (a)	45.2	42.4	5.23	138.66	34.37
120 (a)	46.3	45.1	5.30	111.12	29.67
150 (a)	49.7	49.1	5.46	149.09	34.53
180 (a)	55.0	54.4	6.10	175.04	37.23
Mean	43.72	44.2	5.06	131.45	32.28
L.S.D at 0.05	7.04	4.7	0.56	9.38	1.87

c= chicken manure. a= ammonium nitrate

4-2-Tuber characters:

Data recorded in Table (4) show the effect of nitrogen fertilization levels as well as its sources on number and weight of tubers per plant as well as dry matter percentage of tubers during both seasons of study.

Table (4): Effect of nitrogen fertilizer levels on number and weight of tubers /plant as well as dry matter percentage during summer season of 1999 and 2000.

Treatments N kg /fed.	1999		
	Number of tubers /plant	Fresh weight of tubers/plant (g)	Dry matter of tubers (%)
60 (c) + 60 (a)	5.84	585.80	18.60
75 (c) + 75 (a)	6.76	704.34	18.19
90 (c) + 90 (a)	8.60	813.40	17.44
120 (a)	7.36	607.16	18.76
150 (a)	9.17	713.42	18.09
180 (a)	10.50	880.31	17.31
Mean	8.03	717.40	18.06
L.S.D at 0.05	0.84	21.08	0.12
		2000	
60 (c) + 60 (a)	7.00	604.40	19.01
75 (c) + 75 (a)	8.44	717.17	18.75
90 (c) + 90 (a)	9.60	852.11	17.65
120 (a)	6.83	672.36	18.89
150 (a)	8.13	839.83	18.27
180 (a)	9.60	1023.60	17.61
Mean	8.27	784.91	18.36
L.S.D at 0.05	1.21	14.90	0.51

c= chicken manure. a= ammonium nitrate.

In this respect, such data in Table (4) reveal that number and weight of tubers produced per plant as well as the percentage of dry matter of tubers were significantly affected due to different applied nitrogen fertilizer levels during the two seasons of the experiment. In this regard, increasing the nitrogen level from 120 up to 180 kg N/fed. increased the number and weight of produced tubers per plant. On the other hand, the dry matter percentage tended to decrease with increasing the nitrogen level during the two plantations in both seasons of growth. Moreover, application of nitrogen fertilizer in mineral form at its used levels was more effective than application of the half-used level as organic form (Chicken manure) and the other half as mineral fertilizer. Obtained results are similar to those recorded in case of plant foliage during both seasons of study.

Such results for the effect of nitrogen fertilization agree with those mentioned by Bhowmik and Dandapat (1991), Shehata and Abo-Sedera (1994), Wirsing *et al.* (1994), Abou-Hussein (1995), Banerje and Singhamohpator (1986), Abdel-Ati (1998), Arisha and Bardisi (1999), El-Banna and Abd El-Salam (2000), Kamla and singh (2000), Kumar *et al.* (2001), Thind *et al.* (2001), Belanger *et al.* (2002), Francis *et al.* (2002) and *Singh et al.* (2002) all working on potatoes they found that tuber characters i.e. number and weight of tubers produced per plant as well as the percentage of dry matter of tubers were increased with increasing the application of nitrogen fertilizer either in a mineral form or mixture with organic manure.

4-3-Chemical composition of plant foliage:

4-3-1 Mineral composition (NPK):

Data presented in Table (5) show the effect of nitrogen level and sources on NPK content of plant foliage during both seasons of study The same data in Table (5) show that, the total nitrogen, phosphorus and potassium content was gradually increased with increasing the level of nitrogen fertilizer from 120, 150 up to 180 kg N/fed. either in case the application of nitrogen fertilizer in a mineral form as ammonium nitrate or half of the added amount as organic manure (chicken manure) and the rest half as ammonium nitrate fertilizer during both seasons of growth. In this regard, the highest macro-element concentrations were connected with using the highest level of nitrogen fertilizer (180 kg N/fed.) during the two seasons of growth. The increasing of N, P and K content due to the increase of nitrogen application may be due to the increase of such elements in roots zone and consequently increased the absorption rate of them, which in turn increased their concentrations in different plant parts. Obtained results are the same line with those indicated by Ludwig (1989), Kuz and Shtikans (1990), Srikumar and Ockerman (1990), Westermann *et al.* (1994), Strel-nikov and Erokina (1994), Singh *et al.* (1995), Abdel-Ati (1998, Arisha and Bardisi (1999) and Gabr *et al.* (2001) on potato found that increasing the nitrogen levels from 40 up to 160 kg N/fed. significantly increased N, K contents..

Table (5): Effect of nitrogen fertilizer levels on mineral composition percentage of plant foliage during summer season of 1999 and 2000.

Treatments	1999		
N kg/fed.	N %	P %	K %
60 (c) + 60 (a)	6.29	0.93	7.40
75 (c) + 75 (a)	7.63	1.11	7.80
90 (c) + 90 (a)	8.04	1.27	8.28
120 (a)	6.45	1.01	7.82
150 (a)	7.63	1.25	8.21
180 (a)	8.27	1.48	8.69
Mean	7.38	1.17	8.03
L.S.D at 0.05	0.09	0.03	0.09
		2000	
60 (c) + 60 (a)	6.38	0.94	7.51
75 (c) + 75 (a)	7.39	1.15	7.94
90 (c) + 90 (a)	8.13	1.32	8.28
120 (a)	6.46	1.04	7.88
150 (a)	7.75	1.26	8.17
180 (a)	8.43	1.44	8.60
Mean	7.42	1.19	8.06
L.S.D at 0.05	0.11	0.13	0.06

c= chicken manure. a= ammonium nitrate.

4-3-2- Organic constituents:

Data recorded in Table (6) represent the effect of nitrogen fertilization on protein, reducing and total sugars in plant foliage during the two growing

seasons of study. Such data in indicate that increasing the nitrogen application levels either as ammonium nitrate only or half of recommended dose as ammonium nitrate and the other half in organic form as chicken manure, significantly increased all determined organic constituents i.e., total and reducing sugars as well as protein in aerial plant parts during both seasons of growth. In addition, application of nitrogen fertilizer at the highest used level (180 kg N/fed.) as ammonium nitrate reflected the highest content in all assayed organic constituents during both seasons of study. Such increments in organic constituents due to the increase of nitrogen fertilization level are due to the increase in macro-element content Table, (5) which may affect the rate of such organic constituent's assimilation. Strel-nikov, and Erokina (1994) reported that applying of NPK + FYM increased tuber protein contents in potato. On the other hand, Westermann *et al. (1994)* mentioned that, adding N and K to potato plant decreased reducing sugars content. Abou-Hussein (1995) reported that, starch and N %, P % and K % percentage increased in the leaves by adding cattle manure combined with chicken manure. Singh *et al.* (1995) found that reducing sugars was increased with application of 180 kg N + 80 kg P_2O_5 + 150 kg K_2O /ha.

Table (6): Effect of nitrogen fertilizer levels on protein and sugars content for plant foliage during summer season of 1999 and 2000.

Treatments N kg /fed.	Protein %	Total sugars %	Reducing sugars %
	1999		
60 (c) + 60 (a)	39.33	50.60	30.39
75 (c) + 75 (a)	46.28	54.18	32.26
90 (c) + 90 (a)	50.24	57.32	34.38
120 (a)	40.31	53.44	32.06
150 (a)	47.70	56.11	33.90
180 (a)	51.72	59.21	35.43
Mean	45.93	55.14	33.07
L.S.D at 0.05	0.59	0.90	0.85
		2000	
60 (c) + 60 (a)	39.87	49.28	31.23
75 (c) + 75 (a)	46.22	53.06	32.75
90 (c) + 90 (a)	50.80	56.18	35.15
120 (a)	40.37	52.31	32.91
150 (a)	48.47	54.54	35.15
180 (a)	52.70	57.73	36.88
Mean	46.40	53.85	34.01
L.S.D at 0.05	0.69	0.91	1.13

c= chicken manure. a= ammonium nitrate

4.4. Chemical composition of tubers:

4-4-1- Mineral composition (NPK):

Data in Table (7) show the effect of nitrogen fertilization on total nitrogen, phosphorus and potassium content for produced tubers during both seasons of study. Such data indicate that, there were a significant differences in

total nitrogen, phosphorus and potassium content among the studied nitrogen levels during both seasons of study. In this respect, the highest used nitrogen level (180 kg N/fed.) either in mineral form (ammonium nitrate) or 50 % as a mineral nitrogen and 50 % as organic form (chicken manure) reflected the highest content of all assayed macro-elements compared with other tested nitrogen levels. Such results are true during both seasons of growth. Obtained results are similar to those obtained in case of plant foliage (Table, 5). The positive effect of increasing nitrogen level on total nitrogen, phosphorus and potassium content of tubers may be due to the increasing of the availability of such elements in roots zone due to the addition of nitrogen fertilizers in a mineral or organic source which consequently increased the absorption of those elements and in turn increased its accumulation in plant foliage and tubers. In this respect, Westermann *et al.* (1994), Strel-nikov and Erokina (1994), Singh *et al.* (1995), Abdel-Ati (1998) and Arisha and Bardisi (1999) reported similar results.

Table (7): Effect of nitrogen fertilizer levels on mineral composition of tubers during summer season of 1999 and 2000.

Treatments	1999		
	Tuber		
N kg /fed.	N %	P %	K %
60 (c) + 60 (a)	2.17	0.45	3.61
75 (c) + 75 (a)	2.34	0.50	3.76
90 (c) + 90 (a)	2.55	0.55	3.89
120 (a)	2.28	0.49	3.69
150 (a)	2.45	0.54	3.87
180 (a)	2.68	0.61	4.00
Mean	2.41	0.52	3.80
L.S.D at 0.05	0.05	0.01	0.01
	2000		
60 (c) + 60 (a)	2.26	0.45	3.64
75 (c) + 75 (a)	2.40	0.50	3.78
90 (c) + 90 (a)	2.60	0.55	3.91
120 (a)	2.37	0.49	3.72
150 (a)	2.58	0.54	3.89
180 (a)	2.74	0.61	3.04
Mean	2.49	0.52	3.66
L.S.D at 0.05	0.03	0.01	0.02

c= chicken manure. a= ammonium nitrate.

4-4-2- Organic constituents.

Data recorded in Table (8) show the effect of nitrogen fertilization on protein, sugars and starch content of produced tubers during both seasons of study. Obtained results show that increasing nitrogen level from 120, 150 up to 180 kg N/fed. either as ammonium nitrate or half of the tested levels as ammonium nitrate and the other half as chicken manure increased all determined organic constituents i.e. proteins, reducing and total sugars as well as starch content of produced tubers Such increasing effect due to the increasing nitrogen

level may be attributed to the main role of nitrogen as a constituent of photosynthetic pigments and in turn increased the assimilation rate of such constituents. Moreover, the highest content of such organic constituents was connected with the highest used level of nitrogen in the form of ammonium nitrate followed by the same level used as half of the amount used in organic form and the other half in mineral form. Obtained results are true during both seasons of study. In this regard, Alieva and Trofimova (1985) working on potato found that, application of 5 ton straw 17 ton green manure + 61 kg N + 26 kg P_2O_5 + 58 kg K_2O /ha. gave the highest starch yield. In addition, Srikumar and Ockerman (1990) showed that starch content of tubers was lower with organic manure than mineral fertilizer. Strel-nikov and Erokina (1994) and Abou-Hussein (1995) mentioned that applying NPK fertilizer combined with cattle manure or chicken manure increased proteins and starch content of tubers. Moreover, Singh *et al.* (1995) found that reducing sugars were increased with application of 180 kg N + 80 kg P_2O_5 + 150 kg K_2O/ha.

Table (8): Effect of nitrogen fertilizer levels on protein, starch and sugars content in tubers during summer season of 1999 and 2000.

Treatments N kg /fed.	1999 Tubers			
	Protein %	Starch %	Total sugars %	Reducing sugars %
60 (c) + 60 (a)	13.58	13.31	80.75	32.60
75 (c) + 75 (a)	14.64	13.62	85.51	37.53
90 (c) + 90 (a)	15.95	13.91	88.42	40.50
120 (a)	14.22	13.53	86.50	36.85
150 (a)	15.55	13.81	87.22	39.50
180 (a)	16.73	14.09	89.12	41.31
Mean	15.11	13.71	86.25	38.04
L.S.D at 0.05	0.38	0.03	1.37	3.53
	2000			
60 (c) + 60 (a)	14.12	13.42	81.50	32.37
75 (c) + 75 (a)	15.02	13.72	83.16	38.10
90 (c) + 90 (a)	16.26	14.04	87.07	40.44
120 (a)	14.83	13.60	84.17	34.50
150 (a)	16.12	13.91	86.13	39.26
180 (a)	17.14	14.16	90.87	41.63
Mean	15.58	13.80	85.48	37.71
L.S.D at 0.05	0.21	0.05	1.49	1.13

c= chicken manure. a= ammonium nitrate.

4-5-Tuber yield:

Data presented in Table (9) show the effect of nitrogen fertilization on tuber yield and dry matter percentage of tuber during 1999 and 2000 seasons.

Such data indicate that increasing nitrogen level from 120 up to 180 kg N/fed either as ammonium nitrate only or half of the tested levels as organic manure (chicken manure) and other half as ammonium nitrate led to a significant

increase in both total tuber yield/fed. and the dry matter percentage of tubers during summer and fall plantations in both seasons of study. In this regard, application of nitrogen fertilizer at rate of 180 kg N/fed. as ammonium nitrate only reflected the highest produced yield and dry matter concentration followed by using 180 kg N/fed. 50 % of used amounts as organic form and the other half as mineral form and 150 kg N /fed. as solely or mixture. Obtained results are true during the two seasons of the experiment. The increment in yield and dry matter percentage of tuber with increasing the level of nitrogen fertilizer are connected with the increasing in number and weight of tubers produced per plant Table, 4 and the higher values of vegetative growth parameter Table, 3 which consequently affected the produced yield. Obtained data are in agreement with those reported by Mica and Bohamil (1979), Laurence *et al.* (1985), Abou-Hussein (1995). Roy and Jaiswal (1998) and Singh *et al. (2002)* all working on potatoes reported that, the total yield of potato was increased with the highest used level of nitrogen also with using cattle manure combined with chicken manure. Whereas, the lowest total yield in such studies were obtained when using cattle manure alone.

4-6-Yield grading:

Data presented in Table, (9) show the effect of growing season and nitrogen fertilization on tuber quality expressed as weight of small, medium and large size tubers.

Table (9): Effect of nitrogen fertilizer level and source on total tubers yield (ton/fed.) and tubers grading (ton/fed.) during summer season of 1999 and 2000.

Treatments N kg /fed.	1999				
	Tuber diameter (mm)			Tuber yield (ton/fed.)	Dry matter (g/100 g)
	< 35 mm (ton/fed.)	35-55 (ton/fed.)	>55 mm (ton/fed.)		
60 (c) + 60 (a)	1.16	6.14	7.97	15.27	21.18
75 (c) + 75 (a)	1.51	7.88	8.08	17.47	20.88
90 (c) + 90 (a)	1.78	8.13	9.85	19.60	21.21
120 (a)	1.19	7.07	8.21	16.70	22.15
150 (a)	1.57	8.51	9.07	19.15	20.89
180 (a)	1.08	8.87	10.59	20.54	19.93
Mean	1.38	7.76	8.96	18.10	20.87
L.S.D at 0.05	0.08	0.32	0.35	0.41	1.15
	2000				
60 (c) + 60 (a)	1.181	6.21	7.91	15.30	21.35
75 (c) + 75 (a)	1.37	7.86	8.21	17.40	20.84
90 (c) + 90 (a)	1.74	8.16	9.77	19.70	20.17
120 (a)	1.34	7.20	8.23	16.77	22.15
150 (a)	1.63	8.45	9.11	19.19	20.75
180 (a)	1.08	9.12	10.51	20.71	20.22
Mean	1.31	7.83	8.95	18.29	21.42
L.S.D at 0.05	0.20	0.62	0.82	0.82	0.17

c= chicken manure. a= ammonium nitrate.

Data in Tables, (9) show clearly that, the diameter of large, medium and small size tubers were significantly affected due to nitrogen fertilizers application either as ammonium nitrate or half of tested levels as ammonium and the other half-chicken manure. In addition, the highest used level i.e., 180 kg N/fed. exhibited the highest values for weight of different tuber grades (<35, 35-55 and > 55 mm) compared with other used levels (120 and 150 kg N/fed.) during both seasons of study. Moreover, the highest values of large and medium size tubers were obtained as a result of using the highest level of nitrogen fertilizer in the form of ammonium nitrate while the highest value of small size tuber was recorded as a result of using the higher nitrogen level in the form of 50 % mineral nitrogen and 50 % chicken manure during both seasons of experiment. Similar results were reported by Roy and Jaiswal (1998) who found that N application increased tuber number and weight/plant. Total and large-size tubers (> 75 g). Moreover, Bak and Aminpour (2001) indicated that the size of produced tubers were greatly affected by fertilization, planting date and planting depth.

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تأثير مستويات ومصادر التسميد النتروجينى على النمو والمحصول والصفات النوعية للبطاطس المنزرعة فى الأراضى الرملية.

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أجريت تجربتان حقليتان خلال الموسم الصيفى لعامى ١٩٩٩ و ٢٠٠٠ فى مزرعة التجارب بمحطة جنوب التحرير الزراعية بمحافظة البحيرة مصر والتابعة لمركز البحوث الزراعية وذلك لدراسة تأثير مستويات ومصادر التسميد النيتروجينى بمعدلات (١٢٠- ١٥٠ - ١٨٠ كجم نيتروجين للفدان) وكذلك الخلط بين السماد المعدنى (نترات النشادر) وسماد عضوى (سماد دواجن) بنسبة ٥٠% من الكمية المضافة كسماد عضوى + ٥٠ % سماد نترات على صفات النمو الخضرى ومحصول الدرنات إلى جانب مواصفات المحصول الناتج والمحتوى الكيماوى للنباتات والدرنات للصنف المستخدم(صنف سبونتا) تحت ظروف الأراضى الرملية وكان التصميم الاحصائى المستخدم هو القطاعات كاملة العشوائية وعدد المكررات ٤ مكررات. وكانت النتائج المتحصل عليها عللى النحو التالى:-

١- أدى زيادة التسميد النتروجينى من ١٢٠ – ١٨٠ كجم نتروجين للفدان سواء فى صورة معدنية أو نصف المعدل المستخدم فى صورة معدنية و الأخر فى صورة عضوية (سماد الكتكوت) الى زيادة معدل النمو الخضرى متمثلا فى طول النبات – عدد الأوراق وعدد الأفرع فى بالنبات وكذلك الوزن الخضرى والجاف للنمو الخضرى خلال موسمى الدراسة.

٢- ازدادت المكونات الكيماوية المقدرة سواء فى النمو الخضرى أو الدرنات الناتجة (النتروجين الكلى ، الفوسفور ، البوتاسيوم ، السكريات الكلية والمختزلة والبروتين وكذلك المحتوى من النشا للدرنات) بزيادة معدل التسميد النتروجينى.

٣- إزداد المحصول الكلى للدرنات الناتجة بزيادة معدل التسميد النتروجينى المستخدم سواء فى الصورة المعدنية أو نصف الكمية المستخدمة فى الصورة المعدنية والنصف الأخر فى صورة عضوية الى أعلى معدل مستخدم (١٨٠ كجم نتروجين /فدان).

أدى استخدام المستوى العالى من التسميد النتروجينى (١٨٠ كجم نتروجين /فدان) الى زيادة المحصول من الدرنات المتوسطة والكبيرة مقارنة بالمستويات المستخدمة الأخرى.