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EFFECT OF GROWING MEDIA AND NITROGEN FERTILIZATION ON THE GROWTH AND CHEMICAL COMPOSITION OF *PASPALUM VAGINATUM,* L.

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ABSTRACT: This study was carried out in the Nursery of Floriculture, Ornamental Horticulture and Landscape Gardening Department, Faculty of Agriculture, Alexandria University, during the two successive seasons of 2011 and 2012. The aim was to evaluate the effect of growing media and mineral fertilization on growth of the lawn *Paspalum vaginatum,*L.

Split-plot was the experimented design in three replicates, and sixteen in each. The main plot represented the growing media (A) 100% calcareous soil (B) 50% calcareous soil:50% sand, (C) 50% calcareous soil:50% sewage sludge and (D) 50% calcareous soil:25% sand:25% sewage sludge. The sub-plot nitrogen levels were four (0.00 (N0), 5.00 (N1), 10.00 (N2) and 15.00 (N3) g N/m^2).

The main results of this study can be summarized in the following points:

1- Generally, medium (C), consisting of 50% calcareous soil:50% sewage sludge with the addition of the fourth level of nitrogen (N3), gave the shortest time to complete covering and gave the best results of leaf blade length and the best results for the total dry weight of vegetative growth parts.
2- The medium (B), containing 50% calcareous soil:50% sand with the addition of the fourth level of nitrogen (N3) gave the best results in terms of roots volume.
3- The media containing either 50% or 25% sand with the addition of the fourth level of nitrogen (N3) gave the best results in terms of dry weight of roots.
4- Chemical analysis showed that there were non significant effects for growing media on the total chlorophylls content and the nitrogen percentage in the leaves.
5- Increasing nitrogen levels led to significant increases in the total chlorophylls content of leaves and the nitrogen % in the dry matter.

Key words: Lawns, *Paspalum vaginatum,* L., growing media, nitrogen fertilization, Gramineae.

INTRODUCION

Paspalum (*Paspalum vaginatum,*L) is a genus of the grass family Poaceae (Graminae) commonly as paspalums, Bahia grasses most are tall perennial American grasses. They are most diverse in subtropical and tropical regions.

Paspalum is a perennial grass with rhizomes and/or stolons. The stem grow 10 to 79 cm tall. The leaf blades are 10 to 19 cm long, and in widths of 3-8 mm, they are usually blue-green in color.

Paspalum vaginatum, L. is a warm-season turfgrasses. *Paspalum vaginatum,* L. is one of the major turfgrasses all-over the world. It has a strength of the coarse nature of the creeping (runners) growth and bluish green in color with an attractive appearance, used as lawn in parks, gardens of golf courses, athletic field, recreation and landscape turf.

This grass has been bred into cultivars which are used for golf course turf and other landscaping projects as it forms a higher quality turf than Bermudagrass in poor conditions such as wet soils, low light and with fewer nitrogen soil amendments.

The use of suitable growing media or substrates is essential for production of quality horticultural crops. It directly affects the development and later maintenance of the extensive functional rooting system. A good growing medium would provide sufficient anchorage or support to the plant, serves as reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere outside the root substrate. (Awing *et al.*, 2009)

Lawns need nitrogen fertilizer for keeping alive, when properly fertilized, a lawn maintains good colour, density and vigor, and does not easily succumb to insects, weeds or diseases. When under fertilized, the lawns are not only less attractive, but also are considerably more susceptible to environmental stress and damage. (Mostafa, 2003)

Soils are more commonly deficient in nitrogen than any other element. Two major ionic forms of nitrogen are absorbed from soils: nitrate (NO_3^-) and ammonium (NH_4^+).

Nitrogen (N) is quantitatively the most important mineral nutrient required by plants including turfgrasses. As a structural and functional component of the 20 protein amino acids, numerous other amino acids and amides, nucleotides, nucleic acids and some hormones, N is intimately involved in virtually all aspects of life functions.

The effect of N fertilization on turfgrasses has been researched extensively (Beard, 1973, Turner and Hummel, 1992) and is known to significantly affect turfgrasses shoot and root growth, shoot density, color, stress tolerance, and recuperative potential .

The aim of the present investigation was to evaluate the effect of growing media and mineral fertilization on growth of *Paspalum vaginatum,* L.

MATERIALS AND METHODS

This study was carried out during the two successive seasons of 2011 and 2012 at the Nursery, Department of Floriculture, Ornamental Horticulture and Landscape Gardening, Faculty of Agriculture, Alexandria University, Egypt.

The *Paspalum vaginatum,* L. was chosen for this investigation. Sodding of paspalum grass cultivated were purchased from nursery green oasis, Alexandria Governorate. The sodding was divided to small equal pieces (springs) with an average area of 2 x 2 cm for planting.

The sprigs were cultivated in plastic boxes (40 x 60 x 24 cm) at spacing of 10 x 10 cm. The boxes were backed, with the four chosen growing media mentioned later; these boxes were placed in full sunny place on 19th April, 2011 and 20th April, 2012 in the first and second seasons, respectively.

During the first week, after planting, the grasses were irrigated twice daily, that was once a day in the second and third week. The irrigation was whe applied whenever, the grasses required according to the climatic condition, to maintain favorable moisture during the growing season. Two factors were involved in the present study, the first was growing media (main factor), four different growing media were chosen; The first growing medium was 100% calcareous soil (A), the second one was consisted of 50% calcareous soil + 50% sand (B), the third growing medium consisted of 50% calcareous soil + 50% sewage sludge (C), the fourth medium contained 50% calcareous soil + 25% sand + 25% sewage sludge (D). The main chemical properties of the four chosen growing media are shown in Table (1).

The second factor was fertilization rates of nitrogen (sub factor). Four levels of nitrogen fertilizer (0, 5, 10, and 15 g N/m^2) were applied; ammonium nitrate (33.5%) was the source of nitrogen. The N-fertilizer was applied as dressing on the soil surface.

Nitrogen doses (treatments) were started on the 7th of May and 8th of May in 2011 and 2012, respectively and repeated after biweekly intervals. (Johnson, 1992).

The experiment contained three replicates, each replicate contained 16 treatments (4 growing media x 4 rates of N-fertilizer). Data were statistically analyzed using split-plot design in three replications in 2011 and 2012 seasons. Four growing media randomly arranged in main plot, while the four nitrogen levels were occupied in sub-plots. Comparisons between means of the studied treatments were carried out using least significant difference at 0.05 probability level ($L.S.D_{0.05}$) according to Gomez and Gomez (1984). The average temperature throughout the growing period during the two seasons is shown in Table (2).

Table 1. The main chemical properties of the four chosen growing media.

Growing media	EC (mhos /cm)	pH	Total P (ppm)	Total K (ppm)	Total N (ppm)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
1- 100% calcareous soil (A)	3.40	8.10	36.5	60.80	28.60	2.00	1.20	1.90	1.60
2- 50% calcareous soil + 50% sand (B)	0.40	8.32	30.71	37.50	33.40	1.56	1.02	2.02	0.54
3- 50% calcareous soil + 50% sewage sludge (C)	2.00	7.24	163.7	47.50	228.00	7.50	5.49	16.50	5.16
4- 50% calcareous + 25% sand + 25% sewage sludge (D)	1.30	7.43	124.9	40.00	123.00	6.96	3.12	10.50	1.30

Table 2. The average temperature throughout the growing period of paspalum grass during the two seasons of 2011 and 2012 at El Shatby, Alexandria Governorate.

Month	First season (2011)		Second season (2012)	
	Maximum temperature	Minimum temperature	Maximum temperature	Minimum temperature
April	38 °C	19 °C	32 °C	20 °C
May	34 °C	21 °C	34 °C	23 °C
Jan.	33 °C	26 °C	32 °C	27 °C
July	34 °C	28 °C	33 °C	30 °C
August	37 °C	30 °C	35 °C	30 °C
September	35 °C	29 °C	34 °C	30 °C

*** Egyptian General Authority for Meteorology (Alexandria. Nozha Airport).**

After complete of coverage of all the treatments by grasses, the mowing was started. (Mostafa, 2003).

The data recorded for the vegetative growth parameters included; numbers of the days taken from planting time to the complete covering of the grass, the turfgrass height (cm), leaf blade length (cm), leaf width (cm), dry weight of each clipping (g/m^2). In addition to the roots growth characteristics as roots volume (cm^3), roots dry weight (g) were obtained. The data recorded for the chemical composition included; leaf total chlorophyll content (SPAD units) were measured according to method described by Yadava, (1986) using Minolta SPAD chlorophyll Meter model No. 502. The analysis of nitrogen was done at the end of the experiment (last mowing). The dried material (laves + stolons) were digested with sulfuric acid (H_2So_4) with presence of the hydrogen peroxide (H_2O_2) according to Evenhuis and Dewaard, (1980), then, it was colorimetercally determined according to Evenhuis, (1976) and Murphy and Rily, (1962) in the two seasons of 2011 and 2012 respectively.

RESULTS AND DISCUSSION

Effect of growing media and nitrogen levels on the growth characteristics and chemical composition of *Paspalum vaginatum,* L.:

1- Vegetative growth:

a. Numbers of the days are taking from planting time to the complete covering:

Data preseted in Table (3) showed that there were significant differences between the time taken to complete covering by using the different media. The shortest time taken to complete covering was obtained by using C medium of 50% calcareous soil: 50%sewage sludge, while the longest period was obtained by using A medium of 100% calcareous soil, in both seasons. The results clarified that the sewage sludge in the media in hastened the coverage period. These results may be attributed to the mixture nutrients, micronutrients and organic matter that sewage sludge supplies. These results were agreed with Zhao *et al.* (2002) on lawn-grass and Wang *et al.* (2003) on *Zoysia japonica*.

Also, the data showed that applying of nitrogen gave significant effect on the coverage period of the grass, whereas with increasing nitrogen level, the time taken to complete coverage was significantly decreased. The longest time taken to complete coverage was taken by untreated plants (N0) in both seasons. . These results might be attributed to the important roles played by nitrogen, in the different physiological processes within the plant, which in turn affect plant growth, where nitrogen increases protein synthesis and protoplasmic compound, which led to the formation of new cells, consequently, promoting the initiation of leaf primodia. (Devlin, 1975; Hewitt and cutting, 1979).

The interactions between media and the nitrogen of levels gave significant effect. In general, the lowest value (days) was obtained by using the medium 50% calcareous soil:50% sewage sludge with all nitrogen levels in both seasons.

These results were agreed with the results obtained by Hossni (1993) on *Cynodon dactylon* L, Acosta and Deregibus (2001) on *Paspalum dilatatum*, and Scheffer-Basso *et al.* (2010) on *Paspalum pauciciliatum*.

It is clear from the results of both seasons, that the media at the beginning of the experiment was more effect on the time to complete coverage than the nitrogen level. There were differences in the time taken to complete covering in the first season and the second season. These differences may be due to low night temperature throughout the second experiment.

b. The turfgrass height (cm):

Data illustrated in Table (4) showed that there were significant difference between turfgrass height by using the different media.

Table 3. Average number of days taken to the complete covering of the *Paspalum vaginatum,* L. as affected by the different growing media, nitrogen levels and their interaction during the seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	50.83	48.00	23.16	27.50	37.37	57.00	55.16	29.83	34.33	44.08
N1	48.83	43.50	22.33	28.50	35.79	50.16	46.83	28.50	30.33	38.95
N2	48.66	41.66	22.33	27.00	34.91	49.66	42.66	27.66	31.66	37.91
N3	48.00	42.66	22.66	28.66	35.50	50.66	43.66	26.83	33.66	38.70
Mean	49.08	43.95	22.62	27.91		51.87	47.08	28.20	32.50	

L.S.D 0.05 between media = 2.04 (A) — **L.S.D 0.05 between media = 2.95 (A)**
L.S.D 0.05 between N-levels = 0.90 (B) — **L.S.D 0.05 between N-levels = 1.58 (B)**
L.S.D 0.05 between media×N-levels = 1.80 (AB) — **L.S.D 0.05 between media×N-levels = 3.16 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

Table 4. Average turfgrass height(cm) of the *Paspalum vaginatum,* L. as affected by the different growing media , nitrogen levels and their interaction throughout the two seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	4.46	5.57	9.36	7.49	6.72	4.01	4.39	4.88	5.23	4.63
N1	4.61	9.73	10.91	7.65	8.22	4.69	5.34	5.60	5.78	5.35
N2	5.31	9.46	10.72	6.82	8.07	5.24	5.66	6.14	6.36	5.85
N3	4.92	8.79	12.08	8.15	8.48	5.93	5.97	6.34	6.74	6.25
Mean	4.82	8.38	10.76	7.52		4.97^b	5.34	5.74	6.03	

L.S.D 0.05 between media = 1.70 (A) — **L.S.D 0.05 between media = 0.44 (A)**
L.S.D 0.05 between N-levels = 0.63 (B) — **L.S.D 0.05 between N-levels = 0.23 (B)**
L.S.D 0.05 between media×N-levels = 1.26 (AB) — **L.S.D 0.05 between media×N-levels = 0.46 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

The longest grass was obtained by using C medium of 50% calcareous soil:50%sewage sludge and/or D medium of 50% calcareous soil:25% sand:25% sewage sludge (10.76 and 6.03 cm), while the shortest grass was obtained by using the media of 100% calcareous soil (4.82 and 4.97 cm), in both seasons. The results clarified that sewage sludge in the media affected the turfgrass height. This may be due to the importance of organic matter substances (i.e. sewage sludge) that added. It is necessary to maintain good soil structure. It increases the cation exchange capacity, thereby reducing leashing losses of elements such as potassium, calcium, and magnesium. It serves as a reservoir for soil nitrogen, and it improves water relations. These results were agreed with these obtained by Zhao *et al.* (2002) on lawn-grass, and Wang *et al.* (2003) on *Zoysia japonica*.

As for nitrogen fertilizer levels, any of nitrogen application led to significant increases in turfgrass height compared to the control treatment, however, the longest grass was obtained by using the third level of nitrogen in both seasons, while the shortest grass was produced by untreated plants N0 (control). These results might be attributed to the important role of nitrogen in the plant. N-applied to the turfgrass may affect the amount of protein produced. Twenty or Twenty-one of the different amino acids are then joined together through peptide linkages to form proteins. So, adequate supply of nitrogen is associated with vigorous of the top vegetative growth, increasing the formation of new cells, consequently, the plant height and the stem thickness increased. (Tisdale and Nelson, 1975 and Hewitt and Cutting, 1979).

The interactions between the using media and nitrogen levels were significant. In general the longest grass was produced by using C medium of 50% calcareous soil:50% sewage sludge and N3 (15 g N/m^2) (12.08 cm), in the first season, in the second season the longest grass was obtained by using D medium of 50% calcareous soil: 25% sand:25% sewage sludge with N3 (15 g N/m^2)(6.74 cm), while the shortest grass was obtained by using media of 100% calcareous soil and N0 nitrogen (control) (4.97 cm), in both seasons.

Similar results were obtained by McCarty *et al.* (1985) on tall fescue, Hossni (1993) on Bermudagrass, and Trenhlom *et al.* (1998) on hybrid bermudagrass.

c. Leaf blade length of turfgrass:

Data given in Table (5) proved that the leaf blade length was significantly increased by using the different media. The longest leaf blade was obtained by using C medium of 50% calcareous soil:50% sewage sludge (6.68 cm) and D medium of 50% calcareous soil: 25% sand:25% sewage sludge (6.86 cm), while the shortest was obtained by using A medium of 100% calcareous soil, in the first season. As for the second season the longest blade was obtained by using C medium of 50% calcareous soil: 50% sewage sludge (6.26 cm), while the shortest, was obtained by using A medium of 100% calcareous soil and B medium of 50% calcareous soil: 50% sand (4.29 and 4.22 cm). These results may be due to the importance of organic substances (ie. sewage sludge) when added, which is an important source of organic matter and nutrients. These results are somewhat like that obtained by Zhao *et al.* (2002) on lawn-grass, and Wang *et al.* (2003) on *Zoysia japonica*, and El-Sayed *et al.* (2012) on *Freesia refracta* cv.

As for nitrogen fertilizer levels, any of nitrogen applications led to significant difference in leaf blade length. The longest was produced from application of N3 (15 g N/m^2), while the shortest was obtained by untreated grass N0 (control), in both seasons. These results could be attributed to the role of nitrogen in increasing protein synthesis and protoplasmic compound, which led to the formation of new cells. (Hewitt and Cutting, 1979).

The interactions between the media and nitrogen levels were significant, whereas the longest was produced by using C medium of 50% calcareous soil:50% sewage sludge with N3 (15 g N/m^2), while the shortest was obtained by using A medium of 100% calcareous soil and B medium of 50% calcareous soil: 50% sand with N0 (control), in the second season.

These results are some what like that obtained by McCarty *et al.* (1985) on tall fescue, Johnson (1988) on "Tifway" African bermudagrass, Hossni (1993) on *Cynodon dactylon* L., Emarah (1998) on Bermudagrass, and Mostafa (2003) on *Paspalum vaginatum,L* Tifway, Tifgreen (*Cynodon dactylon* × *C. transvaalensis*).

d. Leaf width of turfgrass:

Data presented in Table (6) showed that there were no significant differences between leaf width by using the different media, in both seasons of 2011 and 2012.

For nitrogen fertilizer levels, any of nitrogen application led to significant increases in leaf width compared to the control treatment, however, there were insignificant differences between the three nitrogen levels studied, in the first season.

As for the second season the more width was obtained when N3 (15 g N/m^2) was applied.

Table 5. Average leaf blade length of the *Paspalum vaginatum*, L. as affected by the different growing media , nitrogen levels and their interaction during the seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	3.23	4.73	6.39	5.99	5.08	2.92	2.97	5.43	3.74	3.77
N1	3.71	6.55	6.34	6.51	5.78	3.90	4.03	6.18	4.37	4.62
N2	3.76	5.65	6.31	6.81	5.63	4.68	4.46	6.55	5.53	5.31
N3	4.55	5.66	7.67	8.12	6.50	5.67	5.41	6.88	6.04	6.00
Mean	3.81	5.65	6.68	6.86		4.29	4.22	6.26	4.92	

L.S.D 0.05 between media = 0.48 (A) — **L.S.D 0.05 between media = 0.41 (A)**
L.S.D 0.05 between N-levels = 0.53 (B) — **L.S.D 0.05 between N-levels = 0.27 (B)**
L.S.D 0.05 between media×N-levels = N.S (AB) — **L.S.D 0.05 between media×N-levels = 0.54 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

Table 6. Average leaf width of turfgrass (cm) of the *Paspalum vaginatum*, L. as affected by the different growing media , nitrogen levels and their interaction throughout the two seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	0.24	0.25	0.27	0.28	0.26	0.24	0.22	0.25	0.26	0.24
N1	0.29	0.29	0.31	0.34	0.31	0.26	0.24	0.25	0.28	0.26
N2	0.28	0.33	0.34	0.31	0.31	0.28	0.24	0.26	0.27	0.26
N3	0.33	0.34	0.34	0.36	0.34	0.32	0.27	0.30	0.29	0.29
Mean	0.29	0.30	0.31	0.32		0.28	0.24	0.26	0.27	

L.S.D 0.05 between media = N.S (A) — **L.S.D 0.05 between media = N.S (A)**
L.S.D 0.05 between N-levels = 0.03 (B) — **L.S.D 0.05 between N-levels = 0.02 (B)**
L.S.D 0.05 between media×N-levels = N.S (AB) — **L.S.D 0.05 between media×N-levels = 0.04 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

The interactions between using media and nitrogen levels, reveled that there were non significant increases in leaf width, in the first season, but in the second season, there were significant increases in leaf width. The more width was produced by using A medium of 100% calcareous soil with N3 (15 g N/m^2) (0.32 cm). These results might be attributed to important roles played by nitrogen, in the different physiologic processes within the plant, which in turn affect the leaf width, where to work on increasing protein synthesis and protoplasmic compound, which led to the formation of new cells and increasing their size.

This trend of result agrees quite closely with that reported by Devlin (1975), Mona (2000) on Tifway" African Bermudagrass and Scheffer-Basso *et al.* (2010) on *Paspalum pauciciliatum*.

e. Dry weight of turfgrass:

Data presented in Table (7), showed that there were significant differences between turfgrass dry weight by using the different media. The maximum dry weight was

Table 7. Average dry weight (g/m²) of *Paspalum vaginatum*, L. as affected by the different growing media, nitrogen levels and their interaction during the seasons of 2011 and 2012.

N-levels \ Media	First season A	First season B	First season C	First season D	First season Mean	Second season A	Second season B	Second season C	Second season D	Second season Mean
N0	18.39	43.46	161.77	240.80	116.10	35.94	70.56	610.08	333.08	262.42
N1	31.36	99.47	217.40	224.55	143.19	69.76	147.78	704.86	442.24	341.16
N2	72.70	171.54	236.08	293.86	193.54	78.60	201.74	693.51	545.10	379.74
N3	84.79	117.13	191.17	321.18	178.56	111.55	223.50	697.44	477.75	377.56
Mean	51.81	107.90	201.60	270.10		73.96	160.89	676.47	449.54	

L.S.D 0.05 between media = 24.61 (A)
L.S.D 0.05 between N-levels = 17.03 (B)
L.S.D 0.05 between media×N-levels = 34.06 (AB)

L.S.D 0.05 between media = 117.49 (A)
L.S.D 0.05 between N-levels = 60.82 (B)
L.S.D 0.05 between media×N-levels = 121.64 (AB)

A= 100% calcareous soil
B= 50% calcareous soil + 50% sand
C= 50% calcareous soil + 50% sewage sludge
D= 50% calcareous soil + 25% sand + 25% sewage sludge

N0= control
N1= 5 g N/m²
N2= 10 g N/m²
N3= 15 g N/m²

obtained by using D medium of 50%calcareous soil: 25% sand: 25% sewage sludge (270.10 g/m²), while the lowest turfgrass dry weight was obtained by using A medium of 100% calcareous soil (51.81 g/m²), in the first season. For the second season, the maximum dry weight was produced by using C medium of 50% calcareous soil:50% sewage sludge (676.47 g/m²), while the lowest dry weight was resulted by using A medium of 100% calcareous soil and B medium of 50% calcareous soil:50% sand. These results may be due to the importance of organic matter substances (i.e. sewage sludge) when used as it is necessary to maintain good soil structure. It increases the cation exchange capacity, thereby reducing leaching losses of elements such as potassium, calcium, and magnesium. It serves as a reservoir for soil nitrogen. It improves water relations, and its mineralization provides on a continuous supply of nitrogen, phosphorus and sulfur to the crop. (Tisdale and Nelson, 1975). Sewage sludge was the greater coherence in the ground and increase its ability to hold water with raising fertility and increase its ability to supply plant their need of nutrients as the organic matter plays an important role in overcoming the problems of calcareous soil where lead added to improve the properties of natural as well as working to enrich the soil organisms precision beneficial. (Deviln,1975). These results are same what like that obtained by Abo El-fadl *et al.* (1989) on *pelargonim graveolens*, Zhao *et al.* (2002) on Lawn-grass and Wang *et al.* (2003) on *Zoysia japonica* .

For nitrogen fertilizer levels, any of nitrogen applications led to significant increases in turfgrass dry weight as compared with control treatment. The maximum dry weight was produced by application of N2 (10 g N/m²) and N3 (15 g N/m²) (178.56 and 193.54 g/m²), while the lowest dry weight was produced by untreated (control)(116.10 g/m²), in the first season. For the second season, the maximum dry weight was obtained when all nitrogen levels were used, while the lowest dry weight was produced by untreated (control). These results might be attributed to the important role of nitrogen in the plant. N-applied to the turfgrass may affect the amount of protein produced. Nitrogen is increasing protein synthesis and protoplasmic compound, which led to the formation of new cells. (Hewitt and Cutting, 1979). This trend of result agrees quite closely with that reported by Hossni (1993) on *Cynodon dactylon* L, Jacobs and Clarke (1993) on *Colocasia esculenenta*, L., Razmjoo and Kanek (1993) on *Lolium perenne*, Griguttsch *et al.* (1999) on *Lolium perenne*, *Poa pratensis* and *Festuca ruba*, Khar kov (1999) on *Bromus* *inermis*, *Festuca pratensis* and *Phleum pretense*, Mona (2000) on Tifway" African bermudagrass, Acosta and Deregibus (2001) on *Paspalum dilatatum*, and Kelly and Guillard, (2002) on bluegrass, ryegrass and fescue mixture.

Generally, the interactions between the different media and nitrogen levels showed significant increases in turfgrass dry weight. The maximum dry weight was produced by using D medium of 50% calcareous soil:25% sand:25% sewage sludge with N3 (15 g N/m^2)(321.18 g/m^2), while the lowest dry weight was produced by using A medium of 100% calcareous soil with N0 (control) and N1 (5 g N/m^2), (18.39 and 31.36 g/m^2), in the first season. For second season, the maximum dry weight was obtained by using C medium of 50% calcareous soil:50% sewage sludge with N3 (15 g N/m^2), N2 (10 g N/m^2) and N1 (5 g N/m^2) (697.44, 693.51 and 704.86 g/m^2), while the lowest dry weight resulted by using A medium of 100% calcareous soil with any of nitrogen levels.

2- Roots growth:

a. Roots volume (cm^3):

Data illustrated in Table (8), showed that there were no significantly difference, between roots volume by using the different media, in the first season, but in the second season, there were significant differences between the roots volume by using different media. In general, B medium of 50%calcareous soil:50% sand gave the largest volume of roots, while the lowest was obtained by using C medium of 50% calcareous soil:50% sewage sludge and/or D medium of 50% calcareous soil:25% sand:25% sewage sludge. These results may be expected in sandy medium. The medium structure, to a greet extent determines the roots volume. (Flocker and Nielson,1962).

Similar results were reported by Karnok and Tucher (2001) on bentgrass, Antunes *et al.* (2007) on *Cynodon dactylon* and *Agrostis stolonifera* and Shulan *et al.* (2009) on *Lolium perenne* L.

For nitrogen fertilizer levels, any of nitrogen applications led to significant increases in roots volume as compared with control treatment (N0). The biggest root volume was obtained from N2 (10 g N/m^2) and/or N3 (15 g N/m^2)(37.50 and 37.14 cm^3), while the least volume was produced by using N0 (control) and/or N1(5 g N/m^2)(32.08 and 33.12 cm^3), in the first season. For the second season, the biggest roots volume was obtained from application of N3 (15 g N/m^2) (35.25 cm^3), while the least roots volume were obtained by untreated (control) (29.20 cm^3). The results might be attributed to the important role of nitrogen in the plant. This results is same what like that obtained by Kohlmeier and Eggens (1983) on bentgrass and Mona (2000) on "Tifway" African bermudagrass.

The interactions between media and nitrogen levels, showed that there were no significant increases in roots volume, in the first season, but, in the second season, there were significant increases in roots volume. Generally, the largest roots volume were obtained by using B medium of 50% calcareous soil:50% sand with N3 (15g N/m^2) (36.21 cm^3), while the smallest roots volume was obtained by using D medium of 50% calcareous soil:25% sand:25% sewage sludge with N0 (control) (29.00 cm^3).

b. Roots dry weight:

Data presented in Table (9), showed that there were significant differences between roots dry weight (g) by using different media. In general, the maximum roots dry weights were obtained by using B medium of 50% calcareous soil:50% sand and/or D medium of 50% calcareous soil:25% sand:25% sewage sludge , while the least dry weight were obtained by using A medium of 100% calcareous soil and/or C medium of 50% calcaerous soil: 50% sewage sludge, in both seasons. These results may be expected in sandy medium. The medium structure, to a great extent determines the fresh and dry weight. Sand addition to medium has high amount of pore spaces, occupied by air and water, the amount of one being inversely

Table 8. Average of roots volume (cm^3) of *Paspalum vaginatum*, L. as affected by the different growing media, nitrogen levels and their interaction throughout of the two seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	28.33	34.16	35.00	30.83	32.08	29.00	31.68	28.50	27.65	29.20
N1	37.50	31.66	30.00	33.33	33.12	31.38	34.01	30.26	30.88	31.63
N2	40.00	35.00	36.25	38.75	37.50	33.96	34.76	31.71	32.68	33.28
N3	37.50	36.00	35.91	39.16	37.14	36.43	36.21	34.53	33.85	35.25
Mean	35.83	34.20	34.29	35.52		32.69	34.17	31.25	31.26	

L.S.D 0.05 between media = N.S (A) — **L.S.D 0.05 between media = 2.01 (A)**
L.S.D 0.05 between N-levels = 3.21 (B) — **L.S.D 0.05 between N-levels = 1.36 (B)**
L.S.D 0.05 between media×N-levels = N.S (AB) — **L.S.D 0.05 between media×N-levels = 2.72 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

Table 9. Average of roots dry weight (g) of the *Paspalum vaginatum*, L. as affected by the different growing media, nitrogen levels and their interaction throughout both seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	20.30	23.83	17.39	30.18	22.92	21.63	22.95	23.16	25.81	24.27
N1	27.22	36.54	22.15	25.10	27.75	23.40	26.76	19.83	27.10	24.27
N2	21.37	27.81	26.12	28.01	25.83	22.16	25.61	21.73	27.75	24.31
N3	24.44	35.46	23.36	34.37	29.41	24.65	30.44	23.30	28.70	26.77
Mean	23.33	30.91	22.25	29.41		22.96	26.44	22.00	27.34	

L.S.D 0.05 between media = 3.95 (A) — **L.S.D 0.05 between media = 3.26 (A)**
L.S.D 0.05 between N-levels = 4.12 (B) — **L.S.D 0.05 between N-levels = 1.57 (B)**
L.S.D 0.05 between media×N-levels = N.S (AB) — **L.S.D 0.05 between media×N-levels = 3.14 (AB)**

A= 100% calcareous soil — **N0= control**
B= 50% calcareous soil + 50% sand — **N1= 5 g N/m^2**
C= 50% calcareous soil + 50% sewage sludge — **N2= 10 g N/m^2**
D= 50% calcareous soil + 25% sand + 25% sewage sludge — **N3= 15 g N/m^2**

related to the amount of other. In sandy medium the amount of air bigger than amount of water, so, the roots easily extended, compared with the other two kinds of media. (Flocker and Nielson, 1962).

These results are same what like that obtained by Karnok and Tucker (2001) on bent grass, and Shulan *et al.* (2009) on *Lolium perenne* L.

For nitrogen fertilizer levels, using nitrogen led to significant increases in roots dry weight. In general, the maximum root dry weight was obtained when N3 (15 g N/m^2) (29.41 g) was applied, while the least dry weight was produced by using the other treatments, in both seasons. The results may by attributed to the important role of nitrogen in the plant. These results are same what like that obtained by Kohlmeier and Eggens (1983) on bentgrass, and Patton *et al.* (2009) on Zoysia grass.

The interactions between the using different media and nitrogen levels showed non significant differences in roots dry weight, in the first season, but, in the second season, there were significant increases in roots dry weight. The maximum dry weight was obtained by using B medium of 50% calcareous soil:50% sand with N3 (15 g N/m^2), while the lowest roots dry weight was obtained by using C medium of 50% calcareous soil:50% sewage sludge with N1 (5 g N/m^2).

c. The chemical analysis:

1- Total chlorophylls content (SPAD units) in the leaves:

Data presented in Table (10), showed that there were non significant differences between the total chlorophyll content due to using the different media, in the first season, but in the second season, there were significant differences between the total leaf chlorophyll content due to using the different media. The highest chlorophyll content was obtained by using D medium of 50% calcareous soil:25% sand:25% sewage sludge, while the lowest chlorophyll content was obtained by using A medium of 100% calcareous soil. Data of the two seasons show that the growing media, were not important for the total chlorophylls in the leaves.

For nitrogen fertilizer levels, any of nitrogen applications led to significant increases in the total leaf chlorophyll content as compared with control treatment (N0). The increase in the total leaf chlorophyll content was obtained from application of N3 (154 g N/m^2), while the lowest the total chlorophyll content was obtained from untreated (control), in both seasons. These are results logic, because nitrogen is an integral part of the chlorophyll molecule.

This molecule consists essentially of a central "Mg" atom around which are coordinated four pyrol rings, each of which contains one nitrogen and four carbon atoms. Therefore, total chlorophylls content significantly increased by increasing nitrogen application. (Owen and Lewis,1986).

The interactions between the different media and nitrogen levels, showed that there were non-significant increases in the total chlorophyll content, in the first season, but in the second season, there were significantly increased in the total leaf chlorophyll content. The highest chlorophyll content was obtained by using D medium of 50% calcareous soil:25% sand:25% sewage sludge with N3 (15 g N/m^2) and/or N2 (10 g N/m^2), while the lowest chlorophyll content was obtained by using A medium of 100% calcareous soil with N0 (control).

These results are a good agreement with those of Emarah, (1998) on Bermudagrass and Tifway, Mona (2000) on Tifway" African bermudagrass and Mostafa (2003) on *Paspalum vaginatum,* L. Tifway, Tifgreen (*Cynodon dactylon* × *C. transvaalensis*).

2- Nitrogen (%) in the leaves:

Data presented in Table (11), showed that there were no significant differences between nitrogen % in the grass by using the different media, in both seasons of 2011 and 2012.

For nitrogen fertilizer levels, any of nitrogen applications led to significant increases in nitrogen content in the grass as compared with control treatment (N0). With increasing nitrogen levels, nitrogen % in the grass was increased. The maximum nitrogen % was obtained from application of N3 (15 g N/m^2), while the lowest in nitrogen % was produced by untreated (control), in both seasons.

The interactions between the using media and nitrogen levels, showed that there were non-significant increases in nitrogen %, in the first season, but in the second season, there were significant increase in nitrogen %. Generally, the highest nitrogen % in the grass was obtained by most of the different media with N3 (15 g N/m^2), while the lowest nitrogen % in the grass was obtained by using all media with N0 (control).

These results are logic, N % of turfgrass was increased by increasing the nitrogen level. It is absorbed by plants primarily in the form of nitrogen, with smaller amounts of other forms can be absorbed. The most of

Table 10. Average total chlorophylls content (SPAD units) in the leaves of the *Paspalum vaginatum*, L. as affected by the different growing media , nitrogen levels and their interaction during the seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	20.63	20.75	21.13	29.05	22.89	20.18	20.90	22.85	29.46	23.35
N1	22.48	23.23	27.21	30.70	25.90	21.28	26.13	24.23	30.83	25.62
N2	25.05	24.83	29.36	29.85	27.27	22.05	24.87	26.47	33.85	26.81
N3	25.00	28.63	34.29	31.71	29.91	24.70	33.10	31.26	33.85	30.73
Mean	23.29	24.36	28.00	30.32		22.05	26.25	26.20	32.00	

L.S.D 0.05 between media = N.S (A) | L.S.D 0.05 between media = 3.28 (A)
L.S.D 0.05 between N-levels = 2.55 (B) | L.S.D 0.05 between N-levels = 1.56 (B)
L.S.D 0.05 between media×N-levels = N.S (AB) | L.S.D 0.05 between media×N-levels = 3.13 (AB)

A= 100% calcareous soil
B= 50% calcareous soil + 50% sand
C= 50% calcareous soil + 50% sewage sludge
D= 50% calcareous soil + 25% sand + 25% sewage sludge

N0= control
N1= 5 g N/m^2
N2= 10 g N/m^2
N3= 15 g N/m^2

Table 11. Average of nitrogen % in the leaves of the *Paspalum vaginatum*, L. as affected by the different growing media, nitrogen levels and their interaction during the seasons of 2011 and 2012.

Media / N-levels	First season					Second season				
	A	B	C	D	Mean	A	B	C	D	Mean
N0	0.26	0.57	0.55	0.64	0.58	0.57	0.56	0.54	0.63	0.57
N1	1.30	1.35	1.31	1.26	1.30	1.52	1.43	1.27	1.42	1.41
N2	1.75	1.73	1.68	1.66	1.70	1.71	1.76	1.71	1.81	1.75
N3	2.01	1.94	1.94	1.99	1.97	2.02	1.98	2.07	2.24	2.08
Mean	1.40	1.40	1.37	1.39		1.45	1.43	1.40	1.52	

L.S.D 0.05 between media = N.S (A) | L.S.D 0.05 between media = N.S (A)
L.S.D 0.05 between N-levels = 0.10 (B) | L.S.D 0.05 between N-levels = 0.13 (B)
L.S.D 0.05 between media×N-levels = N.S (AB) | L.S.D 0.05 between media×N-levels = 0.26 (AB)

A= 100% calcareous soil
B= 50% calcareous soil + 50% sand
C= 50% calcareous soil + 50% sewage sludge
D= 50% calcareous soil + 25% sand + 25% sewage sludge

N0= control
N1= 5 g N/m^2
N2= 10 g N/m^2
N3= 15 g N/m^2

the N-compounds will be converted to the N03- form. This result is a good agreement with those of Rajesh *et al.* (1993) on Zoysia, Geatley *et al.* (1994) on "Tifgreen" Bermudagrass, McCrimmon (1999) on bermudagrass, McCrimmon (2000) on Zoysia grass, Mostafa (2003) on *Paspalum vaginatum,* L. Tifway, Tifgreen (*Cynodon dactylon* × *C. transvalennsis*), Jiang *et al.* (2009) on *Festuca arundinacea*, and Patton *et al.* (2009) on Zoysia grass.

REFERENCES

Abo El-fadl, I.A.; El-Deeb, S.M.A., and Abd-Ella, M.K. (1989). Salt tolerance of geranium in two types of soil. J. Agric. Res. Tanta 14(4):1863-1874.

Acosta, G. and Deregibus, A. (2001). Nitrogen fertilization in *Paspalum dilatatum*, Poir: Herbage production, nutritive value and structural characteristics. Proceeding of the XIX

International Grassland Congress 201-202.

Antunes, C.; Guerrero, C. and Pereira, M. (2007). Evaluation the use of fytofoam on the water management, turfgrass germination and reestablishment in golf courses. International Journal of Energy and Environment. 1(2):70-71.

Awing, Y.; Shaharom, A.S.; Mohamad, R.B. and Selamat, A. (2009). Chemical and physical characteristics of cocopeat-based medium mixtures and their effects on the growth and development of *Celosia cristata*. American Journal of Agricultural and Biological Sciences, 4(1):63-71.

Beard, J.B. (1973). Turfgrass: Science and culture. Prentice Hall, Englewood Cliffs, NJ.

Devlin, R.M. (1975). Plant Physiology. New York: D. Van Nostrand.

El-Sayed, A.; El-Hanafy, H.S.; Nabih, A. and Atwoa, D.I. (2012). Raising *Freesia refrac*ta cv. Red Lion corms from cormels in response to different growing media and actosol levels. Journal of Horticultural Science & Ornamental Plants, 4(1):89-97.

Emarah, M.M. (1998). Studies on The Effect of Fertilization and Mowing of Some Turfgrass Plants. Ph.D. Thesis, Fac. Agric., Cairo Univ.

Evenhuis, B. (1976). Nitrogen determination. Dept. Agric. Res. Royal Tropical Inst., Amsterdam.

Evenhuis, B. and Dewaard, P.W. (1980). Principles and practices in plant analysis. FAO Soil Bull. 38:152-163.

Flocker, W.J. and Nielson, D.R. (1962). The absorption of nutrient elements by tomatoes associated will leaves of bulk density. SSSA. Pros., 26:183.

Geatley, J. M.; Maddox, V.; Lang, D.J. and Crouse, K.K. (1994). "Tifgreen" Bermuda grass response to late-season application of N and K. Agron. J., 89(1):7-10.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. 2nd Ed. John Wiley and sons, New York, USA.

Griguttsch, W.; Entrup, N.L. and Bocksh, M. (1999). Evaluation studies of growth potentials of cultivars, species and mixtures of grasses used on public greens. Hort. Abst. 69, No. 13488.

Hewitt, E.J. and Cutting, C.V. (1979). Nitrogen Assimilation of Plants, Academic Press London. New York, San Francisco. Jaurnal of plant Nutrition and soil Science, 144(1):121-122.

Hossni, Y.A. (1993). Effect of Soil Media, Chemical Fertilization and Salinity on Growth and Chemical Composition of Bermudagrass (*Cynodon dactylon* L.). Ph.D. Thesis, Fac. Agric. Cairo Univ.

Jacobs, B.C. and Clarke, J. (1993). Accumulation and partitioning of dry matter and nitrogen intraditional and improved cultivars of taro *Colocasia esculenta*, L. (schott) under varying nitrogen supply. Field Crops Research, 31(3/4):317-328.

Jiang, H.J.; Li, J.L.; Li, L.X. and Wang, Y. (2009). Effect of nitrogen fertilization on nitrogen metabolism of *Festuca arundinacea* under heat stress. Pratacultural Sciencel, 2009-03.

Johnson, B.J. (1988). Influence of nitrogen on the response of "Tifway" bermudagrass (*Cynodon dactylon*) to flurprimibol. Weed Technology, 2:55-58.

Johnson, B.J. (1992). Response of centipedegrass (*Eremochloa ophiuroides*) to plant growth regulators. Weed Technology, 6:113-118.

Karnok, K.J. and Tucker, K.A. (2001). Wetting agent treated hydrophobic soil and its effect on color, quality and root growth of creeping bentgrass. Research J., 9:537-541.

Kelly, L.K. and Guillard, K. (2002). Clipping management and nitrogen fertilization of turfgrass: growth nitrogen utilization and quality. Published in Crop Sci., 42:1225-1231.

Khar'Kov, G.D. (1999). Nitrogen – the foundation for yield and protein content of grasses. Hort. Abst. 69, No. 13490.

Kohlmeier, G.P. and Eggens, J.L. (1983). The influence of water and nitrogen on creeping bentgrass growth. An. J. Plant Sci., 63:189-193.

McCarty, L.B.; Dipaola, J.M.; Lewis, W.M. and Gilvert, W.B. (1985). Tall fascue response to plant growth retardants and fertilizer sources. Agron. J., 77: 476-480.

McCrimmon, J. N. (1999). Effect of nitrogen and potassium on the macronutrients content of fifteen bermudagrass cultivars. Hort Abst., 69(1):90 No (657).

McCrimmon, J. N. (2000). N and K effects on the macronutrient and micronutrient content of Zoysia grasses. J. Plant Nutr. 24(1): 101-109.

Mona, B.H. (2000). Effect of Nitrogen Fertilizer and Paclobutrazol on Growth of Some Warm Season Turfgrass. M.Sc. Thesis, Fac. Agri., Alex Univ.

Mostafa, H.Z. (2003). Studies on The Irrigation and Fertilization of Some Turfgrass Species. M.Sc. Thesis, Fac. Agri., Cairo Univ.

Murphy, J. and Rily, J.P. (1962). A modified single solution method for the determination of phosphorus in natural water, Anal. Chim. Acta., 27:31-36.

Owen, A. and Lewis, M. (1986). Plants and Nitrogen. First published, Edward and Arnold (Publishers) Ltd.

Patton, A.; Trappe, J. and Pompeiano, A. (2009). Zoysia grass growth as influenced by nitrogen source in a greenhouse trial. Arkansas Turfgrass Report 2009, Ark. Ag. Exp. Stn. Res. 579:74-76.

Rajesh, S.; Parmar, A. S. and Kumar, R. (1993). Effect of levels and timing of N application on the growth of turf of *Zoysia Matrella* L. Punjab. Hort. J., 33(1-4) 135-141.

Razmjoo, K. and Kaneko, S. (1993). Effect of fertility ratios on growth and turf quality of perennial ryegrass (*Lolium perenne* L.) in winter. J. Plant Nutr., 16(8):1531-1538. (Hort. Abst., 64: 3798).

Scheffer-Basso, S. M.; Favero, F.; Cesaro, E. P.; Jouris, C. and Escosteguy, P. A. (2010). Preliminary evaluation of *Paspalum pauciciliatum*: Seasonal production and nitrogen response. ARS veterinaria, Joboticabal, SP, 26(l):53-59.

Shulan, Z.; Wang, L. and Duo, L. (2009). Effects of waste crumb rubber on medium characters and growth of *Lolium perenne* L. J. Bot., 41(6):2893-2900.

Trenholm, L.E.; Dudeck, A.E.; Sartain, J.B. and Cisar, J.L. (1998). Bermudagrass growth, total nonstructural carbohydrate concentration, and quality as influenced by N and K. Crop Sci., 38(1):168-174. (Hort. Abst., 69:1558).

Tisdale, S.L. and Nelson, W.L. (1975). Soil fertility and fertilizers. Third edition. Macmillan public. Co., Inc. New York p. 66-69.

Turner, T.R. and Hummel, N.W. (1992). Nutritional requirements and fertilization. p. 385-439. In D.V. Waddington *et al.* (eds.). Turfgrass, Agronomy Monograph No. 32. ASA, CSSA and SSSJ. Madison, WI.

Yadava, U.L. (1986). A rapid and nor-destructive method to determined chlorophyll in intact leaves. Hort.Science, 21(6):1449-1450.

Wang, X.; Zhou, Q.; Chen, T.; Yinghua, G. and Peidong, T. (2003). Effects of land utilization of sewage sludge on grass and soils. Chinese Journal of Environmental science, 2003-02.

Zhao, L.; Li, Y.X. and Chen, T.B. (2002). The municipal Sewage Sludge compost used as Lawn medium. Acta Ecologica Sinica, 22(6):797-801.

تأثير بيئات النمو والتسميد النتروجيني على النمو و التركيب الكيماوي على *Paspalum vaginatum*, L.

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أجريت هذه الدراسة في مشتل قسم الزهور ونباتات الزينة وتنسيق الحدائق، كلية الزراعة، جامعة الإسكندرية، خلال الموسمين ٢٠١١-٢٠١٢، حيث كان الهدف الرئيسي من البحث هو دراسة تأثير بيئات النمو و التسميد المعدني علي نمو المسطح الأخضر "الباسباليم .*Paspalum vaginatum,*L " الذي يعتبر أحد إعشاب الموسم الدافئ.

صممت هذه التجربة علي صورة القطع المنشقة (Split-Plot) في ثلاث مكررات عشوائية، تحتوي كل مكررة علي ١٦ معاملة، خصصت القطع الكبيرة (Main-Plot) لبيئات النمو وهي (A) ١٠٠% تربة جيرية، (C) ٥٠% تربة جيرية: ٥٠% رمل، (C) ٥٠% تربة جيرية:٥٠% حمأة، (D) ٥٠% تربة جيرية: ٢٥% رمل: ٢٥% حمأة ، أما القطع الصغيرة (Sub-Plot) كانت لمستويات النتروجين الأربعة وهي (صفر (N0)، ٥.٠٠ (N1)، ١٠.٠٠(N2)، ١٥.٠٠ (N3) جرام نتروجين لكل متر مربع)، تضاف بعد كل عملية قص للمسطح خلال فترة التجربة.

ويمكن تلخيص أهم النتائج التي تحصل عليها في النقاط التالية:

١- كانت البيئة (C) المكونة من ٥٠% تربة جيرية: ٥٠% حمأة مع إضافة المستوي الرابع من النتروجين (N3) أعطت أقل فترة زمنية للوصول إلى التغطية الكاملة، وارتفاع المسطح والوزن الجاف للمجموع الخضري.
٢- بشكل عام وجد أن البيئة (B) المكونة من ٥٠% تربة جيرية : ٥٠% رمل مع إضافة المستوي الرابع من النتروجين (N3) أعطت أفضل النتائج من حيث كثافة الجذور.
٣- وجد أن البيئات المحتوية في تكوينها علي ٥٠% أو ٢٥% رمل مع إضافة المستوي الرابع من النتروجين (N3) أعطت أفضل النتائج من حيث الوزن الجاف للجذور.
٤- أظهر التحليل الكيماوي أنه لا يوجد لبيئات النمو تأثير معنوي علي كمية الكلوروفيل الكلي في الأوراق وكذلك المحتوي النتروجيني في المادة الجافة.
٥- أظهر التحليل الكيماوي أنه بزيادة مستويات النتروجين المضافة أدي إلي زيادة معنوية في كمية الكلوروفيل الكلي في الأوراق كما زادت النسبة المئوية للنيتروجين في المادة الجافة في كلا الموسمين.