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COMPARATIVE STUDY ON THE EFFECT OF SOIL AND FOLIAR APPLICATION OF NITROGEN FERTILIZATION ON GROWTH AND PRODUCTIVITY OF EGYPTIAN CLOVER (*TRIFOLIUM ALEXANDRINUM*, L)

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ABSTRACT *Two field experiments were conducted during 1998/1999 and 1999/2000 seasons to study the effect of nitrogen fertilization as soil and foliar applications on the growth, nodulation and fresh and dry yields of Egyptian clover.*

The results obtained indicate that various nitrogen fertilization treatments had no significant effect on root diameter. However, the number of nodules grown on the root were increased significantly by nitrogen fertilization up to 20 kg N/fad. three doses (T_3) as a soil application and up to 2kg urea / fad. six doses (T_7) as a foliar application .

Plant height, stem diameter, number of branches / plant, leaf area, and leaf weight ratio as well as fresh and dry forage yields reached their maximum peak by the soil application of 20 kg N/fad. three doses (60 kg N/fad. T_3) compared to the other tested treatments. However, foliar application of 2 kg urea / fad. six doses (5.52 kg N/fad. T_7) seemed to be the most effective for increasing those traits as compared with the other soil application treatment (T_2) and /or foliar ones (T_4, T_5 and T_6).

The data of nitrogen use efficiency (NUE) indicate that the nitrogen fertilization as a foliar application was so more effective than soil application on Egyptian clover productivity especially by using 1 or 2 kg urea / fad. three doses (T_4 or T_5) which produced the highest values of NUE in the both seasons.

Key words: N fertilization, foliar application, Egyptian clover.

INTRODUCTION

Egyptian clover (*Trifolium alexandrinum*, L) is one of the most important winter forage crops in Egypt. Many efforts have been made to increase its productivity, especially per unit area, to face the increasing nutritional demands for improving the animal production in our country.

Nitrogen is a major nutrient element and considered to be the most factor affecting the growth and productivity of Egyptian clover. In this respect, many researchers found that the soil application of nitrogen fertilizer to Egyptian clover caused an increase in its plant height (Hussein *et al*, 1983,

Shaaban *et al*, 1984), number of branches / plant (Ibrahim and Abdel - Aal, 1990), number of nodules / root (Taneja *et al.* 1994), fresh forage yield (Sharma and Baradkar, 1995; Sinha and Rai, 1995; Sharma *et al*, 1998; and Desole *et al*., 2000) and dry forage yield (Taneja *et al*, 1991; Ratel, 1998; and Bariki and Tiwari, 1998). On the other hand, Bojorquez *et al*, (1993) found that nitrogen fertilizer had a little effect on root development of Egyptian clover. Rubio - Arias *et al*, (1999) show that the number of nodules decreased with increasing nitrogen levels.

Recently, using nitrogen fertilizer through foliar application is profitable for many crops to avoid not only N fixation in the soil, but also its leaching during the driange. In this respect, many investigators reported that the foliar application of nitrogen element was effective for increasing the productivity of many field crops such as cotton (Srinivasan *et al*, 1977; and Sorour *et al*, 1986), maize (Ashour *et al*, 1983), wheat (Saad *et al*., 1984), Soybean (Rubes, 1974) and faba bean (Hafiz and Abd El - Mottaleb, 1998).

Thus, the present investigation was conducted to study the response of growth, forage yield and fertilizer use efficiency of Egyptian clover to soil and foliar applications of nitrogen fertilizer.

MATERIALS AND METHODS

This investigation was carried out at the Experimental Farm, Sers-Elliyan Agricultural Research Station, Minufiya Governorate during 1998-1999 and 1999-2000 seasons to study the effect of soil and foliar applications of nitrogen fertilization on growth, nodulation and forage yield of Egyptian clover (*Trifolium alexandrinum*, L.). The seeds (CV. Miskawi) were sown at a rate of 25 kg seeds / fad. on 25th and 20th November 1998 and 1999, respectively. The experimental plot area was 12m^2 (3 x 4m). During the growth period, three cuts were taken at 70, 130, 180 days after sowing in both seasons. The preceding crop was maize in the two seasons. Calcium superphosphate (15.5% P_2O_5) was added at a rate of 200 kg / fad. during soil preparation. The nitrogen fertilization was added as urea (46 % N) either in soil or foliar application according to the tested treatments.

The nitrogen fertilization treatments were as follows:-

T_1- Control (without N application).

T_2- Soil application at a rate of 20 kg N/fad. (one dose at 20 days after sowing).

T_3- Soil application at a rate of 60 kg N/fad. (20 kg N/fad. three doses at 20 days after each of sowing and 1st and 2nd cuts).

T_4- Foliar application at a rate of 3 kg urea / fad. (1 kg urea / fad. three doses at 20 days after each of sowing and 1st and 2nd cuts).

T_5- Foliar application at a rate of 6 kg urea / fad. (2 kg urea / fad. three doses at 20 days after each of sowing and 1st and 2nd cuts).

T_6- Foliar application at a rate of 6 kg urea / fad. (1 kg urea / fad. six doses at 20 and 30 days after each of sowing and 1st and 2nd cuts).

T_7- Foliar application at a rate of 12 kg urea / fad. (2 kg urea / fad. six doses at 20 and 30 days after each of sowing and 1st and 2nd cuts).

The tested treatments were arranged in a randomized complete block design with four replicates. With regard to foliar treatments, each application dose was done by using 400 liters of water / fad.

At each cut, the following characters were determined: plant height, stem diameter, root diameter, number of root nodules/plant, number of branches/plant, leaf area, leaf weight ratio (leaves dry weight / stem dry weight), and fresh and dry forage yields / fad.

Nitrogen use efficiency (NUE) was calculated according to the formula proposed by Craswell and Godwin (1984) as follows:

$$NUE = \frac{\text{Total yield F - Total yield C}}{\text{Fertilizer N applied}}$$

Where: F = fertilized plants, C = non fertilized plants (control)

NUE determine the forage yield produced per one kg of fertilized N (Kg forage yield / kg N applied).

The data were statistically analyzed according to the procedure outlined by Snedecor and Cochran (1967). Means were compared by least significant difference test (LSD) at 5 % of probability.

RESULTS AND DISCUSSION

1) Growth:-

Mean values for all growth traits studied as affected by soil and foliar nitrogen application treatments at three cuts in 1998 / 1999 and 1999/2000 seasons are presented in Table (1). The data indicate that various nitrogen fertilization treatments had no significant effect on root diameter of Egyptian clover at the three cuts in both seasons with the exception of the second cut in the second season. This means generally that root diameter did not respond to nitrogen fertilization either as a soil or a foliar application.

On the other hand, the number of nodules grown on the root were increased significantly by nitrogen fertilization as soil application up to 20 kg N / fad. three doses (60 kg N / fad. T_3) and as foliar application up to 2 kg urea /fad. six doses (12 kg urea / fad. T_7) compared to unfertilized plant (T_1). Such significant effect was true in the three cuts in both seasons with exception of the second cut in the first season. This result indicate that adding nitrogen fertilizer either at low or high level stimulated nodules formation on plants root.

The data show that nitrogen fertilizer as soil or foliar applications caused an increase in plant height of Egyptian clover compared to the control treatment (no N application, T_1). However, The differences among the tested treatments were significant only in the third cut in the first season, where the soil application of 20 kg N/fad. three doses (T_3) and foliar application of 2 kg urea / fad. three doses (T_6) or six doses (T_7) gave the highest plant height as

Table (1): Effect of soil and foliar application of nitrogen fertilization on the growth of Egyptian clover during 1998 /1999 and 1999/2000 seasons.

Characters / Treatments	Root diameter (mm.)				Number of root nodules / plant				Plant height (cm.)			
	1st cut	2nd cut	3rd cut	Mean	1st cut	2nd cut	3rd cut	Mean	1st cut	2nd cut	3rd cut	Mean
	1998 / 1999 season											
T_1. Control (No application)	5.10	5.50	5.52	5.37	18.55	23.65	19.13	20.44	33.22	42.90	44.43	40.18
T_2.S*. 20 kg N / fad. (20 kg one dose)	5.50	5.90	5.90	5.77	20.79	23.68	21.74	22.07	33.55	43.72	45.97	41.08
T_3.S. 60 kg N / fad. (20 kg three doses)	6.40	7.20	9.10	7.57	25.47	28.09	23.70	25.75	37.16	48.95	50.58	45.56
T_4. F**. 3 kg urea/fad. (1 kg three doses)	5.55	5.68	6.40	5.88	21.79	23.88	21.98	22.55	33.93	44.35	46.28	41.52
T_5. F. 6 kg urea/fad. (2 kg three doses)	6.18	6.22	6.53	6.31	23.77	25.30	23.14	24.07	35.30	44.90	50.47	43.56
T_6. F. 6 kg urea/fad. (1 kg six doses)	4.88	5.85	6.45	5.73	22.04	25.24	22.33	23.20	34.10	44.90	47.70	42.23
T_7. F. 12 kg urea/fad. (2 kg six doses)	6.22	6.78	7.75	6.92	22.33	26.40	24.19	24.31	35.83	47.45	50.53	44.60
L.S.D at 0.05	N.S	N.S	N.S	N.S	3.20	N.S	1.57	2.30	N.S	N.S	4.06	N.S
	1999 / 2000 season											
T_1. Control (No application	4.50	3.97	5.07	4.51	17.06	21.76	17.60	18.81	36.05	53.0	71.25	53.43
T_2.S*. 20 kg N / fad. (20 kg one dose)	5.35	5.13	5.55	5.34	19.13	21.79	20.00	20.31	36.20	56.0	79.75	57.32
T_3.S. 60 kg N / fad. (20 kg three doses)	6.90	7.45	7.50	7.28	23.43	27.85	22.26	24.51	38.50	59.25	88.75	62.17
T_4. F**. 3 kg urea/fad. (1 kg three doses)	5.47	5.95	5.70	5.71	20.05	21.97	20.22	20.75	36.35	56.50	83.0	58.62
T_5. F. 6 kg urea / fad. (2 kg three doses)	5.88	6.53	6.65	6.35	21.87	23.27	21.29	22.14	36.40	50.75	85.75	57.63
T_6. F. 6 kg urea / fad. (1 kg six doses)	5.70	6.53	6.55	6.26	20.30	23.23	20.44	21.36	35.45	55.75	83.00	58.77
T_7. F. 12 kg urea / fad. (2 kg six doses)	6.05	6.65	6.75	6.48	23.31	24.29	21.58	23.06	37.65	57.25	86.50	60.47
L.S.D at 0.05	N.S	1.49	N.S	N.S	2.95	4.29	1.56	4.00	N.S	N.S	N.S	N.S

* S. = Soil application ** F. = Foliar application

Table (1): Cont.

Characters / Treatments	Stem diameter (mm.)				Number of branches / plant				Leaf area cm^2				Leaf weight ratio % LWR			
	1st cut	2nd cut	3rd cut	Mean	1st cut	2nd cut	3rd cut	Mean	1st cut	2nd cut	3rd cut	Mean	1st cut	2nd cut	3rd cut	Mean
	1998/1999 season															
T_1	2.70	2.78	2.80	2.76	4.01	4.29	4.42	4.24	10.60	10.28	11.61	10.83	36.03	37.60	41.32	38.32
T2	3.22	3.10	3.38	3.23	4.30	4.69	4.83	4.61	10.69	11.32	11.82	11.28	38.01	40.52	47.24	41.92
T3	4.03	4.42	4.63	4.36	5.32	5.88	5.59	5.60	13.50	14.86	14.63	14.33	43.79	44.90	51.30	46.66
T4	3.50	3.22	3.45	3.39	4.02	5.05	5.14	4.74	12.14	12.36	11.98	12.16	39.50	42.55	47.68	43.24
T5	3.58	3.50	4.05	3.71	4.70	5.22	5.26	5.06	13.14	13.04	13.30	13.16	40.99	42.80	49.69	44.49
T6	3.53	3.28	3.53	3.45	4.59	5.20	5.22	5.00	12.58	12.72	13.16	12.82	40.60	42.77	49.33	44.23
T7	3.65	3.53	4.13	3.77	5.13	5.32	5.36	5.27	12.14	14.31	14.25	13.57	41.77	43.38	50.24	45.13
L.S.D at 0.05	N.S.	0.88	1.03	0.99	0.63	0.54	0.57	0.55	1.20	1.79	0.87	1.20	1.59	N.S.	3.08	2.50
	1999/2000 season															
T1	2.95	2.70	2.97	2.87	3.84	4.14	4.26	4.08	10.07	9.87	11.14	10.36	26.89	37.69	41.25	35.28
T2	3.17	3.05	3.28	3.17	4.13	4.51	4.66	4.43	10.15	10.87	11.35	10.79	29.40	45.36	42.74	39.17
T3	4.07	4.15	4.47	4.23	5.15	5.62	5.53	5.43	12.83	14.28	13.89	13.67	32.53	55.98	60.67	49.73
T4	3.28	3.38	3.40	3.35	4.10	4.85	4.93	4.63	11.53	11.87	11.40	11.60	29.09	47.60	46.40	41.03
T5	3.40	3.50	3.78	3.56	4.51	5.01	5.05	4.86	12.61	12.52	12.63	12.59	32.01	50.46	48.30	43.59
T6	3.33	3.48	3.47	3.43	4.41	4.99	5.01	4.80	11.65	12.22	12.57	12.15	31.68	48.69	47.17	42.51
T_7	3.55	3.60	4.00	3.72	4.97	5.11	5.15	5.08	12.07	13.73	13.53	13.11	33.74	51.56	53.09	46.13
L.S.D at 0.05	N.S.	N.S.	0.91	N.S	0.71	0.50	0.44	0.51	1.53	1.79	0.80	0.41	N.S.	7.53	6.12	6.50

compared with the other treatments. The increase in plant height with nitrogen application may be due to that N element enhances the meristematic activity of plants.

With regard to stem diameter, the data show that plants fertilized with nitrogen either as soil or as foliar application were more thickness than those unfertilized. This result was significant in the 2nd and 3rd cuts in 1998/1999 season and in the 3rd cut in 1999/2000 season. Moreover, it could be noticed that application of 20kg N/fad. three doses (60kg N/fad. T_3) as soil application and / or 2 kg urea /fad. six doses (12 kg urea i.e, 5.52 kg N/fad. T_7) as a foliar application were the most effective in increasing stem diameter compared to the other nitrogen treatments.

Number of branches / plant seemed to be significantly increased with nitrogen fertilization either as soil or foliar application in the three cuts in both seasons. As an average of the three cuts data in both season, it is clear that application of nitrogen fertilizer at a rate of 20kg N/fad. one dose (T_2) and 20 kg N/fad. three doses (T_3) as soil application as well as 1kg urea/fad. three doses (T_4), 2kg urea three doses (T_5), 1 kg urea /fad. six doses (T_6) and 2 kg urea/fad. (T_7) as foliar applications increased the number of branches /plant by 8.7, 32.6, 12.7, 19.2, 17.8 and 24.4 % over unfertilized plants (T_1), respectively. From these results, it can be concluded that the increase in the number of branches / plant with nitrogen application might be attributed to the importance of nitrogen in building amino acids and consequently proteins necessary for building the protoplasm of the new plant tissues.

The data show that the application of nitrogen fertilizer at any tested level caused an increase in leaf area and leaf weight ratio compared to unfertilized plants. This increase was significant in the three cuts in both seasons for leaf area and in the 1st and 3rd cuts in 1998/1999 season and in the 2nd and 3rd cuts in 1999/2000 season for leaf weight ratio. The increase in leaf area and leaf weight ratio reached its maximum by soil application of 20 kg N/fad. three doses i.e, 60 kg N/fad. (T_3) compared to the other nitrogen treatments. On the other hand, it can be noticed that the foliar application of 1 and 2 kg urea / fad. either three doses (T_4 and T_5) or six doses (T_6 and T_7) were found to be more effective in increasing leaf area and leaf weight ratio than soil application of 20 kg N/fad. one dose (T_2). This result may be due to the failure of plant roots in absorbing all amounts of nitrogen fertilizer applied in the soil.

Similar results were obtained by many investigators who found that nitrogen fertilization to Egyptian clover led to the increase in plant height (Hussein *et al*, 1983 and Shaaban *et al*, 1984), number of branches / plant (Ibrahim and Abdel-Aal, 1990) and number of nodules / root (Taneja *et al*, 1994).

2) Forage yield:-

The fresh and dry forage yields / fad. as well as nitrogen use efficiency as influenced by soil and foliar application treatments in the two growing seasons are shown in Table (2). The data indicate that fresh and dry forage yields / fad. were found to be significantly increased by nitrogen fertilizer either as a soil or a foliar applications in the three cuts in both seasons, with exception of the 3rd cut in the first season. The data of total yield of the three cuts show that the plants fertilized with 20kg N/fad. three doses (60kg N/fad.) as a soil application (T_3) produced the maximum fresh and dry forage yields / fad. (36.01-45.71 and 6.37-10.99 ton, respectively). The yield increases amounted to 56.2-47.2% and 76.0- 89.2 % more than that obtained by unfertilized plants, respectively.

The increase in forage yield of clover by nitrogen fertilizer may be due to the increase in the growth characters such as plant height, stem diameter, number of branches / plant and leaf area. In this concern, favourable effect on Egyptian clover productivity have be reported due to nitrogen application by Sharma and Baradkar (1995), Sinha and Rai (1995), Sharma *et al* (1998) and Desole *et al* (2000) for fresh forage yield, and by Taneja *et al* (1991), Ratel (1998), and Bariki and Tiwari (1998) for dry forage yield.

The data of nitrogen use efficiency (NUE) in Table (2) indicate that each kilogram nitrogen applied as soil application (T_2 and T_3) produced about 117 and 216 kg total fresh yield /fad. in the first season, and 160 and 244 kg / fad in the second season, respectively more than the control treatment (T_1). However, each kilogram nitrogen applied as foliar application (T_4,T_5,T_6 and T_7) produced about 2094, 3155, 2583 and 2034 kg total fresh yield /fad. in the first season, and 3311, 2978, 1735 and 1603 kg /fad. in the second season, respectively more than control treatment (T_1). Moreover, the same trend was observed also for the nitrogen fertilizer efficiency on the dry yield /fad. in the two seasons. From these results, it could be concluded that the nitrogen fertilization was so more efficiency on clover productivity when it was applied as foliar application, especially at the rate of 1 or 2 kg urea /fad. three doses (T_4 or T_5) than the soil applications.

The superiority of nitrogen use efficiency as foliar application rather than soil application may be attributed to the completely absorption of nitrogen fertilization by foliar application by the leaves and translocated directly to the assimilation organs, without any losses, for building the metabolites synthesized.

Table (2): Effect of soil and foliar application of nitrogen fertilization on fresh and dry forage yields (ton/fad), and nitrogen use efficiency (NUE) "Kg yield/ Kg N" during 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Fresh forage yield						Dry forage yield					
	1st cut	2nd cut	3rd cut	Total	Relative	NUE	1st cut	2nd cut	3rd cut	Total	Relative	NUE
	1998 / 1999 season											
T_1. Control (No application	5.72	7.78	9.55	23.05	100.0	-	0.99	0.97	1.66	3.62	100.0	-
T_2.S*. 20 kg N / fad. (20 kg one dose)	5.74	9.65	10.01	25.40	110.2	117.5	1.07	1.25	2.14	4.46	123.2	42.0
T_3.S. 60 kg N / fad. (20 kg three doses)	10.70	12.88	12.43	36.01	156.2	216.0	1.88	1.94	2.55	6.37	176.0	45.8
T_4. F**. 3 kg urea/fad. (1 kg three doses)	6.02	9.75	10.17	25.94	112.5	2094.2	1.15	1.28	2.26	4.69	130.0	756.4
T_5. F. 6 kg urea/fad. (2 kg three doses)	10.09	10.95	10.72	31.76	137.8	3155.8	1.42	1.50	2.30	5.22	144.2	579.7
T_6. F. 6 kg urea/fad. (1 kg six doses)	10.04	9.82	10.32	30.18	130.9	2583.3	1.25	1.32	2.28	4.85	134.0	445.7
T_7. F. 12 kg urea/fad. (2 kg six doses)	10.53	12.10	11.62	34.28	148.7	2034.4	1.46	1.64	2.45	5.55	153.3	349.6
L.S.D at 0.05	1.24	3.04	N.S.	3.94			0.43	0.42	0.38	0.87		
	1999 / 2000 season											
T_1. Control (No application	8.57	9.19	13.30	31.06	100.0	-	1.53	1.76	2.52	5.81	100.0	-
T_2.S*. 20 kg N / fad. (20 kg one dose)	9.27	10.32	14.68	34.27	110.3	160.5	1.83	2.38	3.26	7.47	128.9	83.0
T_3.S. 60 kg N / fad. (20 kg three doses)	12.43	12.95	20.33	45.71	147.2	244.2	2.83	3.62	4.54	10.99	189.2	86.33
T_4. F**. 3 kg urea/fad. (1 kg three doses)	10.15	10.59	14.89	35.63	114.7	3311.6	2.02	2.41	3.15	7.58	130.5	1282.6
T_5. F. 6 kg urea/fad. (2 kg three doses)	10.15	11.46	17.67	39.28	126.5	2978.3	2.10	3.01	3.58	8.69	150.0	1043.5
T_6. F. 6 kg urea/fad. (1 kg six doses)	9.63	10.59	15.63	35.85	115.4	1735.5	1.98	2.60	3.24	7.82	134.6	728.3
T_7. F. 12 kg urea/fad. (2 kg six doses)	10.32	11.20	18.39	39.91	128.5	1603.3	2.14	3.15	3.46	8.75	150.6	532.6
L.S.D at 0.05	2.20	1.99	4.25	6.02			0.50	0.89	0.76	1.74		

* S. = Soil application ** F. = Foliar application

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دراسة مقارنة على تاثير الأضافة الأرضية و الورقية للتسميد النيتروجيني على نمو وإنتاجية البرسيم المصري

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الملخص العربي

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسرس الليان محافظة المنوفية خلال موسمي الزراعة ١٩٩٨/٩٨ ، ٩٩/ ٢٠٠٠ لدراسة تأثير التسميد الآزوتي الأرضي والورقي على صفات النمو وتكوين العقد الجذرية وإنتاجية الفدان من العلف الأخضر والجاف لمحصول البرسيم المصري. واشتملت هذه الدراسة على ٧ معاملات وضعت في تصميم القطاعات الكاملة العشوائية في أربع مكررات والمعاملات المختبرة هي كالآتي :

١) بدون تسميد ازوتي (كنترول)
٢) تسميد ارضي بمعدل ٢٠ كجم ن / فدان (٢٠ كجم ن / فدان دفعة واحدة)
٣) تسميد ارضي بمعدل ٦٠ كجم ن / فدان (٢٠ كجم ن / فدان ثلاث دفعات)
٤) تسميد ورقي بمعدل ٣ كجم يوريا / فدان (١ كجم يوريا / فدان ثلاث رشات)
٥) تسميد ورقي بمعدل ٦ كجم يوريا / فدان (٢ كجم يوريا / فدان ثلاث رشات)
٦) تسميد ورقي بمعدل ٦ كجم يوريا / فدان (١ كجم يوريا / فدان ست رشات)
٧) تسميد ورقي بمعدل ١٢ كجم يوريا / فدان (١٢ كجم يوريا / فدان ست رشات)

ويمكن ايجاز اهم النتائج المتحصل عليها فيما يلي :-

١ –تشير النتائج الى ان جميع معاملات التسميد الأزوتي المختبرة لم يكن لها اي تاثير معنوي على قطر جذر نبات البرسيم المصري في حين أدى زيادة التسميد الآزوتي حتى ٦٠كجم ن/فدان موزعة على ثلاث دفعات كإضافة أرضية و١٢ كجم يوريا/فدان مقسمة على ست رشات كإضافة ورقية إلى زيادة عدد العقد الجذرية زيادة معنوية بالمقارنة بمعاملة الكنترول .

٢ – أمكن الحصول على أعلى قيم لصفات طول النبات، قطر الساق، عدد الأفرع / نبات، مساحة الورقة، نسبة وزن الأوراق/وزن الساق، محصول العلف الأخضر والجاف للفدان بتسميد البرسيم المصري تسميداً أرضياً بمعدل ٦٠ كجم ن موزعة على ثلاث دفعات وذلك بالمقارنة بمعاملة الكنترول وبقية معاملات التسميد الأخرى الأرضية والورقية. هذا وقد أعطى التسميد الورقي بمعدل ١٢كجم يوريا/فدان مقسمة على ست رشات أفضل النتائج للصفات السابقة بالمقارنة بمعاملة الكنترول وبقية معاملات التسميد الورقي الأخرى.

٣– وجد أن معامل كفاءة استخدام السماد الآزوتي لمعاملات الإضافة الأرضية يقدر بحوالي ١١٧– ٢٤٤كجم علف أخضر/١كجم نيتروجين، بينما كان معامل كفاءة استخدام السماد الآزوتي لمعاملات الإضافة الورقية حوالي ١٦٠٣ –٣٣١١كجم علف أخضر/١كجم نيتروجين خلال موسمي النمو مما يشير إلى أن كفاءة استخدام السماد الآزوتي عند إضافته كإضافة ورقية كان أكثر كفاءة من إضافته كإضافة أرضية في زيادة إنتاجية البرسيم المصري.