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EFFECT OF BIOFERTILIZER AND MINERAL NITROGEN ON GROWTH AND FLOWERING OF *Euphorbia pulcherrima, WILLD.*

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ABSTRACT

Application of N as ammonium nitrate (33.5%) at the rates of 0.4, 0.8, 1.6, 3.2 g/plant with or without biofertilizer Nitrobein (Azotobacter + Azospirillum), were used on *Euphorbia pulcherrima, willd* during 2002/2003 and 2003/2004 seasons at Antoniades Research Branch, Hort. Res. Inst., A.R.C. Alexandria. Egypt.

Fertilizing *E. pulcherrima* with 1.6 g ammonium nitrate or 0.8 g ammonium nitrate in presence of biofertilizer gave the highest values in the most of studied characters (plant height, fresh and dry weight of stem and leaves, leaves area and number of leaves per plant). Also, the highest content of total chlorophylls in the leaves.

It can be concluded that, Nitrobein could decrease mineral N to 50% of the suitable dose for the best growth and flowering of *E. pulcherrima*, with minimum environmental pollution.

Keywords: *Euphorbia*, biofertilizer (Nitrobein), ammonium nitrate

INTRODUCTION

Euphorbia pulcherrima, willd (Family Euphorbiaceae) is one of the most important flowering shrubs which flowers in winter whereas; little trees and shrubs flower in gardens at this time. It is characterized with its colored bracts at flowering time. It can be planted in gardens in front of trees and in the background of the green area. It can be used as pot plant as gifts for its graceful colored bracts.

Fertilizer is very important to improve growth and flowering. The intensive use of chemical fertilizer resulted in environmental pollution problems, moreover, the expensive cost. On the other hand, using chemical fertilizer with high rates for a long time decreased the activity of microflora and stability of soil organic matter. (Pokorna Kozova, 1984).

Biofertilizer can change unavailable forms of nutrients into available one easily assimilated by plants, (Alaa EL-Din, 1982). It increases the amount of fixed nitrogen in the plants and in the soil, (EL-Karamity and Hammed, 1992). In this concern, Awad *et al* (1994) indicated that NPK fertilization was effective for increasing vegetative growth characters of *Euphorbia pulcherrima* plants. Haggage and Azzaz (1996) found that, microbein significantly increased the mango seedlings growth as well as N content of leaves. Attia (2000) on *Lawsonia inermis L.* concluded that, values for growth and yield of leaves and branches were effected by fertilizers treatment and the lowest values of growth parameters were obtained from applying biofertilizer alone. Also, Sudhakar *et al* (2000) on *Morus alba* concluded that application of Azotobacter with 150 kg N/ha per year as

inorganic nitrogen gave as much leaf as the recommended dose (300 Kg N/ha per year) of N alone, Abd Alla *et al* (2001) reported that all biofertilizer treatments improved the vegetative growth of sweet pepper compared with the control. Kawther, *et al* (2002) on potato found that, the most promising treatment is biofertilizer combined with 50% recommended dose of nitrogen fertilizer. Also, EL-Fawakhry, *et al* (2004) on three species of *Ficus*, mentioned that, fertilizering *Ficus* transplants with 1g/plant NPK (19:19:19) every two weeks (equal to 50% of used NPK) in presence of biofertilizer gave the highest values in plant height, branch number, leaf number and area, stem diameter, shoot dry weight, root volume and dry weight . Also gave the greatest content of total chlorophyll and nitrogen in the leaves.

For these reasons this experiment aimed to study response of Poinsettia for biofertilizer as a better alternative to chemical fertilizer or decreasing its rates to minimum level.

MATERIAL AND METHODS

This study was carried out during the two successive seasons (2002/2003 and 2003/2004) at Antoniades Research Branch, Hort. Res. Inst., Alexandria, Egypt; aiming to study response of poinsettia to bifertilizer and chemical N fertilizer. Terminal cuttings (15 – 16 cm. in length) were taken on April 1st in both seasons from mother plants grown at Antoniades garden. They were inserted in 10 cm. clay pots, filled with equal parts of clay, sand and peat moss, by volume (1:1:1) using one cutting per pot in the greenhouse. After four months (on August 1st) the transplants of 30 – 32 cm. in length, were chosen and transplanted in (30 cm. in diameter) clay pots filled with the same medium used before, the growing medium contained 0.18% N, 7.2 pH with 0.75 dsm^{-1} (EC). After one month all plants were carried out the greenhouse to the open field.

The biofertilizer was used Nitrobien containing nitrogen fixing bacteria (Azotobacter and Azospirillum). It was used as 20 g/pot divided into two times. The first addition (10 g/pot) was immediately with the final transplanting and the second one was added after six weeks from the fist one. It was applied as dressing and mixed with the medium. The chemical fertilizers were repeated once every two weeks beginning on September, 15 as ammonium nitrate (A.N) 33.5% at the rates of 0.0, 0.4, 0.8, 1.6 and 3.2 g/pot and potassium sulphate (48.5%) at the rate of 1.0 g/pot and calcium super phosphate (15.5%) 3.0 g/pot. They were applied as dressing and mixed with the medium. All plants were treated with the same rate of P and K fertilizers. The control treatment left without fertilizers. Thus, ten treatments were carried out.

1- 0.4 g A.N	2- 0.4 g A.N + biofertilizer
3- 0.8 g A.N	4- 0.8 g A.N + biofertilizer
5- 1.6 g A.N	6- 1.6 g A.N + biofertilizer
7- 3.2 g A.N	8- 3.2 g A.N + biofertilizer
9- 0.0 g A.N	10- Biofertilizer alone.

The treatments were arranged in three replicates with three plants per experimental unit in a complete randomize design, throughout each experimental season.

Regular agricultural practices such as weeding and watering as a basic dressing were carried out whenever necessary as recommended.

The following data were recorded:

A- Vegetative growth:

1- Plant height (cm).
2- Fresh and dry weights of branches (g)/plant.
3- Leaves number and fresh and dry weights (g)/plant.
4- Leaf area (cm^2)/plant.
5- Roots fresh and dry weights (g)/plant.

B- Flowering characteristics:

1- Number of days to flowering for the final transplanting to the shown color stage.
2- Bracts fresh and dry weights (g.).

C- Total chlorophyll content as mg/g. fresh weight of leaves, at flower bud stage according to Moran and Porath (1980).

The experiment was repeated in the second year (2003) at the same date and site. The same steps and techniques of the first year were exactly carried out in the second year.

Duncan's Multiple Range Test was used for comparison between the treatments means according to Sendecor, and Cochran (1974).

RESULTS AND DESCUSSION

A- Vegetative growth

1- Plant height:

Data presented in table (1) showed highly significant differences in plant height among fertilizer treatments. Evidently, using 0.8 g and 1.6, A.N in presence of biofertilizer recorded the highest values in both seasons compared to control, which recorded the least values.

While the high and low rates of A.N recorded low values of plant height. These results are in accordance of those obtained by Awad *et al* (1994) on Poinsettia and EL-Fawakhry *et al* (2004) on *Ficus*.

2- Fresh and dry weights of branches:

Fertilizer treatments significantly affected fresh and dry weights of branches/plant as shown in Table (1). It was observed from the data fertilizing poinsettia treatment with 0.8 g A.N in presence of biofertilizer gave the highest values fresh and dry weight of branches, in both seasons. While, the low and high rates of A.N with or without biofertilizer gave the least values, the thing was recorded with biofertilizer alone and control. These results may be attributed to the effect of biofertilizer in changing forms of nutrients into available forms and increasing N-fixation that could be easily assimilated by plants. (Alaa EL-Din, 1982) and (EL-Karamity and Hammed, 1992), the same results were observed by EL-Fawakhry *et al* (2004) on three species of *Ficus*.

3- Leaves number, fresh and dry weights of leaves/plant:

As it cleared in Table (1), it could be concluded that, leaf number, fresh and dry weights of leaves per plant were significantly effected by fertilizer treatments. The beast effect was from the treatments of 0.8 g A.N in presence of biofertilizer and 1.6 g A.N alone in both seasons were applied. While the high and low rates of N fertilizer were the least effective treatments that closed to the control. Moreover, biofertilizer alone.

These results are in accordance to those of Attia (2000) on *Lawsonia inermis* and Sudhakar *et al* (2000) on *Morus alba*.

4- Leaf area (cm2):

Data obtained in Table (2) showed that biofertilizer in combination with mineral N significantly affected leaf area per plant. The highest leaf area per plant was recorded with 1.6 g A.N or 0.8 g A.N in presence of biofertilizer compared to control which recorded the least value. On the other hand, the high and low rates of A.N and biofertilizer alone had little effect on leaf area. This fact in the both swasons.

These results are in correlation with assimilation rate of N by plant which resulted by biofertilizer (Alaa EL-Din 1982). In addition these results are similar to those reported by EL-Fawakhry *et al* (2004) on *Ficus*.

5- Roots fresh and dry weights /plant:

As it shown in Table (2) no effects were observed in roots fresh and dry weights resulting due to using the different fertilizer treatments. The highest values of fresh and dry weights of roots were observed with using 0.8g A.N in presence of biofertilizer. While the lowest values of fresh and dry weight of roots per plant were recorded with the high rate of A.N in presence of biofertilizer.

These results may be related to the inverse effect to the high rate of N fertilizer on the activity of biofertilizer (Pokorna Kozova 1984)

B- Flowering characteristics

1- Number of days to flowering:

It is clear in Table (2) that, flowering time was effected by fertilizer treatments, the earliest flowering plants were observed with using 0.8 g A.N in presence of biofertilizer which recorded 86.33 and 87.67 days compared to the control which recorded 113.67 and 114.0 days in both seasons respectively. On the other hand, the latest flowering plants were observed with low (0.4 g) and high (3.2 g) rates of A.N, also biofertilizer alone and control.

These results may be due to vegetative growth improve, as a result to using biofertilizer in combination with mineral N.P.K nutrients, and the role of biofertilizer as plant growth promotion.

The same result was observed by Sheikh *et al* (2000) on Dutch iris, who concluded that the interaction between mineral N and biofertilizer was significant for number of days to flowering.

2- Fresh and dry weights of bracts:

Significant differences were detected on fresh and dry weights of bracts as a result to fertilizer treatments (Table, 2). The heaviest fresh and

dry weights of bracts were obtained by using 0.8 g A.N in presence of biofertilizer. On the other hand, the high and low rates of A.N with or without biofertilizer gave the least values of fresh and dry weights of bracts.

These results may be related to the inverse effect to the high rate of A.N on the activity of nutrient accumulation in plant and activity of biofertilizer in this case. (Pokorna Kozova, 1984). These results are in agreement with those of Wange *et al* (1995) on tuberose, who revealed that cut flower yield were highest with 150 Kg/ha N and inoculated with Azospirillum compared to control.

C- Total chlorophyll content:

Data presented in Table (3) reveal that total chlorophyll content was influenced by fertilizer treatments. The highest value of total chlorophyll was resulted by using the intermediate and high levels of ammonium nitrate (0.8, 1.6 and 3.2 g/plant) with and without biofertilizer. While, the least content of total chlorophyll was recorded with using low rate of ammonium nitrate, biofertilizer alone and control.

These results may be attributed to increase accumulation of nitrogen with the high rates of it in the fertilizer used which reflexed on chlorophyll content in the leaves. EL-Fawakhry *et al* (2004) on three *Ficus sp.* Found the same results.

Table (1): Effect of biofertilizer and mineral nitrogen on plant height, fresh and dry weights of branches, number of leaves, fresh and dry weights of leaves/plant of *Euphorbia pulcherrima, willd,* during 2002/2003 and 2003/2004 seasons.

Treatments	plant height (cm)		Fresh weight of branches (g) /plant		Dry weight of branches (g) /plant	
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
0.4 g A.N	45.45e	44.22f	39.23d	40.39f	18.12b	18.67d
0.4 g A.N + bio	53.30d	51.75d	44.59cd	46.17e	21.03ab	22.26bc
0.8 g A.N	55.75c	54.44c	64.76abc	63.92c	22.26ab	24.26b
0.8 g A.N + bio	56.22bc	56.67b	67.39ab	68.23b	27.94a	28.26a
1.6 g A.N	57.44b	58.45b	81.37a	82.07a	24.02ab	23.67bc
1.6 g A.N + bio	63.36a	64.78a	62.93abc	63.59c	22.02ab	24.26b
3.2 g A.N	44.63e	45.11ef	49.54bcd	50.07d	21.55ab	22.12c
3.2 g A.N + bio	40.78f	42.28g	38.72d	39.34f	15.67bc	16.67e
Bio alone.	45.78e	46.53e	45.07cd	44.72e	21.50ab	18.12de
Control	40.45f	41.44g	38.17d	39.07f	9.86c	10.67f

Treatments	Leaves number/plant		Fresh weight of Leaves (g) /plant		Dry weight of leaves (g) /plant	
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
0.4 g A.N	21.67cd	20.00fg	9.59ef	9.10ef	2.37bc	2.00e
0.4 g A.N + bio	22.00cd	21.33ef	11.53de	11.00de	2.40bc	2.50d
0.8 g A.N	26.67bcd	24.67d	13.67d	12.17d	3.01ab	2.90c
0.8 g A.N + bio	35.33ab	34.67b	23.71ab	22.00b	4.01a	3.90b
1.6 g A.N	36.33a	37.33a	26.17a	27.07a	4.12a	4.85a
1.6 g A.N + bio	33.333ab	34.07b	19.92bc	20.87bc	3.26ab	4.00b
3.2 g A.N	27.07abc	28.62c	18.10c	19.50c	3.65a	3.00c
3.2 g A.N + bio	21.33cd	22.00e	7.87efg	8.17f	1.27cd	1.01f
Bio alone.	19.00cd	20.33efg	7.25fg	10.5e0	1.48cd	1.90e
Control	17.67d	18.07g	5.84g	8.17f	0.88d	1.08f

*** Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's Multiple Range Test.**

Table (2): Effect of biofertilizer and mineral nitrogen on leaf area, roots fresh and dry weights, number of days to flowering and fresh and dry weights of bracts of *Euphorbia pulcherrima, willd,* during 2002/2003 and 2003/2004 seasons.

Treatments	Leaf area (cm2)/plant		Roots fresh weight (g) /plant		Roots dry weight (g)/plant	
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
0.4 g A.N	652ef	618de	19.11	20.09	8.38	7.20
0.4 g A.N + bio	784e	748 d	23.78	23.89	8.37	8.30
0.8 g A.N	929de	827d	17.89	20.78	7.39	8.39
0.8 g A.N + bio	1612ab	1696ab	28.97	27.07	8.38	8.40
1.6 g A.N	1779a	1836a	24.51	25.00	8.32	8.39
1.6 g A.N + bio	1354c	1419bc	27.80	28.11	7.11	8.11
3.2 g A.N	1230cd	1326bc	19.58	20.50	8.24	8.20
3.2 g A.N + bio	535fg	555e	16.89	17.51	6.49	7.39
Bio alone.	493fg	714d	19.73	20.12	6.59	7.40
Control	397g	4876f	19.09	18.78	7.11	7.30
			N.S	N.S	N.S	N.S

Treatments	Number of days to flowering		Fresh weight of Inflorescence (g)		Dry weight of Inflorescence (g)	
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
0.4 g A.N	109.33a	110.0b	3.55e	3.95g	0.79d	0.90g
0.4 g A.N + bio	94.33c	95.67e	17.26c	17.78cd	2.92ab	3.10b
0.8 g A.N	93.67cd	95.00e	22.67b	23.00b	2.24bc	2.50d
0.8 g A.N + bio	86.33d	87.67f	30.44a	30.78a	3.73a	4.01a
1.6 g A.N	93.67cd	94.33e	14.50cd	15.26e	2.38bc	2.60d
1.6 g A.N + bio	94.0c	94.00e	18.43bc	19.00c	2.70ab	2.80c
3.2 g A.N	93.33cd	95.33e	15.93cd	16.48de	1.83bcd	2.00e
3.2 g A.N + bio	102.0b	105.0c	11.48d	10.90f	1.40cd	1.30f
Bio alone.	102.0b	102.0d	2.48e	3.27g	0.87d	0.95g
Control	113.67a	114.0a	2.00e	2.80g	0.71d	0.80g

* Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's Multiple Range Test.
* N.S = non-significant.

Table (3): Effect of biofertilizer and mineral nitrogen on Total chlorophyll content of *Euphorbia pulcherrima, willd,* during 2002/2003 and 2003/2004 seasons.

Treatments	Total chlorophylls mg/g	
	2002/03	2003/04
0.4 g A.N	1.91bc	1.39e
0.4 g A.N + bio	1.82bc	1.97de
0.8 g A.N	2.10bc	2.15d
0.8 g A.N + bio	2.37abc	2.40c
1.6 g A.N	3.65a	3.75a
1.6 g A.N + bio	2.49abc	2.40c
3.2 g A.N	3.37ab	3.40b
3.2 g A.N + bio	2.46abc	2.43c
Bio alone.	1.87bc	1.90e
Control	1.36c	1.24f

* Means of each factor designated by the same letter are not significantly different at 5% level using Duncan's Multiple Range Test.

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تأثيرالسماد الحيوى والنيتروجين المعدنى على نمو وإزهار بنت القنصل

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استخدام نترات الامونيوم (٣٣,٥%) كمصدر للنيتروجين المعدنى بالمستويات ٠,٤، ٠,٨، ١,٦، ٣,٢ جرام/نبات فى وجود او غياب السماد الحيوى نيتروبين (ازوتوباكتر + ازوسبريليم) كمعاملات سمادية لنباتات بنت القنصل خلال الموسمين ٢٠٠٢ / ٢٠٠٣ و ٢٠٠٣/٢٠٠٤ فى فرع البحوث بحديقة انطونيادس التابعة لمعهد بحوث البساتين بالإسكندرية وقد أشارت النتائج الى أن تسميد بنت القنصل بمستوى ١,٦ جم/نبات من سماد نترات الامونيوم او ٠,٨ جرام/نبات من سماد نترات الامونيوم فى وجود السماد الحيوى قد أعطى أعلى القيم لمعظم الصفات المدروسة (ارتفاع النبات، الوزن الطازج والجاف للساق والأوراق و المساحة الورقية) كما انه الأكثر تبكيرا فى التزهير واعلى وزن طازج وجاف للنورة كذلك أعلى قيمة لمحتوى الأوراق من الكلوروفيل الكلى.
عموما استخدام السماد الحيوى نيتروبين خفض من استخدام النيتروجين المعدنى إلى ٥٠% لإعطاء أفضل نمو وإزهار لنباتات بنت القنصل.