

RESPONSE OF DRACAENA PLANTS (*DRACAENA FRAGRANS* VAR. *MASSANGEANA*) TO SOME BIOFERTILIZERS

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Abstract

This experiment was performed in the greenhouse at the nursery of Ornamental Plants Res. and Landscape Dep., Hort. Res. Inst., ARC., Giza, Egypt through two successive seasons (2009 and 2010) aiming to find out the response of *Dracaena fragrans* 'Massangeana' to biofertilizers. The obtained results revealed that biofertilization treatments significantly stimulated most of the studied characters compared to control. The treatment of *Dracaena* with Biogien (5 and 10 g pot⁻¹) followed by Rhizobacterien (5 and 10 g pot⁻¹) gave rise to the utmost high values of vegetative growth parameters [plant height (cm), stem diameter (cm), leaves blade area (cm²), number of leaves plant⁻¹, fresh and dry weights of leaves plant⁻¹ (g)] as well as root length, number, fresh and dry weights. The treatment of Biogien followed by Rhizobacterien markedly improved chlorophyll a, b and carotenoids and gave the highest total carbohydrates % in leaves. Likewise, all fertilization treatments greatly raised the percentage of N, P and K in the leaves, as reached the maximum by Biogien (10 g pot⁻¹). The addition of Biogien (10 g pot⁻¹) was the best treatment for all studied parameters of *Dracaena* plant. In general, the dominance in all previous measurements was for Biogien followed by Rhizobacterien which gave the highest values in most cases.

Key words: *Dracaena*, Biogien, Rhizobacterien, Microbien.

INTRODUCTION

The very popular *Dracaena fragrans* 'Massangeana' (Cornstalk *Dracaena*) belongs to Asparagaceae family, it is native to tropical Africa, from Sudan South to Mozambique, West to Côte d'Ivoire and Southwest to Angola, growing in upland regions at 600–2,250 m (2,000–7,380 ft) altitude. It is a slow growing shrub, usually multistemmed at the base, mature specimens reaching 15 m (49 ft) or more tall with a narrow crown of usually slender erect branches. Stems may reach up to 30 cm (12 in.) diameter on old plants, in forest habitats they may become horizontal with erect side branches. The leaves are glossy green, lanceolate, 20–150 cm (7.9–59 in) long and 2–12 cm (0.79–4.7 in) wide. The 'Massangeana' variety is the most popular, due to its dramatic bright yellow central stripe on the leaves. In Africa, cornstalk *Dracaena* is widely grown as a hedge plant, it is suited to frost-free climates, in USDA zones 10–11. Elsewhere, it is primarily popular as a houseplant, valued for its tolerance of a wide range of indoor conditions from full sun to low light conditions.

The temperature requirements for fragrans is a comfortable 75 degrees also, it does well in low light conditions. The water requirements are low. It is also very tolerant to neglect, and has been shown by the NASA Clean Air Study to help remove indoor pollutants such as formaldehyde, xylene and toluene (Huxley, 1992 and Wolverton, 1996).

Biofertilizers are from paramount importance for their beneficial effects on the physical, chemical and biological properties of soil organic matter, cation exchange capacity, availability of mineral nutrients to plant to increase productivity. This is attained through increasing the soil water holding capacity, promoting soil structure and enhancing the metabolic activity of micro organisms. Moreover, they can increase plant growth and quality of most plant species by enhancing water absorption and uptake of nutrients: e.g. phosphorus, potassium and nitrogen as well as Zn, Cu, S, B and Mo (Dorer and Peacock, 1997).

The goal of this research work was to use natural safety environmental materials (Biogien, Rhizobacterien and Microbien) for their beneficial effects on plant growth and avoid the harmful effects caused by chemical fertilizers through decreasing its the use and costs requirements for *Dracaena fragrans* 'Massangeana' plant.

MATERIALS AND METHODS

This study was carried out at the Experimental Greenhouse (saran) of the Ornamental Plants Res. and Landscape Dep., Horticultural Research Institute, Agricultural Research Center, Giza, Egypt for two successive seasons (2009 and 2010). *Dracaena fragrans* 'Massangeana' plants were purchased from a commercial farm with average height of 10-12 cm and 2-3 leaves. On January 1st 2009 and 2010, the plants were individually planted in 25cm plastic pots filled with a mixture of clay: sand: peat (1:1:1, v/v/v). Physical and chemical analysis of the used soil is presented in Tables (a) and (b). Plants were treated as follows during the growth season:

1- Control.

2- Biofertilizers containing effective micro organisms [Microbien (a commercial product contains a specific strain of *Azotobacter*, *Azosprillam*, *Pasudomonus* and *B-Mogatherium*), *Rhizobacterien* (a commercial product contains a specific strain of *Rhizobium* sp. bacteria, conc. 10^7 - 10^9 cells/ml) and *Biogien* (a commercial product contains a specific clone of *Azotobacter chroococcum* bacteria, conc. 10^6 cells/ml)] at the rates of 5 and 10g /pot for each were applied monthly a soil drench.

Measurements

1- Vegetative growth characters:

- Plant height (cm). -Stem diameter (cm) - Number of leaves /plant
- Leaves blade area (cm²) - Fresh and dry weights of leaves/ plant (g)

2- Root characters:

- Root length (cm). -Number of roots/plant - Fresh and dry weights of roots

3- Chemical composition:

- Chlorophyll a, b and carotenoids were determined in fresh leaves (mg/g f.W.) according to Saric *et. al.* (1967).
- Total carbohydrates (%) in leaves was determined according to Herbert *et. al.*, (1971).
- Nitrogen, phosphorus and potassium % in leaves were determined according to Jackson (1973).

The layout of the experiment was completely randomized design containing 7 treatments. Each treatment was repeated three times, each replicate contained 6 plants i.e. 18 plants in each treatment.

Statistical analysis

All data were subjected to statistical analysis according to the procedure reported by Snedecor and Cochran (1982) and means were compared by New Less Significant Difference (L.S.D) test at the 5% level of probability in the two seasons.

Table a. Physical and chemical analysis of the used soil.

Soil type	Particle size (%)	Cations (meq/l)		Anions(meq/l)					
		Ca ⁺⁺	10.00	HCO ₃ ⁻	1.30	N	425 ppm	B.D (g/cm ³)	1.25 5
Sandy	51.39	Mg ⁺⁺	8.02	SO ⁻⁴	0.30	P	38.0 ppm	WHC (%)	46
Silty	31.63	Na ⁺	1.00	Cl ⁻	0.45	K	564 ppm	pH	7.22
Clayey	17.98	K ⁺	0.25	-----	-----		-----	E.C(ds/m)	1.02

Table b. Chemical analysis of the used peatmoss.

Organic matter	90-95 %	Water relation capacity	60-75 %	K	1.77 %
Ash	5-10 %	Salinity	0.3 g/l	Fe	421 ppm
Density (Vol.Dry)	80-90 Mg/l	N	1.09 %	Mn	27 ppm
pH value	3.4	P	0.23 %	Zn	41 ppm

RESULTS AND DISCUSSION

I- Effect of biofertilizers on vegetative growth traits

Data shown in Table (1) prove that different trends on the obtained values were detected due to applying the different biofertilizers levels on plant height, stem diameter and leaves parameters.

Plant height and stem diameter

Data in Table (1) clear that all treatments significantly increased plant height and stem diameter over control except for stem diameter as the differences were not reached to the level of significance in both seasons. Moreover, the highest values of plant height and stem diameter were found with plants treated with 10g followed by 5g pot⁻¹ Biogien in both seasons. However, the second category was occupied by plants treated with 10g pot⁻¹ Rhizobacterien in both seasons. Generally, the increment in biofertilizers level from 5g to 10g pot⁻¹ led to an increase in plant height and stem diameter in both seasons. These results are in harmony with those of Eliwa *et. al.* (2009) on *Iris tingitana* who stated that EM (5%) improved plant height and stalk diameter. Likewise, Martin *et. al.* (2003) mentioned that height and trunk diameter of *Quercus palustris* and scarlet Oak (*Q. coccinea*) seedlings colonized with ectomycorrhizae were better than those of uncolonized ones. Meanwhile, the increase in plant height due to microorganisms of biofertilizer can be attributed to the capability of those microorganisms to induce beneficial effects on plant growth by contributing hormones such as cytokinins and auxins (Bouton *et al*, 1985).

Number of leaves and their fresh and dry weights

Data concerning leaves number formed on plants as affected by biofertilizers are presented in Table (1). Generally, the different fertilization treatments caused an increment in number of leaves plant⁻¹ in both experimental years (which ranged from 13.55 to 16.70 in 1st season and 13.00 to 18.40 in 2nd one) more than control (9.67 and 10.33 in both seasons, respectively). In this respect, the utmost high values in leaf formation was obtained in plants which received Biogien followed by Rhizobacterien in both seasons. Moreover, applying the lowest rate of biofertilizers showed also a favorable effect in this respect.

Regarding fresh and dry weights of leaves (g) as affected by biofertilizers data are presented in Table (1). Generally all treatments significantly increased fresh and dry weights of leaves (g) over control in both seasons. The heaviest fresh and dry weights of leaves were found in treated plants with Biogien followed by Rhizobacterien compared with the other treatments and the differences were significant in both

seasons. The previous results are in parallel line with Abdel Fattah *et. al.* (2009) on *Dracaena* and *Ruscus* who found that 10ml/l biofertilizer significantly increased number of leaves and their fresh and dry weights.

Blade area

The data on blade area shown in Table (1) reveal that supplying plants with biofertilizers at the levels of 5 and 10g pot⁻¹ led to increase blade area over that gained from the control in both seasons. Meanwhile, blade area was significantly increased comparing with that attained from the control or other biofertilizers by receiving plants the level of 10g pot⁻¹. In this connection, the pronounced effect of fertilization resulted from 10g pot⁻¹ Biogien followed by 10g pot⁻¹ Rhizobacterien. These results are in harmony with those of Ahmed *et. al.* (2005) on *Populous nigra* and Sarhan *et. al.* (2007) on *jojoba*.

Table.1. Effect of some biofertilizers on some vegetative traits of *Dracaena fragrans* 'Massangeana' during two successive seasons (2009 & 2010).

1 st season						
Treatments	Plant height	Stem diameter	Leaves			
	(cm)	(cm)	No. (cm)	Blade area (cm ²)	F.W. (g)	D.W. (g)
Control	50.25	1.20	9.67	82.51	37.66	4.11
5g Microbien	56.23	1.44	13.55	94.90	42.71	5.16
10g Microbien	60.32	1.52	15.60	98.60	47.00	7.15
5g Rhizobacterien	62.18	1.46	14.45	95.53	50.00	7.30
10g Rhizobacterien	68.30	1.70	14.85	98.88	55.00	9.08
5g Biogien	73.63	1.75	15.81	100.0	62.77	12.56
10g Biogien	78.90	1.81	16.70	110.0	66.73	13.04
L.S.D. 0.05	2.67	1.26	2.49	2.82	2.63	2.66
2 nd season						
Control	54.17	1.25	10.33	70.40	39.80	4.80
5g Microbien	61.55	1.51	13.00	95.30	46.55	6.33
10g Microbien	65.61	1.72	14.65	110.0	50.20	7.35
5g Rhizobacterien	69.25	1.65	14.89	96.46	54.67	8.05
10g Rhizobacterien	74.58	1.78	15.61	113.5	59.30	10.13
5g Biogien	79.46	1.88	17.82	116.0	64.20	13.35
10g Biogien	82.56	1.91	18.40	125.0	68.00	14.03
L.S.D. 0.05	2.56	1.36	2.51	2.77	2.63	2.56

II- Effect of biofertilizers on root parameters

Data in Table (2) clearly show that all treatments significantly increased root number, length and their fresh and dry weights over control in both seasons. Beneficial effects were scored on root number, length and their fresh and dry weights due to using the biostimulants treatment in both seasons, with the mastery of Biogien followed by Rhizobacterien treatments which gave the highest number, the tallest roots and the heaviest fresh and dry weights of roots than other treatments used in both seasons. On the same line El-Sayed and El-Feky (2007) declared that biogien at 10g plant⁻¹ improved vegetative and root growth of *Ficus binnendijkii* plants. Similar results were obtained by Abdel Fattah *et. al.* (2009) and Ahmed *et. al.* (2005).

In this respect, improving the vegetative and root growth may explain the role of biofertilizers which fix more atmospheric N and secrete more vitamins and growth promoting substances necessary for good and healthy growth.

Table 2. Effect of some biofertilizers on root traits of *Dracaena fragrans* 'Massangeana' during two successive seasons (2009 & 2010).

1st season				
Treatments	Roots			
	No. (cm)	Length (cm)	F.W. (g)	D.W. (g)
Control	10.40	22.80	9.150	2.200
5g Microbien	14.33	33.79	14.75	4.130
10g Micrope	16.27	35.70	15.60	5.067
5g Rhizobacterien	16.67	38.20	16.55	6.100
10g Rhizobacterien	20.26	40.34	18.11	8.350
5g Biogien	22.30	41.26	20.61	8.120
10g Biogien	25.34	44.67	21.80	8.250
L.S.D. 0.05	2.49	2.52	2.51	2.59
2nd season				
Control	11.32	24.50	11.68	2.291
5g Microbien	14.91	37.91	14.87	4.201
10g Microbien	17.50	39.85	16.21	5.360
5g Rhizobacterien	18.09	38.81	17.23	5.820
10g Rhizobacterien	19.80	43.70	18.90	7.620
5g Biogien	21.92	44.60	20.92	8.150
10g Biogien	25.22	48.20	22.09	8.750
L.S.D. 0.05	2.58	2.53	2.54	2.54

III- Chemical composition as affected by biofertilizers

Results of Table (3) show the increment in chlorophyll (a) and (b) accumulation in leaves associated with the different fertilizer treatments compared with the control in both seasons. However, the promotive action was more obvious with applying Biogien followed by Rhizobacterien treatments in the two seasons. However, a favorable influence was detected due to receiving the plants 10g pot⁻¹ Biogien which reached the highest effect in the two seasons. The aforementioned findings are in harmony with those of Eliwa *et. al.* (2009) on *Iris tingitana* cv. Wedgewood. Regarding the effect on the carotenoids content, a clear increment in such constituents in leaves was detected with control treatment (0.44 and 0.46 mg/g f.w., respectively in both seasons). Meanwhile, supplying plants with Biogien as well as Rhizobacterien gave a contrary effect. Such treatments declined the values of the same constituents in the two seasons. In this connection, El- Khateeb *et. al.* (2010) found that the use of mycorrhizae on *Calia secundiflora* decreased the leaves content of carotenoids.

Regarding total carbohydrates % in leaves, as shown in Table (3) plants treated with 10g pot⁻¹ Biogien considerably increased total carbohydrates % in leaves over control and other treatments used (33.73 and 36.80%, respectively) in both seasons. Also, great influence was observed in the obtained values as a result of supplying the plants with 5g pot⁻¹ Biogien (32.38 and 36.25%, respectively) followed by 10g pot⁻¹ Rhizobacterien treatment in both seasons. The other biofertilizers revealed also an increment but with less effect on total carbohydrates content. Referring to the increment in total carbohydrates content in leaves due to biofertilizers, El- Khateeb *et. al.* (2010) found that the use of Mycorrhizae on *Calia secundiflora* increase the leaves content of total carbohydrates.

As for the mineral analysis, data in Table (4) revealed a clear increment in nitrogen, phosphorus and potassium accumulation in leaves in response to the different fertilizer treatments so as to reach their maximum records with the treatment of 10g pot⁻¹ Biogien in the two seasons. Meanwhile, control plants recorded the lowest values in this concern. In addition, supplying plants Rhizobacterien at 10g pot⁻¹ proved its superiority in raising nitrogen accumulation in leaves in both seasons.

These results are supported by the obtained data of Dubey and Ginwal (1997) reported that Mycorrhizae increased the absorption area of the roots and provided host plants with nutrients. Mycorrhizae improve the uptake of nutrients. In addition, a biofertilizer as a preparation containing many races of beneficial bacteria that can fix atmospheric N and can release nutrients from rocks and organic matter in the soil to

become available for plants (Quoreshi, 2003) on *Picea mariana*. On the same line, were those results attained by Attia and Abdel-Azeem (2005) on *Lawsonia inermis*.

Table. 3. Effect of some biofertilizers on total carbohydrates% and photosynthetic pigments content in leaves of *Dracaena fragrans* 'Massangeana' during two successive seasons (2009 & 2010).

Treatments	Total carbohydrates (%)		Cl. a (mg/g f.w.)		Cl. b (mg/g f. w.)		Carotenoids (mg/g f.w.)	
	2009	2010	2009	2010	2009	2010	2009	2010
Control	19.85	20.15	0.80	0.84	0.32	0.30	0.44	0.46
5g Microbien	23.50	26.00	0.98	1.09	0.36	0.37	0.34	0.33
10g Microbien	24.80	28.13	1.08	1.12	0.39	0.41	0.38	0.39
5g Rhizobacterien	28.25	31.40	1.16	1.18	0.41	0.43	0.35	0.36
10g Rhizobacterien	30.68	33.75	1.21	1.25	0.44	0.46	0.37	0.37
5g Biogien	32.38	36.25	1.28	1.31	0.45	0.47	0.35	0.36
10g Biogien	33.73	36.80	1.33	1.35	0.48	0.49	0.33	0.31

Table. 4. Effect of some biofertilizers on N, P and K (%) in leaves of *Dracaena fragrans* 'Massangeana' during two successive seasons (2009 & 2010).

Treatments	Nitrogen		Phosphorus		Potassium	
	2009	2010	2009	2010	2009	2010
Control	1.21	1.19	0.31	0.27	1.65	1.72
5g Microbien	1.46	1.51	0.33	0.34	2.33	2.45
10g Microbien	1.58	1.63	0.35	0.35	2.57	2.51
5g Rhizobacterien	1.60	1.71	0.35	0.36	2.63	2.61
10g Rhizobacterien	1.69	1.77	0.36	0.36	2.67	2.65
5g Biogien	1.78	1.80	0.38	0.40	2.75	2.73
10g Biogien	1.82	1.84	0.39	0.41	2.79	2.78

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استجابة نبات دراسينا الذرة صنف 'Massangeana' لبعض الأسمدة الحيوية

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قسم بحوث نباتات الزينة و تنسيق الحدائق - معهد بحوث البساتين- مركز البحوث الزراعية - الجيزة - مصر .

أجريت تجربة أصص فى صوبة سيران بمشغل قسم بحوث نباتات الزينة و تنسيق الحدائق - معهد بحوث البساتين - مركز البحوث الزراعية- جيزة- مصر خلال موسمى 2009 و2010 لدراسة استجابة نبات دراسينا الذرة صنف 'Massangeana' للمعاملة بالأسمدة الحيوية وتأثير ذلك على الصفات المورفولوجية والمحتوى الكيماوى للنبات وقد أظهرت النتائج الأتى :

- جميع معاملات التسميد الحيوى كان لها تأثير منشط لمعظم الصفات النباتية المدروسة مقارنة بمعاملة الكونترول.

- حققت معاملة نبات دراسينا بالبيوجين (10،5جم/أصيص) أو المعاملة بالريزوباكثيرين (5،10جم /أصيص) حققت أفضل النتائج بالنسبة للنمو الخضرى [ارتفاع النبات (سم) ، قطر الساق (سم) ، مساحة نصل الورقة (سم²)، عدد الأوراق / نبات والوزن الطازج والجاف للأوراق] كما أدت هذه المعاملات أيضاً إلى زيادة كل من أطوال الجذور وعددها والوزن الطازج والجاف للجذور .

- المعاملة بالبيوجين يليها المعاملة بالريزوباكثيرين حسنت بشكل واضح محتوى الأوراق من الكلوروفيل أ، ب والكاروتينويدات (ملجم / جم وزن طازج) كما حققت أعلى زيادة فى النسبة المئوية للكربوهيدرات الكلية فى الاوراق .

-أظهرت النتائج أن كل معاملات التسميد أدت إلى زيادة واضحة فى النسبة المئوية لكل من النتروجين والفسفور والبوتاسيوم فى الاوراق حيث بلغ أقصاه نتيجة للمعاملة بالبيوجين (10جم/ أصيص).

- أشارت النتائج إلى أن إضافة البيوجين (10جم /أصيص) حققت أفضل النتائج فى جميع القياسات النباتية المدروسة لنبات دراسينا .

- بصفة عامة كانت السيادة فى جميع القياسات السابقة نتيجة المعاملة بالبيوجين يليها المعاملة بالريزوباكثيرين والتي أعطت أعلى النتائج فى معظم الحالات.

الكلمات الدالة : نبات دراسينا - بيوجين - ريزوباكثيرين - ميكروبيين .