# Impact of Foliar Spray of Inorganic Fertilizer and Bioregulator on Vegetative Growth and Chemical Composition of *Syngonium Podophyllum* L. Plant at Nubaria

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**Abstract:** A pot experiment was carried out during 2007 and 2008 seasons at Research Production Station, of National Research Centre at Nubaria, Egypt. The aim of this work is to study the effect of foliar spray of inorganic fertilizer (Grow-more) (0.0, 1.0 and 2.0 ml/L) and bioregulator (Putrescine) (0, 100 and 200 ppm) and their interaction on vegetative growth and some chemical composition of *Syngonium podophyllum* L. plant. Most criteria of vegetative growth expressed as plant height, stem diameter, number of leaves, leaf area, fresh and dry weight of plant organs were significantly affected by application of the two factors which were used in this study. Chemical constituents i.e. Chl. (a), Chl. (b), carotenoids, nitrogen, phosphorus and potassium content in the leaves have increased in comparison control plants. Highest values of the mentioned characters were obtained from plants treated with Grow-more 2.0 ml/L combined with Putrescine 100 ppm followed by Grow-more 2.0 ml/L and Putrescine 100 ppm. [Journal of American Science 2010;6(8):288-294]. (ISSN: 1545-1003).

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## 1. Introduction

Genus Syngonium includes thirty three species, native to tropical South America and Africa. *Syngonium podophyllum* L. family Araceae, commonly name arrowhead plant is one of the most well known and verstile herb. African evergreen is the most commonly produced species in the foliage industry. It is recognized by its juvenile leaves, which are simple, alternately, arranged, saggitate in shape, approximately 7.5 -17.5 cm long. Mature leaves are dramatically different they are compound with 3-11 elliptic leaf lets , and the center leaflet may attain a length of 19 cm with petiole reached 38.0 cm in long. The shape and color of the juvenile leaves in frequently used to name the cultivars that are commercially available. Syngonium is commonly used as hanging baskets, if upright growth is desired, a totem, tillers or other support is needed, and otherwise plants can be used as ground covers. The plants can be used in various such as offices, shops, hospitals, conferences, rooms and windows (Uphof, 1959).

There are many beneficial effects of micronutrients on plants and their involvement in the other processes, carbohydrate and nitrogen metabolism, as well as the resistance of plant disease and adverse environmental conditions. Micronutrients are also essential for organization and rapid alternation of nutrition compound within plant owing to their great importance in contribution to direct the enzymes way in metabolism (Massoud *et al.,* 2005). Therefore, both granular and fluid NPK fertilizers are commonly used as carriers of the micronutrients with mixed fertilizers is a convenient method of application and allows more uniform distribution with conventional application equipment. Micronutrients are essential for plant growth, but required in much smaller amount than those of the primary nutrients Brady and Weil, (2000).

Polyamines have been ascribed various roles such as that of a new class of plant growth regulators, hormonal second messengers and as one of resources of carbon and nitrogen at least polyamine synthesis from ornithine and arginine. Polyamines are essential for cell viability, and are correlates with or required for a variety of physiological events. The bound are conjugated to various secondary metabolism, these conjugated may have at least as significant function in plant development as free polyamines. In plant polyamines have been implicated in a wide range of biological processes including growth development, and biotic stress responses, cell division, differentiation, flowering, and delay senescence (Kuehn and Phillips, 2005).

Many investigators found that Putrescine has many physiological processes such as, regulation of elongation, it is correlated with cell division and increased number of roots, stimulated development and growth of economic crops (Yang et al., 1996) and Chattopadhayay *et al.,* 2002). Younghua *et al.,* (1996); Gupta *et al*., (2003); Hussien *et al.,* (2006) reported that polyamines stimulated many physiological; processes including protein synthesis and photosynthetic activity. El-Bassiouny (2004) found that foliar application with polyamines cause significant increase in growth characters, chlorophyll and soluble protein content, consequently increase yield of pea plants.

The objective of the present investigation was to study the effect of foliar inorganic fertilizer (Grow-more) and polyamine (Putrescine) and their interactions on growth and some chemical constituents of *Syngonium podophyllum* L. plant.

## 2. Material and Methods

The experiment was carried out at National Research Centre (Research and Production Station, Nubaria) during two successive seasons of 2007 and 2008, to investigate the response of *Syngonium* plant to foliar inorganic fertilizer (Grow-more) and Putrescine and their interactions on growth and chemical composition. On 20th Feb. 2007, 2008 seasons, vegetative uniform cuttings (18-22 cm long) were taken from *Syngonium* plants cuttings were treated for one minute with 1000 mg/L indole butric acid before planting in pot to enhance rooting.

Rooted cuttings were planted in black plastic pot 10 cm in diameter (one plant/pot) and grown in shaded greenhouse media formulated by combination of peatmoss and sandy soil (1:1 v/v). the seedlings were transplanted on 20th April 2007 and 2008 seasons, in plastic pots 30 cm in diameter filled with 10 kg of peatmoss and sandy soil (1:1, v/v), arranged in a complete randomized design with three replicates. Each replicate consisted of three plants. Water requirement were relative humidity maintained between 40-60 %, allow the surface of potting media to dry slightly before irrigation.

Each pot was fertilized twice with 1.5 g nitrogen as ammonium nitrate (33.3 % N) and 1.0 g potassium sulphate (48.5 % $K_2O$), the fertilizers were applied at 30 and 60 days after transplanting. Phosphorus as calcium superphosphate (15.5 % $P_2O_5$) was mixed with soil before transplanting at the rate of 3.0 g/pot. Other agricultural processes were performed according to normal practice. Plants were sprayed with different concentration of foliar inorganic fertilizer (Grow-more), Table (1) which produced by Ajemco International Company at the rate of (0.0, 1.0 and 2.0 ml/L), Putrescine was sprayed with concentrations (0, 100 and 200 ppm), interactions treatments were of the different concentrations of the two factors had been also carried out, in addition to untreated plants (control) which were sprayed with tap water. Foliar application of Grow-more and Putrescine was carried out two times of 30 days intervals, starting at 20th July at both seasons. The experiments were sit in a completely randomized design (CRD) with three replicates and two factors.

The following data were recorded on 30th Nov. 2007 and 2008 seasons, the recorded data were plant height (cm), stem diameter (mm), number of leaves, leaf area ($cm^2$) of 4 and 5 base leaves, fresh and dry weights (gm) of plant organs. Photosynthetic pigments i.e. chlorophyll (a and b) and careteniods were determined exactly 0.1 g of fresh leaves of syngonium plants using the spectrophotometric method developed by Metzzner ***et al***., (1965). Total nitrogen was determined by Chapman and Pratt (1961); while phosphorus determination carried out colorimetrically according to King (1951) potassium were determined photomerically by the flame photometer method as described by Brown and Lilland (1946).

Data obtained were subjected to standard analysis of various procedures. The values of LSD at 5% level as reported by Snedcor and Cochran (1980).

## 3. Results and Discussions

Effect of foliar fertilizer Grow-more and Putrescine:

1- Vegetative growth:

Data presented in Table (2) elucidate that foliar spray of Grow-more on *Syngonium podophyllum* L. plants significantly increased all growth parameters under study at 1.0 and 2.0 ml/L.

The highest values of plant height, stem diameter, number of leaves/plant, leaf area, fresh and dry weights of roots and leaves were obtained at 2.0 ml/L. as compared with control plants. Fresh weight of roots and leaves were exceeded by 19.73 and 16.48 %, respectively than the control plant. These results are in accordance with those obtained by Nemeat Alla and El-Geddawy (2001), they reported that used two times foliar spray of micronutrients mixture significantly increased root length, root diameter and yield of sugar beet. Mirvat and Alice (2001) reported that foliar application with micronutrients on sugar beet plant growth in reclaimed sandy soil were increased all yield components, El-Zanaty ***et al.,*** (2000) reported that foliar spray of Fe-EDDHA (6% Fe) tow times, significantly increased both fresh and dry weight of sugar beet plant. These results may be due to micronutrients boron, which helps transport vital sugars through plant membranes and promotes proper cell division, cell wall formation and development, also due to zinc which acts as enzyme activator in protein, hormone (i.e., IAA) and RNA / DNA synthesis, metabolism and increased growth.

Data in Table (2) showed that foliar application of Putrescine on syngonium plants significantly increased all growth characters at 100 and 200 ppm. The highest values of plant height, stem diameter, number of leaves, leaf area, fresh and dry weights of roots and leaves were obtained at 100 ppm Putrescine as compared with control plants. Fresh weight of root and leaves were exceeded by 22.41 and 22.31 %, respectively than the control plant.

These results are in agreement with those obtained by (Kuchn and Phillps, 2005), who reported that polyamines have been implicated in a wide range of biological processes including growth development and a biotic stress responses and cell division, differentiation. Talaat *et al.,* (2005) reported that the increase in shoot growth could be due to enhanced cell division activity on *Catharanthus*. Galston (1983) reported that polyamines are currently considered to be regulators of plant growth and development owing to their effects on cell division and differentiation. Polyamines have been ascribed various roles such as that a new class of plant growth regulators, hormonal second messengers and as one of the reserves of carbon and nitrogen at least polamines synthesis from ornithine and originine via ornithine decarboxylase and orginine decarboxylase (Asthir *et al.,* 2004). As regarding the interaction treatments, foliar application of Grow-more and puterscine, the data show that significantly increased all growth parameters under study. The highest values of growth parameters were obtained by Grow-more 2 ml/L combined with puterscine 100 ppm followed by Grow-more 2 ml/L and puterscine 100 ppm as compared with control plants. Data emphasized that interactions effects were significantly all growth parameters under study i.e. plant height, stem diameter, number of leaves, leaf area, and consequently fresh and dry weights of roots and leaves of *Syngonium podophyllum* L. plants.

The aforementioned results indicate that puterscine combined with Grow-more micronutrient solution favours the growth of Syngonium plants, which in turn reflect higher and good growth and consequently fresh weight which was regarded as a better indicator for foliar quality.

**2-Chemical constituents:**

Pigments content: Data in Fig (1) indicate that foliar application of Grow-more and puterscine separately to Syngonium plants significantly increased chl (a), chl (b) and total caroteniods content. Grow-more foliar spray induced effects on previous parameters by increasing its concentration. These results were in accordance with those obtained by Ratanarat *et al.*, (1990).

Putrescine induced effects on chlorophylls content, the highest values was recorded at put. 100 ppm. Yang *et al.,* (1996); Chattopadhayay *et al.*, (2002) reported that polyamines stimulated some physiological responses including vegetative growth and photosynthetic activity.

Concerning the interaction, foliar spray with Grow-more at 2 ml/L combined put. 100 ppm followed by Grow-more 2 ml/L and put 200 ppm, lead to significantly increase in this criterion. As regarding that spraying Syngonium plants with Putrescine at all used levels led to increase in (chl a, chl b and caroteniods) content compared with control plants.

These results may be due to iron and manganese which promote chlorophyll production and photosynthesis processes and cupper which helps in chlorophyll formation, these increments led to positive effects on growth parameters.

Minerals ions content: It is evident from the data in Fig (2) that foliar application of Grow-more or Putrescine increased the total amount of nitrogen, phosphorus and potassium ions content compared with control plants. These results were in line with those obtained by Sharma *et al.,* (2002) who found that application of organic materials either alone or in combination with chemical fertilizers caused substantial increase in total N, and available P, K as well as increased wheat and straw yield. As regarding the interaction treatments, foliar application of the two factors under study, the data show that significantly increased N, P and K contents of Syngonium plant. The highest values of mineral ions content were obtained by Grow-more 2 ml/L combined with put. 100 ppm followed by Grow-more 2 ml/L and put. 200 ppm. The highest recorded data in total protein percentage (11.19 and 10.99 %) were obtained from Grow-more 2 ml/L combined with put. 100 ppm, Grow-more 2 ml/L with put. 200 ppm. These increments led to positive effect of growth parameters and enhancing effect on plant metabolism which was regarded as a better indicator for foliar quality.

**Table (1): Chemical properties of inorganic fertilizer (Grow-more) which used in this study**

| Grow-more content | $N_2$ | $P_2O_5$ | $K_2O$ | Fe | Zn | Mg | Ca | Cu | S | B | Mo |
|---|---|---|---|---|---|---|---|---|---|---|---|
| % | 11 | 6 | 8 | 0.15 | 0.15 | 0.14 | 0.02 | 0.20 | 0.02 | 0.01 | 0.01 |

**Table (2): Effect of foliar inorganic fertilizer (Grow-more) and Putrescine on vegetative growth of *Syngonium podophyllum* L. plants (means of two seasons 2007 and 2008)**

| Characters / Treatments | Plant height | Stem diameter | No. of leaves | Leaf area | Root FW | Root DW | Leaves FW | Leaves DW |
|---|---|---|---|---|---|---|---|---|
| | cm | mm | | $cm^2$ | g/plant | | | |
| Effect of micronutrients | | | | | | | | |
| Control | 158.2 | 192.0 | 19.4 | 62.84 | 29.0 | 9.72 | 68.5 | 23.48 |
| Grow- 1ml/L | 159.2 | 194.0 | 20.7 | 64.10 | 29.1 | 10.37 | 71.1 | 24.05 |
| Grow-2ml/L | 194.0 | 2.5 | 23.2 | 73.45 | 34.7 | 12.28 | 79.8 | 26.92 |
| LSD 5% | 3.2 | 0.2 | 1.7 | 1.95 | 1.9 | 0.94 | 2.2 | 1.71 |
| Effect of Putrescine | | | | | | | | |
| Control | 155.4 | 184.0 | 18.3 | 61.92 | 27.9 | 9.73 | 66.3 | 22.99 |
| Put. 100 ppm | 193.2 | 2.5 | 23.9 | 73.94 | 34.2 | 11.94 | 81.1 | 26.85 |
| Put. 200 ppm | 162.8 | 2.0 | 21.1 | 65.33 | 30.6 | 10.70 | 72.1 | 24.61 |
| LSD 5% | 3.2 | 0.2 | 1.7 | 1.95 | 1.9 | 0.94 | 2.2 | 1.71 |
| Effect of interaction | | | | | | | | |
| Control | 115.7 | 1.2 | 13.0 | 48.45 | 19.5 | 6.20 | 49.3 | 18.00 |
| Grow- 1ml/L | 164.1 | 1.9 | 20.0 | 65.50 | 30.0 | 11.00 | 71.5 | 24.00 |
| Grow-2ml/L | 186.7 | 2.3 | 22.0 | 71.82 | 34.3 | 12.00 | 78.0 | 26.92 |
| Put. 100 ppm | 193.7 | 2.5 | 24.3 | 75.33 | 35.0 | 12.39 | 83.1 | 27.33 |
| Put. 200 ppm | 165.3 | 2.0 | 21.0 | 67.44 | 32.4 | 10.58 | 73.2 | 25.10 |
| Grow 1ml/L +Put. 100 ppm | 165.7 | 1.9 | 21.3 | 66.80 | 31.3 | 10.11 | 72.7 | 24.66 |
| Grow1ml/L +Put. 200 ppm | 147.0 | 1.9 | 20.0 | 60.00 | 26.0 | 10.00 | 69.0 | 23.50 |
| Grow 2ml/L + Put. 100 ppm | 220.3 | 2.9 | 26.0 | 79.68 | 36.3 | 13.33 | 87.5 | 28.56 |
| Grow 2ml/L +Put. 200 ppm | 175.0 | 2.2 | 21.7 | 68.33 | 33.5 | 11.52 | 74.0 | 25.23 |
| LSD 5% | 5.6 | 0.3 | 2.9 | 3.38 | 3.3 | 1.63 | 3.8 | 2.92 |

Micronutrients:micro, Putrescine:Put., Grow: Grow-more, FW: fresh weight, DW: dry weight.

Table (3) Effect of foliar inorganic fertilizer (Grow-more) and Putrescine on vegetative growth of *Syngonium podophyllum* L. plants (means of two seasons 2007 and 2008)

| Treatments \ Characters | Chlorophyll(mg/g) | | | Total carot. | N % | P % | K % | Total protein % |
|---|---|---|---|---|---|---|---|---|
| | a | b | a+b | | | | | |
| **Effect of micronutrients** | | | | | | | | |
| Control | 0.66 | 0.32 | 0.99 | 0.20 | 1.65 | 0.28 | 3.01 | 10.30 |
| Grow- 1ml/L | 0.67 | 0.33 | 1.00 | 0.21 | 1.66 | 0.28 | 3.08 | 10.42 |
| Grow-2ml/L | 0.75 | 0.39 | 1.13 | 0.25 | 1.74 | 0.33 | 3.65 | 11.00 |
| LSD 5% | 0.05 | 0.03 | 0.05 | 0.01 | 0.03 | 0.01 | 0.29 | 0.29 |
| **Effect of Putrescine** | | | | | | | | |
| Control | 0.63 | 0.31 | 0.94 | 0.19 | 1.63 | 0.27 | 2.89 | 10.27 |
| Put. 100 ppm | 0.75 | 0.39 | 1.14 | 0.25 | 1.74 | 0.33 | 3.66 | 10.87 |
| Put. 200 ppm | 0.69 | 0.35 | 1.04 | 0.22 | 1.67 | 0.29 | 3.20 | 10.58 |
| LSD 5% | 0.05 | 0.03 | 0.05 | 0.01 | 0.03 | 0.01 | ** | 0.29 |
| **Effect of interaction** | | | | | | | | |
| Control | 0.51 | 0.21 | 0.72 | 0.12 | 1.50 | 0.19 | 2.17 | 9.40 |
| Grow- 1ml/L | 0.66 | 0.33 | 0.99 | 0.12 | 1.67 | 0.29 | 3.08 | 10.59 |
| Grow-2ml/L | 0.73 | 0.39 | 1.12 | 0.25 | 1.73 | 0.32 | 3.42 | 10.81 |
| Put. 100 ppm | 0.76 | 0.41 | 1.17 | 0.26 | 1.76 | 0.34 | 3.63 | 11.00 |
| Put. 200 ppm | 0.70 | 0.35 | 1.05 | 0.23 | 1.68 | 0.29 | 3.24 | 10.50 |
| Grow 1ml/L +Put. 100 ppm | 0.69 | 0.34 | 1.03 | 0.22 | 1.67 | 0.29 | 3.17 | 10.42 |
| Grow1ml/L +Put. 200 ppm | 0.65 | 0.32 | 0.97 | 0.19 | 1.64 | 0.27 | 3.00 | 10.25 |
| Grow 2ml/L + Put. 100 ppm | 0.80 | 0.42 | 1.22 | 0.28 | 1.79 | 0.36 | 4.18 | 11.19 |
| Grow 2ml/L +Put. 200 ppm | 0.72 | 0.37 | 1.09 | 0.24 | 1.70 | 0.30 | 3.33 | 10.99 |
| LSD 5% | 0.08 | 0.06 | 0.09 | 0.02 | 0.06 | 0.02 | 0.50 | 0.50 |

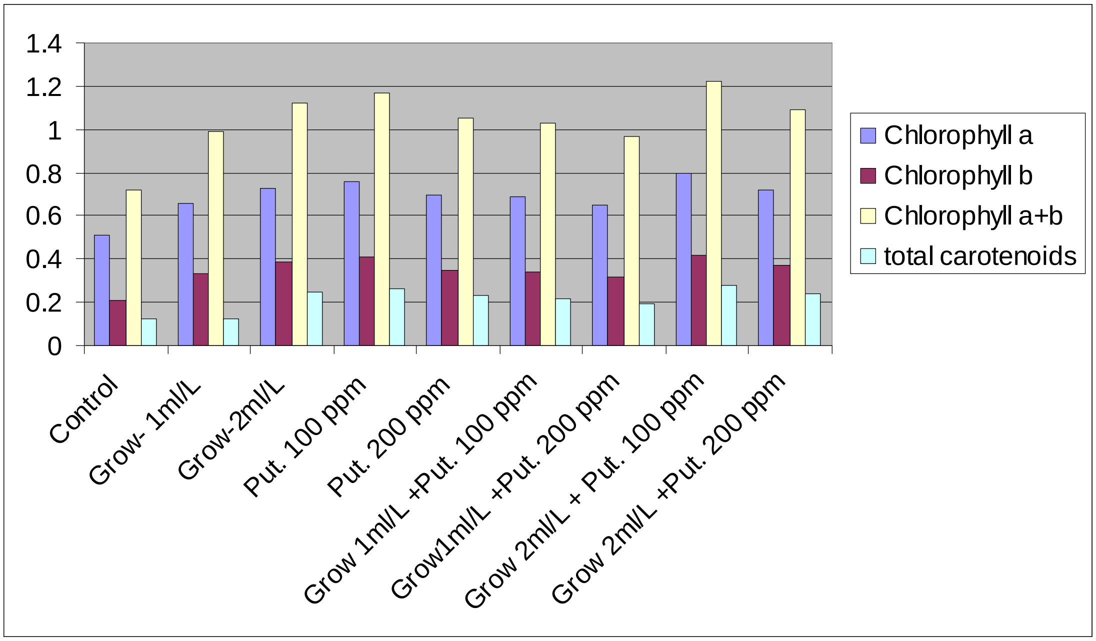


**Fig (1) Effect of foliar inorganic fertilizer (Grow-more) and Putrescine on chlorophyll (a, b, a+b) and total carotenoids of *Syngonium podophyllum* L. plants**

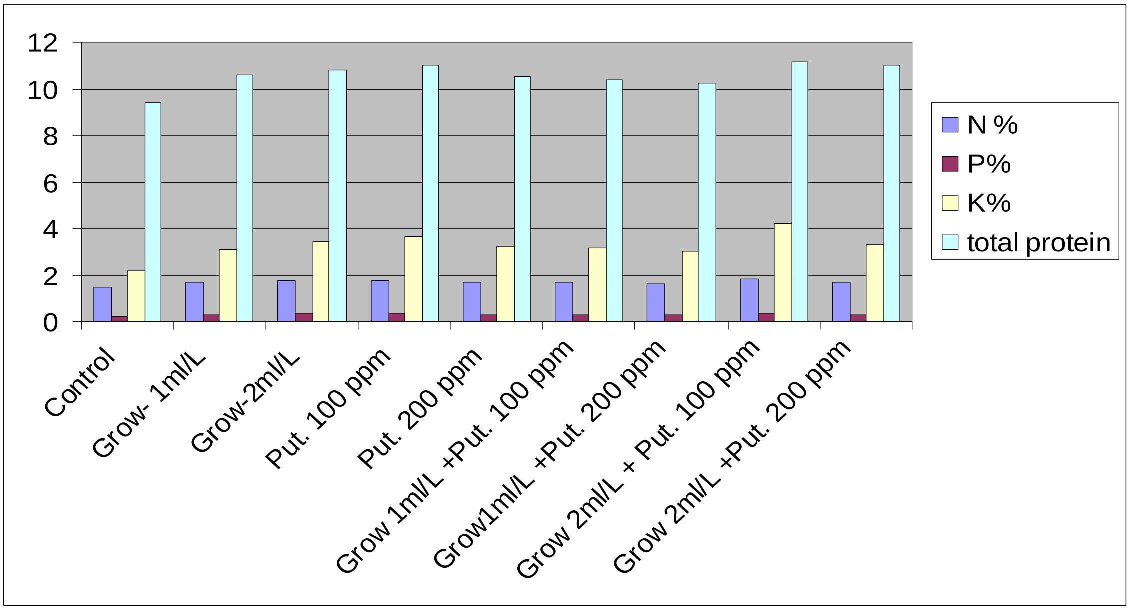


**Fig (2)Effect of foliar inorganic fertilizer (Grow-more) and Putrescine N, P, K and total proteins percentage of *Syngonium podophyllum* L. plants**

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