Int.J.Curr.Microbiol.App.Sci (2020) *9*(12): 2783-2788

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 12 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.912.332

Standardization of Nutrients and Growth Promoters in *Dendrobium* Sonia 'Earsakul'

G. Ashok Kumar* and A. Jaya Jasmine

Floriculture Research Station, Tamil Nadu Agricultural University, Thovalai, Tamil Nadu, India

**Corresponding author*

Keywords

Nutrients, Growth promoter, Growth and flower

Article Info

Accepted:
18 November 2020
Available Online:
10 December 2020

A B S T R A C T

The present investigation entitled "standardization of nutrients and growth promoters in *Dendrobium* Sonia 'Earsakul'" was carried out at Floriculture Research Station, Thovalai, Kanyakumari district of Tamil Nadu during 2018. The experiment was laid out in a completely randomized design with 12 treatments and each treatment replicated thrice. The data recorded on various parameters *viz.*, vegetative growth, flowering and were statistically analyzed. Significant differences were observed among nutrients and growth promoters on various vegetative growth parameters in *Dendrobium* Sonia 'Earsakul'. Among all the treatments,T_8- 20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppmhas recorded significantly the highest plant height (48.12 cm), leaf length (13.88 cm), number of leaves per plant (8.67) and leaf breadth (4.01 cm). In flower traits, among all the treatments, T_8- 20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppmhas recorded significantly the maximum spike length (42 cm), flowers length (8.05 cm), flowers diameter (7.65 cm) and number of flowers per plant (7). Hence, the nutrients NPK (20:10:10) 0.5% and growth regulators GA_3 (100 ppm) and (BA 100 ppm) can be applied to *Dendrobium* plants which are required to produce more number of flowers per plant and spike length.

Introduction

Orchids, with the most fascinating and beautiful flowers in God's creation, are unique with their wide variety in exotic colour, form, size, shape, amazingly long-lasting flowers and their adaptability to diverse habitats, from terrestrial to epiphytic. They belong to the family Orchidaceace, which is one of the largest families of the flowering plants. Taxonomically, it represents the most highly evolved family among monocotyledons with 600-800 genera and 25,000- 35,000 species. Orchids are the major players in the multibillion dollar floriculture trade of the world. Today, orchids such as, *Cymbidium, Dendrobium, Oncidium,*and *Phalaenopsis* are marketed globally and the orchid industry has contributed substantially to the economy of many countries. The orchid cut flower industry is growing at the rate of 10-20 per cent annually (Pradhan, 2001). The

world's production of pot orchids were forecasted to continue increasing at a steady pace to reach a total of 305 million pots by 2014 (Wang, 2004). Hence, research on orchids is needed to support this fast expanding and profitable industry. The cultivation of dendrobiums is a very profitable enterprise; commercial cultivation has not taken the pace in India, due to lack of infrastructural facilities and varied agro-climatic conditions which obstruct the cultivation in open fields.

Orchid hybrids require optimum amount of nutrients since their growth and flowering rates are slow. The type of nutrients, their quality and frequency of application play an important role for the quality of flower. Conventional nutritional application in liquid form has been found to be very effective in orchids. The major constraints encountered in orchid cultivation are growing conditions, long pre-blooming period, susceptibility to pest and diseases *etc*.

The dry weight of *Dendrobium phalaenopsis* was severely affected by omission of N, P, K, Ca or Mg in nutrient solution and leaves dropped before deficiency symptoms appeared (Chin, 1966). Low temperature or short day treatment can affect the level of endogenous regulators (Evans, 1971; Zeevaart, 1975); it appears that the flowering response to low temperature or short day treatment in the sympodial orchids could have been resulted from change in the levels of endogenous growth regulators. Therefore, it is essential to provide continuous application of nutrients in optimum proportion and also growth regulators to produce sufficient growth, yield and quality spike. Hence, a systematic study was presently undertaken in *Dendrobium* Sonia 'Earsakul', using different combination of nutrients and growth regulators so as to maintain productivity and quality.

Materials and Methods

This study was carried out during 2018 at Floriculture Research Station, Thovalai. The experiment pertaining the standardization of nutrients and growth promoters in *Dendrobium* Sonia 'Earsakul'. Collection of new species from different parts of Kanyakumari District was done. Plant multiplication of sympodial orchids *Dendrobium* variety is kept under shade net for further multiplication (Table 1).

The major nutrients NPK at different ratios were applied as foliar sprays during vegetative and flowering stages and frequency of application was at 7 days interval. Nutrient combinations were made using ammonium nitrate, orthophosphoric acid and potassium nitrate. The plant growth regulators such as GA_3(100 ppm) and BA (100 ppm) were applied as foliar sprays and frequency of application was at 30 days interval. The experiment was laid out in a Completely Randomized Design (CRD) with 12 treatments. The observations on growth parameters like plant height (cm), leaf length (cm), number of leaves per plant and leaf breadth (cm) and the floral parameters *i.e.* spike length (cm), flowers length (cm), flowers diameter (cm) and number of flowers per plant were taken. The experimental data were analysed statistically by ANOVA (Analysis Of Variance) technique (Panse and Sukhatme, 1985).

Results and Discussion

Vegetative characters

The data pertaining to the effect of nutrients and growth promoters on plant height, leaf length, number of leaves per plant and leaf breadth of *Dendrobium* Sonia 'Earsakul' is presented in Table 2. Significant differences were observed in plant height, leaf length,

number of leaves per plant and leaf breadth at the end of vegetative stage.

Among all the treatments,T_8- 20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppmhas recorded significantly the highest plant height (48.12 cm), leaf length (13.88 cm), number of leaves per plant (8.67) and leaf breadth (4.01 cm) while, T_{11}-13: 0: 45 NPK (0.5%) + GA_3-100ppm + BA - 100ppm recorded significantly the lowest plant height (42.95 cm), leaf length (11.38 cm), number of leaves per plant (8.30) and leaf breadth (3.73 cm).

Table.1 Treatment details

Treatments	Details
T_1	19:19:19 NPK (0.5%)
T_2	20:10:10 NPK (0.5%)
T_3	13:27:27 NPK (0.5%)
T_4	13:40:13 NPK (0.5%)
T_5	13: 0: 45 NPK (0.5%)
T_6	12:61: 0 NPK (0.5%)
T_7	19:19:19 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm
T_8	20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm
T_9	13:27:27 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm
T_{10}	13:40:13 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm
T_{11}	13: 0: 45 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm
T_{12}	12: 61: 0 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm

Table.2 Standardization of foliar nutrient and growth regulator *Dendrobium* orchids

Treatments	Vegetative characters of orchid			
	Plant height (cm)	No of leaves per plant	Leaf length (cm)	Leaf breadth (cm)
T_1	36.43	7.33	13.67	3.84
T_2	36.22	7.50	13.21	3.97
T_3	34.75	7.83	12.80	3.48
T_4	29.97	6.00	12.53	3.86
T_5	32.05	5.00	13.67	3.86
T_6	36.02	7.50	12.75	3.57
T_7	33.97	7.50	11.63	3.46
T_8	48.12	8.67	13.88	4.01
T_9	32.05	7.33	12.28	3.63
T_{10}	36.55	6.33	11.63	3.68
T_{11}	42.95	8.30	11.38	3.73
T_{12}	40.77	7.17	13.11	3.53
SE (d)	**7.63**	**1.90**	**1.10**	**0.38**
CD (P = 0.05)	**15.82****	**3.95****	**2.29****	**0.80****

Table.3 Standardization of foliar nutrient and growth regulator *Dendrobium* orchids

Treatments	Flowering characters of orchid			
	Spike Length (cm)	No. of flowers / Plant	Flower Length (cm)	Flower Diameter (cm)
T_1	36.00	5.01	7.30	7.20
T_2	29.80	4.00	7.20	7.55
T_3	27.65	4.00	7.60	7.10
T_4	31.50	5.00	5.50	6.00
T_5	35.55	5.40	7.20	6.75
T_6	29.20	5.00	8.00	7.50
T_7	28.50	4.00	7.30	7.30
T_8	42.00	7.00	8.05	7.65
T_9	28.01	5.00	7.09	7.00
T_{10}	33.30	4.50	7.50	7.10
T_{11}	38.50	3.50	8.01	7.50
T_{12}	32.50	4.00	7.20	6.95
SE (d)	**2.35**	**0.62**	**0.40**	**0.48**
CD (P = 0.05)	**4.87****	**1.29****	**0.83****	**0.99****

In the present investigation, it has been observed that the plant height was significantly promoted by the application of different nutrient sources. The maximum plant height was observed with the application of 0.5% of NPK (20:10:10). The reason for increased growth with this treatment might be the influence of balanced nutritional supplements to the plant.

Nitrogen is a chief constituent of proteins for the formation of protoplasm, providing metabolic energy to cell division and cell enlargement. It is also an important constituent of amino acids and coenzymes which are of considerable importance for the growth and development.

The results of the present study are in conformity with the earlier studies (Ramya, 2007; Swapna, 2000) in *Dendrobium* Sonia 'Earsakul'. However, the increase in nitrogen concentration beyond 0.5 per cent did not produce any improvement on plant height. This might be due to the fact that increase in nitrogen above the required level sustains the auxin metabolism which could induce only fleshy growth of very soft shoots (White, 1990).

The results of the present study indicated that increased number of leaves per plant was expressed in the treatment T_8- 20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm. This indicates that the higher carbohydrate accumulation in leaves, facilitated by favourable nutrients has led to higher photosynthetic activities, resulting in an increased number of leaves. These findings are in conformity with those by Sobhana and Rajeevan (1995) in *Cymbidium tracyanum*.

As an invariable component of proteins, and therefore of protoplasm, nitrogen promotes the lateral growth. Similar results were observed in *Cymbidium* 'Pharoah Pathfinder' by Nichols (1982), wherein the author obtained increased number of leaves with increase in nitrogen supply. Similar observation was reported by Nair (2001) in

Dendrobium cv. Sonia 17. In orchids, a good correlation has been observed between leaf length and breadth and flower production as reported by White (1990). Nitrogen might be responsible for enhancing the translocation of metabolites and thereby increasing the growth.BA sprayed plants were healthier compared to GA_3 sprayed plants. Since BA reduces the production of ethylene. Hence, indicating that BA is having an influence on reduction in leaf senescence and shedding (Pileuk *et al.*, 1992).

The defoliation in GA_3 sprayed plants might be due to the epiphytic nature of the crop which receives more photosynthates for the maintenance of plant biomass through foliage. However, the foliar spray of GA_3might have antagonistic effect which is triggering the ABA metabolism in leaves hindering the sufficient supply of nitrogen to the foliage, causing yellowing and defoliation.

Similar reports were obtained by Matsumoto (2006) wherein foliar damage in *Miltoniopsis* and Bivins (1968) indicated that effect of gibberellins, however, effectively defoliated the plants at 250 or 500 ppm concentration, speeded up the senescence of leaves and delayed new growth at higher concentration.

Flower characters

The data pertaining to the effect of nutrients and growth promoters on spike length, flowers length, flowers diameter and number of flowers per plant of *Dendrobium* Sonia 'Earsakul' is presented in Table 3. Significant differences were observed in spike length, flowers length, flowers diameter and number of flowers per plant at flowering stage. Among all the treatments,T_8- 20:10:10 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppmhas recorded significantly the maximum spike length (42 cm), flowers length (8.05 cm), flowers diameter (7.65 cm) and number of flowers per plant (7) while, T_{11}-13: 0: 45 NPK (0.5%) + GA_3 - 100ppm + BA - 100ppm recorded significantly minimum spike length (38.50 cm), flowers length (8.01 cm), flowers diameter (7.50 cm) and number of flowers per plant (3.50).

The potential of exogenous application of nutrients is to cause physiological and biochemical changes, influencing all reproductive characters have been reported by many earlier workers. A balanced supply of nitrogen might have promoted the translocation of phytohormones to the shoot which probably induced flower bud initiation. This confirms the earlier findings of Binisha (2003) in *Phalaenopsis*.

In the present work, application of nutrients 0.5% of NPK in the ratio of 20:10:10 had significantly promoted number of flowers per plant and also increased the spike length. The result is supported by Yoneda *et al.*, (1999) who observed that low N rates resulted in shorter and thinner stalks and fewer flowers in *Odontoglossum* and Wang and Gregg (1994) in *Phalaenopsis*.

In the present work, application of nutrient 0.5% of NPK (20:10:10) had significantly resulted in more flowers diameter and flowers length. This indicated the vigorous photosynthetic activities of the leaf due to the application of inorganic nutrients which might have led to the efficient partitioning of photosynthates towards sink. This is in line with the observation by Bhattacharjee (1982) in *Aerides multiflora*.

In conclusion the application of NPK0.5% (20:10:10) nutrients along with GA_3(100 ppm) and BA (100 ppm) lead to defoliation and reversal towards vegetative growth of *Dendrobium* Sonia 'Earsakul'. Hence, the growth regulators GA_3(100 ppm) and (BA 100 ppm) can be applied to *Dendrobium* plants which are required to produce more number of flowers per plant and spike length.

References

Bhattacharjee, S. K. 1982. Effect of nutrition on growth and flowering of *Aerides*

multiflora Rchb. *Lalbaugh J.*, 27(3): 13-18.

Binisha, S. 2003. *Supplementary Effect of Bio-fertilizers in Dendrobium*. M.Sc. thesis, Kerala Agricultural University, Thrissur, Kerala, India.

Bivins, J. L. 1968. Effect on growth regulating substances on the size of flower and bloom date of *Cymbidium* Sicily Grandee. *Amer. Orchid Soc. Bull.*, 37: 385-87.

Chin, T. T. 1966. Effect of major nutrient deficiencies on *Dendrobium phalaenopsis* hybrids. *Amer. Orchid Soc. Bull.*, 35: 549-54.

Evans, L. T. 1971. Flower induction and the florigen concept. *Annu. Rev. Plant Physiol.*, 22: 365.

Matsumoto, T. K. 2006. Gibberellic acid and benzyl adenine promotes early f lowering and vegetative growth of *Miltoniopsis* orchid hybrids. *Hort. Sci.*, 41(1): 131-35.

Nair, U. S. 2001. *Endogenous and Exogenous Regulation of Growth and Development in Dendrobium c v. Sonia 17 and Sonia 28*. M. Sc. (Hort.) thesis, Kerala agricultural University, Thrissur, Kerala, India.

Nichols, D. G. 1982. Nutritional aspect in the culture of *Cymbidium*. *Australian Orchid Rev*., 47(2): 106-08.

Panse, U. G. and P. V. Sukhatme. 1985. *Statistical Methods for Agricultural Workers*. 4th ed, ICAR publication, New Delhi, India.

Pileuk, C., S. Watthong, and W. Teweesomboom. 1992. Effect of cytokinin application in storage life of *Dendrobium* plants under low tem perature. Fourth Asia Pacific Orchid Conference, pp.78. Chiangmai, Thailand.

Pradhan, U. C. 2001. Orchid commerce in India- guidelines for new century. *In: Orchids Science and Commerce* (eds. Promila Pathak, R. N. Sehgal, N. Shekha, M. Sharma and A. Sood). pp. 509-14. Bishen Singh Mahendrapal Singh, Dehradun, India.

Ramya, P. 2007. *Micronutrient Studies in Orchid Dendrobiumcv. Sonia 17*. M.Sc (Hort.) thesis, Tamil Nadu Agricultural University, Coimbatore, India.

Sobhana, A. and P. K. Rajeevan. 1995. Foliar application of nutrient formulations in *Cymbidium tracyanum*. *J. Orchid Soc. India*, 9(1-2): 45-50.

Swapna, S. 2000. *Regulation of Growth and Flowering in Dendrobium cv. Sonia 17*. Ph.D. thesis, Kerala Agricultural University, Thrissur, Kerala, India.

Wang, Y. T. 2004. Flourishing market for potted orchids. *Flower Tech.*, 7(5): 2-5.

Wang, Y. T. and L. L. Gregg. 1994. Medium and fertilizer affect the performance of *Phalaenopsis* orchids during flowering cycles. *Hort. Sci.*, 29: 269-71.

White, J. 1990. Beginner's series- Part II: Media mania revisited. *Amer. Orchid Soc. Bull.*, 59(2): 114-22.

Yoneda, K., N. Suzuki, and I. Hasegawa. 1999. Effect of macro element concentration on growth, flowering and nutrient absorption in an *Odontoglossum* hybrid. *Hort. Sci.*, 80: 259- 65.

Zeevaart, J. A. D. 1975. Physiology of flower formation. *Annu. Rev. Plant Physiol.*, 27: 321.

How to cite this article:

Ashok Kumar, G. and Jaya Jasmine, A. 2020. Standardization of Nutrients and Growth Promoters in *Dendrobium* Sonia 'Earsakul'. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 2783-2788.
doi: https://doi.org/10.20546/ijcmas.2020.912.332