

## Effect of nitrogen and hormones on growth and development of *Dendrobium* Cv. Sonia-17.

H. USHA NANDHINI DEVI AND N. CHEZHIAN

Horticultural College and Research Institute, Tamil Nadu Agril. Univ., Coimbatore - 641 003, Tamil Nadu

**Abstract :** An experiment to study the effect of graded doses of nitrogen with constant dose of P and K (10:10:10, 20:10:10 and 30:10:10) at two concentrations (0.1% and 0.2%) along with three growth regulators at two concentrations each of BA 100 and 200 ppm, GA<sub>3</sub> 100 and 200 ppm and IAA 250 and 500 ppm on growth and development of orchid *Dendrobium* Cv. Sonia - 17 was conducted in green house. The treatment combination, NPK 30:10:10 at 0.2% concentration + BA 200 ppm resulted in progressive growth of plants. Improvement in vegetative growth was observed through increase in the height of plant, higher number of pseudobulbs and higher number of leaves per plant.

**Key words :** Hormones, Growth regulators.

### Introduction

The commercial cultivation of orchid *Dendrobium* has not picked up in India as in other cut flower exporting countries. This is attributed to lack of infrastructural facilities and also due to varied agro climatic conditions which hinder the suitability of growing *Dendrobium* cultivars in open conditions. The cultivar Sonia - 17 is an important export-oriented cultivar and has good demand in Western Countries. The experimental evidences on improved cultural practices, particularly on their nutritional requirements, are meagre and scanty in our conditions. Therefore, optimization of nutritional requirement is a pre-requisite for getting higher returns from this cultivar. It is necessary to provide a continuous supply of nutrients to the plants to produce sufficient growth and flower spikes. Hence, the present study was undertaken to assess the nutritional requirement of *Dendrobium* Cv. Sonia-17.

### Materials and Methods

The experiment was conducted in Green House at Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 1999 - 2000. The design of the experiment was Factorial Completely Randomised Block Design with forty two treatment combinations, replicated twice. The *ex-vitro* established, 6 months old tissue culture plantlets of *Dendrobium* Cv. Sonia-17 were used as the planting material. The nutrient treatments consisted of three levels of N with constant doses of P and K levels

(10 : 10 : 10, 20 : 10: 10 and 30 : 10 : 10) at two concentrations (0.1 % and 0.2% along with three growth regulators each at two concentrations viz. BA 100 and 200 ppm, GA<sub>3</sub> 100 and 200 ppm and IAA 250 and 500 ppm. The inorganic fertilizers were applied as whole plant spray at weekly interval and plant growth regulators were applied at monthly interval. Observations were recorded on plant growth parameters such as height of the plant, number of pseudobulbs and number of leaves per plant at 45, 90, 135, 180, 225, 270, 315 and 360 days after planting (DAP) in six plants.

### Results and Discussion

The data on plant growth parameters revealed that application of nitrogen and growth hormones increased the plant growth significantly during the experimental period.

The height of the plants was significantly promoted by the application of nitrogen and growth regulators. The height of plant gradually increased as the age of crop progressed from 45 to 360 days from the date of planting. The increased height of plant (16.00 cm) was observed 360 DAP with the application of NPK 30 : 10 : 10 at 0.2% concentration with BA 200 ppm. A lesser height of plant (13.88cm) was observed in the treatment, NPK 10:10:10 at 0.1% concentration (Table 1). Nitrogen, being a chief constituent of protein, is essential for the formation of protoplasm which led to cell division and cell enlargement. Nitrogen might be responsible for enhancing the translocation of metabolites

**Table 1.** Interaction effect of nitrogen and growth regulators on height of plants (cm) after 360 days of planting.

GR levels/ NPK levels	(NPK alone) G <sub>1</sub>	(BA 100 ppm) G <sub>2</sub>	(BA 200 ppm) G <sub>3</sub>	(GA <sub>3</sub> 100 ppm) G <sub>4</sub>	(GA <sub>3</sub> 200 ppm) G <sub>5</sub>	(IAA 250 ppm) G <sub>6</sub>	(IAA 500 ppm) G <sub>7</sub>	Mean
10:10-10, 0.1%) F <sub>1</sub>	13.88	15.14	15.75	14.66	15.10	14.01	14.00	14.65
10:10:10, 0.2%) F <sub>2</sub>	13.97	15.24	15.78	14.72	15.21	14.18	14.10	14.74
20:10:10, 0.1%) F <sub>3</sub>	13.91	15.19	15.76	14.71	15.17	14.03	14.08	14.69
20:10:10, 0.2%) F <sub>4</sub>	14.00	15.50	15.97	14.92	15.49	14.50	14.49	14.98
30:10:10, 0.1%) F <sub>5</sub>	13.99	15.33	15.81	14.81	15.30	14.33	14.32	14.84
30:10:10, 0.2%) F <sub>6</sub>	14.02	15.66	16.00	15.00	15.51	14.61	14.52	15.05
Mean	13.96	15.34	15.85	14.80	15.30	14.28	14.25	
		F	G		FxG	Control x Treatment		
SEd		0.23	0.24		0.59	0.43		
CD (P=0.05)		0.46	0.49		1.20	0.86		

**Table 2.** Interaction effect of nitrogen and growth regulators on number of pseudobulbs per plant after 360 days of planting.

FGR levels/ NPK levels	(NPK alone) G <sub>1</sub>	(BA 100 ppm) G <sub>2</sub>	(BA 200 ppm) G <sub>3</sub>	(GA <sub>3</sub> 100 ppm) G <sub>4</sub>	(GA <sub>3</sub> 200 ppm) G <sub>5</sub>	(IAA 250 ppm) G <sub>6</sub>	(IAA 500 ppm) G <sub>7</sub>	Mean
(10:10-10, 0.1%) F <sub>1</sub>	9.50	11.50	12.33	11.00	11.44	10.00	10.01	10.83
(10:10:10, 0.2%) F <sub>2</sub>	9.55	11.99	12.47	11.11	11.95	10.50	10.42	11.14
(20:10:10, 0.1%) F <sub>3</sub>	9.50	11.83	12.45	11.08	11.88	10.33	10.31	11.05
(20:10:10, 0.2%) F <sub>4</sub>	9.73	12.06	12.55	11.21	12.03	10.67	10.56	11.26
(30:10:10, 0.1%) F <sub>5</sub>	9.60	12.00	12.50	11.19	12.00	10.55	10.53	11.20
(30:10:10, 0.2%) F <sub>6</sub>	9.87	12.23	12.56	11.27	12.18	10.88	10.78	11.40
Mean	9.63	11.94	12.48	11.14	11.91	10.49	10.44	
		F	G		FxG	Control x Treatment		
SEd		0.17	0.18		0.18	0.34		
CD (P=0.05)		0.34	0.37		0.18	0.64		

and thereby increasing the growth. The reason for better growth might be due to the favourable and additive effect of nitrogen and growth regulators on balanced nutritional requirements for growth of the plant. This is in corroboration with the findings of Poole and Seeley (1978) who investigated three orchid genera viz. *Cattleya*, *Cymbidium* and *Phalaenopsis* and found that the N and K levels influenced the growth with a constant level of P. Similarly, increased height of plant was obtained by Reyes *et al.* (1990) in *Epipremum aureum* and Yoneda *et al.* (1997) in *Phalaenopsis*.

Greater number of pseudobulbs per plant (12.56) was observed 360 DAP by the application of NPK 30: 10: 10 at 0.2% concentration along with BA 200 ppm. This was followed by NPK

20 : 10 : 10 (0.2%) + BA 200 ppm, NPK 30 : 10: 10 (0.1%) + BA 200 ppm, NPK 10: 10: (0.2%) + BA 200 ppm and NPK 20: 10: 10 (0.1%) + BA 200 ppm with 12.55, 12.50, 12.47 and 12.45 cm respectively and were on par with treatment combination NPK 30: 10 : 10 (0.2%) + BA 200 ppm (Table 2). This might be due to the activation of lateral buds which might be due to better N nutrition and growth regulators.

As an invariable component of proteins, and therefore of protoplasm, nitrogen promoted the lateral growth. Likewise, BA is believed to result in the formation of a vascular connection which might have increased water and solute supply for the renewed growth of the lateral buds. Similar line of work was documented

Table 3. Interaction effect of nitrogen and growth regulators on number of leaves per plant after 360 days of planting.

PGR levels/ NPK levels	(NPK alone) G <sub>1</sub>	(BA 100 ppm) G <sub>2</sub>	(BA 200 ppm) G <sub>3</sub>	(GA <sub>3</sub> 100 ppm) G <sub>4</sub>	(GA <sub>3</sub> 200 ppm) G <sub>5</sub>	(IAA 250 ppm) G <sub>6</sub>	(IAA 500 ppm) G <sub>7</sub>	Mean
(10:10:10, 0.1%) F <sub>1</sub>	13.23	14.56	14.78	14.40	14.55	14.79	17.05	14.24
(10:10:10, 0.2%) F <sub>2</sub>	14.00	14.61	14.81	14.41	14.60	14.20	14.14	14.40
(20:10:10, 0.1%) F <sub>3</sub>	13.97	14.60	14.80	14.40	14.57	14.13	14.11	14.37
(20:10:10, 0.2%) F <sub>4</sub>	14.01	14.70	14.87	14.51	14.69	14.35	14.32	14.49
(30:10:10, 0.1%) F <sub>5</sub>	14.00	14.65	14.85	14.44	14.63	14.23	14.21	14.43
(30:10:10, 0.2%) F <sub>6</sub>	14.03	14.75	14.99	14.55	14.71	14.39	14.35	14.54
Mean	13.87	14.65	14.85	14.45	14.63	14.26	14.23	

	F	G	FxG	Control x Treatment
SEd	0.22	0.24	0.58	0.41
CD (P=0.05)	0.44	0.48	1.16	0.83

by Zheng Xin Shu *et al.* (1998) in three *Cymbidium* cultivars.

Number of leaves per plant was also significantly enhanced with increased levels of nitrogen and growth regulators as that of number of pseudobulbs per plant and height of the plant. Application of NPK 30 : 10 : 10 (0.2%) + BA 200 ppm registered the highest number of leaves per plant (14.99) 360 DAP. A lesser number of leaves (13.23) was exhibited in the treatment, NPK 10:10:10 at 0.1% concentration. (Table 3). The higher leaf number may be due to continuous availability of nitrogen and also owing to foliar spray of growth regulators.

Nitrogen, being an important constituent of aminoacids which are essential for protein synthesis, might have stimulated the vegetative growth of plants treated with higher doses of N. This is in consonance with the findings of Sagarik and Siripong (1963), who obtained more number of leaves in orchids with complete inorganic fertilizer in 20% coconut milk. The present findings are also in agreement with the earlier works of Poole and Seeley (1978) in *Cymbidium* and *Phalaenopsis*, Khaw and Chew (1980) in Aranda Cv. Noorah -Alsagoff, Schum and Fischer (1985) and Yoneda *et al.* (1997) in *Phalaenopsis*.

From this study, it may be concluded that treatment combination, NPK 30 : 10 : 10 at 0.2% concentration along with BA 200 ppm

increased the height of plants (16.00 cm), enhanced the number of pseudobulbs per plant (12.56) and resulted in more number of leaves per plant (14.99) at different stages of plant growth.

#### References

- Khaw, C.H. and Chew, P.S. (1980). Preliminary studies on the growth and nutrient requirements of orchids (Aranda Noorah Alsagoff cds., Singh, K.G. *et al.* Proceedings third ASEAN orchid congress, Ministry of Agriculture, Malaysia, 49-64.
- Poole, H.A. and Seeley, J.G. (1978). Nitrogen, Potassium and Magnesium nutrition of three orchid genera. *J. Amer. Soc. Hort. Sci.*, **103**: 455-488.
- Reyes, T., Chase, A.K. and Poole, R.T. (1990). Effect of nitrogen level and light intensity on growth of *Epigremnum aureum*. *Proc. Florida State Hort. Soc.* **103**: 176-178.
- Sagarik, R. and Siripong, S. (1963). A study of some orchid fertilizers. *Amer. Orchid Soc. Bull.* **32**: 174-176.
- Schum, A. and Fischer, P. (1985). The N : K<sub>2</sub>O ratio in *Phalaenopsis*. *Deutscher Gartenbau.* **39**: 1704-1706.
- Yoneda, K., Usui, M. and Kubota, S. (1997). Effect of nutrient deficiency on growth and flowering of *Phalaenopsis*. *J. Japan Soc. Hort. Sci.* **66**: 141-147.
- Zheng Xin Shu, Kamuro, Y. and Matsui, S. (1998). Effects of combined application of Abscissic acid and Gibberellic acid on plant growth, flowering and levels of NPK in *Cymbidium*. *J. Soc. Hitech. in Agri.* **10**: 27-33.

(Received : January 2001; Revised : March 2002)