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Influence of foliar spray of nutrients and gibberellins on yield improvement in *Dendrobium orchid*

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ABSTRACT

The present investigation entitled "Influence of foliar spray of nutrients and gibberellins on yield improvement in *Dendrobium orchid*" was conducted under protected conditions at Hi-tech unit, College of Horticulture, Dapoli during 2025-2026 in Konkan. The experiment was carried out in factorial randomized block design with three replications. There were two factors viz., foliar nutrient treatments and GA_3 concentrations.

Foliar nutrient and GA_3 treatments showed a marked influence on crop performance. The treatment combination N_{1G1} (NPK 19:19:19 @ 0.2% + GA_3 @ 100 ppm) demonstrated the best overall performance, recording maximum plant height (32.98 cm, leaf area (60.71 cm²), number of florets (7.32), flower longevity (46.15 days) and number of spikes (3.50). In contrast, N_{2G1} (NPK 0:52:34 @ 0.2% + GA_3 @ 100 ppm) was most effective in promoting earliness, recording minimum days for spike emergence (42.15 days).

Keywords: *Dendrobium*, Orchid, Gibberellins, Nutrients

1. Introduction

Dendrobium is a very significant orchid genus. It is also called as angel blossom among orchids (Gupta and Saravana, 2017). *Dendrobium* is one of the Orchidaceae family second biggest genera with around 1340 species and perhaps thousands of hybrids dispersed across the old world (Baker *et al.*, 1996) [1]. The Konkan region in Maharashtra exhibits a distinctive tropical climate distinguished by elevated levels of humidity and moderate temperatures setting it apart from other areas within the state. The understanding is vital for enhancing cultivation techniques and guaranteeing the triumph of orchid cultivars in the region. The main agricultural activities in Konkan region revolve around the cultivation of rice, coconut and mango. However, the introduction of *Dendrobium* orchid cultivation can bring about a diversification in agriculture practices in area. This would not only provide farmers with additional income opportunities but also contribute to the overall horticulture economy of the region.

At present, the productivity and quality of flowers are not much encouraging due to lack of proper nutrition and other scientific practices. To ensure maximization of productivity in any crop, nutrient supply is an important factor. Fertilization is generally a useful practice to fulfil plant nutritional need, it influences the yield and quality of crops where, foliar fertilization means the application *via* spraying of nutrients to plant leaves and stems and their absorption at those sites is one of the approaches to achieve an improvement in yield and quality of different flower crops. Nitrogen, Phosphorus and Potassium are the three important nutrients that play very important role in altering various growth, yield and quality attributes.

Plant growth regulators also play a significant role in regulating plant growth and development. Among them, Gibberellins are known to promote cell elongation, stimulate vegetative growth and influence flowering behaviour in many ornamental crops. Application of Gibberellic acid has been reported to enhance spike length, number of florets and overall flower quality in several floricultural crops. Gibberellins (GA_3) are a group of growth promoting plant hormones influencing a range of developmental processes in higher plants. When supplemented with gibberellins a class of plant growth regulators known to promote cell elongation, division and enzyme activation, this treatment is expected to stimulate enhanced vegetative growth characterized by increased leaf area, pseudobulb development and root proliferation.

2. Material and methods

The study on "Influence of foliar spray of nutrients and gibberellins on yield improvement in *Dendrobium orchid*" was conducted at Hi-tech Nursery, Floriculture and Landscaping Department, College of Horticulture, Dapoli under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri. The experiment was conducted during 2025-2026.

2.1. Experimental site

The field experiment was conducted at Hi-tech Nursery, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) during 2025-2026.

2.2. Climate and weather condition

Dapoli, located on the west coast of Maharashtra, India (17° 44' N latitude, 73° 18' E longitude), exhibits a tropical climate characterized by high humidity (average 78%) and warm temperatures throughout the year. The region's altitude of 174 meters above mean sea level contributes to its warm and humid climate from May to October, with slightly cooler temperatures from November to February. A notable increase in temperature occurs from March to May.

2.3. Experimental details

Crop	:	Orchid (<i>Dendrobium</i> spp.)
Year	:	2025-2026
Design of experiment	:	Factorial Randomized Block Design (FRBD)
Treatments	:	16
Replications	:	3
No. of plants per treatment	:	15
Total no. of plants	:	720

2.4. Treatment details

Factor 'A'	Factor 'B'
Nutrients (NPK) (Weekly interval)	GA₃ (Monthly interval)
N ₁ 19:19:19 @ 0.2%	G ₁ @ 100 ppm
N ₂ 0:52:34 @ 0.2%	G ₂ @ 150 ppm
N ₃ 13:0:45 @ 0.2%	G ₃ @ 200 ppm
N ₄ 0:0:50 @ 0.2%	G ₄ control

3. Results and discussion

3.1. Effect of nutrient and GA₃ treatments on plant height (cm)

The interaction significantly influenced plant height at all growth stages. N₁G₁ (NPK 19:19:19 @ 0.2% + GA₃ @ 100 ppm) recorded the maximum plant height of 21.47, 26.93, 29.59 and 32.98 cm at 30, 60, 90 and 120 DAP, respectively, while N₄G₄ (NPK 0:0:50 + Control) recorded the minimum height of 14.51, 16.41, 19.06 and 22.39 cm, respectively. Plant height increased progressively with crop age, with N₁G₁ showing superior growth. The response may be attributed to the synergistic effect of balanced NPK nutrition and optimum GA₃ concentration, promoting cell division, elongation, nutrient utilization and vegetative growth. The results were in agreement with Jawaharlal *et al.* (2004) [2], Gajbhiye *et al.* (2017) [3] in gladiolus and Kumar *et al.* (2020) [4] in orchid.

3.2. Effect of nutrient and GA₃ treatments on leaf area (cm²)

The interaction between nutrient and GA₃ treatments was significant, indicating that the response of leaf area to GA₃ treatments varied with the nutrient treatments. The maximum leaf area was recorded under the N₁G₁ combination (60.71 cm²), whereas the minimum leaf area was recorded under the N₄G₄ combination (55.67 cm²).

N₁ and G₁ proved superior, recording the highest leaf area, whereas N₄ and G₄ recorded the lowest values might be because of beneficial synergistic effect of nutrients and gibberellins together. The N₁G₁ combination was the best treatment combination for enhancing leaf area, while N₄G₄ recorded the minimum leaf area. This results are in accordance with Gajbhiye *et al.* (2017) [3] in gladiolus and Sunawan *et al.* (2020) [5] in *Phalaenopsis amabilis*.

3.3. Effect of nutrient and GA₃ treatments on on days required for spike emergence

The interaction between Nutrient and GA₃ treatments was significant. The N₄G₄ combination recorded the maximum number of days required for spike emergence (53.15 days), whereas the N₂G₁ combination recorded the minimum (42.15 days). Thus, based on the available interaction values, the treatment combinations were ranked as N₄G₄ (53.15 days) > N₂G₁ (42.15 days).

Table 1. Effect of nutrient and GA₃ treatments on plant height, leaf area (cm²) and days required for spike emergence

Plant height (cm)						Leaf area (cm ²)						Days required for spike emergence					
Treat.	G ₁	G ₂	G ₃	G ₄	Mean	Treat.	G ₁	G ₂	G ₃	G ₄	Mean	Treat.	G ₁	G ₂	G ₃	G ₄	Mean
N ₁	32.98	30.91	30.49	29.63	31.00	N ₁	60.71	59.48	59.12	58.30	59.40	N ₁	49.34	50.27	51.81	52.76	51.04
N ₂	27.85	26.44	26.32	24.66	26.32	N ₂	59.27	58.68	56.21	57.32	57.87	N ₂	42.15	43.91	47.15	45.16	44.59
N ₃	29.59	29.17	28.26	24.15	27.79	N ₃	58.80	58.52	56.79	57.72	57.96	N ₃	47.59	48.63	50.21	49.31	48.94
N ₄	26.46	24.44	24.50	22.39	24.45	N ₄	56.57	57.58	57.22	55.67	56.76	N ₄	50.11	51.70	51.52	53.15	51.62
Mean	29.22	27.74	27.39	25.21	27.39	Mean	58.84	58.57	57.33	57.25	58.00	Mean	47.30	48.63	50.17	50.09	49.05
	N	G	N X G				N	G	N X G				N	G	N X G		
S.Em. (±)	0.06	0.06	0.24			S.Em. (±)	0.07	0.07	0.28			S.Em. (±)	0.08	0.08	0.31		
CD 5%	0.17	0.17	0.69			CD 5%	0.20	0.20	0.80			CD 5%	0.22	0.22	0.89		
F - Test	SIG	SIG	SIG			F - Test	SIG	SIG	SIG			F - Test	SIG	SIG	SIG		

3.4 Effect of nutrient and GA₃ treatments on number of florets

The treatment combination N₁G₁ recorded the maximum number of florets (7.32), whereas the N₄G₄ combination recorded the minimum (4.42). The treatment combinations were ranked in descending order as N₁G₁ (7.32) > N₂G₁ (7.09) > N₃G₁ (7.03) > N₁G₂ (6.97) > N₄G₁ (6.93) > N₃G₂ (6.91) > N₂G₄ (6.54) > N₃G₄ (6.30) > N₁G₃ (6.21) >

N₁G₄ (6.08) > N₂G₂ (6.50) > N₂G₃ (6.44) > N₄G₂ (6.31) > N₃G₃ (5.84) > N₄G₃ (5.62) > N₄G₄ (4.42). Thus, the N₁G₁ combination was the most effective for increasing the number of florets, while the N₄G₄ combination recorded the lowest floret production. Synergistic effect of balanced nutrition and optimum GA₃, might enhanced floral initiation and floret development. The similar findings are reported by Jawaharlal *et al.*, (2004) [2], G. Ashok Kumar *et al.* (2020) [4].

Table 2. Effect of nutrient and GA₃ treatments number of florets, flower longevity and number of spikes

Number of florets						Flower longevity						Number of spikes					
Treat.	G ₁	G ₂	G ₃	G ₄	Mean	Treat.	G ₁	G ₂	G ₃	G ₄	Mean	Treat.	G ₁	G ₂	G ₃	G ₄	Mean
N ₁	7.32	6.97	6.21	6.08	6.65	N ₁	46.15	44.62	44.44	40.74	43.99	N ₁	3.50	3.33	3.24	2.16	3.06
N ₂	7.09	6.50	6.44	6.54	6.64	N ₂	44.50	40.29	41.90	36.22	40.73	N ₂	3.14	3.12	2.75	2.15	2.79
N ₃	7.03	6.91	5.84	6.30	6.52	N ₃	43.10	44.33	42.52	39.30	42.31	N ₃	3.18	2.95	2.77	2.10	2.75
N ₄	6.93	6.31	5.62	4.42	5.82	N ₄	34.99	36.19	34.50	32.04	34.43	N ₄	2.22	2.15	1.88	1.68	1.98
Mean	7.09	6.67	6.03	5.84	6.41	Mean	42.18	41.36	40.84	37.07	40.36	Mean	3.01	2.89	2.66	2.02	2.65
	N	G	N X G				N	G	N X G				N	G	N X G		
S.E.m.	0.03	0.03	0.10			S.E.m.	0.07	0.07	0.28			S.E.m.	0.01	0.01	0.04		
(±)						(±)						(±)					
CD	0.07	0.07	0.30			CD	0.20	0.20	0.81			CD	0.03	0.03	0.12		
5%						5%						5%					
F - Test	SIG	SIG	SIG			F - Test	SIG	SIG	SIG			F - Test	SIG	SIG	SIG		

3.5 Effect of nutrient and GA₃ treatments on flower longevity

The N₁G₁ combination recorded the maximum flower longevity (46.15 days), whereas the N₄G₄ combination recorded the minimum (32.04 days). Thus, the maximum flower longevity was observed under N₁G₁, while the shortest longevity was recorded under N₄G₄. The significant interaction effect of N × G, with maximum flower longevity under N₁G₁, indicates the synergistic influence of balanced nutrition and optimum GA₃ application.

3.6 Effect of nutrient and GA₃ treatments on number of spikes

The N₁G₁ combination recorded the maximum number of spikes (3.50), whereas the N₄G₄ combination recorded the minimum (1.68). Thus, the maximum number of spikes was observed under N₁G₁, while the lowest spike production was recorded under N₄G₄. The maximum spike number under N₁G₁ (NPK 19:19:19 @ 1% + GA₃ @ 100 ppm) indicates the synergistic effect of balanced nutrition and optimum GA₃ application. The combined treatment improved vegetative growth, photosynthetic efficiency and assimilate supply, leading to enhanced spike initiation and development. The minimum under N₄G₄ may be due to poor nutrient availability and ineffective hormonal stimulation. The findings are supported by Kumar *et al.* (2020) [4] in orchid, Sunawan *et al.* (2020) [5], Sahu *et al.* (2025) [6] in Anthurium

4. Conclusion

The present investigation clearly demonstrated that foliar application of water-soluble nutrients and gibberellic acid (GA₃) significantly influenced the vegetative growth, flowering behaviour, flower quality, yield and economic returns of *Dendrobium* orchid under protected cultivation. The interaction between foliar nutrient and GA₃ treatments also had a marked influence on the crop. The treatment combination N₁G₁ (NPK: 19:19:19 @ 0.2% + GA₃ @ 100 ppm) recorded the best overall performance by producing vigorous vegetative growth, higher number of spikes and florets and improved flower longevity on the plant. In contrast, the treatment combination N₂G₁ (NPK: 0:52:34 @ 0.2% + GA₃ @ 100 ppm) was the most effective in reducing the time required for spike emergence, first flowering and flower harvest.

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