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Influence of different grade of nitrogen and potassium on growth and yield of *Dendrobium* orchid cv. Sonia 17

HP Shah, Alka Singh, MA Patel and SL Chawla

Abstract

Experiment was carried out to study influence of different levels of nitrogen, potassium and their combination in form of foliar spray on *dendrobium* plants grown in a naturally ventilated polyhouse at floriculture farm of ASPEE College of Horticulture and Forestry for two years (2014-15 and 2015-16). The study was carried out in a completely randomized design with nine treatments T₁ (10% N & 10% K), T₂ (10% N & 20% K), T₃ (10% N & 30% K), T₄ (20% N & 10% K), T₅ (20% N & 20% K), T₆ (20% N & 30% K), T₇ (30% N & 10% K), T₈ (30% N & 20% K), T₉ (30% N & 30% K). Treatments were given in a form of foliar spray once every week and 0.2 % solution of above treatments was used for spraying. Significantly maximum height of plant, number of leaves, leaf area and number of shoots were produced by application of treatment T₉ (30% N & 30% K). Flowering characters viz. inflorescence length, rachis length, number of inflorescence, number of florets and post harvest life of inflorescence were also found significantly highest with treatment T₉ (30% N & 30% K). However for most of the characters other treatments like T₈, T₇, T₆, T₅, T₄ and T₃ were at par with treatment T₉. Hence statistically T₃ (10% nitrogen + 30% potassium) can be considered as best among all treatments from economic view point.

Keywords: dendrobium, nitrogen, potassium

Introduction

Orchids have a very wide range of distribution and found to occur in all parts of the world except, perhaps, in the Antarctica. Though the family is cosmopolitan, many more species are found in the tropics than in the temperate regions (Abraham and Vatsala, 1981)^[1]. The genera of orchids which are commercially important are *Cymbidium*, *Dendrobium*, *Phalaenopsis*, *Oncidium*, *Vanda*, *Mokara*, *Arachnis* and *Cattleya* (Hew, 1994 and Laws, 1995)^[4, 6]. India is conferred with wide range of environment to grow almost all type of orchid species and have diversity of more than 1600 indigenous types which is almost 10% of the world orchid flora (Singh, 1990)^[9]. Among these genera, *Dendrobiums* are most popular tropical orchid getting fame as cut flowers in India as well as in the world. The orchids especially *Dendrobiums* are supreme among the floriculture plants due to the beauty and diversity of their long-lasting and colourful flowers. In view of the easiness in management practices and ready availability of hybrids from private importers, *dendrobium* cultivation is getting popularity in the tropical states of India (Sugapriya, 2012)^[11]. *Dendrobium* has got an excellent market potential in the floriculture industry both at domestic and international level but research work on various growth aspects including nutritional management specific to South Gujarat climatic condition is negligible. Application of nutrients in optimum proportions, quantities and frequencies is the key factor in regulating growth and flowering in cut flowers. Thus, this experiment was conducted to evaluate nutrients requirement of *dendrobium* orchid.

Material and Method

The efficiency of different combination of nitrogen and potassium in *dendrobium* was studied for two years (2014-15 and 2015-16). The experiment was laid out in a naturally ventilated polyhouse at the floriculture farm of ASPEE college of Horticulture & Forestry, Navsari Agricultural University, Navsari which is located at 20° 57' N latitude and 72° 54' E longitudes at an altitude of 10 m above the mean sea level. Shading was provided inside the polyhouse with 50% green shade net at 3.5 m high from surface. The beds of 1 meter width were prepared with Tuflon® plastic fencing nets supported on cement pole along with iron

Stands to hold the planting material properly. Coconut husk cut in halves, pre-treated with 1% Carbendazim for 2 – 3 hours, was used as growing media, after arranging in two layers.

Experimental design & treatments

Experimental design laid out was completely randomised design with nine treatments, T₁ (10% N & 10% K), T₂ (10% N & 20% K), T₃ (10% N & 30% K), T₄ (20% N & 10% K), T₅ (20% N & 20% K), T₆ (20% N & 30% K), T₇ (30% N & 10% K), T₈ (30% N & 20% K), T₉ (30% N & 30% K). Treatments were given in form of 0.2 % foliar spray once every week.

Methodology for recording observation

Five plants from each treatment were selected randomly and tagged for recording observation from net plot (avoiding boundary lines). Observations of vegetative growth were recorded at the end of the year, while flowering attributes were recorded as and when required.

Statistical analysis

The experiment data pertaining to all the characters were analysed by the method of analysis of variance for completely randomised design (CRD).

Table 1: Effect of different combination of nitrogen and potassium on height of plant, number of leaves and leaf area of *Dendrobium* cv. Sonia 17

Treatment	Height of plant (cm)		No. of leaves		Leaf area (cm ²)		
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	
T ₁	10 % N + 10 % K	22.63	26.00	7.20	9.80	31.97	38.27
T ₂	10 % N + 20 % K	23.10	30.47	7.20	10.07	33.67	39.49
T ₃	10 % N + 30 % K	24.13	31.87	8.27	11.47	35.31	41.29
T ₄	20 % N + 10 % K	25.37	34.07	8.40	12.00	36.33	42.32
T ₅	20 % N + 20 % K	25.53	34.43	8.67	12.00	36.98	42.46
T ₆	20 % N + 30 % K	26.43	35.07	9.20	12.27	38.88	43.79
T ₇	30 % N + 10 % K	26.20	34.93	9.07	12.13	37.77	43.37
T ₈	30 % N + 20 % K	26.37	35.07	8.93	12.00	38.37	43.63
T ₉	30 % N + 30 % K	26.80	35.20	9.20	12.33	39.51	44.17
	S.E.M (±)	0.94	1.74	0.47	0.44	1.42	1.14
	C.D. (0.05)	2.81	5.17	1.40	1.32	4.23	3.38

Result and Discussion

The data regarding vegetative characters viz. height of plant, number of leaves, leaf area and number of shoots are depicted in table no. 1 and 2. The data concerning vegetative characters clearly showed remarkable effect of different combination of nitrogen and potassium. Height of the plant (26.80 cm and 35.20 cm), number of leaves (8.27 and 11.47) leaf area (39.51 cm² and 44.17 cm²) and number of shoots (3.60 and 3.93) were recorded maximum when sprayed with treatment T₉ (30% nitrogen + 30 % potassium), i.e. with maximum level of nitrogen and potassium, which were at par with other treatments T₈, T₇, T₆, T₅, T₄ and T₃ during first year and second year while, minimum values were observed with treatment T₁ (10% nitrogen + 10% potassium) i.e. with minimum level of nitrogen and potassium during both the years. Nitrogen being a vital element for plant growth and is a major part of the chlorophyll and cytochromes, the primary light harvesting compound involved in photosynthesis (Kumar, 2009) [5] and thereby influenced better plant growth in dendrobium. Further, it is a key constituent of all nucleic acid, amino acids and proteins and thereby serves a crucial role in cellular metabolism so as in plant growth (Thanapornponpong *et al.*, 2008) [13]. On other hand potassium regulates photosynthesis process of the plant

(Thomas and Thomas, 2009) [14] and is also essential for production of Adenosine Triphosphate (ATP) for energy transfer in plants (Wang *et al.* 2013) [16]. Hence, high dose of nitrogen and potassium resulted into better plant growth in dendrobium. Incremental increase in vegetative growth of plant with increasing dose of nitrogen and potassium in foliar form have also been observed earlier in *Dendrobium* (Swapna, 2000, Saravanan, 2001 and Bichsel *et al.*, 2008) [12, 8, 3]. However, *Dendrobium* responds to even very low doses of nitrogen and potassium as per this study.

Data of various flowering characters like inflorescence length, rachis length, number of inflorescence, number of florets and postharvest life of inflorescence are illustrated in table 3 and 4. The data in relation to flowering characters clearly showed that higher concentration of nitrogen and potassium significantly altered different attributes. Inflorescence length (23.53 cm and 35.33 cm), rachis length (17.93 cm and 21.20 cm) and number of florets per inflorescence (9.00 and 11.33) were noticed significantly highest when plants were sprayed with treatment T₉ which were at par with treatments T₈, T₇, T₆, T₅, T₄ and T₃ during both years of experiment. Number of inflorescence (1.20 and 3.53) which is also a yield attribute of experiment and post-harvest life of inflorescence (27.87 days and 29.47 days) were noticed.

Table 2: Effect of different combination of nitrogen and potassium on number of shoots, inflorescence length and rachis length of *Dendrobium* cv. Sonia 17

Treatment	No. of shoots		Inflorescence length (cm)		Rachis length (cm)		
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	
T ₁	10 % N + 10 % K	2.47	2.93	19.47	30.33	15.53	17.67
T ₂	10 % N + 20 % K	2.73	3.13	19.80	30.83	15.92	18.20
T ₃	10 % N + 30 % K	3.07	3.60	21.67	32.50	16.61	19.53
T ₄	20 % N + 10 % K	3.13	3.80	22.33	33.83	17.05	20.00
T ₅	20 % N + 20 % K	3.20	3.80	22.23	34.17	17.23	19.87
T ₆	20 % N + 30 % K	3.47	3.87	23.33	34.50	17.60	21.13
T ₇	30 % N + 10 % K	3.47	3.80	22.50	34.67	17.53	20.67

T ₈	30 % N + 20 % K	3.47	3.87	22.33	35.00	17.50	20.67
T ₉	30 % N + 30 % K	3.60	3.93	23.53	35.33	17.93	21.20
	S.E.M (±)	0.19	0.18	0.86	1.12	0.45	0.59
	C.D. (0.05)	0.58	0.52	2.56	3.32	1.33	1.76

Table 3: Effect of different combination of nitrogen and potassium on number of inflorescence, number of florets per inflorescence and postharvest life of inflorescence of *Dendrobium* cv. Sonia 17

Treatment	No. of inflorescence		No. of florets/ inflorescence		Postharvest life of inflorescence (days)		
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	
T ₁	10 % N + 10 % K	1.00	2.73	7.00	8.47	24.80	26.87
T ₂	10 % N + 20 % K	1.07	2.87	7.80	8.47	25.40	27.20
T ₃	10 % N + 30 % K	1.00	3.13	8.33	8.47	26.27	27.87
T ₄	20 % N + 10 % K	1.07	3.20	8.53	9.67	26.73	28.33
T ₅	20 % N + 20 % K	1.13	3.33	8.60	10.07	26.93	28.40
T ₆	20 % N + 30 % K	1.20	3.47	8.40	10.93	27.27	29.27
T ₇	30 % N + 10 % K	1.20	3.40	8.67	10.53	27.47	29.27
T ₈	30 % N + 20 % K	1.20	3.47	8.87	10.67	27.60	29.07
T ₉	30 % N + 30 % K	1.20	3.53	9.00	11.33	27.87	29.47
	S.E.M (±)	0.10	0.17	0.37	0.49	0.65	0.59
	C.D. (0.05)	0.30	0.50	1.10	1.45	1.93	1.75

Significantly maximum with T₉ treatment during both the years of experiment. Increase in number of inflorescence with nitrogen application might be due to improvement in the growth of the plant and increase in number of shoots due to nitrogen and potassium application. In *Dendrobium*, the number of new shoots produced by the plant determines the extent of flower production as also observed earlier by Swapna (2000) [12]. Increase in all the flowering parameters with the spray of 30% potassium might be due to crucial role of potassium in plant growth which further leads to the better flower quality. Besides, potassium is involved in synthesis of peptide bond and protein and carbohydrate metabolism and also participates in rapid cell division and differentiation that influenced flowering parameters as explained by Pal and Gosh (2010) [7]. Present study showed good response in *Dendrobium* even with low level of nitrogen and potassium. Better flower yield and quality in *Dendrobium* with higher level of nitrogen and potassium has been reported earlier (Bhattacharjee, 1981 and Swapna, 2000) [2, 12].

Conclusion

The treatment T₉ (30% nitrogen + 30% potassium) @ 0.2% recorded significantly highest vegetative growth and flower production with good quality which was at par with Treatment T₈, T₇, T₆, T₅, T₄ and T₃. Thus, statistically T₃ (10% nitrogen + 30% potassium) can be considered best among all treatments.

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