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Influence of Inorganic and Organic Fertilizers on Growth and Yield of Dendrobium Orchid cv. Sonia 17

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A B S T R A C T

Experiment was carried out to study the 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 T_1 [(10% N + 10% K) +Water], T_2 [(10% N + 10% K) + Vermiwash], T_3 [(10% N + 10% K) + Cow urine], T_4 [(20% N + 20% K) + Water], T_5 [(20% N + 20% K) + Vermiwash], T_6 [(20% N + 20% K) + Cow urine], T_7 [(30% N + 30% K) + Water], T_8 [(30% N + 30% K) + Vermiwash] and T_9 [(30% N + 30% K) + Cow urine]. Inorganic fertilizers *i.e.* nitrogen and potassium were given in form of foliar spray once every week in a concentration of 0.2 %, while, organic fertilizers such as vermiwash and cow urine were sprayed in a concentration of 2 % once every fortnight. Significantly maximum height of plant, number of leaves, leaf area and number of shoots were produced by application of -treatment T_9 [(30% N + 30% K) + Cow urine]. 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 T_9 [(30% N + 30% K) + Cow urine]. However, for most of the characters T_8 was at par with treatment T_9.

Introduction

Orchids have a very wide range of distribution and found to occur in all parts of the world except, perhaps, in the Antarctica. Orchids belong to the largest and most diverse family, orchidaceae consisting of about 700-800 genera and more than 25000 species (Begum, 2000). Though the family is cosmopolitan, many more species are found in the tropics than in the temperate regions (Abraham and Vatsala, 1981). The genera of orchids which are commercially important are *Cymbidium, Dendrobium, Phalaenopsis, Oncidium, Vanda, Mokara, Arachnis* and *Cattleya* (Hew, 1994; Laws, 1995). 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). Among these genera, Dendrobiums are most popular tropical orchid getting fame as cut flowers in India as well as in the world. Dendrobium has got an excellent market potential in the floriculture industry both at domestic and international level 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, dendrobiums occupy maximum area under orchid cultivation in the country (Sobhana and Rajeevan, 1993). 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. Proper relationship between different major nutrients, major and minor nutrients, inorganic and organic forms etc., also play a significant role in growth and flowering. Investigations on these lines are, however, meagre in Dendrobium. Thus, this experiment was conducted to evaluate requirement in form of inorganic and organic fertilizer of dendrobium orchid.

Materials and Methods

The efficiency of different combination of nitrogen, potassium and organic liquids such as vermiwash and cow urine 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 20^0 57' N latitude and 72^0 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 and treatments

Experimental design laid out was completely randomised design with nine treatments, T_1[(10% N + 10% K) + Water], T_2[(10% N + 10% K) + Vermiwash], T_3[(10% N + 10% K) + Cow urine], T_4[(20% N + 20% K) + Water], T_5[(20% N + 20% K) + Vermiwash], T_6[(20% N + 20% K) + Cow urine], T_7[(30% N + 30% K) + Water], T_8[(30% N + 30% K) + Vermiwash] and T_9[(30% N + 30% K) + Cow urine]. Inorganic fertilizers (nitrogen and potassium) were given in form of 0.2 % foliar spray once every week. Common treatment of 20% phosphorus (@ 0.02%) was also given once in a week along with inorganic fertilizers. Organic fertilizers such as vermiwash and cow urine were given @ 2% once every fortnight in form of foliar spray.

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).

Results and Discussion

The data regarding vegetative characters viz. height of plant, number of leaves, leaf area and number of shoots are depicted in table 1 and 2. The data concerning vegetative characters clearly showed remarkable effect of different combination of nitrogen, potassium and organic liquids. Height of the plant (30.10 cm and 38.93 cm), number of leaves (11.27 and 14.27) leaf area (41.69 cm^2 and 47.17 cm^2) and number of shoots (4.07 and 4.60) were recorded maximum when sprayed with treatment T_9 [(30% nitrogen + 30 % potassium) + Cow urine], i.e. with higher level of nitrogen and potassium along with cow urine, which were at par with treatment T_8 [(30% nitrogen + 30% potassium) + Vermiwash] while, minimum values were observed with treatment T_1 [(10% nitrogen + 10% potassium) + water] i.e. with minimum level of nitrogen and potassium without any organic liquid 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) 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 (Thanapornpoonpong *et al.*, 2008). On other hand potassium regulates photosynthesis process of the plant (Thomas and Thomas, 2009) and is also essential for production of Adenosine Triphosphate (ATP) for energy transfer in plants (Wang *et al.*, 2013). Hence, higher 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 has also been observed earlier in Dendrobium (Swapna, 2000, Saravanan, 2001 and Bichsel *et al.*, 2008). However, Dendrobium responds to even very low doses of nitrogen and potassium as per this study. Further, better growth of Dendrobium observed with foliar spray of 2 % cow urine might be due to presence of growth promoting auxin like IAA (Zhang, 2000). Apart from this, cow urine contains many elements needed for plants like N, P, K, Ca, Mg, S and others (Phrimantoro, 1995) which also contributed for improved plant growth. The present findings are in conformity with report of Mankar *et al.*, (2003) in China aster.

Table.1 Effect of different combination of nitrogen, potassium and organic fertilizers on height of plant, number of leaves and leaf area of Dendrobium cv. Sonia Red

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) + Water	22.63	26.00	7.20	9.80	31.97	38.27
T_2	(10 N + 10 K) + Vermiwash	22.87	30.00	6.87	10.87	33.20	38.95
T_3	(10 N + 10 K) + Cow Urine	23.43	30.60	7.20	10.93	34.69	40.88
T_4	(20 N + 20 K) + Water	25.53	34.43	8.67	12.00	36.98	42.46
T_5	(20 N + 20 K) + Vermiwash	27.37	36.00	9.33	12.60	40.42	45.30
T_6	(20 N + 20 K) + Cow Urine	28.03	36.47	9.53	12.80	40.68	45.97
T_7	(30 N + 30 K) + Water	26.80	35.20	9.20	12.33	39.51	44.17
T_8	(30 N + 30 K) + Vermiwash	29.03	37.33	10.07	13.80	41.03	46.53
T_9	(30 N + 30 K) + Cow Urine	30.10	38.93	11.27	14.27	41.69	47.17
	S.E.M (±)	0.63	0.91	0.42	0.88	0.78	0.87
	C.D. (0.05)	1.87	2.72	1.25	2.62	2.31	2.59

Table.2 Effect of different combination of nitrogen, potassium and organic fertilizers on number of shoots, inflorescence length and rachis length of Dendrobium cv. Sonia Red

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) + Water	2.47	2.93	19.47	30.00	15.53	17.67
T_2	(10 N + 10 K) + Vermiwash	2.67	3.00	19.77	31.67	15.78	17.73
T_3	(10 N + 10 K) + Cow Urine	2.80	3.47	21.07	31.67	16.22	19.00
T_4	(20 N + 20 K) + Water	3.20	3.80	22.23	34.17	17.23	19.87
T_5	(20 N + 20 K) + Vermiwash	3.67	4.07	23.83	36.00	18.13	21.47
T_6	(20 N + 20 K) + Cow Urine	3.73	4.27	24.87	37.00	18.58	23.00
T_7	(30 N + 30 K) + Water	3.60	3.93	23.53	35.33	17.93	21.13
T_8	(30 N + 30 K) + Vermiwash	3.93	4.53	26.33	39.33	18.67	24.67
T_9	(30 N + 30 K) + Cow Urine	4.07	4.60	27.50	42.00	19.47	26.00
	S.E.M (±)	0.086	0.094	0.49	0.51	0.51	0.42
	C.D. (0.05)	0.256	0.280	1.45	1.50	1.50	1.26

Table.3 Effect of different combination of nitrogen, potassium and organic fertilizer on number of inflorescence, number of florets per inflorescence and postharvest life of inflorescence of Dendrobium cv. Sonia Red

Treatment		No. of inflorescence		No. of florets/ inflorescence		Post-harvest life of inflorescence	
		Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
T_1	(10 N + 10 K) + Water	1.00	2.73	7.00	8.47	24.80	26.87
T_2	(10 N + 10 K) + Vermiwash	1.00	2.80	7.53	8.07	25.27	27.07
T_3	(10 N + 10 K) + Cow Urine	1.00	2.93	8.00	8.73	25.87	27.47
T_4	(20 N + 20 K) + Water	1.13	3.33	8.60	10.07	26.93	28.40
T_5	(20 N + 20 K) + Vermiwash	1.33	3.73	9.33	12.13	28.13	29.80
T_6	(20 N + 20 K) + Cow Urine	1.33	3.80	9.40	13.20	28.53	30.07
T_7	(30 N + 30 K) + Water	1.20	3.53	9.00	11.33	27.87	29.27
T_8	(30 N + 30 K) + Vermiwash	1.53	4.00	10.00	14.33	28.80	30.40
T_9	(30 N + 30 K) + Cow Urine	1.80	4.13	10.33	14.87	29.20	30.53
	S.E.M (±)	0.11	0.20	0.30	0.25	0.40	0.37
	C.D. (0.05)	0.33	0.59	0.90	0.74	1.19	1.11

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, potassium and cow urine significantly altered different attributes. Inflorescence length (27.50 cm and 42.00 cm),rachis length (19.47 cm and 26.00 cm), number of inflorescence (1.80 and 4.13), number of florets per inflorescence (10.33 and 14.87)and post-harvest life of inflorescence (29.20 days and 30.53 days) were noticed significantly highest when plants were sprayed with treatment T_9 [(30% nitrogen + 30% potassium) + Cow Urine] during both the years, which were at par with treatment T_8 [(30% nitrogen + 30% potassium) + Vermiwash] for inflorescence length in first

year, rachis length in first year, number of inflorescence in both the tears and for number of florets per inflorescence in first year 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 along with application of cow urine. In Dendrobium, the number of new shoots produced by the plant determines the extent of flower production as also observed earlier by Swapna (2000). 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). Better flower yield and quality in Dendrobium with higher level of nitrogen and potassium has been reported earlier (Swapna, 2000). Further, stimulated reproductive phase through photosynthesis and translocation of food with cow urine application has been also observed in gladiolus (Ramachandrudu and Thangam, 2007; Tamrakar, 2016).

The treatment T_9*i.e* 30% nitrogen + 30% potassium @ 0.2% at weekly interval and 2% cow urine once in fortnight, significantly enhance vegetative growth and flower production with good flower quality in Dendrobium hence, can be considered best among all treatments.

References

Abraham, A., Vatsala, P. 1981. Introduction to Orchids. Tropical Botanical Garden and Research Institute; 10-27.

Begum, F. 2000. Training courses on Orchid production in Bangladesh organised by Hortex Foundation, BARI, Joydebpur, Bangladesh

Bichsel, R. G., Starman, T. W. and Wang, Y. T. 2008. Nitrogen, Phosphorus and Potassium requirements for optimising growth and flowering of the nobile Dendrobium as a potted orchid. Hort. Sci. 43(2):328-332.

Hew, C. S. 1994. Orchid cut flower production in ASEAN countries. Orchid Biology: Reviews and perspectives. 6: 363-401.

Kumar, A. 2009. Influence of varying plant population and nitrogen levels on growth, yield, economics and nitrogen use efficiency of popcorn maize (*Zea mays*). Crop Res. 37(1, 2 & 3): 19-23.

Laws, N. 1995. Cut orchids in the world market. Flora Culture Intl. 5(12): 12-15.

Mankar, S. S., Haldankar, P. M., Rangwala, A. D. and Joshi, G. D. 2003. Effect of growth regulators and organic compound on growth, flowering and yield of China aster (*Callistephus chinensis*) var. "Ostrich Plume Mixed". South Ind. Hort. 52 (1-6): 210-212.

Pal, P. and Ghosh, P. 2010. Effect of different sources and levels of potassium on growth, flowering and yield of African marigold (*Tagetes erecta* Linn.) cv. 'Siracole'. Indian J. Nat. Prod. Resources. 1(3): 371-375.

Phrimantoro. 1995. Cow urine as element of plant hara Stockholm. Environment Institute, EcoSanRes Series, 2009-1, website http://agrotechnopark.blogspot.in/2011/08/cow-urine-as-element-of-plant-hara.htm.

Ramachandrudu, K. and Thangam, M. 2007. Response of plant growth regulators, coconut water and cow urine on vegetative growth, flowering and corm production in gladiolus. J. Ornamental Hort. 10(I): 38-41.

Saravanan, S. 2001. Studies on standardization of certain production

technologies for Dendrobium orchid hybrid Sonia – 17, Tamil Nadu, India. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, India.

Singh, F. 1990. Indian Orchids. Indian Horti. 35(1): 14-16.

Sobhana, A. and Rajeevan, P. K. 1993. Performance of certain epiphytic species in central Kerala. Ind. J. Orchid Soc. 7(1&2): 31-35.

Swapna, S. 2000. Regulation of growth and flowering in Dendrobium var. Sonia 17, Kerala, India. Ph.D. Thesis, Kerala Agricultural University, Thrissur, India.

Tamrakar, S.K. 2016. Effect of plant growth regulators, vermiwash and cow urine on vegetative growth, flowering, corm production and vase life of gladiolus var. Candyman, Chhattisgarh, India. Ph.D. Thesis, Indira Gandhi Krishi Vishwavidyalaya, Raipur, India.

Thanapornpoonpong, S. N., Vearasilp, S., Pawelzik, E. and Gorinstein, S. 2008. Influence of various nitrogen applications on protein and amino acid profiles of amaranth and quinoa. J. Agri. and Food Chem. 56: 11464–11470.

Thomas, T. C. and Thomas, A. C. 2009. Vital role of potassium in the osmotic mechanism of stomata aperture modulation and its link with potassium deficiency. Plant Signal Behaviour. 4(3): 240-243.

Wang, M., Zheng, Q., Shen, Q. and Guo, S. 2013. The critical role of potassium in plant stress response. Int. J. Mol. Sci. 14(4): 7370 – 7390.

Zhang, Y. 2000. The origin and summary of the theory of the cloning of mammal. Sci. and Tech. Review. 2: 10-13.

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