

Original Research Article

Growth and flowering responses of *Cymbidium orchid* (*Cymbidium erythrostylum*) in different potting media, NPK and sucker management

Abstract

Aims: The study aimed to evaluate the effect of growing media including mineral nutrition and sucker management to determine the effective growing media composition for plant growth and early flowering.

Study design: The experiment was conducted at Himalayan Orchid Farm, Godawari during 2013 to 2014. Three factors: media (viz. farmers' media, bark + charcoal + litter, and bark only); NPK and sucker management (control and removal of side sucker) were evaluated under factorial design with four replications.

Results and discussion: The result revealed that emergence of flower differed among the media and NPK level as media having bark only gave the highest number of flowering plants, while farmers practiced media was resulted in none flowering plants. The sucker retained management showed the higher vegetative growth; while sucker removed treatment gave the higher flowering plants. Similarly, bimonthly application of NPK 19:19:19 was found superior over control.

Conclusion: It is concluded that the emergence of flowers found excellent on the media having bark only among the potting media and NPK level as while farmers practiced media was resulted in none flowering plants. Thus, potting media having higher proportion of pine bark would be advised for early flowering in contrast to compost on the media.

Key words: *cymbidium orchid*; mineral nutrition; juvenile; vegetative growth; flowering; sucker

INTRODUCTION

Cymbidium orchid (*Cymbidium erythrostylum*) account a large share both as cut and pot flowers in the global floriculture trade [4, 2, 7, 18]. In Nepal, it has been grown commercially for last decade and the annual production was estimated at 20000-25000 cut stems in 2014 [12]. There are many aspects affecting the commercial production, of which, plant nutrition is very important [16]. Orchids usually have long juvenile periods up to 13 years that causes delayed transition to reproductive development [16, 17]. The transition from vegetative growth to flowering may be influenced by various factors, including hormones and nutrients [6]. Thus, the shortening the period of vegetative growth through adequate management of plant nutrition, especially in commercial varieties and hybrids, is one of paramount factors for commercial production.

Currently, a mixture of leaf litter and compost is the common growing media (farmers' media) for orchid cultivation in Nepal [12, 13]. In the existing condition, mineral nutrition is not applied in the potting media and agronomical practice for sucker management is also lacking. As the result, plants normally take almost 4 to 5 years for flowering [12], and that longer periods ultimately makes the cost of production very high. The flowering period can be significantly reduced by appropriate nutrient and sucker management practices [1, 15, 9]. So far, research work on these aspects is lacking [11]. Moreover, knowledge on the physiology and factors affecting growth and development of orchids in the specific climate are essential [2]. To expand the production, improved production husbandry including plant nutrition has to be adopted.

In this context, the aim of this study were to evaluate the effect of potting media, mineral nutrition, and sucker management on vegetative growth and flowering of *cymbidium orchid*.

MATERIALS AND METHOD

The experiment was conducted under screen house condition at Himalayan Orchid Farm, Godawari from November 2013 to May 2014. The temperature inside the screen house during the experimental period was measured at 5 to 30°C. The experimental site was shaded with a 60% of lighting agro-net. The tissue-cultured plants of 5-year-old *Cymbidium erythrostylum* were hardened in community pots for 6 to 8 weeks before transferring them into experimental pots. Three factors: NPK (viz. control, 19:19:19 NPK, 25:19:25 NPK); potting media (farmers' media, bark + charcoal + litter, bark only); and sucker management (retained and removal of side sucker) were evaluated under 3 x 3 x 2 factorial complete randomized design (CRD) with 4 replications, with one plant per replication. The site and set up of the experiment is given in Figure 1. The leaf length, leaf breath, sucker diameter, number of leaves, number of branches and number of flowers were observed. The data were analyzed using analysis of variance and the least significant difference (LSD) test with GENSTAT software.



Figure 1 Experimental design under screen-house

RESULTS AND DISCUSSION

The results of sucker management, potting media and NPK on vegetative growth are presented in Table 1 that all have non-significant effect on the growth of leaf and sucker except the effect of growing media and NPK respectively on leaf length and sucker growth. The effect of sucker management that leaf and sucker growth were found similar between suckers retained and sucker removal treatments. On comparing the growing media, it is evident that media combination with leaf-litter, charcoal and bark was slightly better over farmers' media and media with bark only for leaf and sucker growth.

The result showed a significant variation on the number of leaves and branch per plant due to the effect of media, while it was non-significant on NPK effect. The leaf numbers were differed from 9 to 11 and branch from 4 to 5 at different media. It was observed the same leaf number (nos 10) and branch number of 4 to 5 at NPK effect.

Table 1. Effect of potting media and NPK on the vegetative growth during 2013-2014

Treatments	Leaf Length (cm)	Leaf Breath (mm)	Sucker Diameter (mm)
Sucker management			
1. Sucker retained	39.82	11.22	18.0
2. Sucker removed	39.87	11.11	17.69
P-value	ns	ns	ns
LSD (0.05)	1.688	0.3738	1.397

CV %	9.1	7.1	16.5
Potting media			
1. Farmer's media	38.14	11.3	17.45
2. Leaf litter + charcoal + bark	40.79	11.23	18.83
3. Bark only	40.61	10.98	17.25
P-value	*	ns	ns
LSD (0.05)	2.068	0.4578	1.71
CV %	9.1	7.1	16.5
NPK			
1. Control	40.92	11.19	17.37
2. NPK 19:19:19	39.55	11.34	19.27
3. NPK 25:19:25	39.06	10.97	16.9
P-value	ns	ns	*
LSD (0.05)	2.068	0.4578	1.71
CV %	9.1	7.1	16.5

*Notes: Values are the means of four replications. Means in the column with different letters indicate significantly differences ($P \leq 0.05$); * indicates significantly differences at $P \leq 0.05$ level.*

The effect of sucker management was found significant on production of number of leaf and branch, while it was insignificant to the number of plants producing flower. However, higher numbers of flower plants was found at sucker removal compared to sucker retained management. Similarly, emergence of flower differed among the potting media and NPK levels. The potting media having bark only gave the highest number of plants producing flower (nos 0.250), while farmers practiced media as having higher proportion of compost had none of flowering plant (Table 2).



Figure 2 Three different potting media and their effects on flowering

Table 2. Effect of potting media and NPK on the leaf and branch number, and emergence of flower during 2013-2014

Treatments	No. of leaves/ branch	No of branch/ Plant	No of plants producing flowers
Sucker management			
1. Sucker retained	9.69	3.81	0.083
2. Sucker removed	10.31	4.53	0.167
P-value	*	*	ns
LSD (0.05)	0.605	0.449	0.148
CV %	12.8	22.8	55.9
Potting media			
1. Farmer's media	10.75	4.21	0.000
2. Leaf litter + charcoal + bark	9.46	4.5	0.125
3. Bark only	9.79	3.79	0.250

P-value	*	*	*
LSD (0.05)	0.742	0.550	0.1812
CV %	12.8	22.8	55.9
NPK			
1. Control	10.04	3.83	0.250
2. NPK 19:19:19	10.04	4.5	0.125
3. NPK 25:19:25	9.92	4.17	0.000
P-value	ns	ns	*
LSD (0.05)	0.742	0.550	0.1812
CV %	12.8	22.8	55.9

*Notes: Values are the means of four replications. Means in the column with different letters indicate significantly differences ($P \leq 0.05$); * indicates significantly differences at $P \leq 0.05$ level.*

The results revealed that potting media combination with leaf-litter, charcoal and bark was found better over farmers' media and media with bark only for leaf and sucker growth, however, media with bark only appeared better for bearing highest flowering. In the review study of Pun and Adhikari (2015), a proper combination of peat moss, bark, compost, and wood pieces including litters has been recommended for potting medium, having porous and drainable. Similarly, bimonthly application of NPK 19:19:19 gave the better results in the present study that similar finding was obtained by Bichsel et al. [1]. In an investigation, Vaz et al. [14] observed increased flower spike number on high carbohydrate levels accumulated in the plants.

In the present study, the media having bark only gave the highest number of plants producing flower, while farmers practiced media as having higher proportion of compost had none of flowering plant. Ng and Hew [8] showed that the active accumulation of mineral nutrients during the period of pseudo bulb development constitutes an important source of reserve in determining the numbers of flowers produce. It is therefore recommended that special attention be paid to the fertilization regime, especially during the period of new shoot development.

In the investigation of Kostenyuk et al. [6] that it was reported that concerted actions of cytokinin, root excision and restricted nitrogen supply resulted in early flowering of *C. niveo-marginatum* in vitro. De Kreij & Van den Berg [3] found that good vegetative growth is needed to obtain a large number of generative buds, but too much vegetative growth can reduce generative bud formation, thus a combination of a high nitrogen level during vegetative growth and omitting fertilizer during generative bud emergence should give the highest yield and earlier flowering. Griesbach [5] showed that fertilization was critical for commercial production.

CONCLUSION

The study revealed that potting media combination with leaf-litter, charcoal and bark was found better over farmers' media and media with bark only for leaf and sucker growth, however, media with bark only appeared better for bearing highest flowering. Based on the results, the emergence of flowers found excellent on the media having bark only among the potting media and NPK level as while farmers practiced media was resulted in none flowering plants. Thus, potting media having higher proportion of pine bark would be advised for early flowering in contrast to compost on the media.

Ethical approval and consent are not applicable.

REFERENCES:

1. Bichsel RG, Starman TW, Wang YT. Nitrogen, phosphorus, and potassium requirements for optimizing growth and flowering of the Nobile dendrobium as a potted orchid. *HortScience*; 2008; 43(2):328-332.
2. Chugh S, Guha S, Rao IU. Micropropagation of orchids: a review on the potential of different explants. *Scientia Horticulturae*; 2009; 122(4):507-520.
3. De Kreij C, Van den Berg TJ. Effect of electrical conductivity of the nutrient solution and fertilization regime on spike production and quality of *Cymbidium*. *Scientia horticulturae*; 1990; 44(3-4):293-300. [https://doi.org/10.1016/0304-4238\(90\)90129-3](https://doi.org/10.1016/0304-4238(90)90129-3).
4. De LC, Pathak P, Rao AN, Rajeevan PK. 2 Global Orchid Industries. In *Commercial Orchids* (pp. 13-19). Sciendo Migration; 2014: 13-19.
5. Griesbach RJ. Development of *Phalaenopsis* orchids for the mass-market. Trends in new crops and new uses. ASHS Press, Alexandria, VA; 2002: 458-465.
6. Kostenyuk I, Oh BJ, So IS. Induction of early flowering in *Cymbidium niveo-marginatum* Mak in vitro. *Plant Cell Reports*; 1999; 19(1):1-5.
7. Lopez RG, Runkle ES. Environmental physiology of growth and flowering of orchids. *HortScience*; 2005; 40(7):1969-1973.
8. Ng CKY, Hew CS. Orchid pseudobulbs–false bulbs with a genuine importance in orchid growth and survival. *Scientia Horticulturae*; 2000; 83(3-4):165-172.
9. Poole HA, Seeley JG. Nitrogen, potassium and magnesium nutrition of three orchid genera (Doctoral dissertation, Cornell University); 1974.
10. Pun AB, Adhikari D (Eds). Climatic Requirements of Major Cut Flowers in Nepalese Context. Floriculture Association Nepal (FAN), Battishputali-9, Kathmandu, Nepal; 2015:20-21.
11. Pun AB, Pun UK. Floriculture Research in Nepal: Status and Challenges. *Agriculture Development Journal*; 2009; 6:1-8.
12. Pun U. Commercial Orchid Farming in Nepal: Challenges and Opportunities. In U Pun, LN Gaire, MB Tamang, JB Tamang (Eds.), *Nepalese Floriculture, 19th Flora Expo 2016*. Floriculture Association Nepal (FAN), Battishputali-9, Kathmandu, Nepal; 2016:33-35.
13. Pun UK, Shrestha SR, Upreti G. Standardization of media for the establishment of orchid *Rhynchstylis retusa* in Chitwan. *J. Inst. Agric. Anim. Sci.* 1995; 16:81-84.
14. Vaz APA, Rita de Cássia L, Kerbauy GB. Photoperiod and temperature effects on in vitro growth and flowering of *P. pusilla*, an epiphytic orchid. *Plant Physiology and Biochemistry*; 2004; 42(5):411-415.
15. Wang YT, Gregg LL. Medium and fertilizer affect the performance of *Phalaenopsis* orchids during two flowering cycles. *HortScience*; 1994; 29(4):269-271.
16. Wang YT. Effects of six fertilizers on vegetative growth and flowering of *Phalaenopsis* orchids. *Scientia Horticulturae*; 1996; 65(2-3):191-197. [https://doi.org/10.1016/0304-4238\(96\)00875-8](https://doi.org/10.1016/0304-4238(96)00875-8)
17. Zhang SB, Yang YJ, Li JW, Qin J, Zhang W, Huang W, Hu H. Physiological diversity of orchids. *Plant Diversity*; 2018.
18. Zhenjian L, Yan W, Zhenhua P, Kun M. Orchid Status and Development of Floriculture Trade in the World [J]. *Chinese Agricultural Science Bulletin*; 2008; 5 (35).