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Nutrient Requirement of *Phalaenopsis* Hybrid cv. Shagan

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A B S T R A C T

An investigation was carried out to find out the effect of water soluble fertilizers on growth of orchid (*Phalaenopsis* Hybrid) cv. Shagan at BTCC, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha during the period January 2016 to March 2017. The tissue cultured orchid plantlets were planted in pots containing potting mixture comprising of coal and coconut fibre, in equal proportion. Total population was ninety nine having eleven different treatments and each treatment contains 3 pots. The trial was conducted with ten treatments *viz.* T_1 (NPK 0:0:50 @0.1%), T_2 (NPK 0:0:50 @ 0.2%), T_3 (NPK 0:52:34 @ 0.1%), T_4 (NPK 0:52:34 @ 0.2%), T_5 (NPK 13:0:45 @ 0.1%), T_6 (NPK 13:0:45 @ 0.2%), T_7 (NPK 19:19:19 @ 0.1%), T_8 (NPK 19:19:19 @ 0.2%), T_9 (NPK 20:20:20 @ 0.1%), T_{10} (NPK 20:20:20 @ 0.2%) and T_{11} (control). The experiment was laid out in Completely Randomized Design with three replications. Water soluble fertilizers were applied by dissolving in water. The study revealed that there was significant difference in vegetative and floral characters due to application of different grades of fertilizers at different concentrations. Among all treatments, T_7 (NPK 19:19:19 @ 0.1%) recorded the maximum value for vegetative characters, like plant height (8.90 cm), number of leaves per plant (5.77), leaf length (19.83 cm), leaf breadth (5.83 cm) and leaf area (84.83 cm^2); floral characters like number of spike per plant (2.0) and number of flowers per spike (10.00) as compared to other treatments. It is therefore suggested that for getting better quality plant, treatment T_7 (NPK 19:19:19 @ 0.1%) is recommended under Bhubaneswar condition in *Phalaenopsis* cv. Shagan.

Introduction

Orchids are distinctive plants and highly priced in international market due to their intricately designed spectacular flowers, brilliant colours, delightful appearance, myriad sizes, shapes, forms and long lasting qualities. Orchidaceae family consists of about 600 - 800 genera and 25,000 - 35,000 species and over 74,000 natural and manmade hybrids. They are always in demand in the international florist trade for their longer

lasting and bewitchingly beautiful flowers. India is the centre of origin of many Orchid species and nearly 1300 species and 140 genera dwell in the country. Majority of the orchids are day neutral and are not influenced by day length.

The genus *Phalaenopsis* was established by Dr. Karl Lud-Wig Blume, the Dutch botanist in 1825. These are also called as moth orchids. Plant epiphytic on trees and rocks, with monopodial growth; stems short with few to several leaves borne together. Flowers are small to large of various colours. Petals are similar to sepals, slightly narrower or much broader. Lip three lobed, joined to the column foot without a hinge, variable and complex with antenna like appendages usually present. Column short to elongate, with a prominent foot. Anther terminal, incumbent two celled. Pollinia two, waxy, subglobose or ovoid, somewhat cleft, on a fairly long stripe.

As a rule, some kind of *Phalaenopsis* is in bloom at any time of the year, although the hybrids are far less seasonal and tend to bloom in varying degree throughout the year. Since *Phalaenopsis* has a monopodial manner of growth, the flower spikes can be produced at any time without regard to the maturity of the new growth. The inflorescence arises from the base of the leaves and continues to grow in some species as flowers are produced in succession.

Phalaenopsis grows well in temperature ranging from 65^0F at night to 80^0F in the day. It does not require a great deal of light, approximately 1000 foot candles being sufficient. During the day time a high humidity must be maintained with about 70% minimum and higher if the temperature rises. *Phalaenopsis* demand good air movement. It requires proper nutrition for its growth and development. Importance of N, P, K fertilizations has been demonstrated in different species of orchids. Spray application of cow dung and oilcake solution, and micronutrients gave better results in several epiphytic orchids. Use of coated and slow release fertilizers, for example, Osmocote is most suitable for terrestrial orchids. To monitor the weather and nutrient requirements of orchid plants regularly during different growth phases and to administer in proper dose at right time, misting and fertigation technology can be profitably employed.

Several studies found that *Phalaenopsis* plants require high nutrient concentrations for optimal growth under warm environmental conditions (Lee and Lin, 1988; Wang, 1996; Wang and Gregg, 1994). *Phalaenopsis* cannot uptake nutrient significantly from root so foliar nutrient application is very widespread practice in orchid cultivation. So water soluble Nitrogen, phosphorus and potassium with different concentration are commonly used as foliar spray which can be taken up by the plants almost immediately. Otherwise if the plant gets too much NPK at a time it may produce abundant foliage but cannot produce quality flowers. But information regarding the nutritional supplement to *Phalaenopsis* orchids through foliar spray is very scanty. Moreover, the farmers are not able to follow the recommendations, as the recommended NPK formulations are not readily available in the market.

Materials and Methods

The orchid used in the study for the experiment was *Phalaenopsis* Hybrid cv. Shagan producing purple colour flower. It shows a monopodial growth habit: a single growing stem produces 1 or 2 alternate, thick, fleshy, elliptical leaves. Small size clay pots with aeration holes are used for planting of orchid seedlings. Potting of tissue cultured orchid seedlings are done by using coal and coconut husk as potting mixture and crutches are placed below the pot for proper drainage.

Seedlings are placed in the middle of the pot & pots are placed in iron benches in the net house.

The different treatment manipulated as follows T_1 NPK (0:0:50) 0.1%, T_2 NPK (0:0:50) 0.2%, T_3 NPK (0:52:34) 0.1%, T_4 NPK (0:52:34) 0.2%, T_5 NPK (13:0:45) 0.1%, T_6 NPK (13:0:45) 0.2%, T_7 NPK (19:19:19) 0.1%, , T_8 NPK (19:19:19) 0.2%, T_9, NPK (20:20:20) 0.1%, T_{10} NPK (20:20:20) 0.2%, T_{11} (CONTROL).. The treatments were arranged in a completely randomized design with 11 treatments in 3 replications.

Different water soluble fertilizers containing macro nutrients (N, P, K) in different proportions are used for the experiment for better growth and yield of *Phalaenopsis* orchid. 10gms of fertilizer are taken by weighing in an electronic balance and mixed with 100 ml water which can be measured by use of measuring cylinder and these are mixed thoroughly in a beaker. We can stir the solution till it gets mixed properly. Then the nutrient solution can be used immediately or can be kept in air tight bottles at a cool temperature for future use. 5ml /10 ml of nutrient solution is taken in a beaker and can be diluted with 495 or 490 ml water respectively and is applied to the plants by the use of a clean hand pump sprayer.

The plants under the treatment were sprayed with the fertilizers (nutrients) with the help of a clean hand pump sprayer. While spraying maximum care was taken to prevent the adjoining plants getting sprayed.

Control plants were sprayed with only clean tap water. During flowering maximum care was taken to avoid the flowers getting sprayed. Along with these proper horticultural practices like irrigation, weeding & plant protection measures need to be followed.

Results and Discussion

Plant height

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) (8.23 cm) showed highest plant height followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (8.10 cm) and the treatments were statistically at par.

Number of leaves per plant

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) (5.77) showed highest number of leaves per plant followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (5.50) which was statistically at par.

Leaf length

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) (19.83 cm) showed maximum leaf length followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (19.37 cm) and the treatments were statistically at par.

Leaf breadth

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) (5.83 cm) showed maximum leaf breadth followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (5.73 cm) which was statistically at par.

Leaf area

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) (84.83 cm^2) showed maximum leaf area followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (78.75 cm^2) and the treatments were statistically at par.

Number of spike per plant

The data presented in Table 1 revealed that among the different applications of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), treatment T_7 (NPK 19:19:19 @ 0.1%) showed highest number of spike per plant (2.0) followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (1.67) and T_5 (NPK 13:0:45 @ 0.1%) (1.67) and the treatments T_5, T_7 and T_9 were statistically at par.

Table.1 Effects of water soluble fertilizers on vegetative growth and flowering of (*Phalaenopsis* hybrid) cv. Shagan

	Treatments	Plant height (cm)	Number of leaves per plant	Leaf length (cm)	Leaf breadth (cm)	Leaf area (cm^2)	Number of spike per plant	Number of flowers per spike
T_1	NPK 0:0:50 (0.1%)	6.57	3.73	16.17	5.33	69.66	1.00	6.33
T_2	NPK 0:0:50 (0.2%)	5.33	3.77	16.83	5.33	71.66	1.00	6.00
T_3	NPK 0:52:34 (0.1%)	6.50	3.87	16.50	5.50	65.16	1.00	5.33
T_4	NPK 0:52:34 (0.2%)	7.20	4.43	16.10	5.50	72.45	1.33	6.00
T_5	NPK 13:0:45 (0.1%)	7.90	4.93	19.20	5.67	77.50	1.67	8.33
T_6	NPK 13:0:45 (0.2%)	7.30	4.67	16.83	5.50	74.87	1.33	7.33
T_7	NPK 19:19:19 (0.1%)	**8.23**	**5.77**	**19.83**	**5.83**	**84.83**	**2.00**	**10.00**
T_8	NPK 19:19:19 (0.2%)	7.53	4.67	17.40	5.33	70.66	1.33	7.67
T_9	NPK 20:20:20 (0.1%)	8.10	5.50	19.37	5.73	78.75	1.67	8.67
T_{10}	NPK 20:20:20 (0.2%)	7.47	4.67	17.10	5.17	72.41	1.33	6.33
T_{11}	Control	3.90	3.00	13.33	4.33	54.16	1.00	4.33
S.E		**1.06**	**0.66**	**1.49**	**0.32**	**6.43**	**0.27**	**1.33**
C.D		**1.92**	**1.20**	**2.71**	**0.59**	**11.66**	**0.49**	**2.42**

Number of flowers per spike

The data presented in Table 1 revealed that among the different treatments of water soluble fertilizers on *Phalaenopsis* hybrid cv. Shagan, treatment T_7 (NPK 19:19:19 @ 0.1%) showed highest number of flowers per spike (10.00) followed by treatment T_9 (NPK 20:20:20 @ 0.1%) (8.67) and the treatments T_7 and T_9 were statistically at par.

By spraying orchid (*Phalaenopsis* Hybrid) plant with different concentration of water soluble fertilizers significantly increased in the different vegetative growth parameters like plant height, number of leaves, leaf length, leaf breadth, leaf area and different flowering parameters like number of spikes per plant, number of flowers per spike compared to the untreated plants.

Foliar spray of different concentration of water soluble fertilizers on orchid (*Phalaenopsis* Hybrid), maximum plant height (8.23 cm), number of leaves per plant (5.77), leaf length (19.83 cm), leaf breadth (5.83 cm), leaf area (84.83 cm^2), number of spikes per plant (2.00) and number of flowers per spike (10.00) were recorded in treatment T_7 (NPK 19:19:19 @ 0.1%) followed by T_9 (NPK 20:20:20 @ 0.1%) which was statistically at par.

It is evident that nitrogen is one of the key element for the plant growth and increase in nitrogen supply accelerates the synthesis of chlorophyll and amino acids which enhanced the vegetative growth in terms of plant height, number of leaves, leaf length, leaf breadth, leaf area etc. (Mengel and Kirkby, 1987; Devlin, 1973).

Phosphorus plays a vital role in photosynthesis, energy storage, cell division and enlargement (Singh, 1996). Beneficial effects of phosphorus on the growth were probably be the resultant of the increased synthesis of metabolites in the presence of directly applied phosphorus to these plants. Since phosphorus is found in nucleic acids and is involved through ATP in the activation of amino acids for the synthesis of proteins, thus the importance of this element is well documented (Devlin, 1973).

Potassium plays a key role in promoting the vegetative growth, cell expansion and synthesis of chlorophylls (Wilcox, 1964). Ahmed and Tullosh Reid (1968) opined that at the higher levels of potassium uptake and utilization, the availability of nitrogen and phosphorous increases resulting into vigorous growth of the plants. Potassium is an essential element for all the living organisms. In plant physiology, it is the most important cation not only in regard to its contents in plant tissues but also with respect to its physiological and biochemical functions. One main feature of K+ is the high rate at which it is taken up by plant tissues. This rapid rate of uptake of K+ is dependent on the relatively high permeability of the plants membranes of K which probably results from ionophores located in membrane which enable facilitated diffusion. Potassium is involved in the meristematic growth and is of utmost importance for the water status of plants. Uptake of water in cells and tissues is frequently the consequence of active K+ uptake (Lauchli and Pfluger, 1978).

Phosphorus has been called the 'the key to life' because it is directly involved in most of life processes. An adequate supply of phosphorus in the life of a plant is important in laying down the primordia for its reproductive parts (Tisdale and Nelson, 1975). Potassium moves readily with in plants and tends to translocate to the areas of growth (Troeh and Thompson, 1993). Potassium is also involved in the meristematic growth and is of utmost importance for maintenance of water status of the plant. Uptake of water in the cells and tissues is frequently as a consequence of active K+ uptake (Lauchli and Pfloger, 1978). Therefore, more uptakes of P and K resulted into healthy growth and ultimately could produce highest number of spike per plant and flowers per spike.

These results support the findings of Higaki and Imamura (1987) in Vanda; Poole and Seeley (1978) in *Cattleya*, *Cymbidum* and *Phalaenopsis*; Wang and Gregg (1994), Wang (1996), Amberger and Roeber (1997) in *Phalaenopsis*; Wang (1995) in *Dendrobium* and *Phalaenopsis*; Wang (2000) in Hybrid Moth Orchid; Naik and Barman (2006) in *Cymbidium* hybrid; Bhattacharjee (1981), Swapna *et al.*, (2002); Bichsel and Starman (2010), Nair and Sujatha (2010), Kabir *et al.*, (2012), Ahmad and Saravanan (2014) and Trishita *et al.*, (2014) in *Dendrobium* and

Rajesh (2009) and Ali *et al.*, (2014) in *Mokara* sp.

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