



Influence of Biostimulants on Yield and Quality of Dendrobium Orchid (Dendrobium Nobile Lindl.) var. Sonia-17 under Protected Cultivation

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Authors' contributions

This work was carried out in collaboration among all authors. Author PPH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors BCP, NKH, MH and MSK managed the analyses of the study and edited the manuscript. Authors LK and MS managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2020/v32i1030334

Editor(s):

(1) Dr. Fatemeh Nejatzadeh, Islamic Azad University, Iran.

Reviewers:

(1) Gayatri Sahu, Siksha 'O' Anusandhan (SOA), India.

(2) Moataz Eliw Mostafa, Al-Azhar University, Egypt.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/59429>

Original Research Article

Received 27 May 2020
Accepted 31 July 2020
Published 12 August 2020

ABSTRACT

An experiment was carried out at farmer's field, Chapparamane during 2017-19 to know the efficacy of biostimulants on yield and quality of dendrobium orchid var. Sonia-17. Eight biostimulants in two combinations were taken for the study in comparison with Recommended dose of Fertilizers (30:10:10 at vegetative stage and 10:20:20 at flowering stage) as control. The results revealed that among the biostimulant treatments, the plants receiving Biovita (Brown seaweed extract) @ 1.5 per cent produced maximum number of spikes per plant, spikes per square meter and spike yield per 560 square meter (3.93, 55.67 and 31,170 numbers, respectively) with maximum number of florets per spike (9.74), spike length (45.89 cm) spike girth (4.10 mm), spike weight (30.06 g), diameter of floret (9.14 cm) and enhanced vase life of 32.75 days compared to all other treatments and control.

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Keywords: Biostimulant; dendrobium orchid; biovita; seaweed extract.

1. INTRODUCTION

Orchids are the most beautiful flowers in God's creation and have conquered the cut flower industry all over the world during the last few decades. There are more than 25000-35,000 species in nearly 600-800 genera distributed throughout the world and more than 1,25,000 hybrids. India being one of the mega biodiversity regions in the world, is endowed with a rich heritage of orchids with about 1,300 species in 167 genera distributed all over, mainly from North East Himalayas, North West Himalayas, Western Ghats and Andaman and Nicobar Islands [1]. At present cultivation of orchids, is gaining momentum in India. It has got excellent market potential in the floriculture industry.

The decline in natural resources and the environmental damage inflicted by current agricultural practices have become major limitations in conventional agriculture. Therefore, in the recent decades, flower growing practices have been evolving towards organic, sustainable or eco-friendly approaches due to the impact of the green revolution [2]. Accordingly, in modern floriculture new insights have been developed to achieve sufficient and sustainable yield and quality. One of these approaches is the use of biostimulants. They are also referred as 'metabolic enhancers' [3]. They promote plant growth besides improving yield and quality. They can increase crop yield by at least 5-15 per cent (%) and improve fertilizer use efficiency by at least 5-25 per cent [4]. Therefore, the present investigation was carried out to study the influence of biostimulants on yield and quality of Dendrobium orchid var. Sonia - 17 under protected condition.

2. MATERIALS AND METHODS

The study was carried under naturally ventilated polyhouse condition during 2017-19 at farmer's field, chapparamane, sirsi under K R C College of Horticulture, Arabhavi. Three month old healthy tissue cultured plants of var. Sonia - 17 were planted in orchid pots (earthen pots) containing charcoal + tile pieces + coconut husk as a growing media and were placed on concrete benches. The experiment was laid out in Completely Randomized Design with seventeen treatments and two replications. Treatments include T₁ : Control (RDF - 30:10:10 @ 0.2% during vegetative stage and 10:20:20 @ 0.2 % during flowering stage), T₂ - Humigrow (Humic

acid) @ 1% , T₃ - Humigrow @ 1.5% , T₄ - Super growth (Fulvic acid) @ 1% , T₅ - Fulvic acid @ 1.5% , T₆ - Biovita (Sea Weed Extract) @ 1% , T₇ - Biovita @ 1.5% , T₈ - Spic cytozyme (GA₃ 0.001%) @ 0.3% , T₉ - Spic cytozyme @ 0.5% , T₁₀ - Isabion @ 1% , T₁₁ - Isabion @ 1.5% , T₁₂ - Boom flower (Nitro benzene) @ 1% , T₁₃ - Boom flower @ 1.5% , T₁₄ - Formula 15 (Humic Acid + Fulvic Acid + Amino acid) @1% , T₁₅ - Formula 15 @ 1.5% , T₁₆ - Humicel plus (Humic Acid + Fulvic Acid+ Sea Weed Extract) @ 1% , T₁₇ - Humicel plus @ 1.5%. RDF and biostimulants were applied as a foliar spray at weekly intervals.

3. RESULTS AND DISCUSSION

The practical way of measuring the efficiency of the treatment in any crop perhaps lies in the evaluation of crop yields. The results obtained in the present investigation presented in Tables 1-2 showed that the Biovita @ 1.5 per cent (extract of *Ascophyllum nodosum*- a brown sea weed) gave significantly more number of spikes per plant, spikes per square meter and spike yield per 560 square meter (3.93, 55.67 and 31,170 numbers, respectively) which was statistically at par with Humicel plus @ 1.5 per cent (3.81, 54.05 and 30,260 numbers, respectively). Improvement in yield over control is due to the greater availability of essential elements especially nitrogen and phosphorous in seaweed extracts which is responsible for maximum shoot growth, more number of branches and the ultimate size of the plant resulting in the production of higher photosynthates, which subsequently led to desirable C: N ratio. These favourable situations led to the production of more spikes and ultimately higher yield. The above results are supported by Khandelwal et al. [5], Shinde and Naik [6] Karthiraj et al. [7] Basheer and Thekkayam [8] and Pruthvi et al. [9].

The number of florets per spike and floret diameter are one of the important qualitative characters that play an important role in extending the vase life of cut flowers. The longest spike with 9.74 number of florets/spike and maximum flower diameter of 9.14 cm was observed in the foliar application of Biovita @ 1.5 per cent and it was statistically at par with Humicel plus @ 1.5 per cent (9.55 florets and 9.12 cm, respectively). Whereas, the minimum was observed in control (8.35 florets and 8.25 cm, respectively). These results were in

accordance with Shinde and Naik [6] Karthiraj et al. [7] and Karuppaiah and Sendhilnathan [10] who stated that the enlargement in size of the flower might be due to production of more food

which was diverted to the flowering area. The highest stem length was observed in seaweed extract sprayed plants as they are the precursors of auxin, cytokinin and micronutrients.

Table 1. Influence of biostimulants on yield parameters of Dendrobium orchid var. Sonia-17 under protected cultivation

Treatment	Number of spikes per plant	Number of spikes per square meter	Number of spikes per 560 m ² (000' numbers)
T ₁ - Control (RDF)	2.68	37.09	20.77
T ₂ - Humigrow @ 1%	2.82	41.24	23.09
T ₃ - Humigrow @ 1.5%	3.33	46.60	26.09
T ₄ - Super growth @ 1%	3.13	45.31	25.37
T ₅ - Super growth @ 1.5%	3.57	51.68	28.90
T ₆ - Biovita @ 1%	3.59	51.94	29.05
T ₇ - Biovita @ 1.5%	3.93	55.67	31.17
T ₈ - Spic cytozyme @ 0.3%	2.78	39.22	21.96
T ₉ - Spic cytozyme @ 0.5%	3.17	44.20	24.57
T ₁₀ - Isabion @ 1%	2.71	37.47	20.98
T ₁₁ - Isabion @ 1.5%	2.81	40.26	22.54
T ₁₂ - Boom flower @ 1%	2.76	39.54	22.14
T ₁₃ - Boom flower @ 1.5%	3.26	45.88	25.69
T ₁₄ - Formula 15 @ 1%	2.85	42.67	23.89
T ₁₅ - Formula 15 @ 1.5%	3.32	48.95	27.41
T ₁₆ - Humicel plus @ 1%	3.54	51.33	28.74
T ₁₇ - Humicel plus @ 1.5%	3.81	54.05	30.26
S.Em ±	0.05	0.77	0.43
C.D. (5%)	0.15	2.31	1.29

Note* RDF is common for all treatments
RDF: 30:10:10 NPK @ 0.2% at vegetative stage
10:20:20 NPK @ 0.2% at flowering stage

Table 2a. Influence of biostimulants on quality parameters of Dendrobium orchid var. Sonia-17 under protected cultivation

Treatment	Number of florets per spike	Spike length (cm)	Spike girth (mm)
T ₁ - Control (RDF)	8.35	36.50	3.58
T ₂ - Humigrow @ 1%	8.49	39.35	3.59
T ₃ - Humigrow @ 1.5%	8.75	41.20	3.71
T ₄ - Super growth @ 1%	8.80	40.78	3.68
T ₅ - Super growth @ 1.5%	9.30	43.01	3.87
T ₆ - Biovita @ 1%	9.40	41.61	3.86
T ₇ - Biovita @ 1.5%	9.74	45.89	4.10
T ₈ - Spic cytozyme @ 0.3%	8.38	39.13	3.64
T ₉ - Spic cytozyme @ 0.5%	8.61	40.98	3.78
T ₁₀ - Isabion @ 1%	8.34	36.83	3.59
T ₁₁ - Isabion @ 1.5%	8.56	38.50	3.65
T ₁₂ - Boom flower @ 1%	8.47	39.13	3.65
T ₁₃ - Boom flower @ 1.5%	8.60	41.15	3.75
T ₁₄ - Formula 15 @ 1%	8.48	40.70	3.63
T ₁₅ - Formula 15 @ 1.5%	8.81	41.70	3.79
T ₁₆ - Humicel plus @ 1%	9.07	41.25	3.82
T ₁₇ - Humicel plus @ 1.5%	9.55	44.18	3.94
S.Em ±	0.07	0.39	0.02
C.D. (5%)	0.21	1.18	0.05

Note* RDF is common for all treatments
RDF: 30:10:10 NPK @ 0.2% at vegetative stage
10:20:20 NPK @ 0.2% at flowering stage

Table 2b. Influence of biostimulants on quality parameters of Dendrobium orchid var. Sonia-17 under protected cultivation

Treatment	Spike weight (g)	Floret diameter (cm)	Vase life (days)
T ₁ - Control (RDF)	24.94	8.25	27.00
T ₂ - Humigrow @ 1%	26.65	8.71	28.50
T ₃ - Humigrow @ 1.5%	27.69	8.91	30.75
T ₄ - Super growth @ 1%	28.46	8.93	31.23
T ₅ - Super growth @ 1.5%	29.60	9.08	32.20
T ₆ - Biovita @ 1%	29.31	8.95	31.79
T ₇ - Biovita @ 1.5%	30.06	9.14	32.75
T ₈ - Spic cytozyme @ 0.3%	26.88	8.81	29.50
T ₉ - Spic cytozyme @ 0.5%	27.59	8.89	31.00
T ₁₀ - Isabion @ 1%	26.26	8.54	27.50
T ₁₁ - Isabion @ 1.5%	26.63	8.69	30.00
T ₁₂ - Boom flower @ 1%	26.91	8.83	30.25
T ₁₃ - Boom flower @ 1.5%	27.80	8.90	31.20
T ₁₄ - Formula 15 @ 1%	27.84	8.82	30.70
T ₁₅ - Formula 15 @ 1.5%	28.25	9.01	31.25
T ₁₆ - Humicel plus @ 1%	29.13	8.95	31.35
T ₁₇ - Humicel plus @ 1.5%	29.92	9.12	32.21
S.Em ±	0.08	0.04	0.30
C.D. (5%)	0.24	0.13	0.90

Note* RDF is common for all treatments
 RDF: 30:10:10 NPK @ 0.2% at vegetative stage
 10:20:20 NPK @ 0.2% at flowering stage

Spike length, spike girth and spike weight are one of the important qualitative characteristic traits in Dendrobium which plays a prime role in grading of cut flowers. Considerable variations within biostimulant treatments were observed on the above parameters. Among which Biovita @ 1.5 per cent recorded the maximum (45.89 cm, 4.10 mm and 30.06 g, respectively) of all parameters and was found to be statistically at par with Humicel plus @ 1.5 per cent (44.18 cm and 29.92 g respectively) with respect to spike length and spike weight. However, control recorded minimum 36.50 cm, 3.58 mm and 24.94 g, respectively) spike length, spike girth and spike weight in all the intervals. The application of seaweed extracts might have increased the various endogenous hormonal levels in the plant tissue, which ultimately increased the spike length, girth and weight. These results are in line with the findings of Karuppaiah and Sendhilnathan [10].

In terms of vase life, foliar application of Biovita @ 1.5 per cent was found to be more effective and it had a maximum vase life of 32.75 days in normal tap water as compared to control (27 days). But, it was at par with Humicel plus @ 1.5 per cent and Super growth @ 1.5 per cent (32.21 and 32.1 days, respectively). The biostimulant induced photosynthesis that might have been led

to recombination of nutrients in flower that is used for remaining long days in vase life. Entry of seaweed extract into the plant, which might have mediated the respiration by acting as a hydrogen acceptor and thus altering the carbohydrate metabolism of plants promoting the accumulation of sugar as inferred by Karuppaiah and Sendhilnathan [10] Pruthvi et al. [9] and Dhutraj [11]. In addition, Humic and fulvic acids contain cytokinin and auxin that might have increased the antioxidant levels and resistance to senescence leading to enhanced longevity of stem.

4. CONCLUSION

Increase in flower production both qualitatively and quantitatively are the important objectives to be reckoned in commercial flower cultivation. From the study it can be concluded that among the biostimulants used for the study, Biovita @ 1.5% and Humicel plus @1.5% have significant impact on improving yield and quality of Dendrobium orchid var. Sonia 17.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ahmad G, Saravanan S. Effect of NPK and potting media on plant growth and spike yield of *Dendrobium* orchid cv. Sonia Hiskula. Hort Flora Research Spectrum. 2014;3(4):383-385.
2. Wezel A. Agroecological practices for sustainable agriculture. A review. Agron. Sustain. Dev. 2014;34(1):1-20.
3. Calvo P, Nelson L, Kloepper J. Agricultural uses of plant biostimulants. Plant Soil. 2014;383:3-41.
4. European Biostimulants Industry Consortium report on use of biostimulants in the European Continent; 2011.
5. Khandelwal S, Jain N, Singh P. Effect of biozymes and pinching on growth and yield of African marigold (*Tagetes erecta* L.). J. Ornam. Hort. 2003;6(3):271-273.
6. Shinde D, Naik M. Effect of bioenzymes on flowering, yield and vase life of marigold (*Tagetes erecta* L.). Asian J. Hort. 2010; 5(2):420-422.
7. Karthiraj K, Patil R, Vasmate S, Manollikar R. Effect of Bioenzyme on growth, flower yield and vase life of China aster. Asian J. Hort. 2008;3(1):178-179.
8. Basheer SN, Thekkayam SG. Effect of organic nutrition on vegetative growth in Anthurium plants (*Anthurium andreaum* cv. Tropical). The Asian J. Hort. 2012;7(2):354-358.
9. Pruthvi H, Hemla Naik B, Shivaprasad M, Beeralingappa. Effect of biostimulants on morphology, flowering and yield of chrysanthemum under NVPH. The Bioscan. 2017;12(1):273-276.
10. Karuppaiah, Sendhilnathan. Effect of Vermiwash on Dendrobium Orchid Cv. Sakura pink. Asian J. Hort. 2011;45(7):21-23.
11. Dhutraj SV. Effect of various bioenzymes on growth, flower yield and vase life of Gaillardia. M. Sc. (Agri) Thesis, MAU, Parbhani; 2013.

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Peer-review history:

The peer review history for this paper can be accessed here:
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