International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 1987-1990

Received: 21-03-2020
Accepted: 23-04-2020

Kanchan Kushwaha
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

S Saravanan
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Sunita Kumari
Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Ashish Jaiswal
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Corresponding Author:
Kanchan Kushwaha
Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Impact of different micronutrient spray on flower quality production of *Dendrobium* orchid cv. Sonia Hisakula under shade net conditions

Kanchan Kushwaha, S Saravanan, Sunita Kumari and Ashish Jaiswal

DOI: https://doi.org/10.22271/chemi.2020.v8.i3aa.9496

Abstract
The present investigation entitled "Impact of micronutrients spray on quality flower production of *Dendrobium* orchid cv. Sonia Hisakula under shade net conditions" was conducted at the "Orchidarium", Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during the year 2014-15. This experiment was laid out in Completely Randomized Design with thirteen treatments *viz*. T_0-Control, T_1- $CuSO_4$ @ 300ppm, T_2- $ZnSO_4$ @ 300ppm, T_3- Boron @ 200ppm, T_4- $FeSO_4$ @ 300ppm, T_5- $CuSO_4$ @ 600ppm, T_6- $ZnSO_4$ @ 600ppm, T_7- Boron @ 400ppm, T_8- $FeSO_4$ @ 600ppm, T_9-CuSO4 @ 1000ppm, T_{10}- $ZnSO_4$ @ 1000ppm, T_{11}- Boron @ 800ppm & T_{12}- $FeSO_4$ @ 1000ppm with three replications. The results revealed that length of plant, number of leaves per plant, number of roots per plant, root length, leaf area and number of new shoots per plant had found significantly superior with the treatment $FeSO_4$ @ 1000ppm. However, total number of spikes yield per plant per year, average number of florets per spikes, average length of spikes and vase life had observed best with treatment Boron @ 800ppm.

Keywords: Boron, *Dendrobium* Orchid, Micronutrients, Flower Quality, and Production

Introduction
Orchids, also called 'Angel flowers' are the most fascinating and beautiful creation of the nature. Orchids occupy the prime position among all the flowering plants valued for cut flower production and as potted plants (Wang *et al*. 2019) [28]. These extraordinary flowers belong to the family orchidaceae, which has about 35,000 species in 800 genera (Wani, 2018; Chase, 2005) [29, 3]. Orchids are grow all over the world, ranging from Equator to Arctic Circle and from tropics to temperate regions with Amazon and Indo-Malayan region considered as their main centres of origin (Sheela, 2008) [26]. The beauty of orchid flower has obsessed man from time immemorial. India is blessed with a wealth of orchid flora and about 1600 species are estimated to occur in our country, out of which 200 are found in South India, especially in Western Ghats and majority in the North-East Himalayan region (Medhi and Chakrabarthi, 2009; Hegde, 1997) [19, 11]. They play a major role in the economies of many South-East Asian countries. This is also gaining momentum as a lucrative business among the flower growers of South Indian States of Kerala, Tamil Nadu and Sikkim. India is presently exporting cut flowers worth 100 crores annually and is slowly but surely gaining firm feet in this potential business (APEDA 2011) [1].

The importance of micronutrients in Indian agriculture is truly well recognized and their use had significantly contributed to the increased productivity of several crops. The micronutrients are not only essential but also equally important like other major nutrients. The micronutrients like particularly Zinc, Ferrous, Boron and Cupper are play important role in growth, development and production of orchids as well as flower crops (Patil and Kalaivanan, 2019). Their deficiency causes typical symptoms adding to the adverse market acceptance resulting in low profits from flower plants (Ganesh and Kannan, 2013) [5]. Nowadays, micronutrients are gradually gaining momentum among the flower growers because of their beneficial nutritional support and at the same time ensure better harvest and returns. Therefore, we have needed to standardize the best micronutrient spray for quality flower production under shade net condition.

Materials and methods

This experiment was conducted at the "Orchidarium", Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during the year 2014-15. This experiment was laid out in Completely Randomized Design with thirteen treatments *viz*. T_0- Control (only RDF applied), T_1-$CuSO_4$ @ 300ppm, T_2- $ZnSO_4$ @ 300ppm, T_3- Boron @ 200ppm, T_4- $FeSO_4$ @ 300ppm, T_5-$CuSO_4$ @ 600ppm, T_6- $ZnSO_4$ @ 600ppm, T_7- Boron @ 400ppm, T_8-$FeSO_4$ @ 600ppm, T_9- $CuSO_4$ @1000ppm, T_{10}-$ZnSO_4$ @1000ppm, T_{11}-Boron @ 800ppm & T_{12}- $FeSO_4$ @ 1000ppm with three replications during the year 2014-15. This experiment was conduct under shade net conditions. The plants were grown in 12 inch earthen pots and pots were placed over 5cm sand surface. The potting media like soil, rice husk, wheat husk, charcoal, coconut-fibers and brick pieces in 2:1:1:1:2:3 ratio had been used for orchid cultivation. The water-soluble fertilizer 19:19:19 NPK @ 2g was applied weekly interval during the plant growing period. Irrigation was done daily basis as well as requirement of plant. The spray of micronutrients was done two times in a week. The observations like length of plant, number of leaves per plant, new shoots per plant, number of roots per plant, length of roots, number of spike/plant/year, number of florets per spike, length of spike and vase life of spike were recorded during the experimentation. The data had analyzed by STPR-3 software.

Results and discussion

The results shows that the effect of spray of micronutrients were significantly effecting the length of plant (cm), number of leaves per plant, new shoots per plant, number of roots per plant, length of roots (cm), number of spike/plant/year, number of florets per spike, length of spike and vase life of spike (days).

Effect of micronutrient sprays on vegetative and root characters

The data related to above observations are present in table 1 and figure 1 & 2. The treatment ferrous sulphate @1000ppm had significantly maximum length of plant (37.33cm) while, control had minimum length of plant (33.76cm). The treatments zinc sulphate @ 600 pap (35.73cm), ferrous sulphate @ 600ppm & copper sulphate @ 1000ppm (36.23cm), zinc sulphate @1000ppm (37.06cm) and boron @ 800ppm (36.83cm) were found statistically at par over treatment ferrous sulphate @ 1000ppm (figure 1). The statistically maximum average number of leaves per plant (11.00) was recorded with the ferrous sulphate @ 1000ppm whereas; minimum average number of leaves was noted in control (8.00) and data are shown in figure 1. The treatment zinc sulphate @1000ppm (10.66) was statistically at par over treatment ferrous sulphate @ 1000ppm. The statistically maximum leaf area (35.46 cm^2) was recorded with the treatment ferrous sulphate @ 1000ppm followed by ferrous sulphate @ 300ppm (33.66 cm^2), copper sulphate @ 600ppm (34.13cm^2), zinc sulphate @ 600ppm (34.60cm^2), boron @ 400ppm (34.06cm^2), ferrous sulphate @ 600ppm (33.60cm^2), copper sulphate @ 1000ppm (34.80cm^2), zinc sulphate @ 1000ppm (35.00cm^2) as compared to control (31.26cm^2) and data are presented in table 1. The treatment ferrous sulphate @ 1000ppm had significantly produced average number of new shoots per plant per year (6.33), average number of roots (24.00/plant), average length of root (17.00cm) as compared to control (like-3.66/plant/year, 19.00/plant & 14.66 cm, respectively).

This is might be due to iron plays the part of a vital catalyst in synthesis of chlorophyll molecule and helps on the absorption of other elements and key element in various redox reactions of respiration, photosynthesis and reduction of nitrates and sulphates (Rout and Sahoo, 2015) [22]. As redox-active metal, it is involved in photosynthesis, mitochondrial respiration, nitrogen assimilation, hormone biosynthesis (Ethylene, Gibberellic acid, Jasmonic acid), and production (Hansch and Mendel, 2009), scavenging of reactive oxygen species, osmoprotection and pathogen defense (Sharma *et al*., 2012) [25]. Ganga *et al*. (2009) [6] reported that foliar spray of ferrous ammonium sulphate (1000 ppm) significantly increased the plant vegetative parameters (like plant height, number of leaves/plant, number of pseudobulbs/plant, number of roots/plant). Similar results had reported by Gupta (2018) [7] in orchid (*Dendrobium nobile*) cv. Sonia White under shade net house. Saud *et al*. (2016) [24] noted that vegetative and flowering characters was significantly influenced by treatment zinc @1000ppm but treatment RDF + Zn @750 ppm was found superior in respect of least days to flower bud appearance & harvest of spike of orchid (*Dendrobium* spp.) cv. Sonia. Kumar & Arora (2000) observed that spray of $FeSO_4$ @ 0.2% at 3-leaf and 6-leaf stages had been increased the plant height and number of leaves of gladiolus var. White Prosperity and similar result also reported by Lahijie (2012) [17]; Halder *et al.* (2007) [8]; Singh *et al*. (2012) [27] and Maurya & Kumar (2014) [18] in gladiolus.

Effect of micronutrient sprays on flowering traits

The significantly maximum number of spike (5.66/plant/year) was produced with the treatment Boron @ 800ppm followed by ferrous sulphate @ 300ppm, zinc sulphate @ 600ppm, boron @ 400ppm (4.66/plant/year, respectively), ferrous sulphate @ 600ppm, copper sulphate @ 1000ppm (5.33/plant/year, respectively) and zinc sulphate @ 1000ppm, ferrous sulphate @ 1000ppm (5.33/plant/year) as compared to control (3.00/plant/year) (figure 2). The treatment boron @ 800ppm had maximum average number of spike (6.00/spike) however, least no of florets (3.33/spike) was recorded with the control. The treatments boron @ 400ppm (5.00/spike, respectively), ferrous sulphate @ 600ppm, zinc sulphate @ 1000ppm (5.33/spike, respectively) and ferrous sulphate @ 1000ppm (5.66/spike) were found statistically at par over the treatment boron @ 800ppm. The same treatment had maximum length of spike (34.00cm) followed by treatment ferrous sulphate @ 600ppm & zinc sulphate @ 1000ppm (32.33cm), copper sulphate @ 1000ppm & ferrous sulphate @ 1000ppm (32.66cm) as compared to control (27.66cm) (figure 2). The significantly maximum vase life (14.00 days) was registered with the treatment boron @ 800ppm while least vase life (11.00 days) was noted with control (table 1). The treatments ferrous sulphate @ 600ppm, zinc sulphate @ 1000ppm, copper sulphate @ 1000ppm and ferrous sulphate @ 1000ppm were found statistically at par over treatment boron @ 800ppm.

This is might be due to boron is essential for plant growth, new cell division in meristematic tissue, translocation of sugar, starch, nitrogen, phosphorus, certain hormones, synthesis of amino acids and protein, regulations of carbohydrate metabolism, development of phloem etc. In the absence of adequate supply, middle lamella of new cell develops poorly and phloem tubes break down (Hänsch & Mendel, 2009) [9, 10]. Ganga *et al*. (2009) [6] reported that foliar spray of ferrous ammonium sulphate (1000 ppm) significantly increased the qualitative traits like number of spikes/plant, number of florets/spike, spike length, flower pedicel length,

and vase life of *Dendrobium* orchid under shade net house conditions. Saikia *et al.* (2018) [23] reported that application of recommended dose of fertilizers with foliar spray of Zn @ 750ppm significantly increase the flower quality parameters of Foxtail orchid (*Rhynchostylis retusa* L.) under shade net house conditions. Bashir *et al.* (2013) [2] recorded significant effect of micronutrient spray on vegetative and flowering parameter attributes *Gerbera jamesonii* L. Kumar & Arora (2000) [16] observed that spray of 0.4% $FeSO_4$ + 0.2% $ZnSO_4$ at 3-leaf & 6-leaf stages had been increased the quality of flower of gladiolus var. White Prosperity. The similar results were reported by Muthumanickam *et al.* (1999) [20] in gerbera, Katiyar *et al.* (2005) [12] and Erao (2005) [4] in gladiolus, Khalifa *et al.* (2011) [13] in iris, Kumar *et al.* (2009) [15] in chrysanthemum, Kumar *et al.* (2012) [14] in tuberose.

Tables 1: Effect of micronutrient sprays on plant growth and quality traits of *Dendrobium* orchid CV. Sonia Hisakula under shade net house conditions

Treatments	Parameters				
	Leaf area/ plant (cm^2)	No. of new shoots/plant/year	No of roots/plant	Length of root (cm)	Vase life (day)
Control	31.26	3.66	19.00	14.66	11.00
Copper sulphate@300ppm	31.53	4.33	19.66	14.93	12.00
Zinc sulphate@300ppm	32.40	4.66	20.33	15.80	11.33
Boron@200 ppm	32.73	5.00	20.66	15.63	12.33
Ferrous sulphate@300ppm	33.66	4.66	20.66	16.03	12.33
Copper sulphate@600ppm	34.13	5.00	21.00	16.33	12.33
Zinc sulphate@600ppm	34.60	5.33	20.66	15.93	11.66
Boron@400ppm	34.06	5.00	20.66	16.26	12.33
Ferrous sulphate@600ppm	33.60	4.66	21.66	16.60	12.66
Copper sulphate@1000ppm	34.80	5.66	21.66	16.26	12.66
Zinc sulphate@1000ppm	35.00	6.00	22.33	16.93	13.00
Boron@800ppm	34.40	5.66	23.00	16.46	14.00
Ferrous sulphte@1000ppm	35.46	6.33	24.00	17.00	13.33
F- test	S	S	S	S	S
S.Ed ±	2.23	0.61	1.00	0.51	0.84
CD (5%)	2.50	1.31	1.67	1.20	1.54

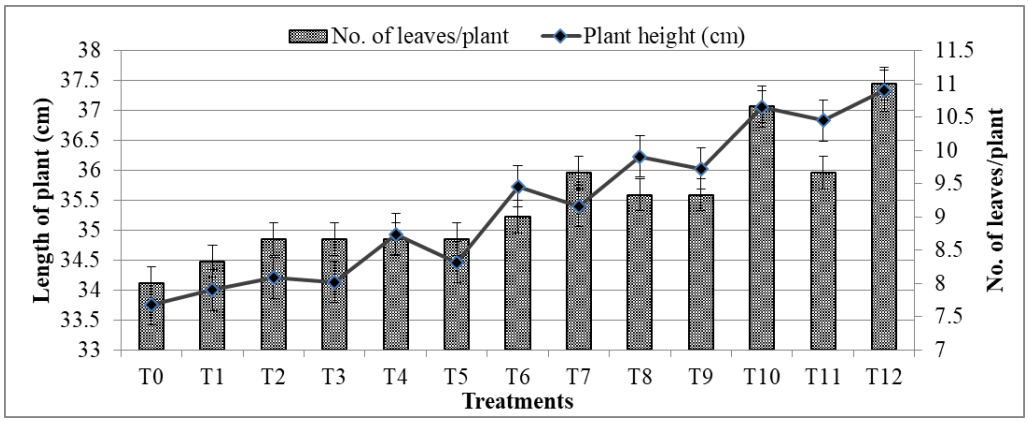

Fig 1: Effect of micronutrient sprays on length of plant and no of leaves/plant of *Dendrobium* orchid cv. Sonia Hisakula under shade net house conditions.

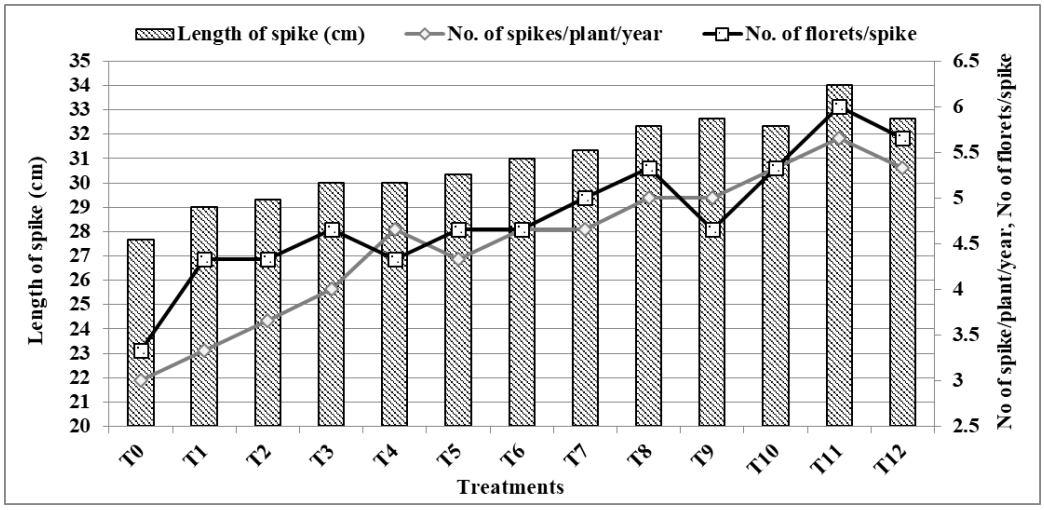

Fig 2: Effect of micronutrient sprays on no of spike /plant/year, no of florets/plant and length of spike of *Dendrobium* orchid cv. Sonia Hisakula under shade net house conditions.

Conclusion

It may concluded that ferrous sulphate @ 1000ppm has been recommended for better vegetative growth but boron @ 800ppm is recommended for quality production of orchids under shade net conditions.

References

1. APEDA. Agricultural & Processed Food Products Export Development Authority. Ministry of Commerce & Industry, Govt. of India, India, 2011. Available at: www.apeda.gov.in/ (accessed 11.01.12).
2. Bashir MA, Ahmad W, Ahmad KS, Shafi J, Shehzad MA, Sarwar MA *et al*. Efficacy of foliar application of micronutrients on growth and flowering of *Gerbera jamesonii* L. Universal J Agric. Res. 2013; 1(4):145-149.
3. Chase MW. Classification of Orchidaceae in the age of DNA data. Curtis's Bot. Mag. 2005; 22(1):2-7.
4. Erao KS. Influence of iron nutrition on growth, flowering and corm yield in gladiolus. Journal of Ornamental Horticulture. 2005; 8(4**)**:293-295.
5. Ganesh S, Kannan M. Essentiality of micronutrients in flower crops: a review. Research & Reviews: Journal of Agriculture and Allied Sciences. 2013; 2:52-57.
6. Ganga M, Padmadevi K, Jegadeeswari V, Jawaharlal M. Performance of Dendrobium cv. Sonia 17 as influenced by micronutrients. Journal of Ornamental Horticulture. 2009; 12(1):39-43.
7. Gupta H, Verma LS, Sahu HK. Studies on the effect of micronutrient on the growth of orchid (*Dendrobium nobile*) cv. Sonia white under shade net house. IJCS. 2018; 6(6):2303-2308.
8. Halder NK, Rafiuddin MD, Siddiky MA, Gomes R, Begum KA. Performance of Gladiolus as influenced by boron and zinc. Pakistan Journal of Biological Sciences, 2007; 10:581-585.
9. Hänsch R, Mendel RR. Physiological functions of mineral micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, cl). Current opinion in plant biology. 2009; 12(3):259-266.
10. Hänsch R, Mendel RR. Physiological functions of mineral micronutrients (Cu, Zn, Mn, Fe, Ni, Mo, B, cl). Current opinion in plant biology. 2009; 12(3):259-266.
11. Hegde S. Orchid wealth of India. Proc, Indian natn. Sci. Acad. B63 No. 1997; 3:229-244.
12. Katiyar RS, Garg VK, Singh PK. Foliar spray of Zn and Cu on growth, floral characteristics and yield of gladiolus grown in sodic soil. Indian journal of Horticulture. 2005; 62(3):272-275.
13. Khalifa RKHM, Shaaban SHA, Rawia A. Effect of foliar application of zinc sulfate and boric acid on growth, yield and chemical constituents of iris plants. Ozean Journal of Applied Sciences. 2011; 4(2)**:**129-144.
14. Kumar J, Kumar P, Pal K. Effect of biofertilizer and micronutrient on growth and flowering of tuberose (*Polianthes Tuberosa* L.) cv. pearl double. Agricultural Science Digest-A Research Journal. 2012; 32(2):164-167.
15. Kumar PN, Misra RL, Dhiman SR, Ganga M, Lalitha K. Effect of micronutrient sprays on growth and flowering of chrysanthemum. Indian Journal of Agricultural Sciences. 2009; 79(6):426-428.
16. Kumar P, Arora JS. Effect of micronutrients on gladiolus. Journal of Ornamental Horticulture. 2000; 3(2):91-93.
17. Lahijie MF. Application of micronutrients Feso4 and Znso4 on the growth and development of Gladiolus variety" Oscar". International Journal of Agriculture and Crop Sciences (IJACS). 2012; 4(11):718-720.
18. Maurya R, Kumar A. Effect of micronutrients on growth and corm yield of gladiolus. Plant Archives. 2014; 14(1):529-531.
19. Medhi RP, Chakrabarthi S. Traditional knowledge of NE people on conservation of wild orchids. Indian Journal of Traditional Knowledge. 2009; 8(1):11-16.
20. Muthumanickam D, Rajamani K, Jawaharlal M. Effect of micronutrients on flower production in gerbera. Journal of Ornamental Horticulture, 1999; 2(2):131-132.
21. Patel TD, Viradia RR, Tejashwini CR, Patel HV, Patel, UR. Studied on effect of foliar application of micronutrient (Fe and Zn) on growth, flowering quality and yield of tuberose (*Polianthes tuberosa* L.) cv. Prajwal. International Journal of Chemical Studies. 2017; 5(6):93-97.
22. Rout GR, Sahoo S. Role of iron in plant growth and metabolism. Reviews in Agricultural Science. 2015; 3:1-24.
23. Saikia P, Talukdar MC, Das P. Optimization of zinc, magnesium and calcium on growth and flowering of *Rhynchostylis retusa* L. Acta Scientific Agriculture. 2018; 2(4):12-15.
24. Saud BK, Biju B, Talukdar MC. Response of hybrid orchid (*Dendrobium* spp.) cv. Sonia to application of micro nutrients. Hort Flora Research Spectrum. 2016; 5(1):57-60.
25. Sharma P, Jha AB, Dubey RS, Pessarakli M. Reactive oxygen species, oxidative damage, and antioxidative defense mechanism in plants under stressful conditions. Journal of botany, 2012, 1-26.
26. Sheela VL. Flowers for trade, 2008, (10). New India Publishing.
27. Singh JP, Kumar K, Katiyar PN. Effect of zinc, iron and copper on yield parameters of gladiolus. HortFlora. Res. Spect. 2012; 1:64-68.
28. Wang SL, Viswanath KK, Tong CG, An HR, Jang S, Chen FC *et al*. Floral induction and flower development of orchids. Frontiers in plant science. 2019; 10:1258.
29. Wani AH. Orchids. Potential in temperate areas. Rashtriya Krishi. 2018; 13(1):1-5.