

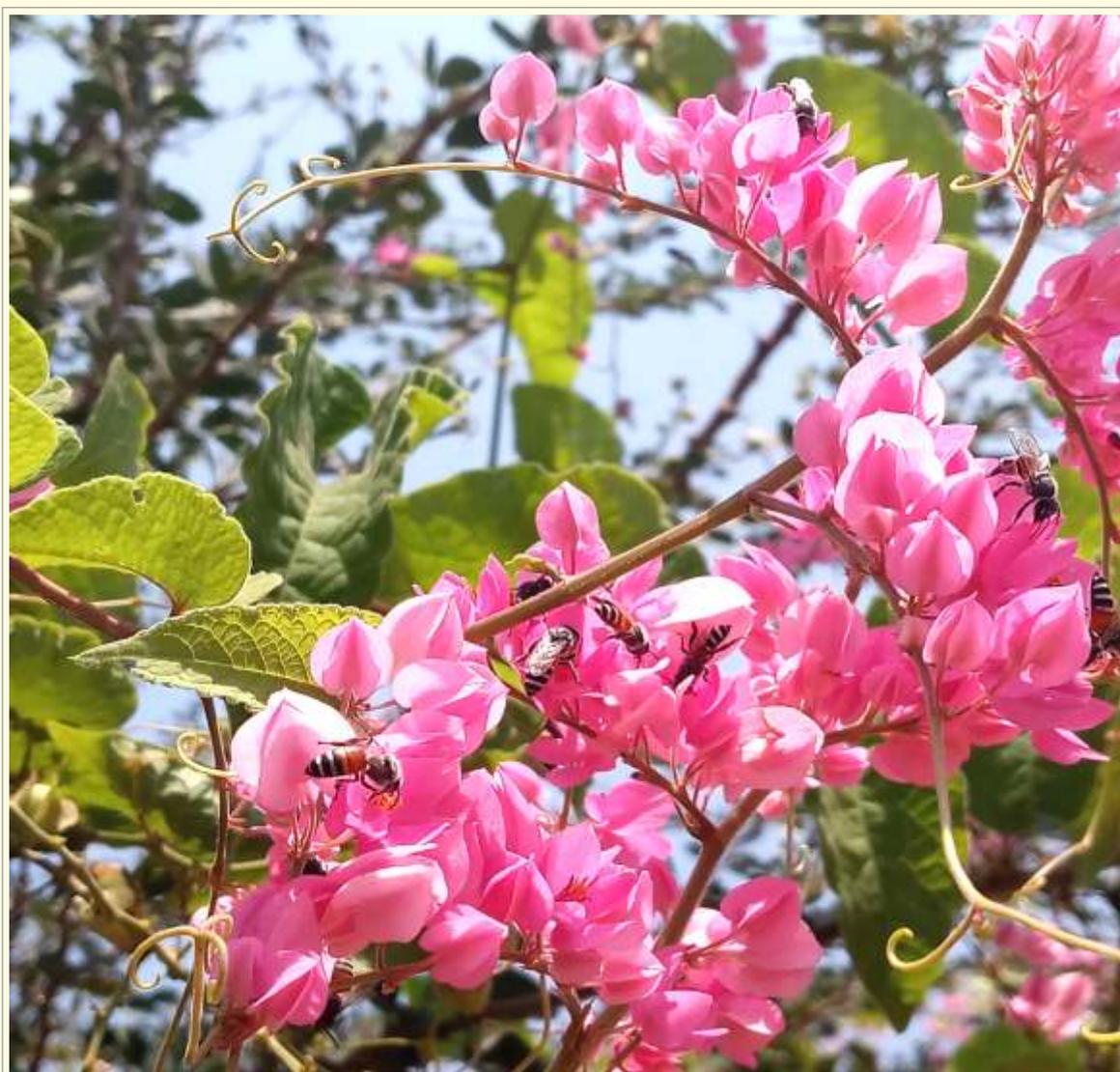
ISSN 0973-354X  
eISSN 2582-4899

# JOURNAL OF HORTICULTURAL SCIENCES

Volume 15

December 2020

Number 2



Conserving Honey Bees with Forage Plant Mexican Creeper - *Antigonon leptopus*



**Society for Promotion of Horticulture**  
ICAR - Indian Institute of Horticultural Research, Bengaluru - 560 089



# JOURNAL OF HORTICULTURAL SCIENCES

(Founded in 2005 by the Society for Promotion of Horticulture, Bengaluru, India)

Email : [chiefeditor.jhs@gmail.com](mailto:chiefeditor.jhs@gmail.com) Webpage : <https://jhs.iihr.res.in/index.php/jhs>

## Editor-in-Chief

Dr. S. Sriram

## Editors

Dr. K. Himabindu

Dr. G. Senthilkumaran

Dr. Tejaswini Prakash

Dr. M. Manamohan

Dr. Anil Kumar Nair

Dr. J. Satisha

Dr. P. Venkata Rami Reddy

Dr. I.M. Doreyappa Gowda

Dr. R.H. Laxman

Dr. G.C. Sathisha

## Editorial Advisory Board

### International Editorial Advisory Board

Dr. Nanthi S. Bolan, Australia

Dr. Rod Drew, Australia

Dr. J. Mithila, USA

Dr. Claus Helmut Franz Orth, South Africa

Dr. Ilan Paran, Israel

Dr. Gi-Cheol Song, Republic of Korea

Dr. Jill Stanley, New Zealand

Dr. Palitha Weerakkody, Sri Lanka

### National Editorial Advisory Board

Dr. S. D. Shikhamany

Dr. V. A. Parthasarathy

Dr. K. V. Peter

Dr. Sisir K. Mitra

Dr. S.K. Tikoo

Dr. Seetharam Annadana

Dr. A. Krishnamoorthy

Dr. Leela Sahijram

## SOCIETY FOR PROMOTION OF HORTICULTURE (REGD.)

Email : [sphihr2005@gmail.com](mailto:sphihr2005@gmail.com) Website : [www.sphindia.org](http://www.sphindia.org)

### Executive Council - 2020

**President** : Dr. M.R. Dinesh

**Vice Presidents** : Dr. G. S. Prakash  
Dr. T.N. Shivananda

**General Secretary** : Dr. C. Aswath

**Editor-in-Chief** : Dr. S. Sriram

**Treasurer** : Dr. D.V. Sudhakar Rao

**Joint Secretaries** : Dr. P.C. Tripathi  
Dr. T.H. Singh

**Members** : Dr. T.S. Aghora  
Dr. K.S. Shivashankara  
Dr. Prakash Patil  
Dr. H. S. Oberoi  
Dr. C.K. Narayana  
Dr. B. Narayanaswamy  
Dr. B. Hemla Naik  
Dr. L.N. Mahawer  
Dr. Sanjay Kumar Singh  
Dr. S.K. Mitra  
Dr. S. Hazarika  
Dr. Gobind Acharya

**This Journal is abstracted in CABI, Current Contents, AGRIS, Indian Science Abstracts, Scopus, DOAJ and Redalyc. It is a participant of AmelICA.**

Request for membership subscriptions along with cheque/DD drawn in favour of **Society for Promotion of Horticulture, Bengaluru** may be sent to General Secretary, Society for Promotion of Horticulture, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru - 560 089, India. All members except student members and subscribers get all publications of SPH free of cost. Any correspondence other than editorial may be addressed to General Secretary, Society for Promotion of Horticulture, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru - 560 089, India.

Advertising space in the journal is available. For information and rates, please contact General Secretary, SPH, IIHR, Bengaluru - 560 089, India. Advertising material should cater to the interest of researchers, subscribers, etc. who are involved in promotion of horticulture. Publication of advertisement is not an endorsement or approval, expressed or implied by the SPH or the editors of any service, product or claim made by the manufacturer.

Coverpage Courtesy : **Rami Reddy P.V.**, P.No. 225

### SUBSCRIPTION RATES

Patron	₹ 20,000
Life member	₹ 5,000
Annual Member	₹ 1,000 / US \$ 100 (US \$ 50 for SAARC countries)
Student Member	₹ 500
Student Life Member	₹ 3,000
Annual Subscription	₹ 1,500 / US \$ 100 (US \$ 60 for SAARC countries) (for institutions)
Enrolment Fee	₹ 200 / US \$ 5 (Additional for all types of Membership)

**NAAS rating of this journal is 3.43. JHS is now available online.  
Authors have to submit manuscripts using the link : <https://jhs.iihr.res.in/index.php/jhs>**

*Technical Assistance : Dr. Sridhar Gutam, Thippeswamy S. and Pramida A.*

# JOURNAL OF HORTICULTURAL SCIENCES

Volume 15

Number 2

December 2020

## CONTENTS

### ***In this Issue***

i-ii

### ***Review***

- Biodiversity of tropical fruits and their conservation in India** 107-126  
Sankaran M. and Dinesh M.R.
- An overview of canopy management in cashew (*Anacardium occidentale* L.)** 127-135  
Adiga D.J., Veena G.L., Thondaiman V. and Babli M.

### ***Original Research in Papers***

- Phenotypic variability for horticultural and fruit quality attributes in plastic house grown tomato** 136-146  
Adeniji O.T., Tenebe A.V., Ishaka A., Jandong E., Adamu J.T., Adekoya M., Zamzam M.A. and Aremu C.A
- Development and evaluation of novel gladiolus hybrid selections IHRG-7 (IC620379) and IHRG-11 (IC620380) for flower quality and *Fusarium* wilt resistance** 147-152  
Rao T.M., Janakiram T., Negi S.S., Aswath C., Dhananjaya M.V., Kumar R. and Ramachandran N.
- Evaluation of potassium salt of phosphonic acid in Nagpur mandarin with special reference to *Phytophthora* management** 153-160  
Ingle Y.V., Paithankar D.H., Sadawarte A.K. and Bhonde S.R.
- Genetic analysis in mango (*Mangifera indica* L.) based on fruit characteristics of 400 genotypes** 161-172  
Sankaran M., Dinesh M.R., Gowda D.C.S. and Venugopalan R.
- Standardization of nitrogen application for potted *Chrysanthemum morifolium* cv. kikiobiory** 173-176  
Tanya Thakur
- Influence of inorganic nutrients on growth, flowering and quality of *Dendrobium* cv. Singapore white** 177-182  
Sujatha A. Nair, Sankar V., Muralidhara, B.M., Awcharae C.M. and Singh D.R.
- Palynological investigations in *Jasminum* spp.** 183-190  
Ganga M., Lakshmi J., Manivannan N. and Rajamani K.



- Effect of putrescine and benzyl adenine on growth, flowering and post-harvest keeping quality parameters in chrysanthemum (*Chrysanthemum morifolium ramat*)** 191-196  
Taranjit Singh and Madhu Bala
- Studies on bioavailability of iron from fe-fortified commercial edible mushroom *Hypsizygusulmarius* and standardization of its delivery system for human nutrition** 197-206  
Pandey M., Gowda N.K.S., Satisha G.C., Azeez S., Chandrashekara C., Zamil M. and Roy T.K.
- Amino acid profile of eighteen isolate of different edible macrofungal species** 207-220  
Azeez S., Pandey M., Jasmin M.R., Rachitha R., Satisha G.C., Roy T.K.  
Chandrashekara C. and Shivashankara K.S.

### **Short Communications**

- A promising new tamarind selection-lakshamana : Linking biodiversity with livelihood** 221-224  
Kanupriya C., Karunakaran G. and Singh P.
- Mexican creeper, *Antigonon leptopus* Hook. and Arn : An effective bee forage plant to conserve honey bee** 225-228  
Rami Reddy P.V.
- First report on honeydew excretion by the melon thrips, *Thrips palmi* karny (Thysanoptera : Thripidae) and its biochemical analysis** 229-232  
Aravintharaj R., Asokan R. and Roy T.K.
- Influence of potting mixture on growth and economics of stone graft of mango cv. alphonso** 233-237  
Lad O.A., Kulkarni M.M., Ragaji S.G., Gavankar M.S., Burondkar M.M., Gokhale N.B.  
Pawar C.D., Khandekar R.G., Kshirsagar P.J. and Desai V.S.

## ***In this issue...***

### ***Hearty New Year Greetings from our Editorial Team to all the readers of JHS!***

*As the world is slowly coming out of glitches of pandemic, there is no other better way than celebrating 2021 as Year of Fruits and Vegetables as announced by United Nations Assembly to welcome the new year and recognize the importance of nutrition for better health. Fruits and Vegetables ensure the Nutritional Security to humankind. They play key role in addressing the malnutrition that is a major concern. We are proud that JHS creatins awareness of importance of fruits and vegetables by publishing the recent developments in research with respect to these crops.*

*Diversity of fruit crops and genetic resources available with respect to fruit crops are important for developing better fruit crop varieties. **Sankaran and Dinesh** have reviewed the “Biodiveristy of Fruit Crops in India” in a very comprehensive way. There is diversity in Jasmine species. **Ganga et al.** carried out the palynological investigations and recorded the variability in pollen morphology in different species of Jasmine by documenting images using scanning electron microscope. Biodiversity can be linked to livelihood also. One such success story with tamarind selection ‘Lakhamna’ is being reported by **Kanupriya et al.** This tamarind selection has been identified from participatory breeding programme. It has a better pod characters and more preferred by consumers.*

*Protected cultivation has seen greater momentum in last two decades. **Adeniji et al.** identified the best varieties of tomato for polyhouse cultivation in Nigeria. **Rao et al.** selected two gladiolus hybrid selections IIHRG-7 and IIHRG-11 with red purple and red coloured flowers respectively. These hybrids have resistance to Fusarium wilt and suitable for cut flower and flower arrangement purposes. **Sankaran et al.** analysed the variance for 6 quantitative and 30 qualitative traits in mango in 400 genotypes and identified 18 clusters. Selected genotypes from specific clusters can be used in hybridization programme.*

*The production aspects are important in perennial crops. It is crop management that needs to be prioritized for enhanced yield. **Adiga et al.** have reviewed the research work carried in “Canopy Management in Cashew”, providing the wholistic view of cultural operations to have a better crop. Use of soilless medium in nursery industry is gaining importance. Best suited potting mixture for mango stone graft of cv. Alphonso has been identified by **Lad et al.** They found that cocopeat + leaf manure + compost (1:1:2) as pot mixture provided better plant growth.*

*Growing Chrysanthemum in pots is practiced in home and terrace gardens. The cultivar Kikiobiory is well suited for this purpose. **Thakur** has studied the nitrogen requirement for this cultivar and has come out with the recommendation of 300 mg of N per pot applied*



twice in September and October in Punjab for best results. In another study, **Singh and Bala** confirmed that use of benzyl adenine at 200 ppm helped in extended vase life of *Chrysanthemum morifolium* flowers. **Nair et al.** recorded that foliar spray of 30:20:20 NPK at weekly interval recorded more number of flowers of *Dendrobium* cv. Singapore White with significantly longer spikes.

Crop production is directly influenced by pollinators. Decline in honey bee population is a serious concern and to conserve the pollinators community approach through ecosystem services is required. **Rami Reddy** reports the benefits of having ornamental plant Mexican Creeper (*Antigonon leptopus*) as forage plant. This creeper attracted all the four species of honey bees studied. This creeper can be used as bioindicator of honey bee population.

**Aravindaraj et al.** have reported the honey dew secretion by *Thrips palmi* and analysed the composition of it. They had identified different sugars present in the honey dew secretion of *Thrips*. *Thrips* not only cause direct damage but act as vectors of many plant viruses. Management of diseases in perennial crops is a challenge. *Phytophthora* incited root infection in citrus needs concerted efforts. **Ingle et al.** have demonstrated that use of potassium salt of phosphonic acid could help in management of *Phytophthora* root rot in Nagpur Mandarin.

Mushrooms can fill the gaps in nutritional security as they are rich in nutritive value. Iron deficiency is important issue to be addressed. Iron fortified oyster mushroom products have been developed by **Pandey et al.** The bioavailability of iron from Arka Mushroom Fe-Fortified Rasam Powder has been confirmed. In another study, the amino acid profile of 18 isolates of oyster mushroom species belonging to 4 species have been documented by **Azeez et al.** Quantification of essential and non-essential amino acids has been reported. Nutritionally superior isolates can be selected from these isolates.

The editorial team of JHS expresses the sincere efforts of reviewers who really complement the publication processes. All scientists and scholars can utilize the open access of JHS. Recently FAO has made JHS available through AGRIS. It is indexed by Redalyc, CABI\_Hort and Scopus. All subscribers, scientists and scholars are requested to continue their support in publishing quality information in **Journal of Horticultural Sciences**.

**S. Sriram**  
Editor in Chief

**Original Research Paper**

## **Influence of inorganic nutrients on growth, flowering and quality of *Dendrobium* cv. Singapore white**

**Sujatha A. Nair<sup>1\*</sup>, Sankar V.<sup>1</sup>, Muralidhara, B.M.<sup>3</sup>, Awcharae, C.M.<sup>2</sup> and Singh D.R.<sup>4</sup>**

<sup>1</sup>ICAR-Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru

<sup>2</sup>ICAR-Directorate of Cashew Research, Puttur

<sup>3</sup>ICAR-Central Horticultural Experimental Station, Chetalli, Kodagu

<sup>4</sup>ICAR- National Research Centre for Orchids, Pakyong

\*Corresponding author Email: SujathaA.Nair@icar.gov.in

### **ABSTRACT**

***Dendrobium* orchid cv. Singapore White is cultivated commercially for cut flower purpose. The performance of this orchid in response to the different nutrient concentrations was evaluated under the agro-climatic conditions of Kodagu during 2017-2020. Twelve nutrient doses were applied as foliar sprays at weekly intervals to study their effect on vegetative growth, flower production and quality parameters of the cut flowers. Plant height, number of leaves plant<sup>-1</sup>, leaf area, number of pseudobulbs plant<sup>-1</sup>, number of spikes plant<sup>-1</sup> year<sup>-1</sup>, number of flowers spike<sup>-1</sup> and spike length varied significantly with the nutrient doses. Foliar spray of 30:20:20 NPK 0.1% at weekly intervals recorded the maximum plant height of 53.21cm, number of spikes plant<sup>-1</sup>year<sup>-1</sup> (10.01) with spike length of 44.43 cm and 16.20 flower spike<sup>-1</sup>.**

**Key words:** Cut flower production, *Dendrobium*, Nutrients, Orchid and Quality

### **INTRODUCTION**

*Dendrobium* orchid cv. Singapore White is an epiphyte belonging to the family Orchidaceae. It produces long spikes bearing attractive white flowers and is commercially cultivated for cut flower purpose. Globally orchids are traded as cut flowers and potted plants and are estimated to comprise of about 10% of the total cut flower trade (De *et al.*, 2014). Indian orchid trade registered an increased trend of import value of orchids as compared export value during 2013-2014 to 2018-2019. According to De (2020) the highest import of orchids was recorded in 2013-2014 (Rs. 3425.76 lakh) followed by 2015-2016 (Rs. 2985.19 lacs) and 2018-2019 (Rs. 2321.84 lakh). Commercial cultivation of orchids in India has lot of scope to meet the demand for orchid cut flowers thereby reducing our dependence on imported flowers.

In India, states such as Kerala, Tamil Nadu, Karnataka, and Maharashtra are commercially cultivating *Dendrobium* orchids for cut flower production. This species comprises of 90% of the orchids in commercial cultivation (Rajeevan and

Shobhana, 1993). Similarly, in Karnataka, *Dendrobium* cultivation has been taken up in a cluster mode under Kanflora Society (Hegde, 2017). Kodagu, in Karnataka harbours about 75 species of native orchids and has conducive climatic conditions for commercial cultivation of orchids (Rao, 1998). Among the exotic orchids, *Phalaenopsis*, *Dendrobium* and *Oncidium* are grown by orchid enthusiasts in this region. There is a lot of potential for commercial cultivation of orchids in this region.

Orchid plants receive water and nutrition from rainfall, air, breakdown of humus accumulated in the crevices of tree trunks and bird droppings in its natural habitats (Naik *et al.*, 2009). For commercial cultivation orchid plants have to be provided with inorganic nutrients through foliar sprays for proper growth and development. Frequent application of diluted fertilisers to cater to the nutrient absorption and storage capacity is the general norm. Considering these facts, the present study was conducted to identify the



optimum nutrient regime for *Dendrobium* orchids to realise higher cut flower yield of superior quality under Kodagu conditions.

## MATERIALS AND METHODS

The present investigations to study the effect of inorganic nutrients on growth and flowering of orchids, *Dendrobium* cv. Singapore White was conducted during 2017-2020 at the Central Horticultural Experiment Station of ICAR- Indian Institute of Horticultural Research, located in Chetalli in Kodagu district of Karnataka. Chetalli is located between 12° 37' North latitude and 75° 83' East longitude at an elevation of 1050 m above MSL, with temperature ranging from 19°C to 32°C and relative humidity from 55- 90%. Hardened tissue cultured plants were planted in 8" plastic pots in a medium comprising of broken tile bits, chopped coconut husk and charcoal in 1:1:1 ratio (v/v) and was housed in a naturally ventilated polyhouse. The experiment comprised of twelve different ratios of NPK viz., T<sub>1</sub>: 10:10:10 NPK @ 0.1% ; T<sub>2</sub>: 10:20:10 NPK @ 0.1% ; T<sub>3</sub>:10:10:20 NPK @ 0.1%; T<sub>4</sub>:10:20:20 NPK @ 0.1% ; T<sub>5</sub>:20:10:10 NPK @ 0.1% ; T<sub>6</sub>: 20:20:10 NPK @ 0.1% ; T<sub>7</sub>:20:10:20 NPK @ 0.1% ; T<sub>8</sub>:20:20:20 NPK @ 0.1% ; T<sub>9</sub>: 30:10:10 NPK @ 0.1% ; T<sub>10</sub>:30:20:10 NPK @ 0.1% ; T<sub>11</sub>:30:10:20 NPK @ 0.1% and T<sub>12</sub>: 30:20:20 NPK @ 0.1%. The nutrients were applied at weekly intervals as foliar sprays. The experiment was laid out in completely randomized design (CRD) with three replications and ten plants per replication. The observations were recorded for three consecutive years on plant height, number of leaves plant<sup>-1</sup>, leaf area, number of pseudobulbs plant<sup>-1</sup>, internodal length, girth of pseudobulbs number of spikes plant<sup>-1</sup> year<sup>-1</sup>, number of flowers spike<sup>-1</sup>, spike length, flower size, pedicel length and vase life of cut flowers. Data recorded for the vegetative and floral parameters over the three-year period was pooled and analysed using the OPSTAT statistical package (Sheoran *et al.*, 1998).

## RESULTS AND DISCUSSION

Among the vegetative parameters presented in Table 1, plant height, number of leaves plant<sup>-1</sup>, leaf area and number of pseudobulbs plant<sup>-1</sup> varied significantly among the treatments. Foliar spray of

30:20:20 NPK @ 0.1% (T<sub>12</sub>) at weekly intervals recorded the maximum plant height of 53.21 cm and was at par with treatments T<sub>2</sub>:10:20:10 NPK@0.1% (53.11 cm); T<sub>3</sub>:10:10:20 NPK @ 0.1%; (52.41 cm), T<sub>9</sub>: 30:10:10 NPK @ 0.1% (50.71 cm) and T<sub>11</sub>:30:10:20 NPK @ 0.1% (49.43 cm). The results are in accordance with the findings of Bichsel *et al.* (2008) who found that an increase in nitrogen was found to have a favourable effect on plant height in *Dendrobium* hybrids. This is also corroborated by the findings of Anitha and Kannan (2015a) in *Dendrobium* orchid cv. Earsakul. The minimum plant height (43.80 cm) was recorded in treatment T<sub>8</sub>:20:20:20 NPK @ 0.1%. Weekly foliar application of T<sub>10</sub>:30:20:10 NPK @ 0.1% recorded the maximum number of leaves plant<sup>-1</sup> (47.82) and was at par with treatments T<sub>4</sub>:10:20:20 NPK @ 0.1% (46.44); T<sub>11</sub>:30:10:20 NPK @ 0.1% (46.02) and T<sub>12</sub>:30:20:20 NPK @ 0.1% (44.72). Application of higher levels of nitrogen was found to significantly increase the total chlorophyll content in *Dendrobium* orchid cv. Earsakul according to Anitha and Kannan (2015b). The number of leaves affects the photosynthetic efficiency of the plant and this is in accordance with the findings of Wang (1996) in *Phalaenopsis*. The minimum number of leaves plant<sup>-1</sup> (25.05) was recorded in treatment T<sub>7</sub>:20:10:20 NPK @ 0.1%. Foliar spray of T<sub>2</sub>:10:20:10 NPK @ 0.1% recorded the maximum leaf area (48.40 cm<sup>2</sup>) whereas, minimum leaf area (30.75 cm<sup>2</sup>) was recorded in treatment T<sub>5</sub>: 20:10:10 NPK @ 0.1%. The treatment T<sub>4</sub>:10:20:20 NPK @ 0.1% recorded the maximum number of pseudobulbs plant<sup>-1</sup> (9.10) and was at par with T<sub>12</sub>:30:20:20 NPK @ 0.1% (8.89), whereas application of T<sub>3</sub>:10:10:20 NPK @ 0.1% resulted in the minimum number of pseudobulbs plant<sup>-1</sup> (6.63). Improved vegetative growth of the plants may be attributed to the increase in the photosynthetic capacity of the plants. This is in corroboration with the findings of Sailo, *et al.* (2014) that though the leaves are the source of photosynthates for inflorescence development, the pseudobulb is responsible for the redistribution of assimilates from the leaves. There is substantial mobilisation of carbohydrate to the inflorescence through the pseudobulb. The internodal length and girth of pseudobulbs did not vary significantly with the treatments.

**Table 1. Effect of inorganic nutrients on vegetative characters of *Dendrobium* cv. Singapore White**

Treatments	Plant height (cm)	No. of leaves per plant	Leaf area (cm <sup>2</sup> )	No. of pseudo-bulbs per plant	Internodal length (cm)	Girth of pseudobulbs (mm)
T <sub>1</sub>	48.63	30.67	37.29	7.15	3.35	12.56
T <sub>2</sub>	53.11	43.42	48.40	8.44	3.12	12.76
T <sub>3</sub>	52.41	37.38	38.11	6.63	3.19	12.31
T <sub>4</sub>	46.78	46.44	31.68	9.10	3.44	12.03
T <sub>5</sub>	46.82	36.65	30.75	7.33	3.57	11.79
T <sub>6</sub>	48.89	36.76	35.67	8.07	3.57	12.06
T <sub>7</sub>	46.79	25.05	32.07	8.34	3.22	11.96
T <sub>8</sub>	43.80	43.16	34.57	8.18	3.28	12.05
T <sub>9</sub>	50.71	29.79	36.34	6.98	3.07	12.67
T <sub>10</sub>	47.76	47.82	37.17	7.86	3.18	12.08
T <sub>11</sub>	49.43	46.02	36.83	7.99	3.26	12.55
T <sub>12</sub>	53.21	44.72	35.19	8.89	3.37	13.01
CD (P=0.05)	3.78	4.02	3.50	0.63	NS	NS

**Treatment details :**

T <sub>1</sub> : 10:10:10 NPK @ 0.1%	T <sub>2</sub> : 10:20:10 NPK @ 0.1%	T <sub>3</sub> : 10:10:20 NPK @ 0.1%	T <sub>4</sub> : 10:20:20 NPK @ 0.1%
T <sub>5</sub> : 20:10:10 NPK @ 0.1%	T <sub>6</sub> : 20:20:10 NPK @ 0.1%	T <sub>7</sub> : 20:10:20 NPK @ 0.1%	T <sub>8</sub> : 20:20:20 NPK @ 0.1%
T <sub>9</sub> : 30:10:10 NPK @ 0.1%	T <sub>10</sub> : 30:20:10 NPK @ 0.1%	T <sub>11</sub> : 30:10:20 NPK @ 0.1%	T <sub>12</sub> : 30:20:20 NPK @ 0.1%

The floral traits and the vase life of cut flowers were recorded and have been presented in Table 2. The number of spikes plant<sup>-1</sup>year<sup>-1</sup>, number of flowers spike<sup>-1</sup> and spike length varied significantly among the treatments. Maximum number of spikes plant<sup>-1</sup>year<sup>-1</sup> (10.01) was recorded with foliar spray of T<sub>12</sub>: 30:20:20 NPK @ 0.1% and the minimum number of spikes plant<sup>-1</sup>year<sup>-1</sup> (7.07) were recorded with application of T<sub>7</sub>:20:10:20 NPK 0.1%. Maximum number of flowers spike<sup>-1</sup> (16.69) was recorded in treatment T<sub>4</sub>: 10:20:20 NPK @ 0.1% and was at par with foliar application of T<sub>12</sub>:30:20:20 NPK @ 0.1% (16.20) and T<sub>3</sub>:10:10:20 NPK @ 0.1% (16.00) whereas the minimum number of flowers spike<sup>-1</sup> was recorded in the treatment T<sub>8</sub>:20:20:20 NPK @ 0.1% (10.68). Maximum spike length was recorded in the

treatment T<sub>2</sub>:10:20:10 NPK @ 0.1% (49.06 cm) and was at par with foliar application of T<sub>5</sub>:20:10:10 NPK @ 0.1% (46.69 cm), whereas T<sub>7</sub>:20:10:20 NPK @ 0.1% had the minimum spike length (41.28 cm). The main factors that could increase profitability of orchid cultivation is the improvement of flowering characteristics such as number of spikes produced and number of flowers per spike. This is in accordance with the findings of Wang (2004). Increase in levels of NPK in the foliar spray has played a significant role in increasing the spike length and the number of flowers per spike even while the production of flower spikes per plant has substantially increased, which is desirable for profitable commercial production. At higher levels of nutrient application, there was significant increase in spike length which might be due to

higher nutrient absorption in plants (Sudeep *et al.*, 2018). Other parameters like flower size, pedicel length and vase life did not vary significantly with the treatments. This might be due to the fact that these are predominantly governed by the genetic

traits. This contradicts the findings of Higaki and Imamura (1987) that increasing the level of N generally increases the flower size of Vanda ‘Miss Joaquim’ and addition of P and K further increases Vanda flower size.

**Table 2. Effect of inorganic nutrients on floral characters and vase life of *Dendrobium* cv. Singapore White**

Treatments	No. of spikes plant <sup>-1</sup> year <sup>-1</sup>	No. of flowers / spike	Spike length (cm)	Flower size (Length-cm)	Flower size (Breadth - cm)	Pedicel length (cm)	Vase life (days)
T <sub>1</sub>	8.26	15.23	45.52	6.78	6.65	5.60	14.38
T <sub>2</sub>	8.70	14.43	49.06	6.90	6.73	5.78	13.11
T <sub>3</sub>	8.80	16.00	43.80	7.00	6.92	5.75	12.13
T <sub>4</sub>	8.03	16.69	45.40	6.91	6.93	5.83	11.67
T <sub>5</sub>	7.77	13.87	44.43	6.86	6.94	5.84	13.24
T <sub>6</sub>	7.90	11.48	43.59	6.90	6.93	5.30	12.38
T <sub>7</sub>	7.07	11.10	41.28	6.57	6.82	5.61	11.82
T <sub>8</sub>	7.59	10.68	42.89	6.47	6.89	5.71	14.51
T <sub>9</sub>	8.15	11.92	45.98	6.93	7.10	5.81	13.84
T <sub>10</sub>	7.45	11.99	45.35	6.82	7.35	5.88	13.36
T <sub>11</sub>	7.11	12.25	43.74	6.40	7.12	5.86	15.29
T <sub>12</sub>	10.01	16.20	46.69	6.77	6.76	5.70	12.45
CD (P=0.05)	0.83	1.32	3.22	NS	NS	NS	NS

**Table 3. Correlation of vegetative and floral traits with flower spike yield as influenced by inorganic nutrient doses**

Character	No. of leaves/ plant	Leaf area (cm <sup>2</sup> )	No. of Pseudo bulbs/plant	Inter -nodal length	Pseudo-bulb girth (mm)	No. of flowers / spike	Spike length (cm)	No. of spikes / plant
<b>Plant Height (cm)</b>	0.059	0.628*	-0.125	-0.336	0.791**	0.491	0.626*	0.731**
<b>No. of Leaves / plant</b>		0.212	0.480	0.073	0.120	0.239	0.371	0.162
<b>Leaf area (cm<sup>2</sup>)</b>			-0.064	-0.550	0.586*	0.110	0.667*	0.317
<b>No. of pseudo bulbs / plant</b>			0.224	0.043	0.084	0.140	0.084	
<b>Internodal length</b>					-0.436	0.174	-0.224	0.002
<b>Pseudobulb girth (mm)</b>						0.353	0.658*	0.674*
<b>No. of flowers / spike</b>							0.513	0.707*
<b>Spike length (cm)</b>								0.624*

\* Significant at 5% level    \*\* Significant at 1% level

Estimates of the correlation coefficients among the various characters indicated that economic characters like spike length, number of flowers spike<sup>-1</sup> and spike yield were positively correlated (Table 3). Among the vegetative characters, plant height recorded highly significant positive correlation (0.731) followed by girth of pseudo stem (0.674) which was significantly and positively correlated with spike yield. The results are in accordance with the findings of Zimmerman (1990). Pseudobulbs have ability to store water, mineral and carbohydrates. The active accumulation of mineral nutrients during the period of pseudobulb development constitutes an important source of reserve for the subsequent development of the inflorescence and new shoots as reported by Hew and Ng (1996). Hence vegetative growth in sympodial orchids has a direct effect on flowering and flower quality. Significant positive correlation with the number of spikes plant<sup>-1</sup> was observed for number of flowers

spike<sup>-1</sup> (0.707) followed by spike length (0.624). Low positive correlation with spike yield was recorded for number of leaves plant<sup>-1</sup>, leaf area, number of pseudobulbs plant<sup>-1</sup> and internodal length. Significant positive correlation was recorded for spike length with leaf area (0.667) followed by pseudostem girth (0.658) and plant height (0.626). Girth of pseudobulb recorded a highly significant positive correlation with plant height (0.791) and was also positively correlated with leaf area (0.586). Leaf area recorded a significant positive correlation with plant height (0.628).

It may be concluded that foliar spray of NPK in the ratio of 30:20:20 at 0.1% at weekly intervals was found to be promising, resulting in higher cut flower yield and superior quality of spikes in *Dendrobium* cv. Singapore White under the agro climatic conditions of Kodagu.

## REFERENCES

- Anitha, M. and Kannan, M. 2015a. Effect of water-soluble fertilizers on growth and yield of *Dendrobium* orchid cv. Earsakul. *Trends in Biosci.* **8**: 1591-1594
- Anitha, M. and Kannan, M. 2015(b). Effect of water-soluble fertilizers on composition of chlorophyll, total phenols, IAA oxidase activity and major nutrients (N, P and K) in *Dendrobium* orchid cv. Earsakul. *Trends in Biosci.* **8**:1587-1590
- Bichsel, R.G., Starman, T.W., and Wang, Y.T. 2008. Nitrogen, phosphorus, and potassium requirements for optimizing growth and flowering of the noble *Dendrobium* as a potted orchid. *Hort. Sci.*, **43**:328-332
- De, L. C. 2020. Export and import scenario of orchids in India. *J. Agric Forest Meteorol. Res.*, **3**: 402-404
- De, L.C., Khan, A.M., Kumar R. and Medhi, R.P. 2014. Orchid farming- a remunerative approach for farmers' livelihood. *Social Science*, **3**:469-471
- Hegde, S. 2017. Commercial potential and development of orchids in Karnataka. *The Orchid Soc. Kar. Newsletter*, **4**:8-16
- Hew, C. S. and Ng, C. K.Y. 1996. Changes in mineral and carbohydrate content in pseudobulbs of the C3 epiphytic orchid hybrid *Oncidium goldiana* at different growth stages. *Lindleyana*, **11**: 125-134
- Higaki, T. and Imamura, J. S. 1987. NPK requirement of Vanda 'Miss Joaquim' orchid plants. *College of Tropical Agriculture and Human Resources, University of Hawaii, Research Extension Series* 087: 5
- Rajeevan, P. K. and Sobhana, A. 1993. Performance of certain epiphytic orchid species in Central Kerala. *J. Orchid Soc. Ind.*, **7**:31-35
- Rao, T. A. 1998. Conservation of wild orchids of Kodagu in the western ghats. *World Wide Fund for Nature-India., Karnataka Association for the Advancement of Science., Agricultural Technologies and Services Private Ltd., Centre for Technology Development, Bangalore* :242
- Naik, S. K., Usha Bharathi, T., Barman, D., Devadas, R., Pal, R. and Medhi. R.P. 2009. Status of mineral nutrition of orchid - a review. *J. Ornam. Hort.*, **12**: 1-14
- Sailo, N., Rai, D. and De, L.C. 2014. Physiology of temperate and tropical orchids- An overview. *Int. J. Sci. Res.*, **3**: 7
- Sheoran, O.P., Tonk, D.S., Kaushik, L.S., Hasija, R.C. and Pannu, R.S. 1998. Statistical software package for agricultural research workers.

- CCS HAU, Hisar. P:139-143. <http://www.202.141.47.5/opstat/index.asp>
- Sudeep, H.P., Seetharamu, G.K., Aswath, C., Munikrishnappa, P.M., Sreenivas, K.N., Basavaraj, G. and Gowda, D.M. 2018. Influence of varying levels of foliar nutrients on flower quality and yield of *Dendrobium* orchid cv. Sonia-17, *Int. J. Pure App. Biosci.* **6**(5): 384-390
- Wang, Y.T. 1996. Effect of six fertilizers on vegetative growth and flowering of *Phalaenopsis*. *Scientia Horticulturae*, **65**:191-197
- Wang, Y.T. 2004. Flourishing market for potted orchids. *Flower Tech.* **7**:2-5
- Zimmerman, J.K. 1990. Role of pseudobulb in growth and flowering of *Catasetum viridiflavum* (Orchidaceae). *Amer. J. Bot.*, **77**: 533-542.

*(Received on 15.07.2020 and Accepted on 5.12.2020)*

# INFORMATION TO CONTRIBUTORS

*Journal of Horticultural Sciences*, an international journal, is the official publication of **Society for Promotion of Horticulture (SPH)**. It covers basic and applied aspect of original research on all branches of horticulture and other cognate disciplines, which promotes horticulture in its broadest sense. Its goals are to apprise horticultural scientists and others interested in horticulture of scientific and industrial developments and extension findings. The area of research include evaluation of germplasm, breeding, agronomic practices, physiology, biochemistry, biotechnology, soils and plant nutrition, plant protection, weed control, pesticide residue, post harvest technology, economics, extension, farm machinery and mechanization, etc. which facilitate in the growth and expansion of horticulture. The journal is published twice a year, in June and December.

**The Journal of Horticultural Sciences (JHS)** publishes critical reviews, research papers and short communications. Three copies of the manuscript and an electronic form (CD, MS Word) should be submitted to the Chief Editor, JHS, SPH, Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore-560 089. The manuscript should preferably pertain to the research work carried out during the last five years. Author(s) must certify that the manuscript (s) has/have not been sent elsewhere for publication. All the authors have to become the members of SPH when a paper is accepted for publication. All papers will be refereed. Short communications on significant research findings, new record / technology are welcome. Besides invited review papers, scientists with vast experience on a particular field of research can also submit review papers which will be refereed. Decision of the Chief Editor / Editorial board is final. Authors are permitted to photocopy their article for non-commercial and scientific purpose. No reprints shall be provided *gratis*. Acceptance of manuscript for publication in JHS shall automatically mean transfer of copyright to the SPH. The chief editor/ Editorial board assumes no responsibility for the statements, opinion or facts expressed in the journal, which rests entirely with the author(s) thereof. Mention of a pesticide or a commercial or proprietary product does not constitute an endorsement or recommendation for the use.

**Title:** The title of the article should be bold and in running form. Use the font Times New Roman (14 point). Botanical / scientific names should be italicized. Author name(s) should be in running and bold with full address of the first author including e-mail address (it is mandatory as future correspondence will be only through e-mail). The address of other author(s), if different from the first author, should be given as footnotes and indicated by consecutive superscript numbers. A brief running title should be provided on a separate sheet.

**Abstract:** The abstract should not exceed 200 words. It should be suitable for indexing and publication in abstracting journal. Very pertinent keywords may be furnished.

**Text:** The text should be typed in double space on one side of good quality paper (21 x 29 cm) with 3cm margin on all sides **without justifying the text** and in clear and concise English. Use the font Times New Roman (12 point). The paper should be divided into subheadings (placed on the left margin and in upper case) such as Introduction, Material and Methods, Results and Discussion, Acknowledgements, and References. Units and abbreviations should be in metric (SI) system. It is desirable that authors take due care on clarity and brevity of the paper. The length of the paper should not exceed 2500 words.

**Tables/ Illustrations/ Photographs:** Each table should be on a separate sheet with a short title at the end of the paper, numbered in the order in which it appears in the text. The data reported must be subjected to appropriate statistical analysis. The illustrations should be relevant to the research findings and should not be repeating of data presented in the table. Only very good photographs, mounted on hard paper to avoid folding, given on a separate sheet of paper with title, which are reproducible, will be accepted. Data to be presented in graphical form should be sent on quality glossy contrast paper without folding.

**References:** References should be cited in the text in the form of (Anon., 1999; Prakash, 2002; Krishnamoorthy and Mani, 2004). The term *et al* should be used when there are more than two authors. The letters, a,b,c,... should be used following the year, to distinguish between two or more papers by the same author(s) in one year. References at the end of the text should be given in the following form:

Shikhamany, S. D. and Satyanarayana, G. 1973. A study on the association of leaf nutrient contents with poor yields in Anab. E.shahi grape (*Vitis vinifera* L.). *Ind. J. Hort.*, **30**: 376 - 380

Panse, V. G. and Sukhatme, P. V. 1978. Statistical methods for Agricultural workers. ICAR, New Delhi, p 108.

Srinivas, K. 1987. Response of watermelon (*Citrullus lanatus* Thunb. Musf) to drip and furrow irrigation under different nitrogen and plant population levels. Ph.D thesis, UAS, Bangalore

Mehta, N. K. and Sharma, S. D. 1986. Studies on flowering and fruit retention in some cultivars of peach (*Prunus persica* Batch). In: Advances in Research on Temperate Fruits. *Proc. Nat'l. Symp. Temp. Fruits*, Solan (India), Dr. Y. S. Parmar Univ. Hort. and Forestry, pp 37-42

Krishnamoorthy, A. and Mani, M. 2000. Biological Control of Pests of Vegetable Crops.p367-78. In: Biocontrol Potential and its exploitation in sustainable Agriculture. Vol. 2: Insect Pests. Upadhyay, R. K. Mukerji, K. G. and Chamola, B.P. (ed.). Kluwer Academic / Plenum Publishers, New York

Cover photo (s) shall be included at the discretion of Editor. Authors may submit photographs/figures/diagrams for cover page while submitting the manuscript.

## AUTHOR INDEX - VOL. 15 ( 1&2) 2020

Name	Page	Name	Page
<b>A</b>		Gavankar, M. S.	233
Adamu, J.T.	136	Gokhale, N. B.	233
Adekoya, M.	136	Gowda D. C. S.	161
Adeniji, O.T.	136	Gowda, N. K. S.	197
Aghora T.S.	62	I	
Ahamed N.	17	Ingle Y. V.	153
Aravintharaj, R.	229	Ishaka, A.	136
Aremu, C.A.	136	J	
Ashok Kumar J.	45	Jadhav S.B.	67
Asokan, R.	229	Janakiram, T.	147
Aswath C.	93	Jandong, E.	136
Aswath, C.	147	Jasmin M. R.	207
Awcharae, C. M.	177	Jessy Mol K.K.	52
Azeez, S.	197, 207	K	
<b>B</b>		Kalaivanan D.	9
Babli, M.	127	Kanupriya, C.	221
Bala, M.	191	Karunakaran, G.	221
Bhatt R.M.	62	Katwate S.M.	67
Bhonde, S. R.	153	Khandekar, R. G.	233
Burondkar, M. M.	233	Kshirsagar, P. J.	233
<b>C</b>		Kulkarni, M. M.	233
Chandran, N. K.	81	Kumar D.	17
Chandrashekara C.	197, 207	Kumar, R.	147
<b>D</b>		L	
Desai, V. S.	233	Lad, O. A.	233
Dhananjaya, M. V.	147	Lakshmana Reddy D.C	52
Dinakara Adiga, J.	127	Lakshmi, J.	183
Dinesh, M. R.	107, 161	Laxman R.H.	35
<b>G</b>		M	
GaneshamurthyA.N.	9	Madhavi Reddy K	52
Ganga, M.	183	Manivannan, N.	183
		Manjunath B.L.,	35



<b>Name</b>	<b>Page</b>	<b>Name</b>	<b>Page</b>
Manoj Y.B.	52	Sankar V	177
Meena H.R.	72	Sankaran, M.	107, 161
Mohan N.	62	Satisha G.C.	197, 207
Muralidhara, B. M	177	Shejal A. Porob	97
<b>N</b>		Shilpa Pandurangaiah,	27
Nair A.K.	35	Shivashankar K.S.	27
Negi, S. S.	147	Shivashankara, K. S.	207
<b>P</b>		Singh D. R.	177
Paithankar, D. H.	153	Singh S.R.	17
Pandey, M.	197, 207	Singh, P.	221
Pawar, C. D.	233	Singh, T.	191
Priya Devi S	45, 97	Somasundaram J.	72
<b>R</b>		Sriram S.	81
Rachitha R.	207	Srivastava K.K.	17
Radha T.K.	72	Sudhakar Rao D.V.	27
Ragaji, S. G.	233	Sujatha A. Nair	177
Raghu B.R.	1	Susmita C.	62
Raghupathi H.B.	9	<b>T</b>	
Rajamani, K.	183	Tanya Thakur	173
Rajiv Kumar	93	Tejaswini Prakash	81
Ramachandran, N.	147	Tenebe, A.V.	136
Ramachandrudu K	45	Thangam M	45, 97
Rami Reddy, P. V.	225	Thondaiman, V.	127
Rao, T. M.,	147	<b>V</b>	
Rashmi I.	72	Veena, G.L.	127
Ravishankar K.V	27	Venugopalan, R.	161
Roy, T. K.	197, 207, 229	Vichare S.V	67
Rupa T.R	9	<b>Y</b>	
<b>S</b>		Yousuf S.	17
Sadashiva A.T.	27	<b>Z</b>	
Sadawarte, A. K.	153	Zamil, M.	207
Safeena S.A.	45	Zamzam, M.A.	136

## SUBJECT INDEX - VOL. 15 (1&2) 2020

Name	Page	Name	Page
<b>A</b>			
Alphonso	233	Foot rot	152
Amino acid score	207	Free amino acids	207
Antigonon	225	Fruit development	97
Anti-senescence compound	191	Fruit trees	9
Apis spp	225	Fruit quality	136
Arka Mushroom Rasam	197	Fruit shape	136
<b>B</b>			
B:C ratio	233	Fruit yield	136
Bee flora	225	Fruits	107
Bioavailability	197	Fusarium wilt	147
Biplot analysis	161	<b>G</b>	
Bound amino acids	207	Garden pea	62
Breeding	62	GCV	161
Bulb	67	Genetic diversity	17
<b>C</b>			
Canopy management	127	Genetic analysis	161
Carotene	27	Genetic divergence	45
Carotenoid	27	Genotype by environment	136
CGMS	52	Gerbera	93
Character correlation	136	Germplasm	1, 107
Chrysanthemum	173, 191	GIS	107
Conservation	107	Gladiolus	147
Copper	72	Goa	97
Correlation coefficient	45	Groundwater depletion	9
Curry leaves	1	Growth	67
Cut flower production	177	Growth parameters	233
Cut-flower	93	Gummosis	152
<b>D</b>			
Delayed flowering	191	<b>H</b>	
Dendrobium	177	Heritability	161
Distribution	1	High temperature	62
Diversity	1	Honey bees	225
Drought	9	Honeydew	229
<b>E</b>			
Early summer	62	Hot pepper	52
Evaluation	93, 147	Hybrid	67
Ex situ	107	Hypsizygus ulmarius	197
<b>F</b>			
Flower	67	<b>I</b>	
Flowering	147	In situ	107
		Iron	72
		Iron fortified	197
		<b>J</b>	
		Jasminum spp	183
		<b>K</b>	
		Kikiobiory	173



<b>Name</b>	<b>Page</b>	<b>Name</b>	<b>Page</b>
<b>L</b>			
LC-MS-MS	229	Pruning	127
Leaf analysis	72	Pulp recovery	221
Lycopene	27	<b>Q</b>	
<b>M</b>			
Manganese	72	Quality	177
Mango	161, 233	Quantitative character	45
Marker Assisted Selection	52	<b>R</b>	
Micronutrient deficiency	72	Resistance Gene Analogues (RGA)	81
Mitochondria	52	Rootstocks	127
Morphotypes	1	Rose	81
Mushrooms	197	<b>S</b>	
<b>N</b>			
Nagpur mandarin	152	Sapota	72
Nitrogen	173	Scheduling irrigation	35
Novel hybrids	93	Selection	221
Nucleotide Binding Site-Leucine	81	Single linkage cluster analysis	17
Rich Repeats (NBS-LRR)		Single type tuberose	67
Nutrients	177	Soil volume wetting	35
Nutrition	207	Soilless media	233
<b>O</b>			
Onion	17	Solanum lycopersicum	136
Orchid	177	Spacing	35
ORF	52	Standardization	173
Ornamental creeper	225	Stress tolerance	62
<b>P</b>			
Palynology	183	Sugars	229
Papaya yield	35	<b>T</b>	
PBZ	127	Tamarind	221
PCV	161	Thrips palmi	229
Peak water	9	Tomato	27
Perennial crops	9	Training	127
Phytophthora	152	Tropical	107
Pink types	97	<b>V</b>	
Planting geometry	127	Variability	136
Podosphaera pannosa	81	Varieties	107
Policy issue	9	Vase life	147, 191
Pollen germination	183	Vegetable cowpea	45
Pollen morphology	183	<b>W</b>	
Polyhouse	93, 136	Water use efficiency	35
Potassium salt of phosphonic acid (PSPA)	152	Wax apple	97
Potted plants	173	White types	97
Powdery mildew	81	Wild species	107
Principal component analysis	17	<b>Y</b>	
		Yield	221
		<b>Z</b>	
		Zinc	72



**STATEMENT OF OWNERSHIP AND OTHER PARTICULARS ABOUT  
JOURNAL OF HORTICULTURAL SCIENCES**

(Form IV)

Place of Publication : Bengaluru

Periodicity of publication : Half-yearly

Printer's Name : Mr. Ravikumar, B.A.

Nationality : Indian

Address : Resolution Print Media  
#131, 6<sup>th</sup> Main, Meenakshinagar  
Kamakshipalya, Bengaluru - 560 079.

Publisher's Name : Society for Promotion of Horticulture

Address : ICAR-Indian Institute of Horticultural Research  
Hessaraghatta Lake P.O.  
Bengaluru - 560 089

Editor-in-Chief : Dr. S. Sriram

Nationality : Indian

Address : ICAR-Indian Institute of Horticultural Research  
Hessaraghatta Lake P.O.  
Bengaluru - 560 089.

Name and addresses of individuals who own the journal and partners or are shareholders holding more than one per cent of the total capital : Society for Promotion of Horticulture  
ICAR-Indian Institute of Horticultural Research  
Hessaraghatta Lake P.O.  
Bengaluru - 560 089.

I, Dr. S. Sriram, hereby declare that the particulars given above are true to the best of my knowledge and belief.

June 30, 2020

Sd/-  
(S. Sriram)  
Editor-in-Chief



## SOCIETY FOR PROMOTION OF HORTICULTURE

ICAR-Indian Institute of Horticultural Research  
Hessaraghatta Lake Post, Bengaluru-560 089, India  
sphiihr2005@gmail.com / chiefeditor.jhs@gmail.com  
Website : <https://sphindia.org>

### ENROLMENT FORM

Name in full (in block letters) :  
Dr./Mrs./Mr./Ms.

Designation :

Address for communication :

Phone No. :

E-mail ID :

Type of membership : Patron / Life member / Annual member / Student member\*

Payment :

Demand Draft No. / Date :

Bank :

Place :

Date : SIGNATURE

#### Membership fee structure :

Type of membership	Membership amount	Enrolment fee	Total membership amount payable by Demand Draft (₹)
Patron	20,000/-	200/-	20,200/-
Life Member	5,000/-	200/-	5,200/-
Annual Member (India )	1,000/-	200/-	1,200/-
i. For SAARC authors	US \$ 100	US \$ 5	US \$ 105
ii. For SAARC countries	US \$ 50	US \$ 5	US \$ 55
Student member*	500/-	200/-	700/-

\*The application of student members must be certified by their Head of dept. or equivalent and the student member shall not receive a copy of the journal.

Please send the duly filled-in enrolment form along with Demand Draft drawn in favour of Society for Promotion of Horticulture, by post to General Secretary, Society for Promotion of Horticulture ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru - 560 089.



## ACKNOWLEDGEMENTS

The editorial team acknowledges the services of the following reviewers

**Dr. Shylesha A.N.**

Principal Scientist, ICAR-NBAIR, Bengaluru

**Dr. Ashwath Narayan**

Associate Professor, UAS, Raichur

**Dr. Mohan C.**

Principal Scientist, ICAR-CTCRI, Trivandrum

**Dr. Chavalli Sarada**

Associate Professor, YSRHU, Guntur

**Dr. Dinesh R.**

Principal Scientist, ICAR-IISR, Calicut

**Dr. Kalaivanan D.**

Scientist, ICAR-IIHR, Bengaluru

**Dr. Sudhakar Rao D.V.**

Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Fakrudin B.**

Professor, College of Horticulture, UHS, Bengaluru

**Dr. Hebbar K.B.**

Principal Scientist, ICAR-CPCRI, Kasaragod

**Dr. Hima Bindu**

Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Satisha J.**

Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Krishnamurthy K.S.**

Principal Scientist, ICAR-CPCRI, Kasaragod

**Dr. Kundan Kishore**

Principal Scientist, CHES (ICAR-IIHR), Bhubaneswar

**Dr. Sankaran M.**

Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Madhu Bala**

Associate Professor, PAU, Ludhiana

**Dr. Nandeesh P.**

Senior Scientist, ICAR-IIHR, Bengaluru



**Dr. Venkatarami Reddy P.**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Prakash Tripathi**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Prasad R.D.**  
Principal Scientist, ICAR-IIOR, Hyderabad

**Dr. Rajashekar P.E.**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Rajiv Kumar**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Ravindran Chandran**  
Horticulturist, TNAU, Coimbatore

**Dr. Ramani S.**  
Former Project Coordinator, AICRP on Honey Bees and Pollinator,  
Bengaluru

**Dr. Veena S.S.**  
Principal Scientist, ICAR-CTCRI, Trivandrum

**Dr. Smaranika Mishra**  
Scientist, ICAR-IIHR, Bengaluru

**Dr. Sujatha A. Nair**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Tejaswini Prakash**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Usha Bharathi T.**  
Scientist, ICAR-IIHR, Bengaluru

**Dr. Sridhar V.**  
Principal Scientist, ICAR-IIHR, Bengaluru

**Dr. Srinivasan V.**  
Principal Scientist, ICAR-IISR, Calicut

Sd/-  
**(S. Sriram)**  
Editor-in-Chief

## New Varieties/ Technologies of ICAR-IIHR



**New Water Melon - Arka Shyama variety**



**Arka Red - New Gerbera variety**



**Leaf curl resistant chilli varieties Arka Tejaswi, Arka Saanvi and Arka Tanvi**



**Arka Abhi**



**Arka Shuba**

## New Varieties/ Technologies of ICAR-IIHR



Arka Herbiwash - Safe way of removing pesticide residues



Arka Bharath - New teasel gourd variety

***Journal of Horticultural Sciences is indexed by the following abstracting and indexing services***



*Article published in Journal of Horticultural Sciences are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.*

