National Dialogue on

Harnessing the Potential of Floriculture in India

16 – 17 February 2023

Proceedings and Recommendations

Trust for Advancement of Agricultural Sciences (TAAS)

Avenue II, IARI Campus, Pusa, New Delhi 110012
Website: *www.taas.in*

Indian Council of Agricultural Research (ICAR)

Krishi Bhawan, Dr Rajendra Prasad Road, New Delhi 110001
Website: www.icar.org

National Academy of Agricultural Sciences (NAAS)

NASC Complex, DPS Marg, Pusa, New Delhi 110012
Website: www.naas.org.in

Ministry of Agriculture & Farmers' Welfare (MoA&FW)

Krishi Bhawan, Dr Rajendra Prasad Road, New Delhi 110001
Website: www.agricoop.nic.in

National Bank for Agriculture and Rural Development (NABARD)

Regional Office Parking lot, 7, Govind Lal Sikka Marg, Rajendra Place, New Delhi, Delhi 110008
Website: www.nabard.org

Agricultural and Processed Food Products Export Development Authority (APEDA)

3rd Floor, NCUI Building 3, Siri Institutional Area, August Kranti Marg, opp. Asiad Village, New Delhi, Delhi 110016
Website: www.apeda.gov.in

Indian Society of Ornamental Horticulture (ISOH)

ICAR-IARI, Pusa, New Delhi - 110012
Website: www.isoh.co.in


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For copies and further information, please write to :

Secretary
Trust for Advancement of Agricultural Sciences (TAAS)
Avenue II, Pusa Campus, New Delhi - 110012
Ph.: +91-11-25843243; +91-8130111237
E-mail: taasiari@gmail.com; Website: www.taas.in

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Acronyms and Abbreviations

AI	Artificial Intelligence
AICFIP	All India Coordinated Floriculture Improvement Project
AIF	Agriculture Infrastructure Fund
APCoAB	Asia-Pacific Consortium on Agricultural Biotechnology and Bioresources
APEDA	Agricultural & Processed Food Products Export Development Authority
ASCI	Agriculture Skill Council of India
ADG	Assistant Director General
C&F	Cost and Freight
CAGR	Compound Annual Growth Rate
CDP	Cluster Development Program
CERI	Central Electrochemical Research Institute
CFTRI	Central Food Technological Research Institute
CoE	Centre of Excellence
CPCT	Centre for Protected Cultivation Technology
CSIR	Council of Scientific & Industrial Research
CVRC	Central Varietal Release Committee
DAC	Department of Agriculture and Cooperation
DARE	Department of Agricultural Research and Education
DDG	Deputy Director General
DFR	Directorate of Floricultural Research
DIHAR	Defence Institute of High Altitude Research
DKMA	Directorate of Knowledge Management in Agriculture
DRDO	Defence Research and Development Organisation
EDV's	Essentially Derived Varieties

EXIM	Export-Import
FFDC	Fragrance and Flavour Development Centre
FFP	Fresh Flowers Fair Plants
FLP	Flower Label Program
FOB	Flowers of Baku
FPOs	Farmer Producer Organisations
FSI	Floriculture Sustainability Initiative
FSPF	Farm Sector Promotional Fund
FVS&MP	Flower, Vegetables, Spices and Medicinal Plants
GAPs	Good Agronomic Practices
GoI	Government of India
GST	Goods & Services Tax Council
GVO	Gross Value Output
HS	Harmonized System
IARI	Indian Agricultural Research Institute
IASRI	Indian Agricultural Statistics Research Institute
ICAR	Indian Council of Agricultural Research
IFAB	International Flower Auction Bengaluru
IFAC	International Flower Auction Centre
IHBT	Institute of Himalayan Bioresource Technology
IIHR	Indian Institute of Horticultural Research
IIIM	Indian Institute of Integrative Medicine
INR	Indian Rupees
IoT	Internet of Things
IPR	Intellectual Property Rights
ISOH	Indian Society of Ornamental Horticulture
KVIC	Khadi and Village Industries Commission
KVKs	*Krishi Vigyan Kendras*

MBr	Methyl Bromide
MEIS	Merchandise Exports from India Scheme
MIDH	Mission for Integrated Development of Horticulture
MIS	Management Information Systems
MoA&FW	Ministry of Agriculture and Farmers' Welfare
MoC&I	Ministry of Commerce and Industry
MSMEs	Ministry of Micro, Small & Medium Enterprises
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agriculture and Rural Development
NARS	National Agricultural Research System
NRC	National Research Centre
NAU	Navsari Agricultural University
NBPGR	National Bureau of Plant Genetic Resources
NBRI	National Botanical Research Institute
NCDC	National Cooperative Development Corporation
NDMC	New Delhi Municipal Corporation
NEP	National Education Policy
NFM	National Floriculture Mission
NHB	National Horticulture Board
NHM	National Horticulture Mission
NEIST	North East Institute of Science and Technology
NRCO	National Research Centre on Orchids
PACs	Primary Agricultural Cooperative Credit Societies
PGRs	Plant Growth Regulators
PHT	Post Harvest Technology
PPP	Public-Private Partnership
PPV&FRA	Protection of Plant Varieties and Farmers' Rights Authority
PRA	Pest Risk Analysis

R&D	Research and Development
RET	Rare Endangered Threatened
RRBs	Regional Rural Banks
SAUs	State Agricultural Universities
SFAC	Small Farmers' Agribusiness Consortium
SHGs	Self-help Groups
SOP	Standard Operating Procedure
SSL	Solid State Lighting
TAAS	Trust for Advancement of Agricultural Sciences
TNAU	Tamil Nadu Agricultural University
TRIFED	Tribal Cooperative Marketing Development Federation
UK	United Kingdom
USD	United States Dollars
VKUY	*Vishesh Krishi Upaj Yojna*
YSPUHF	Dr Yashwant Singh Parmar University of Horticulture & Forestry

National Dialogue on
Harnessing the Potential of Floriculture in India

BACKGROUND

Floriculture is a fast emerging and highly competitive industry in India. Today, India has the second largest area of flower production in the world (next to China), though our share in the world trade is negligible (0.89%). Being a multifaceted enterprise, floriculture is characterized by growing traditional loose flowers and cut flowers under open field conditions and protected environment. It also has a strong dry flower industry, with substantial contribution (>60%) to floricultural exports. Other segments like cut greens (fillers), indoor and landscaping plants, seeds and planting material, turf grass and value-added products also contribute their share in the overall growth of the sector. Production of flowers is estimated to be 2151.96 th tonnes of loose flowers and 828.09 th tonnes of cut flowers in 2020-21. India exported 23,597 mt of floriculture products to the world mainly the USA, the Netherlands, Germany, UK, UAE, and Canada, valued at USD 103.47 million in 2021-22. It is expected that the Indian floriculture market will grow exponentially in the future.

The exports could be a key motivator for the cultivators, but the domestic demand for flowers is also increasing exponentially. Modernization and increased affluence have driven largely the young population to buy flowers on occasions mainly during marriages and religious functions, popular events like anniversaries, birthdays, Christmas, Valentine's Day, Friendship Day, Mothers' and Fathers' Day, etc. In fact, floriculture is an integral part of Indian culture which has a special mention in sacred scriptures of the Vedic time, entwining flowers with social fabric of worship and religious rituals. The offering and exchange of flowers on all social occasions, in places of worship and their use for adornment of hair by women and for home decoration has been an integral part of Indian culture since time immemorial. With changing life styles and increased urban affluence, floriculture provides tremendous scope for its growth.

CONSTRAINTS AND FUTURE POTENTIAL OF FLORICULTURE

Appreciation of commercial floriculture resulted in its blossoming into a viable agri-business option. Floriculture is also recognised as an agricultural activity, which is labour intensive, capable of generating employment, particularly for farm women, besides providing higher economic returns. Diverse agro-climatic conditions prevailing in the country also provide opportunities for production of a wide range of temperate and tropical flowers, almost round the year. The promotion of flower cultivation has changed the very landscape of agriculture as it brings prosperity to the farmers and mainly attracting youth in agriculture. Also, the support being provided by the Government in the past 2-3 decades, further provided impetus to commercial production. The economic reforms and liberalization policies (1991) coupled with revised EXIM policies (1995-96 and 1999-2002) enhanced the potential of floriculture. In the early 1990s, the Government identified floriculture as a Sunrise Industry and accorded it 100 per cent export-oriented status. Thus, flower farming suddenly got a tag of blossoming industry. However, it was realised that we were neither equipped nor oriented to harness available opportunities for want of R&D backing and infrastructure support, including marketing and exports. The Government, however, continued its support as the Ministry of Agriculture and Farmers' Welfare (MoA&FW) increased substantially its allocation for horticulture from the VII Plan (Rs 25 crore) to VIII Plan (Rs 1,000 crore), and this support has been increasing steadily since then. Ministry of Commerce and Industry (MoC&I) also continued supporting floriculture projects through APEDA funding. Besides, several State Governments are implementing specific schemes for floriculture development. Generally, floriculture is considered as growing of flowers alone. This is because business of flowers accounts for more than 75 per cent. However, over a period of time, floriculture has grown to encompass many sub-sectors, which have emerged as viable business options on their own. The global floriculture business today comprises cut flowers (dominated by rose, carnations, chrysanthemum, gerbera, lilium, orchids, etc.); loose flowers (marigold, chrysanthemum, jasmine, tuberose, rose, *Crossandra*, etc.); live plants for indoor and outdoor landscaping (sale and renting); cut foliage; turf grass; dry flowers and plants; essential oils and pigments; seed and planting material, etc.

Cut flowers are produced on less than 2 per cent of the total production area (3 lakh ha), but the production is reportedly increasing @ 5 per cent annually, besides the product range expanded, which includes Calla Lily, Bird of Paradise, and Heliconia, etc. Similarly, loose flower production has tripled in the past two decades. The main consumers of flowers are in major metros and larger Indian cities. The sub-sector of cut flower production has also given rise to

several centres producing and / or importing tissue-cultured planting materials of specific crops. The demand for cut foliage is also increasing constantly due to their natural freshness and attractive colours and forms. They have aesthetic value in weaving flowers and floral arrangements, bouquets, wreaths, indoor decorations, weddings, etc. In the past two decades, custom production of flower seeds for exports and domestic use has also increased several folds, with Punjab and to some extent Karnataka are leading this segment. The ornamental plants sector, both seasonal flowering plants for outdoor landscaping and the perennial shrubs and foliage plants for indoor and outdoor decoration, is increasing rapidly. The use of rented plants in interior housekeeping in hotels, offices and even homes, is increasing. These plants, besides their decoration value, also purify and revitalise air. Industrial application of flowers is also steadily increasing. This includes flavours, fragrances, natural colour, essential oils, medicines, etc. Extraction of essential oils from several flowers, e.g. rose, jasmine, lavender, tuberose, etc. and pigments from flowers such as marigold (in great demand in poultry industry) is increasing. Use of several nutraceutical pigments and edible flowers has added floriculture to the nutritional food basket. Lately, several start-ups have tied up with temples and other religious centres for recycling of used (offered) flowers for manufacturing incense sticks, etc., which has contributed also to a cleaner environment.

The turf grass industry has expanded globally and is around USD 100 billion currently. In India, it reportedly covers more than 10,000 ha production area catering to nearly 50 international cricket grounds, more than 500 domestic cricket grounds and athletic fields, besides a large number of golf courses being developed across the country. Another potential area for floriculture development in the country is Eco-tourism to Flower Valley (Chamoli in Uttarakhand), *Neelakurinji* Flower Valley (Munnar in Kerala), *Kas Pathar* Plateau (Satara in Maharashtra), *Yumthang* Valley (Sikkim), *Kansai & Khira* Valley (West Bengal), etc. which present a wide range of natural flower splendour during specific seasons. An emerging area in floriculture has been the vertical gardens, also known as Green Walls. It is common to see green plants adorning walls in airports, hotels, corporate buildings, flyovers and metro pillars, railway stations and bridges. In addition to beautification, these green walls contribute to environmental protection, by reducing air pollution, improving air quality by removing toxicants, dust, as well as lowering the noise levels.

Horticulture sector in India has been flourishing well during the last five decades. But among the horticultural crops, floriculture seems to have received low focus. The industry is facing a number of challenges relating to production / post-harvest, marketing and exports. Despite the Government's recognition of the potential of floriculture industry and conferring 100 per cent export-oriented industry status, it

has not developed as per expectations due to several bottlenecks. As the industry is still in its primitive stage and facing many problems, such as non-availability of quality planting materials, lack of specific information on area and production of different species; lack of information on novel/ruling varieties; lack of advanced production technology; inadequate infrastructure facilities like greenhouse, cold storage, etc.; lack of coordination among Government departments and growers and exporters; lack of cooperation among growers for collective actions; no direct cargo flights from major production centres; very high air freight; lack of research for developing new varieties, post-harvest technology (PHT) and production practices; role of commission agents and middlemen and lack of systematic market planning; and inadequate extension services. While the domestic flower business is affected by small farm size, inadequate post production infrastructure, poor access to the latest R&D advances due to very poor extension / knowledge transfer, low access to institutional credit for setting up commercial units and unorganised market infrastructure, the export-oriented flower farms have problems related to floriculture export (market access, high air freight, poor cool-chain, etc.). The export of floriculture products from India picked up significantly in 1990s with the setting up of nearly 200 export-oriented units in the private sector. While focusing mainly on rose, Indian suppliers could gain a good market share replacing the regular suppliers in a highly competitive and quality conscious Japanese cut flower market. The initial success enabled India emerged as a major flower power in the world. Encouraged by this growth trend, the Government announced a target of INR 1,000 crore by 2010. But over a period of time, most of these export units got closed, leaving only a handful of cut flower exporters selling their produce in USA, UK, Europe, Japan, Australia and the gulf countries. Among the floriculture products exported from India, dry flowers and plants account for more than 60 per cent, worth nearly INR 250 crore annually. Non-availability of suitable market infrastructure like auction houses in all production zones, seriously affects the export of flowers.

In India, floriculture research has low priority and is largely focused on garden display, and commercial aspects are not paid much attention. Very few of over 600 varieties in 12 crops developed by the research institutions are in commercial stream. Inadequate extension system resulted in poor dissemination of the technologies. The dry flowers business, presently a major component of the country's exports, lacks required R&D backup. Floriculture supply-chain, with the long haul of products for sale in distant markets and the energy requirements of greenhouse production created negative environmental impact. Globally, this aspect is receiving attention of the major players and examples like Floriculture Sustainability Initiative (FSI) – established a decade ago by a

group of international stakeholders– are active in the floriculture supply-chain, development of protocols for sea transportation of floriculture products, and all have strived to reduce the carbon footprint of the industry. Hence, research support is needed in this direction, which is also critical for future growth of floriculture in India.

THE NATIONAL DIALOGUE

In view of above, the Trust for Advancement in Agricultural Sciences (TAAS), New Delhi – a neutral Think Tank, Indian Council of Agricultural Research (ICAR), Ministry of Agriculture and Farmers' Welfare (MoA&FW), and Agricultural & Processed Food Products Export Development Authority (APEDA) in collaboration with National Academy of Agricultural Sciences (NAAS), National Bank for Agriculture and Rural Development (NABARD), Regional Centre, New Delhi and Indian Society of Ornamental Horticulture (ISOH), New Delhi, organized a **'National Dialogue on Harnessing the Potential of Floriculture in India'** on 16-17 February, 2023 at New Delhi. The National Dialogue brought together 125 diverse stakeholders from the Central and State Governments, research institutions, development agencies, private floriculture industry and farmers on a neutral platform and discussed and assessed specific gaps in research and development of floriculture in India; identified technological options for accelerating flower production, processing and marketing including exports; and suggested strategies for enhancing income of stakeholders engaged in floriculture business.

INAUGURAL SESSION

Dr RS Paroda, a Padma Bhushan awardee, and Chairman, Trust for Advancement of Agricultural Sciences (TAAS), Former Secretary, DARE and Director General, ICAR chaired the Inaugural Session. The National Dialogue was inaugurated by **Dr Trilochan Mohapatra**, Former Secretary, DARE & DG, ICAR and Former President, National Academy of Agricultural Sciences (NAAS). **Dr Anand K Singh**, DDG (Hort. Science), ICAR and **Dr Prabhat Kumar**, Horticulture Commissioner, Government of India presented special remarks on this occasion.

Dr Narendra Dadlani, the Dialogue Convener welcomed the Chief Guest Dr Trilochan Mohapatra, Dr RS Paroda, Chair of the Session, Dr Anand K Singh, DDG (Hort. Science), ICAR and Dr Prabhat Kumar, Horticulture Commissioner, Government of India - Guests of Honour; distinguished invitees and eminent experts to this important national meeting to discuss the challenges and the way forward for the floriculture sector in the country. He thanked all the participants attending the National Dialogue and felt that the large turnout from across the country reflected the importance attached to floriculture and the effort of TAAS

to develop a strategy for its growth. Setting the Context of the Dialogue, Dr Dadlani felt that growth of the sector in the last decade or so has not been commensurate with the status of being the second largest producer of flowers. The sector showed significant progress in terms of many new verticals emerging as individual business bastions in cut greens (foliage), indoor and landscaping plants, seeds and other planting materials, turf grass, value-added products, vertical gardens, etc. The whole sector remains unorganized, both in terms of production and marketing. The effect of tremendous R&D infrastructure and the contributions have failed to impact the producers significantly. The exports of floriculture products have remained below 1 per cent of the global trade and dry flowers and plants, with no or low technical backstopping, still constitute nearly two-third of the export revenue. The Government support (starting from about INR 10 crore in the Eighth Plan) has increased many- fold, but it has not yet instilled the confidence among the floriculture community. He mentioned that the National Dialogue has been convened to understand the issues constraining the growth and develop a 'way forward' for promoting the growth of floriculture industry.

Dr Prabhat Kumar, Horticulture Commissioner, GoI, mentioned that floriculture is a year-round activity and the floricultural development options are limited. He agreed that the area and production, particularly for flowers, have significantly increased, but the data collection system fails to capture the actual growth; new floricultural products like edible flowers added to the basket and the exports of planting materials also increased; and the sector has tremendous employment generation ability and a biotech company in Pune provided quality employment and empowered more than 1,300 women. He appreciated the growth in exports of floricultural products, and opined that a revision of HS (Harmonized system) code would further help in increasing the export. He also mentioned that nursery industry is to be promoted as ancillary industry; and emphasized on the importance of tree flowers, new start-ups, dry flower export (60%), on natural dyes especially marigold (INR 200 crore business), use of flowers in incense industry. He further informed that the GoI is developing a Strategy Paper addressing the current status, challenges and opportunities, specific R&D needs, trade related matters including export, traceability, post-harvest management and value-addition, need for good agronomic practices (GAPs), and ways to become world leader in the export of flowers and foliage. He strongly felt that with a young millennial population, the future of Indian floriculture is very bright.

Dr Anand K Singh, DDG (Hort. Science), ICAR outlined that floriculture industry has become very vibrant currently. Running a flower business with proper marketing and services can be highly profitable. There is also a good scope in

dried flower business. He suggested that under 'One-District-One-Commodity' program, flower drying activities can be enhanced. Flower plants are one of the most money-making plants in the market. On profitability of flower farming, he cited an example and mentioned that if rose is cultivated in open field, it can produce 3.75-5.00 lakh stems, while in greenhouse, it can yield 4.75-8.00 lakh stems per acre every year. With APEDA's support, floriculture business can be enhanced. He stressed the importance of data rationalization for better channeling the support programs for floriculture. He opined that the smallholder farmers are the strength of Indian floriculture. He lamented that the research achievements from a sound R&D set-up have not reached the flower producers and hence, could not impact their enterprise. In his opinion, enhancing the use of our own varieties and testing their potential will swiftly align the sector to the government's *Atmanirbhar Bharat* initiatives. He also suggested that value-added technologies should receive more focus and cited the huge potential in marigold pigment business (around INR 300 crore). He felt that floriculture has to be sustainable and all activities related to overuse of resources, like water requirements for lawns, needed to be re-examined. He stressed on reduced use of agro-chemicals and strongly advocated access of the producers to appropriate technical and policy support.

Dr Trilochan Mohapatra, Former Secretary DARE and DG ICAR and Chief Guest of the Inaugural Session, highlighted the huge potential that exists for this sector. Citing the example of his small village with 4 temples and 400 families, the daily use of flowers for worship was huge. This is just one of the floriculture vertical and put together, the sector has very high potential. He stressed that we need to have a scientific demand-supply analysis, and new business models in each vertical, for different scale, should be studied. He cited an example of *jangali gainda* (wild marigold) and lavender (*Lavandula angustifolia*) work at CSIR-IHBT, Palampur which improved the livelihood of smallholder farmers a great deal. He opined that the sector has tremendous employment generation possibility if proper value-chains are worked out. He felt that the availability of varied climate in India provides opportunities for growing different kind of flowers in one or the other areas in the country. He was very optimistic in saying that floriculture industry should focus on color, anti-oxidant product of pharmaceutical value. He queried if gene editing can be used to create different colors in flowers. He witnessed the growth of a new FPO in wild marigold and felt that such success stories need to be replicated with different products all over India. In his opinion, the industrial use of flowers is increasing and this area needs more research support. Dr Mohapatra advocated for better linkages between research and the floriculture industry and development of new varieties for the industry needs. Discussing the export potential, he said that with so many valued products like seeds, flowers,

planting materials, dry flowers, value-added products, etc., we are touching only the tip of the iceberg.

In his Chairman's remarks, **Dr RS Paroda,** Chairman, TAAS, suggested that the Rainbow Revolution is incomplete without floriculture revolution. He agreed that looking at the long use of floriculture products for social and religious purposes in the country, we were fortunate to have a huge internal market to sustain the sector, unlike the global giant like the Netherlands, which has to depend on imports from India, among other nations, to survive. Perhaps we were late in planning floriculture development and we need to be active before this sunrise industry faces an early sunset. Dr Paroda also felt that the floricultural research system in the country needs strengthening. With the creation of the Division of Floriculture & Landscaping at ICAR-IARI, followed by establishment of separate floriculture departments in most horticulture institutes under ICAR / CSIR and the state agricultural universities (SAUs), we have a strong infrastructure set-up for taking up floricultural research. Looking at the potential of orchids in the north eastern region, ICAR has set-up the National Research Centre on Orchids (NRCO) at Pakyong (Sikkim) and later the Directorate of Floricultural Research (DFR) was established at Pune to consolidate and guide the floricultural research in the country. He stated that we have institutions, HRD, youth, and learnings from entrepreneurs, and now need to capitalize on this strength. He felt that with a young population, we not only need to involve them in the business, but also learn and benefit from their new ideas. We also need to understand from the successes of certain FPOs and also encourage formation of such groups in other verticals. Farmers always need new knowledge, as they learn from success stories and the developmental agencies need to channelize the support system accordingly. He further emphasized to work on mission-mode approach, and suggested that protected cultivation will help a great deal in promoting floriculture industry. Dr Paroda recommended use of PPP to support the government to realize the potential and avail the opportunities. Government needs to prepare a strategy for policy support. Among others he discussed to work in diversified fields, such as fragrance industry, vertical floriculture, turf grasses, and establishing golf courses. While summarizing, he stated that India has great potential to develop and flourish this money spinner industry with several advantages: (i) India is endowed with proximity to market in Japan, South- East Asia and Middle East countries; (ii) in the world market, scarcity of flowers is found during winters because of more festivals (Christmas, New Year, Valentine Day), while in winter in European countries flower production declines due to freezing conditions of major production centres and even if produced somehow the production cost is higher, hence European countries may look towards us for low cost flowers; and (iii) being blessed with varied agro-climatic

conditions of country, India can lead in production of cut flowers required in the global market.

FELICITATION OF PATH BREAKERS

A few pioneers and path breakers in the field of floriculture were recognized for their outstanding contributions and achievements in different areas of floriculture development. These included **Indo American Hybrid Seeds**, Bengaluru, for pioneering the exports of floriculture products from India; **Beauscape Farms**, Ludhiana (Punjab) for pioneering production and exports of flower seeds from India; **Media Today Group**, New Delhi for publishing the first magazine dedicated to floriculture and also organising the International Flora Expos; **Sir Arthur Cotton Kadiyam Nursery Farmers' Association**, Kadiyam (AP) for revolutionising the ornamental plants business in India and ***Pawna Phul Utpadak Sangh***, Pawna (M.S.) for pioneering setting up of a Farmer Producer Organization for production and exports of flowers from India. They were all felicitated with a 'Commemorative Plaque', a shawl and a flower bouquet, for their contributions. Indo American Hybrid Seeds, Bengaluru, couldn't be present and were awarded in absentia.

Dr Bhag Mal, Secretary TAAS, expressed gratefulness to Dr Mohapatra for inaugurating the National Dialogue as Chief Guest and giving a thought-provoking address. He expressed profuse thanks to Dr RS Paroda, Chairman, TAAS, for his address in Inaugural Session as well as continued guidance and meticulous planning of the program and catalyzing the various co-organizers for their kind support. He was thankful to both Dr Anand K. Singh and Dr Prabhat Kumar, for their special remarks and assuring the support for both the research and development of the sector. He thanked Dr Dadlani for his welcome remarks, setting the context, and for the help and support provided for organizing the Dialogue. Finally, he thanked all the distinguished guests, eminent experts, invitees and participants for their kind presence and all those who helped in organizing the National Dialogue.

TECHNICAL SESSION I: FLORICULTURE RESEARCH AND DEVELOPMENT

The first Technical Session was chaired by **Dr Sudhakar Pandey**, ADG (Hort. Science), ICAR. **Dr SP Das**, Director, ICAR–NRC Orchids, Pakyong (Sikkim) was the Convenor of the Session. Dr P Naveen Kumar, ICAR-DFR, Pune and Dr Gunjeet Kumar, ICAR-IARI, New Delhi were the rapporteurs for the Session. Five presentations were made on R&D in floriculture by Drs KV Prasad, KJ Singh, Prabhat Kumar, KP Singh and Meenakshi Meena.

Dr KV Prasad, Director, ICAR-DFR, Pune presented the status and prospects of the floriculture sector. He mentioned that floriculture is an important component of the global Lifestyle Horticulture Industry, worth USD 300 billion. The global trade of floriculture products is presently more than USD 8 billion and is expected to reach USD 10 billion by 2030 (with a CAGR of 8.8%). Europe with a production share of nearly 40 per cent is the most important group. Among the European nations, the Netherlands accounts for nearly half of the exports of floriculture products. The Netherlands is followed by Colombia and Ecuador from South America and Kenya from Africa. The USA ranks at the top of the importing nations followed by Germany, UK and the Netherlands. Among the Asian nations, Japan is the biggest importer. India ranks 51st among more than 170 countries involved in floriculture trade. India exports floriculture products worth more than INR 770 crore to more than 100 countries, though its share of the global trade is less than 1 per cent. Majority of the export basket is taken up by the dry flowers and floriculture products business accounting for nearly 70 per cent. The fresh flowers rank second with a share of about 20 per cent. India is strategically located to reduce carbon miles and can service the markets both in the east and the west. India's import of floriculture products is more than INR 250 crore and includes mainly, orchids, tulips, iris, etc. India can reduce this import by promoting bulbous production in the Himalayan states. India has a strong domestic market worth USD 1.33 billion, largely due to increased urbanization, with more people having disposable income and India being a young nation with nearly two-third of the population aged below 35 years. Floriculture research got a boost with the start of the All India Coordinated Floriculture Improvement Project (AICFIP) in 1971 and floricultural research started at ICAR-IARI, ICAR-IIHR, and at CSIR-NBRI. Besides these, floricultural research in the country was extended with the establishment of NRC Orchids, Pakyong (October 1996) and ICAR-DFR at Pune (2009) and is now also conducted at 46 SAUs and 22 AICFIP centres across the country. Research gaps both immediate and long- term were identified and being addressed.

With India endowed with a wide range of agroclimates, production of floriculture products is done in all the states and the country has the second largest production base. Several State Governments have introduced floriculture development schemes and with major floriculture production clusters coming up, particularly in the north eastern states and with increasing per capita spending on these products, the production is likely to increase. A major concern in the growth of floriculture business is the unorganised marketing system. We need to strengthen the existing big markets at Delhi, Mumbai, Bengaluru, Kolkata and Pune among others with integrated facilities and backward linkages and also work towards reducing the

post- harvest losses, presently pegged at 30 per cent. Development of value-chain is the key for the development of the sector. Festivals / weddings are the main driver for the market at present. A good step would be needed to incentivise the FPOs. Development of value-added products, more particularly the essential oils being exported to Colombia, Ecuador, Kenya, Ethiopia, etc., waste-to-wealth products, and linking the greenhouse production clusters with flori-malls will also help improve the trade. Efforts should be increased on linking the apiculture initiatives of National Bee Board with the floriculture production belts to improve production. He also identified the various verticals like loose / cut flowers, dry flowers and products, cut foliage, potted plants, plug plants, lawn grass, flower seeds, value-added products, essential oils, plant tissue culture, nutraceuticals, vertical gardens, etc. and suggested that proper development plans should be prepared. He also emphasized on the data rationalization for planning effective developmental programs.

Dr KJ Singh from CSIR-National Botanical Research Institute (NBRI), Lucknow presented the main features of the National Floriculture Mission (NFM) launched in March 2021 with the main objectives of development of new varieties, area expansion, urban floriculture development, development of post- harvest and value-addition, institutional / school floriculture garden development, integration of apiculture and floriculture, appropriate national registration and release of varieties system development and establish linkages to domestic and international markets. The NFM is being implemented by five CSIR institutes, namely, CSIR-NBRI, Lucknow; CSIR – Institute of Himalayan Bioresource Technology, Palampur; CSIR – North East Institute of Science and Technology, Jorhat (Assam); CSIR – Indian Institute of Integrative Medicine (CSIR-IIIM), Jammu; and CSIR- Central Food Technological Research Institute (CSIR-CFTRI), Mysuru (for value-addition). The Project partners are ICAR, Khadi and Village Industries Commission, state horticulture departments, APEDA, Tribal Cooperative Marketing Development Federation (TRIFED), Fragance and Flavour Development Centre (FFDC), Ministry of Micro, Small & Medium Enterprises (MSME), GoI and Tamil Nadu Agricultural University (TNAU), Coimbatore. Under the development of new varieties, efforts initiated have resulted in identification of 18 promising cultivars in chrysanthemum, gerbera, etc., as also efforts at domestication of wild ornamental plants (more than 50) for improving the crop diversity for markets, have yielded good results. The NFM efforts at area expansion have resulted in increased area of more than 1,200 ha in Uttar Pradesh, Maharashtra, Punjab, Himachal Pradesh, Assam, etc. in 133 districts under more than 250 clusters. A major incentive is the distribution of planting materials with the help of ICAR, which has resulted in attracting more than 6,000 farmers to floriculture. Work was initiated with marigold, jasmine,

rose, lotus, tuberose etc. on mapping the fragrance so as to highlight the area producing these products, and the Gunjam area in Andhra Pradesh was identified for tuberose.

Among others, Dr Singh emphasised besides mapping of fragrance in floricultural crops, value-added technologies and products, herbal wound healing gels, integrating both apiculture and floriculture, and establishing domestic and international market linkages. Under urban floriculture development, promotion of vertical gardens on metro and flyover pillars and at airports and railway stations, roof top gardening with the help of progressive farmers and start-ups, and hydroponic development at CSIR institutes have been initiated. Floriculture gardens are being developed in institutes (like CSIR- Central Electrochemical Research Institute (CSIR-CERI), Karaikudi, Tamil Nadu) and many schools (in Uttar Pradesh, etc.) to introduce more people to benefits of floriculture farming. The value-added floriculture programs were taken up with the support of MSMEs, start-ups, FFDC, CSIR-CFTRI, etc., to develop floral pigments, biopesticides, natural bioactive agents for vase life extension, value-added marigold oleoresins for food products, growing from waste-to-wealth through production of herbal *gulal* and *sindoor,* herbal incense sticks and cones, hand wash and soaps, etc., other value-added products like hand-made paper, dehydrated floral crafts, lotus and chrysanthemum perfumes, etc. A total of 20 value-added products were developed for which technology is ready for transfer. The NFM initiatives for linking apiculture with floriculture was taken up with the help of KVIC and more than 4,500 ha area was brought under apiculture through distribution of honey bee boxes, honey extractors and other tool kits through SHGs and organising training programs for farmers from various clusters.

Very productive initiatives were taken for linking the floriculture producers with the domestic and international markets with the support of APEDA and State Marketing Boards. A major program was on development of Uttar Pradesh Floriculture Corridor linking Varanasi, Lucknow to the Gazipur Flower Market (Delhi), reaching flowers from Ladakh to Delhi market; organising cluster skill development at CSIR-IIIM for farmers, florists, nurseries, etc.; joining the Herbaroma 2.0 at Nagpur; convening Scientists – Industry Meet to discuss production, cold-chain development, product based skill development, introduction of new crops, etc.; organising a large flower marketing event at *Kisan Bazar*, Lucknow with support from State Agriculture Marketing Board. The success of NFM so far has enthused state governments (Uttar Pradesh, Madhya Pradesh, Haryana, Odisha, Manipur, among others) to develop State Floriculture Mission proposals for holistic development of the sector.

Dr Prabhat Kumar, Horticulture Commissioner, Government of India, presented the progress of programs taken by MoA&FW for floriculture development. He mentioned that broadly the interventions are coordinated under the programs of Mission for Integrated Development of Horticulture (MIDH), National Horticulture Board (NHB), Centre of Excellence (CoE); Cluster Development Program (CDP), *Agriculture* Infrastructure Fund (AIF) of GoI, FPOs and APEDA. All these agencies / schemes are targeting to improve the sector from increasing the area (presently 3,22,000 ha) and production (presently, 21,52,000 tonnes loose and 8,25,000 tonnes cut flowers) and increase the exports by 20-25 per cent, with a combined investment of about INR 10,000 crore.

The MIDH programs with a 60 per cent investment from GoI (90% for North Eastern States) and 40 per cent (10% in NE states) support from State Governments, for pre-production, production and post-harvest management development and introduction of innovative projects like dry flower technology, essential oil extraction and marketing, etc. and market development through creation of terminal markets under PPP mode. Out of Rs 1,900 crore budget of MIDH, the share of floriculture was only 5 per cent. The NHB programs are aimed at development of commercial horticulture through production and post-harvest management; cold-chain development; technology development and transfer for promotion of floriculture; development of MIS for better returns to the farmers and development of floriculture clusters, particularly in the North Eastern States. He further informed that NHB is expanding protected cultivation program, focuses on technology development and transfer. The Government is setting-up Centres of Excellence under bilateral assistance programs with Government of Israel (Indo-Israel Cooperation) and the Netherlands (Indo-Dutch Cooperation), to serve as demonstration and training centres, as well as for generating quality planting materials. Centres of Excellence for floriculture were set-up in Tamil Nadu and Haryana (under Indo-Israel support) and Maharashtra and Punjab (under Indo-Dutch support).

The Cluster Development Program of MIDH is a major program aimed at development of nurseries (for quality planting material), increasing GAP certified areas, pack houses, cold stores and processing units for effective post-harvest management and collection centres and provision of reefer vans for better marketing options, besides addressing other concerns of the value-chain. Under the CDP, 55 potential clusters were planned across the country with 12 of them as Pilot Centres. Under floriculture, the clusters are being developed in areas around Pune, Kolkata (Kalyani) and Bengaluru, for flowers, natural *gulal* and dyes, herbal tea, essential oils, incense sticks, etc. The AIF is an INR 1,00,000 crore top-up fund (with many states giving top-up matching) through FPOs, Self-help

Groups (SHGs), Cooperatives, Primary Agricultural Cooperative Credit Societies (PACs), and others for greenhouse farming, logistics, vertical farming, development of hydroponics and aeroponics, etc. The major focus is on supporting farm gate infrastructure, infrastructure for addressing vagaries of nature, avoid regional disparities, development of human resource, to realise the full potential of our limited land resources. There are plans to develop FPOs for floriculture through the support of Small Farmers' Agribusiness Consortium (SFAC), National Cooperative Development Corporation (NCDC) and National Bank for Agriculture and Rural Development (NABARD) for better collective strength for access to quality inputs, technology and marketing. The MoA&FW also coordinates with APEDA to promote exports of horticulture produce (including floriculture products) through market development, quality development and development of export infrastructure. He also emphasized on market intelligence and the need for addressing the major limitations in planning effective development plans due to insufficient data capture, improper value estimates (with several silent contributors), post-harvest losses and marketing.

Ms Meenakshi Meena, Assistant General Manager, NABARD Delhi Regional Office, spoke about the NABARD's initiatives for development of the horticulture (including floriculture) sector. She mentioned that the floriculture sector has exhibited significant growth with increased area expansion and enhanced production. The exports are increasing. Most states have increased their floriculture base through central or state government support. She agreed that the main challenges facing the sector include shortage of quality planting materials, high cost of certain planting materials, lack of awareness of quality standards, high perishability of the produce, lack of adequate post-harvest infrastructure, and poor access to markets.

She expressed that production and trade of floriculture has increased consistently over the last 10 years. The country has exported to the world 15,695.31 mt of floriculture products worth of INR 575.98 crore in 2020-21 and 23,597 mt worth INR 771.41 crore in 2021-22. Top exporters include USA, the Netherlands, UAE, UK, Germany, Japan, Canada, etc. Among states, in terms of production, Karnataka stands first with a total of 253.24 th tonnes. In terms of area, Kerala is the leader in floriculture with about 53.26 ha under floriculture cultivation. Other major flower growing states are Tamil Nadu and Andhra Pradesh in the south, West Bengal in the east, Maharashtra in the west and Rajasthan, Delhi and Haryana in the north. According to Horticulture Statistics (2018-19), the total area under flower crops was 303 th ha, which is the second largest in the world only next to China.

Owing to the steady increase in demand for flowers, floriculture has become one of the important Commercial trades in Agriculture. It has emerged as a hi-tech activity-taking place under controlled climatic conditions inside greenhouse. These hi-tech greenhouses provide the best conditions for export quality cut flowers, and are presently used by large number of export units. The liberalization of industrial and trade policies paved the way for the development of export-oriented production of cut flowers. The new seed policy has already made it feasible to import planting materials of international varieties. It was found that commercial floriculture has higher potential per unit area than most field crops and is, therefore, a lucrative business for small and marginal farmers. The liberalized economy has given an impetus to the Indian entrepreneurs for establishing export-oriented floriculture units under controlled climatic conditions.

Ms Meena informed that NABARD is providing grant assistance under Farm Sector Promotional Fund (FSPF) for providing various promotional initiatives in agriculture, farm innovations, technology transfer and capacity building of various stakeholders. She emphasised that the various agri-startups, providing technology-based solutions for the development of the sector are also eligible for support under FSPF (maximum of 90% project outlay), support of cold storage facilities, and incubation centres. NABARD was also refinancing the Cooperative Banks and RRBs for financing the production, as also providing assistance to high tech units for post-harvest infrastructure like cold storage, etc. To support the business ideas generated in the rural sector, NABARD provided support to 7 rural business incubation centres, which has directly / indirectly benefitted nearly 3 lakh farmers and youth. These centres also helped in establishing connect of 150 investors with incubators. She stressed that NABARD is also an important arm in implementing AIF and the Government of India's scheme for development of FPOs. The recent popularity and acceptance of an environment-friendly lifestyle expanded the scope of the floriculture industry. Many farmers and garden enthusiasts from all over the globe have started growing and marketing flowers with much interest and passion. There is a yearning need of spreading awareness about floriculture among farmers as floriculture can provide 5 times more return than traditional crops. Though both traditional and modern flowers have a high demand in the hospitality and wedding industry, there is also an entrepreneurship wave and many floriculture- based startups are booming.

India has diverse agroclimatic and rich plant diversity but it shares only 0.6 per cent of the global floriculture market. There are multiple challenges in the flower industry but rapid urbanization, better flower transportation facilities and other measures have aided the floriculture industry in India and helped in

maintaining the high growth rate of the sector. Floriculture thus, offers a great opportunity to farmers in terms of income generation and empowerment. Small and marginal farmers may also use every inch of their land for raising the flower and foliage crops. Floriculture also offers careers in production, marketing, export and research. One can find employment in the floriculture industry as a farm manager, plantation expert, supervisor or project coordinator. Besides, one can work as consultant or landscape architect with proper training. In addition, floriculture also provides career opportunities in service sector, which include such jobs as floral designers, landscape designers, landscape architects and horticultural therapists. Research and teaching are some other avenues of employment in the field.

Dr Kanwar Pal Singh, Prof and Head, Division of Floriculture and Landscaping, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, spoke about the human resource development for the floriculture sector. He emphasised that while a strong infrastructure in terms of dedicated departments of floriculture exists in the SAUs and many research institutes, most of those who qualify from these centres have little knowledge about the requirements of commercial floriculture. Dr Singh suggested that the students in floriculture should be encouraged / facilitated to work with the industry part-time while pursuing their degree programs so as to prepare them better, more skilled, industry friendly and improve their employability. He also expressed concern that the systems for development of middle level workers like technicians, supervisors, etc., are almost missing for floriculture sector and suggested introduction of vocational courses / short-term certificate courses for training persons in different floriculture sub-sectors. In his opinion, industry associated / sponsored research at universities / institutes would align the research work with the industry needs. He felt that in the floriculture sector, we had more of trained manpower but not the skilled manpower. Programs for skilling need to be introduced / strengthened, particularly in areas like greenhouse management, value added industry, landscaping, turf grass management, etc. He also opined that the Government should encourage the start-ups in fast emerging verticals of floriculture and the floriculture faculty also should be encouraged to get training at advanced centres across the world for updating their knowledge and skills.

At the end of session, **Dr JL Karihaloo,** Former Director, ICAR-NBPGR and Coordinator APCoAB emphasized on the need for evaluation and conservation of indigenous floricultural germplasm. **Dr Umesh Srivastava,** Former ADG (Hort. Science), ICAR emphasised that orchids have tremendous variability in Arunachal Pradesh and Sikkim. Orchids have greater shelf-life and earn more exchequer on import, hence orchids may be given major focus in government / ICAR schemes.

In his concluding remarks, **Dr Sudhakar Pandey**, ADG (Horticulture-FVS&MP), ICAR advised to focus on: (i) system of standardisation for floriculture varieties; (ii) database development, (iii) refinement of production technologies for increasing shelf-life, and (iv) procedure for notification of varieties.

The salient points emerged from the deliberations in this Session are as follows:

- Greater attention needs to be given to the domestication of indigenous flowering plants and their conservation.
- Arunachal Pradesh and Sikkim are full of orchids but very less work has been done on orchid collection, characterization and conservation, which needs to be intensified.
- The biggest problem of HRD which floricultural industry is facing is paucity of middle level management in greenhouses, which needs to be addressed.
- There is need to train more people who will actually work on farms and take care of quality control.
- Greater attention is needed for the domestication of indigenous flowering plant sand their conservation.

TECHNICAL SESSION II: INNOVATIONS IN FLORICULTURE

Dr Umesh Srivastava, Former ADG (Hort.), ICAR, and the Convener for the Session introduced the Chair and the speakers for the Session. After the opening remarks by the Chair, **Dr Suresh Malhotra**, President, Indian Society of Ornamental Horticulture (ISOH) and Director ICAR-Directorate of Knowledge Management in Agriculture (DKMA) stressed the need of innovations for sustainable development of floriculture. Dr Parminder Singh, PAU, Ludhiana, and Dr Reeta Bhatia, ICAR-IARI were the rapporteurs for the Session.

Dr AK Shasany, Director, CSIR-National Botanical Research Institute (NBRI), Lucknow made a presentation on the various applications of biotechnology in floriculture. He highlighted the importance of the floriculture sector, which with its appreciable gross value output (GVO) was contributing significantly to the national economy. In his opinion, the main challenge facing the sector was non-availability of quality planting materials. He highlighted on the need for major biotechnological applications for the improvement of floriculture related to development of new varieties, expanding the floriculture gene pool, use of new technologies like RNAi, gene silencing, gene editing, transgenics, etc., for altering certain flower traits, to obtain early flowering, flower colour improvement, changing the flower morphology, fragrance engineering, extending the vase life,

improving stress tolerance and improving nectar production. He felt that both the conventional (hybridization and mutation breeding) and non-conventional (biotechnological and genetic engineering and tissue culture) breeding methods were in use. Tissue culture is being widely used for obtaining round the year, true to type and uniform planting materials.

Dr Shasany opined that gene editing overcomes almost all the limitations of traditional breeding approaches, and is being used for getting novel flower colours (e.g. blue rose), modifying flower colour by regulating flavonoid biosynthesis (e.g. petunia, torenia, gentiana, rose), for enhancing the vase life, changing the plant architecture, plant height, etc., enhancing the scent by manipulating synthesis of enzymes controlling these pathways. Silencing of genes has been successfully used for obtaining novel miniatures in chrysanthemum. The vase life extension has also been obtained by exploiting ethylene sensitivity to regulate flower senescence. He also stressed the importance of nectar enhancement, which is emerging as a huge market.

Dr Alka Singh, Principal and Dean, ASPEE College of Horticulture, Navsari Agricultural University (NAU), Navsari, spoke about various innovations for the improvement of floriculture, a sector with so many verticals. She mentioned that the innovative approaches for the sector improvement included precision techniques for growth management for changing the canopy / architecture (by mechanical means and use of plant growth regulators (PGRs) and flowering; mechanizations and robotics, use of artificial intelligence (AI) and internet of things (IoT); novel tools of genomics and gene editing; growing in soilless media (hydroponics / aeroponics); flower designing (fresh and dry); indoor plant designing for better air quality; and designer containers etc. Dr Alka discussed the process for use of gene editing for obtaining novel colour, flat grafting for Adenium growing and grafting in cacti and succulents. She mentioned about the different advanced irrigation systems like drip irrigation, water trays and saucers, sub-irrigation, capillary mat system and ebb and flow system in different ornamentals; and use of soilless growing of new potted ornamentals, particularly succulents like *Howarthia* and *Euphorbia,* and ferns. For mechanization in floriculture, she discussed about potting machine, media mixing, tray filling, seed sowing and packaging of pots. She also stressed the importance of bio-walls. The increased use of robotics for setting pots in greenhouses, harvesting, plant thinning, sorting and grading and for assessing plant condition was discussed. She mentioned about the designing of flower arrangements by robots. The emerging area of solid state lighting (SSL) and use of LED light for use in greenhouses with unfavourable light conditions, suppressing powdery mildew development and maximising plant quality was also highlighted.

She further discussed the use of less explored dry flowers and plants and home fragrance products, as well as the new customised printed flower industry and also the increasing use of freeze-dried flowers in decoration and jewellery, as well as use of edible flowers. The increasing use of flower wastes, particularly from temples, for making value-added products like incense sticks and cones, etc., fleather (the leather), as well as use of terra bricks, Oshun pouches (compostable water retaining flower pouches) to replace the environment pollutant flower foams, was also mentioned. She also highlighted the plants with special characteristics like absorbing harmful pollutants for improving the air quality.

She concluded her presentation with focussed attention on the following points:

- Soilless production technology for ornamentals (hydroponics/aeroponics) is available for a few ornamental plants. It needs to be standardized for all ornamental plants to augment international trade and exports as well as to facilitate domestic trade.
- Plant canopy/ plant architecture for pot plants is an important criterion to influence floriculture trade. Canopy management technology through molecular, physical and chemical means was developed and exploited for a few pot plants but it needs to be further explored using wider germplasm base for ornamental plants.
- Mechanization for growing media preparation, mixing, filling of seedling trays as well as pots along with planting and transplanting is well developed and established in Europe. This should be introduced, explored in Indian condition, and further demonstrated and adopted in high-tech nurseries and flower cultivation units.
- Flower waste management in terms of dry flowers, pigment extraction, incense sticks, vegan leather (fleather) needs to be explored, this can further generate more employment, encourage startups with a new perspective to floriculture.
- There is a need of research industry meet as well as academic industry meet (Industry linkage) to improve HRD and strengthen research with stronger base and application.

Mr Prasannamurti Desai, Vice President (Landscaping), Kempegowda International Airport, Bengaluru, mentioned about his involvement in the development of green airport at Bengaluru. He highlighted about his journey from airport terminal in a garden to developing a terminal in a biodiversity hotspot. He discussed about the use of more than 180 rare endangered threatened (RET) species, more than 3,600 plant species belonging to 74 families and 84 genera,

use of nearly 200 different palm species and also lotus and lily varieties, besides nearly one crore shrubs and ground covers, and more than 300 butterfly and moth types for developing Terminal 2 at the Bengaluru International Airport.

He discussed how the terminal was designed over 45 themes, using enriched soil and media and climate smart irrigation systems. The terminal has more than 20,000 sq m vertical garden area, 620 endemic plants from the State of Karnataka, creating 10 ecological habitats. More than 7,000 large trees were shifted and replanted at the terminal. This translocation of trees with multi-stem, clump and shrub forms, of varying measurements, spread and height, is in itself a huge landscaping achievement in India. He discussed the development of the fully grown tree nursery and various challenges faced in the introduction and acclimatization of various plant species. He also discussed about the challenges in implementing such large projects with various types / segments (landscaping and garden designing, construction and landscaping management, landscape and garden maintenance), nursery stock shipping requirements and selection of risk mitigation measures. The actual site planning and execution, developing the different components of an airport terminal like drop off kerb, slot garden, departure halls, check in halls, immigration area, etc., and designing appropriate garden features for each was a challenge, but very fruitful.

Dr C Subesh Ranjith Kumar, Professor of Horticulture, TNAU, Coimbatore spoke on the sustainability in floriculture industry and stressed that for this sector, important measures to be addressed are the same for India as for other countries. In his opinion, the sustainability of the floriculture industry depends on effective management of the supply chain and its logistics; the control on carbon footprints (focussing on carbon credits and ensuring social accountability audit); recognizing the importance of international labels (MPS, FFP, FLP, Fair Trade, etc.), particularly for the consumers in the global trade; transportation of produce (sea transportation has better carbon footprint, as compared to air transportation); plant quarantine measures (both for imports and exports); the EXIM procedures; and developing clean energy strategies among others.

The diverse floriculture products encounter different challenges. The issues related to imports of seeds and bulbs were different from those for live plants and trees. The issues related to exports of cut flowers and cut foliage encountered various maritime challenges, packaging standards, post quarantine and post export issues, supply-chain logistics. The plant quarantine procedures and requirements were not very clearly defined for different products. He opined that there should be single window clearance of the consignment to ease the process including provision of additional declaration on demand by importing countries. For fumigation procedures, he suggested eco-friendly CO_2 fumigation. He mentioned that the role

of AI in both production and trade is not well understood at present and further stated about reefer logistics as Green Reefer Containers exclusively for export of live plants and trees. He recommended establishment of an Export Consultation Authority to guide and facilitate exports of floricultural products. This could be a part of the Floriculture Board constituted on the lines of other commodities (Rubber Board, Spices Board, Coffee Board, etc.) for overall holistic development of the sector.

Dr Murtaza Hasan from the Centre for Protected Cultivation Technology (CPCT), ICAR-IARI, New Delhi, spoke on the IoT and sensor operated smart urban farming. He defined smart urban farming as dealing with growing high-value horticultural crops including floriculture products inside protected structures of greenhouse, net house, shade net, etc. This would also include the soilless farming using the methods of hydroponics and aeroponics and also vertical farming / gardening. Dr Hasan emphasised that use of precision farming techniques drip irrigation, fertigation, etc. are adding value to smart urban farming. He mentioned that ICAR-IARI, developed IoT and sensor operated smart urban farming models, and use of these computer-based technologies provide better overall management of the farming. ICAR-IARI has also developed appropriate information literature to assist those who wish to take it up. He also stressed on using automation in floriculture through AI based sensor technology for better production and advocated development of crop specific good agronomic practices (GAP) guidelines.

The important points emerged from the deliberations in the Session are as follows:

- Appropriate assessment system for area, and production is required to be developed
- There is need to explore the possibilities of using genetic engineering and genome editing tools for modifications of traits of interest in flower crops; and prioritize floriculture areas for using biotechnological tools such as regulating flavonoids, biosynthesis, longer vase life, plant architecture, and floral scent induction.
- Trait-specific breeding is the need of the hour in floriculture. Crop-specific and market-driven traits are required to be identified and accordingly breeding strategies to be developed.
- Basic research in floriculture in line with industry needs to be taken up on priority. Crop-specific protocols for micro-propagation needs to be refined.
- Regulatory system for import of elite planting materials needs to be simplified so that at least one time import could be done and own capacity for future use could be developed through the establishment of mother block. Difficulties

faced by the exporters and importers need to be brought under the knowledge of the EXIM committee. Export and import policies for various flower crops need to be defined clearly.

- Standards for nursery plants and seed standards for ornamental plants have to be developed. Tree standards need to be adopted by MoA&FW, so that country's strength could be utilized for expanding business both for indigenous as well as export market.
- Planting material production standards recently developed and accepted by the MoA&FW for *Chrysanthemum, Crossendra, Gladiolus*, rosemary, and tuberose are required to be adopted for acceptance of varieties for CVRC to accrue benefit to farmers.
- In order to bring efficiency in flower production, new tools, drone etc., required to be utilized for monitoring the crops as well as for application of inputs. The SOPs are required to be developed and validated for such crops.

TECHNICAL SESSION III: MARKETING INTERVENTIONS IN FLORICULTURE

The Session was chaired by **Dr KV Prasad**, Director, ICAR-Directorate of Floricultural Research (DFR), Pune. **Dr SS Sindhu**, Former Head of Floriculture and Landscaping, ICAR-IARI, New Delhi was the Convener of the Session and Dr Shiv Lal Chawla, Navsari Agricultural University (NAU), Navsari and Dr Sapna Panwar, ICAR-IARI, New Delhi were the rapporteurs.

Ms Vinita Sudhanshu, Deputy General Manager, APEDA presented the APEDA's initiatives for supporting the floriculture sector. She mentioned that floriculture has been a part of APEDA's vision to establish India as a consistent quality supplier. Floriculture is an important constituent of APEDA's current portfolio of 17 different agro-products. Agri-exports account for nearly half of the total exports from India and floriculture products exports have shown an appreciable jump consistently over the years. She, however, felt that our export of nearly USD 166 million is too miniscule and our share of global trade can go up much higher. She emphasized that India with a large production base and multiple floriculture products has huge potential for exports. India's exports presently include cut flowers, dry flowers etc., tissue culture plants, cut foliage and live plants and the main destinations are USA, the Netherlands, Germany, UK, UAE, etc. India's advantage lies in its diverse and favourable climate, small land holdings (low volume, high-value floriculture), low cost of production, etc. and needs to be tapped without further delay.

APEDA's promotional scheme which benefits the floriculture sector, focuses on export infrastructure development (mainly for post -harvest management, including setting-up of pack houses, provision of reefer vans, etc.); quality development (developing quality management systems) and market development (establishing market connect, organization and participation in trade fairs, BSM, trade delegations, product development, R&D, etc.). APEDA has set-up flower auction centres and the one at Bengaluru (IFAB) is doing well, earning much revenue and providing fair price and transparency in dealing with traders / growers. APEDA initiated measures to enhance the competitiveness of Indian floriculture through organising regular interaction meetings of the stakeholders, interaction with embassies for market connect, connect with other government agencies for channelizing support, creation of Export Promotion Forums, and sending trial shipments of ethnic / unique products, etc.

Mr KK Mammen Mappillai, Managing Director of Indo Bloom Ltd., Bengaluru, with more than 25 years of experience in exports of cut roses to global markets, focussing on extremely quality conscience markets in Japan and New Zealand, besides Europe and UK, highlighted the challenges being faced by the exporters of cut flowers, both in production and marketing. He opined that the biggest setback to the cut flower exporter at present is the high transportation cost. The air freight has increased considerably during the recent times. As per his information, the post-COVID-19 air freight to Japan increased by 88 per cent as compared to pre-COVID-19 period. Similarly, the air freight to New Zealand went up by more than 200 per cent, while to the markets in Europe etc., the increase was around 30 per cent.

The second important factor affecting cut flower exports was the issue related to introduction of GST. The introduction of 18 per cent GST on air freight since October 2022 and change in refund rules since July 2022, have severely affected the exports. GST documentation is also tedious and affects the overall returns. There were also quarantine issues with several market destinations, particularly Australia. In terms of production, he mentioned that the cost of most fertilizers has gone up in the recent times by 9-117 per cent (important ones by around 60%) and the cost of packing materials by 55 per cent (local) and 62 per cent (exports). Even the flower wrapping sheets have become more than 50 per cent dearer.

Dr CR Aswath, Head, Division of Flower and Medicinal Crops, ICAR-Indian Institute of Horticultural Research (ICAR-IIHR), Bengaluru, spoke about the necessity for infrastructure development for floriculture. He mentioned that for better marketing prospects for various floriculture products and verticals, necessary supporting infrastructure is to be developed. For exports, there are problems

related to very expensive and inadequate cargo space. There is shortage of cold storage facility at the gateway airports. The present facilities at Delhi, Mumbai, Bengaluru, Hyderabad, Chennai and Thiruvananthapuram, are small and many a times booked for other export items. Presently, in India nearly 80 per cent of the flowers are sold on roadsides as the markets at Gazipur (Delhi), Dadar (Mumbai), Howrah (Kolkata), Huvina (Bengaluru), etc. are inadequate and not well-organised. Most of loose flowers are sold in open conditions. The share of producers in the retail market price (consumer) of flowers is less than 30 per cent. He suggested that to overcome the issues of unscientific packaging of flowers, particularly for exports, suitable and appropriate packaging technology for flowers from farm to retail market, as well as for exports (destination specific) be developed. He also suggested that wherever possible, there should be a cold-chain from farms to markets and at the markets, flowers should be stored in cold stores to prolong the life of these highly perishable products. For better realisation in floriculture, he suggested to include new products like new crop species in flowers, value-added products like herbal dyes, etc. (from waste flowers), native ornamentals, flower seeds, tissue culture plants, etc.

Dr Aswath summarised in the end that: (i) flowers from South India goes across India, however, the farmers do not know the prices in different markets; (ii) the middlemen are exploiting the situation and there is a huge margin for the commission agents, hence, an APP by GoI connecting importers, exporters, buyers and sellers should be made available, which can give information on selling price in different markets and will enhance the bargaining capacity of the farmers; (iii) most of the flower markets operating in India do not have proper structures to sell the flowers, HENCE proper infrastructure in designated markets need to be provided in at least Tier 1 and Tier 2 cities with cold storages; (iv) better transport arrangements to trade across India should be provided preferably separate bogies in *Kisan* rail; (v) traditional flowers should be popularized, packed and should be targeted to Indian population outside the country; (vi) issues like plant protection for surveillance, certification, inspection, etc. for export of flowers need to be addressed judiciously; (vii) waste flowers are to be converted into various products; and (viii) there is need to open a dedicated perishable cargo terminal or a dedicated flower terminal to facilitate air-freight exports.

Mr PS Suresh, CEO of M/S Ramesh Flowers, Tuticorin (Tamil Nadu), among the major global players in dry flowers / plants business, spoke about the opportunities in the dry flower business. He felt that the dry flowers, also known as everlasting flowers, need to receive better attention from the government and other concerned agencies. India currently exports 500 varieties of dry flowers

worth INR 250 crore annually to 30 countries. The product basket is impressive, but the dried botanicals used for these arrangements are usually collected from forests and there is no scientific production of raw materials in India.

India is the fifth largest exporter with only about 7 per cent share of the global trade worth more than USD 500 million. M/S Ramesh Flowers currently exports to major super market chains / stores in USA, UK and Europe, but feels there is much scope to explore new markets through market research, participation in trade fairs and relevant product and client promotion. Presently, the botanicals are sourced from forests and obtained from agricultural waste (also through authorised and controlled supply chains), brought to warehouses, processed (dried, coloured, bleached, graded, etc.) before being assembled as the final product. In future, it is expected to use some cultivated species, conduct surveys of valleys and mountains, planned use of agriculture waste, etc. to improve the trade. In recent years, products from natural banana fibre obtained from 100 per cent biodegradable banana trunks, have shown lot of promise and need promotion. The dry flower industry feels it would be useful to restart the Merchandise Export from India Scheme (MEIS) for incentives and freight subsidy, allow imports from airports other than Chennai also, and develop a comprehensive dry flower growth policy.

The salient points emerged after the deliberations in Session III are as follows:

- India with a large production base and multiple floriculture products has huge potential for exports of cut flowers, dry flowers, etc. tissue culture plants, cut foliage and live plants.
- Introduction of 18 per cent GST on air freight and change in refund rules have severely affected the exports. GST documentation is also tedious and affects the overall returns.
- There is need for cold-chain from farms to markets and provision of cold stores for flower storage for their prolonged shelf life.
- For better realisation in floriculture, work needs to be initiated on new products like new crop species in flowers, value-added products like herbal dyes etc. (from waste flowers), native ornamentals, flower seeds, tissue culture plants, etc.
- Dry flowers need to receive better attention from the government and other concerned agencies. It would be useful to restart the Merchandise Export from India Scheme (MEIS) for incentives and freight subsidy, allow imports from airports other than Chennai also, and develop a comprehensive dry flower growth policy.

TECHNICAL SESSION IV: THE EMERGING OPPORTUNITIES IN FLORICULTURE

The Session was chaired by **Dr Prabhat Kumar**, Horticulture Commissioner, GoI, Pune. **Dr CR Aswath**, Head of Floriculture and Landscaping, ICAR-IIHR, Bengaluru was the Convener for the Session and Drs AK Tiwari, ICAR-IARI, New Delhi, and TN Saha, ICAR-DFR, Pune, were the rapporteurs. There were 5 presentations from Bala Shiva Prasath, Pradeep Ganu, S Chellaiah, K Sethumadhavan, and Ashish Phadke.

Mr Bala Shiva Prasath, President, Hosur Flower Growers' Association, presented his views on harnessing the potential of floriculture in India. He felt that flowers, the symbol of love, affection and care, have been a part of Indian culture since ages and even today in temples we offer different flower species to different deities. The floriculture business is estimated to engage directly / indirectly about 5 crore persons (farmers, traders, retailers, value-addition personnel, transporters, etc.). Flower growing provides employment to 6-8 persons per acre. He felt that the main drivers for floriculture business in India are marriages (60-70 days/year) and festivals (25 major ones). The price is high for one-third of the year, while it remains average or low for the rest of the period, thus balancing out the returns. However, post- COVID-19, the online sales have increased. These online – anywhere sales, fuelled by the social media, have resulted in considerable market transparency and regular payments (reducing credits) and sharing of market information, etc. The trade in local markets still depends on traders fixing the price of the product, often arbitrarily.

Mr Prasath opined that the low availability of quality planting materials, increased costs post-COVID-19 for water soluble fertilizers and chemicals, shortage of skilled manpower, high costs for packaging and transport, and other factors are hampering the growth of the sector and must be addressed. Better access to R&D support based on market demand and international standards, widening the production base to more active locations, encouragement of FPOs and floriculture startups, and identification of location based suitable product, etc. will help in the development of the sector. He concluded that sector needs:(i) updated and authentic floriculture data, (ii) establishment of independent National Floriculture Board apart NHB, and flower export trade centre which can give information like demands vs supply, potential areas, potential crops to grow for domestic market and exports; (iii) development of new flower crops and varieties as per market demands; (iv) clear guidelines for hydroponics, aeroponics, and multi-layer crop systems; (v) reduction in tax and import duty for water soluble fertilisers and chemicals, by GoI; (vi) establishment of training centres for nursery management training to farmers for growing, traders for packing, decoration workers for flower

arrangements, and farm workers for farm operations; and (vii) ban on use of artificial flowers.

Mr Pradeep Ganu of Ganu Farms, Hyderabad, a leading name in production and promotion of turf grass made a presentation on turf production and management as a viable floriculture business. In his opinion, the concrete surroundings increase the ambient temperatures by up to 20º and turf which in about half the cost has huge potential for growth in urban areas. Turfs can also be developed from urban solid waste to replace the top soil at very minimal costs. For turf management, even the treated sewage water can be used, as the lawn grass is not used as cattle feed. Turfs have also been developed as a cover crop in fruit orchards, reducing the cost of management and keeping the environment cool. With using top soil for lawns, etc. becoming unsustainable, soilless turf grass is the future. Its usage in developing sport fields is increasing, as the turf needs low maintenance and always remains cool. Even in cities, its usage is increasing, as turf with trees reduces the claustrophobic effect of glass and concrete all around. However, in the recent times, the costs have escalated, as the turf unit cost has gone up two times, but the labour wages have increased 40 times in most areas.

Mr S Chellaiah, Director (Horticulture), New Delhi Municipal Corporation (NDMC), New Delhi expressed that although India has all opportunities in the landscape and urban horticulture industry, it does not have political will as that of Singapore. The Singapore has attractive business as it displays with neat and clean beautiful landscape architecture and opt urban horticulture in a big way. He stated that there should be strict policy in each and every greening project, township project and landscape and institutional projects with strict enforcement by law of the land. In India, the greening/landscaping, and urban horticulture activities are under unorganized sector resulting in poor standard of landscape. Generally greening work is done by civil engineers and contractors who seldom have acquaintance of horticulture. They cannot conceptualize the novel ideas, and seek advice of horticulturist in the last minute, but at the same time do not allow them to work freely as per standards to minimize the expenditure on greening and many a times do not even pay their dues. There is a need to have a regulatory authority for monitoring projects, safeguarding of greening agency involved and bringing successful and sustainable projects. Therefore, landscape institutions for producing skilled gardeners (currently lacking), standard norms, guidelines and SOP, budgetary funding, infrastructure, plan of irrigation network, mechanization, promoting professional approach and professional contractors, standardization of NIT, payment system, and standardizing specification of landscape plants and inputs are the need of hour.

There is a need to have pro-green friendly policies for terrace gardening, urban farming, vertical gardening, eco-friendly gardening, etc. To evolve a new system, suitability of plants, best practices, R&D program are required for every city so as to make them beautiful. It is observed that most of the government institutions focus on cash crops, foodgrains, millets, pulses, oil and plantation crops, vegetables, fruits and commercial floriculture, and do not pay much attention on aesthetics/ornamentation. Private institutions should be encouraged to develop shade, partial shade and photo-insensitive varieties of *Chrysanthemum*, *Poinsettia* and other indoor plants and gift plants, vertical greens, succulents, bulbs, annuals for winter and summer to suit different agroclimatic regions across the country. This particular area has the potential but remains untapped limiting the better landscape due to non- availability of suitable varieties and less attention. GoI needs to promote Garden Tourism, organize Virtual Garden Tours, Flower Festivals round the year; develop Garden *Bazar* and Garden Centre Centric City, promote kitchen gardening, and implement green building plans.

Mr K Sethumadhavan of Vanguard Exports, Coimbatore, presented useful information about the supply-chain of Indian traditional flowers for exports. The flowering plants used in this trade include jasmine, marigold, button rose, lotus, champaka, loose chrysanthemum, etc. He studied the value-chain for Jasmine developed by the TNAU and started implementing it scientifically. He has been exporting these flowers for more than 20 years. With the increase of Indians settled abroad and establishment of more temples in other countries, the demand has increased tremendously. Explaining the value-chain of jasmine (as an example), he mentioned that the flowers are picked early at the farm and brought to the pack house by 8 am, washed, sorted and graded (in AC rooms), converted into value-added forms of strings and garlands, packed in individual small cartons, arranged in thermocol boxes with ice gel sheets, loaded in reefer vans and despatched to the airports by 1.00 pm.

The major challenges faced in the trade is the low shelf-life of these flowers (necessitating the cold-chain and research on special packaging), non-consistent availability of flowers of uniform quality, non-availability of good quality jasmine flowers during winter (development of cold-tolerant winter flowering jasmines), with pests commonly getting embedded inside the flowers, fumigation time and system needing attention (a 30 minute treatment required and need for development of pest resistant varieties), lack of artisans for making value-added products, with no new designs for wedding and temple garlands (training of artisans especially women with new designs required) and export facilitation in view of high perishability and present system of volume cargo. He also expressed

that traditional flowers like jasmine have low yield and very small in size during winter. Therefore, a cold-tolerant cultivar with normal size flower needs to be developed. Flowers should be free of pests, and hence pest-resistant varieties are highly desired. Unlike cut-flowers, sufficient data are not available in traditional flowers, which are mostly sold by street vendors where flowers are exposed to unhygienic street dust. By providing Flower Kiosk to women folk would increase their sale and thereby farmers too will be benefitted. Also, there is need to develop short-term and safe-to-use fumigants.

Mr Ashish Phadke, General Manager of KF Bioplants, Pune, India's largest plant biotech company, spread over 20 ha area, with 12,000 sq m tissue culture labs, 32 fully monitored growth rooms to hold 20 million plants and 6.5 ha climate-controlled greenhouses, discussed the opportunities of introducing new crops for domestic floriculture farmers. He mentioned that KF Bioplants has made agreements with leading international floriculture companies like Hilverda, Rosen Tantau, Floricultura, Kapiteyn, Danziger, Royal van Zanten, among others and multiplying and distributing 60 million quality planting materials of carnation, gerbera, rose, orchids, calla lily, gypsophila, lilium, etc., to growers in India and another 30 countries.

He opined that with varied climates, increased urbanization, better economy and young skilled workforce, India has tremendous potential for developing successful entrepreneurship in rural areas transferring technical knowhow and encouraging e-commerce. He suggested introduction of new genetics, providing financial support and introducing favourable policy environment, besides making organised efforts to promote flower consumption in the country. He mentioned that new crops like calla lily, *Phalaenopsis, Delphinium*, Sunflower, *Limonium, Celosia, Echinacea, Lisianthus, Hydrangea, Antirrhinum*, etc. are being introduced for the Indian growers and have huge market potential. Their subsidiary, Futura Bioplants, has started supplying 45 million *Phalaenopsis* to the market. Among the policy support changes he suggested that there should be no PRA procedures for the import of tissue cultured (*in vitro*) plants, which are grown in aseptic conditions and are free from any microbes; incentivise exports through freight support, create necessary infrastructure in Tier 1 and Tier 2 cities for storing and selling perishables, revise NHM and NHB costs of support in view of inflation, provide soft loans for setting-up new enterprise and ban imports of artificial flowers to promote production and use of fresh flowers.

The following salient points emerged from the deliberations in Session IV:

- Produce flowers as per the calendar of peak demand to fetch the maximum price.

- Turf grass production may become a viable flori-business option and also to mitigate the adverse effect of climate change.
- Develop standard operating procedure (SOP) for growing plants for the landscape industry.
- Strengthen the supply chain management of traditional loose flowers for domestic and industrial market.
- Ease the process of import of tissue cultured plants of new types and also promote export incentivization in ornamental sector.

PANEL DISCUSSION: WAY FORWARD IN FLORICULTURE

Dr Narendra Dadlani moderated Panel Discussion and Mr Avtar Singh (Beauscape Farms), Dr SP Das, NRC Orchids, Pakyong; Dr OP Chaurasia, DRDO-Defence Institute of High Altitude Research (DIHAR-DRDO), Leh (Ladakh); Dr Priyanka Thakur, Dr Yashwant Singh Parmar University of Horticulture & Forestry (YSPUHF), Solan; Dr K Rajamani, TNAU, Coimbatore; Mr J Subramanian (Bunnik Creations); Dr Pulla Ramakrishna (Satyadeva Nursery), Dr HP Sumangala, ICAR-IIHR Bengaluru; Mr Prasant Choudhari, Darjeeling Gardens, Mirik (West Bengal), Ms Shrinkhala Singh, Agriculture Skill Council of India (ASCI) and Dr Arvind Kapur, ACSEN Agriscience made their interventions as panelists for the way forward keeping in view the challenges faced for their specific vertical for the overall development of floriculture.

Mr Avtar Singh highlighted the challenges faced in flower seed production in northern Indian plains related to diseases and insect pests, as well as frost. He requested for technology support to address these challenges. In his opinion, the customers abroad are looking for new novel products and suggested that native ornamentals could be explored for commercial production. He requested for initial planting material and offered to produce enough material for commercial trials.

Dr Priyanka Thakur mentioned that several beautiful wild flowers have been collected from northern Himalayas and many of them show great promise. She suggested that large scale multiplication should be taken up and commercial trials conducted to identify the potential candidates. She also suggested setting-up of a model nursery, especially for native flowers. She agreed to share the planting material of the native flowers with Mr Avtar Singh.

Dr OP Chaurasia emphasized that the cold desert area was a treasure house of ornamentals including several wild ones and this high-altitude climate can be effectively utilized for growing different floriculture products, including off- season planting and seed production.

Dr Arvind Kapur suggested for greater focus on use of polyploidy, mutation breeding and new biotechnological interventions like gene silencing and gene editing to create desired variation in ornamentals. He mentioned that there was always a growing demand for newer products and stated that most of the floriculture plants are vegetatively propagated, and hence protection of Breeders' Rights is of utmost importance. Many breeders develop essentially derived varieties (EDV's) of existing types by changing one trait. It is very important to strengthen the EDV identification mechanisms through genetic distance estimation by using markers. Balancing the Breeders' and Farmers' Rights is very important particularly in floricultural crops. Many suppliers of floriculture plants in the name of farmers multiply protected varieties either by clonal propagation or by rooting cuttings. Hence, there is need to have the Farmers' Rights in place without compromising the Breeders' Rights'.

Prof Rajamani strongly advocated development of complete value-chain for different flower crops and planning interventions for different stages for further improvement. He was happy that the value- chain for jasmine developed by TNAU was being successfully used by entrepreneurs in Tamil Nadu.

Dr SP Das expressed that focus should be on developing temperate orchid hybrids. He also urged efforts through PPP mode. In his opinion, a centre needs to be established for taking up intensive research in tropical orchids somewhere in Western Coastal area and exploit the wealth of orchids available in the country.

Mr Prasant Choudhari suggested increased efforts for ensuring the availability of quality planting materials of different orchids and providing the necessary technical backstopping to really make the orchid industry successful. He agreed to work closely with NRCO and also suggested that orchid-based tourism, particularly in the North Eastern region has tremendous potential and needs concerted efforts for promotion.

Dr Pulla Ramakrishna mentioned that more technical interventions are needed for developing the nursery trade. He emphasized that more research was needed for several aspects of nursery development and gave example of scanty research information available for technologies required to germinate difficult root plant species. He also requested for more efforts for capacity building on scientific lines for the nursery personnel.

Mr J Subramanian suggested identification of new botanicals for improving the product range in dry flower business and developing complete technology package for the standard products for better marketing prospects. He shared his experience that Bunnik creations / Bunnik plants imports dried flowers and pots

in metal, glass, ceramic and terracotta from India and ornamental plants from China. The dried flower industry also needs real dried flowers and foliage in the form of finished bouquets for European and American market. This industry again needs some support from the Government by introducing *Vishesh Krishi Upaj Yojna* (VKUY) for exporters, allow some plant material into India without methyl bromide (MBr) fumigation or with phosphine fumigation certificate, and CO_2 process for fumigation and can add into quarantine norms.

Dr HP Sumangala highlighted the importance of wild ornamentals and native flowers for improving the product portfolio in ornamentals and suggested more programs and enhanced funding for their faster promotion.

Ms Shrinkhala Singh opined that skill development to suit the market demand should receive greater focus. She suggested suitable changes in the education system to align the present system with vocational training. She expressed serious concern on the dearth of skilled workforce for the floriculture sector and suggested for intensive training programs for training of trainers.

Major highlights of interventions by the panelists for the way forward are given below:

- Holistic approach should be adopted for controlling diseases and insect pests for flowering and seed production of ornamentals.
- Wild flora needs to be introduced; evaluated and multiplied through private nurseries. New species or flora needs to be introduced for dry flower industry as consumer preference changes day by day.
- Strengthening of research for genetic manipulation or biotechnological intervention is required for creation of variability among flowering crops of India.
- Research on developing standard production technology for export-oriented flowering plants suited for export market; appropriate nursery management is extremely important and needs urgent attention.
- Keeping in view the marketing opportunities, breeding approach of high value flowering crops need to be reoriented through PPP model.
- Cold desert or high-altitude area should be exploited for seed production and commercial cultivation.

PLENARY SESSION

The Plenary Session was co-chaired by **Dr RS Paroda**, Chairman, TAAS and **Dr Anand K Singh**, DDG (Hort. Science), ICAR, and **Dr Prabhat Kumar**, Horticulture Commissioner, Government of India was the Special Guest. Dr VS Raju, ICAR-DFR and Rajeev Kumar, ICAR-IIHR were the rapporteurs.

Dr Narendra Dadlani presented in brief the major recommendations emerged from different Technical Sessions which focused on data rationalization, close collaboration between research and industry, promoting exports to realize the USD 1 billion target and establishment of an institutional mechanism for a holistic development of the floriculture sector. These along with other recommendations are elaborately given separately under the head "Recommendations"

Dr Prabhat Kumar felt that immediate steps should be taken to organize the floriculture sector and suggested that the problems and solutions discussed during the Dialogue should be studied and analyzed for preparation of a National Framework for floriculture development. Promoting cluster development for production, effective implementation of the Model Nursery Act, strong linkages with agencies like National Bee Mission, developing annual calendars for different agroclimatic zones, establishing terminal markets for transparency and better returns to the producers are some of the steps suggested by Dr Prabhat Kumar to develop this important sector. He assured that based on a National Plan, the government will develop enabling policies for the sector.

Dr Anand K Singh emphasized on the proper data documentation and suggested that with PPP, the country could capitalize on the potential and exploit the opportunities for better growth of floriculture. He felt that identification of selected potential crops, understanding the needs for support and development of crop-wise strategies will help in the overall growth. The important suggestions made by him were: harnessing the potential of indigenous materials, production of quality planting materials, dissemination of technology through innovative extension technologies, identification of district-wise suitable products for promotion, special attention to developing value added products, strengthening the marketing infrastructure and systems, promoting FPOs in various sub-sectors.

In his concluding remarks, **Dr RS Paroda** stressed that this should not be the last National Dialogue to discuss the strategies for growth, but the Department of Agriculture and Cooperation (DAC), GoI and other agencies should convene regular roundtable and other interactive meetings with the industry partners and prepare development plans. Interaction with ICAR-Indian Agricultural Statistics Research Institute (IASRI) and other agencies was necessary to review and improve the data collection system. Regional priorities need to be identified and the work should be initiated accordingly. The National Floriculture Mission needs to be revisited and the roles and responsibilities of the institutional partners well defined to derive the desired benefits. Effective linkage with the network of research infrastructure available across the country would be immensely helpful in realizing the goals of the Mission. The Horticulture Commissioner must ensure

that the state horticulture departments allocate larger funds for floriculture. He opined that the present national exports of floriculture products do not reflect the potential. The APEDA should pay greater attention and have regular interactions with the industry to discuss solutions for GST, IPR, PRA, etc., identify more products to be added in the export basket, and also strengthen the dry flower and plants business to enhance the present revenue from floriculture products to USD 1 billion. The export facilitation infrastructure also needs to be strengthened. The DAC should publish some success stories for the guidance of other growers. He recommended that ICAR should set- up a Centre of Excellence in Floriculture, as well as strengthens the support system through KVKs for floriculture. He felt that the need for establishing a Floriculture Board to plan and execute programs for development which will be really very useful for the sector.

Dr Umesh Srivastava, Former ADG (Hort.), ICAR, and Consultant, TAAS profusely thanked the Chief Guest, dignitaries, eminent experts, and invitees for their gracious presence in the National Dialogue and sharing their experiences during the discussions. He also thanked all the session chairs, speakers, panelists, convenors, rapporteurs and participants for their active participation and making the event highly successful. He also thanked all the organizers and co-organizers as well as the sponsors for their kind support and cooperation in organizing this important National Dialogue.

RECOMMENDATIONS

I. Development Initiatives

1. A reliable database relating to area, production, yield, etc. is required for realistic and eco-regional planning by the Government. Hence, statistical data on demand and supply of different floricultural products, including value-added products, are urgently needed considering the enormous potential of floriculture sector in the national economy. ICAR-IASRI may thus take a lead for getting reliable statistics on floriculture as a special case.
2. The floriculture industry in India has to get better organized. Exporters need to develop strategy around diversified products and market them through dedicated channels/outlets and expand markets outside the traditional ones through proper labelling, branding, certification and quality standards around value chain.
3. Effective interface mechanism between academia, research institutions and the industry needs to be developed for regular exchange of views and information relating to floriculture development both at the national and global level.

4. Many areas such as Himalayas, North East and West Coast are home to beautiful flowers, such as Flower Valley (Uttarakhand), *Kas Pathar* Plateau (Maharashtra), *Khirai* Valley (West Bengal), *Neelakurinji* Flower Valley (Kerala) and orchids and Rhododendron in North Eastern Himalayan region are very rich in agrobiodiversity. Therefore, there is an urgent need to collect, intensify research and develop new market potential while promoting eco-tourism around them.
5. Protected cultivation needs to be promoted in a big way with technical backstopping by the institutions and through competent human resource. Also, there is need for incentives to individual farmers, FPOs/entrepreneurs for linking them to markets. Concerted efforts are also needed on production of quality seed and faster *in vitro* multiplication of disease-free planting materials by the nurseries that are accredited and located in different eco-regions of the country.
6. Nutrients do play an important role in the production of decorative and indoor plants. With changing climatic conditions, new molecules of plant growth regulators be evolved, tested and released soon through Pesticide Registration Committee.
7. Like advanced countries, we need to develop and follow our own protocols and good agronomic practices (GAPs) for growing floriculture plants. Also, there is need to promote cluster system in major production belts so as to generate large volumes for better marketability and to promote FPOs who are specialized in different floriculture products.
8. Greater efforts are required for public awareness and dissemination of knowledge, for production of flowers that are unique, through innovative extension methods. *Krishi Vigyan Kendras* (KVKs) exclusively for floriculture development be identified and supported both technically and financially.
9. A 'White Paper' on overall development of floriculture in India is urgently needed specifying the current status, challenges and opportunities, specific R&D needs including good agronomic practices (GAPs), diversification and related aspects such as post-harvest management, value-addition, marketing, export potential, traceability, PRA requirements, quarantine regime of potential importing countries, etc. Such a document will help in effective planning for enhanced production, marketing and export of flowers and floriculture products.

II. Research Reorientation

10. India has rich floricultural genetic diversity, and has variable agroclimatic conditions that enhance the scope for faster floricultural development. Concerted efforts are, therefore, needed to explore potential of indigenous species of flowers, green indoor plants, and unique shrubs for their commercial

exploitation. Also, scope of floriculture needs to be enlarged beyond just flowers (cut and loose) to those of ornamental plants, turf grass, flower seeds, fillers and value-added/dry flower products, etc., considerable variability for which also exists.

11. The research efforts in floriculture must be reoriented keeping in specific needs of the industry and consumers. In this context, there is need for selective breeding in rose, chrysanthemum, gladiolus, and marigold, especially for developing varieties/hybrids suitable for year-round cultivation and production of flowers. Use of innovative breeding techniques such as genetic engineering/ genome editing, gene pyramiding, etc. be used for improving traits of specific interest such as colour, fragrance and general appearance. In-depth studies are also needed on physiological and biochemical changes relating to flower senescence and the processes for enhanced shelf-life. for better marketability.
12. Breeding orchid hybrids needs to be intensified at the ICAR-National Research Centre (NRC) on Orchids, Pakyong, Sikkim. Also, a Regional Centre for breeding of Tropical Orchids needs to be established soon at a suitable location in the west-coast of India. Also, the orchid hybrids developed by the private entrepreneurs need to be given Breeder's Rights and encouraged for commercialization in a big way as being done in Thailand.
13. There is an urgent need to mainstream around 600 new varieties of major flower crops bred and released through the national agricultural research system (NARS) so that they are used for commercial production and become available in the market. Also, the protocols need to be developed for the production of off-season crops in temperate areas having high-altitude such as Leh-Ladakh, Jammu & Kashmir, Himachal Pradesh, Uttarakhand, etc.
14. A ‘Consortium on Floriculture’ to strengthen research in public-private partnership (PPP) mode, in order to explore the potential of native and wild flora possessing unique commercial traits and to breed superior varieties for large-scale multiplication, is urgently needed to harness the hidden potential that exists.

III. Infrastructure and Capacity Building

15. An integrated cold-chain system for flowers (such as for the milk, fish/shrimp, etc.) from production to consumption needs to be developed. Infrastructure development relating to modern cargo handling facilities, making internal container depots suitable for floricultural products, increasing the frequency of international flights for floriculture cargo, and encouraging private sector for co-investment in building the cold-chain for marketing is urgently needed to harness the full potential that exists.

16. Both Center and State Governments need to urgently strengthen required infrastructure for domestic markets in the major cities to cover different regions, e.g., Gazipur (Delhi), Dadar (Mumbai), Mullik Ghat, Howrah (Kolkata), Huvina (Bengaluru), etc. The auction centers at Noida and Mumbai need to be made operational soon and those at Bengaluru (IFAB) and Hosur (IFAC) be further strengthened, besides establishing more auction centers in other potential regions throughout the country.
17. APEDA needs to consider creating on priority a Floriculture Export Facilitation Unit to guide on various aspects such as: demand and supply, potential new crops, potential destinations, awareness on EXIM policy among producers/ exporters and information related to various support programs of the government on floriculture. This can serve as a single window system for promoting the exports.
18. The new national education policy (NEP) demands reorientation by educational institutions and universities towards informal training programs through certificate/ diploma courses for skill development so as to meet specific needs of farmers, gardeners, and youth as entrepreneurs, mid-level farm management related to floriculture verticals, including flower production, turf grass management, green walls development, dry flower business, packaging, value-added products (pigments, essential oil, nutraceuticals, etc.), the garland/bouquet making, etc.
19. The success stories of progressive farmers, farmer producer groups and the entrepreneurs in the field of floriculture need to be published and disseminated among stakeholders for faster scaling of innovations.

IV. Enabling Policies

20. There is full justification to establish a National Floriculture Board on the lines of other commodity boards for promoting the sector, including greater investments as well as development of required infrastructure, including renovation of infrastructure (green houses, nurseries, processing facilities, cold storages etc.). The Board could also ensure effective implementation of the Nursery Registration Act for quality assurance of planting materials and could serve as a single window system for development of floriculture sector in the country.
21. The National Floriculture Mission implemented by the CSIR-National Botanical Research Institute (NBRI), Lucknow must be made broad-based and suitably linked with MIDH program of GoI for inter-ministerial / inter-departmental collaboration. To begin with the current fund allocation for floriculture under MIDH could be doubled (from INR 90 to 200 crore) to accelerate the pace of floriculture development in the country.

22. The floriculture sector as a whole has enormous potential to generate revenue through expanding internal market as well as export of various products. To capitalize on this, Government has to consider providing incentives in the form of either low or no GST and reduced freight charges. The notification on inclusion of freight on exports of floriculture products in the ambit of GST and the notification related to input credit on FOB value rather than the C&F value is affecting adversely the floriculture exports. Hence, there is an urgent need to revisit the existing tax regime on floriculture related products for India to emerge as a major exporting nation.
23. Protection of intellectual property rights (IPR) is important for promoting unique indigenous variability and to provide an easy access to Indian f*a*rmers to the best available planting materials across the globe. In addition, the IPR and quick registration system for both sexual and asexual floriculture plant varieties must, therefore, be provided under the PPV&FRA. Such a provision would build much needed confidence in the private sector to invest and promote floriculture sector in a big way.
24. For promoting the export of dry flowers, for which considerable potential exists, there is a need to revive the benefits to dry flower industry under the Merchandise Exports from India Scheme (MEIS). In fact, the current export of floriculture products from US$200 million could achieve a target of US$ 1 billion in next five years provided enabling policies and environment, as stated in these recommendations, is created at the earliest.
25. Imports of new planting materials (e.g., tissue culture plants of *Echinacea* spp., *Anemone* spp., *Lupinus* spp., *Rudbeckia* spp., etc.) from other countries require PRAs. Also, the exports of tissue culture plants of several floriculture species get delayed due to wrong HSN code. Since these plants do not fall under the Wild Life (Protection) Act 1972 and hence do not need trtificate, there is an urgent need to have better clarity concerning HSN code and the guidelines to be followed.
26. Artificial (silk/plastic) flowers and plants have lately flooded the local markets and are at times preferred for decorations in public functions over the natural flowers/plants in view of their non-perishability and durability. This obviously affects adversely the demand and the price of natural flowers as well as green plants. Hence, there is need to reconsider the tax regime concerning the import of artificial flowers/products, which invariably are non-degradable resulting in environmental hazard.

Annexure I

Technical Program

DAY 1: THURSDAY, 16 FEBRUARY 2023

08.30 hrs	**REGISTRATION**	
09.30-11.10	**INAUGURAL SESSION**	
Chairman	**: Dr RS Paroda**, Chairman, TAAS	
09.30-09.35	**Lighting of Lamp - Dignitaries on Dais**	
09.35-09.50	**Welcome & Setting the Context**	**Narendra Dadlani**, Dialogue Convenor, TAAS
09.50-10.05	**Special Remarks**	**Prabhat Kumar**, Hort. Commissioner, GoI
10.05-10.20	**Special Remarks**	**Anand K Singh**, DDG (Hort. Science), ICAR
10.20-10.35	**Felicitation of Path Breakers:**	
	Rashmi Attavar, Indo American Hybrid Seeds, Bengaluru **Avtar Singh Dhindsa**, Beauscape Farms, Ludhiana **Mukund Thakar**, President, Pawna Phul Utpadak Sangh, Pawna (M.S.) **MB Naqvi**, Media Today, New Delhi **Pulla Satyanarayana**, Sir Arthur Cotton Nursery Farmers' Association, Kadiyam	
10.35-10.50	**Address by the Chief Guest**	**T Mohapatra**, Former Secretary DARE & DG, ICAR
10.50-11.05	**Remarks by the Chairman**	**RS Paroda**, Chairman, TAAS
11.05-11.10	**Vote of Thanks**	**Bhag Mal**, Secretary, TAAS
11.10-11.30	***Tea/Coffee Break***	

11.30-13.00	**TECHNICAL SESSION I : Floricultural Research and Development**	
Chairman	**: Sudhakar Pandey**, ADG (Hort. Science), ICAR	
Convenor	**: SP Das**, Director, ICAR-NRCO	
Rapporteurs	**: P Naveen Kumar**, ICAR-DFR & **Gunjeet Kumar**, ICAR-IARI	
11.30-11.45	Floriculture- Status and Prospects	**KV Prasad**, Director, ICAR-DFR
11.45-12.00	National Floriculture Mission	**KJ Singh**, Sr. Scientist, CSIR-NBRI
12.00-12.15	National Programs for Floriculture Development	**Prabhat Kumar**, Hort. Commissioner, GoI
12.15-12.30	Human Resource Development in Floriculture	**Kanwar Pal Singh**, Prof & Head (Floriculture), ICAR-IARI
12.30-12.45	Floriculture Development in India	**Meenakshi Meena**, AGM, NABARD
12.30-13.00	**Discussion**	
13.00-14.00	***Lunch***	
14.00-15.30	**TECHNICAL SESSION II : Innovation in Floriculture**	
Chairman	**: Suresh Malhotra**, President, ISOH & Director ICAR-DKMA	
Convenor	**: Umesh Srivastava**, Former ADG (Hort. Science), ICAR	
Rapporteurs	**: Parminder Singh**, PAU & **Reeta Bhatia**, ICAR-IARI	
14.00-14.15	Application of Biotechnology in Floriculture	**AK Shasany**, Director, CSIR-NBRI
14.15-14.30	Innovation for Improvements in Floriculture	**Alka Singh**, Dean, College of Agriculture, Navsari Agricultural University
14.30-14.45	Developing Green Airports	**Prasannamurti Desai**, Vice President (Landscaping), Kempegowda International Airport
14.45-15.00	IoT and Sensor Operated Smart Urban Farming	**Murtaza Hasan**, Pr Scientist, CPCT, ICAR-IARI
15.00-15.15	Sustainability in Floriculture Industry	**C Subesh Ranjith Kumar**, Prof (Hort. Science), TNAU
15.15-15.30	**Discussion**	
15.30-15.50	***Tea/ Coffee Break***	

15.50-17.20	**TECHNICAL SESSION III : Marketing Interventions in Floriculture**	
Chairman	**: KV Prasad**, Director, ICAR-DFR	
Convenor	**: SS Sindhu**, Principal Scientist & Former Head (Floriculture), ICAR-IARI	
Rapporteurs	**: Shiv Lal Chawla**, NAU & **Sapna Panwar**, ICAR-IARI	
15.50-16.05	Export Facilitation from India	**Vinita Sudhanshu**, DGM, APEDA
16.05-16.20	Constraints in Cut Flower Exports	**Mammen Mappilai**, MD, Indo Bloom
16.20-16.35	Need for Infrastructure Development for Floriculture	**CR Aswath**, Head (Floriculture), ICAR-IIHR
16.35-16.50	Opportunities in Dry Flower Business	**PS Suresh**, CEO, Ramesh Flowers
16.50-17.20	**Discussion**	

DAY 2: FRIDAY, 17 FEBRUARY 2023

09.30-10.50	**TECHNICAL SESSION IV: The Emerging Opportunities in Floriculture**	
Chairman	**: Prabhat Kumar**, Horticulture Commissioner, MoA&FW, GoI	
Convenor	**: CR Aswath**, Head (Floriculture), ICAR-IIHR	
Rapporteurs	**: AK Tiwari**, ICAR-IARI & **TN Saha**, ICAR-DFR	
09.30-09.45	Harnessing the Potential of Flowers in India	**Bala Shiva Prasath**, President, Hosur Flower Growers' Association
09.45-10.00	Turf Production & Management as a viable Floriculture Business	**Pradeep Ganu**, MD, Ganu Farms
10.00-10.15	Addressing the Flower Value-Chain	**K Sethumadhavan**, Vanguard Exports
10.15-10.30	Exploring the Potential of New Crops for Indian Flower Growers	**Ashish Phadke**, GM, KF Bioplants
10.30-10.50	**Discussion**	
10.50-11.20	***Tea/ Coffee Break***	

11.20-14.00	**PANEL DISCUSSION : Way Forward in Floriculture**	
Moderator	**: Narendra Dadlani**, Dialogue Convenor	
Rapporteurs	**: D Barman**, ICAR-IARI & **Namita Banyal**, ICAR-IARI	
	Avtar Singh Dhindsa, Beauscape Farms, Ludhiana - Flower Seeds **SP Das**, Director, ICAR-NRC Orchids, Pakyong (Sikkim) - Orchids **OP Chaurasia**, Director, DIHAR (DRDO) – Floriculture in Cold Desert Area **J Subramanian**, Bunnik Creations, Tuticorin - Dry Flowers **K Rajamani**, TNAU, Coimbatore - Flower Value-Chain **Pulla Ramakrishna**, Satyadeva Nursery, Kadiam - Ornamental Plants **Priyanka Thakur**, YSPUHF, Solan / Dehradun - Natural Flowers **HP Sumangala**, ICAR-IIHR, Bengaluru - Vertical Gardens **Prasant Choudhari**, Director, Darjeeling Gardens, Darjeeling - Flower-based Tourism **Shrinkhala Singh**, Head Assessments, ASCI – Skilling Requirements in Floriculture **Arvind Kapur**, CEO, Acsen Hyveg - Technological Interventions for Improving Market Potential of Floriculture Crops	
13.30-14.00	**Discussion**	
14.00-15.00	***Lunch***	
15.00-16.00	**PLENARY SESSION**	
Co-Chairs	**: RS Paroda**, Chairman, TAAS **: Anand Kumar Singh**, DDG (Hort. Science), ICAR	
Rapporteurs	**: VS Raju**, ICAR-DFR & **Rajiv Kumar**, ICAR-IIHR	
15.00-15.10	Presentation of Major Recommendations	**Narendra Dadlani**, Dialogue Convenor
15.10-15.20	Special Remarks	**Prabhat Kumar**, Hort. Commissioner, GoI
15.20-15.55	Concluding Remarks by Co-Chairs	**Anand K. Singh**, DDG (Hort. Science), ICAR **RS Paroda**, Chairman, TAAS
15.55-16.00	Vote of Thanks	**Umesh Srivastava**, Former ADG (Hort. Science), ICAR
16.00-16.30	***Tea/Coffee***	

List of Participants

1. **Dr. Anuradha Agrawal**
   National Coordinator, NAHEP,
   ICAR, KAB II, Pusa Campus,
   New Delhi 110012.
   (anuagrawal1@yahoo.co.in)

2. **Ms. Ediga Amala**
   Ph.D. Student (Floriculture),
   ICAR – IARI, New Delhi 110012.
   (ammuamala0092@gmail.com)

3. **Ms. Monia Aneja**
   Sr. Sales Manager, Fresh Exchange,
   398, Lane No. 3, Saiyed Ul Ajaib
   Extension, Sainik Farm, New Delhi
   - 110030
   New Delhi
   (monia@flowerexchangegroup.com)

4. **Ms. Eram Arzoo**
   Ph.D. Student (Floriculture),
   ICAR – IARI, New Delhi 110012.
   (erammuz123@gmail.com)

5. **Dr. CR Aswath**
   Head, Division of Floriculture &
   Medicinal Crops, ICAR-IIHR,
   Hessaraghatta, Bengaluru 560089.
   (aswathiihr@gmail.com)

6. **Dr. D Barman**
   Head, IARI Regional Station,
   LB Road, Kalimpong.
   (head_kalim@iari.res.in)

7. **Dr. V Baskaran**
   ICAR-Central Island Agricultural
   Research Institute,
   Andaman & Nicobar Islands,
   Port Blair 744 101
   (vbaski01@gmail.com/v.baskaran@
   icar.gov.in)

8. **Dr. Nirmal Chandra**
   Principal Scientist, ICAR-IARI,
   New Delhi 110012.

9. **Dr. OP Chaurasia**
   Director, Defense Institute of High
   Altitude Research (DIHAR),
   Leh, Ladakh
   (director.dihar@gov.in)

10. **Dr. Shiv Lal Chawla**
    Department of Floriculture &
    Landscape Architecture, ASPEE
    College of Horticulture & Forestry,
    NAU, Navsari – 396450
    (shivlalchawla@gmail.com)

11. **Dr. S Chellaiah**
    Director (Horticulture), NDMC,
    Palika Kendra, Sansad Marg,
    New Delhi 110001.
    (chellaiahndmc@gmail.com)

12. **Mr. Prasant Choudhari**
    Director, Darjeeling Gardens,
    Rato Mati, Pehla Gaon, Mirik,
    Dist. Darjeeling.
    (prasant@darjeelinggardens.com)

13. **Dr. Malavika Dadlani**
Former Joint Director (Res.), ICAR-IARI
#802, Tower 28, Lotus Panache,
Sec 110, NOIDA 201304
(malavikadadlani.md@gmail.com)

14. **Dr. Narendra Dadlani**
Dialogue Convenor
#802, Tower 28, Lotus Panache,
Sec 110, NOIDA 201304
(nkdadlani@gmail.com)

15. **Dr. VS Raju Dantuluri**
Principal Scientist, ICAR-DFR,
Zed Corner, Mundhwa-Manjari
Road, Mundhwa, Pune 411036.
(raju.dantuluri@icar.gov.in)

16. **Dr. SP Das**
Director, National Research Centre
for Orchids
Pakyong, Sikkim 737106.
(director.nrco@icar.gov.in)

17. **Mr. Mohammad Musa Daudzai**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(obidi_m@yahoo.com)

18. **Ms. Koppala Deepthi**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(deepthi.9290@gmail.com)

19. **Mr. Prasannamurti Desai**
Vice President (Landscape),
Kempegowda International Airport
Bengaluru
(prasannamurti@bialairport.com)

20. **Dr. Reeta Bhatia Dey**
Senior Scientist, Division of Floriculture
& Landscaping, ICAR–IARI,
New Delhi 110012.
(reetaiari@yahoo.com)

21. **Dr. MV Dhanasekaran**
Department of Horticulture, Faculty
of Agriculture, Annamalai University,
Annamalai Nagar 608 002 (TN)
(dhansflora@gmail.com)

22. **Ms. Deachen Dolma**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(deachen342@gmail.com)

23. **Dr. RK Dubey**
Professor of Landscaping, PAU,
Ludhiana
(rkdubey.flori@pau.edu)

24. **Ms. Mariyam Firdous**
M.Sc. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(mariyamfirdous92@gmail.com)

25. **Mr. Pradeep Ganu**
Chief, Ganu Farms Group
402-2-2-18/32/C,
Shiv Dhanush Apartments,
Durgabai Deshmukh Colony,
Bagh Amberpet, Hyderabad 500013.
(pradeepganu@gmail.com)

26. **Mr. A Gopalakrishna**
Coordinator, Sir Arthur Cotton
Nursery Farmers Association,
Kadiyapulanka, Kadiyam, Andhra
Pradesh.

27. **Dr. Murtaza Hasan**
Principal Scientist, Centre for Protected Cultivation Technology, ICAR-IARI, New Delhi 110012. (hasaniari40@gmail.com)

28. **Dr. Ritu Jain**
Senior Scientist, Division of Floriculture & Landscaping, ICAR – IARI, New Delhi 110012. (ritujain.iari@gmail.com)

29. **Dr. Ganesh Kadam**
Senior Scientist, ICAR-DFR, Zed Corner, Mundhwa-Manjari Road, Mundhwa, Pune 411036. (ganeshiari@gmail.com)

30. **Mr. Shantesh Kamath**
Ph.D. Student (Floriculture), ICAR – IARI, New Delhi 110012. (shanteshkamath@gmail.com)

31. **Dr. Manish Kapoor**
Professor & Head, Department of Botany, Punjabi University, Patiala 147002 (jdmanishkapoor@yahoo.com)

32. **Dr. Arvind Kapur**
CEO, ACSEN Agriscience, Nunhera, Sohna-Ballabhgarh Road, Sohna, Gurugram 122 103 (a.kapur02@gmail.com; arvindkapur@acsenhyveg.co.in)

33. **Dr. JL Karihaloo**
Former Coordinator, APCoAB, Bangkok New Delhi 110012 (jlkarihaloo@gmail.com)

34. **Dr. C Subesh Ranjith Kumar**
Professor of Horticulture, TNAU Regional Research Station, Aruppukottai 626107. (subesh@tnau.ac.in)

35. **Dr. Gunjeet Kumar**
Principal Scientist, Division of Floriculture & Landscaping, ICAR – IARI, New Delhi 110012. (kumar_gunjeet@yahoo.com)

36. **Dr. P Naveen Kumar**
Principal Scientist, ICAR-DFR, Zed Corner, Mundhwa-Manjari Road, Mundhwa, Pune 411036. (naveeniari@gmail.com)

37. **Dr. Prabhat Kumar**
Horticulture Commissioner, Govt. of India, Ministry of Agriculture & Farmers' Welfare, Krishi Bhawan, New Delhi 110001. (prabhatflori@gmail.com; hort. comm-agri@nic.in)

38. **Dr. Rajiv Kumar**
Division of Floriculture & Medicinal Crops, ICAR-IIHR, Hessaraghatta, Bengaluru 560089. (rajiv.kumar11@icar.gov.in)

39. **Dr. Ravindra Kumar**
Dy. Director (Hort. Science), Ministry of Agriculture & Farmers' Welfare, Krishi Bhawan, New Delhi 110001. (ravindra14@gmail.com)

40. **Dr. Sandesh Kumar**
SAA, ICAR-IASRI, New Delhi 110012 (sandesh2900bishnoi@gmail.com)

41. **Mr. Devarai Lava Kumar**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(dlavakumar1996@gmail.com)

42. **Mr. P Sheshu Kumar**
Joint Secretary, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

43. **Ms. K Madhavi**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(hortimadhavi@gmail.com)

44. **Dr. Bhag Mal**
Secretary, TAAS
Avenue II, Pusa Campus,
New Delhi 110012.
(bhagml@gmail.com)

45. **Dr. Suresh Malhotra**
Director, ICAR-DKMA,
KAB I, New Delhi 110012.
(director.dkma@icar.gov.in)

46. **Mr. KK Mammen Mappillai**
Managing Director, Indo Bloom Limited
Empire Infantry, 29 Infantry Road,
Bengaluru 560001.
(mammen@indobloom.net)

47. **Ms. Meenakshi Meena**
Asstt. General Manager,
NABARD Regional Office,
Rajendra Place, New Delhi 110008.
(Meenakshi.meena@nabard.org)

48. **Dr. RL Misra**
Former Project Coordinator (Floriculture), ICAR-IARI,
New Delhi 110012
(rlmisra650@gmail.com)

49. **Dr. Trilochan Mohapatra**
Former Secretary, DARE & DG, ICAR and Former President, NAAS,
New Delhi 110012.
(tmnrcpb@gmail.com)

50. **Mr. Bhanumurthy KC**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(k.c.bhavmurthy1989@gmail.com)

51. **Mr. Girish PM**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(girish.girish512@gmail.com)

52. **Mr. Shreekant**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(shreekantflori97@gmail.com)

53. **Mr. Syed, MK**
Media Today Group,
J 73, Paryavaran Complex,
IGNOU Road, Neb Sarai,
New Delhi 110068.

54. **Mr. Teju Kumar BK**
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(tejukumar1995@gmail.com)

55. **Mr. Vallarasu S**
M.Sc. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(white183.vallu@gmail.com)

56. **Ms. Chaithra**
M.Sc. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(padmajahunsur12@gmail.com)

57. Ms. Chaitra K
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(chaitrakv91@gmail.com)

58. Ms. Kusuma MV
M.Sc. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(kusumamv7@gmail.com)

59. Dr. Namita
Senior Scientist, Division of Floriculture & Landscaping,
ICAR – IARI, New Delhi 110012.
(namitabanyaliari@gmail.com)

60. Mr. MB Naqvi
CEO, Media Today Group,
J 73, Paryavaran Complex, IGNOU Road, Neb Sarai, New Delhi 110068.
(mb.naqvi@mediatoday.in)

61. Mr. S Jafar Naqvi
Chief Editor, Floriculture Today,
Media Today Group,
J 73, Paryavaran Complex, IGNOU Road, Neb Sarai, New Delhi 110068.

62. Dr. Imtiaz T Nazki
Head, Deptt. of Floriculture & Landscaping, SKUAST – K, Shalimar Campus, Srinagar 190025.
(mitnazki@gmail.com)

63. Mr. Neeraj Singh Negi
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(neerajnegi0@gmail.com)

64. Dr. Naresh Pancholi
D 205, Prajeet Apartments,
Umra, Surat 395007.
(abrpanch@gmail.com)

65. Dr. Sudhakar Pandey
Asstt. Director General (Hort. Science), ICAR, KAB II,
New Delhi 110012.
(sudhakariivr@gmail.com)

66. Ms. Saipriya Panigrahi
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(panigrahisaipriya@gmail.com)

67. Dr. Sapna Panwar
Scientist, Division of Floriculture & Landscaping, ICAR–IARI,
New Delhi 110012.
(sapna.panwar8@gmail.com)

68. Dr. RS Paroda
Chairman, TAAS
Avenue II, Pusa Campus,
New Delhi 110012.
(raj.paroda@gmail.com)

69. Dr. VB Patel
Asstt. Director General (Hort. Science), ICAR, KAB II,
New Delhi 110012.
(patelvb7@gmail.com)

70. Mr. Narendra Patil
Director, SOEX Flora,
Nirmal Building (21st Floor),
Nariman Point, Mumbai 400021.
(narendra@soexflora.com)

71. Mr. Ashish Phadke
General Manager (Marketing),
KF Bioplants,
129/1, Manjari Road, Manjari,
Haveli, Pune 412307.
(ashish@kfbioplants.com)

72. **Mr. C Polaraju**
Treasurer, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

73. **Mr. Bibin Poulose**
Ph.D. Student (Floriculture), ICAR – IARI, New Delhi 110012. (bibinnilgiris@gmail.com)

74. **Ms. Srijana Pradhan**
Ph.D. Student (Floriculture), ICAR – IARI, New Delhi 110012. (shrijanap73@gmail.com)

75. **Dr. KV Prasad**
Director, ICAR-DFR, Zed Corner, Mundhwa-Manjari Road, Mundhwa, Pune 411036. (kvprasad66@gmail.com)

76. **Mr. Bala Shiva Prasath**
Shivashakthi Floritech, 2/224 Gudisettlu Gate, Thumanapalli Post, Berikai Main Road, Hosur 635109 (balashivaprasath@gmail.com)

77. **Prof. K Rajamani**
Professor & Head, Department of Floriculture & Landscape Architecture, TNAU, Coimbatore 641003. (flowers@tnau.ac.in)

78. **Mr. S Govinda Raju**
Director, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

79. **Dr. Pulla Ramakrishna**
Satyadeva Nursery, Kadiyam, Andhra Pradesh

80. **Dr. Pulla Ramakrishna**
P.R.O., Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

81. **Dr. JC Rana**
Country Representative, Biodiversity International, G1 B Block, NASC Complex, New Delhi 110012. (j.rana@cgiar.org)

82. **Ms. Sanghita Roy**
M.Sc. Student (Floriculture), ICAR–IARI, New Delhi 110012. (sanghitaroy02@gmail.com)

83. **Dr. TN Saha**
Senior Scientist, ICAR-DFR, Zed Corner, Mundhwa-Manjari Road, Mundhwa, Pune 411036. (tarak.saha@icar.gov.in)

84. **Mr. Panchal Sangmesh**
Ph.D. Student (Floriculture), ICAR – IARI, New Delhi 110012. (panchalsangmeshad123@gmail.com)

85. **Mr. Pulla Satyanarayana**
President, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh. (kadiyamnurserymen@gmail.com)

86. Mr. K Sethumadhavan
Vanguard Exports,
384, Gowri Narayanan Nilayam,
Thappakulam 1st street,
Coimbatore 641001.
(vanguard.exports@yahoo.in)

87. Dr. Gaurav Sharma
Head, Department of Floriculture & Landscaping,
RLBCAU, Gwalior Road,
Jhansi 284003
(gauravhort@gmail.com)

88. Dr. Puja Sharma
Deptt. of Floriculture & Landscape Architecture, Dr. Y S Parmar Univ. of Horticulture & Forestry,
Nauni, Solan 173 230
(pujasharma03@gmail.com)

89. Dr. AK Shasany
Director, CSIR-NBRI,
Rana Pratap Marg, Lucknow 226001.
(akshasany@gmail.com; director@nbri.res.in)

90. Mr. Gurpreet Singh Shergill
Farmer, Vill. Majaal Khurd, P.O. Panjala, Patiala 147101.
(shergill_farms@yahoo.com)

91. Mr. K Naga Shivaji
Vice President, Sir Arthur Cotton Nursery Farmers Association,
Kadiyapulanka, Kadiyam, Andhra Pradesh.

92. Ms. Chandana Shivaswamy
Ph.D. Student (Floriculture),
ICAR–IARI,
New Delhi 110012.
(chandanasamath@gmail.com)

93. Ms. Sindhu K
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(sindhukoghli44@gmail.com)

94. Dr. SS Sindhu
Former Head, Division of Floriculture & Landscaping,
ICAR – IARI, New Delhi 110012.
(sssindhuiari@gmail.com)

95. Dr. Alka Singh
Dean & Principal, ASPEE College of Horticulture & Forestry,
NAU, Navsari – 396450
(alkaflori@nau.in)

96. Dr. Anand Kumar Singh
Dy. Director General (Hort. Science), ICAR,
KAB II, New Delhi 110012.
(ddghort.icar@gov.in; aksingh36@yahoo.com)

97. Mr. Avtar Singh
CMD, Beauscape Farms,
J 26, Sarabha Nagar, Ludhiana
(avtar_dhindsa@yahoo.com)

98. Dr. Babita Singh
Scientist, Division of Floriculture & Landscaping, ICAR–IARI,
New Delhi 110012.
(bflori17feb@gmail.com)

99. Dr. KJ Singh
Sr. Scientist, CSIR-NBRI,
Rana Pratap Marg,
Lucknow 226001
(jskhuraijam2019@gmail.com)

100. Dr. Kanwar Pal Singh
Prof. & Head, Division of Floriculture & Landscaping, ICAR – IARI, New Delhi 110012. (kanwariari@gmail.com)

101. Dr. Markandey Singh
Principal Scientist, Division of Floriculture & Landscaping, ICAR – IARI, New Delhi 110012. (singh_markandey@yahoo.com)

102. Dr. Om Prakash Singh
Principal Scientist (Agri. Extn.), ICAR-IARI, New Delhi 110012. (prakash1964om@gmail.com)

103. Dr. Parminder Singh
Head, Department of Floriculture, PAU, Ludhiana 141004. (Parminder.flori@pau.edu)

104. Ms. Shrinkhala Singh
Head, Assessment & Training of Assessor, Agriculture Skill Council of India, Unit 101, Greenwoods Plaza (Block B), Greenwoods City, Sector 45, Gurugram 122009. (shrinkhala@asci-india.com)

105. Dr. PS Sirohi
Former Head, Division of Vegetable Science, ICAR-IARI, EA 172, Arya Samaj Mandir Road, Inderpuri, New Delhi 110012. (pssirohi2005@yahoo.com)

106. Mr. S Srinivasarao
Director, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

107. Dr. Umesh Srivastava
Former ADG (Hort. Science), ICAR and Consultant, TAAS, Avenue II, Pusa Campus, New Delhi 110012. (srivastavaumesh@gmail.com)

108. Mr. B Subbaraidu
Secretary, Sir Arthur Cotton Nursery Farmers Association, Kadiyapulanka, Kadiyam, Andhra Pradesh.

109. Mr. J Subramanian
Bunnik Creations, 4/125 E, State Bank Colony, 5th Cross Street, North, Tuticorin 628002. (j.subramanian@bunnikcreations.com)

110. Ms. Vinita Sudhanshu
Dy. General Manager, APEDA, NCUI Bldg., Siri Institutional Area, August Kranti Marg, New Delhi 110016. (vinitas@apeda.gov.in)

111. Dr. HP Sumangala
Division of Floriculture & Medicinal Crops, ICAR-IIHR, Hessaraghatta, Bengaluru 560089. (sumangala.hp@icar.gov.in)

112. Mr. PS Suresh
Managing Director & CEO, Ramesh Flowers (Gala Group), A 62 (A), Sipcot Industrial Complex, Tuticorin 628002. (ps.suresh@gala-group.com)

113. Dr. Kishan Swaroop
Principal Scientist, Division of Floriculture & Landscaping, ICAR – IARI, New Delhi 110012. (kishan.swaroop@rediffmail.com)

114. Ms. Rayavarapu Tejaswi
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(tejaswirayavarapu03@gmail.com)

115. Mr. Mukund Thakar
President, Sai Roses,
Pavana (Pune)
(mukund@sairoses.com)

116. Ms. Seema Mukund Thakar
Pawna Flower Producers Association
Pavana (Pune)

117. Dr. Priyanka Thakur
Principal Floriculturist, Dr Y S Parmar Univ. of Hort. & Forestry, Regional Station, Dhaulakuan, Himachal Pradesh.
(priyankathakurfloriculturist@gmail.com)

118. Dr. AK Tiwari
Principal Scientist, Division of Floriculture & Landscaping,
ICAR – IARI, New Delhi 110012.
(drajaitiwari@gmail.com)

119. Ms. Vaishali C
Ph.D. Student (Floriculture),
ICAR – IARI, New Delhi 110012.
(vaishalichinnathampi.97@gmail.com)

120. Dr. SK Vasal
Former Distinguished Scientist,
CIMMYT, Mexico,
Vasant Kunj, New Delhi 110070
(skvasal@gmail.com)

121. Dr. MK Verma
Director, ICAR-CITH,
Old Air Field, Rangreth,
Srinagar 191132.
(director.cith@icar.gov.in)

122. Ms. Vidyashree S
Ph.D. Student (Floriculture),
ICAR–IARI,
New Delhi 110012.
(siriallu97@gmail.com)

123. Dr. Ajay Kumar Yadav
Technical Assistant, ICAR-IIMR,
Delhi University, Delhi 110006
(yadavbikaner61@gmail.com)

124. Ms. Priya Yadav
Ph.D. Student (Floriculture),
ICAR–IARI,
New Delhi 110012.
(priyayadav131093@gmail.com)

125. Mr. Anand Zambre
Executive Director,
National Committee for Precision Agriculture & Horticulture,
10th Floor, International Trade Town, Nehru Place,
New Delhi - 110019
(ed@ncpahindia.com)

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Trust for Advancement of Agricultural Sciences (TAAS)
Avenue II, ICAR-Indian Agricultural Research Institute (IARI)
Campus, New Delhi - 110012, India
Ph.: +91-11-25843243; +91-8130111237
E-mail: taasiari@gmail.com; Website: www.taas.in