Recent Technologies in Commercial Floriculture

(A compilation of the ***Salient Research Achievements*** from AICRP on Floriculture during 2015-16 – 2017-18)

भाकृअनुप – पुष्पविज्ञान अनुसंधान निदेशालय
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Preface

All India Coordinated Research Project (AICRP) on Floriculture since its inception (in the year 1970-71) has contributed significantly for strengthening the technological base to support commercial floricultural activities across the country. Under AICRP, research projects are formulated on priority areas in floriculture every three years for execution at various coordinated Centres. Varieties tested and found suitable for agro-climatic zones; technologies standardized in crop production, crop protection and post-harvest technology are compiled in the Annual Group Meeting of the AICRP in the concluding year.

The technologies evolved from AICRP are brought into various technical bulletins from time to time, either crop based (crop specific monographs) or subject oriented (Agro-techniques or Plant Protection or PHT). In the light of Doubling Farmers Income by 2022 and to take the recent technologies to the needy farmers on priority, an attempt is made to compile all the technologies generated in AICRP on Floriculture based on the three years of research (2015-16 to 2017-18) at various coordinated Centres.

These technological interventions presented here in this bulletin are over and above the recommended package of practices of the respective region. Hence, flower growers, farmers and all those interested may utilize them as per the need.

K. V. Prasad
Director, ICAR-DFR

Contents

1. Germplasm Conservation and Evaluation

Germplasm collection, characterization, conservation, maintenance and their use in commercial production as well as in breeding programme is a continuous process at all the Coordinated Centres of AICRP on Floriculture. It's well understood that the availability of plant genetic resources/ germplasm is more crucial than anything else for the development of varieties through breeding (either conventional or non-conventional).

The organized efforts of the Coordinated Centres in germplasm collection, evaluation and maintenance in the last three years have sufficiently enriched the gene pool of flower crops which would be highly useful in developing new varieties as well as using the best ones directly for flower crop production. The list of promising germplasm (either for specific traits or for specific purpose) in each crop are mentioned in Table.1.

Table.1 List of promising varieties/genotypes crop-wise and Centre-wise

S. No.	Crop	Promising varieties
		Rose
1	Bhubaneswar	**Cut flower –** Mainu Parle, Gladiator, Montezuma & Papa Meilland. **Borders and garden display -** Pusa Baramasi, Sadabahar & Arunima.
2	New Delhi	**Cut flower -** Raktagandha. **Loose flower -** Desi type & Rose Sherbet, Pusa Gaurav. **Garden display -** Pusa Gaurav, Pusa Ajay, Raktima & Pusa Baramasi.
3	Ludhiana	**Cut flower -** Marcopolo (yellow), Double Delight (bicoloured), Ferry Porsche (Red), Manas (Striped Pink), Mainu Parle, Gladiator, Montezuma & Papa Meilland. **Loose flower -** Queen Elizabeth, Charleston, Brown Velvet, Summer Snow & Papa Meilland (Red).
		Gladiolus
1	Hyderabad	Arka Amar, IIHR G - 12, Sindhur, Shagun, Arka Kesar, Yellow Frill, Pusa Kiran & Advance.
2	Solan	**Cut flower -** Vink's Glory, Nova Lux, Red Beauty & Mayur. **Corm production -** Intrepid, Pascal, Punjab Dawn, Nova Lux, Tiger Flame, Mayur, Red Beauty, Darshan, Pacifica and Spic &Span.

S. No.	Crop	Promising varieties
3	Srinagar	**Cut flower -** Amsterdam, Apple Blossom, Big Time Supreme, Jasckson Ville Gold, Jester, Jester Gold, Mascagani, Moralla, Oscar, Peter Pears, Priscilla, Rose and Wine, Rose Delight, Rose Supreme, Sancerre, Sunset Jubilee, Trader horn, Vink's Glory, Water Melon Pink, White Friendship, White Giant, White Goddess, White Prosperity, Wind Song & Yellow Stone. **Corm production -** Buff Beauty, King Lear, Mayur, Priscilla, Purple King, Pusa Suhagin, Regency, Trader Horn & Wig's Sensation.
4	New Delhi	**Early flowering -** Punjab Lemon Delight, Fire Flame & Nicola. **Max. no. of florets -** Lady John & Pink Lady.
5	Ludhiana	Punjab Pink Elegance, Punjab Glance, Plumtart & Purple Flora.
		Carnation
1	Pune	Kiro, Domingo & Dover.
2	Solan	Jurano, Bizet & Ambrose.
3	Ooty	Gioloe & Red King.
		Chrysanthemum (Loose flower)
1	Coimbatore	Statesman, Jubilee, Vijay Kiran, Kajal, Punjab Gold, Punjab Anuradha, Sunil, Mayur & Coffee.
2	New Delhi	Ajay, Pusa Anmol, Thai-chen Queen, Lalpari, Jaya & Sadbhawana.
3	Hyderabad	Bidhan Mallika, Agnipath, PAU-B-107, Lalima, HYCC-21, Preet Shringar, Ratlam Selection, Silper, Usha Kiran, Rekha, Rupanjali, Poonam, Punjab Gold, Local Button, HYD-C-40, HYD-C-1, HYD-C-39, HYD-C-53 & HYD-C-49.
4	Ludhiana	Solan Shringar, Baggi, Birbal Sahni & Ratlam Selection. **Standard -** Cassa Grande Yellow, Zinfandel, Red Wine & Royal Prince.
5	Pantnagar	Prof. Harris, Ajay, Purnima, Baggi & Gauri.
		Chrysanthemum (Cut flower)
1	Bhubaneswar	Arka Chandrika, Bidhan Madhuri & Bidhan Jayanti.
2	Hyderabad	Star White, Reagan Emperor, Pusa Centenary, Yellow Delight, Autumn Joy, Snow Ball, Ravikiran, PAU-B-64 & Snow Sem.

S. No.	Crop	Promising varieties
3	Ludhiana	Punjab Shyamli, Reagan Emperor, Reagan White, Kelvin Mandarin, Kelvin Tatoo, Ajay & Yellow Delight.
4	Pantnagar	Suneel, Pusa Centenary, Thai-chen Queen, UHFS Chry-81 & Sova.
Chrysanthemum (Pot culture)		
1	Bhubaneswar	Pusa Aditya, Arka Pink Star & UHFS-Chr-56.
2	Ludhiana	Punjab Gold, Mother Teresa, Yellow Charm, Anmol, Royal Purple, Mayur & Pancho.
3	Pantnagar	Sadbhavna, Mother Teresa & Suhag Shingar.
4	Hyderabad	Coffee, Arka Pink Star, Julie & Dolly Pink.
5	Udaipur	Pusa Sona
Chrysanthemum (Garden decoration)		
1	Ludhiana	Autumn Joy, Garden Beauty & Winter Queen.
2	Hyderabad	Garden Beauty, PAU-B-43 & Winter Queen.
Orchids		
1	Kalimpong	**Cut flower Species -** *Paphiopedilum spicerianum, Paphiopedilum hirsutissimum, Paphiopedilum insigne, Paphiopedilum fairrieanum, Paphiopedilum venustum, Cymbidium trachyanum* & *Vanda coerulia*. **Hybrids for cut flower -** Colorado Park, Laevis Duke Bella Vista, Mini Beacon, Red Torch, Beauty Fred 60, Golden Girl, Kennywine, December Gold, Ames Bury & Honey Green Melissa. **Landscaping -** *Aeridesodoratum, Coelogyne nitida, Coelogyne cristata, Coelogyne ovalis, Dendrobium densiflorum, Dendrobium moschatum, Dendrobium nobile, Phaiustanker villea*& Cymbidium spp. **Hybrids for pot culture -** Baltic Glacier Mint Ice & Without Peer Soft Touch.
2	Vellanikkarra	**Cut flower -** *Neostylis* Lou Sneary, *Rhynchorides* Bangkok Sunset, *Vasco* Blue Bay Blue, *Vasco* Blue Bay White, *Vasco* Blue Bay Pink, *Ascda* Sirichai Fragrance, *Vascostylis* Crownfox Red Gem, *Ascda* Peggy Foo *x Rhyn. coelestis* Blue, *Ascda* Udomchai. **Pot culture -** *Rhynchorides* Bangkok Sunset, *Neostylis* Lou Sneary, *Vasco* Blue Bay Blue & *Vasco* Blue Bay Pink. **Garden display -** *Neostylis* Lou Sneary & *Vasco* Blue Bay White.

S. No.	Crop	Promising varieties
		Anthurium
1	Coimbatore	Diablada, Glamour & Sunshine Orange.
2	Hessaraghatta	Tropical & Eternity.
		Tuberose
1	Coimbatore	**Single –** Prajwal **Double -** Suvasini, Vaibhav & Hyderabad Double
2	Hyderabad	**Single –** Prajwal, Arka Nirantara & Hyderabad Single. **Double –** Vaibhav, Hyderabad Double & Suvasini.
3	Pune	**Single –** Prajwal, Shringar & Phule Rajani **Double –** Local Double, Suvasini, Hyderabad Double & Vaibhav.
4	Pasighat (2017-19)	Phule Rajani, Prajwal & Bidhan Rajani-1
5	Ludhiana	**Single –** Prajwal **Double –** Vaibhav & Suvasini
6	Pantnagar	**Single –** Prajwal, Arka Nirantara & Shringar **Double –** Vaibhav & Suvasini
7	Hessaraghatta	**Single -** Arka Nirantara & Prajwal **Double -** Vaibhav
8	Kalyani	**Double -** BRH-19 & BRH-24
		Gerbera
1	Pune	Batvia, T. Orange Country, T. Kalina, T. Juba & T. Faith.
2	Kahikuchi	**Polyhouse -** Renee, Elite, Tecta, Sonata & Loreto.
3	Kalimpong	**Cut flower -** Balance, Goliath, Intense, Sangria & Dana Ellen. **Garden decoration -** Kalimpong Yellow, Kalimpong White & Kalimpong Pink.
4	Ranchi	Salvador, Quote, Dune & Julia.
5	Barapani	RCGH-23, RCGH-33, RCGH-1, RCGH-51, RCGH-89, RCGH-95, RCGH-28, RCGH-12, RCGH-22, RCGH-114 & RCGH-117.

S. No.	Crop	Promising varieties
		Tulip
1	Srinagar	**Cut flower production -** Abba, Apledoorn, Ballerian, Cassini, Golden Melody, Inzell Lucky Stricke, Parade &Purisima. **Garden decoration -** Cassini, Beethoven's Memory, Cantala & Golden Melody.
2	Katrain	Litouween, Indian Summer Set & Topeka.
3	Solan	Red Impression, Benja Luka, Golden Oxford, White Dream & Christmas Negrita.
		Daffodils
1	Katrain	**Cut flower -** Golden Ducot, Obdam, Carlton, Prof. Einstein & Lemon Beauty. **Garden/bedding -** Dick Wilden, Pubalo, Cumlaude and Yellow Cheerfulness.
2	Solan	Cum Laude, Blues, Replete, White Lion & Yellow Cheerfulness.
3	Srinagar	**Cut flower Production -** Vension, Wrestler, N-23, White Well, Golden Pedestal & Tunis. **Pot culture -** Scilly White, N-25, N-30 & Texas.
		Lilium
1	Katrain	Eyeliner, Tresser, Ceb Dazzle, Ercolano, Original Love, Pavia & Yellow Tycoon. **Early flowering -** Best Seller & Salmon Classic.
2	Solan	**Asiatic hybrids -** Brunello & Tresor. **LA hybrids -** El Divo, Frans Hals, Nashville & Pavia. **Oriental hybrids -** Sorbonne, Signum & Justina.
3	Srinagar	**Cut flower production -** Pollyanna, Royal Trinity, Monorca, Brindsi, Courier, Dreamland, Novocenta, Elite, Star Gazer, Navona & Eldivo.
4	Ooty	**Asiatic varieties -** Treser & Brunello. **LA hybrids -** Orange Tycoon **Oriental hybrids -** Acapulco
		Alstromeria
1	Solan	Serena, Cinderella, Capri, Pink Panther, Tiara & Red Collection.
2	Srinagar	**Cut flower -** Alla Din, Pluto & No. 14. **Pot culture -** Serena &Rina.

S. No.	Crop	Promising varieties
3	Kalimpong	**Cut flower -** Pink Panther, Pluto, Rina & Rosita. **Pot culture -** Serena & Kalimpong Collection-1.
4	Ooty	**Cut flower -** Aladdin, Tiara & Riana.
Specialty flowers (Heliconia, Ginger lily, Bird of Paradise etc.)		
1	Pune	*Alpinia purpurata* Eden White, *Heliconia pendula.*
2	Hyderabad	*Heliconia latispatha* 'Alan Carle' & *Heliconia rostrata*.
3	Vellanikkara	**Cut flower (export) -** Emerald forest, Kamehameha, Halloween & Island Yellow. **Cut flower (local) -** Bucky, Oriole Orange, Orange Marmalade, Sassy Pink, Hot Rio Nights & Yamakawa Chocolate. **Pot plant -** Bucky, Oriole Orange & Orange Marmalade.
4	Kahikuchi	**Cut flower -** Red & Pink Heliconia, Bihai Yellow Dancer & Bihai Orange Dancer. **Decoration -** *Heliconia pendula* **Bird of Paradise -** HRS-BOP-1
Ornamental Fillers & Florist greens		
1	Pune	Asparagus (Narrow leaves) & Asparagus (Broad leaves).
2	Hyderabad	*Asparagus densiflorus* Springeri, Solidago, Philodendron, Ruscus & Aspidistra (longer shelf life).
3	Ooty	**Cut foliage -** *Cordyline australis* Purple Tower, *C. australis* Cabbage Tree, *Nephrolepis exaltata*, *Asparagus densiflorus* var. Mayers, Box Wood, Baby Dollar, Podocarpus. **Foliage arrangement -** *A.densiflorus VAR. Springeri & A. densiflorus* var. Mayers.
4	Vellanikkara	*Nephrolepis biserrata*-Miniata, *N. biserrata*-Furcans, *N. cordifolia*, *N. exaltata* Chidisii*, Asplenium nidus*, *A. longissimum, Diaplazium acrostichoides, Botoniensis compacta*, *Pteris ensiformis*, *Dracaena fragran 'Massangeana', D. sanderiana, Pleomele reflexa, (Cordyline termnalis*-Rainbow, Carnival & Surprise*).*
5	Bengaluru	*Nephrolepis exaltata & N. cordifolia.*

S. No.	Crop	Promising varieties
Native Ornamentals		
1	Solan	**Trees -** *Prunus cerasoides, Pistacia integerrima & Wendlandia exserta* **Shrubs -** *Capparis zeylanica, Caesalpinia sepiaria, Jasminum humile & Clerodendron villosum* **Herbaceous perennials -** *Anaphalis margaritacea, Celosia argentea*, *Celosia argentea* (pink)*, Aerva scandens* & *Strobilanthes glutinosus* (white) **Ferns -** *Onychium contiguu & Woodwardia unigemmata*
2	Vellanikkarra	*Clitoria ternatea, Helicteresisora, Thevetia peruviana, Clerodendrum phlomidis, Leucasaspera* & *Melastomamalabarthricum.*
Landscape plant material		
1	Vellanikkara	Melastoma spp., *Rondeletia leucophylla*, *Ruellia brittoniana*, *Ageratum haustonianum*, *Pentas laceolate*, *Graptophyllum hortense*, *Leucophyllum zygophyllum*, *Clerodendrum macrosiphon*, *Thunbergia erecta*, *Caesalpinia pulcherrima*, *Calliandra chinensis*, *Turnera subulata*, Ixora spp., Jasminum spp., *Nyctanthes arbortristis*, *Jatropa podagrica* & *Ruellia brittoniana*.
2	Hessaraghatta	*Murraya exotica, Gardenia jasminoides & Nyctanthus arboria*
3	Ludhiana	*Box microphylla, Nandina domestica* (white), *Holmskoildea sanguine* (Red) & *Thunbergia erecta* (blue).
4	Solan	*Lolium perenne*
Turf grasses, ground cover & grasses for cut foliages		
1	Coimbatore	Turf grass species *viz*., *Zoysia japonica* and *Z. tenuifolia* can be recommended for sports turfs, golf courses and for landscaping purposes
2	Hyderabad	*Zoysia japonica* (Korean carpet) was found to be ideal due to its slow growing nature followed by Bermuda, *Argentine bahia* (hardy & best for least maintenance) & *Cynodon dactylon*.
3	Solan	*Agrostissto lonifera* & *Lolium perenne*
4	New Delhi	Tif dwarf-419 (*Cynodondactylon*) & Selection-1 (*Cynodon dactylon*)
5	Hessaraghatta	**Turf grasses for lawn making -** *Eragrostis curvula, Paspalum notatum & Argentine bahia.*
6	Ludhiana	*Cynodon dactylon & Paspalum notatum.*

2. Crop Improvement

New genotypes/varieties developed at various R&D organizations including the Coordinated Centres are being tested for their performance under diverse agro-climatic conditions all over India to determine their suitability in respective agro-climatic region (in addition to the agro-climatic zone of the breeding centre).

The varieties/genotypes found promising at various Coordinated Centres based on the testing during 2015-16 to 2017-18 (three years) are mentioned below crop-wise (Table.2). These varieties are recommended for release in the respective states/region through SVRC/CVRC in order to bring them in to seed chain to cater to the needs of stakeholders.

Overall, there were 46 entries (varieties/genotypes) in seven flower crops which were tested across Coordinated Centres. Highest numbers of entries were in Chrysanthemum (17 nos.) followed by gladiolus (10 nos.), marigold, African & French (8 nos). gerbera (5 nos. under open filed and 2 nos. under polyhouse); crossandra (4 nos.), tuberose (3 nos of single type) and China aster (3 nos).

Table.2 List of promising new varieties/genotypes, crop-wise & Centre-wise

S. No.	Centre	Recommended varieties
Gladiolus (Plains) - Arka Naveen, Arka Manorama, ACC-7 and Punjab Glad -1		
1	Pune	Phule Ganesh (check variety)
2	Pusa	Arka Naveen
3	Ludhiana	Punjab Glad-1
4	Udaipur	Arka Naveen
5	New Delhi	**Corm production -** Arka Naveen, Pusa Srijana, Pusa Unnati, Pusa Sinduri & Pusa Manmohak. **Spike length -** Pusa Unnati & Pusa Red Valentine.
6	Kalyani	Acc. No. 7 & Punjab Glad-1
7	Hessaraghatta	**Cut flower -** Arka Naveen and check varieties, Arka Aayush, IIHRG-1, IIHRG-6, IIHRG-11 & IIHRG-12.
Gladiolus (Hills) - SK-96-1, SK-96-2, SK-96-3, SK-96-4, UHFSGla- Hb 11-10 & UHFSGla- Hb 2-24		
8	Katrain	**Hills -** UHF Gla-Hyb 11-10

S. No.	Centre	Recommended varieties
9	Solan	**Cut flower -** UHFS Gla 2-24 **Corm production -** UHFS Gla 11-10
Chrysanthemum (Loose flowers) - Arka Gold, Arka Chandrika, HCC-1, HCC-2, HCC-3, Bidhan Madhuri, Bidhan Jayanti & Bidhan Purna		
1	Bhubaneswar	Bidhan Madhuri (purple 78D flowers @687.4g flowers/plant); Bidhan Jayanti (yellow flowers-3C@522.69 g/pl), Arka Chandrika (white flowers -157D @487.08 g/pl) & Arka Gold (yellow flowers with flower size of 7.23 cm & shelf life of 12 days).
2	Coimbatore	HCC-2 (154.5 fls/plant) & HCC-1 (154.0 fls/plant)
3	Hyderabad	Bidhan Madhuri (151.24 fls/plant) and HCC -1 (101.49 fls/pl)
4	Udaipur	Bidhan Mallika; and check varieties BidhanTaruna, Red Gold, Mayur & Honey Comb
5	Hessaraghatta	Arka Yellow Gold & Arka Chandrika.
6	Kalyani	Bidhan Madhuri, Bidhan Jayanti, Bidhan Purna; and check varieties Bidhan Rajat, BidhanLalima Pusa Chitraksha & Basantika.
7	Pantnagar	HCC -1
Chrysanthemum (Pot culture) - UHFS Chr-56 & UHFS Chr-68; and Arka Pink Star, Arka Kirti and Arka Usha Kiran; Pusa Aditya & Pusa Chitraksha; and Bidhan Mum and BCH 14-1		
1	Bhubaneswar	Arka Pink Star (208.89 flowers/plant) & UHFS-Chr-56 (203.44 flowers/plant); and Pusa Aditya was promising with attractive bicolor flowers & good flowering duration.
2	Coimbatore	Pusa Aditya (63 fl.pl), UHFS Chr-68 (62 fl/pl), UHFS Chr-56 (59 fl/pl)
3	Hyderabad	Arka Pink Star (208.89 fl/pl), UHFS Chr-56 (203.44 fl/pl)
4	Solan	Arka Usha Kiran, Arka Kirti, Arka Pink Star, UHFS Chry-56 & UHFS Chry-68
5	Udaipur	Pusa Aditya, Pusa Chitraksha, Arka Pink Star, (and check varieties, Apoorva Shringar Pusa Sona and Ajina Purple)
6	Pantnagar	Arka Pink Star (57.86 fl/pl) and check variety Sadbhavana (54.07 fl/pl)
7	Ludhiana	Pusa Aditya, Pusa Chitraksha, Arka Pink Star & Arka Kirti.
8	Kalyani	Arka Pink Star (588.33 fl/pl), Pusa Chitraksha (498.50 fl/pl), BCH-14-1 (468 fl/pl)
9	Hessaraghatta	E-95 (check variety) followed by Pusa Chitraksha, Aditya and Arka Pink Star

S. No.	Centre	Recommended varieties
Tuberose (Single type) - Bidhan Rajani H-1, Bidhan Rajani H-2 & GK-T-C4		
1	Hyderabad	Bidhan Rajani– 2 and check varieties, Prajwal & Hyderabad Single
2	Pune	Check varieties, Prajwal, Arka Nirantara & GK-T-S-1.
3	Pusa	Bidhan Rajani H-1
4	Kahikuchi	Bidhan Rajani H-2 and check variety, Prajwal
5	Udaipur	Bidhan Rajani H-1and check varieties, Prajwal & Phule Rajani
6	Coimbatore	Check varieties, Prajwal & Arka Nirantara
7	Hessaraghatta	Check variety, Prajwal
8	Ludhiana	Bidhan Rajani H-1 and Bidhan Rajani H-2
9	Kalyani	Check varieties, Bidhan Snigdha, Bidhan Ujjawal & Bidhan Jyoti
Marigold (African) - Bidhan Marigold -1, Bidhan Marigold -2, Bidhan Marigold -3; & Arka Bangara		
1	Bhubaneswar	Arka Bangara (1.25 kg/pl) and Arka Agni (1.08 kg/pl) (check variety)
2	Coimbatore	Arka Agni (check variety)
3	Pune	Arka Bangara (36 fls/pl) and check varieties, Pusa Narangi Gainda & Arka Agni
4	Pusa	Arka Bangara (0.72 kg/pl) at par with check variety Pusa Narangi Gainda (0.79 kg/pl)
5	Solan	Arka Agni (check variety)
6	Ludhiana	Bidhan Marigold-1, Bidhan Marigold-2 & Bidhan Marigold-3.
7	Kalyani	Bidhan Marigold-1, Bidhan Marigold-2 & Bidhan Marigold-3.
8	Hessaraghatta	Arka Bangara-2 & Arka Agni (both checkvarieties)
Marigold (French) - UHFS-FM-Mari-786 and IIHRMO-2, IIHRMO-4 & IIHRFm-1		
1	Bhubaneswar	Check variety (Jafri - 227.22 fl/pl) is superior than IIHR MO – 2 & IIHR FM – 1
2	Pusa	Jafri marigold Local (check variety)
3	Raipur	IIHRMO-2
4	Coimbatore	UHFS-FM-Mari-786 (255.98 g/pl) followed by IIHR Fm-1 (225.87 g/pl)

S. No.	Centre	Recommended varieties
5	Hessaraghatta	IIHR FM – 2, IIHRMO-4, IIHRMO-2 & UHFS-FM-Mari-786
6	Solan	IIHRMO-2
7	Kahikuchi	Jafri Marigold (check variety)
Crossandra - Arka Ambara, Arka Kanaka, Arka Shreeya, and Arka Shravya		
1	Hyderabad	Arka Ambara, Arka Kanaka, Arka Shreeya (orange) & Arka Shravya (red group)
2	Pune	Arka Shravya (35 fl/spike), Arka Shreeya (22.25 fl/spike)
3	Hessaraghatta	Arka Shreeya, Arka Ambara, Arka Shravya and Arka Kanaka
China aster - Arka Aadya, Arka Archana and Kamini		
1	Coimbatore	Arka Archana and Arka Aadya
2	Navsari	**Loose flower -** Arka Archana (2.20 kg/plot) and check varieties, Phule Ganesh White & Phule Ganesh Pink.
3	Pune	Check varieties (Phule Ganesh White, Phule Ganesh Purple, Phule Ganesh Violet) and Arka Archana.
4	Solan	Check varieties, Local White & Arka Poornima
5	Hyderabad	Arka Kamini, Arka Archana & Arka Aadya.
6	Kalyani	Arka Archana (54.17 fl/pl) and Arka Kamini (43.47 fl/pl)
7	Hessaraghatta	Arka Aadya, Arka Archana & Arka Kamini.
Gerbera (Open field) - Arka Krishika, RCGH 12, RCGH 22, RCGH 114 and RCGH 117		
1	Bhubaneswar	Arka Krishika
2	Ooty	RCGH-117
3	Hessaraghatta	Arka Krishika
4	Barapani	RCGH 12, RCGH 22, RCGH 114 & RCGH 117
Gerbera (Polyhouse) Arka Ashwa & Arka Nesara		
1	Solan	Arka Ashwa

Note: The list includes check variety (wherever found better than approved entries) and promising hybrids if found better than or at par with approved entries. Due to various reasons few of the above entries were not tested for three years.

3. Crop Management

Improved agro-techniques (production technologies) are vital in minimizing the cost of production and maximizing the output. The output from crops although depends on number of factors (variety/quality planting material used, soil nutrient profile, availability and quality of irrigation water), adoption of some of the improved agro-techniques would certainly help in increasing the farm returns.

Effect of pre and post-emergence herbicides in rose (Open)

- The treatment Pendimethain as pre-emergence application @ 1.0 kg a.i./ha followed by post-emergence weedicide, ethoxysulfuron 20.0 gm a.i./ha at 30 DAS + hand weeding at 30 days interval starting from 75 days thereafter was found effective and recommended for control of weed in rose under open conditions **(at Pune, Ranchi, and Ludhiana).**
- Herbicide treatment with Pendimethalin as pre-emergence application @1kg a.i./ha followed by post-emergence weedicide, ethoxysulfuron (20g a.i./ha) is effective in controlling weeds in rose **(Bhubaneswar).**
- The pre-emergence application of Atrazine 1.0 kg/ha, and after one month post-emergence application of Ethoxysulfuron 20g/ha was the best treatment which reduced the weed count and fresh weight of weeds/m^2 in comparison to weedy check in rose cv. Raktagandha. The weedicides did not affect the plant height, number of branches per plant, flowering duration, days to flowering, number of flowers per plant, length of flower bud and vase life significantly. The weed flora observed were: *Chenopodium album, Chenopodium murale, Cyperus rotundus, Poa annua, Polygonum plebejum, Rumex dentatus, Trigonella* spp. **(New Delhi).**

Drip irrigation and fertigation studies

- In tuberose, fertigation with 100% of RD of water soluble fertilizers (WSF) were found to be superior with respect to growth, flowering and yield parameters. The cost economics worked out also indicated that the BCR was highest (2.65) in this treatment **(Coimbatore),** whereas similar results were obtained with 75% WSF + 25% straight fertilizer at **Hessaraghatta**.
- In tuberose, maximum number of florets/spike and bulbs were found with the use of 100% straight fertilizer (T7) at **Pantnagar.**
- In African marigold (Bidhan Marigold-3), application of WSF (50% of RD) + Straight Fertilizer SF (50% of RD) through drip recorded significant improvement (yield/plot and estimated per ha yield @10.9 kg and 117.5 quintal, respectively) at **Kalyani.** Similar results were obtained with this treatment at

Hessaraghatta with an increase in yield of 47.2% over the control and highest benefit cost ratio of 3.26 in the cv. Arka Bangara-2.

- In marigold cv. Pusa Narangi Gainda, the best treatment was found to be WSF (75% of RD) + SF (25% of RD) through fertigation at **Hyderabad.**

Effect of organic supplement on growth and flowering of orchids

- T2 (T1 + Poultry manure @20/pot) followed by T5 (T1 + Neem cake @20g/pot) is recommended for higher growth characteristics in *Cymbidium* hybrids **(Barapani).**
  (T1- common basal dose consisting of FYM@100g/pot + decomposed coir compost@100 g/pot + biofertilizers (VAM+Azospirillum+PSB) @2g/pot each at 6 months interval + Trichoderma@20 g/pot (applied by mixing it moist FYM dose and covered with polythene sheet for a week then apply in pots)
- Organic supplements, neem cake (@ 20g per pot or bone meal (@ 10g per pot) along with FYM (100g) + decomposed coir compost (100g) + biofertilizer (2g each of PSB, VAM, *Azospirillum*) + *Trichoderma* (20g per pot) was found better for higher spike production, better shelf life as well as vase life in Dendrobium **(Kalyani).**
- Application of vermicompost (500g), *Azospirillum* (2g) and PSB (2g) per pot and followed by common basal dose of FYM @ 100g per pot with biofertilizers was found to be better for vegetative growth of *Dendrobium* **(Kahikuchi).**
- Application of fish meal @ 10g per pot + common basal dose {FYM @ 100g per pot + decomposed coir compost 100g/pot + biofertilizer (VAM + *Azospirillum* + PSB) 2g/pot each at 6 months interval + *Trichoderma* 20g/pot} recorded maximum plant height (110.83 cm), pseudobulb girth (9.05 cm), leaf area (163.90 sq. cm) and highest number of pseudobulbs per plant (5.13) in *Cymbidium laevis* Duke Bella Vista **(Kalimpong).**
- Vermicompost 500 g+ *Azospirillum* 2g/pot + AMF 2g/pot in potting media can be recommended for improving spike length and number of flowers in *Dendrobium* (**Vellanikkarra**).

Effect of biofertilizers on growth and flowering of orchids

- T9 (T2 + *Azospirillium* @2g/pot + VAM @2g/pot + PSB @2g/pot) followed by T6 (T2 + *Azospirillium* @2g/pot + VAM @2g/pot) is recommended for higher growth characteristics in cymbidium hybrids **(Barapani).**
  (T2- vermicompsot@500 g/pot)
- Biofertilizers, *Azospirillium* @2g/pot + VAM @2g/pot + PSB @2g/pot) along with a common inorganic nutrient dose as foliar spray (N:P:K:: 30:10:10 @ 0.1%) was effective for higher spike production in *Dendrobium* **(Kalyani).**

- Application of vermicompost @500g/pot + PSB@2g/pot) recorded maximum pseudobulb girth (6.69 cm), leaf area (191.07 cm Sq.) and number of leaves per palnt (43.53) in Cymbidium Margaret Thatcher **(Kalimpong).**
- Largest stem girth, maximum number of pseudo bulbs and inter nodal length was registered in control where the plants were treated with inorganic spray with N:P:K:: 30:10:10 @ 0.1% at weekly interval and followed by treatment T9 (vermicompost 500g, *Azospirillum* 2g and PSB 2g/pot) **(Kahikuchi).**

Effect of inorganic nutrients on growth and flowering of orchids

- Weekly application of higher amount of nitrogen at a dose combination of N:P:K::30:10:20 @ 0.1% was effective for better vegetative growth and for higher spike production the dose combination of NPK::20:10:10 @ 0.1% was better in *Dendrobium* cv. Sonia 17 **(Kalyani).**
- Application of N:P:K::30:10:10 @ 0.1% recorded maximum plant height (70.37 cm) and leaf number per plant (10.56) in Cymbidium Margaret Thatcher compared to biofertilizer at **Kalimpong**.
- Foliar application of NPK 30:10:10 @ 0.1 per cent at weekly intervals along with Zn @0.05 ppm at 15 days intervals can be recommended for improvement of spike length, no. of flowers per spike and flower size in *Dendrobium* **(Vellanikkarra)**.

Effect of micronutrients on growth, development and flowering of orchids

- Monthly application of Boron @ 0.05-0.1 ppm along with the scheduled nutrient applications was effective for better growth and flowering in *Dendrobium* cv. Sonia 17 **(Kalyani).**

Studies on staggered plantings of carnation for extending flower availability

- The maximum plant height (73.30 cm), flowers / plant (7.00), flowers diameter (5.80 cm), flowers per m^2 (175.00), flowering duration (50.40 days), stem diameter (0.65 cm) and stem length (50.40 cm) was produced in October planting in carnation **(Pune).**
- On the basis of studies conducted on staggered flowering, April planting of cultivars 'Dumas', 'Kiro' and 'Master' proved most beneficial, hence recommended for commercial flower production. Highest returns (701.10 Rs /m^2/ year) were obtained in cultivar 'Dumas' under April planting **(Solan).**

Standardization of propagation technology for hybrid lilies

- Among different growth regulators, IBA (500 ppm) was best for early rooting, earliest bulblet formation, bulblet sprouting, number of leaves/scale and maximum percent response, while NAA (500ppm) alone or in combination with IBA (500ppm) was effective for the production of more bulblets with higher weight and propagation index. Out of propagation media, perlite + vermiculite and cocopeat was the best for all the traits except bulblet size and root length and recommended

for mass propagation of lilium **(Katrain).**

- Cocopeat as growing medium and NAA 500 ppm as auxin treatment was found to be the best combination for propagation of lilies through scaling at **(Solan).**
- Scales treated with 500 ppm NAA and incubated in medium containing Sand + Soil + FYM (1:1:1) resulted in superior propagation indices in all the cultivars at **(Srinagar).**
- Treatment of lilium (LA & Asiatic hybrid) scales with NAA (500 ppm) as quick dip and planting in the cocopeat was found best for bulb and bulblet production at **(Ooty).**

Standardization of growing media

- In lilium, among different growing media, media (sand + soil + FYM) + Vermicompost, 2:1 v/v) was best for plant height, spike length and for early flowering, while media (sand + soil + FYM) + Vermicompost + Cocopeat, 2:1:1 v/v) was found best for maximum flowers, bud length, bulbous traits like number of bulblets, weight of bulbs and size of bulblets. For longer flowering duration sand + soil + FYM, 2:1:1, v/v was found best at **Katrain**
- In lilium, growing medium comprising of [(Sand+Soil+FYM(1:1:1;v/v)] + Vermicompost + Cocopeat; (2:1:1;v/v) is recommended for cut-flower production at **Solan.** The treatment also found superior for flower and bulb production under polyhouse conditions at **Srinagar.**
- For all 3 liium types at **Ooty**, growing medium consisting of (sand+soil+FYM) +vermin-compost+ cocopeat @ 2:1:1, v/v was found superior for flower and bulb production under polyhouse conditions.
- In standardization of growing medium for alstromeria for flower & rhizome production mixture of [Sand+Soil+FYM (1:1:1; v/v)] + Vermicompost + Cocopeat; (2:1:1, v/v) is recommended at **Solan, Kalimpong** and **Srinagar**. Whereas combination of Cocopeat and FYM (1:1; v/v**)** is also found suitable for rhizome multiplication at **Solan.**

Effect of colored shade nets on cut foliage plant (*Asparagus plumosis* and Nephrolepis)

- The 50% green shadenet was found to be effective in respect of the growth and yield parameters of cut foliage fern and asparagus at **Pune, Coimbatore** and **Kalyani.**
- In Boston fern, frond production was maximum under 75% shade at 45 cm x 30 cm distance **(Ludhiana).**
- In Nephrolepis spp., growth characters like height, plant spread, length and breadth of leaves were maximum under black and red nets while maximum height and length of leaves were under red net for Asparagus spp. at **Vellanikkarra.**

Efficacy of media incorporated with Pusa hydrogel on growth and production of quality foliage plants

- Incorporation of 40g of Pusa hydrogel/5kg potting media significantly reduced the frequency of irrigation (once in 5.43 days, 5.0 days and 4.0 days) for the pot grown ornamental foliage plants viz., *Schefflera arboricola*, *Aglaonema commutatum* and *Syngonium podophyllum,* respectively **(Coimbatore).**
- Potting medium incorporated with Pusa hydrogel @ 40 g/5 kg of was the best media and resulted in production of quality foliage plants of *Aglaonema* spp. and *Philodendron xanadu* for better growth. Incorporation of Pusa hydrogel in potting media also reduced the frequency of irrigation and also save 30-40% of quantity of water required at **Ludhiana, Kahikuchi** and **Bengaluru.**
- Incorporation of growing media with 20g of Pusa hydrogel/5kg pot mixture with four days irrigation interval was found to maintain compact growth in *Philodendron serratum* at **Vellanikkarra.**

4. Crop Protection

Disease diagnostics in major ornamental crops of the region

- The survey was conducted during kharif season of 2017. In kharif season of 2017-18 at Kasurdi Dist: Pune, the tuberose showed 3.50% incidence of stem rot with 4.50 % leaf blight intensity, while marigold showed 6.75% leaf blight intensity. At Induri Tal. Rajgurunagar in Pune district the marigold showed 5.5 % leaf blight intensity and Kamini showed 3.50 % wilt incidence. At Dehu, Tal. Haveli, Dist. Pune the tuberose showed 4.75 % stem rot incidence and 5.75 % leaf blight intensity **(Pune).**
- In rose, the incidence of blossom blight (*Botrytis cinerea*) was recorded maximum during the months of December and January under cool and wet weather conditions **(Ludhiana).**
- Two new fungal pathogen *Phoma polyanthis* and *Phoma tuberose* were identified causing leaf spot/blight in single and double type tuberose. Three fungal pathogens causing foliar infection in gerbera selected for cultivating in open conditions were identified. These were *Aschochyta gerberae* in Red Monarch (causes brownish blight originate either from the leaf tip or leaf margin and proceeds towards midrib), *Phoma glomarata* in Red Monarch (causes both blight/leaf spot) and *Botrydiplodia theobromae* in Red Gem (causes leaf spot). In gladiolus, incidence of leaf blight caused by *Stemphyllium botryosum* was observed in the varieties, Red Candyman and White Prosperity in Assam region. Leaf spot/blight caused by *Fusarium equiseti* and *Drechslerarostrata* was recorded in Lucky bamboo and Draceana, respectively **(Kahikuchi).**
- Incidence of *Cucumber mosaic virus* (CMV) 5.5%, *Bean Yellow Mosaic Virus* (BYMV) 15.5%, *Ornithogalum Mosaic Virus* (OrMV) 11.5% and *Tobacco Streak Virus* (TSV) 1.5% on gladiolus was indicated **(Hessaraghatta).**

Control of black spot of rose under open field condition

- Amongst the six fungicides tested, the fungicides azoxystrobin 0.1% and propiconazole 0.1% showed significantly the least disease intensity (5.59% and 6.56%, respectively) of black leaf spot disease and also gives significantly more number of flowers (39.78 and 38.44, respectively) per plant **(Pune).**
- All the fungicides, except for mancozeb, reduced the incidence of disease significantly over the control. The number of flowers per plant was improved significantly by carbendazim and trifloxystrobin **(Ludhiana).**
- Trifloxystrobin + Tebuconazole available as a combination product with 50 and 25% respectively at 0.1% spray at 15 days interval was very effective against black spot with 2-18 PDI **(Hessaraghatta).**

Management of Fusarium wilt in gladiolus

- Pre-storage and pre-planting of corms treatment with captan 0.2% + carbendazin 0.2% for 30 min. + Soil drenching either with captan 0.2% + carbendazim 0.2% or *T. harzianum* @ 10 gm in 1 kg FYM for 10 m^2showed significantly the least disease incidence (5.54 % and 6.47 % respectively) and found at par with each other with maximum flower stalk per plot (11.22 and 10.45 respectively). These treatments also give maximum number of healthy corms and cormels **(Pune, Kahikuchi & Hessaraghatta).**
- First week of July to third week of August is the most suitable time for planting of gladiolus varieties 'Punjab Glance' and 'Punjab Lemon Delight' for early flower production **(Ludhiana).**

Management of collar rot and wilt of carnation

- The root dip with soil drenching and foliar spray with metalaxyl 0.25% after one month of planting (4.92 % collar rot and 7.38 % wilt incidence) was showed significantly the least disease incidence of collar rot and wilt over rest of the treatments **(Pune).**

Evaluation of Bio-efficacy of *Bacillus subtilis*– 1 % W.P. in the management of root knot nematode, *M. incognita* infesting tuberose

- Dipping of tuberose bulbs in *Bacillus subtilis* W. P. (1% suspension @ 10g/L of water) followed by soil application of 5 tons/ha of FYM enriched with *B. subtilis* (5kg) recorded the maximum reduction in nematode population in soil (67.82%) and roots (69.97%). This treatment also recorded the maximum increase in flower (30.81%) and spike yield (25.95%) **(Hessaraghatta).**

5. Post Harvest Technology and Value Addition

Effect of ethylene inhibitors for prolonging keeping quality of cut carnation flowers

- The significantly maximum vase life (8.80days) was noted in AOA-25ppm while maximum flower diameter (5.50cm) was observed in AOA-25ppm and was at par with AOA-50ppm (5.30cm) and significantly higher. Total water absorbed (46.70ml) was recorded more in AOA-25ppm **(Pune).**
- Maximum vase life was recorded in treatment AOA @ 50 ppm **(Ooty).**
- Treatment of carnation (var. Gaudina) stems with ethylene inhibitor amino oxyacetic acid (AOA) at 25 ppm was found to be ideal for increasing the vase life (7.5 days), flower diameter (5.6 cm) and maximum water absorption (44.23 ml) at **Hyderabad**.

Studies on effect of storage of pulsing stock solutions of carnation on their efficacy

- The pulsing solution of Sucrose- 10% + 8 HQC @ 300 ppm+ BA @ 15 ppm of 10X concentration used in the month of December is recommended for more vase life (8.90 days), more flower diameter (6.60 cm) and more total water absorbed (47.35 ml) in carnation **(Pune).**
- Pulsing solution comprising of Sucrose (10%) + 8 HQC (300ppm) +BA (15ppm) can be stored safely under refrigerated condition up to 14 months without losing their effectiveness in increasing the vase life of cut carnation cvs. Bizet and Gwen **(Solan).**
- It was found that storage of stock solutions can be extended up to 4 months **(Hyderabad).**

Studies on effect of storage of holding stock solutions of carnation on their efficacy

- The holding solution Sucrose- 10% +8 HQC @300 ppm+ BA @15 ppm of 10x concentration used in the month of December is recommended for more vase life(9.30days), flower diameter(6.75cm) and total water absorbed (55.40 ml) in cut carnation **(Pune).**
- It is recommended that holding solution comprising of Sucrose (2%) +8-HQC(150ppm) +BA (5ppm) can be stored safely under refrigerated condition up to 14 months without losing their effectiveness in increasing the vase life of cut carnation cvs. Bizet and Gwen **(Solan).**
- It was found that storage of stock solutions can be extended up to 4 months **(Hyderabad).**

Standardization of packing techniques for flower strings

- The marigold flower strings stored in thermocol boxes with ice gel packs retained flower freshness with minimal physiological loss in weight up to 3rd day of storage **(Hyderabad).**
- In marigold packaging flower strings in thermocol box for 1 day was found best with respect to significantly minimum change in fresh weight (5.70%, 10.43% and 19.74%), maximum percent of

fresh flowers (97.24, 83.53 & 53.31) at first, second and third day, respectively with highest acceptability on visual basis at ambient condition **(Navsari).**

- In marigold packaging in bamboo baskets with paper lining and ice pack in the centre was found suitable in respect of PLW (11.90), longevity (5.16 days), percent fresh wt. (34.82) and less rotting (65.52%). While one day storage showed significantly more percent of fresh weight (38.43%), longevity (4.86 days) and less rotting (68.33%) and PLW (10.46). However, interaction between bamboo basket and one day storage duration reported significantly maximum percent fresh wt. (60.90), longevity (6.40 days), less rotting (50.70%) and PLW (7.50) at **Pune.** Similar results were obtained at **Kahikuchi, Ludhiana** and **Periyakulam** centres**.**
- For packaging of marigold strings CFB boxes were found to be more useful alternative to bamboo basket and thermocol boxes. It required less than 50% costing (Rs. 15/kg vs Rs. 7/kg) per kg of flowers compared to the thermocol boxes **(Kalyani).** The boxes also found suitable for storage up to 3 days at **Hessaraghatta.**
- The packing technique for flower string of tuberose packed in bamboo basket and one day storage duration is recommended for more percent fresh weight of flowers (51.62%), and longevity (5.77days) **(Pune).**
- Packaging of tuberose flower strings in bamboo basket and CFB box were at par **(Hessaraghatta).**
- Packing in thermocol box (size 1 x 0.5 feet) with ice packing was found tuberose strings. Flower strings stored at 30.5-33^{0} C and Relative Humidity- 65-75.5% in thermocol boxes (with ice gel packs in the centre) for one day exhibited least weight loss, more freshness and maximum shelf life at **Kalyani** (1.94 days), **Hyderabad** (3 days), **Ludhiana, Kahikuchi** and **Periyakulam**.

Standardization of postharvest treatment using boric acid and sodium benzoate for improving postharvest life of loose flowers of tuberose

- Four percent boric acid treatment to loose flowers of tuberose (variety Prajwal) was found superior with respect to minimum changes of fresh weight (6.91 %, 17.38 %, 29.67 % and 45.74 %) and maximum fresh flowers (98.67 %, 81.00 %, 56.00 % and 35.00 %) at 12, 24, 36 and 48 hours, respectively. The same treatment also recorded maximum longevity (39.33 hrs), minimum rotting (40.25 %) at 48 hrs and highest acceptability on visual basis (8.05) at 36 hrs under ambient condition **(Navsari).**
- The data showed that the treatment Boric acid 5% found statistically superior in respect of change in fresh weight (27.80g), percent fresh weight of flowers (70.80), rotting (50.50%) and longevity (6.50 days) **(Pune).**
- Treatment with Boric acid (2%) found to be sufficient at **(Hyderabad & Periyakulam).**
- Treatment with Sodium benzoate (10 ppm) gave best result of maximum shelf life of 2 days (49.25

hours), highest freshness score (61.43%) along with higher percent bud opening at a lower cost (Rs. 4.32/kg of flowers) **(Kalyani).**

- Sodium benzoate (10 ppm) or Boric acid (5%) was found to be effective **(Ludhiana).**
- Sodium benzoate (25 ppm) or Boric acid (5%) was found to be effective **(Kahikuchi).**

Studies on use of food dyes for tinting of tuberose stems

- Tinting of tuberose cut flowers with food colours such as Lemon yellow, Kesar yellow at 8% concentration for 2 hour was found promising to produce attractive colours to double coloured tuberose spikes **(Hyderabad).**
- Four percent lemon yellow food dye with one hour immersion duration for tuberose stems was found best regarding maximum vase life (6.02 days), opening of florets (49.66%), floret diameter (3.29 cm) and visual appearance with minimum physiological loss in weight (16.91 and 34.04 % at second and fourth day, respectively) **(Navsari).** Similar Results were obtained with cv. Suvasini at **Udaipur.**
- The treatment combination Rose pink 4% for one hour (A10B2) showed more uptake of dye solution (52.20 ml) and more percentage of floret opening at **Kalyani** and **Pune** (47.27%)
- Tinting of tuberose cut flowers with Kesar Yellow and Orange Red both at 8% was found better **(Periyakulam).**
- Tinting of tuberose cut flowers with Kesar Yellow 4% for 1 hour was found better **(Kahikuchi).**
- Color retention was better at lower concentration of food colours evaluated and dye uptake decreased with the higher concentrations tried **(Hessaraghatta).**

Identification of ornamental species for preparation of value added dried products

- *Pinus roxburghii, Pinus wallichiana, Pinus gregii, Cedrus deodara, Agathis robusta, Lagerstroemia flos-reginae, Jacaranda mimosaefolia, Bixa orellana, Celastrus paniculata, Lagurus ovatus, Briza minor, Bromus rubens, Aerva scandens, Iris orientalis, Moraea iridioides, Zea mays, Celosia argentea, Helianthus angustifolius, Anaphalis margaritacea, Phoenix sylvestris, Linum utilissimum, Pennisetum* spp., *Sesamum indicum* and *Sorghum bicolour* **(Solan).**
- The flowers of Gomphrena/ panicles of Golden rod/ peduncles of Golden Rain Tree can be dried best by hanging in inverted position in well ventilated dark room for 4-5 days and can be used up to 6 months **(Ludhiana).**
- Drying of flowers, foliage and pods by embedding in silica gel or oven drying at 50^0 C found to be best with regard to brittleness, colour retention and overall acceptability and can be recommended for adaptation **(Periyakulam).**
- Microwave oven drying (4 min.) for *Antigonon leptopus*, press drying (5 days) for *Barleria obtuse*, press

drying (4 days) for *Calicopteris floribunda*, embedded drying (6 days) for *Cassia fistula* and microwave oven (5 min.) for *Clerodendrum paniculatum* were observed to be the best treatments. Among the ornamental spp. *Cassia fistula* was found to be highly suitable for dry flower **(Vellanikkara).**

- Thirty four botanical were collected, dried and tested for bleaching, drying and value added products such as corner bouquet arrangement, stick materials, carry bags, jewellery box and greeting cards were prepared at **Kalyani** centre.

Standardization of glycerinization for increasing vase life of cut foliages

- Full dip method of glycerinization with 40% concentration of glycerine is recommended for drying cut- foliage of *Buxussem pervirens* and *Polystichum squarrosum, Thuja compacta* and *Cupress ustorulosa.* Maximum cost benefit ratio (**1:2.72)** was obtained by greeting cards prepared from the glycerinized leaves of *Polystichum squarrosum* **(Solan).**
- The foliage of Asparagus, Fern and Silver Oak can be dehydrated by dipping them in 20% glycerine solution in a well ventilated dark room for 7 to 8 days and can be used up to 6 months **(Ludhiana).**
- Glycerinization of cut foliage by full dip method in 20% glycerine solution for 24 hr. is ideal for overall acceptance in terms of texture, brittleness, shape, glossiness and color retention in *Dracaena sanderiana* **(Vellanikkarra).** The same treatment was also found suitable at **Hyderabad.**
- Minimum time taken for drying of cut foliage, maximum texture, minimum brittleness as well as minimum changes in colour of foliage was noted at 20% glycerin solution by uptake method (**Ranchi).**
- Glycerinization of cut foliage by both full dip method and uptake method in 20% glycerine solution was found most effective for increasing the shelf life **(Kalyani).**
- Flower drying using glycerine (20%) through full dip method was found promising for drying and long term storage for Ruscus, Aspedicia spp. and glycerine (10%) for Bird of Paradise **(Hyderabad & Ranchi).**

Effect of holding solutions on keeping quality of orchid stems

- In Dendrobium Sonia-17, harvesting of the flower at bud opening stage coupled with pre-cooling at 12^0 C for 6 hr and keeping in vase solution containing sucrose (4%) + 8 HQS (100 ppm) + citric acid (150 ppm) results in more than 20 days of vase life even at 31.95^0 C and 72.72% RH at **Kalyani** and vase life of 31.40 days at **Kalimpong**. The treatment was also found effective in improving vase life of *Dendrobium* cv. Sonia at **Vellanikkarra.**
- Holding solution (Sucrose (4%) + 8 HQS (100 ppm) + citric acid (150 ppm)) was found effective for improving the vase life of The maximum vase life was observed when the spikes were treated with a holding solution containing 50% coconut water, 4% sucrose and 0.2% sodium hypochlorite (NaOCl) **(Kahikuchi).**

भाकृअनुप–पुष्पविज्ञान अनुसंधान निदेशालय

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