



वार्षिक प्रतिवेदन Annual Report 2014-15



भा.कृ.अनु.प.- पुष्प विज्ञान अनुसंधान निदेशालय
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ICAR-Directorate of Floricultural Research

College of Agriculture Campus, Shivajinagar, Pune-411005, Maharashtra, India

Annual Report 2014-15



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Preface

Floriculture is getting attention globally due to change in the lifestyle of people, concern for environment, conscious efforts towards greening and better purchasing capacity of people. The natural worth of rich bio-diversity of ornamentals provides countless opportunities to harness their potential. The domestic industry is growing at an impressive annual rate of 7-10%. Apart from cut flowers and loose flowers, value added products like dry flowers and foliage, essential oils, nutraceuticals, natural colours, etc. are gaining an uptrend. It is estimated that 232.74 thousand ha area is under flower cultivation in 2012-13 and is concentrated mainly in Tamil Nadu, Andhra Pradesh, Maharashtra and West Bengal (NHB 2013). During 2012-13 production of loose flowers was estimated to be 1.729 million metric tonnes (MT) and cut flowers 7673.18 million number. The country has exported 2.712 million MT of floriculture products having worth of Rs.4234.4 million in 2012-13 (APEDA-DGCIS, 2014).



To strengthen the research on floriculture, the AICRP on floriculture, was established during the IV Five Year Plan in the year 1970-71 to carry interdisciplinary research at the national level which has been further upgraded to Directorate of Floricultural Research (DFR), at New Delhi in December, 2009 during XI Plan (2010-11) to invigorate the floriculture research in India. The Annual Progress Report 2014-15 in hand highlights the programmes and achievements made by the DFR during the period from 1st April 2014 to 31st March, 2015.

I extend my debt of gratitude to Dr. S. Ayappan, Hon'ble Secretary, Department of Agricultural Research and Education (DARE) and Director General, ICAR and Dr. N. K. Krishna Kumar, Deputy Director General (Horticultural Science) for their constant encouragement, support and guidance. I would like to express my gratitude to Dr. T. Janakiran, ADG (Horticultural Science), ICAR, New Delhi for their valuable guidance.

The support provided by the scientific and administrative staff of the Directorate is duly recognised and I place on record my appreciations to all of my colleagues for efforts in compilation, editing and vetting of the Annual Report.

A handwritten signature in black ink, appearing to be 'K. P. Singh', written in a cursive style.

(K. P. Singh)
Director (Acting)

Executive Summary

Directorate of Floricultural Research (DFR) as an Institute under Indian Council of Agriculture research was formally launched on 10th December, 2009 during the XIX Group meeting of All India Coordinated Research Project on floriculture held at Indian Agricultural Research Institute (IARI), New Delhi to promote and strengthen floricultural research and enhance the technological base in floriculture the first of its kind in the Country. Initially it was established in IARI Campus, New Delhi. Recently, the Directorate has been shifted to its new location i.e. College of Agriculture Campus, Shivajinagar, Pune, Maharashtra. The institute is at its infancy at the new location. Land acquisition has been completed and field preparations and planting is in progress. There are nine institutional projects under four mega projects on Crop improvement, Production technology, post harvest technology and crop protection. The following externally funded projects, Validation of DUS testing Guidelines for Tuberose, Validation of DUS testing Guidelines for Gladiolus, new initiative project on protected horticulture, ICAR Consortia research platform for management of borers in horticulture crops and studies on male sterility systems to increase the efficiency of F₁ hybrids in Horticultural crops (marigold) are also running in ICAR-DFR.

Improvement of Commercial flower crops and Standardization of production Technology

- Gladiolus germplasm brought from Delhi has been planted at the Pune condition in the current year. Morphological data were collected and it was found that the cultivars like Yellow Stone, Jester, Jester Gold, Invitatie, Snow Princess, Priscilla, Purple Flora, Chemistry, Ocilla, Plumart, Forta Rosa, Prince Margarate Rose, San Remo, Deepest Red, Chinon, Charisma, Chimarosa were performed better as compared to Mascagni, Argentina, New wave, Essential, Ice Cap, Gold Field, Limoncello, Cha Cha and Bangladesh. In miniature group two cultivars Flevo Amoico and Flevo Laguna performed significantly better under Pune condition.
- Chrysanthemum germplasm (40 varieties namely Neelima, Purnima, Red Stone, Punjab Gold, Rajahmundry, Basanti, Local Batton, Freedom, Yellow Star, Punjab Anuradha, Rekha, Poonam, Ace, Anmol, Pankaj, Chandrika, Priya, Raichoor, Rajat, Sabita, Yellow Charm, Sony, Garden Beauty, Winter Queen, Flirtation, Ratlam Selection, Ravikiran, Approva Shringar, Statesman, Yellow Gold, Akitha, Mother Teresa, Salora, Terry, Agnidev, Agnipath, ArkaPikn Star, Co-2, Malikka, and Vasanthika) were brought and planted at Pune.
- Seeds of six species (*Zyosia junisia*, *Cynodon dactylon*, *Diechondra*, *Agrostis stolonifera*, *Eragrostis curvula*, *Poa pratensis*) of lawn grasses were planted in pots at DFR Pune. Five dwarf mutant lines (DFR 440, DFR-C-444, DFR-C-445, DFR-C-446 and DFR-C-448) were planted at Pune and maintained at IARI Research farm Delhi to evaluate the performance.
- Standardization of procedure for molecular characterization of turf grasses by Inter-Simple Sequence Repeat (ISSR) markers has been undertaken.

Plant Protection of commercial flower crops

- Survey was undertaken in crops like gerbera, rose, carnation, China aster, tuberose and annual chrysanthemum in Pune and nearby areas. The incidence of *Helicoverpa armigera*, *Spodoptera*

litura, *Liriomyza trifolii*, *Scirtothrips dorsalis* and *Tetranychus urticae* were recorded at varying levels. *Tetranychus urticae*, *Spodoptera litura* and *Liriomyza trifolii* were found to be major limiting factors under polyhouse in gerbera. While *Tetranychus urticae* and *Scirtothrips dorsalis* were found to be a major limiting factors in rose under polyhouse. Aphids, leafhoppers, mirid bugs and bud borer (*Helicoverpa armigera*) were recorded on different gladiolus germplasm. Mirid bugs, aphids, thrips and bud borer (*Helicoverpa armigera*) were recorded on different aster germplasm at varying magnitude in Pune condition.

- In the research field of the directorate, 40 varieties of chrysanthemum were evaluated for insect pest infestation. Aphids, Leaf bugs (Miridae: Hemiptera) and thrips were found to be infesting chrysanthemum.
- 65 varieties of gladiolus were screened for insect pest incidence. Aphids, leafhoppers, leaf bugs (Miridae: Hemiptera) and bud borer (*Helicoverpa armigera*) were found to be infesting gladiolus.
- Study on the incidence of different viral and phytoplasmal diseases of flower crops under Pune conditions was undertaken. The following diseases observed under polyhouse or field conditions were Crown gall, Powdery mildew, Anthracnose, Mosaic and flower colour breaking in Rose; leaf blight, flower malformation, phyllody, mosaic, yellowing, oak leaf pattern in Gerbera; leaf spot and stem rot in Tuberose; stunting and witches-broom in Marigold; yellows, stunting, phyllody and flower malformations in China aster; stem rot and leaf blight in Tuberose; rust in Golden rod; Mosaic and leaf malformations in Chrysanthemum and Fusarium yellows, Mottling and flower colour breaking in Gladiolus. Electron microscopy and molecular diagnostics identified infection of Potyvirus in Gladiolus with mottling and colour-breaking.
- A survey conducted in Pune region to assess the incidence of root-knot nematode on tuberose indicated that the 50 to 70% of individual tuberose fields showed severe stunted growth and reduced number of spikes with severe root-galling due to root-knot nematode (*Meloidogyne* spp.) infestation.

Publications/Training/Conferences/Seminar etc.,

- Ten research papers were published during 2014-15 in various national and international journals.
- All the scientists participated and presented their research findings in one or more national conferences, symposia, seminar etc.,
- To strengthen the linkage with farmers, the Directorate participated in Krishi Vigyan Mela organised by KVK, Naraingaon, Pune (6-8 January, 2015) and Central Potato Research Station, Patna (19-21 February, 2015). A field demonstration was also conducted at farmer field in Village Nirwana district Muzaffarnagar (Uttar Pradesh) jointly with DFR and KVK Baghra, Muzaffarnagar.

Other activities

- The Directorate of Floricultural Research celebrated its fifth Foundation Day on December 10, 2014. Dr. S. K. Sharma, Head, ICAR-IARI Regional Station, Pune was the Chief Guest of the function. The third Research Advisory Committee (RAC) meeting of DFR was held on 9-10 February, 2015 under the chairmanship of Dr. V.A. Parthasarathy, Formerly Director, ICAR- Indian Institute of Spices Research, Calicut.
- The meetings of the Institute Research Committee (IRC-2014-15) to review the progress made during the last year and to examine the newly approved research projects was held on 11.12.2014, 23.12.2015 and 26.03.2015 under the Chairmanship of Dr. K. P. Singh, Director, DFR & Chairman, IRC.

About the Directorate

ICAR-Directorate of Floricultural Research (DFR) as an Institute under Indian Council of Agricultural Research was formally launched on 10th December, 2009 during the XIX Group Meeting of All India Coordinated Research Project (AICRP) on Floriculture, held at ICAR-Indian Agricultural Research Institute (IARI), New Delhi, to promote and strengthen floricultural research and enhance the technological base in floriculture, the first of its kind in the Country. Initially, it was established in IARI campus, New Delhi. Recently, the Directorate has been shifted to its new location i.e. College of Agriculture Campus, Shivajinagar, Pune, Maharashtra. Presently, AICRP on Floriculture is an integral part of the DFR, having 21 Centres comprising of 15, Budgetary, four Institutional and two Voluntary centres.

Considering the research needs and potential of floriculture in India, the mandate of the DFR has been revised to provide the technological support to the growers and entrepreneurs that help in providing employment generation and prosperity to the rural youth.

Mandate

- Effective management, enhancement, evaluation of genetic resources and development of improved cultivars, with high quality characteristics for export, productivity and resistance to pests and diseases.
- To undertake basic, applied and strategic research for addressing national problems, enhance productivity, shelf life, product diversification and value addition.
- To develop technologies for protected cultivation of flowers.
- To act as a repository of scientific technology and information relevant to floriculture and develop region specific technologies.
- To frame policy research and intensify outreach programme. To act as an advanced centre for training for up gradation of scientific manpower in modern technologies of flower production.
- To collaborate with relevant national and international agencies to bring synergy between the technologies.

Vision

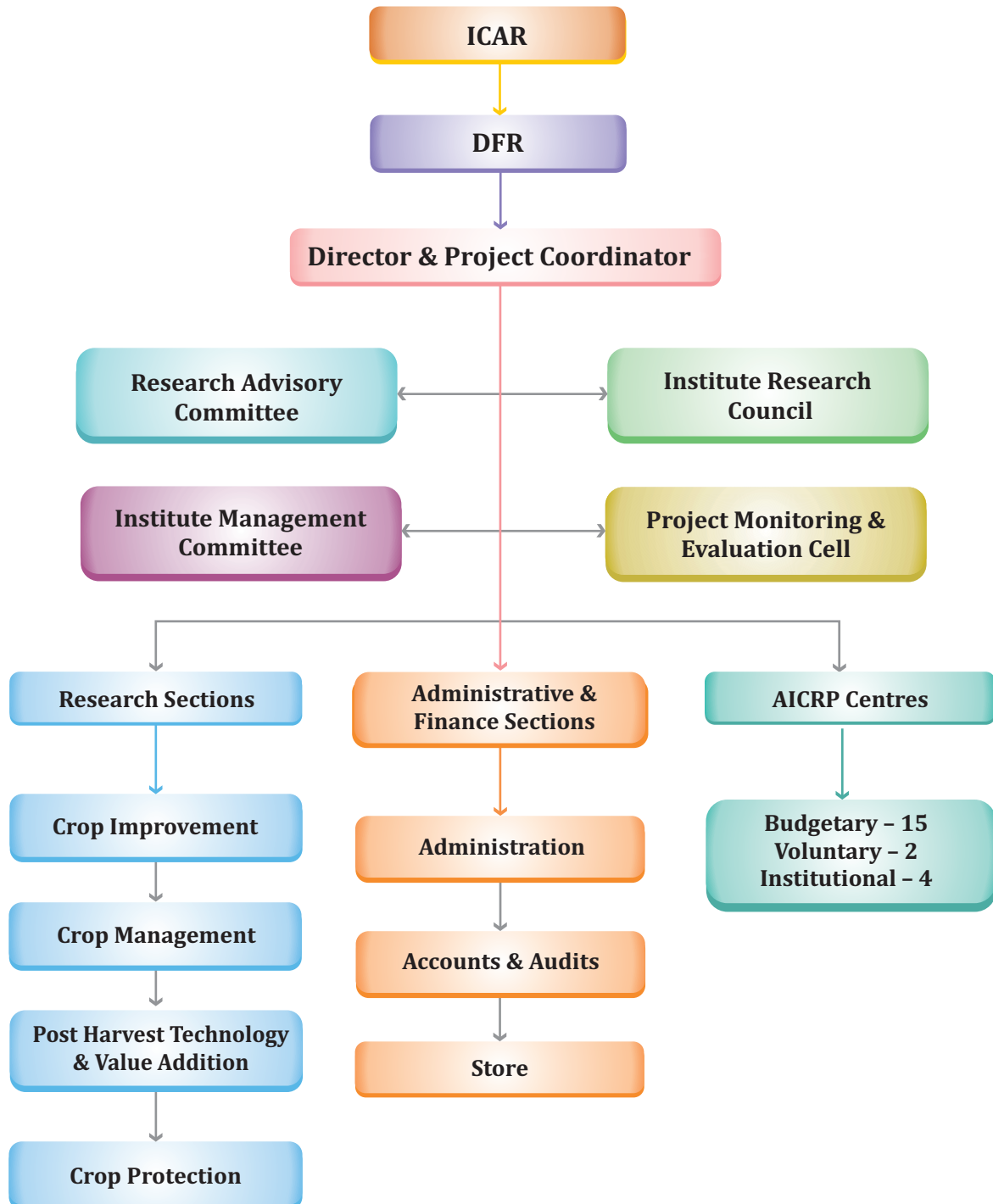
Harnessing the research and development activities in flower crops and landscape gardening for promotion of domestic and export markets.

Mission

To carry out research, impart education, conduct out-reach programmes in floriculture and landscaping with national and international partners for enhancing the production, productivity, profitability besides alleviating the rural poverty.



**Organizational Structure of
ICAR-Directorate of Floricultural Research, Pune**



Salient Research Achievements

Mega project: Improvement of Commercial Flower Crops

Project01: Breeding of gladiolus for quality and yield

The corms of 65 cultivars of gladiolus brought from Delhi were planted in Shivajinagar farm. The morphological data were collected and it was found that the cultivars like Yellow Stone, Jester, Jester Gold, Invitatie, Snow Princess, Priscilla, Purple Flora, Chemistry, Ocilla, Plumart, Forta Rosa, Prince Margarate Rose, San Remo, Deepest Red, Chinon, Charisma, Chimarosa were performed better as compared to Mascagni, Argentina, New Wave, Essential, Ice Cap, Gold Field, Limoncello, Cha Cha and Bangladesh. In miniature group, two cultivars Flevo Amico and Flevo Laguna performed better under Pune condition. The observations on corm characters will be taken after lifting of corms.

Crossing was attempted in six selected parents. Parents selected were, Yellow Stone, Plumart, Snow Princess, Purple Flora, Flavo Laguna and Flavo Amico. The setting behavior of crosses were observed and found that most of the crosses failed to set the seeds. Few crosses set the seed and these were harvested. It was found that cultivars viz., Yellow Stone, Purple Flora, Snow Princess, Plumart, Flavo Amico, Flavor, Laguna, Punjab Dawn, Candani Priscilla have good seed setting ability through open pollination. The open pollinated seeds of some of these cultivars were harvested and germination behavior will be studied in coming season.

The cultivars developed at IIHR, PAU and IARI were also evaluated and found Arka Amar, Arka Kesar, Urmil, IIHR-G-11 and IIHR-G-12 from IIHR, Pusa Kiran, Pusa Suhagin Chandani and Dhanvantari from IARI and Punjab Dawn, Punjab Lemon Delight, Punjab Elegance from PAU, Ludhiana performed better. The corms of all these cultivars will be lifted and data will be collected for corms yield and quality. These will be then stored for next season planting.

Project02: Breeding of Chrysanthemum for quality flowering and pot mums

The germplasm of 40 genotypes namely, Neelima, Purnima, Red Stone, Punjab Gold, Rajahmundry, Basanti, Local Batton, Freedom, Yellow Star, Punjab Anuradha, Rekha, Poonam, Ace, Anmol, Pankaj, Chandrika, Priya, Raichoor, Rajat, Sabita, Yellow Charm, Sony, Garden Beauty, Winter Queen, Flirtation, Ratlam Selection, Ravikiran, Approva Shringar, Statesman, Yellow Gold, Akitha, Mother Teresa, Salora, Terry, Agnidev, Agnipath, Arka Pkn Star, Co-2, Malikka, and Vasanthika were brought and planted at new location i.e. Pune in the small space provided by the University. Since, the planting was done late, the plants could not attained proper vegetative growth. The germplasm are surviving. Suckers of these genotypes were formed and will be planted after field preparation.

Project03: Improvement of lawn grasses for turf

Seeds of six species (*Zyosia junisia*, *Cynodon dactylon*, *Dichondra*, *Agrostis stolonifera*, *Eragrostis curvula*, *Poa pratensis*) of lawn grasses were planted in pots at DFR Pune. Five dwarf mutant lines (DFR 440, DFR-C-444, DFR-C-445, DFR-C-446 and DFR-C-448) were planted at Pune to evaluate the performance. Standardization of procedure for molecular characterization of turf grasses by inter-simple sequence repeat (ISSR) markers has been undertaken.

Mega project: Standardization of Production Technology in Commercial Flower Crops

Project 01: Production Technology of Tuberose

Characterization of genetic diversity in tuberose cultivars using RAPD and ISSR markers

Characterization of germplasm provides description of the material for their identification, conservation, management and utilization in crop improvement programs. Under the present study, molecular diversity among the 12 genotypes of tuberose namely, Hyderabad Single, Shringar, Mexican Single, STR-505, Pearl Double, Suvasini, Calcutta Double, Vaibhav, Sikkim Selection, GKT C-4, Arka Nirantara and Swarn Rekha was assessed using randomly amplified polymorphic DNA (RAPD) and its inter simple sequence repeat (ISSR) markers. Out of 80 RAPD and 47 ISSR primers initially screened, 16 RAPD primers and 9 ISSR primers that produced a clear and reproducible band were chosen for further study. A total of 86 bands were amplified with 16 selected RAPD polymorphic primers (5.37 bands per primer) of which 70 (80.12%) were polymorphic with an average of 4.37 band per primer ranging between 1 (SBSB-17) to 6 (SBSD-16, SBSC-11) and ranged in size from 100-3000bp. ISSR primers amplified a total of 40 scorable fragments (4.44 bands per primer) ranging between 2 (UBC-856) to 8 (UBC-834) fragments with a size of 100-3000bp. Thirty six fragments (92.22%) with an average of 4.1 per primer were polymorphic. The highest diversity at individual level has been due to clonal method propagation used to maintain the cultivars. Clustering of cultivars within RAPD groups remained more or less similar in ISSR and combined data of RAPD and ISSR. The RAPD and ISSR markers may be utilized for characterization of large collection of tuberose genotypes and for genetic improvement using molecular breeding methods.

Morphological characterization of tuberose germplasm using DUS testing

As there is much confusion in the naming of genetic material existing in various Indian states as they are exclusively referred to as single genotype and all the local doubles probably from another. The major thrust at present is to maintain their purity besides registration (patents) and commercial release of new varieties. Therefore, an attempt was made to characterize most of the already released tuberose varieties over years so as to develop identification keys that are reliable and relatively easy to perform while implementing DUS testing. The morphological characterization of fifteen genotypes clearly brought out the differences. The result indicated that these genotypes did not differ significantly when one trait i.e. leaf waxiness of vegetative character are taken into consideration. However, distinct differences were noticed in thirteen floral characters and ten in foliage (vegetative character). The study on tuberose genotypes has successfully demonstrated that fifteen genotypes of tuberose differ significantly in 13-10 characters, which makes the candidate genotype eligible to seek protection in future.

Effect of chemicals with packaging and storage on shelf life of tuberose cultivars

For prolonging the shelf life, tuberose florets (in buds) were harvested from cv. Prajwal, Arka Nirantara and Mexican Single and their shelf life of the harvested buds was studied with boric acid (2%, 3% and 4%) and citric acid (150ppm, 300ppm and 450ppm). The treated buds were kept in polypropylene (PP) bags with or without vent (0.2%) at 4°C. It was found out that cultivar Arka Nirantara had maximum number of open flowers (45.33%) after five days of treatment in citric acid at 450 ppm with the vented polypropylene bags. The fresh weight loss of the same cultivar was minimum (14.628%) in the vented PP bags with 2% boric acid. In cultivar Mexican Single, 150ppm citric acid and 2% boric acid were at par for shelf life of flowers opening (11.56 and 11.5 days, respectively) in non-vented PP bags. The cultivar Prajwal also produced maximum percentage (30.67%) of bud open after 5 days in 450ppm citric acid i.e. with vented polypropylene bags. The maximum CO₂ rate (129.04ml CO₂/kg/l) with zero bud rotting was also observed in cv. Prajwal in the treatment of 450 ppm citric acid with vented polypropylene bag.

Mega project: Post-harvest Management and Value Addition

Project 02: Standardization of drying techniques for flowers and greens

Trials on Solar Drying of *Limonium*

A filed solar tunnel drier was designed and erected at the DFR research field. UV Stabilized Polyethylene sheet of 200 micron thickness was used for the experiment. Inside tunnel floor was covered with black polythene sheet to absorb more solar radiation. Chimney was fixed on the top with 5cm dia PVC pipe. Nylon net was attached in the front and back of the drier to improve the air flow. Solar drying characteristics of *Limonium* under different bed thickness were analyzed. Sun drying of *Limonium* on a black polythene sheet with different bed thickness was also carried out and compared with the solar drying and hot air drying methods.



Fig1: Solar tunnel drier in DFR research field – Delhi

Table 1: Hot air Drying (60°C) characteristics of *Limonium* with different bed thickness (0,5,10 cm)

Time (h)	Moisture content (db)			Drying rate (g/h.100g)		
	0 cm	5 cm	10 cm	0 cm	5 cm	10 cm
0	376.2	376.2	376.2			
2	245.6	296.0	311.6	65.29	40.09	37.30
4	156.2	212.2	215.1	55.01	40.99	40.28
6	71.7	158.6	169.2	50.75	36.27	34.50
8	28.9	90.7	108.9	43.41	35.69	33.42
10	12.8	68.1	73.7	36.34	30.80	30.25
12	11.7	40.5	51.3	30.38	27.98	27.08
14	10.0	25.5	30.8	26.16	25.05	24.67
16	10.0	12.2	22.2	22.89	22.75	22.12
18	—	10.9	18.9	—	20.29	19.85
20	—	10.1	12.6	—	18.30	18.18
22	—	10.1	10.9	—	16.64	16.61
24	—	—	10.2	—	—	15.25
26	—	—	10.2	—	—	14.08

Table 2: Solar Drying characteristics of *Limonium* with different bed thickness (0,5,10 cm)

Time (h)	Moisture content (db)			Drying rate (g/h.100g)		
	0 cm	5 cm	10 cm	0 cm	5 cm	10 cm
0	376.2	376.2	376.2	—	—	—
2	269.1	313.9	329.7	53.55	31.16	23.26
4	180.7	229.2	274.4	48.88	36.74	25.46
6	107.6	151.8	246.6	44.76	37.40	21.60
8	53.2	97.1	210.0	40.37	34.88	20.78

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Time (h)	Moisture content (db)			Drying rate (g/h.100g)		
	10	30.7	79.1	163.3	34.55	29.71
12	17.5	67.0	135.7	29.89	25.77	20.04
14	12.6	49.7	108.7	25.97	23.32	19.11
16	11.5	31.9	84.3	22.79	21.52	18.24
18	10.4	18.4	50.8	20.32	19.88	18.08
20	10.4	12.5	34.2	18.29	18.19	17.10
22	—	10.5	20.3	—	16.62	16.18
24	—	10.5	12.4	—	15.24	15.16
26	—	10.5	10.9	—	14.06	14.05
28	—	—	10.7	—	—	13.05
30	—	—	10.7	—	—	12.18
32	—	—	10.7	—	—	11.42

Table 3: Sun drying characteristics of *Limonium* with different bed thickness (0, 5, 10 cm)

Time (h)	Moisture content (db)			Drying rate (g/h.100g)		
	0 cm	5 cm	10 cm	0 cm	5 cm	10 cm
0	376.1905	376.1905	376.1905	—	—	—
2	286.2685	319.7378	334.9353	44.92	28.24	20.64
4	221.7962	277.3514	263.1775	38.56	24.72	28.27
6	151.6684	231.9642	264.4942	37.38	24.05	18.62
8	87.76157	174.5738	216.546	36.02	25.21	19.96
10	36.2968	113.8075	152.9076	33.95	26.25	22.34
12	18.76485	92.42671	127.8912	29.76	23.66	20.70
14	14.24047	65.98211	108.251	25.83	22.17	19.15

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Time (h)	Moisture content (db)			Drying rate (g/h.100g)		
16	12.54383	38.59975	84.8804	22.70	21.11	18.21
18	11.41274	28.84713	50.31819	20.24	19.30	18.11
20	10.84719	16.28125	36.05442	18.25	18.00	17.01
22	10.84719	14.2182	25.85034	16.59	16.46	15.93
24	10.84719	12.53024	21.13232	15.21	15.16	14.80
26	—	11.59249	15.97542	—	14.03	13.86
28	—	10.84229	13.23239	—	13.05	12.97
30	—	10.84229	12.02546	—	12.18	12.14
32	—	10.84229	10.92824	—	11.4212	11.41
34	—	—	10.92824	—	—	10.74
36	—	—	10.92824	—	—	10.15



Fig 2: Sun drying of *Limonium* on black polythene sheet with different bed thickness

Data analysis on wet drying of Marigold

Marigold flowers were dried under wet drying method using nine different combinations of PEG, Glycerol, Ethanol and Polypropylene. After drying, the effect of different treatments and its combinations were analyzed based on the flower colour and its size. The colour was analyzed by Sigma Pro software.

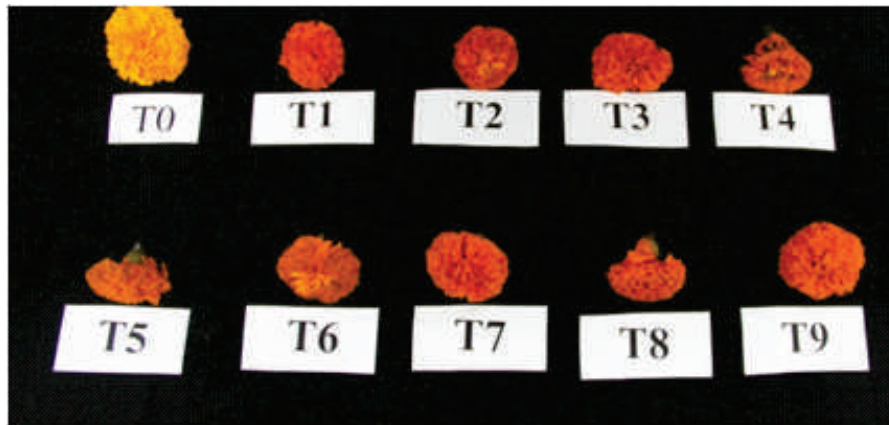


Fig 3: Control vs wet dried Marigold flowers

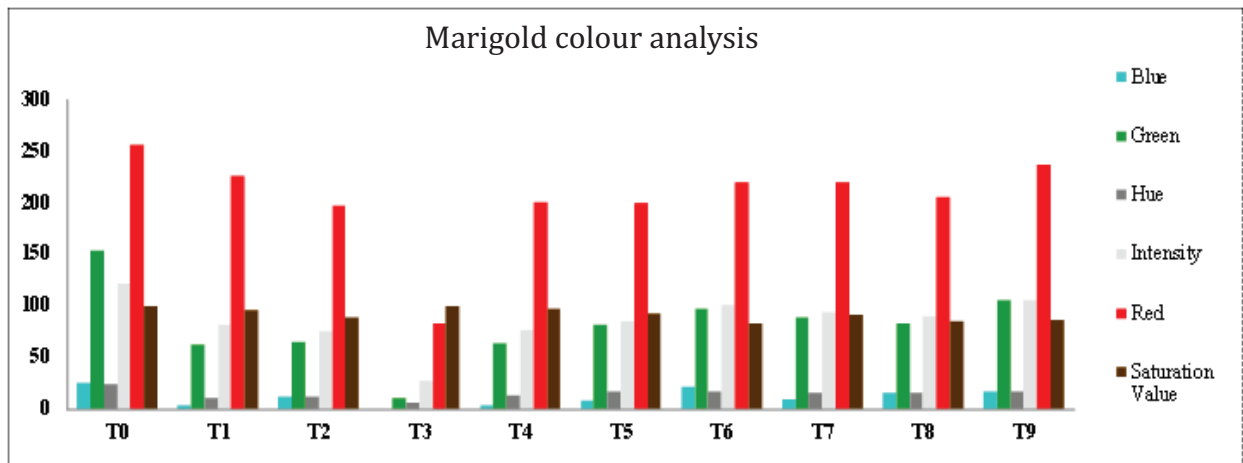


Fig 4: Colour analysis of wet dried marigold flowers using Sigma pro software

Table: 3 Change in marigold flower weight and parameter during wet drying process
(I - 0 h, II - 24 h, III - 48 h)

Treatments	Flower weight (g)			Flower diam (mm)		
	I	II	III	I	II	III
T1	11.50	5.57	3.23	51.8	39.1	35.5
T2	10.60	6.93	3.50	52.3	38.7	34.1
T3	11.83	6.10	3.93	57.0	44.1	42.0
T4	12.73	7.90	4.67	57.0	38.6	37.0
T5	11.42	8.97	45.20	57.0	50.2	45.2

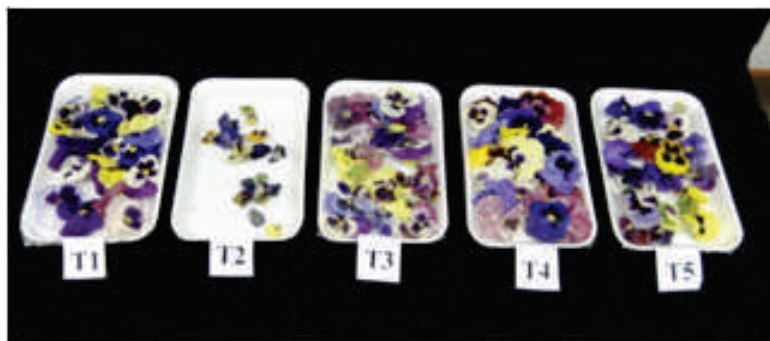
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Treatment	Flower weight (g)			Flower diam. (mm)		
	I	II	III	I	II	III
T6	9.76	5.17	4.00	54.1	33.0	36.4
T7	10.39	6.07	4.87	53.6	43.3	42.9
T8	10.07	7.40	5.13	55.6	41.2	43.7
T9	10.47	6.63	5.00	54.8	43.5	42.2

DFR 03-03: Nutraceuticals studies on flowers

Lutein content in 5 different marigold varieties has been analyzed under HPLC. Apart from that edible flower like pansy was packed with different packaging material and its shelf-life was analysed. The packaging materials used for the study were LDPE, PP, LDPE with antifog, LDPE micro-perforated bags. The flowers were washed with calcium chloride (2%) solution before packaging. The packed flowers were kept under refrigerated condition and evaluated for its shelf-life. Shelf-life of the flowers were evaluated with the parameters like sensory analysis, weight, TSS, moisture content, microbial load and polymeric colour index.



Shelf-life studies on edible pansy flowers with different packaging material

Mega project: Plant Protection of Commercial Flower Crops

Project 01: Insect-pest management in commercial flower crops

- Population dynamics of pollinators in winter annuals shows, honey bees are major pollinators followed by hover flies and bees. The pollinators activity was more during morning hours compared to noon and after-noon hours under Delhi condition. *Helicoverpa armigera* was found to be feeding on the pods of annual flowers. A pentatomid bug was found to be feeding on the pods of poppy under Delhi condition.
- Survey was undertaken in crops like gerbera, rose, carnation, China aster, tuberose and annual chrysanthemum in Pune and nearby areas. The incidence of *Helicoverpa armigera*, *Spodoptera*

litura, *Liriomyza trifolii*, *Scirtothrips dorsalis* and *Tetranychus urticae* were recorded at varying levels. *Tetranychus urticae*, *Spodoptera litura* and *Liriomyza trifolii* were found to be a major limiting factors in gerbera under polyhouse. *Tetranychus urticae* and *Scirtothrips dorsalis* were found to be a major limiting factors in rose under polyhouse.

- Aphids, mirid bugs and thrips were recorded on different chrysanthemum germplasm. Aphids, leafhoppers, mirid bugs and bud borer (*Helicoverpa armigera*) were recorded on different gladiolus germplasm. Mirid bugs, aphids, thrips and bud borer (*Helicoverpa armigera*) were recorded on different China aster germplasm at varying magnitude under Pune condition.



Bud borer, *Helicoverpa armigera* damage on winter annuals

Incidence of bud borer, *Helicoverpa armigera* on various winter annuals

Sl. No.	Crop	No. of larvae per plant
1	Cosmos	0.58 - 1.78
2	Coreopsis	0.32 - 1.68
3	Hollyhock	0.54 - 1.12
4	Malva sylvestris	0.32 - 0.85
5	California poppy	0.44 - 1.50

Incidence of bud borer, *Helicoverpa armigera* on various winter annuals

Village/Place	Crop
Arvi	Tuberose, China aster and annual chrysanthemum
Kusur	China aster
Gunawadi	Tuberose and China aster
UruliKanchan	Tuberose, rose and gaillardia
Sortapwadi	Tuberose, rose, gerbera, gaillardia and spider lily
Alandi	China aster, marigold
LoniKalbhori	Carnation, rose, tuberose
Hi-Tech Floriculture Park, Talegaon Dabhade	Gerbera, rose, chrysanthemum, China aster

Incidence of insect pests on various crops under polyhouse

Crop	Insect pest	Infestation/ damage (%)
Gerbera	Cut worm, <i>Spodoptera litura</i>	0.64 - 2.28
	Leaf miner, <i>Liriomyza spp.</i>	3.56 - 7.79
	Mites, <i>Tetranychus urticae</i>	72.08 - 121.26
	Thrips (unidentified)	1.12 - 7.50
Rose	Mites, <i>Tetranychus urticae</i>	60.50 - 150.50
	Thrips, <i>Scirtothrips dorsalis</i>	1.32 - 6.06
	Bud borer, <i>Helicoverpa armigera</i>	0.99 - 1.68
Carnation	Mites, <i>Tetranychus urticae</i>	11.68 - 18.42
	Bud borer, <i>Helicoverpa armigera</i>	0.11 - 0.58



Incidence of insect pests on various crops under open field condition

Crops	Insect pests	Infestation/ damage (%)
Rose	Thrips, <i>Scirtothrips dorsalis</i>	2.32 - 7.22
	Bud borer, <i>Helicoverpa armigera</i>	2.25 - 4.50
	Scale insects (unidentified)	0.10 - 0.65
China aster	Leafhoppers (unidentified)	0.50 - 2.25
	Bud borer, <i>Helicoverpa armigera</i>	0.10 - 1.50
	Thrips (unidentified)	0.54 - 0.72
	Aphids, <i>Aphis gossypii</i>	0.50 - 1.25
Tuberose	Thrips (unidentified)	0.10 - 1.20
	Mealybugs (unidentified)	0.11 - 1.25
Annual chrysanthemum	Aphids (unidentified)	0.05 - 0.10

In the research field of the directorate, 40 genotypes of chrysanthemum were evaluated for insect pest infestation. Aphids, leaf bugs (Miridae: Hemiptera) and thrips were found to be infesting chrysanthemum. 65 genotypes of gladiolus were screened for insect pest incidence. Aphids, leaf hoppers, leaf bugs (Miridae: Hemiptera) and bud borer (*Helicoverpa armigera*) were found to be infesting gladiolus. Insect pest incidence in four cultivars of China aster, Leaf bugs (Miridae: Hemiptera), aphids, thrips and bud borer (*Helicoverpa armigera*) were found to be infesting China aster at varying magnitude. Insect pest incidence on two cultivars of marigold was recorded. Thrips and aphids were found to be infesting marigold.



Bud borer damage in rose



Red spider mite on rose



Leafminer damage in gerbera



Red spider mite in gerbera



Spodoptera litura damage in gerbera



Thrips damage in gerbera

Insect pests on various crops under polyhouse



Mirid bug on chrysanthemum



Leafhopper on chrysanthemum



Leafhopper in China aster



Mirid bug in China aster



Bud bore in China aster



Aphids in gladiolus



Mealybug in tuberose



Thrips damage in tuberose

Insect pests on various crops under open field condition

Project 02: Investigations on virus and phytoplasma diseases of commercial flower crops

Studies on the incidence of different viral and phytoplasmal diseases of flower crops under Pune conditions was undertaken.

- 1) As part of survey of open/protected cultivation following field/units were visited and observations were made.

Sl. No.	Units/Field	Crops	Disease symptoms observed
a)	High-tech horticulture unit, College of Agriculture, Pune	Gerbera, Rose	Rose - Crown gall, Mosaic Gerbera - Leaf blight, Flower malformation
b)	KVK, Narayangaon	Tuberose, Marigold, China aster	Tuberose - Leaf spot and stem rot Marigold-Stunting and witches broom- Stolbur China aster- yellows, stunting, phyllody and flower malformations
c)	AICRP (Floriculture) Ganeshkhind, Pune	Tuberose, Gerbera, Golden rod	Tuberose - Stem rot and Leaf blight Gerbera-phyllody, mosaic, yellowing, oak leaf pattern Golden rod- rust
d)	KF Bioplants, Manjri	Gerbera	Phyllody and flower malformations
e)	MIDC Floriculture Park, Talegaon	Rose, Chrysanthemum	Rose - Crown gall, Powdery mildew, Anthracnose, Mosaic and flower colour breaking Chrysanthemum - Mosaic
f)	China aster field, College of Agriculture (MPKV), Pune	China aster	Stunting, witches broom, flower malformation and phyllody Leaf spot in early stage and wilt later stage

- 2) Electron microscopy of symptomatic samples suspected for virus infections was undertaken for the following samples.

Crops, variety	Symptom	Results
Gerbera		
a) Circuit variety	Mosaic and oak leaf pattern	No virus particle observed
b) Cash	Mosaic and yellowing	-do-
c) Terra aquatica	Leaf cupping, curling and mosaic	-do-
d) Terra excite	Phyllody, crinkling, mosaic	-do-

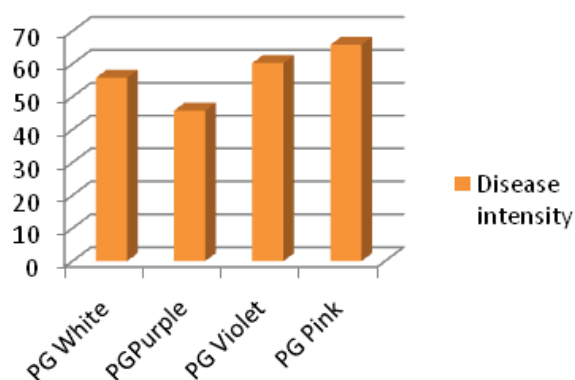
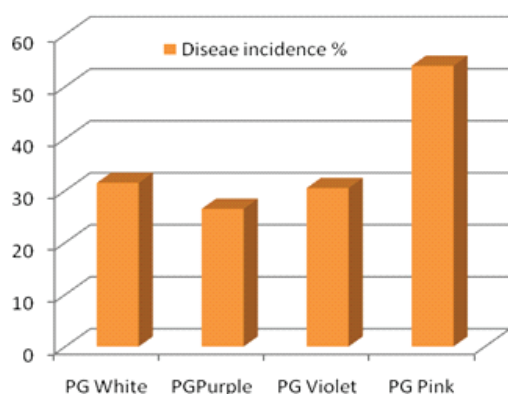
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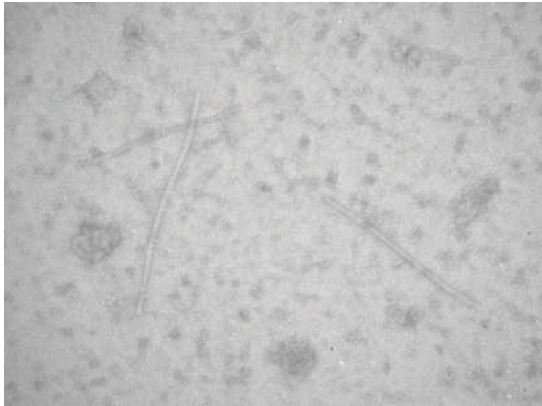
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Crops (variety)	Symptoms	Results
Jasmine (Madan ban local)	Yellow ringspots	Flexuous particle seen indicating Potyvirus infection
Gladiolus - Priscilla	Mottling, Leaf streak and flower colour breaking	Flexuous particle of similar size of Potyvirus seen - Indicates infection of Bean yellow mosaic virus (BYMV) Isometric particles were also seen mixed with flexuous particles indicates infection of Cucumber mosaic virus (CMV)
Chrysanthemum		
a) Local button	Yellow ringspot later turned brown and necrotic, reduced growth and flower size	No virus particle observed
b) R21	Reduced leaf size, mosaic, stunting	-do-
Tuberose	Mottling and mosaic	Flexuous particle observed - Indicate infection of Tuberose mild mottle virus
Amaryllis	Mottling	Flexuous particle observed

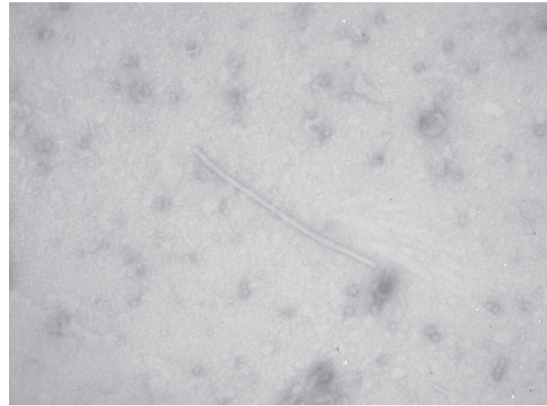
- 3) Symptomatic samples of China aster (Phule Ganesh White, Phule Ganesh Pink, Phule Ganesh Pink, Phule Ganesh Violet, Phule Ganesh Purple, 4 samples from AICRP centre Pantnagar), Chrysanthemum (Local Button, R 21) and Gladiolus (Priscilla and Beajour) tested for identification of the causal agent Priscilla cultivar of gladiolus tested positive for Potyvirus using the degenerate genus specific primer.
- 4) Survey of incidence of phytoplasma symptoms in different cultivars of China aster in Pune condition was undertaken and details given below:



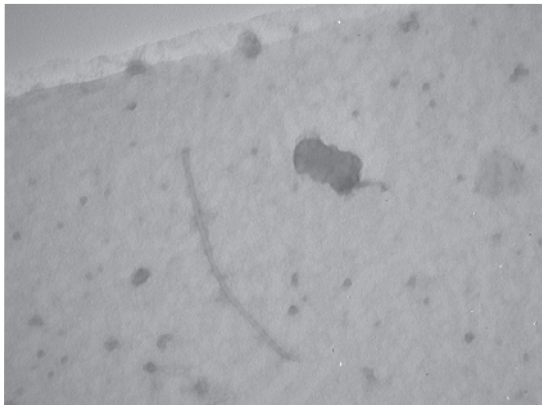
5) **Electron micrographs of virus particles observed in infected samples of flower crops given below**



A) Electron micrograph of Flexuous virus particles seen in Gerbera leaves showing oak leaf pattern



B) Electron micrograph of Flexuous virus particles seen in Amaryllis leaves with mottling



C) Electron micrograph of Flexuous virus particles seen in Tuberose leaves with mottling



A) Electron micrograph of Flexuous and isometric virus particles seen in Gladiolus with mottling and flower colour breaking

6) **Diseases observed under open/ protected conditions in various flower crops during the survey of floriculture units given below.**



A) Leaf blight in Tuberose cultivar Phule Rajani



B) Collar rot in Tuberose cultivar Phule Rajani



C) Botrytis blight in rose



D) Crown gall in rose (cultivar Topsecret)



E) Anthracnose in rose (cultivar Topsecret)



F) Virus infected rose showing mosaic, stunting, narrowing of leaves, flower malformation (cultivar Poison)



G) Colour breaking due to Potyvirus infection in Gladiolus (cultivar Pusa Suhagin)



H) Fusarium yellows in Gladiolus (cultivar Argentina)



I) Oak leaf pattern in virus infected Gerbera (cultivar Toscana)



J) Virescence in Gerbera (cultivar Toscana)



K) Phyllody in China aster (cultivar Phule Ganesh Pink)



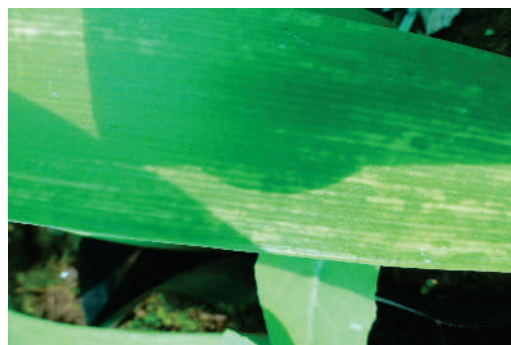
L) Stunting and witches broom in China aster (cultivar Phule Ganesh White)



M) Stolbur in Marigold raised from cuttings (Calcutta/Capri)



N) Yellow ringspot symptoms (virus infection) in Chrysanthemum (cultivar Local Button)



O) Leaf mottling in Amaryllis due to viral infection

Project 03: Assessment of nematode infestation in major commercial flower crops and management of root-knot nematode in tuberose

1. Survey and damage assessment of root-knot nematode, *Meloidogyne* spp. associated with tuberose growing areas of Pune region.

A survey was conducted in Pune region to assess the incidence of root-knot nematode infection on tuberose. A total of 12 random tuberose growing fields were surveyed during the study. The study revealed that out of 12, 10 fields were infected with root-knot nematode. 50 to 70% of the infected field showed severe stunted growth and reduced number of spike (Fig 1). Further, four tuberose plants were uprooted from each field and they were visually scored for the root-knot index on 0-10 scale with 0 representing no galls, 5 representing 50% infestation and 10 representing severe infestation with all the root system knotted. Based on root-knot index, all the sampled roots showed more than 50% infestation of root-knot nematodes, *Meloidogyne* spp. (Fig 2).



Fig 1. Stunted growth and reduced number of spikes of tuberose due to root-knot nematodes



Fig 2. Galls on tuberose roots due to root-knot nematodes

Externally Funded Projects

Project 1: Validation of DUS testing guidelines for gladiolus (*Gladiolus grandiflorus*. Hort)

Validation of DUS testing guidelines for gladiolus (*Gladiolus grandiflorus*. Hort) is sponsored by the Protection of Plant Varieties and Farmers Right's Authority, New Delhi. To develop the test guidelines 28/15 reference varieties were collected.

Project 2: Validation of DUS testing guidelines for tuberose (*Polianthes tuberosa* L.)

The project is sponsored by Protection of Plant Varieties and Farmers Rights Authority, New Delhi. The tuberose germplasm are being transferred to new location i.e. Pune.

Project 3: New initiative project on protected horticulture

Protected horticulture is ICAR funded project started in four centres with nodal centre at IIHR, Bengaluru. This project has started at DFR and basic work of developing infrastructure and recruitment of contractual staff is being done as per the set guidelines of the project.

Project 4: Studies on Male Sterility systems to increase the efficiency of F₁ hybrids in Horticultural Crops (Marigold)

The recruitment of contractual staff were done as per the set guidelines of the project. Germplasm of marigold were collected from various places. The necessary work could not be undertaken due to poor flowering in marigold cultivar Pusa Arpita. Seeds of some apetalous flower were collected.

Institutional Building

After shifting of ICAR-DFR to its new location i.e Pune, necessary steps regarding demarcation of land, acquisition of land from Maharashtra Government, seating space for scientific and administrative staff, land cultivation/reclamation, etc. were undertaken on massive way. Initially land development work was undertaken at Shivajinagar farm with proper leveling and heavy cultivation to make it atleast, suitable for temporary planting of ornamental germplasm.



Foundation Day Celebration

The Directorate of Floricultural Research celebrated its fifth Foundation Day on December 10, 2014. Dr. S. K. Sharma, Head, ICAR-IARI Regional Station, Pune was the Chief Guest of the function. All scientists and staff of DFR participated in the function. On this occasion, the winner staff were felicitated with certificates of the Rajbhasha Competition.

Swatch Bharat Abhiyan

The Directorate celebrated the Swatch Bharat Abhiyan on 2nd October, 2014.



Vigilance week

The Directorate celebrated Vigilance Week on 28 October to 1 November, 2014 to bring transparency in the day to day office work.

Hindi Pakhwara

The Directorate celebrated Hindi Pakhwada. Various competitions were held during the week like essay writing, hindi translation etc. All the staff of the Directorate actively participated in the competition organised during the period. The winners were felicitated with certificates also.



ICAR Foundation Day Celebration

The Directorate celebrated ICAR Foundation Day on 16 July, 2014 at New Delhi.



Meetings of RAC/ IRC/ IMC

Meeting of third Research Advisory Committee

The third Research Advisory Committee (RAC) meeting of DFR was held on 9-10 February, 2015 under the Chairmanship of Dr. V.A. Parthasarathy, former Director, ICAR - Indian Institute of Spices Research. The other members who attended the meeting were Dr. T. Janakiram, ADG (Horticultural Science) ICAR New Delhi; Dr. K P Singh, Director Directorate of Floricultural Research; Dr SPS Raghawa, Former Professor, Discipline of Horticulture, IARI, New Delhi; Dr. J.S. Arora,



Former Head, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana; Dr. T. Manjunath Rao, Director, ICAR-Indian Institute of Horticultural Research, Bengaluru; Mrs. Megha Borse, President, Floriculture Association, Maharashtra; Mr. S. Jafar Naquvi, Chief Editor, Floriculture Today, Media Today Pvt. Ltd, New Delhi and Dr. Ajai Kumar Tiwari, Senior Scientist & Member Secretary (RAC). All Scientists of DFR attended the RAC meeting.

Dr. V.A. Parthasarthy, in his introductory remarks conveyed his appreciation for the excellent research accomplishments made by the DFR scientists over the past one year, based on previous RAC recommendations. He also appreciated the publications brought out during the period. The Chairman emphasized that research agenda of the Institute need to be reoriented, prioritized and linked with problems of national importance. After the brief introductory remarks by the Chairman, Dr. A.K. Tiwari presented the Action Taken Report of the last RAC meeting, followed by presentation by Dr Tarak Nath Saha, Scientist, DFR, of the research achievements of the Directorate made during the last year. The Chairman and RAC members appreciated the presentations and were pleased to note that there was a follow-up of most of the recommendations of the previous RAC and good progress has been made despite relocation of Directorate to a new place.

Composition of Research Advisory Committee (RAC)

Chairman

Dr. V. A. Parthasarathy, Former Director, ICAR-Indian Institute of Spice Research, Calicut, Kerala.

Members

Dr. T. Janakiram, Assistant Director General (Horticultural Science), ICAR, Krishi Anusandhan Bhawan-II, Pusa, New Delhi -110012

Dr. Ramesh Kumar, Director, ICAR-Directorate of Floricultural Research, College of Agriculture Campus, Shivajinagar, Pune 411005, Maharashtra (upto 21.08.2014 Forenoon).

Dr. K P Singh, Director (Acting), ICAR-Directorate of Floricultural Research, College of Agriculture Campus, Shivajinagar, Pune 411005, Maharashtra (wef 21.08.2014 Afternoon).

Dr S. P.S. Raghawa, Former Professor, Discipline of Horticulture, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi 110012.

Dr. J. S. Arora, Former Professor and Head, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, Punjab.

Dr. T. Manjunath Rao, Director (Acting), ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru-560089, Karnataka.

Dr. A. A. Deshpande, Head, Vegetable Seed Research, JK Agri Genetics Ltd., Bengaluru, Karnataka.

Mrs. Megha Borse, President, Floriculture Association, First Floor Nadkarni Chambers, Vakildadi, Nasik - 422001, Maharashtra.

Mr. S. Jafar Naquvi, Chief Editor, Floriculture Today, Media Today Pvt. Ltd, T-30, First Floor, Khirki Extension, Malviya Nagar, New Delhi-110078.

Member Secretary

Dr. Ajai Kumar Tiwari, Senior Scientist, ICAR-Directorate of Floricultural Research, College of Agriculture Campus, Shivajinagar, Pune 411005, Maharashtra.

Institute Management Committee (IMC)

Chairman

Director, ICAR - Directorate of Floricultural Research, College of Agriculture Campus, Shivaji Nagar, Pune - 411005 (Maharashtra)

Members

Joint Director (Agriculture), Govt. of NCT of Delhi, 11th Floor, Multi-storey Office Building (Police Hqrs.), IP Estate, New Delhi - 110002.

Head, Deptt. of Floriculture & Landscaping, College of Horticulture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan - 173230 (Himachal Pradesh).

Head, Deptt. of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, (Haryana).

Mrs. Megha Borse, President, Floriculture Association, Maharashtra, 1st Floor, Nadkarni Chambers, Vakildadi, NASIK - 422001 (Maharashtra).

Mr. S. Jaffar Naqvi, Chief Editor (Floriculture Today) & Director, Media Today Pvt Ltd, J-73, Paryavaran Complex, Neb Sarai, IGNOU Road, New Delhi - 110068.

Dr. (Mrs.) Jyoti Sharma, Principal Scientist (Plant Pathology), ICAR - National Research Centre on Pomegranate, NH-65, Sholapur-Pune Highway, Kegaon, Solapur - 413255 (Maharashtra).

Dr. Vijay K. Mahajan, Principal Scientist (Horticulture), ICAR - Directorate of Onion and Garlic Research, Rajgurunagar, District-Pune-410 505 (Maharashtra).

Dr. R.G. Somkumar, Principal Scientist (Horticulture), ICAR -National Research Centre for Grapes, Post Bag No. 3, Manjari Farm PO, Sholapur Road, Pune - 412 307 (Maharashtra)

Dr. Ashok Kumar, Principal Scientist (Plant Breeding), Germplasm Evaluation Division, ICAR-NBPGR, Pusa Campus, New Delhi-110 012 .

Dr. V. Pandey, Principal Scientist (Horticulture), Division of Horticultural Science, ICAR KAB-II, Pusa, New Delhi -110 012.

Finance and Accounts Officer, ICAR Headquarters, Krishi Bhawan, New Delhi- 110 001

Member Secretary

Administrative Officer, ICAR - Directorate of Floricultural Research, College of Agriculture Campus, Shivaji Nagar, Pune - 411 005 (Maharashtra)

IRC Meeting

The meetings of the Institute Research Committee (IRC-2014-15) to review the progress made during the last year and to examine the newly approved research projects was held on 11.12.2014 and 23.12.2014 under the Chairmanship of Dr. K. P. Singh, Chairman, IRC and Director DFR, Pune.

Another meeting of the Institute Research Committee (IRC) was conveyed on 26.03.2015 to review the progress of the in-house research projects and to modify the programme as per the recommendation, of RAC (held on 9-10 February, 2015). Dr. K. P. Singh, Director, DFR & Chairman, IRC chaired the meeting.

Transfer of Technology

Participation in Krishi Vigyan Mela in Pune and Patna

To strengthen the linkage with farmers, the Directorate participated in Krishi Vigyan Mela organised by Krishi Vigyan Kendra, Naraingaon, Pune (6-8 January, 2015) and Eastern Regional Agricultural Fair held at Central Potato Research Institute Regional Station, Patna, Bihar (19-21 February, 2015).

Field Demonstration of tuberose in farmer field in Meerut district

A field demonstration was conducted at farmer field in Village Aadkaul, district Meerut (Uttar Pradesh) jointly with DFR and KVK Hastinapur, Meerut. This field demonstration included six cultivars of Single petalled cultivars namely, Mexican Single (Local Control) Sikkim Selection, Shringar, Prajwal, Arka Niranthara and Phule Rajani.



Research Projects

In-House Research Projects

S.No	Mega Projects	PI	Co-PI
01	Improvement of Commercial Flower Crops	Dr A. K. Tiwari wef 29.10.2014 in place of Dr. Gunjeet Kumar	
	Project 01 Breeding of gladiolus for quality and yield.	Dr. Ganesh B. Kadam	Dr. Tarak Nath Saha & Dr A. K. Tiwari (Dr. Gunjeet Kumar upto 28.10.2014 , Dr. Puja Rai upto 05.12.2014)
	Project 02 Breeding of chrysanthemum for quality flower and pot mum production.	Dr. Tarak Nath Saha	Dr. Ganesh B. Kadam (Dr. Gunjeet Kumar upto 28.10.2014 and Dr. Puja Rai upto 05.12.2014)
	Project 03 Breeding of tuberose for novel colour and oil recovery.	Dr. Tarak Nath Saha wef 20.05.2014 (in place of Dr. Jayoti Majumder	Dr. K. P. Singh and Dr.A.K.Tiwari
	Project 05 Improvement of lawn grasses for turf.	Dr A. K. Tiwari	Dr. K P Singh, Mr. Girish, K. S. and Mrs Shephalika Amrapali (wef from 26.03.2015)
02	Standardization of Production Technology in Commercial Flower Crops	Dr. K. P. Singh	
	Project 03 Production technology of tuberose	Dr. K.P. Singh	Dr. Prasanna Holajjer (wef 17.11.2014)
03	Post-harvest management and value addition	Dr. A.K Tiwari	
	Project 01 Development of ready to serve floral Preservatives for commercial flowers	Dr. A.K Tiwari wef 6.12.2014 (Dr. Babita Singh upto 05.12.2014)	Dr. Ganesh B. Kadam, wef 11.12.2014 (Dr. A.K Tiwari Mrs. Sellam, P. and Dr. Puja Rai upto 05.12.2014)



S.No	Mega Projects	PI	Co-PI
04	Plant Protection of Commercial Flower Crops	Mr. Girish, K. S.	
	Project 01 Insect pest management of commercial flower crops	Mr. Girish, K. S.	Dr Ganesh B Kadam and Dr. Prasanna Holajjer (wef 17.11.2014)
	Project 02 Investigation on viral and phytoplasmal diseases of major flowering crops in India (wef 25.09.2014).	Dr. Prabha K.	Mr.Girish, K. S., Dr. K. P. Singh and Dr Ganesh B Kadam (upto 26.03.2015)
	Project 03 Assessment of nematode infestation in major commercial flower crops and management of root knot nematodes in tuberose (wef 17.11.2014).	Dr. Prasanna Holajjer	Mr. Girish, K. S., Dr. Prabha K. and Dr. K. P. Singh

Externally Funded Projects

S.No	Project Title	Sponsored by	PI	Co-PI
1	Validation of DUS Testing Guidelines For Tuberose (<i>Polianthes tuberosa</i> L.).	PPV&FRA, Ministry of Agriculture, GOI, New Delhi	Dr. Gunjeet Kumar (Upto 28.10.2014) Dr. Tarak Nath Saha (wef 29.10.2014)	Dr. Tarak Nath Saha
2	Validation of DUS Testing Guidelines For Gladiolus (<i>Gladiolus</i> (Tourn) L.).	PPV&FRA, Ministry of Agriculture, GOI, New Delhi	Dr. Ajai Kumar Tiwari	Dr. Gunjeet Kumar (Upto 28.10.2014) Dr. Ganesh B. Kadam
3	New initiative project on protected horticulture.	ICAR	Dr. Ganesh B. Kadam	
4	ICAR Consortia research platform for management of borers in horticulture crops.	ICAR	Mr. Girish K. S.	
5	Studies on Male sterility to increase the efficiency of F ₁ hybrids in horticultural crops (Marigold).	ICAR	Dr. Tarak Nath Saha	



Publications

Papers in research journals (National/ International):

- i. Lakhotia Prativa, K.P. Singh, S. K. Singh, M. C. Singh, K. V. Prasad and Kishan Swaroop (2014). Influence of biotic and abiotic elicitors on production of betalain pigments in bougainvillea callus cultures. *Indian Journal of Horticulture*, 71 (3):373-378.
- ii. Kumari Shyama, K. P. Singh, Ajay Arora and M. C. Singh (2014). Regulation of tuberose cut flower senescence by using certain chemicals. *Progressive Horticulture*, 46(2): 322-329.
- iii. Tiwari, A. K., G. Kumar, G.B. Kadam and T.N. Saha (2014): Comparing digital image analysis and visual rating of gamma ray induced perennial rye grass (*Lolium perenne*) mutants. *Hort Flora Research Spectrum*, 3 (3): 211-217
- iv. Kumar, G., G.B. Kadam, T.N. Saha, A.K. Tiwari and R. Kumar (2014): Evaluation of pre-emergence herbicides in gladiolus (*Gladiolus*). *Indian Journal of Agricultural Sciences*, 84 (12): 1546-1559
- v. Kadam, G.B., G. Kumar, T.N. Saha, A.K. Tiwari and Ramesh Kumar (2014). Varietal evaluation and genetic variability studies in gladiolus (*Gladiolus* (Tourn) L.), *Indian Journal of Horticulture*, 71(3): 379-384.
- vi. Tiwari, A.K., Ramesh Kumar, Gunjeet Kumar, Ganesh B Kadam, Jayoti Majumdar, T.N. Saha and Girish K.S. (2014) Comparing digital image analysis and visual rating of gamma ray induced bent grass (*Agrostis stolonifera*) mutants. *Indian Journal of Agricultural Sciences*, 85 (1):93-96.
- vii. Saha, T.N., J. Majumder, G.B. Kadam, A.K. Tiwari, K.S. Girish and R. Kumar (2014) Role of All India Coordinated Research Project in Development of Floriculture in India. *International Journal of Bio-resource and Stress Management*, 5(1): 159-165.
- viii. Majumdar, J., K.P. Singh, P. Sellam, Babita Singh and Puja Rai (2014). Effect of various chemicals with packaging and storage on tuberose (*Polianthes tuberosa* L.) shelf-life. *Hort Flora Research Spectrum*, 3(2): 138-141.
- ix. Nataraja, M.V., Harish, G., Holajjer, P. and Savaliya, S.D. (2015). Efficacy of imidacloprid seed treatment for the control of leafhoppers and thrips in groundnut. *Legume Research*, DOI: 10.5958/0976-0571.2015.00044.2.
- x. Sharma, S.K., Kumar, V., Poswal, R., Rai, R., A., Geetanjali, S., Prabha, K., Jain, R.K. and Baranwal, V.K. (2014). Occurrence and distribution of banana streak disease and standardization of a reliable detection procedure for routine indexing of banana streak viruses in India. *Scientia Horticulturae*, 179; 277-283.

Technical/ Popular articles :

- Singh, K. P. and A. K. Tiwari (2015). Floriculture Industry: Rehabilitating in North Eastern States. In: *Souvenir of National Seminar on Sustainable Horticulture Vis-à-vis Changing Environment*, held at SASRD, Nagaland University, Medziphema, Nagaland, during 26-28 February, 2015, pp. 39-46.
- Bharti, H., M.C. Singh and K.P. Singh (2014). Role of ornamentals in phytoremediation. *Floriculture Today*, 18 (12): 26-30.
- Singh, K.P. and H. Bharti (2014). Improved production technology for tuberose. In : *Training manual on teaching of post-graduate school courses in horticulture-Floriculture and Landscape Architecture* published by Dean and Joint Director (Education), IARI, New Delhi, pp 83-39.
- Singh, B., P. Selam and Jayoti Majumder (2014). *Pushp Vyavsai me sukhaye hue phoole ka mahatba*. (in Hindi). *Phal Phool* (May-June, 2014), pp 8-11.
- Jyothi, R. and K. P. Singh (2014). Flower preservation: An old and unique concept for value addition. In: *Souvenir of 2014. Chrysanthemum Flower Show and Competition*, organised by Dahlia and Chrysanthemum Society, 22 City Centre, Begum Bridge Road, Meerut (Uttar Pradesh), pp 39-41.

Presentations in conferences/ symposia/ seminar/ other fora

- Girish K.S., Ganesh B. Kadam and K.P. Singh (2015). Evaluation of tuberose germplasm against thrips (*Thrips spp.*) infestation. In : *National Conference on Emerging Challenges and Opportunities in Biotic and Abiotic Stress Management*, held from 13-14 December, 2014 at ICAR-Directorate of Rice Research, Rajendranagar, Hyderabad, pp. 66-67.
- Prabha, K., S.S. Bhondave, K.S. Girish, M.S. Patil, K.P.Singh and V.K. Baranwal (2015). Emerging pathogens and phytobiosecurity in the context of phytoplasma and floriculture in India. In: *National Symposium on Argochemicals for Food and Environment Safety*, held from 28-30 January, 2015 at ICAR- Indian Agricultural Research Institute, New Delhi, p. 141.
- Holajjer,P., K.P. Singh, K.S. Girish and K. Prabha. (2015). Nematode threats to flower crops: Issues and Challenges. In : *National Symposium on Nematode Management: A Challenge to Indian Agriculture in the Changing Climate*, held during 8-10 January, 2015 at Yashwantrao Chavan Academy of Development Administration (YASHADA), Baner road, Pune. pp. 34-35.
- Rai P., T.N. Saha, G.B. Kadam, Girish K.S., Gunjeet Kumar, Ramesh Kumar and K.P. Singh (2014). Effect of fluorescent light on the performance of LA Liliium Hybrids under Delhi Condition. In : *6th Indian Horticulture Congress*, held during 6-9 November, 2014, at Tamil Nadu Agricultural University, Coimbatore, pp 236.
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- Kadam G.B., Gunjeet Kumar, Tarak Nath Saha and K.P. Singh (2014). Effect of pre-emergence herbicides on weed management in gladiolus (*Gladiolus* (Tourn) L.). In : Abstract of *6th Indian Horticulture Congress held at T.N.A.U. Coimbatore from 6-9 November, 2014*, p-420.



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- Kumar, G., Tarak Nath Saha, Ganesh B. Kadam, A.K. Tiwari, Girish K.S. and Ramesh Kumar (2014). Diversity and distribution of indigenous genetic resources of ornamentals. In: Abstract: *6th Indian Horticulture Congress* held at T.N.A.U. Coimbatore from 6-9 November, 2014, pp-41-42.
- Tiwari, A.K. and K.P. Singh (2015). New varieties of turf grass (*Cynodon dactylon*). In : *Souvenir and Conference Book on National Conference on Emerging Challenges and Opportunities in Biotic and Abiotic stress Management*, held at Hyderabad, during 8-10 January 2015, pp. 219.

Compilation & Documentation

- Kumar, R., P. Sellam, Gunjeet Kumar, A.K. Tiwari, K. S. Girish and Tarak Nath Saha (2014). *Annual Report (2013-14). Directorate of Floricultural Research*, Indian Council of Agricultural Research, New Delhi-110012, pp 1-63.
- Kumar, R., G. Kumar, T.N. Saha, K.S. Girish, G.B. Kadam and J. Majumdar (2014) *Annual Report (2013-2014). All India Coordinated Research Project on Floriculture*. Published by Director, Directorate of Floricultural Research, IARI Campus, New Delhi, pp. 841.
- Saha, T.N., G.B. Kadam, K.S. Girish, G. Kumar, A.K. Tiwari and R. Kumar (2014). *Proceedings of the XXIII Group Meeting of AICRP (Floriculture)*, held at Punjab Agricultural University, Ludhiana, during 25-27 February, 2014, pp 1-69.

Training and Capacity Building

- Dr. K.P. Singh attended Special Convocation of Post-Graduate School of Indian Agricultural Research Institute, New Delhi, held on 08 September, 2014, at NAAS Complex, New Delhi, to confirm Degree of Doctor of Science (*Honoris causa*) to Dr. Jose Graziano do Silva, Director General of FAO.
- Dr. K.P. Singh and Dr A.K. Tiwari attended Silver Jubilee Symposium on Strategic Approaches for Horticultural Research, Education and Development - Way Forward held at NAAS Complex, Pusa, New Delhi, during 26-27 December, 2014.
- Dr. K.P. Singh and Dr. Tarak Nath Saha participated in Vision-2050 meeting of Directors of all Institutes/Directorates/NRCs /under Horticultural Science Division of ICAR, held at KAB-II and Krishi Bhavan, New Delhi, during 25-27 November, 2014.
- Dr. K.P. Singh attended Scientific Advisory Committee meeting of Krishi Vigyan Kendra, Narayangaon, district-Pune on 25 February, 2015.
- Dr. A.K. Tiwari attended XXXth Review workshop of Plant Germplasm Registration Committee at NBPGR, New Delhi, convened on 04 September, 2014.
- Dr. A.K. Tiwari attended Indo-US Workshop on Urban-futures 2014 at Bengaluru from 02-05 November, 2014.
- Dr. A.K. Tiwari attended Workshop for Review of Mid-term Achievements of RFD 2014-2015 held on 24 November, 2014 at NASC Complex. Pusa Campus. New Delhi-110012.
- Dr. A.K. Tiwari and Mr K.S. Girish attended two days National Conference on Emerging Challenges and Opportunities in Biotic and Abiotic Stress Management (ECOBASAM-2014) held at ICAR-Directorate of Rice Research, Hyderabad during 13-14 December, 2014.
- Dr. A.K. Tiwari attended foundation stone laying ceremony for Establishment of Centre of Excellence for Vegetable Production under Indo-Dutch action plan at KVK Baramati (Maharashtra) on 14 February, 2015.
- Dr. A.K. Tiwari Delivered lecture on Importance of flowers in Eastern Region of India in Eastern Regional Agriculture Fair at ICAR-CPRI Regional Station Patna on 19 February, 2015.
- Dr Tarak Nath Saha attended training cum workshop for HRD Nodal Officers of ICAR on 26 February, 2015 at ICAR-National Academy of Agricultural Research Management, Hyderabad.
- Prasanna Holajjer conducted and worked as Co-Convener for organizing *National Symposium on Nematode Management: A Challenge to Indian Agriculture in the Changing Climate*, held at Pune, during 8-10 January, 2015.



- Mr. Girish K.S. attended Brain Storming Session on Nematode Problem under Protected Cultivation, held on 8 September, 2014 at ICAR – Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru.
- Mr. Girish K.S. attended Five days training on International Programme on Pest Risk Analysis from 1– 5 September, 2014 at National Institute of Plant Health Management, Hyderabad.
- Mr. Girish K.S. attended 21 days training on Capacity Building in Taxonomy of Insects and Mites, held from 7– 27 October, 2014, at the Department of Entomology, UAS, Bengaluru.
- Dr. Ganesh B Kadam attended 21 days Winter School at CPCT, IARI, New Delhi on Recent Advances in Crop Management under Protected Cultivation (from 26 December, 2014 to 16 January, 2015).
- Dr. Ganesh B Kadam attended launching programme of new initiatives project on protected horticulture at IIHR, Bengaluru from 9-11 September, 2014.

Awards and Recognition

Society for Agricultural Research and Communication conferred "Outstanding Investigator Award-2014" to Dr. K.P. Singh in the *International Conference on Technological Interventions in Agricultural Sciences for Enhanced Productivity, Nutritional Quality and Value Addition*, held on 17 March, 2015, for his outstanding contribution in the field of floriculture.

Honourable Vice-Chancellor of Sher-e-Kashmir University of Agricultural Sciences and Technology (K) Srinagar nominated Dr. K.P. Singh as an Expert for reviewing the contributions of Dr. Mohammad Qasim Sheikh for his promotion under Career Advancement Scheme from Associate Professor/ Senior Scientist to Professor/ Chief Scientist in the discipline of floriculture.

Honourable Vice-Chancellor of Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow nominated Dr. K.P. Singh as Member of Interview Board for the promotion of Associate Professor to Professor under Career Advancement Scheme in the discipline of Horticulture. The interview was held on 29 January, 2015.

Honourable Vice-Chancellor of Govind Ballab Pant University of Agriculture and Technology Pantnagar nominated Dr. K.P. Singh as External Examiner for evaluation of two M.Sc. Horticulture (Floriculture and Landscaping) thesis and also conduct of final *Viva-Voce* examination. The *Viva-Voce* examination was conducted on 02 January, 2015 (Students: Mr. Naveen Wegr and Mr. Pankaj Panwar).

Honourable Vice-Chancellor of Navasari Agricultural University, Navasari (Gujarat) nominated Dr. K.P. Singh as External Examiner for *Viva-Voce* examination of Ph.D. Horticulture (Floriculture and Landscape Architecture) student (Mr. Mangave Bahubali). The *Viva-Voce* examination was held on 06 November, 2014

Honourable Chairman of Agricultural Scientist Recruitment Board, ICAR nominated Dr. K.P. Singh as Member of Interview Board for the promotion of Senior Scientist to Principal Scientist Under Career Advancement Scheme. The interview was held on 18 January, 2015.

Honourable Chairman of Agricultural Scientists Recruitment Board, ICAR nominated Dr. K.P. Singh as Question Paper Setter for award of Senior Research Fellowship in different Agricultural Universities.

Head, Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut nominated Dr. K.P. Singh as Judge in Horticulture Show and Competition, held on 16 October, 2014.

Honourable Vice-Chancellor of Sher-e-Kashmir University of Agricultural Sciences and Technology (K) Srinagar nominated Dr. K.P. Singh as Expert to review the Written Contribution of Dr. (Ms) Neelofar for her assessment from Associate Professor/Senior Scientist (Floriculture) to Professor/Chief Scientist under Career Advancement Scheme for teachers.

Honourable Vice-Chancellor of Chaudhary Charan Singh University, Meerut (Uttar Pradesh) nominated Dr. K.P. Singh as Examiner for setting up Question Paper (multiple choice question) for M.Phil. (Horticulture) entrance examination conducted by the University for 2014 Session Admissions.



Honourable Vice-Chancellor of Chaudhary Charan Singh University, Meerut (Uttar Pradesh) nominated Dr. K.P. Singh as External Examiner for conducting Practical Examination of M.Sc. (Ag.) Horticulture IV Semester at Gochar Mahavidyalya, Rampur Manihaaran, District Saharanpur (Uttar Pradesh). The Practical Examination was conducted on 12 July, 2014.

Honourable Vice-Chancellor of Chaudhary Charan Singh University, Meerut (Uttar Pradesh) nominated Dr. K.P. Singh as External Examiner for evaluation of Ph.D. (Horticulture) Thesis submitted to the University.

Honourable Vice-Chancellor of Govind Ballab Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) nominated Dr. K.P. Singh as Examiner for evaluation of Two M.Sc. Horticulture (Floriculture and Landscaping) Thesis submitted to the University.

Honourable Director- General of ICAR appointed Dr. K.P. Singh as Director (Acting) of ICAR-Directorate of Floricultural Research, Pune. Dr. K.P. Singh has taken over the charge of Director (Acting) on 21 August, 2014 afternoon.

Best Oral presentation was awarded to Dr (Ms.) Prabha K. for the deliberation entitled "Emerging pathogens and phytobiosecurity in the context of phytoplasma and floriculture in India". In : *National Symposium on Argochemicals for Food and Environment Safety*, held from 28-30 January, 2015 at ICAR Indian Agricultural Research Institute, New Delhi.

Mahatma Phule Krishi Vidyapeeth, Rahuri recognized Dr A.K. Tiwari, Senior Scientist; Dr Tarak Nath Saha, Scientist and Dr. Ganesh B. Kadam, Scientist as faculty for guiding Post-Graduate students in the discipline of Horticulture (Floriculture)

Personnel

Sl. No.	Name	Designation
1.	Dr. Ramesh Kumar	Director (upto 21.08.2014 Forenoon)
2.	Dr. K. P. Singh	Principal Scientist (Horticulture-Floriculture) and Director (Acting) wef 21.08.2014 Afternoon
3.	Dr. Gunjeet Kumar (upto 28.10.2014)	Senior Scientist(Horticulture-Floriculture)
4.	Dr. Ajai Kumar Tiwari	Senior Scientist (Horticulture-Floriculture)
5.	Dr. Tarak Nath Saha	Scientist (Horticulture-Floriculture)
6.	Dr. Prasanna Holajjer (wef 17.11.2014)	Scientist (Nematology)
7.	Dr (Ms) Prabha K. (wef 11.06. 2014)	Scientist (Plant Pathology)
8.	Ms. Sellam P. (upto 06.12.2014)	Scientist (Agriculture Structure and Process Engineering)
9.	Dr (Ms). Jayoti Majumder(upto 20.06.2014)	Scientist (Horticulture-Floriculture)
10.	Dr. Ganesh B. Kadam	Scientist (Horticulture-Floriculture)
11.	Dr (Ms). Babita Singh (upto 06.12.2014)	Scientist (Horticulture-Floriculture)
12.	Dr(Ms). Puja Rai (upto 06.12.2014)	Scientist (Plant Physiology)
13.	Mr. Girish K. S.	Scientist (Agricultural Entomology)
14.	Ms. Shephalika Amrapali (wef 05.03. 2015)	Scientist (Economic Botany)
15.	Mr. Anil Kumar Maithani	Administrative Officer
16.	Mr. Radhey Shyam Bhatt	Assistant Finance and Accounts Officer
17.	Mr. Sandeep Gaur	Assistant
18.	Mr. Deepak Verma	Assistant
19.	Mr. Rupesh Kumar Pathak	Assistant
20.	Mr. Ajay Kumar Uniyal	Steno Grade III
21.	Mr. Sudesh Kumar	Lower Division Clerk
22.	Mr. Pratap Singh (Upto 31.08.2014)	Lower Division Clerk

AICRP on Floriculture

The All India Coordinated Research Project (AICRP) on Floriculture was established during IV Five-Year Plan in the year 1970-71 to carry out nation-wide interdisciplinary research by linking ICAR Institutes with State Agricultural Universities (SAUs). The necessity of the project has been examined from time to time in view of growing importance and potential for floriculture in different regions of the country and the number of Coordinated Centres as well as the research programmes were modified accordingly. At present the Coordinated Project has 21 Centres which includes 15 budgetary, 4 institutional and 2 voluntary Centres.

S. No.	Centre	Year of Start	Mandate Crops
Budgetary Centres			
1.	B.C.K.V, Kalyani (West Bengal)	1972	Carnation, Orchids, Anthurium, Tuberosa, Gerbera
2.	Dr. Y.S. Parmar University of Horticulture & Forestry, Solan (Himachal Pradesh)	1975	Gladiolus, Carnation, Chrysanthemum, Tulip, Daffodils, Liliun, Alstroemeria
3.	Kerala Agricultural University, Vellanikkara, Thrissur (Kerala)	1975	Orchids, Anthurium, Gerbera
4.	Zonal Agricultural Research Project (Plain Zone) (MPKV) Pune (Maharashtra)	1975	Rose, Gladiolus, Carnation, Chrysanthemum, Tuberosa, Gerbera,
5.	Punjab Agricultural University, Ludhiana (Punjab)	1975	Rose, Gladiolus, Chrysanthemum, Tuberosa, Gerbera, Liliun
6.	Rajasthan College of Agriculture (MPUAT), Udaipur (Rajasthan)	1980	Rose, Gladiolus, Chrysanthemum, Tuberosa
7.	Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)	1982	Carnation, Chrysanthemum, Orchids, Anthurium, Tuberosa, Gerbera
8.	Regional Research Station (Uttar Banga Krishi-Viswavidyalaya) Kalimpong (WB)	1985	Gladiolus, Carnation, Orchids, Anthurium, Alstroemeria
9.	Agricultural Research Institute (SKLTSHU), Hyderabad (Telangana State)	1987	Gladiolus, Chrysanthemum, Tuberosa
10.	Sher-e-Kashmir University of Agricultural Sciences & Technology, Wadura (J&K)	1987	Gladiolus, Chrysanthemum, Tulip, Daffodils, Liliun, Alstroemeria

S. No.	Centre	Year of Start	Mandate Crops
11.	Horticultural Research Station (AAU), Kahikuchi, P.O. Azara, Guwahati (Asom)	2001	Gladiolus, Orchids, Chrysanthemum, Anthurium, Tuberose, Gerbera
12.	Odisha University of Agricultural Science and Technology, Bhubaneswar	2011	Rose, Chrysanthemum, Orchids, Anthurium
13.	G. B. P. U. A & T, Pantnagar (Uttarakhand)	2001	Rose, Gladiolus, Chrysanthemum, Tuberose, Gerbera
14.	Birsa Agricultural University, Ranchi	2001	Gladiolus, Chrysanthemum, Gerbera
15.	Rajendra Central Agricultural University, Pusa, Samastipur (Bihar)	2010	Rose, tuberose, gladiolus and Marigold
Institutional centres			
16.	ICAR-Indian Agricultural Research Institute, New Delhi	1971	Rose, Gladiolus, Chrysanthemum and Tuberose
17.	ICAR-Indian Agricultural Research Institute, Regional Station, Katrain, (Himachal Pradesh)	1971	Gladiolus, Carnation, Gerbera, Tulip, Daffodils, Lilium, Alstroemeria
18.	ICAR-Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru (Karnataka)	1971	Rose, Gladiolus, Carnation, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera
19.	ICAR Research Complex for NEH Region, Barapani, Shillong (Meghalaya)	1971	Orchids, Anthurium, Gerbera
Voluntary Centres			
20.	Gandhi Krishi Vigyana Kendra, University of Agricultural Sciences, Bengaluru	1977	Carnation, Anthurium
21.	Horticultural College and Research Institute (TNAU), Periyakulam	2010	Marigold, Tuberose, Chrysanthemum



Distinguished Visitors

1. Dr. P. S. Minhas, Director, ICAR-NIASM, Malegaon, Baramati, District Pune
2. Dr. S.K Malhotra, Horticulture Commissioner, Government of India, New Delhi
3. Dr. T. Janakiram, ADG (Horticultural Science), ICAR, New Delhi.
4. Dr. Jai Gopal, Director, ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune
5. Dr. A. Verghese, Director, ICAR-NBAIR, Hebbal, Bengaluru.
6. Dr. R. S. Patil, Director Research, MPKV, Rahuri.
7. Dr. S. K. Sharma, Head, IARI Regional Station, Pune
8. Mr. M. K. Jain, Deputy Secretary (Horticultural Science), ICAR, New Delhi
9. Dr. S. K. Ali, Programme Coordinator, Krishi Vigyan Kendra, Malegaon Khurd, Baramati.



Results -Framework Document (RFD)

Section 1: Vision, Mission, Objectives and Functions

Vision

To harness the research and development activities in flower crops and landscape gardening for promotion of domestic and export markets.

Mission

To carry out research, impart education, conduct outreach programmes in floriculture and landscaping with national and international partners for enhancing the production, productivity, profitability besides alleviating the rural poverty.

Objectives

- Management and utilization of genetic resources.
- Production management and value addition.
- Dissemination of knowledge.

Functions

- Collection, evaluation and maintenance of flower crop germplasm.
- To act as National Repository of selected commercial flower crops.
- Development of new and improved varieties in flower crops through conventional as well as non-conventional methods.
- Human resource development and transfer of technologies.
- Standardization of post harvest technologies including value addition in commercial flower crops.

Section 2: Inter se Priorities among Key Objectives, Success indicators and Targets

S. No	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value				
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%
1.	Management and utilization of genetic resources	40	Collection & characterization of genetic resources.	Germplasm collected	Number	20	35	30	25	20	15
2.	Production management and value addition	35	Development of production, protection and post harvest technologies, Production of planting materials	Germplasm evaluated Technologies developed	Number Number	20 15	75 06	60 05	55 04	50 03	45 02
3.	Dissemination of knowledge	14	Transfer of technology through training, demonstrations, Kisan Melas, & exhibitions etc.	Planting materials produced Training and demonstrations organized Kisan Melas, awareness camps & exhibitions organized	Number Number Number	20 6 8	1.5 5 5	1.0 4 4	0.75 3 3	0.50 2 2	0.45 1 1
	Efficient functioning of the RFD system	3	Timely submission RFD (2013-14) for approval Timely submission of results for RFD (2012-13)	On-time submission On-time submission	Date Date	02 01	May 15, 2013 May 1, 2013	May 16, 2013 May 2, 2013	May 17, 2013 May 5, 2013	May 20, 2013 May 6, 2013	May 21, 2013 May 7, 2013
	Administrative Reform	4	Implement ISO 9001 as per approved action plan Prepare an action plan for innovation	% Implementation On time submission	% Date	2 2	100 July 30, 2013	95 Aug.10, 2013	90 Aug. 20, 2013	85 Aug.30, 2013	80 Sep.10, 2013

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S. No	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / Criteria Value				
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%
	Improving Internal Efficiency / responsiveness / service delivery of Ministry / Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	2	100	95	90	85	80
				Independent Audit of implementation of public grievance redressal system	%	2	100	95	90	85	80

Section 3: Trend values of the success indicators

S.No.	Objectives	Actions	Success Indicators	Unit	Actual Value		Target Value		Projected Value	
					2011-12	2012-13	2013-14	2014-15	2015-16	
1.	Management and utilization of genetic resources	Collection & characterization of genetic resources.	Germplasm collected	Number	-	25	30	35	37	
			Germplasm evaluated	Number	-	10	60	62	65	
2.	Production management and value addition	Development of production, protection and post harvest technologies,	Technologies developed	Number	-	-	05	5	6	
			Planting materials produced	Number in lakhs	-	-	1.0	1.10	1.12	
3.	Dissemination of knowledge	Transfer of technology through training s, demonstrations, KisanMelas, & exhibitions etc.	Training and demonstrations organized	Numbers	-	3	4	4	5	
			KisanMelas, awareness camps & exhibitions organized	Number	2	4	4	4	5	

Section 4: Description and definition of success indicators and proposed measurement methodology

Sl. No.	Success indicator	Description	Definition	Measurement	General Comments
1	Germplasm collected	Germplasm are genetic resources of flowers which are source of genetic variability	Germplasm is collection of all cultivars, wild species etc for conservation and utilization and best performer will be identified for their evaluation before release	Number of accessions added/ characterized or clones developed or under process of development	-
2	Germplasm evaluated	On the basis of their performance collected germplasm are evaluated	It is an asexual method of propagation by which disease free planting material is evaluated.	Number	In flowers planting material are not disease free and commonly grown asexually
3	Technologies developed	Developing production technologies to improve input use efficiency and increase Benefit: cost ratio of growers	Input use efficiency refers to judicious use of floricultural inputs to increase flower production per unit of inputs used.	Developing irrigation schedules, INM, IPM schedules etc.	Improving water use efficiency, nutrient use efficiency and pesticide use efficiency is most important factor to reduce cost of production in flowers.
4.	Planting materials produced	Elite planting material will produced to meet the demand of stakeholders	Lack of planting materials are the major constraint in floriculture through production of planting material we can cope-up with this problem	Numbers of planting materials produced (in lakhs)	-
5.	Training and demonstrations organized	Capacity building activities to improve knowledge and skill of flowers growers, extension workers etc.	Training is a process of acquiring new skill, attitude and knowledge through various means	Number	
6.	Kisan Melas, awareness camps & exhibitions organized	Developed technology for improved production and protection technology for growers will be demonstrate	Imparting knowledge to growers about the new scientific methods for enhancing the production of flowers	Number	

Acronyms

Sl. No	Acronym	Description
1	RFD	Results Framework Development
2	ISO	Indian Standard Organization

Section 5: Specific performance requirements from other Departments

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement from this organisation	Justification for this requirement	Please quantify your requirement from this Organisation	What happens if your requirement is not met.
Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Section 6: Out-Come/Impact of Department/Ministry

S. No.	Outcome/Impact of organisation	Jointly responsible for influencing this outcome/impact with the following organisation(s)/ departments/ministry(s)	Success Indicators	Unit	2011-12	2012-13	2013-14	2014-15	2015-16
1.	Production of quality, planting materials of Floricultural crops, development of improved varieties and technologies	DAC/ and SAUs/ etc.	Increase in production of flower crops	%	1	1.2	1.3	1.3	1.4



**Annual (April 1, 2013 to March 31, 2014) Performance Evaluation Report of RFD 2013-2014
of Directorate of Floricultural Research, IARI Campus, New Delhi-110012**

**Name of the Division: Horticulture Name of the Institution: Directorate of Floricultural Research IARI Campus New Delhi
Rfd Nodal Officer of the RSC: Dr Ajai Kumar Tiwari, Sr. Scientist**

S. No.	Objective (s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
1.	Management and utilization of genetic resources	40	Collection & characterization of genetic resources.	Germplasm collected	Number	20	35	30	25	20	15	35	100.00	20.00	116.66	DFR is maintaining national repository for chrysanthemum and gladiolus
2.	Production management and value addition	35	Development of production, protection and post harvest technologies	Germplasm evaluated Technologies developed	Number	20	75	60	55	50	45	60	100.00	20.00	100.00	
3.	Dissemination of knowledge	14	Production of planting materials Transfer of technology through trainings, demonstrations, Kisan Melas, camps & exhibitions etc.	Planting materials produced Training and demonstrations organized Kisan Melas, awareness camps & exhibitions organized	Number (in lakhs) Number	20	6	20	15	10	5	5	90.00	13.50	125.00	DFR is maintaining national repository for chrysanthemum and gladiolus
													90.00	5.40	100.00	
													90.00	7.20	100.00	

S. No.	Objective (s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
4.	Efficient functioning of the RFD system	3	Timely submission RFD (2013-14) for approval	On-time submission.	Date	02	May 15, 2013	May 16, 2013	May 17, 2013	May 20, 2013	May 21, 2013	May 15, 2013	100.00	02.00	100.00	
			Timely submission of results for RFD (2012-13)	On-time submission.	Date	01	May 1, 2013	May 2, 2013	May 5, 2013	May 6, 2013	May 7, 2013	15 th April 2013	100.00	01.00	100.00	
5.	Administrative Reform	4	Implement ISO 9001 as per approved action plan	% Implementation	%	2	100	95	90	85	80	100	100	02.00	100.00	
			Prepare an action plan for innovation	On time submission	Date	2	July 30, 2013	Aug.10, 2013	Aug. 20, 2013	Aug.30, 2013	Sep.10, 2013	July 30, 2013	100.00	02.00	100.00	
6.	Improving Internal Efficiency / responsiveness / service delivery of Ministry / Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	2	100	95	90	85	80	100	100.00	02.00	100.00	
				Independent implementation of public grievance redressal system	%	2	100	95	90	85	80	100	100.00	02.00	100.00	

Total Composite Score: 96.10

Procedure for computing the Weighted and Composite Score

1. Weighted Score of a Success Indicator = Weight of the corresponding Success Indicator x Raw Score / 100
2. Total Composite Score = Sum of Weighted Scores of all the Success Indicators

Budget 2014-15

The details of the budget including AICRP (Floriculture) are tabulated as under.

(Rs. in lakhs)

Sl. No.	Head of Account	Plan		Non-Plan	
		Budget	Expenditure	Budget	Expenditure
1	Establishment Charges	367.49	367.49	190.00	175.06
2	TA	9.86	9.86	16.98	16.98
3	HRD	0.39	0.39	0.00	0.00
4	Other Charges	74.26	74.25	43.52	27.58
TOTAL (A)		452.00	451.99	250.50	219.62
5	Equipment	0.00	0.00	0.00	0.00
6	Furniture	0.00	0.00	2.00	1.96
7	Loan and Advances	0.00	0.00	5.00	1.84
TOTAL (B)		0.00	0.00	7.00	3.80
GRAND TOTAL (A+B)		452.00	451.99	257.50	223.42



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