

# **Annual Report**

## **2011 - 12**



**Directorate of Floricultural Research**  
**(Indian Council of Agricultural Research)**  
**Pusa Campus, New Delhi-110 012**

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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. Flowers are intricately entwined in the social fabric of India and no function is complete without it. The rich bio-diversity of ornamentals is a great natural worth that provides countless scientific opportunities to harness their potential. The domestic industry is growing at an impressive annual rate of 7-10%. The area under floriculture in the country is approximately 1.91 lakh ha (2010-11) which is concentrated mainly in Tamil Nadu, Andhra Pradesh, Maharashtra and West Bengal with a total production of 10,31,000 metric tonnes (MT) of loose flower and of 69,027 Lakh numbers of cut flower (*Indian Horticulture Database, 2011 NHB*).

Research on floriculture received an impetus during the XI Plan (2010-11) successively with the establishment of Directorate of Floricultural Research (DFR), New Delhi in December, 2009 by upgradation of Project Coordinators Cell of All India Coordinated Research Project (AICRP) 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 by linking the ICAR Institutes with the State Agricultural Universities (SAUs). The DFR aims at harnessing research in floriculture. The projects aim to address diverse and need-based research and development (R&D) priorities, that include genetic resource utilization, crop improvement, standardization of production technologies, efficiency of resource utilization such as productive use of water, plant architecture engineering and management, technology for crop protection and value addition and developing repository of information in the data bank. The Annual Progress Report 2011-12 in hand highlights the programmes and achievements made by the DFR during the period from 1<sup>st</sup> April 2011 to 31<sup>st</sup> March, 2012.

I extend my gratitude to Dr. S. Ayappan, Hon'ble Secretary, Department of Agricultural Research and Education (DARE) and Director General, ICAR and Dr. H.P. Singh, Deputy Director General (Horticulture) for his constant encouragement, support and guidance which was helpful in gaining momentum and moving on fast track. The physical facilities and support provided by Dr. H.S. Gupta, Director, IARI from time to time is duly acknowledged. We also acknowledge the help and co-operation extended by Dr. Umesh Srivastava, Dr. S. Rajan, Assistant Director General (Hort.), Dr. S.K. Malhotra, and Dr. P.L. Saroj, Principal Scientists (Horticulture Division) of ICAR.

The support provided by all the scientific, administrative, financial and technical staff is duly recognised. I place on record my appreciation to my colleagues, Dr. P. Naveen Kumar, Dr. Gunjeet Kumar, Dr. Tarak Nath Saha, Dr. Jayoti Majumder and Ms Sellam P. from the Directorate for their effort in compilation, editing and vetting of the Annual Report.

June 24, 2012  
New Delhi



**(Ramesh Kumar)**  
Director



## Contents

<i>Preface</i>	iii
<i>Executive Summary</i>	vii
About the Institute	1
Salient Research Achievements	3
Institutional Building	24
Meetings of RAC/IRC/IMC	28
Transfer of Technology	31
Publications	33
Awards and Recognitions	39
Seminars/Symposia/Conferences/Workshops Attended	42
Personnel	45
AICRP on Floriculture	47
Distinguished Visitors	49
Budget 2011-12	52
XII Five Year Plan	53



## Executive Summary

The salient findings made by the DFR during the period under report (2010-11) are given here under:

- In the existing collection thirty additional varieties of gladiolus including 6 each from IIHR and IARI namely Arka Kesar, Arka Amar, Arka Gold, Arka Naveen, Poonam and Sapna; Pusa Shubham, Pusa Shanam, Anjali, Gunjan, Gulaal and Urmil respectively were added to the existing collection (58). In chrysanthemum, 153 new collections (63 spray, 90 standard) were added to the existing germplasm (70). In the annuals 369 accessions belonging to 106 species were introduced from exotic sources.
- In gladiolus, 76 cross combinations were made between the promising varieties and previous year harvested seed was sown for getting planting stock.
- In chrysanthemum, the open pollinated seeds from promising parents (22) were collected for further evaluation. The germination behaviour of open-pollinated seeds harvested during 2010-11 was studied and varieties such as Baggi, Ratlam Selection, Birbal Sahni, Yellow Charm, White Prolific, Red Gold, etc. germinated.
- In flowering annuals, selfing was attempted in the selected crops namely, petunia, pansy and antirrhinum to develop inbred lines. Inter specific crosses were made between *Alcea rosea* and *Malva sylvestris* to generate variability for different plant types, flower shape and colour. The interspecific crosses between these species made during 2010-11 (19) were sown and five F<sub>1</sub> seeds germinated which were planted for further field evaluation.
- Ten varieties, namely, Arka Nirantar, Calcutta Single, Calcutta Double, Hyderabad Single, Hyderabad Double, Prajwal, Vaibhav, Phule Rajnai, Rajat Rekha, Shringar, Suvasini and Sikkim Selection were irradiated with gamma rays (2.5, 5.0 and 7.5 Gy) and planted in pots. However, no significant variation was observed for plant growth and flowering.
- In gladiolus, 11 varieties were planted during October and December, to observe their suitability and performance at different times. The delay in planting adversely affected the growth and flowering performance.
- Four gladiolus cultivars namely, White Prosperity, Snow Princess, Big Time Supreme and Jackson Ville Gold were planted in flat and raised beds, and except superior number of cormels per plant no other growth and flowering characters was affected by planting methods.
- Pendimethalin @1.0 kg a.i. per ha was found to be effective for controlling weeds upto 70 days.
- In chrysanthemum, 153 varieties were evaluated for their performance. The cultivars Anmol, Himanshu and Flash Point were found to be suitable for pot culture. The cultivars, Lucido, Red stone, Cloverlea Star, Spacer, Autumn Eyes and Flash Point were very early in flowering whereas, cultivar Coffee, Dark Eyes, Maghi, were late

bloomers. The 'no pinch' and 'no stake' cultivars were found to be Bindiya, Bi-colour Bonsai, Valerie, Miko, Kotoi No Kaori, Yellow Charm and Gum Drop.

- Based on their plant height the flowering annuals were classified into three groups, Tall (> 60 cm): poppy, sweet sultan, helichrysum, dimorpotheca, cosmos, lupin, *Coreopsis tnctoria*, bells of ireland, gaillardia, *coreopsis lanceolata* and statice; medium (30-60 cm): lagurus, linaria, saponaria, sweet william, phlox, acroclinum, verbena, aster, candytuft, nasturtium, calendula, gazania, wall flower, brumus and breeza; dwarf (<30 cm): brachycome, metrocaria, *Chrysanthemum multicaule*, sweet alyssum and ice plant.
- The blooming for longer duration was observed in petunia, phlox, gaillardia, statice, hollyhock; whereas sweet alyssum, pansy, brachycome, pansy and metrocaria were early in flowering and flowered for a short duration.
- More seed setting and seed yield were found in coreopsis, gaillardia, helichrysum, calendula, nasturtium and verbena, whereas pansy, sweet alyssum and linaria were poor seed setters and low yielders; phlox, sweet william, mesembranthenum, bells of ireland, sweet sultan were observed to be medium seed setters and moderate yielders.
- In tuberose cv. Prajwal, Pendimethalin @ 1.00 kg a.i./ha as pre emergence application proved more effective than other herbicides.
- In gladiolus cultivars Flevo Laguna, Flevo Amico, Gold Field, Amsterdam, Jessica, Invitatie and Blues were observed to have longer vase life (10-12 days).
- Helichrysum, statice, acroclinum, gaillardia, annual chrysanthemum, brumus, lagurus were dried using different drying methods for standardization of harvesting stage of the flowers and greens. Inverted drying method has given encouraging results in helichrysum, acroclinum and statice.





# About the Institute

The Directorate of Floricultural Research (DFR) has been upgraded from the Project Coordinator's cell of All India Coordinated Research Project (AICRP) on Floriculture, during the XI plan to strengthen floricultural research and augmenting the technological base in floriculture. It has completed 2 year by 2012. Being integral part of DFR, AICRP on Floriculture has 23 Centres which

includes 16 budgetary and 7 voluntary Centres. Considering the research needs and potential scope of floriculture in India, the mandate of 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

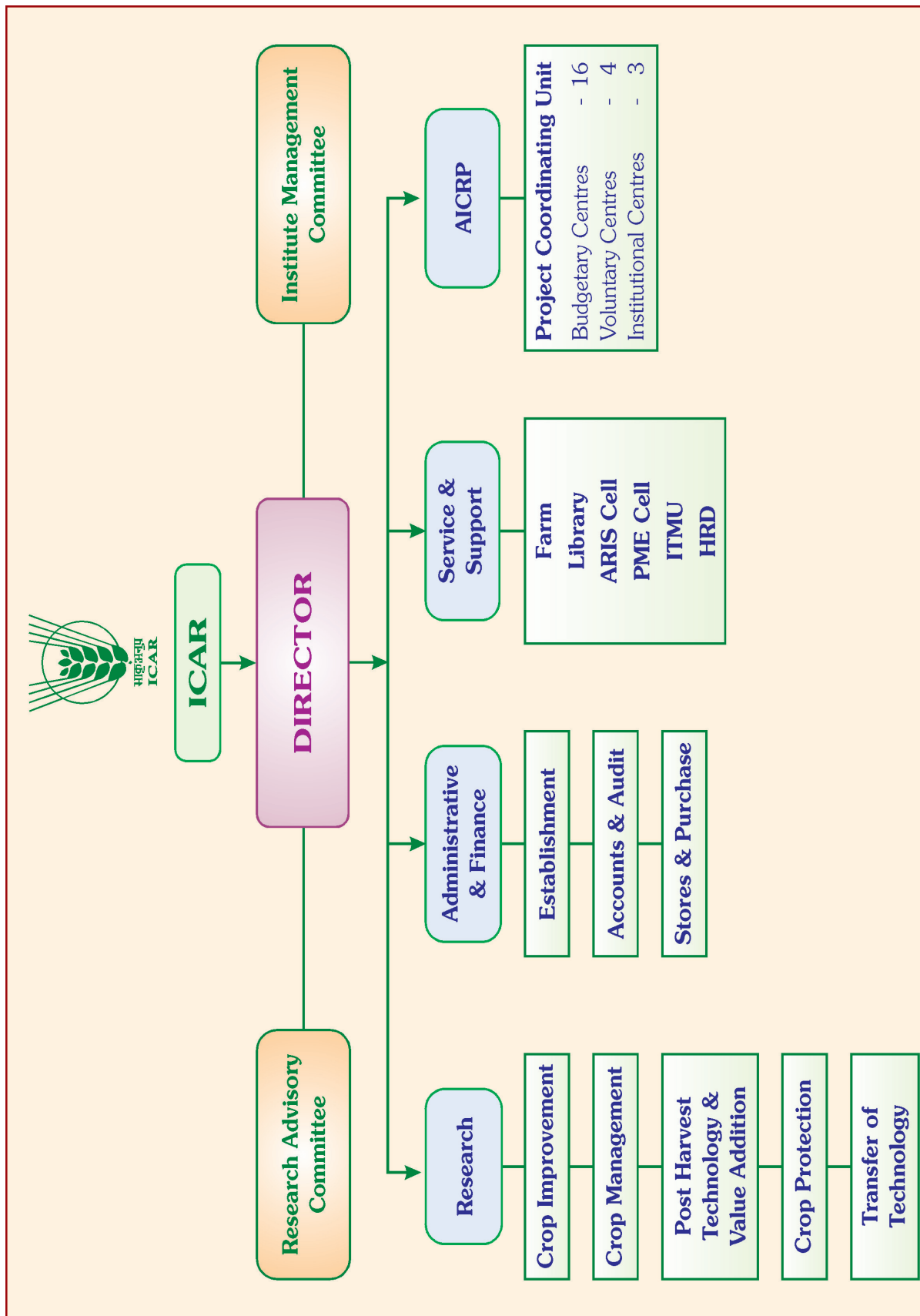
- Effective management, enhancement, evaluation of genetic resources and development of improved cultivars, with high quality characteristics for export, productivity and resistance to pests and diseases.
- To undertake basic, applied and strategic research for addressing national problems, enhance productivity, 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 of training for up gradation of scientific manpower in modern technologies flower production.
- To collaborate with relevant national and international agencies to bring synergy between the technologies.

## 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 out-reach programmes in floriculture and landscaping with national and international partners for enhancing the production, productivity, profitability besides alleviating the rural poverty.



Organizational Setup of DFR

# Salient Research Achievements

## CROP IMPROVEMENT

### Gladiolus

#### *Germplasm collection and evaluation*

The existing gladiolus germplasm (58) was enriched with the introduction of 30 more varieties (Table 1). These includes 6 varieties of IIHR namely, Arka Kesar, Arka Amar, Arka Gold, Arka Naveen, Poonam and Sapna and 6 varieties of IARI namely Pusa Shubham, Pusa Shanam, Anjali, Gunjan, Gulaal and Urmil. The new collections include some of the dwarf/miniature varieties (Flevo Amico and Flevo Laguna) which are highly suitable as bedding plants and for pot culture.



Field view of gladiolus

All the indigenous and exotic varieties were planted for their evaluation of growth, flowering and corm/cormel production behaviour under Delhi conditions (Table 2 and Table 3). The varieties were screened for resistance/tolerance against the incidence of *Botrytis gladiolorum* and *Fusarium* rot/ wilt disease.

#### *Breeding*

During the year, large 76 number of crosses were made between the promising varieties (Table 4). The potential of all existing germplasm including new ones were used in the breeding programme for seed set among them, both under natural and artificial pollination. The open pollinated seeds and a few seed from selected crosses of the last year were sown for obtaining planting stock (corms/cormlets) for the next season.

Dr. P. Naven Kumar, Senior Scientist DFR is associated with three gladiolus hybrids namely, Pusa Manmohak (Mayur x Hunting Song), Pusa Red Valentine (Selection among open pollinated seedlings of Regency) and Pusa Vidhusi (Melody x Berlew) developed at IARI, were identified by the IARI variety Identification Committee (IVIC). The proposals for the release of these varieties in Delhi state were submitted to Delhi State Seed Sub-Committee. Out of these, Pusa Manmohak has been released during the Golden Jubilee Convocation of IARI on 20<sup>th</sup> February 2012.



Chrysanthemum Germplasm in Field and Pots

**TABLE 1 : Gladiolus varieties being maintained at DFR, New Delhi during 2011-12**

<b>S. No.</b>	<b>Variety</b>	<b>S. No.</b>	<b>Variety</b>	<b>S. No.</b>	<b>Variety</b>
1	Aarti	31	Gulaal	61	Purple Flora
2	Adagio	32	Gunjan	62	Pusa Kiran
3	Alexander the Great	33	Hunting Song	63	Pusa Shanam
4	Amsterdam	34	IIHR G 11	64	Pusa Shubham
5	Anjali	35	IIHR G12	65	Pusa Suhagin
6	Arka Amar	36	Invitatie	66	Red 54
7	Arka Gold	37	Jackson Ville Gold	67	Red Advance
8	Arka Kesar	38	Jessica	68	Red Beauty
9	Arka Naveen	39	Jyotsna	69	Regency
10	Big Time Supreme	40	Kum kum	70	Rose Supreme
11	Blues	41	Lemon Drop	71	Sagar
12	Chadha Farm -1	42	Mascagni	72	Sancerre
13	Chadha Farm -2	43	Novalux	73	Sapna
14	Chadha Farm -3	44	Ocilla	74	Shagun
15	Chandini	45	Ovatie	75	Shakti
16	Chemistry	46	Overture	76	Shobha
17	CPG	47	Peasano	77	Snow Princess
18	Darshan	48	Peter Pears	78	Solist
19	DH-1 (Delhi Hybrid)	49	Pink Friendship	79	Spic – n-span
20	DH-2 (Delhi Hybrid)	50	Plumtart	80	Sylvia
21	Dhanwantari	51	Poonam	81	Tilak
22	Essentral	52	Praha	82	Trader Horn
23	Esta Bonita	53	Priscilla	83	Urmil
24	Eurovision	54	Pune Hybrid	84	Verona
25	Fidelio	55	Punjab Beauty	85	White Friendship
26	Flevo Amico	56	Punjab Dawn	86	White Prosperity
27	Flevo Laguna	57	Punjab Elegance	87	Wigs Sensation
28	Flew Souvenir	58	Punjab Flame	88	Yellow Stone
29	Gold Field	59	Punjab Glance		
30	Green Star	60	Punjab Lemon Delight		

TABLE 2 : Evaluation of indigenous varieties (from IARI, IIHR and PAU) at DFR during 2011-12

S. No.	Variety	Days to spike emergence	Plant Height (cm)	Spike length (cm)	Rachis length (cm)	No. of florets	No. of leaves	No. of tillers	Stem thickness (mm)	Floret colour
1	Aarti	-	70.8	58.2	35.8	9.6	8.8	2.4	18.8	Red
2	Anjali	88	93.2	82.4	49.2	15.4	7	1.8	22	Light Pink
3	Arka Amar	104	81	70	41	15	9	2.33	21.67	Red with Yellow spot
4	Arka Gold	109	89	78.33	33.33	10.33	10	1.33	20.33	Yellow with Red spot
5	Arka Kesar	101	90.67	78.67	49.67	15.33	8	1.67	28.67	Saffron Yellow
6	Arka Naveen	110	73.33	62	31.67	12	7	1.33	25	Purple
7	Chandini	84	100.4	86.2	39.8	12.6	8.6	2.8	15.8	Light Yellow
8	Darshan	-	70.67	59	30.67	12	9	1.67	28	Light Purple
9	Dhanvantari	95	108.2	88.8	43.6	14.6	10	2.6	17	Yellow
10	Gulal	102	60	49	24	8.67	7	2	19.33	Pink
11	Gunjan	82	70.2	60.8	24.4	8	7	1.8	12.6	Light Orange
12	IIHR G-12	76	93.6	77.4	39.6	14	8	1.4	19.8	Purple
13	IIHR G -11	80	74	60	37.4	15	10	2	22.2	Purple
14	Jyotsna	91	95.4	82.4	57.6	14.8	8	2.8	18.8	Orange
15	Kum Kum	108	67	57.67	36	11.67	7	3.33	18	Red
16	Lemon Delight	-	72.2	59.2	39	10.4	8	2.2	17.6	Lemon Yellow
17	Punjab Dawn	-	91.8	75.2	42	16	8	3.4	20.2	Reddish Orange
18	Punjab Elegance	-	65.8	53.4	39	14	8	2.4	14.4	Pinkish White
19	Punjab Glance	-	83.8	70.4	52.4	13.8	8	1.2	22.8	Orange
20	Pusa Kiran	88	90.6	71	43.6	15.2	8	2.6	18	White
21	Pusa Shubham	90	73.4	64.4	29	10.8	6.8	2.8	13.6	Light Yellow
22	Pusa Suhagin	-	95	78	53.8	15.2	8	2.2	19.4	Red
23	Sagar	-	82.67	65	43	11.67	9	3	21	Light Pink
24	Sapna	99	61.33	52.67	31	12.67	7	1	17.33	Yellowish White
25	Shabnam	93	78	64.67	29.33	10.33	7	3.67	14.33	White
26	Shagun	-	73.2	58.4	32.6	13	11.2	1.2	16.2	Red
27	Urmil	106	57	-	-	-	6.4	1.6	15.4	Purple

**TABLE 3 : Performance of exotic varieties of gladiolus at DFR, Pusa, New Delhi during 2011-12**

S. No	Variety	Days to flowering	Plant Height (cm)	Spike length (cm)	Rachis length (cm)	No. of florets	No. of leaves	No. of tillers	Stem thickness (cm)	Floret colour
1	Adagio	109	103.2	82.8	57.8	17	8	1	2.34	Yellow
2	Alexander The Great	92	127.6	108	67	15.8	8	2.2	1.9	White
3	Amsterdam	109	111.4	93.4	54.6	17.6	8.2	1	2.02	White
4	Big Time Supreme	95	103.6	89.0	46.4	13.2	10	2.6	2.5	Light pink
5	Blues	107	107.6	92	58.4	18.2	8	1	1.86	Blue
6	Chandini	85	100.4	86.2	39.8	12.6	8.6	2.8	1.58	Light yellow
7	Chemistry	81	98	81.4	51.6	16.6	9	1.4	2.76	Bluish purple
8	Essential	111	99	82.2	61.2	20	8	1	2.24	White
9	Esta Bonita	113	106.2	91.4	54.2	14.8	8	1	1.94	Apricot orange
10	Eurovision	84	106.2	95	60.4	18	8.6	2.2	2.5	Red
11	Flevo Laguna	115	73.6	61.6	40.2	16.2	8	2	1.7	Yellow with dark pink border
12	Fidelio	98	96.4	78.6	42.2	13.2	8	1.2	2.0	Dark pink
13	Flevo Amico	116	68	58	41.8	17.6	8	2.8	1.6	Pink
14	Flevo Souvenir	98	71	57.8	41.2	13.2	8	1.6	1.64	Yellow
15	Green Star	106	78	64.4	39.8	14	8	1	2.26	Green
16	Hunting Song	71	71.6	58.6	36.8	14.4	8	1	2.32	Dark orange
17	Invitatie	108	94	81.2	40.2	11.6	9.8	1	2.04	Pink
18	Jackson Ville Gold	102	89.4	75	38.6	10.8	8	1.8	2.14	Yellow
19	Jessica	76	84.2	68	48.6	17.8	6.8	1.8	2.26	Peach (salmon)
20	Lemon Drop	115	92.2	68.2	48.8	16.4	8	1	2.24	Yellow
21	Mascagni	108	92.4	79	51	15.6	8	1.4	2.82	Red
22	Novalux	105	88.6	71.8	36.6	11	8	2.4	2.12	Yellow
23	Ocilla	98	101.8	88.6	52.8	17.4	8.4	1.6	2.12	White
24	Ovatie	105	95	79	51.2	14.2	8	1	2.58	Coppery orange
25	Overture	101	100.8	86.2	50.4	15	8	2.2	2.38	Dark orange
26	Peasano	91	122.2	103.2	46.6	11.6	10	2.2	2.02	Orange
27	Peter Pears	97	93.4	75.6	49.4	16.6	8	1.4	2.1	Salmon orange
28	Pink Friendship	102	93.2	76.4	47.6	13.8	8	1.4	2.12	Light pink
29	Plumtart	107	98	83	51.8	16.6	8	1	1.88	Purple
30	Priscilla	81	95.0	80.4	49.8	14.4	8.00	2.8	2.12	Pink
31	Purple Flora	81	77.6	65.0	34.2	11.6	7.00	1.8	1.74	Dark purple
32	Red 54	104	96.4	79	42.6	22.6	8.4	2.6	1.78	Red
33	Red Advance	98	75.2	63	33.2	13.2	8	1	1.86	Red
34	Red Beauty	102	98	75.2	45.8	17.2	10	1.4	2.1	Red
35	Rose Supreme	88	108	86	57.8	17.6	10	2.8	2.22	Rose pink

36	Snow Princess	91	87.4	75	44	16.8	8	2.4	2.36	White
37	Solist		101.2	80.8	52.4	19.4	8	1	2.44	White
38	Spic & Span	112	91.6	75.6	46.2	16	8	1	2.24	Salmon pink
39	Trader Horn	99	97	80.4	44.4	17.4	10	1	2.08	Red
40	Verona	114	95	77.6	51.2	16	8	1	2.16	Dark pink
41	White Prosperity	88	112	96	61.8	18.6	8.4	2.2	2.2	White
42	Wigs Sensation	95	108.2	93	60	17.4	9.2	2	2.24	Red
43	Yellow Stone	100	104.2	91.2	45.4	14.6	9.2	2.2	2.12	Yellow

**TABLE 4 : Parents of the crosses made during 2011-12**

S No.	Seed Parent	Pollen Parent	S. No.	Seed Parent	Pollen Parent
1.	Alexander The Great	Red Beauty	31	Ocilla	Wigs Sensation
2.	Alexander The Great	Yellow Stone	32	Ocilla	Yellow Stone
3.	Alexander The Great	Big Time Supreme	33	Pink Friendship	Chemistry
4.	Alexander The Great	Fidelio	34	Priscilla	Alexander The Great
5.	Alexander The Great	Purple Flora	35	Priscilla	Alexander The Great
6.	Big Time Supreme	Yellow Stone	36	Priscilla	Chemistry
7.	Chemistry	Adagio	37	Priscilla	Purple Flora
8.	Chemistry	Amsterdam	38	Priscilla	Red Beauty
9.	Chemistry	Mascagni	39	Priscilla	Yellow Stone
10.	Chemistry	Ovatie	40	Purple Flora	Esta Bonita
11.	Chemistry	Priscilla	41	Purple Flora	Esta Bonita
12.	Chemistry	Yellow Stone	42	Purple Flora	Flevo Amico
13.	Chemistry	Alexander The Great	43	Purple Flora	Gold Field
14.	Chemistry	Red Beauty	44	Purple Flora	Invitatie
15.	Eurovision	Solist	45	Red Beauty	Alexander The Great
16.	Fidelio	White Prosperity	46	Red Beauty	Fidelio
17.	Fidelio	Yellow Stone	47	Red Beauty	Purple Flora
18.	Flevo Laguna	Essential	48	Red Beauty	Yellow Stone
19.	Flevo Laguna	Invitatie	49	Rose Supreme	Chemistry
20.	Flevo Laguna	Jessica	50	Rose Supreme	Yellow Stone
21.	Flevo Souvenir	Green Star	51	Snow Pricness	Red Beauty
22.	Flevo Souvenir	Red Beauty	52	Snow Pricness	Yellow Stone
23.	Flevo Sovneir	Alexander The Great	53	Snow Princess	Chemistry
24.	Flevo Laguna	Big Time Supreme	54	Snow Princess	Wigs Sensation
25.	Mascagni	Essentials	55	Solist	Fidelio
26.	Mascagni	Gold Field	56	Solist	Purple Flora
27.	Mascagni	Purple Flora	57	Solist	Red Beauty
28.	Mascagni	Verona	58	Solist	Yellow Stone
29.	Ocilla	Chemistry	59	Trader Horn	Ocilla

30.	Ocilla	Red Beauty	60	White Prosperity	Fidelio
31.	White Prosperity	Purple Flora	69	Yellow Stone	Big Time Supreme
32.	White Prosperity	Yellow Stone	70	Yellow Stone	Ocilla
33.	Wigs Sensation	Alexander The Great	71	Yellow Stone	Red Beauty
34.	Wigs Sensation	Chemistry	72	Yellow Stone	Red Beauty
35.	Wigs Sensation	Fidelio	73	Yellow Stone	Wigs Sensation
36.	Wigs Sensation	Purple Flora	74	Yellow Stone	Chemistry
37.	Wigs Sensation	Yellow Stone	75	Yellow Stone	Alexander The Great
38.	Wigs Sensation	Purple Flora	76	Yellow Stone	Purple Flora

**Note:** Open Pollinated seed of the varieties Big Time Supreme, Eurovision, Flevo Souvenir, Novalux, Peter Pears, Purple Flora, Red Beauty and Yellow Stone were also collected.

## Chrysanthemum

### *Germplasm collection and evaluation*

Chrysanthemum varieties (standard and spray types) collected from various sources, were evaluated for growth, flowering and their suitability for different purposes and to find promising genotypes to be used as parents in future research

programme. The growth and flowering behavior of spray type chrysanthemum (2010-11) is presented in table no. 5. All the cultivars are being maintained at germplasm block. The standard types were planted variety wise in pots for evaluation and exhibited in December during the foundation day (Table 6).

**TABLE 5 : Growth and flowering behaviour of chrysanthemum varieties under Delhi condition (2010-11)**

Sl. No	Variety	No. of Branches	No of flowers	Plant height (cm)	Plant spread (cm)	Flower diameter (cm)	Bud initiation (days)	Days to flower
1	Anmol	19	336	47.8	45	3	67	76
2	Aprajita	45.2	60	48.8	51.6	4.7	57	68
3	Autumn Joy	17	123.6	30.8	40.1	3.8	60	67
4	Dolly Orange	25.4	214.6	44.2	38.3	4.4	74	84
5	Dolly White	20.4	137.2	29.6	35.4	4	65	80
6	Flirt	14.8	128.8	52.8	41.9	6	66	87
7	Garden Beauty	11.8	82.6	46.4	39.7	9	70	84
8	Gitanjali	21.6	110.8	49.8	34.9	7	74	89
9	Gulmohar	10.8	48.8	61.4	30	6.1	74	86
10	Himanshu	43.8	178.6	29.4	49.2	5	76	86
11	IAH-White	3	23	35	10.75	5.25	53	69
12	IAH-Yellow	19.4	105.6	47.6	32.6	5	55	71
13	Jayanti	26.8	130.4	40	31.5	3.6	76	88
14	Lal Pari	12.4	89.6	45	36.8	5	70	83
15	Lalima	9.8	31.4	24.2	18.9	3	63	75
16	Liliput	14.4	220.6	35.8	38.7	2	77	95



17	Little Hemant	15.4	57.6	27.6	22.6	3.8	55	73
18	Little Kusum	22.8	120.4	39.2	35.6	3.7	45	79
19	Little Orange	10.8	69.6	26	29.9	4.1	70	83
20	Little Pink	37.4	118.4	36.8	37.1	4.1	74	84
21	Mallika Yellow	92	82	40	48.9	4.6	56	65
22	Mother Teresa	36.4	187.4	29.2	33.3	3.6	56	76
23	PAU 23	14	44.2	39.6	34.2	6.2	70	101
24	PAU 24	12.4	76.8	29.2	42	5.45	53	76
25	PAU 25	22	266	43.8	39.1	5	72	85
26	PAU 26	10.8	54.8	37.6	28.5	5.6	53	73
27	PAU 29	13.8	66	32.4	37.9	7.4	76	91
28	PAU 30	7.4	42	34.2	27.1	6.1	55	67
29	PAU 32	14.8	89.4	36.2	49.1	5.4	55	76
30	PAU 32	14.8	166.2	46.2	38.8	5	67	81
31	PAU 33	9.2	32	43.4	32.9	5	56	78
32	PAU 37	15	47.2	29.2	27.9	5.25	54	104
33	PAU 38	31.6	299.8	33.6	48.4	4.2	63	76
34	PAU 39	26.2	108.8	44	29.5	5	76	87
35	PAU 4	13.6	131	19	21.2	2.2	41	51
36	PAU 42	3.4	15.6	26.8	16.5	2	53	73
37	PAU 43	7.8	29.4	34.2	20.5	5.2	52	73
38	PAU 44	13.8	22.8	26.6	11.2	4	52	66
39	PAU 50	30	242	44.2	44.8	4.4	56	86
40	PAU 55	15.8	123.8	37	38.2	4	70	94
41	PAU 58	11.6	161.6	47.8	30.2	5.3	76	85
42	PAU 60	20.2	208	48.6	37.8	5.1	74	88
43	PAU 610	15	91.5	14.5	21.25	2	53	67
44	PAU 62	17.6	222.4	44.4	44.1	5.8	73	94
45	PAU 65	9.2	73.61	33	26.7	4.8	51	66
46	PAU 66	16	178.2	55.8	31.4	4	76	101
47	PAU 69	13	164.6	40.4	41.7	5.4	76	94
48	PAU 70	13.4	164	53.6	34.3	6	76	98
49	PAU 74	11.2	129.4	28.4	35.9	4.4	76	89
50	PAU 81	21.6	360.8	26.6	39.6	2.8	53	76
51	PAU 90	10.2	20.4	35.4	29.7	5.7	54	76
52	PAU 91	8.4	71.2	39.6	41.1	4.9	73	89
53	PAU 99	4	18	17	17	4	73	84
54	PAU A-18	10	67	24	27.5	3.5	60	74

55	PAU A-43	34.6	275.6	45.4	48.3	6	76	84
56	PAU A-64	22.8	344.8	311.2	43.4	3	64	87
57	PAU B- 107	23	197.2	50	46.4	6	65	87
58	PAU B-43	19	278.6	53.6	50	5.09	63	81
59	PAU D-11	18.6	101.4	26.8	30.4	3	73	96
60	PAU H-3	9.4	58	32.6	27.1	4	50	55
61	PAU H-4	15	170	34.33	34.67	5	56	73
62	PAU K-21	32.8	139.4	23.6	29.8	3	53	73
63	PAU Q	27	150	25.8	37.6	6	76	104
64	PAU T-14	8	40	11	15.5	2	99	109
65	PAU-1	16.2	47.6	45	30.6	6.2	56	76
66	PAU-I	15.8	97.8	37.8	30.2	5.1	56	73
67	PAU-II	13.6	93.4	46.8	34	8.1	73	94
68	PAU-III	13.2	95	30.2	26.6	4.8	50	56
69	PAU-IV	9.8	33	33	20.5	2	51	70
70	PAU-IX	9.4	32.2	34.6	18.4	4	78	94
71	PAU-V	15.2	195	51	38.4	3	56	73
72	PAU-VI	19.4	331.4	51	55	5	76	104
73	PAU-VII	15.8	42.2	39	19.2	6	76	90
74	PAU-VIII	16.5	110	44	26.88	4	79	93
75	Pink Star	7.33	280	27.33	35.33	2	70	85
76	Red Gold	7.6	146.6	49.6	35.8	6.2	56	77
77	Royal Purple	11.8	127.4	37.8	37.1	5	55	69
78	Sharad Mala	11.6	100.2	33.2	27	4.1	57	66
79	Shyamal	7.25	33	35.75	24.63	7	76	88
80	Star White	15.2	39.8	50	32.3	11.1	71	77
81	Star Yellow	5	27	44	25	8	70	76
82	Sukla	15	114.8	59.6	52.8	6.55	64	75
83	Sunny	13.2	94.4	39.4	38.4	7	67	77
84	Tata Centenary	21	19.8	46.6	23.7	9.3	58	71
85	Vijay	15.6	94	21.6	29.3	3	53	67
86	White Prolific	82	64.6	43.8	28.6	5.6	52	74
87	Winter Queen	24.4	269.4	48.8	50.6	7	77	89
88	Yellow Delight	11	35.6	32.8	25.1	5	53	64

TABLE 6 : List of Standard chrysanthemum being maintained at germplasm block

<b>Chrysanthemum Standard type</b>		
1. Bola De Ora	2. Apricot Parasol	3. Ajina Purple
4. Casa Grande (Pink)	5. Autumn Pink	6. Ajina Purple
7. Cello	8. Bob Dear	9. Appert
10. Cello	11. Butter Buff	12. Autumn King
13. Cheasapeake	14. Dazzler	15. Beatrice May
16. Crimson Tide	17. Emperor	18. Casa (Grande (Y)
19. Houston	20. Eva Turner	21. Casa Grande
22. Kokka Katakū	23. Fire Flash	24. Chandrama
25. Kokka Kohgun	26. Fish Tail	27. Classic Perfection
28. Kokka No Waza	29. Jessie Habgood	30. Cornetto
31. Kokka Senkin	32. Kokka Horgiku	33. Coronation Buff
34. Kokka Taijyu	35. Kokka Syoneri	36. Dignity
37. Moira	38. Miss India	39. Dream Castle
40. Mt. Sasta	41. Nancye Furneaux	42. Gambit
43. Mt. Whitney	44. Red Stone	45. Gloria Deo
46. Mt. Whitney	47. S. S. Arnold	48. Golden Punder
49. Pink Giant	50. Skater's Waltz	51. Golden Punder
52. Pink Giant	53. Skater's Waltz (White)	54. Guzman Red
55. Pot Black	56. Sover Glow	57. Kikubiyori
58. Red Wine	59. Sylvia Green	60. Lady Frank Clarke
61. River City	62. Tokio	63. Luxor
64. Satin Ribbon	65. Valliant	66. Mahatma Gandhi
67. Seatons Galaxi	68. White Kenroku	69. Morris White
70. Seatons Lace	71. White Silk Brocade	72. Rajah
73. Seatons Lady	74. White Silk Brocade	75. Robin Hood
76. Snow Crown	77. Willium Tumer	78. Royal Prince
79. Stuart Hall	80. Y. Kokka Gown	81. S. Mukherjee
82. Symphony	83. Yellow Knight	84. Snow Ball
85. White Cover Girl	86. Yellow Rayonnante	87. Sous Lt. Andre
88. Zinfandel	89. Zhengis Khan	90. Temptation

### Collection of seeds

The seed from promising parents were collected based on their floriferousness and noble traits. These were planted in plug trays for germination and further evaluation. The germination behaviour of Open Pollinated (OP) chrysanthemum seed collected during 2010-11 were under taken. Out of these observed germination occurred in varieties of Baggi, Ratlam Selection, Birbal Sahani, Yellow Charm, White Prolific, Red Gold, Anmol, Liliput, Garden Beauty, Autumn Joy, Royal Purple, Little Darling Hemant, Dolly White, Yellow Delight, Flirt, Little Darling Pink, Sunny, Shukla, Little Darling Orange, Jaya, Sharad Mala, Little Darling Kusum, Gitanjali, Dolly Orange, B-28, A-32, B-26, A-76, A-74, A-43, A-64, D-1, A-64, B-107, A-43 and B-43. However no germination was recorded in Mallika Yellow, Aprajita, Himanshu, A-44 and LF-26.

### Evaluation of Open Pollinated seedlings in field for novel traits

The raised seedlings were transplanted in evaluation block for screening against the growth and flowering behavior. Due to improper flowering



Promising Selection

in some of the seedlings, proper study could not be completed in the first year. However, a promising noble traits has been obtained in the seedling raised from the parent Garden Beauty. Its flower possess flute type florets with a spoon ending.

### Harvesting of fresh Open Pollinated seeds (2011-12)

Seed from the varieties namely, Spacer, Chandi, Red stone, Fire Ball, River city, Symphony, Red Devil, Dark Eyes, Statesman, Autumn Eyes, Anney, Shin Otome, Yukari, Seatons Lace, Chrystmus Carol, Apricot Alexis, Casa Granda, Kelvin Mandarin, Kelvin Tattoo, Flash Point, Cloveria Star, Pinki, Coffee, Lucido and Himanshu were harvested.

### Tuberose

Ten varieties namely, Arka Nirantar, Calcutta Single, Calcutta Double, Hyderabad Single, Hyderabad Double, Prajwal, Vaibhav, Phule Rajani, Rajat Rekha, Shringar, Suvasini and Sikkim Selection were subjected to irradiation with gamma rays (2.5, 5.0 and 7.5 Gy) and planted in pots for evaluation. However, no significant variation was observed for plant growth and flowering characteristics so far. The non-sprouted and sprouted bulbs of two varieties, Prajwal (single) and Vaibhav (double) were treated again with gamma rays (2.5, 5.0, 7.5, 10.0 and 12.5 Gy), MMS (1.00 %), EMS (0.75 %) and colchicine (0.50 %), and have been planted in field and pots for further evaluation.

### Flowering Annuals

Breeding programme in flowering annuals has been initiated in selected crops namely, petunia, pansy, hollyhock and antirrhinum. Attempts to isolate the collected germplasm based on flower



Bud Pollination and Selfing in Petunia

colour in petunia and antirrhinum through selfing have been made. The crosses between *Althea rosea* and *Malva sylvestris* were attempted reciprocally and seed setting occurred in 19



Hybridization in *Malva Sylvestris*

crosses. Out of 19, 5 germinated and  $F_1$  seeds were collected for further evaluation. During 2011-12 fresh crosses involving these species



Field View of Annuals

were attempted to generate variability in plant stature, flower colour, shape, etc. A large number of germplasm of flowering annuals was introduced from exotic sources (Table 7). The list of germplasm of winter annuals maintained at Directorate are Bells of Ireland, Calendula, *Coreopsis lanceolata*, *Coreopsis tinctoria*, Dimorpotheca, Escholtzia poppy, Helichrysum (Yellow, pink, white), Hollyhock (*Malva spp. and Alcea spp.*), Ice Plant, Larkspur, Lupin, Metrocaria, Nemesia, Ornamental rye, Phlox, Poppy, Saponaria, Stock, Sweet Alassum, *Chrysanthemum coronarium*, *Chrysanthemum*



Variability in Annual Chrysanthemum

*multicaule*, *Chrysanthemum paludosum*, *Chrysanthemum lucanthemum*, *Chrysanthemum carinatum*, China Aster (Purple, pink, white), Gaillardia (Yellow and Red-tall & dwarf), Sweet Sultan, Cosmos, Verbena, Sweet William, Antirrhinum, Pany, Cron Flower, Acroclinum, Petunia, Nasturtium and Monarda.

TABLE 7. Germplasm introduction

Crop	No. of accessions	No. of species
Coreopsis	22	9
Cosmos	2	2
Dianthus	68	21
Gaillardia	1	1
Gypsophila	17	11
Leucanthemum	85	4
Liatris	1	1
Oenothera	5	4
Penstemon	15	9
Petunia	18	4
Ranunculus	1	1
Rudbeckia	70	10
Silene	5	5
Snapdragon	23	11
Tagetes	19	4
Verbena	3	3
Viola	3	1
Zinnia	11	5
<b>Total</b>	<b>369</b>	<b>106</b>

## 1. CROP PRODUCTION

### Gladiolus

#### *Staggered planting*

Eleven varieties (Big Time Supreme, Chandini, Chemistry, Fidelio, Jackson Ville Gold, Overture, Red 54, Red Beauty, Solist, White Prosperity and Wigs Sensation) were planted during October and November to find their suitability to varied time and planting. The data (Table 8.) revealed that except three varieties (Chandini, Fidelio and Red 54), all the others performed better during November planting in respect of plant height, spike length and rachis length. Number of florets and the leaves did not show marked variation. In November planting, number of tillers increased but the stem thickness decreased in all the varieties.

Eleven new varieties (Adagio, Amsterdam, Essential, Esta Bonita, Flevo Laguna, Flevo Amico, Flevo Souvenir, Green Star, Lemon Drop, Plumtart and Verona) were planted during November and December for evaluating their performance under Delhi conditions. The data (Table 9) indicated that delay in planting adversely affected the growth and flowering performance of all the varieties.

Five varieties (Jessica, Peter Pears, Priscilla, Purple Flora and Rose Supreme) were planted during October, November and December to evaluate the effect of planting date on the growth and flowering (Table 10). The performance of all the varieties was found to be the best in November planting except Rose Supreme which showed superiority in December planting.

TABLE 8 : Effect of planting date on the growth and flowering during 2011-12 at DFR

Sl. No.	Variety	Plant Height (cm)		Spike length (cm)			Rachis length (cm)			No. of florets			No. of leaves			No. of tillers			Stem thickness (cm)		
		Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov	Oct	Nov		
1	Big Time Supreme	103.6	108.4	87.0	89.6	46.4	48.6	13.2	14.6	10.0	8.0	2.6	2.4	2.50	1.72						
2	Chandini	100.4	94.8	86.2	82	39.8	42.6	14.2	12.6	8.6	8.0	2.8	3.6	1.58	1.50						
3	Chemistry	98.0	110.2	81.4	94.4	51.6	59	16.6	16.8	9.0	8.0	1.4	1.4	2.76	2.04						
4	Fidelio	96.4	85.6	78.6	73.2	42.2	38.4	13.2	11.4	8.0	8.0	1.2	2.2	2.00	1.82						
5	Jackson Ville Gold	89.4	105.6	75	87.0	38.6	58.8	10.8	16.6	8.0	8.0	1.8	2.0	2.14	1.84						
6	Overture	100.8	102.8	86.2	87.8	50.4	54.2	15.0	15.4	8.0	8.0	2.2	2.6	2.38	1.70						
7	Red - 54	105.8	96.4	86.2	79.0	50.0	42.6	15.0	14.6	8.0	8.4	2.2	2.6	1.40	1.78						
8	Red Beauty	98.0	110.2	75.2	83.6	45.8	51.8	17.2	18.4	9.0	8.0	1.4	1.4	2.10	1.78						
9	Solist	101.2	121.4	80.8	101.6	52.4	70.4	19.4	20.0	8.0	8.0	1.0	1.6	2.44	1.66						
10	White Prosperity	112.0	119.4	96.0	104.8	61.8	69.8	17.6	17.8	8.4	8.0	2.2	2.0	2.20	2.24						
11	Wigs Sensation	108.2	116.2	93.0	97.2	60.0	58.6	17.4	19.0	9.2	8.0	2.0	3.4	2.24	1.98						

TABLE 9 : Effect of planting date on growth and flowering during at DFR (2011-12)

Sl. No.	Variety	Plant Height (cm)		Spike length (cm)			Rachis length (cm)			No. of florets			No. of leaves			No. of tillers			Stem thickness (mm)		
		Nov	Dec	Nov	Dec	Nov	Dec	Nov	Dec	Nov	Dec	Nov	Dec	Nov	Dec	Nov	Dec				
1	Adagio	103.2	91.6	82.8	81.2	57.8	39.2	17.0	12.8	8.0	8.0	1.0	1.0	23.4	15.6						
2	Amsterdam	111.4	90.4	93.4	79.8	54.6	42.2	17.6	13.4	8.2	7.4	1.0	1.4	20.2	16.2						
3	Essential	99.0	88.2	82.2	75.8	61.2	42.2	20.0	13.8	8.0	7.2	1.0	1.0	22.4	21.8						
4	Esta Bonita	106.2	101.8	91.4	89.8	54.2	43.2	14.8	12.4	8.0	10.2	1.0	1.0	19.4	19.6						
5	Flevo Laguna	73.6	55.0	61.6	44.4	40.2	27.4	16.2	11.0	8.0	7.0	2.0	1.8	17.0	11.0						
6	Flevo Amico	68.0	56.8	58.0	47.8	41.8	29.8	17.6	12.6	8.0	6.8	2.8	2.0	16.0	16.2						
7	Flevo Souvenir	71.0	57.8	57.8	47.4	41.2	24.4	15.2	11.6	8.0	7.4	1.6	1.0	16.4	17.6						
8	Green Star	78.0	64.0	64.4	54.4	39.8	23.2	14.0	8.4	8.0	8.0	1.0	1.0	22.6	16.0						
9	Lemon Drop	92.2	73.6	68.2	63.4	48.8	37.8	16.4	13.2	8.0	8.0	1.0	1.0	22.4	20.8						
10	Plumtart	98.0	73.8	83.0	61.0	51.8	33.8	16.6	11.8	8.0	8.0	1.0	1.4	18.8	13.6						
11	Verona	95.0	81.4	77.6	69.8	51.2	37.0	16.0	11.8	8.0	7.4	1.2	1.0	21.6	17.2						

TABLE 10 : Effect of staggered planting on the growth and flowering at DFR (2011-12)

Sl. No.	Variety	Plant Height (cm)			Spike length (cm)			Rachis length (cm)			No. of florets			No. of leaves			No. of tillers			Stem thickness (mm)		
		Oct	Nov	Dec	Oct	Nov	Dec	Oct	Nov	Dec	Oct	Nov	Dec	Oct	Nov	Dec	Oct	Nov	Dec	Oct	Nov	Dec
1	Jessica	84.2	90.8	61.8	68.0	72.8	51.6	46.6	48.6	31.6	17.8	14.2	12.0	6.8	8.0	6.4	1.8	2.8	1.6	22.6	14.6	14.2
2	Peter Pears	93.4	109.6	97.0	75.6	93.0	83.4	49.4	64.6	49.0	16.6	18.6	15.8	8.0	8.0	8.0	1.4	2.2	1.2	21.0	20.6	11.6
3	Priscilla	95.0	101.2	83.4	80.4	84.0	70.8	49.8	59.0	41.8	14.4	16.6	12.0	8.00	8.0	7.0	2.8	3.4	2.2	21.2	16.2	16.6
4	Purple Flora	77.6	93.8	83.6	65.0	79.4	69.8	34.2	50.4	35.4	11.6	15.8	12.6	7.00	8.0	8.0	1.8	1.0	1.0	17.4	19.4	13.0
5	Rose Supreme	108	103.8	117.6	86.0	90.2	101.0	56.6	44.0	57.8	15.2	13.8	17.6	10.0	7.8	8.0	2.8	2.5	2.2	22.2	12.0	24.4

## Method of Planting

Four gladiolus varieties namely, White Prosperity, Snow Princess, Big Time Supreme and Jackson Ville Gold were evaluated for their performance in respect of corm and cormel production by planting them in raised and flat beds. It was found that the method of planting did not affect number of corms produced, weight of corms and cormels except for the number of cormels which was recorded the highest in raised beds (Table 11).

## Chemical Weed Control

Weed management in gladiolus by chemicals was carried out as per the technical programme. It was found that Pendimethalin @ 1.0 kg a.i. per ha followed by Atrazine @ 1.5 kg a.i. per ha were found to be effective in weed control up to 70 days in gladiolus.

## Chrysanthemum

One hundred and fifty three varieties of standard and spray type were collected from various sources for evaluation of their performance under Delhi conditions.

Among varieties of the spray group (63), 13 were the rare varieties. The cultivar Anmol, Himanshu and Flash Point were found suitable for pot culture. The cultivars, Lucido, Red stone, Cloverlea Star, Spacer, Autumn Eyes and Flash Point were observed to be very early flowering whereas, the cultivar Coffee, Dark Eyes, Maghi, were late bloomers. The no-pinch and no-stake cultivars were found to be Bindiya, Bi-colour Bonsai, Valerie, Miko, Kotoi No Kaori, Yellow Charm and Gum Drop. The spray type cultivars were grouped as per colour (Table 12).

**TABLE 11 : Effect of method of planting on the corm and cormel production (2011-12)**

S. No.	Variety	White Prosperity		Snow Princess		Big Time Supreme		Jackson Ville Gold	
		Raised	Flat	Raised	Flat	Raised	Flat	Raised	Flat
	Planting Method								
1	No. of corms	2.8	3.0	3.8	3.6	3.0	3.2	1.8	1.6
2	Weight of corms (g)	16.57	23.75	11.278	18.55	31.69	35.56	16.416	23.35
3	Diameter of corms (cm)	20.52	28.35	20.262	24.35	21.77	23.45	20.594	26.57
4	Number of cormels	41.40	19.00	54.80	30.00	38.00	23.00	43.80	14.00
5	Weight of cormels (g)	5.20	2.45	5.71	3.22	7.56	3.85	5.25	1.55

**TABLE 12 : Classification of chrysanthemum based on colour**

S. No.	Group	Varieties
1	Red	Shyamal, Lucido, Red Stone, Miko, Fireball, Shin Otome, Bindiya, Merlot, Red Devil, Pot Black
2	White	Cloverlea Star, Apsara, Mother Teresa, Spacer, Crystal Fall
3	Yellow, cream, etc	Kelvin Tattoo, Statesman, Autumn Eyes, Preet Shringar, Moharaj, Bicolour Bonsai, Statesman-Improved, Yellow Charm, Gum Drop
4	Pink	Pinki, Kelvin Victory, Dark Eyes, Chandi, Wisp Of Pink
5	Orange, saffron, etc	Kelvin Mandarin, Anney, Dolly Orange, Yellow Coin
6	Bronze	Kotoi No Kaori
7	Brown	Cofee
8	Bi-colour	Flash Point, Jubilee



Since chrysanthemum is a short day plant, it responds to artificial lighting. Long day encourages vegetative growth and short day promotes flowering. Incandescent light was provided to all the cultivars. The varieties responded differently as- No flowering (Not flowered at all), Partial flowering (Sparsely flowered) and Full flowering. Complete flowering was observed in cultivars White Prolific, Red Gold, Dolly White, Anmol, Little Darling Kusum, Himanshu, Lal Pari, Royal Purple, Reagan White, Garden Beauty, Valerie, Miko, Jubilee, Wisp Of Pink, Seatons Lady, Mt. Sasta, Lucido, Spacer, Chandi, Red Stone, Fire Ball, Symphony, River City, Red Devil, Dark Eyes, Statesman, Autumn Eye, Shin Otome, Yukari, Seatons lace, Christmas Carol, Apricot Alexis,

Cassa Grande Pink, Kelvin Mandarin, Kelvin Tattoo, Flash Point, Cloverlea Star, Pinki, Coffee, Kelvin Victory, W. Macferson, Pot Black, Maghi, Akitha, Preet Shringar and Local Button; partial flowering in Aparajita, Sharad Mala, Autumn Joy, Flirt, Gitanjali, Star White, Little Pink, Shyamal, Sadbhawna, Mother Teresa, Kaul, Kushoo, Yellow Charm, Chrystal Fall, Mauve Sharah, Punjab Anuradha, Chandrima and Panchu; whereas no flowering was found in cultivars Mallika Yellow, Shukla, Sunny, Yellow Delight, Winter Queen, Liliput, Lalima, Vijay, Kotai No Kaori, Bicolour bonsai, Gum Drop, Bindia, Merlot, Statesman Improved, Anney, Dolly Orange and Gulmohar. All the collected varieties were evaluated for out of season flowering behaviour (Table 13).

**TABLE 13 : Growth and flowering behavior in chrysanthemum as affected by incandescent lighting**

Sl. No.	Variety	Plant height (cm)	Plant spread (cm)	No. & main branch	No. of Flower	Diameter of Flower (cm)
1.	Akitha	73.54	54.95	14.69	183.55	5.6
2.	Anmol	92.36	102.58	9.93	740.88	3.95
3.	Anmol	68.65	60.35	17.375	240.51	3.8
4.	Aprajita	33.56	49.36	8.22	159.13	3.23
5.	Aprajitha	44.6	42.52	12.88	78.30	3.7
6.	Autumn Eyes	42.2	35.1	16.35	189.74	2.5
7.	Autumn Joy	53.89	83.14	10.21	129.38	6.84
8.	Chandi	52.24	27.3	8.34	97.95	3.5
9.	Chandrika	32.8	24.28	10.16	98.6	2.2
10.	Cloverlea star	48.19	35.36	6.38	102.39	4.2
11.	Coffee	60.14	60.37	38.6	140.55	5.5
12.	Crystal Fall	64.66	49.8	12.36	163.56.	3.6
13.	Dark Eyes	49.88	34.55	9.06	145.4	4.5
14.	Dolly White	38.74	45.04	4.54	92.58	4.64
15.	Fire Ball	44.38	49.69	12.27	310.45	3.5
16.	Flash point	28.65	26.54	10.36	65.66	5.3
17.	Flirt	65.14	55.09	6.63	60.78	7.75
18.	Garden Beauty	61.31	26.56	14.83	92.88	9.4
19.	Himanshu	55.54	90.86	9.54	537.11	6.5
20.	Kaul	44.78	50.89	12.55	98.05	5.53
21.	Kelvin mandarin	40.49	29.09	12.54	86.10	3.7

22	Kelvin Tattoo	38.57	18.11	11.56	82.25	2.7
23	Kelvin Victory	28.29	30.61	6.22	97.87	2.5
24	Kushoo	44.35	42.85	24.11	184.56	3.5
25	Lal Pari	52.89	55.34	9.59	106.59	4.4
26	Little Darling Kusum	55.42	49.47	3.85	74.56	5.3
27	Little Pink	42.22	68.22	5.77	84.45	4.5
28	Local Button	46.63	60.81	14.08	240.66	1.5
29	Lucido	42.64	38.22	13.07	130.65	6.5
30	Mauve Sarah	98.33	70.5	15.06	320.54	7.6
31	Miko	10.82	35.46	14.59	162.75	0.8
32	Mother Teresa	40.27	60.75	44.6	225.58	3.25
33	Mt. Sasta	54.54	44.46	16.68	69.25	9.8
34	Panchu	38.19	44.46	16.29	180.56	2.5
35	Pinki	51.16	42.25	8.56	220.44	5.4
36	Preet Shringar	48.38	3236	13.71	69.89	2.2
37	Punjab Anuradha	46.94	32.61	15.58	74.22	2.5
38	Pusa Centenary	40.32	42.54	13.60	165.85	5.36
39	Reagan White	75.23	60.35	23.84	143.98	6.56
40	Red Davil	50.54	36.3	9.35	150.21	4.4
41	Red Stone	75.25	52.65	15.04	401.75	4.5
42	Royal Purple	50.44	54.21	14.16	273.25	2.5
43	Sadbhavna	23.61	36.36	9.18	89.20	4.5
44	Seatons Lady	60.86	36.58	902	89.33	10.1
45	Sharad Mala	34.26	52.25	12.23	80.39	5.65
46	Shin Otome	76.51	55.02	13.29	145.65	3.8
47	Shyamal	45.24	40.61	10.35	67.57	6.56
48	Spacer	62.34	54.2	10.36	68.85	10.4
49	Star White	48.56	42.94	3.56	40.66	11.2
50	Statesman	39.9	29.12	10.11	63.89	3.8
51	Symphony	583	44.04	10.12	110.8	12.8
52	Valerie	46.37	32.54	13.42	90.28	1.2
53	White Prolific	40.24	45.32	3.36	50.25	7.52
54	Wisp of Pink	69.43	49.78	22.16	107.21	7.5
55	Yellow Charm	24.81	35.13	11.57	220.52	1.5
56	Yukari	64.87	40.04	16.22	175.55	5.5

The chrysanthemum cultivars/ accessions that responded to ratoon flowering (2010-11) were Autumn Joy, Mother Teresa, Lal Pari, PAU-4, PAU-65, PAU-44, PAU H-4, PAU-80, PAU-III and PAU-IV.

## Tuberose

In tuberose it has been found that application of Pendimethaline @ 1.00 kg a.i./ha as pre emergence on cv. Prajwal proved more effective than other herbicides. For growth and flowering behaviour cultivars Prajwal, Phule Rajani, Suvasini and Vaibhav found suitable than other cultivars. Tuberose mild mosaic virus was also detected from tuberose plants. The percent incidence was calculated from 0 to 100 percent.

## Flowering Annuals

In the existing collection three species of annual chrysanthemum, variegated nasturtium and escholtzia poppy were added. The flowering annuals namely, calendula, sweet alyssum, nasturtium, pansy, petunia, phlox, stock, verbena, sweet sultan, brachycome, cosmos, candytuft, molucella, dimorphotheca, acroclinum, helichrysum, brumus, breeza, lagurus, aster, wall flower, antirrhinum, corn flower, monarda, saponaria, etc, were transplanted and evaluated for growth, flowering and seed production behaviour under Delhi condition.

Based on plant height they were classified into three groups, Tall (>60 cm): Poppy, Sweet Sultan, Helichrysum, Dimorphotheca, Cosmos, Lupin, *Coreopsis tinctoria*, Bella of Ireland, Gaillardia, *Coreopsis lanceolata* and Statice; Medium (30-60 cm): Lagurus, Linaria, Saponaria, Sweet William, Phlox, Acroclinum, Verbena, Aster, Candytuft, Nasturtium, Calendula, Gazania, Wall Flower, Brumus and Breeza; Dwarf (<30 cm): Brachycome, Metrocaria, *Chrysanthemum multicaule*, Sweet Alyssum and Ice Plant.

The flowering for longer duration was observed in Petunia, Phlox, Gaillardia, Statice, Hollyhock; whereas Sweet Alyssum, Pansy, Brachycome and Metrocaria were early in flowering and flowered for a short duration.

More seed set and seed yield were found in *Coreopsis*, Gaillardia, Helichrysum, Calendula, Nasturtium and Verbena. Whereas, Pansy, Sweet Alyssum and Linaria were poor seed setter and low yielder; and Phlox, Sweet William, Mesembrenthemum, Bells of Ireland, Sweet Sultan were medium in seed setting and yield. The seed yield per plant and thousand seed weight is given in Table 14.

TABLE 14 : Seed weight and thousand seed weight in annuals

Sl. No.	Annuals	Seed weight per plant (g)	1000 seed weight (g)
1.	Acroclinum	18.81	-
2	Antirrhinum	19.37	-
3	Bells of Ireland	48.86	6.24
4	Calendula	35.56	5.25
5	China Aster	2.2	1.49
6	<i>Chrysanthemum coronarium</i>	5.3	1.45
7	<i>Coreopsis lanceolata</i>	20.79	1.66
8	<i>Coreopsis tinctoria</i>	24.53	0.486
9	Corn Flower	33.51	4.60
10	Cosmos	13.65	6.39
11	Dimorphotheca	42.33	14.81
12	Escholtzia poppy	16.90	1.34
13	Helichrysum	10.72	0.66
14	Ice Plant	19.20	-

15	Larkspur	11.75	1.67
16	Lupin	25.75	16.06
17	Metrocaria	22.35	1.93
18	Monarda	5.1	0.78
19	Nasturtium	15.5	155.28
20	Nemesia	17.18	0.97
21	Phlox	9.11	1.06
22	Poppy	11.27	-
23	Saponaria	26.89	3.52
24	Stock	13.10	1.46
25	Sweet Alyssum	13.18	-
26	Sweet Sultan	14.43	4.05
27	Sweet William	17.34	0.87
28	Verbena	-	1.84

### 3. POST HARVEST MANAGEMENT

#### Gladiolus

In gladiolus, twenty eight varieties (Table 15) were evaluated for their vase life (days) in distilled water and classified into three different categories i.e. longer (10-12 days), medium (7-9 days) and short (4-6 days). Among different varieties Flevo Laguna, Flevo Amico, Gold Field, Amsterdam, Jessica, Invitatie and Blues had longer vase life (i.e. 10-12 days of vase life). Whereas, varieties Plumtart, Peter Pears, Alexander the Great, Chemistry, Essential, Rose Supreme, Priscilla, Esta Bonita, Adagio, BTS, Jackson Ville Gold, Lemon Drop, Verona, Spic-n- Span and Wigs Sensation recorded 7-9 days of life. Over Star, Mascagini, Red-54, Pink

Friendship, Ovatie and Red Beauty showed poor vase life (4-6 days).

#### Marigold

In African marigold var. Calcutta Double, the loose flower harvested at fully open stage were packed in different materials (gunny bags, nylon mesh bags, plastic crates and bamboo baskets covered with news paper) and placed at ambient conditions for simulated transit for 20h. Thereafter, shelf life of the flowers were evaluated under laboratory conditions. Among different packaging material used, maximum shelf life (6.0 days) was obtained in plastic crates followed by bamboo baskets with least per cent weight loss after simulated transit. While minimum shelf life of 3.5 days was recorded in gunny bags with higher weight loss ( 28.33%).

**TABLE 15 : Vase life (days) of gladiolus varieties**

Duration(days)	Varieties
High (10-12 Days)	Gold Field, Flevo Amico, Blues, Amsterdam, Jessica, Invitatie, Flevo Laguna
Medium (7-9 Days)	Plumtart, Peter Pears, Alexander the Great, Chemistry, Essential, Rose Supreme, Priscilla, Esta Bonita, Adagio, BTS, Jackson Ville Gold, Lemon Drop, Verona, Spic-n- Span, Wigs Sensation
Low (4-6 Days)	Overture, Mascagni, Red-54, Pink Friendship, Ovatie, Red Beauty

## Flower Drying

Various flowers and greens namely, Helichrysum, Statice, Acroclinium, Gaillardia,



Dry Flower Briza in the Field

Annual chrysanthemum, Brumus, Lagurus were dried under different drying methods.

Harvesting stages of the flowers and greens were optimized. Drying methods namely, inverted



Dry Flower Lagurus in the Field

drying, hot air drying with/without embedding and microwave drying (with/without embedding) were compared for their drying efficiency. Inverted hang



Dry Flower Bromus in the Field

drying method has given good results for Helichrysum, Acroclinium and Statice. Whereas, hot air drying and microwave oven drying with silica gel embedding used for gaillardia and annual chrysanthemum were found suitable.



Dry Flower Helichrysum in the Field

Inverted drying method took longer time (10 days) to dry the flowers were as hot air drying took 6-8 hrs at 60°C. Under microwave embedded drying it has taken 3-4 min for drying under 20°C. The dried flower materials were packed in Low Density Polyethylene (LDPE-200 gauge thickness) and stored for further evaluation.



Dry Flower Statice in the Field



Dry Flower Bells of Ireland in the Field

## Netraceuticals and Pharmaceuticals

### Collection of marigold varieties

Eleven African marigold varieties namely, Pusa Narangi Gaiinda, Pusa Arpita, Cupidian Mix, Sunset Orange, Craker Jack, Inca Gold, Inca Orange, Visa Light orange, African Tall Mix, Garland orange and Serakal have been collected for the primary evaluation.

### Selection of varieties

The varieties namely, Pusa Narangi Gaiinda, Pusa Arpita, Serakal, Inca Orange and sunset orange have been identified for having good yield, flower colour and duration of flowering.

### Lutein extraction

It was undertaken in variety Pusa Narangi Gaiinda. The extract has been kept at -20°C for further evaluation.

## 4. PLANT PROTECTION

### Insect pests on Chrysanthemum

Both standard type and spray type chrysanthemum germplasm were affected with following insect pests both under open field and shade-net conditions.

1. Chrysanthemum aphid (*Macrosiphoniella sanbornii*) was observed throughout the crops period affecting the vigor of the plant.
2. Another aphid (unidentified spp) infested the crop at flowering stage. Infested flower buds fail to open.
3. The incidence of Mealy bug (*Phenacoccus solenopsis*) was sporadic. The infested plants fail to produce any flower buds.
4. The incidence of *Spodoptera litura* damage on chrysanthemum was sporadic. Gregarious early stage larvae fed on leaves by scraping leading to skeletonization of leaves.

5. The incidence of *Helicoverpa armigera* damage on chrysanthemum was sporadic. Infestation was noticed at flower bud initiation stage. The green larvae fed on flower buds and also damaged fully opened flowers.

### Insect pests on winter annuals

The following insects were recorded on the winter annuals.

1. *Pieris brassicae* on nasturtium. The gregarious larvae fed on leaves leading to complete defoliation of the plant.
2. *Helicoverpa armigera* on dahlia and hollyhock. The larvae damaged the flower buds and fully opened flowers.
3. Aphids were recorded on liliun, dahlia, annual chrysanthemum, marigold, etc.

### Insect pests on Gladiolus

The incidence of following insects was recorded on gladiolus at isolated spots.

1. *Helicoverpa armigera*: The larvae fed on flower buds by feeding on the internal content of the buds.
2. *Spodoptera litura*: The early stage gregarious larvae fed on leaves by scraping the green matter, leading to skeletonization of leaves.



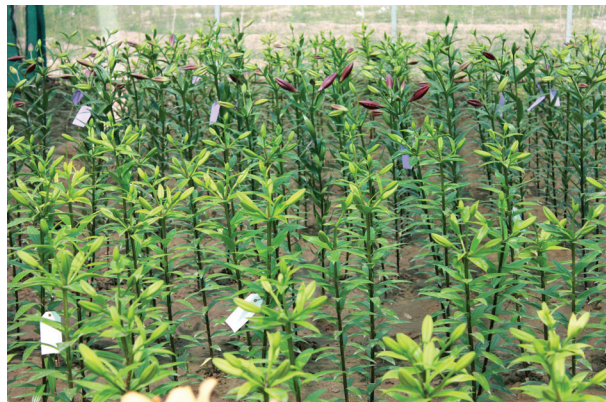
3. Aphids: The infestation noticed at different stages of the crop.

## Natural Enemies of insect pests

A number of predatory ladybird beetles were recorded on chrysanthemum, winter annuals and liliium.

## 5. PROTECTED CULTIVATION

Screening of liliium cultivars under shade-net house and field was carried out. Nine cultivars



Lilium under Shadenet

(Mero Star, Avocado, Medusa, Canberra, Rialto, Salmon Classic, Red Alert, Bright Diamond and Pavia) planted under shade net house and open field were compared for their performance under these two environments. The effect of growing environments on the performance of these cultivars was investigated. It was found that growth, flowering and bulbs production was significantly better in the shade net house. Bulbs production was found to be scanty under open field conditions. Yellow coloured cultivar Salmon Classic was found to be early in flowering followed by Bright Diamond and Pavia.

Flower stems were harvested at three heights from ground (5 cm, 10 cm and 15 cm from first pair of leaves) for observing the effect on the bulbs production in Delhi conditions. The data on bulb production were recorded and being analyzed. Bulbs were lifted and stored after fungicidal pre-treatment for further evaluation.

# Institutional Building

## FOUNDATION DAY CELEBRATION

The Directorate celebrated its 2<sup>nd</sup> foundation day on December 9, 2011 in the research farm. A number of dignitaries including Dr. Umesh Chandra Srivastava ADG (Hort-II), Dr. S. Rajan ADG (Hort-I), Directors of ICAR institutes located in Delhi i.e NBPGR, DMR, IASRI, NCIPM, Joint Director (Research) IARI, Joint Director (Education) IARI Heads of the Divisions IARI, Unit In-charges of FOSU, CPCT, Former Project Coordinators, Scientists, press & media representative were present to mark the occasion. Dr. Gurbachan Singh, Chairman, ASRB, ICAR was the Chief



Hon'ble Dignitaries on the Dias

Guest of the function. The chief guest highlighted the growth and potential of the floriculture sector in the agricultural GDP of the country and stressed upon strengthening research and development in this agricultural sector. He appreciated the efforts made by DFR in the collection of large germplasm of Chrysanthemum and gladiolus within a short

span of time under the leadership of Director, Dr. Ramesh Kumar. This day was also celebrated as chrysanthemum day. The showcasing of new research findings and display of chrysanthemum germplasm at DFR farm was very much appreciated by all the dignitaries.

## RENOVATION OF LABORATORY, OFFICE AND FARM STORE

The office building of Directorate of Floricultural Research was shifted to the erstwhile Post Harvest Technology division located in Horticulture Building on August, 2011. Necessary steps were undertaken for the creation of basic facilities for office staff and scientists in the building. All the scientists have been provided with independent seating space, need based furniture, intercom and computer facility with access to internet. The existing two big rooms were renovated and are being converted into laboratories.

Besides this, the ground floor has been earmarked for creation of office space. A common room facility and a library is also being developed within the building. There is a provision for creation of conference room and training hall.

In the Research Farm necessary steps were taken for keeping farm items properly with the construction of store. Iron racks, boxes were put in place for safe keeping of propagating materials (bulbs, seeds, etc.) implements, tools, etc.

## Purchase of Equipments

To create a strong foundation for research in the Directorate, need based of equipment is



## Foundation Day Celebrations



necessary. Steps are being taken for procuring equipments and other items as per scientist needs.

## XXI GROUP MEETING OF AICRP ON FLORICULTURE

The XXI Group Meeting of All India Coordinated Research Project on Floriculture was held at CTRI, Rajahmundry, Andhra Pradesh from



Inauguration of the XXI Group Meeting of AICRP

4-6 November 2011. The work done at different coordinated centres was reviewed and new technical programme was formulated for the year 2012-13. Two technical bulletins namely "Marigold" and



Releasing of Publications

"Prospects of Floriculture in Andhra Pradesh" were released on this occasion. Dr. H.P Singh, DDG (Hort), ICAR, Chief Guest on this occasion focused

on the role of floriculture in coming years in the country constantly the changing lifestyle, urbanization and increasing population. He emphasised about the emerging challenges in the



Hon'ble Chief Guest Dr. H.P. Singh Address the Gathering

face of floriculture in the coming years due to declining land and water resources as well as climate change. Dr. Singh also briefed about the historical perspective of All India Coordinated Projects for their unique research mechanism under the National Research System (NARS) of ICAR. He highlighted the imminent need for reprioritization and reorientation of research programmes of AICRP on Floriculture to address the new challenges. The AICRP on floriculture must take note of G X E interaction and adaptability mechanism due to climate change and the technical programme need to be revised accordingly, said Dr. Singh.



Participants of the XXI Group Meeting of AICRP

Dr. P. Das discussed about the development of floriculture in the country and emphasized that much more is required to make floriculture a vibrant enterprise for farmers and satisfying consumer needs.

Dr. U. C. Srivastava, ADG (Hort-II), ICAR emphasized about the focus given to horticulture including floriculture in the 12<sup>th</sup> Five Year Plan.



Dr. J.S. Arora, Ex-Head PAU Ludhiana Chairing the Technical Session

Sh. C. V. S. K. Sharma, Hon'ble Vice Chancellor, YSRHU, spoke about the scope of floriculture in Andhra Pradesh and requested for ICAR support in his pursuit for development of floriculture in the state.

Dr. Krishnamurthi, Director, Central Tobacco Research Institute (CTRI), Rajahmundry expressed his happiness for organizing group meeting at CTRI.



Participants of the XXI Group Meeting of AICRP on Floriculture Held at CTRI Rajahmundry

Dr. K. Purushottam, Director of Research, YSRHU gave presentation about floriculture status in Andhra Pradesh which is a focused area for development of floriculture and requested for an AICRP (Floriculture) center at YSRHU at University head quarter.

The function was also attended by Dr. K. Purushottam, Director of Research, Dr. YSRHU, Dr. J.S. Arora (invited expert by ICAR) Ex-Head, Department of Floriculture & Landscaping, Punjab Agricultural University, Ludhiana, scientists of various AICRP centres, CTRI and other ICAR institutes, leading nurserymen, farmers and industry. The progress of ongoing research programmes of the AICRP centres was reviewed and the technical programme for the two years (2011-12 & 2012-13) was discussed and finalized.



# Meetings of RAC/IRC/IMC

## INSTITUTE MANAGEMENT COMMITTEE (IMC) MEETING

The first IMC meeting of Directorate of Floricultural Research under the Chairmanship of Dr. Ramesh Kumar was held on 18 January, 2012



IMC Meeting in Progress

in the committee room of Directorate of Maize Research (DMR), Pusa, New Delhi.

Dr. Umesh Srivastava, ADG (Hort.), ICAR appreciated the work done by the Directorate so far and suggested that the research programmes of the directorate should be reframed so as to provide suitable platform to all the scientists including the newly joined ones. Following are the outcome of the meeting as suggested by the members of IMC:

- Directorate needs to maintain germplasm of named/authentic varieties of mandate crops for distribution and should also focus on regional/local requirements of flower growers

through the use of network of AICRP centers besides initiating research on turf grass management.

- To develop and maintain a database of germplasm/genetic resources of floricultural



crops including flora from temperate/Himalayan regions, etc., state-wise status reports on area, production and availability of genetic resources.



Members of IMC at DFR Research Farm

- The extension activities involving print and electronic media, publication of research/technical bulletins in bilingual/multilingual should be taken up proactively for popularizing floriculture.
- To concentrate on newer areas in floricultural research and coordinate with other institutes/organizations so as to avoid duplicacy in research work.
- Provisions should be made in XII Five year Plan for supply of quality plant material and demonstrations for effective technology dissemination
- Database of floriculture research being conducted in the country which should be made available on the web site of the Directorate.
- Developing website of DFR
- The research findings published in the scientific journals may also be published in non technical simple way as popular articles.

The IMC members visited DFR Research fields and appreciated the overall progress of the farm research.. While interacting with the scientists in the field about the ongoing research activities, they got impressed by the large collections of chrysanthemums, gladiolus, other bulbous plants and winter annuals In the IMC meeting, problems faced by the Directorate such as purchase of staff car, availability of land, procurement of equipments etc. were discussed.

### INSTITUTE RESEARCH COUNCIL (IRC)

The meeting of the pre- Institute Research Council (Pre-IRC) under the chairmanship of Dr. Ramesh Kumar, Director, DFR was held on March 22, 2012 to review the progress of the research projects. All the scientist presented the work done during the year based on the approved RPF-I and some new projects were presented and approved. It was suggested to revise and reorient the ongoing research projects, and also the work load and association of the scientist per project should be reduced as far as possible.

The constitution of IMC is given below:

Name		Designation
Dr. Ramesh Kumar	Director, DFR	Chairman
Dr. Umesh Srivastava	ADG (H-II), ICAR,KAB-II, Pusa Campus, New Delhi - 110 012	Member
Mrs. Megha Borse	President, Floriculture Association, Maharashtra, 1st Floor, Nadkarni Chambers, Vakilwadi NASIK – 422 001 (Maharashtra)	Member
Mr. Jaffar N. Naqvi	Chief Editor (Floriculture Today) & Director, Media Today Pvt Ltd T-30, 1st Floor, Kirki Extension Malviya Nagar, New Delhi – 110 017	Member
Dr. R.C. Srivastava	Jt. Director, Botanical Survey of India Salt Lake, Kokata (West Bengal)	Member
Dr. T. Janakiram	Head, Div. of Floriculture & Landscaping, IARI, New Delhi 110012	Member
Sh. Anil Maithani	Admn. Officer, DFR	Member Secretary
Dr. P. Naveen Kumar	Senior Scientist, DFR	Special Invitee
Sh. R.S. Bhatt	AFAO, DFR	Special Invitee

**List of In-House Research Projects at DFR**

<b>Project</b>	<b>Project Code</b>	<b>Effective from</b>	<b>Principal Investigator</b>	<b>Co- Principal Investigators</b>
Breeding of gladiolus for quality and yield	DFR: 01	11.08.2010	Dr. P. Naveen Kumar	Dr. Gunjeet Kumar, Dr. T. N. Saha and Dr. Ganesh Kadam
Breeding of chrysanthemum for quality flower and pot mum production	DFR: 02	11.08.2010	Dr. Tarak Nath Saha	Dr. P. Naveen Kumar, Dr. Gunjeet Kumar and Dr. Ganesh Kadam
Breeding of tuberose for novel colour and oil recovery	DFR: 03	11.08.2010	Dr. Binod Kumar Singh (w.e.f 7.10.2011) Dr. P. Naveen Kumar (up to 6.10.2011)	Dr. P. Naveen Kumar and Dr. Jayoti Majumder and Dr. K. P. Singh
Improvement of flowering annuals	DFR:04	11.08.2010	Dr. Gunjeet Kumar (w.e.f 1.4.2011) Dr. Jayoti Mazumdar (up to 31.3.2011)	Dr. P. Naveen Kumar, Dr. T. N. Saha and Dr. B. K. Singh
Production technology of gladiolus	DFR:05	11.08.2010	Dr. P. Naveen Kumar (w.e.f 7.10.2011) Dr. Tarak Nath Saha (up to 6.10.2011)	Dr. Gunjeet Kumar, Dr. T. N. Saha and Dr. Ganesh Kadam
Production technology of annuals	DFR:06	11.08.2010	Dr. Gunjeet Kumar (w.e.f 1.4.2011) Dr. P. Naveen Kumar (up to 31.3.2011)	Dr. T. N. Saha, Dr. B. K. Singh and Dr. Jayoti Majumder
Standardization of harvesting, storage, packaging and post harvest treatments of commercial cut flower	DFR:07	01.04.2011	Dr. Babita Singh (w.e.f 7.10.2011) Mrs. P. Sellam (up to 6.10.2011) Ms. Sellam P, Dr. Puja Rai and Dr. Jayoti Majumder	Ms. Sellam P, Dr. Puja Rai and Dr. Jayoti Majumder
Standardization of drying techniques for flowers and greens	DFR:08	01.04.2011	Ms. P. Sellam (w.e.f 7.10.2011) Dr. Jayoti Mazumdar (up to 6.10.2011)	Dr. Jayoti Majumder, Dr. Puja Rai and Dr. Babita Singh
Production technology of chrysanthemum	DFR:09	7.10.2011	Dr. Tarak Nath Saha	Dr. Ganesh Kadam, Dr. Babita Singh and Mr. Girish
Production technology of Tuberose	DFR:10	7.10.2011	Dr. Krishan Pal Singh	Dr. B. K. Singh, Dr. Gunjeet Kumar and Dr. Babita Singh
Insect pest management of commercial flower crops	DFR:11	7.10.2011	Mr. Girish, K. S.	Dr. Vaibhav Singh and Dr. B. K. Singh
Disease management of commercial flower crops	DFR:12	7.10.2011	Dr. Vaibhav Singh	Mr. Girish, K. S., and Dr. B. K. Singh
Nutraceuticals and pharmaceuticals from flower crops	DFR:13	7.10.2011	Dr. Jayoti Majumder	Dr. Jayoti Majumder, Dr. Babita Singh, Dr. Puja Rai and Ms. P. Sellam
Protected cultivation of commercial flower crops	DFR:14	7.10.2011	Dr. Ganesh B. Kadam	Dr. T N Saha, Ms. P. Sellam and Mr. Girish, K. S.

# Transfer of Technology

## PARTICIPATION IN PUSA HORTICULTURE SHOW

The Directorate of Floricultural Research participated in the Pusa Horticulture Show 2012 organized by Delhi Agri-Horticulture Society on 25-26 February 2012 at IARI, New Delhi. On this occasion, flowers of different varieties of bulbous ornamentals such as gladiolus, iris, daffodils, etc



and various flowering annuals; loose flowers of such as marigold and chrysanthemum; potted plants; literature and other technical information; etc. were displayed. The information on germplasm



collection, new varieties and latest technologies in flower cultivation developed by different coordinated centres of AICRP on Floriculture were put on display. The live specimens as well as the technology blow-ups of flowers and ornamentals were highly appreciated by the distinguished visitors and flower lovers.

## PARTICIPATION IN PUSA KRISHI VIGYAN MELA

The Directorate of Floricultural Research participated in the 'Pusa Krishi Vigyan Mela 2012' organized by IARI, New Delhi on 1-3 March 2012 with theme "Prosperity through Innovative Farm Technologies". The stall with live specimens of flowers along with copies of publications and other literature was visited by Hon'ble Agriculture



Ministers for state Mr. Harish Rawat and Mr. Charan Das Mahant, Deputy Director General (Horticulture), Director IARI; Director, NBPGR and farmers from various states, scientists, students of

various schools, amateur gardeners, flower lovers and representative for press and media persons.



Pusa Krishi Vigyan Mela is one of the largest platforms for dissemination of agricultural technologies including that of DFR.

### TV / RADIO TALKS

- Dr. Ramesh Kumar, Delivered TV talks on different aspects of flower cultivation on 6<sup>th</sup> May 2011 and 1<sup>st</sup> February 2012.
- Dr. Ramesh Kumar, Delivered and recorded regarding flower cultivation in India in the field during the celebration of Foundation Day in 9<sup>th</sup> December, 2011.
- Dr. Ramesh Kumar, Delivered a radio-talk about the Role of Women in Floriculture during February 2012.
- Dr. Ramesh Kumar, Delivered a Radio-talk “bat phoole ki” on March, 2012.



### On-farm Demonstration

- Dr. Ramesh Kumar and other scientist (Dr. P. Naveen Kumar, Dr. Gunjeet Kumar and Dr. T. N. Saha) attended farmers from



Jammu & Kashmir, Himachal Pradesh, Andhra Pradesh, Tamil Nadu, Bihar, Uttar Pradesh and Uttarakhand on 2-3 March, 2012, and apprised them about the fellowship the technologies on flower cultivation.



### Others

- The Directorate participated in the National Exhibition on Horticulture, Horti-Expo – 2011 and National Conference on Hortibusiness-Linking farmers with market, at Swadesh Prem Jagriti Sangosthi held at Dehradun, Uttarakhand, from 28-31 May, 2011.



# Publications

During the period under report, the scientists of DFR published their work in different research journals, extension bulletin, books, etc. A select list is given below;

## RESEARCH PAPERS

- Singh K, Singh R and Kumar R (2011) Effect of GA<sub>3</sub>, pulsing and dry storage on keeping quality of gladiolus spikes. *Journal of Horticulture Science* 6(1): 69-70.
- Singh P J, Sidhu G S, Kumar R and Thind T S (2011) Superior performance of Kresomin – methyl (Stroby) and trifloxystrobin (Flint) against botrytis blight (*Botrytis gladiolorum*) of gladiolus (*Gladiolus X hortulans* Bailey). *Plant Disease Resistant*. 26 (2): 101-105.
- Kadam, G.B., Krishan P. Singh and Jyothi, R. 2011. Role of sterilants in establishment of aseptic culture using different explants in tuberose (*Polianthes tuberosa* Linn.). *Progressive Horticulture*, 43(1) : 105-109.
- Kadam, G.B., Krishan P. Singh and Madan Pal, 2011 Effect of elevated carbon dioxide levels on morphological and physiological parameters in gladiolus. *Indian Journal of Horticulture*, (Communicated).
- Kumar P. Naveen, Reddy Y.N. and Chandrashekar R. (2011). Effect of different chemicals on breaking dormancy, growth and flowering of gladiolus cultivars. *Indian Journal of Horticulture*, 68 (4): 540-546.
- Panwar N.S., Kumar Ashok, Malik S.S., Dwivedi V.K., Kumar Gunjeet and Singh P.B. (2011) Studies on Genetic Divergence in Basil (*Ocimum basilicum*) germplasm. *Indian Journal Plant Genetic Resources*. 24 (2): 223-226.
- Arivalagan, M., Gangopadhyay, K.K., Kumar, G., Bhardwaj, R., Prasad, T.V., Sarkar, S.K., & Roy, A., (2012). Variability in minerals composition of Indian eggplant (*Solanum melongena* L.) genotypes, *Journal of Food Composition and Analysis*, doi:10.1016/j.jfca.2012.03.001.
- Randhawa Gurinder Jit, Singh Monika, Gangopadhyay K.K., Kumar Gunjeet and Archak Sunil (2012). Genetic analysis of fenugreek (*Trigonella foenum-graecum*) accessions using morphometric and ISSR markers (2012). *Indian Journal of Agricultural Sciences* 82(5): 393-401.
- Sindhu, S.S. and Saha, T.N. (2010). Research highlights and business opportunities in floriculture. *Harayana Journal of Horticultur*, 39(1&2):30-41.
- Singh B K, Sharma S R and Singh B. 2011. Combining ability for antioxidants and economic traits in cabbage (*Brassica oleracea* var. *capitata* L). *Indian Journal of Horticulture* 68 (4): 490-497.
- Ganesh. B. Kadam, Krisahn P. Singh and R. Jyothi (2011) Role of sterilants in establishment of aseptic culture using different explants in tuberose (*Polianthes tuberosa* Linn.) *Progressive Horticulture*, 43(1): 105-109.

- Barnwal M.K., Singh Vaibhav K., Sharma R.B. and Singh.B.N. (2012). Field evaluation of rice genotypes for resistance and new fungicides for control of blast (*Pyriculariaoryzae* Cav.). *Indian Phytopathology*, 65 (1): 56-59.
  - Singh Vaibhav K. and Pundhir V.S. (2012). Occurrence of physiological races of *Phytophthorainfestans* around local areas of Pantnagar. *Crop Research*, 43 (3). (in press)
  - Singh Vaibhav K. and Pundhir V.S. (2012). Detection of metalaxyl resistance in *Phytophthora infestans* isolates at Pantnagar. *Crop Research*, 43 (3). (in press)
  - Singh Vaibhav K. and Pundhir V.S. (2012). Expansion of late blight lesions in relation to fungicidal spray on different potato cultivars. *Crop Research*, 43 (3). (in press)
  - Kumar P. Naveen and Misra R.L. (2012). Studies on the effect of plant growth regulators on growth, flowering and corm production of gladiolus cv. Snow Princess. *Indian Journal of Agricultural Sciences* (in press), New Delhi.
  - Gangopadhyay K. K., Tehlan S. K., Saxena R. P., Mishra A. K., Raiger H. L., Yadav S. K., Kumar Gunjeet, Arivalagan M., and Dutta M..(2012) Stability analysis of yield and its component traits in Fenugreek germplasm (*Trigonella foenum-graecum* L.). *Indian Journal of Horticulture*. 69 (2). (in press)
  - Ganesh B. Kadam, Krishan Pal Singh and Madan Pal (2012) Effect of elevated carbon dioxide levels on morphological and physiological parameters in gladiolus, *Indian Journal of Horticulture*. (in press)
  - Singh, Babita and Srivastava, Ranjan (2011). Induction of genetic variability in gerbera (*Gerbera jamesonii* Bolus Ex Hooker F.) through gamma radiation. *Indian Journal of Horticulture*. (in press)
- TECHNICAL BULLETINS/BOOKS**
- P.L. Kameswari; A.Girwani; P. Naveen Kumar; Gunjeet Kumar;Tarak Nath Saha and Ramesh Kumar (2011). Marigold, DFR Extension Bulletin No. 4. Published by Director, DFR, New Delhi.
  - A. Girwani;, P.L.Kameswari; A. L. N.Prasad; P. Naveen Kumar; Ramesh Kumar; Gunjeet Kumar and Tarak Nath Saha (2011). Prospects of Floriculture in Andhra Pradesh, DFR Extension Bulletin No. 5. Published by Director, DFR, New Delhi.
  - Ramesh Kumar, Gunjeet Kumar, P. Naveen Kumar, Tarak Nath Saha and P. Sellam (2011). Vision 2030 of Directorate of Floricultural Research, Published by Director, DFR, New Delhi.
  - Ramesh Kumar, P. Naveen Kumar, Gunjeet Kumar, Tarak Nath Saha, Sellam. P. and Suchitra (2011). Annual Report-2010-11 All India Coordinated Research Project on Floriculture, Published by Director, DFR, New Delhi.
  - Ramesh Kumar, P. Naveen Kumar, Sellam. P., Tarak Nath Saha and Gunjeet Kumar (2011). Annual Report-2010-11 Directorate of Floricultural Research, Published by Director, DFR, New Delhi.
  - Vaibhav K. Singh, Shailbala and V.S. Pundhir. (2011). *A Manual for Late Blight of Potato*. Published by Potato Pathology Laboratory, Department of Plant Pathology, G.B. Pant University of Agriculture & Technology, Pantnagar.
  - Brajendra, Vaibhav K. Singh, G.P. Mishra, S. Sridhara, N.K. Singh, Atul Kumar, P. Muthuraman, B.D.K. Yadav, P. Vaidya, M. Sharma. (2011). *Model Test Paper in AGRICULTURE*. Published by Sharma Publications and Distributions, New Delhi (India). ISBN 978-81-920090-5-6.
  - Vaibhav K. Singh, Yogendra Singh and Akhilesh Singh.(2012). *Eco-friendly*

*Innovative Approaches in Plant Disease Management*. Published by International Book Publisher and Distributors, New Delhi (India). ISBN 817089375-5.

### BOOK CHAPTER

- Vaibhav K. Singh, Shailbala, Jameel Akhtar and Bijendra Kumar. (2011). Cultural practices: an ecological and economical approach for plant disease management. In: *Plant Diseases Management in Horticultural Crops* (Eds. Dr. Shahid Ahamad, Dr. Ali Anwar and Dr. P.K. Sharma) published by Daya Publishing House, New Delhi. pp. 243-259.
- Vaibhav K. Singh and Shilpi Chawla. (2012). Cultural practices: an eco-friendly innovative approach in plant disease management. In: *Eco-friendly Innovative Approaches in Plant Disease Management* (Eds. Dr. Vaibhav K. Singh, Dr. Yogendra Singh and Dr. Akhilesh Singh) published by International Book Distributors and Publisher, New Delhi. pp. 01-20.
- Vaibhav K. Singh and Pratima Pandey. (2012). Physical Methods in Management of Plant Diseases. In: *Eco-friendly Innovative Approaches in Plant Disease Management* (Eds. Dr. Vaibhav K. Singh, Dr. Yogendra Singh and Dr. Akhilesh Singh) published by International Book Distributors and Publisher, New Delhi. pp. 12-30.
- Vaibhav K. Singh, Shailbala and V.S. Pundhir. (2012). Forecasting Models: An Effective Tool for Potato Late Blight Management. In: *Eco-friendly Innovative Approaches in Plant Disease Management* (Eds. Dr. Vaibhav K. Singh, Dr. Yogendra Singh and Dr. Akhilesh Singh) published by International Book Distributors and Publisher, New Delhi. pp. 101-112.
- Vaibhav K. Singh, Yogendra Singh and Prabhat Kumar. (2012). Diseases of Ornamental Plants and their Management.

In: *Eco-friendly Innovative Approaches in Plant Disease Management* (Eds. Dr. Vaibhav K. Singh, Dr. Yogendra Singh and Dr. Akhilesh Singh) published by International Book Distributors and Publisher, New Delhi. pp. 543-572.

### PRESENTATIONS IN CONFERENCES/ SYMPOSIA/SEMINAR/OTHER FLORA

- Ramesh Kumar and K. G. Balkrushna (2011): Scenario of flower breeding for protected cultivation, In souvenir and abstract: National seminar on protected cultivation of vegetables and flowers- A value chain approach held during January 11-12, 2012 at GBPAUT, Pantanagar, (pp91-95).
- Ramesh Kumar and Jayoti Majumder (2011). Orchid: Research and Achievements of AICRP. In Souvenir of National Conference on orchids In India: Diversity, characterization and resource development for community livelihood held during 21-23 December 2011 at NASI, Allahabad.
- Ramesh Kumar, Tarak Nath Saha and Jayoti Majumder (2012). Urban Landscaping using Plant Biodiversity, lead paper presented in International Congress in Urban Green Space, New Delhi, 5-7 March, 2012.
- Ramesh Kumar, Tarak Nath Saha and Jayoti Majumder (2012). Urban Landscaping using Plant Biodiversity, abstract in International Congress in Urban Green Space, New Delhi, 5-7 March, 2012.
- Ramesh Kumar, Jayoti Majumder, Tarak Nath Saha and P. Naveen Kumar (2012). Role of AICRP in development of Floriculture in India, lead presentation in conference on New Frontier and future challenges in Horticultural crops held at Ludhiana from 6-8 March. 2012.
- Ramesh Kumar, Gunjeet Kumar and Tarak Nath Saha 2011. Seed production of flowering annuals. In Souvenir, International

- conference on issues for climate change, land use diversification and biotechnological tools for livelihood security held at SVPUA&T, Meerut, UP. pp. 352 – 355.
- Dhatt K.K. and R Kumar (2011) Punjab Pink Elegance and Punjab Flame: New varieties of gladiolus for cut flower. In Proceedings of International Conference: Preparing Agriculture for climate change held at Punjab Agricultural University, Ludhiana (Punjab) during February 6-8, pp 94.
  - Singh, Krishan P. and Mam C. Singh, 2011. Evaluation of Double petalled cultivars of tuberose (*Polianthes tuberosa* Linn.) under Delhi conditions. In : Souvenir and Abstracts of *International Conference on Issues for Climate Change, Land use Diversification and Biotechnological Tools for Livelihood Security*, held at SVPUA&T Meerut (Uttar Pradesh), during 8-10 October 2011, p 39.
  - Kadam G.B., Krishan P. Singh and Madan Pal, 2011. Effect of elevated CO<sub>2</sub> on morphological and physiological characters in gladiolus. In : *Souvenir and Abstracts of International Conference on Issues for Climate Change, Land use Diversification and Biotechnological Tools for Livelihood Security*, held at SVPUAT, Meerut (Uttar Pradesh) during 8-10 October 2011, pp 25-26.
  - Jyothi, R., Krishan Pal Singh and G.B. Kadam, 2011. Studies on mutagenic effect of gamma irradiation on tuberose (*Polianthes tuberosa* L.). In: *Souvenir and Abstracts of International Conference on Issues for Climate Change Land use Diversification and Biotechnological Tools for Livelihood Security*, held at SVPUA&T Meerut, during 8-10 October 2011, p 26.
  - P. Naveen Kumar, Ganesh B. Kadam and Ramesh Kumar: Floriculture a viable option of diversification in the light of climate change: National dialogue on climate resilient horticulture held during 28-29 January, 2012 at IIHR Bangalore, (pp253-260).
  - P. Naveen Kumar, Ganesh B. Kadam and Ramesh Kumar: Role of environmental horticulture in combating climate change: 1st Biennial international congress on urban green spaces (5-7 march 2012), New Delhi (p133).
  - P. Naveen Kumar and Gunjeet Kumar (2011). Scope and potential of commercial floriculture in India: Focus on production of bulbous crops. One day seminar on 'Possibilities and Prospects of Commercial Floriculture in Korea district of Chhattisgarh' held on 17 November 2011 at Baikunthpur, Korea Dist., C.G.
  - Gunjeet Kumar, T. N. Saha, P. Naveen Kumar and Ramesh Kumar. 2011. Linking flower growers to market – An innovative approach. In: National Conference on Horti-Business linking farmers with market held at Dehradun, Uttarakhand during 28-31 May, 2011, pp.104.
  - Tarak Nath Saha, Ramesh Kumar, Jayoti Majumder and Gunjeet Kumar (2012). Heritage gardens of India, oral presentation in International Congress on Urban Green Space, IIC New Delhi, 5-7 March, 2012.
  - Tarak Nath Saha (2012). Role of AICRP (Floriculture) for farmers of West Bengal. Growers-Scientist Interaction at KrishiVigyan Kendra, BCKV, Goyespur, on 3<sup>rd</sup> January, 2012.
  - Tarak Nath Saha (2011). Lead lecture on "Bulbous Flowers" in the Conference on Floriculture and Landscaping organised by Northern Railway at National Rail Museum, Chanakypuri on 1<sup>st</sup> October, 2011.
  - G. B. Kadam presented a poster "International Conference on Issues for Climate Change, Land Use Diversification and Biotechnological Tools for Livelihood Security" at Meerut, UP during 8-10 Oct 2011.

- G.B. Kadam represented DFR and presentation of project proposal were made in challenge programme (Platform Project) on Protected Cultivation held at IIVR, Varanasi.
- Awani K. Singh, Vaibhav K. Singh, Ajay K. Singh, V.K. Singh, K.S. Mehta, Balraj Singh, S.S. Sindhu, Rakesh Kumar and Mukul Kumar. 2012. Socio-economic empowerment of hills women through protected cultivation technology. Global Conference on Women in Agriculture. March, 13-15, 2012, New Delhi, pp. 115-116.
- Puja Rai, presented a poster "International Conference on Plant Biotechnology for Food Security: New Frontiers" held at NASC complex, New Delhi during 21-24 Feb 2012.
- Srivastava, Ranjan, Singh, Babita and Satish Chand. 2012. Assessment of gerbera germplasm as influenced by growing conditions. *Proc. of National seminar on Protected Cultivation of Vegetables and Flowers-A value chain approach*. Jan 11-12, 2012 at Pantnagar, Uttarakhand.
- on Recent Trends and Future Prospects in Floriculture, held at SVPUA&T Meerut (Uttar Pradesh) during 5-8 March 2011. (Published in June 2011).
- Gunjeet Kumar, P. Naveen Kumar, Tarak Nath Saha and Ramesh Kumar (2011). Proceedings of the XXI Annual Group Meeting of AICRP on Floriculture, Action taken report on the recommendations of XX Group Meeting of AICRP on Floriculture, Salient Research Achievements 2010-11 of AICRP on Floriculture, Technical Programme 2011-12 & 2012-13 XXI of AICRP on Floriculture.
- P. Naveen Kumar, Ganesh B. Kadam and Girish, K. S. Flagship project on 'Characterization of Genetic Resources in Floriculture for Efficient Harnessing of Their Potential' of DFR proposed in the EFC Memo of XII Five Year Plan (2012-2016).
- P. Naveen Kumar and Ganesh B. Kadam. Preparation of Platform Projects (5 no.) on Quality planting material in horticultural crops (CISH), Diseases diagnostics in horticultural crops (CPRI), Protected cultivation of flower crops (IIVR), Agro-biodiversity (National Active Germplasm Sites – NAGS) (NBPGR) and F<sub>1</sub> Hybrids/annuals of flower crops (IIVR) during the XII Five Year Plan.
- P. Naveen Kumar and Girish K. S. Preparation of draft proposal of EFC Memorandum of DFR for the XII Five Year Plan (2012-13 to 2016-17).

### COMPILATION/ DOCUMENTATION

- Ramesh Kumar, P. Naveen Kumar, Gunjeet Kumar, Tarak Nath Saha, Sellam. P. and Suchitra (2011). Annual Report-2010-11. All India Coordinated Research Project on Floriculture, New Delhi.
- Ramesh Kumar, P. Naveen Kumar, Sellam. P., Tarak Nath Saha and Gunjeet Kumar (2011). Annual Report-2010-11. Directorate of Floricultural Research, New Delhi.
- Ramesh Kumar, Tarak Nath Saha P. Naveen Kumar and Gunjeet Kumar (2011). Background Information- Quinquennial review 2006-2011. Directorate of Floricultural Research, New Delhi.
- Singh, Krishan Pal, I.P. Singh, Mam Chand Singh, Sunil Malik and Mukesh Kumar, 2011. *Book of Abstracts of National Conference*

### TECHNICAL/ POPULAR ARTICLES

- P. Naveen Kumar and Ramesh Kumar (2011). Potted Plants as a Potential Avenue For Higher Income. In: Horti-Business, published by Delhi Agri-Horticulture Society, IARI, New Delhi.
- P. Naveen Kumar, Ganesh Kadam and Ramesh Kumar (2012). Floriculture a viable option of diversification in the light of climate change. In : Adaptation and mitigation

- strategies for climate resilient horticulture, (eds. K.S. Shivashankara, Praksh patil, G. Selva Kumar and V. Sridhar) published on the occasion of National Dialogue on Climate Resilient Horticulture held on 28-29 January 2012. Pp.253-260.
- Tarak Nath Saha, Jayoti Majumder, Gunjeet Kumar, P. Naveen Kumar and Ramesh Kumar (2012). Heritage Gardens of India, *In Horticulture for environment and Eco-tourism*, DAHS pp.118-132.
  - B K Singh, K A Pathak, Y Ramakrishna, V K Verma and B C Deka. (2011). Purple-podded French bean with high antioxidant content. *ICAR News: A Science and Technology Newsletter* 17 (3): 9.
  - Vaibhav K. Singh and Yogendra Singh. (2011). Papaya diseases and their management. *Indian Farmer's Digest*, Vol. 44, No. 12, pp. 12-16.
  - Vaibhav K. Singh, Akhilesh Singh and Yogendra Singh. (2012). Protect onion crop from diseases. *Indian Farmer's Digest*, Vol. 45, No. 02, pp. 27-29.
  - Vaibhav K. Singh, Yogendra Singh and D.S. Mishra. (2011). Management of post-harvest disease of pome and stone fruits. *Indian Farmer's Digest*, (Accepted).
  - Bhupendra Singh Khairyat, Yogendra Singh and Vaibhav K. Singh. (2012). Gerbera ke pramukh rog evam unki roktham. *Kissan Bhart*, Vol. 43, No. 05, pp. 34-35.
  - P. Preetham, Deepti Singh and, Babita Singh. (2011). Cut Foliage: An Emerging industry. *Sikkim Express*, Monday, September 12, 2011, Gangtok. (Part-I)
  - P. Preetham, Deepti Singh and, Babita Singh. (2011). Cut Foliage: An Emerging industry. *Sikkim Express*, Monday, September 26, 2011, Gangtok. (Part-II)

# Awards and Recognitions

## Dr. Ramesh Kumar

- Awarded 'Life time achievement award' by Hi-tech Horticulture Society, Meerut during International Conference on issues for



climate change, land use diversification and biotechnological tools for livelihood security at Dr. Sardar Vallabhai Patel University of Agril & Tech, Meerut on 8 October, 2011.

- Recognized and honoured by Alumini Association, College of Agriculture. Punjab



Agricultural University, Ludhiana on 21-22 February, 2012 for being placed at the national level as Director, Directorate of Floricultural Research in ICAR.

- Recognized as Guest of Honour at the Annual Prize Distribution Function of the Rajasthan College of Agriculture, Udaipur on 13- 14 September, 2011.
- Recognized as Guest of Honour at the inaugural function of the Advance Training Programme conducted by Dr.Y.S.Parmar University of Horticulture & Forestry, Solan on 30 June to 3 July 2011.
- Recognized as Guest of Honour at Chrysanthemum germplasm exhibition at Punjab Agricultural University, Ludhiana held during 1- 4 December, 2011.
- Honoured as Chief Guest of The Annual Function of Ritambhra Public School, Sunder Nagar, Ludhiana on 30 December, 2011.
- Honoured plaque for outstanding contribution in floriculture in National Seminar on Challenges in Horticultural Crops at College of Agriculture, Punjab Agricultural University, Ludhiana on 15-16 March 2011.
- Nominated as Vice-President, Indian Society of Ornamental Horticulture, New Delhi.

## Dr. K.P. Singh

- Conferred "Dr. Ambedkar Ratan Samman Award – 2011" by Bhartiya Dalit Vikas

Sansthan (Registered) Meerut (Uttar Pradesh) for his outstanding contribution in the field of science and technology.

- Received Best Poster Paper Presentation Award for their article entitled “Effect of elevated CO<sub>2</sub> levels on morphological and physiological characters in gladiolus, during *International Conference on Issues for Climate Change, Land use Diversification and Biotechnological Tools for Livelihood Security*, held at SVPUA&T Meerut during 8-10 October 2011.
- Received Best Poster Paper Presentation Award for their article entitled “Evaluation of Double petalled cultivars of tuberose (*Polianthes tuberosa* L) under Delhi conditions”, during *International Conference on Issues for Climate Change, Land use Diversification and Biotechnological Tools for Livelihood Security*” held at SVPUA&T Meerut, during 8-10 October 2011.
- Nominated by Director General ICAR as Secretary of Quinquennial Review Team (QRT) of All India Coordinated Research Project (AICRP) on Floriculture located at Directorate of Floricultural Research New Delhi to review the work done during 01.04.2006 to 31.03.2011 at various centres of AICRP (Floriculture) spread across the country.
- Nominated by Director NAARM Hyderabad as Question Paper ICAR – SRF for pursuing Ph.D programme.
- Nominated by Dean, Home Science, GBPUA&T Pantnagar as Question Paper Setter for Course No. HRM/APH – 320 title Ornamental Horticulture.
- Nominated as External Examiner for conducting Practical Examination of M.Sc. (Horticulture) second years by Hemvati Nandan Bahuguna Garwal University Srinagar, Garwal (Uttarakhand).
- Nominated as External Examiner for thesis evaluation and conducting of *viva voce* examination of Ms Muzumil Rosool, a Ph.D. (Floriculture and Landscaping) student by Sher-e-Kashmir University of Agricultural Sciences and Technology (K) Srinagar (J&K).
- Nominated as External Examiner for thesis evaluation and conducting of *viva voce* examination of Ms Muzumil Rosool, a Ph.D. (Floriculture and Landscaping) student by Sher-e-Kashmir University of Agricultural Sciences and Technology (K) Srinagar (J&K).
- Nominated as External Examiner for thesis evaluation and conducting of *viva voce* examination of Mr. Ram Pal, a Ph.D. (Horticulture) student by Babasaheb Bhimrao Ambedkar Univeristy, Lucknow (Uttar Pradesh).
- Nominated as External Examiner for evaluation of Ph.D. (Horticulture) thesis submitted to Navasari Agricultural University, Navasari (Gujarat).
- Nominated as External Examiner for evaluation of Ph.D. (Horticulture) thesis submitted to University of Agricultural Sciences Dharwad (Karnataka).
- Nominated as External Examiner to conduct Preliminary Oral examination of Ms Neeraja Singh a Ph.D. (Horticulture) student by Narendra Deva Univeristy of Agriculture and Technology Kumarganj, district Faizabad (Uttar Pradesh).
- Nominated as Advisory Board Member of Hort flora Research Spectrum, a Quarterly Journal, Published by Bioscience and Agriculture Advancement Society (BAAS) Meerut (Uttar Pradesh).
- Nominated by Director, IARI New Delhi as member of Assessment Committee for considering the Assessment Promotion Cases of Technical Staff at IARI New Delhi.
- Invited to act as Judge in Flower Show and Competition organized by Dahliya and Chrsanthemum Society Meerut (Uttar Pradesh) on 11.12.2011.



- Nominated as Reviewer by Editor of *Karnatak Journal of Agricultural Sciences*, Published by University of Agricultural Sciences Dharwad Karnataka).
- Nominated as Reviewer by Chief Editor of *Indian Journal of Horticulture* published by horticultural Society of India, New Delhi.
- Nominated as reviewer by Managing Editor of agricultural research communication centre sadar Karnal (Haryana).
- Nominated as an Outside Expert of Departmental Recruitment Committee (DRC) to interview eligible candidates for filling up scientific post in Botanical Survey of India, Ministry Environment and Forestry, Govt. of India on 30 November 2011.
- Nominated by Director, IARI, New Delhi as Member of the Committee to finalize the samples/ARC of the miscellaneous store items for IARI New Delhi.

#### **Dr. P. Naveen Kumar**

- Acted as rapporteur of different sessions of XXI Annual Group Meeting of AICRP on Floriculture, 4-6 November 2011 held at CTRI, Rajahmundry.
- Nominated as external examiner (Question paper setting and evaluation) of the floriculture courses in different SAU's (OUAT, SKUAST, YSPUHF, CAU, etc).
- Acted as reviewer for the international (Journal of Horticulture and Forestry) and National (Indian Journal of Agricultural Sciences, Journal of Horticulture Science, Indian Journal of Horticulture, etc.) journals.

- Nominated as editor of *Indian Journal of Horticulture* official journal of Horticulture Society of India for the year 2011.
- Nominated as Assistant Editor of *Journal of Ornamental Horticulture*, office journal Indian Society of Ornamental Horticulture, New Delhi for the period 1.1.2012 to 31-12-2014.

#### **Dr. Gunjeet Kumar**

- Conferred Gold Medal by the Hi-tech Horticulture Society, Sardar Vallabhai Patel Univ. of Agriculture & Technology, Modipuram, Meerut on 8<sup>th</sup> Oct. 2011 during International Conference on issues for climate change, land use diversification and biotechnological tools for livelihood security.
- Elected Treasurer, Indian Society of Ornamental Horticulture, Pusa Campus, New Delhi.

#### **Dr. Tarak Nath Saha**

- Nominated as a member in the executive council in Indian Society of Ornamental Horticulture.
- Nominated as Nodal Officer for PERMISNET.
- Acted as Reviewer of articles submitted for publication in the Indian Journal of Horticulture and Journal of Applied Horticulture.

#### **Dr. Ganesh B. Kadam**

- Received first best lead paper "Effect of elevated CO<sub>2</sub> on morphological and physiological characters in gladiolus" at International Conference on Issues for Climate Change, Land Use Diversification and Biotechnological Tools for Livelihood Security (Oct 8-10, 2011), Meerut.

# Seminars / Symposia / Conferences / Workshops Attended

During the period under report, the scientists of DFR participated in several seminars, symposia, conferences, workshops, interacted with subject experts and refreshed their knowledge about the latest developments. A list of various programmes is given below;

## **SEMINARS / SYMPOSIA/ CONFERENCES/ WORKSHOP**

- Dr. Ramesh Kumar attended the National Seminar on New Frontier and Future Challenges in Horticultural Crops at College of Agriculture PAU, Ludhiana during March 15-17, 2011.
- Dr. Ramesh Kumar attended the National Workshop on Horti-Business Linking Farmers to market at Dehradun on May 27-29, 2011.
- Dr. Ramesh Kumar attended the International Conference on Issue for Climate Change and Land use Diversification and Biotechnological Tools and Livelihood Security at Meerut on Oct 8-10, 2011.
- Dr. Ramesh Kumar, P. Naveen Kumar, Gunjeet Kumar, Tarak Nath Saha, Ganesh B. Kadam and Jayoti Majumder attended the 1<sup>st</sup> Biennial International Congress on Urban Green Spaces” organized by centre for Urban Green Spaces (Aravali Foundation for Education) and Department of Environment, Government of NCT of Delhi at New Delhi on March 5, 2012.
- Dr. K.P. Singh has attended “Global Conference on Augmenting Production and Utilization of Mango: Biotic and Abiotic Stress”, held at Lifestyle Hotel Private Limited, Lucknow (Uttar Pradesh) during 21-24 June 2011.
- Dr. K.P. Singh has attended “International Conference on Issues for Climate Change, Land use Diversification and Biotechnological Tools for Livelihood Security” held at SUPUA&T, Meerut (Uttar Pradesh) during 5-8 October 2011.
- Dr. K.P. Singh has attended “Third Swadesh Prem Jagriti Sangosthi-2011” and “National Conference on Horti Business – Linking Farmers with Markets” held at ONGC Coplex Dehradun (Uttarkhand) during 28-31 May 2011.
- Dr. K.P. Singh has attended ‘National Conference on Shaping Human Resource for Global Competitiveness and Global Anumni Meet” held at IARI New Delhi on 18.02.2012.
- Dr. K.P. Singh has attended “XXI Group Meeting of all India Coordinated Research Project on Floriculture” held at CTRI Rajamundry (Andhra Pradesh) during 4-6 November 2011.
- Dr. K.P. Singh has attended “National Conference on Farmer Led Innovations” organized by Haryana Kisan Aayog, ICAR, PPVFRA, NFI, TASS and CCSHAU at Hisar (Haryana) during 23-24 December 2011.
- Dr. K.P. Singh has attended Interaction Meet with NGO’s and Farmer Entrepreneurs,

organized by ICAR at NASC Complex, Pusa, New Delhi on 23 September 2011.

- Dr. K.P. Singh has attended one day meet of President/Secretaries/Key Functionaries of Professional Societies, organized by ICAR at NASC Complex, Pusa, New Delhi on 22 July 2011.
- Dr. P. Naveen Kumar attended brainstorming Session on 'Prioritization of Plant Physiology and Biochemistry Research for 12<sup>th</sup> five year plan period at Dr. B.P. Pal auditorium, IARI, New Delhi on August 5-6, 2011.
- Dr. Ramesh Kumar, P. Naveen Kumar, Gunjeet Kumar, Tarak Nath Saha, Ganesh B. Kadam, Girish K.S, V.K. Singh and Puja Rai attended XXI Annual Group meeting of AICRP on Floriculture held at CTRI, Rajahmundry on November 4-6, 2011.
- Dr. P. Naveen Kumar and Gunjeet Kumar attended and delivered lecture in one-day seminar on 'Possibilities and Prospects of Commercial Floriculture in Korea district of Chhattisgarh' at Baikunthpur, Korea Dist., C.G held on November 17, 2011.
- Dr. P. Naveen Kumar and Tarak Nath Saha attended National Conference on Orchids in India: Diversity, Characterization and Resource Development for Community Livelihood at National Academy of Science India (NSAI) Allahabad held on December 21-23, 2011.
- Dr. P. Naveen Kumar and Ganesh B. Kadam attended National Dialogue on Climate Resilient Horticulture at IIHR, Bengaluru held on January 29-30, 2012.
- Dr. P. Naveen Kumar and Tarak Nath Saha attended National Conference on Shaping Human Resources for Global Competitiveness and Global Alumni Meet of IARI at IARI, New Delhi on February 18, 2012.
- Dr. P. Naveen Kumar attended sensitization cum training workshop for the PME Cell In-Charge (Nodal Officer) of HYPM held at IASRI, New Delhi on March 3, 2012.
- Dr. TN Saha, attended 30<sup>th</sup> All India Rose Convention & Rose Show and 23<sup>rd</sup> Annual Flower Show at Jamshedpur from January 6-8, 2012.
- Dr. Ganesh B. Kadam and Girish K.S. attended the National Seminar on "Protected Cultivation of Vegetables and Flowers- A Value Chain Approach". GBPUAT, Pantnagar, Uttarakhand 11-12 January 2012.
- Dr. Vaibav Kumar Singh participated in the "Global Conference on Women in Agriculture" (*Overarching Goal: Empowering Women for Inclusive Growth in Agriculture*) held at NASC Complex, New Delhi, March 13-15, 2012.
- Dr. Vaibav Kumar Singh Attended the "Conference on Agri-biotechnology" held at, IARI, New Delhi, December 19-20, 2011.
- Dr. Vaibav Kumar Singh participated in 5<sup>th</sup> International Conference on Plant Pathology in Globalized Era, India Phytopathological Society held at I.A.R.I., New Delhi, November 10-13, 2011.
- Mr. Girish KS attended the 2<sup>nd</sup> Horticulture-Industry meet held at Indian Institute of Horticulture Research, Hessarghatta, Bengaluru on March 6, 2012.

## TRAINING PROGRAMMES ATTENDED

- Training on 'Bioinformatics and its Applications in Agriculture' at KAU, Vellanikkara sponsored by NAIP, ICAR, New Delhi held on May 2-16, 2011.
- Dr. Jayoti Majumder and Dr. Puja Rai, attended a training program on "Naturally occurring nutraceuticals, crop protectants and other biomolecules for application in human and crop health" organised during Jan 23 - Feb2, 2012 at IARI, New-Delhi.
- Dr. Jayoti Majumder and Dr. Puja Rai, Scientist attended a training program on

“Conservation of Plant Genomic resources” held at NBPGR, New-Delhi 12 during Feb12-25, 2012.

- Dr. Ganesh B. Kadam attended national training programme on “Seed Production and Quality Regulation” held at College of Agriculture, Pune, Maharashtra, organised by National Seed Research and Training

Centre, Varanasi during February 13- 17, 2012.

- Dr. Vaibhav Kumar Singh and Girish K. S. attended a training on “ELISA and PCR Based Detection of Plant Viruses” held at Plant Virology Unit, Division of Plant Pathology, IARI, New Delhi during November 14-19, 2011.

# Personnel

Name	Designation	E-mail
Dr. Ramesh Kumar	Director	directordfr@gmail.com
Dr. Krishna Pal Singh	Principal scientist	kpsingh.dfr@gmail.com
Dr. P. Naveen Kumar	Senior scientist	naveeniari@gmail.com
Dr. Gunjeet Kumar	Scientist (SS)	kumargunjeet@yahoo.com
Dr. B.K. Singh	Scientist	bksinghkushinagar@yahoo.co.in
Dr. Tarak Nath Saha	Scientist	tnsaha@gmail.com
Dr. (Ms) Jayoti Majumder	Scientist	jayotisarkar1@gmail.com
Ms. Sellam P.	Scientist	chella.perinban@gmail.com
Dr. Kadam Ganesh Balkrushna	Scientist	ganeshiari@gmail.com
Dr. Puja Rai	Scientist	pujaiari@gmail.com
Dr. Babita Singh	Scientist	bflori17feb@gmail.com
Dr. V.K. Singh	Scientist	dr.singhvaibhav@gmail.com
Mr. Girish K.S.	Scientist	girishchakra@gmail.com
Dr. S.M. Trivedi	Technical Officer (T7/8)	trivedishruti81@gmail.com
Mr. O.P. Singh	Technical Officer (T-6)	
Ms. Suchitra Pushkar	Technical Officer (T-5)	suchi.iar@gmail.com
Mr. S.K. Rai	Technical Assitt. (T-1)	
Mr. A.K. Maithani	Administrative officer	akmaithani61@yahoo.in
Mr. R.S. Bhatt	AF&AO	afaodfr@gmail.com
Mr. Pratap Singh	L.D.C	pratapbisht1979@gmail.com

## NEW APPOINTMENTS

### Scientific

- Dr. Krishna Pal Singh, Principal Scientist (Floriculture), Division of Floriculture and Landscaping, IARI, New Delhi joined DFR, New Delhi on 01.04.2011.
- Dr. B.K. Singh, Scientist, ICAR Research Complex, NEH region, Mizoram centre joined DFR, New Delhi on 14.11.2011.
- Dr. Kadam Ganesh Balkrushna, Scientist (Hort-Floriculture) joined on 01.09.2011.
- Dr. Puja Rai, Scientist (Crop Physiology) joined on 02.09.2011.
- Dr. Babita Singh, Scientist (Hort-Floriculture) joined on 05.09.2011.

- Mr. Girish K.S, Scientist (Entomology) joined on 02.09.2011.
- Dr. Vaibhav Kumar Singh, Scientist (Crop Pathology) joined on 05.09.2011.

### Administrative

- Mr. R.S. Bhatt, Assistant Finance and Accounts Officer, NRC Citrus, Nagpur, joined DFR New Delhi on 11.08.2011.
- Mr. Pratap Singh, LDC, NBAIM, Mau joined DFR on 05.03.2012.

### Retirements

- Mr. R.C. Paswan, Skilled supporting staff retired from his service on October, 2011.

# AICRP on Floriculture

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 Centers as well as the research programmes were modified accordingly. At present the Coordinated Project has 23 Centers which includes 16 budgetary, 4 institutional and 3 voluntary Centres.

S. No.	Centre	Year of	Crops Alloted
<b>Budgetary Centres</b>			
1.	Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (upto September 1977 it was at B.S.I. Calcutta)	1972	Carnation, Orchids, Anthurium, Tuberose, Gerbera
2.	Dr.Y.S. Parmar University of Horticulture & Forestry, Solan	1975	Gladiolus, Carnation, Chrysanthemum, Tulip, Daffodils, Liliun, Alstroemeria
3.	Kerala Agricultural University, Vellanikkara	1975	Orchids, Anthurium, Gerbera
4.	Mahatma Phule Krishi Vidyapeeth, Pune	1975	Rose, Gladiolus, Carnation, Chrysanthemum, Tuberose, Gerbera,
5.	Punjab Agricultural University, Ludhiana	1975	Rose, Gladiolus, Chrysanthemum, Tuberose, Gerbera, Liliun
6.	Rajasthan College of Agriculture (MPUAT), Udaipur	1980	Rose, Gladiolus, Chrysanthemum
7.	Horticultural Research Station (TNAU), Yercaud	1982	Carnation, Gladiolus, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera
8.	Horticultural College and Research Institute (TNAU), Coimbatore	1982	Carnation, Gladiolus, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera
9.	Uttar Banga Krishi Viswavidyalaya, Kalimpong	1985	Gladiolus, Carnation, Orchids, Anthurium, Alstroemeria
10.	Agricultural Research Institute (APHU), Hyderabad	1987	Gladiolus, Chrysanthemum, Tuberose
11.	Sher-E-Kashmir University of Agricultural Sciences & Technology, Wadura campus, Sopore	1987	Gladiolus, Chrysanthemum, Tulip, Daffodils, Liliun, Alstroemeria
12.	Horticultural Research Station (AAU), Kahikuchi, P.O. Azara, Guwahati	2001	Gladiolus, Orchids, Chrysanthemum, Anthurium, Tuberose, Gerbera
13.	Orissa University of Agriculture and Technology, Chiplima	2011	Rose, Chrysanthemum, Orchids, Anthurium

<b>S. No.</b>	<b>Centre</b>	<b>Year of</b>	<b>Crops Alloted</b>
14.	G. B. Pant University of Agriculture & Technology, Pantnagar	2001	Rose, Gladiolus, Chrysanthemum, Tuberose, Gerbera
15.	Birsa Agricultural University, Ranchi	2001	Gladiolus, Chrysanthemum, Gerbera
16.	Rajendra Agricultural University, Pusa, Samastipur, Bihar	2010	Rose, tuberose, gladiolus and Marigold
<b>Institutional centres</b>			
17.	Indian Agricultural Research Institute, New Delhi	1971	Rose, Gladiolus, Chrysanthemum and Tuberose
18.	Indian Agricultural Research Institute, Regional Station, Katrain, Himachal Pradesh	1971	Gladiolus, Carnation, Gerbera, Tulip, Daffodils, Liliun, Alstroemeria
19.	Indian Institute of Horticultural Research, Hesaraghatta, Bangalore	1971	Rose, Gladiolus, Carnation, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera
20.	ICAR Research Complex for NEH Region, Barapani, Shillong (Meghalaya)	1971	Orchids, Anthurium, Gerbera
<b>Voluntary Centres</b>			
21.	National Botanical Research Institute, Lucknow	1971	Rose, Gladiolus, Chrysanthemum, Tuberose
22.	University of Agricultural Sciences, Bangalore	1977	Carnation, Anthurium
23.	Horticultural College and Research Institute (TNAU), Periyakulam	2010	Marigold, Tuberose, Chrysanthemum



# Distinguished Visitors

The Directorate of Floricultural Research remained abuzz with visitors that include policy planner, administrators, scientists and extension personnel. During the period of report is given herewith:

- Dr. S. Ayyappan, Hon'ble Secretary, Department of Agricultural Research & Education (DARE), Ministry of Agriculture and Director-General, ICAR, New Delhi.



- Mrs. Ayyappan, wife of Hon'ble DG, ICAR visited the research farm and appreciated the efforts made.



- Dr. Gurbachan Singh, Chariman ASRB, ICAR.



- Dr. H.P. Singh DDG (Hort.), ICAR, New Delhi.
- Dr. H.S. Gupta, Director, IARI, New Delhi.



- Mr. D.N. Takarpa, Hon'ble Agriculture Minister of Sikkim.
- Mr. Nalin Soren, Hon'ble Agriculture and Animal Husbandry Minister of Jharkhand.

- Prof. P. Das, Chairman & Managing Director, The Science Foundation for Tribal & Rural Resource Development, Bhubaneswar.
- Dr. S. Rajan, ADG (Hort-I), ICAR, New Delhi.
- Dr. H.S. Gaur, Joint Director (Education), IARI, New Delhi.
- Dr. K.C. Bansal, Director, NBPGR, New Delhi.



- Dr. Jagmohan Singh, Ex-VC, DrYSPUHF, Solan.



- Dr. Umesh Chandra Srivastava, ADG (Hort-II), ICAR, New Delhi.
- Dr. A.S. Siddhu, Director, IIHR, Bangalore.
- Dr. V.K. Bhatia, Director, IASRI, New Delhi.
- Dr. T.P. Trivedi, Asst. Director General (AKM) and Director, DIPA, ICAR, New Delhi.
- Dr. Malvika Dadlani, Joint Director (Res) IARI, New Delhi.

- Dr. S.P.S. Raghava, Former Project Coordinator, AICRP (Floriculture).
- Dr R.L. Misra, Former Project Coordinator, AICRP (Floriculture).
- Dr. A.P. Singh, Former Head, FLS, IARI, New Delhi.



- Dr. K.V. Prabhu, Head, Genetics, IARI, New Delhi.
- Dr. T. Janakiram, Head, FLS, IARI, New Delhi.
- Dr. Pritam Kalia, Head, Vegetable Science, IARI, New Delhi.
- Dr. A.K. Singh, Head, Division of Fruits and Horticulture Technology, IARI, New Delhi.
- Dr. T M Rao, Head, Division of Ornamental Crops, IIHR, Bangalore.
- Dr. Balraj Singh, In-charge, CPCT, IARI, New Delhi.
- Dr. B. S. Tomar, In-charge, SPU, IARI, New Delhi.

- Dr. Y.C. Gupta, Head, Dept of Floriculture and Landscaping, Dr. YSPUHF, Solan.



- Dr. Man Singh, In-charge, FOSU, IARI, New Delhi.

Beside this, many scientists from ICAR and SAUs, Programme coordinators of ATMA, NHM of different states, students, press and media persons had visited the DFR Research Farm from time to time. Feedback and suggestions received from them were very useful for reprioritization of floriculture research and technology transfers program in the country.

# Budget 2011-12

(₹ in lakhs)

S. No.	State	Centre	Released
1	Assam	1. Assam Agricultural University, Kahikuchi	15.55
2	Andhra Pradesh	1. Andhra Pradesh Horticultural University, Hyderabad	17.83
3	Bihar	1. Rajender Agricultural University, Pusa, Samastipur	3.92
4	Delhi	1. Indian Agricultural Research Institute, New Delhi	0.80
5	Himachal Pradesh	1. Dr. Y.S. Parmar University of Horticulture and Forestry, Solan	20.14
		2. I.A.R.I Regional Station, Katrain	0.80
6	Jammu & Kashmir	1. S.K. University of Agricultural Sciences and Technology, Srinagar	8.97
7	Jharkhand	1. Birsa Agricultural University, Ranchi	4.86
8	Karnataka	1. Indian Institute of Horticultural Research, Bengaluru	0.80
		2. University of Agricultural Sciences, Bengaluru	0.80
9	Kerala	1. Kerala Agricultural University, Vellanikkara	16.79
10	Maharashtra	1. Mahatma Phule Krishi Vidyapeeth, Pune	24.62
11	Meghalaya	1. ICAR Research Complex for NEH Region, Barapani	0.80
12	Orissa	1. Orissa University of Agriculture and Technology, Chiplima	16.05
13	Punjab	1. Punjab Agricultural University, Ludhiana	29.46
14	Rajasthan	1. Maharana Pratap University of Agriculture and Technology, Udaipur	11.85
15	Tamil Nadu	1. Tamil Nadu Agricultural University, Coimbatore	22.18
		2. Horticultural college and Research Institute, Periyakulam	0.80
16	Uttar Pradesh	1. National Botanical Research Institute, Lucknow	0.80
17	Uttarakhand	1. G.B. Pant University of Agriculture and Technology, Pantnagar	5.16
18	West Bengal	1. Bidhan Chandra Krishi Viswavidyalaya, Kalyani	18.17
		2. Uttar Banga Krishi Viswavidyalaya, Kalimpong	9.26
19	Delhi	1. DFR/ P. C. Cell	306.59
<b>Total</b>			<b>537.00</b>

## XII FIVE YEAR PLAN

During the XII Five Year Plan (2012-13 to 2016-17) the Directorate of Floricultural Research has proposed a budget outlay of Rs 16190.58 lakhs (ICAR share – 14779.97 lakhs & state share – 1410.61 lakhs). This includes an amount of Rs 10383.15 lakhs for the Directorate itself and Rs 5807.43 lakhs for the other AICRP on Floriculture Centres. The provision for non-recurring contingencies (NRC) for works was proposed at 6009.50 lakhs including Rs. 5448.00 lakhs for Directorate and Rs. 561.50 lakh for AICRP. NRC for Equipment was 1155.20 lakhs including Rs 611.00 lakhs for Directorate and Rs. 544.20 lakhs for AICRP. In addition to the above, the outlay comprises of provision for Library (80.00 lakhs), strengthening of IT (100.00 lakhs) and HRD (60.00 lakhs).

In the proposal, an additional staff of 74 (12 scientific, 28 technical and 34 supporting) have been proposed. This includes an additional staff of 61 (10 scientific, 17 technical and 34 supporting) for Directorate and 13 (2 scientific and 11 technical) for the other coordinated centres of AICRP on Floriculture.

Adequate provision has been made for land and building, laboratory equipments and field infrastructures. Provision has also been made for Information Technology including creation of Directorate of Floricultural Research's website and simultaneously its maintenance, Intellectual Property Rights, unforeseen expenditure, etc.

Besides this, the budgetary requirements of a flagship project on 'Characterization of Genetic Resources in floriculture for efficient harnessing of their potential', have also been proposed.

Four new voluntary centres have been proposed at Navsari Agricultural University, Navsari (Gujarat), Central Agricultural Research Institute, Portblair (Andaman & Nicobar Islands), Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) and Sher E Kashmir University of Agricultural Sciences and Technology, Jammu (J & K) in order to give wider coverage to the coordinated project in the country and to give a boost to the on-going floricultural research activities in these regions and also to bring non-traditional areas into floriculture.