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India is bestowed with rich bio-diversity of ornamentals. Its varied agro-climatic conditions, ample sunshine during flowering and proximity to the markets of the Middle East and South East Asian countries offer great opportunities to harness potential in floriculture and other ornamentals. India ranks second in area of flower cultivation next to China. About 1,91,600 ha of area is under floriculture producing 10,31,000 metric tonnes (MT) of loose flowers and 69,027 lakh numbers of cut-flowers during 2010-11. The overall exports of floricultural produce from India touched Rs. 294.4 crore by the end of 2009-10.

The Directorate of Floricultural Research, an Institute established through the up-gradation of Project Coordinator’s cell of All India Coordinated Research Project (AICRP) on Floriculture during the XI Plan has successfully completed by 2010-11. The AICRP on Floriculture was established during the IV Five-Year Plan in the year 1970-71 to carryout nation-wide interdisciplinary research by linking the ICAR Institutes with the State Agricultural Universities (SAU’s) remains an integral part of the DFR with its 23 Coordinated Centers including 16 budgetary and 7 voluntary Centres.

The Directorate has a mandate to coordinate floricultural research on genetic resource utilization, crop improvement, standardization of production technology, focus on resource utilization such as productive use of water, developing repository of data bank, plant architecture engineering and management, generating the need-based technology for crop protection and value addition. The Directorate aims at development of environment-friendly, cost-effective and user friendly technologies apt for variable agro-climatic conditions, thereby reducing the dependence on cost-intensive extraneous technologies.

I wish to express my gratitude to Dr. S. Ayyappan, Hon’ble Secretary, Department of Agricultural Research & Education (DARE) and Director General, ICAR; Dr. H.P. Singh, Deputy Director General (Horticulture) for their valuable guidance and support extended to the Directorate. The physical facilities and support provided by Dr. H.S. Gupta, Director, IARI is duly acknowledged. We also acknowledge the help and co-operation extended by Dr. Umesh Srivastava, Dr. S. Rajan, Assistant Director Generals (Hort.), Dr. S.K. Malhotra and Dr. P.L. Saroj, Principal Scientists (Horticulture Division) of ICAR from time to time.

I am grateful for the efforts of my colleagues, Dr. P. Naveen Kumar, Dr. Gunjeet Kumar, Dr. Tarak Nath Saha and Ms. Sellam P. from the Directorate and Dr. J.S. Dhiman, PAU, Ludhiana for their role in compilation, editing and vetting of the maiden Annual Report of the Directorate.

June 24, 2011
New Delhi

(Ramesh Kumar)
Director
Preface

Executive Summary

About the Institute

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Budget Provision
11वीं योजना के दौरान अर्थव्यवस्था भारतीय पृष्ठभूमि सम्बन्धित अनुसंधान परियोजना के विषय में समन्वयक रूप से का उन्मादन करते हुए पृष्ठभूमि अनुसंधान निदेशालय की स्थापना एक संस्थान के रूप में की गई, जिसने वर्ष 2010 के अंत तक अपनी स्थापना का एक वर्ष समयलापिक अंतर्गत कर लिया है। राज्य कृषि विश्वविद्यालयों के साथ भारतीय कृषि अनुसंधान परिशद संस्थानों का संपर्क बनाये रखते हुए राष्ट्रीय स्तर पर अंतर-विषयी अनुसंधान करने के उद्देश्य से वर्ष 1970-71 में चौथी पंचवर्षीय योजना के दौरान अर्थव्यवस्था भारतीय पृष्ठभूमि समन्वयत अनुसंधान परियोजना की स्थापना गई थी, जो कि 23 समन्वयत केंद्रों जिनमें 16 वित्तीय और 7 विभिन्न केंद्र शामिल हैं, के साथ पृष्ठभूमि अनुसंधान निदेशालय का आत्मनिर्देश हिस्सा बन गया है।

चूँकि यह एक नई स्थापना है, अत: इसमें नवीन अनुसंधान परियोजनाओं का निरूपण तथा बृहत्यादी सुविधाओं का विकास किया जाना एक अविलंब आवश्यकता है। सीमित स्रोत एवं संसाधनों के साथ, हालांकि, पृष्ठभूमि अनुसंधान निदेशालय (अर्थव्यवस्था भारतीय पृष्ठभूमि समन्वयत अनुसंधान परियोजना सहित) द्वारा की गई अनुसंधान प्रगति उल्लेखनीय है।

विभिन्न पृष्ठीय फसल जननविषय एक राष्ट्रीय संगठनों का दर्शन में निदेशालय में ग्रेडियोलास, गुलदाउदी, कृष्णा तथा विभिन्न पृष्ठीय फसलों में बड़ी संख्या में किस्मों/प्राप्तियों का संकलन किया गया। ग्रेडियोलास तथा गुलदाउदी में प्रजनन कार्यक्रम के प्रथम वर्ष में क्रमशः सफल क्रान्तियों तथा खुले परागण से पर्याप्त मात्रा में बीज उत्पादन किया गया।

प्रजनन कार्यक्रम के अंतर्गत 6 नई किस्मों, ग्रेडियोलास में चार (पंजाब कृषि विश्वविद्यालय, लुधियाना से पंजाब फ्लेम, पंजाब ऐलिगेंस, पंजाब लेमन डिलाइट तथा पंजाब ग्लास) तथा गुलदाउदी में दो (पन. बी. आर. आई., लखनऊ से कौल एवं खुशाल) को अर्थव्यवस्था भारतीय पृष्ठभूमि समन्वयत अनुसंधान परियोजना के अंतर्गत विकसित किया गया और अनेक आशाजनक संकेतों/वंशक्रमों का बहुभाषानिक परीक्षण कार्य प्रगति पर है। पृष्ठीय फसलों की विभिन्न देशी एवं विदेशी किस्मों के मूल्यांकन के आधार पर विभिन्न क्षेत्रों के लिए गुलदाउदी, ग्रेडियोलास, गुलदाउदी, कृष्णा, एलिगियंस, जर्बिया, कंदवाक्का, आल्ट्रीलारिया, आइरिस और डेटोलिया में उपयुक्त किस्म पायी गई। अर्थव्यवस्था पृष्ठभूमि समन्वयत अनुसंधान परियोजना के समन्वयत केंद्रों में उत्पादन, संसाधन, कटाई उपरांत तेश-तेश तथा मूलय संकरण में कुछ उल्लेखनीय अनुसंधान परिणामों को नीचे दर्शाया गया है।

जस्ते समाचार प्रकाशित “डेबोरा” (हेसरगर्डटा), “सोलिटर” (पुलिन), “रेड मोनार्च” (काहारकुब्बी) तथा “एलोंट” (कर्नल) में उर्वरकों की सुझाई गई मात्रा (75 प्रतिशत) + 1 किग्रा। प्रति वर्ग मीटर की दर से गोवर की खान + 300 ग्रा। प्रति वर्ग मीटर की दर से वर्गमीटर + 2 ग्रा। प्रति पीटा प्रति वर्ग की दर से एजोक्सिल्ट + 2 ग्रा। प्रति पीटा प्रति वर्ग की दर से पी. एस बी समीक्षित में पेश करके वर्गमीटर संबंध प्रशंसन संपूर्ण पाया गया। काहारकुब्बी में एजोक्सिल्ट प्रकाशित सोनिया में एजोक्सिल्ट और पी. एस बी के साथ 0.2 प्रतिशत की दर से पी. एस के (20-10-10) का अनुप्रयोग करने से वृद्धि एवं पुष्प उत्पादन में सुधार हुआ। इस उपचार के अतिरिक्त क़ैल्चरी में जड़ क्षेत्र में 2 ग्राम/पीटा की दर से पी. एस. का अनुप्रयोग लाभदायक पाया गया।

ग्रेडियोलास में खपतपता नियंत्रण परीक्षण में यह पाया गया कि पंजाबगर, श्रीनगर, एवं रांची में स्वास्थ्य में, उड़ीसा में (1.0 kg a.i./ha); लुधियाना में मेट्रॉबुफ्निज (0
0.50 kg/ha; कालीकुम व 44 एट्राजिन 1.5 kg a.i./ha; पुष्पा विश्वास में एंट्रीकिमियल @1.0 kg a.i./ha अथवा एट्राजिन @44 kg a.i./ha या मेट्रिक्स ज @0.25 kg a.i./ha; और एंट्राजिन @0.25 kg a.i./ha एवं @ 44 kg a.i./ha की छत्री हुई मात्रा में समान रसायन के अनुप्रयोग उपचार संबंधित क्षेत्रों में प्रभावी पाए गए। इस प्रकार लुधियाना, पुरू, राठी और पंजाब में गुलाब की खेती में खतरनाक जनसंख्या को नियंत्रित करने में काली पंखीलिया (200 माइक्रोन) के साथ पालन करना भी प्रभावी रहा हुआ।

जर्जरेस में पाद विभाग/मूल विभाग श़ीमारी आवार की रोकथाम के लिए 500 ग्राम/वर्गसेकंट की पय 0.3 ज्रोकोर्मा हार्ज़क्स द्वारा गौरं के उपचार एवं 0.3 ग्राम/वर्गसेकंट का कर्नी (9.67 पी दी आई) या 0.3 प्रतिशत की दर से एमोक्रोर्मा (9.33 पी दी आई) एवं आउडोलिया + 0.2 प्रतिशत की दर से कार्बनाल्डिम (9.57 पी दी आई) एवं 0.05 प्रतिशत की दर से डाइफॉनोकोनाफलितोन (10.27 पी दी आई) के अनुप्रयोग पुष्प में प्रभावी पाए गए।

गुलाब में संक्रमण-पूर्व घोल (एल्युमिनियम सक्केट @300 ppm), ग्रेडियोल में संक्रमण-पूर्व बंधन घोल (सुकोज @20 प्रतिशत) + एल्युमिनियम सक्केट @300 ppm + GA₃ @50 ppm), जीज घोल (सुकोज @2% + AOA @45 ppm + एलार @90 ppm) + ट्रिटॉन @100 ppm + GA₃ @1 ppm + काउनटिन @0.2 ppm; सुकोज (2%) टार्टरिक एसिड @3.00 ppm; सुकोज @2%. एल्युमिनियम सक्केट @100 ppm; एवं सुकोज @2 % + 8-HQC @150 ppm) उपचार क्रमशः कानेजर, जर्जरेस, टेक्स्टिल किम्स ट्रेप्टेटे तथा लिली किस्म सिलेटेट किम्स ट्रेप्टेटे तथा लिली किस्म सिलेटेटा में संबंधित फूलों के फूलदान जीवन को उत्तेजित रूप से बढ़ाने में प्रभावी पाए गए। संबंधित फूलों की गुणवत्ता बनाए रखने में सुधार लाने हेतु संबंधित फसलों में श्री-कूलिंग (कंटकार में 4 डिग्री सेल्सियस) एवं एकजिंग (पॉलीप्रोप्लेशल स्लीव्स में गुलाबाड़ी के तनों अथवा नास्तिक क्रेट में गेंदे के फूलों को लपेटना) लाभदायक पाया गया।

सिल्वर ऑक, बुधा एवं केमिया के पत्तों, सिलोशिया एवं जर्जरेस के फूलों तथा अक्सरों और-कूलिफ्मिया एवं टार्मिनिया अर्धुन के फलों के लिए तुषक विष्ट का मानकीकरण किया गया। जैविक नमक किस्म रामनाथपुर सुदमली से सुरक्षित तेल की बसूली बढ़ाने के प्रयास में यह पाया गया कि जै-उदारक छिद्रक (हल्किम एसिड + पंचाय) लाभकारी थे।
The Directorate of Floricultural Research (DFR), an Institute established through the upgradation of Project Coordinator’s cell of All India Coordinated Research Project (AICRP) on Floriculture during the XI Plan has successfully completed a year by 2010. The AICRP on Floriculture which was established during the IV Five-Year Plan in the year 1970-71 to carryout nation-wide interdisciplinary research by linking ICAR Institutes with State Agricultural Universities (SAU’s) in a network mode remains as an integral part of the DFR with 23 Coordinated Centers which includes 16 budgetary and seven voluntary Centres.

Being a new establishment, formulation of need-based research projects and development of infrastructural facilities have been the immediate concerns. Even with limited staff and resources, the progress of research at DFR including the AICRP on Floriculture is significant.

The collection of large number of varieties/accessions in gladiolus, chrysanthemum, tuberose and flowering annuals was made in the direction of establishing a national repository of flower crops germplasm. The first breeding cycle in gladiolus and chrysanthemum yielded reasonable seed from successful cross combinations and open pollination, respectively.

The breeding program resulted in development of six new varieties including four in gladiolus (Punjab Flame, Punjab Elegance, Punjab Lemon Delight and Punjab Glance) at Punjab Agricultural University (PAU) Ludhiana center and two in chrysanthemum (Kaul and Khoshoo) from National Botanical Research Institute (NBRI), Lucknow centre under the AICRP on Floriculture in addition to several promising hybrids/lines through the multilocational testing. Evaluation of range of indigenous and exotic varieties of flower crops (rose, gladiolus, chrysanthemum, carnation, anthurium, gerbera, tuberose, alstroemeria, iris, daffodils, etc) was identified for different regions in the country.

Salient Findings

Salient research findings of the coordinated centres of AICRP on Floriculture pertaining to production, protection, post harvest handling and value addition of floriculture produce are mentioned below.

- In chrysanthemum, cocopeat (IIHR), soil + sand + vermicompost (2:1:1v/v) [Ludhiana and Solan], cocopeat + sand + FYM + vermicompost (2:1:0.5:0.5 v/v) [Pantnagar and Coimbatore] and soil + sand + FYM [Hyderabad] were found to be optimum potting mixture for pot mum production.
- In gerbera cvs. ‘Debora’ (Hessarghatta), ‘Rosaline’ (Pune), ‘Red Monarch’ (Kahikuchi) and ‘Elegant’ (Kalyani), integrated nutrient management in terms of recommended doses of fertilizers (75%) + FYM (1 kg/m²)+ vermicompost (300g/m²)+ Azospirillum (2g/plant/year) + Phosphate Solubilizing Bacteria (PSB) (2g/plant/year) was found to be the best. Application of NPK (20:10:10) (0.2%) alongwith Azospirillum and PSB resulted in the improved growth and flower production in Dendrobium cv. Sonia at Kahikuchi. In addition to this treatment,
application of VAM (2g/plant) in the root zone was found beneficial at Kalyani.

- The results of the weed control trials in gladiolus, revealed that the chemicals, Pendimethalin (1.0 kg a.i./ha) at Pantnagar, Srinagar and Ranchi; Metribuzin (0.5 kg/ha) at Ludhiana; Atrazine 1.5 kg a.i./ha at Kahikuchi; Pendimethalin (1.0 kg a.i./ha) or Atrazine (1.5 kg a.i./ha) or Metribuzin (0.25 kg a.i./ha) followed by the same chemical at higher dose of 0.50 kg a.i./ha at Hyderabad were effective. Mulching with black polythene sheet (200 micron) also proved superior for checking weed population in rose plantation at Ludhiana, Pune, Ranchi and Pantnagar centres.

- In gerbera, for controlling foot rot/root rot disease at Pune, Neem cake colonized by the disease bio-control agent *Trichoderma harzianum* (500 g/m²) followed by drenching and foliar spray either with captan (0.3%) or Metalaxyl MZ 72 WP @ (0.3%) or Copper oxychloride (0.3 %) and for the checking the leaf spot/blight intensity, Azoxystrobin (0.1 %), Iprodine + Carbendazim (0.2 %) and Difenoconazole (0.05%) were found effective.

- For the management of *Fusarium wilt* in gladiolus, the pre-storage treatment of corms with hot water (50°C for 30 min) followed by bulb dip in captan and carbenazim @ 0.2% and pre-planting bulb dip treatment in *Trichoderma harzianum* @ 10 g/l for 30 min was found effective with least disease incidence at Pune.

- Foliar sprays for the control of marigold bud blight (Iprodine + Carbendazim @ 0.2% each) at Pune and alternaria blight (Mancozeb-Dithane M-45), Iprodione + carbendazim (Quintal) and difenoconazole (Score), @ 0.2, 0.2 and 0.1%, respectively) were found effective at Ludhiana. An Epidemiological survey conducted in different areas revealed that at Charoli Dist Pune, the Golden rod showed 55% intensity of rust, at Rajgurunagar the tuberose showed 15% incidence of stem rot with 20% intensity of leaf blight and 15% intensity of leaf blight. In rabi season at Satara, the polyhouse gerbera and at Astagaon Dist Ahmednagar, the chrysanthemum showed 25% intensity of leaf blight.

- In tuberose, incidence of leaf blight was significantly less with the foliar spray of Azoxystrobin @ 0.1% whereas, the final population of *Meloidogyne* and the root galling index in cv. “Single Local”, was significantly less in case of treatment with neem seed powder, carbofuran, *Trichoderma harzianum* and *Paecilomyces lilacinus + T. harzianum* treated soils at Ludhiana.

- Pre-transit solution (aluminium sulphate @ 300 ppm) in rose, pre-storage pulsing solutions in gladiolus (20% sucrose + 300 ppm aluminium sulphate +50 ppm GA₃), holding solutions (2% sucrose + 45 ppm Amino Oxy Acetic acid + 90 ppm Alar + 100 ppm Triton + 1 ppm GA₃ + 0.2 ppm Kinetin), in carnation (2%sucrose + 300 ppm tartaric acid), in gerbera (2%sucrose + 100 ppm aluminium sulphate), and in daffodil cv. Trumpet and lily cv. Cilesta (2% sucrose + 100 ppm 8-HQC + 150 ppm GA3) extended the vase life of flowers significantly. Precooling (at 4°C in tuberose) and packaging (wrapping of stems of chrysanthemum stems and marigold flowers in plastic crates were found to be beneficial in improving the keeping quality of the respective flowers.

- Drying methods were standardized for the leaves of silver oak, thuja and camellia, flowers of *Celosia* and gerbera; and fruits of *Acacia auriculiformis* and *Terminalia arjuna*. To increase the recovery of essential oils from *Jasminum sambac* var. Ramanathapuram Gundumalli, it was found that bio stimulant spray (Humic acid + Panchagavya) was beneficial.
Directorate of Floricultural Research (DFR), an Institute established by upgrading the Project Coordinator’s Cell of All India Coordinated Research Project (AICRP) on Floriculture during the XI Plan has successfully completed a year by 2010. AICRP on Floriculture which was established during the IV Five-Year Plan in the year 1970-71 to carry out nation-wide interdisciplinary research by linking ICAR Institutes with State Agricultural Universities (SAU’s) remains as an integral part of the DFR with 23 Coordinated Centers which includes 16 budgetary and seven voluntary Centres.

The Indian Council of Agricultural Research (ICAR)’s decision to start an independent enormously in materializing the efforts made in the direction of having a full fledged Institute for floriculture. Considering the research needs and dimension-less potential of floriculture in India, providing crucial technological support to the growers and entrepreneurs, besides providing employment generation to rural youth is entrusted in its mandate.

DFR was established to harness the huge potential of floriculture in India considering the ever increasing demand in the domestic and international flower trade. The commercial floriculture has changed rapidly in the last two decades. For the new and much required areas such as protected cultivation, crop improvement through biotechnology, the country was largely dependent on exotic technology that incur huge outflow of precious foreign exchange.

‘Directorate of Floricultural Research’ was the much needed act in the direction of strengthening floricultural research and augmenting the technological base in this area. The dynamic leadership and vision of Dr. H.P. Singh, Deputy Director General (Horticulture) contributed Inauguration and Launching of Directorate of Floricultural Research

To address the emerging areas of floriculture, DFR will act as a torch bearer and play a lead role
in standardizing technologies/protocols for flower drying, extraction of essential oils, pharmaceutical and nutraceutical compounds, natural dyes, plant pigments, production of potted and plug plants, etc. Emphasis will be given to bring more areas especially hilly and tribal dominated pockets under floriculture thereby benefiting rural and tribal youth including women. Further, the focus will be on the development of cost-effective technologies, suitable to different agro-climatic conditions and thereby reducing the dependence on costly and often variable exotic technologies. To realize the rapid gain, the DFR focuses on conducting interdisciplinary research in flower crops which is meager at the moment. It would strive to develop the need-based region specific technologies and outreach programmes involving its coordinated centers spread in different locations of the country. Strengthening of outreach programmes will help the floriculture industry to bridge the gaps in realized and potential productivity by way of faster adoption of generated technologies.

**Mandate**

- Effective management, enhancement, evaluation of genetic resources and development of improved cultivars, with high quality characteristics for export, productivity and resistance to pests and diseases.
- To undertake basic, applied and strategic research for addressing national problems, enhance productivity, shelf life, product diversification and value addition.
- To develop technologies for protected cultivation of flowers.
- To act as a repository of scientific technology and information relevant to floriculture and develop region specific technologies.
- To frame policy research and intensify outreach programme. To act as an advanced centre for training for upgradation 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.
**Crop Improvement**

**Gladiolus**

*Germplasm collection and evaluation*

Gladiolus varieties (58) comprising of both exotic and indigenous origins were collected (Table.1) and evaluated in the DFR research farm for their growth, flowering and corm/cormel production. Their potential as parents in the breeding programme was studied so that these are involved in the gladiolus improvement programmes.

Seeds from the crosses and also from open pollination were collected for further research. Also, the seed set behaviour both from natural and artificial pollination was recorded. All the varieties were screened for field tolerance against the biotic stresses (attack of *Botrytis gladiolorum* and *Fusarium*).

**Chrysanthemum**

A total of 94 germplasm collection including 36 varieties were evaluated for their performance under Delhi conditions (Table 2). Rooted cuttings prepared from the existing varieties were planted in the new mother block of chrysanthemum. Open pollinated seed from selected varieties namely A-32, A-43, A-43, A-44, A-64, A-76, Anmol, Aprajita, Autumn Joy, B-107, B-26, B-28, B-43, Baggi, Birbal Sahani, D-1, Dolly White, Dolly Orange, Flirt, Garden Beauty, Gitanjali, Hemant, Himanshu, Jaya, LF-26, Liliput, Little Kusum, Little Orange, Little Pink, Mallika Yellow, PAU-74, Ratlam Selection, Red Gold, Royal Purple, Sharad Mala, Shukla, some of the collections such as Purple Flora (dark purple), Chemistry (purple), Jessica and Peasano (peach), Yellow Stone (yellow & ruffling florets), Red Advance and Red 54 (bright red) were found to be unique and of high value in research and for commerce.

**Breeding**

A large number of crossings (H"2000) were attempted in gladiolus between selected promising parents in different permutation combinations. Seeds from the crosses and also from open pollination were collected for further research. Also, the seed set behaviour both from natural and artificial pollination was recorded. All the varieties were screened for field tolerance against the biotic stresses (attack of *Botrytis gladiolorum* and *Fusarium*).
Sunny, White Prolific, Yellow Charm and Yellow Delight were sown for their evaluation. Pot plants were made to evaluate their suitability for pot culture and also for display in events such as the DFR Foundation Day, Flower Show, Kisan Mela, etc., and also for survival of the newly introduced varieties having lass number of rooted cuttings.

**Tuberose**

Twelve varieties of tuberose namely, Arka Nirantar, Calcutta Single, Calcutta Double, Hyderabad Single, Hyderabad Double, Prajwal, Vaibhav, Phule Rajani, Rajat Rekha, Shringar, Suvasini and Sikkim Selection were collected from AICRP – Hyderabad Centre (APHU) and multiplied to obtain adequate number of bulbs for laying out the trials for their evaluation and also for breeding especially mutation breeding.

**Flowering Annuals**

Breeding program in flowering annuals has been initiated in selected crops such as petunia, hollyhock and antirrhinum. In order to develop inbreds and to purify the collected germplasm in petunia and pansy selfing was attempted. Inter-specific crosses (including reciprocal) were successfully attempted between hollyhock (*Althea rosea*) and *Malva sylvestris*. The breeding programme will be extended further in other selected annuals in the ensuing season for development of inbred lines.

**Table 1 : Gladiolus germplasm maintained at DFR**

<table>
<thead>
<tr>
<th>No.</th>
<th>Variety</th>
<th>No.</th>
<th>Variety</th>
<th>No.</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Alexander the Great</td>
<td>22.</td>
<td>Kum kum</td>
<td>42.</td>
<td>Red Beauty</td>
</tr>
<tr>
<td>4.</td>
<td>Chadha Farm -1</td>
<td>24.</td>
<td>Ocilla</td>
<td>44.</td>
<td>Rose Supreme</td>
</tr>
<tr>
<td>5.</td>
<td>Chadha Farm -2</td>
<td>25.</td>
<td>Overture</td>
<td>45.</td>
<td>Sagar</td>
</tr>
<tr>
<td>7.</td>
<td>Chandini</td>
<td>27.</td>
<td>Peter Pears</td>
<td>47.</td>
<td>Shagun</td>
</tr>
<tr>
<td>9.</td>
<td>CPG</td>
<td>29.</td>
<td>Priscilla</td>
<td>49.</td>
<td>Shobha</td>
</tr>
<tr>
<td>10.</td>
<td>Darshan</td>
<td>30.</td>
<td>Pune Hybrid</td>
<td>50.</td>
<td>Snow Princess</td>
</tr>
<tr>
<td>11.</td>
<td>DH-1 (Delhi Hybrid)</td>
<td>31.</td>
<td>Punjab Beauty</td>
<td>51.</td>
<td>Solist</td>
</tr>
<tr>
<td>12.</td>
<td>DH-2 (Delhi Hybrid)</td>
<td>32.</td>
<td>Punjab Dawn</td>
<td>52.</td>
<td>Sylvia</td>
</tr>
<tr>
<td>15.</td>
<td>Fidelio</td>
<td>35.</td>
<td>Punjab Glance</td>
<td>55.</td>
<td>White Friendship</td>
</tr>
<tr>
<td>17.</td>
<td>IIHR G 11</td>
<td>37.</td>
<td>Purple Flora</td>
<td>57.</td>
<td>Wigs Sensation</td>
</tr>
<tr>
<td>18.</td>
<td>IIHR G12</td>
<td>38.</td>
<td>Pusa Kiran</td>
<td>58.</td>
<td>Yellow Stone</td>
</tr>
<tr>
<td>20.</td>
<td>Jessica</td>
<td>40.</td>
<td>Red 54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Crop Production

Gladiolus

To increase the availability span of gladiolus for longer period, eight varieties namely, Big Time Supreme, Chandini, Eurovision, Novalux, Rose Supreme, Red Beauty, Snow Princess and White Prosperity were planted on staggered dates namely, on 17th July, 31st July and 16th August. The results indicated that the quality gladiolus spikes can be produced in Delhi during the months of October and November thus reducing dependence on the supplies from other parts of Country.

Table 3: Effect of staggered planting on the days taken to spike emergence in gladiolus

<table>
<thead>
<tr>
<th>Date of Planting</th>
<th>White Prosperity</th>
<th>Snow Princess</th>
<th>Chandini</th>
<th>Big Time Supreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 17</td>
<td>68 (September 23)</td>
<td>66 (September 21)</td>
<td>66 (September 21)</td>
<td>88 (October 13)</td>
</tr>
<tr>
<td>July 31</td>
<td>57 (September 26)</td>
<td>57 (September 26)</td>
<td>63 (October 2)</td>
<td>69 (October 8)</td>
</tr>
<tr>
<td>August 16</td>
<td>68 (October 23)</td>
<td>69 (October 24)</td>
<td>68 (October 23)</td>
<td>69 (October 24)</td>
</tr>
</tbody>
</table>

The varieties namely, White Prosperity, Snow Princess, Chandini and Big Time Supreme were planted at 15 days interval starting from mid July, to study the effect of off-season planting under Delhi conditions. The number of days taken to spike emergence was not much affected but the availability of quality flower spikes was advanced much before the regular planting season, i.e September-October (Table 3). It was also found that the quality of the spikes was not affected by earlier planting.

The corm and cormel production was also not affected by advancing the time of planting from the usual September/October. The number of days taken for flowering was not affected by different dates of planting (Varieties Eurovision, Rose Supreme, Novalux and Red Beauty) took 70 & 70, 86 & 90, 97 & 104 and 99 &104 days

Table 2: Chrysanthemum germplasm maintained at DFR

|----------|-------------|---------------|-----------------|---------------|---------|------------------|--------------|------------|---------|-------------|-------------------|
Flowering Annuals

In the existing collection, 25 annuals have been added from PAU, Ludhiana. The annuals viz., Acroclinum, Antirrhinum, Aster, Brachycome, Breeze, Bromus, Calendula, Candytuft, Cosmos, Corn Flower, Dimorphotheca, Helichrysum, Lagurus, Molucella, Monarda, Nasturtium, Pansy, Petunia, Phlox, Saponaria, Sweet Alyssum, Stock, Sweet Sultan, Verbena, Wall Flower were transplanted and evaluated for various plant growth, flower and seed production behavior under Delhi conditions.

The observations were recorded on plant height, plant spread, number of branches, number of flowers per branch, flowering duration and seed yield. Based on plant height they were classified into three groups, Tall (> 90 cm): Bells of Ireland, Coreopsis tinctoria, Coreopsis lanceolata, Cosmos, Dimorphotheca, Gaillardia, Helichrysum, Lupin, Poppy, Sweet Sultan and Statice; Medium (30-90 cm): Acroclinum, Aster, Breeze, Brumus, Calendula, Candytuft, Gazania, Lagurus, Linaria, Nasturtium, Phlox, Saponaria, Sweet William, Verbena and Wall Flower; Dwarf (< 30 cm): Brachycome, Chrysanthemum multicaule, Ice plan, Metricaria, and Sweet alyssum.

The duration of flowering was longer in Gaillardia, Hollyhock, Petunia, Phlox and Statice; whereas Brachycome, Metricaria, Pansy and Sweet alyssum flowered for a short duration.

Higher seed set and seed yield were found in Calendula, Coreopsis, Gaillardia, Helichrysum, Nasturtium and Verbena, whereas, Linaria, Pansy and Sweet alyssum set seed poorly and thereby low seed yield. Bells of Ireland, Mesembranthemum, Phlox, Sweet william, and Sweet sultan were medium in seed setting and yield. On the basis of seed production behavior, flowers like Calendula, Coreopsis, Gaillardia, Helichrysum and Phlox were found better.

Other Bulbous Flowers

Besides Gladiolus, other bulbous flowers viz. Iris, Daffodils, Lilium, Ranunculus, Ornithogalum, Freezia has also been introduced for evaluating their growth, flower & bulb production behaviour. The performance of different varieties of Iris, Ranunculus, Ornithogalum and freezia has been rated to be satisfactory in comparison to Daffodils and Lilium varieties, where bulb production has not been found to be satisfactory. The lifted bulbs has been stored in cold storage at 4°C.
Salient Research Achievements from AICRP (Floriculture) Centres

The Directorate of Floricultural Research is providing leadership in coordinating floriculture research and development to address location specific problems through different centres under AICRP on Floriculture. The salient accomplishments from the coordinated centres are summarized as under.

Crop Improvement

The crop improvement work on different crops such as rose, gladiolus, chrysanthemum, carnation, gerbera and anthurium were undertaken at different coordinating centres. Six varieties were developed during this period in gladiolus and chrysanthemum. Besides some promising lines have been identified which are in the advance stage of evaluation.

Under this four new varieties, in gladiolus viz., Punjab Flame, Punjab Elegance, Punjab Lemon Delight and Punjab Glance were developed by PAU Ludhiana centre. In chrysanthemum two varieties viz., Kaul and Khoshoo were developed by NBRI, Lucknow centre.

- In gladiolus, newly developed hybrid from IIHR, Hessaraghatta, IIHR-G-1 produced significantly higher plant height (118.37 cm), spike length (96.77 cm). Whereas, variety Phule Neelrekha recorded significantly more florets per spike (17.33), rachis length (58.80 cm) and corms per plant (1.87) at Pune. At Srinagar Centre twelve promising gladiolus hybrids were identified from the previous season’s breeding material viz., SK-86-10, SK-86-8, SK-96-4/1, SK-96-4/4, SK-96-5/1, SK-96-5/2, SK-96-5/3, SK-96-5/5, SK-96-5/6, SK-96-8/1, SK-96-7/17, SK-96-4/16.

- Rose cvs. Rakatgandha, Taj Mahal, Papa Meilland in HT Group; Summer Snow, Charleston, Arunima and Banjaran in Floribunda group; Wild Plum, Small Virtue and Centre Piece in miniature group were found promising at Ludhiana. Whereas at Pune, the rose variety Aqua produced more number of flowers per plant (10.4) followed by Upper Class (10.0) and Bordo (9.50).

- In chrysanthemum, evaluation of 200 varieties at Ludhiana led to identification of promising varieties namely, Ajay, Kelvin Mandarin, Kelvin Tattoo, Kermits, Majoor
Bosshardt Wit, Nanako, Obsession, Reagan White, Reagan Emperor, Statesman, White Bouquet and White Staphour for cut flowers; Bagg, Birbal Sahni, Basanti, Ratlam Selection for loose flower; and Chiddori, Dolly Pink, Gum Drop, Kotai No Kori, Little Dipper, Mother Teressa, Tomiko and Yellow Charm for pot culture.

- In gerbera, the varieties, Alcatraz, Basic, Cross Road, Rosalin, Prime Rose and Sunway were found promising in respect of number of flowers/plant, Stalk length and flower diameter at Pune.

- New tuberose varieties viz., Arka Nirantara and GK-T-C-4 were evaluated along with Phule Rajani, Shringar, Prajwal and Hyderabad single (local check) at Hyderabad and maximum plant height and number of leaves were observed in Prajwal and Hyderabad single respectively. Early flowering was noticed in Prajwal (68.91 days) while late flowering was observed in GK-T-C-4 (88.20 days). The varieties Prajwal and Hyderabad single produced maximum spike length and spike weight respectively. The variety Arka Nirantara produced maximum number of florets per spike (48.11) and maximum floret size i.e. floret length (6.23 cm) and floret diameter (4.50 cm).

- In tuberose, 10 crosses made at Pune formed bulbs. The numbers of seedlings (bulbs) germinated from open pollinated seeds were more than hand pollination. In respect of growth and flowering characters, the hybrids GKT-C-4 and GKT-C-1 were found promising.

- Anthurium cv. Verdun Red with bright red medium sized spathe was found to be superior in performance. It was found that the production of flower was higher during June–November and March – February except August months under Yercaud conditions. Pollen viability and stigma receptivity was also higher during these months. Compatibility was found to be good in Tropical Red and Verdun Red as female parents and White as male parents in anthurium.

- In alstroemeria, among the seven accessions, Acc. No. 6 and 7 were found to be suitable as cut flowers due to their long rachis at Yercaud. For raising in beds and as fillers, Acc.No. 5 found suitable because of its dwarf stature and more flower length and longevity with double coloured flowers. Whereas at Katrain, the cvs. Aladdin, Cinderella and Pluto were found suitable for cut flowers, whereas cultivars Capri and Serena for pot culture purpose. At Kalimpong, the best varieties performed better were Pluto and Pink Panther.

- Orchid species namely, Ascoscentrum ampullaceum, Cymbidium aburneum, Cymbidium gigantium, Cymbidium devonianum, Coelogyne spp., Dendrobium nobile, Dendrobium densiflorum, Paphiopedilum insigne, Vanda coerulea, Vanda parishii, Thunia alba have been found superior for cut flower production as well as for pot cultivation at Kalimpong. In Cymbidium - Golden Girl, Red Star, Kenny Wine, December Gold, Minishara Artision hybrid have been found suitable for cut flower production.

**Crop Production**

- In roses, the treatment T4 (75 % RDF + FYM (1 kg/m²) + Vermicompost (300 g/m²) + Azospirillum@ 2g/pl/y + PSB @ 2g/pl/y) and T1 (2 kg FYM,140:70:70 g/m²/y) were at par with each other and recorded significantly more plant height (107.71 cm and 106.40 cm), yield per plant (30.33 and 30.13 flowers) and yield/m²/y (212.33 and 210.93 flowers) at Pune. Also, the same treatment showed significantly more plant height(38.53 cm), no. of flowers/ plant (15.60), flower diameter (2.40 cm), flower bud length (0.60 cm) and stem length of flower (22.60 cm) in pot grown roses.
Mulching with black polythene (200 µ thick) recorded significantly less weed count/ m² (100.80), fresh wt. of weed (172.43 g) and dry wt. of weed (28.40 g). For yield and quality parameters, black polythene (100 µ) (T2) was found significantly better in rose cv. Gladiator at Pune and Ludhiana. The Carnation variety Liberty planted at a distance of 20x20 cm accommodating 25 plants/m² showed significantly superior results in respect of growth and yield contributing characters at Pune.

In the micronutrient studies at Coimbatore in var. Co 1 of chrysanthemum, spraying of FeSO₄ @ 0.8% at bimonthly interval after planting recorded earliest flowering (100.40 days) with extended flowering duration (50.67 days). It also recorded higher flower yield per plant (133.27 g) compared to control (92.40 g).

At Coimbatore, application of 50% of fertilizers + 500 g/m² of vermicompost twice a year + spray of Panchagavya (3%) was found to be superior in respect of all the desired parameters viz., the least number of days taken for first flower bud appearance after planting (50.26 days), the highest flower yield (109.11 g/plant and 1585.29 g/m²), the largest flowers (4.55 cm dia) and the longest flowering duration (57.71 days) in chrysanthemum cultivar Co2.

In chrysanthemum var. Mayuri the application of T₄ (75% RDF + FYM @ 1kg / m² + Vermicompost @ 300 g/m²) + Azospirillum + PSB resulted in maximum plant height (32.47 cm.), number of flowers per spray (21.33) and number of flowers per plant (131.80) at Hyderabad.

In gladiolus, var. Arka Amar, the application of 75% of recommended dose of fertilizers (NPK@200:75:75 kg/ha) along with FYM @1kg/m²/y+ Vermicompost@300 g/m² +Azospirillum @2 g/m²+PSB @ 2 g/m² resulted in maximum plant height (115.16 cm), spike length (54.12 cm) and number of florets per spike (15.20) at Hyderabad.

In chrysanthemum cv. Basanti, application of Pendimethalin @ 0.75 kg a.i/ha and 1.0 kg a.i/ha were effective in controlling the weeds recording minimum weed count (g/m²), fresh weight of weeds (g/m²) and dry weight of weeds (g/m²) at Hyderabad.

In tuberose, cv. Vaibhav, 75% of RDF (200 N, 100 P₂O₅ and 150 K₂O kg/ha) along with FYM (1 kg/m²/year) + vermicompost (300 g/m² ) + Azospirillum (2 g/plant) + PSB (2 g/plant) is found superior for increased production of flower spike and bulb yield.

In gladiolus, among four weedicides (Atrazin, Metribuzin, Butachlor and Pendimenthlin) tested, Pendimethalin @0.75 kg a.i/ha or 1.0 kg a.i /ha proved to be most effective in controlling weeds at Hyderabad and Srinagar. Metribuzin and butachlor had detrimental effect on the crop and also exhibited little influence on weeds.
● The micro-nutrient studies were undertaken at different centres using different concentration. The results using Zinc Sulphate (0.6%) application in gerbera resulted in significantly higher plant height (40.20 cm), plant spread (44.60 cm), length of flower stalk (53.96 cm), no. of flowers/plant (40.60) and no. of suckers per plant (10.50) at Pune centre.

● Among the heliconia accessions, Alancari, Alex Red, Andromeda, Dwarf Jamaica, Gyana, Lady Di, Kenya Red, Petracover Strawberry cream and Tropics performed well under Yercaud conditions and also observed to bloom year round.

● At Katrain in lilium, cultivars Ercolano and Samur were found to be superior in vegetative and floral characters under open field conditions.

● In anthurium, application of Basacote plus 6 m @ 6 g/pot once in six months increased the number of spikes / plant (7.75), suckers/plant (7.45), stalk length (52.65 cm) and longevity of flower on plant (19.50 days) in the variety Red Dragon at Coimbatore.

● Application of 50% of RDF (NPK 30:10:10 @ 0.2% twice a week + FYM spray @ 1:10 ratio once a week) + 3% vermiwash + 3% panchagavya was found to be superior in respect of all the vegetative parameters viz., plant height (49.86 cm), number of leaves/plant (15.61), number of pseudobulbs/plant (12.53), internodal length (5.35 cm) as well as flowering parameters viz., number of spikes/plant (10.71), number of florets/spike (13.14), spike length (49.11 cm), longevity of spikes on plant (47.61 days) and vase life (19.42 days) in Dendrobium orchid cv. Sonia at Coimbatore.

● At Kahikuchi, application of NPK ratio of 20:10:10 @ 0.2% along with Azospirillum and Phospho bacterium each of 2 g per plant twice a week is recommended for optimum growth and flower production in Dendrobium orchid cv. Sonia.

**Crop Protection**

● Amongst seven modules tested for the management of *Fusarium* wilt in gladiolus, the pre-storage treatment with hot water (50°C for 30 min) followed by bulb dip in captan and carbendazim @ 0.2% and pre-planting bulb dip treatment in *Trichoderma harzianum* @ 10 g/l for 30 min showed the least disease incidence (3.33 PDI) at Pune.

● The pre-storage treatment of gladiolus corms in hot water combined with Captan (0.2%) and Carbendazim (0.2%) at 50°C for 30 min was found to be effective in reducing *Fusarium* wilt at Ludhiana. It also improved the number of spikes, corms and weight of cormels.

● The use of Neem cake colonized by the disease bio-control agent *Trichoderma harzianum* @ 500 g/m² followed by drenching and foliar spray either with captan @ 0.3% (9.67 PDI) or Metalaxyl MZ 72 WP @ 0.3% (10.67 PDI) or Copper oxychloride @ 0.3 % (11.33 PDI) for foot rot/root rot disease incidence in gerbera was found to be effective at Pune. Also, the fungicides Azoxystrobin @ 0.1 % (9.33 PDI), Iprodine + Carbendazim @ 0.2 % (9.57 PDI) and Difenoconazole @ 0.05% (10.27 PDI), recorded significantly least leaf spot/blight intensity in gerbera.

● In Marigold, the fungicide Iprodine + Carbendazim @ 0.2% each recorded
significantly least disease intensity of leaf blight (9.50 PDI) and bud blight (2.13 PDI) over the rest of the treatments and also recorded more number of flowers per plant at Pune.

- The fungicides, namely mancozeb (Dithane M-45), iprodione + carbendazim (Quintal) and difenconazole (Score), at a concentration of 0.2, 0.2 and 0.1 per cent respectively, reduced severity of *Alternaria* blight of *marigold* significantly at Ludhiana.

- In a survey conducted by Pune centre during Kharif & Rabi season (2010) at Charoli, Distt Pune, it was found that the Golden rod showed 55% intensity of rust, while at Raigurunagar the tuberose registered 15% incidence of stem rot with 20% intensity of leaf blight and 15% intensity of leaf blight of *marigold*. In rabi season at Satara the polyhouse gerbera showed 25% leaf blight intensity and at Astagaon, Dist Ahmednagar the chrysanthemum showed 25% intensity of leaf blight.

- The fungicide *Azoxystrobin* @ 0.1 % showed significantly least tuberose leaf blight intensity (4.17 PDI) with maximum disease reduction (86.69 %) and was found significantly superior over rest of the treatments and also gave more number of flowers per plant at Pune.

- The final population of *Meloidogyne* in tuberose, cv. Single Local, was recorded to be statistically less in the treatments. The root galling index was found to be significantly lower in neem seed powder, carbofuran, *Trichoderma harzianum* and *Paecilomyces lilacinus* + *T. harzianum* treated soils. Neem cake and carbofuran (1 kg a.i./acre) significantly improved weight of bulbs and bulblets, whereas *T. harzianum* and *P. lilacinus* + *T. harzianum* enhanced weight of bulblets at Ludhiana.

**Post Harvest Technology**

- The pre-transit and storage treatment, with aluminium sulphate (300 ppm) significantly improved vase life of cut rose stems at Ludhiana, Pune and Ranchi.

- The holding solution containing sucrose (1.5%) + aluminium sulphate (300 ppm) were most suitable for improving vase life of cut rose stems in cv. First Red at Pune.

- For local marketing, the spikes of gladiolus cv. White Prosperity could be stored at S3 stage when one basal floret was half open (Ludhiana and Srinagar) but for transportation to distant markets, the spikes should be stored at S2 stage i.e. when 5-6 florets show colour at Ludhiana.

- Pre-storage pulsing treatments of gladiolus spikes with sucrose (20%) + aluminium sulphate (300 ppm) + GA₃ (50 ppm) was found best for improving keeping quality after dry refrigerated storage (Ludhiana, Hyderabad, Kahikuchi, Pune, Srinagar, UAS Bangalore).

- The varieties of gladiolus differed with regard to their response to wet storage. The suitable varieties for wet storage were Jacksonville Gold (Ludhiana), American Beauty (Kahikuchi), White Prosperity (Srinagar) and Phule Neelrekha (Pune). S2 stage (when 5-6 florets showed colour) were more suitable for storage.

![Spikes of gladiolus cv. Jacksonville Gold in vase for evaluation of keeping quality](image)

(Kahikuchi), White Prosperity (Srinagar) and Phule Neelrekha (Pune). S2 stage (when 5-6 florets showed colour) were more suitable for storage.
● LDPE and polypropylene (PP) 100 gauge thick sleeves were more suitable for modified storage of gladiolus spikes (Ludhiana).

● Among the pulsing solutions, sucrose (10%) + STS + aluminium sulphate + kinetin (25 ppm) or BAP (25 ppm) recorded maximum vase life of carnation flowers (Hyderabad).

● Holding solution comprising of sucrose (2%) + AOA (45 ppm) + Alar (90 ppm) + Triton (100 ppm) + GA3 (1 ppm) + Kinetin (0.2 ppm) recorded maximum vase life of cut carnation flowers (Hessaraghatta and Pune).

● The stems of chrysanthemum held in solution of BAP (50 ppm) exhibited delayed wilting of florets as well as yellowing of leaves after storage (Ludhiana and Solan).

● For distant marketing, the stems of chrysanthemum wrapped in polypropylene (PP) sleeves of 100 gauge thickness maintained higher water content and exhibited prolonged vase life. (Ludhiana, Coimbatore and Solan).

● Pulsing treatment for one minute with aluminium sulphate (100 ppm) recorded the maximum vase life of stems of Dendrobium orchid cv. Sonia (Kahikuchi).

● Maximum vase life in Cymbidium orchid was observed with vase solution comprising of sucrose (5%) + BAP (25 ppm) + aluminium sulphate (300 ppm) (Kahikuchi).

● Pre-transit pulsing treatment of cut stems of anthurium with NaOCl (1000 ppm) for 16 h at 13-15°C significantly improved vase life and delayed blackening of spadix (Kahikuchi and Kalyani).

● Holding solution containing sucrose (5%) + aluminium sulphate (300 ppm) + kinetin (25 ppm) was found most effective for improving vase life of anthurium (Kalimpong and Kalyani).

● Among the three cultivars of anthurium, Eliza exhibited maximum vase life. The spikes harvested when fully mature and pre-cooled at 14-15°C showed the maximum vase life (Kahikuchi).

● Vase solution containing (5%) sucrose + aluminium sulphate (300 ppm) was most effective for increasing vase life of tuberose stems (Hyderabad, Kahikuchi and Ludhiana).

● The cut stems of tuberose when stored under refrigerated condition beyond 3 days, showed considerable reduction in vase life (Hyderabad, Kahikuchi, Kalyani and Ludhiana).

● Polypropylene (PP) sleeves when used as packaging material for 16 h showed increase in vase life of cut tuberose stems (Kahikuchi and Kalyani).

● Pre-cooling of tuberose buds (for garland purpose) at 4°C was beneficial for extending their vase life (Hessaraghatta and Kalyani). The buds could be stored at 4°C for 6 days. Prolonged storage inhibited the opening of buds.

● Paclobutrazol (300 ppm) significantly improved opening of buds and vase life in tulip.
- Vase solution containing sucrose (2%) + tartaric acid (300 ppm) was most effective for increasing vase life of gerbera stems (Pune and Kahikuchi).

- Pulsing treatment with aluminium sulphate (1000 ppm) for one minute was found to be the best for improving vase life and preventing stem break in gerbera (Pune, Hessaraghatta and Kahikuchi).

- Pulsing of daffodil cv. Yunis for 12 h with sucrose (4%) + STS (2mM) recorded the maximum vase life (Srinagar).

- The best holding solution for improving vase life of LA hybrid lily cv. Cilesta was sucrose (2%) + 8-HQC (100 ppm) + GA_3 (150 ppm) (Katrain).

- Best holding solution for maintaining the keeping quality of cut daffodil cv. Trumpet was sucrose (2%) + aluminium sulphate (100 ppm) (Katrain and Srinagar).

- Post harvest packaging of marigold flowers in plastic crates showed maximum vase life whereas packing in gunny bags showed the minimum vase life (Hessaraghatta and Kalyani).

**Value Addition**

The experiments were undertaken on value addition in different flowers at various centres and the results obtained are as under:

- *Celosia* flowers were found to take instant colour by dyeing. Techniques were developed for drying of fruits of *Acacia auriculiformis* and *Terminalia arjuna* (Kalyani).

- Flowers of six species, foliage of seven species and fruiting structures of nine species were dried and used for making decoration pieces such as decorative pots, greeting cards, baskets, candles, etc (Solan).

- Six plant species viz. leaves of *Camellia reticulata*, *Grevillea robusta*, *Adiantum venustum*, pods of *Callistemon lanceolatus*, and flowers of *Gerbera jamesonii* and *Plumeria alba* were identified for drying. Shade drying was found to be best for *Callistemon lanceolatus*, silica gel embedding for *Camellia reticulate*, *Gerbera jamesonii* and *Grevillea robusta* and press drying for *Adiantum venustum* (Coimbatore).

- Full bloom stage and silica gel drying was considered most suitable for drying gerbers (Yercaud). For dehydration of leaves of silver oak, thuja and camellia, glycerization was found most suitable (Yercaud).

- Biostimulant sprays (Humic acid + Panchagavya) improved concrete content in *Jasminum sambac* var. Ramanathapuram Gundumalli (Coimbatore).

- While comparing the stages of harvest, the open florets in tuberose showed more concrete content than the unopened florets (Pantnagar).
Research Farm Development

Land Development

The Directorate got 8 acre of land from IARI. The farm layout was prepared and the whole area was divided into plots, and paths were prepared for movement of farm machinery and other purposes. After layout the whole area was laser leveled. Irrigation channels and drainage facilities were also created. The research farm has been developed in such a way that each and every corner of field is approachable.

Farm Office/Farm Store

A new farm office-cum-store has been built in research field to facilitate research experiments, keeping farm implements, machinery, pesticides, fertilizers and other consumable & non-consumable items. Also the existing old farm shed has been renovated and put to use for research purposes. Besides this, a threshing floor has also been constructed for threshing and cleaning seeds of annual flowers. An over head water storage structure along with treatment tanks has been made for treating corms/bulbs.

Renovation of Nethouse and Polyhouse

The renovation of existing shade-net house and polyhouse was taken up on priority. These structures are being intensively used for raising chrysanthemum cuttings, maintaining potted plants, etc.

Renovation of Office Building

The Directorate has been allotted the old building of Post Harvest Technology Division of IARI. The handed over space requires substantial renovation. The work has been undertaken on priority and necessary renovation/repairing is underway.

XX Annual Group Meeting of AICRP on Floriculture

All India Coordinated Research Project on Floriculture has the responsibility of reviewing the performance of the Coordinated Centres after every two years by holding biennial group meetings. In the XIX Group Meeting held on 10-12 December, 2009 at IARI, New Delhi, it was recommended to hold the Group Meeting annually. Accordingly, the XX Annual Group Meeting was held on 13-15 November, 2010 at Bidhan Chandra Krishi Vishyavidyalaya, Kalyani, West Bengal. Besides, Inaugural and Plenary Sessions, there were seven technical sessions in the Group Meeting. The XX Group Meeting was blessed with the presence of Sh.Mohanto Chatterjee, Hon'ble Minister Incharge, FPI and Horticulture as Chief Guest, Dr. H. P. Singh, Deputy Director General (Hort), Indian Council of
Agricultural Research as Guest of Honour, Dr. S. K. Sanyal, Vice Chancellor, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur as Chairman, Dr. P. K. Pramanik, Director, Directorate of Horticulture and FPI, Government of West Bengal, Dr. Bir Pal Singh, Director, CPRI, Shimla, emeritus scientists from CSIR (Dr. S. K. Datta, Dr. Debhasis Mukherjee), etc. All the scientific staff from the coordinated centres, scientists from BCKV, ICAR representatives, representatives from floriculture industry, farmers, etc participated in the meeting.

On this occasion, three publications namely ‘Production Manual on Tuberose’, ‘The Genesis of Directorate of Floricultural Research’, and ‘Floriculture in West Bengal – Scope and Opportunities’ were released by the Chief Guest, Sh Mohanto Chatterjee, Hon’ble Minister, Incharge, FPI and Horticulture, Govt. of West Bengal, Dr. H.P.Singh, DDG (Horticulture), ICAR, New Delhi and Dr. S. K. Sanyal, Vice Chancellor, BCKV, Kalyani, respectively. The progress of ongoing research programmes of the AICRP centres was reviewed and relevant recommendations were given. The technical programme for the next two years (2011-12 & 2012-13) was discussed and finalized.

**Foundation Day Celebration**

It is needless to mention the huge scope and potential of floriculture in India. But to realize this potential and to encash the enormous opportunities, it is vital to have a strong R & D in floriculture sector. It is in this direction, the Directorate of Floricultural Research has been established in XI Five Year Plan under Indian Council of Agricultural Research and formally launched on 10 December, 2009. It is indeed good that floriculture is not only an option of crop diversification but a means in itself for higher returns per unit area and increased (round the year) employment. Also, in these modern days where not only the youth, but the traditional farmers are preferring to white-collar jobs, floriculture, under protected conditions, value addition in the form of essential oils, dry flowers, etc. is not less than any officer job. The Directorate of Floricultural Research celebrated foundation day on 10 December, 2010, to commemorate its first year of establishment. Dr. U.C. Srivastava, ADG (Hort-II), ICAR was the Chief Guest of the function. The function was attended by former Project Coordinators (AICRP, Floriculture), Directors of various institutes, Heads of the Divisions (IARI), Scientists, Technical staff, Students, Press & Media. The Chief Guest appreciated the efforts made by the director within a short period of his
Foundation Day Celebrations
Meetings of RAC/IRC/IMC

Research Advisory Committee (RAC)

The first Research Advisory Committee of Directorate of Floricultural Research (DFR) was held under the Chairmanship of Prof. P. Das, Chairman & Managing Director, The Science Foundation for Tribal & Rural Resource Development, Bhubaneswar on 12-13 January, 2011 in the Committee Room of the Directorate of Maize Research (DMR), Pusa, New Delhi. It was recommended that necessary infrastructure for research in the field and laboratories to work on plant improvement should be developed expeditiously. Also, it is suggested that the sanctioned scientific manpower need to be deployed early to work on Plant improvement, Production technologies including soil, water management, Post-harvest management (Physiology & Biochemistry), Plant protection (insect pests, diseases including viruses), Dry flower production technologies, Landscape development, Germplasm introduction, documentation including molecular characterization and conservation and Transfer of technologies. It was also recommended that the AICRP centres should be allotted specific crops depending on climatic advantages and on their competency developed during the past decades, those can work as lead centres for...
conservation and maintenance of germplasm of these crops. The RAC members also visited the research farm where they were shown the recent research & developmental activities undertaken. The members appreciated the efforts of the directorate in this regard in a short span of time.

Research Advisory Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
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</thead>
<tbody>
<tr>
<td>Prof. P. Das</td>
<td>Chairman, The Science Foundation for Tribal &amp; Rural Resource Development</td>
</tr>
<tr>
<td>Dr. V. P. Ahlawat</td>
<td>Professor &amp; Head, CCS, Haryana Agricultural University</td>
</tr>
<tr>
<td>Dr. S. P. Vij</td>
<td>NASI, Senior Scientist Fellow</td>
</tr>
<tr>
<td>Dr. R. C. Upadhyay</td>
<td>Former Director, NRC Orchids</td>
</tr>
<tr>
<td>Shri. Sundaram Raju</td>
<td>Progressive Farmer, East coast Coconut Hybrid Centre</td>
</tr>
<tr>
<td>Shri Santosh Attavar</td>
<td>C.E.O., Indo-American, Hybrid Seeds Private Limited</td>
</tr>
<tr>
<td>Dr. Ramesh Kumar</td>
<td>Director, Directorate of Floricultural Research</td>
</tr>
<tr>
<td>Dr. Umesh Srivastava</td>
<td>Assistant Director General (H-II), ICAR</td>
</tr>
<tr>
<td>Mrs. Megha Borse</td>
<td>President, Flower Grower Association, Maharashtra</td>
</tr>
<tr>
<td>Shri. Jaffar N. Naqvi</td>
<td>Chief Editor (Floriculture Today) and Director Media Today Pvt. Ltd.</td>
</tr>
<tr>
<td>Dr. Krishan Pal Singh</td>
<td>Principal Scientist</td>
</tr>
</tbody>
</table>

Institute Management Committee (IMC)

The IMC in respect of Directorate of Floricultural Research was constituted as mentioned below:

Institute Management Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
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</thead>
<tbody>
<tr>
<td>Dr. Ramesh Kumar</td>
<td>Director, Directorate of Floricultural Research</td>
</tr>
<tr>
<td>Jt. Director (Agri)</td>
<td>Govt. of Delhi, I.P. Estate, New Delhi</td>
</tr>
<tr>
<td>Jt. Director</td>
<td>Directorate of Horticulture and Food Processing, Govt. of Uttar Pradesh, Sapru Marg, Lucknow</td>
</tr>
<tr>
<td>Prof. and Head</td>
<td>Division of Horticulture, Sardar Vallabh Bhai Patel University of Agriculture &amp; Technology, Meerut</td>
</tr>
<tr>
<td>Mrs. Megha Borse</td>
<td>President, Flower Grower’s Association, Maharashtra</td>
</tr>
<tr>
<td>Mr. Jaffar N. Nagvi</td>
<td>Chief Editor (Floriculture Today) and Director, Media Today Pvt. Ltd.</td>
</tr>
<tr>
<td>Finance &amp; Account Officer</td>
<td>IASRI, New Delhi</td>
</tr>
<tr>
<td>Dr. R.C. Srivastava</td>
<td>Jt. Director, BSI, Kolkata</td>
</tr>
<tr>
<td>Dr. M. Jawahar Lal</td>
<td>Prof. and Head, Horticulture College &amp; Research Station, TNAU</td>
</tr>
<tr>
<td>Dr. T. Janakiram</td>
<td>Head, Division of Floriculture &amp; Landscaping, IARI, New Delhi</td>
</tr>
<tr>
<td>Dr. N. Ramachandran</td>
<td>Pl. Scientist, Plant Pathology, IIHR, Bangalore</td>
</tr>
<tr>
<td>Mr. Anil Kumar Maithani</td>
<td>AO, Directorate of Floricultural Research, New Delhi</td>
</tr>
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</table>
**Institute Research Council (IRC)**

A meeting of Institute Research Council (IRC) was held on 7 October, 2010 under the chairmanship of Dr. Ramesh Kumar, Director, DFR. The presentations of project proposals (Draft RPF I’s) were made by the scientists (Dr. P. Naveen Kumar, Dr. Tarak Nath Saha and Dr. Jayoti Majumdar). The resource person, Dr. S.K. Malhotra, Principal Scientist (Hort), Horticulture division, ICAR and Director, DFR suggested for reducing the proposed work load as the scientific staff and infrastructural facilities are limited.

The second meeting of the Institute Research Council (IRC) was held under the chairmanship of Dr. Ramesh Kumar, Director, DFR and in presence of Dr. A.P. Singh, Former Project Coordinator, AICRP on Floriculture & scientific staff of the DFR was held on 26 March, 2011 to review the progress of the research projects. The work done despite limited staff and other resources was well appreciated. It was suggested to revise the ongoing research projects for enabling the newly joined scientists to associate in the projects. The list of ongoing projects is given below:

**List of On-going (in-house) Research Projects**

<table>
<thead>
<tr>
<th>Mega/Sub-project</th>
<th>Programme Leader</th>
<th>Principal Investigator</th>
<th>Co-Principal Investigator</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mega Project-1 : Improvement of commercial flower crops</strong></td>
<td></td>
<td></td>
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<tr>
<td>Sub- Project-1 Breeding of gladiolus for quality and yield</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. P. Naveen Kumar Sr. Scientist</td>
<td>Dr. Tarak Nath Saha Scientist Dr. Jayoti Majumder Scientist</td>
<td>Collaboration may be required from Plant Pathology for screening of parents/hybrid against diseases</td>
</tr>
<tr>
<td>Sub- Project-2 Breeding of chrysanthemum for quality flowering and pot mums</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. Tarak Nath Saha Scientist</td>
<td>Dr. P. Naveen Kumar Sr. Scientist Dr. Jayoti Majumder Scientist</td>
<td>Enrichment of germplasm and systematic breeding has to be strengthened</td>
</tr>
<tr>
<td>Sub- Project-3 Breeding of tuberose for novel colour and oil recovery</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. P. Naveen Kumar Sr. Scientist</td>
<td>Dr. Tarak Nath Saha Scientist Dr. Jayoti Majumder Scientist</td>
<td>Fresh collection of germplasm has to be initiated</td>
</tr>
<tr>
<td>Sub- Project-4 Improvement of flowering annuals</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. Jayoti Majumder Scientist</td>
<td>Dr. P. Naveen Kumar Sr. Scientist Dr. Tarak Nath Saha Scientist</td>
<td>Systematic breeding program in selected annuals has to be taken up</td>
</tr>
<tr>
<td><strong>Mega Project-II : Standardization of production technology of commercial flowers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub- Project-1 Gladiolus</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. Tarak Nath Saha Scientist</td>
<td>Dr. P. Naveen Kumar Sr. Scientist</td>
<td>Off season production for extended availability and use of PGRs</td>
</tr>
<tr>
<td>Sub- Project-2 Flowering Annuals</td>
<td>Dr. Ramesh Kumar Director</td>
<td>Dr. P. Naveen Kumar Sr. Scientist</td>
<td>Dr. Tarak Nath Saha Scientist</td>
<td>Collection and evaluation of germplasm of different flowering annuals</td>
</tr>
</tbody>
</table>
Participation in Horticulture Show

Directorate of Floricultural Research participated in the Pusa Horticulture Show, 2011 organized by Delhi Agri-Horticulture Society on 26-27 February, 2010 at IARI, New Delhi. On this occasion, fresh flowers of different varieties of bulbous ornamentals such as gladiolus, iris, daffodils, tulip, etc. and flowering annuals; loose flowers of marigold, chrysanthemum, etc; publications and other technical information; potted plants, etc were displayed in the exclusive DFR stall. Also, information on germplasm collection, new varieties and latest technologies in flower cultivation developed by coordinated centres of AICRP on Floriculture were disseminated. The live specimens as well as the literature offered was highly appreciated by the distinguished visitors and flower lovers.

Participation in Krishi Vigyan Mela

Directorate of Floricultural Research participated in the ‘Pusa Krishi Vigyan Mela 2011’ organized by IARI, New Delhi on 3-5 March, 2011 with theme ‘Farm Technologies for Enhanced Productivity and Income’. The exclusive DFR stall with live specimens of fresh flowers along with copies of DFR publications and other relevant literature displays were visited by Hon’ble Minister, Director, IARI and farmers from various states. Pusa Krishi Vigyan Mela is considered one of the largest platforms for dissemination of technologies.
TV / Radio Talks

- Dr. Ramesh Kumar delivered TV recording on DFR Foundation Day on 10 Dec., 2010.
- Dr. Ramesh Kumar delivered a radio talk during February, 2011.
- Dr. Ramesh Kumar delivered a TV talk during Pusa Krishi Vigyan Mela, 2011 at IARI, New Delhi during 3-5 March, 2011.
- Dr. Ramesh Kumar delivered a Live TV talk on 31 March, 2011.
- Dr. P. Naveen Kumar and Dr. Tarak Nath Saha delivered TV talks from Doordarshan and CNEB about Ornamental Crops and Scope in Floriculture.
- Dr. Tarak Nath Saha delivered Radio talk twice (bat phule ki) on AIR.
- Dr. Gunjeet Kumar, delivered talk on flower cultivation on Doordarshan

Participation in other activities

The DFR has participated in the ‘National Conference on Horticultural Biodiversity for livelihood, Economic Development and Healthcare & Swadesh Prem Jagriti Sanghosthi 2010’, held at UHS Campus, Doddabetthali, Bangalore on 29-31 May, 2010. Along with the exhibits of fresh flowers, publications related to floriculture were displayed in the exclusive stall of DFR.
The Directorate of Floricultural Research (DFR), Pusa, New Delhi has conducted a training program on Recent Advances in the Production Technology of Commercial Flower Crops on 07-11 February, 2011 to the farmers (46) of the Bihar state. It was sponsored by the Project Directors, Agricultural Technology Management Agency (ATMA) from the Districts of Jehanabad and Madhubani, Bihar. This was the beginning of training programme conducted by the DFR after its establishment in XI Five Year Plan.

In the inaugural session, Dr. T. P. Trivedi, Assistant Director General, AKM & Director, DIPA, ICAR emphasized the need for transfer of technologies in emerging areas of floriculture and the need for imparting trainings in relevant fields. In addition to the faculty from DFR, Scientists from different divisions/units of IARI (Floriculture, Agronomy, Entomology, Nematology and Centre for Protected Cultivation Technology, CPCT) were involved in theory as well as practical classes. Dr. S. Rajan, Asst. Director General (Hort.), ICAR graced the valedictory function and congratulated the successful participants and advised them to share the knowledge gained here with all those interested in floriculture in their respective region.

Training was imparted on various aspects of floriculture viz., production technology of commercial flower crops including production under protected conditions, water and nutrient management, post harvest handling, management of insect pests and diseases (integrated pest and disease management), value addition in flower crops (dry flowers, extraction of essential oils, etc.) and marketing. Emphasis was laid on imparting practical knowledge and hands-on experience, and accordingly the trainees were taken to flower markets, nurseries in Delhi and to the research farms of DFR, Centre for Protected Cultivation Technology etc. to enhance their knowledge on flower marketing traits, opportunities and scope so as to promote floriculture at their places.
**Publications**

**Research Papers**

**Technical/Popular Articles**


### Technical Bulletins/Books


### Presentations in Conference/Symposia/Seminar etc.

- Ramesh Kumar, presented the Lead Paper “Orchid research in AICRP” in National Consultation for Production and utilization of Orchids held on 19-21 February, 2011 at National Research Centre for Orchid, East Sikkim.
- Ramesh Kumar and P. Naveen Kumar (2011). Recent Advances in the Production of Bulbous Ornamentals under AICRP on Floriculture. Lead paper presented in
National Consultation on production of disease free quality planting material propagated through tubers and rhizomes held at CPRI Modipuram campus, 4-5 March, 2011. Souvenir, p 39-47.


**Compilation/Documentation**


Dr. Ramesh Kumar was awarded with ‘Lotus Purashkar’ by Indian Society of Ornamental Horticulture, for outstanding contribution in the field of floriculture & landscaping in the National consultation at IIHR, Bangalore from 29-30 April, 2010.

Dr. Ramesh Kumar was ‘Guest of Honour’ at the inaugural function of farmers training organized by Directorate of Extension, Dr. Y.S. Parmar University of Horticulture and Forestry at Solan on 14-15 January, 2011.

Dr. Ramesh Kumar was ‘Guest of Honour’ at Honey Festival-cum-Bee keeping workshop held on 22-24 February, 2011 at PAU, Ludhiana.

Dr. Ramesh Kumar was honoured as ‘Guest of Honour’ at Kisan Melas organised at RAU, Pusa, Samastipur (13-14 March, 2011), and at PAU, Ludhiana (19-20 March, 2011) respectively.

Dr. P. Naveen Kumar was conferred with Fellowship of Indian Society of Ornamental Horticulture, New Delhi for the outstanding contributions in the field of Horticulture (5 March, 2011).

Dr. Ramesh Kumar received best Oral Presentation Award in the National Conference on Production of Quality Seeds ad Planting Material- Health Management in Horticultural Crops, New Delhi (11-14 March, 2010).

Dr. P. Naveen Kumar received a Certificate of Merit for presentation of Best Paper ‘Off-season flower production in gladiolus (Gladiolus grandiflora) cv. Snow Princess’ in poster session of National Conference on Recent Trends and Future Prospects in floriculture (5-8 March, 2011).

Dr. P. Naveen Kumar received a Certificate of Merit for presentation of Best Paper ‘Study on growth and flowering in gladiolus (Gladiolus hybrid) cv. White Prosperity as affected by planting dates’ in poster session of National Conference on Recent Trends and Future Prospects in floriculture. ( 5-8 March, 2011).
Dr. P. Naveen Kumar was nominated as Assistant Editor of Indian Journal of Horticulture, published by Horticultural Society of India, New Delhi for the year 2011.

Dr. P. Naveen Kumar acted as Rapporteur of different sessions of National workshop on Urban Horticulture, 26 March, 2011 held at IARI New Delhi; National Conference on Recent Trends and Future Prospects in floriculture, held at SVBPUAT, Meerut, XX Annual Group Meeting of AICRP on Floriculture, 13-15 November, 2010 held at BCKV, Kalyani (5-8 March, 2011).

Dr. P. Naveen Kumar acted as external examiner (Question paper setting and evaluation) of the floriculture courses in different SAU’s (OUAT, SKUAST, YSPUHF, CAU, etc)

Dr. P. Naveen Kumar reviewed research papers submitted for publication in Journal of Horticulture and Forestry, Journal of Horticulture Science, Indian Journal of Horticulture, etc.

Dr. Gunjeet Kumar reviewed research papers submitted for publication in Journal of Plant Genetic Resources, Indian Journal of Ornamental Horticulture, etc.

Dr. Gunjeet Kumar acted as external examiner for conducting viva-voce examination of M.Sc. student of SVBPUAT, Meerut.

Dr. Tarak Nath Saha received the Best Poster Paper Award in National Consultation on Landscape Gardening for Aesthetic Values and Environmental Services, IIHR, Bangalore for “Minimize the use of Harmful Plants in Landscaping” (29-30 April, 2010).

Dr. Tarak Nath Saha received Best poster “Studies on growth and flowering in gladiolus cultivar White Prosperity” at National Conference on Recent Trends and Future Prospects in Floriculture at SVPUAT, Modipuram, Meerut (5-8 March, 2011).

Dr. Tarak Nath Saha received Best poster “Off season flower production in gladiolus cultivar Snow Princess” at National Conference on Recent Trends and Future Prospects in Floriculture at SVPUAT, Modipuram, Meerut (5-8 March, 2011).

Dr. Tarak Nath Saha received Best poster “Studies on growth and flowering in gladiolus cultivar Snow Princess” at National Conference on Recent Trends and Future Prospects in Floriculture at SVPUAT, Modipuram, Meerut (5-8 March, 2011).

Dr. Tarak Nath Saha acted as rapporteur in the technical session during XX Group Meeting of AICFIP at Kalyani.

Dr. Tarak Nath Saha acted as rapporteur in one of the sessions of National workshop on Urban Horticulture, held at IARI New Delhi (26 March, 2011).

Dr. Tarak Nath Saha was nominated as Nodal Officer for PIMS-ICAR activity.

Dr. Tarak Nath Saha was nominated as expert for writing chapter in Horticulture for IGNOU application oriented course curriculum.

Dr. Tarak Nath Saha acted as reviewer of research articles submitted for publication in Indian Journal of Horticulture.
P. Naveen Kumar attended workshop of the Otto Warburg Minerva Biotechnology Centre of the Robert H Smith Institute of Plant Sciences, Rehovot (Hebrew University of Jerusalem) at S’de Yaav, Israel (17-18 February, 2010).

P. Naveen Kumar attended National workshop on Urban Horticulture for Nutritious Food and Environmental Security’ held at IARI, Pusa, New Delhi, (22 March, 2011).

P. Naveen Kumar attended National Conference on Recent Trends and Future Prospects in Floriculture, held at SVBPUAT Meerut jointly organized by Indian Society of Ornamental Horticulture and Department of Horticulture, SVBPUAT, Meerut (5-8 March, 2011).

P. Naveen Kumar attended National Conference on Plant Diversity for Aesthetic Values and Landscape Gardening, held at TNAU Coimbatore, jointly organized by Tamil Nadu Agricultural University, Coimbatore & Indian Society for Ornamental Horticulture, New Delhi (26-28 November, 2010).

Tarak Nath Saha, participated at National Conference on Horticultural Biodiversity for livelihood, economic development and healthcare, held at Swadesh Prem Jagriti Sanghosthi 2010, held at UHS Campus, Doddabetthali, Bangalore (29-31 May, 2010).

P. Naveen Kumar under faculty upgradation program, training on ‘CAD for Landscaping’ at Division of Floriculture and Landscaping, IARI, New Delhi (23-28 August, 2010).

P. Naveen Kumar attended NAIP sponsored ‘National Training on Bio-informatics and its Applications in Agriculture’ at KAU, Vellanikkara(2-16 May, 2011).


Tarak Nath Saha, participated in the training on “Creative Writing In Agriculture” at Indian Institute of Mass Communication, Dhenkanal, Orissa (10-15 May, 2010).

Jayothi Majumder, attended hands on training programme on “Dehydrated flowers and floral crafts” at the Division of Floriculture, NBRI Lucknow during 25-27 January, 2011.

Sellam, P, attended hands on training programme on “Dehydrated flowers and floral crafts” at the Division of Floriculture, NBRI Lucknow (25-27 January, 2011).
New Appointments

**Scientific**
- Dr. (Ms.) Jayoti Majumdar, selected for the ARS (Hort-Floriculture) has joined as Scientist after undergoing the mandatory Foundation Course in Agricultural Research Service at NAARM, Hyderabad.
- Ms. Sellam P., Scientist (ASPE), NDRI, Karnal has joined DFR, New Delhi on 27 December, 2010.
- Dr. Gujneet Kumar, Scientist (SS), NBPGR, New Delhi has joined DFR, New Delhi on 23 March, 2011.

**Administrative**
- Mr. Anil Kumar Maithani, Administrative Officer, NRC for Equines has joined DFR, New Delhi on 4 February, 2011.

**Transfers**
- Mr. Chetan Swaroop Issar, Assistant Administrative Officer, DFR, New Delhi has been transferred to IARI, New Delhi w.e.f. 14 February, 2011.

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>E-mail</th>
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<tbody>
<tr>
<td>Dr. Ramesh Kumar</td>
<td>Director</td>
<td>director@<a href="mailto:dfdr@gmail.com">dfdr@gmail.com</a></td>
</tr>
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<td>Dr. P. Naveen Kumar</td>
<td>Sr. Scientist</td>
<td>naveeni@<a href="mailto:dfdr@gmail.com">dfdr@gmail.com</a></td>
</tr>
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<td>Dr. Gunjeet Kumar</td>
<td>Scientist (SS)</td>
<td><a href="mailto:kumargunjeet@yahoo.co.in">kumargunjeet@yahoo.co.in</a></td>
</tr>
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<td>Dr. T.N. Saha</td>
<td>Scientist</td>
<td><a href="mailto:tsaha@gmail.com">tsaha@gmail.com</a></td>
</tr>
<tr>
<td>Dr. (Ms.) Jayoti Majumdar</td>
<td>Scientist</td>
<td><a href="mailto:jayotisarkar1@gmail.com">jayotisarkar1@gmail.com</a></td>
</tr>
<tr>
<td>Ms. Sellam P</td>
<td>Scientist</td>
<td><a href="mailto:chella.perinban@gmail.com">chella.perinban@gmail.com</a></td>
</tr>
<tr>
<td>Mr. Anil Kumar Maithani</td>
<td>Administrative Officer</td>
<td><a href="mailto:akmaithani61@yahoo.in">akmaithani61@yahoo.in</a></td>
</tr>
<tr>
<td>Dr. S.M. Trivedi</td>
<td>Tech. Officer (T7/8)</td>
<td><a href="mailto:trivedishruti81@gmail.com">trivedishruti81@gmail.com</a></td>
</tr>
<tr>
<td>Mr. O.P. Singh</td>
<td>Tech. Officer (T-6)</td>
<td></td>
</tr>
<tr>
<td>Ms. Suchitra Pushkar</td>
<td>Tech. Officer (T-5)</td>
<td><a href="mailto:suchi.iari@gmail.com">suchi.iari@gmail.com</a></td>
</tr>
<tr>
<td>Mr. S.K. Rai</td>
<td>Tech Asstt. (T-1)</td>
<td></td>
</tr>
<tr>
<td>Mr. R.C. Paswan</td>
<td>Skill Support Staff</td>
<td></td>
</tr>
</tbody>
</table>
All India Coordinated Research Project on Floriculture was established during the IV Five-Year Plan in the year 1970-71 to carryout nationwide interdisciplinary research by linking ICAR Institutes with State Agricultural Universities (SAU’s). 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 programme was modified accordingly. At present the Coordinated Project has 23 Centers which includes 16 budgetary, four institutional and three voluntary Centres.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Centre</th>
<th>Year of Start</th>
<th>Crops Dealt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Agricultural Research Institute (APHU), Hyderabad</td>
<td>1987</td>
<td>Gladiolus, Chrysanthemum, Tuberose</td>
</tr>
<tr>
<td>2.</td>
<td>Horticultural Research Station (AAU), Kahlukuchi, P.O. Azara, Guwahati</td>
<td>2001</td>
<td>Gladiolus, Orchids, Chrysanthemum, Anthurium</td>
</tr>
<tr>
<td>4.</td>
<td>Birsa Agricultural University, Ranchi</td>
<td>2001</td>
<td>Gladiolus, Chrysanthemum, Gerbera</td>
</tr>
<tr>
<td>5.</td>
<td>Dr.Y.S.Parmar University of Horticulture &amp; Forestry, Solan</td>
<td>1975</td>
<td>Gladiolus, Carnation, Chrysanthemum, Tulip, Daffodils, Lilium, Alstroemeria</td>
</tr>
<tr>
<td>6.</td>
<td>G. B. Pant University of Agriculture &amp; Technology, Pantnagar</td>
<td>2001</td>
<td>Rose, Gladiolus, Chrysanthemum, Tuberose, Gerbera</td>
</tr>
<tr>
<td>7.</td>
<td>Kerala Agricultural University, Vellanikkara</td>
<td>1975</td>
<td>Orchids, Anthurium, Gerbera</td>
</tr>
<tr>
<td>8.</td>
<td>Mahatma Phule Krishi Vidyapeeth, Pune</td>
<td>1975</td>
<td>Rose, Gladiolus, Carnation, Chrysanthemum, Tuberose, Gerbera, Alstroemeria</td>
</tr>
<tr>
<td>10.</td>
<td>Punjab Agricultural University, Ludhiana</td>
<td>1975</td>
<td>Rose, Gladiolus, Chrysanthemum, Tuberose, Gerbera, Lilium</td>
</tr>
<tr>
<td>11.</td>
<td>Rajasthan College of Agriculture (MPUAT), Udaipur</td>
<td>1980</td>
<td>Rose, Gladiolus, Chrysanthemum</td>
</tr>
<tr>
<td>12.</td>
<td>Regional Plant Resource Centre, Bhubaneswar</td>
<td>1994</td>
<td>Rose, Chrysanthemum, Orchids, Anthurium</td>
</tr>
<tr>
<td>13.</td>
<td>Sher-E-Kashmir University of Agricultural Sciences &amp; Technology, Srinagar</td>
<td>1987</td>
<td>Gladiolus, Chrysanthemum, Tulip, Daffodils, Lilium, Alstroemeria</td>
</tr>
<tr>
<td>S. No.</td>
<td>Centre</td>
<td>Year of</td>
<td>Crops Dealt</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>14.</td>
<td>Horticultural College and Research Institute (TNAU), Coimbatore</td>
<td>1982</td>
<td>Carnation, Gladiolus, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera</td>
</tr>
<tr>
<td>15.</td>
<td>Horticultural Research Station (TNAU), Yercaud</td>
<td>1982</td>
<td>Carnation, Gladiolus, Chrysanthemum, Orchids, Anthurium, Tuberose, Gerbera</td>
</tr>
<tr>
<td>16.</td>
<td>Rajendra Agricultural University, Pusa, Samastipur, Bihar</td>
<td>2010</td>
<td>Rose, tuberose, gladiolus and Marigold</td>
</tr>
</tbody>
</table>

**Institutional Centres**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Centre</th>
<th>Year of</th>
<th>Crops Dealt</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>Indian Agricultural Research Institute, New Delhi</td>
<td>1971</td>
<td>Rose, Gladiolus, Chrysanthemum and Tuberose</td>
</tr>
<tr>
<td>18.</td>
<td>Indian Agricultural Research Institute, Regional Station, Katrain, Himachal Pradesh</td>
<td>1971</td>
<td>Gladiolus, Carnation, Gerbera, Tulip, Daffodils, Lilium, Alstroemeria</td>
</tr>
<tr>
<td>20.</td>
<td>ICAR Research Complex for NEH Region, Barapani, Shillong (Meghalaya)</td>
<td>1971</td>
<td>Orchids, Anthurium, Gerbera</td>
</tr>
</tbody>
</table>

**Voluntary Centres**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Centre</th>
<th>Year of</th>
<th>Crops Dealt</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.</td>
<td>University of Agricultural Sciences, Bangalore</td>
<td>1977</td>
<td>Carnation, Anthurium</td>
</tr>
<tr>
<td>23.</td>
<td>Horticultural College and Research Institute (TNAU), Periyakulum</td>
<td>2010</td>
<td>Marigold, Tuberose, Chrysanthemum</td>
</tr>
</tbody>
</table>
Since the inception of the Institute, a large number of dignitaries including eminent scientists, growers, florists, nurseriesmen etc. visited the Directorate. This facilitated the fruitful interaction with the scientists. The prominent visitors are as follows:

- Dr. S. Ayyappan, Secretary, Department of Agricultural Research & Education (DARE), Ministry of Agriculture and Director-General, ICAR, New Delhi.
- Dr. H.S Gupta, Director, IARI, New Delhi.
- Prof. P. Das, Chairman & Managing Director, The Science Foundation for Tribal & Rural Resource Development, Bhubaneswar.
- Dr. B. Meenakumari, Deputy Director General (Fisheries), ICAR, New Delhi.
- Dr. K.R. Dhiman, Vice Chancellor, Dr.YSPUHF, Solan.
- Dr. O.M. Bambawale, Director, NCIPM, New Delhi.
- Dr. A.S. Sidhu, Director, IIHR, Bangalore.
• Dr. A.P. Singh, Former Head, FLS, IARI, New Delhi.
• Dr R.L. Misra, Former Project Coordinator, AICRP (Floriculture).

• Dr. S.P.S. Raghava, Former Project Coordinator, AICRP (Floriculture).
• Dr. N.K. Dadlani, President, National Seeds Association, New Delhi.

• Dr. S. Rajan, Asst. Director General (Hort II), ICAR, New Delhi.
• Dr. T.P. Trivedi, Asst. Director General (AKM) and Director, DIPA, ICAR, New Delhi.
• Dr. Malvika Dadlani, Joint Director (Research) 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, FHT, IARI, New Delhi.
• Dr. R.K. Pal, Head, PHT, IARI, New Delhi.
• Dr. T.M. Rao, Head, Division of Ornamental Crops, IIHR, Bangalore.
• Dr. Y.C. Gupta, Head Dept of Floriculture and Landscaping, Dr. YSPUHF, Solan.
• Dr. Balraj Singh, In charge, CPCT, IARI, New Delhi.
• Dr. Man Singh, In charge, FOSU, IARI, New Delhi.

• Mr. Le Duc Thao, Deputy Director, Agricultural Genetics Institute, TU LIEU Distt. Hanoi, Vietnam had detailed discussion on seed production.

Besides above, all the members of RAC team, officers of different state development agencies & NGOs, officials of Press and Media also visited the research farm and showed keen interest in the activities.
## Budget 2010-11

<table>
<thead>
<tr>
<th>S. No.</th>
<th>State</th>
<th>Centre</th>
<th>Released</th>
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<tbody>
<tr>
<td>1</td>
<td>Delhi</td>
<td>Directorate of Floricultural Research/ PC Cell, New Delhi</td>
<td>92.83</td>
</tr>
<tr>
<td>2</td>
<td>Assam</td>
<td>Assam Agricultural University, Kahikuchi</td>
<td>10.98</td>
</tr>
<tr>
<td>3</td>
<td>Andhra Pradesh</td>
<td>Andhra Pradesh Horticultural University, Hyderabad</td>
<td>11.48</td>
</tr>
<tr>
<td>4</td>
<td>Bihar</td>
<td>Rajender Agricultural University, Pusa, Samastipur</td>
<td>2.66</td>
</tr>
<tr>
<td>5</td>
<td>Delhi</td>
<td>Indian Agricultural Research Institute, New Delhi</td>
<td>0.80</td>
</tr>
<tr>
<td>6</td>
<td>Himachal Pradesh</td>
<td>Dr. Y.S. Parmar University of Horticulture and Forestry, Solan</td>
<td>11.73</td>
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<tr>
<td></td>
<td></td>
<td>I.A.R.I. Regional Station, Katrain</td>
<td>0.80</td>
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<td>7</td>
<td>Jammu &amp; Kashmir</td>
<td>S.K. University of Agricultural Sciences and Technology, Srinagar</td>
<td>11.32</td>
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<td>8</td>
<td>Jharkhand</td>
<td>Birsa Agricultural University, Ranchi</td>
<td>2.66</td>
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<td>9</td>
<td>Karnataka</td>
<td>Indian Institute of Horticultural Research, Bangalore</td>
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<td></td>
<td></td>
<td>University of Agricultural Sciences, Bangalore</td>
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<td>10</td>
<td>Kerala</td>
<td>Kerala Agricultural University, Vellanikkara</td>
<td>12.48</td>
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<td>11</td>
<td>Maharashtra</td>
<td>Mahatma Phule Krishi Vidyapeeth, Pune</td>
<td>20.55</td>
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<td>12</td>
<td>Meghalaya</td>
<td>ICAR Research Complex for NEH Region, Barapani</td>
<td>0.80</td>
</tr>
<tr>
<td>13</td>
<td>Orissa</td>
<td>Regional Plant Resource Centre, Bhubaneswar</td>
<td>0.48</td>
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<tr>
<td>14</td>
<td>Punjab</td>
<td>Punjab Agricultural University, Ludhiana</td>
<td>22.45</td>
</tr>
<tr>
<td>15</td>
<td>Rajasthan</td>
<td>Maharana Pratap University of Agriculture and Technology, Udaipur</td>
<td>11.32</td>
</tr>
<tr>
<td>16</td>
<td>Tamil Nadu</td>
<td>Tamil Nadu Agricultural University, Coimbatore</td>
<td>18.64</td>
</tr>
<tr>
<td>17</td>
<td>Uttar Pradesh</td>
<td>National Botanical Research Institute, Lucknow</td>
<td>0.80</td>
</tr>
<tr>
<td>18</td>
<td>Uttarakhand</td>
<td>G.B. Pant University of Agriculture and Technology, Pantnagar</td>
<td>2.66</td>
</tr>
<tr>
<td>19</td>
<td>West Bengal</td>
<td>Bidhan Chandra Krishi Viswavidyalaya, Kalyani</td>
<td>15.08</td>
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<td></td>
<td></td>
<td>Uttar Banga Krishi Viswavidyalaya, Kalimpong</td>
<td>7.16</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>259.53</strong></td>
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</tbody>
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