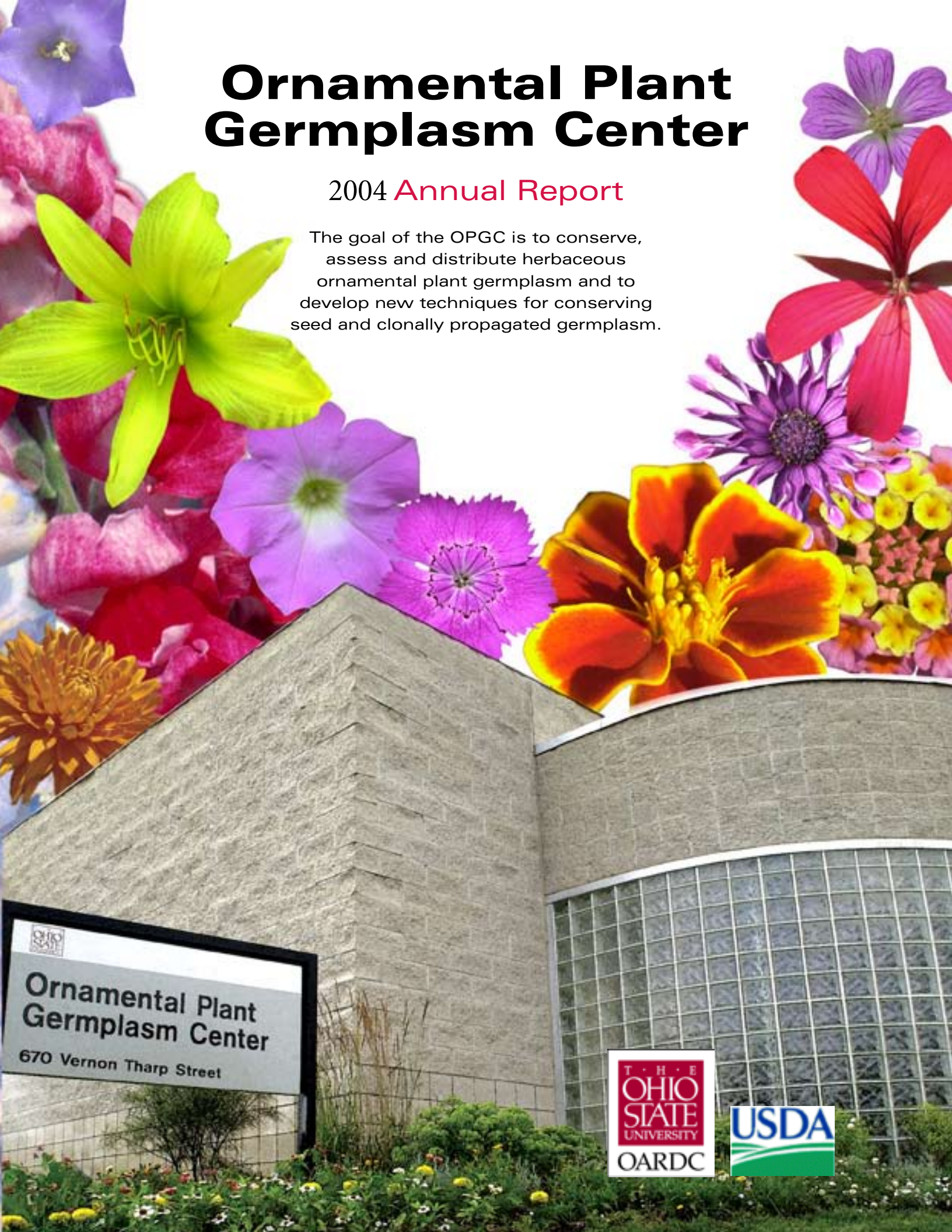
Ornamental Plant Germplasm Center

2004 Annual Report

The goal of the OPGC is to conserve, assess and distribute herbaceous ornamental plant germplasm and to develop new techniques for conserving seed and clonally propagated germplasm.



Permanent Staff

Steve Slack, Ph.D., Principal Investigator
David Tay, Ph.D., Co-Principal Investigator
Jennifer Ehrenberger, M.S., Clonal Crop Curator
Susan Stieve, M.S., Seed Crop Curator
Eric Renze, B.S., Research Assistant
Art Wells, B.S., Research Assistant
Russell Eckley, Research Aide

Graduate Students

Samuel Contreras, Department of Horticulture and Crop Science, The Ohio State University
Xiaolei Hu, Department of Horticulture and Crop Science, The Ohio State University
Ka Yeon Jeong, Department of Horticulture and Crop Science, The Ohio State University
Jing Luo, Department of Horticulture and Crop Science, The Ohio State University
Alice Mweetwa, Department of Horticulture, Virginia Polytechnic Institute and State University
Rose Palumbo, Department of Plant Pathology, The Ohio State University
Roel Rabara, Department of Horticulture and Crop Science, The Ohio State University
Susan Stieve, Department of Horticulture and Crop Science, The Ohio State University

Undergraduate Honor Student

Lizzy Chirlin, Department of Horticulture and Crop Science, The Ohio State University

Student Workers

Danny Beane
Morgan Bettinazzi
Stephanie Burns
Timothy Copeland III
Russell Eckley
Jacob Fugate
Nick Graves
Fred Higginbotham III
David Kohls
Michael Sartor
Paul Schnapp
Tyler Scott
Brian Shininger
Sylena Smith
Tuyen Thai
Brian Thomason
Joseph Tychonievich

High School Student Interns

Nathan Addis, The Graham School, Columbus, Ohio
Mohamed Ahmed, Columbus Alternative High School, Columbus, Ohio
Andika Gunadi, Columbus Alternative High School, Columbus, Ohio
Kunjal Patel, Columbus Alternative High School, Columbus, Ohio
Jacob Portier, Columbus Alternative High School, Columbus, Ohio

Volunteers

Caye Aiello
Vicki Baugess
Kathy Green
Bob Gutches
Barb House
Linda Johnson
Dorothy Pettenski
Louis Pettenski
Jenny Taylor
Al Warner

Major Accomplishments

- The establishment of the center is on target based on the development plan formulated at inauguration. The project was renewed with a second Special Cooperative Agreement between the U.S. Department of Agriculture (USDA) and The Ohio State University (OSU) for another three years from September 1, 2004, to August 31, 2007.
- A Clonal Crop Curator, Jennifer Ehrenberger, M.S., from the University of Hawaii, was hired. This allowed the formation of two curatorial teams where one concentrates on seed-maintained crops and the other on clonally-maintained crops. The USDA Herbaceous Ornamental Crop Germplasm Committee (HOCGC) priority genera maintained at the OPGC were divided between the two teams as follows:
  - Clonal Curatorial Team: Curator Jennifer Ehrenberger and Research Assistant Art Wells
    - § Priority genera: Anthurium, Begonia, Chrysanthemum, Dieffenbachia, Euphorbia, Hemerocallis, Narcissus, Pelargonium, Philodendron, and Spathiphyllum.
    - § Other genera: miscellaneous bulbs and other clonally-maintained genera.
  - Seed Curatorial Team: Curator Susan Stieve and Research Assistant Eric Renze
    - § Priority genera: *Aquilegia, Aster, Baptisia, Campanula, Dianthus, Geranium, Impatiens, Iris, Lilium, Petunia, Phlox, Rudbeckia, Tagetes, Verbena, Veronica, and Viola.*
    - § Other genera: *Antirrhinum, Asclepias, Cleome, Coreopsis, Oenothera, Penstemon, Stokesia, Zinnia,* and other seed-maintained genera.
- Research Aide Russell Eckley was hired to carry out maintenance of the greenhouse, laboratory, and field equipment. This brings the permanent staff to a total of six.
- A work place safety system was established, which includes an OPGC Employee Orientation Handbook and Work Place Safety and Hazardous Communication Safety Training Manuals. Procedures for training documentation were established for all OPGC employees. The Center passed the university safety inspection by Tim Butcher, College of Food, Agricultural, and Environmental Sciences Safety Officer, on January 13, 2004, and Art Wells replaced Susan Stieve as the OPGC Building Coordinator and Safety Officer in 2004. The Building Coordinator performs monthly testing of safety equipment and ensures safety procedures and maintenance are being followed.
- Four OPGC staff (Stieve, Wells, Renze, and Ehrenberger) maintained their Ohio Pesticide Applicator Licenses and received OSU pesticide physical examinations (March 3, 2004). Stieve, Wells, and Renze had OSU Pesticide Mask Fit Tests (August 26, 2004) and pesticide masks and gear were purchased for safe chemical application.
- The center, in cooperation with OSU Seed Biology group, attracted a second Fulbright Scholar, Roel Rabara, from the Philippines National Genebank, Los Banos. We also collaborated with the Department of Horticulture, Virginia Polytechnic Institute and State University (Virginia Tech) in a Ph.D. graduate student, Alice Mweetwa, with a Virginia Tech Teaching Assistantship. This brings the total number of graduate students to eight, with six in Ph.D. programs and two in M.S. programs in cooperation with OSU's Department of Horticulture and Crop Science and Department of Plant Pathology.
- The Center continued to provide training and work opportunities for 17 university students; this included 11 Federal Work-Study students. Five high school students also interned at the OPGC.
- A reference library specializing in herbaceous plants has been established and is in use.
- Greenhouse repairs of fans, ridge vents, and benches were completed by Kent Belau, contractor, and later by Russell Eckley. The infrastructure is operational and Russell has taken over all facility maintenance.
- The Tissue Culture Laboratory, a joint facility with OSU's Department of Horticulture and Crop Science in Howlett Hall, was renovated with independent temperature controls and began operation February 2004. A data logger was installed to monitor growth room conditions.
- Sensaphone systems were installed in the seed storage cooler and Tissue Culture Laboratory to monitor any malfunction of cooling systems 24 hours a day, and to notify staff in case of a malfunction. It forms the third tier of the alarm system of the seed cooler where a low- and high-temperature alarm is the first tier and the total power cut-off to the cooling and dehumidifying machinery in case of high cooler temperature is the second tier.
- The Center has been fully equipped with the addition of 50 pollination cages (for a total of 150), four storage trailers, concrete mixer for potting mix, two Oregon seed blowers, a second vibrating deck seed separator, a second seed dryer, extra seed cleaning sieves, heat sealer for seed envelopes, free-standing display unit, photocopier, digital camera, LCD projector, pesticide sprayer, Goelst laboratory cabinetry, water distiller, Qiagen tissuelizer, centrifuge adaptor, two Zeiss microscopes, ultrasonic bath, pipettes, hot bead sterilizer, cryogenic storage equipment, and light shelves and a peristaltic pump for the tissue culture laboratory.
- A computerized digital Faxitron MX-20D X-ray machine was purchased and installed on June 3, 2004, and tested for OSU X-ray machine safety compliance on August 27, 2004. An individual-user X-ray monitoring device is not required to operate the X-ray machine. A system to train all new users on safe operating procedures was established. The Faxitron has proved to be very useful in our seed cleaning process.
- Germplasm Resources Information Network (GRIN) taxonomy of HOCGC priority genera was completed by John Wiersema, Systematic Botany and Mycology Laboratory, Agricultural Research Service, USDA.

I. Germplasm Collections

Acquisition

During 2004, 864 new accessions of herbaceous ornamentals were received. The largest group of these, 512 *Pelargonium* accessions, resulted from a donation of heirloom cultivars from Chuck Heidgen, Shady Hill Greenhouses. Lynette Kinser, OPGC-supported graduate student, collected 44 *Rudbeckia* accessions from various native stands in Ohio for her M.S. thesis research.

OPGC staff participated in seed collection trips with Jim McCormac, Greg Schneider, and Rick Gardner of Ohio Division of Natural Areas and Preserves; OPGC staff collected a total of 282 accessions from 12 Ohio nature preserves. The OPGC is also serving as the point of entry for herbaceous ornamental plant releases from the USDA's Natural Resources Conservation Service (NRCS) into the National Plant Germplasm System (NPGS) for conservation. OPGC curators continued to work with National Center for Genetic Resources Preservation (NCGRP) staff to transfer appropriate genera and expired Plant Variety Protection (PVP) accessions to the OPGC. Additional germplasm was acquired through USDA-sponsored collection trips to Tajikistan (2 accessions) and Armenia (1).
The Palmer, Alaska, genebank transferred one accession to the OPGC.

The American *Begonia* Society (Bill Claybaugh) continued on with the program to identify and send Begonia species to the OPGC for long-term conservation. In 2004, 25 species were received.

Jennifer Ehrenberger and Susan Stieve visited the Chicago Botanic Garden in August 2004 to collect 18 accessions of priority genera. A collection trip to Stucker Meadows, Ohio, added 69 native plant specimens to the collection.

Jennifer Ehrenberger contacted botanical gardens, universities, floricultural industry, crop-specific societies, and individuals to donate germplasm. As a result of her efforts, many people contributed to the OPGC including Botanical Interests Inc. (7), Mr. Fother gill's USA Inc. (10), Western Native Seed (9), St. Andrews Botanic Garden, Scotland (125), and Netherland Bulb Company (4).

Additional germplasm were donated by Ball Seed Co, Inc. (1), David Hanger (1), Dr. Miguel Carravedo (2), Frank Porter (1), Jeff Noruhi (1), Jennifer Ehrenberger (1), Nicole Cavender (1), Pat Schabel (4), Peg Corbin (1), Plant Delights Nursery (4), Plant Gene Resources of Canada (1), Agrecol (10), Robert Terwillegar (1), Seeds of Change (1), and Wildflowers of Florida Industries (1).

The total collection by HOCGC priority genera is as follows:

Priority Genus	Acquired Pre-2004	Acquired 2004	Total
Alstroemeria	1	1	2
Aquilegia	8	25	33
Aster	8	54	62
Baptisia	3	10	13
Begonia	136	29	165
Campanula	35	24	59
Chrysanthemum	12	3	15
Dianthus	110	19	129
Euphorbia	2	2	4
Geranium	9	5	14
Hemerocallis	20	1	21
Impatiens	50	4	54
Iris	44	22	66
Lilium	54	6	60
Narcissus	12	1	13
Pelargonium	362	512	874
Petunia	4	4	8
Phlox	2	1	3
Rudbeckia	13	60	73
Tagetes	123	1	124
Verbena	19	10	29
Veronica	4	0	4
Viola	18	13	31
Priority Genera	1,049	807	1,856
Other Genera	797	462	1,259
Total	**1,846**	**1,269**	**3,115**

Maintenance

The director and curators divided the HOCGC priority genera into seed and clonal collections to facilitate more efficient conservation as discussed previously in this report. Accessions available for distribution were 426/3115 (14%). The number of accessions available for distribution is less than the number of accessions backed up at NCGRP. This is due to low seed quantity or viability for many of the accessions that are backed up, making them unavailable for distribution.

Several plant culture changes were made to improve greenhouse plant health as follows: constant fertigation of all greenhouse plants with a neutral pH GreenCare fertilizer donated by Aaron Perminas, more effective use of greenhouse environmental controls to control plant growth, e.g. lower day and night temperatures in *Pelargonium* compartments, and bi-weekly pH testing. The move toward automating irrigation wherever possible was begun in 2004 and will continue through 2005. The vegetatively-maintained *Impatiens* collection was tested for Impatiens Necrotic Spot Virus (INSV) using ELISA and Agdia Immunostrip technologies. Agdia Immunostrips were used to test various plants in the collection for Cucumber Mosaic Virus (CMV), Tobacco Mosaic Virus (TMV), Impatiens Necrotic Spot Virus (INSV), and Tomato Spotted Wilt Virus (TSWV) as needed and some tested positive. Seed cooler organization was improved by the completion of 2002–2004 seed production inventory lot processing and completion of initial germination tests.

The clonal curatorial team researched and worked on developing the best method for harvesting tissue from hundreds of different types of *Pelargonium* species and cultivars and placing them *in vitro*. Two hundred accessions of *Pelargonium* were attempted in tissue culture in 2004. Current research is underway to reduce contamination and eliminate callus in cultures.

Our Tissue Culture Laboratory developed an *in vitro* technique for germinating *Petunia* seed with very low viability. These seed lots had been stored since the 1960s in a long-term (–18°C) storage facility of the National Center for Genetic Resources Preservation, Fort Collins, CO. This research showed that *Petunia* seed can be stored for about forty years.

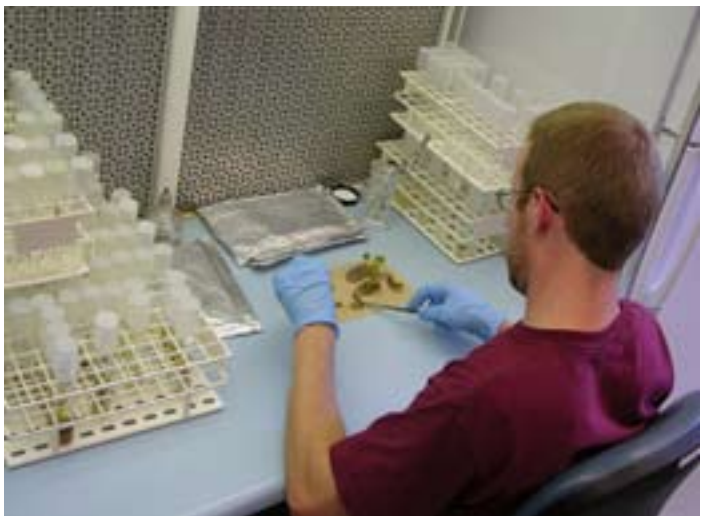
Many other improvements were made to the collection now that OPGC personnel are proficient at using GRIN. These included the establishment of the OPGC inventory lot suffix code and implementation of its use; identification and organization of seed inventory lots for distribution into jars with printed labels on both jars and lids in the seed storage cooler; counting all seed quantities in OPGC original inventory lots; updating records in GRIN to reflect inventory changes; and continued addition of OPGC accessions to GRIN. The OPGC received valuable assistance from many NPGS personnel including visits to the OPGC by Mark Millard (NC7, Ames, IA) to train OPGC staff and upload many OPGC accessions to GRIN, and Dave Kovach (NC7, Ames, IA) to install the Zebra printer for labeling. The uploading of OPGC accessions into GRIN and data checking of accessions transferred from other sites will continue in future years.

Distribution

Eighteen distributions containing accessions from 18 genera were shipped.

Genus	No. of Accessions Shipped
Antirrhinum	15
Aquilegia	1
Asclepias	24
Begonia	16
Campanula	1
Chrysanthemum	9
Coreopsis	1
Dianthus	3
Iris	2
Leucanthemum	1
Pelargonium	25
Penstemon	1
Rudbeckia	25
Stokesia	28
Tagetes	7
Verbena	11
Viola	1
Zinnia	18
Total	189

Germplasm distribution was hindered by inability to use GRIN to process orders, creating a backlog, since many accessions and inventory lots are not yet entered into the system. Documentation to enclose with shipments was developed, including a letter from the Director, postcard acknowledging germplasm receipt, germplasm disclaimer, and a "Help Us Grow" card. The OPGC follows the USDA policy in only distributing germplasm for research purposes. A letter to enclose with non-research germplasm requests was developed and is being used. As GRIN records and staff knowledge of GRIN both continue to improve, germplasm distribution will be more efficient and the backlog will be reduced.



II. Duplication

Backed up at NCGRP: 652/3115 (21%).
Additionally, 47 accessions that have been successfully regenerated (see below) will be sent to NCGRP once inventory lots have been entered into GRIN.

III. Regenerated

To date 47 accessions have been successfully regenerated as follows:

2002—4 accessions

2003—18 accessions

2004—25 accessions

In 2004, seed was harvested from 60 accessions in the greenhouse and 103 accessions in field cages. We have been focusing on accessions with a critical need for regeneration. This has included very old accessions that have never been regenerated, accessions with very low viability, and wild-collected material. Viable seeds are extremely limited for these accessions, resulting in fewer plants available for use in seed production. It has been necessary to carry many accessions over for two or more years in the greenhouse or field cages until enough seed has been produced. Also, a significant proportion of herbaceous perennial plant accessions have not flowered the first year from seed and required two or more years to flower and produce seed.

IV. Viability Testing

Germination tests performed: 80/2056 accessions held as seed (4%).
These were initial germination tests performed post-harvest, before storage.

V. Other Research and Teaching Activities

Research

- Chirlin, Lizzy. Undergraduate student, Department of Horticulture and Crop Science, The Ohio State University. Conducting a two-year student research project to determine if there is a species of *Dianthus* that is suitable for use as an ornamental substitute for grasses that grow between pavers. (HCS 593 Advisor—David Tay).
- Contreras, Samuel. Fulbright Scholar from Chile and Ph.D. student in the Department of Horticulture and Crop Science, The Ohio State University. Researching how environmental factors during seed development affect seed germination in species from the Asteraceae family. (Advisors—Mark Bennett, David Tay).
- Hu, Xiaolei. Ph.D. student, Department of Horticulture and Crop Science, The Ohio State University. Researching computerized seed vigor testing methodology on ornamental species. (Advisors—Miller McDonald, David Tay).
- Jeong, Ka Yeon. M.S. student, Department of Horticulture and Crop Science, The Ohio State University. Evaluating the effects of pH, EC, and shading levels on growth of several OPGC *Begonia* accessions. (Advisors—Claudio Pasian and David Tay).
- Luo, Jing. Ph.D. student, Department of Horticulture and Crop Science, The Ohio State University. Researching the biological traits that make a plant species become weedy utilizing *Taraxacum* and *Abutilon* species. (Advisors—John Cardina, David Tay).
- Mweetwa, Alice. Ph.D. student, Department of Horticultural Sciences, Virginia Polytechnic and State University. Creating a protocol for the long-term storage of Phalaenopsis orchid seeds. (Advisors—Gregory Welbaum, David Tay).
- Palumbo, Rose. Ph.D. student, Department of Plant Pathology, The Ohio State University. Utilizing Target Region Amplified Polymorphism (TRAP) reactions to develop a phylogeny of Pelargonioum accessions maintained at the OPGC. (Guo-Liang Wang, David Tay).
- Rabara, Roel. Fulbright Scholar from the Philippines and M.S. Student, Department of Horticulture and Crop Science, The Ohio State University. Determining moisture isotherms, desiccation tolerance in seeds, and storability of ultra-dried seeds utilizing Aster, Tagetes, Lupinus, and other species. (Advisors—Miller McDonald, David Tay).
- Stieve, Susan. Ph.D. Student, Department of Horticulture and Crop Science, The Ohio State University. Developing descriptors for evaluation of *Viola* accessions and researching seed production and dormancy of native and commercial species of *Viola*. (Advisors—Miller McDonald, David Tay).
- Stieve, Susan and Tay, David. Researching *Asarum* germination to assist Chuck Powell and Gilson Gardens, an Ohio commercial greenhouse.

Academic Teaching

- Grader, University Scholar Maximus Competition, February 18 and 25, 2004
(David Tay).
- Judge, Denman Research Forum, May 12, 2004 (David Tay).
- HCS 993 Independent Study—Roel Rabara, Summer 2004 (David Tay).
- HCS 830 What makes a plant invasive? Autumn 2004 (John Cardina, David Tay).
- HCS 420 Seed Science, NPGS and OPGC, October 18, 2004 (David Tay).
- Alessia Lodi, Department of Food Science and Technology, Ph.D. candidacy examination member, December 2004 (David Tay).

VI. Communication Activities

Presentations and Abstracts

- Ehrenberger, J. 2004. Enhanced Histological Technique for Observation of Spathe Pigmentation in Anthurium species and hybrids. American Society of Horticultural Science. Austin, TX. July 2004. Oral Presentation.
- Stieve, S. M. and Tay, D. 2004. Seed Production of Field- and Greenhouse-Grown Herbaceous Ornamental Plants: Flowering and Pollinator Effects. American Society for Horticultural Science Annual Conference, July 20, 2004 (HortScience 39:891). Oral presentation.
- Stieve, S. M. 2004. Introduction to the Ornamental Plant Germplasm Center. Ohio Prairie Association Annual Conference. August 20, 2004.
- Tay, D. 2004. Ornamental Plant Genetic Resources Conservation. Harran University, Sanliurfa, Turkey, April 9, 2004 (150 attendants and reported in local TV and newspaper).
- Tay, D. 2004. The Ornamental Plant Germplasm Center—A new genebank for herbaceous ornamental plants. 2nd World Botanic Gardens Congress, Barcelona, Spain, April 17–23, 2004.
- Tay, D. 2004. Seed technology in plant germplasm conservation. HortScience 39:753.
- Hong, W. F., Bai, C. Q., Broe, M., Hu, J. G., Krause, C., Tay, D., and Wang, G. L. 2004. Assessing genetic variability of Pelargonium species using PCR-based TRAP markers. HortScience 39:812.
- Tay, D. 2004. The USDA Ornamental Plant Germplasm Center—Its role in the conservation of American native flowers. 19th North American Prairie Conference, Madison, WI, August 8-12, 2004.
- Tay, D. 2004. The USDA Ornamental Plant Germplasm Center—Its role in the conservation of American native herbaceous plants. 31st Natural Area Conference, Chicago, IL, October 13–16, 2004.
- Tay, D. 2004. The USDA Ornamental Plant Germplasm Center. Department of Horticulture, Virginia Polytechnic Institute and State University, Blacksburg, October 25, 2004.

Publications

- Ehrenberger, J., Kuehnle, A. R., and Amore, T. 2004. Evaluation of University of Hawaii Anthurium Accessions 1986 to 2001. CTAHR. University of Hawaii Press.
- Ehrenberger, J. and Kuehnle, A. R. 2004. Enhanced histological technique for observation of spathe pigmentation in Anthurium species and hybrids. Aroideana 26:120–124.
- Tay, D. (2004). Conserving herbaceous ornamental plant germplasm. (ed. McDonald, M. B. and Kwong, F. Y. Flower seeds: Biology and technology). CABI Publishing, Wallingford, UK.
- Tay, D., Widrlechner, M. P., and Corfield, J. L. (2004). Establishment of a new genebank for herbaceous ornamental plants. Plant Genetic Resources Newsletter, 138:26–33.
- Esitken, A., Ercisli, S., Eken, C., and Tay, D. (2004). Seed priming effect on symbiotic germination and seedling development of *Orchis palustris* jacq. HortScience 39:1700–1701.

Manuscript and Book Chapters

- Tay, D. (In publication). Ornamental plant genetic resources conservation and utilization in CBD era. Acta Hort. (ISHS).
- Tay, D. (In publication). New crop development: Collection, germplasm preservation and utilization. In Flower breeding and genetics: Issues, challenges and opportunities for the 21st century. Kluwer Academic Publishers.
- Tay, D. (In publication). Hartmann's plant science (Revision of Chapter 3 & 4 into 8). Prentice Hall, NJ.
- Tay, D. (In publication). Seed technology in plant germplasm conservation. In Seed science and technology: Trends and advances. Haworth Press.
- Tay, D. (In publication). Vegetable hybrid seed production in the world. In Seed science and technology: Trends and advances. Haworth Press.

Manuscript and Proposal Review

- Journal of Food, Agriculture and Environment (JFAE), WFL Publisher (David Tay—Editorial Board).
- Journal of New Seeds, Food Products Press (David Tay—Editorial Board).
- "Germination of Somatic Embryos of *Cyclamen persicum* after encapsulation" HortScience manuscript #00102. (David Tay).
- "Promotion of Immature Seeds Germination in *Jacaranda mimosifolia*" HortScience manuscript #00720. (David Tay).

Conferences/Meetings Attended

- OSU Nursery Seminar and Central Environment Nursery Trade Show, January 2004 (Jennifer Ehrenberger, Russell Eckley, Eric Renze, Susan Stieve (moderator), David Tay).
- ODNR–DNAP wildflower walk led by State Botanist Jim McCormack to view *Trillium nivale*, March 25, 2004 (Russell Eckley, Jennifer Ehrenberger, Eric Renze, Susan Stieve, Art Wells).
- 4th Annual Ohio Botanical Symposium, April 2, 2004 (Russell Eckley, Jennifer Ehrenberger, Eric Renze, Susan Stieve, Art Wells).
- 2nd World Botanic Gardens Congress, Barcelona, Spain, April 17–23, 2004 (David Tay).
- GRIN meeting in Griffin, GA, May 18–19, 2004 (Jennifer

Ehrenberger, Eric Renze, Susan Stieve).

- NPGS PGOC meeting, Beltsville, MA, June 8–10, 2004 (Jennifer Ehrenberger, David Tay).
- OFA Short Course and Trade Show, July 9–14, 2004 (Jennifer Ehrenberger, Eric Renze, Susan Stieve, David Tay, Art Wells).
- HOCGC meeting at the OFA Short Course, July 13, 2004 (Jennifer Ehrenberger, Eric Renze, Susan Stieve, David Tay, Art Wells).
- American Society for Horticultural Science annual meeting, July 17–20, 2004 (Jennifer Ehrenberger, Susan Stieve, David Tay).
- 19th North American Prairie Conference, Madison, WI, August 8–12, 2004 (Susan Stieve and David Tay).
- Dr. Dennis Stimart Laboratory, University of Wisconsin, August 12, 2004 (Susan Stieve and David Tay).
- Agrecol, Inc., open house August 11, 2004, to view commercial prairie seed production methods (Susan Stieve).
- 23rd Ohio Prairie Association Conference, The Wilderness Center, Wilmot, OH, August 20–22, 2004 (Jennifer Ehrenberger and Susan Stieve).
- 31st Natural Areas Conference, Chicago, IL, October 13–16, 2004 (David Tay).
- Cincinnati Flower Show, April 21, 2004 (Susan Stieve).
- Mill Creek Greenhouses, May 14, 2004, to view polyhouses (Jennifer Ehrenberger and Susan Stieve).

Training Received

- Horticulture and Crop Science 420, Seed Science, was audited by Jennifer Ehrenberger and taken for credit by Russell Eckley.
- Horticulture and Crop Science 694, Seed Evaluation and Enhancement, was taken by Jennifer Ehrenberger and Susan Stieve for credit.
- PI Portal training, OSU Research Foundation, January 29, 2004 (David Tay).
- National Seminars Leadership Conference for Women, March 16–17, 2004 (Susan Stieve).
- OPGC staff visited Oglevee Ltd. on April 29, 2004, to observe *Pelargonium* tissue culture lab techniques including meristem tip culture and microcuttings (Russell Eckley, Jennifer Ehrenberger, and Art Wells).
- Mark Millard visited from NC7 (Ames, IA) to train OPGC staff in GRIN use and to organize OPGC accessions, transfers from other sites, upload OPGC Excel file, etc., June 28–30, 2004.
- Toured NC7 with OPGC personnel August 16–19, 2004, to familiarize OPGC staff with equipment and procedures (Russell Eckley, Jennifer Ehrenberger, Eric Renze, Susan Stieve, Art Wells).
- Dave Kovach came from NC7 (Ames, IA) to install Zebra printer and software and instruct OPGC personnel in its use, October 20–21, 2004.
- Dick Craig, Chair of OPGC *Pelargonium* Technical Working group discussion on the *Pelargonium* collection, October 27, 2004 and December 17, 2004 (Jennifer Ehrenberger, Susan Stieve, Rose Palumbo).

Publicity

- Poster— "Centers of Origin for Common Ornamental Plants," OPGC bookmark on OPGC Endowment, and postcard on seed distribution acknowledgment were produced.
- To encourage germplasm donation, "Help Us Grow" postcards were developed for advertising and circulation at conferences and other events.
- Featured in OARDC Annual Report online slide show presentation of OPGC responsibilities, viewable at http://oardcreport.osu.edu/2003/viewstory.asp?id=36, posted February 2004.
- "Plant Germplasm Center securely stores seeds," NEWS at Ohio State Horticulture & Crop Science, Issue 6, March 23, 2004.
- "Smart Gardening" TV program used OPGC greenhouse as setting, July 10, 2004.
- "Saving the World's Flowers" article published in USDA–ARS Agricultural Research, August 2004.
- OPGC Poster Display, OFA Short Course and Nursery Show, July 9–14, 2004.
- OPGC Poster Display and brief introductory speech at the Ohio Prairie Association Annual Conference, August 20–22, 2004.
- China Guangxi TV filmed OPGC greenhouse and interviewed David Tay, September 2, 2004.
- The OPGC web site was updated with photos and articles written by staff.

OPGC Visitors

- Douglas Kinghorn, University of Illinois and Tom Li, College of Pharmacy, OSU, January 6, 2004 (David Tay).
- Jim McCormac, State Botanist, Ohio Department of Natural Resources, January 12, 2004 (Susan Stieve, Jennifer Ehrenberger, David Tay).
- Steve Carver, OFA, January 15, 2004 (David Tay).
- Marleen Kromer, Director of Inter-Agency Program Development, Nature Conservancy, Greg Schneider, Director of ODNR–Division of Natural Areas and Preserves, Rick Gardner, Nature Conservancy and Melissa Moser, ODNR, January 15, 2004 (David Tay).
- Kikuo Fujimura, Honda America, California, January 23, 2004 (David Tay).

- Grzegorz Lecki, Petra Sternberg, Monika Tracz, and Gabriella Pearse, OSU overseas internship program, January 30, 2004 (David Tay).
- Joykumar Laishram, Phanjoubam Sobita Devi, and Akoijam Bijaya Devi, Central Agricultural University, India, January 30, 2004 (David Tay).
- Angela Masters, Penn State University Horticulture Alumni, February 29, 2004 (Jennifer Ehrenberger).
- R. C. Ratiyar, Agro Food Consultants, Shimla, India, March 4, 2004 (David Tay).
- Eric Barrett, OSU Extension, Master Gardeners and Growers of Washington County (16 participants), March 10, 2004 (David Tay).
- Illinois Central College Horticulture group (8 participants), March 23, 2004 (David Tay).
- Warrenstown College group (7 participants), March 25, 2005 (David Tay).
- Ohio Botanic Gardens and Arboreta (22 participants), March 26, 2004 (David Tay).
- Carol and Jerry Baskin, University of Kentucky, April 16, 2004 (Susan Stieve).
- Muskingum Co. Gardeners (40 participants), April 17, 2004 (Susan Stieve, Art Wells).
- Peter Curtis, OSU/EEOB, May 6, 2004 (David Tay).
- Laura Deeter, OSU/ATI, Wooster, May 11, 2004 (David Tay).
- Jim Chatfield and 4 OSU Extension Agents, May 14, 2004 (David Tay).
- Alex Mata, Earth University, Costa Rica, June 6, 2004 (David Tay).
- Garry Clarke and Barb Arnold, Franklin Park Conservatory curatorial team, June 15, 2004 (David Tay).
- Nouhou Ndam, Director, Limbe Botanic Garden, June 16–17, 2004 (David Tay).
- Christopher Fominyam, Curator, Limbe Botanic Garden, June 21, 2004 (David Tay, Susan Stieve).
- Gregory Welbaum, Department of Horticulture, Virginia Tech, June 24, 2004 (David Tay)
- Mark Millard, NCRPIS, Iowa State University, June 28, 2004 (Susan Stieve, David Tay).
- 4-H Tony Vaccaro group, July 2, 2004 (David Tay).
- OFA group tours (100 participants), July 10, 2004 (Susan Stieve).
- HOCGC and WLPCGC tour (12 participants), July 12, 2004 (David Tay).
- Serbian Seed delegates (4 participants), July 14, 2004 (David Tay).
- Bakers Acres group (3 participants), July 21, 2004 (Susan Stieve).
- Paul Orrick, Grolink Mums, July 27, 2004 (Susan Stieve).
- Japanese Horticultural Trade Mission (6 participants), August 16, 2004 (David Tay).
- Janet Oberlison, Ohio Historical Society, August 18, 2004 (David Tay).
- Eugene Amberson, Wisconsin Crop Improvement Association, Madison, August 27, 2004 (David Tay).
- Suely Vilela, Provost of the University of Sao Paolo and delegates, and Rutgers University (5 people), September 8, 2004 (David Tay).
- Robert Hawes, Botanizer, The Wilderness Center, Ohio, September 13, 2004 (Susan Stieve, Jennifer Ehrenberger, David Tay).
- Wang Jianhua, Chair, and Sun Qun, Department of Seed and Technology, China Agricultural University, Beijing, September 15, 2004 (David Tay).
- OSU Horticulture and Crop Science Graduate Student Orientation (12 participants), September 17, 2004 (Susan Stieve and David Tay).
- Gregory Welbaum, Department of Horticulture, Virginia Tech, September 20, 2004 (David Tay).
- National Chrysanthemum Society Annual Convention, October 7, 2004 (David Tay).
- Ed Hiler, Dean of Texas A&M, October 7, 2004 (David Tay).
- Allison Cusick, OSU Herbarium, October 8, 2004 (Susan Stieve, David Tay).
- Todd West, West Virginia University, October 22, 2004 (David Tay).
- Gordon Mitchell, Columbus Metro Park, November 1, 2004 (Susan Stieve, Jennifer Ehrenberger, David Tay).
- Francis Kwong, Pan American Seeds, November 8, 2004 (David Tay, Susan Stieve).
- Rick Gardner, State Botanist, Ohio Department of Natural Resources, November 10, 2004 (Susan Stieve, Jennifer Ehrenberger, David Tay).
- Roane Logan, Delta and Pine Seed Co. (2 participants), November 10, 2004 (David Tay).
- Todd Barkman, Western Michigan University, November 18, 2004 (David Tay)
- Sudhindra R. Gadagkar's group (4 participants), University of Dayton, OH, December 3, 2004 (David Tay).
- Ronna Gibson and Nathan Addis, The Graham School, Columbus, December 7, 2004 (David Tay).
- Joe Boggs, OSU Extension, December 10, 2004 (David Tay).
- John Gray, Department of Biological Science, University of Toledo, December 16, 2004 (David Tay).
- James Locke and Futong Yu, USDA/University of Toledo, December 17, 2004 (David Tay, Jennifer Ehrenberger, Susan Stieve).

OSU Activities

- Core partner of the OSU International Seed Consortium and its Distance Education project (David Tay).
- Kiplinger Chair Committee member (David Tay).
- OSU Floriculture group member (David Tay).
- Mentoring graduate students meeting, The Graduate School, January 21, 2004 (David Tay).
- Franklin County Master Gardener Recognition program, January 22, 2004 (David Tay, Art Wells).
- CFAES/OARDC meeting, January 28, 2004 (David Tay).
- Nicole Cavender, The Wilds and Master Gardeners volunteers using OPGC seed cleaning facility, February 18, 2004 (David Tay).
- Lectured to Washington County plant nursery growers and Master Gardeners, Marietta (27 participants), March 30, 2004 (David Tay).
- OARDC Annual Research Conference, April 29, 2004 (David Tay).
- Worked with Ken Chamberlain to provide plants for OARDC exhibit at Wayne County Fair, June 11, 2004 (Jennifer Ehrenberger, Susan Stieve).
- Organized Nouhou Ndam, Director, Limbe Botanic Garden to present an OPGC special seminar, June 16, 2004 (David Tay).
- Yugoslavia Seed group—lecture, July 14, 2004 (David Tay).
- International Seed Consortium—China Agricultural University group visit, September 9–18, 2004 (David Tay).
- Farm Science Review—Vice President's Luncheon, September 21, 2004 (David Tay).
- Germplasm grow-out for the National Chrysanthemum Society Annual Convention, Columbus Marriott Northwest, October 6–10, 2004 (David Tay).
- Seed Biology Group weekly meetings (Susan Stieve, David Tay).
- Department of Horticulture and Crop Science Seminar Committee—organized a visit from Carol and Jerry Baskin of the University of Kentucky to discuss their research in the area of seed dormancy (Susan Stieve).
- Organized Todd West, West Virginia University, to present a Department of Horticulture and Crop Science departmental seminar, October 22, 2004 (David Tay).
- OFA Poinsettia Trial at OSU, December 3, 2004 (Jennifer Ehrenberger, Susan Stieve, David Tay).

USDA National Plant Germplasm System

- Herbaceous Ornamental Crop Germplasm Committee (Jennifer Ehrenberger, Susan Stieve, David Tay—*Ex-officio*).
- Associate Germplasm Collections Subcommittee (David Tay).
- In Situ Collections Subcommittee (David Tay).
- Medicinal Plants Subcommittee (Susan Stieve, David Tay).
- Operational Manual Revision Subcommittee (David Tay).

USDA/ISTC Project

- Back-stopping a 3-year ISTC project (KR-973)—Conservation and Use of Germplasm of Kyrgyzstan's Wild Flora for Management of Genetic-Selectional and Economical Tasks undertaken by the Kyrgyz Republic National Academy of Science Biotechnology Institution, Kyrgyzstan (David Tay).
- Back-stopping a 1.5-year US Food for Progress Act of 1985 project—Community-based Floriculture Industry Project (CFIDP) undertaken by Limbe Botanical Garden, Cameroon (David Tay).

Association and Society Memberships

- American Association of Botanic Gardens and Arboreta (David Tay).
- American Horticultural Society (Jennifer Ehrenberger, David Tay).
- American Penstemon Society (Susan Stieve).
- American Society for Horticultural Science (Jennifer Ehrenberger, Susan Stieve, David Tay—Chair-elect Seed and Stand Establishment Working Group [WG], Member of Floriculture WG, Ornamental Plant Breeding WG, Genetic and Germplasm WG, Nursery Crop WG and International Horticultural Consultants WG).
- International Seed Testing Association (ISTA) (David Tay—Member of Flower Seed Committee).
- International Society for Horticultural Science (David Tay).
- Mohican Native Plant Society (Susan Stieve).
- OFA (Susan Stieve—Member Educational Affairs Committee, David Tay—Member Educational Affairs Committee).
- Ohio Prairie Association (Jennifer Ehrenberger).
- Society of American Florists (David Tay).

Professorship (David Tay)

- Adjunct Professor, Department of Horticulture, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Visiting Professor in Agronomy & Biotechnology, China Agricultural University, Beijing, China.
- Adjunct Associate Professor, Department of Evolution, Ecology and Organismal Biology, The Ohio State University, Columbus, OH.

VII. Conclusions and Plans for 2005

1. Continue seed collection trips with Rick Gardner, Botanist, Ohio Division of Natural Areas and Preserves. Five collection trips are scheduled for five different nature preserves in Ohio.
2. Develop a document for germplasm donors to sign off donated germplasm for free distribution to researchers according to NPGS distribution policy.
3. Continue progressing with GRIN in areas such as uploading OPGC accessions, inputting inventory lots, data checking of accessions transferred from other sites, and backup of regenerated accessions with NCGRP.
4. Continue to determine the germination of regenerated seed lots for storage with NCGRP.
5. Work to eliminate backlog of germplasm requests by continued improvement of GRIN data and staff knowledge of GRIN.
6. Continue automation of greenhouse irrigation using both capillary mat and drip-tube systems.
7. Continue seed production through use of greenhouse compartments and field cages at Waterman Farm. The seed curatorial team goal for 2005 is 40 successful regenerations, an increase of 15 from 2004. This should be possible, as many of the herbaceous perennial plant accessions that have been in field cages and greenhouses for several years begin to flower and produce seeds, and plant culture and pollination techniques learned in past years make strategies and staff more effective and efficient.
8. Continue to put more clonal materials into *in vitro* collections and to research minimizing culture contamination and callusing.
9. Expand our work in the area of characterization and evaluation of accessions. This will necessitate drafting descriptor lists for all of the many genera.
10. Continue promotion and publicity of OPGC through display at OFA, Ohio Prairie Association Conference, 5th Annual Ohio Botanical Symposium, news stories, tours, etc.
11. Proactively develop and utilize technical working groups for specific genera recommendations.
12. Send established *Pelargonium* plants *in vitro* to NCGRP for cryogenic storage experimentation and OPGC germplasm backup.
13. Post digital images of clonally maintained plants on GRIN for viewing by germplasm users.
14. Continue to participate in USDA NPGS activities and professional society activities.
15. Continue to prepare an OPGC operation manual based on information and experience accumulated.