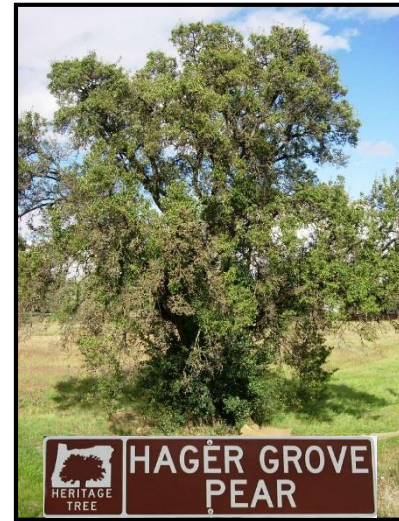


2014 ANNUAL REPORT FOR W-6 TAC
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 Yvonne Pedersen, Program Assistant
 Joseph Postman, Plant Pathologist/Curator
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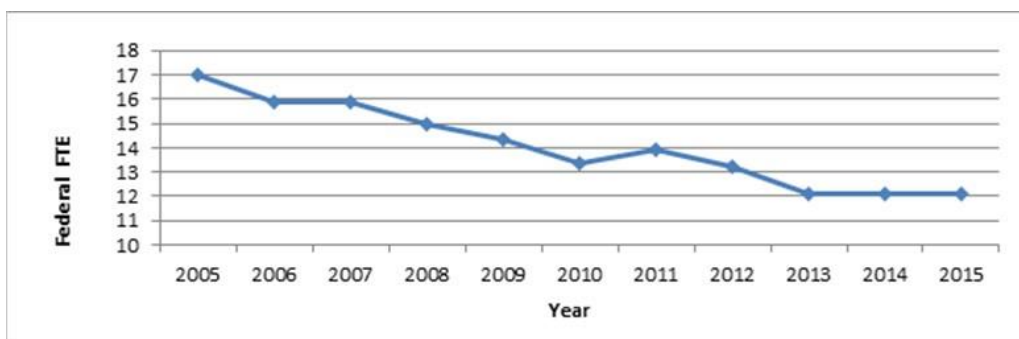
Temporary Staff & Students

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 Mitchel Elstad, Work Study
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 Larry Alice, Scientist/ Western KY State University
 Meera Das, Visiting Scientist/India
 Sukalya Poothong, GRA, OSU, Hort. Thailand
 Victoria Rivero, Visiting Scientist/Argentina
 Natalia Salinas, Fulbright/Ecuador
 Sugae Wada, Post Doc. OSU



Stakeholder/Service Accomplishments

- 12,070 accessions, 65 genera and 748 taxa of 653 species of temperate fruit, nut, and specialty crops were conserved.
- Obtained a total of 103 new accessions and 203 new inventory items in CY 2014.
- Received a record number: 1108 order requests and shipped 7,727 items in CY 2014.
- Improved the management and maintenance of 3200 accessions in the pear, hazelnut, quince and related tree field collections.
- Collaborated with NCGRP, Ft. Collins, CO, on cryopreservation protocols of dormant blueberry, hazelnut, pear, and currant.
- Served as advisory panel member for SCRI Research and Ext. Planning Project Seattle.
- Advised *Citrus* and *Malus* community on development of Global Conservation Strategies working with the Global Crop Diversity Trust.
- Participated on Governing Board for USDA National Clean Plant Network.
- Member of the organizing committee and editor of the proceedings for the ISHS IHC symposium on Plant Genetic Resources
- Trained visiting scientists Dr. Larry Alice, Western Kentucky State University for 6 months in molecular marker techniques.
- Provided tissue culture assistance to hop breeders for a hop mutation breeding project.
- Mentored an OSU Horticulture Department Intern in tissue culture techniques for 9 months.
- Hosted two hop industry technicians to work with hops tissue culture and cryopreservation.
- Meristemmed heat-treated pear and hazelnut accessions for virus elimination.

Accomplishments

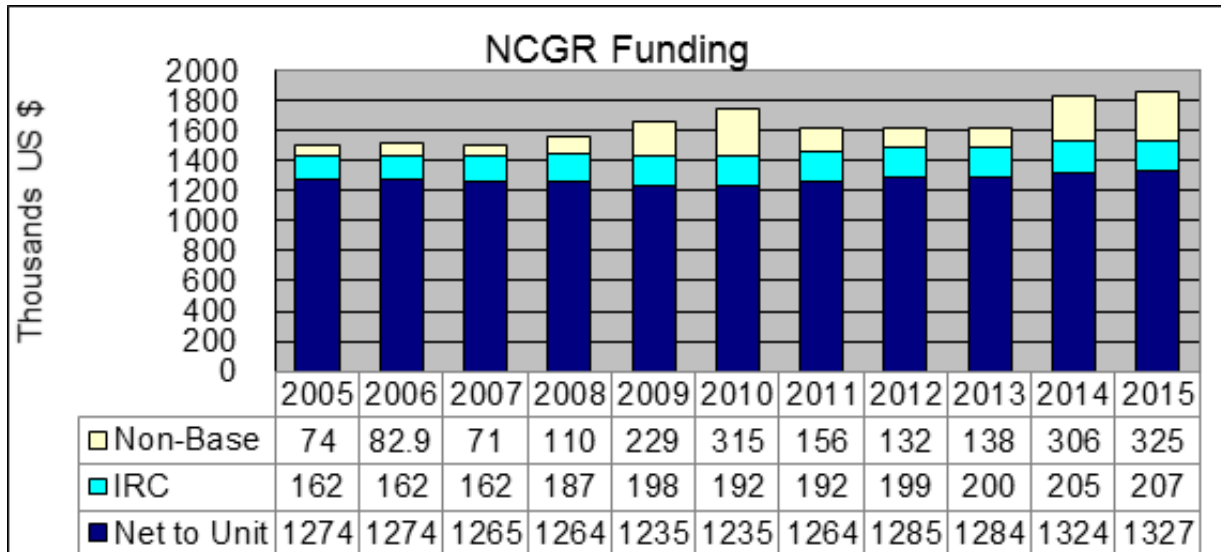
- Published the first high throughput 90K genotyping platform in strawberry an octoploid crop.
- Obtained samples of the threatened *Rubus bartonianus* from Eastern Oregon
- Determined that *Vaccinium myrtillus* has tetraploid and hexaploid cytotypes in Oregon.
- Determined that *Rubus* species in Subgenus *Micranthobatus* have very small sized genomes.
- Reported on improved microsatellite markers for quince and analyzed genetic fingerprints of more than 100 *Cydonia* and *Pseudocydonia* germplasm accessions.
- Reported on successful development of microsatellite markers to assess genetic diversity and phylogenetic relationships of medlar (*Mespilus* sp.) accessions.
- Harmonized SSR profiles of pear cultivars with those from the Brogdale collection in England.
- Determined ploidy levels for *Rubus* species and related genera using flow cytometry.
- Completed pear rootstock *in vitro* rooting study for the pear industry.
- Completed *in vitro* raspberry mineral nutrition studies and produced improved growth media.
- Determined initial *in vitro* nutrient requirements for blueberry.

Administrative Overview

Our federally-supported scientific permanent federal staff is now 10 permanent FTE. In addition we have 2.1 FTE part time federally funded staff. Four permanent employees retired recently: Bruce Bartlett, Distribution Technician in 2014; Yvonne Pedersen, Program Support Assistant in February, 2015; and Joe Snead, Field Technician in March, 2015. Barbara Reed, Plant Physiologist will retire in July 2015. Two positions are presently under recruitment and we will begin seeking a new scientist in fiscal 2016.

Budget

We received a programmatic increase in spring 2014 that helped to reduce the effect of the recession and sequestration cuts of FY 2013. Our total federal budget is about \$1.54 million. Our scientific staff is encouraged to obtain soft funding from a wide variety of research granting opportunities.



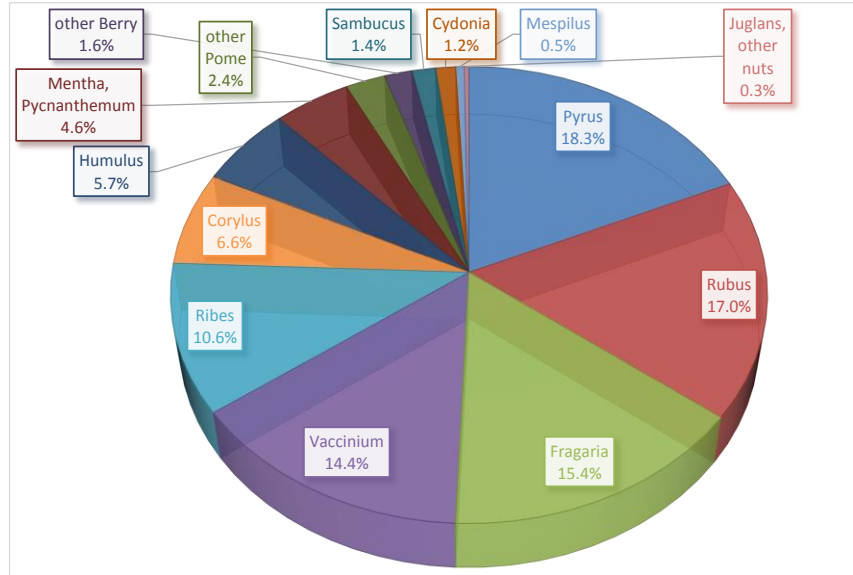
Non-base and Extramural Funding for the USDA-ARS NCGR- Corvallis

Research Proposals Funded	FY 2014		
California Pear Board	\$35,050	Pear rootstock chlorosis	Reed
OR Hazelnut Commission	\$12,000	Hazelnut elite selection tissue culture	Reed
ISTC-ARS Kazakhstan	\$10,000	Pear and apricot tissue culture	Reed
OAN/ODA Nursery Crops	\$24,000	Hazelnut medium development	Reed
SCRI subcontract	\$10,000	Hazelnut micropropagation	Reed
Ag Res. Foundation	\$12,500	Blueberry medium development	Reed
SCRI GRANT	\$127,822	Genomic infrastructure black raspberry	Bassil
Western Kentucky	\$12,500	Targetseq in <i>Rubus</i> /Cytology	Bassil/Hummer
NWCSFR	\$33,905	aphid resist in black raspberry/ Markers	Bassil
Schmidt	\$5,000	labeling of <i>Corylus</i> with QR code	Postman/Hummer
NARBA	\$1,000	labeling of <i>Rubus</i> with QR code	Postman/Hummer
WA Tree Fruit Comm.	\$2,500	labeling of <i>Pyrus</i> with QR code	Postman
PWA Summer Intern	\$1,500	labeling of genera	Postman/Hummer
APHIS	\$16,500	Survey of Berry germplasm for viruses	Postman
NPGS Evaluation	\$1,503	Pear tree architecture	Postman
Total	\$305,780		

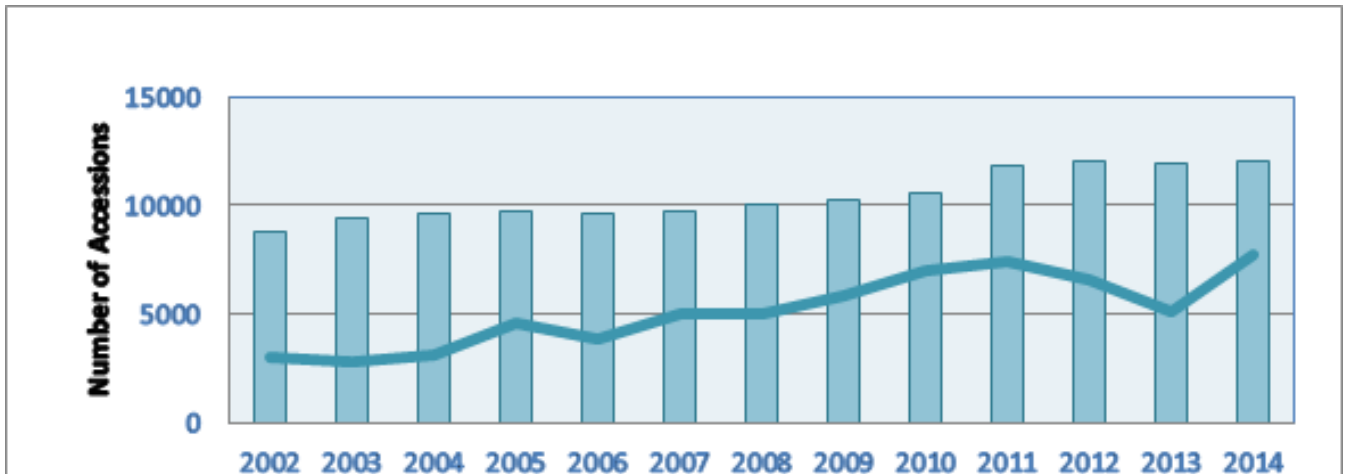
Germplasm Collections

Summary of Corvallis Holdings, May, 2015: 12,098 Seed and Plant Accessions

Genus	Accessions
Pyrus	2196
Rubus	2034
Fragaria	1841
Vaccinium	1726
Ribes	1269
Corylus	793
Humulus	684
Mentha, Pycnanthemum	553
other Pome	286
other Berry	196
Sambucus	170
Cydonia	143
Mespilus	60
Juglans, other nuts	34



Number of accessions (bars) and items distributed (line) from 2002 to 2014



Travel 2014 - Compiled by Yvonne Pedersen

Highlighted entries indicate contributed travel, paid by inter/intra agency or outside private funds.

Joseph Postman – Riverside, CA; ARS Citrus Germplasm Repository Review; Jan. 2014

Nahla Bassil – San Diego, CA; Fruit & Nut Workshop and PAG meeting; Jan. 2014

Barbara Reed – Portland, OR; Hop Research Council meeting; Jan. 2014

Joseph Postman – Yakima, WA; pear industry research review; Feb. 2014

Joe Snead – Albany, CA; OSHA 6000 Course; April 2014

Barbara Reed – Watsonville, CA; Global Tissue Culture/Nursery Clean Stock and Plant Health; April 2014.

Kim Hummer – Richmond, CA; attending PWA Leadership Development/Training Conference; April 2014.

Barbara Reed – Kazakhstan; ISTC grant work and International Scientific Conference of Plant Biology and Biotechnology; May, 2014.

Barbara Reed – Savannah, GA; Joint meeting of the Society for *In vitro* Biology and the Society for Cryobiology, May 31-June 5.

Jill Bushakra – Wenatchee and Seattle, WA; Rosaceae Genome Conference; June 2014.

Nahla Bassil – Wenatchee and Seattle, WA; Rosaceae Genome Conference; June 2014.

Joseph Postman – Davis, CA; Western Regional (W-6) Technical Advisory Committee; June 2014.

Kim Hummer – Baker City, OR; plant collecting; June 2014.

Kim Hummer – Seattle, WA; collecting germplasm from Rhododendron Botanical Gardens; June 2014.

Joseph Postman – Riverdale, MD; National Clean Plant Network proposal review; June 2014.

Joseph Postman – Leuven, Belgium; ISHS International Pear Symposium; July 2014.

Jill Bushakra – Orlando, FL; ASHS conference; July 2014.

Kim Hummer – Orlando, FL; ASHS conference; July 2014.

Nahla Bassil – Orlando, FL; ASHS conference; July 2014.

Joseph Postman – Troutdale, OR; co-hosting NAFEX-CRFG-HOS meeting; August 2014.

Kim Hummer – Brisbane, Australia; ISHS planning meeting and International Hort. Congress (IHC); August 2014.

Barbara Reed – Melbourne and Brisbane, Australia; International Association of Plant Biotechnologists and IHC; August 2014

Joseph Postman – Davis, CA; Plant Germplasm Operations Committee; October 2014.

Barbara Reed – Santos, Brazil; Brazilian Congress of Genetic Resources; November 2014.

Visitors in 2014 - By Yvonne Pedersen

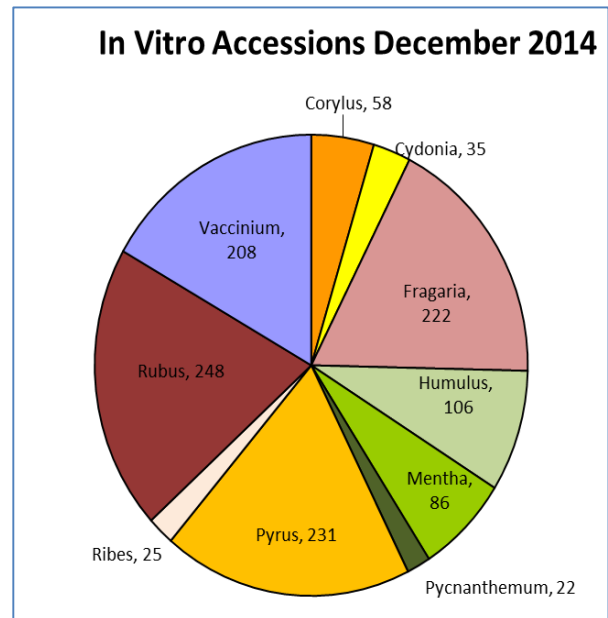
More than 463 visitors came through the Repository's front door in 2014. About 25 people attended a blueberry open house in July. Educational tours ranging from of 2 to 150 individuals came from Willamette University, Home Orchard Society, Chemeketa and Linn-Benton Community Colleges, Oregon State University, various garden clubs, Eugene Permaculture, Slow Food, and Life-Long Learning Institute. Our ARS-Corvallis Outreach Diversity and Equal Opportunity Committee arranged a tour for 28 summer students to the three ARS Corvallis units. International visitors came from India, China, Japan, New Zealand, Columbia, Spain, Turkey, Thailand, Australia, and Canada. We also hosted graduate students and visiting scholars from Thailand, Ecuador, Turkey, India, Argentina, and Kentucky State University.

Tissue Culture and Cryopreservation By Barbara Reed and Jeanine DeNoma

The *in-vitro* collection contains mostly core and highly requested accessions. In December 2014, 1,241 accessions were in culture and most were in cold storage (figure right).

Our 10 year collaboration with Dr. Irina Kovalchuk, Institute of Plant Biology and Biotechnology on Apricot and Pear Diversity and Germplasm Preservation in Kazakhstan is nearing completion. Micropropagation medium of apricot was improved and apricot seeds were successfully cryopreserved for the first time.

Rooting protocols were improved for *in vitro* pear selections. An improved *Corylus* culture medium was developed based on experiments by graduate student Chip Hand. Sukalya Poothong completed her Ph.D. using surface response design to improve the response of raspberry cultivars to mineral nutrients. Dr. Poothong is now a Lecturer in the School of Agriculture and Natural Resources, University of Phayao, Thailand. A metabolomics study was used to investigate the effects of meso components of mineral nutrition on plant metabolism in collaboration with Dr. Claudia Meier, OSU Department of Chemistry. In collaboration with Fall Creek Nursery, we are evaluating *in vitro* growth medium for blueberry cultivars.



Molecular Genetics - By Nahla V. Bassil

M.S. student Natalia Salinas continued her work on strawberry, validating markers associated with remontancy; validating a marker associated with high soluble solids content; and using genotyping by sequencing (GBS) in octoploid strawberry. Dr. Lawrence Alice, Plant Systematics and Herbarium Curator at Western Kentucky University, spent a sabbatical at NCGR implementing a new genomic sequence-based technique for phylogenetic analyses in *Rubus*.



Projects Completed in 2014

- Compared fingerprints of 61 pear accessions in common between the Brogdale and NCGR collections using an ECPGR universal fingerprinting set and multiplex PCR.
- Used microsatellite markers to evaluate genetic diversity of 41 clones of *Mespilus germanica* and one accession of *M. canescens* using SSR markers adapted from apple and pear.
- Evaluated a 90K strawberry array in 306 cultivated strawberry accessions to develop a high-throughput genotyping platform for marker-assisted breeding in cultivated strawberry.
- Developed new microsatellite markers for red and black raspberry using next generation sequencing in collaboration with Michael Dossett.

Projects in Progress in 2014

- **Developing genomic tools for blueberry.** Construction of linkage maps and development of SNP markers in the tetraploid mapping population of ‘Draper’ x ‘Jewel’ using genotyping by sequencing.
- **Testing markers associated with remontancy in strawberry** in collaboration with Daeil Kim, Jim Hancock, Chad Finn and Beatrice Denoyes using SSR markers on LG IV.
- **Testing markers associated with high soluble solids content in strawberry.** In collaboration with Jim Hancock and Chad Finn we are analyzing the results of genotypic and phenotypic data in 947 strawberry accessions for association with high soluble solids content.
- **Black raspberry genomic resource development.** We are building the genomic infrastructure for black raspberry by developing genomic tools including molecular markers for construction of linkage and physical maps, and a draft genome assembly that will benefit both black and red raspberry breeding programs.

NCGR Corvallis Tree Collections – by Joseph Postman

Summary of Tree Fruit and Nut Collections, May 2015

Genus	Accessions	Taxa	Genus	Accessions	Taxa
<i>Amelanchier</i>	49	10	<i>Juglans</i>	28	3
<i>Amelasorbus</i>	1	1	<i>Malus</i>	10	6
<i>Castanea</i>	3	2	<i>Mespilus</i>	60	2
<i>Celtis</i>	1	1	<i>Peraphyllum</i>	8	1
<i>Chaenomeles</i>	17	4	<i>Pseudocycdonia</i>	3	1
<i>Corylus</i>	793	21	<i>Pyronia</i>	7	1
<i>Crataegomespilus</i>	3	1	<i>Pyrus</i>	2196	36
<i>Crataegosorbus</i>	1	1	<i>Sorbaronia</i>	7	4
<i>Crataegus</i>	23	9	<i>Sorbocotoneaster</i>	3	2
<i>Crataemespilus</i>	1	1	<i>Sorbopyrus</i>	11	2
<i>Cydonia</i>	140	1	<i>Sorbus</i>	135	46

Pears. As of January 1, 2015, the NCGR *Pyrus* collection included 2232 clonal pear accessions and 335 seedlots representing 36 *Pyrus* taxa from 59 countries. Perry pears continue to be some of the most requested accessions, reflecting the surge of interest in hard cider in the U.S.

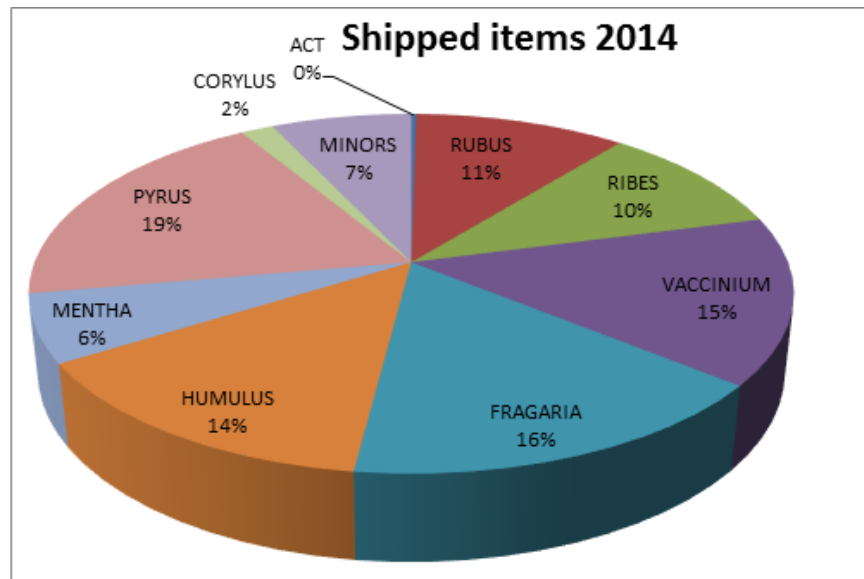
Hazelnuts. The *Corylus* collection consists of 860 living trees including 453 cultivars/selections and 407 wild relative species trees and representing 20 *Corylus* taxa from 36 countries. Several Eastern Filbert Blight (*Anisogramma anomala*) strikes were found in early 2015, making annual prophylactic fungicide sprays and pruning to remove infections essential. Propagation efforts continue in support of the establishment of field rows dedicated to *C. americana* and *C. heterophylla*, and to the relocation of various tree-hazel species to a separate plot. We are propagating the core collection (177 accessions) as self-rooted trees to replace the remote backup collection at the USDA genebank in Parlier, California.

Quince. The Corvallis genebank maintains 172 clonal accessions and 25 seedlots of *Cydonia* and the closely related genera *Docynia*, *Pseudocydonia*, *Pyronia*, and *Chaenomeles*. The various species of quince are represented by 9 taxa from more than 21 countries. SSR fingerprints generated using microsatellite markers developed at NCGR identified a number of identical accessions (either synonyms or misidentified trees). More than a dozen duplicate trees were removed from the *Cydonia* field plot, opening up vacant spaces for new, unique genotypes.

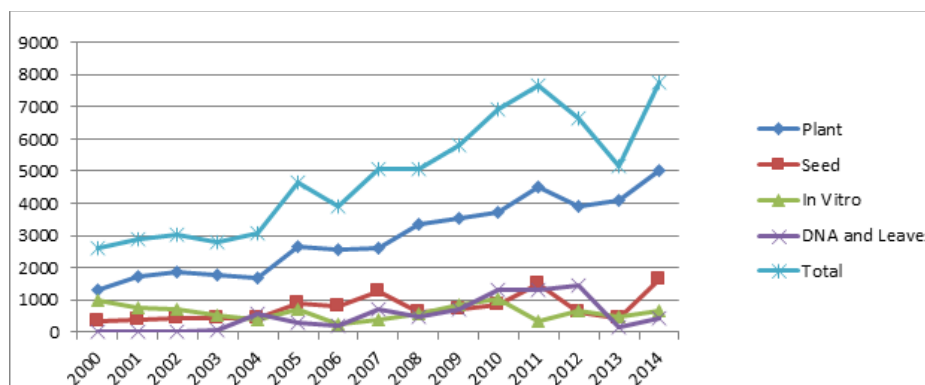
Distribution

by Kim Hummer and Missy Fix

- The pears and strawberries topped the list of crops distributed in 2014.
- NCGR staff shipped 7,739 items as seeds, cuttings, runners, scionwood, rooted plants, tissue cultures and DNA and leaf samples and informational material.
- 856 new orders were received for small fruit and 179 new orders for scion or budwood. More than 823 orders were shipped.
- Domestic individuals, state agencies and universities, and ARS researchers received the most germplasm from Corvallis in 2014.



Items shipped from 2000 to 2014 by form



Publications

1. **Bassil, N.**, Davis, T., Amaya, Iraida, Bellon, Luca (19 additional authors). 2014. First evaluation of the IStraw90 axiom array in the cultivated strawberry [ABSTRACT]. Genomics of the Rosaceae.
2. **Bassil, N.**, Davis, T., Amaya, Iraida, Bellon, Luca (22 additional authors). 2014. First evaluation of the IStraw90 axiom array in the cultivated strawberry (*Fragaria xananassa*) [ABSTRACT]. Plant and Animal Genome Conference.
3. **Bassil, N.**, Davis, T., Zhang, H., Ficklin, S. (24 additional authors). 2014. Development and preliminary evaluation of a 90K Axiom SNP array for the allo-octoploid cultivated strawberry *Fragaria xananassa*. Biomed Central (BMC) Genomics.
4. **Bassil, N.**, **A. Nyberg**, Y.K. Kim and **J. Postman**. [ABSTRACT] 2014. Improved microsatellite markers for quince (*Cydonia oblonga*) genetic analysis. Acta Horticulturae.
5. Bradish, C., Fernandez, G., Dossett, M., **Bushakra, J.**, **Bassil, N.**, Finn, C. 2014. Genotyping and phenotyping heat tolerance in black raspberry (*Rubus occidentalis* L.) Acta Horticulturae.
6. Bradish, C., Overbaugh, E., Ballington, J., Fernandez, G., **Bassil, N.** 2014. Comparative diversity analysis of southeastern *Rubus* germplasm through molecular and pedigree techniques. Acta Hort.
7. Bryant, D., **Bushakra J.**, Dossett, M., Vining, K., Filichkin, S., Weiland, G., Lee, J., Finn, C., **Bassil, N.**, Mockler, T. [ABSTRACT] 2014. Building the genomic infrastructure in black raspberry. American Society of Horticulture Science Meeting.
8. **Bushakra, J.**, **Bassil, N.**, Bradish, C. (8 additional authors). 2014. Toward understanding genotype x environment interactions in black raspberry (*Rubus occidentalis* L.) Acta Horticulturae.
9. **Bushakra, J.**, Bradish, C., Weber, C., Scheerens, J., Dossett, M., Peterson, M., Fernandez, G., Lee, J., **Bassil, N.**, **Finn, C.** 2014. Toward understanding genotype x environment interactions in black raspberry (*Rubus occidentalis*) [ABSTRACT]. 2014. Proc. American Soc. of Horticultural Sciences.
10. **Bushakra, J.**, Bryant, D., Dossett, M., **Gilmore, B.**, Filichkin, S., Weiland, G., Peterson, M., Bradish, C., Fernandez, G., Lewers, K., Graham, J., Lee, J., Mockler, T., **Bassil, N.**, Finn, C. [ABSTRACT] 2014. Black raspberry genetic and genomic resources development. Plant Biology Annual Meeting.
11. **Buskakra, J.**, Bryant, D., Vining, K., Dossett, M., Mockler, T., Lee, J., Finn, C., **Bassil, N.** 2014. A linkage map for black raspberry (*Rubus occidentalis*) [ABSTRACT] Genomics of the Rosaceae.
12. Chen, G., Ren, L., Zhang, J., **Reed, B.**, Zhang, D., Shen, X. 2014. Cryopreservation affects ROS-induced oxidative stress and antioxidant response in *Arabidopsis* seedlings. Cryobiology.
13. Evans, K.M., Fernández- Fernández F., **Bassil N.**, **Nyberg A.**, and **Postman J.** [ABSTRACT] 2014. Comparison of accessions from the UK and US national pear germplasm collections with a standardized set of microsatellite markers. Acta Horticulturae.
14. Hand, C., Maki, S., **Reed, B.** 2014. Modeling optimal mineral nutrition for hazelnut micro propagation. Plant Cell Tissue and Organ Culture.
15. Hand, C., **Reed, B.** 2014. Minor nutrients are critical for the improved growth of *Corylus avellana* shoot cultures. Plant Cell Tissue and Organ Culture.
16. **Hummer, K.** 2014. In the footsteps of Vavilov: plant diversity then and now. American Society of Horticulture Science Meeting.
17. **Hummer, K.** 2014. List 47: currants. HortScience.
18. **Hummer, K.** 2014. The naming of the Cascade strawberry. Kalmiopsis.
19. **Hummer, K.**, **Bassil, N.**, Rodriguez, A., Olmstead, J. 2014. Vaccinium species ploidy assessment. Acta Horticulturae.
20. **Hummer, K.**, Bors, R. 2014. List 47: blue honeysuckle. HortScience.
21. **Hummer, K.**, Dempewolf, H., Bramel, P., Markham, R., Stover, E. 2014. Status of global strategies for horticultural fruit crops. Acta Horticulturae.
22. **Hummer, K.**, Hancock, J. [ABSTRACT]. 2014. Vavilovian centers of diversity; implications and impacts. HortScience.
23. **Hummer, K.E.**, **J.D. Postman** and J.E. Preece. 2014. Managing nut genetic resources under disease threat. Acta Horticulturae 1070:193-200.
24. Iezzoni, A., Peace, C., **Bassil, N.**, (8 additional authors). 2014. Where are we now as we merge genomics into plant breeding and what are our limitations? Experiences from RosBREED. Acta Horticulturae.

25. Jenderek, M., Tanner, J., Ambruzs, B., **Postman, J.**, West, M., **Hummer, K.** 2014. Testing for suitable harvest time for effective cryopreservation of blueberry dormant buds. *Cryobiology*.
26. Jenderek, M., Tanner, J., **Postman, J.**, **Hummer, K.** [ABSTRACT] 2014. Seasonal variation in viability of cryopreserved *Vaccinium* dormant buds. Meeting Abstract.
27. Poothong, S., **Reed, B.** 2014. Optimization of CaCl₂, MgSO₄ and KH₂PO₄ to improve the growth of micro propagated red raspberries. *Scientia Horticulturae*.
28. Poothong, S., **Reed, B.** 2014. The optimization of nitrogen salts for micro propagated red raspberry germplasm. *Scientia Horticulturae*.
29. **Postman, J.**, **Bassil, N.**, Bell, R. [ABSTRACT] 2014. Ploidy of USDA (United States Department of Agriculture) world pear germplasm collection determined by flow cytometry. *Acta Horticulturae*.
30. **Reed, B.**, **DeNoma, J.** 2014. Medium-term in vitro storage as a complementary germplasm preservation technique. *Acta Horticulturae*.
31. **Reed, B.**, **DeNoma, J.**, Wada, S., Niedz, R. 2014. Determining optimum in vitro mineral nutrition for diverse pear germplasm using response surface methodology. *Acta Horticulturae*.
32. **Reed, B.**, Wada, S., Poothong, S., Hand, C., Hovalchuk, I., Niedz, R. 2014. Improving in vitro mineral nutrition for diverse germplasm. [ABSTRACT] 2014. *Plant Biotechnology Symposium Proceedings*.
33. Ren, L., Chen, G., Zhang, J., **Reed, B.**, Shen, X., Zhang, D. 2014. Effect of ROS-induced oxidative stress and apoptosis on the viability of cryopreserved embryogenic callus in *Agapanthus*. *Plant Science*.
34. Roos, M., Gmitter, F., Lee, R., **Hummer, K.** [ABSTRACT] 2014. Conservation of citrus germplasm – an international survey. *Acta Horticulturae*.
35. Rowland, L., Ogden, E., **Bassil, N.**, Buck, E., McCallum, S. 2014. Construction of a genetic linkage map of an interspecific diploid blueberry population and identification of QTL for chilling requirement and cold hardiness. *Molecular Breeding*.
36. Salinas, N., Hancock, J., Gunduz, K., Denoyes, B., Van De Weg, E., Sargent, D., Amaya, I., Mathay, M., Iezzoni, A., Peace, C., Finn, C., **Bassil, N.** [ABSTRACT] 2014. Validating microsatellite markers linked to soluble solids content in octoploid strawberry. *HortScience*.
37. Salinas, N., Kim, D., Hancock, J., Gunduz, K., Denoyes, B., Perrotte, J., Mathay, M., Mookerjee, S., Van De Weg, E., Sargent, D., Amaya, I., Iezzoni, A., Peace, C., Finn, C., **Bassil, N.** [ABSTRACT]. 2014. Validating microsatellite markers linked to remontancy in octoploid strawberry. *Proceedings American Society of Horticultural Sciences*.
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40. Shuang Jiang, Yu Zong, Xiaoyan Yue, **Joseph Postman**, Yuanwen Teng and Danying Cai. 2014. Prediction of retrotransposons and assessment of genetic variability based on developed retrotransposon-based insertion polymorphism (RBIP) markers in *Pyrus* L. *Mol. Genet. Genomics*
41. Volk, G., Chao, C., **Hummer, K.** [ABSTRACT] 2014. A global conservation strategy for apple. Meeting Abstract.
42. Volk, G., **Hummer, K.**, Bramel, P. [ABSTRACT] 2014. Development of a strategy to conserve worldwide apple genetic resources. Meeting Abstract.
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44. Wada, S., Niedz, R., **Reed, B.** 2014. Determining nitrate and ammonium requirements for optimal in vitro response of diverse pear species. *In Vitro Cellular and Developmental Biology – Plants*.
45. Zheng, X., Cai, D., Potter, D., **Postman, J.**, Liu, J., Teng, Y. 2014. Phylogeny and evolutionary histories of *Pyrus* L. revealed by phylogenetic trees and networks based on data from multiple DNA sequences. *Molecular Phylogenetics and Evolution*.